

Appendix Y: Goods Movement Planning and 2021 San Diego and Imperial Counties Freight Gateway Study Update

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Appendix Y Part 1: Goods Movement Planning

Why Goods Movement Matters

Why Goods Movement is a Key Component of Our Lives and Our Economy

Though it may not be obvious to many, the transportation of materials, parts, and goods is a vital aspect of every San Diegan's life. If this complex network of physical infrastructure and information technology systems were to fail, essential services like hospitals and grocery stores would exhaust their supplies within a handful of days.¹ In fact, all businesses rely on goods movement to some degree. The timely and reliable delivery of goods from warehouses and factories to retailers and consumers boosts productivity and strengthens the economy. The International Transport Forum's "Transport Outlook 2021" report noted that worldwide, "total transport activity will more than double by 2050 compared to 2015 under the trajectory reflecting current efforts. Passenger transport will increase 2.3-fold. Freight transport will grow 2.6-fold."² Across California, freight accounts for approximately one-third of the state's total gross domestic product.³

Despite the substantial benefits that goods movement yields for the state and the region, many of the industry's integral functions face growing challenges caused by increasing demand, aging infrastructure, and shifting marketplaces. The factors that destabilize and disrupt goods movement can ultimately have ripple effects that are felt throughout the economy. For this reason, it is important that the San Diego region make the necessary investments to keep its existing freight assets in working order and adapt its broader goods movement network to meet the evolving needs of consumers.

What Goods Movement in the San Diego Region Looks Like

San Diego has a diverse and expansive goods movement network. The region serves nearly every mode of freight between its interstate highways and arterials, rail corridors, land ports of entry (POEs), maritime port, and international airport. San Diego also enjoys a distinct competitive advantage from its proximity to the U.S.–Mexico border. The two nations have grown increasingly interdependent since the passage of the North American Free Trade Agreement (NAFTA) in 1994 and the resulting integration of many North American supply chains. Between 1993 and 2019, U.S.–Mexico trade increased by more than 654%.⁴ As noted in Appendix J: Megaregion and Borders Planning and

¹ "Why Goods Movement Matters," Regional Plan Association, June 2016, rpa.org/work/reports/why-goods-movement-matters.

² "Executive Summary: ITF Transport Outlook 2021," International Transport Forum, 2021, itf-oecd.org/sites/default/files/transport-outlook-executive-summary-2021-english.pdf.

³ "California Sustainable Freight Action Plan," Caltrans, dot.ca.gov/programs/transportation-planning/freight-planning/csfap.

⁴ U.S. Census Bureau, as of March 2021 (calculated on a nominal basis), census.gov.

Collaboration, our California–Baja California megaregion hosts one of the world's strongest crossborder supply chains. In 2019, more than two million trucks crossed bidirectionally through San Diego's Otay Mesa and Tecate POEs alone.⁵

Much of San Diego's existing goods movement network is intertwined with the region's legacy of urban sprawl. Decades of low-density development patterns have increased dependency on the region's highways for both personal transportation and freight. Changes in land use patterns and increases in urban land value have also pushed warehousing to the outskirts of urban areas. The vast majority of the region's goods are moved along the highway system, which increases congestion and creates bottlenecks along many key regional corridors.

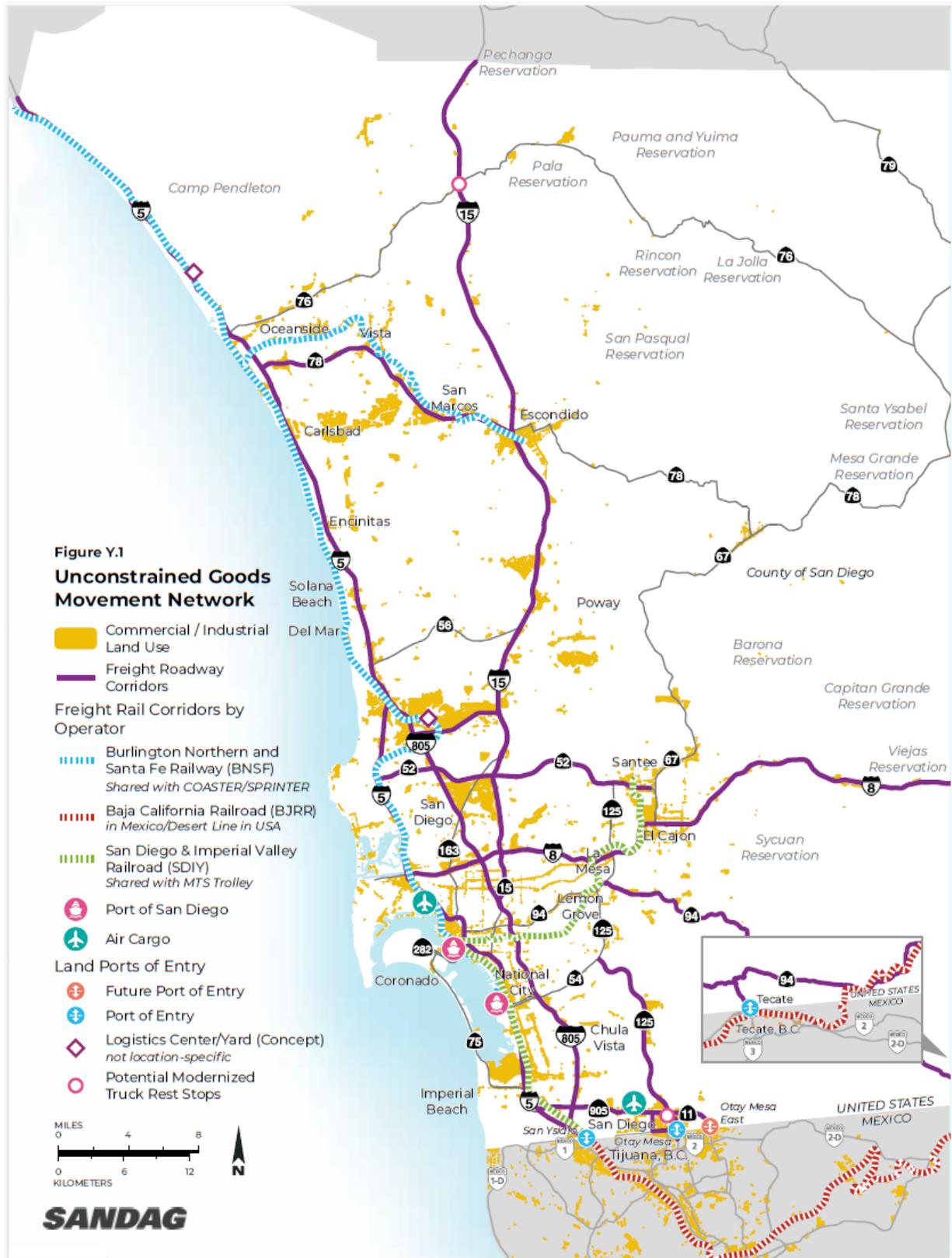
How the San Diego Region Will Grow in the Future

Changing attitudes toward preserving open space and climate resilience have placed a new emphasis on strategic, high-density development. As the region seeks to orient future growth around its existing urban footprint, the transportation network as a whole will face new challenges. As part of its plans to create a more efficient, accessible, and sustainable transportation network of the future, the San Diego Association of Governments (SANDAG) has identified a bold new Vision centering around 5 Big Moves for San Diego Forward: The 2021 Regional Plan (2021 Regional Plan).⁶ Within these innovative new investments lie opportunities to increase the efficiency of the goods movement network and ensure that it continues to meet the region's needs. An overview of these future regional goods movement investments is shown in Figure Y.1.

⁵ "California–Baja California Border Crossing and Trade Statistics," SANDAG, sandag.org/index.asp?classid=19&projectid=451&fuseaction=projects.detail.

⁶ "A Bold New Transportation Vision in 5 Big Moves," San Diego Forward, SANDAG, sdforward.com/mobility-planning/5-big-moves.

Figure Y.1: Unconstrained Goods Movement Network



Observed Changes in the Goods Movement Industry

In addition to the shifting paradigm of how the region's cities are built out, San Diego's goods movement systems must also keep pace with changes within the highly dynamic freight industry. Over the last several decades, revolutionary innovations like containerization and automation have sparked a broad restructuring of how goods are moved. Changing international trade relationships fueled the proliferation of global trade and multinational supply chains, particularly with NAFTA, further shuffling existing goods movement networks.

In more recent years, the rise of online shopping has had dramatic implications on goods movement systems. Compared to traditional retail, e-commerce demands tighter delivery windows and additional logistical/storage spaces.⁷ To meet their unique needs, many e-commerce companies have turned to new forms of goods movement like contracting with transportation network companies for last-mile deliveries. Growth in e-commerce sales has outpaced traditional retail sales for well over a decade, a trend that was greatly accelerated by the COVID-19 pandemic. Across the United States, e-commerce's share of total retail jumped from 11.8% in the first quarter of 2020 to 16.1% in the second quarter.⁸ While the lasting impacts of the pandemic are far from known, many expect the proliferation of e-commerce to continue.

Beyond e-commerce, many suppliers and retailers have adopted "just in time" inventory practices, in which the time between when goods are needed and when they are ordered is minimized. These practices use sophisticated modeling techniques to anticipate demand and can significantly reduce the amount of product that needs to be kept on site. For suppliers and retailers, this frees up storage space and increases available cash on hand. For freight companies, this means that goods must be moved in smaller quantities and at more frequent intervals.

Environmental/Quality of Life Considerations

Like any service that operates within the public right-of-way, the goods movement network is subject to considerations of the "triple bottom line": economic growth, environmental resilience, and quality of life. While measures to increase the efficiency of freight operations in the region may succeed in improving economic productivity, they may also have adverse effects like increased noise, congestion, or pollution if innovative strategies are not used to mitigate these impacts. Currently, freight is responsible for 50% of diesel particulate matter (DPM) emissions and 6% of total greenhouse gas (GHG) emissions within the State of California.

The negative impacts of goods movement have historically been disproportionately borne by socioeconomically disadvantaged and marginalized communities. Disentangling these externalities and environmentally vulnerable populations will require

⁷ "California Freight Mobility Plan 2020," Caltrans, dot.ca.gov/programs/transportation-planning/freight-planning/cfmp-2020.

⁸ "E-commerce in the time of COVID-19," OECD, October 7, 2020, oecd.org/coronavirus/policy-responses/e-commerce-in-the-time-of-covid-19-3a2b78e8.

a concerted and focused effort from the region's planning entities. To address these impacts, California Assembly Bill 805 (Gonzalez Fletcher, 2017) calls for SANDAG to include transportation strategies in its regional plans to reduce pollution exposure in the region's disadvantaged communities. Recent goods movement strategies developed and implemented by SANDAG, such as developing a border wait time system to assist in managing demand at our regional border crossings, have therefore focused on providing sustainable and innovative freight solutions that reduce emissions in local disadvantaged communities while still promoting trade. In addition, SANDAG has been a member of the California Assembly Bill 617 (Cristina Garcia, 2017) (AB 617) Portside Environmental Justice Community Steering Committee since 2018. AB 617 was enacted to create programs to reduce air pollution in the state's most impacted communities. As a result, a community emissions-reductions plan has been drafted for the Barrio Logan, Logan Heights, Sherman Heights, and West National City neighborhoods.

In addition to the communities through which the goods movement network runs, there are also important equity considerations regarding the employees who operate these systems. As freight companies look to advance operational efficiency through the adoption of automation, the workforce and skills required to operate vehicles and conduct warehouse operations will change. It is crucial that the necessary programs be put in place to support these workers if and when automation becomes the industry norm. As policies and programs are adopted to support communities impacted by freight operations, consideration also must be given to how the region will continue to accommodate necessary goods movement operations to keep food on the table and products on the shelves for the county's residents. Additionally, policies must consider the impacts of decisions on the ability for goods movement businesses, both small and large, to maintain the jobs that are essential for the supply chain to continue to function efficiently.

The remaining sections of this appendix provide a closer look at how goods movement affects and is affected by the regional economy, considerations for equity for goods movement-impacted communities and for workers within the trucking industry, how the environment is affected by goods movement and the programs currently underway to mitigate those effects, and finally, a discussion of goods movement projects and studies—including potential strategies that align with the 5 Big Moves.

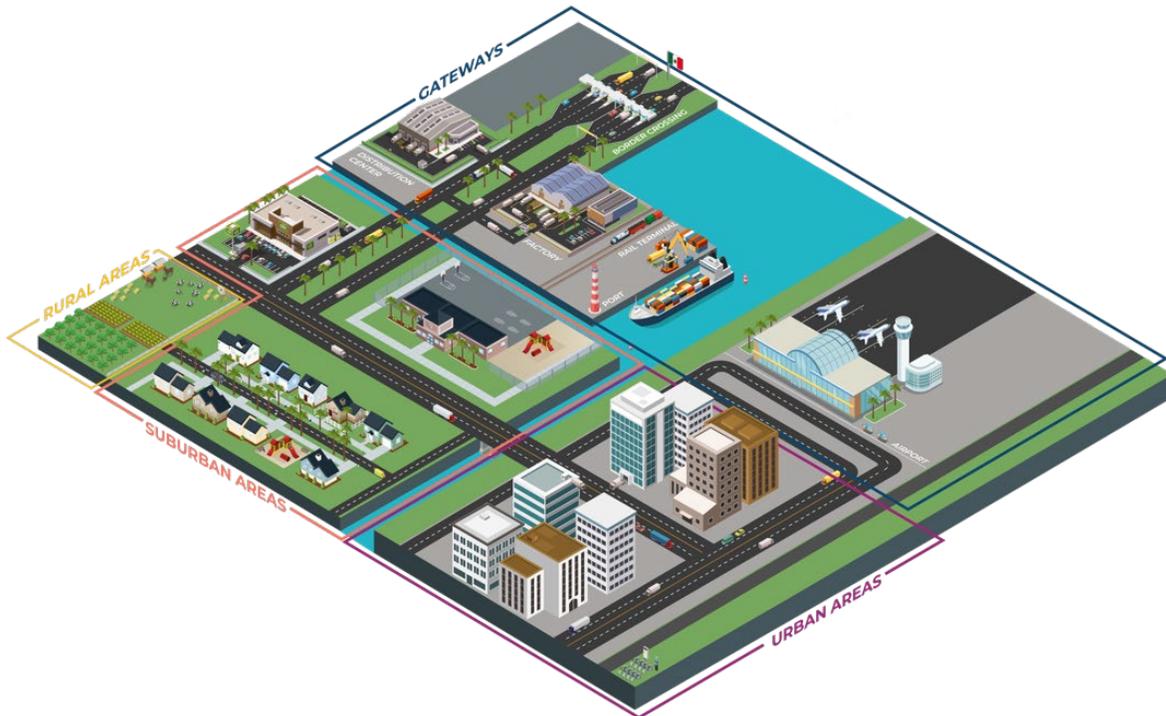
Economy and Goods Movement

While mechanisms to transport raw materials and finished products have always been a foundational characteristic of any functioning system of trade, never in history have goods movement networks played such a central role in the global economy. With today's globalized markets, goods movement enables manufacturers to source material from nearly every corner of the planet and gives the modern consumer access to a virtually boundless supply of products. This has enabled countries and regions to boost economic productivity by specializing in production of their most competitively advantageous goods, while relying on imports to meet demand for other products.

Situated between major production, trade, and population centers, San Diego depends on an integrated transportation network to effectively move people and goods within and through the region to the rest of the nation and around the world. Due to the interdependent nature of its binational economy with Tijuana and Tecate, San Diego's globally competitive business environment hosts a manufacturing sector that is one of the world's strongest crossborder supply chains, with a combined gross domestic product of approximately \$253 billion for San Diego County in 2019.⁹

Our region therefore connects some of the largest supply chains in the nation by bridging the major goods movement gateways in Southern California—the California–Baja California border region; the Ports of San Diego, Los Angeles, and Long Beach; and the Inland Empire distribution centers. As shown in Figure Y.2, these freight gateways are major economic hubs for Southern California's metropolitan areas, and the transportation corridors linking them together provide the backbone for supply chains to deliver goods smoothly to urban and rural areas. For these connections to thrive, the freight transportation system in the San Diego region includes interstate and state highways, Class I freight rail operations, short line railroads (most freight operations occur on tracks shared with passenger rail services), airport cargo systems, the Port of San Diego (with two working marine terminals), and the Otay Mesa and Tecate commercial border crossings.

Figure Y.2: Goods Movement Overview



⁹ "California Freight Mobility Plan 2020," San Diego - Imperial Counties Border section, Caltrans, March 2020, dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/freight-planning/cfmp-2020-final/final-cfmp-2020-chapters-1-to-6-remediated-ally.pdf.

Truck

The predominant mode in San Diego's diverse and expansive goods movement network is commercial trucking. Trucking has played a pivotal role in enabling the region to harness the economic benefits of growing international trade. Since the passage of NAFTA in 1994, trade between the United States and Mexico has grown sevenfold.¹⁰ In 2019, Mexico became the United States' top overall trade partner. That year, the region's land POEs handled \$48.3 billion, with the Otay Mesa POE being the second-busiest truck crossing along the U.S.–Mexico border.⁵ The most common commodities that cross the California-Mexico border by truck include high-value items like electronics, medical devices, and automobiles. These commodities are expected to continue to dominate crossborder trade, especially with the passage of the United States–Mexico–Canada (USMCA) Trade Agreement. International trade, however, accounts for only a portion of the goods that trucks carry goods through San Diego County. Freight traveling within San Diego County or to/from other domestic locations accounts for more than 85% of the truck tonnage on the region's interstate freeways, highways, and local roads (approximately 50 million tons per year).¹¹

Rail

In addition to commercial truck crossings, San Diego also has a rail freight crossing at its San Ysidro POE, where the Main Line—owned by the San Diego Metropolitan Transit System (MTS) subsidiary San Diego and Arizona Eastern Railway Company—terminates. Freight on this short line is operated by the San Diego and Imperial Valley Railroad (SDIV) with Genesee & Wyoming Inc. as its short line railroad holding company. While accounting for only a small portion of total crossborder trade, approximately \$96 million of goods passed through San Diego's rail crossing in 2019.¹² These rail imports consist primarily of agricultural goods and raw materials like stone, iron, and steel. The Desert Line, a non-operational short line rail, also exists about five miles east of the Tecate POE.

San Diego's rail infrastructure also carries a significant amount of domestic freight. Of the approximately 3,200 rail carloads carried by SDIV in 2019, about half are transported between locations other than the international border.¹³ The region is also served by the Los Angeles – San Diego – San Luis Obispo (LOSSAN) Rail Corridor, which carries approximately \$1 billion of freight annually by its Class I freight operator, the Burlington Northern Santa Fe (BNSF) Railway Company.^{14, 15} Both BNSF and SDIV must work around the operating times of popular passenger service routes.

¹⁰ "Trade in Goods with Mexico," U.S. Census Bureau, [census.gov/foreign-trade/balance/c2010.html](https://www.census.gov/foreign-trade/balance/c2010.html). U.S.–Mexico trade grew from \$81.5 billion in 1993 to \$614.5 billion in 2019.

¹¹ "2016 Freight Gateway Study Update," SANDAG, December 2016, [sandag.org/uploads/projectid/projectid_437_21373.pdf](https://www.sandag.org/uploads/projectid/projectid_437_21373.pdf).

¹² "TransBorder Freight Data," Bureau of Transportation Statistics, [bts.gov/transborder](https://www.bts.gov/transborder).

¹³ San Diego Metropolitan Transit System – San Diego and Arizona Eastern Railway Company, [sdmts.com/about-mts-meetings-and-agendas/sdae](https://www.sdmts.com/about-mts-meetings-and-agendas/sdae).

¹⁴ "LOSSAN Rail Corridor Agency Fact Sheet," OCTA, November 15, 2019, [octa.net/pdf/LOSSAN_Agency_Fact_Sheet_11.2019.pdf](https://www.octa.net/pdf/LOSSAN_Agency_Fact_Sheet_11.2019.pdf).

