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NEVADA COVID-19 COORDINATED ECONOMIC RESPONSE PLAN: SUPPLY CHAIN ANALYSIS

PREPARED FOR THE:



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I. INTRODUCTION

The COVID-19 pandemic has affected the State of Nevada’s (“the state” or “Nevada”) economy in a variety of ways, including the state facing disruptions to its supply chain infrastructure. The strain placed on Nevada’s supply chain resulting from the pandemic has “caused significant delays for the delivery of essential products and lifesaving prescription medications for Nevada residents,” according to the Nevada Governor’s Office of Economic Development (“GOED”).

To help the state effectively respond to the adverse economic effects of COVID-19 and future emergencies in a timely way, GOED and the Nevada State Treasurer’s Office (“STO”) are working collaboratively to develop a coordinated economic response plan that can be immediately implemented to respond to the COVID-19 pandemic.

As part of this process, the Consultant Team (“CT”) of RCG Economics (“RCG”) and Spatial Economic Concepts (“SEC”) has been retained to conduct research and prepare a study that analyzes the effects the COVID-19 pandemic has had on Nevada’s existing supply chain infrastructure and to provide recommendations for how the state can improve its supply chain capabilities and enhance last-mile delivery services to make it more resilient post-COVID-19 and beyond. This study is one of five other initiatives that will be incorporated into Nevada’s upcoming COVID-19 Coordinated Economic Response Plan, which will be implemented by GOED upon completion.

In this report, the CT discusses the effects of the COVID-19 pandemic on Nevada’s supply chain and infrastructure. We also examine supply chains in general as background for the discussion regarding logistics in Nevada that followed. Next, the CT reviews the market demand for various supply chain elements within the state and included emerging technologies. Following this, we take a more in-depth look at the Nevada Rail Plan as well as financial resources that would be helpful in building additional infrastructure assets in Nevada, with particular attention to rail. The CT also have prepared an in-depth discussion on the pros and cons of a state infrastructure bank (“SIB”). Following this, we consider best practices used by a number of other states to improve their supply chain infrastructure. Finally, the CT provides a list of relevant Nevada Revised Statutes that should be investigated by the state for revision and/or updating.

II. NEVADA: THE CURRENT SITUATION

A. The Historical Setting

It is important to understand the economic and political forces that have shaped the growth and development of Nevada today, and will continue to exert influence into the future. Perhaps the single most significant event was the discovery of large silver deposits. “Modern mining began in Nevada in 1849 with the discovery of placer gold in a stream flowing into the Carson River near the present town of Dayton. This discovery, made by Mormon ‘49ers on their way to the California gold fields, led others upstream into what was later known as the Virginia Range to find the croppings of the Comstock Lode in 1859.”¹

During the first six years of mining the Comstock Lode, from 1859 to 1865, an estimated \$50 million in ore was taken from the claims. More importantly in terms of Nevada history was that over the next decade, representatives of the Bank of California, based in San Francisco, acquired most of the Comstock claims and mines when the market began to decline. Eventually, they took over the other area banks and become the controlling influence in Virginia City, even building the Virginia and Truckee Railroad, which dramatically reduced transportation costs. The Virginia and Truckee Railroad can be considered the first large scale infrastructure project in Nevada having a significant impact on economic growth. Transportation of silver ore was further improved with the construction of the Central Pacific Railroad to Reno.²

This early stage of Nevada’s history played a vital role in establishing the strong influential association, both economically and culturally, with California that continues to this day. This, in turn, was influenced by the ore refinement and smelting infrastructure, as well as railroad and seaport transportation infrastructure already established in the Bay Area.

Silver and Gold wealth was also a key factor, though not the only significant one, in Nevada becoming first a territory and then a state. “Nevada Territory was a federal territory, a part of the Union, and President Abraham Lincoln appointed Governor James Warren Nye, a former Police Commissioner in New York City, to ensure that it stayed that way. Governor Nye put down any demonstration in support of the Confederacy, and there were some. The federal government bought much of Nevada’s silver and gold bullion to support its currency. Therefore, Nevada’s creation as a TERRITORY on March 2, 1861 by the United States Congress ensured that its riches would help the Union and not the Confederate cause.”³

¹ “Mining History” J.V. Tingley, University of Nevada, Reno, online, December 2020

² “Comstock Lode – Creating Nevada History” Legends of America, internet, November 2020

³ “Why Did Nevada Become a State?” Guy Rocha, Nevadaweb.com, November 2020

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In 1864, Nevada had only 40,000 inhabitants, considerably short of the 60,000 normally required for statehood. But the 1859 discovery of the incredibly large and rich silver deposits at Virginia City had rapidly made the region one of the most important and wealthy in the West. However, the decisive factor in easing the path to Nevada's statehood was President Lincoln's proposed 13th Amendment banning slavery. Throughout his administration Lincoln had appointed territorial officials in Nevada who were strong Republicans, and he knew he could count on the congressmen and citizens of a new state of Nevada to support him in the coming presidential election and to vote for his proposed amendment. Since time was so short, the Nevada constitutional delegation sent the longest telegram on record up to that time to Washington, D.C., containing the entire text of the proposed state constitution and costing the then astronomical sum of \$3,416.77.⁴

B. Economic and Infrastructure Linkages

This "short cut" to statehood not only influenced the development of mineral resources in Nevada, but also had a profound impact on its infrastructure development that lingers to this day. By having only 40,000 inhabitants instead of the normal requirement for statehood, Nevada did not have a well-defined system of settlements that would demand road, or rail connectivity throughout the state. Furthermore, most of Nevada's population was centralized in what are today the communities of Reno, Carson City and Virginia City; reinforcing the ties to Northern California.⁵

If not for the mineral resources, it can be speculated that statehood would be more in line with some of our neighboring states: Idaho 1890; Utah 1896; Arizona 1912. This "premature statehood" is an important point for infrastructure development that can be demonstrated by looking to Utah as an example. The string of settlements and communities that existed in Utah at the time of its statehood required infrastructure to connect its population and economic areas. This infrastructure eventually became the route for I-15 as well as the main rail line that connected the 1st transcontinental railroad to Southern California.

Nevada did not have, and still does not have, well-integrated population and commerce centers spread throughout the state as might be anticipated utilizing Central Place Theory, a significant factor as to the lack of strong infrastructure connection between Northern and Southern Nevada. Nevada is now and has always been, an East/West oriented state when it comes to transportation and commerce, limiting the economic activities that can be pursued as a state.

If not for the somewhat arbitrary location of Nevada's political boundaries there is little economic interaction to bond the state together. Nor is there a central urban area that is the focus of the state's economic activities, such

⁴ "The U.S. Congress admits Nevada as the 36th State" History.com, December 2020

⁵ Nevada Place Names Population 1860-2000, public domain internet, November 2020

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as you find in the relationship between Salt Lake City and Utah, as well as Phoenix and Arizona. Additionally, the three major economic regions of Nevada, the Reno/Carson City area, the mining districts of the Northeast, and the Las Vegas area, are all within the sphere of economic influence generated from outside the state by the Bay Area, Salt Lake City and the Los Angeles, respectively.

This interaction of economic along with cultural activity with California is readily acknowledged in both Northern and Southern Nevada. One of the significant advantages Nevada has in attracting basic employment opportunities, such as manufacturing and logistics, is its accessibility to the California market. In the early days of the COVID-19 pandemic even Governor Sisolak acknowledged the critical ties to California when he announced Nevada would mirror that state's rules and regulations addressing the pandemic.

This economic activity can also be explained by "Central Place Theory", which is concerned with the size, number, functional characteristics and spacing of settlements, which are modal points for the distribution of goods and services to surrounding market areas. The theory concludes that the most efficient spatial arrangement of central places takes the form of a triangular lattice so that each central place has a hexagonal market area and is depicted in Figure II-1.⁶

While Central Place Theory is rooted in industrial aged Western Europe, more recent theories and observations regarding the economic linkages between Nevada and California have been put forth in studies regarding Megalopolis regions. A megalopolis is typically defined as a group of two or more roughly adjacent metropolitan areas, which may be somewhat separated or may merge into a continuous urban region.⁷

Perhaps more important to future economic development policies in Nevada is the introduction of the idea of "Megaregions." While there is no simple definition of a megaregion, there is general agreement that it is a large network of metropolitan regions that share several or all of the following: Environmental systems and topography, infrastructure systems, economic linkages, settlement/land use patterns and culture and history. "The megaregion concept provides cities and metropolitan regions a context within which to cooperate across jurisdictional borders, including the coordination of policies, to address specific challenges experienced at the megaregion scale, such as planning for high-speed rail, protecting large watersheds, and coordinating regional economic development strategies."⁸

There have even been studies which combine megaregions, such as the ones contained in Figure II-2.

⁶ "Central Place Theory" J. Malczewski, International Encyclopedia of Human Geography, 2009

⁷ "Megalopolis" Wikipedia, December 2020

⁸ Ibid.

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The recent evolution of “megapolitan area” and megapolitan cluster concepts by Dr. Robert Lang and his colleagues at the Brookings Institution is applied to a series of projects, including ‘Sun Corridor’ in 2006 (Phoenix-Tucson) and the Southwest Triangle (SoCal-Sun Corridor-Las Vegas) in 2014. The article ends with the future application of megapolitan area concept in the rapidly growing Southwest-Triangle megapolitan cluster.⁹

Within the two megaregions defined by Lang et. al., that include Nevada, the Southwest Region in the south and the Sierra Pacific Region in the north, live over 30M people, or approximately 10 percent of the U.S. population, and 14M people or five percent of the U.S. population, respectively. Throughout these studies the importance of connectivity between the major population centers of the megaregions is seen as critical.

“Infrastructure networks - the first critical driver of megapolitan and national prosperity – provide essential linkages that knit together an urban system. Infrastructure connectivity promotes economic synergy by clustering related economic activity and fostering regional specialties. Infrastructure connectivity improves access to jobs and educational opportunities, further supporting economic health and prosperity. And likewise, strategically developed infrastructure can also play a critical role in determining a region’s shape and improving its ability to adapt to the climate and resource challenges of the 21st century.” The Brookings study goes on to say, “The bottom line for the megapolitan West: Every mega needs to locate its own competitive advantages as a regional economy, while considering what forms of cooperation between places may prove to be mutually beneficial.”¹⁰

These relationships with California and Utah reduce the requirement for strong interaction among the various regions within Nevada. This is demonstrated by Figure II-3.

In Figure II-3 we see that Nevada has the lowest percent of intra-state shipments of any state west of the Mississippi River. Furthermore, Nevada is one of only four states where the value of shipments within the state account for less than 30 percent of total shipments. The other states are Vermont, West Virginia, Kentucky and Tennessee. The evolution of Nevada’s economy being dominated by forces outside the state is also evidenced by the historical transportation infrastructure development of its railroad and interstate networks. Figure II-4 depicts all the operational rail routes existing in Nevada today.

The distance between the Thorne Branch which terminates in Hawthorne, Nevada and the Las Vegas area is approximately 315 miles, and this is the nearest point at which to connect to the Reno area with the Las Vegas area by rail. This is a significant distance, and if there was sufficient market demand to connect Nevada’s two largest population and economic areas, it would have already been completed.

⁹ “The Origin, Evolution and Application of the Megapolitan Area Concept” Robert E. Lang, Jaewon Lim and Karen A. Daurelsen, International Journal of Urban Sciences, November 2019

¹⁰ “Mountain Megas” Metropolitan Policy Program, The Brookings Institution, 2008

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As with rail, there is also a lack of connectivity within Nevada via the interstate system. This is depicted in Figure II-5.

The distances between Northern and Southern Nevada connection points via an interstate highway is also significant. Though this connectivity hiatus is currently being addressed with the planning of I-11, it will be many years before this project is completed.

This lack of an economic center with North, South, East and West rail and interstate connectivity, impairs Nevada from achieving a robust economic development/diversification strategy. This can be revealed with the following anecdote from the 2012 I-80 Corridor Master Plan Study that RCG was part of:

In the summer of 2012, John Restrepo, principal of RCG and Mike Majewski, principal of Spatial Economic Concepts set out to interview Economic Development Organizations along I-80. This was done to provide a snapshot of the existing economic activity along I-80 as well as identify future economic development strategies which may have an impact on the infrastructure along the western portions of the corridor. The study focused on the section of I-80 that extends from Cheyenne, Wyoming to the Bay Area. The major objective in the first stage of this study was to identify communities which would have an economic dominance over a trade area, or labor shed, in a region beyond the community itself. Population size was the metric utilized for this identification. Central Cities within the Metropolitan Statistical Areas ("MSA") through which I-80 runs were the first cities selected. Central Cities customarily have the largest populations within an MSA. For the more rural areas outside of California along the I-80 corridor, communities with populations over 15,000 people were also selected.

An interesting observation emerged during our research, which was related to the economies and communities along the study portion of the I-80 Corridor. We learned how well these economies and communities were organized in conforming to the spatial distribution of urban development outlined in Central Place Theory. The geographic service areas and spheres of economic influence can be easily observed along I-80. Along the same lines, it is also important to note that state boundaries, while meaningful for infrastructure construction and maintenance budgeting within the I-80 corridor, have little or no impact on the geographic economic spheres of influence. Perhaps the most interesting take-a-way from conducting the corridor study was returning to consolidate and write the narrative from all the interviews. As all the interview notes were assembled it became evident, though it was not noted during the interviews themselves, that three locations stood out prominently in the volume of notes taken, indicating the amount of economic activity currently underway, as well as future initiatives and projects. These three communities were Cheyenne, Wyoming, Salt Lake City, Utah and Sacramento, California.

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This is additional evidence as to the importance transportation infrastructure has on local economies, and their prospects for future growth. These were the only communities along the corridor that had existing north, south, east and west rail and interstate linkages. Additionally, all three regions lie along officially designated North American Free Trade Agreement (“NAFTA”) corridors, marked from east to west, Camino Real, CANAMEX, and Interstate 5, offering excellent transportation connections between Canada and Mexico.

What speaks volumes as to the prospects for logistics center development is the fact that Nevada is the only state along the entire length of I-80, from the New York MSA to the Bay Area that does not have a community on the route with north/south rail and interstate access.

Infrastructure that is well-defined in Nevada’s two major metros is internet access and the international airports. If there is one infrastructure system that has been highlighted and impacted by COVID-19 it is telecommunications. The COVID-19 pandemic has forced many businesses across the U.S. to implement work from home (“WFH”) policies that have been in place for almost eight months. During that time, many of those companies have either made their WFH policy permanent for the foreseeable future or are at least considering it.¹¹

Fortunately for Nevada, it lies along the route of two major segments of the national “information highway” which follows the right-of-way of I-80 and I-15. Because of this Las Vegas developed into one of the first recognized “digital cities” in the United States. This designation was achieved by the area establishing the first digital switching system connected by fiber optics, and the hospitality industry’s demand for “cutting edge” telecommunication technologies. This in turn allowed the Las Vegas MSA to attract companies wishing to take advantage of this technology that provided near instant connectivity to the entire globe. At the turn of the century Las Vegas was able to offer more advanced telecommunication options at a lower bundled cost than most areas of Los Angeles. This is the primary reason over the past two decades that the Las Vegas and Reno areas have been so successful in attracting large-scale data processing centers as well as e-commerce fulfillment areas.

An example of this demand and its impact on the Nevada economy is Amazon, which operates 11 sites in Nevada that support customer fulfillment and delivery operations employing more than 10,500 full- and part-time employees across the state. Amazon broke ground in October on an 855,000-square-foot fulfillment center in North Las Vegas, creating 1,500 full-time jobs when it opens in 2021. The site will be the second fulfillment center in the state using Amazon Robotics to help associates pick, pack and ship smaller items to customers. And Amazon plans to build eight more buildings across Nevada to support customer fulfillment and delivery operations which means approximately 2000 permanent positions will be added.¹²

¹¹ “Are Corporate HQ’S Dead?” Joe Dyton, Connected Real Estate Magazine, October 29, 2020

¹² “Amazon details Nevada plans for 8 buildings, 2K more jobs” Sabrina Hudson, Las Vegas Review Journal, December 2, 2020

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However, this access to state-of-the-art telecommunications is not ubiquitous throughout the state. Many rural locations and some lower income neighborhoods in Nevada's larger cities do not share the same access, which limits their potential for economic growth and advancement. And, while this lack of access is primarily due to a demand not significant enough for the private sector to financially justify the investment in these underserved areas, it is imperative to solve this issue if Nevada is to achieve prosperity throughout the state.

"According to the authors of a 2015 study on rural broadband expansion, 'While the vast majority of federal programs dealing with broadband have focused on the provision of infrastructure, many economists and others involved in the debate have argued that the emphasis should instead be on increasing demand in the areas that are lagging behind.' The study found that rural households' broadband adoption rate lagged that of urban households by 12–13 percentage points and that while 38 percent of the rural-urban "broadband gap" in 2011 was attributable to lack of necessary infrastructure, 52 percent was attributable to lower adoption rates. Implicit in many supply-side arguments is an assumption that demand-side issues will resolve themselves once there is ample supply of cheap and ultra-fast broadband, wrote the directors of the Advanced Communications Law & Policy Institute ("ACLP") in a public comment to the Commerce Department's Broadband Opportunity Council in 2015. Though appealing, this reductive cause-and-effect has been questioned by social scientists, researchers, practitioners, and others who have worked to identify and better understand the complex mechanics associated with broadband adoption across key demographics and in key sectors."¹³

Fortunately, broadband can be accessed through several high-speed technologies which include: Digital Subscriber Line ("DSL"); cable modem; fiber; wireless; satellite; and Broadband over Powerlines ("BPL").

The need to establish better connectivity throughout the rural areas of Nevada is evidenced by the Broadband Whole Community Connectivity Report in which the communities of Austin, Mesquite and Ely, as well as the counties of Elko, Humboldt, Pershing and White Pine all listed the "establishment of a Broadband Action Team" as their number one accomplishment.¹⁴

C. Digital Nomads

Perhaps the single largest impact of COVID-19 is on the workforce. As more people work from home, many jobs, if not the industries in which they are employed, can now be classified as footloose. Bill Gates was quoted recently as saying that he believes that 30 percent of the U.S. workforce will permanently and partially work from home. In the interview, he also said that 50 percent of global business travel will not return. "Footloose" is an economic

¹³ "Demand for Broadband in Rural Areas: Implications for Universal Access" Congressional Research Service, December 2019

¹⁴ "Broadband Whole Community Connectivity Report" Brian L. Mitchell, Jojo Myers Campos, Governor's Office of Science, Innovation & Technology, 2018

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geography term that traditionally referred to a broad industry group that does not have a strong locational preference because the resources, production skills and consumers on which it depends can be found in numerous places. With the advent of the internet and high-speed optical connectivity, significant segments of the workforce are now able to work from remote locations, even half-way around the world. And, while the concept of work-from-home was gaining acceptance in relatively small incremental steps, the pandemic thrust it into the spotlight as a viable option, with many companies across a broad spectrum of industries re-evaluating their workplace strategies. In a very real sense, the term footloose can now be utilized for specific job functions. This, in turn, will change the scope and activities of economic development programs and strategies.

What has not changed for economic development programs are their reliance on “Economic-Base Theory” and the need for a community or region to attract or create basic jobs. A “basic job” is any which is involved in the export of its goods and services to bring in money from outside a region or MSA, for example. Traditionally, basic jobs include those in manufacturing, tourism, corporate or regional headquarters, as well as state and federal government. These jobs, through what is termed the “multiplier effect,” will increase market demand for additional jobs. For example, persons hired at a new or expanded manufacturing facility will need additional gas stations, food stores, movie theaters, etc., all of which, in turn, must also hire new employees. In this way, money received by the basic industries “turns over” or “multiplies” in a community, thus indirectly benefitting people other than those they originally hire. This is called the “multiplier effect,” which plays a prominent role in any economic impact analysis. So, in a very real sense, economic development growth is driven more by the disposable income individuals have to spend than a company itself. Therefore, it makes sense to develop programs and policies that attract the footloose worker.

The current advancement of the work-from-anywhere concept has even given rise to a new term: digital nomads. “Digital Nomads are a population of independent works who choose to embrace a location-independent, technology-enabled lifestyle that allows them to travel and work remotely, anywhere in the world. Our research finds that 4.8 million independent workers currently describe themselves as digital nomads, and many more, 17 million, aspire to someday become nomadic. Much like independents themselves, nomads are a diverse group, made up of no single generation, profession, or social-economic class. While they skew young and male, one-third are female, and 54 percent are over the age of 38. Creative professions dominate, but IT and marketing are also strong participants in the movement. One in six earn more than \$75,000 annually.”¹⁵

There are several areas in the United States that recognize the economic growth potential of attracting digital nomads and are incorporating the targeting of this workforce group as they would any business or industry. One of the more proactive programs is sponsored by the City of Tulsa, Oklahoma. In an effort to attract digital nomads

¹⁵ “Digital Nomads: A Rising Workforce Trend” MBO Partners, online, December 8, 2020

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from outside the Tulsa area, the city will pay qualified individuals up to \$10,000 to relocate there. The deal includes \$2,500 toward relocation costs, a \$500 monthly stipend and a \$1,500 bonus at the completion of 12 months in the city, according to the program's website. To qualify, you must be a full-time remote worker or self-employed outside of the state. But what makes Tulsa's program unique is its focus on remote workers. On top of the cash subsidies, the program, dubbed "Tulsa Remote," comes with a free membership to 36 Degrees North, a co-working space in the city, which ordinarily charges members \$149 per month or more. In essence, Tulsa has created the equivalent of a small business incubator for individuals. Additionally, Tulsa has incorporated a listing of vetted residential spaces within their central core to assist the remote worker in finding a place to live, as well as designed programming, events, and meet ups to help the workers engage with organizations, nonprofits, and other individuals like themselves.

The City of Las Vegas has also initiated a marketing program to attract digital nomads. While the city does not offer financial incentives at this time, it has created an innovation center in the heart of downtown. In its promotional materials the city states: "Las Vegas is becoming known for innovation and state-of-the-art technology. The testing of autonomous vehicles and drone technology is helping transform our city. Innovative startups in the city's downtown are crafting new ideas, helping to create the next big thing, and the casino industry boasts some of the latest and most technologically advanced gaming equipment. You don't have to do this alone – and we don't want you to. We've built an environment conducive to brainstorming, formulating, and executing. We have room for you to join our Innovation Center Today." The brochure goes on to say, "if remote working is in your forecast, why live in states with high tax rates and astronomically high housing costs when other locations offer so much more for your money? And why not live in a state that leaves more money in your own pocket because you don't pay any state income tax?"¹⁶

Still another concept that has been introduced to encourage the co-location of individuals and companies is the Innovation District. In 2014, The Brookings Institution noted that "A new complementary urban model is now emerging, giving rise to what we and others are calling "innovation districts." These districts, by our definition, are geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators. They are also physically compact, transit-accessible, and technically-wired and offer mixed-use housing, office, and retail. Innovation districts are the manifestation of mega-trends altering the location preferences of people and firms, and, in the process, re-conceiving the very link between economy shaping, place making and social networking. Innovation districts represent a radical departure from traditional economic development. Unlike customary urban revitalization efforts that have emphasized the commercial aspects of development (e.g., housing, retail, sports stadiums), innovation districts help their city and metropolis move up the value chain of global competitiveness by growing the firms, networks, and traded sectors that drive

¹⁶ "Pilot Program" City of Las Vegas, online, November 30, 2020

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broad-based prosperity. Instead of building isolated science parks, innovation districts focus extensively on creating a dynamic physical realm that strengthens proximity and knowledge spillovers. Rather than focus on discrete industries, innovation districts represent an intentional effort to create new products, technologies, and market solutions through the convergence of disparate sectors and specializations (e.g., information technology and bioscience, energy, or education).¹⁷

The Brookings Institution report went on to provide 12 guiding principles for innovation districts:

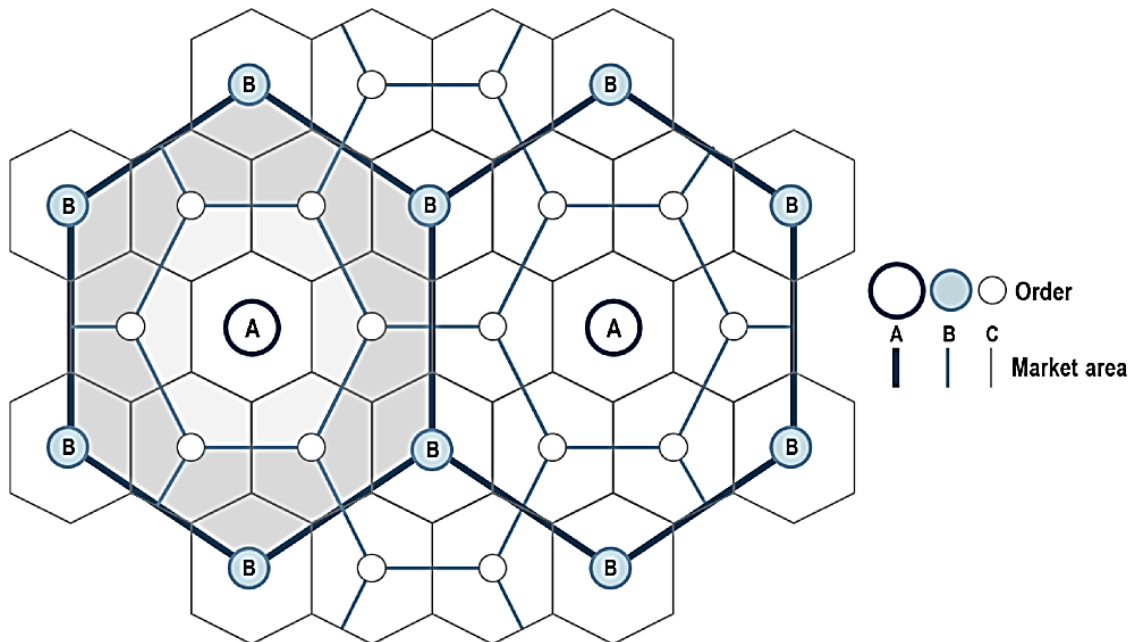
1. “The clustering of innovative sectors and research strengths is the backbone of innovation districts.
2. For innovation districts, convergence – the melding of disparate sectors and disciplines – is king.
3. Districts are supercharged by a diversity of institutions, companies, and start-ups.
4. Connectivity and proximity are the underpinnings of strong district ecosystems.
5. Innovation districts need a range of strategies – large and small moves, long-term and immediate.
6. Programming is paramount. Programming – a range of activities to grow skills, strengthen firms, and build networks – is the connective tissue of a district.
7. Social Interactions between workers – essential to collaboration, learning and inspiration – occur in concentrated “hot spots.”
8. Make innovation visible and public.
9. Embed the values of diversity and inclusion in all visions, goals and strategies.
10. Get ahead of affordability issues.
11. Innovative finance is fundamental to catalyzing growth.
12. Long-term success demands a collaborative approach to governance.”¹⁸

As more and more of the workforce has the option of working from wherever they wish, it will be important to design a statewide program that may link various remote working facilities (even individuals working from home) and innovation districts together to form a strong backbone of support for the new emerging workforce. If an individual can work from any geographic location, it just makes sense that Nevada, with its variety of places and locales, is perfectly situated to appeal to and attract digital nomads.

¹⁷ “The Rise of Innovation Districts: A New Geography of Innovation in America” Bruce Katz and Julie Wagner, Metropolitan Policy Program at Brookings, May 2014

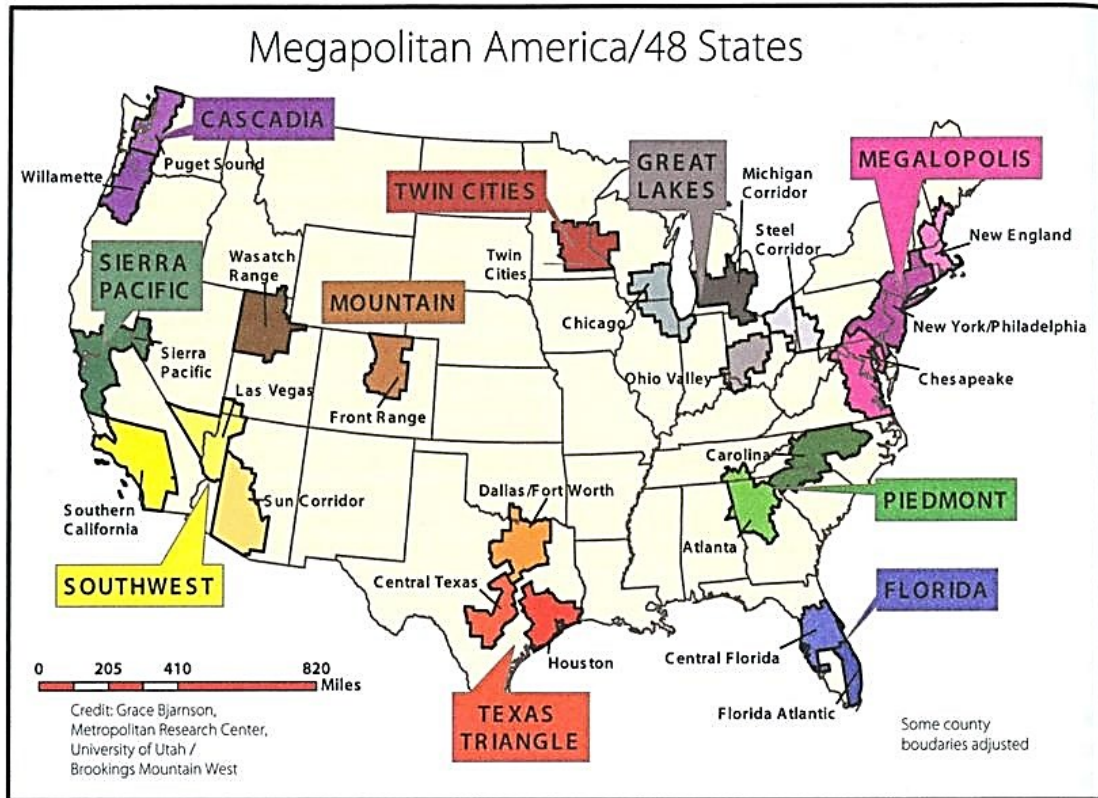
¹⁸ “12 Principles guiding innovation districts” Julie Wagner, Scott Andes, Steve Davies, Nathan Storrington and Jennifer S. Vey, Brookings Institution, September 2017

Figure II-1: Central Place Theory Diagram



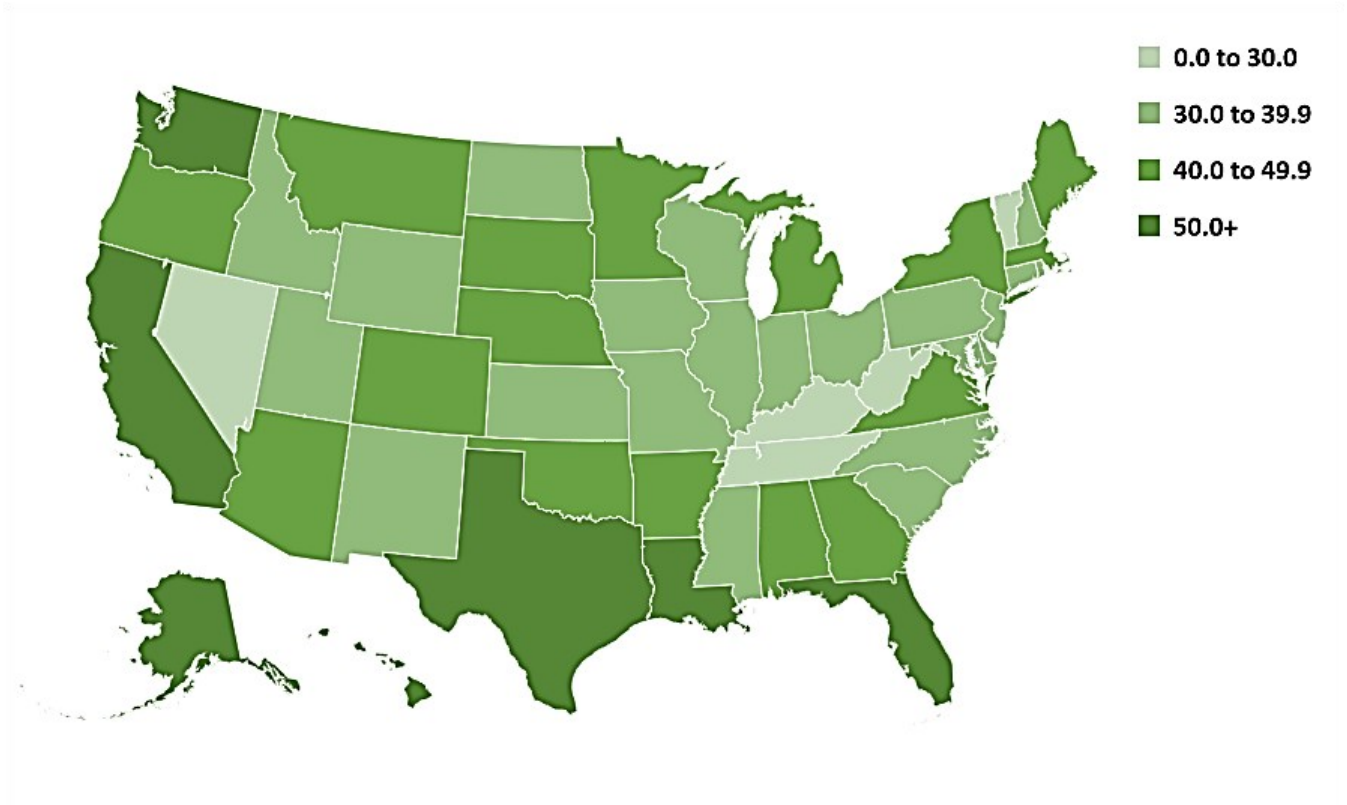
Source: "Central Place Theory" J. Malczewski, *International Encyclopedia of Human Geography*, 2009

Figure II-2: Megapolitan America/48 States



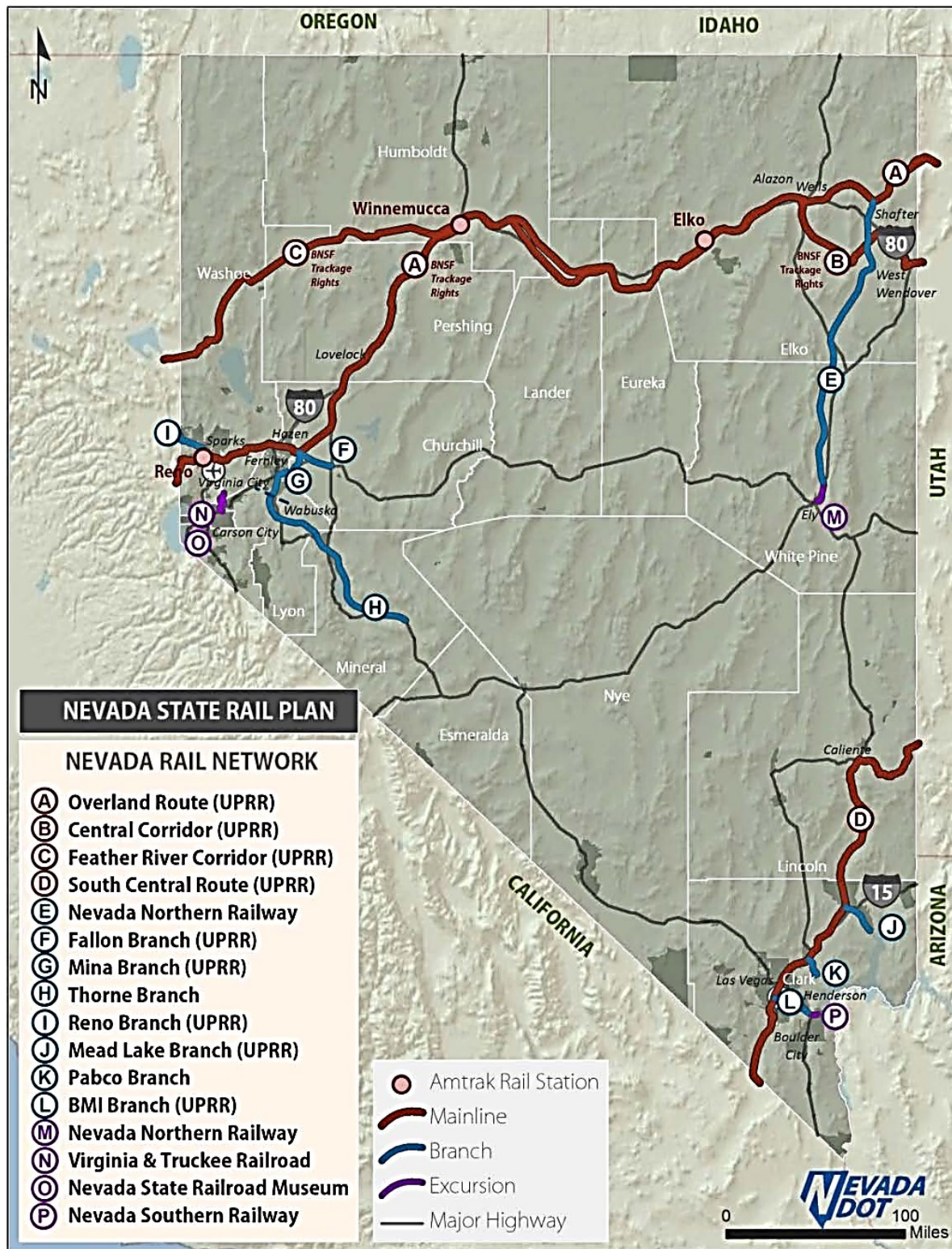
Source: Grace Bjarnson, Metropolitan Research Center, University of Utah, Brookings Mountain West

Figure II-3: Value of Shipments Within A State: 2015



Source: USDOT, BTS, FHWA, Freight Analysis Framework

Figure II-4: Nevada State Rail Map



Source: Nevada State Rail Plan

Figure II-5: Nevada Roadmap



Source: Wikimedia Commons

III. SUPPLY CHAINS

A. The Concept

Over the past several decades the concept of warehousing and distribution has evolved dramatically. From the idea of a simple warehouse as a facility where raw materials or manufactured goods may be stored before moving on to the next place of the manufacturing process or distributed for sale; to the perception that the movements between warehouses and its suppliers or customers must be considered gave rise to the term logistics. Logistics has a vital effect on shipped goods and includes all activities involved in the movement of those goods.

The supply chain concept was developed in the pursuit of better planning, management, cost control and customer service in delivering finished products from raw materials to end user. While logistics manages the flow of goods within a company and between a company and its suppliers and customers, supply chain includes the management and demand planning which coordinates processes within and among companies.

A supply chain is an entire system of producing and delivering a product or service, from the very beginning stage of sourcing the raw materials to the final delivery of the product or service to end-users. The supply chain lays out all aspects of the production process, including the activities involved at each stage, information that is being communicated, natural resources that are transformed into useful materials, human resources, and other components that go into the finished product or service.

Supply chain has blurred the demarcation between distribution and manufacturing. Figure III-1 provides an example of a generic supply chain.

“The generic supply chain begins with the sourcing and extraction of raw materials. The raw materials are then taken by a logistics provider to a supplier, which acts as the wholesaler. The materials are taken to a manufacturer, or probably to various manufacturers that refine and process them into a finished product. Afterward, it goes to a distributor that wholesales the finished product, which is next delivered to a retailer. The retailer sells the product in a store to consumers. Once the consumer buys it, this completes the cycle, but it is the demand that then goes back and drives the production of more raw materials, and the cycle continues.”¹⁹

The acceptance and implementation of supply chain management has given rise to one of the most significant recent phenomenon in the consumer process: e-commerce. E-commerce, in turn, has blurred the lines between

¹⁹ “What is a Supply Chain” Corporate Finance Institute, online, December 8, 2020

manufacturing/logistics and retail. In addition to removing the requirement for brick-and-mortar retail buildings, it also integrated financial institutions and payment processors into the supply chain process. Figure III-2 is a visual portrayal of the e-commerce process.

“In this example, the e-commerce company operates a website, and that website sells various products. When a customer places an order for a product, the product order is being processed by technology such as a checkout cart, an order system, or a third-party product. The payment processors then come in and deal with payment transactions for the order, which actually opens up a new supply chain. The payment processors use their own systems but, in most cases, third parties such as PayPal and Stripe are employed, and they involve banks and other providers. When a product order is placed, the warehouse receives the order and ensures the product is ready for delivery. The warehousing company can be either in-house or a third-party logistics provider. The order then goes from the warehouse to the shipping company. Once again, the shipping may be in-house or a third-party shipping company. From there it goes directly to the consumer.”²⁰

B. Online Economic Activity

E-commerce has exploded in recent years and while the pandemic has accelerated e-commerce growth with online sales reaching a level not previously expected until 2022, it shows little sign of regressing. Figure III-3 depicts the growth of U.S. retail e-commerce sales in recent years, and projects sales for the next three years.

As can be seen from Figure III-3, U.S. e-commerce sales will reach \$794.50 billion this year, up 32.4 percent year-over-year. Furthermore, e-commerce sales will reach 14.4 percent of all U.S. retail spending this year and 19.2 percent by 2024. Notably, “while the entire e-commerce pie is expanding faster than expected, so too will the shares of the top 10 e-commerce players. They will further widen their gap to account for 63.2 percent of all online sales this year. This is up from 57.9 percent in 2019. Highlights among the top 10 include:

- Amazon's share will grow to 39.0 percent in 2020. Despite being the biggest player by far, Amazon will also experience the largest dollar gain.
- Walmart's share will reach 5.8 percent. Walmart displaces eBay this year as the No. 2 e-commerce player in the U.S.
- Best Buy (up 105.5 percent) and Target (up 103.5 percent) will see their e-commerce sales more than double, due in large part to the popularity of their curbside pickup offerings.

²⁰ Ibid.

- The Kroger Co. displaces Macy's as the 10th biggest retailer by e-commerce sales, even as Macy's grows its online business"²¹

Table III-1 provides more detail for the top 10 e-commerce retailers in the U.S.

In pursuit of better supply chain management, and thereby better cost control, new technologies will fuel the growth of on-line shopping, and may even reshape the e-commerce requirements for warehousing. Perhaps the most significant of these technologies is that of blockchain.

C. Digitalization

Blockchain is one of the key innovative technologies revolutionizing digital supply chain management. As supply chains grow more complex in nature, involve diverse stakeholders and mainly rely on a number of external intermediaries, blockchain emerged as a strong contender for de-tangling all the data/documents/communication exchanges happening within the supply chain ecosystem. Figure III-4 is an illustrated example of how blockchain works.

Some of the advantages of blockchain technology that will make it highly applicable for supply chain managers are:

- "Transparent and controlled transactions. Blockchain has no intermediary (e.g., a bank). It results in faster and more transparent settlements, as the ledger is updated automatically, including the visibility of a transaction, so that it can only be visible to the authorized participants.
- Preapproved transaction fees. When making cross-border payments with Swift, the commission for the transaction is deducted only after the transaction completion – or to be more exact, upon running through a whole number of the intermediary banks, which have been executing this transaction. In case of blockchain, you know the fees beforehand.
- Auditability. All the transactions are immediately visible to authorized parties, meaning no one can tamper, delete, or conceal any information added to the blockchain.

²¹ "U.S. E-commerce Growth Jumps More Than 30 percent" eMarketer, October 12, 2020

- Reliable. Due to its distributed nature, blockchain does not have a single point of failure. Besides, all the transactions processed on the blockchain are immutable and irrevocable, further eliminating the risks of fraud.”²²

By example, one of the most troubling aspects of e-commerce is the dramatic rise in product counterfeiting. “The Global Brand Counterfeiting Report, 2018 estimates that the losses suffered due to online counterfeiting globally have amounted to 323 Billion USD in the year 2017. Counterfeit consumer goods account for nearly 188 billion dollars of lost revenue regarding prescription drugs alone. Blockchain enables an individual to verify that a product was sourced accurately and ethically. Documentation counterfeiting and fraud are also common among diplomas, certifications, and official identification. Blockchain records can transparently verify certifications, official legal documents, and coordinate record-keeping immutable, which prevents counterfeiting or fraud.”²³

The reliability and oversight that blockchain technology allows, especially around anti-counterfeiting measures, can only accelerate the growth of factory-direct sales to consumers. This has given rise to emerging marketing channels. Omnichannels, unlike the more prominent multichannel retail that revolves around the product and lets the customers engage and purchase from many separate channels, revolves around the customer and creates a single experience across brands by unifying sales and marketing. In other words, omnichannel revolves around the customer, not the product. And, though omnichannels have existed for a for a few years, they have begun to rapidly increase in popularity and utilization and have increased the most of any marketing channel within the past three years, as depicted in Figure III-5.

D. Emerging Channels

Figure III-5 also illustrates a new type of emerging marketing channel: micro-fulfillment centers:

“Micro fulfillment centers (“MFC”) are small warehouses that are compact enough to place almost anywhere, and they are designed to fulfill online orders fast and efficiently close to where customers live. To satisfy the expanding demand for e-commerce fulfillment, click-and-collect, and home deliver, MFCs seek to transform last-mile delivery logistics so that on demand e-commerce can become a profitable and scalable business model. For retail industries in which profit margins are slim, last-mile logistics have become the battleground for a competitive advantage. MFCs have the potential to shift the entire landscape on this battlefield. By building in dense urban settings where more than half the population lives, retailers can reduce the cost of last-mile delivery by simply shortening ship-to-door distance. Retailers who can lower last-mile related costs will be at a competitive advantage.