¹⁵ "NCTD & SANDAG Receive \$106 Million Grant to Implement \$202 Million of Improvements on the San Diego Portion of the LOSSAN Corridor," NCTD, December 8, 2020, [gonctd.com/nctd-sandag-receive-106-million-grant-for-rail-improvements](https://www.gonctd.com/nctd-sandag-receive-106-million-grant-for-rail-improvements).

Maritime

While the majority of imports that pass through the San Diego goods movement network complete a portion of their journey on trucks or trains, many international goods first arrive to the region by ship. Between the Tenth Avenue Marine Terminal (TAMT) and National City Marine Terminal (NCMT), more than 1.6 million metric tons of waterborne cargo are processed by San Diego's seaports annually.¹⁶ In addition to standard shipping containers, San Diego's maritime ports are equipped to process breakbulk and refrigerated cargo. NCMT primarily handles lumber and automobiles, while TAMT receives a wider variety of goods, including fruit, sand/cement, and petroleum products. Both TAMT and NCMT have on-site rail connections and are minutes away from major highways.

While the region's ports have long processed almost exclusively international goods, the Port of San Diego sought and, in August 2021, received approval from the U.S. Maritime Administration for designation of the West Coast Marine Highway 5 (M-5) Coastal Connector. With this new designation, San Diego's ports could expand trade with the Southern Oregon Port and Port of Bellingham (Washington). This could alleviate commercial truck traffic along the I-5 corridor, saving an estimated \$240,000 in diesel fuel costs and \$85,000 in road maintenance per round trip voyage.¹⁷

By providing the region with valuable goods and high-quality employment, the Port of San Diego is an important economic driver. A 2017 economic impact analysis found that industrial and maritime commerce at the port directly contributed 13,348 jobs and \$2.65 billion in economic output to the county. With tourism activity and indirect economic benefits included, the Port of San Diego's total economic impact to the region is estimated to be over \$9.3 billion.¹⁸

Air Cargo

Another way goods enter and leave San Diego County is through its airports. In addition to being the nation's busiest single-runway commercial airport, San Diego International Airport handled more than 150,000 tons of cargo in 2019.¹⁹ Mail makes up a significant portion of the cargo that arrives at the airport. Upon arrival, mail is trucked to off-site sorting facilities before being sent to its final destination. Unlike the region's maritime ports, which almost exclusively process international goods, San Diego International Airport primarily handles domestic cargo.

¹⁶ "Waterborne tonnage for principal U.S. ports and all 50 states and U.S. territories," USACE, [usace.contentdm.oclc.org/digital/collection/p16021coll2/id/1492](https://www.usace.contentdm.oclc.org/digital/collection/p16021coll2/id/1492). USACE reports tonnage in short tons. All tonnage figures have been converted to metric tons in this report.

¹⁷ Port of San Diego M-5 Application.

¹⁸ "Economic Impacts of the San Diego Unified Port District in 2017," Port of San Diego, Economic & Planning Systems, Inc, February 28, 2019, pantheonstorage.blob.core.windows.net/administration/port-of-san-diego-economic-impact-report-2017.pdf.

¹⁹ "Air Traffic Reports: Monthly," San Diego International Airport, san.org/news/air-traffic-reports.

Pipeline

Finally, San Diego's goods movement network also includes two privately owned pipelines which bring in about 700,000 tons of aviation fuel and gasoline per year.

Over numerous modes, San Diego's goods movement network supplies the region with a plethora of commodities and materials from across the globe. Because virtually every industry depends on these goods to some degree, improvements to the freight network benefit the regional, state, national, and international economies. The most immediate benefits are shorter travel times and enhanced reliability for freight companies, which lower operations costs. This, in turn, reduces commodity prices and increases output. Investments in freight networks can also increase employment and income, further stimulating the economy.

Conversely, failure to address constraints on freight movement leads to network-wide inefficiencies and ultimately stifles economic growth for the region and beyond. As shown in Table Y.1, a recent SANDAG analysis found that delays to freight vehicles at California–Baja California border crossings cost the U.S. and Mexico economies more than 55,000 jobs, \$256 million in labor income, and more than \$1.2 billion in lost output.²⁰

Table Y.1: Economic Impacts from Delays for Freight Movements at the California–Baja California Border, 2016

Economic Impacts from Delays for Freight Movements at the California–Baja California Border, 2016			
Areas	Output, \$M	Labor Income, \$M	Employment, jobs
United States	-\$285	-\$89	-1,251
Mexico	-\$956	-\$167	-53,843
United States and Mexico	-\$1,240	-\$256	-55,094

Source: Impacts of Border Delays at California–Baja California Land Ports of Entry (2021)

In addition to border crossings, economic impacts have also been quantified for delays on the region's highway system. The Texas A&M Transportation Institute estimated that trucking delays on San Diego's roadways amounted to more than 6 million hours of lost time and \$306 million of associated costs for the industry in 2017.²¹ Much of the region's trucking congestion is concentrated along certain segments of the highway network and during peak hours.

²⁰ "Impacts of Border Delays at California-Baja California Ports of Entry," SANDAG, sandag.org/index.asp?classid=19&projectid=535&fuseaction=projects.detail.

²¹ "Congestion Data for your City," Texas A&M Transportation Institute, mobility.tamu.edu/umr/congestion-data.

Goods Movement and COVID-19

When the COVID-19 pandemic struck in early 2020, its sudden and dramatic impacts were felt across practically every aspect of human life, and goods movement systems were no exception. Early in the pandemic, demand for personal protective equipment (PPE) caused shortages that manufacturers and freight providers struggled to address. Although China, the world's leader in medical PPE manufacturing, had already dramatically ramped up production by the time the pandemic took hold in the United States,²² many shipments experienced delays due to a complication within the air cargo industry.

Prior to the pandemic, 45% of the world's air cargo was carried in the belly hold of commercial passenger planes.²³ With travel restrictions and border closings causing many passenger flights to be cancelled, international air cargo capacity was down 24.6% in March 2020 compared to previous years.²⁴ However, the need to move PPE and other goods kept demand relatively high, causing air cargo prices between Asian and North American markets to spike.²⁵ To shore up shortages in air cargo supply, many passenger airlines began running cargo-only flights. Some airlines even resorted to carrying packages in empty passenger seats.

The mismatch of air cargo supply and demand is far from the only example of potential shortcomings that the pandemic revealed within goods movement networks. However, considering the magnitude and ubiquity of the crisis, freight systems remained relatively reliable. One analysis found that at the height of the pandemic, nationwide personal vehicle miles traveled fell by about 46%, while trucking and freight activity experienced only a 13% reduction.²⁶

The continuation of freight services was critical in mitigating some of the direst impacts of the pandemic. Not only did freight systems help keep healthcare providers stocked with essential equipment, but they also played a particularly critical role in supporting business activity. After shelter-in-place orders placed restrictions on the majority of in-person activities, many retailers depended on e-commerce to supplement their lost revenue. While not all businesses were able to adapt to an online environment, those that did relied on various aspects of the goods movement network to scale up direct shipments to consumers' homes. National e-commerce sales jumped 44% between 2019 and 2020.²⁷

²² "China Dominates Medical Supplies, in This Outbreak and the Next," New York Times, July 5, 2020, [nytimes.com/2020/07/05/business/china-medical-supplies.html](https://www.nytimes.com/2020/07/05/business/china-medical-supplies.html).

²³ "As coronavirus empties the sky of passenger planes, air cargo marches on," The Air Current, March 27, 2020, theaircurrent.com/airlines/as-coronavirus-empties-the-sky-of-passenger-planes-air-cargo-marches-on.

²⁴ "Immediate and Severe Air Cargo Capacity Crunch," IATA, April 28, 2020, [iata.org/en/pressroom/pr/2020-04-28-01](https://www.iata.org/en/pressroom/pr/2020-04-28-01).

²⁵ "Airfreight Rates – Baltic Exchange Airfreight Index," Aircargo News, [aircargonews.net/data-hub/airfreight-rates-tac-index](https://www.aircargonews.net/data-hub/airfreight-rates-tac-index).

²⁶ "COVID-19's Impact on Freight: An Analysis of Long-Haul Freight Movement During a Pandemic," INRIX, [inrix.com/campaigns/impact-of-coronavirus-on-freight-movement-study](https://www.inrix.com/campaigns/impact-of-coronavirus-on-freight-movement-study).

²⁷ "Charts: How the coronavirus is changing ecommerce," Digital Commerce 360, February 19, 2021, [digitalcommerce360.com/2021/02/15/ecommerce-during-coronavirus-pandemic-in-charts](https://www.digitalcommerce360.com/2021/02/15/ecommerce-during-coronavirus-pandemic-in-charts).

Even as the economy recovered from the initial impacts of the pandemic, the goods movement network continued to face new challenges. For example, as American retailers sought to restock their inventories, the Los Angeles and Long Beach ports were hit with record import levels in late 2020. This created a backlog of container ships waiting to berth and increased congestion at ports across the West Coast.^{28, 29}

While the complete scope of the economic consequences from the COVID-19 virus are currently unknown, they certainly would have been more severe if goods movement systems had been less adaptable to pandemic conditions. The degree to which pandemic-related changes become permanent in freight systems will ultimately depend on larger economic factors and market conditions.

Equity and Goods Movement

Equity applies to goods movement in two distinct ways:

- Impacts of inequities on communities, neighborhoods, and residents that are adjacent to freight facilities and routes
- Impacts of inequities on the goods movement workforces, particularly small trucking businesses, owner-operator truckers, and truck drivers

Equity and Communities

San Diego County, like many major urban centers throughout the country and the world, has concentrated goods movement and supporting infrastructure along historically established industrial, intermodal areas and supporting access routes. Neighborhoods have grown up around many of these facilities and along the routes, and likewise, goods movement facilities have expanded around established neighborhoods.

Although there are freight movements in some form within all communities throughout San Diego County, the following are examples of freight-impacted types of communities.

Portside Communities

Communities along the Port of San Diego's working waterfront and goods movement facilities have historically coexisted. As trucks, trains, and ships have increased in size and volume, commensurate noise, traffic, and emissions have also increased, along with the impacts on the adjacent and often under-resourced neighborhoods and people of the community. For communities adjacent to San Diego's marine terminals, primary concerns include air quality, truck and train traffic, parking, safety, noise, and infrastructure impacts. Recent efforts through the AB 617 Portside Community look to address some of these impacts through community emission-reduction strategies.³⁰

²⁸ "4 charts show the effects of West Coast port congestion and supply chain delays," Supply Chain Dive, February 16, 2020, supplychaindive.com/news/california-port-congestion-los-angeles-long-beach-data/594715.

²⁹ "Carriers eye alternate ports as congestion at LA-Long Beach tightens," The Load Star, February 28, 2020, theloadstar.com/carriers-eye-alternate-ports-as-congestion-at-la-long-beach-tightens.

³⁰ "Community Air Protection Program (AB 617)," SDAPCD, sandiegocounty.gov/content/sdc/apcd/en/community-air-protection-program--ab-617-.html.

For all communities and residents, the importance of preserving access to a recreational waterfront must be balanced with the need for appropriate truck routes and parking to serve the marine terminals, rail yards, warehouse districts, and distribution centers. Safe parking and basic services (e.g., bathrooms, food, and lodging) for regional and long-haul truck drivers serving the marine terminals and surrounding freight facilities is a challenge for portside communities and truck drivers. Truck drivers often must attempt to find parking on city streets so they are closer to needed services which conflicts with the parking regulations for commercial vehicles. Parking in allowable areas closer to the trucker's destination warehouse or the port terminal often isolates drivers from needed services.

Border Communities

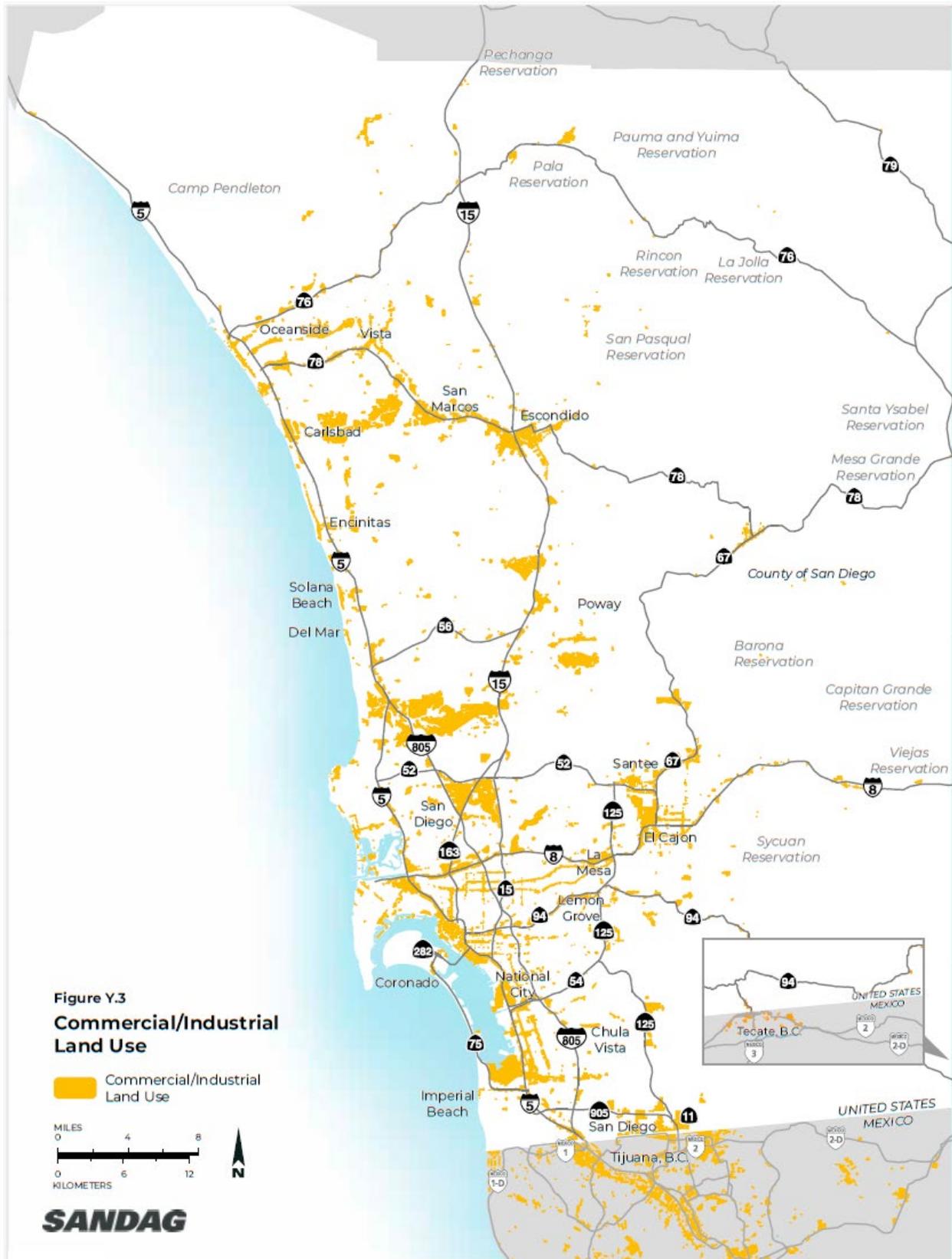
The communities situated along the region's U.S.–Mexico border crossings have similar concerns. As the number of trucks crossing the border adds to the continual increases in vehicle traffic, the surrounding communities are also impacted by the resulting noise, traffic, and emissions due to crossborder delays. In 2016, truck delays at the region's land POEs resulted in an average of 182 metric tons of carbon dioxide (CO₂) emitted per day. In addition, residents of the South Bay Subregional Area, which includes communities in San Ysidro and Otay Mesa, are more susceptible to direct and long-term health impacts from mobility/built environment factors than other areas of San Diego County.³¹ In an area where crossborder freight movement has significant economic benefits to our international economies, there is a need to improve air quality while increasing connectivity to provide equitable solutions for community members on both sides of the border.

Commercial/Industrial Zone Communities and Military Bases

There are commercial and industrial zones throughout the San Diego region where concentrations of heavy or light manufacturers, distribution centers, warehouses, equipment yards, and other construction-related trades engage in the movement of goods to serve their business needs and their customers. Although they have unique characteristics from commercial or industrial zones, the San Diego region's military bases have similar goods movement needs when moving mission-critical equipment to/from our region to the rest of the nation. Trucks are required for the largest share of the freight moves that serve these zones. The commercial land uses concentrations in the county are shown in the map in Figure Y.3.

³¹ "Border Health Equity Transportation Study: A Case Study of the San Ysidro Community," SANDAG sandag.org/index.asp?projectid=445&fuseaction=projects.detail.

Figure Y.3: Commercial/Industrial Land Use



Many of these land uses abut residential neighborhoods and share arterial access with trucks, delivery vehicles, and residents. Concerns similar to those identified for the portside and border communities must be considered as these communities mitigate air quality, traffic, and noise impacts.

Rural and Tribal Communities

Rural and tribal communities in the San Diego region are subject to higher transportation costs and often longer delivery times and less flexible delivery options for goods, including groceries. While lower volumes of freight vehicles typically traverse rural roads, delays still occur due to bottlenecks in some locations and variable and adverse weather conditions that impact the delivery capabilities for some types of freight. With the accelerated expansion of an already upward trend in e-commerce during the COVID-19 pandemic, package and parcel deliveries have increased even to rural communities. With 12.4% of all retail sales projected to be online at the end of 2020, 73% of those sales will come from rural consumers.³² Parcel lockers and centralized delivery locations, with opportunities for co-location at rural Mobility Hubs, become increasingly important as a way to provide access for rural residents to the same goods available to their urban counterparts in more densely populated parts of the region. Rural parts of the region also host a variety of sensitive habitats that must be considered for preservation as freight-related aspects of the transportation network are expanded and improved to serve rural and tribal communities.

The National Multimodal Freight Policy (23 USC 167) includes requirements addressed by the California Freight Mobility Plan 2020 goal of Healthy Communities, such as objectives to prioritize social equity for all freight-related projects, conduct meaningful outreach to environmental justice communities, and promote noise- and other pollution-abatement strategies alongside residential areas and sensitive habitats. SANDAG and other local agencies are keenly aware of the importance of working with the private sector, communities, and community leaders to ensure that plans for solutions and changes to the working waterfront, the border, industrial/commercial zones, and related freight access routes are closely vetted by these communities. SANDAG is committed to working closely with the region's community-based organizations through the SANDAG Social Equity Working Group and SANDAG Interagency Technical Working Group on Tribal Transportation Issues to understand community needs and opinions regarding the advancement of freight projects and policies identified in the 2021 Regional Plan.

³² "Rural America Is the Next E-Commerce Frontier," E-Commerce Times, October 21, 2020, ecommercetimes.com/story/86890.html.

Equity and Goods Movement Workforce and Small Businesses

An aspect of equity that is often overlooked includes the equitable opportunity, treatment, and well-being of the goods movement workforce—including truck drivers, owner-operator truckers, warehouse workers, customs brokers, railroad employees, maritime employees, air cargo employees, and small business transportation service workers. These workers and small businesses are a vital link in the goods movement supply chain and lifeblood of our regional economy.

Truckers move the largest share of goods, so it is helpful to understand their needs with regard to equity for small-business truckers and truck drivers. Eighty-four percent of trucking companies operate very small fleets (from one to six trucks).³³ There is typically less cohesive industry representation across potentially impacted segments of trucking than for maritime and rail employees who have strong union representation. It is important to note that the majority of small truckers do not belong to any association or industry organization, often due to membership costs or awareness of benefits, and are therefore underrepresented in the transportation planning and decision-making processes.

Small companies face limitations when recruiting truck drivers as they must compete with larger carriers for an already insufficient pool of qualified new drivers. Further, new drivers must also contend with a variety of barriers for entry into the industry. The driver shortage is due to attrition, higher-paying employment alternatives, California's high cost of living, insurance costs, regulations, lack of experienced drivers, and perceptions of poor conditions for some segments of the trucking industry.³⁴ Many current truck drivers are among the “baby boomer” generation (with an average age of 55 years old) and are expected to retire in the coming decade. Thus, retiring drivers are not expected to be replaced in the same numbers with new drivers.

Transportation programs, projects, plans, policies, and regulations often overlook the financial impact on small trucking operations or owner-operators and how they will pay for resulting fees, taxes, equipment, technologies, or other costs of new programs. There are a variety of policies and regulations that may have inequitable impacts on small operators, including those that govern business credentials, independent contractor status, operating authority, fuel taxes, parking restrictions for commercial vehicles, truck routes/restrictions, tolling, access to services, and hours of service. These costs take a greater percentage of a small operator's revenue compared with much larger carriers. When considering and planning new programs, projects, policies, and regulations in the region, effects on the trucking community must also be considered as a routine part of the planning process to avoid further impairment of small trucking firms' abilities to profitably continue their businesses and maintain their livelihood.

³³ “Proposition 1B: Goods Movement Emission Reduction Program December 2020 Semi-Annual Status Report,” CARB, December 31, 2020, arb.ca.gov/sites/default/files/2020-12/Proposition%201B%20-%20Goods%20Movement%20December%202020%20Semi-Annual%20Report.pdf.

³⁴ “Truck Driver Shortage Analysis 2019,” American Trucking Associations, July, 2019, trucking.org/sites/default/files/2020-01/ATAs%20Driver%20Shortage%20Report%202019%20with%20cover.pdf.

A recent example of legislation that has potential consequences for small-business truckers and owner-operators is California Assembly Bill 5 (Gonzalez, 2019) (AB 5). In 2019, AB 5 was passed to regulate the use of independent contractors in a variety of activities that included trucking. In January 2020, San Diego U.S. District Court Judge Roger Benitez issued a preliminary injunction blocking the enforcement of AB 5 against California trucking companies that contract with owner-operator truckers. The initial lawsuit was filed by the California Trucking Association (CTA) and two owner-operators seeking to prevent the application of AB 5 to the trucking industry. In late April 2021, in a ruling from a three-judge panel of the Ninth Circuit Court of Appeals, the panel reversed the granting of CTA's preliminary injunction. Following the Ninth Circuit's denial of CTA's petition for rehearing in June, CTA filed a petition for a writ of certiorari with the U.S. Supreme Court on August 9, 2021. At this time, the deadline for the State of California's response is October 12, 2021.

Parking regulations are an illustration of how policies to preserve neighborhood aesthetics, roadway infrastructure, and quality of life may adversely impact truck drivers. Most owner-operators do not have an off-street industrial yard to park their truck—unless it is offered by the contracting motor carrier, or they pay for one that averages \$25-\$35/night or \$300 or more per month³⁵—and often park their truck at home during off-duty time. Truck and equipment theft, in conjunction with cargo theft, is a continuing problem in the nation and in San Diego County,³⁶ thus the need for an owner-operator to park their investment in a secure location and nearby their home. There is also need for safe parking, staging, and basic services (e.g., bathrooms, water, food, and lodging) for long-haul truck drivers serving marine terminals, cruise ship terminals, air cargo terminals, and industrial and warehouse districts. Due to a lack of safe and convenient regional truck parking and staging lots, truck drivers often attempt to find parking on local city streets that are closer to needed services, which often conflicts with a city's parking regulations for commercial vehicles. Parking in allowable areas closer to their destination warehouse or the port terminal often isolates drivers from needed services.

The Digital Divide

Supply chain businesses are fully dependent on today's digitized and electronic devices and data exchanges to conduct business. Computers, cloud-based systems, smartphones, tablets, and access to the internet are essential. For truck drivers, and particularly owner-operators, their trucks are often the place where they conduct their business, and smartphones have become the device of choice to connect them to customers, vendors, freight brokers, transportation brokers, and a variety of other entities and systems. KJ Media, a driver recruitment marketing company, conducted a survey in 2015 of a driver database and found that 95.7% of drivers based in the United States have smartphones. Truck drivers are using smartphones to help them succeed both personally and professionally, and these devices have changed the way people interact with drivers. Smartphones allow drivers to stay on top of their business and stay in touch with their

³⁵ Trucking Industry Survey Research performed as part of Caltrans Statewide Truck Parking Study, 2021.

³⁶ "Cargo Theft Interdiction Program," California Highway Patrol, chp.ca.gov/programs-services/programs/cargo-theft-interdiction-program.

families and friends while they are on the road. As mobile applications and information systems are planned and developed, it is important to note that truckers use both smartphone technology platforms (37% iOS, 63% Android, with the market share for iOS continuing to grow).³⁷

According to a 2017 Samsung enterprise mobility trends study³⁸ conducted by GfK Public Communications and Social, one-third of all drivers already believe their smartphones have replaced the need for a traditional PC, with 61% choosing a smartphone if forced to pick just one device. Two-thirds said that they would be able to do their work today using only a smartphone—this is a higher portion than any of the other sectors surveyed.

Eighty-seven percent of drivers say they used their smartphones every single day for work, and, on average, they spend 37% of their workday using a smartphone. Here are drivers' top three uses for smartphones:

- **Making calls:** 70%
- **Navigation:** 55%
- **Texting or chatting:** 51%³⁹

Half of drivers surveyed said that they always communicate with dispatch using their smartphones, indicating just how important of a tool smartphones are for mobile fleet management.

Opportunities exist to assist drivers in conducting their daily business more effectively via their smartphones by providing electronic access to required data exchange, information, and credentials portals. Mobile device–friendly electronic access further alleviates the burden of paper documentation and reporting throughout the trucker's involvement in the supply chain, which can include bills of lading, credentials and security, fuel tax reporting, reporting to the California Air Resources Board (CARB), and electronic logging devices compliance. This is particularly important for owner-operators who conduct most of their business support activities from the cabs of their trucks. As highlighted in the Next Operating System (Next OS) section below, support for trucking information systems is another potential function of Next OS, one of the 5 Big Moves.

Environmental Regulations for Truckers

The below environmental regulations have helped reduce statewide emissions from the freight sector. However, these regulations have impacted operations for small fleets and owner-operators and indicate how public agencies need to continue providing incentives or other funding solutions to keep these businesses sustainable when transitioning fleets to greener technologies.

³⁷ "The Future of Trucking Is Built on Smartphone Technology," Samsung, August 1, 2017, insights.samsung.com/2017/08/01/the-future-of-trucking-is-built-on-smartphone-technology.

³⁸ "New Study Shows Critical Role of Smartphones in Workforce Productivity," Samsung, June 26, 2017, insights.samsung.com/2017/06/26/new-study-shows-growing-role-of-cellphones-at-work.

³⁹ "The Future of Trucking."

California Air Resources Board Truck and Bus Regulation

Light commercial vehicles (14K–26K gross vehicle weight rating [GVWR]) and heavy commercial vehicles (26.1K GVWR and greater) are subject to federal and state air quality and GHG emissions regulations. As of 2020, all trucks must have 2010 model year or newer engines (based on the Emissions Control Label) by 2023, and most heavy trucks must have a particulate matter (PM) exhaust filter installed.

As of January 1, 2021, lighter commercial vehicles with 2006 model year and older engines are not allowed in California, with the only option to repower (i.e., replace the engine). For heavy commercial vehicles, trucks with 2004 or older engines must be replaced with a 2010 or newer model year engine as of January 1, 2021. Later model years have a sunset date continuing through 2023. Single truck owners will be able to delay the replacement of their trucks until 2023.

CARB introduced some flexibility options in 2014 to allow additional years to comply with the regulations, which was particularly helpful to small fleets and owner-operators. These flexibility options were challenged by large trucking companies that invested in equipment retrofits to comply with the ruling when it was first enacted. CARB rolled back the flexibility options, and this decision affects owner-operators, small fleets, farmers, low-use truck operators, and those who invested in the installation of PM filters early. Some counties in Northern California and along the Central Coast are only required to have a PM filter and are instead exempt from meeting the 2010 model year engine standard.⁴⁰ Southern California, including San Diego County, is outside this Low Nitrogen Oxide (NOx) exemption area. Truckers based in the San Diego region, or based elsewhere and serving the San Diego region, still must comply with the CARB 2010 engine year regulation. One other exception (called the Low-Use Exemption) applies for trucks that operate less than 1,000 miles or less than 100 hours in California per year.⁴¹ Additionally, vehicles will need to be in compliance with the Truck and Bus regulation to be registered with the Department of Motor Vehicles beginning in 2020. If subject to other regulations, such as port drayage programs, then proof of compliance with the regulation will be accepted from these programs. Tampering with particulate systems results in heavy fines.

Tractor-Trailer Greenhouse Gas Regulation

The purpose of the Tractor-Trailer GHG Regulation is to reduce GHG emissions from heavy-duty trucks and 53-foot box-type semitrailers that transport freight on a highway within California. This regulation includes dry van and refrigerated van trailers and the heavy-duty tractors that pull them. In order to reduce emissions, vehicles subject to the regulation will be required to use low-rolling-resistance tires and meet SmartWay-certified aerodynamic equipment requirements. Owners of tractors subject to the regulation must either purchase new SmartWay-verified tractors or retrofit existing tractors with low-rolling-resistance tires. Owners of trailers must either purchase new

⁴⁰ "Compliance Requirement Summary Based on the Voided 2014 Amendments of the Truck and Bus Regulation," CARB, December 14, 2018, arb.ca.gov/msprog/onrdiesel/documents/fspre14.pdf.

⁴¹ "Truck and Bus Regulation Low-Use Vehicle Exemption," CARB, September 25, 2019, arb.ca.gov/msprog/onrdiesel/documents/flowuse.pdf.

SmartWay-certified trailers or retrofit existing trailers with SmartWay-verified aerodynamic technologies and low-rolling-resistance tires. This places an additional cost burden that affects small fleets and owner-operators increasing their investment in equipment to meet the regulation.⁴²

Transport Refrigeration Unit (Reefer) Airborne Toxic Control Measure Regulation

CARB staff proposed amendments to the transport refrigeration unit (TRU) Airborne Toxic Control Measure that CARB adopted on February 26, 2004, and that was last amended in 2010. The regulation was designed to reduce emissions of DPM from diesel-powered engines used to refrigerate perishable goods in insulated truck and trailer vans, rail cars, and domestic shipping containers. The regulation also applies to TRU generator sets (gensets), which provide onboard electric power to electrically driven refrigeration systems that are used in shipping containers and trailers. A variety of amendments and compliance measures have been enacted by CARB to try to improve overall compliance, including increasing inspections at border crossings. This has particular significance to the San Diego regional truckers, including those crossing the border, in terms of cost to retrofit or replace equipment to meet the regulation. The regulation does not apply to drayage tractors and trailers that operate within a 100-mile radius of a port or intermodal rail yard.⁴³ Therefore, this exemption does not assist crossborder drayage truckers destined for the Ports of Long Beach or Los Angeles.

Environment and Goods Movement

San Diego County has established itself as a key player in the distribution of regional, national, and international trade in the United States. As a result of San Diego's proximity to the Pacific Coast and the U.S.–Mexico border, the region is home to a robust freight transportation system that spans across various transportation modes, including truck, rail, pipeline, marine, and air cargo distribution networks. While the movement of goods within and through San Diego County plays an integral role as one of the drivers of the region's economy, the prosperity of the system generates environmental and quality-of-life impacts to surrounding communities and natural resources. SANDAG strives to be a national leader in efforts to mitigate climate change and air pollution and improve the quality of life in San Diego County.

Climate and Air Quality Impacts of Goods Movement

Mobile sources and fossil fuels are currently responsible for 80% of NO_x emissions, 50% of GHG emissions from fuel production, and more than 95% of DPM emissions in California.⁴⁴ The equipment used to move goods at both the large scale (e.g., trucks and trains) and the small scale (e.g., forklifts and onboard ship equipment) traditionally uses fuels such as diesel that negatively contribute to the climate and air quality. The use of these fuels leads to emissions such as CO₂, NO_x, sulfur oxides (SO_x), a variety of PM, and other air

⁴² "Tractor-Trailer Greenhouse Gas Regulation," CARB, arb.ca.gov/msprog/truckstop/trailers/trailers.htm.

⁴³ "Transport Refrigeration Unit (TRU or Reefer) Regulation," CARB, arb.ca.gov/msprog/truckstop/trus/trus.htm.

⁴⁴ "Advanced Clean Trucks Fact Sheet," CARB, August 20, 2021, arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-fact-sheet.

pollutants that pose a risk to public health and environmental safety. These fuel emissions pose a risk to communities situated along the path of travel for the freight network—particularly those communities located near our region’s freight gateways and corridors. It is anticipated that if no changes are made to current trends, environmental conditions will worsen in the San Diego region by 2050. Predicted impacts include hotter and drier climates, sea-level rise, increased and more dangerous wildfires, and public health crises.⁴⁵

To mitigate these issues, CARB established the Goods Movement Emission Reduction Program throughout various districts in the state of California. In 2020, CARB estimated that PM_{2.5} and NO_x levels within the San Diego County Air Pollution Control District (SDAPCD) have been reduced by 128,000 pounds and 4,522,300 pounds, respectively, since the implementation of this program in 2008.⁴⁶ While strides are being made to create positive change, a continuing challenge for the region is balancing the movement of needed and desired goods to support our economy and finding and deploying strategies and technologies to reduce negative environmental impacts.

Challenges and Considerations of the Environmental Impact of Each Mode *Truck*

Trucks account for the largest percentage of goods movement within the San Diego region. As a result, they are one of the leading causes of GHG emissions in the supply chain and produce air pollutants at a much higher rate than privately owned vehicles. One study showed that heavy-duty diesel trucks in the San Diego region emit an average of 19.7 tons of NO_x per day.⁴⁷ Trucks are also the mode of transportation that operates in closest proximity to residential neighborhoods due to their ability to use the expansive road network and handle last-mile deliveries, and they are the first- and last-mile connectors to the other modes outlined below. This results in more exposure to air pollution for communities situated near commercial districts. At the binational land POEs, emissions are a concern due to commercial vehicle idling caused by insufficient processing stations that result in long wait times. The SANDAG *Impacts of Border Delays at California–Baja California Land Ports of Entry* study states that in 2016, truck border delays at the San Diego–Tijuana land POEs resulted in an average of approximately 182 metric tons of CO₂ emitted per day.⁴⁸

Rail

Rail freight operations make up a small percentage of total regional freight movement, but they are a crucial alternative for reducing interregional freight-related road congestion. In 2012, rail freight operations made up less than 2% of all goods movement operations in the San Diego region. These freight lines move more than 30,000 carloads annually and are

⁴⁵ “San Diego, 2050 Is Calling. How Will We Answer?” catcher.sandiego.edu/items/usd/2050.pdf.

⁴⁶ “Proposition 1B: Goods Movement.”

⁴⁷ “Draft Community Emissions Reduction Plan,” SDAPCD, 2020, sandiegocounty.gov/content/dam/sdc/apcd/PDF/AB_617/Portside%20Environmental%20Justice%20DRAFT%20CERP%20Oct%202020.pdf.

⁴⁸ “Impacts of Border Delays.”

expected to exceed 60,000 carloads by 2030.⁴⁹ The rail corridors in the region operate both passenger and freight service on the same infrastructure. For future service improvements and freight planning recommendations, it is important to consider improvements that benefit both Class I and short line rail lines. Strategies such as electrification could reduce GHG emissions on both systems, creating a wider benefit for the region. Rail also crosses into Mexico near the San Ysidro POE, meaning future strategies must comply with the recently enacted USMCA trade agreement where applicable.

Pipeline

There are two pipelines in the San Diego region that are used for gasoline and aviation fuel. The Kinder Morgan Santa Fe Pacific Pipeline, L.P. extends from Los Angeles to San Diego, as well as into Imperial County, while the WestPac Pipelines, LLL spans from the TAMT at the Port of San Diego to the San Diego International Airport. These pipelines run across the region in all directions. Future planning and development should be careful to consider where future developments are being placed to ensure that the pipeline systems are kept intact to reduce the chance of regional exposure to harmful pollutants.

Marine

The types of vessels used for marine goods movement include commercial harbor crafts and ocean-going vessels. Commercial harbor crafts are one of the major contributors to air pollution in the communities adjacent to the Port of San Diego. These vessels produce 47% of NOx emissions and 53% of DPM emissions in these communities. At a countywide scale, one study showed that ships emit an average of 17.4 tons of NOx per day while commercial harbor crafts emit an average of 4.9 tons of NOx per day.⁵⁰

In 2014, the Port of San Diego implemented a new shore-power system at the TAMT.⁵¹ The shore-power system allows for refrigerated cargo ships to use electrical power from San Diego Gas & Electric while at berth instead of relying on diesel fuel engines. The use of this shore-power system will improve air quality and reduce GHG emissions around the terminal.

Air Cargo

Air cargo operations in the region operate predominantly out of the San Diego International Airport. Cargo facilities are used by a small number of operators. Due to the limited space available for air cargo operations at the airport, processing activities are conducted off site.⁵² This necessitates the movement of goods to and from the airport via truck, increasing the amount of GHG emissions resulting from air cargo. One study showed that aircrafts in the San Diego region emit an average of 7.9 tons of NOx per day.⁵³

⁴⁹ "2016 Freight Gateway Study."

⁵⁰ "Community Emissions Reduction Plan."

⁵¹ "Port of San Diego CA plugs into shore power system," Refrigerated Transporter, February 28, 2014, refrigeratedtransporter.com/going-green/emissions/article/21718732/port-of-san-diego-ca-plugs-into-shore-power-system.

⁵² "2016 Freight Gateway Study."

⁵³ "2020 Plan for Attaining the National Ambient Air Quality Standards for Ozone in San Diego County," SDAPCD, October 2020, [sandiegocounty.gov/content/dam/sdc/apcd/PDF/Air%20Quality%20Planning/Att%20A%20\(Attainment%20Plan\)_ws.pdf](http://sandiegocounty.gov/content/dam/sdc/apcd/PDF/Air%20Quality%20Planning/Att%20A%20(Attainment%20Plan)_ws.pdf).

Combined with truck movements through the adjacent commercial and industrial zones, most neighborhoods surrounding the airport have above-average pollution burdens.⁵⁴

Affected Communities

The environmental impacts of goods movement have a history of disproportionately affecting disadvantaged and low-income communities. These communities tend to have high exposure to pollutants, adverse environmental conditions caused by pollution, and/or socioeconomic factors that increase pollution vulnerability. The California Environmental Protection Agency's California Communities Environmental Health Screening Tool Version 3.0 (CalEnviroScreen 3.0) maps these pollution exposure and sensitivity indicators to show the severity by geography relative to the State of California. Higher scores, reported by statewide percentile, indicate more significant impact and disadvantage.