²² “Blockchain in Supply Chain Management: Key Use Cases and Benefits” Impulse, online, October 7, 2019

²³ “Blockchain in Supply Chain Management” consensys.com, online, December 1, 2020

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MFCs change the path of a product. At the store level, product moves from the warehouse to the store's backroom, then to the store floor. Online orders then oftentimes require the product to move from the store floor back to the backroom before it is sent out for delivery. MFCs simplify this path, requiring a product simply to go from the MFC to the store's backroom, and then to the customer's door. Sometime, the trip to the backroom is unnecessary because the backroom is the MFC."²⁴

Still another e-commerce channel to emerge is the systematic factory direct on-demand sales. In this model, the e-commerce consumer buys from the factory and the product is shipped to the consumer directly from the factory. This method eliminates the need for both wholesaler and retailer. This new marketing and distribution channel has even given rise to apps whose sole purpose is to facilitate these transactions. One such app is Wish. Perhaps the single biggest benefit from using the app is price. Wish's prices are presented as 80 or 90 percent off their original price. "In exchange for these bargains, Wish demands patience. Most delivery estimates range from two to four weeks, giving the marketplace's vendors time to ship their products from countries like China. Last year, Wish says it saw revenue double from the year prior, to \$1.9 billion; the company earns money by taking a 15 percent cut of each sale and, to a lesser extent, collecting fees from sellers in exchange for promoting their products. It has raised \$1.3 billion since it was founded in 2011, and at its last funding round in 2017, was valued at more than \$8.7 billion. It was also the world's most downloaded e-commerce app of 2018, with 161 million installs globally."²⁵

These new supply chain concepts will have profound effects on real estate and economic development. E-commerce supply chains already require more than three times the warehouse space as traditional brick and mortar distribution centers. The new omnichannel and MFC's will be able to repurpose a variety of commercial space designed and constructed for traditional retail activities. "This shift in warehouse utilization has renewed demand for older, smaller warehouses located close to dense urban areas and primary transportation routes. These warehouses may not have the clear heights, dock-to-square-footage ratios or yard space needed for modern large-scale logistics uses, but they can accommodate fast-moving, quick-turning and frequently ordered e-commerce inventory, and they are well positioned to serve as micro-distribution or micro-fulfillment centers. Additionally, strategically located older urban warehouses that cannot be effectively retrofitted can be replaced with new vertical, multistory automated warehouses that double or triple the usable square footage on the same footprint. An emerging network of nano-distribution sites – even smaller than MDCs – is filling unconventional space in a relentless push to be closer to consumers. Instead of displaying items for passing customers, vacant storefronts are becoming storerooms and delivery depots for businesses that have moved entirely online."²⁶

²⁴ "How will micro-fulfillment centers change the retail identity?" IAMROBOTICS, online, December 7, 2020

²⁵ "Wish, the super popular, ultra-cheap shopping app, explained" Hilary George-Parkin, Vox, July 2019

²⁶ The Evolution of the Warehouse: Trends in Technology, Design, Development and Delivery" Steve Weikal and James Robert Scott, NAIOP Research Foundation, October 2020

E. Types of Facilities & Activities

A summary review of the new types of warehouses is outlined below:

- **Multistory Warehouses:** Designed to overcome the limitations of smaller lots, these warehouses are built vertically, with truck ramps and docks located on multiple floors.
- **Darkstore Distribution Centers:** These distribution centers are designed to replace retail distribution centers with last-mile delivery and frequently employ partially automated fulfillment systems. Although they are not open to the public, many appear similar to conventional stores, with aisles and shelves.
- **Grocery Conversion:** Micro-fulfillment systems installed in existing grocery stores.
- **Flexible Micro-Distribution Centers ("MDC"):** Smaller spaces that have been repurposed for distribution using automated systems, such as turning an empty underground parking garage into a grocery fulfillment center.
- **Nano-Distribution:** "Last-touch" fulfillment from former office or retail space.²⁷

A subgroup of e-commerce that receives much attention from the logistics industry itself, but still does not seem to have an agreed upon solution is reverse logistics:

"Reverse logistics is defined as the processes of receiving returned components or products for the purpose of recapturing value or proper disposal. Reverse logistics processes and plans rely heavily on reversing the supply chain so that companies can correctly identify and categorize returned products for disposition, an area that offers many opportunities for additional revenue. It is much more than simply counting defective items returned by customers. Also, it is much more complex than outbound shipping in that customers and or consumers initiate a return, making it an inbound shipment process that is less predictable."²⁸

"For the majority of supply chain members, product returns are the most significant aspect of reverse logistics. The types of items that come back and require reverse logistics processing may include product returns, product recalls, end-of-lease equipment, old/obsolete items being replaced, packaging materials and myriad other items. Some statistics that highlight the importance of reverse logistics include the following:

²⁷ Ibid.

²⁸ "Recovering Lost Profits by Improving Reverse Logistics" Curtis Creve and Jerry Davis, United Postal Service, online, November 30, 2020

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- Reverse logistics costs account for between 0.5 percent and 1 percent of total U.S. gross domestic product.
- Average return rate for online retail sales is 5.6 percent, although it varies by product and time of year.
- Ninety-five per cent of consumers would rather return a product purchased over the Internet to a physical location; 43 percent would always use that option if it were available; 37 percent of online buyers and 54 percent of online browsers were deterred from purchasing online because of return and exchange processes that were too difficult.
- The cost of processing a return can be two to three times that of an outbound shipment.”²⁹

“In a reverse supply chain model, materials that are sold through the forward supply chain are received back at the point of purchase as “returns” for a number of reasons including wrong item, color, style, price, user issues, buyer remorse, defective product, etc. Materials received are then forced back through the forward supply chain channel to the manufacturer through their existing distribution network. In many instances, materials are accumulated at a processing center until a quantity large enough for cost effective processing is achieved. This accumulation could take place over several weeks to several months and is not the primary focus of the product support teams. It is estimated that 70 percent to 85 percent of products returned through this channel have what is known as no trouble found (“NTF”), where materials are returned for reasons other than a product defect. However, amongst the advanced processes prevalent in today’s supply chain, which are primarily designed to minimize costs, there is not a well-defined focus on the timely repair, warranty evaluation, remarketing and intelligently reintroducing product back into the service supply chain.”³⁰

Most e-commerce companies understand the need for reverse logistics. Products returned for repairs are often treated as inbound shipments, but they are not the same as receiving raw materials or components. Repairs often go into a separate workflow, requiring parts, personnel and processes that differ from new products. Without a reverse logistics process and plans in place to manage returns, which are often an unpredictable inbound shipment, companies lack visibility into the volume and the nature of returns. This can result in excessive spending on repair parts and staffing levels.³¹

However, there does not seem to be a consensus on how to handle the reverse logistics issue. Some experts recommend that forward and reverse flows should be merged into one process.

²⁹ “Reverse Logistics in the Supply Chain” James R. Stock, Transport & Logistics, online, November 24, 2020

³⁰ “The Intelligent Supply Chain” John Borrelli, Reverse Logistics Association, online, November 11, 2020

³¹ “Recovering Lost Profits by Improving Reverse Logistics” Curtis Greve and Jerry Davis, United Postal Service, online, November 30, 2020

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“The most successful reverse logistics solutions merge efficient forward and reverse flows into one process. Implications are that, in much the same way as companies realized significant customer service and financial benefits through the integration of inbound and outbound distribution activities, the combination of forward and reverse logistics together result in benefits. Equipment, facilities and personnel can share both forward and reverse logistics activities, resulting in synergy in terms of reduced costs and improved service levels.”³²

Other experts warn about the combining the forward and reverse flows. “Creating a reverse logistics strategy allows outbound and reverse logistics to function as efficiently as possible. Trying to shoehorn reverse logistics into the traditional supply chain framework can lead to bottlenecks and customer dissatisfaction. Most distribution facilities were not designed to handle reverse product flows, nor are personnel trained to effectively or efficiently decide whether to reshel, repair, discard or return items to vendors/suppliers. The implications are that, often, when touring warehouse facilities or retail ‘backrooms’, product returns are usually just ‘sitting around’ rather than being handled and stored within the same diligence as products moving in a forward direction. Pallets of returns do not resemble the neat and efficient stacks of new merchandise being shipped to customers.”³³

And still others recommend that the best strategy is to just build better products. “Good product quality and efficient logistics programs on the forward side invariably reduce the number of returns on the reverse side. The implications here are that ‘the best return is no return’. Product returns that can be eliminated before they become returns dispense with unnecessary time and costs needed to handle, store and dispose of them. The most highly efficient and effective forward logistics programs have fewer product returns as a percentage of total revenues or sales.”³⁴

In addition to the new technologies and repurposing of land and facilities, the COVID-19 virus has had a significant impact on the supply chain network. While the virus has decimated the hospitality/hospitality and brick and mortar retail industries, two of the industries on which the Nevada economy relies the most, it has been a boon for e-commerce and its ancillary functions such as last mile delivery. Ken Barnes, Senior Manager for FedEx Ground in Las Vegas, stated that his operations have experienced a 30 – 40 percent increase in volume over a one-year period.³⁵

³² “Reverse Logistics in the Supply Chain” James R. Stock, Transport & Logistics, online, November 24, 2020

³³ “45 Things You Should Know About Reverse Logistics” Warehouseanywhere.com, June 10, 2019

³⁴ “Reverse Logistics in the Supply Chain” James R. Stock, Transport & Logistics, online, November 24, 2020

³⁵ Ken Barnes, Senior Manager, FedEx Ground, personal interview, December 8, 2020

F. The COVID-19 Effect

The impact of COVID-19 on supply chains has resulted in skyrocketing demand for online purchases. The supply chain is, after all, an element of daily life that has an impact, either directly or indirectly, on just about everyone on the planet. The pandemic put a spotlight on the critical nature of this industry. Truck drivers and warehouse employees became everyday heroes on the front lines, making sure essential goods got where they needed to go. At the root of those changes is the explosive growth in e-commerce, as homebound consumers embraced online purchasing for everything from food and other necessities to furniture and appliances.³⁶

The virus has however spotlighted some weaknesses in the industry. Those revelations tend to be in the areas of:

- Labor – it is difficult to ramp-up hiring at a high rate equal to the demand for both the logistics and transportation sectors;
- Infrastructure – the increased volumes in sales has strained not only the transportation systems, but also the vehicles or conveyances themselves;
- Suppliers – far flung suppliers around the globe have found it difficult to ship production long distances in a timely manner, even if they have the production capacity.

“E-commerce has exploded in recent years, but as COVID-19 emerged the sector has seen unprecedented growth. While many industries battled disruptions, e-commerce provides opportunity. E-commerce and logistics companies are accelerating planned innovation and restructuring initiatives to stay ahead of the curve – if that is even possible- spurring the implementation of three to five years of advancements in a span of just five months to keep up. It is akin to upgrading the jet while traveling at Mach speed. This significant growth in online sales shows no signs of slowing, with Deloitte forecasting e-commerce sales to increase by 25-35 percent year-over-year during this upcoming holiday season, compared to an increase of 14.7 percent in 2019. Retailers and shippers cannot deliver on these demands unless the broadest selection of inventory is positioned close to significant populations. It all boils down to having the right inventory in the right places at the right time. Nothing happens on the shop floor, whether digital or physical, that does not have an impact on the supply chain. Ever-changing consumer behaviors mean real estate and supply chain professionals must make quick decisions during a time when nearly every aspect of the industry is in flux. Everything from network planning and building size to labor and automation is changing – not to mention the expectation of free and faster shipping.”³⁷

Throughout the breadth of current literature about COVID-19 and the supply chain, the word resiliency is most often used to characterize the response of the industry to the virus. However, many articles also point out that

³⁶ “Supply Chain Execs Respond as Pandemic Creates E-Commerce Surge” Ashfaque Chowdhury, Area Development, Q4 2020

³⁷ “E-Commerce Growth Surge Sparks a Logistics Free-for-All” Ben Cornwell, Area Development, Q4 2020

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recent trade wars had negatively impacted the supply chain before COVID-19 arrived. “The COVID-19 outbreak isn’t an isolated event. Disruptions are increasing in frequency and magnitude, including geopolitical events, climate-related disasters and public health crisis. Brexit and the U.S.-China trade war are recent examples. For decades, low-cost supply and minimal inventory were the key tenets of supply chain management. But in an increasingly turbulent world, supply networks that are overly dependent on the lower-cost supplier and minimal inventory levels can rapidly imperil the business.”³⁸

“The impact of COVID-19 has shown that traditional supply chains are not always resilient or adaptable enough to handle a pandemic or another widespread disaster. During the pandemic, for example, many companies have suffered serious supply chain disruptions, perhaps most acutely in the healthcare sector, which was disrupted by shortages of vital medical equipment and supplies. In the early days of the pandemic, affected companies had to make rapid decisions to resolve supply chain issues, but in many cases such efforts were stymied by the inefficiencies of traditional systems, where real time data needed to diagnose the problem and find new supply chains may not have been available or reliable. Even during the best of times, the data on a supply chain may reside with numerous parties and may not be passed accurately along the chain. Such issues are in addition to any regulatory hurdles from government agencies, which themselves likely were short-staffed or affected by the crisis. Thus, as the supply chain issues became highly pressing, companies struggled to solve provenance issues or conduct adequate due diligence on new suppliers (particularly those new manufacturers who pivoted from another industry to produce goods needed to fight the virus). As a result, many businesses found themselves unable to onboard alternative suppliers and perform contractual obligations. Given that other events of similar impact are likely to occur in the future, many companies are seeking to mitigate current and future disruptions by rethinking their supply chains, whether by diversifying, ‘near-shoring’, or looking to adopt a blockchain solution.”³⁹

During the pandemic, those companies and industries which exhibited flexibility within their production and distribution systems fared the best. “The COVID-19 crisis has thrown a spotlight on companies that already have flexible production lines. The fashion industry could not be further removed from the production of disinfectants and medical gear. But when the spread of COVID-19 overwhelmed the French and Italian healthcare system and medical supplies ran short, nimble luxury goods manufacturers overhauled operations to make the urgently needed items. Within 72 hours of the French government’s call for businesses to pitch in, LVMH’s perfume factories were producing hand sanitizer. Giorgio Armani, Gucci and Prada repurposed their designer clothing factories in Italy to churn out medical overalls, and Burberry harnessed a trench coat plant to make face masks and nonsurgical gowns.

³⁸ “Supply Chain Lessons from COVID-19: Time to Refocus on Resilience” Olaf Schatterman, Drew Woodhouse, Joe Teniro; Bain & Company, April 2020

³⁹ “Traditional Supply Chain Challenges During COVID-19 Spur Innovation in Blockchain Applications” National Law Review, December 1, 2020

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It was more than a feat of factory retooling. Flexible supply chains played a critical role, including rapid raw material sourcing, product design, development and testing, and distribution.”⁴⁰

As stated earlier, resiliency is the new buzz-word within the supply chain industry. However, understanding the importance of it, and achieving it are two different things. Many articles lay out a myriad of ways to accomplish resiliency. The most comprehensive narrative describes five capabilities in which leaders must invest to create resilient supply chains. These five capabilities are described below:

- “Network agility. Reacting quickly to disruption requires a flexible ecosystem of suppliers and partners that can handle sudden shortfalls or even produce new products. That means setting up alternative manufacturing sites and assembly nodes and making the most of Industry 4.0 tools to optimize cost, improve visibility across the network and accelerate reaction times. Leaders develop tailored solutions for each segment of their supply chains to boost performance and cut costs. Those dependent on offshore production move some manufacturing onshore or closer to their core markets. Toyota reduces risk by having one supplier produce 60 percent of the needed parts, and two additional suppliers each produce 20 percent.
- Digital Collaboration. Cloud-based supply chain applications and collaborative platforms and tools enhance information sharing. They also improve the quality and speed of decision making within an organization and with suppliers and other external partners in a secure environment. Amid the COVID-19 pandemic, manufacturers have demanded greater visibility into the supply chains of their suppliers – a practice worth continuing. Leaders are applying automation and robotics to make their supply chain more autonomous and adding suppliers in their home markets to ensure business continuity.
- Real-time network visibility. Control tower solutions that integrate data across the entire supply chain, 5G technology and blockchain offer leadership teams real-time visibility. Companies can better calibrate supply with forecast demand by comparing internal production capacity data with real-time demand signals such as weather data.
- Rapid generation of insights. Leadership teams can stay a step ahead of supply chain disruptions by improving their ability to rapidly analyze internal data and external sources of big data. That means harnessing machine learning and artificial intelligence for predictive and prescriptive analytics. Those tools can deploy early-warning technologies, model risk scenarios and develop preprogrammed responses.

⁴⁰ “Supply Chain Lessons from COVID-19: Time to Refocus on Resilience” Olaf Schatteman, Drew Woodhouse, and Joe Terino; Bain & Company, April 2020

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Increased risk of disruption also requires updated planning parameters and objectives, since old assumptions are no longer valid.

- Empowered teams. Decentralized teams can react quickly to insights generated by advanced analytics and create rapid-recovery capabilities that will help companies navigate smoothly in times of disruption. The frequency and intensity of shocks to the global economy are increasing. The COVID-19 outbreak has exposed just how vulnerable far-flung supply chains have become. What long passed for adequate flexibility is now subpar. Companies that begin investing today in a resilient supply chain will be best positioned to weather the next event that obstructs the global flow of goods.”⁴¹

A technology that was discussed previously herein, and that appears regularly in the responses to COVID-19, is blockchain. “Before the onset of the COVID-19 pandemic, companies were already exploring the promise of blockchain to modernize certain aspects of their supply chains. Traditional supply chains can be inefficient, data intensive and costly, often characterized by burdensome paperwork, conflicting records and delays resulting from manual reconciliation processes involving a series of transactions and document exchanges among multiple parties. Blockchain offers potentially substantial benefits in this context, including the secure and auditable validation of transactions, automated documentation to support legal and customs compliance, improved quality control, enhanced end-to-end transparency (e.g., for verifying sustainability or ethical sourcing standards), and overall improvements in efficiency and cost-control. Indeed, ever since news reports in 2018-29 that Walmart had successfully tested a blockchain platform for food traceability and accountability to track mangoes and other products through the supply chain, entities have been looking in earnest at, and investing in, blockchain solutions targeting the supply chain. Indeed, Walmart has continued to invest and conduct trials of blockchain solutions, having recently announced in August the promising results of Walmart Canada’s use of blockchain technology to reduce inefficiencies and invoice disputes for freight and trucking payments.”⁴²

Still another consequence receiving much attention arising from the COVID-19 pandemic is a resurgence in nearshoring, which is defined as: “The transfer of business processes to companies in a nearby country, where both parties expect to benefit from one or more of the following dimensions of proximity: geographic, temporal (time zone), cultural, linguistic, economic, political, or historical linkages. Nearshoring is a derivative of the business term offshoring. In contrast, nearshoring means that the business has shifted work to a lower cost organization, but within its own region broadly defined.”⁴³

⁴¹ Ibid.

⁴² “Traditional Supply Chain Challenges During COVID-19 Spur Innovation in Blockchain Applications” National Law Review, December 1, 2020

⁴³ “Nearshoring” Dictionary of International Trade, online, December 12, 2020

G. Cross-Border Linkages

Of importance to Nevada is the fact that Mexico has been rated within the top 15 countries for nearshoring in the world. “Mexico continues to be the highest-ranking country in the Americas. Even though it has been a hotspot for decades, we are seeing even more U.S. based companies eyeing Mexico under the current global political and economic climate. It has all the key factors that make it ideal for those seeking to move production closer to the U.S. Labor costs are a tenth of those in the USA. Overall, Mexico is hard to beat with a young, high quality, and lower cost workforce than that of the U.S. The average age in Mexico is 29, which makes it one of the youngest nations in the world. Mexico is set to benefit from the rising wages, tariffs, and trade war with China.”⁴⁴

Perhaps one of the more interesting facts is that wages in Mexico have consistently stayed below those in China. In 2016, wages in Mexico were on the average 23 percent less than in China; in 2020, this differential has increased to 25 percent, as can readily be seen in Figure III-6.

This renewed interest in the potential of Mexico for nearshoring investment has not been lost on infrastructure and transportation companies. “As the coronavirus pandemic continues to disrupt international trade, Mexico stands to benefit from more companies moving manufacturing to North America, said Patrick Ottensmeyer, president and CEO of Kansas City Southern. To take advantage of increased trade, Class 1 railroad Kansas City Southern (NYSE: KSU) recently received a presidential permit to build a second international rail bridge in Laredo, Texas, which could handle up to 30 cross-border crossings daily. The railroad, which runs its Mexican operations through its subsidiary Kansas City Southern de Mexico, operates the largest rail freight-interchange point between the U.S. and Mexico at the border crossing in Nuevo Laredo, Mexico.”⁴⁵

One major obstacle for Nevada, which is geographically positioned to take advantage of nearshoring in Mexico, is the incomplete I-11 interstate link to Phoenix. Without the completion of I-11, Las Vegas will not be able to realize its full potential with regards to nearshoring. Additionally, without the extension of I-11 to the Reno area, Nevada will not participate in the benefits of nearshoring as well.

“The pandemic has forced organizations to prioritize supply chain resilience, with two-thirds (66 percent) stating that their supply chain strategy will need to change significantly to adapt to the new normal. Only 14 percent of organizations are expecting a return to business-as-usual.”⁴⁶

⁴⁴ “Top 15 Countries for Nearshoring” Research on Investment, online, December 1, 2020

⁴⁵ “New USMCA trade deal could increase demand for nearshoring in Mexico” Noi Mahoney, Freight Waves, September 8, 2020

⁴⁶ Supply Chain Resilience is a Priority After COVID-19” Oliver Freeman, Supply Chain, November 27, 2020

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“Between the pandemic and the new U.S. trade tensions, it is evident just how increasingly complex risk management within the global supply chain can be. Although “Black Swan” events such as the Coronavirus are unpredictable in their very nature, the supply chain of the future must be reconfigured to ensure it can be agile for sudden changes. To mitigate risk in this volatile environment, it has never been more important for businesses to have the data, tools and processes in place to respond appropriately, and proactively.”⁴⁷

⁴⁷ “Compliance During COVID-19: Assessing Risk in the Supply Chain” Guy Harrison, Supply and Demand Chain Executive, November 2, 2020

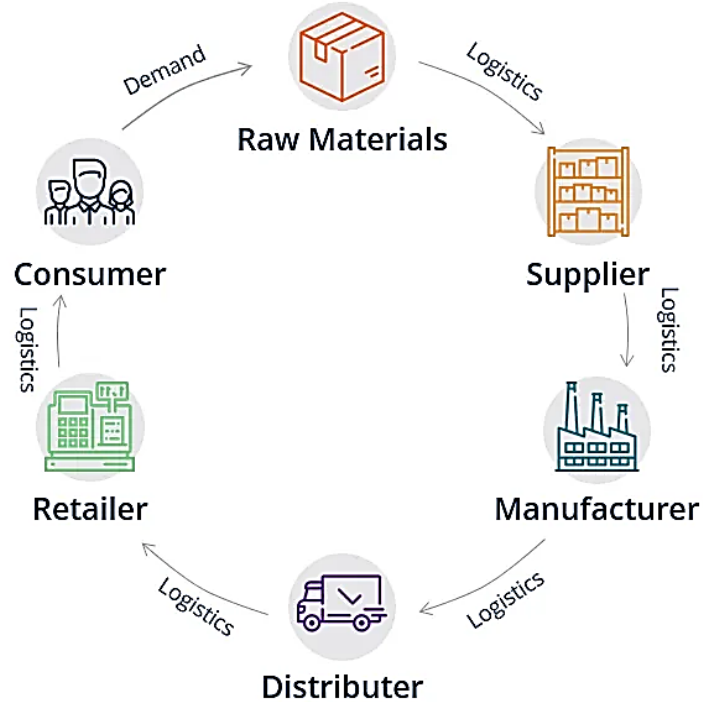
Table III-1: U.S. Top 10 Retailers, by Retail E-commerce Sales (in Billions): 2020

Rank	Company	Retail e-Commerce		% of Total Retail e-Commerce Sales
		Sales	% Change	
1	Amazon	\$309.58	39%	39.0%
2	Walmart	\$46.20	65%	5.8%
3	eBay	\$38.80	26%	4.9%
4	Apple	\$27.51	32%	3.5%
5	The Home Depot	\$16.71	71%	2.1%
6	Best Buy	\$15.70	105.5%	2.0%
7	Target	\$13.82	105.3%	1.7%
8	Wayfair	\$11.66	51%	1.5%
9	The Kroger Co.	\$11.28	79%	1.4%
10	Costco Wholesale	\$11.18	60%	1.4%

"Note: Represents the gross value of products or services sold via the Internet (browser or app), regardless of the method of payment or fulfillment; excludes travel and event tickets."

Source: eMarketer.com

Figure III-1: Supply Chain Example



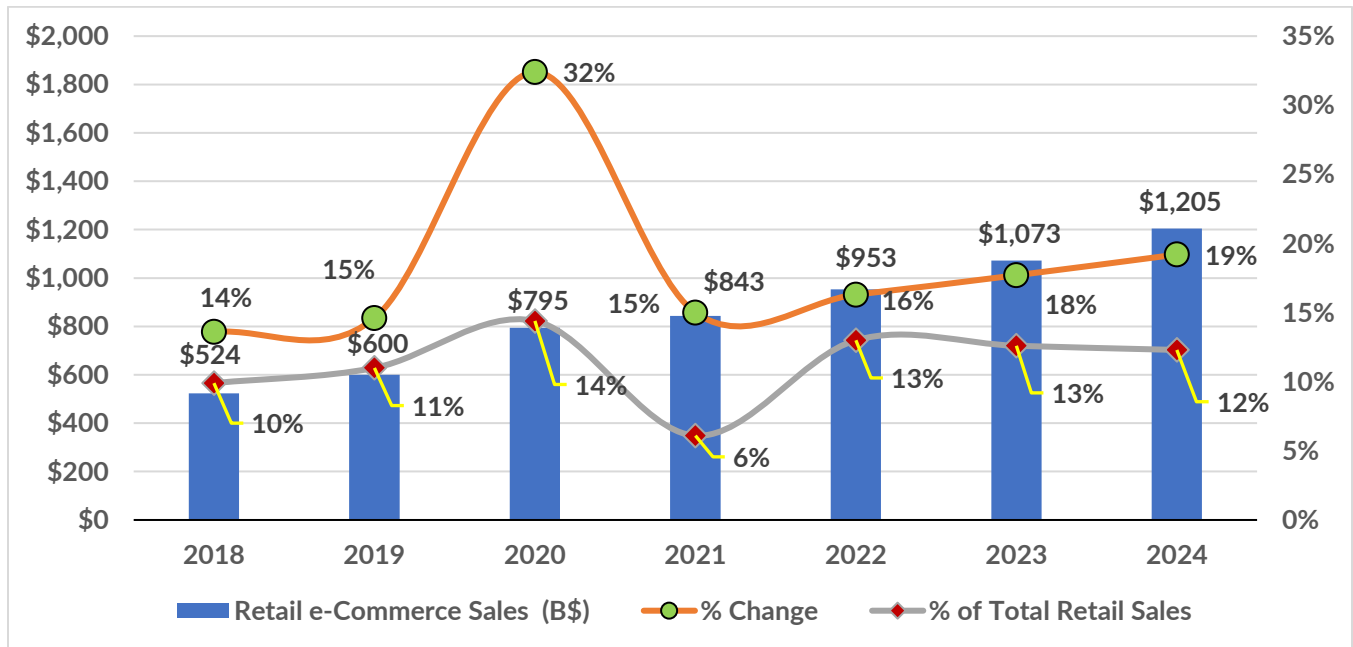
Source: Corporate Finance Institute, 2020

Figure III-2: E-commerce Supply Chain Example



Source: Corporate Finance Institute, 2020

Figure III-3: U.S. Retail E-commerce Sales: 2018 – 2024 (\$ Billions)



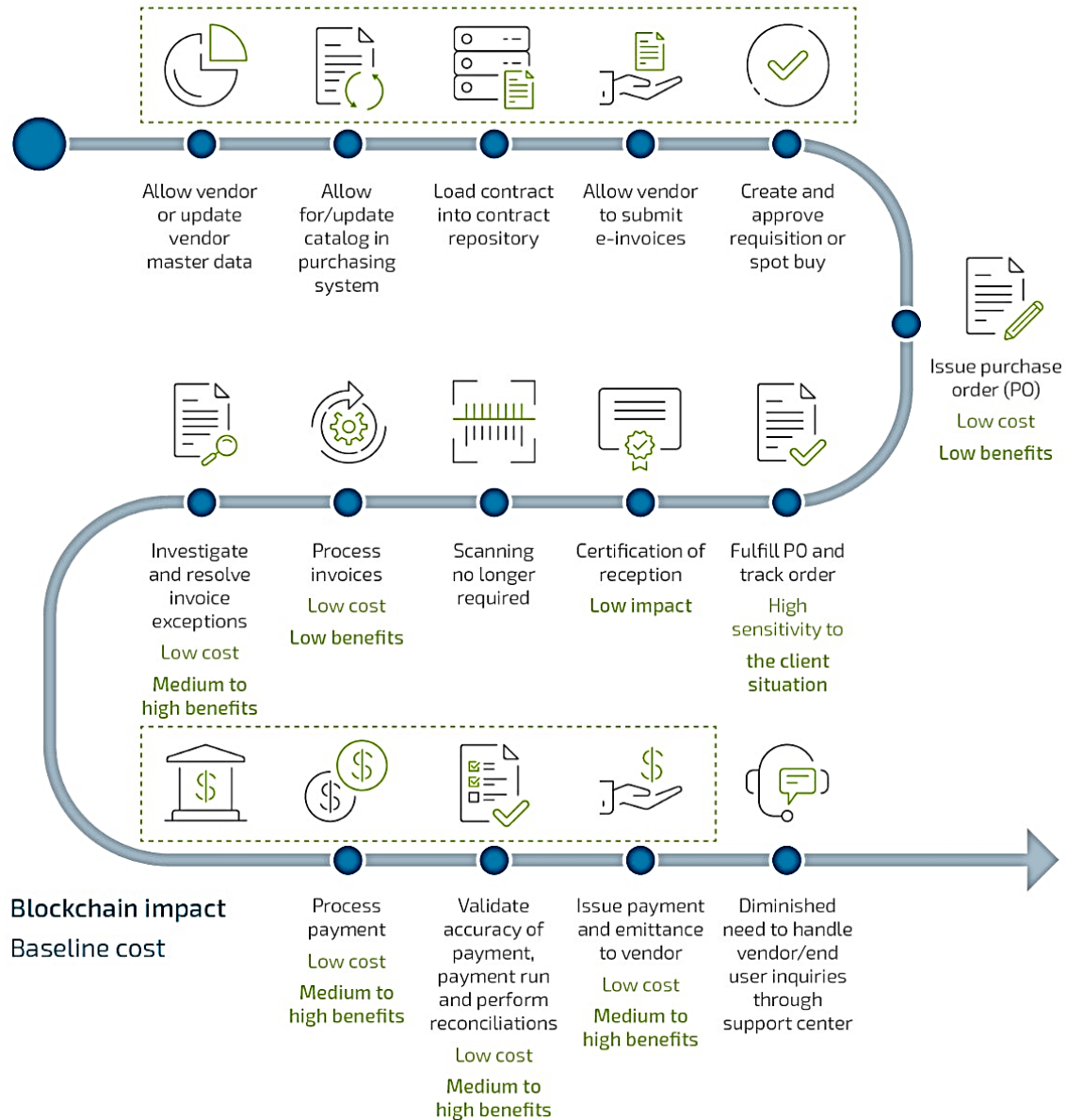
"Note: Includes products or services ordered using the Internet, regardless of the method of payment or fulfillment; excludes travel and event tickets, payments, such as bill pay, taxes or money transfers, food services and drinking place sales, gambling and other vice goods sales."

Source: eMarketer.com

Figure III-4: Blockchain Procure-to-Pay Process

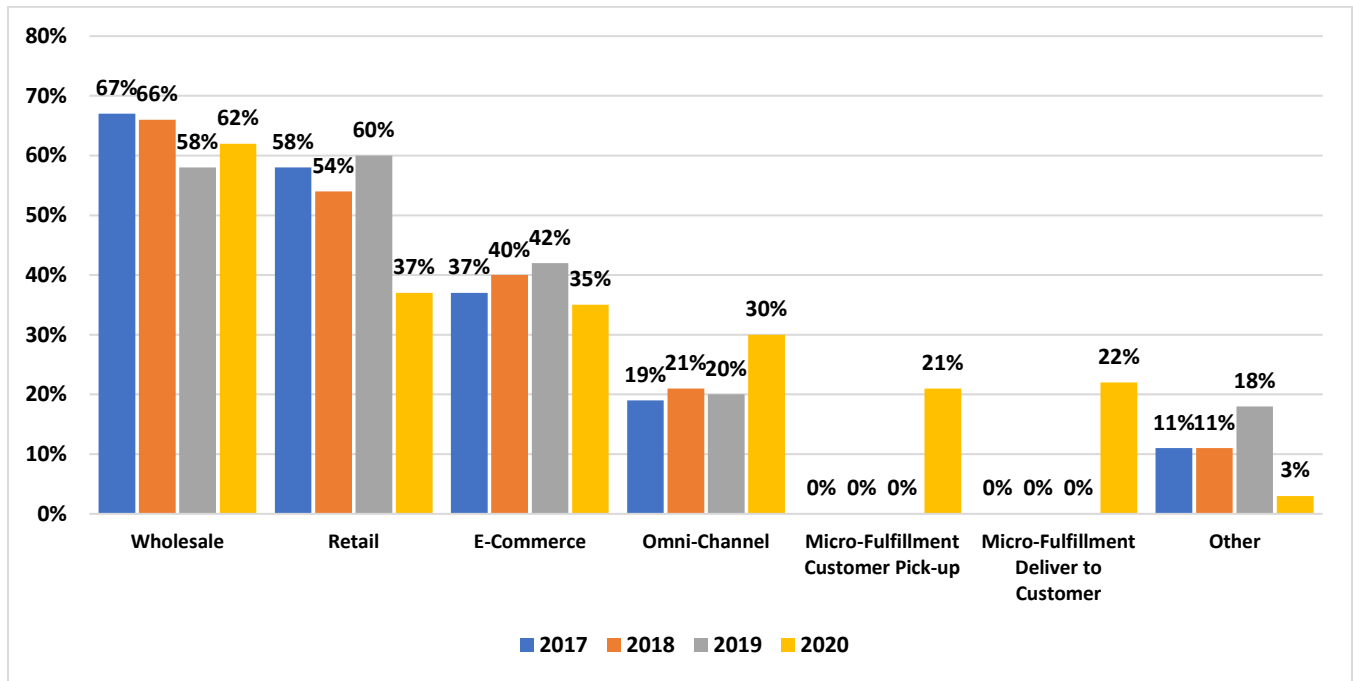
Sensitive to baseline situation

Medium impact



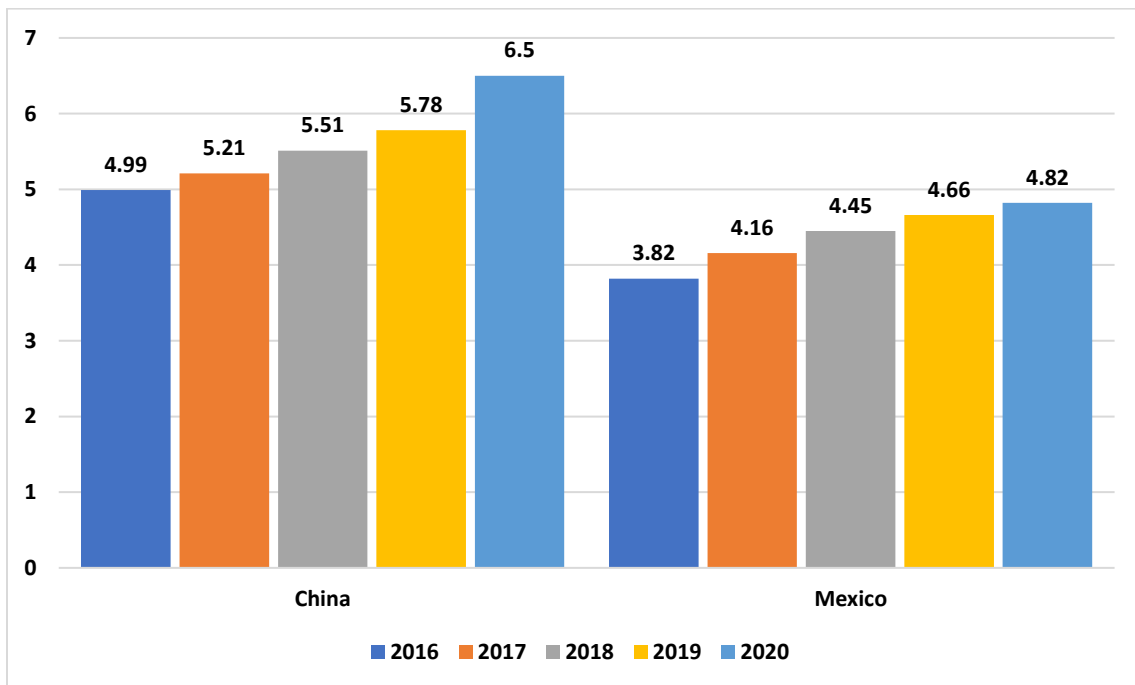
Source: Infopulse

Figure III-5: Market Channels Serviced by Industry: 2017 - 2020



Source: Peerless Research Group

Figure III-6: Manufacturing Labor Costs per Hour for China and Mexico: 2016 - 2020



Source: Tetakawi.com

IV. LOGISTICS IN NEVADA

Understanding Nevada's role in logistics takes on many aspects and was discussed extensively in the Market Demand section of this report. First and foremost is the feasibility of inland ports (facilities to transport containers from the ports in Oakland and Southern California) and intermodal facilities. In conversations with NDOT's Freight Advisory Committee ("FAC"), it was stated that the breakeven distance between rail and truck has been shrinking over the past few years and may now be as low as 250 miles. As noted in this report, our research and other interviews conveys a different story. As stated in the Market Demand section the breakeven distance has been growing due to more energy efficient trucks on the road and other transportation related technologies. The new formula pegs the breakeven distance at 600 – 750 miles, placing all of Nevada, and especially the Reno and Las Vegas areas, within the radius of the advantage going to trucks. This breakeven distance as well as the costs of construction and operation of expensive intermodal facilities, along with requirements for ongoing government subsidies, seems to not make Nevada a candidate for such facilities.

This said, it is important to note that all the information regarding their feasibility is for a generalized facility. Each situation or project has its own set of circumstances that can have a significant impact on feasibility. For this reason, particular attention should be given to the multi-modal feasibility study now being conducted by the Industrial Realty Group for a facility near Fernley. When completed, this specific feasibility study should provide information that could be utilized as an indicator for other projects of its type in the Reno/Fernley/Fallon area.

Also, during a NDOT FAC conference call it was stated that both the Port of Oakland and the Union Pacific Railroad have been contacted and responded positively to the concept of an inland port in Northern Nevada. While this may be the case, and indeed the Port of Oakland may be exploring options for a remote "day port" facilities, experience dictates that large organizations, especially those that must keep a strong and positive relationship with local governments, like the Union Pacific, may be circumspect in providing less than fully positive feedback to state government agencies. So as not to unnecessarily expend resources, a definitive strategy would be to schedule a meeting among the Union Pacific Railroad, the Port of Oakland and Nevada representatives. Only in this manner can an accurate assessment be made regarding the feasibility of an inland port in the state.

Transload facilities also face market demand challenges in Nevada at this time. There are no transload facilities in Reno, and the one in Sparks operates at a small scale. There were two transload facilities (Specialized Rail Service and Pan-Western), in the Las Vegas area, both located in North Las Vegas. Currently, only Specialized Rail Services remains operational, and it is exclusively utilized by the Union Pacific Railroad. Consequently, there are no operational third party transload facilities in the Las Vegas area. This leads to the conclusion that market demand for these types of facilities is presently limited, otherwise the private sector would be currently providing these

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services if they were profitable. Here again, this is a generalized statement and individual project circumstances, and factor could allow for transload facilities to be built in the future. An example may be in the Elko area where the cultivation and processing of cannabis on a large scale is being explored. In this example, the cannabis would be processed into oils and extracts near a rail link. The more valuable processed products would be shipped by truck, and the residual fibers could be bundled and transported by rail to a company that utilizes it in their manufacturing process.

E-commerce provides Nevada with perhaps the best opportunity for economic growth in the short term. As discussed earlier in the report, this subset of logistics continues to grow dramatically, both globally and here in Nevada. The state must make every effort to understand the requirements of this industry and ensure an environment is created that nurtures not only e-commerce itself, but the “last-mile” services that support it. Within RCG’s 2012 Inland Ports Study prepared for GOED, e-commerce was also singled out as the low hanging fruit for the state, along with a recommendation that a taskforce be established just for this industry group. It was further recommended and noted that last mile delivery companies should form the core of an e-commerce taskforce.

We noted in the report, “While the transportation sector should be represented by a sample of companies from the various modes, such as trucking and freight forwarders, it cannot be stressed enough the importance of bringing in every single package delivery company, (FedEx, UPS, DHL, USPS, etc.). The rewards of working with these companies could be tremendous, because for all practical purposes they are site selection consultants to the supply chain industry and at some point may want to be organized into a separate, distinct group for target marketing purposes.”⁴⁸

Last mile companies like FedEx already participate in state sponsored groups such as NDOT’s Transportation Advisory Committee, however, the company is still willing to participate in one that primarily focuses on e-commerce. This is an important differentiation in that transportation advisory groups are facilitated by NDOT and address broad transportation issues while an e-commerce taskforce should be under the jurisdiction of GOED and focus on the economic development efforts of the state and include local government entities as well. By example, Henderson readjusted its traffic signal synchronization near FedEx’s facilities to accommodate the peak period delivery flows resulting in time and cost savings, which is greatly appreciated by the company.

While COVID-19 has had minimal negative effect on last mile delivery systems, residual infrastructure constraints can limit the potential for future growth and expansion. Ken Barnes, Senior Manager for FedEx Ground, has stated that he has high regard for Southern Nevada as a place to conduct business, and he would promote the area for additional regional hub facilities, if there were better highway connections to Southern California, Phoenix and

⁴⁸ “Nevada Inland Ports: Visibility & Funding Study” RCG Economics, September 2012

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Reno. Various sections of I-15 to Southern California many times is at capacity during certain time periods, and one accident can cause unacceptable delays. The completion of I-11 would also be a game changer for regional distribution companies according to Mr. Barnes.

A. Land

Returning to infrastructure is the fact that Nevada has numerous parcels of vacant land that could be suitable for large-scale manufacturing, logistic and business parks, except that they lack infrastructure and many, especially in the Southern Nevada are controlled by the Federal government, especially BLM.

It was announced earlier this year that Northern Nevada has put forth the Truckee Meadows Public Management Act that recommends 90,000 acres of BLM land (approximately half is developable) be made available for sale to better support infill development. While the land earmarked in the lands act is in proximity to existing infrastructure, none of it can be considered “shovel ready.” In addition to this huge tract of land there are also numerous other parcels of land in Northern Nevada along the U.S. Highway 50 and I-80 corridors. Some of these lands are already engaged in various stages of the development process.

The Tahoe Reno Industrial Center (“TRIC”) still has land available and Terra Scale is planning to develop an addition 700 acres, called Energos Reno, near TRIC. However, wastewater systems are at capacity in the area and funding is being pursued for a gray-water pipeline to the TRIC area.

In the Fernley area, Industrial Realty Group is conducting a feasibility study for a multi-modal facility that includes 100M square feet of building space. This should be of particular interest to the state because the private sector is taking on the feasibility analysis that will eliminate any guessing as to the viability of a multi-modal facility. Another major project in the Fernley area is a 4,300-acre industrial center called Victory Logistics proposed by Mark Ford Capital. All in all, there are twelve new industrial parks under consideration in the Fernley area.

Other industrial/logistic projects in the Reno/Fallon area include an undetermined amount of land in the Spanish Springs area along Pyramid Highway, as well as a project called the Western Nevada Rail Park. This rail park is generally located near Highway U.S. 50 and U.S. 95. Railroad track layout for the park has already been approved by the Union Pacific and it would be a rail gateway to the Hawthorne area. However, as is the case throughout the state, infrastructure remains an issue for the entire area.

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Unlike the north, Southern Nevada does not have the supply of land readily available for private large-scale industrial/business/logistic parks. According to a 2020 study by RCG,⁴⁹ for NAIOP of Southern Nevada, the Las Vegas Valley will run out of high-quality developable land around the year 2030. The study found that there are about 19,000 acres of remaining 20+ acre parcels in the region, and that assumes that the BLM releases all land within the disposal boundary. Of those 19,000 acres, only about 9,000 are well-suited to commercial development (see Figure IV-1). Furthermore, of the remaining non-federally-owned parcels of 20+ acres in the Las Vegas Valley, only nine parcels are 80+ acres (see Figure IV-2). Land scarcity is a major issue in Southern Nevada that affects its overall economic prospects and ability to attract large multimodal centers and parks as noted above. Southern Nevada is very dependent on the Federal government to help open up additional land to develop as additional employment centers to protect its economic future.

The area around the Las Vegas Raceway has been developed at an accelerated rate and while parcels of land for development are still available, they can only accommodate individual building projects.

Three sections of land, approximately 2,000 acres has been set aside north of I-215 and Pecos Road in the northern part of the Las Vegas Valley for a satellite UNLV Campus, and associated commercial activities, but those activities would not include large manufacturing or logistic operations.

There is land available that is also suitable for a rail park northeast of the Raceway, but it is owned by BLM, and at this time there are no plans to bring infrastructure to the area. An area that has received offsite infrastructure funding is the 18,000-acre Apex Industrial Park. A \$250M capital project to bring water and sewer to Apex is currently underway. However, completion of these utilities is estimated to take up to eight years.