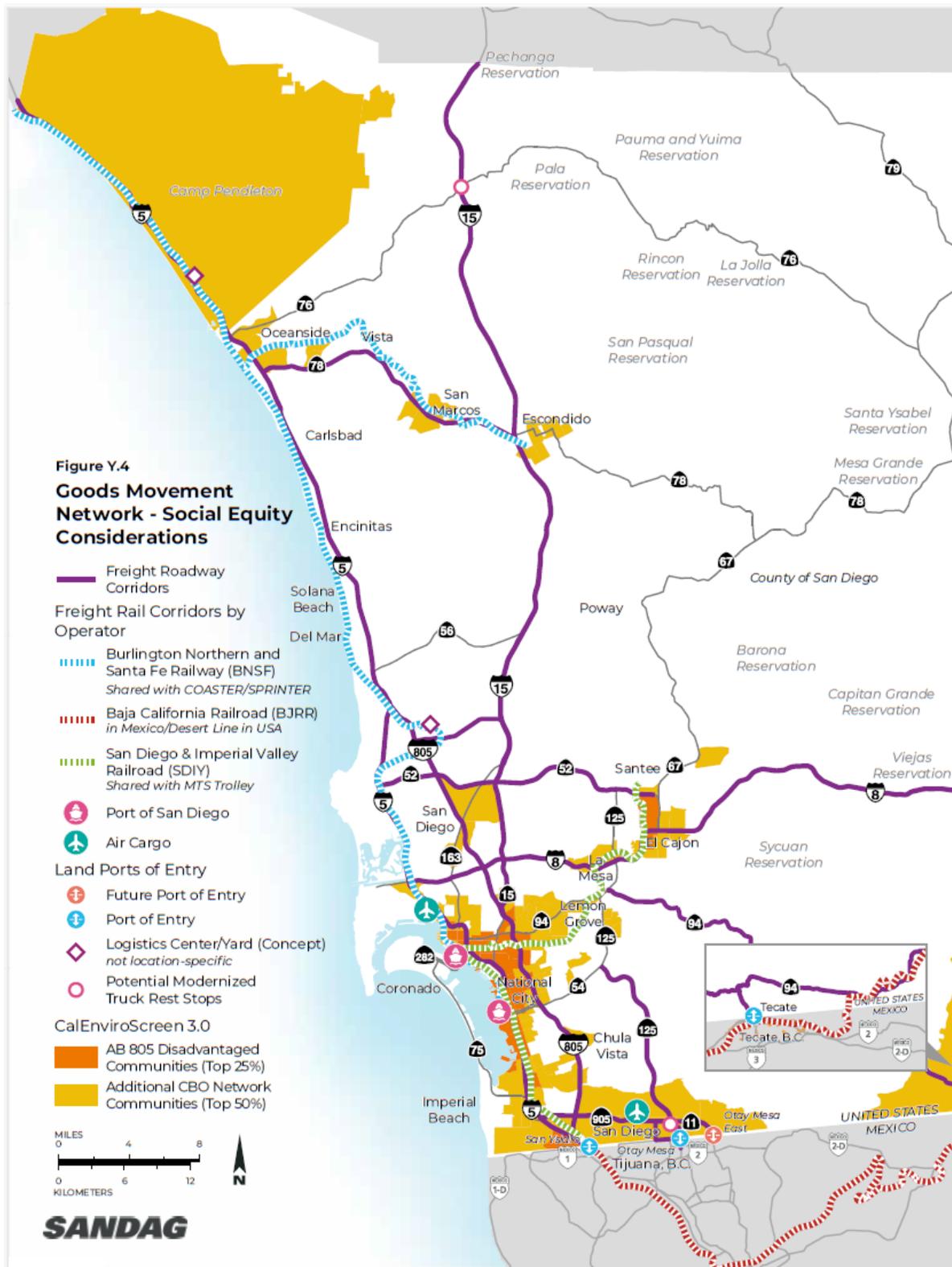
The CalEnviroScreen 3.0 map identifies the following areas in the San Diego region as disadvantaged communities: the neighborhoods located in proximity to the Port of San Diego, the communities located near the binational land POEs, communities in El Cajon situated near Gillespie Field Airport, and communities in Kearny Mesa near Montgomery Field.⁵⁵ Disadvantaged communities are defined as the top 25% scoring areas from CalEnviroScreen along with other areas with high amounts of pollution and low populations. The San Diego communities situated near these important commercial industrial zones rank above the 65th percentile compared to other northern and inland San Diego communities, which typically fall below the 40th percentile (June 2018). Residents with increased exposure to pollution could be at much higher risk for respiratory and cardiac health problems, leading to a strain on the public health system.⁵⁶ Figure Y.4 shows the disadvantaged communities in the San Diego region and proximity to freight infrastructure.

⁵⁴ "CalEnviroScreen," OEHHA, oehha.ca.gov/calenviroscreen.

⁵⁵ "CalEnviroScreen."

⁵⁶ "San Diego's Changing Climate: A Regional Wake-Up Call," The San Diego Foundation, sdfoundation.org/wp-content/uploads/2015/10/2009-Focus2050glossySDF-ClimateReport.pdf.

Figure Y.4: Goods Movement Network – Social Equity Considerations



The freight-impacted Portside, Border, and Commercial/Industrial Zone communities mentioned previously have substantially higher scores and pollution burdens in particular, as shown in Figure Y.5.

Figure Y.5: Freight-Impacted Communities in the San Diego Region



In 2018, CARB selected the AB 617 Portside Environmental Justice Community (Portside Community) as a monitoring community. In 2019, CARB selected this community to transition and develop a community emissions reduction plan (CERP) in addition to continued implementation of the 2018 Community Monitoring Plan. The CERP is a result of the AB 617 Community Air Protection Program (CAPP) and outlines detailed information and strategies that will reduce emissions and exposure to air pollution in CAPP communities statewide.⁵⁷ The Portside Community includes the

⁵⁷ "Community Emissions Reduction Plan."

neighborhoods of Barrio Logan, Logan Heights, Sherman Heights, and West National City. CARB hosted multiple workshops with the AB 617 Steering Committee, various subcommittees, and community members to gather data on what existing conditions were like in the area, what the major contributing factors were, and what types of plausible strategies could be used to alleviate health and environmental impacts.

As environmental policies and strategies are put into place to reduce GHG emissions, operators in the goods movement industry will also be affected. A large portion of truck operators in the freight industry are independent contractors who own their own vehicles and work for larger corporations. As policies start to implement regulations that discourage the continued use of heavy-duty diesel trucks and enforce the use of zero-emission vehicles, independent truck owners will be left with outdated vehicles they can no longer use, leading to potential unemployment for these operators. For example, as of January 2020, CARB's Truck and Bus Regulation only allows for trucks and buses with 2010 or newer model year engines to be registered by the California Department of Motor Vehicles.⁵⁸ To help alleviate the cost burdens that may be placed on small business fleet owners, CARB has also implemented the Truck Loan Assistance Program to help fleet owners secure financing for fleet upgrades.⁵⁹ On a local level, SDAPCD established the Voucher Incentive Program to replace older heavy-duty diesel vehicles (2009 or older model year diesel engines) with replacement heavy-duty vehicles (2013 or newer model year diesel engines).⁶⁰

Environmental Stewardship within Goods Movement

As the metropolitan planning organization and regional transportation planning agency for the San Diego region, SANDAG is charged with implementing strategic plans throughout San Diego County to bring about positive change for its residents. SANDAG is dedicated to creating an expansive, comprehensive transportation ecosystem in the San Diego region that will protect the environment and promote healthy communities. Data-driven strategies and exploration of innovative technologies are being used to determine what policies and strategies would be most appropriate for the region. SANDAG is on track to meet its future GHG-reduction goals and is prioritizing its goal of reducing per capita GHG emissions from passenger vehicles and light trucks by 19% below 2005 levels by 2035. With regard to goods movement, strategies such as new infrastructure, operational improvements, and transitioning fleets to zero/near-zero-emission technologies are being implemented in a variety of SANDAG and statewide plans, including the 2021 Regional Plan, 2021 San Diego and Imperial Counties Freight Gateway Study Update (included as Part 2 of this appendix), California Sustainable Freight Action Plan, California Freight Mobility Plan 2020, and the 2021 California–Baja California Border Master Plan Update.

⁵⁸ "Truck and Bus Regulation," CARB, arb.ca.gov/our-work/programs/truck-and-bus-regulation/about.

⁵⁹ "Truck Loan Assistance Program," CARB, arb.ca.gov/our-work/programs/truck-loan-assistance-program.

⁶⁰ "Voucher Incentive Program (VIP)," SDAPCD, July 21, 2021, sdapcd.org/content/sdc/apcd/en/grants-and-incentives/voucher-incentive-program--vip-.html.

In addition, the San Diego region has committed to upholding state and national goals and legislative policies in our region's own vulnerability assessments and Climate Action Plans (CAPs). The vulnerability assessments analyzed how various natural hazards may impact the region's transportation network, which includes our critical freight gateways and corridors. Specific strategies shared by the region's CAPs include increasing access to clean and renewable energy, considering climate change factors when designing transportation facilities, and increasing multimodal mode share.

Effects of E-Commerce and Same-Day Shipping Practices on the Environment

In recent years, the United States has seen a rise in the prevalence of e-commerce in the market economy. In 2020, e-commerce grew 32.4% nationally, reaching the highest annual growth of U.S. e-commerce in the past two decades.⁶¹ As a result of online shopping's growing popularity, retailers have begun to introduce new standard practices, such as same-day shipping, that combine the convenience of online shopping with the immediacy of brick-and-mortar shopping. While these practices offer convenience for shoppers, this expansion has a significant impact on the environment.

To meet the demand for same-day shipping practices, businesses are required to expand their business operations. This includes the addition of new processing facilities, more long-haul shipping to pre-position materials from major warehouses to local warehouses, less consolidation of products being shipped to similar locations, and more frequent trips to deliver products to their final destinations. These practices produce more emissions, which negatively impact communities. Furthermore, the final trip to get a product to the consumer's doorstep, or the "last mile," was typically completed by shoppers in privately owned vehicles. Increases in online orders combined with promises of same-day shipping lead to less consolidation of packages going to similar locations and, therefore, more trips. Those trips that were previously made by privately owned vehicles are being completed by trucks that are much less fuel-efficient.

Major retailers have begun to promote same-day shipping practices for their products. As new distribution facilities prepare to open in our region shortly, it will be important to keep in mind the challenges that come with creating sustainable shipping practices in an age that is dominated by online shopping.⁶²

The movement of goods has to be planned and managed so that operations are sustainable. There is a need to balance mobility and speed, the capacity for growth, economic competitiveness goals, and the importance of clean air and healthy communities. SANDAG is implementing strategies in its regional planning efforts that will consider emerging e-commerce and land use trends that may impact delivery methods and freight emissions. For example, the region's Mobility Hubs will incorporate amenities such as parcel delivery lockers to reduce car trips for those using Transit Leap services.

⁶¹ "US ecommerce grows 32.4% in 2020," Digital Commerce 360, January 29, 2021, digitalcommerce360.com/article/us-ecommerce-sales.

⁶² "Amazon facility in Otay Mesa eyes summer completion," San Diego Union Tribune, February 12, 2021, sandiegouniontribune.com/business/story/2021-02-12/amazon-facility-in-otay-mesa-eyes-summer-completion.

Innovative modes, such as zero-emission autonomous vehicles, e-cargo bikes, or unmanned aircraft systems (drones), also are assumed to handle a portion of last-mile deliveries through Flexible Fleets. Although these modes will be able to handle some of the urban and suburban deliveries in our region, drones are unique in that they can potentially assist with critical deliveries to our rural communities.⁶³

Innovative delivery methods also may influence our region's land use authorities to allow two traditionally incompatible land uses—warehousing and residential—to be in closer proximity, thereby reducing heavy-duty truck vehicle miles traveled. Since e-cargo bikes and other innovative freight modes will require shorter delivery distances, logistics companies have started to develop urban warehouses, also called logistics hotels, in the hearts of Paris and New York City.⁶⁴ Although urban warehouses may still require heavy-duty trucks delivering packages to the warehouses themselves, last-mile deliveries may be handled by these innovative and sustainable modes that reduce GHG emissions.⁶⁵ These urban warehouses also may be sited at or near regional Mobility Hubs to reduce some last-mile delivery distances.

Environmental Policies and Legislation

CARB has outlined several environmental programs and regulations that will have an effect on the freight industry in the San Diego region. These programs cover truck, marine, and rail operations. In September 2020, CARB provided funding to replace older trucks with outdated emission control features for newer, cleaner models in the San Diego region. As a result, SDAPCD launched the Clean Air for All Grant Campaign, allowing businesses, nonprofits, and government agencies to apply for financial support to swap their polluting heavy machinery and equipment for low-carbon-emission alternatives.⁶⁶ CARB's *Proposition 1B: Goods Movement Emission Reduction Program December 2020 Semi-Annual Status Report* shows that similar programs in previous years have led to a reduction of up to 5,000 pounds of PM_{2.5} and 764,000 pounds of NOx.⁶⁷

⁶³ "Drone Delivery Services Provide Much-needed Supplies to Rural Communities," PR Newswire, June 5, 2020, prnewswire.com/news-releases/drone-delivery-services-provide-much-needed-supplies-to-rural-communities-301071196.html.

⁶⁴ "Urban fulfillment centers: Helping to deliver on the expectation of same-day delivery," Deloitte, deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-urban-fulfillment-centers.pdf.

⁶⁵ "The electric bike that could change delivery as we know it," University of Washington Supply Chain Transportation & Logistics Center, December 7, 2020, depts.washington.edu/sctlctr/news-events/in-the-news/electric-bike-could-change-delivery-we-know-it.

⁶⁶ "Clean Air For All: Moyer/FARMER/CAPP Grants," SDAPCD, August 19, 2021, sdapcd.org/content/sdc/apcd/en/grants-and-incentives/carl-moyer-program.html.

⁶⁷ "Proposition 1B: Goods Movement."

Table Y.2: Emissions Reductions by CARB Program (SDAPCD)

Emissions Reductions by CARB Program (SDAPCD)			
Funding Year/ Category	Project Description/ Grant Number	Emission Reductions (Pounds)	
		PM _{2.5}	NO _x
Year 6: Other Trucks	Replace old dirty trucks with newer clean models	0	208,300
Year 5: Other Trucks	Replace old dirty trucks with newer clean models	0	764,000
Year 4: Other Trucks	Replace old dirty trucks with newer clean models	5,000	507,000

Source: CARB Proposition 1B: Goods Movement Emission Reduction Program December 2020 Semi-Annual Status Report

Additionally, CARB is planning for a network of zero/near-zero-emission transportation and freight technology systems by the year 2050. All trucks and buses will be required to operate using low-emission technologies that will reduce air pollution, with the Advanced Clean Trucks Regulation accelerating the first wave of zero-emission trucks.⁴⁴ Established in 2017, the Innovative Technology Regulation (ITR) also provides a more flexible short-term certification pathway for innovative truck and bus technologies. To comply with these future regulations on a reasonable schedule, vehicles must follow this advancement schedule:

- Installation of a heavy-duty spark-ignition engine (through the 2021 model year [MY]) or a heavy-duty compression-ignition engine (through the 2024 MY) to meet California’s optional low-NO_x emission standards
- Installation of a heavy-duty engine in a hybrid heavy-duty vehicle (hybrid engine) through the 2021 or 2024 MY, dependent upon whether or not the vehicle is capable of at least 35 miles all-electric range
- Installation of a heavy-duty engine that meets the proposed ITR’s optional low-CO₂ emission standards, reflective of a 15% CO₂ reduction relative to a 2017 baseline engine, through the 2027 MY

With regard to marine operations, the Ocean-Going Vessel Fuel Regulation was established in 2009 and requires the use of marine distillate grade fuel (marine gas oil or marine diesel oil) with a maximum sulfur level of 0.1% while operating auxiliary diesel and diesel-electric engines, main propulsion diesel engines, and auxiliary boilers on ocean-going vessels within Regulated California Waters (all waters within 24 nautical

miles of the California baseline).⁶⁸ As of January 1, 2020, the limit for sulfur in fuel oil used on board vessels operating outside the International Maritime Organization’s designated emission control areas is 0.5% m/m (mass by mass).

In terms of rail, CARB has developed and implemented measures aimed at reducing locomotive and railyard emissions in California.⁶⁹ These measures are focused on limiting idling of combustion-powered vehicles and mobile equipment and reducing emissions resulting from stationary locomotive operations. The implementation and impacts of these measures and regulations are anticipated to begin in 2023.

Goods Movement Projects and Studies

Accomplishments and Projects/Plans Underway

SANDAG, along with various jurisdictions within San Diego County, adjacent regions, and state and federal agencies are planning or have undertaken various studies and projects that will contribute to or benefit from one another to ensure that goods movement efforts and endeavors are well coordinated within the region. These studies and projects have an opportunity to be advantageous to economies of scale and share data and information when appropriate.

2021 San Diego and Imperial Counties Freight Gateway Study Update (Study):

The Study, which is included as Part 2 of this appendix, refreshes the work of the 2016 Freight Gateway Study Update by assessing the current and future growth potential of the region’s freight modes, including their potential to serve as international intermodal trade gateways and the impacts of recent freight trends. Since it is initiated under evolving circumstances related to the impacts of COVID-19 on the transportation system, the Study provides a refresh to the 2016 Freight Gateway Study Update by providing an up-to-date holistic analysis of freight traffic in the Gateway Region and how that freight traffic should be managed from a total supply chain perspective. In addition, the Study also provides new insights into emerging freight trends such as converting to zero/near-zero-emission freight vehicles, e-commerce impacts, and increases in first/last-mile deliveries. The Study’s two main objectives are:

- Develop a freight forecast to 2050 for San Diego County and Imperial County that addresses all factors influencing intermodal and crossborder freight traffic and trends in goods movement for the California–Baja California border region, the Port of San Diego, the region’s airports, the region’s railways, and their area of influence broadly defined as northern Baja California and Southern California (gateway forecast)

⁶⁸ “California Air Resources Board Marine Notice 2020-1: Advisory to Owners or Operators of Ocean-Going Vessels Visiting California Ports,” CARB, January 2020, arb.ca.gov/sites/default/files/2020-01/Marine%20Notice%202020-1_final_rev_ADA.pdf.

⁶⁹ “Evaluation and Potential Development of Regulations to Reduce Emissions from Locomotives,” CARB, March 2018, arb.ca.gov/resources/documents/evaluation-and-potential-development-regulations-reduce-emissions-locomotives.

- In addition to the international gateway forecast, develop a freight forecast to 2050 for three specific urban areas of the Gateway Region that addresses emerging freight trends, such as the transition to zero/near-zero-emission freight vehicles, first/last-mile deliveries, and e-commerce

Comprehensive Multimodal Corridor Plans (CMCPs): CMCPs are data-driven plans that offer solutions to reduce congestion, support climate action initiatives, generate transportation choices, and increase access for residents, commuters, visitors, and goods movement. A CMCP evaluates all travel modes and transportation facilities in a defined corridor—highways and freeways, parallel and connecting roadways, transit options (local bus, *Rapid* bus, commuter rail, light rail, intercity rail, etc.), pathways, and bikeways. CMCPs are required in order to apply for certain state and federal funds, which can be leveraged to support regional transportation projects. CMCPs are designed to reduce congestion in highly traveled and highly congested corridors through performance enhancements that balance transportation improvements with community impacts. SANDAG and Caltrans are currently developing CMCPs in coordination with agency partners and local city governments. Per the September 27, 2019, decision by the SANDAG Board of Directors, the following five plans are being created:

- Central Mobility Hub and Connections
- Coast, Canyons, and Trails – SR 52
- North County – SPRINTER/Palomar Airport Road/SR 78/SR 76
- San Vicente – SR 67
- South Bay to Sorrento – Purple Line/I-805/Blue Line/I-5 South

An additional seven corridors will be studied in future CMCPs within the next five years to inform the next regional plan.

2021 California–Baja California Border Master Plan (BMP) Update: The California–Baja California BMP helps resolve a number of challenges to border planning and brings a number of benefits. Challenges that it helps resolve include inconsistencies in POE and transportation project priorities; limited opportunities to improve the tools and data that contribute to more informed decision making; a desire to balance service, technological advancements, and equity; community, economic, and environmental impacts related to border crossing operations; congestion and delays at border crossings; and coordination across binational stakeholders.

In addition to resolving challenges, the BMP also provides value-add benefits in terms of continuity in decision-making; harmonization of binational priorities; added value for seeking public funding for project implementation; increased alignment with GHG emissions–reductions and vehicle idling efforts; greater emphasis on binational multimodal needs and efforts; increased awareness of needs for future truck electrification; the establishment of sound, data-driven, and systematic planning processes; and the shared benefits of binational information sharing that collectively help

to move border-associated projects forward in a collaborative, informed manner that is considerate of surrounding communities and emerging technologies. The 2021 BMP incorporates the aforementioned concerns and benefits and updates previous recommendations to incorporate multimodal considerations, leverage technology for efficient border crossings, and lay out specific steps for increased collaboration and coordination across the border.