Within the past decade Boulder City initiated a process that would bring 750 acres of land suitable for manufacturing or logistics operations together in a master planned business park, at the I-11/U.S. 95 interchange. An additional 500 acres could also be incorporated into the park for future needs, but Boulder City who retains ownership of the land, has decided not to pursue the project.

The site that may have the greatest long-term potential for large scale manufacturing and logistics operations is in the Ivanpah area and slated as the next location for an airport to service Las Vegas. The concept for this airport originated as a global airfreight transfer facility. The location in Ivanpah for such a facility holds great promise. The site is located between the Union Pacific main line servicing Southern California and the I-15. And, while rail is seldom associated in tandem with air freight, the rail line could prove invaluable for manufacturing operations.

⁴⁹ RCG Economics. Sep 2020. "Southern Nevada Industrial Land Analysis: Inventory & Implications for Economic Growth & Economic Development." <https://rcgecon.com/wp-content/uploads/2020/10/2020-10-9-NAIOP-Emp-Lands-Rpt-w-Cover-Final.pdf>

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Furthermore, Ivanpah, which sits on the border with California, would be a perfect location from which to perform break-bulk and truck cross-dock operations since California does not allow for triple-trailer trucks. Furthermore, the agreed-upon routes of a high-speed passenger train, as well as the Hyperloop proposal to Southern California, would pass in close proximity.

Another project that may be compatible with this area is the testing, manufacturing, and maintenance of cargo airships that were discussed previously in the Market Demand section of this report. The current leader in this innovative form of freight transportation is Lockheed, and they are conducting work on this vehicle out of their skunk-works facility in Palmdale, California, which is approximately a 2.5-hour drive from Ivanpah. Lockheed could be engaged to build research, testing and manufacturing facilities at the expansive Ivanpah area and perhaps integrate their air operations with those of the airport to be located there. It would even be a good marketing tool for Lockheed to utilize the area for demonstrations and bring potential customers from throughout the world to Las Vegas. Unfortunately, the Environmental Impact Statement ("EIS") conducted for the Ivanpah airport concentrated only on those land uses required to support airport operations only. The original EIS was started in 2005 and covered 6,000 acres but did not include a review for logistic or manufacturing facilities. This EIS was suspended in 2010 but plans are underway to restart the process and could be expanded to 17,000 acres surrounding the proposed airport site, but it is undetermined whether the restarted EIS would include logistic and manufacturing functions. It is imperative that this restart EIS include logistic and manufacturing operations.

Offsite infrastructure is an ongoing issue for all the sites outlined in this Southern Nevada section. Economic development as well as commercial real estate development professionals all rank lack of land available for large scale manufacturing and logistics operations as the single biggest obstacle in Southern Nevada economic diversification.

As Nevada moves forward to address the infrastructure needs of large-scale manufacturing as well as business and logistic parks, there could be a wave of requests to service large parcels throughout the state. In all likelihood there will not be enough funding to accommodate all these requests, and political considerations are likely to emerge. To minimize these considerations to the greatest extent practical, it will be essential to devise a rating system based on the merits of a site and location that would be adopted before the first government financial outlays occur and to provide transparency to the process. Elements of this selection criteria could include:

- Target supply chain enterprises, emphasize manufacturing, logistics, and the creation of well-paying skilled basic jobs
- Wet utilities should be the priority, followed by power and telecommunications

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- A cost benefit analysis should be required before funds for a loan are obligated to a project to identify those sites, utilizing the following criteria proposed, having the highest propensity for success and contribution to the state's economic development efforts
 - Buildable land (no natural or manmade barriers)
 - Buildable acres map
 - Distance to interstate highways
 - Distance to all weather airports
 - Single ownership of land
 - Compatibility with surrounding land uses
 - Local land use/zoning designation, including allowable uses
 - Population/workforce within 15 – 20-mile radius/30-minute commute
 - Land uses alignment with GOED target industry clusters
 - Master plan of property
 - Phase I environmental study
 - Geotechnical study
 - Flood zone/drainage plan
 - Site development cost estimates
 - Proximity to community services
 - Visibility for potential high-profile users
- Provision to ensure that “windfall profits” do not accrue to a singular development entity, so that any incentive produced by this funding is passed on to those activities producing the optimal economic benefit, (employment, taxable revenues, etc.)
- Mechanism to allow State participation in site utilization as an economic incentive for appropriate companies, and corresponding balance due offset
- An oversight committee to review site criteria and award funding

B. Integrated Connectivity Corridors

Integrated connectivity within the state has been studied extensively over the last decade and has been discussed in the Section II, *Nevada: The Current Situation*, of this study. I-80 and I-15 are the economic lifeblood of Northern and Southern Nevada, respectively. Efforts should focus on extending the six lanes of I-15 currently operation in Nevada to the Inland Empire in California. I-80 must also be studied to identify any choke points between Reno and I-5. Particular attention should be paid to the bottleneck of I-80 through downtown Reno. Without exception,

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all the major industrial/logistic centers planned for the Reno to Fallon area lie east of downtown Reno, and it is safe to say that the vast majority of truck freight traffic will be heading west to the I-5 commercial spine of the west coast. This will place a large strain on a highway already dealing with capacity issues at various times of the day. Two solutions that could be explored are to double-deck I-80 through downtown Reno (the land uses infringing on route, such as Saint Mary's Regional Medical Center will be costly, if not impractical to relocate). Alternatively, an interstate bypass or truck route could be established along the northern route of highway 659, though that too would require significant relocation costs.

One of the most impactful project to Nevada's future is the extension of I-11 from Las Vegas to I-80 and beyond. Time and time again various studies and conversations with economic development agencies, truck freight interests, last mile delivery companies and real estate developers have emphasized the need for I-11 as a connectivity corridor linking North and South Nevada. The importance of this connectivity cannot be overstated. However, if Nevada wishes to realize this connectivity in a somewhat timely manner, it must also study and promote the benefits to the entire western region, as well as the entire country. The cost of I-11 is so great that the political power of Nevada alone will not see the project to fruition.

In addition to an economic impact study outlining the benefits Nevada growth has on California, a focus should be on establishing a new United States-Mexico-Canada Agreement ("USMCA") corridor along an I-11 route that spans from Mexico to Canada through the states of Arizona, Nevada, Oregon and Washington, or perhaps Idaho, whichever alignment would garner the most political and financial support to complete the project. This route would not only take advantage of the renewed interest in nearshoring in Mexico but should be touted as an interstate truck route or alternative to the often congested I-5 corridor through California, Oregon and Washington. I-5 runs through the most densely populated areas of those three states, which may be an opportunity to gain support for I-11 as a truck route, or traffic congestion reliever. For example, "Oregon's Department of Transportation ("ODOT") is proposing to spend half a billion dollars to add two lanes to Interstate 5 at the Rose Quarter in Portland, with the hope that it will help relieve traffic congestion. But practical experience with freeway widenings in this area shows that more capacity actually makes the traffic worse. Today we show evidence that when ODOT widened I-5 between Lombard and Victory Boulevard a few years ago, it only managed to funnel more traffic more quickly into the I-5 Columbia River bridge chokepoint. The result: the bridge actually carried less peak hour traffic than before. The practical experience with widening I-5 shows that eliminating bottlenecks in one place simply leads to the more rapid congestions of the next downstream bottleneck and, ironically, lower throughput on the freeway system. It might seem paradoxical that highway engineers would allow this to happen, but if you're more interested in generating excuses to build things, rather than actually managing traffic flows, it makes some sense."⁵⁰

⁵⁰ "Backfire: How widening freeways can make traffic congestion worse" Joe Cartwright, City Commentary, February 26, 2019

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The idea of utilizing an interstate as a truck route or traffic reliever that runs parallel at a relatively close distance to an existing interstate that connects large population areas has been employed before in the United States. I-81 is a major north/south interstate linkage that runs parallel to I-95, one of the most congested interstates in the U.S. today that links the major population centers of the eastern seaboard. I-81 runs from Knoxville, Tennessee, through Virginia, Maryland, Pennsylvania and New York, to the Canadian border. Its route does not go through a city with a population over 100,000 people. Being mostly rural, I-81 is heavily utilized as a truck corridor and is often used as a bypass of busier interstates to the east. I-81 was initiated by a six-state coalition which was organized to handle issues such as truck traffic and air pollution. I-81 is part of the fastest route between Washington D.C. and Ottawa, Canada. The commission organized to oversee the project still meets today and could prove to be a blueprint as to how Nevada might organize a coalition of states for I-11. It is important that Nevada contact the I-81 commission to learn as much as possible as to their success.

Homeland Security may also prove to be another avenue to pursue the completion of I-11. Should I-5 experience a lengthy shutdown due to accidents, terrorist plots, or inclement weather, the United States should have an alternative route to keep the west coast economy moving.

Another approach Nevada could consider is the rerouting I-11 from its current proposed alignment through Las Vegas to Beatty. Even though an environmental impact statement is currently being conducted for a U.S. 95 highway alignment, the state could look at another alignment which takes I-11 west from Las Vegas along highway 160 through Pahrump. Pahrump is one of the largest population areas in Nevada. As can be seen from Table IV-1, if Pahrump were a municipality, it would be the seventh largest city in the state. The U.S. 95. alignment west from Las Vegas passes through sensitive areas controlled by the U.S. Department of Energy, U.S. Fish and Wildlife and the U.S. Department of Defense (see Figure IV-3).

And, though obtaining land from the BLM for large industrial/logistic parks can be burdensome, it is an easier task than obtaining land from the Department of Energy, Department of Defense, or the U.S. Fish and Wildlife. Pahrump offers wide open spaces and in time could be comparable to U.S. Highway 50 east of Carson City. Such a project has the potential provide Nevada with additional opportunities for economic growth. Also, a highway segment could be constructed from Pahrump to the Ivanpah area in the southern part of Clark County, linking the future airport and its commercial environs to Northern Nevada, and could even be utilized by trucks from the Inland Empire traveling north to Oregon, Washington and Canada.

There is also a proposal to include I-11 into what has been called the Nevada Technology Corridor. In addition to I-11, the corridor would also be the route of a reconnected rail line between Las Vegas and Reno. It is believed that the new rail lines would only have to be extended from Las Vegas to Hawthorne where it would connect with the Thorne Branch line. While this rail connection may be desirable, it should be viewed as a long-term project due to

its costs. Assuming the Thorne Branch line can accommodate heavier and faster rail traffic, it is still approximately 315 miles from Las Vegas. Based on that mileage, it would still cost between \$502 and \$572M for a single high-speed track. Should two tracks be desirable, one for high speed and one at standard speed, the estimate increases to \$2.5M per mile, for a total cost of \$788M.

C. Conclusions

One of the first items contained within the “Infrastructure Road Map” outline for Nevada is: “Whole Nevada approach: integration and collaboration.” This is a key element to Nevada’s economic future. Nevada has always strived to act in a well-coordinated statewide economic development approach—and for good reason. The divide between North/South and Urban/Rural has persisted over the last few decades. While politics and the vast open spaces in Nevada most likely contribute to the lack of economic integration, current and historical spatial economics is the primary reason. The economic gravity exerted by Los Angeles, the Bay Area and Salt Lake City is difficult to break. This, in addition to lacking a well-developed transportation network throughout the state (e.g., the only way to fly into Elko on a scheduled airline is through Salt Lake City), has hindered Nevada’s attempts to form a comprehensive state-wide integrated economic development policy.

Perhaps the best policy would be to recognize the economic linkages from outside the state and separate into strategies (e.g., taskforces) that address the needs and geographic situations of the different parts of Nevada. This may entail the creation of three or four focus groups, based on geo-economic areas, which can concentrate on their economic conditions and strengths, without interference from geo-political forces. When each designated region formulates its conclusions, based on their situation, they can all come together to “hammer out” a state-wide strategy, much like a political caucus. This approach of recognizing Nevada’s three distinct geo-economic regions will make for a timelier statewide policy. It may also be helpful for the state to conduct a “distance-decay” study to better determine the exact spheres of spatial economic influence the three major economic centers of the state exert throughout the rural areas.

Redefining Nevada’s role in the Western U.S. macro-region is vital if the state is to develop an economic development strategy that plays to its strengths and does not expend resources pursuing projects that are not compatible with regional economic realities. First and foremost is to not redefine Nevada’s role in the region, but rather accept it. To use the term “redefine” infers that Nevada can exclusively decide its role in the Western U.S.’s economy. California’s economy at \$3.1T (2019) of annual gross state product is not only the largest in the U.S. but would rank as the world’s fifth largest economy if it were a sovereign nation. What the state can do is understand its role and develop strategies that complement the regional economy and Nevada’s competitive advantages. Being congruent with Southern and Northern California megaregions will provide Nevada with an effective path to economic resilience, growth and development.

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This concept of Nevada being a part of a much larger market area is readily accepted by the majority of economic development practitioners and economists in and out of the state. Most economic development marketing materials vigorously tout Nevada's proximity and accessibility to West Coast markets, usually in tandem with the state's low business tax regime. However, for example, no matter how low a state's tax burden is, it will not, in and of itself, be a determining factor in location selection if the state does not have direct and timely accessibility to large population centers and markets. We have observed over the years the belief by some in Nevada that the state can have a stand-alone economy that can be retooled without fully considering California, or other western states for that matter. This is not the case.

As will be discussed later, the infrastructure projects having the largest impacts on the state's economy: the widening of I-15 from Las Vegas to Southern California, the widening of I-80 between Reno and I-5, particularly addressing the route through downtown Reno and the completion of I-11 from Phoenix to Reno will all require a collaborative effort with the other states in the western region, especially the political power of California.

To accomplish this, Nevada must find a way to engage California in a manner that benefits both states. As an intermediary step, a study should be undertaken to determine the economic impact Nevada's growth has on California. This recommendation is rooted in another study that was attempted in the early 1990's. Southern Nevada and California were collaborating to attract the first super collider potentially located in the United States. The agreed upon site straddled the Nevada/California border west of Pahrump, Nevada and north of Baker, California. At the time, the City of Las Vegas and the UNLV Center for Business and Economic Research ("CBER") were attempting to quantify the economic impacts of such a project to Nevada to determine the magnitude of the incentive to be offered by the state. CBER had just purchased one of the first commercially available input/output models, but because of its cost Nevada was the only geographic area for which the data was available. Consequently, the full impact of the project could not be determined because the model predicted that only between 35 – 40 percent of the economic benefits from the project would accrue to Nevada even though Las Vegas was the closest metropolitan area to the proposed super-collider site. While it was not known exactly what area(s) would receive the majority of the economic impact, it was assumed to be Southern California. Knowing the impact Nevada has on the California economy, (there may be a need for two studies, one for the north and one for the south) would arm GOED with information on which to devise a strategy that entices California to support the state's efforts.

While California is the predominant economic and political entity in the Western U.S., it is also imperative that Nevada engage Arizona, Idaho, Oregon and Washington as well.

Table IV-1: Population of Nevada Cities & Places: 1980 – 2019

Name	Status	1980	1990	2000	2010	2019
Las Vegas	City	164,674	258,295	480,042	584,489	651,319
Henderson	City	24,363	64,942	175,480	257,001	320,189
Reno	City	100,756	133,850	183,547	225,317	255,601
North Las Vegas	City	42,739	47,707	116,527	216,667	251,974
Paradise	CDP	84,818	124,682	186,070	223,167	245,000
Spring Valley	CDP	...	...	117,390	178,395	220,000
Sunrise Manor	CDP	44,155	95,362	156,120	189,372	200,000
Enterprise	CDP	...	6,412	14,676	108,481	190,000
Sparks	City	40,780	53,367	66,426	91,117	105,006
Carson City	Mun	32,022	40,443	52,477	55,269	55,916
Whitney	CDP	...	...	18,273	38,585	45,000
Pahrump	CDP	...	7,424	24,631	36,441	38,000
Fernley	City	...	...	8,609	19,368	21,476
Elko	City	8,758	14,736	16,473	18,341	20,452
Mesquite	City	...	1,873	9,505	15,276	19,726
Boulder City	City	9,590	12,567	14,974	15,020	16,207
Summerlin South	CDP	...	...	...	24,085	...
Sun Valley	CDP	8,822	11,391	19,461	19,299	...
Spanish Springs	CDP	...	...	9,018	15,064	...

Source: U.S. Census Bureau

Figure IV-1: NAIOP Southern Nevada Industrial Land Analysis Executive Summary: 2020



EXECUTIVE SUMMARY: SOUTHERN NEVADA INDUSTRIAL LAND ANALYSIS
INVENTORY & IMPLICATIONS FOR ECONOMIC GROWTH & ECONOMIC
DEVELOPMENT ("THE STUDY")
JULY 2020

Study Purpose & Need

NAIOP-Southern Nevada ("NAIOP") commissioned RCG Economics ("RCG") to prepare an analysis whose main purpose was to investigate the issue of land scarcity in Clark County (or the "Las Vegas MSA"; "Southern Nevada"). The focus of RCG's scope of work was to evaluate whether future short- and long-term developable land constraints that could negatively impact the region's economic resilience. The Study Period used goes from 2018 through 2035.

Note: RCG did not consider the negative impacts on the Clark County economy associated with the COVID-19 pandemic. The Study was essentially completed prior near closing of the Clark County economy in mid-March 2020.

Recommendations & Major Findings

- Nevada's Congressional delegation should immediately and aggressively pursue changes to federal law included in the Southern Nevada Economic Development and Conservation Act to expand Southern Nevada's disposal boundary.
- Southern Nevada will face a land shortage, stunting economic development around 2030 if nothing is done to expand regional access to lands; sooner if the BLM fails to release lands as needed.
- There are roughly 19,100 gross acres of developable employment land in 198 parcels of 20+ acres remaining in Clark County.
- Approximately 9,100 of those acres are most optimal for development. Includes federally-owned parcels that have not yet been released under SNPLMA.
- The region is projected to require about 14,100 acres of developable employment land to meet the needs of the expected economic and job growth by 2035.
- Based on the estimated 9,100 acres note above, there would be a deficit of 5,000 acres.
- Failing to ensure an adequate supply of employment land could lead to a reduction in yrly. gross regional product growth from 2.8 percent per year to 1.5 – 2.0 percent per year.

Three Forecast Scenarios Developed (2018 – 2035)

- Base-Case (No land constraints)
- 3% cost disadvantage (due to land constraints)
- 5% cost disadvantage (due to land constraints)

Economic Output Impact

Base-case: Average yrly. growth rate: 2.8% or \$119.4 billion reaching \$318.3 billion in 2035

3% cost disadvantage: Avg. yrly. growth rate: 1.9%
Growth reduction over Study Period: \$43.6 billion or by 13.7%

5% cost disadvantage: Avg. yrly. growth: 1.3%
Growth reduction over Study Period: \$69.5 billion or by 21.8%

Job Impact

Base-case: Avg. yrly. growth rate: 1.9% or 504,000 jobs reaching 1.8 million in 2035

3% cost disadvantage: Avg. yrly. growth rate: 1.2%
Growth reduction over Study Period: 204,800 jobs or by 11.3%

5% cost disadvantage: Avg. yrly. job growth rate: 0.7%
Growth reduction over Study Period: 329,100 jobs or by 18.1%

Earnings (Wages and Business Income) Impact

Base-case: Avg. yrly. growth rate: 2.8% or \$40.4 billion reaching \$109.1 billion in 2035

3% cost disadvantage: Avg. yrly. growth: 2%
Growth reduction over Study Period: \$12.2 billion or by 11.1

5% cost disadvantage: Avg. yrly. labor income growth: 1.6%
Growth reduction over Study Period: \$19.5 billion or by 17.9%

Gross Regional Product Impact

Base-case: Avg. yrly. growth rate: 2.8% or \$71.7 billion reaching \$191.3 billion in 2035

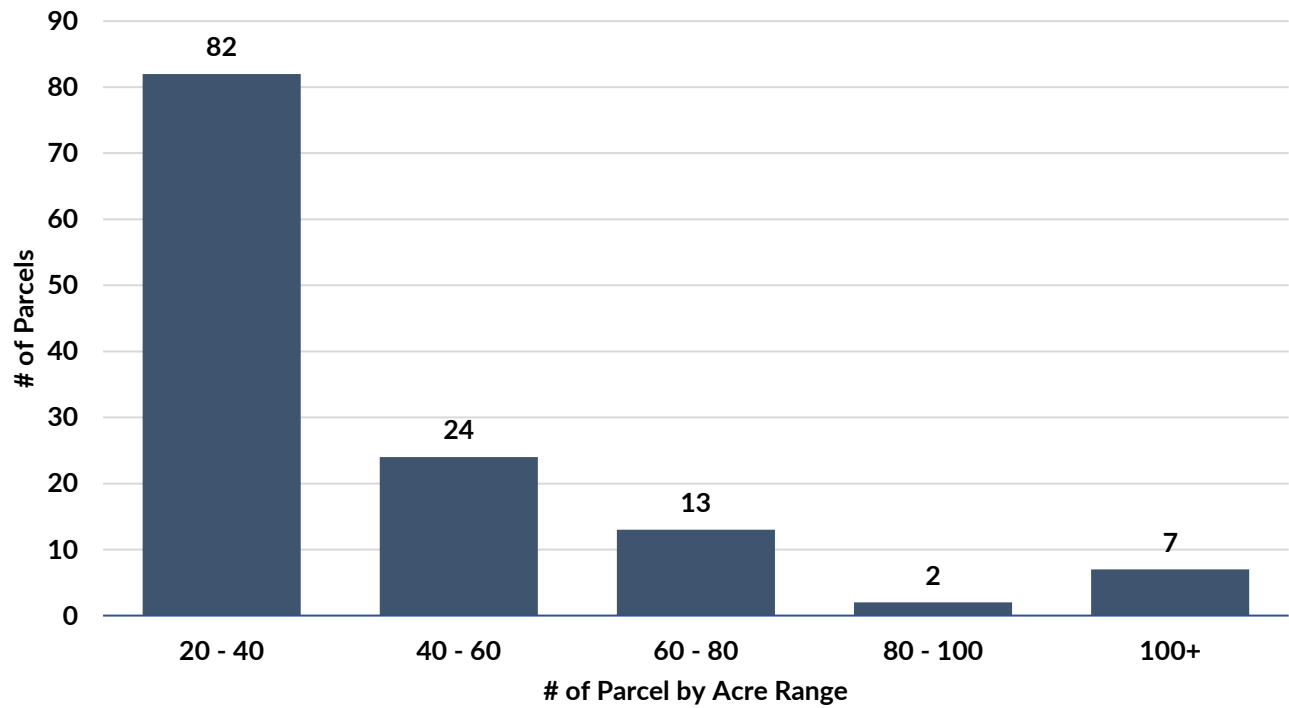
3% cost disadvantage: Avg. yrly. growth: 2%
Growth reduction over Study Period = \$22.5 billion or by 11.8%

5% scenario disadvantage: Avg. yrly. growth: 1.5%
Growth reduction over Study Period = \$36.1 billion or by 18.9%

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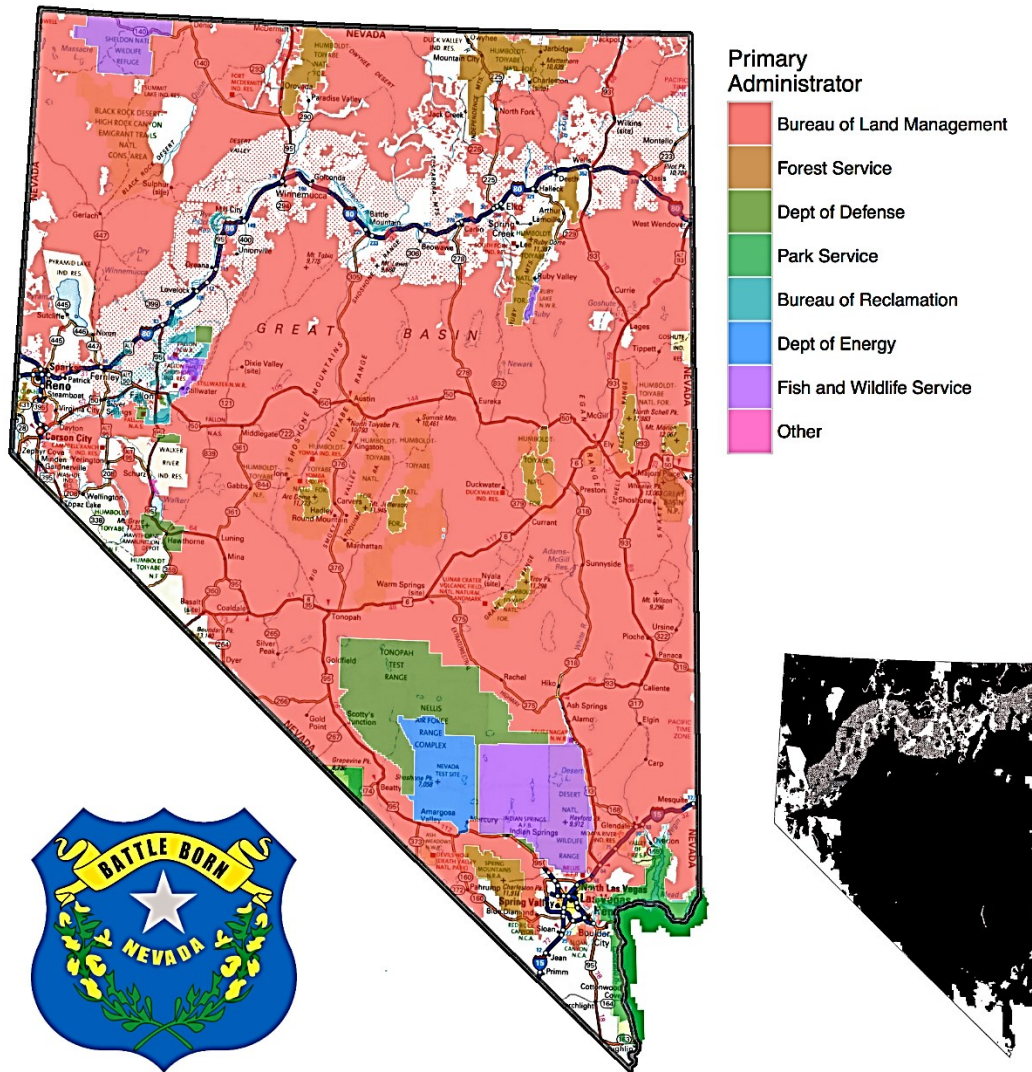
Source: RCG Economics

Figure IV-2: Non-Federally-Owned Parcel Inventory, by Acres: 2019



Source: RCG Economics

Figure IV-3: Land Owned or Administered by the Federal Government: 2019



Source: U.S. Department of the Interior

V. MARKET DEMAND

Unlike manufacturing which makes its location decisions based on one or more of the following variables: raw materials, market, labor and transportation, logistics operations focus on population centers. The term “hub and spoke” is often used to describe the logistic process in that the geographic location of the facility will be at a location that can service the most people in the shortest delivery times. Once again, Central Place Theory takes center stage:

“One of the most enduring concepts in urban geography is the Central Places Theory, with its emphasis on centrality as a feature of the urban hierarchy. Cities more centrally located to markets are larger with a broader range of functions. Transport accessibility is equated with size, and thus many large terminals arise out of centrality. Centrality in turn focuses on the terminal as a point of origin and destination. Thus, centrality is linked with the generation and attraction of movements, which are related to the nature and the level of economic activities within the vicinity of the concerned terminal.”⁵¹

While centrality is still the major focus of logistic centers, the areas of service have shifted over the past few years from a single metropolitan area to the entire United States and even the globe (see Figure V-1).

This aspect of centrality is especially important to Nevada in that both its major population and economic activity centers are located at the eastern-most edges of their respective megaregions. Figure V-2 is an excellent depiction of the size of the Nevada market, as well as the population centers east of the state. As can be seen from the figure, most of the population within a one-day truck haul from anywhere in Nevada lies to the west of the state along I-5, with some additional population centers to the south in Arizona.

Nevada’s location at the eastern edge of California, as well as its relatively small population centers as a percentage of the megaregions, combine to make the state a net importer of freight. Figure V-3 brings into focus the imbalance of freight movements.

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; b) even more aggressive growth in outbound freight is made possible by investment into

⁵¹ “Transport Terminals and Hinterlands” Dr. Jean-Paul Rodrigue, Dr. Brian Slack and Dr. Theo Notteboom, The Geography of Transport Systems, 2017

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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.⁵²

This trade imbalance is perhaps the single largest deterrent to large-scale logistic centers locating in Nevada. Transportation systems require near equal inbound and outbound flows of goods and commodities to become feasible. And, while the Freight Study offers some solutions to combat this imbalance, there is no way of determining whether they will, or can, take place in the future. While Northern Nevada has made great strides in attracting companies with outbound freight movements, there is still challenges that must be faced. Even if Nevada is successful in achieving a trade balance, it will take years, if not decades, to accomplish.

"Non-metallic minerals" is the only commodity among Nevada's top five that ships more outbound product than is imported, and the vessels utilized to transport this product are specialized to the exclusion of being adaptable for general logistic or supply chain uses. Table V-1 provides a detail of Nevada's top five commodities for both tons and value.

As can be seen from the table, high value commodities, such as machinery and electronics, which would favorably affect the freight imbalance, are imported into Nevada at a rate almost three times higher than those exported.⁵³ Additionally, Nevada is a truck market, as can readily be seen from the table in Figure V-4.

The most recent figures show that trucks carry over 10 times more freight tonnage than rail, and this disparity continues with little improvement in the 2040 projections. The imbalance is even more pronounced when the value of the shipments is compared. Trucks carry 57 times more valuable products than rail in the base-year and climb to an astounding 84 times more value in the 2040 projections.⁵⁴

This imbalance, as noted earlier, can become equalized with more manufactured products either finished goods or as components within the supply chain, or through the development of large logistic centers. Manufacturing provides the best alternative to correcting this imbalance, because logistic centers requiring multi-modal facilities continue to face economic and financial challenges.

"Terminals may be points of interchange within the same modal system, which ensure continuity of the flows. This is particularly the case for air and port operations with hubs connecting parts of the network. Terminals, however, are also critical points of transfer between modes. Buses and cars deliver people to airports, trucks haul freight to rail terminals, and rail brings freight to docks for loading on ships. One core attribute of transport terminals is their convergence function. They are obligatory points of passage, capitalizing on their geographical location, which is

⁵² "Nevada State Freight Plan" Nevada Department of Transportation, January 2017

⁵³ Ibid.

⁵⁴ Ibid.

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generally intermediate to commercial flows. Thus, transport terminals are either created by the centrality or the intermediacy of their respective locations.

Three major attributes are linked with the importance and the performance of transport terminals:

- **Location.** The locational factor of a transport terminal is obviously to serve a large concentration of economic activities, representing a terminal's market area. Specific terminals have specific locational constraints, such as port and airport sites.
- **Accessibility.** Accessibility to other terminals (at the local, regional and global scale) as well as how well the terminal is linked to the regional transport system is of importance.
- **Infrastructure.** The primary function of a terminal is to handle and transship freight or passengers since modes are physically separated. They have a nominal capacity, which is related to the amount of land they occupy and their level of technological, labor, and managerial intensity. Infrastructure considerations are essential as they must accommodate current traffic and anticipate future trends along with technological and logistical changes. Modern terminal infrastructures consequently require massive investments and are among the largest structures ever built. A utilization rate of 75 to 80 percent of design capacity is considered optimal.”⁵⁵

Table V-2 provides development cost estimates for several types of intermodal rail terminals. As noted above these facilities come at considerable expense, so utilization for cost efficiency is paramount. Additionally:

“Broadly speaking, it is possible to identify seven characteristics of infrastructure investments, which might also have implications for terminal investments. First, the expected economic life of infrastructure is very long and may range from 20 years to more than a century. The payback period of infrastructure investments is also long, typically 15-30 years. In general, private investments must generate profits in a far more restricted period (5-10 years), meaning that there will be no investment in intermodal rail terminals (“IRT”) without government involvement. Second, during the construction time, a large amount of capital is required. This large investment in IRTs leads to immediate costs, while the sales cannot yet be realized. A third feature of infrastructure investments is that the waiting period, prior to actual infrastructure construction can be very long due to the time involved in political decision-making. These formalities often lead to project changes that might influence the costs of IRT projects. In general, private companies are not willing to run these political risks, which is the reason for government intervention in IRT investment. A fourth characteristic is the irreversibility of the investments once the project has

⁵⁵ “The Function of Transport Terminals” Dr. Jean-Paul Rodrigue and Dr. Brian Slack, *The Geography of Transport Systems*, 2017

started. From the investor's point of view, the irreversibility of IRT investments is a fundamental obstacle, which increases the threshold of the minimum rate of return required. The fifth feature of infrastructure investment is the long construction period. This period may take two to seven years, depending on the scale of the project. During this period there are no revenues; however, there are already interest payments and other costs. A sixth characteristic is the uniqueness of each infrastructure project. This is likely to have an influence on cost estimates owing to lack of experience, low learning possibilities, and lack of comparability. Finally, the seventh characteristic, in many cases, is the relatively low level of operational (variable) costs. In such cases, setting prices according to marginal costs, which is economically optimal, does not allow for a satisfactory return on investment. This typically makes infrastructure investments (including IRTs) unattractive to the private investor."⁵⁶

Economic feasibility of IRTs depends on two variables: size of the IRT and level of utilization. Figure V-5 provides relative handling costs for the five different sized IRTs depicted in Table V-2. Specifically:

"Given the analysis of the cost characteristics of IRTs, the average costs per handling are not high because only the necessary investments are made and in this sense the cost characteristics are representative. The analysis demonstrates that extra-large IRTs actually have the lowest handling costs, followed by small IRTs. The highest IRT handling costs occur at the medium and large terminals because these terminals require relatively large investments. When the real costs of IRT handling are calculated and compared to market prices, it reveals that the price for an IRT handling is, in fact, lower than the average handling cost, except for extra-large terminals operating near full capacity. This means that when comparing terminal handling costs with its price, the costs are not in all cases representative. Given the cost structure of IRTs, terminals have several options to cope with difficulties resulting from the cost characteristics: (1) reduce costs by changing terminal design, (2) obtain subsidies, (3) offer extra services to generate extra sales that generate profits, and (4) reduce terminal service quality without harming the core handling activity.

One way for IRTs to cope with their difficult cost situation is to offer extra services to customers to generate more profits. These include services such as cleaning and/or repairing containers, inland waterway and/or rail transport, pre- and end-haulage, and logistics. In principle, this could be a good strategy to generate more sales, make more profits, and increase the quality of the terminal services. In the final strategy, the terminal operator might concentrate on reducing terminal service quality without harming the core activity of the terminal, the handling service. In this strategy, operating hours could be limited, the quality of the personnel (such as knowledge and responsiveness) could be reduced, and additional terminal services might be eliminated from the terminal service assortment. Ultimately, the main

⁵⁶ "A review and analysis of the investment in, and cost structure of, intermodal rail terminals." Bart Wiegman and Behzad Behdani, Published online, March 2017

aim of an IRT should be to make handling costs equal to, or lower than, the market price of rail handling. In economic terms, there appears to be no way for IRT operators to become profitable without subsidies.”⁵⁷ With economic subsidies required for most IRTs, it is important to identify key roles in the development and operation of an intermodal or inter-terminal transport (“ITT”). Generally, three types of actors have been discussed in the hinterland ITT literature: policymaker, transport operator (freight forwarder and/or carrier), and terminal operator. The policymaker could be a regional or national government agency that provides subsidy, determines the land use, makes regulations, or owns the infrastructure; the freight forwarders organize the transport in cooperation with terminal operators and transport operator, who runs a fleet of transport vehicles. Specially, in the railway transport system, there could be an infrastructure manager who is responsible for infrastructure construction and maintenance. The responsibilities of port ITT stakeholders are relatively clear in the existing research: the terminal operator could run ITT service on a self-owned network; the transport operator could transport ITT containers if these operations are profitable, and the port authority is also assumed to act as a third-party ITT provider. However, the situation is more complicated in the hinterland. The existing research shows that the multiple policymakers, such as local government, national government, and international organizations, are involved in the hinterland ITT. These policymakers play a significant role as they not only determine the network layout and subsidize the infrastructure construction, but also get involved in the transport and terminal operations.”⁵⁸

In summary, five main criteria ensure that inland terminals fulfill their role as an interface between global and regional freight distribution systems efficiently:

- “Site and situation. Like any transport facility of significance, an inland port requires an appropriate site with good access to rail or barge terminals as well as available land for development. Access to an area of significant economic density, such as a large population base, is important since it will be linked to the level of traffic handled by the inland port. Transportation remains the most significant logistics cost, underlining the importance of an accessible location. Several inland ports also have an airport in proximity, which can help support a variety of freight activities.
- Massification. The hinterland massification opportunities offered by inland ports are associated with lower transport costs and better accessibility. It takes place over two interdependent dimensions. The first concern the massification of flows between the port terminal and the inland port through a high-capacity corridor. Intermodal rail and barge services represent the dominant means over which this process is

⁵⁷ Ibid.

⁵⁸ “Critical Literature Review into Planning of Inter-Terminal Transport: In Port Areas and the Hinterland” Qu Hu, Bart Wiegman, Francesco Corman, and Gabriel Lodewijks, *Journal of Advanced Transportation*, June 2019

achieved. The second relates to the consolidation and deconsolidation of cargo flows, depending on if it concerns inbound or outbound logistics.

- **Reconciling cargo flows.** Since most long-distance trade (and some domestic) is supported by containerization, there are numerous instances where a regional market imports more than it exports (or vice-versa). Under such circumstances, an inland port must provide the physical and logistical capabilities to ensure that empty containers are repositioned efficiently to other markets if local cargo cannot be found. This can take the form of empty container depots and arrangements with freight forwarders to have slots available for repositioning. Whether there are imbalances in container flows or not, an inland port must ensure that the inbound and outbound flows are reconciled as quickly as possible. A common way involves a cargo rotation from import activities where containers are emptied to exports activities where containers are filled with goods. For container owners, let them be maritime shipping or leasing companies, a rapid turnover of their assets is fundamental and will secure a continuous usage of the inland port. Effective repositioning and cargo rotations strategies ensure higher revenue for both the container owners and the inland port operators.
- **Trade and transactional facilitation.** An inland port can also be a fundamental structure promoting both the import and export sectors of a region, particularly for smaller businesses unable to achieve economies of scale independently. Through these, new market opportunities become possible as both imports and exports are cheaper. The setting of a Foreign Trade Zone ("FTZ") is also an option to be considered as a trade facilitation strategy. The functional pairing of inland ports is a transactional strategy where an inland port is an activity seeking agreements with other inland ports so that reciprocal supply chains are established or reinforced.
- **Governance.** The way an inland port is owned and operated indicates its potential to identify new market opportunities and invest accordingly. In many cases, the commitment of a large private investor such as a terminal operator or real estate developer can be perceived as a risk mitigation strategy, in addition to providing expertise in the development of facilities and related activities. Sections of an inland port can be shared facilities (e.g., distribution centers) so that smaller players can get involved by renting space and equipment."⁵⁹

Because cost is the single most important variable in the analysis of intermodal facility economic feasibility, a determination of when to choose truck over rail, or vice versa, is important. "One of the most common debates is over-the-road ("OTR") vs. intermodal (rail). Many shippers stick to using trucks/vans to move their product because

⁵⁹ "A New Role for Inland Terminals" Dr. Jean-Paul Rodrique and Dr. Theo Notteboom; Port Economics, Management and Policy 2020

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it is what they are familiar with, and it works. But there is potential to switch traditional OTR shipments to rail, with possible savings of a few hundred dollars per load. Here are some qualifiers to help determine if your shipments are a good fit for rail: high volume, flexible timeline, transit over 700 miles, dry or temperature-controlled and/or high-value freight. Over the road transportation includes full truckload, less-than truckload, and van transportation. Trucks can also move a wide range of products – arguably more so than rail, including: any size order, from a single pallet to 30 skids (more if stackable); expedited or time-sensitive shipments; any distance; dry or temperature-controlled; high-value freight; and/or fragile or vibration sensitive product.”⁶⁰

Another source determines that the breakeven distance for rail vs truck is at least 600 miles. “Although intermodal transportation is making a comeback in the shipping industry, it’s important to know under what circumstances you will find the best rates via this mode. First, rail proves most cost-effective when line-hauls exceed 600 miles or more.”⁶¹

Still another source, utilizing Figure V-6, finds the breakeven distance at 750 miles:

“Transportation modes have different cost functions according to the serviced distance. Using a simple linear distance effect, road, rail, and maritime transport have C1, C2, and C3 cost functions. While road transport has a lower cost for short distances, its cost increases faster than rail and maritime costs. It becomes more profitable at a distance D1 to use rail transport than road transport while from a distance D2, maritime transport becomes more advantageous. These are referred to as break-even distances. Point D1 is generally located between 500 and 750 km of the departure point, while D2 is near 1500 km. There are also regional differences impacting the break-even distance. For Europe, due to higher market densities, the break-even distance is in the range of 650 miles (1050 km), while in the United States, it is around 750 miles (1200 km). For the United States, only around 5 percent of the intermodal rail traffic concerns distances of less than 750 miles underlining the clear dominance of trucking for such a service range. The average rail haul length is about 1900 miles (3050 km), with around 65 percent involving distances of more than 2000 miles (3200 km).”⁶²

A more detailed comparison of shipping costs from either Las Vegas or the Inland Empire was conducted by the Theodore Roosevelt Institute for the Southern Nevada Chapter of NAIOP in a 2009 report. Table V-3 presents the cost advantages for several variables within the regional model. As can be seen the Inland Empire enjoys a 6.5 percent savings over Las Vegas.⁶³

⁶⁰ “OTR vs Intermodal: Which Shipping Strategy is Right for You?” Zipline Logistics, October 2018

⁶¹ “Rail vs Road – Where Rail Always Wins” Rachel Thielen, Commerce Express, January 2020

⁶² “Distance, Modal Choice and Transport Costs” Jean-Paul Rodrigue, Geography of Transport Systems, 2020

⁶³ “A Strategic Analysis of Southern Nevada’s Economy: Implications of Industrial Land Constraints for Regional Growth and Income” Theodore Roosevelt Institute, January 2009

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In addition to the consensus that the break-even distance between truck and rail is anywhere between 600 and 750 miles, market forces and new transportation technologies may exert forces that contribute to the break-even distance gap increasing.

"It's essentially an issue of two markets heading in different directions, shifting the modal balance. Class 1 railroads are widening their margins by improving service, raising rates on shippers, and slashing expenses. Spot truckload rates declined about 20 percent year over year in April, according to DAT Solutions and Truckstop.com. Truckload contract rates either are rising slightly or flat year over year, depending on carrier and lane, after hitting record highs in 2018. In a strange inversion of market dynamics, intermodal rail now is the more expensive modal choice in some secondary markets, even though few shippers are willing to pay more for a slower service. Historically, intermodal rail has been the lower-cost, slower option for shippers – that's how railroads sold intermodal. The question is whether this recent inversion is a market-blip that will soon be corrected or a sign the balance between the modes is changing."⁶⁴

Perhaps more important to the future of intermodal transportation and its impact on location decisions is the wide array of new technology in the field of transportation. Following is an overview of some of these technologies.

A. Trucks

Trucks are the most important mode of freight transportation for both the United States and Nevada even more of a hub and spoke distribution method. The 2017 Nevada State Rail Plan noted:

"The motor carrier industry is the most essential mode in U.S. freight transportation. 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. 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."⁶⁵

⁶⁴ "Softening U.S. Truck Market Resets Battle for Domestic Freight" An' Ashe, JOC.com, May 2019

⁶⁵ Nevada State Freight Plan: A Strategic Framework for Freight Mobility and Economic Competitiveness" Michael Gallis & Associates, Nevada Department of Transportation, January 2017

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However, over the next several years, the trucking industry will be experiencing significant transformations which will change how this mode of transportation functions and is utilized. Electric trucks, whether generation is achieved through hydrogen fuel cells or batteries, as well as self-driving trucks, are being researched and tested throughout the world.

And on the issue of fuel, “Diesel undoubtedly will remain trucking’s primary fuel for years to come, and the internal combustion engine still has a long road ahead of it, but manufacturers believe that electric trucks are poised to become an increasingly important piece of the freight transportation industry.”⁶⁶

The reason for this heightened interest in electric trucks is as old as transportation itself: the great potential electric trucks have for reducing diesel expenses. As competition among the various modes of freight transportation heats up, trucking companies will adopt those vehicles providing the lowest cost per mile of use.:

“Converting to electric medium trucks makes economic sense. A 2013 study placed the total cost savings of electric versus diesel truck ownership at 22 percent. That study assumed a cost premium of \$25,000 to \$37,000 for electric compared to diesel trucks. Notably, since that study was published, battery prices have dropped from \$625/kWh, the value used in the study, to under \$200/kWh. Because the up-front cost of an electric truck is significantly influenced by the cost of the battery pack, the study likely understates current lifetime cost savings of switching to electric trucks.

Electric delivery trucks also offer significant savings in fuel and maintenance costs as compared to diesel vehicles. Fuel cost savings from switching to electric trucks are tremendous. For example, diesel costs between \$2-3 per gallon and “last mile” diesel vehicles are extremely inefficient: the average fuel economy ranges from 4.6 MPG to 9.6 MPG depending on route characteristics. Electricity prices average approximately \$1.29 per gallon of diesel equivalent, though prices vary by region and electric utility provider. Electric delivery trucks average between 16.7 MPGe and 34.3 MPGe for those same routes. These improvements in efficiency add up to significant real-world savings in fuel and maintenance costs. EVI estimates that the owner of an electric Class 6 truck should expect to spend only \$2,022 per year on electricity while the owner of a similar model diesel vehicle would spend \$6,036 on diesel at current prices. Over a projected ten-year lifespan, the cost savings are even greater with an electric vehicle requiring only \$17,901 of electricity versus \$144,632 spent to fuel a diesel truck.