The California–Baja California BMP itself was first envisioned by the U.S.–Mexico Joint Working Committee, led by the U.S. Federal Highway Administration and Mexico’s Secretariat of Communications and Transportation, as a pilot project to improve the binational coordination on planning and delivery of land POEs and transportation projects serving those POEs across the entire U.S.–Mexico border. The pilot study was completed in 2008 to include the first binational prioritization process for border planning that included a methodology for ranking POE and related infrastructure projects that was accepted binationally. It was updated in 2014. The 2021 BMP was developed by Caltrans, in partnership with the State of Baja California Secretariat of Infrastructure, Urban Development, and Territorial Reorganization; consultant assistance from the SANDAG Service Bureau; subconsultant assistance from the IBI Group Team; and technical support from HNTB Corporation.

California Sustainable Freight Action Plan: Advanced Technology Corridors at Border Ports of Entry: Regional agencies in San Diego and Imperial counties also have been some of the first to integrate sustainability efforts into their freight strategies and projects. SANDAG, in partnership with Caltrans District 11, Imperial County Transportation Commission, the Southern California Association of Governments, and other stakeholders, is making progress in implementing the initial phases of their *California Sustainable Freight Action Plan: Advanced Technology Corridors at Border Ports of Entry* pilot project.⁷⁰ These initial phases focus on installing equipment to measure southbound border wait times and displaying this information through an advanced traveler information system to better manage commercial and passenger vehicle traffic at the border, thereby implementing elements of Next OS. As part of this project, SANDAG and Caltrans District 11 will be installing air monitoring equipment to track progress in improving air quality in border communities.

California Freight Mobility Plan 2020 (CFMP 2020): As the state’s Freight Plan, Caltrans developed the CFMP 2020 to provide a long-term vision for California’s freight future. The CFMP is a comprehensive plan that governs the immediate and long-range planning activities and capital investments by the state with respect to freight movement. This multimodal freight transportation system facilitates the reliable and efficient movement of goods while ensuring a prosperous economy, social equity, and human and environmental health. SANDAG collaborated with Caltrans District 11 and its regional and interregional partners on developing the CFMP 2020 San Diego and Imperial counties freight investment strategy, which identifies regional priority projects and policies.

⁷⁰ “Sustainable Freight Action Plan Pilot Project Work Plan: Advanced Technology Corridors at Border Ports of Entry,” July 31, 2017, sandag.org/uploads/publicationid/publicationid_4723_28351.pdf.

Impacts of Border Delays at California–Baja California Land Ports of Entry: In 2012, SANDAG and the Imperial County Transportation Commission completed the *Impacts of Border Delays at California–Baja California Land Ports of Entry* study, which details how border delays from passenger and commercial vehicles harm the economy and environment on both sides of the border.⁷¹ The economic and environmental impacts from border delays in 2016 include:

- \$3.4 billion in lost economic output, which equates to about as much economic impact as 23 Comic-Con conventions⁷²
- More than 88,000 jobs lost, which is approximately as many jobs as 15 Fashion Valley malls⁷³
- An average of 457 metric tons of CO₂ each day, which is equivalent to making about 200 round trips between Downtown San Diego and New York City in an average car⁷⁴

The study shows that without additional enhancements to the region’s POEs, the estimated economic loss will continue to grow to more than \$5 billion and more than 97,000 jobs lost by 2025. According to the report, these losses could be fully mitigated with additional enhancements, including the opening of the SR 11/Otay Mesa East–Mesa de Otay II POE.

SR 11/Otay Mesa East POE: To address the economic and environmental impacts from border delays, SANDAG and Caltrans District 11 are collaborating with state and federal partners in the U.S. and Mexican governments to develop the SR 11/Otay Mesa East POE, a 21st-century border crossing for the San Diego–Baja California region. The project provides a unique opportunity to develop a new multimodal land POE in close coordination with Mexico’s future Mesa de Otay II POE. Using variable tolls to manage traffic demand for commercial and passenger vehicles, the POE will provide a new relief valve, resulting in decreased congestion and wait times at the other San Diego land POEs. The project partners are constructing the final segments of SR 11 and plan to open the Otay Mesa East POE by late 2024.

Near-Zero/Zero-Emission Truck and Freight Signal Priority Pilot: The San Diego Port Tenants Association, through a California Energy Commission grant, recently transitioned some of their fleet to near-zero/zero-emission vehicles and is currently implementing a freight signal prioritization (FSP) pilot project along Harbor Drive.⁷⁵ The FSP pilot will operate for a year, with results anticipated to be released in winter 2021.

⁷¹ “Impacts of Border Delays.”

⁷² Estimated regional economic impact of Comic-Con convention was \$149 million in 2019. (CIC Research Inc.).

⁷³ Jobs comparison is SANDAG calculation with 2018 data from the California Employment Development Department.

⁷⁴ SANDAG calculation with data from the U.S. Environmental Protection Agency – Greenhouse Gas Equivalencies Calculator.

⁷⁵ “Cleaning the Air: San Diego Port Tenants Association Zero-Emission Freight Project,” San Diego Port Tenants Association YouTube Channel, November 16, 2020, [youtube.com/watch?v=RCOHGs86YHs](https://www.youtube.com/watch?v=RCOHGs86YHs).

Harbor Drive 2.0 Project: Through the Harbor Drive 2.0 project, the Port of San Diego, SANDAG, and Caltrans District 11 are hoping to expand this FSP project into a larger intelligent transportation system project along Harbor Drive that will provide greater efficiency for trucks and the other multimodal users of this corridor. These partners are currently working with the AB 617 Portside Steering Committee to identify strategies to improve air quality in the surrounding communities.

LOSSAN Rail Corridor: SANDAG has also partnered with its regional rail partners, including North County Transit District, MTS, and BNSF Railway, to improve the San Diego coastal section of the LOSSAN Rail Corridor with the goal of increasing capacity and ensuring the reliability and safety of intercity, commuter, and freight rail services. The corridor is the only viable freight rail link between San Diego and the rest of the nation. BNSF Railway operates freight service on the San Diego segment of the corridor, with the Port of San Diego as a major customer. During the next 20 years, SANDAG plans to construct nearly \$1 billion in improvements in the San Diego segment, including a primary effort to double-track the corridor from Orange County to Downtown San Diego. To date, two-thirds of the San Diego segment has been double-tracked. Other infrastructure improvements include bridge and track replacements, new platforms, pedestrian undercrossings, and other safety and operational enhancements. Recent bluff collapses along the Del Mar Bluffs have expedited the need to study the realignment of the tracks off the bluffs.⁷⁶ SANDAG and its regional rail partners are currently studying potential alternatives for realigning LOSSAN segments near the Del Mar Bluffs.

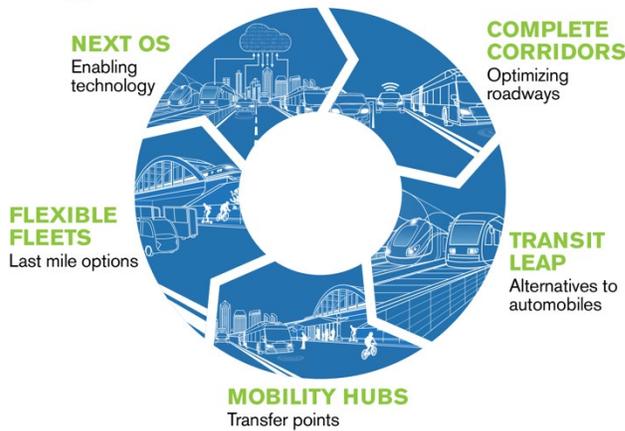
⁷⁶ "Bluff repairs could restrict beach access," San Diego Union Tribune, March 13, 2021, [sandiegouniontribune.com/communities/north-county/story/2021-03-13/bluff-repairs-could-restrict-beach-access](https://www.sandiegouniontribune.com/communities/north-county/story/2021-03-13/bluff-repairs-could-restrict-beach-access).

Future Projects and Strategies

Overarching and Cross-Cutting Considerations for Goods Movement

Figure Y.6: SANDAG 5 Big Moves

5 Big Moves



Goods movement is a component of all of the 5 Big Moves and thus has overarching and cross-cutting considerations across the 5 Big Moves.

There are hubs for freight mobility and freight activity centers in various parts of the county that are the origin and terminus of freight throughout the day (Complete Corridors, Mobility Hubs). Nearly all rail tracks are shared by freight rail and passenger trains (Transit Leap). Staging, parking, truck services, and curb and sidewalk management will

continue to be required for freight and package pick-up and delivery (Mobility Hubs, Flexible Fleets). Future support for the movement of freight within and through the county will require supportive technologies to optimize movements, create efficiencies, and improve safety (Next OS).

The following sections consider the types of goods movement programs, projects, strategies, and policies that fall under each of the 5 Big Moves.

Complete Corridors

Corridors of all typologies throughout the county are used by freight and are not bounded by length of haul, size of vehicle, or type of freight. Some exceptions include routes for hazardous, oversize, overweight, or truck route restricted segments—some described in the Surface Transportation Assistance Act designated truck routes (for legal-sized and legal weight trucks) for the San Diego County and Imperial County region (coinciding with Caltrans District 11).⁷⁷ Beyond these state- and federally designated routes, it is important to note that truck routes (formal and informal) span all typologies in order to serve many types of origins and destinations in San Diego County. Freight origins and destinations include a variety of types of facilities—from large warehouse complexes, intermodal yards, and POEs (land, air, sea) to small retail locations, restaurants, and small businesses in the urban core, most without formal receiving facilities. Residential package delivery has grown most substantially with the acceleration of e-commerce. Commercial vehicles serving these origins and destinations may be any size—large 18 wheelers, delivery vans, small private delivery vehicles, e-bikes, and now drones. In addition, freight rail corridors are shared in the county with passenger rail and are subject to hours of operation in order to accommodate daytime passenger rail needs.

⁷⁷ "CA Truck Network Maps," Caltrans, dot.ca.gov/programs/traffic-operations/legal-truck-access/truck-network-map.

All types of freight conveyances have the need for access to intermodal facilities to transfer freight from one type of conveyance to another, consolidate freight into a larger shipment, or break down shipments for further distribution via smaller vehicles. Access routes are often a source of delay for goods moving to and from freeways toward their destinations or from their origins, hence the importance of considering freight movement corridors in their entirety, from origin to destination, regardless of roadway type.

Another goods movement consideration for Complete Corridors includes designated or dedicated lanes for trucks along highway segments where speed disparities exist with passenger vehicle traffic. In cases such as on-ramps or off-ramps, where trucks need time to reach safe traveling speeds, longer designated truck merge lanes can help. Climbing and descending lanes are another example of an opportunity to keep trucks safely moving up or down steep grades and allow surrounding passenger vehicles to continue in other lanes unimpeded by the slower trucks. Truck bypass lanes would be beneficial for higher truck volume bottlenecks such as the SR 905/I-805 interchange. Dynamic lane assignments on highways and arterials provide the opportunity to accommodate trucks during seasonal, event-driven, or daily peak truck traffic times, allowing trucks to travel without mixing—or with reduced mixing—with general-purpose traffic. Dynamic lane assignments with variable speed limits by lane also help reduce speed differentials and stop-and-go traffic conditions, thus reducing shifting and resulting in fewer emissions and better fuel economy. Combined with intelligent transportation systems (ITS) technologies such as lane-keeping and in-vehicle notifications, these strategies can enhance truckers' communications with regulatory agencies and improve truck mobility and safety.

Lastly, managed lane projects found within Complete Corridors will benefit trucks. Diversion of passenger vehicles off the general-purpose lanes onto managed lanes, particularly during peak traffic periods, helps reduce overall congestion and provides an alternative lane for higher-speed vehicles, thereby reducing speed disparities between cars and trucks—especially on steep grades. In a SANDAG study, *The Analysis of Freeway Operational Strategies Related to the Use of Managed Lanes by Trucks*, the question of how certain light- and medium-duty trucks might use high-occupancy vehicle (HOV)/ high-occupancy toll managed lanes revealed mixed opinions from trucking industry stakeholders. Primary concerns included the method of access to the HOV lanes, mixing of trucks and passenger vehicles, the size of the trucks acceptable for travel in the lanes, the number of lanes that would be available on the facility, and the potential cost.⁷⁸ The study also identified the potential truck management strategy application locations shown in the map in Figure Y.7.

⁷⁸ SANDAG, *Analysis of Freeway Operational Strategies Related to the Use of Managed Lanes by Trucks*, 2013.

Figure Y.7: Trucking Freeway Corridors: Potential Truck Management Strategy Application Locations



Transit Leap

Some goods movement considerations for Transit Leap include:

- Concepts for rail that should consider track configurations to support freight movement
- Small freight and parcel delivery that can coincide with transit operations

There are opportunities to align infrastructure for transit services to also serve truck movements, rail cargo, maritime shipping, and new modes/infrastructure that support goods movement (e.g., new grade-separated/tunneled infrastructure; operational improvements to highways, roads, and rail; and new modes). Transit and small parcel delivery have traditionally coincided through carriers such as Greyhound's parcel delivery. This model could be considered as an opportunity to use transit to also increase the region's goods movement capacity.

The California Sustainable Freight Action Plan includes an action for short line rail improvements. In the San Diego region, the current MTS Trolley Blue Line from downtown to the U.S.–Mexico border is the same rail line that accommodates short-haul rail (SDIV is the operator). Therefore, any transit improvements should be complementary to freight needs as well. Rail improvements on the LOSSAN Rail Corridor are key to continued, essential freight service in the county. Similar to the Blue Line serving a short-haul rail carrier, the LOSSAN Rail Corridor also accommodates off-peak rail services for the only Class I rail service (BNSF is the operator); therefore, any rail corridor investments or replacements must take freight rail needs into account.

Mobility Hubs

Beyond passenger-focused hubs, Mobility Hubs for freight are also a consideration. There are key freight activity centers such as the Port of San Diego marine terminals at National City and Tenth Avenue, the National Distribution Center, U.S.–Mexico border, San Diego International Airport, and numerous small airports, along with various manufacturing facilities, warehouses, and commercial and industrial zones scattered throughout the region. Opportunities and needs exist to enhance, create, or collocate freight Mobility Hubs within some freight facilities, and in some cases, within transit facilities or at tribal casino facilities to accommodate rural deliveries. The types of opportunities include a variety of modes and pre-existing, naturally occurring freight activity hubs that have grown around the port, airports, border, and other commercial and industrial zones.

Air cargo support and access to air cargo facilities play a large role in the commitment many retailers have made to overnight and same-day deliveries. Airport-to-airport mobility is important to provide hand-offs between larger cargo jets and smaller airports that have small cargo shuttle services to distribute or move cargo to or from other locations, including Mexico.

Border Mobility Hubs represent another opportunity to ensure that trucks and small package carriers are properly accommodated with parking, queueing, separate spaces for vans and larger trucks, or other types of hub accommodations (e.g., accommodations similar to those provided by Amazon hubs).

Within the Mobility Hubs that accommodate people movement, there are also opportunities to accommodate staging, parking, services, and curb management for small package delivery (including parcel lockers), thereby reducing the number of trips by package-delivery vehicles into neighborhoods. As pedestrians and package-delivery personnel compete for space in dense urban areas, curb management is an important part of this strategy.

San Diego's cruise ship terminal must provide a mix of tourist amenities and opportunities for dockside access for trucks delivering supplies and provisions needed by the ships for their operations and passenger services. Hubs that accommodate this need will better serve the needs of cruise ship lines that have been important to the local economy while increasing efficiency by creating access for trucks and proper delivery facilities at the cruise ship hubs.

Harbor Drive, which runs north and south along the Port of San Diego's Working Waterfront, is a critical area for port cargo and intermodal activities, waterfront recreational activities, military bases, and industrial uses. Freight moving along Harbor Drive must intermingle with traffic and pedestrians on land and recreational watercraft on the water—whether moving by truck, train, or ship. For trucks, a variety of projects and programs are underway to provide ITS deployments (e.g., freight signal priority) and segregate trucks from car traffic and pedestrians (via new pedestrian-friendly bridges) to ensure that freight moves smoothly along this important corridor.

As the region moves toward near-zero/zero-emission vehicles (ZEVs), electric charging, hydrogen fueling, renewable natural gas (RNG) fueling, and other types of ZEV infrastructure, such infrastructures will continue to come to the forefront as a primary need to promote and sustain the use of these technologies by freight carriers. For example, electric vehicle charging infrastructure will likely include a mix of dynamic/wireless and plug-in facilities, with a trend toward the former as the technologies mature. The trucking industry's confidence in these ZEV technologies will largely depend on the range of operations and the wide availability of charging/fueling stations. However, Governor Newsom's recent Executive Order N-79-20 has accelerated this transition by setting goals that all drayage trucks shall be ZEVs by 2035, and all medium- and heavy-duty vehicles shall be ZEVs by 2045.⁷⁹ Mobility Hubs that include package-delivery services, residential units, or commercial businesses will therefore need to incorporate appropriate ZEV technologies for last-mile delivery needs.

Finally, unmanned aircraft systems (UAS) or drones are on the horizon for small package or parcel deliveries, depending on a variety of operational issues that are being resolved by those interested in their use. Some considerations for UASs include safe co-operation with conventional aircraft, other air space regulations and policies, compliance with military moratoriums for drones in restricted air space, land use policies for siting deployment locations, and potential noise and privacy impacts. Pilot programs for drones may include how and where they will be docked, recharged, and access parcels for delivery, and will likely be part of the future Mobility Hubs strategies. In May 2018, the City of San Diego was selected by the U.S. Department of Transportation, Federal Aviation Administration, as one of ten agencies in the nation to participate in the UAS Integration Pilot Program (IPP). As an IPP participant, the City of San Diego worked with several public and private sector partners to test the feasibility of advance UAS operations, including unmanned traffic management, night operations, flight over people, and flight beyond visual line of sight.

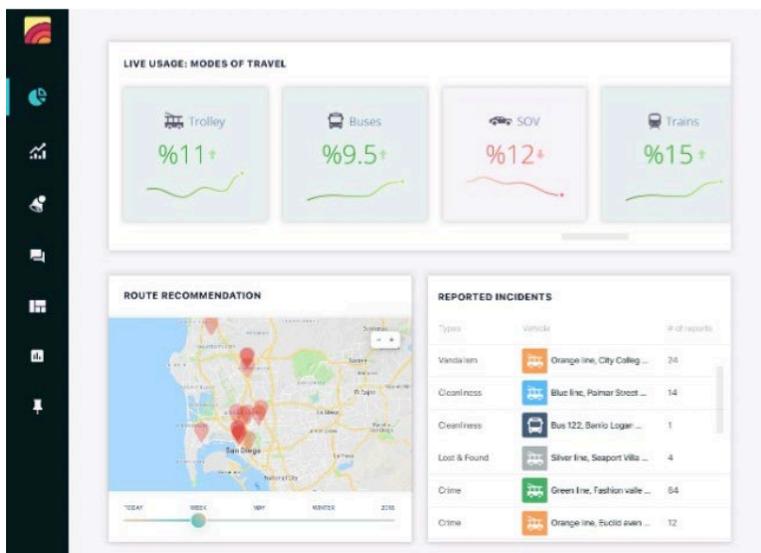
⁷⁹ "Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20)," CARB, January 19, 2021, arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20.

Next Operating System

Next OS is often called the “brain” of the entire transportation network, intending to manage all services in real time to promote sustainability, efficiency, and safety. The Next OS digital platform, or system of systems, includes data exchange and management, analytics, communications, and information dissemination through applications, dashboards, and websites to a variety of users. A variety of goods movement supportive technology systems for rail, highway, and air are being considered as part of Next OS. Users will include truck operators and other supply chain service providers. Next OS is unique among the 5 Big Moves in that the technologies that comprise it will allow coordinated operations, management, and improved transportation services across all of the 5 Big Moves, resulting in a modernized transportation system with roads and

services that operate smoothly and serve people better.

Figure Y.8: Sample Custom Dashboard



For transportation operators and service providers, it will be possible to use Next OS to shift from process-driven operations to data-driven operations using analytics software and dashboards that can be customized (Figure Y.8). Next OS will provide transportation operators and service providers with these insights and tools to optimize dispatching, routing, and scheduling.

With comprehensive, accurate datasets and shared information, public transportation operators, parking authorities, traffic engineers, and other public- and private-sector transportation operators (such as truck drivers, trucking companies, and package delivery service providers) can break down siloes in their respective organizations. More collaborative business processes will improve regional coordination of transportation operations and the use of new technologies.⁸⁰ Involvement of the private sector in understanding, planning, and protecting competitively sensitive information will be a key activity in deploying Next OS solutions that engage and serve the goods movement community.