Electric trucks also save significant maintenance costs over their lifetime. For example, a diesel “last mile” truck registers maintenance costs around \$.22/mile. These costs include oil changes, brake repairs, belt

⁶⁶ “The Dawn of Electric Trucks” Seth Clevenger, Transport Topics, December 6, 2019

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replacements, and regular inspections. An electric delivery truck, by contrast, costs only \$.056-\$.11/mile. Electric trucks simply have fewer parts to replace and repair. Additionally, electric drive trains and regenerative braking reduce wear and tear on remaining parts like brake pads. Because delivery trucks make frequent stops and travel in congested urban areas, brakes are historically one of the most frequent and expensive costs. With electric drive trains brake repairs can be reduced by 20-30 percent.”⁶⁷

An additional benefit when comparing electric to diesel trucks is a significant reduction in air pollution. This is particularly important as new Federal policies targeting the reduction of greenhouse gas emissions are surely forthcoming over the next several years. For example:

“Diesel powered class 4-7 trucks emit, on average, between 4.35 and 7.47 grams of NOx per mile traveled. Electric vehicles have zero tailpipe emissions. Converting to electricity therefore has a significant impact on local air pollution. Additionally, from a well-to-wheels perspective, electric delivery trucks can reduce greenhouse gas emissions by 27-61 percent, and they keep improving their environmental performance as our electricity grids get cleaner and cleaner.

Lots of pollution from class 4-7 trucks stems from their unique operational requirements. Many of these vehicles register significant idling times, during which they continue to pollute without any additional vehicle miles travelled. A Diesel truck uses between .40 and .85 gallons of diesel per hour of idling. This costs operators money and contributes to air pollution. To address this issue from long-haul trucks, states have electrified truck stops. However, this has not addressed the issue of idling in the local freight and parcel delivery fleets. It is important to address these emissions because they tend to occur in populated urban and suburban settings. Electric vehicles can idle without emitting and have more efficient start-up/shut-down abilities that may further reduce the need to idle.”⁶⁸

The debate continues as to whether hydrogen fuel cells or batteries will become the power plant to move freight in the future. There is a body of work that proposes batteries will be primarily utilized in freight deliveries within a 250-mile radius (the current estimates of how long a battery charge will last) while hydrogen will be reserved for the longer route, semi-market:

“Battery-electric vehicles remain the most prevalent development pathway toward zero-emission trucking, but a growing number of developers also are espousing hydrogen fuel cells as a complementary technology. In the near term, electric trucks will be best suited to short-haul and regional operations in which the vehicle returns to a terminal for recharging.

⁶⁷ “Our State Should Use EMT Funds to Electrify its Medium Truck Fleets” Sierra Club Fact Sheet, November 9, 2020

⁶⁸ “Our State should use EMT Funds to Electrify its Medium Truck Fleets” Sierra Club Fact Sheet, November 9, 2020

“We have designed our electric vehicles to perform as well as a diesel powertrain truck,” said Scott Newhouse, Peterbilt’s chief engineer. “We believe these three applications-refuse, regional haul and city delivery- will provide the most immediate and near-term return on investment for our customers.”⁶⁹

Deployment of battery powered electric trucks has primarily been in Southern California, which has become an early incubation zone for this technology in North America. Most of these operational trucks, to date, have been utilized in Southern California drayage operations. However, the uses for electric trucks continuously expands, and several truck manufacturers are gearing up for the market’s demand.

“All of the established truck manufacturers in North America have since introduced their first electric truck models and have outlined plans to begin series production with the next couple of years.”⁷⁰

One of the first to manufacture a mid-range electric truck is a company named Nikola, a company formed to specifically manufacture electric vehicles. Their newest freight vehicle, the Nikola Tre, is an exciting truck (based on the IVECO-S-Way), that has been converted to run on electricity. This vehicle was recently unveiled and “has a range of 400 km or 250 miles, courtesy of a modular battery pack up to 720 kWh. Power is rated at 652 horsepower and torque at 1,800 Nm (1,327 pound-feet), but the official site claims it can have over 1,000 horsepower and 2,700 Nm (1,991 pound-feet) and a range of up to 1,200 km. It’s set to reach its first customers in 2021.”⁷¹

And this is not the only long-haul electric truck currently making its way to the market. One of the more recent manufacturers to join the fray is Tesla, which is simultaneously developing two semi-trucks, one having a range of 300 miles, and the other with a 500 – 600-mile range. Unveiling the new truck, Elon Musk told the audience “A traditional diesel truck can be operated for \$1.51 a mile: the Tesla Semi, he said, beats that with \$1.26. But it gets better. Using convoys – Tesla Semis yoked together with connected auto pilot technology (a convoy would consist of a lead semi with several others following autonomously), operating like road-going trains would drop the cost to \$0.85 a mile. This beats rail, Musk said.”⁷²

In addition to Nikola and Tesla, other companies that have entered the race are:

⁶⁹ “The Dawn of Electric Trucks” Seth Clevenger, Transport Topics, December 6, 2019

⁷⁰ “The Dawn of Electric Trucks” Seth Clevenger, Transport Topics, December 6, 2019

⁷¹ “Get Ready for the All-Electric Long-Haul Truck” Andrei Nedelea, Autorevolution, December 6, 2019

⁷² “Elon Musk Just Put the Rail Industry on Notice” Matthew De Bord, Business Insider, November 16, 2017

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“BYD – Unlike other companies looking to disrupt the long-haul trucking industry, BYD- is eyeing the short-haul goods movement sector, primarily in America’s ports, rail yards and freight-handling facilities. BYD is headquartered in Shenzhen, China, with offices and an assembly factory in Lancaster, California. In 2020, it is preparing to roll out more of its battery-electric trucks to customers across the United States.

BYD’s Class 8 Day Cab has a range of 125 miles and a top speed of 65 miles per hour. The truck’s battery packs can recharge in as little as two hours with a high-speed direct current system or about 14 hours with a standard 240-volt charging system.

Chanje – A Chinese backed start-up based in Los Angeles. The company’s nearly 30-foot long V8100 electric medium-duty panel van can carry a 3-ton payload. What is more, the van’s lithium-ion battery pack holds enough charge for a 150-mile range. According to the company, that is more than double the number of miles most commercial delivery vans drive in a day.

Chanje’s V8100s are already on the roads. In 2018, Ryder System announced it would buy 900 of Chanje’s Class 5 electric vans to lease to FedEx. Later, the delivery and logistics company said it would buy an additional 100 of the all-electric trucks (all of FedEx’s 1,000 Chanje V8100’s will operate in California), and Ryder ordered 500.

Daimler Trucks – The largest truck maker in the world, announced its all-electric 18-wheeler: the Freightliner eCascadia. The big rig has a 250-mile range and was designed for regional transportation and port service. Daimler’s other all-electric model, the Freightliner eM2 106, has a 230-mile range and is intended for more local distribution and deliveries. The company also has an all-electric box truck (for urban deliveries) and a school bus in the pipeline. Daimler said it is expecting to have the eCascadia and eM2 106 in production in its Portland, Oregon factory in late 2021.

Rivian – Rivian made headlines in September when Amazon (one of its investors) announced its plans to purchase 100,000 of the automotive startup’s all-electric delivery trucks. It was a huge, China-scale order, geared toward helping Amazon reach its 2040 net-zero carbon goal. Fulfilling that order, however, will be challenging.

First, in its 10 years of existence, Michigan-based Rivian has yet to produce an EV for the masses. It is in the final stages of testing its electric pickup truck, the R1T, which it plans to begin full-scale production on in 2020. According to Amazon, that is also when it will make its first delivery with a Rivian prototype.

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The company expects to have 10,000 Rivian delivery vehicles on the road by 2022, and Rivian said that all 100,000 electric delivery trucks will be in service by 2023 (it remains unclear whether those vehicles will operate in the United States and/or globally).

Volvo – Volvo Trucks has developed a zero-emission truck called the VNR Electric that is intended for regional use in North America. The company reportedly began highway road tests in 2019, it has said commercial production and sales will begin in late 2020.

VNR Electric is part of Volvo's broader Low-Impact Green Heavy Transport Solutions ("LIGHTS") initiative with California's South Coast Air Quality Management District ("SCAQMD"). According to a company statement, the \$90 million pilot program (half of which is funded by the California Air Resources Board) is part of California Climate Investments, a statewide initiative that funnels billions of Cap-and-Trade dollars toward reducing greenhouse gas emissions and improving public health.

Workhorse – Another electric truck startup to watch in 2020 is Workhorse Group. The company is behind the Workhorse W-15 plug-in electric pickup truck, and it is also developing an all-electric delivery van called the C1000. Workhorse is reportedly building 950 electric delivery vans for UPS, most likely in the former General Motors' plant it purchased in Lordstown, Ohio, in November.

Where Workhorse really stands to grab headlines this year is with the United States Postal Service ("USPS"). That is because the USPS is moving forward with long-delayed plans to award an estimated \$6.3 billion contract to produce 186,000 new mail trucks over the next five to seven years. That's nearly double Amazon's order for Rivian's all-electric delivery trucks."⁷³

Regarding electric cars, the infrastructure to support these trucks will have to grow exponentially. "Using the current number of trucks in the EU and an average distance of 50,000 kilometers per year, the authors estimated an energy requirement of 324 terawatt-hours for a purely electric truck fleet in the EU, which works out at roughly 10 percent of the energy generated in the EU in 2015.

The most promising concept for the charging problem of electric trucks is in replaceable batteries. A truck would simply replace an empty battery with a full one at a designated station. Such a change would only take two to three minutes. When the batteries are not in use, they could be used as storage for the power grid. In the future, this electricity could be supplied by idle truck batteries without significantly losing any of the energy the vehicle technician said."⁷⁴

⁷³ "8 Electric Truck and Van Companies to Watch in 2020" Shane Downing, Transport Weekly, January 13, 2020

⁷⁴ "Electric Trucks like the Tesla Semi are pointless both economically and ecologically according to a vehicle tech expert" Johannes Haufmann & Qayyah Moynihan, Business Insider Deutschland, April 3, 2019

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The dilemma facing government, as well as the marketplace is which type of power generating plant will win out. Much like predicting whether Blu-ray or HD DVDs were going to prevail, it is not known at this time if batteries or hydrogen fuel cells will become the most prevalent, and thus has implications as to the types of infrastructure required. However, one thing is for certain – electric trucks are coming. “Andreas Juretzka, director for product development at DTNA’s e-mobility group, said the electric truck market may ramp up slowly when the vehicles first become available, but he predicted that this new truck category eventually will take off. He acknowledged that electric trucks currently rely heavily on government grants and incentives to offset higher vehicle costs, caused primarily by the high cost of batteries. Battery prices are coming down but must continue to drop to reduce the price disparity with diesel. However, in the decades to come, Juretzka said it is not difficult to envision a day when renewable energy has become widely available. He predicted that future generations would marvel that people once extracted fossil fuels from the ground just to be mobile.”⁷⁵

Still another technology making its way into mainstream transportation is autonomous vehicles. Driverless vehicles are being tested throughout the world, including shuttle transports in the Las Vegas Downtown area. What is relatively new is that the technology is being researched and tested for commercial freight hauling, both for localized and long-haul destinations. As is the case with electric powered freight trucks, California seems to be leading the way in this technology as well.

“Over the summer, San Francisco-based Starsky Robotics partnered with Loadsmart, a New York City logistics company, to automatically dispatch a freight truck. Through Loadsmart, the goods were priced, tendered and booked. Starsky, which has remotely driven a freight truck over nine miles on an Orlando, Florida highway, can handle the actual driving. That trip was the first unmanned test of a self-driving truck on a public highway. All this is to say that the partnership is working toward a human hands-free operation. Xos Trucks in Los Angeles is working with UPS to test fully electric delivery trucks. Pronto.ai, founded by former embattled Uber engineer, Anthony Levandowski, has engineered a highway safety system that offers full adaptive cruise control, automatic emergency braking and proactive lane centering.”⁷⁶

Additionally, these trucks are not just being tested on localized short routes, but cross-country freight hauling as well. “Plus.ai, an artificial intelligence startup in Cupertino, California, has engineered an autonomous driving system for commercial freight trucks. This week, it made the world’s first cross-country trip of its kind to deliver butter to a small town in Pennsylvania. While this is not the first time an autonomous truck has made a cross-country trip, it is likely the first time a commercial freight truck has made a real delivery like this. The trip took about 41 hours to complete, according to data from Google Maps, and spans over 2,800 miles. It took the Plus.ai

⁷⁵ “The Dawn of Electric Trucks” Seth Clevenger, Transport Topics, December 6, 2019

⁷⁶ “A Self-Driving Freight Truck Just Drove Across the Country to Deliver Butter” Courtney Luidner, Popular Mechanics, December 11, 2019

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truck three days to complete the journey, during which it made a few stops, but never because it could not handle the driving. In fact, there was a safety driver aboard the vehicle, but they never had to take over and intervene for the truck other than during fuel stops and federally mandated breaks. The company said there were zero “disengagements,” where the truck lost control. And let us not forget that it was pulling around a refrigerated cooler with 40,000 pounds of butter onboard. The other primary obstacle, besides the perishable goods, is weather. This trip, which took place during the week of Thanksgiving, encompassed 12 states and some pretty inclement conditions, including snow.”⁷⁷

Other companies conducting research and testing of artificial intelligence specifically for autonomous freight deliveries include: Aurora Innovation; IKE; Einride; Kodak Robotics; and Embark.

One company taking this technology a step further is TuSimple. “On Wednesday, a California tech company announced that they were partnering with some of the largest trucking companies in the U.S. to launch a nationwide – and then global – autonomous freight network. On July 1, San Diego based-tech company TuSimple went public with their plans for the “world’s first” Autonomous Freight Network (“AFN”), which they describe as “an ecosystem consisting of autonomous trucks, digital mapped routes, strategically placed terminals.” TuSimple says that they have launched AFN in partnership with UPS, Penske Truck Leasing, U.S. Xpress and McLane, a supply chain services company.

The company says that the AFN will roll out in three phases and will lay the groundwork for self-driving trucks to become commercially available by 2024.

- Phase I (2020-21) will offer service between the cities of Phoenix, Tucson, El Paso, Dallas, Houston, and San Antonio
- Phase II (2022-23) will expand AFN service from Los Angeles to Jacksonville and connect the east coast with the west.
- Phase III (2023-24) will expand driverless operations nationwide adding major shipping routes throughout the lower 48 states allowing customers to utilize their own TuSimple equipped autonomous trucks on the AFN by 2024.”⁷⁸

“Back in March 2017, Plus.ai became one of the first autonomous trucking companies to land a California Autonomous Vehicle Testing License, which is exactly what it sounds like. According to the California Department of Motor Vehicles, there are now 65 companies that hold one of these permits.”⁷⁹

⁷⁷ Ibid.

⁷⁸ “Driverless Truck Company Launches World’s First Autonomous Freight Networks”, Ashley, CDL Life, July 1, 2020

⁷⁹ “The Dawn of Electric Trucks” Seth Clevenger, Transport Topics, December 6, 2019

B. Trains

As with trucks, trains are researching and testing alternative electric powered trains with an eye on the future. These include batteries as well as hydrogen cells.

“The 2010s saw battery-powered electric cars move into the mainstream, led by Elon Musk’s Tesla, and as that trend gains steam there are signs the decade ahead will see hydrogen gain commercial viability in transportation, particularly for heavy vehicles like trains and long-haul semis. Electric cars have become viable because “battery costs plummeted when production scaled up and the same is likely with fuel cells and renewable hydrogen,” says transportation researcher Dan Sperling, a University of California, Davis, professor and a member of the state’s Air Resources Board which sets the nation’s toughest exhaust pollution rules. Electric trains are common, but traditionally require costly catenary power lines or electrified rails to operate. By contrast, a fuel cell system creating electricity onboard the vehicle allows trains to run on existing tracks with no additional investment needed.”⁸⁰

These new technologies are now breaking out of the R&D phase, as adaptation into the real world begins.

“On Monday, rail engineering company Alstom put its hydrogen-powered train into commercial service for the first time. The train was designed by a French company, then tested for 18 months in Germany. It will now run on Austria’s rail network, where the national rail operator is considering whether to replace its diesel stock with the new design.”⁸¹

And while the applications for this technology has focused on passenger trains, it is only a matter of time before this technology is applied to freight trains as well. “Freight locomotives for long-distance hauling is the most technically challenging but has the highest societal value in that the diesel volume displacement with hydrogen fuel would add significantly to economies of scale and reduced fuel cost, according to a recent report for the Energy Department and Federal Rail Administration prepared by Sandia National Laboratories.”⁸²

⁸⁰ “Heavy-Duty Hydrogen: Fuel Cell Trains and Trucks Power Up for the 2020s” Alan Ohnsman, Forbes.com, December 29, 2019

⁸¹ “The Test Projects Pushing Hydrogen-powered Transports Forward” Matthew Farmer, Power Technology, September 15, 2020

⁸² “Heavy-Duty Hydrogen: Fuel Cell Trains and Trucks Power Up for the 2020s” Alan Ohnsman, Forbes.com, December 29, 2019

C. Cargo Airships

Another freight innovation that adapts one of the oldest forms of air travel to today's transportation matrix is the utilization of lighter-than-aircraft. New aerodynamics and structural design, as well as advanced materials technology and advanced engine design have made for more durable airships capable of longer, more autonomous flights.⁸³

Airships are unlikely to significantly challenge traditional heavier than air ("HTA") aircraft for passenger operations, however they are well suited to the transportation of cargo with its reduced priority on speed and the airship's ability to offer a more cost-effective service. Cargo airships are an emerging mode of freight transportation (designed specifically for the transportation and handling of freight) which have had many theorized designs and uses over the years, but now look to be finally emerging from the realms of theory into production in the near future.⁸⁴

"After working for 20 years on a number of prototypes, Lockheed Martin said it has received an order for 12 of its LMH-1 "hybrid cargo airships." With a payload capacity of about 20 tonnes, roughly the same as a 737-400 freighter, the LMH-1 hybrid cargo airships can also be converted to passenger configuration to carry up to 19 passengers and two pilots. The estimated cost of the LMH-1 will be about a third of the cost of a 737 and as much as one-tenth the cost of the specially designed heavy-lift helicopters currently in use in the oil and gas industry. Plus, the range of the airship will be vastly greater than a helicopter and would require much less maintenance."⁸⁵ Current testing is being conducted at Lockheed's famed Skunk-Works facility in Palmdale, CA (see Figure V-7). "Not only can we take off and land with the air cushion landing system, but it doubles in grip mode that allows the system to grab the ground and hold it even in shifting winds, so we don't need any kind of mooring system or tie down as we do our change operations on the ground." Bob Boyd, program manager for the P-791 Hybrid Air Vehicle, added "the airship would also be highly efficient as it can fly two or three weeks without fuel."⁸⁶

To date, the only airships in continued operation are the Goodyear Zeppelins, which are primarily used for scenic flights and filming purposes. However, Goodyear has recently developed a new airship, the LZ N07-101 which is currently being assessed for cargo operations. Aeroscraft, another airship manufacturer is currently in research and design of the ML868, which is the longest of the airships being researched today. Figure V-8 provides a comparison among the various airships, including with a Boeing 747-800F.

⁸³ "Is there a Future in Airships?" Bruce Dorminey, Scientific American, May 3, 2011

⁸⁴ "The Emergence of Cargo Aviation: An Opportunity for Airports" Craig Neal, International Airport Review, July 18, 2017

⁸⁵ "Will this be the first Cargo Airship on the Market?" Randy Woods, Air Cargo World, April 15, 2016

⁸⁶ "Inside Lockheed's Giant Blimp: Long Range LMH-1 Airship will carry cargo & people to remote locations around the world" Richard Gray, Daily Mail.com, March 10, 2016

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Cargo airships, like HTA aircraft will require hangar space for maintenance and repair activities, with a similar scheduled requirement. However, the glaringly obvious difference is the size of the space required with some of the current airship hangars. Given the massive proportions of airship hangars it is very unlikely that new facilities will be built at major airports given the premium on space, and that new facilities (hangar and associated infrastructure) would be located at secondary airports with significantly more space and ability to integrate airship operations at the airport.⁸⁷

D. Unmanned Aerial Systems

Nevada has been a leader in the field of unmanned aerial systems ("UAS"). This was recognized at the onset of the United States' efforts to commercialize UAS, with the selection of Nevada by the Federal Aviation Administration as one of the first six states to be officially selected as a testing and research location. Three areas within the state were designated for this use: the El Dorado Valley within Boulder City, the Stead Airport area north of Reno, and the Nevada National Security Site (formally known as the Nevada Test Site). The State of Nevada formulated an entity to provide oversight of the program's management office in July of 2013. This entity was named the Nevada Institute for Autonomous Systems.

"On behalf of the Governor's Office of Economic Development, the Nevada Institute for Autonomous Systems, a non-profit corporation, leads the growth of the Nevada Autonomous Aerial Vehicle Industry through business teaming relationships, collaboration with primary research institutions, and helping enhance the UAS industry knowledge base in order to attract new and permanent business within the State of Nevada. The NIAS mission is to coach, teach, and mentor public and commercial UAS companies as well as their staff to develop advanced and innovative UAS applications, procedures, techniques, and technologies to facilitate safe integration into the NAS as mandated by Congress. NIAS has the unique mission to plan and executive UAS flights in collaboration with Nevada teammates, collect FAA flight performance data, and develop enhanced National Airspace safety control measures."⁸⁸

Both short haul as well as medium range capabilities have positioned cargo drones to become prominent within the logistics industry. "Cargo drones are a proven technology – they can now drop online shopping deliveries in back yards, deliver vital medicines to otherwise inaccessible locations and zip around warehouses delivering parts at the precise moment they're needed. As a result, the civil UAV market is booming. It had a global volume of about USD 5.5 bn in 2019, and the market for production and services applications is forecasted to grow at around

⁸⁷ "The Emergence of Cargo Airships: an opportunity for airports" Craig Neal, International Airport Review, November 6, 2020

⁸⁸ Nevada Institute for Autonomous Systems website, November 2, 2020

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11 percent per annum over the next five to six years, largely driven by the infrastructure sector. This suggests a valuation of around USD 10 bn by 2025.”⁸⁹

“Today, it is the logistics industry that leads the way in already-operational UAV use cases. This is largely thanks to the growing number of national authorities that have issued permits allowing companies to trial commercial cargo drones, led by pioneers such as Australia, Singapore, Iceland and Switzerland. These usually involve firms being allowed to operate fee-charging UAV services at certain times, and surveying customers afterwards to improve their offering. Currently, there are four different cargo drone use cases, in varying states of implementation: automation of intralogistics, covering factories and warehouses; parcel delivery (first/last-mile), catering to dense urban areas; supply of medical goods, normally to hard-to-reach places; and transportation of air freight, usually in rural areas.”⁹⁰

Research and testing of drone application for freight and package delivery are being conducted at an accelerated rate throughout the world. “Wing, the cargo drone specialist owned by Google-parent Alphabet, achieved a breakthrough in this respect in April 2019. It was awarded the first ever U.S. Federal Aviation Administration (“FAA”) air carrier certificate licensing unlimited commercial deliveries using cargo drones. The license made no restrictions on flights over crowds or urban areas- the first time this has been granted outside a pilot project. Meanwhile, in March 2018, China-based logistics giant SF Express became the first company to be issued a commercial license for last mile parcel delivery by the Civil Aviation Administration of China (“CAAC”). Domestic rival JD.com soon received a similar license, and it has now completed government-approved deliveries of more than 250km between islands in Indonesia, overcoming previously insurmountable boundaries and distances.”⁹¹ Larger drones having long-range delivery capabilities are also being tested for freight delivery. “Elroy Air, an aerospace and logistics company, has developed an autonomous hybrid VTOL aircraft for cargo transport and deliver. It is targeted towards three applications: commercial, humanitarian aid, and military. The aircraft has a payload of 250 to 500 pounds and a range of 300 miles. On August 28, 2019, it completed its first successful test flight with a 1,125-pound VTOL named Chaparral that flew up 10 feet for 64 seconds before safely landing. The company is hoping to start using the product with its partners by 2021. We believe that now is the moment in history when autonomous VTOL aircraft can be developed to expand the reach of air cargo at scale- the enabling technology is ready, and regulators are on board to help,” the company wrote in a blog post.⁹²

Another company, Sabrewing Aircraft, in Camarillo California., is developing an even larger drone, called the Rhaegal:

⁸⁹ “Cargo Drones: The Future of Parcel Delivery” Manfred Hader and Stephan Baur, Roland Berger, February 19, 2020

⁹⁰ “Cargo Drones: The Future of Parcel Delivery” Manfred Hader and Stephan Baur, Roland Berger, February 19, 2020

⁹¹ “Cargo Drones: The Future of Parcel Delivery” Manfred Hader and Stephan Baur, Roland Berger, February 19, 2020

⁹² “Elroy Air has developed a transport drone it says can deliver anything from shipping cargo to humanitarian aid” Brittany Chang and Rachel Premock, Business Insider, December 27, 2019

"If need be, it can lift almost 2,500 kg (5,500 pounds) of cargo straight up from the ground, like a helicopter; if a short runway is available, it can take off in the standard way, then fly straight ahead carrying as much as 4,500 kg (10,000 pounds). That is more than the new Cessna 408 SkyCourier can manage, and the Rhaegal flies much faster and higher. Also, it is designed to load and unload without the help of forklifts, pallet jacks, or other specialized equipment. Additionally, the Rhaegal has a cruise speed of 180 knots, a ceiling of 6,700 meters and, most importantly, a range of 1000 nautical miles.

The Rhaegal sits low to the ground, whether on tarmac or even a sand dune, then tilts its nose upward so that either containerized or bulk cargo can be quickly loaded and secured. The aircraft's high-flotation "tundra tires" and four-post landing-gear arrangement allow it to land in mud, snow, sand, marsh, or deep puddles, and an integral loading ramp with rollers can be used to ease loading of pallets or containers.

Because the Rhaegal has a maximum gross weight above 600 kg (1,320 pounds) it falls under U.S. Federal Aviation Administration Regulation Part 23, which requires that it be remotely monitored and controlled and that it remains in contact with air traffic control at all times. Its operator, who can be hundreds or even thousands of miles away, controls the aircraft via a satellite link. In this way, the local air traffic and control authority speaks to the operator through the aircraft, just as if the operator were sitting in the cockpit itself."⁹³

"Individual drone-based parcel delivery services are already being rolled out. The problem is, they will need to be part of an over-arching system if urban UAV delivery is to become a commercial reality. This will involve developing a framework for the system, that is, determining the conditions in which it will exist, as well as implementing the system itself. A key condition is determining how the infrastructure of the over-arching system, such as drone landing pads and charging stations, will be organized. For example, as batteries become lighter and longer lasting, drones will become more efficient. Eventually they will be able to dispense with batteries altogether and charge as they fly using solar panels, removing the need for expensive charging infrastructure. Investments therefore need to be carefully targeted."⁹⁴

E. Vacuum Tubes

Perhaps the most fanciful of the evolving transportation system technologies that may have significant impacts on the movement of both freight and passengers are the Hyperloop concepts. Hyperloop technology represents a new transportation mode, more specifically, a sealed capsule inside a vacuum tube propelled by magnetic levitation. The Hyperloop infrastructure is a tube that can be buried underground, as might be the case through

⁹³ "Can Cargo-Carrying Drones Jump over Air Freight's Logistical Logjams?" Ed De Reyes, IEEE Spectrum, May 23, 2020

⁹⁴ "Cargo Drones: The Future of Parcel Delivery" Manfred Hader and Stephan Baur, Roland Berger, February 19, 2020

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densely populated areas, or placed above ground. The vehicle is a pod that accelerates through the tube or tunnel via electric propulsion. The vehicle does not touch the sides of the tunnel, but floats along the route at considerable speed with reduced friction via vacuum technology.

The environment inside the tube is sealed and the pressure is very low, offering little resistance to the vehicle as it travels. Because of the risks associated within the tunnels for human travel (even a small rupture in the tube operating at near vacuum environment would result in a loss of pressure, causing catastrophic structural damage) initial testing and utilization will be for freight. While all the benefits of Hyperloop technology cannot be ascertained at this time, several associated with freight have been identified. These benefits include:

- “It is supposed to cut on delivery time and the palletized and light freight will be transported between two cities delivered with airspeed. For example: If it usually takes 23 hours for the goods to be delivered by plane, and 4 days by truck, with the Hyperloop it will only take 16 hours, making it faster than an airplane!
- It will have a rather cheaper shipping cost than airplanes. The Hyperloop will cut costs on freight, or to be more precise, it will be eight times cheaper than airplanes and only 1.5 times more expensive than trucks.
- Greater efficiency to the warehouses due to faster Movement of the goods. This will have the businesses cut on costs, as they will reduce the finished goods inventory and therefore, the need for bigger warehouses.
- It can withstand almost any weather conditions. The material the tunnel is built with is very thick metal that will protect the inside capsule. If by any chance there is a leakage of air inside the tunnel, it will only slow down the speed of the pod, and not cause any damage to it. The Hyperloop is designed to withstand earthquakes and changes in pressure inside the tunnel.”⁹⁵

Because of the initial costs of this technology, those companies with the need to serve their customers with a faster delivery time. Much like air freight, it will favor those products having a high value to weight and mass. E-commerce businesses with smaller packages, as well as the medical supply and food industries, will probably adopt this technology first because of their need for prompt delivery. One of the Hyperloop companies Virgin Hyperloop One, had begun testing the concept in North Las Vegas. Virgin Hyperloop One has formed a collaboration with international port operator DP World, called DP World Cargospeed. DP World Cargospeed will aim to deliver goods at speeds of up to 620 miles per hour and link to existing roads, rail and air infrastructure. The project, DP World Cargospeed, will be powered with Virgin Hyperloop One’s technology to “enable ultra-fast, on-demand

⁹⁵ “Will Hyperloop Bring Changes in the Freight Transport?” Monika Kelesovska Eurosender/blog, February 3, 2020

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deliveries of high-priority goods and can revolutionize logistics, support economic zones, and create thriving economic megaregions,” according to the two companies.⁹⁶

Another entry into the Hyperloop system is headed by Elon Musk who has leveraged his success with SpaceX and Tesla to introduce a high-speed travel tunnel between Los Angeles and San Francisco. “The estimated cost is between \$6 and \$7.5 billion. California broke ground in 2015 on a conventional high-speed rail system. Projected costs for this steel-on-steel system are around \$70 billion. The proposed Hyperloop travel time is around 35 minutes one-way, while the high-speed rail system takes around 2.5 hours, and traditional over the road trucks would take one day.”⁹⁷

In addition to SpaceX and Tesla, and DP World Cargospeed, other prominent players include Hyperloop Transportation Technologies (“HTT”), Transpod, Hardt Global Mobility, Zeleros, Hyper Chariot, Hyper Poland and Euroloop.

Overall, Hyperloop is a mode of transport which could become commercially operational for cargo transportation in the next half of the decade. If it does indeed become an accepted mode of cargo delivery, it is likely to reduce the number of cargo trucks on the road, thereby contributing to reduced traffic congestion and related accidents. It could also have a ripple effect in accelerating the adoption of Hyperloop to transport people.⁹⁸

⁹⁶ “Hyperloop for Freight could be Faster & Cheaper than Air” Chad Prevost Sonar Research, May 14, 2018

⁹⁷ “Hyperloop v high speed rail travel: What’s the Difference?” Tolvin Nathu, Investopedia, December 19, 2020

⁹⁸ “Hyperloop: Ushering In the 4th Dimension of Travel” Sarwant Singh, Forbes.com, May 20, 2019

Table V-1: Nevada's Top Five Commodities, by Tons and Value: 2012

SCTG Commodity	Tons (Thousands) by Commodity and Percentage Distribution by Direction				
	All Directions	Outbound	Inbound	Intra	Total
Nonmetal Mineral 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 (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%

Source: Nevada State Freight Plan

Table V-2: The Cost Per Intermodal Rail Terminal Type: 2017

Name	TEU volume	Infrastructure	Terminal Area	Equipment	Realization Costs (total infra, ground breaking and equipment)	
					Million Euro	Million 2017 USD
1. XL	500,000	12 tracks	40 ha	23 million	138	167
2. L	100,000	6 tracks	10 ha	13 million	47	57
3. M	30,000	3 tracks	6 ha	3 million	9.5	11.5
4. S2	20,000	2 tracks	4 ha	1.5 million	5.5	6.7
5. S1	10,000	1 track	4 ha	1 million	3.5	4.2

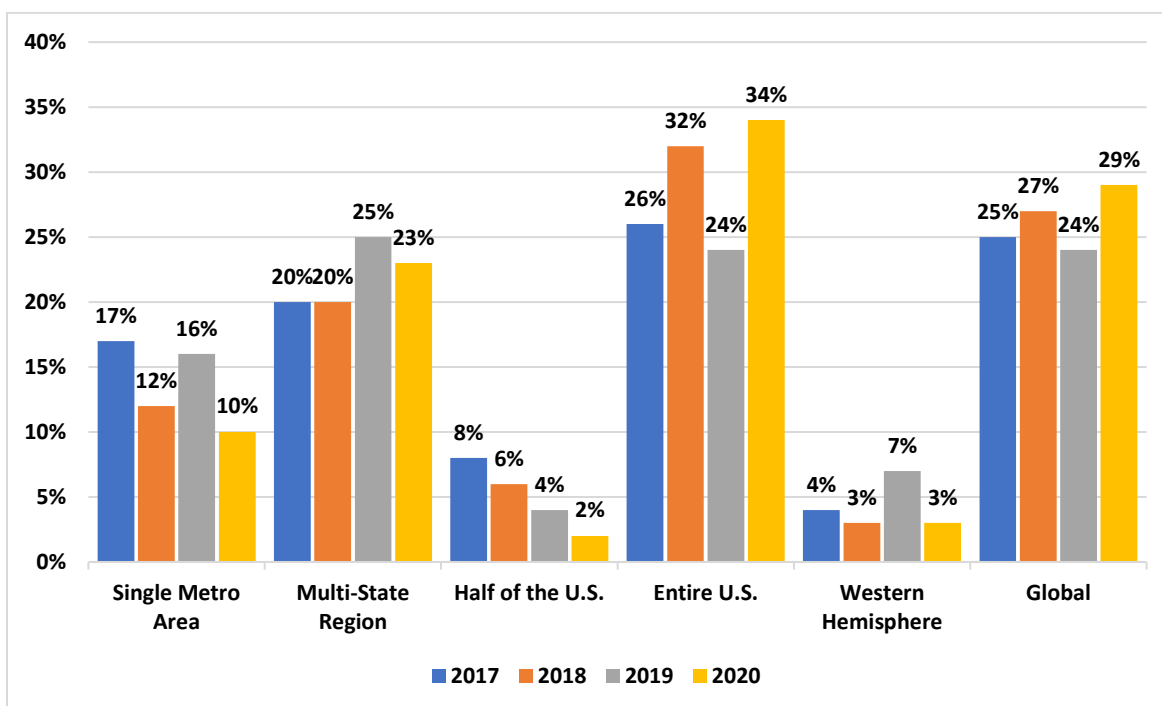
Source: Bart Wiegman & Behzad Behdani

Table V-3: Shipments to Regional Distribution Centers via Staging from Inland Empire Area or from Las Vegas after Initial Distribution: 2007 – 2008

Description	Las Vegas	Inland Empire	Difference: LV - IE
Transportation			
# of Containers	3,500	3,500	
Cost of Dray	\$850	\$250	
Transportation Costs per Year	\$2,975,000	\$875,000	\$2,100,000
Storage			
Warehouse Square Footage	400,000	400,000	
Cost per Foot for Warehouse	\$0.46	\$0.34	
Storage Costs per Year	\$2,208,000	\$1,632,000	\$576,000
Labor			
Workers Needed per Warehouse	45	45	
Wage per Hour	\$12	\$12	
Workmen Comp %	8%	22%	
Labor Costs per Year	\$1,166,400	\$1,317,600	-\$151,200
Utilities			
Utilities KW per Year	857,000	857,000	
Cost per KWh	\$0.075	\$0.10	
Utility Costs per Year	\$64,275	\$85,700	-\$21,425
Hauling			
Average length of Haul to DC	1,100	1,400	
Hauls per Year	2,625	2,625	
Cost per Mile	\$1.25	\$1.50	
Hauling Costs to Regional DC per Year	\$3,609,375	\$5,512,500	-\$1,903,125
Operating Costs per Year	\$10,023,050	\$9,422,800	\$600,250

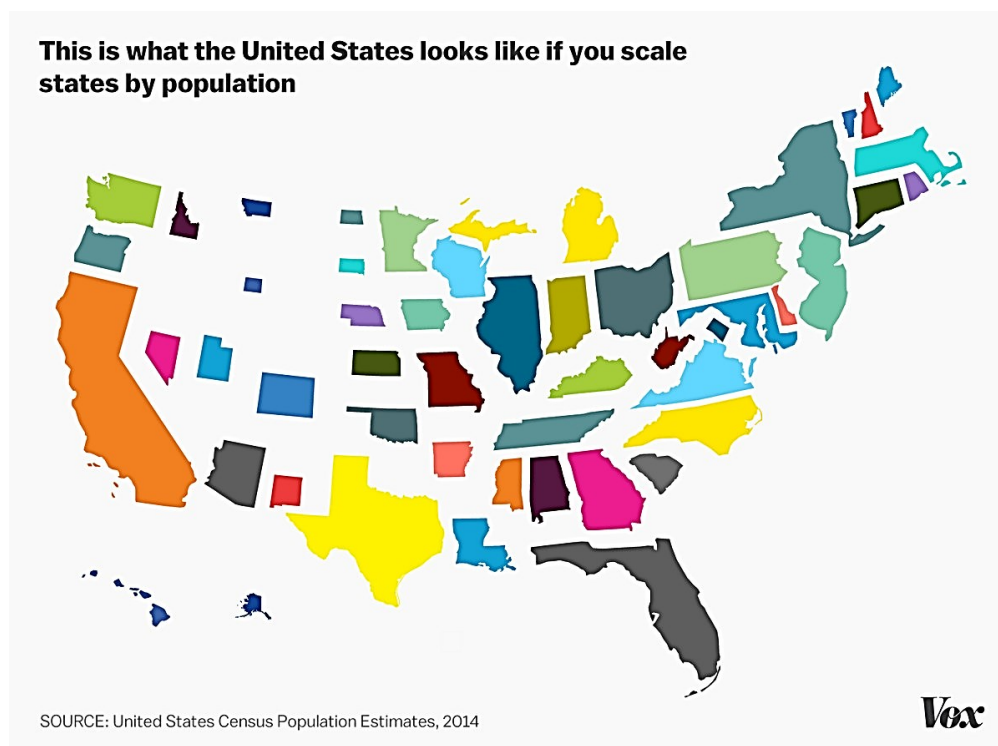
Source: Theodore Roosevelt Institute

Figure V-1: Scope of Distribution Center Operations: Areas of Service



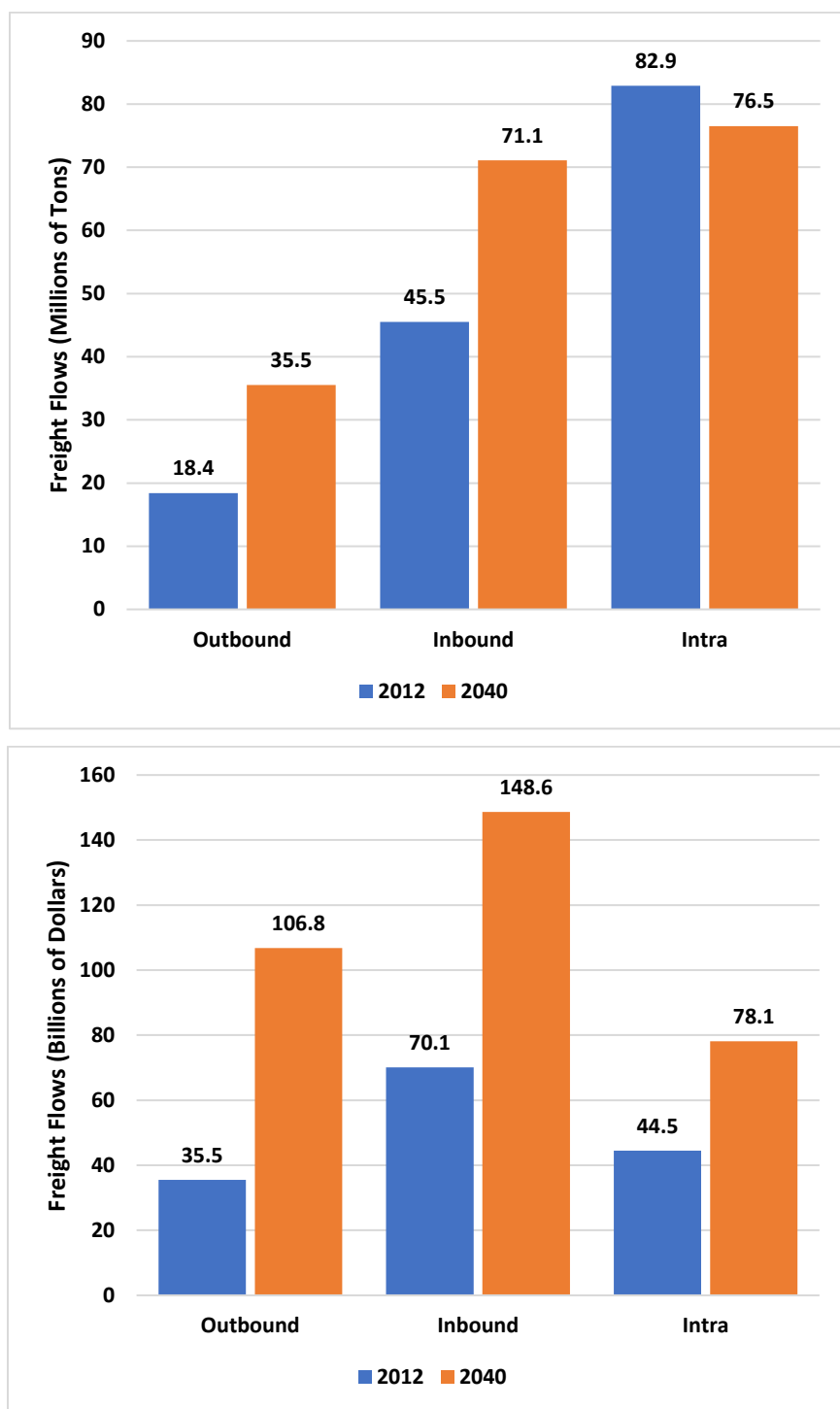
Source: Peerless Research Group

Figure V-2: USA Map Scaled by Population: 2014



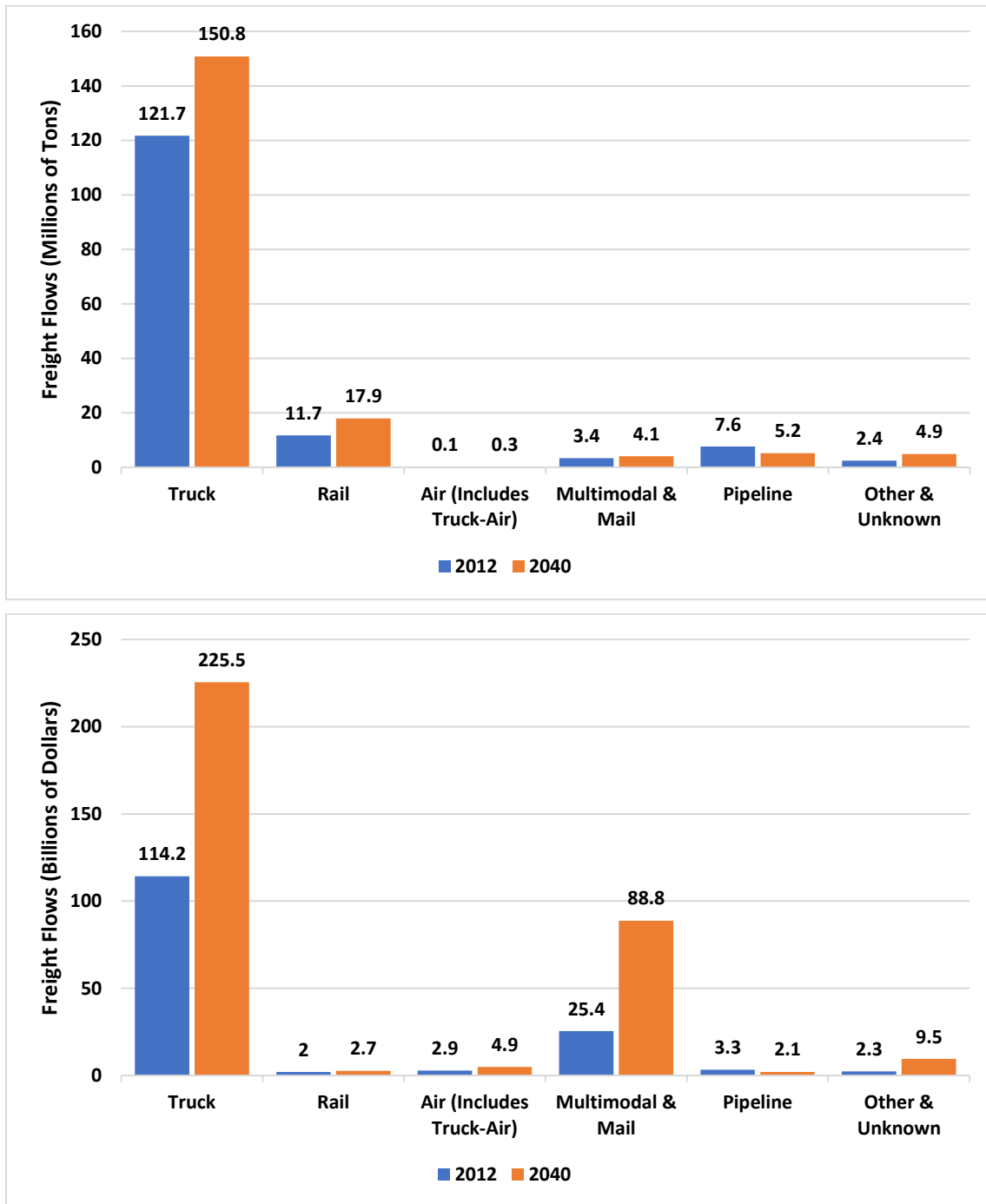
Sources: U.S. Census, Vox

Figure V-3: Nevada's Growth in Freight Flows in Tons and Value by Direction of Flow: 2012 - 2040