Access to better, real-time information for better decision-making for trucking companies, truck drivers, logistics service providers, third-party logistics companies, intermodal operators, and government agencies responsible for planning and programming is a key benefit for goods movers. Other transportation efficiency strategies that may benefit from Next OS coordination include ITS technologies, such as freight

⁸⁰ “San Diego Forward: Next OS Concept White Paper,” SANDAG, August 2020, sdforward.com/docs/default-source/2021-regional-plan/san-diego-forward_next-os-concept-white-paper.pdf?sfvrsn=9499fe65_2.

signal priority systems to support freight throughput along congested arterial corridors. Another example of a Next OS project is a border-management system with wait times, incident reports, and dynamic tolling to improve crossborder travel times. Next OS could also help to provide data and management for drone deliveries, assist with truck parking information through smart truck parking systems, help trucks move through congestion with dynamic lane management, provide congestion information through variable message signs or through 511 (or other information system) notifications, and ease queueing and staging through coordination of appointment systems at land POEs, seaports, and airports. Data exchange between various government and private industry systems and provision of that data to end users would be at the heart of a truck information system to guide truck operators and trucking company management to a variety of information. This information system would assist trucks in optimizing their operations and would include information about truck routes, rest areas, and other truck parking options and availability; hazardous materials routes and safe parking; California Highway Patrol inspection stations; public weigh stations; fuel and repair facilities; operating and oversize/overweight permits; major freight facility queue and appointment information; and a variety of vehicle-to-vehicle, vehicle-to-infrastructure, and other truck operating information for the region.

Flexible Fleets

Flexible Fleets address a variety of goods movement opportunities, focusing particularly on last-mile delivery and the transition to cleaner fuel technologies. This move proposes that in the future, driverless vehicles, e-bikes, drones, and bots will deliver a range of goods from a distribution hub to individual consumers, businesses, or smart lockers at Mobility Hubs. Some last-mile delivery services can consolidate trips by carrying passengers and goods at the same time.⁸¹ Flexible Fleets can either be publicly or privately operated.

Other potential Flexible Fleets considerations for goods movement include the adoption of near-ZEV/ZEV technologies for a variety of freight vehicles, including over-the-road trucks (of all sizes), yard trucks, and forklifts. These technologies include vehicles that are powered by electricity or an alternative fuel such as hydrogen or RNG. Policies governing the widespread and mandated use of these technologies or fuels must also consider the larger net effects of these energy alternatives throughout the entire life cycle of the energy source or fuel from its point of origin (or manufacture) through processing and delivery to the vehicle, concluding with its emissions profiles and any residual impacts on the environment. The transition to ZEVs is largely a private-sector responsibility—although mandated by federal and state legislation—and may be supported (for some types of businesses and operators) through grant and loan programs. The path forward toward the adoption of these technologies is outlined through CARB’s Advanced Clean Trucks regulation, approved in June 2020.⁸² This regulation builds upon Executive Order N-79-20 by requiring truck manufacturers to sell ZEV trucks as an increasing percentage

⁸¹ “Flexible Fleets,” San Diego Forward, SANDAG, sdforward.com/mobility-planning/flexible-fleets.

⁸² “Advanced Clean Trucks,” CARB, arb.ca.gov/our-work/programs/advanced-clean-trucks.

of their annual California sales and requiring large companies to report on their existing fleet operations to ensure that ZEV trucks are transitioning into fleets. One of the first grant programs to kickstart this transition was the CARB and California Energy Commission's Zero-Emission Drayage Truck and Infrastructure Pilot Project funding opportunity. This funding program was released in 2020 to support large-scale deployments of on-road, zero-emission Class 8 drayage and regional haul trucks as well as the ZEV fueling infrastructure needed for service operation. Recognizing the regulatory shift toward ZEV trucks and the local interest in pursuing these funding programs, SANDAG and its regional partners have been seeking opportunities to develop a medium- and heavy-duty ZEV strategy to identify strategic investments that will transition our region into these Flexible Fleet technologies.

Beyond the infrastructure needs, technology and mobility providers are working to address issues around battery range and recharging. One technology that may address this issue is wireless charging, where a battery could be recharged by placing the vehicle over an in-ground inductive charging system at a Mobility Hub, truck rest area, truck stop, or other intermodal or truck facility, for example. Wireless electric vehicle charging is based on inductive charging, which involves electricity being transferred between two magnetic coils via the air gap between the ground and the vehicle. Inductive charging would enable vehicles to recharge without the need for a human driver to physically plug the vehicle in. Initial wireless charging applications are designed for parking spaces while the technology is being developed to operate on roadways and through initiatives via Complete Corridors.⁸³

Policies and Programs

As each of the programs, strategies, and projects to support goods movement are planned and developed, the policies surrounding the solutions and decisions must support their eventual deployment, usefulness, and realization of expected benefits to the region and the goods movement industry. Among the policy considerations that are important in supporting goods movement now and in the future, the following have special significance: truck parking and staging areas, community and goods movement industry interface, information/data sharing, curb management, Mobility Hub coordination, connected and automated vehicle policies, and rural/tribal goods movement coordination.

A strategy to assist with residential/urban community and truck interactions, especially relative to parking, includes off-hour deliveries for facilities that have this capability. That said, there are many retailers and restaurants that are open or operating during peak daytime hours and only receive their deliveries during this time; this is a case where parking and curb management policies must be carefully and creatively crafted to ensure that these deliveries can be made while minimizing the effects on local traffic and reducing the burden of citations on the trucking industry. Smart truck parking systems

⁸³ "Frequently Asked Questions about Flexible Fleets," San Diego Forward, SANDAG, sdforward.com/docs/default-source/2021-regional-plan/faqs-flexible-fleets-final.pdf?sfvrsn=408bf865_2.

and commercial-vehicle-specific permit programs offer the possibility of better management of truck parking and delivery activities. For urban areas, curb management and prioritization for delivery vehicles is another essential policy decision.

Truck parking is also an important need for long-haul and regional truckers coming in and out of the region—parking is needed for mandated rest breaks, staging for pick-up or delivery, awaiting dispatch, or simply parking when off duty. Use of Park & Ride facilities for off-hour parking for commercial vehicles is a potential opportunity and policy consideration.

Regional coordination for freight resiliency is an essential part of planning for natural disasters or other unplanned catastrophes that require a strong, nimble transportation system and network of transportation providers to supply needed materials and supplies to residents and businesses. The Department of Homeland Security conducts periodic simulations regarding border operations with the local “trade” (freight brokers, warehouse and logistics providers, and trucking businesses) to ensure all know their roles, responsibilities, and resources during a disaster. This type of planning could be emulated or extended to include more emergency-management entities and agencies within the region to augment the resilience of goods movement during these events. Resiliency, and efficiency in general, require excellent cross-jurisdictional coordination, communication, and information sharing. For plans and systems to work well, coordination must be established and periodically reviewed to keep it current and ensure that responsible leaders and personnel continue to uphold the policies set forth by their predecessors. An example of a system where this coordination is essential to ensure continued data-exchange agreements is a border wait-times system.

As the growth of e-commerce continues to trend upward rapidly, the number of residential deliveries continues to climb, and policies supporting space for smart lockers at Mobility Hubs and in building lobbies becomes more important; this reduces the amount of time delivery vehicles use curb space in urban areas and reduces the number of trips through neighborhoods in suburban and rural areas.

As technology continues to evolve toward vehicle automation and connection, policies considering dedicated or dynamic lanes for commercial vehicles are becoming more crucial. Semi-autonomous and autonomous vehicles, including UAS, will require policy decisions regarding their right-of-way and priority. Smart intersections and vehicle-to-vehicle technologies will assist with safety, but policies must be established in coordination with and aligned to national standards to ensure everyone is playing by the same rules.

Appendix Y Part 2: 2021 San Diego and Imperial Counties Freight Gateway Study Update

Appendix Y Part 2: 2021 San Diego and Imperial Counties Freight Gateway Study Update

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Introduction to Freight Dynamics in the Gateway Region

Visuals or tables in this section that reference 2020 data reflect data from the period pre-COVID-19 and related economic closures.

1. Introduction to Freight Dynamics in the Gateway Region

Transportation infrastructure networks must accommodate and reflect how resources, goods, and services are distributed. In the short run, conditions in the economy drive the demand for freight moving on the transportation system. We have seen this vividly demonstrated during the COVID-19 pandemic, with initial dramatic declines in activity followed by a strengthening demand for goods and associated freight activity. In the long run, however, it is the capacity and efficiency of regional transportation systems to accommodate freight volumes which can significantly impact the sustainability of economic growth and the reliability of supply chains serving the population in the Gateway Region. SANDAG's focus on the 5 Big Moves (Moves) vision is an opportunity to underscore the cross-cutting nature of goods movement across all of the Moves throughout the Gateway Region and understand how freight will be addressed and integrated into each of the Moves. The Southern California Association of Governments (SCAG) has similarly adopted *Connect SoCal, the 2020–2045 Regional Transportation Plan/Sustainable Communities Strategy*, which presents a long-range vision that balances future mobility and housing needs with economic, environmental, and public health goals in Imperial County and the 5 other counties SCAG represents.

Complete Corridors address how modes interact and move efficiently through the region on the roadway network. Freight moves on all types of roadways (freeways, arterials, and local roads) and requires safe and efficient access to designated or dedicated lanes for freight activity at points of origin and destination and throughout the entire trip. This Study revisits key freight routes and planned improvements with a renewed focus on technology, real-time information, and strategies for applying this information to improve safety and efficiency on shared corridors, at important freight access points, and at points of conflict, including the curbside.

Transit Leap considers the balance between transit and freight access on the region's rail corridors, the needs for improving transit access and options for freight industry employees, and opportunities for supporting transit ridership by coupling trip purposes, such as e-commerce parcel boxes at transit stations or mobility hubs. Rail corridors such as the Los Angeles–San Diego–San Luis Obispo (LOSSAN) corridor are particularly important for prioritization of projects to help manage the shared passenger and freight rail lines in the Gateway Region so both are served safely and efficiently.

Mobility Hubs suggest including hubs for freight mobility alongside and in addition to passenger mobility as important opportunities for efficiency and access improvements. Suites of services for freight mobility hubs may also include zero-emission vehicle (ZEV) charging infrastructure and access to other information and services for truckers. Freight opportunities at a few select mobility hubs identified in the region are examined through this study. A detailed case study of the planned Urban Core mobility hub, including portions of Downtown San Diego, Barrio Logan, and the Midway District, provides opportunities and strategies for identifying the best locations to include parcel lockers. The case study analyzes multimodal access, mobility hub amenities, location factors, and surrounding land uses and provides a set of recommendations and strategies for siting parcel lockers within mobility hubs. The Gateway Region study team will be conducting outreach to community stakeholders to ensure that the proposed strategies are aligning with community goals and ongoing planning efforts.

Flexible Fleets support the use of shared mobility services, such as on-demand rideshare services, autonomous vehicles and other conveyances such as cargo bikes, bots and drones to move parcel and package goods to their final destinations. These fleets are intended to provide flexible and efficient options for delivering goods to front doors and providing a last-mile connection. From the environmental perspective, Flexible Fleets include the conversion of diesel vehicles to those powered by electricity and alternative fuels to further improve air quality, reduce other impacts to the environment, and protect the health of communities in the region.

Next Operating System (Next OS) will play a critical role in the proposed implementation of freight delivery systems ranging from autonomous trucks to sidewalk robots, and real-time information to improve freight efficiencies on highways, at border ports of entry (POEs) and terminal gates. The role of Next OS in collecting and disseminating important freight data and information to public and private users is key to Next OS mission as a coordinating or "orchestrating" system to support goods movement. Information to support freight movement is diverse and spans border wait times, appointment systems, access and queue information for Port of San Diego marine terminals or San Diego International Airport as well as regulatory, safety, security and service information. And in the future, when autonomous trucks become a reality, the Next OS will play an even more critical role in the safe and efficient movement of trucks.

1.1 Understanding Freight Movement

The COVID-19 Pandemic created acute awareness among the general public about the importance of supply chains, domestic freight flows, and international trade and manufacturing. Temporary factory shutdowns in China resulted in a lack of ventilators, personal protective equipment (PPE) like facemasks, and personal hygienic supplies, such as toilet paper and hand sanitizer. Domestically, stay-at-home orders prompted surges in home deliveries ranging from retail goods to groceries to restaurant orders and significant surges in demand for home improvement goods, laptop computers, and home office supplies. Unlike recessions of the past, this particular recession created a clear divide between those with the ability to work from home and those deemed to be “essential workers” in various sectors, including health care, food service, and manufacturing. California’s unemployment rate increased from 3.9 to 8.3 percent between January 2020 and March 2021. In the Gateway Region, San Diego County’s unemployment rose from 3.2 to 6.9 percent and Imperial County experienced a very slight decrease from 17.1 to 15.7 percent.¹ Demand for agriculture and cross-border trade remained stable, and as the COVID-19 health restrictions are reduced, demand for services is already beginning to rebound allowing most service workers (and consumers) in the Gateway Region to go back to work. As the recovery continues, and the U.S. economy rebounds from the sharp and deep recession experienced during the pandemic, demand for goods, services, and related freight transportation activity is projected to increase. Growth is projected for heavy shipping industries like energy, farming, and mining as well as sectors such as e-commerce, high tech, medical equipment, construction, and the military, which also impact demand for the movement of goods. E-commerce growth that accelerated greatly in 2020 is anticipated to continue adding pressure on the freight network in the region, particularly from the last-mile delivery vehicles carrying e-commerce shipments to residents and businesses in the region.

The American freight transportation network experienced tremendous growth in the past decades due to changes in the makeup of the economy and expansion in international trade. While the growth in the past 35 years was fueled by declines in transportation and communication costs, future trade patterns are expected to shift as supply chains are revised to reduce source supply risk and improve environmental performance. The shift towards zero emissions vehicles (ZEV) and more sustainable freight transport practices will influence supply chain design, thereby affecting the Gateway Region.

The shifts in established patterns of international trade will contribute to trade growth, and that includes a trend towards ‘near-shoring’² of production to Mexico for the North American market with some shifting away from overseas production that is no longer based only on minimizing labor costs. This trend particularly benefits Mexico as a

¹ California Employment Development Department. <https://edd.ca.gov/newsroom/unemployment-march-2021.htm>, April 2021.

² Dictionary of International Trade definition: “The offshoring of a business process or manufacturing plant to a lower cost foreign location that is in close geographic proximity to the contracting company.”

rapidly growing source for U.S. goods imports and exports, echoing the boom in crossborder goods trade that followed the adoption of the North American Free Trade Agreement (NAFTA) twenty-seven years ago and anticipated to continue with the recently enacted United States-Mexico-Canada Agreement (USMCA). The recent trend is for the United States (U.S.) and even Asian and European manufacturers to expand production in Mexico in order to serve the entire North American market, often with advanced technologically manufactured goods and suppliers also locating manufacturing in Mexico. The California-Baja California (CaliBaja) border region economy benefits from the increase in associated Mexico economic activity.

Additionally, U.S. energy markets have been transformed in the past decade, with the rapid growth in use of natural gas, due to lower prices from increased domestic production of both natural gas and oil, facilitated by new well drilling technologies. The import transportation requirements for U.S. crude oil consumption have fallen while the U.S. further expands transportation of natural gas for export, including via pipeline to Mexico. Lower relative energy costs have resulted in increased demand for transportation of North American production of energy-intensive products such as petroleum products and chemicals. Natural gas adoption as an alternative fuel source for freight transportation equipment has been occurring over the past ten years, including for over-the-road heavy trucks, due to the attraction of reduced emissions and reduced costs as a transition fuel before electrification becomes the norm. The industry understands the goal to move towards zero-emission technologies, such as electric and hydrogen fuel cell, but as of the time of this report, the predominant cleaner technology (as compared to diesel) available to the trucking industry is natural gas because of vehicle cost, range, and proven reliability. Strides are being made to increase the amount of natural gas derived from renewables, but the ultimate goal of the State and the freight industry is a greener freight system served by a reliable and sustainable zero-emission technology.

To remain competitive, logistics firms are re-designing their supply chains and distribution networks across industries to enable timely and yet flexible delivery services, which has been accelerated by changes experienced by households and businesses during the pandemic. These changes require the current freight system to become more efficient and reliable. The interconnectedness of various modes of transportation is growing in importance, especially at international gateways such as border crossings, airports, and seaports and the corridors that support them (e.g., interstates, state highways, and local roadways).

1.2 The Role of Freight Movement in the National and Regional Economy

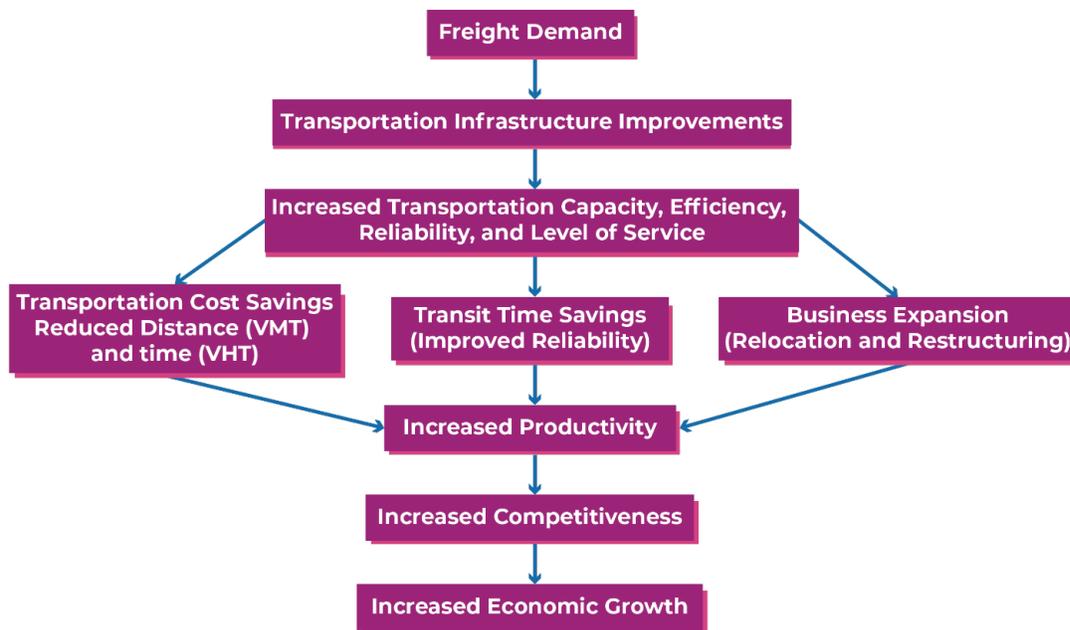
The relationship between freight transportation and economic growth has long been recognized as an important element in any national or regional development policy.

Enhancing freight transportation networks can lead to significant economic benefits by lowering transportation costs, lowering emissions, and improving service. Network

improvements can help increase practical distances traveled and the velocity and reliability of delivery, adding flexibility to the design of supply and distribution networks, resulting in market development and economies of scale while achieving reduced emissions.

Improving freight transportation services by reducing transit times and improving reliability enhances inventory and supply chain management. The effects of the time savings and cost reductions can work through the economy via additional efficiency gains due to changes in companies' logistics processes and operations, also known as "reorganization" effects.³ These changes can include more efficient inventory practices as well as improvements to manufacturing processes. These improvements can, in the aggregate, make the Region more competitive and support a more sustainable economy.