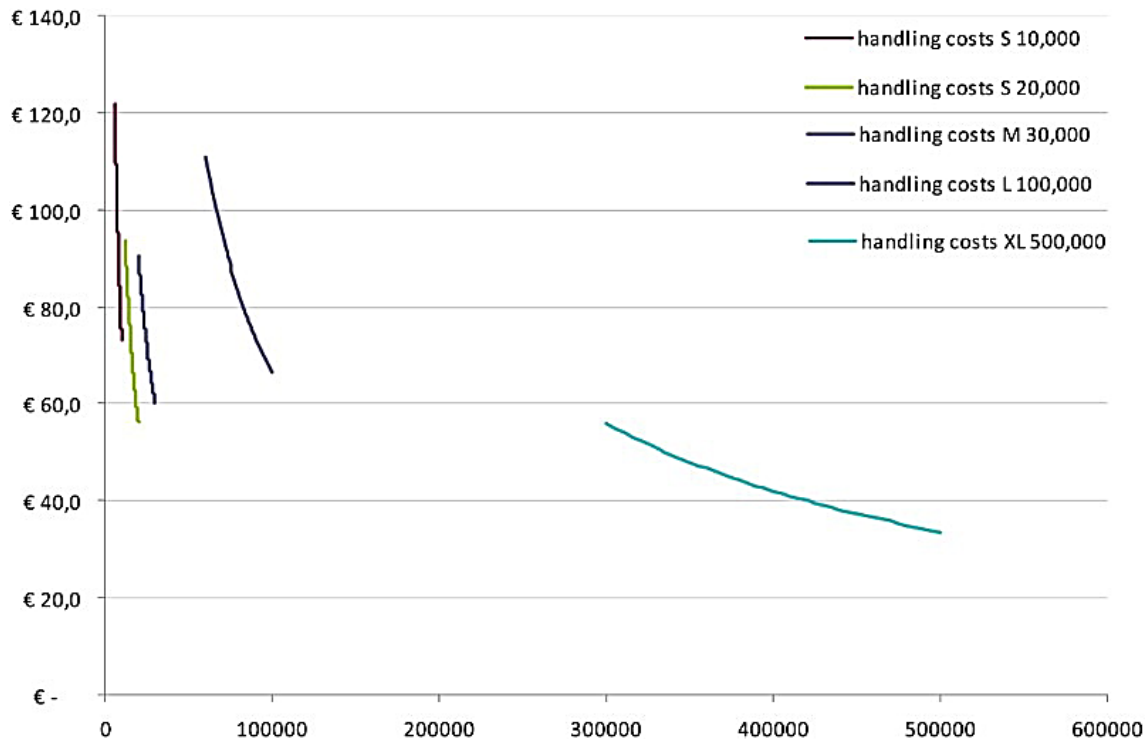
Source: Nevada State Freight Plan

Figure V-4: Nevada's Growth in Freight Flows, Tons and Value by Mode: 2012 - 2040



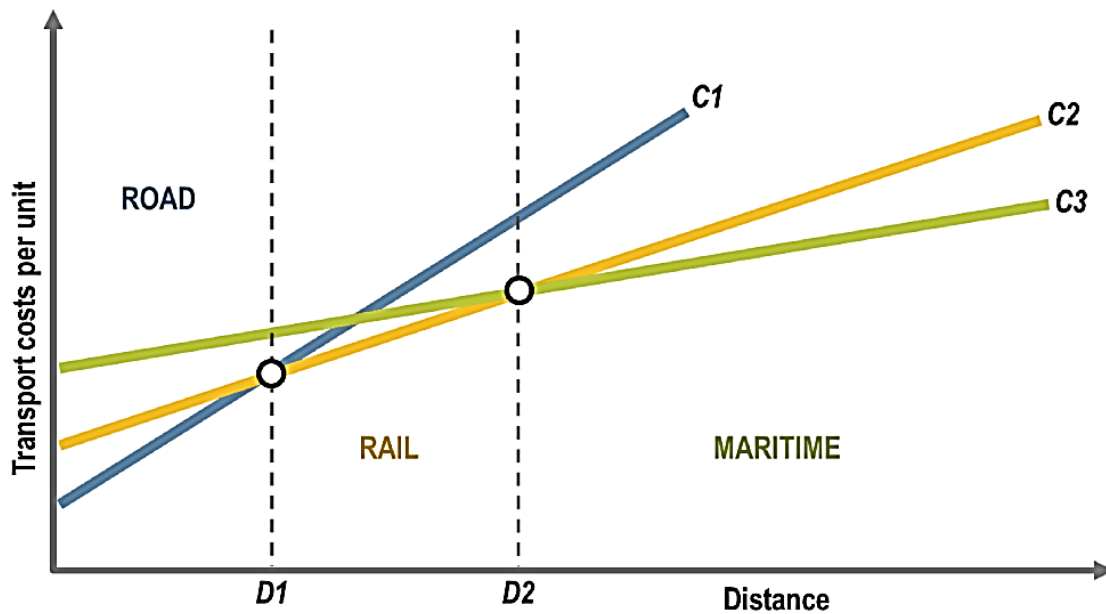
Source: Nevada State Freight Plan

Figure V-5: Handling Costs of All Five Intermodal Rail Terminals



Source: Transsport Reviews

Figure V-6: Distance, Modal Choice and Transport Costs



Source: Model Competition, The Geography of Transport Systems, Jean-Paul Rodrigue, 2020

Figure V-7: Lockheed Martin LMZ1M Cargo Hybrid Airship



Source: Lockheed Martin

Figure V-8: Drones Are Deployed for Various Use Cases in The Logistics Sector

Drones are deployed for various use cases in the logistics sector

Roland Berger

Distance

Use cases cargo drones

	Automation of intralogistics	Parcel delivery (first/last mile)	Supply of medical goods	Transportation of air freight
Pilot project	Audi pilot plant Ingolstadt tests transportation of material for the manufacturing process via drones	Beta phase "Amazon Prime Air" launched by Amazon in Cambridge area in UK to deliver products via electronically powered drones	Pilot project delivering medical supplies with the Parcelcopter 4.0 by DHL and GIZ in Tanzania	Testing phase in 2019 and service phase in 2020 with focus on commercial cargo delivery
Characteristics	<ul style="list-style-type: none">➔ Transport and surveillance applications possible➔ Indoor navigation via sensors	<ul style="list-style-type: none">➔ Fully autonomous and guided via GPS signals➔ Vertical start/landing and horizontal transition➔ Altitude 120 m	<ul style="list-style-type: none">➔ Small landing area➔ Vertical start/landing and horizontal transition	<ul style="list-style-type: none">➔ Autonomous flight and cargo loading/unloading➔ No airport or electric charging station required➔ Pod attached to the drone
Trip max.	n/a	30 minutes	40 minutes	n/a
Weightload max.	2 kg	2.3 kg	4 kg	225 kg
Speed max.	8 km/h	160 km/h	130 km/h	n/a
Distance max.	Indoor	Few kilometres	65 km	500 km

Source: Roland Berger, DHL, Amazon, Elroy, Audi

VI. REQUIRED DEVELOPMENT RESOURCES

This section presents a discussion and analysis of the infrastructure components and financial resources needed prior to the development of improved rail transportation, last-mile delivery services, and other supply chain improvements. The analysis particularly focuses on these relative to the findings of NDOT's 2020 Nevada State Rail Plan ("Rail Plan") draft. The Rail Plan's information comes, in part, from NDOT's interviews with 235 stakeholders and an additional 141 shippers.

The U.S. rail system is dominated by freight. Freight rail makes up 81 percent of total Class I rail capacity.⁹⁹ Passenger rail, which makes up the remaining 19 percent, is at the mercy of freight because much of it runs along lines owned by freight companies. It shares right-of-way with freight trains and in cases where both freight cars and passenger cars need access to the same rails, freight has priority. The rail system in the U.S. is built for freight, and for that reason U.S. freight rail is highly efficient and has been characterized by The Economist as the world's best system.¹⁰⁰ As evidence of this efficiency, total track mileage in the U.S. has decreased since deregulation via Staggers Act of 1980, despite an 81 percent increase in freight volume and 46 percent lower costs.¹⁰¹ Another statistic showing the importance of freight is that in 2018 rail carried 33 percent of the nation's freight, almost as much as the 39 percent carried by truck.

In contrast, Western Europe has among the most-used passenger rail systems in the world.¹⁰² The rail system there is geared toward passenger rail rather than freight rail. For this reason, passenger rail enjoys efficiencies that U.S. rail cannot hope to achieve on any rail with freight priority. However, these systems are heavily subsidized, whereas U.S. rail is not. The opposite circumstances are also why European freight rail lags American freight rail.¹⁰³

These realities suggest that both freight and passenger rail require their own infrastructure in order to reach the necessary efficiencies that would allow each to be economically feasible, at least over long distances.¹⁰⁴ This explains the repeated attempts at developing a passenger rail line between Southern California and Southern

⁹⁹ U.S. Bureau of Transportation Statistics. Accessed Dec 14, 2020. "System Mileage Within the United States." <https://www.bts.gov/content/system-mileage-within-united-states>

¹⁰⁰ The Economist. Jul 22, 2010. "High-speed railroading." <https://www.economist.com/briefing/2010/07/22/high-speed-railroading>

¹⁰¹ Smith, SS and Earle, PC. American Institute for Economic Research. Dec 11, 2019. "Why Passenger Railways are Terrible and Freight Railways are Amazing." <https://www.aier.org/article/why-passenger-railways-are-terrible-and-freight-railways-are-amazing/>

¹⁰² Union Internationale des Chemins de fer. Accessed Dec 14, 2020. "Railis UIC Statistics." <https://uic.org/support-activities/statistics/>

¹⁰³ Rajamanickam, V. Freight Waves. Oct 5, 2019. "Why is Europe so absurdly backward compared to the U.S. in rail freight transport." <https://www.freightwaves.com/news/why-is-europe-so-absurdly-backward-compared-to-the-u-s-in-rail-freight-transport>

¹⁰⁴ Freemark, Y. The Transport Politic. Oct 23, 2011. "Opportunities Abound for Transporting Goods by Tram — If Properly Coordinated." <https://www.thetransportpolitic.com/category/transportation-mode/freight/>

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Nevada. Amtrak's Desert Wind service between the two areas was discontinued in 1997 due to high costs along with long, inconsistent travel times, over seven hours each way on average.¹⁰⁵

Apart from the problem of shared infrastructure, there are other issues facing Nevada freight rail. Currently, there does not appear to be demand for more freight rail in Nevada. According to the Rail Plan, rail lines in Nevada are already operating below capacity even with the current infrastructure.¹⁰⁶ Additionally, traffic on Nevada's rail system, may further decline. This is the case regarding rail shipments terminating in Nevada, because much of the state's rail traffic includes coal deliveries and the state's remaining coal plants are set to close by 2025.¹⁰⁷

UP has invested heavily in the Sunset Route that runs between Southern California and New Orleans.¹⁰⁸ That line is also double-tracked, as opposed to UP's single-tracked South Central Route running through Las Vegas and connecting Southern California with Salt Lake City, which significantly increases its capacity.¹⁰⁹ In line with this observation is that UP has no track renewal projects along the South Central Route. However, there are maintenance projects in the Reno area along the Overland Route connecting Oakland and Chicago as well as on the more southern Sunset Route.¹¹⁰

Due to UP's investments and geographic factors—like much of Nevada's mountainous topography—it is generally more cost efficient to send goods from the Los Angeles area to Chicago along the longer Sunset Route through El Paso than it is to do so through the more direct South Central Route via Las Vegas.¹¹¹ This poses a challenge for Nevada's near to intermediate-term rail infrastructure prospects. Additionally, while the Overland Route through Northern Nevada is quite developed, it is operating below capacity—as mentioned above. This is a function of factors outside of Nevada more so than factors inside the state. Shipping ports in Northern California do not have the same volume as those in Southern California.¹¹² This presents a constraint on how much that line can be used for through-traffic.

¹⁰⁵ Teng, H and Kutela, B. Institute of Transportation Engineers, Western District. 2015 Las Vegas Meeting. Jun 25, 2015. "Technical Feasibility Study of Passenger Rail Service along the West Route between Las Vegas and Los Angeles." https://www.westernite.org/annualmeetings/15_Las_Vegas/Papers/9C-Kutela.pdf

¹⁰⁶ Rail Plan, pg. 2-76

¹⁰⁷ Nevada Statewide Greenhouse Gas Emissions Inventory and Projections, 1990-2039. Nevada Division of Environmental Protection, Nevada Division of Environmental Protection Bureau of Air Quality Planning. 2019.

¹⁰⁸ Rail Plan, pg. 2-47

¹⁰⁹ Samuel L. Sogin, Yung-Cheng (Rex) Lai, C. Tyler Dick, and Christopher P. L. Barkan. Comparison of Capacity of Single- and Double-Track Rail Lines. Transportation Research Record: Journal of the Transportation Research Board, No. 2374, Transportation Research Board of the National Academies, Washington, D.C., 2013, pp. 111–118. DOI: 10.3141/2374-13

¹¹⁰ Union Pacific. Accessed Dec 15, 2020. "Major Track Renewal Projects."

https://www.up.com/cs/groups/public/@uprr/@customers/documents/up_pdf_natedocs/pdf_up_cust_major_track_gsp.pdf

¹¹¹ Rail Plan, pg. 2-47

¹¹² U.S. Bureau of Transportation Statistics. Accessed Dec 14, 2020. "Tonnage of Top 50 U.S. Water Ports, Ranked by Total Tons." <https://www.bts.dot.gov/content/tonnage-top-50-us-water-ports-ranked-total-tons>

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The Rail Plan did find that there may be demand for expanding and improving rail between Nevada's two main metro areas and their corresponding California metros—Los Angeles to Las Vegas and the Bay Area to Reno. However, even that is not a certainty at this time. There might be pent-up demand for rail, but that demand has not been sufficient to-date to spur private investment, at least not without subsidy or public partnership. Still, NDOT does have plans and strategies to grow demand through a variety of outreach initiatives, and these should be pursued.

Based on the findings above, and others discussed throughout this report, it is important to focus on those infrastructure components and financial instruments most likely to succeed in facilitating future infrastructure development in Nevada.

A. Rail Transportation

According to the Rail Plan, rail is only one part of the supply chain that could complement the trucking industry. Much of the Study discusses other potential solutions to improve logistics in the state. Some of the solutions are based on emerging technologies. However, rail is underrepresented as far as goods movement within the state is concerned. For this reason, the Rail Plan lays out objectives to better integrate rail into the state's logistics structure to create a comprehensive plan for economic growth and diversification in Nevada. In this section, we discuss the infrastructure components and financial resources likely to be needed prior to the development of improved rail transportation, last-mile delivery services and other supply chain improvements in the state.

i. Infrastructure Components

NDOT's mission includes new rail planning and upkeep of certain existing rail, but not constructing and managing new rail lines. This is standard practice across the country since passage of the Staggers Rail Act in 1980 deregulated the industry, generally leading to positive results.¹¹³ However, the disconnect between private railroads and state planners leaves states with relatively little role in shaping the future of freight rail. This is because the railroads understand best what their businesses need to succeed, and state rail plans are at times at odds with this understanding. Nevertheless, NDOT could play an important role in terms of lowering barriers to entry and reducing bureaucratic friction to enable private industry. Still, industry will only follow through if it is financially advantageous for them to do so.

¹¹³ Winston, C. Brookings Institution. Oct 15, 2005. "The Success of the Staggers Rail Act of 1980."
<https://www.brookings.edu/research/the-success-of-the-staggers-rail-act-of-1980/>

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For this reason, constructing capital projects such as tracks and yards, transload facilities and intermodal terminals is not the most important component in building out rail infrastructure in Nevada. Dialogue and planning between stakeholders and interested parties and increasing return on investment are the most important components.

Railroads have the means to spend tens of billions of dollars on infrastructure each year. Additionally, goods producers in the state would probably be willing to make investments in supply chain that ultimately lower their costs. The current problem impeding the development of rail in Nevada is in finding ways to increase the return on investment¹¹⁴ so that the railroads move projects up in priority and getting businesses that have latent demand for rail to cover their share of costs. NDOT is aware of these facts and the Rail Plan posits solutions for these challenges.

Building tracks and yards, transload facilities and intermodal terminals will not necessarily make rail more viable and it could cost the state revenues—revenues that it cannot likely afford to spend, particularly post-pandemic.¹¹⁵ Nevada rail planners must convince the private sector that they should make the investments. To do so, the NDOT must facilitate discussions between the various interested parties. NDOT is now working in doing just that via its Connect Rail Nevada (“CRN”) initiative.¹¹⁶ CRN is an organization comprising NDOT management, Strategic Rail Finance (“SRF”) project leaders, the Nevada Governor’s Office of Economic Development and Regional Economic Development Authority leaders.¹¹⁷ SRF is a rail advisory firm that works with public and private institutions to facilitate capital projects.¹¹⁸ CRN is the most important piece of “infrastructure” needed to promote supply chain improvements in Nevada because it can grow demand by disseminating pertinent information and work with state authorities to achieve higher rates of return through federal grant programs and other fund-generating means.

This type of deeper integration between potential stakeholders, Class I railroads and public institutions is necessary to developing rail-based logistics in the state. Rather than rely on the two Class I freight operators in Nevada to build myriad branches, the parties that directly benefit should be encouraged to build their own short lines that connect to the main Class I lines—with funding options discussed herein. This could be part of NDOT’s plan for “radical inclusion.”¹¹⁹ In cases where there are multiple parties, or customers,¹²⁰ that desire a connection to Class I lines, the parties could engage in risk pooling¹²¹ and enter into agreements to share the costs of these lines.

¹¹⁴ Rail Plan, pg. 4-23

¹¹⁵ State of Nevada Press Release. Jun 9, 2020. “Gov. Sisolak details plan to address Fiscal Year 2020 shortfall.”

https://gov.nv.gov/News/Press/2020/Gov_Sisolak_details_plan_to_address_Fiscal_Year_2020_shortfall/

¹¹⁶ Rail Plan, pg. 5

¹¹⁷ Rail Plan, pg. 15

¹¹⁸ Strategic Rail Finance. <https://strategicrailfinance.com/>

¹¹⁹ Rail Plan, pg. 4-7

¹²⁰ Rail Plan, pg. 4-23

¹²¹ Simchi-Levi, E. Supply Chain News. Oct 9, 2013. “The Most Important Concept in Supply Chain Management - Risk Pooling.”

https://www.supplychain247.com/article/the_most_important_concept_in_supply_chain_management_-_risk_pooling/ops_rules_management_consultants

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For example, consider two mining operations that are both 30 miles away from a Class I rail line. Also consider that they are 10 miles apart from each other. Each could build a 30-mile short line to the Class I rail line but doing so could be prohibitively expensive. However, if the two were to enter into an agreement, they could share the costs of building one 40-mile short line running between their properties that then connected to each of their operations. This type of agreement would provide significant cost savings to both parties and require little to no investment on the part of the Class I operator. This assumes that the Class I operator were to approve such an arrangement.

Additional these kind of arrangements might require direct or indirect sharing of financial data in order to facilitate equitable cost sharing. Detailed feasibility studies on a project-by-project basis would be vital to determine whether potential partners were willing to share their portion of a project's costs. The two Class I carriers in Nevada would need to be intimately involved in any such plans, particularly UP due to the usage rights on its rail.¹²² NDOT's Mining Materials Supply Chain Logistics Strategy will be key in realizing these types of partnerships.¹²³

It is also important to be able to identify where these types of partnerships are most likely to succeed. Fortunately, as part of NDOT's efforts to engage the many stakeholders within the state, access to freight trucking data can be used to tease out where demand for additional rail may exist.¹²⁴ According to the Rail Plan, trucking data is more useful to improve Nevada rail infrastructure than rail data. This is because rail data reflects already successful rail freight movement.

To increase rail's share of freight, it is necessary to determine where trucking is less successful and where rail could improve the situation. The state's goal is that CRN could obtain, maintain and disseminate the data. Gathering and organizing these data is immensely important as there would be little chance of creating a feasible and functional ambitious rail plan without them. This information would allow the state to identify and prioritize the most valuable projects in Nevada and to maximize the probability of obtaining federal funding where possible. It should be said that planning in tandem with neighboring states,¹²⁵ particularly California, is important as well. The Rail Plan found that 70 percent of all trucks in Nevada are coming or going to California.¹²⁶

Essentially, we found that the Rail Plan represents a sound approach to move potential rail projects forward, particularly relative to freight. That is why it is critical to bring in as many stakeholders as possible. The state must convince these parties that tight relationships with other entities, both public and private, are necessary if there is

¹²² Rail Plan, pg. 2-41

¹²³ Rail Plan, pg. 4-11

¹²⁴ Rail Plan, pg. 2-60

¹²⁵ Rail Plan, pg. 6-4

¹²⁶ Rail Plan, pg. 4-20

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to be measurable progress in Nevada's supply chain logistics. However, while the general framework outlined by the Rail Plan appears solid, some of the goals may be harder to attain in the near to intermediate terms, such as electrification of freight.¹²⁷ ¹²⁸ Another area that will need additional study are the targets for the various regional plans. The next section discusses various financial resources that could be used to bring these plans to fruition, as well as potential innovative approaches to obtaining those funds.

ii. Financial Resources

This section contains a discussion of various financial resources available to the State of Nevada, sub-state entities and the private partners of those state and local entities. These funding sources can be used to fund state efforts, such as the Nevada Freight Rail Development Fund¹²⁹ or to directly fund projects in the state. This is not an exhaustive list of available resources. But it is a list of selected programs that are, or could be, used to generate significant funding opportunities for Nevada stakeholders, particularly with respect to rail. The resources discussed herein are:

- Surface Transportation Grants
- Infrastructure Bank
- Public-Private Partnerships
- Lease/Purchase Agreements
- Municipal Bonds
- Private Activity Bonds
- Railroad Rehabilitation & Improvement Financing Program

Surface Transportation Grants

The U.S. Department of Transportation ("USDOT") offers a range of competitive grant programs for the development of rail and other surface transportation-oriented infrastructure. The Federal Railroad Administration ("FRA") is one of USDOT's departments that awards grants.¹³⁰ The Federal Transit Administration ("FTA") is

¹²⁷ <https://www.eesi.org/articles/view/electrification-of-u.s.-railways-pie-in-the-sky-or-realistic-goal>

¹²⁸ Energy Skeptic. Dec 13, 2016. "Electrifying freight trains in the U.S. is a really bad idea." <http://energyskeptic.com/2016/electrification-of-freight-rail/>

¹²⁹ Rail Plan, pg. 4-25

¹³⁰ U.S. Department of Transportation, Federal Railroad Administration. Accessed Dec. 16, 2020. "Competitive Discretionary Grant Programs." <https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/competitive-discretionary-grant-programs>

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another,¹³¹ as is the Federal Highway Administration (“FHWA”).¹³² These programs can cover the direct costs of rail or mitigate associated costs, including those related to operations. However, these grants are not consistently available and cannot be relied on exclusively as the driver for developing the rail system in Nevada. Still, they can be a good source of funding that can improve the odds of development in many cases.

The FRA states that the grants program is “designed to develop safety improvements and encourage the expansion and upgrade of passenger and freight rail infrastructure and services.”¹³³ This is in line with NDOT’s goals for rail in the state. The FRA strives to accomplish its goals using a three-pronged approach.

1. Consolidated Rail Infrastructure & Safety Improvements
2. Restoration & Enhancement
3. Federal-State Partnership for State of Good Repair

The first grant program is used to increase safety, efficiency and reliability in intercity passenger and freight rail. This includes updating and building new infrastructure across all parts of rail: track, stations, equipment, etc. It also includes covering costs for rail-related analyses and training programs. The second program helps to start new and enhance existing intercity passenger rail, particularly covering operating expenses, such as new staff, fuel, etc. The third program is less applicable to Nevada, as it is used to repair publicly-owned and Amtrak-owned rail. The state is eligible to apply for all these grant types. Private rail carriers may generally apply for grants in either of the first two programs.

Federal grants are structured in such a way that states are incentivized to own passenger rail infrastructure. For example, Federal-State Partnership for State of Good Repair Grant Program grants can be awarded specifically only to states or government agencies established by the state. In Nevada, the regional transportation commissions appear to fall into this category as they were enabled by state law.¹³⁴ However, it might be prudent for Nevada to create a state-level transit commission to own and operate passenger rail, or to bestow that authority upon NDOT, if such an undertaking were to be attempted. Empowering the state or increasing cooperation between the state and regional transportation commissions regarding passenger rail, would allow the state to be more competitive in terms of securing grants, including federal matching funds for new infrastructure.

¹³¹ U.S. Department of Transportation, Federal Transit Administration. Accessed Dec. 22, 2020. “Grant Programs.” <https://www.transit.dot.gov/grants>

¹³² U.S. Department of Transportation, Federal Highway Administration. Accessed Dec. 17, 2020. “Grant Programs.” <https://highways.dot.gov/research/technology-innovation-deployment/grant-programs>

¹³³ U.S. Department of Transportation, Federal Railroad Administration. Accessed Dec. 16, 2020. “FRA Competitive Grant Programs Information.” <https://railroads.dot.gov/library/fra-competitive-grant-programs-information>

¹³⁴ Regional Transportation Commission of Southern Nevada. Accessed Dec. 18, 2020. “About the RTC.” <https://www.rtcnv.com/about/about-the-rtc/>

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There are many grants and the amounts available to award vary from year-to-year, but a few of the more substantial programs include the following.

- Federal-State Partnership for State of Good Repair (“SOGR”) Grant Program
- Better Utilizing Investments to Leverage Development (“BUILD”) Grants
- Consolidated Rail Infrastructure and Safety Improvements (“CRISI”) Program
- Capital Investment Grants (“CIG”)

For example, SOFR is a program meant to facilitate the repair, replacements or rehabilitation of passenger rail throughout the nation. Eleven SOGR grant recipients were awarded \$291M in FY2020. This was a bit less than the \$303M awarded in FY2019 but more than the combined \$272M in FY2017 and FY2018.¹³⁵ Eligible recipients include states, groups of states, public agencies established by states, political subdivisions of states (e.g., county, city, transit authorities, etc.), Amtrak and any combination thereof. The program provides cost matching up to 80 percent—based on the FY 2020 Appropriations Act—with the remaining 20 percent or more coming from non-federal sources and can include private funds.¹³⁶

Another grant program is BUILD, which was formerly known as “TIGER.” In FY2020, BUILD provided \$1B in funding for surface transportation infrastructure. It awarded \$900M in FY2019 and \$1.5B in FY2018. It is significantly larger than SOFR in terms of available funds. The funds are also available for a wider variety of uses and to a greater number of recipients. BUILD can fund roads, public transportation, freight and passenger rail, ports, intermodal projects and even broadband projects, and can provide capital to any public entity.¹³⁷ The program is also friendly to smaller rural projects. Awards range from \$5 to \$25M, but for rural projects, awards can be as low as \$1M, which allows smaller rural projects to qualify. Funds are capped at an 80 percent match in urban areas but may exceed that limit with special permission for rural projects. State, sub-state and private funding is valid for matching purposes. This meshes well with the grant’s “innovation” criteria, which appear to encourage the use of different project delivery schemes, such as public-private partnerships.¹³⁸

The third program discussed is CRISI. This program funded \$312M in projects in FY2020. It had \$245M available for funding in FY2019, \$318M in FY2018 and \$65M in FY2017. The program specifically funds intercity passenger

¹³⁵ U.S. Department of Transportation, Federal Railroad Administration. Accessed Dec. 17, 2020. “Federal-State Partnership for State of Good Repair Grant Program.” <https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/federal-state-partnership-state-good-repair-1>

¹³⁶ U.S. National Archives, Federal Register. Jun 10, 2020. “Notice of Funding Opportunity for the Federal-State Partnership for State of Good Repair Program.” <https://www.federalregister.gov/documents/2020/06/10/2020-12542/notice-of-funding-opportunity-for-the-federal-state-partnership-for-state-of-good-repair-program>

¹³⁷ U.S. Department of Transportation. Accessed Dec. 19, 2020. “About BUILD Grants.” <https://www.transportation.gov/BUILDgrants/about>

¹³⁸ U.S. National Archives, Federal Register, pgs. 10811 – 10823. Feb 25, 2020. “Notices.” <https://www.transportation.gov/sites/dot.gov/files/2020-03/2020%20BUILD%20NOFO%20Federal%20Register-03711.pdf>

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and freight rail capital projects. The funds can also pay for certain plans and studies relative to new rail projects. Much like SOFR, it is generally directed at states, although Class II and Class III railroad companies are also eligible to apply.¹³⁹ Unlike BUILD, there is no minimum or maximum award size. Like with the other grant programs, funds are capped at 80 percent of project costs. CRISI appears to be directed at helping not only general rail projects, but short-line projects as well.¹⁴⁰ This may be advantageous to a joint development project for mining firms, but this would need to be planned in concert with UP and the state.

The fourth major grant program discussed is the CIG. This program is run by the FTA. These grants can be used to fund transit capital investment projects, including heavy, commuter and light rail as well as streetcars and bus rapid transit. The process may last several years, requiring several steps, but the rewards are potentially large. For example, Phoenix was able to secure \$530M for a light rail project in 2020 from the FTA.¹⁴¹ In total, the CIG program is appropriated about \$2.3B every year. Funding from CIG grants is limited to 60 percent of project costs, though other federal grants may fund up to 80 percent of the project.¹⁴² Projects have historically been about 50 percent funded by CIG grants. Funding and grant requirements are also based on the size and scope of the capital project.

There are three main funding levels: “New Starts,” “Small Starts” and “Core Capacity.” New Starts projects are those seeking to build a fixed guideway project of more than \$300M or that are seeking more than \$100M in CIG funds. Small Starts are projects seeking to build fixed guideway or bus rapid transit projects costing less than \$300M and seeking less than \$100M in CIG funds. Core Capacity projects are those that seek to increase the capacity of a fixed guideway corridor by 10 percent or more or a corridor that is at capacity or will be at capacity within five years. Core Capacity projects cannot include SOGR elements, such as track replacement, station rehabilitation and signal system replacement without additional capacity.¹⁴³ Projects require a sponsor, but may have partners, which include private firms.

Based on the bidding process of many federal grants, there are several ways that private firms can participate. In fact, for some grants, private participation is encouraged due to its greater efficiencies and can increase the

¹³⁹ U.S. Department of Transportation, Federal Railroad Administration. Accessed Dec 18, 2020. “Consolidated Rail Infrastructure and Safety Improvements Program.” <https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2>

¹⁴⁰ U.S. National Archives, Federal Register. Apr 20, 2020. “Notice of Funding Opportunity for Consolidated Rail Infrastructure and Safety Improvements.” <https://www.federalregister.gov/documents/2020/04/20/2020-08226/notice-of-funding-opportunity-for-consolidated-rail-infrastructure-and-safety-improvements>

¹⁴¹ Vanek, C. Phoenix Business Journal. Dec 7, 2020. “\$638M in federal grants will help South Central light rail extension reach finish line.” <https://www.bizjournals.com/phoenix/news/2020/12/07/south-central-light-rail-gets-federal-funding.html?ana=knxv>

¹⁴² U.S. Department of Transportation, Federal Transit Administration. “Fact Sheet: Fixed Guideway Capital Investment Grants.” https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/5309_Capital_Investment_Grant_Fact_Sheet.pdf

¹⁴³ U.S. Department of Transportation, Federal Transit Administration. Nov 14, 2016. “FTA Core Capacity Presentation.” <https://www.youtube.com/embed/38YqCIA0dW8>

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probability of winning a bid. There are four forms of private participation that the federal government has stated are options for bids for at least one of the above grant programs:¹⁴⁴

- Public-Private Partnership
- Joint Development¹⁴⁵
- Capital Leasing¹⁴⁶
- Third Party Contracting.

NDOT should study these possibilities further with legal counsel and test the waters for some sort of public ownership stake in projects if it improves the odds of winning grants. These stakes can then be sold off to the main private partner when appropriate.

State Infrastructure Banks

Some states have established state infrastructure banks (“SIB”) to fund capital projects. SIBs are revolving funds that are used to pay for surface transportation projects, including transit such as rail/tram. This is done using state and local funds, as well as with matching federal funds. The federal government allowed for these banks in 1995 and Nevada legislators established a SIB in 2017.¹⁴⁷ AB 399 in the 2017 legislative session established the structure for a SIB in Nevada that could help construct many types of infrastructure projects, including transit projects. However, the state has yet to initially fund the SIB¹⁴⁸, so, currently, Nevada has a SIB in name only. The SIB is discussed in greater detail in Section VII.

Public-Private Partnerships

As noted previously, another method of transportation funding that has gained traction in recent years are PPP. This funding mechanism involves the government contracting with a private entity to renovate, build, operate, maintain, manage and/or finance a project. An example of a PPP is a toll road.¹⁴⁹ In the case of a transit project, fare revenues would be used to recoup the investment capital. PPPs are similar to revenue bonds in that a project's

¹⁴⁴ U.S. Department of Transportation, Federal Transit Administration. Accessed Nov 18, 2016. “Private Sector Participation.” <https://www.transit.dot.gov/PIPP>

¹⁴⁵ U.S. Department of Transportation, Federal Transit Administration. Accessed Nov 18, 2016. “Joint Development.” <https://www.transit.dot.gov/JointDevelopment>

¹⁴⁶ U.S. Department of Transportation, Federal Transit Administration. Accessed Nov 18, 2016. “Capital Leasing.” <https://www.transit.dot.gov/funding/funding-finance-resources/capital-leasing/capital-leasing>

¹⁴⁷ Nevada A.B. 399, 79th Legislative Session. <https://www.leg.state.nv.us/App/NELIS/REL/79th2017/Bill/5477/Overview>

¹⁴⁸ Tucker, R. Aug 22, 2018. NAIOP Blog. “Putting Nevada on the Path to Better Infrastructure.” <http://blog.naiop.org/2018/08/putting-nevada-on-the-path-to-better-infrastructure/>

¹⁴⁹ There has been some question as to whether toll roads would be constitutional in Nevada, but it would appear that a toll charge as a result of a privately funded road would be legal. <https://www.npri.org/are-privately-funded-toll-roads-coming-to-nevada/>

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financing is rooted in the revenues produced by the project itself. SB 448¹⁵⁰ in the 2017 legislative session allowed Clark County to enter into these partnerships for the purpose of transit projects pursuant to federal law.¹⁵¹ A PPP maybe a viable option to fund potential transit projects in Nevada. PPPs do not create new money but, instead, leverage private sector finance and other resources to develop infrastructure.

However, agreement on whether PPPs are preferable to public-only funded endeavors remains elusive. One of the apparent benefits of PPPs is that they do not necessarily burden the government with debt. However, there is some literature that suggests that PPPs should be given the same treatment in budgetary accounting as publicly provided infrastructure.¹⁵² This is, in part, because the government is often responsible if the operations revenues do not meet expectations. This is all dependent on the type of agreement between the public and private partners. One suggestion to make PPPs work is to have the private partner operate the project after completion. This would incentivize them to make sure that the construction process goes smoothly and efficiently. Still, though PPPs are not optimal for many transportation projects, they have been shown to reduce upfront public costs through accelerated or more efficient project delivery. Again, the success of a PPP is dependent on the details of the agreement.

The Bipartisan Policy Center ("BPC") lays out seven core principles when considering a PPP.¹⁵³

1. Develop a clear understanding of the public purpose and benefits of the project, including clear measures for success.
2. Include key stakeholders early in the project's development.
3. Proactively look for opportunities to monetize assets.
4. Analyze life-cycle costs and risk-transfer benefits in addition to the upfront cost of capital.
5. Structure P3 agreements to encourage efficient management and protect the public interest.
6. Look for opportunities to bundle together multiple sources of funding and financing.¹⁵⁴
7. Use transparent, competitive bidding that allows room for innovation.

The BPC found two recent examples of PPPs for rail transit construction: the Oakland Airport Connector (2014) and the Portland (Oregon) Airport MAX Red Line (2001). It came to a few conclusions on each project. Regarding the Oakland Airport Connector:

¹⁵⁰ Nevada S.B. 448, 79th Legislative Session. <https://www.leg.state.nv.us/App/NELIS/REL/79th2017/Bill/5556/Overview>

¹⁵¹ Gonzalez, Y. Las Vegas Sun. Jun 27, 2017. "Southern Nevada officials can 'get aggressive' to research, fund proposed light rail." <https://lasvegassun.com/news/2017/jun/27/southern-nevada-officials-can-get-aggressive-to-re/>

¹⁵² The Basic Public Finance of Public-Private Partnerships. E Engel, R Fischer, A Galetovic. 2011.

¹⁵³ Bipartisan Policy Center. Accessed Dec 18, 2020. "Lessons from Public-Private Partnerships." <https://bipartisanpolicy.org/infrastructure-case-studies/>

¹⁵⁴ Davies, P. LinkedIn Pulse. Jul 27, 2016. "Funding or financing - a policy confusion." <https://www.linkedin.com/pulse/funding-financing-policy-confusion-paul-davies/>

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- Private investors will not hesitate to walk away from a deal if planning draws on for too long
- The project failed to attract significant private investment
- The project is drawing higher ridership than a proposed bus alternative

Regarding the Portland Airport MAX Red Line:

- Well-planned, this development was completed ten years ahead of schedule due to the PPP
- PPPs can avoid state and federal funds by drawing on private equity and finance techniques like TIF
- When negotiating, parties should keep in mind that projects may take time to reap rewards
- PPPs can use public assets, like land, in negotiations

Lease/Purchase Agreements

Another type of funding method used by municipalities is the lease/purchase agreement. In more colloquial terms, this equates to “rent-to-own.” In this case, the local government would lease the transit system from a private builder for the term of the system’s useful life, possibly 30 years, at the end of which, it would own the asset. In this case, the transit system would appear as a line-item expense in the public agency’s annual finances.

However, lease/purchase agreements are not designed for large capital projects. According to the Municipal Finance Corporation, “lease-purchase financing works best for assets with a useful life of three to seven years, that serve an essential governmental function and carry an initial cost that would consume a disproportionate amount of available cash.”¹⁵⁵ In effect, these are items that must fit into an organization’s foreseeable budget in the medium-term without raising additional funding. This would likely not provide a viable funding path for expanded supply chain logistics infrastructure in the state.

¹⁵⁵ Municipal Finance Corporation. Accessed Dec 9, 2020. “Frequently Asked Questions.” <http://munifinance.com/faq>

Municipal Bonds

Municipal bonds could be one method of obtaining funding for infrastructure projects in the state. According to Merrill, “A municipal bond is an interest-bearing debt obligation issued by a state or local municipality, which may support general government needs or fund a public works project.”¹⁵⁶ NRS 350 deals with municipal bonds.¹⁵⁷

In reference to bonds, there are four types in Nevada:

- General Obligation (“GO”) Bonds (paid from property tax)
- General Obligation Bonds/Revenue Secured (“GO/Rev”) Bonds
- Medium-Term Bonds
- Revenue Bonds

Nevada municipalities have the authority to issue all these bonds¹⁵⁸, but they are subject to varying limitations. GO bonds backed by property tax revenue must go through a long approval process and be approved by voters in an election.

On the other hand, GO/Rev Bonds do not require voter approval, which are backed by revenue streams.¹⁵⁹ However, they must have an unused revenue stream available. If not, the county would need legislative approval for an increase in some tax source. Medium-term bonds would not require voter approval. However, the public agency must show the Department of Taxation that it has the revenues to pay off the bond over the term period. The maximum term is limited to 10 years. One of the major drawbacks of these types of bonds are the high debt service payments. Public agencies are free to issue pure revenue bonds. However, they must demonstrate that the pledged revenues are more than sufficient to cover the debt service.

A dedicated tax is the most straightforward mechanism for funding an infrastructure project. A state or local government simply passes some new tax at a rate capable of covering the cost of the given project.

With GO and GO/Rev bonds, bonds are sold by the state or municipality to obtain the necessary funding up front, and the future tax revenues pay off the bond with interest, just like a personal loan. In Nevada, GO bonds can only be secured with property tax revenues. GO/Rev bonds are backed by any other tax, such as Sales & Use tax, room

¹⁵⁶ Merrill, A Bank of America Company. Accessed Dec 9, 2020. “Earn tax free income with municipal bonds.” <https://www.merrilledge.com/article/earn-tax-free-income-with-municipal-bonds>

¹⁵⁷ Nevada Revised Statutes, Chapter 350. <https://www.leg.state.nv.us/nrs/nrs-350.html>

¹⁵⁸ Ibid.

¹⁵⁹ No voter approval is necessary unless petition for bond election is successful. However, the municipal government must hold hearings.

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tax, etc. and could also include operations revenues. However, these bonds attain their better rating because of the tax revenue assurance.

We should note that GO bonds are highly valued because of their comparative safety as an investment. GO bonds are paid via general (property tax) revenues, as a primary or secondary source of repayment, and are backed by the full faith and credit of the issuing government agency. As such, the relevant jurisdiction will be required to pay any difference between revenues of a project, like a transit system investment, and the debt service requirements of the respective bonds from general taxes. Therefore, GOs generally have relatively higher bond ratings compared to other types of bonds. In the case of sub-state agencies, the CT also understands, if tax revenues fall short of the debt service, the state can help the sub-state entity meet its debt obligations using a fund specified for tax revenue shortfalls.

In the case of state infrastructure projects, pay-as-you-go—whereby public agencies use funds to directly pay for a project as they come in—is probably not feasible. Using pay-as-you-go funds for large capital projects requires years, if not decades, of saving tax revenue prior to the start of construction, as has been done in Maricopa County, Arizona.¹⁶⁰ No such funding has been accumulated for large projects in Nevada.

A revenue bond is a type of municipal bond that is backed by the future revenues generated by a specific project's operating revenue stream. These are higher risk bonds than GO bonds, which are backed by the full faith and credit of the borrower. However, those sentiments might be changing as some now say that revenue bonds might be the less risky option in light of the recent increase in municipal bankruptcies throughout the United States since the Great Recession.¹⁶¹ As such, these bonds generally carry a higher interest rate. Revenue bonds are often issued to build or expand essential services that produce operating revenues, such as sewage utilities, electric utilities, toll roads, airports and prisons.¹⁶²

A revenue generating proposition, such as a transit system in the state, would have the ability to generate revenues. Therefore, it could potentially issue revenue bonds. These bonds have been used before in Nevada. In fact, several entities in the state and in Clark County have used revenue bonds to fund operations, including McCarran Airport. Also, there are no legal hurdles to issuing these bonds by sub-state entities in Nevada.

¹⁶⁰ Luzer, D. Governing.com. Dec 2013. "How to Make 'Pay As You Go' Work for Large Capital Projects."

<http://www.governing.com/columns/public-money/gov-how-to-make-paygo-work.html>

¹⁶¹ MuniNet Guide. May 29, 2017. "McCarran Airport Revenue Bonds (Clark County) - \$148 Million - MuniNet Featured Bond." <https://muninetguide.com/mccarran-airport-revenue-bonds/>

¹⁶² Hayes, P. Investment News. Jul 12, 2016. "General obligation bonds have encountered problems as municipal issuers face rising fixed legacy costs that challenge revenue growth." <https://www.investmentnews.com/article/20160613/FREE/160619980/the-case-for-favoring-revenue-bonds-over-general-obligation-bonds>

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However, a review of the literature^{163 164} shows that pure revenue bonding for large-scale infrastructure projects is still rare and that operations revenues are usually accompanied by other funding sources as well. Nevertheless, the use of revenue bonds certainly should be further studied, if not for fully funding a potential infrastructure project, then partially funding it.

Private Activity Bonds

Private Activity Bonds (“PAB”) are a type of municipal bond. Essentially, they are municipal bonds for state or local governments on projects’ whose use can be leased out to the private sector. They can help lower costs on projects because they may be tax-exempt. For example, Brightline is planning on using these subsidized loans to help fund the XpressWest passenger rail project that is planned to connect Clark County to Southern California.¹⁶⁵

According to the Municipal Securities Rulemaking Board,¹⁶⁶ a municipal security is considered a PAB if it meets two sets of conditions set out in Section 141 of the Internal Revenue Code:

1. More than 10 percent of the proceeds of the issue are used for any private business use and the payment of the principal of or interest on more than 10 percent of the proceeds of such issue is secured by or payable from property used for a private business use.
2. The amount of proceeds of the issue used to make loans to non-governmental borrowers exceeds the lesser of five percent of the proceeds or \$5M.

PABs are similar to a municipal loan in that the public is directly responsible for paying back the loan. However, they are also similar to private loans in that the public receives payments from the private firms that lease the asset.

A drawback is that some of these bonds are limited by a volume cap, based on each state’s population. This includes high-speed intercity rail projects. Based on Nevada’s population estimate for 2019, this limit would be around \$300M per year, with only half available to the state and the other half at the sub-state level.¹⁶⁷ However,

¹⁶³ Ortiz, IN, Maring, GE. Cambridge Systematics, Inc. 2008. “Case Studies of Freight Finance Options.”

<http://onlinepubs.trb.org/Onlinepubs/sr/sr297CaseStudies2.pdf>

¹⁶⁴ Batic Institute. “Case Study—\$169.5 Million Los Angeles County Metropolitan Transportation Authority General Revenue Bonds (Union Station Gateway Project) Series 1995-A.” http://transportation-finance.org/pdf/funding_financing/financing/mechanisms/bonding_debt_instruments/farebxrevbnds_lacmtacasestdy.pdf

¹⁶⁵ Brightline. Jul 24, 2020. “Nevada Approves Private Activity Bonds for XpressWest.” <https://www.gobrightline.com/press-room/nevada-approves-private-activity-bonds-xpresswest>

¹⁶⁶ Bourgi, S. MunicipalBonds.com. Oct 2, 2019. “Understanding Private Activity Bonds.”

<https://www.municipalbonds.com/education/understanding-private-activity-bonds/>

¹⁶⁷ U.S. Internal Revenue Service. “TEB Phase II - Lesson 4, General Rules for Private Activity Bonds” https://www.irs.gov/pub/irs-tege/teb2_lesson4.pdf

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only portions of a loan may be subject to the volume cap. There are several exceptions regarding the laws governing PABs, which require knowledgeable application on the part of the governments and firms considering their use.

Furthermore, the funded project must be located within the state. Therefore, for any multi-state project, only that part of the project located within Nevada could be funded with PABs taken out by Nevada entities. This would require states to work together to complete interstate projects, such as was done with the delayed¹⁶⁸ XpressWest.¹⁶⁹

Railroad Rehabilitation & Improvement Financing (“RRIF”) Program

Another program available for railroad improvement is the USDOT RRIF program.¹⁷⁰ This program differs from several discussed above. While other federal programs were grant programs, this is a subsidized financing program. RRIF offers low-interest loans with flexible options. For one, interest does not accrue until proceeds are drawn. Second, the program offers longer repayment periods in addition to a five-year deferment after substantial project completion. Additionally, there is no pre-payment penalty. These loans can fund up to 100 percent of a project.

USDOT is authorized to provide up to \$35B in loans and loan guarantees to finance rail projects. At least \$7B is reserved for non-Class I railroads. Borrowers eligible for the program include states, local governments, government-sponsored authorities and corporations, limited option freight shippers and joint ventures. The funds can be used for anything from acquiring and building new rail and intermodal facilities to rehabilitation of those items. These monies can also reimburse planning and design expenses as well as refinance outstanding debt used for any of the above actions.

B. Last-Mile Delivery Services & Other Supply Chain Improvements

“Last-mile” delivery can refer to several phenomena. Relative to personal transportation, it refers to moving people from a starting location to public transportation (aka the “first-mile”) or vice versa—last-mile. Taxis and rideshare companies (e.g., Uber, Lyft) are examples of this type of service. In terms of utilities, it refers to the last piece of infrastructure needed to provide services to a consumer, such as water or electricity to a home. One example

¹⁶⁸ Akers, M. Las Vegas Review-Journal. Nov 2, 2020. “Construction of high-speed rail line delayed as bond sale postponed.” <https://www.reviewjournal.com/business/tourism/construction-of-high-speed-rail-line-delayed-as-bond-sale-postponed-2171748/>

¹⁶⁹ Varghese, R. Bloomberg Quint. Nov 2, 2020. “Fortress Fails to Sell Record Bond Deal for Las Vegas Rail.” <https://www.bloombergquint.com/business/fortress-fails-to-sell-record-bond-deal-for-las-vegas-rail>

¹⁷⁰ U.S Department of Transportation, Build America Bureau. Accessed Dec 18, 2020. “Railroad Rehabilitation & Improvement Financing (RRIF).” <https://www.transportation.gov/buildamerica/financing/rrif/railroad-rehabilitation-improvement-financing-rrif>

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would be delivering from the main water line under a road to one's home. However, relative to supply chain and logistics it generally refers to moving goods from a local area warehouse to the final consumer.

In the logistics space, this is an issue that is mostly relevant to private industry. Public entities do not have a direct role in solving problems associated with the last-mile. However, public entities can support private industry in its goals and refrain from creating obstacles. In support, public entities at the federal and state levels can fund research into technologies with the potential to solve the last-mile problem. The federal, state and local governments can also keep from erecting regulations that limit the ability of private industry to innovate in the field. California recently enacted a type of regulation that would likely have hurt rideshare businesses; however, the state effort was rebuked by voters.¹⁷¹

The last-mile contributes significantly to a good's costs. According to the Bureau of Economic Analysis ("BEA"), the last leg makes up about 28 percent of logistics expenses.¹⁷² This figure shows just how important the last-mile problem has become in supply chain and logistics. For this reason, it is important to consider last-mile logistics in any future planning relative to Nevada infrastructure and freight. Facilitating the transfer of goods and people between the multitude of transportation modes is essential to improving Nevada's supply chain infrastructure.

Rideshare company Uber is not only trying to make inroads into the people-moving business. It is also trying to apply its business approach to the supply chain via its Uber Freight operation.¹⁷³ Rather than match drivers to riders, Uber Freight matches shippers to carriers. Currently, the company matches clients with carriers for point-to-point shipments, which is one way to solve the first/last-mile problem. In order to help bolster this part of its business, Uber has committed \$200M a year to its freight division and has acquired a self-driving trucking startup.¹⁷⁴

Dirigibles or airships are another potential source of supply chain innovation and are making a comeback. They are relatively slow, but like ships, airships could be used to carry large amounts of cargo.¹⁷⁵ These could be especially benefit rural communities, which are too remote for rail and too expensive for truck service.¹⁷⁶ Several companies have been working to develop the technology necessary to make these viable. Lockheed Martin, for example,

¹⁷¹ Conger, K. New York Times. Nov 7, 2020. "Uber and Lyft Drivers in California Will Remain Contractors."

<https://www.nytimes.com/2020/11/04/technology/california-uber-lyft-prop-22.html>

¹⁷² Smith, A. Freight Waves. Dec 2, 2019. "Is the U.S. final mile market size \$8 billion or \$417 billion?"

<https://www.freightwaves.com/news/is-the-us-final-mile-market-size-8-billion-or-417-billion>

¹⁷³ Uber Freight. <https://www.uber.com/us/en/freight/>

¹⁷⁴ Hawkins, AJ. The Verge. Sep 9, 2019. "Uber will spend \$200 million to expand its Uber Freight trucking venture."

<https://www.theverge.com/2019/9/9/20856812/uber-freight-200-million-expansion-chicago-headquarters>

¹⁷⁵ International Airport Review. Accessed Dec 20, 2020. "The emergence of cargo airships: An opportunity for airports."

<https://www.internationalairportreview.com/article/37170/cargo-airships/>

¹⁷⁶ Prentice, BE and Thomson, J. University of Manitoba. Nov 2, 2020. "Economics of Airships for Northern Re-supply."

https://umanitoba.ca/faculties/management/ti/media/docs/AA04_airship_small1.pdf

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developed plans for an airship capable of carrying 47,000 pounds of cargo.¹⁷⁷ A rare earths mining operation in Canada is even planning on using airships instead of building roads to their mine, reducing the startup costs of the operation as well as being more environmentally friendly by sparing a caribou migration habitat.¹⁷⁸ This is an option that Nevada miners could potentially consider in lieu of rail. While the role of the state and its communities is limited in terms of developing infrastructure relative to the options being discussed, the state could possibly look to facilitate the construction or financing of airship testing around the state. One or two could help test the viability of airships, particularly with respect to mining or rural community supply chains.

Drones have now been around for several years and are relatively well known throughout popular culture, from military drones to small personal drones that are used to take video from a bird's eye view. The first unmanned aerial systems ("UAS" or "drone") were invented decades ago. However, progress in drone technology started to pick up in 2000 with the U.S. military's introduction of the Predator drone. Then, in 2006, the FAA issued the first commercial drone permit. Since then, there has been an explosion in drone innovation.¹⁷⁹ While early advances in UAS originated in government laboratories, it is now being largely driven by the private sector. Drones could finally make flying cars a reality.¹⁸⁰ Their potential to move people is a reason that investment in fixed-rail personal transportation may not be the best way to expend resources. They could also be used to transform last-mile delivery.¹⁸¹ There is a limited role for state governments to play in the deployment of these drones.

However, the government will surely have a role in facilitating research and in regulating where these drones can fly. Amazon recently gained FAA approval to operate a fleet of delivery drones.¹⁸² The federal government's rules will be applicable to many drone flights, but state and local governments will have a role as well. For example, these governments will be able to restrict airspace that cannot be used by UAS operators.¹⁸³ Nevada jurisdictions should begin a discussion between communities and drone operators now in order to expedite the use of this technology in the state. Amazon already has patents on floating warehouses from which drones will operate and deliver goods.¹⁸⁴ Along with their FAA approval and stated intent to deploy drones, a proactive approach is needed to stay ahead of the curve and be a leader relative to other states and communities in this space.

¹⁷⁷ DC Velocity. Apr 9, 2016. "Cargo blimps designed for low-cost air freight." <https://www.dcvelocity.com/articles/27919-cargo-blimps-designed-for-low-cost-air-freight>

¹⁷⁸ Topf, A. Mining.com. Nov 22, 2016. "Canadian rare earths mine to transport ore using airships." <http://www.mining.com/canadian-rare-earths-mine-transport-ore-using-airships/>

¹⁷⁹ Vyas, K. Interesting Engineering. Jun 29, 2020. "A Brief History of Drones: The Remote Controlled Unmanned Aerial Vehicles (UAVs)." <https://interestingengineering.com/a-brief-history-of-drones-the-remote-controlled-unmanned-aerial-vehicles-uavs>

¹⁸⁰ Uber Air. <https://www.uber.com/us/en/elevate/uberair/>

¹⁸¹ Amazon Prime Air. <https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011>

¹⁸² Palmer, A. CNBC. Aug 31, 2020. "Amazon wins FAA approval for Prime Air drone delivery fleet." <https://www.cnbc.com/2020/08/31/amazon-prime-now-drone-delivery-fleet-gets-faa-approval.html>

¹⁸³ Federal Aviation Administration, Office of the Chief Counsel. Dec 17, 2015. "State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet." https://www.faa.gov/uas/resources/policy_library/media/UAS_Fact_Sheet_Final.pdf

¹⁸⁴ Shearer, N. University of Nevada, Reno, Nevada Today. Jun 25, 2020. "Researchers say drone technology will change the face of last-mile logistics." <https://www.unr.edu/nevada-today/news/2020/drone-technology-impacts-last-mile-logistics>

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Relative to drone technology, Nevada has already made progress. Because of federal government policy, Nevada had a head start in terms of drone technology. Creech Air Force Base located about an hour and a half north of the Las Vegas Valley is home to many of the military's drone pilots.¹⁸⁵ In 2013, GOED entered into a partnership with the Nevada Institute for Autonomous Systems ("NIAS") to provide oversight and help get Nevada designated as an official UAS test site. Since then, NIAS' mission has been to facilitate the testing of UAS technologies and incentivize companies in the space to locate in the state.¹⁸⁶ Additionally, in early 2019, Nevada was chosen as one of three states to begin UAS trials in urban airspace.¹⁸⁷ Also, following the 2019 Commercial UAV Expo in Las Vegas, NIAS and the FAA announced the Nevada-Global Drone Trade Alliance, a business-to-business trade platform.¹⁸⁸ These are positive steps, but efforts must continue to make sure that the technology's future drivers—private sector firms—locate to Nevada.

Another important supply chain infrastructure component is broadband internet. One new method of bringing internet into homes and business is satellite broadband internet service. This is an emerging technology that could bring high-speed internet to anywhere on Earth. So, while it is not specific to Nevada, Nevada would benefit from it greatly, in any case. The company that is leading the charge into this new frontier is SpaceX, one of the companies headed by Elon Musk. SpaceX is in the earlier stages of launching its Starlink satellite network. As of December 2020, SpaceX has launched 955 Starlink satellites into space.¹⁸⁹ SpaceX has already received approval from the Federal Communications Commission to launch 12,000 satellites and it is looking to launch up to 30,000 more as part of the constellation.¹⁹⁰ The system is now in beta testing¹⁹¹ but a full rollout is expected to take a few more years.¹⁹² SpaceX also received \$886M in federal subsidies to provide high-speed internet to rural

¹⁸⁵ CBS News. Jul 23, 2019. "Behind the scenes of the Air Force's anti-terrorism drone program." <https://www.cbsnews.com/news/air-force-anti-terrorism-drone-program-behind-the-scenes/>

¹⁸⁶ NIAS. Accessed Dec 20, 2020. "About." <https://nias-uas.com/about/>

¹⁸⁷ Schulz, B. Las Vegas Review-Journal. Jan 14, 2019. "Nevada chosen as drone test site for pilot program." <https://www.reviewjournal.com/business/nevada-chosen-as-drone-test-site-for-pilot-program-1573504/>

¹⁸⁸ Inside Unmanned Systems. Nov 16, 2019. "Commercialization of Autonomous Systems: The Nevada-Global Drone Trade Alliance." <https://insideunmannedsystems.com/commercialization-of-autonomous-systems-the-nevada-global-drone-trade-alliance/>

¹⁸⁹ Foust, J. Space News. Nov 24, 2020. "SpaceX sets new Falcon 9 reuse milestone on Starlink launch." <https://spacenews.com/spacex-sets-new-falcon-9-reuse-milestone-on-starlink-launch/>

¹⁹⁰ Henry, C. Space News. Oct 15, 2019. "SpaceX submits paperwork for 30,000 more Starlink satellites." <https://spacenews.com/spacex-submits-paperwork-for-30000-more-starlink-satellites/>

¹⁹¹ Mack, E. C-Net. Nov 22, 2020. "How SpaceX Starlink broadband will envelop Earth and transform the sky." <https://www.cnet.com/features/how-spacex-starlink-broadband-service-will-envelop-earth-transform-the-sky/>

¹⁹² Cooke, K. Satelliteinternet.com. Accessed Dec 20, 2020. "SpaceX Starlink Satellite Internet Service." <https://www.satelliteinternet.com/providers/starlink/>

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communities throughout the country, including in Nevada.¹⁹³ Other companies, such as Amazon,¹⁹⁴ are planning internet constellations as well, but Starlink will be the largest based on current plans.¹⁹⁵

Another way that technology is pushing the boundaries of supply chain is through innovations via the Internet of Things (“IoT”). IoT is the next step in digitizing the world. Essentially, it connects “things,” rather than people, to the internet. This will allow companies to track and communicate with items in real-time. For example, a prescription medication can notify the shipper and client if the temperature-controlled truck in which it is being shipped gets too warm. It will also allow items to make decisions on their own, based on pre-programmed responses, in order to increase efficiencies. These advances will help ensure quality control as well as provide more information to both clients and suppliers.¹⁹⁶ IoT is dependent on the emergence of 5G wireless internet service, which will help accommodate the additional internet traffic that all these new connected devices will produce.¹⁹⁷

An additional technology that could further efficiency gains within IoT is cryptocurrency. This remains an emerging field with use-cases that are in their infancy or even yet to emerge. However, efforts are already being made to apply cryptocurrencies to IoT and supply chain management.¹⁹⁸ According to Harvard Business Review, blockchain technology has the potential to transform the supply chain industry for the better, allowing for more efficiency, transparency and trust.¹⁹⁹ This potential industry is of particular interest to Nevada because of Blockchains, LLC’s plans for growth in the state.²⁰⁰ One strength that this approach offers is that goods being transported may themselves be able to determine the most efficient route to take to move between two points. With access to real-time information, the goods can make the most efficient decision based on pricing algorithms and initiate transactions themselves. Another use-case could be to ensure that a product is genuine. For example, a shoe company could embed its product with a chip that contains a cryptocurrency token that cannot be forged. The buyer and seller could then both access a record of the item’s progress from factory floor to the buyer’s front door while ensuring its authenticity.

¹⁹³ Brodtkin, J. Ars Technica. Dec 7, 2020. “SpaceX gets \$886 million from FCC to subsidize Starlink in 35 states.”

<https://arstechnica.com/tech-policy/2020/12/spacex-gets-886-million-from-fcc-to-subsidize-starlink-in-35-states/>

¹⁹⁴ Brodtkin, J. Ars Technica. Dec 17, 2020. “Amazon’s answer to SpaceX Starlink delivers 400Mbps in prototype phase.”

<https://arstechnica.com/information-technology/2020/12/amazons-answer-to-spacex-starlink-delivers-400mbps-in-prototype-phase/>

¹⁹⁵ Malik, T. Space.com. Oct 24, 2019. “SpaceX’s Starlink Broadband Service Will Begin in 2020: Report.”

<https://www.space.com/spacex-starlink-satellite-internet-service-2020.html>

¹⁹⁶ Blume Global. Accessed Dec 20, 2020. “How the Internet of Things Is Transforming Supply Chain Management.”

<https://www.blumeglobal.com/learning/internet-of-things/>

¹⁹⁷ Collela, P. Ericsson.com. Accessed Dec 20, 2020. “5G and IoT: Ushering in a new era.” <https://www.ericsson.com/en/about-us/company-facts/ericsson-worldwide/india/authored-articles/5g-and-iot-ushering-in-a-new-era>

¹⁹⁸ Agrawal, H. Coinsutra. Jun 2, 2020. “Here Are The Top Supply Chain Management Cryptocurrency Projects.”

<https://coinsutra.com/supply-chain-management-cryptocurrency-blockchain-projects/>

¹⁹⁹ Gaur, V. and Gaiha, A. Harvard Business Review. May – Jun 2020. “Building a Transparent Supply Chain.”

<https://hbr.org/2020/05/building-a-transparent-supply-chain>

²⁰⁰ Blockchains LLC. Accessed Dec 19, 2020. “The Latest.” <https://www.blockchains.com/the-latest/>

VII. NEVADA INFRASTRUCTURE BANK

Infrastructure has been an essential component for economic evolution, and actually, any human endeavor throughout history. Early human settlements were situated and established near natural waterways such as rivers, estuaries and bays. These locations allowed for ease of cultural interactions and the earliest forms of commerce by providing linkage into the hinterlands. Goods and technology moved in two directions from land-locked interiors to port communities, as well as the world beyond. In this manner, rivers and waterways became the commercial highways of civilization throughout the world and major commerce centers developed and prospered along the riverbanks and natural ports.

While there is a myriad of funding sources, such as tax policies as well as loan and grant programs available to address infrastructure issues, in this section, only infrastructure banks are explored. “They can be set up with a specific mandate to support the deployment of economically and socially important projects and promote sustainable design and operation of these assets. They can offer a wide range of financial instruments to mobilize private capital worth several times their own funds and even provide project preparation assistance. The unconditional backing of their respective governments enables infrastructure banks to have a high credit rating, allowing them to borrow cheaply from both domestic and international capital markets.”²⁰¹

A. Infrastructure Background

As humans ventured beyond their immediate areas into lands not connected by waterways, trails or roads began to become established. Merchants and travelers braved weather and highwaymen to establish vast networks of trading routes. Along those new trade routes comfort stations began to emerge to provide services and a safe haven for those utilizing the routes. Over time these service communities developed into larger towns and cities. At this time, the infrastructure for these routes were the towns and cities themselves. One of the more famous of these routes, the “Silk Road”, stretched approximately 4,000 miles from Asia Minor through Central Asia, and on to China. The Silk Road fostered trade and economic growth for many cultures. However, just as in today’s world of commerce and trade, new technology (the advent of long-distance sailing ships and the navigational techniques utilized to find their way on the vast ocean) allowing for safer and quicker transportation of goods, rendered the Silk Road obsolete for long distance trade between Europe and China.

Over time, the next great leap in technology to influence commerce and transportation was the railroad. The railroad was not tethered to waterways, thus making it more flexible than water bound transportation, but quicker

²⁰¹ “Infrastructure Banks: Solutions and Best Practices” David Uzsoki, International Institute for Sustainable Development, January 2018

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and safer than long-distance roadways and trails. And though the railroad connected existing populations and commerce centers at the time, it opened up vast amounts of land for development. Much like the earliest land trade routes, service and trade communities sprang up at various points along the routes to take advantage of the economic opportunities the rail provided. In this manner the railroad greatly influenced the location and establishment of communities along its route. Additionally, unlike waterways and overland trails, the railroad itself was the infrastructure.

In its pursuit of safe, efficient, flexible and speedy delivery of goods and people, the next transportation system to influence commerce and the locations of economic activity was the interstate highway system. More than other transportation systems, interstate highways, while connecting the largest economic activity modes and population centers, allowed for economic development to flourish in the hinterlands, through what can be considered “infill” development.

Utilizing shopping malls as an example, the large cities, or commerce centers, act as anchors for development, allowing the various smaller communities along its route to take advantage, or syphon off, the traffic generated between the major nodes of economic activity. This infill is generated to take advantage of lower labor costs; lower land and construction costs, lower taxes, lower cost of living and adding value to raw materials at extraction or agricultural sites; thereby, lowering transportation costs by shipping higher value components or products to the next phase of the production cycle, or final market. In a very real sense, the interstate highway system gave rise to supply chain economics. Much like railroads, the interstate highway itself is the infrastructure that requires careful pre-construction and budgetary planning.

Chronologically, the next infrastructure program to influence urban growth and economic activity was the development of regional and international airports. Airports allow for the rapid movement of people and goods throughout the world. Time sensitive materials and products such as medicine, fresh food, or high value to low weight/volume components quickly travel around the globe via air freight. In this manner, airports have also been a critical component to value-added, or supply chain economics. Without extensive air freight handling capabilities, a city will not realize its full economic potential. Of course, with the complexities surrounding the site location analysis, planning and construction of the airport, costs and lag time between initial planning and flight operations increase substantially from the other infrastructure programs described above.

Finally, the most recent infrastructure technology is both the most flexible and least costly to install while having the potential to significantly change the impact on cultural exchange and commerce in all of human history. This technology is telecommunications. Telecommunications uniquely transfers a portion of the infrastructure costs to the end users in that the equipment required to take advantage of the technology, whether it be a workstation, or mobile device, is financed by the end users. To understand the potential of the new technology, one must adhere

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to the concept that transportation is not only the movement of people and goods, but of information and ideas as well. And, while great strides have been made over the past couple decades on how to best utilize this technology, the COVID-19 virus has acted as a conduit to explore new uses, and more importantly, hastened acceptance of this communication within a business setting.

The implications of how telecommunications will transform everyday life have yet to be fully discovered. From the economic development point of view, the commercial real estate industry will most likely see the most change. Today, we have already witnessed the impact this technology has on the retail sector with e-commerce growing exponentially, at the cost to brick-and-mortar retail. Will COVID-19 open the floodgates to more work-from-home, or other remote locations? Which, in turn, could reduce the demand for office space. It could lead to the reuse of outdated big box retail from office/call centers to warehouse and distribution facilities. It enables employees to relocate and live in remote areas should they so desire. This could allow unique locations, such as Goldfield, NV, to realize an economic resurgence. As stated earlier, the implications could be staggering. It will be interesting to experience how commerce and economics respond as this technology allows the three basic principles of theoretical capitalism, perfect knowledge, as well as the perfect mobility of capital, and especially labor, to become more of a reality.

How is infrastructure viewed today? “There is no agreed-upon meaning of “infrastructure.” The term generally refers to long-lived, capital-intensive systems and facilities. Some definitions are limited to systems and facilities that have traditionally been provided largely by the public sector directly, such as highways and drinking water systems. Others add facilities that in the United States belong predominantly to private entities, such as electricity production and distribution, reflecting both their importance to the economy and the different public-private arrangements through which services can be provided. Some definitions include a narrow range of “core” systems, typically transportation, energy, water, and telecommunications, whereas others include facilities for such purposes as education, recreation, health, and protection of natural resources.”²⁰²

While there may not be unanimity on what is included within the term infrastructure, there is agreement that the infrastructure in the United States today needs immediate attention:

“There is a broad consensus in the United States that we have reached a point where urgent steps must be taken to repair and upgrade our crumbling infrastructure. The nation needs a modern, 21 Century infrastructure and industrial platform, as is being constructed in many parts of the world. The American Society of Civil Engineers, International Association of Machinists and Aerospace Workers, U.S. Chamber of Commerce, and North America’s Building Trades Unions estimate that a minimum of \$3-5 trillion is

²⁰² “Transportation Infrastructure Investment as Stimulus: Lessons from the American Recovery and Reinvestment Act of 2009” Congressional Research Service, May 5, 2020

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needed to address the needs. A new national mission, like a Roosevelt New Deal or Kennedy Space Program is needed to lift the nation out of economic collapse, falling real wages, and cultural despair. Only a concerted effort comprised of federal appropriations, state and local programs, and a new National Infrastructure Bank can surmount this crisis.”²⁰³

“And each segment needs investment. The United States has consistently received failing grades on its aging infrastructure. As seen in Table VII-1, a 2013 report by the American Society of Civil Engineers gave the country a D+ grade. The underlying conditions behind this grade are felt by local communities, governments, and industries. Billions of dollars are lost as commercial goods move slower and more fuel is consumed, exports and imports bog down at ports, travelers miss businesses meetings, and perishable goods take longer to reach their destinations. According to a 2013 report released by the McKinsey Global Institute, road congestion alone costs drivers over \$100 billion in added fuel costs and time.”²⁰⁴

A more recent study by the American Society of Civil Engineers breaks down the country's infrastructure requirements by type, and their estimated funding requirements. Their findings are depicted in Figure VII-1.²⁰⁵

As can be seen from Figure VII-1, the infrastructure categories that are the least in need of additional funding are airports and rail facilities. This may be due to rail being primarily constructed and funded by the private sector and specifically the railroads themselves. While airports, when operated correctly, generate large volumes of revenues which make them excellent candidates for revenue bond financing.

The United States is not unique in its needs for infrastructure upgrades and investment. However, for a country that leads the world in the size and volume of its economy, it does not rank among the elite of the developed nations of the world. As can be seen from Table VII-2 the U.S. ranks 19 when comparing the global rankings of the quality of overall infrastructure, having an index value below Oman, and equal to Bahrain.²⁰⁶

And this lack of infrastructure quality, and thereby lack of funding or investments, is not equal among the states in the United States. As can be seen in Figure VII-2, Nevada is close to average when comparing the various state's capital spending as a share of total spending.²⁰⁷

²⁰³ “Conditions Overripe for an Infrastructure Bank” Nancy Spannaus, American System Now, July 24, 2019

²⁰⁴ “Public-Private Infrastructure Financing Solutions” Caitlin MacLean, Milken Institute, November 2014

²⁰⁵ “It's Time for States to Invest in Infrastructure” Elizabeth C. McNichol, Center on Budget and Policy Priorities, March 19, 2019

²⁰⁶ “Public-Private Infrastructure Financing Solutions” Caitlin MacLean, Milken Institute, November 2014

²⁰⁷ “It's Time for States to Invest in Infrastructure” Elizabeth C. McNichol, Center on Budget and Policy Priorities, March 19, 2019

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And, while Nevada is close to the average when compared to the other states infrastructure funding, its rapid rate of population growth will most likely account for its standings in these spending estimates, in that infrastructure investments are a prerequisite in order for population growth to take place. Nevada, one of the fastest growing states over the past three decades, has capital spending as a share of total state spending approximately equal to Delaware, Massachusetts and Pennsylvania, three states that do not experience high population growth rates.

As can be seen from Figure VII-3, Nevada ranks dead last when a comparison is made among states ranked by percentage-point change in state and local infrastructure spending as a share of gross domestic product from 2002 through 2016, a time when Nevada was leading the nation in population growth and economic expansion.²⁰⁸

The condition of existing infrastructure, or lack thereof, has a significant negative impact on function and growth of the economy, which can be experienced at the Federal, state and local levels of government. For commerce to function at high levels requires a well-maintained multi-level transportation structure. Highways, railroads, airports, seaports and telecommunications must be efficient for the movement of raw materials and components within the supply chain process, as well as delivering finished products to the consumer. Growing states like Nevada, and the rapidly growing communities within the state, also rely on well-functioning water and sewer systems.

“No matter the climate—whether in good times or in bad—infrastructure investment is a crucial component to a successful economy, says Brian Oakley, executive vice president, JLL Public Institutions. On a foundational level, infrastructure spending is necessary for the supply chain to operate effectively and for people to travel to and from work. Maintenance of existing transportation infrastructure, including simple wear and tear, is needed to move products and people affordably and efficiently. Similarly, environmental infrastructure, such as water and wastewater systems, and energy infrastructure are “fundamental to any economic activity,” Oakley says. “If you don’t have advanced infrastructure, you’re just not going to have a well-functioning economy,” he explains.”²⁰⁹

Efficient infrastructure not only impacts the means of production, but also what is considered by many as the most important input to the supply chain process: labor. “State-of-the-art schools free from crowding and safety hazards improve educational opportunities for future workers. Better roads and public transit make it feasible (or more efficient) for workers to get from their home communities to more of the places where the jobs are.”²¹⁰

A long-term, robustly funded infrastructure package is one of the best ways to stimulate the economy. According to Brian Raff, Director of Communications and Public Affairs, American Institute of Steel Construction “Lower

²⁰⁸ Ibid.

²⁰⁹ “Infrastructure Investment as an Economic Stimulus Tool” Tom Gresham, Area Development, Q3, 2020

²¹⁰ “It’s time for States to Invest in Infrastructure” Elizabeth C. McNichol, Center on Budget and Policy Priorities, March 19, 2019

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interest rates make borrowing cheaper compared to recent years, reducing the upfront costs of generational projects. Infrastructure spending can also create immediate professional opportunities across a mix of design, construction, and operational jobs. The mix of short-term employment and long-term investment makes infrastructure an attractive area for federal stimulus.”²¹¹

“Economists prepared a number of estimates of the impact of an additional dollar of infrastructure spending on GDP growth in 2008 during the debate over a federal fiscal stimulus package. These estimates found that in the depths of the Great Recession, a dollar in infrastructure investment would result in \$1.50 in GDP growth, according to the Council of Economic Advisers. Similarly, Moody’s, a leading private econometric firm, estimated the effect at \$1.60. The Congressional Budget Office found that the impact ranged from a low estimate of \$1.00 to 2.50.”²¹²

The Hamilton Project noted in May 2015 that: “There is little dispute that the United States would benefit from enhanced infrastructure investment. The barrier has been finding a politically viable solution to the financing challenge. An infrastructure overhaul is timely for macroeconomic and employment reasons. Public Borrowing rates are at historical lows, and the lower cost of funds today will result in greater net benefits for society in the long run. Also, while the labor market has rebounded significantly from the economic recession, sectors that contribute heavily toward infrastructure, such as construction and manufacturing, remain slack and would benefit from greater demand.”²¹³

Identifying needs is the first step in addressing requirements for federal, state and local governments’ infrastructure investment. And, while this initial step is imperative for the future, it is by far not the most daunting task of the process. That label goes to finding the money necessary to address the problem which the American Society of Civil Engineers (“ASCE”), in its 2017 Infrastructure Report Card, “points out that the country will need to invest \$4.59 trillion by 2025 to improve its condition.”²¹⁴

So, the paramount question is: How do we identify sources of revenue to address this \$4.6T requirement, which, as the ASCE report explains, is needed just to “improve” infrastructure’s condition. This is especially pertinent when addressing infrastructure prerequisites for economic diversification in the state of Nevada. A local government policy of “Growth pays for itself” or “Pay as you go” is prevalent in the state. While this may work for large-scale, or master-planned residential communities, and their directly associated community retail and service

²¹¹ “Infrastructure Investment as an Economic Stimulus Tool” Tom Gresham, Area Development, Q3, 2020

²¹² “It’s Time for States to Invest in Infrastructure” Elizabeth C. McNichol, Center on Budget and Policy Priorities, March 19, 2019

²¹³ “Financing U.S. Transportation Infrastructure in the 21st Century” Roger C. Altman, Aaron Klein, and Alan B. Krueger, The Hamilton Project, May 2015

²¹⁴ “U.S. Infrastructure Scores a D+: More Than \$4.5 Trillion needs to be Invested by 2025” Civil Engineer, internet post, November 23, 2020

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commercial development, it fails when addressing the long term needs of transformational growth that enhances a local jurisdictions' ability to attract basic employment opportunities and private capital investment.

B. Commercial Space

Economic growth through the creation of private sector capital investment and employment creation is essential for any healthy economy. One primary obstacle to achieving this goal in Nevada is lack of "shovel ready" (meaning all off-site utilities are in place), large scale business parks. Nevada must develop a process or program whereby funding is set aside to construct infrastructure to identified business park sites, which can provide a return on investment to the state in the realization of additional private capital investment and job opportunities. Unlike large scale residential development which can start recouping infrastructure costs with the relatively quick sale of homes, industrial properties must be patient for its end users and return on investment, something the private sector is unable, or unwilling to do.

An individual company may take several years to determine expansion or relocation opportunities, but once that determination is made, they want to move as quickly as possible. Oftentimes, a manufacturer's optimum location can include a several-state region, and the lack of existing "turnkey" buildings or improved, correctly zoned sites will disqualify a location in Nevada from further consideration.

This need for large industrial/logistics sites has been proven time and again through various studies and practical applications conducted by economic and real estate development organizations in Nevada. In a study conducted for the Las Vegas Global Economic Alliance, ("LVGEA"), in March of 2014, titled "Industrial Building Survey & Comparative Market Analysis", it was discovered that 91 percent of all respondents cited "land price & improvement, (infrastructure), costs as a significant factor in not attracting private company locations and expansions. In response to this study, Jonas Peterson, CEO of the LVGEA, is quoted, "Southern Nevada missed out on up to 151 businesses and 18,000 jobs over 12 months because potential companies were not able to find suitable large industrial space."

A 2015 study prepared by RCG for the LVGEA, titled "Southern Nevada Employment Lands Analysis" stated, "...the quantity and quality of utility services available is an important factor in private companies choosing a location." The study goes on to say, "However, servicing certain Southern Nevada lands with utilities may not be easy when considering the budget constraints of local governments versus the high cost of providing utilities, especially water." Additionally, during the panel discussion of large scale industrial real estate developers, and real estate brokers, which took place at this study's presentation, infrastructure costs were cited a primary obstacle in developing new industrial parks in Southern Nevada.

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Yet another study commissioned by NAIOP-Southern Nevada, with support from the Nevada Contractors Association, the Society of Industrial & Office Realtors (“SIOR”), and the Certified Commercial Investment Members (“CCIM”), titled, “Strategic analysis of Southern Nevada’s Economy: Potential Land Constraints on Economic Growth & Development” May 2016, paints a similar picture. This study finds, “The return of the Valley’s industrial market has been quite dramatic, to the point that supply shortages are common for certain types of space, especially large units – those over 100,000 square feet.” It goes on to say, “...there are signs that the Southern Nevada (economy) is even now suffering from structural problems in its industrial markets. The Las Vegas area is already at a competitive disadvantage in terms of inputs and other costs.” “This is reflected in the region’s high industrial land prices. In fact, of the selected (Western U.S.) cities, Southern Nevada has the highest industrial space rents per square foot.”

In November 2016, the LVGEA asked several real estate professionals specializing in industrial properties for their input. The responses received included: “It is not so much companies are overlooking us; as it is no product in some locations, and limited product in all locations.” “Any mid-size to larger single user buildings for sale are nonexistent in this recovery cycle.” “Anything from 50,000 SF up to larger 500,000 SF e-commerce facilities would do well here.” This lack of available buildings and sites equates into a substantial loss of potential jobs to Nevada. Should you extrapolate the two announcements of Amazon’s 1,000 employee, and Fanatic’s 400 base, 900 peak employee logistic facilities, the negative impacts of not having shovel ready sites becomes apparent.

“Public sector resources for infrastructure are strained, especially for transportation. Revenue from traditional sources such as the fuel tax are dwindling, and the political appetite to raise the rate, or even index it to inflation, is not strong in most states or at the federal level. With their major source of revenue diminished and municipal bond markets more risk averse due to the past economic downturn, states and localities are scrambling to find financing to fill the gap. Over the last two decades, the federal government created many innovative finance programs to help states stretch their transportation dollars. Loan programs such as the Transportation Infrastructure Finance and Innovation Act (“TIFIA”), the Railroad Rehabilitation and Improvement Financing (“RRIF”) Program, Grant Anticipation Revenue Vehicle (“GARVEE”) Bonds, and others provide flexibility to finance projects and attract a range of public and private investors. Financing is also provided through state infrastructure banks (“SIB”), subsets of state revolving funds which are publicly regulated loan funds capitalized from a variety of grant sources to assist projects across a range of infrastructure modes.”²¹⁵

Generally, SIBs are intended to complement the traditional Federal-aid highway and transit programs by supporting certain projects with dedicated repayment streams that can be financed in whole or in part with loans, or that can benefit from the provision of credit enhancements. As loans are repaid, or the financial exposure

²¹⁵ “Banking on Infrastructure: Enhancing State Revolving Funds” Robert Puertes and Jennifer Thompson, Brookings-Rockefeller, September 2012

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implied by a credit enhancement expires, the SIB initial capital is replenished and can be used to support a new cycle of projects.

“The federal government established SIBs as a pilot in the 1995 National Highway System Designation Act (“NHS”), allowing states to use a portion of their federal transportation allocation as “seed money” for an initial capitalization. State funds were to match the federal funding. The ten states selected to participate in the initial pilot were: Arizona, Florida, Ohio, Oklahoma, Oregon, South Carolina, Texas and Virginia. After California and Missouri were subsequently selected, all had started their SIBs by July 1997.

C. SIB Programs

The SIB program provided states the first opportunity to use federal apportionment dollars outside of the direct grant process, allowing them to leverage additional funds by securing low-cost debt financing. The ability to leverage SIB funding, either through capital markets, or by attracting additional public or private investment, increased the universe of projects and range of investment sources states could use to meet their infrastructure needs.

The 1995 law stipulated that SIBs must maintain separate accounts for contributions by the federal highway and transit funds. Several other provisions stipulated how state money could be added to the SIB and in what type of projects the SIB could invest. States could contribute up to 10 percent of the funds apportioned for FY1996, and again in FY1997, from their highway and transit accounts. The funds could be used to help with the construction of federal-aid highways as outlined in Title 23 of the U.S. Code, and transit capital projects under Title 49. Each state had to contribute at least 25 percent of the amount of each capitalization grant made to the SIB.

A \$150M appropriation in 1997 further capitalized the SIBs and expanded the pilot to 23 states. The additional funds became an attractive opportunity for states to set up SIBs without using any of their original apportionment. This wave of applicants also included the establishment of two “multistate” SIBs: one for Nebraska-North Dakota-South Dakota-Wyoming, and one for Arkansas-Tennessee. The latter was to have accounts for both states as well as one for joint projects. However, it appears that disagreements about which projects to finance resulted in no activity from either collaboration.

The 1998 Transportation Equity Act for the 21st Century (“TEA-21”) established new funding sources and provisions for four SIBs-California, Florida, Missouri, and Rhode Island- but only Florida and Missouri signed cooperative agreements using the funds. The rest remained under the 1995 and 1997 SIB legislation structures. TEA-21 changed previous legislative provisions by excluding the 10 percent cap on the percentage of federal

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apportionment allocated for SIB capitalization. It also allowed highway and transit funds to be deposited into the same account, rather than requiring SIBs to maintain them separately.”²¹⁶

Table VII-3 provides a list of all the state Infrastructure Banks in descending order of cumulative federal capitalization amounts as well as the year(s) and federal acts under which they were established.

As can be seen from the table there are large discrepancies between the 33 states that opted into the program as it was initiated, from a high of \$171M for Texas, down to \$1.2M for North Carolina. Though it can be expected that the larger populated states like Texas and Florida would have larger needs, and therefore receive more federal dollars, this is not a universal formula, as New York and California only received \$12M and \$3M respectively, while states with small populations such as Wyoming and New Mexico received \$24M and \$12M, respectively. Even Puerto Rico received over \$12M in two rounds of funding, while Nevada was one of the few states not participating in the pilot programs. It is reasonable to assume that those states most prepared to comply with the program criteria received the most funding.

Generally, infrastructure banks have been started with initial capital provided by the federal government. The capital can then be lent directly to other government entities, such as localities and school districts, or to other entities undertaking an infrastructure project. Loan repayments (in excess of any bank debt service) are usually designated to be re-lent to additional projects.

In a very real sense this type of lending activity closely replicates a revolving loan fund. However, revolving loan funds in various forms have been utilized by economic development programs in the U.S. for decades and are not limited to just standard types of commercial loans. As a matter of fact, revolving loans can consist of one, or even several types of financial assistance, including: low interest loans for all or part of a project; loans with interest-only periods in early years; construction period financing; refinancing; extended-term credit; lines of credit to support market studies; credit enhancement to qualify for private market bond insurance; subordinated debt instruments for revenue bonds; pooled credit for small issuers of debt; and equipment leasing pools.

Perhaps the most important consideration in the implementation of the SIB program is the ability to leverage scarce Federal funds with other funding mechanisms. This is important not only because of the benefit of attracting additional investment, but also because the presence of additional capital contributions by the project sponsor may reduce the default risk of the SIB loan.

²¹⁶ “Banking on Infrastructure: Enhancing State Revolving Funds” Robert Puertes and Jennifer Thompson, Brookings-Rockefeller, September 2012

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According to the Office of Economic Development Finance (2018): “The ability of such banks to issue debt solely backed by its loan repayments is based on the make-up of its loan portfolio, the bank’s management and credit practices, and bondholder protections such as debt service reserves. Credit rating agencies will underwrite the bank’s entire loan portfolio to review its concentration and the credit strength of the borrowers. To achieve an investment grade rating under Moody’s rating criteria, for example, the pool of loans should include at least 20 loans, with the top 5 largest loans representing less than 50 percent of the portfolio. Rating agencies will also analyze the expected cash flow coverage ratio for the bond debt service. Similarly, but on a much larger scale, Europe’s infrastructure bank, the European Investment Bank (“EIB”), received initial capital from its member states when it was established in 1957, and it has since been able to leverage 57 percent of its capital through bond offerings. Although the bank’s bonds have received the highest AAA-rating, its member governments plan to expand lending capacity through a \$14 billion (£10 billion) capital injection in the near future. The bank’s history of such capital infusions and expectations of future capital infusions if necessary (due to the political importance of the bank to the policies of European integration) have been critical to the bank’s AAA credit rating.”²¹⁷

And we can learn much from the EIB model, or more especially the European Union which funded and owns the bank. The EIB funds its lending activities mainly by issuing bonds on capital markets and projects that must be bankable, as well as meet strict social and environmental standards. Customarily, the EIB finances one-third of a project and is structured so its long-term financing attracts other investors.

The EIB philosophy and mandate also contribute to its success. These include support projects that contribute to growth; employment; regional cohesion and environmental sustainability in the following sectors: food and rural development, agriculture, education and training, digital economy, forestry, energy, health and life science, regional development, transport, and water and wastewater management.

Nevada in its 2017 Legislative Session decided to pursue the creation of a SIB. Two separate bills, AB 399 and SB 517, were taken up in the 2017 session. These two bills were reconciled and resulted in the adoption of a Nevada Infrastructure Bank encompassed within NRS 408.55048 – 408.55088. While this legislation enabled the Nevada SIB to be formed, it has been funded, nor operational activities initiated. However, a key aspect of the law vitally important to economic development is the definition of “utility infrastructure” which means any infrastructure allowing for the connection of the transmission or distribution system of a utility to a distribution facility installed by a master-planned industrial or business park in conformance with the tariffs of the utility and includes, without limitation, the engineering and construction of the infrastructure.

²¹⁷ “White Paper-Infrastructure Banks, Office of Economic Development Finance, January 17, 2018

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This simple definition specifically calls out the need for the bank to finance large-scale industrial and business parks. It is now the responsibility of economic development organizations throughout the state to ensure that much needed raw land is prioritized and provided with the necessary infrastructure to attract large employment generating projects. Economic development entities and practitioners must support and coordinate with the Nevada Department of Transportation. Only through a coordinated implementation effort among economic developers, planners, financial managers, and engineers, will a better understanding of the associated benefits of the SIB mechanism be realized.

Should Nevada move forward to establish the infrastructure bank, it will have to conform to the most recent federal guidelines contained in the provisions of 23 USC 610 and the FAST Act. In addition to requirements common to all SIB's such as: 35-year maximum loan term; bonds issued must achieve a rating of BBB- or better; local matches can be provided by state funds or repaid loans; and administrative expenses are allowed up to two percent of the Federal-aid funds capitalized; the FAST Act also contains the following:

- Reinstates provision that allows new Federal-aid apportionments (FYs 2016 through 2020) to be used to capitalize SIB's
- When States capitalize FAST Act apportionments, they are automatically converting their "Pilot" SIBs to "Permanent" SIBS
- States should note that Permanent SIBs are subject to all Federal requirements for new second and subsequent generation lending
- Allows capitalization of formula funds apportioned under:
 - National Highway Performance Program (\$116.4B over five years)
 - Surface Transportation Block Grant Program (formerly Surface Transportation Program; \$58.3B over five years)
 - National Highway Freight Program (new program providing \$6.3B over five years)
- Capitalization may not exceed 10 percent of funds apportioned to State under each of the above individual formula programs
- SIBs may establish a Rural Projects Fund for Rural Infrastructure Projects; this fund is separate from the highway, transit and rail accounts
- Projects must be located outside of an urbanized area with a population greater than 150,000
- Projects costs must be anticipated to be at least \$10M, but no more than \$100M
- For rural projects, SIBs may issue loans to public or private entities
- Loans may not exceed 80 percent of project costs
- TIFIA funds may be used to capitalize the Rural Projects Fund via a secured loan to the SIB
- The loan agreement must be executed with two years of the secured loan being obligated, otherwise the Secretary may extend the term of the loan or withdraw the loan commitment

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- The loan must be repaid within 35 years
- Other terms of TIFIA Program apply²¹⁸

Per the Coalition for a National Infrastructure Bank, “Unfortunately, most of the state infrastructure banks initially created under the federal pilot program have become inactive, primarily due to undercapitalization and the slow repayment of the revolving loan funds. Two states, North Dakota and Rhode Island, currently have the most active and successful banks in large part due to those states creating fully operational public banks.”²¹⁹

A study conducted by the University of Southern California provides more detail as to the condition of the SIB program:

“Research found that the SIB program underperformed due to (a), inadequate planning and execution by Congress which led to fundamental flaws being incorporated into the initial legislation, (b) inadequate administrative procedures at the FHWA which led to insufficient resources to implement and administer the program, (c) undercapitalization by Congress due to battles over devolution and the Davis-Bacon Act, and (d) failures of the legislative process (cycle) which prevented Congress to learn of or address the program’s flaws over its 22 year history.”