Figure 1.1: Freight Transportation and Economic Growth



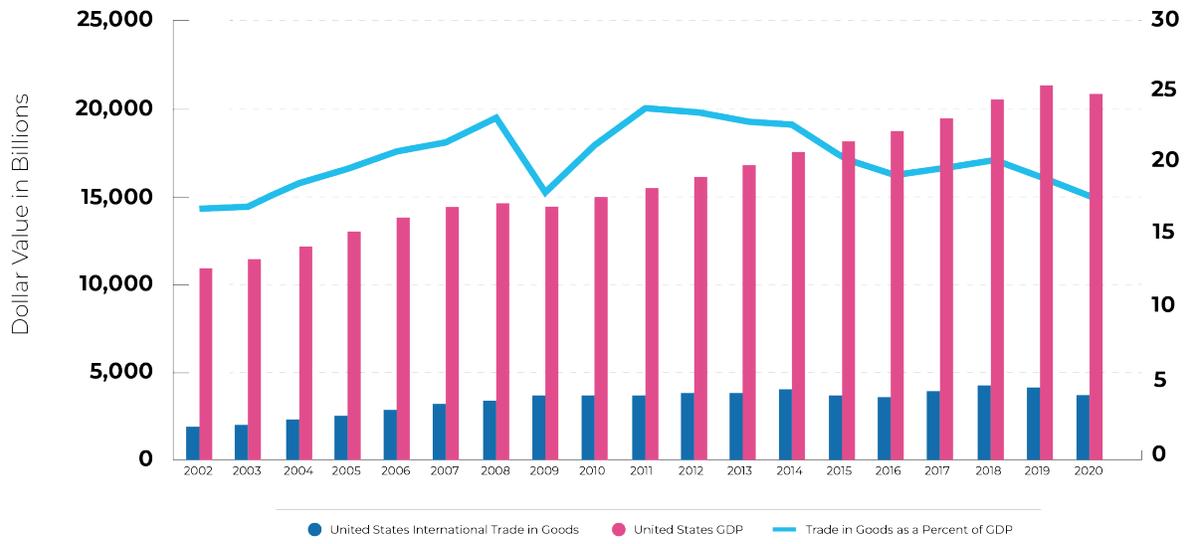
Note: VMT is vehicle miles travelled; VHT is vehicle hours traveled

The time and cost savings generated by investments in the freight transportation network can enhance the overall performance of logistics systems, which in turn can increase productivity in manufacturing and distribution, as depicted in **Figure 1.1**. This enhanced productivity reflects a more efficient use of labor, capital, and resource materials, all of which lead to improved production and increased economic growth. The concept of productivity enhancement is fundamental in economic theory as it is a key determinant of economic growth and improvements in the quality of life, as exhibited by the close

³ U.S. Department of Transportation, Federal Highway Administration, The Economic Effects of Transportation: The Freight Story. January 2002. https://ops.fhwa.dot.gov/freight/documents/freightstory_12902.pdf.

relationship between how much economic output there is per person (measured as Gross Domestic Product [GDP] per capita) and the growth of labor productivity.

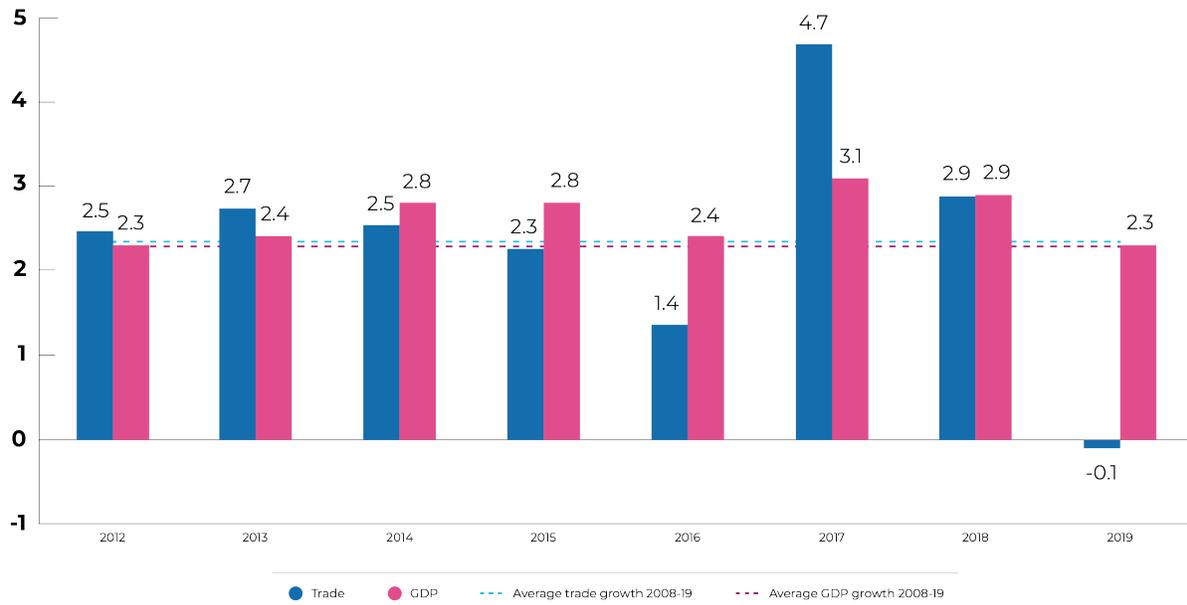
Figure 1.2: U.S. Gross Domestic Product and Trade, 2002–2020



Source: Bureau of Economic Analysis and International Trade Association, U.S. Department of Commerce

In the U.S., trade in goods is a significant element in the country's economy, measured as GDP, and U.S. international trade in goods; this is depicted in **Figure 1.2**. U.S. GDP and international trade grew from 2002 until the recession in 2009 and then again in recovery until the global energy correction in 2015. Since 2012, the U.S. goods trade share of the overall economy has declined from the peak, falling from near 25 percent of the economy to 18 percent in the pandemic year of 2020. This reflects changes in trade policy combined with changes in the composition of the U.S. economy, with U.S. energy sources replacing previously imported oil and gas.

Figure 1.3: Trade Growth and Economic Growth in Metropolitan Areas Globally



Source: World Trade Organization

The relationship between trade and economic growth of the U.S. is also found at the global level. **Figure 1.3** illustrates the recent relationship of trade and GDP for the world. Even before the pandemic in 2020, recent years have seen more volatility in trade growth than in overall world economic growth. Changes in world trade policy have been reflected in trade volume growth, which has exceeded overall world economic growth only three years since 2012. With the disruptions to the world economy and trade during 2020, the path of world trade is unclear. It is possible that global supply chains will be modified to reduce reliance on sourcing from single distant countries overseas. This may result in greater reliance on regional trading blocs such as within North America, Europe and Asia. This pattern has already been evident in recent years with substantial foreign direct investment in Mexico expanding manufacturing for export. By 2019, Mexico had become the number one trade partner of the US, ahead of China and Canada. While Mexico lost share to China due to Mexican manufacturing and trade disruptions from the pandemic in 2020, Mexican-US trade growth is anticipated to return to the pre-pandemic path, especially considering the additional boost to the trade expected from the full implementation of USMCA.

Figure 1.4: Trade Growth and Economic Growth by Metropolitan Area



Source: Bureau of Economic Analysis and International Trade Association, U.S. Department of Commerce

The regional economy of the San Diego Metropolitan Statistical Area (MSA)⁴ has performed well compared with the US national average for metropolitan areas since 2003. However, following the 2009 recession, San Diego growth has lagged the growth of Los Angeles and Orange County MSAs in six of the ten years. Measured as real regional GDP in the bar graph in **Figure 1.4**, San Diego's annual growth has ranged from 1.3 percent to 3.9 percent, after the recovery from the 2008-2009 recession took hold in 2011. In 2015, 2016, and 2019, the annual GDP growth for the Southern California Metropolitan Region outperformed the U.S. international trade growth in goods. The economic performance of the relatively smaller El Centro MSA is more volatile, reflecting the composition of the economy more tied to agriculture, renewable energy and trade. Regional GDP growth in El Centro has ranged from -6.3 percent to 13.9 percent between 2003 and 2019, reflecting changes in commodity prices, government spending and renewable energy projects. The recent performance of each of the Southern California MSAs was affected by trade policy changes impacting US trade before the pandemic.

⁴ U.S. Census Bureau definition: Metropolitan Statistical Areas are geographic entities delineated by the U.S. Office of Management and Budget for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics. A metro area contains a core urban area of 50,000 or more population. Each metro area consists of one or more counties and includes the counties containing the core urban area as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

The effects on the economy of improving freight transportation can be classified into groups, some of which have been used to quantify benefits for use in economic feasibility analyses⁵ of freight transportation projects:

1. Immediate cost reductions to carriers and shippers, including gains to shippers from shorter transit times and better reliability.
2. Gains associated with reorganization effects (improved logistics) that lead to lower prices and higher output.
3. Product/service improvements or the development of new products/services.
4. Higher employment and income, which helps to stimulate the economy.

The real cost of freight transportation has generally decreased over the past three decades, primarily due to industry restructuring and innovations in supply chain management. However, in recent years before the pandemic, volatility in energy prices, increased attention to environmental mitigation measures, transportation safety regulations, trade policy change impacts on energy commodities, and reductions in public funding available for capacity expansion, contributed to increases in freight transportation costs. Continued escalation in transport costs may dampen growth in goods movement in the future, as goods producers need to recapture some of the increased costs, leading to lower overall goods demand. Prior to the pandemic, capacity issues had resulted in congestion problems across major freight corridors and gateway access points. Congestion significantly impacts the supply chains of high-value, time-sensitive commodities, and contributes to higher freight costs, which may ultimately result in higher consumer prices and a reduction in export competitiveness across the economy. Consequently, strategic investments in major freight corridors and gateway access points are essential to contain and/or mitigate rising transportation costs.

1.3 Characteristics of and the Challenges to the Regional Freight Network

Uniquely located between major production, trade, and population centers, the Gateway Region possesses a wide array of transportation infrastructure assets. These include: major land POEs along the border with Mexico (including the Calexico East aggregate only conveyor belt); interstate highways, state routes, and local arterials; Class I and short line railroads; marine cargo terminals; pipelines; industrial warehousing/manufacturing (including Maquiladoras in Baja California); and an integrated air cargo system.

The location of the Gateway Region contributes greatly to its role in global supply chains and the facilitation of international trade. The border crossings are critical assets for the physical movement of goods, as they serve as gateways to and from the U.S./USMCA⁶

⁵ Economic feasibility analysis of projects is most commonly carried out using Benefit Cost Analysis.

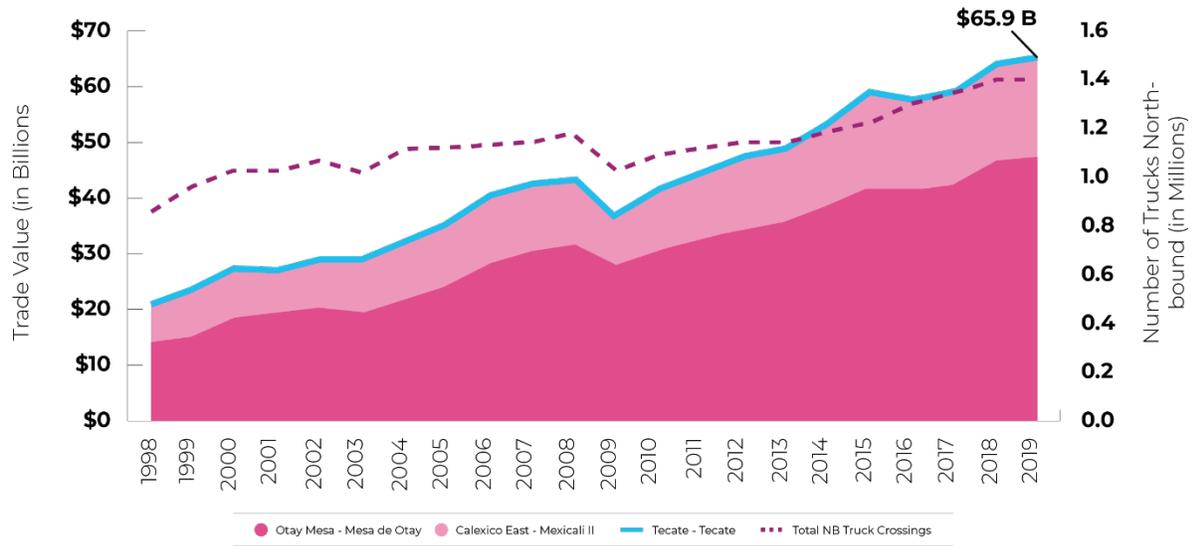
⁶ The USMCA is the US Mexico Canada trade Agreement which replaced NAFTA starting in July 2020. NAFTA was the North American Free Trade Agreement covering the U.S., Mexico, and Canada, in force between 1994 and 2020.

trading partner Mexico and facilitate use of maquiladora manufacturing and agricultural trade on both sides of the border. Similarly, the Port of San Diego's two marine terminals are gateways for waterborne commerce, while the San Diego International Airport (SDIA) hosts a significant amount of air cargo and courier services. Some air cargo is also handled at the Imperial County Airport. Corridors linking to these gateways (highways and local roadways, pipelines, and rail lines) are equally important, as they provide the connection to the gateways that facilitate the circulation of goods between producers and consumers.

Given how significant trade is to the economy, the freight infrastructure network serving trade is critical. There is a freight triangle in Southern California between the California-Baja California border, the Ports of Los Angeles and Long Beach, and the Inland Empire that together are the core of California's freight economy. Because of the integration of production and distribution processes across the California/Mexico border, the conduct of international trade not only benefits the national economy, but the regional economy as well. Economic growth in the Gateway Region has been closely related to international trade and more specifically, the 1994 to 2020 NAFTA trade period, and since July of 2020, trade under USMCA.

The value of border trade through California's POEs via truck with Mexico is large, reaching a value of \$65.9 billion in 2019 as observed in the chart in **Figure 1.5**. This annual two-way trade has more than tripled in value since reaching a low in 2009 after the Great Recession, and in 2019 was dominated by U.S. imports (\$42.1 billion) compared to U.S. exports (\$23.8 billion). Trade in 2019 was facilitated by over 1.4 million northbound and southbound truck movements. Otay Mesa, as the main commercial gateway for international trade between California and Mexico, ranked second in total volume of trucks and third in total trade value moved by truck among the southern border land ports. Among the key commodities in this two-way trade are electronics, agricultural goods, vehicles, and medical devices.

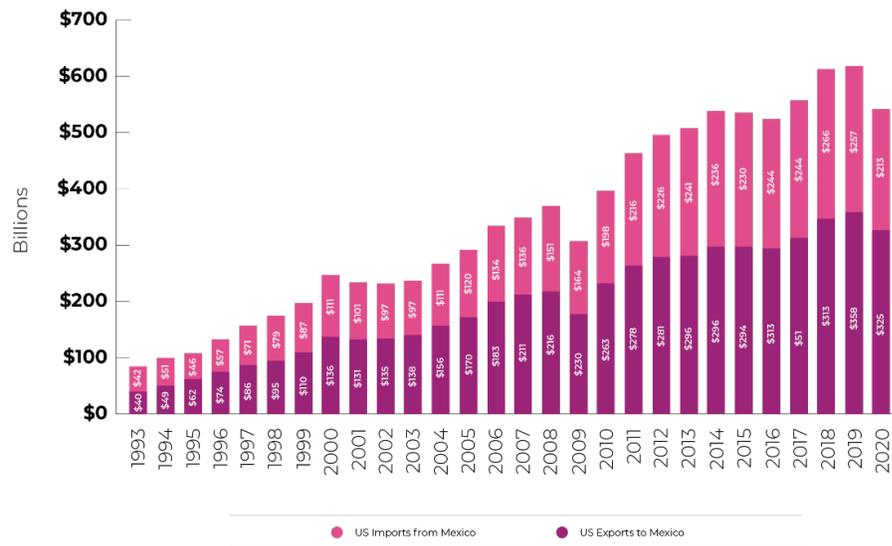
Figure 1.5: Bilateral Trade Value via Truck – California Commercial Land Ports of Entry, 1998–2019



Source: U.S. Department of Transportation BTS

U.S./Mexico trade has grown significantly since the adoption of NAFTA back in 1994. As seen in the **Figure 1.6**, the U.S. Department of Commerce statistics show the total value of this bilateral trade increased 750 percent from 1993 (before the beginning of NAFTA) through 2019 (before the pandemic in 2020). Both imports and exports increased annually after the 2009 recession through 2019. The new USMCA that replaced NAFTA in July 2020 is anticipated to attract additional trade between the U.S. and Mexico, due to additional trade facilitation and incentives. Among the many provisions of the USMCA, the agreement includes a higher “domestic content” requirement for the parts that are used to manufacture motor vehicles. This is anticipated to result in more trade in auto parts between the U.S. and Mexico as a consequence of the USMCA being in force (e.g., the Toyota maquiladora, which produces Tacomas, is near Tecate, and the assembled Tacomas cross into the US using the Otay Mesa POE to seaport, rail, and local roadways).

Figure 1.6: Annual U.S. Imports and Exports since the North American Free Trade Agreement



Source: U.S. Department of Commerce

A well-functioning freight transportation system, which includes gateways and links between the gateways, is also essential to satisfying local demand for consumer products and maintaining quality of life. This is particularly true of **terminating markets** such as the Gateway Region. According to the US Freight Analysis Framework, goods movements terminating in the Region (“inbound” freight flows) exceed goods movements originating in the Region (“outbound” freight flows). To accommodate the projected growth in population and employment—and the associated growth in consumption—more inbound freight flows and overall freight volumes are necessary to enable that growth.

The highway system carries the vast majority of regional freight, which means road bottlenecks can affect system performance and consequently the cost of transportation in the Region. Congestion at the border crossings between California and Mexico can affect the Region’s economic growth and reduce the competitiveness of businesses depending on the highway system.

Other factors are restraining the Region from reaching its potential for prosperity and improvements in quality of life. A key challenge is the limited growth in regional income, attributed to an increasing proportion of low-wage employment. There also has been a widening gap between average wages for high and low earners. And a relatively high cost of living from housing and energy expenses has challenged the economic standing for a majority of the population.⁷

⁷ SANDAG Demographics and other data available at <https://datasurfer.sandag.org/>.

1.4 Policies and Potential Impacts of Sustainable Goods Movement in the Region

Gateway Region policymakers face the complex task of enhancing mobility for the Region's residents, workers, and businesses and improving the quality of life for these users, while at the same time promoting international trade by improving the efficiency of the Gateway Region's airports, seaport, roadways, rail, and border-crossings. To assist in this task, it is helpful to identify the types of infrastructure investments that will best contribute to economic growth and understand how various local, state and federal policies support or impact freight mobility and efficiency for the goods movement industry and governments. To enhance efficiency at the international gateways, the strategies adopted must accommodate growing needs to reduce congestion and waiting times. Businesses must be able to take advantage of scale economies as well as agglomeration economies from consolidation of production and warehousing facilities. Ultimately, a more efficient and improved Gateway Region transportation system will support mobility and trade growth.

When considering options for improving the Region's quality of life, planners and policymakers in the Gateway Region have an interest in promoting a wider understanding of the impact of improving freight infrastructure, policies and services, and in addressing related economic, environmental, equity, and social issues. Example questions include:

- What investments would help support trade among sectors of the economy associated with higher wage employment and higher value products?
- Should the Region promote growth in more value-adding activities? And if so, of what types?
- What policy actions can promote local business connections, small business vitality, access to labor and other inputs?
- What policy actions are needed to promote environmental benefits and/or community sensitive responses?
- Which infrastructure investments can alleviate bottlenecks, improve efficiencies, and/or lower costs?

Whatever combination of strategies is pursued, regional policy makers will want to focus on how to improve the Region's comparative advantage (e.g., proximity to Mexico's manufacturing industry, high quality labor force, attractive location for tourism) while ensuring that their policies are consistent with the strategies and initiatives pursued on the Mexican side of the border.

To plan for a more efficient and reliable transportation system that will better serve the Region's growing population, SANDAG is seeking to better integrate existing transportation system components in San Diego Forward: The 2021 Regional Plan and align with the SCAG Connect SoCal plans for Imperial County's transportation network.