The study goes on to underline undercapitalization as the leading cause of the program’s lackluster performance.

“With the defeat of President Clinton’s U.S. DOT reorganization, the \$2 billion in funding first dropped to \$250 million and then \$150 million. No additional funding was supplied due to conflicts over devolution and the role the U.S. government should play in funding infrastructure. Because there was no assessment of the actual cost to the U.S. and the states, based on different SIB program funding levels, the dominant political philosophy won the day. With the funding cut, the SIB program was essentially relegated to a niche program that has funded less than 0.6 percent of the FHWA’s projects during its operation.”²²⁰

“Public banking is banking operated in the public interest, through institutions owned by the people through their representative governments. Public banks can exist at all levels, from local to state to national or even international. Any governmental body which can meet local banking requirements may, theoretically, create such a financial institution. These banks are distinguished from private banking in that its mandate begins with the public’s

²¹⁸ “State Infrastructure Banks 101” Frederick Werner and Kevin McDonald, Innovative Program Delivery, U.S.S Department of Transportation, Federal Highway Administration, Spring 2016

²¹⁹ Alphecca Muttardy (Macroeconomist for the Coalition for a National Infrastructure Bank) in discussion with author, October 2020

²²⁰ Lessons Learned from the FHWA State Infrastructure Bank Program, 1995 to 2016” Stephen M. Hubbard, Dissertation submittal, University of Southern California, August 2017

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interest. Privately-owned banks, by contrast, have shareholders who generally seek short-term profits as their highest priority. Public banks are able to reduce taxes within their jurisdictions because their profits are returned to the general fund of the public entity. The costs of public projects undertaken by governmental bodies are also greatly reduced, because public banks do not need to charge interest to themselves. Eliminating interest has been shown to reduce the cost of such projects, on average, by 50 percent.”²²¹

In the case of the Bank of North Dakota (“BND”), formed in 1919, “its stated mission is to deliver sound financial services that promote agriculture, commerce and industry in North Dakota. Today it is a major source of profit for the state, generating a whopping 25 percent return on equity even in 2008, when revenues in other states were plummeting. North Dakota has the lowest foreclosure rate in the country, the lowest credit card default rate, and the lowest unemployment rate. It has no debt at all, and it has had no bank failures at least in the last decade, which is due to the bank having a massive, captive deposit base. All of the state’s revenues are deposited in the bank by law. Most state agencies also must deposit with the BND. Although the bank takes some token individual deposits, most of its deposits come from the state itself. The BND does not compete with local banks for commercial deposits or loans. Municipal government deposits are generally reserved for local community banks, which can use those funds to back loans because the BND provides letters of credit guaranteeing them. Furthermore, the BND has built up a sizable capital fund. By the end of 2010, it had capital of \$327 million. It had \$4 billion in assets, of which \$2.8 billion were loans; and it had deposits of \$3 billion.”²²²

D. National Infrastructure Bank

An interesting proposal that has been discussed for almost a decade, but has recently gained in popularity and support, is the establishment of a National Infrastructure Bank (“NIB”). This NIB will be organized as a public bank, like the Bank of North Dakota.

“Legislation (HR 6422) has been introduced in Congress (March 31, 2020) to create a \$4 trillion National Infrastructure Bank (soon to be raised to \$5 trillion). This “NIB” would be a separate institution from the Budget, set up as a government-sponsored, lending, deposit-money bank and capitalized with existing Treasuries held by the public sector. Except for a relatively small appropriation from Congress to get started, the NIB will pay its own way. It will not create any new Federal debt, nor require any new Federal taxes. As such, it is configured to attract maximum political support from both Republicans and Democrats in Congress.

Highlights of this bank’s operation include:

²²¹ “What is Public Banking?” Public Bank Institute, internet, November 19, 2020

²²² “What are Public Banks and How do They Operate?” Ellen Brown, Web of Debt, September 2015

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- The NIB would be capitalized by purchasing up to \$500 billion in existing Treasury bonds held by the private sector (e.g., in pension and other savings funds), in exchange for an equivalent in shares of preferred stock in the NIB. The exchange would take place via a sales contract with the NIB/Federal Government that guarantees a preferred stock dividend of 2 percent more than private holders currently earn on their Treasuries. The contract would form a binding obligation to provide the incremental 2 percent, or about \$10 billion per year, from the Budget. While temporarily appearing as mandatory spending under the Budget, the \$10 billion per year would ultimately be returned as a dividend paid to government, from the NIB's earnings stream.
- The NIB will provide up to \$4 trillion in infrastructure loans. Using standard commercial bank accounting procedures, the NIB will create a deposit in the borrower's name, equal to the loan amount, as each loan is approved and made. The NIB will charge interest on the loans equal to the benchmark Treasury bond rate (or a minimum of 2 percent per year) plus points to reflect the borrower's credit quality. At those interest rates, the NIB should be earning at least \$80 billion per year, out of which it will pay: operating expenses; interest on deposits held at the NIB; and loan loss provision set-asides. What is left over should be more than enough to return \$10 billion per year back to the Budget, as a dividend payment to government.
- It is expected that borrowers from the NIB will be state and local governments because they own 87 percent of the nation's public infrastructure. No further privatization of public infrastructure - beyond what has already taken place (e.g., at ports, airports, and other places that normally collect user fees) - would result from NIB loan operations. State and local governments will be able to service their loans out of recovering revenues, especially as millions of workers are re-employed in great-paying jobs created by these large public investments.
- Infrastructure projects will be vetted according to their cost-benefit analysis, and a set of specific criteria set out in the Bill. Preliminary estimates suggest that, for every \$1 spent on a public infrastructure project, anywhere from \$3-7 is returned to the economy. Careful planning - to maximize economic growth and "dig up the road only once" - would be facilitated by Regional Economic Accelerator Planning Groups with state and local government participation, and technical assistance coordinated by the NIB."²²³

As introduced, HR 6422 can provide a substantial benefit to Nevada. An example of the types of activities and benefits that can accrue to Nevada are contained within the definitions of the Bill. These include:

²²³ Alphecca Muttardy (Macroeconomist for the Coalition for a National Infrastructure Bank) personal communication, October 20, 2020

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- **Energy Infrastructure Project** – The term “energy infrastructure project” means any project for energy transmission and distribution, energy generation as needed, energy efficiency enhancement for buildings, and energy storage.
- **Environmental Infrastructure Project** – The term “environmental infrastructure project” means any project for the establishment, deferred maintenance, or enhancement, including security enhancement, of any drinking water and wastewater treatment facility, storm water management system, flood gate, dam, levee, dredging, wetland restoration or other open space conservation, infill development, solid waste disposal facility, hazardous waste facility, or industrial site cleanup or remediation project.
- **Infrastructure Project** – The term “infrastructure project” means any transportation, energy, environmental, telecommunications, community development, or other infrastructure project for which a development plan is presented to the Bank for financing. It shall exclude military infrastructure.
- **Public Benefit** – The term “public benefit” means the clear and measurable benefit to society resulting from the public’s use of the infrastructure with respect to which a project is carried out, or the improvement such infrastructure provides in –
 - Economic growth and productivity
 - Air and water quality
 - Energy savings
 - High-wage jobs
 - Poverty reduction
 - Increased Federal, State, and local revenues
- **Telecommunications Infrastructure Project** – The term “telecommunications infrastructure project” means any project involving infrastructure required to provide communications by wire, fiber optic cable, or radio, including broadband, or to enhance security for such infrastructure.
- **Transportation Infrastructure Project** – The term “transportation infrastructure project” means any project for the construction, deferred maintenance, or enhancement, including security enhancement, of highways, roads, bridges, transit and intermodal systems, inland waterways, commercial ports, airports, high speed rail, and freight rail systems.

Table VII-4 provides a detailed breakout of how the NIB proposes to utilize its funding over the first 10 years.

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In addition to providing financing to Nevada for a variety of infrastructure projects in which it would be interested, Alphecca Muttardy writes in her email: That includes everything within Nevada, as well as projects that go across state lines (like high-speed rail and large water replenishment projects). A rough estimate of Nevada's share from this NIB is \$30 billion over about 10 years, which is expected to create about 185,000 permanent, good paying jobs in Nevada.

Though it is hard to predict how this national infrastructure bank legislation may fare in the next few years, both parties in Congress believe the need exists for additional funding to address the country's aging infrastructure needs. How each of the parties decide to address the issue and come to a bipartisan solution remains to be seen. A recent opinion piece in the Las Vegas Review Journal states "The problem is that most "infrastructure" legislation become larded with special-interest pork and turned into vehicles for incumbent preservation rather than addressing serious needs when it comes to roads, bridges, airports and the like. Given the toll the pandemic has taken in both human and financial terms, it's even more important today that any infrastructure spending bill be an exercise in restraint."²²⁴

This kind of view lends itself perfectly to support a National Infrastructure Bank with its formally adopted procedures and policies that can act as a safeguard to the pitfalls described in the editorial. Consequently, HR 6422 may soon find a ripe environment for passage.

E. Conclusions

Appendix I: Vision and Solutions (January 2017) of the Nevada State Freight Plan identifies a detailed list of priority freight projects for Reno/Sparks, Carson City, Las Vegas and Rural Nevada. The aggregate of these "priority" projects totals over \$24B. While some of these projects have been completed, or re-prioritized since 2017, other projects have most likely been added to the list. Regardless, Nevada must find new funding sources to address its current and future infrastructure needs. This was perhaps the primary impetus in passing the Nevada infrastructure bank legislation in 2017.

Currently, it is imperative that Nevada to be creative and flexible to take advantage of any and all future funding opportunities to address its infrastructure needs, wherever they might originate. Even though SIBs have a checkered history of ongoing success, Nevada must take the immediate steps necessary to implement and fund its SIB. The key will be adopting the practices and processes that have worked in other states while avoiding what has not worked. This specific recommendation was offered in ASCE's Nevada 2018 Infrastructure Report Card.

²²⁴ "Another Infrastructure Spending Fight on the Horizon", the Review-Journal's view, Las Vegas Review-Journal, November 27, 2020

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“Nevada should fund the State Infrastructure Bank: With the passage of Senate Bill 517 in 2017, a State Infrastructure Bank was authorized but not funded. A fully funded State Infrastructure Bank provides loans and grants to local jurisdictions looking for financial support to qualify for federal funds. Local funding has grown more critical as the amount of funds provided through federal programs has steadily decreased the past decade. The decreasing availability of federal funds mean local and state jurisdictions are responsible for providing a larger percentage of their own funding. A fully funded State Infrastructure Bank can help them make this happen.”²²⁵

Should federal funding become available within the next six to 18 months, Nevada must have an operational entity to receive and distribute the funds in a timely manner. Should a mechanism not exist in the state when federal funding may be disbursed, then Nevada will once again “miss out” as it had in the late 1990’s when it did not avail itself of the pilot infrastructure bank funding.

To avoid the pitfalls other states have experienced with their infrastructure banks, Nevada can ensure a higher degree of success by learning from the mistakes of others and following the lessons learned over the 25 years SIBs have been in existence. Appendix A comes directly from an International Institute for Sustainable Development 2018 discussion paper, and though it is based on the European experience, it still provides a good basis from which to start developing a policy outline for Nevada.

In addition to Appendix A there are procedures a state can undertake to improve the odds of the infrastructure bank’s success. These include:

- “Expand program outreach and marketing. Marketing is one of the most effective strategies of the SIB. While potential applicants for SIB assistance exist in most States, it is important to inform project sponsors about the program and to determine how best to overcome any barriers to participants in the SIB. Outreach will also increase support for any needed legislative action.
- Implement more formal application processes. A well-documented process facilitates program management and can help identify future applicants and financing gaps.
- Prioritize projects to achieve sustainable economic development actions. Appendix B provides an example of how the Utah SIB prioritizes their applications and can be useful as a template for Nevada.

²²⁵ “Nevada 2018 Infrastructure Report Card” Nevada Section of the American Society of Civil Engineers, Infrastructurereportcard.org/Nevada, 2018

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- Consider establishing shorter terms for loan repayments. Accelerated repayment of SIB assistance would enable the SIB to provide assistance to more projects at an earlier date and would also reduce interest costs to the project sponsor. However, it is recognized that each project assisted by a SIB will be unique and repayment terms should be structured to meet the needs of the project without sacrificing the stability of the SIB.
- Explore the potential for assisting revenue-generating projects, such as traffic management, parking management, or Intelligent Transportation System projects.
- Improve financial reporting and the timeliness of financial reports. State SIB managers should work closely with the Federal Highway Administration's Division Financial Manager in providing up-to-date information on projects and financial activity. Reporting should be at least quarterly."²²⁶

There are also several policies the bank's management can implement to avoid the traps of bureaucracy and inefficiency with governance. These include:

The SIB should consider having most of the board from outside the government to create a degree of independence. Decision making should be delegated to credit and investment committees that meet regularly to review short, simple presentations. These committees should discourage "shadow" approval processes in which investment and credit officers have to make the rounds of committee members to campaign for their support.

SIB staff should adopt lean principles, such as the following:

- Requiring less documentation for smaller, less risky, or simpler projects setting bankability standards, so that sponsors know what would-be investors need.
- Working in cross-functional teams oriented around projects in the same sector or geography.
- Ensuring accountability at every stage by clarifying who is responsible, who approves, who supports, and who is consulted on any decision.
- Building a culture of continuous improvement.²²⁷

Finally, as transportation and communications continue to evolve and emerge, Nevada should move beyond viewing infrastructure as traditional transportation systems, but rather as a complex, multi-level and integrated system to move people, goods, ideas and information.

²²⁶ "State Infrastructure Bank Review" Federal Highway Administration, U.S. Department of Transportation, February 2002

²²⁷ "Creating an Infrastructure Bank: Principles of Success" Tyler Duvall, Mike Kerlin and Rob Potter, McKinsey & Company, April 12, 2017

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According to The Infrastructure View From 2025 – Why We Need an Infrastructure Bank report:

“Our infrastructure institutions – committees of Congress, agencies of the federal government, associations, think tanks – have not been hitting on all cylinders for some time. All too often, when they think about infrastructure, their focus is limited to “roads, streets and bridges. The countries that are forging ahead into infrastructure leadership are thinking about infrastructure networks – software, 5G communications, satellite data, robotics, AI, blockchain, 3D printing and all the technology networks that drive real growth and opportunity. The immutable truth is that infrastructure systems can either lock us into the past or propel us into the future.

A successful infrastructure bank will be a catalytic agent shifting our thinking to a higher level. Legacy practices about funding roads and bridges chronically undershoot our needs and have little to do with the technology required to design, build and maintain the high-performing networks that will drive modern economic productivity.”²²⁸

The bottom line is that Nevada must pursue every avenue to assist in securing funding for its present and future infrastructure needs. While organizing the Nevada Infrastructure Bank and making it operational, may not guarantee success, not taking the necessary steps to do so will become a major impediment to Nevada of not meeting its economic resiliency needs from not taking advantage of new or expanded infrastructure and supply chain funding strategies and programs in the future.

²²⁸ “The Infrastructure View From 2025 – Why We Need an Infrastructure Bank” Norman Anderson, internet blog, July 21, 2020

Table VII-1: SIB Pilot Programs and Federal Capitalization

NHS Act SIBs	Years of Federal Capitalization	Amount of Federal Capitalization by State
Texas	1996 & 1997	\$171,288,804
Ohio	1996 & 1997	\$87,000,000
Arizona	1996 & 1997	\$46,185,974
Minnesota	1997 & 1999	\$35,069,200
Wyoming	1997	\$23,541,942
Virginia	1996 & 1997	\$18,000,000
Pennsylvania	1997	\$17,390,000
Oregon	1996 & 1997	\$14,483,000
New Mexico	1997	\$12,071,948
Puerto Rico	1997 & 1998	\$12,008,588
New York	1997	\$12,000,000
South Dakota	1997	\$11,152,719
Michigan	1997	\$11,050,000
Delaware	1997	\$4,800,000
Indiana	1997	\$3,390,000
California	1996	\$3,000,000
South Carolina	1997	\$3,000,000
Nebraska	1997	\$2,830,000
North Dakota	1997	\$2,540,000
Maine	1997	\$2,540,000
Alaska	1997	\$2,490,000
Utah	1997	\$2,310,000
Vermont	1997	\$2,060,000
Arkansas	1997	\$1,500,000
Colorado	1997	\$1,500,000
Iowa	1997	\$1,500,000
Rhode Island	1997	\$1,500,000
Tennessee	1997	\$1,500,000
Washington	1997	\$1,500,000
Wisconsin	1997	\$1,500,000
North Carolina	1997	\$1,260,000
TEA-21 SIBs		
	1996, 1997, 1998, 1999,	
Florida	2003	\$101,065,437
Missouri	1996, 1997, 1999	\$48,410,000

Sources: Center for Innovative Finance Support, U.S. Dept of Transportation

Table VII-2: Breakout of Infrastructure to be Financed by the NIB
Cumulative Amounts over 10 Years (in billions of \$s)

Last Updated October 20, 2020					
Infrastructure Projects			NIB Financing Amount		
Total			Original	Updated	
			\$ 4,000	\$ 5,000	
			(Of which: HR Re-	ASCE	ASCE
			Estimated	Estimated	Estimated
			Funding 3/	Funding Gap	Funding Gap
ASCE 2017 Report Card 1/ (Unless Updated 2/)			4/)		
Subtotal	\$ 4,590	\$ 2,527	\$ 738	\$ 2,063	\$ 3,078
Roads, Bridges & Transit (Updated 2020)	\$ 2,042	\$ 941	\$ 426	\$ 1,101	\$ 1,090
Water & Wastewater (Updated 2020)	\$ 150	\$ 45	\$ 65	\$ 105	\$ 1,100
Schools	\$ 870	\$ 490	\$ 140	\$ 380	\$ 380
Electricity Grid (Updated 2020)	\$ 934	\$ 757	\$ 70	\$ 177	\$ 208
Dams, Levees, Waterways & Port	\$ 162	\$ 38	\$	\$ 124	\$ 124
Public Parks & Recreation	\$ 114	\$ 12	\$ 8	\$ 102	\$ 102
Airports	\$ 157	\$ 115	\$	\$ 42	\$ 42
Passenger Rail	\$ 154	\$ 125	\$ 29	\$ 29	\$ 29
Hazardous & Solid Waste	\$ 7	\$ 4	\$	\$ 3	\$ 3
Additional Mega Projects:				\$ 1,936	\$ 1,922
Affordable Housing 5/		\$ 100	\$	\$ 720	\$ 720
High Speed Rail 6/				\$ 650	\$ 650
Broadband Complete Access 7/		\$ 100	\$	\$ 80	\$ 80
Renewable Energy Super-Grid Overlay 8/				\$ 80	\$ 80
Large Water Redistribution Projects				\$ 406	\$ 392

1/ www.infrastructure.org www.cbpp.org

2/ ASCE Failure to Act Reports updated in 2020: www.asce.orf

3/ Includes ongoing: Federal grants and loans, and state and local financing (through budgets, municipal bonds & P3 projects).

4/ Moving Forward Act HR2 Fact Sheet: explicit amounts for the \$1.5 trillion Re-Authorization Bill passed by House.

5/ Estimated 7.2 million affordable housing units needed (www.nlich.org) times \$100,000 per unit.

6/ High Speed Rail Alliance estimate for 70% of RGA's 11 High Speed Rail Corridors covering 8,965 miles.

7/ 2016 Broadband Progress Report by, the Federal Communications Commission, January 29, 2016.

8/ US DOE estimate, see www.eenews.net

Sources: Various

Table VII-3: America Infrastructure Report Card: 2013

D+	Aviation	D	Ports	C
	Bridges	C+	Public Parks and Recreation	C-
	Dams	D	Rail	C+
	Drinking Water	D	Roads	D
A = Exceptional	Energy	D+	Schools	D
B = Good	Hazardous Waste	D	Solid Waste	B-
C = Mediocre	Inland Waterways	D-	Transit	D
D = Poor	Levees	D-	Wastewater	D
F = Failing				

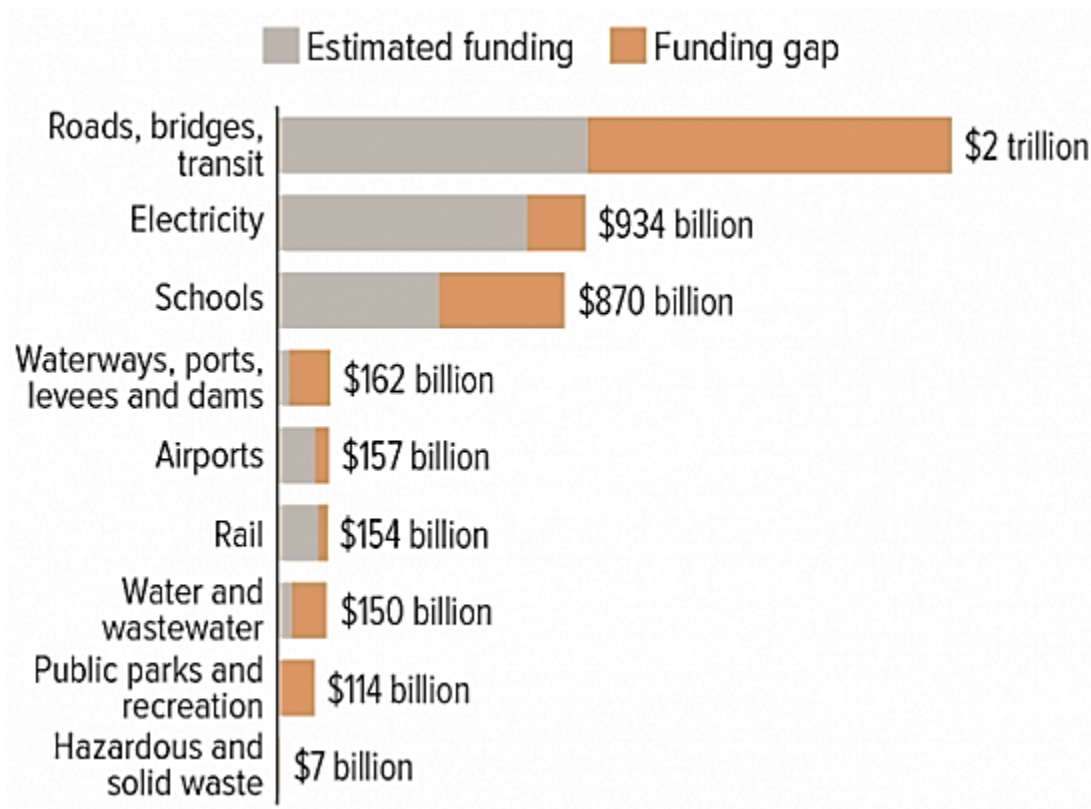
Source: American Society of Civil Engineers

Table VII-4: Quality of Overall Infrastructure Ranking: 2013

Rank	Country	Value	Rank	Country	Value
1	Switzerland	6.6	14	Japan	6
2	Hong Kong SAR	6.5	15	Canada	5.8
3	Finland	6.5	16	Belgium	5.8
4	United Arab Emirates	6.4	17	Oman	5.8
5	Singapore	6.4	18	Denmark	5.7
6	France	6.3	19	United States	5.7
7	Iceland	6.3	20	Bahrain	5.7
8	Austria	6.2	21	Sweden	5.7
9	Netherlands	6.2	22	Saudi Arabia	5.7
10	Germany	6.2	23	South Korea	5.6
11	Portugal	6.1	24	Barbados	5.6
12	Spain	6	25	Malaysia	5.5
13	Luxembourg	6			

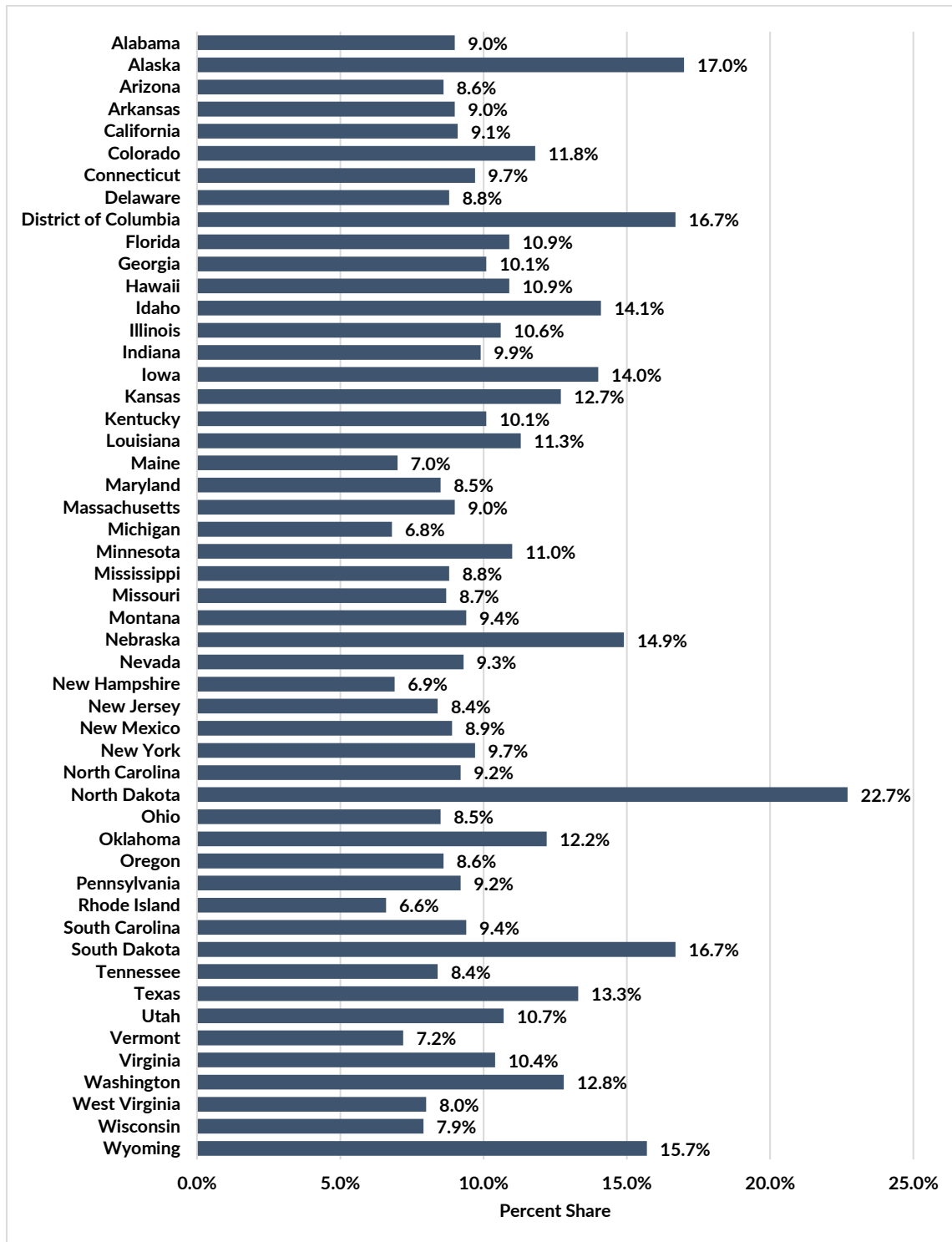
Source: World Economic Forum

Figure VII-1: Funded and Unfunded Infrastructure Needs: 2016 – 2025



Source: American Society of Civil Engineers

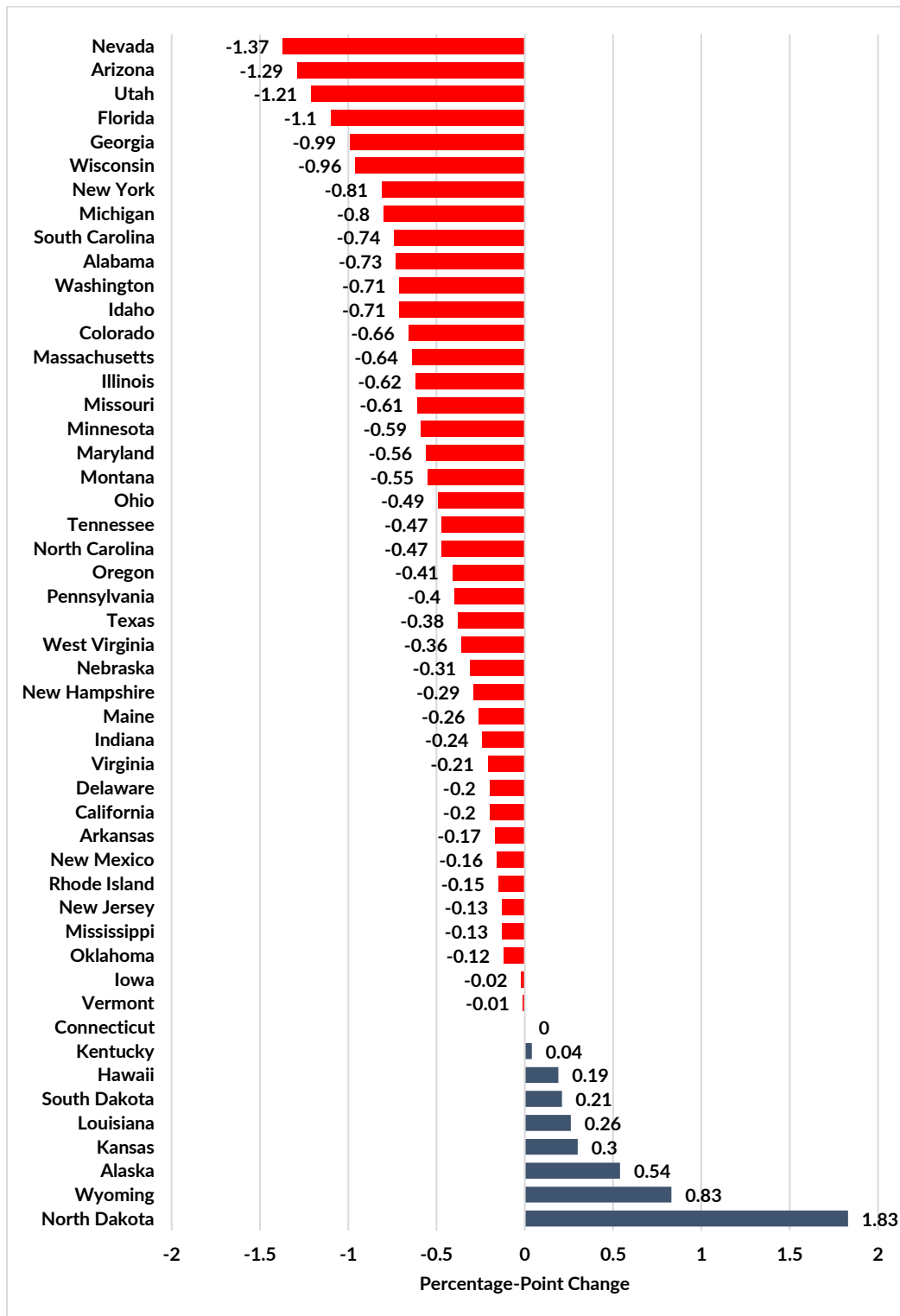
Figure VII-2: Capital Spending as a Share of Total State Spending: 2016



Note: Census data on capital spending include the costs of construction and of the purchase of buildings, equipment and land and of major alterations.

Source: U.S. Census Bureau

**Figure VII-3: Percent-Point Change in State & Local Infrastructure Spending as Share of GDP:
2002 - 2016**



Source: U.S. Census Bureau, BEA

VIII. STATE LOGISTICS DEVELOPMENT BEST PRACTICES

This section contains a discussion and analysis of case studies from around the U.S. It is also a review of “best practice” that other states are employing regarding improved supply chain logistics and delivery services by paying particular attention to intermodal networks and implementing new technologies. However, we did not find many definitively adept approaches to supply chain management on the part of governments. In general, progress in supply chain management has been by the private sector. Based on our research, Other infrastructure construction and management performed by the public sector is generally lagging private sector efforts.

We reviewed both supply chain logistics data as well as other infrastructure information. We investigated both because the two are intertwined and dependent on each other. Additionally, supply chain activities are generally an undertaking of the private sector and this made it more difficult to directly judge the performance of states regarding logistics. However, the state of infrastructure investment can provide insight into how states handle supply chain logistics.

First, we compiled a list of infrastructure/logistics grades (e.g., A, B, C) by state and compared them to Nevada’s strengths and weaknesses. We then compared Nevada to a set of six states that have pertinence to the state. We then examined the cases of selected states as they best relate to Nevada’s goals.

A. National & State-level Ratings

The American Society of Civil Engineers’ (“ASCE”) 2017 Infrastructure Report Card estimated that the U.S. required about \$2.1B in infrastructure need by 2025.²²⁹ Surface transportation (i.e., roads, bridges) made up \$1.1B of the total, slightly over 50 percent. The other most significant areas of need were schools (\$380M), electricity (\$177M), water/wastewater (\$105M) and public parks (\$102M). Levees, airports, dams and rail were next with inland water ways/marine ports and hazardous/solid waste completing the list. Some of these are not applicable to Nevada, but the report indicates the significant shortcomings of national infrastructure.

Several sources have compiled ratings for state-level infrastructure. Nevada’s performance varied significantly across the various rankings. Some sources rank Nevada highly, while others rank it poorly. For example, Smart Asset rated Nevada second in the nation for infrastructure in 2019, behind only Utah.²³⁰ They ranked states based

²²⁹ American Society of Civil Engineers. Accessed Dec 16, 2020. “2017 Infrastructure Report Card.”

<https://www.infrastructurereportcard.org/the-impact/economic-impact/>

²³⁰ Horan, S. Smart Asset. Jan 7, 2020. “States With the Best Infrastructure – 2019 Edition.”

<https://smartasset.com/mortgage/states-with-the-best-infrastructure-2019>

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on road quality, bridge quality, water infrastructure needs and broadband coverage. However, these criteria are limited based on all the areas of infrastructure that exist.

CNBC also produced its own state infrastructure ratings. Nevada was tied with Florida as the nation's eighth best state in 2018.²³¹ This ranking was based on bridge quality, commute time, air traffic and water system needs. However, again, this does not provide a comprehensive look at state infrastructure.

USA Today produced a state infrastructure ranking based on 2016 – 2017 data.²³² They pegged Nevada as the top state in the nation for infrastructure. Their ranking was based on the rate of roads in poor condition, deficient bridges, highway spending per driver and commute time. Like the previous rankings, this one is skewed toward road quality.

U.S. News & World Report corroborates this narrative, also giving Nevada the nation's top rank in its transportation rankings, based on 2016 – 2017 data.²³³ This ranking was based on commute time, public transit, road quality and bridge quality. Once again, road quality served Nevada well, although coming in 10th relative to public transit was unexpectedly high.

Nevada also did well in U.S. News & World Report's infrastructure ranking, coming in fourth based on energy infrastructure, internet accessibility and transportation infrastructure.²³⁴ Nevada was eighth, eighth and first in those areas, respectively.

The primary limitation with all of these rankings is that they are generally skewed toward road and bridge quality. Accordingly, we could obscure Nevada's potential infrastructure challenges. This said, the CT also researched two other sources that provide more comprehensive overviews of state-level infrastructure conditions: the American Society of Civil Engineers ("ASCE") and Ball State University's Center for Business and Economic Research ("BSUCBER").

The ASCE awarded Nevada a C overall in its 2018 analysis, up from a C- in its 2014 edition.²³⁵ The C equates to "mediocre." This grade was developed against an absolute scale instead of a relative scale, meaning that ASCE did

²³¹ Cohn, S. CNBC. Jul 10, 2018. "Top 10 states with the best infrastructure in America."

<https://www.cnbc.com/2018/06/28/these-10-states-are-beating-americas-infrastructure-crisis.html>

²³² Stebbins, S. USA Today. Jul 8, 2019. "This Northeast state has the worst infrastructure in the US. Where does yours rank?"

<https://www.usatoday.com/story/money/2019/07/08/states-that-are-falling-apart/39644781/>

²³³ U.S. News & World Report. Accessed Dec 16, 2020. "Transportation Rankings." <https://www.usnews.com/news/best-states/rankings/infrastructure/transportation>

²³⁴ U.S. News & World Report. Accessed Dec 16, 2020. "Infrastructure Rankings." <https://www.usnews.com/news/best-states/rankings/infrastructure>

²³⁵ American Society of Civil Engineers. Accessed Dec 16, 2020. "Nevada 2018 Infrastructure Report Card."

<https://www.infrastructurereportcard.org/wp-content/uploads/2018/12/ASCE-Report-Card-2018-Final.pdf>

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not compare states against each other but against their perceived level of infrastructure quality, which led to lower scores than would have otherwise occurred. The overall grade was based on the following 12 criteria and their grades.

1. Aviation (C)
2. Bridges (B-)
3. Dams (D+)
4. Drinking water (C-)
5. Energy (B-)
6. Parks and recreation (B-)
7. Roads (C)
8. Schools (C-)
9. Solid waste (C)
10. Stormwater (C)
11. Transit (C)
12. Wastewater (B-)

ASCE found that while the state's roads are in good condition because they are generally new, future funding to maintain the roads and keep them in high-quality condition may pose challenges. Additionally, other types of infrastructure are good in some parts of the state, while poor in others. ASCE's general consensus appears to be that, as of 2018, the urban infrastructure in Nevada fairly good, while rural infrastructure is not.

BSUCBER produces an annual rating called the Manufacturing Scorecard.²³⁶ Its most recent scores are for 2020. BSUCBER's 2020 rating's methodology graded states relative to one another based on nine criteria. Overall, Nevada earned a D grade. These criteria include the following, along with their 2019 to 2020 grades:

1. Manufacturing industry health (F up to D-)
2. Logistics industry health (D, no change)
3. Human capital (D+ up to C-)
4. Worker benefit costs (B+, no change)
5. Tax climate (C, no change)
6. Expected fiscal liability (C- up to C)
7. Global reach (C down to C-)

²³⁶ Hicks, MJ and Devaraj, S. Ball State University Center for Business and Economic Research. "Manufacturing Scorecard 2020." <https://mfgscorecard.cberdata.org/files/Manufacturing%20and%20Logistics%20Scorecard%20-%20National%20-%202020.pdf>

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8. Sector diversification (C, no change)
9. Productivity and innovation (C- down to D+).

Based on BSUCBER's annual rating, Nevada improved in three criteria, worsened in two and remained unchanged in the remaining four. However, only one grade was above a C, with a B+ for worker benefit costs. This more detailed look at Nevada infrastructure and manufacturing capability shows that Nevada has additional room for improvement.

For example, relative to logistics, Nevada rated a D. States with an A are Texas, Illinois, Ohio, Pennsylvania and Kentucky. Midwestern states did well in general in many of these measures, likely due to their centralized locations and established manufacturing sectors.

The Association of American Railroads ("AAR") completed a rail-specific analysis of freight rail infrastructure for 2017.²³⁷ Unfortunately, much of Nevada's data have been withheld due to privacy concerns, but AAR's analysis still offers useful insights. Nevada is the seventh largest state by area and 33rd by population. However, Nevada is 48th by number of freight railroads and 39th by rail miles. Nevada also lags in terms of freight employees and wages at 42nd and 41st, respectively.

These results, along with those of other analyses, tend to show that states with expansive freight rail systems are relatively flat states, are geographically centrally located regarding the nation's population centers, and have large mining and manufacturing sectors. None of these attributes describe Nevada. Nevada's mining sector is not as large as some believe, as discussed below. However, that does not mean Nevada cannot improve its standing regarding rail, as discussed below.

Additionally, because Nevada is not a coastal state, it does not have seaports. The findings in the above reports and the research herein suggest that if Nevada is to improve its logistics infrastructure and competitiveness, it ought to concentrate on its linkages to California, possibly connecting its mining operations to rail and being on the forefront of new supply chain technology.

To help Nevada better plan for future supply chain development, the CT has reviewed the status of a set of selected states' infrastructure systems. There are other states that may have more developed supply chain infrastructure than some of those selected herein, but many of those states are too dissimilar to Nevada to be

²³⁷ Association of American Railroads. AAR State Rankings, 2017. Accessed Dec 3, 2020. <https://www.aar.org/wp-content/uploads/2019/05/AAR-State-Rankings-2017.pdf>

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comparable for several reasons such as location, topography, industry mix, etc. The following six states were considered.

1. California
2. Texas
3. Arizona
4. Utah
5. Wyoming
6. Florida

The following does not present an exhaustive examination of the infrastructure components of the six states. The discussion below does not focus on road infrastructure since Nevada is generally considered to have among the nation's best road network. Instead, our analysis is concentrated on certain areas that authorities (e.g., GOED, NDOT) in Nevada have signaled as areas of interest.

B. California

No economic discussion regarding Nevada is complete without California. Nevada's economy is highly dependent on and intertwined with California's.²³⁸ Many actions concerning interstate commerce and infrastructure in Nevada would likely include California.

California has a Freight Railroad Liaison that serves a similar function as NDOT's Freight Advisory Committee. The California counterpart has similar functions as the Nevada planners in terms of coordinating with the private industry and also does not build rail itself.

Based on its rail plan, California has lofty goals for an integrated state rail system.²³⁹ The state discusses options for sharing lines between freight and passenger rail. However, as discussed herein, that is not a likely option. Freight and passenger rail have different needs in terms of capital infrastructure. Sharing that infrastructure leads to inefficiencies for one type or the other. Where California's actions matter, its approach has been the same as other states discussed below. The private sector drives the growth and direction of freight rail infrastructure and even California concedes this fact throughout its rail plan. However, the public sector has been able to defray some costs for the private sector using federal grants and loans to help build out certain complementary

²³⁸ Southern Nevada Tourism Infrastructure Committee. Economic Connections Between Southern Nevada and California. <http://sntic.org/meeting/05/staff/SNTIC%20California-Nevada%20Economic%20Ties%20FINAL.pdf>

²³⁹ 2018 California State Rail Plan. Chapter 5: Freight Rail Investment Strategy. <https://dot.ca.gov/-/media/dot-media/programs/rail-mass-transportation/documents/rail-plan/5-chapter-5csrpfinal.pdf>

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infrastructure, such as signaling, sidings and grade crossings, though most of that infrastructure is also generally funded by private industry.

Throughout recent American history, high-speed passenger rail has been an elusive goal. It has not materialized anywhere, except for on Amtrak's Acela line in the Northeast Corridor,²⁴⁰ and even that is a stretch to call "high-speed" with a top speed of 150 miles per hour along an only 34-mile stretch of track.²⁴¹ There are countless high-speed rail proposals all over the country. Few are likely to succeed, however. One of the most spectacular failures of a recent high-speed rail project is the California High-Speed Rail Network.

In 2008, California voters approved nearly \$10B in bonds for the construction of a state-wide high-speed rail network.²⁴² Then in 2009, the state secured another \$3.3B from the federal government. However, the project kept facing new technical and political obstacles as well as ballooning costs. By 2018, the state's rail authority estimated that the project was 13 years behind schedule and that costs had risen to over \$77B. By 2019, California Governor Gavin Newsom said that the project would scale back for the time being and that the state would concentrate on completing the portion of the network between Merced and Bakersfield, two communities in the Central Valley. This plan was derided as a "train to nowhere."²⁴³ In 2020, the California High-Speed Rail Authority increased its estimate for the project's costs to over \$80B.²⁴⁴ This project shows the pitfalls that could face a Los Angeles-Las Vegas project, which also faces technical challenges in traversing the Cajon Pass. However, the Los Angeles-Las Vegas route is sparsely populated for most of its run, which reduces the likelihood of running into legal issues regarding rail rights. It is also a privately-run project, which likely means it would be more efficiently managed.

In terms of rapid transit networks, California is home to the famous Bay Area Rapid Transit ("BART") system and the lesser-known Los Angeles Metro Rail. One interesting fact uncovered in our research is that no regional rail transit system has a profitable operating budget. BART appears to be the closest to covering its operating costs out of 14 metro systems analyzed by the San Francisco Chronicle at 78 cents of revenue per dollar cost (see Figure VIII-1).²⁴⁵ Part of the reason for this is that all of these are publicly-run operations. Allowing the private industry to

²⁴⁰ A few other lines can reach speeds of up to 125 miles per hour, but these are not always considered high-speed routes.

²⁴¹ CNBC. May 7, 2019. "The US is terrible at building high-speed rail — here's why." <https://www.cnbc.com/2019/05/07/why-is-there-no-high-speed-rail-in-the-us.html>

²⁴² California Transportation Commission. Proposition 1A. <https://catc.ca.gov/programs/proposition-1a-high-speed-passenger-train-bond-program>

²⁴³ Swan, R and Alexander, K. San Francisco Chronicle. Feb 17, 2019. "Train to nowhere? Here's how high-speed project went off the rails." <https://www.sfchronicle.com/politics/article/Train-to-nowhere-Here-s-how-high-speed-project-13621347.php>

²⁴⁴ Thompson, D. Associated Press. Feb 12, 2020. "California bullet train cost rises by another \$1 billion." <https://apnews.com/article/4b93901b82fa4e8495b893c3492583fc>

²⁴⁵ Cabanatuan, M. San Francisco Chronicle. May 26, 2017. "BART's future on line: Can transit system gain voters' trust?" <https://www.sfchronicle.com/bayarea/article/BART-once-efficient-must-convince-voters-it-9968133.php>

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operate and possibly build these systems might alleviate the burden on taxpayers.²⁴⁶ Of course, there is an argument to be made that public transit provides a social benefit and therefore should be subsidized.²⁴⁷ However, a National Bureau of Economic Research study found that privatized bus transit services could provide the same level of service for significantly less cost.²⁴⁸ It may be possible for a community to think outside the box and find a way to privatize public rail transit while still obtaining federal funds to defray part of the costs. At least, more study should be undertaken to evaluate the possibility.

California also subsidizes phone service for low-income households in the state through the Lifeline program.²⁴⁹ This is a limited program that provides a discount on phone service up to nearly \$15 per month for a single line per household. This should act as a broadband subsidy when 5G becomes widespread.

C. Texas

Like California, Texas is another large, populous state that is not directly comparable to Nevada. Furthermore, unlike California, it does not share a border with Nevada either. However, its differences can highlight some of Nevada's shortcomings, particularly with respect to the mining industry.

As in other states, most rail investment in Texas comes from private investment. BNSF and UP invested \$825m in Texas rail projects in 2018 alone. Numbers like these may be quite challenging for a state like Nevada, with less than a tenth of the population and economic output of Texas, to attain. Texas has two large metropolitan areas that each contain more than double the population of Nevada. It has a third metro larger than the Las Vegas MSA and a fourth almost identical in size to Las Vegas. Additionally, Texas' fifth through ninth largest metros are larger than or about the same size, in terms of population, as Nevada's second largest metro—the Reno-Sparks MSA.

Like Nevada, Texas also has a sizable mining industry, although its industry specializes in oil and gas extraction rather than mineral mining. However, again, Texas' mining operations dwarf Nevada's. The Nevada mining industry's GDP was \$15.9B in 2019 according to the Bureau of Economic Analysis ("BEA"), compared to Texas' \$580.2B, or 36.5 times larger than Nevada's. These figures show that Nevada cannot hope to match Texas' investment in rail infrastructure. The money is not there. Nevertheless, that does not mean that Nevada cannot

²⁴⁶ O'Toole, R. Cato Institute Commentary. May 7, 2018. "Why We Need to Stop Subsidizing Public Transit."

<https://www.cato.org/publications/commentary/why-we-need-stop-subsidizing-public-transit>

²⁴⁷ Jaffe, E. Bloomberg CityLab. Mar 18, 2013. "The Economic Case for Rail Subsidies."

<https://www.bloomberg.com/news/articles/2013-03-18/the-economic-case-for-rail-subsidies>

²⁴⁸ Jerch R, Kahn ME, Li S. "Efficient Local Government Service Provision: the Role of Privatization and Public Sector Unions."

NBER Working Paper No. w22088. March 21, 2016. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2752293

²⁴⁹ California Public Utilities Commission. Accessed Dec 15, 2020. "California LifeLine."

<https://www.cpuc.ca.gov/general.aspx?id=2752>

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make strides in developing its rail infrastructure, but to do so the state must have a very defined purpose in mind and must work closely with private industry.

Like NDOT, the Texas Department of Transportation (“TxDOT”) does not have funding dedicated to rail improvement, save for grade crossing improvement. However, Texas has been relatively successful at obtaining federal funding, which necessitated matching funds at the local level.

Texas is also working toward a new high-speed passenger rail service between the Dallas and Houston metros, the Texas Central Project. This project is being planned by the Texas Central High-Speed Railway (“Texas Central”), a private entity, and aims to use Japanese technology that would allow trains to reach speeds over 200 miles per hour. This rail service would build and own its own tracks, sharing none of it with freight services. As discussed above, interstate and intercity rail can only financially succeed with the efficiencies that come with single-use rail. Dual-use does not appear to be a good option. Construction on the project could begin in 2021.²⁵⁰ However, its construction remains uncertain due to ballooning costs and possible weaknesses in Texas Central’s finances. Also, despite claiming that the railroad would be privately funded, Texas Central now appears to be looking for federal assistance.²⁵¹ This implies that the feasibility for connecting even two metropolitan areas, each with a population double that Nevada, may not exist. This uncertainty all but eliminates any hopes for high-speed intercity rail in Nevada, aside from a possible Southern Nevada-Southern California connection.

D. Arizona

Arizona has a mining industry of a relatively similar size as that of Nevada. According to the BEA, Arizona’s mining industry had a GDP of \$21.5B in 2019, approximately 35 percent larger than Nevada’s mining industry. However, Class I freight in Arizona has significantly more volume passing through it (see Figure VIII-2).²⁵² For several reasons, the freight rail firms concluded that it was more cost effective to transport goods through the two major Arizona routes—the UP’s Sunset Route and the BNSF’s Southern Transcon Route—than Nevada’s major east-west routes—the UP’s Overland Route and South Central Route.

Class I freight in Arizona has followed the same pattern of private investment as in other states. The state has played only a small role in assisting private firms build up these lines, aside from helping private railroads secure relatively small federal grants, such as through the BUILD grants program. This shows that the mining industry in

²⁵⁰ Garnham, JP. The Texas Tribune. Sep 21, 2020. “High-speed train between Dallas and Houston gets federal approval.” <https://www.texastribune.org/2020/09/21/dallas-houston-high-speed-train/>

²⁵¹ Roberts, K. The Texan. Jul 10, 2020. “Potential Funding for Texas Central High Speed Rail in New Federal Infrastructure Bill.” <https://thetexan.news/potential-funding-for-texas-central-high-speed-rail-in-new-federal-infrastructure-bill/>

²⁵² U.S. Bureau of Transportation Statistics. “Tonnage of Trailer-on-Flatcar and Container-on-Flatcar Rail Intermodal Moves: 2016.” <https://www.bts.gov/tonnage-trailer-flatcar-and-container-flatcar-rail-intermodal-moves-2016>

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Arizona is not a priority for Class I railroads. The railroads' main concern in the region appears to be moving bulk goods from marine ports in California to Midwestern markets. What railroads do exist to move mined raw materials are generally Class III railroads that live and die by mining activity.²⁵³ For example, the Magma Arizona Railroad is inactive due to a cessation of mining activity, though it might be used again should the mine reactivate. Connecting mines to Class I rail in Nevada would require collaboration among the interested parties and possibly federal funds.

However, as is discussed in the forthcoming Arizona state rail plan²⁵⁴ there is a potential project that could benefit both Nevada and Arizona that should be studied further, particularly with potential industry growth in Mexico: the CANAMEX Corridor Coalition. This project aims to connect Mexico with Phoenix, Las Vegas and more northern cities with Canada. However, any such project would need the free-market incentives to exist such that private industry would drive its construction.

There are currently no realistic high-speed rail plans in Arizona. There is one potential route for which the state completed an environmental analysis in 2015 that would connect Arizona's two largest metro areas—Phoenix and Tucson. However, there are no plans to move forward beyond the study and no funding available for such a project.²⁵⁵

The Phoenix MSA does have a light rail system, Valley Metro Rail ("VMR"). It is a single line, double-tracked network. The rail system is heavily subsidized using federal, state and local tax monies, covering about 72 percent of the system's operating costs.²⁵⁶ Additionally, VMR is planning on extending the rail line and the extension's costs have ballooned far beyond their initial estimates. As of July 2019, the City of Phoenix had announced that the cost of an extension had increased from \$700M to \$1.35B, up from an original estimate of \$530M. This new estimate equated to \$245M per mile of rail.²⁵⁷ This is problematic, but at the same time, the rail authority has won grants bringing in vast sums of federal dollars through capital investment grants. In fact, VMR won \$638M in federal funding in December 2020.²⁵⁸ These funds are estimated to cover about 40 percent of the VMR's South Central Light Rail Extension.

²⁵³ Arizona State Rail Plan, Role of Rail: Technical Memo No. 1. May 2018.

https://azdot.gov/sites/default/files/2019/08/arizona-rail-plan-tech-memo-1-chapter-1-role-of-rail_0.pdf

²⁵⁴ Ibid.

²⁵⁵ Arizona Department of Transportation. "Passenger Rail Study: Tucson to Phoenix."

<https://azdot.gov/planning/transportation-programs/state-rail-plan/passenger-rail-study-tucson-phoenix>

²⁵⁶ Boehm, J. The Republic. Dec 20, 2018. "10 years and \$2B later, what is the future of light rail in metro Phoenix?"

<https://www.azcentral.com/in-depth/news/local/phoenix/2018/12/20/ten-years-into-light-rail-continue-expand-metro-phoenix/2144400002/>

²⁵⁷ Arizona Free Enterprise Club Blog. Jul 11, 2019. "Cost for South Phoenix Light Rail Explodes to \$1.35 BILLION Dollars"

<https://www.azfree.org/cost-for-south-phoenix-light-rail-explodes-to-1-35-billion-dollars/>

²⁵⁸ Wanek-Libman, M. Mass Transit. Dec 7, 2020. "Valley Metro secures \$638 million for South Central Light Rail Extension"

<https://www.masstransitmag.com/rail/infrastructure/article/21165419/valley-metro-secures-638-million-for-south-central-light-rail-extension>

E. Utah

The single component in Utah's infrastructure system that is of most interest to Nevada is the Utah Inland Port, a proposed dry port in the Salt Lake City ("SLC") area. There are no major dry ports in the Western U.S. There is a small dry port in Tucson, Arizona, but it is only about five percent of the size by acreage²⁵⁹ of the Utah Inland Port. This is an area of interest for Nevada because the state considered pursuing such an installation in the state at one point.²⁶⁰ However, Nevada did not appear to be an optimal site for such a dry port for a variety of reasons. If successful, it is also of interest to Nevada because it could increase traffic along Nevada's two Class I rail lines.

One advantage that Utah has over Nevada for an inland port is that SLC is located at the junction of U.S. Interstate 80 and Interstate 15, freeways that travel through Reno and Las Vegas, respectively, as well as being at the crossroads of two major UP lines—the Overland Route that runs through Reno and the South Central Route that runs through Las Vegas. Converging in SLC, these rail lines connect the Bay Area and Los Angeles with Chicago. Additionally, SLC is also much closer to major U.S. population centers in the Midwest than Nevada. It is also more centrally positioned relative to the North-South borders of the U.S. An inland port project makes more sense in Utah, though there are no guarantees that the project will yield positive economic results for the region.

Utah legislators enacted Senate Bill 234²⁶¹ in the 2018 legislature to create the Utah Inland Port Authority and provide for 16,000 acres of land for the multimodal port, which includes access to road, rail and air connections. House Bill 2001 made some changes to the original law that included some compromises with municipalities in the state.²⁶² The port is publicly administered rather than being a private enterprise, which raises some flags. Opponents have voiced concerns that the project may not be of sufficient value if it must function as a public sector enterprise. Still, the authority will only manage the port. Ownership of the parcels will be via private firms and the rail service will be privately run as well.

The plan has significant opposition though, which has at times turned violent.²⁶³ More than half of SLC voters disapproved of the port's construction in a 2019 Utah Policy poll.²⁶⁴ The reasons for opposition vary but include environmental concerns such as air quality, wildlife habitats as well as possible negative effects on the nearby

²⁵⁹ Port of Tucson. "About Us." Accessed Nov 14, 2020. <http://0370bdc.netsolhost.com/PortofTucson/about-us/>

²⁶⁰ RCG Economics, Dr. Alan Schlottmann and Spatial Economic Concepts. Nevada Inland Ports Viability & Funding Study. Sep 2012. <https://rcgecon.com/reports/nevada-inland-port-study/>

²⁶¹ Utah State Legislature. S.B. 234 Utah Inland Port Authority. <https://le.utah.gov/~2018/bills/static/sb0234.html>

²⁶² McKellar, K. Deseret News. Jul 18, 2018. "Heat on the Hill: Utah Legislature passes 'not perfect' inland port bill backed by Salt Lake Council, fought by mayor." <https://www.deseret.com/2018/7/18/20649516/heat-on-the-hill-utah-legislature-passes-not-perfect-inland-port-bill-backed-by-salt-lake-council-fo>

²⁶³ Kauffman, G. Deseret News. Oct 21, 2019. "14 people charged in Utah Inland Port protest." <https://www.deseret.com/2019/10/21/20925830/10-people-charged-in-utah-inland-port-protest>

²⁶⁴ Utah Policy. Nov 12, 2019. "Poll shows overwhelming opposition to inland port among Salt Lake City voters." <https://utahpolicy.com/index.php/features/today-at-utah-policy/22163-poll-shows-overwhelming-opposition-to-inland-port-among-salt-lake-city-voters>

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minority-heavy residential communities.²⁶⁵ Another reason voiced by the opposition in the Utah Policy poll was that the state overstepped its authority in developing the port.

Some interests were also opposed to the way that the port is being publicly funded. The state legislature approved a tax increment district for the port. A tax increment district, or tax incremental financing, is a tax scheme that caps the property tax revenues of a certain area—the land within the district—at the levels as at the time the district was formed. Increases in the tax assessments of those lands above that cap are used to fund improvements in the district.²⁶⁶ Additional direct funding for the authority comes directly from the state, though this funding is relatively small, with \$5.2M budgeted for 2021.²⁶⁷

Nevertheless, it remains to be seen whether the Utah Inland Port will be successful and be a boon to the state and the SLC region, and it will likely remain uncertain for some time. If successful, the project would potentially benefit Nevada since two main rail lines merge in SLC. Accordingly, the success of the Utah Inland Port could spur activity and investment in Nevada's freight rail infrastructure.

Utah is a special case when it comes to commuter and metro rail due to the systems' heavy federal subsidies. It has a commuter rail system that runs along an 89-mile corridor between Ogden and Provo through SLC called FrontRunner.²⁶⁸ This is not a high-speed system. It has a top speed of just 79 miles per hour. The SLC area is also serviced by three light rail lines and a streetcar line. However, this interconnected multi-modal passenger rail system would probably not exist today had it not been for federal funding provided after SLC was awarded the 2002 Olympic Games.²⁶⁹ These lines are publicly-owned and operated by the state's transit body, the Utah Transit Authority Board ("UTA"), akin to a state-level version of Nevada's regional transportation commissions.

FrontRunner has been in operation since 2008. Originally, it ran between SLC and Ogden.²⁷⁰ The line cost \$611m to build. It was largely funded by the federal government, which covered 80 percent of the \$611m cost, a \$489m contribution by the U.S. in the form of reimbursements.²⁷¹ However, the system is single-tracked, which appears to

²⁶⁵ Stevens, T. Salt Lake Tribune. Jun 22, 2020. "Utah Inland Port Authority approves strategic business plan over objections from the public." <https://www.sltrib.com/news/politics/2020/06/22/utah-inland-port/>

²⁶⁶ National Housing Conference. "Tax Increment Financing: The Basics." <https://nhc.org/policy-guide/tax-increment-financing-the-basics>

²⁶⁷ McKellar, K. Deseret News. Jun 22, 2020. "Utah Inland Port Authority approves five-year plan, 10% cut to budget." <https://www.deseret.com/utah/2020/6/22/21299164/utah-inland-port-authority-business-plan-budget-air-pollution-quality-green>

²⁶⁸ Utah Transit Authority. <https://www.rideuta.com/Services/FrontRunner>

²⁶⁹ Metro Jacksonville. Aug 10, 2007. "I'm Smaller than Jax and I have Rail: Salt Lake City." <https://www.metrojacksonville.com/mobile/article/2007-aug-im-smaller-than-jax-and-i-have-rail-salt-lake-city>

²⁷⁰ Raymond, A. Deseret News. Apr 26, 2008. "UTA FrontRunner up and running today." <https://www.deseret.com/2008/4/26/20084515/uta-frontrunner-up-and-running-today>

²⁷¹ Deseret News. Jun 15, 2007. "UTA gets \$80M for FrontRunner" <https://www.deseret.com/2007/6/15/20024699/uta-gets-80m-for-frontrunner>

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be limiting its growth and capacity. The state has not been able to fund an expansion of the system to make it double-tracked.²⁷² Nevertheless, the project could serve as a source of inspiration to Nevada policymakers as to how to fund and build commuter trains in the Las Vegas and Reno metros—namely getting the federal government to foot the bill.

As mentioned, SLC has a network of light rail and streetcar lines (“TRAX”) serving the region. At the time that TRAX’s initial line was completed, the SLC area had about half of the population of the Las Vegas MSA. Today, the network is comprised of four lines, including the streetcar line. Funding for these projects came from a mix of federal grants, fund matching and local municipal bonding.²⁷³ ²⁷⁴ Upcoming improvements to the regional passenger rail system is also coming from municipal bonds, repayment of which makes up UTA’s largest expense.²⁷⁵

Utah is flirting with high-speed rail in the state. However, no serious plans are in the works.²⁷⁶ The state’s rail plan imagines a line within Utah’s Wasatch Front—Utah’s main population corridor where FrontRunner currently runs—and even lines connecting Salt Lake City to St. George and Moab. At present, these are nothing more than “pie-in-the-sky” ideas, as Republican state Senator Jake Anderegg termed it.²⁷⁷

F. Wyoming

Wyoming has a large network of freight rail. The state is served by three Class I and two Class III carriers, despite being the nation’s least populous state. This network was created to meet the needs of the mining industry in the state, particularly the coal industry. According to the BEA, Wyoming’s mining industry had a GDP of \$28.1B in 2019, nearly double Nevada’s industry. According to the Wyoming Rail Plan, “Class I railroad companies in Wyoming must use private financing to cover the cost of equipment acquisition and infrastructure improvements aimed at renewing, upgrading or expanding the state rail network.” This means that these rail companies funded and financed these projects on their own. In 2013 alone, the three Class I railroads budgeted \$8.8B for rail projects in the state. These private market forces have incentivized Class I carriers to as much as quadruple-track sections

²⁷² Davidson, L. Salt Lake Tribune. Mar 27, 2019. “Utah’s FrontRunner commuter rail could use a serious upgrade but the cost is a deal breaker.” <https://www.sltrib.com/news/politics/2019/03/27/utahs-fronrunner/>

²⁷³ Light Rail Progress. Dec 2003. “Salt Lake City Opens Medical Center LRT Extension – Another US Rail Transit Project On Budget and Ahead of Schedule” https://www.lightrailnow.org/news/n_slc002.htm

²⁷⁴ Deseret News. Dec 3, 2004. “TRAX’s bumpy pas.” <https://www.deseret.com/2004/12/3/19864695/trax-s-bumpy-past>

²⁷⁵ Davidson, L. Salt Lake Tribune. Oct 9, 2019. “UTA OKs \$400M-plus construction plan that includes new airport TRAX station and Ogden bus rapid transit.” <https://www.sltrib.com/news/politics/2019/10/09/uta-oks-m-plus/>

²⁷⁶ Winslow, B. Fox 13 Salt Lake City. Feb 3, 2020. “Faster Fronrunner and rail from SLC to Moab envisioned in new bill in the Utah legislature.” <https://www.fox13now.com/faster-fronrunner-and-rail-from-slc-to-moab-envisioned-in-new-bill-in-the-utah-legislature>

²⁷⁷ Davidson, L. Salt Lake Tribune. Feb 6, 2020. “Proposal to create a statewide rail plan leaves station.” <https://www.sltrib.com/news/politics/2020/02/07/proposal-create-statewide/>

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of rail in the state.²⁷⁸ This is just another example that shows that there is little role for a state in developing freight rail. However, the one key role for the state, as stated by Wyoming officials, is to use PPP to fund rail improvements. This is where Nevada should seek to make efforts.

G. Florida

Florida is home to a new Brightline passenger rail line being constructed. Brightline is the same company that is planning the Los Angeles-Las Vegas line and the nation's only major intercity rail carrier that is not Amtrak.²⁷⁹ The new Florida line will run from Miami to West Palm Beach. However, the company expanded its plans for the line. In April 2019, it secured funding for an extension to Orlando. This funding was secured through the sale of municipal bonds. Municipal bonds are an attractive option because they are tax-exempt (although they could be subject to the alternative minimum tax). Brightline was able to obtain \$1.75B for the project through the sale, which was handled by Morgan Stanley.²⁸⁰ The project is currently under construction and about 45 percent complete on its expansion from West Palm Beach.²⁸¹ This makes it the most progressed high-speed passenger rail line in the country yet. It is also on track to meet its expected completion date in late 2021. This would be a major milestone for high-speed rail in the U.S.

The South Florida Regional Transportation Authority also operates the Tri-Rail commuter rail system²⁸² in Southern Florida that is unlikely to compete directly against Brightline's high-speed operations. While Tri-Rail also connects Miami to West Palm Beach, it has 18 stations between those points, whereas Brightline will have only three to five. Additionally, Miami-Dade Transit operates Metrorail,²⁸³ a heavy-rail rapid transit system in the Miami area.

²⁷⁸ Wyoming State Rail Plan. Mar 2015.

http://www.dot.state.wy.us/files/live/sites/wydot/files/shared/Planning/Railroads/Wyoming_SRP_Complete.pdf

²⁷⁹ Furillo, A. Mobility Lab. Apr 23, 2019. "Proposal to create a statewide rail plan leaves station."

<https://mobilitylab.org/2019/04/23/will-new-private-sector-rail-operators-change-the-look-of-intercity-train-travel-in-the-us/>

²⁸⁰ Sigo, S. The Bond Buyer. Apr 3, 2019. "'Wowed' investors snap up bonds for Florida's Virgin Trains USA."

[https://www.cdfa.net/cdfa/cdfaweb.nsf/pages/38514/\\$file/%E2%80%98Wowed%E2%80%99%20investors%20snap%20up%20bonds%20for%20Florida%E2%80%99s%20Virgin%20Trains%20USA.pdf](https://www.cdfa.net/cdfa/cdfaweb.nsf/pages/38514/$file/%E2%80%98Wowed%E2%80%99%20investors%20snap%20up%20bonds%20for%20Florida%E2%80%99s%20Virgin%20Trains%20USA.pdf)

²⁸¹ Lynch, R. Orlando Business Journal. Nov 12, 2020. "Brightline gives construction update on Orlando expansion."

<https://www.bizjournals.com/orlando/news/2020/11/12/brightline-gives-construction-update-on-orlando.html>

²⁸² South Florida Regional Transportation Authority Tri-Rail. <https://www.tri-rail.com/>

²⁸³ Miami-Dade County Metrorail. <https://www.miamidade.gov/global/transportation/metrorail.page>

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Both Tri-Rail²⁸⁴ and Metrorail²⁸⁵ were and continue to be funded in part through federal grants. It also receives state subsidies.²⁸⁶ Orlando's SunRail commuter service is also heavily subsidized by the state, which covers over 80 percent of its operating costs.²⁸⁷

An interesting and related program in Florida facilitated last-mile delivery. This occurred in the city of Altamonte Springs. The program was the first of its kind. The city provided a 20 percent subsidy to riders for all rides originating or terminating in the city and a larger 25 percent subsidy for rides to or from the commuter train stations. Four other Florida cities joined similar programs as part of the initial pilot in 2016.²⁸⁸ However, the cost-effectiveness of these methods has been yet to be seen. Some, such as the mayor of Arlington, Texas suggested that these services cost municipalities less,²⁸⁹ while others claim that they cost more.²⁹⁰

H. Conclusions

Based on these case study reviews, the CT concludes that Nevada should look for innovative ways to partner with private industry to promote infrastructure development in the state by winning a greater share of federal funds and decreasing the costs of borrowed monies. However, there is only so much the state can do, and it will be the private sector that ultimately drives infrastructure investment. Still, using innovative methods to forge public-private partnerships could allow the state to find significant funding for the private sector that would design and build the infrastructure necessary to improve the state's supply chain.

In terms of freight rail, our main finding is that the private sector largely determines the direction of development and investment and that, up to now, there has been little that states could do to alter private sector plans. Since the industry's deregulation in 1980, the nation's freight rail has turned around, from a series of bankruptcies to a leading model of efficiency. The number of rail-miles has been in decline ever since despite increasing freight volume and dropping costs.

²⁸⁴ Broward Metropolitan Planning Organization. "SFRTA/Tri-Rail Receives \$31.63 Million for Positive Train Control." <https://browardmpo.org/news-updates/229-sfrra-tri-rail-receives-31-63-million-for-positive-train-control>

²⁸⁵ Miami-Dade County. "FY 2018 - 19 Adopted Budget and Multi-Year Capital Plan." <http://www.miamidade.gov/budget/library/fy2018-19/adopted/volume-2/transportation-and-public-works.pdf>

²⁸⁶ Hafenbrack, J. South Florida Sun-Sentinel. Dec 16, 2009. "Crist signs Tri-Rail funding into law." https://www.sun-sentinel.com/sfl-mtblog-2009-12-crist_signs_trirail_funding_in-story.amp.html

²⁸⁷ Sun Rail Riders Blog. Jan 11, 2019. "SunRail could be headed for a financial wreck." <https://sunrailriders.blogspot.com/2019/01/sunrail-could-be-headed-for-financial.html>

²⁸⁸ Dovey, R. Next City. Aug 22, 2017. "5 Florida Cities Team Up to Subsidize Uber Rides." <https://nextcity.org/daily/entry/five-florida-cities-subsidize-uber-rides>

²⁸⁹ Hawkins, AJ. The Verge. Mar 12, 2018. "Texas town ditches its bus service for ride-sharing app Via." <https://www.theverge.com/2018/3/12/17109708/via-arlington-texas-rideshare-app-replaces-bus>

²⁹⁰ Dunn, S. National Motorists Association. Jul 1, 2018. "Texas town ditches its bus service for ride-sharing app Via." <https://www.motorists.org/blog/microtransit-costs-too-much-per-passenger/>

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The number of rail-miles has been in decline ever since despite increasing freight volume and dropping costs. However, the leanness of the nation's freight rail infrastructure that has occurred due to this march toward efficiency has made it more difficult for many state and local governments to connect to the rail infrastructure. Instead, rail, particularly in the Western U.S., has transitioned toward a business model revolving around moving goods from California seaports to Midwestern population centers, before those goods are distributed to the rest of the country by truck. Nevertheless, that is the reality that Nevada must confront. Such a reality leaves freight rail expansion limited to increasing current line capacity and possibly using short lines to connect mining operations to the main Class I lines in the state. Any grander plans envisioning Nevada as a rail junction on the West Coast is unlikely in the near to intermediate terms without a great deal of federal spending. Nevada's, and the West's, geography and population distribution make the goal of an expansive freight rail system difficult. This is particularly true in light of coming innovations in supply chain management as discussed herein.

Relative to high-speed intercity passenger rail, Nevada has done a relatively good job of trying to act as a catalyst for a Southern Nevada-Southern California connection. The state has worked with California authorities to assist the private sector in building the line. Both states helped Brightline secure rights to tax-free private activity bonds to reduce project costs and have helped navigate them through regulatory hurdles. Unfortunately, the COVID-19 pandemic appears to have stalled progress with respect to this project.²⁹¹ However, the state cannot be faulted for this.

Short of directly funding Brightline with public funds, there are not many options for ensuring the project be built. However, using state or local public funds—which are now very limited—is probably untenable. The best thing now would appear to be for Nevada and California to make their best efforts to keep the project alive by continuing communication with Brightline in the hopes that after the pandemic ends, there is still a desire on its part, due to investor interest, to move forward. To make this happen, both states would likely need to reapprove the private activity bonds in 2021. The two states could also look to secure federal grants to offset part of the costs and get the project over the barriers created by the recession.

Current passenger rail systems are heavily funded and subsidized by taxpayers. This in part due to federal incentives that incentivize public ownership and stewardship of passenger rail systems. However, there are caveats that support innovative PPP projects. Nevada and its sub-state partners should study options PPP to overcome the drawbacks associated with public ownership and operations of passenger rail. Looking at rail in a new light through the lens of private investment, while at the same time more aggressively pursuing federal grants based on these joint relationships, could be used to introduce passenger rail to the state.

²⁹¹ Las Vegas Review-Journal. Nov 18, 2020. "EDITORIAL: Vegas to Victorville rail line goes off the tracks."
<https://www.reviewjournal.com/opinion/editorials/editorial-vegas-to-victorville-rail-line-goes-off-the-tracks-2186330/>

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A complication with passenger rail that all regions face is the network effect. The problem with rail is that to maximize the number of people that use rail, the infrastructure needs to be sprawling, which leads to high fixed costs before even selling the first ticket. This is part of the reason that smaller rail systems struggle. They have a limited reach and therefore a limited value to the community and corresponding low ridership. Then these systems appear to be financial failures and become dependent on public subsidy. As a rail system expands, it becomes more accessible. This means that the value of the service grows as more people use it.

Even though it may be useful to study different types of PPP for passenger rail, it also may be a better idea to focus on future technologies that replace current methods of mass transit like commuter rail. Nevada, as already mentioned, has a relatively good road infrastructure. Future technologies such as autonomous vehicles could make commuter rail obsolete.²⁹² That technology holds a great deal of potential. It would also circumvent the first/last-mile problem because it would provide door-to-door services. Additionally, the costs of operating self-driving vehicles could be vastly lower than current taxi and rideshare costs due to eliminating most of the labor costs in the car (i.e., the driver). This could reduce the cost per mile to about 10 percent of current levels.²⁹³ If someone could order a ride for \$2 using a rideshare service that currently costs \$20, local rail services would not stand a chance. Any state or municipal government holding debt for such an expense would be on the hook for large amounts.

Relative to technological advancements used to promote the growth of infrastructure, it is generally incumbent upon private sector interests to incorporate those into their business models. And that is what we have seen happen. Relative to broadband internet, as discussed elsewhere in this report, SpaceX and other companies are expanding the abilities of satellite-based internet, which can vastly improve connection in rural areas, as well as urban areas.

Additionally, 5G could transform internet as well. This would likely help urban areas, although rural areas could also benefit substantially. Again, these technological advances in supply chain infrastructure are being driven by the private sector. Nevertheless, both industries are receiving subsidies, but those subsidies are generally coming from the federal government rather than from states. For example, SpaceX and several other companies received nearly \$900m in subsidies to help bring broadband to rural areas.²⁹⁴ Additionally, the Federal Communications Commission ("FCC") launched the Facilitate America's Superiority in 5G Technology ("FAST")²⁹⁵ plan to fund \$9B

²⁹² Wiseman Y. In an Era of Autonomous Vehicles, Rails are Obsolete. *International Journal of Control and Automation*, Vol. 11, No. 2 (2018), pp.151-160. <http://dx.doi.org/10.14257/ijca.2018.11.2.13>

²⁹³ Huston, C. MarketWatch. Sep 19, 2016. "Driverless cars could cost 35 cents per mile for the Uber consumer." <https://www.marketwatch.com/story/demand-for-driverless-cars-could-boost-uber-to-2016-09-19>

²⁹⁴ Brodtkin, J. Ars Technica. Dec 7, 2020. "SpaceX gets \$886 million from FCC to subsidize Starlink in 35 states." <https://arstechnica.com/tech-policy/2020/12/spacex-gets-886-million-from-fcc-to-subsidize-starlink-in-35-states/>

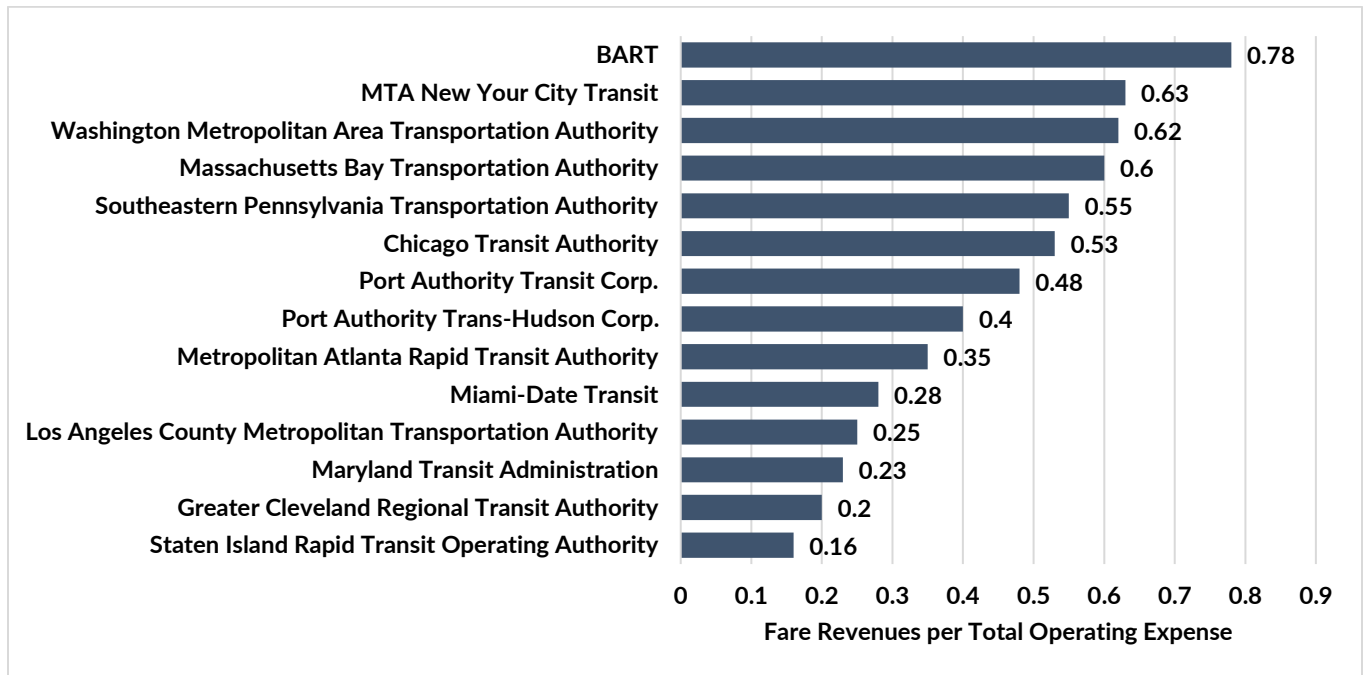
²⁹⁵ U.S. Federal Communications Commission. Accessed Nov 28, 2020 "The FCC's 5G FAST Plan." <https://www.fcc.gov/5G>

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worth of subsidies to incentivize the rollout of 5G in underserved rural communities.²⁹⁶ Still, there sometimes are state-level subsidies, as mentioned above in the case of California.

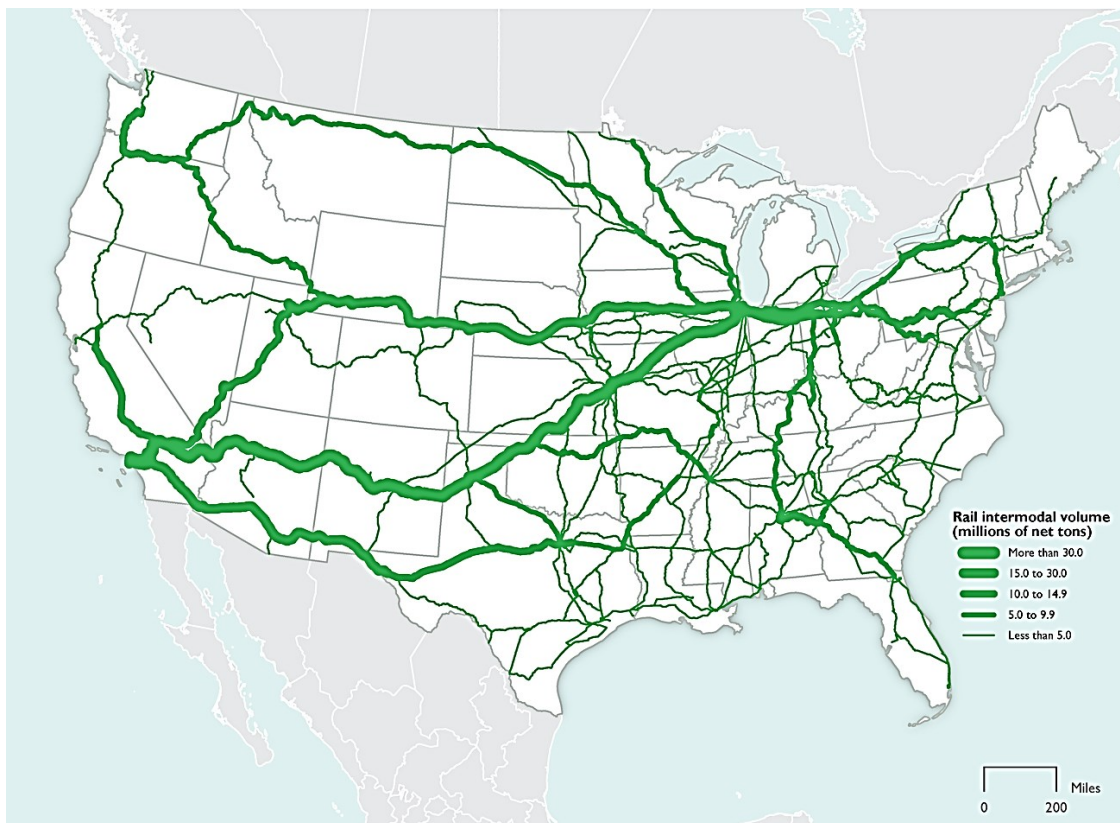
²⁹⁶ Reardon, M. C-Net. Dec 4, 2019. "FCC to create \$9 billion 5G subsidy program for rural America."
<https://www.cnet.com/news/fcc-to-create-9-billion-5g-subsidy-program-for-rural-america/>

Figure VIII-1: Fare Revenues Operating Cost Coverage: 2014



Source: San Francisco Chronicle

Figure VIII-2: Tonnage of Flatcar Rail Intermodal Moves: 2016



Source: Bureau of Transportation Statistics

IX. NEVADA REVISED STATUTES REVIEW

In order to execute or move forward on the conclusions presented in this study, it is important to identify which Nevada State Statutes will have to be reviewed in detail to determine any modifications required to take place. This will be an essential step before various projects or strategies the state wishes to undertake can be enabled or made operational. While this is a critical and necessary step, only after determining which specific programs the state wishes to pursue can a detailed analysis be undertaken to “zero in” on the affected statutes. Consequently, following is a “high-level” overview of the NRS Chapters that might be affected by the conclusions of this study.

Title 3 – Remedies; Special Actions and Proceedings

- Chapter 37 Eminent Domain
- Chapter 38 Mediation and Arbitration
- Chapter 39 Partition of Real Property and Mining Claims
- Chapter 40 Actions and Proceedings in Particular Cases Concerning Property
- Chapter 41 Actions and Proceedings in Particular Cases Concerning Persons

Title 7 – Business Associations; Securities; Commodities

- Chapter 76 State Business Licenses
- Chapter 78 Private Corporations
- Chapter 78A Close Corporations
- Chapter 78B Benefit Corporations
- Chapter 80 Foreign Corporations
- Chapter 81 Miscellaneous Organizations
- Chapter 84 Corporations Sole
- Chapter 86 Limited-Liability Companies
- Chapter 87 Partnerships
- Chapter 87A Uniform Limited Partnership Act (2001)
- Chapter 88 Uniform Limited Partnership Act
- Chapter 88A Business Trusts
- Chapter 91 Commodities
- Chapter 92A Mergers, Conversions, Exchanges and Domestications

Title 8 – Commercial Instruments and Transactions

- Chapter 102 Interparty Agreements (Uniform Act)
- Chapter 104 Uniform Commercial Code – Original Articles
- Chapter 104A Uniform Commercial Code – Additional Articles

Title 18 – State Executive Department

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Chapter 231 Economic Development, Tourism and Cultural Affairs

Chapter 231A Nevada New Markets Jobs Act

Chapter 233B Nevada Administrative Procedure Act

Chapter 233E State System of Communications

Title 19 – Miscellaneous Matters Related to Government and Public Affairs

Chapter 237 Miscellaneous Provisions Applicable to Governmental Entities

Chapter 237A Foreign Trade Zones and Trade Districts

Title 20 – Counties and Townships: Formation, Government and Officers

Chapter 244A Counties: Financing of Public Improvements

Title 21 – Cities and Towns

Chapter 268 Powers and Duties Common to Cities and Towns Incorporated Under General or Special Laws

Chapter 270A Joint Municipal Organizations

Chapter 270B Foreign Municipal Corporations

Title 22 – Cooperative Agreements by Public Agencies; Regional Transportation Commissions; Planning and Zoning; Development and Redevelopment

Chapter 271 Local Improvements

Chapter 271A Tourism Improvements

Chapter 271B Economic Diversification

Chapter 274 Zones for Economic Development

Chapter 277 Cooperative Agreements: State, Counties, Cities, Districts and Other Public Agencies

Chapter 277A Regional Transportation Commissions

Chapter 277B Inland Port Authority Act

Chapter 278 Planning and Zoning

Chapter 278A Planned Development

Chapter 278B Impact Fees for New Development

Chapter 278C Tax Increment Areas

Chapter 279 Redevelopment of Communities

Title 25 – Public Organizations for Community Service

Chapter 308 Control of Special Districts

Chapter 318 General Improvement Districts

Chapter 320 Districts for Maintenance of Roads

Title 26 – Public Lands

Chapter 321 Administration, Control and Transfer of State Lands

Chapter 322 Use of State Lands

Chapter 323 Exchange of State Lands

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- Chapter 324 Lands Under Carey Act
- Chapter 326 Possessory Actions Concerning Public Lands
- Chapter 328 Federal Lands

Title 27 – Public Property and Purchasing

- Chapter 332 Purchasing: Local Governments
- Chapter 333 Purchasing: State
- Chapter 334 Purchasing: Generally

Title 28 – Public Works and Planning

- Chapter 340 Eminent Domain: Expeditious Procedure
- Chapter 342 Acquisition of Real Property and Assistance in Relocation

Title 30 – Public Borrowing and Obligations

- Chapter 348A Issuance of Private Activity Bonds
- Chapter 349 State Obligations
- Chapter 350 Municipal Obligations

Title 31 – Public Financial Administration

- Chapter 354 Local Financial Administration
- Chapter 355 Public Investments
- Chapter 358 Nevada Advisory Council on Federal Assistance

Title 32 – Revenue and Taxation

- Chapter 360 General Provisions
- Chapter 360A Administration of Certain Taxes and Fees on Fuels
- Chapter 360B Sales and Use Tax Administration
- Chapter 361 Property Tax
- Chapter 361A Taxes on Agricultural Real Property and Open Space
- Chapter 362 Taxes on Patented Mines and Proceeds of Minerals
- Chapter 363A Business Tax: Financial Institutions and Mining
- Chapter 363B Business Tax
- Chapter 363C Commerce Tax
- Chapter 364 License Taxes
- Chapter 365 Taxes on Certain Fuels for Motor Vehicles and Aircraft
- Chapter 366 Tax on Special Fuel
- Chapter 371 Governmental Services Tax
- Chapter 372 Sales and Use Taxes
- Chapter 372A Tax on Controlled Substances
- Chapter 373 County Taxes on Fuel
- Chapter 374 Local School Support Tax

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- Chapter 375 Taxes on Transfers of Real Property
- Chapter 376A Taxes for Development of Open-Space Land
- Chapter 377 City-County Relief Tax
- Chapter 377A Taxes for Miscellaneous Special Purposes
- Chapter 377B Tax for Infrastructure
- Chapter 377C Tax for School Capital Projects
- Chapter 377D Tax for Miscellaneous Local Purposes

Title 33 – Libraries; Museums; Historic Preservation

- Chapter 383 Historic Preservation and Archeology
- Chapter 384 Historic Districts

Title 35 - Highways; Roads; Bridges; Parks; Outdoor Recreation

- Chapter 403 County Roads, Highways and Bridges
- Chapter 404 Road Districts
- Chapter 405 Control and Preservation of Public Highways
- Chapter 407 State Parks and Monuments
- Chapter 407A Outdoor Recreation
- Chapter 408 Highways, Roads and Transportation Facilities
- Chapter 410 Beautification of Highways

Title 40 – Public Health and Safety

- Chapter 444A Programs for Recycling
- Chapter 445A Water Controls
- Chapter 445B Air Pollution
- Chapter 445C Environmental Requirements; Cleanup of Discharged Petroleum
- Chapter 445D Environmental Covenants (Uniform Act)
- Chapter 453 Controlled Substances
- Chapter 453A Medical Use of Marijuana
- Chapter 453D Regulation and Taxation of Marijuana
- Chapter 459 Hazardous Materials
- Chapter 459A Generators of Electricity

Title 42 – Protection from Fire; Explosives

- Chapter 474 County Fire Protection Districts
- Chapter 476 Explosives and Inflammable Materials
- Chapter 477 State Fire Marshal

Title 43 – Public Safety; Vehicles; Watercraft

- Chapter 480 Administration of Laws Relating to Public Safety
- Chapter 481 Administration of Laws Relating to Motor Vehicles

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- Chapter 481A Transportation on Highways (Multistate Agreement)
- Chapter 482 Motor Vehicles and Trailers: Licensing, Registration, Sales and Leases
- Chapter 482A Autonomous Vehicles
- Chapter 482B Alternative Electronic Transportation Systems
- Chapter 484D Equipment, Inspections and Size, Weight and Load of Vehicles
- Chapter 486A Alternative Fuels; Clean-Burning Fuels

Title 44 – Aeronautics

- Chapter 493 General Provisions
- Chapter 494 State Airports
- Chapter 496 Municipal Airports
- Chapter 497 Zoning

Title 46 – Mines, Minerals, Oil and Gas

- Chapter 513 Commission on Mineral Resources
- Chapter 514 Bureau of Mines and Geology
- Chapter 514A Mining Oversight and Accountability Commission
- Chapter 517 Mining Claims, Mill Sites and Tunnel Rights
- Chapter 519 Purchase, Assaying and Recovery of Ores
- Chapter 519A Reclamation of Land Subject to Mining Operations or Exploration Projects
- Chapter 520 Mining Corporations and Partnerships

Title 47 – Forestry; Forest Products and Flora

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