Among other elements, SANDAG's plan includes an extensive set of managed lanes to accommodate transit services, carpools, vanpools, and fee-paying patrons. These lanes will help improve accessibility for various traffic types and, indirectly, activities, and provide funding incentives for transit-oriented, sustainable land use and development. Connect SoCal includes several transportation system improvements to reduce vehicle miles travelled, emissions, and delays in the county.

SANDAG's planning considers federal freight-planning guidance, as recommended by the US DOT in their implementation of the most recent federal surface transportation program. Known as the Fixing America's Surface Transportation Act (FAST Act), this program was enacted in December 2015 and through Congressional extensions remains the governing Federal transportation and planning program. Along with a continued emphasis on freight planning and performance management in general, the legislation promoted development of needed projects using both discretionary Federal grant and state-issued formula funding programs. The legislation endorsed the type of freight-planning already established and continuing at SANDAG, and through the State of California, provides implementation funding opportunities.

In response to the need to maintain and improve the Region's access to domestic and international markets, SANDAG includes goods movement discussions in the Regional Plan. These discussions aim to assess the Region's goods movement system and identify opportunities and needs for freight system improvement, while considering impacts on the economy, environment, and equity. SANDAG freight-planning also works with Caltrans, local jurisdictions, Port of San Diego, San Diego County Airport Authority, neighboring counties planning agencies, and the U.S. DOT in establishing definitions of a national freight network that can be used to help guide inter-regional corridor planning. The U.S. DOT has defined a National Highway Freight Network (NHFN) that was called for in the FAST Act legislation to also help guide freight transportation policy decisions. The NHFN consists of the following roadway subsystems:

- **Primary Highway Freight System (PHFS):** This is a network of highways identified as the most critical highway portions of the U.S. freight transportation system determined by measurable and objective national data. The network consists of 41,518 centerlines miles, including 37,436 centerline miles of Interstate and 4,082 centerline miles of non-Interstate roads.
- **Other Interstate portions not on the PHFS:** These highways consist of the remaining portion of Interstate roads not included in the PHFS. These routes provide important continuity and access to freight transportation facilities. These portions amount to an estimated 9,843 centerline miles of Interstate, nationwide, and will fluctuate with additions and deletions to the Interstate Highway System.
- **Critical Rural Freight Corridors (CRFCs):** These are public roads not in an urbanized area which provide access and connection to the PHFS and the Interstate with other important ports, public transportation facilities, or other intermodal freight facilities. Nationwide, there are 4,412 centerline miles designated as CRFCs.

- **Critical Urban Freight Corridors (CUFCs):** These are public roads in urbanized areas which provide access and connection to the PHFS and the Interstate with other ports, public transportation facilities, or other intermodal transportation facilities. Nationwide, there are 2,213 centerline miles designated as CUFCs.

Since the recovery from the 2009 Recession, a set of competitive federal grant-based awards were available for major infrastructure projects. Initially known as Trade Investment Generating Economic Recovery (TIGER) under President Obama, renamed to Better Utilizing Investments to Leverage Development (BUILD) under President Trump, and renamed to Rebuilding American Infrastructure with Sustainability and Equity (RAISE), this program mirrors the Projects of Regional and National Significance program from prior ISTEA and TEA-21 transportation bills. SANDAG was awarded \$20.2 million in TIGER 2009 funds for the I-805/SR-905 Interchange Project, the Port of San Diego was awarded \$10 million in TIGER 2015 funds for the Tenth Avenue Marine Terminal Modernization Project, and ICTC was awarded \$20 million in BUILD I funds for Calexico East Port of Entry Bridge Widening Project. The RAISE program has been continued with grant funding of \$1 billion available in 2021 which can fund freight projects but are open to all major infrastructure. The Infrastructure for Rebuilding America (INFRA), formerly called Fostering Advancements In Shipping And Transportation For The Long-Term Achievement Of National Efficiencies (FASTLANE), focuses on funding projects that improve freight efficiencies. In 2016, Caltrans and SANDAG received \$49 million in FASTLANE funding for the SR-11 Project. The INFRA program has been continued with grant funding of \$889 million in 2021, which may prove a source of support for the Region's project needs. In addition, the Federal Maritime Administration also administered a new funding program for port-related infrastructure through its Port Infrastructure Development Program (PIDP). On January 1, 2021, the National Defense Authorization Act appropriated \$230 million for the 2021 PIDP. The Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) provides funds for Intelligent Transportation Systems. In 2020, SANDAG received \$9 million in ATCMTD funds for deploying intelligent transportation solutions at the U.S.-Mexico Border and neighboring communities.

The State of California created the Trade Corridor Infrastructure Fund, which was followed by a more permanent transportation funding source created by the adoption of Senate Bill 1 (SB1). Within SB1, the legislature established the Trade Corridor Enhancement Account to fund corridor-based freight projects nominated by local agencies and the State. Implementing legislation was enacted with the approval of SB 103 (Chapter 95, Statutes of 2017) which directs the California Transportation Commission (Commission) to allocate the Trade Corridor Enhancement Account funds and the federal National Highway Freight Program funds to infrastructure improvements along corridors that have a high volume of freight movement. The Commission oversees the SB1 Trade Corridor Enhancement Program (TCEP), which is a discretionary funding program that allocates these federal and state freight funds and provides a funding source for freight projects throughout the state. In total, the Gateway Region has received over \$280 million in SB1 TCEP funds. Through innovative financing mechanisms such as

public-public partnerships, SANDAG, Caltrans, and the U.S. Customs and Border Protection, together with counterpart agencies in Mexico are exploring new infrastructure investment partnerships at the Otay Mesa East POE. Similarly, landside ingress and egress issues (on roadways and railways) are significant freight infrastructure challenges for the San Diego International Airport (SDIA) and the seaport, which will require unique partnerships and blended funding solutions. Although such partnerships usually require lengthy negotiations on issues concerning design, construction, and responsibility for operation and maintenance, they could help pay for building and maintaining infrastructure networks that the Region could not otherwise afford. These agencies are constrained in funding improvements made outside their jurisdictions because they are self-funded agencies depending mostly on leasing agreements and fees.

While policies aimed at encouraging international trade could improve the efficiency of the transportation network and support sustainable growth in the Region, they might also lead to business restructuring and re-allocation that could eventually shift jobs and production. This speaks to why SANDAG is applying key strategies (the 5 Big Moves) to envision a balanced transportation network that moves people and goods more quickly and easily, increases access to opportunity, and meets state greenhouse gas emissions mandates. The result is a comprehensive vision that leverages technology to create a safe, adaptable, and socially equitable transportation ecosystem that responds to the unique needs of the wonderfully diverse communities throughout the region.

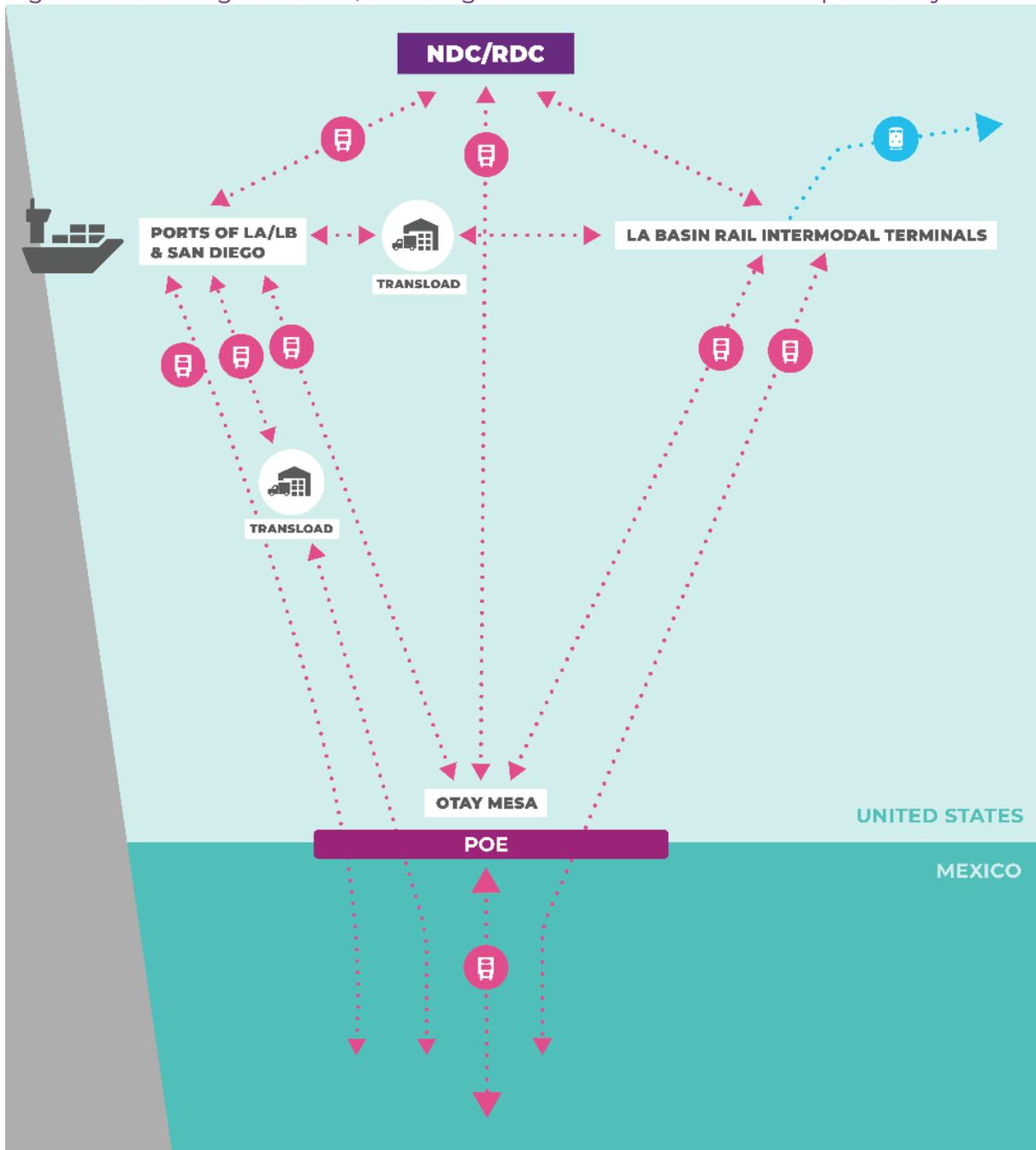
SANDAG will use this Study, in partnership with related agencies and organizations⁸ to jointly work towards advancing public support for trade and the infrastructure needed to accommodate trade. For example, joint efforts could involve raising the public's awareness and understanding of USMCA impacts on labor and environmental policies, and other policies to promote sustainability in the Region.

There is a clear interdependency between SANDAG, SCAG, ICTC, and Caltrans in planning for crossborder freight movements and regional intermodal freight. The diagram in **Figure 1.7** shows an example of regional distribution schematic of cross-border, international, and domestic intermodal freight in which the capacity links, nodes, and bottlenecks exist across planning jurisdictional lines. In Southern California, National Distributions Centers (NDCs) and Regional Distribution Centers (RDCs) are located in the Los Angeles Basin and the Inland Empire. They are connected to the major Southern California container port gateways of Long Beach and Los Angeles, as well as the Port of San Diego by truck, and in turn connected to the rest of the country via truck and intermodal rail service. Mexico traffic connects through San Diego at Otay Mesa POE and through Imperial County at Calexico East to and from the seaports, the distribution

⁸ Related agencies and organizations in Southern California include the Southern California Association of Governments (SCAG), the Imperial County Transportation Commission (ICTC), the Unified Port of San Diego, San Diego County Regional Airport Authority, Caltrans, Riverside County Transportation Commission (RCTC), the Orange County Transportation Authority (OCTA), San Bernardino County Transportation Authority (SBCTA), and the Western Riverside Council of Governments (WRCOG).

centers, and the intermodal rail terminals in the Los Angeles Basin. There also are intermediate freight handling facilities in the Region used in the network. The Gateway Study provides a means to illustrate the complexity of global supply chains, suggest the Region's role in facilitating the updates to these supply chains, and identify cooperative approaches for researching and planning supply chain improvements.

Figure 1.7: Los Angeles Basin/San Diego Truck Distribution Interdependency



Note: NDC: National Distribution Centers; RDC: Regional Distribution Centers

With limits on funding, it is imperative that freight infrastructure investments be prioritized and allocated efficiently. Such planning not only requires a clear understanding of existing capacity and its utilization, but more importantly, an accurate and reliable forecast of future transportation and infrastructure needs.

Policies to support federal and state environmental mandates are a major consideration for all aspects of the freight industry, particularly trucking. Vehicle engine and transport refrigeration units (TRU) powered by diesel engines are required, through a series of mandated incremental steps, to be phased out in the next few years (based on the California Air Resources Board (CARB) 2014 Truck and Bus Regulation). The overall objective for CARB is to move toward zero-emission vehicles (ZEVs) or near zero-emission vehicles, as evidenced with the Advanced Clean Trucks regulation adopted by CARB in 2020. For the Port of San Diego, motor carriers will be required to replace engines or vehicles to comply with the regulations, at their own cost. There are grant and loan assistance programs in place to assist some motor carriers, but these programs have not attracted many of the small, independent owner-operators due to a number of factors, such as cost and reliability. Strategies that consider the compliance rates, potential changes in the availability of motor carriers and small/owner-operators with compliant vehicles, and the resulting impacts to truck freight, especially across the border, is another important policy consideration for the region's decision-makers.

Other policy considerations that will contribute to the efficient movement of freight through gateways and the region include those that facilitate intermodal connections such as: efficient routing, staging, queueing and parking for commercial vehicles interfacing with planes, ships and trains. Access to San Diego's working waterfront, the land ports of entry, the airport, rail intermodal facilities and various other commercial/industrial/agricultural zones and truck trip generators throughout the region are essential components for meeting the demands borne of increased e-commerce and expectations for rapid (same day, overnight) delivery times along with just-in-time manufacturing requirements.

1.5 Study Benchmarks

This Study gives the Region benchmarks to assist with the freight investment and freight policy issues noted earlier. The study also informs San Diego Forward: The 2021 Regional Plan.

Another critical component of this update is to identify and annotate the impacts of the COVID-19 pandemic and provide a detailed discussion on the latest economic drivers affecting the freight forecast.

After this introductory chapter, **Chapter 2** of this Study provides an updated detailed description of existing infrastructure and capacity constraints in the Region. **Chapter 3**, provides new estimates of existing freight flows; the chapter also includes snapshot information about major commodities and modes of conveyance. Emerging freight

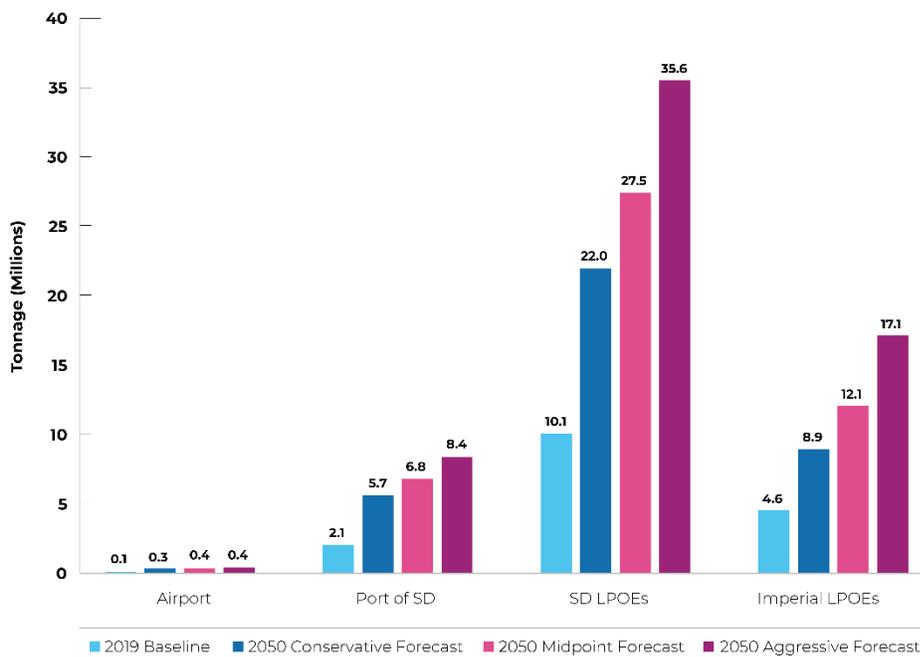
trends, including consolidated package hubs, e-commerce, and zero emission freight vehicles are discussed in **Chapter 4**. The policy constraints, market conditions, and regulatory issues affecting the transportation under this study are addressed in **Chapter 5**. The technical appendices include the following additional items:

- An overview of the methodology and a list of data sources
- The updated 2050 freight forecast gateway tables: a compendium report distilling mode of conveyance, and volume and value illustrating various commodities and gateways

1.6 Gateway Flows: Summary Snapshots of Regional Freight

As noted in **Section 1.5**, the subsequent chapters delve into greater detail on regional freight issues, but the following summary snapshots will inform the reader of key freight issues. Most of the freight data in this report used a common metric, which is measuring freight dynamics by cargo weight in tons. Assessing freight flows by tons is a very useful metric that is common to all modes and to all gateways. By using tons, gateways can be compared and understood through a common lens.

Figure 1.8: Summary of Freight Flows through the Region's International Gateways in Volume: 2050 Forecast

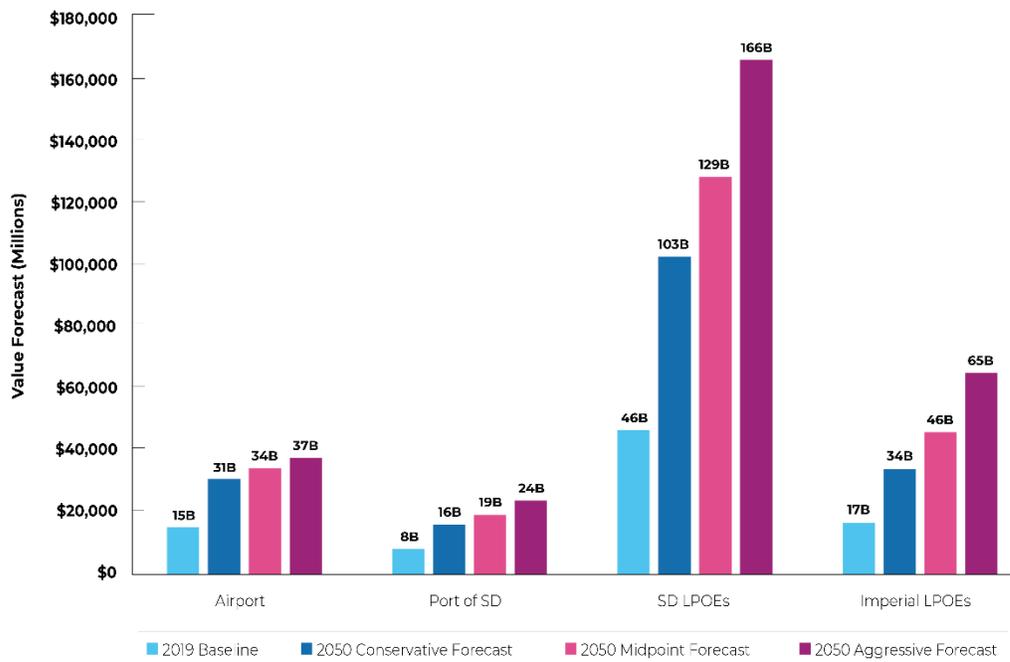


Source: IHS Markit Transearch, Port of San Diego, and San Diego International Airport

San Diego and Imperial Counties land ports of entry reflect the highest amount of combined import and export tonnage and highest annual average growth rates through 2050 (**Figure 1.8**). A substantial majority of total tonnage for these counties is moved

through the land ports of entry in San Diego County (Otay Mesa and Tecate) with an estimated 60 percent and Imperial County (Calexico East) with 27 percent. The San Diego International Airport's tonnage is lower than land ports of entry due to the high cost of shipping heavier goods in the air, which results in lighter, but often higher value commodities that move by air freight to the other major international gateways. The Port of San Diego represented 12 percent of the international freight flows in the region.

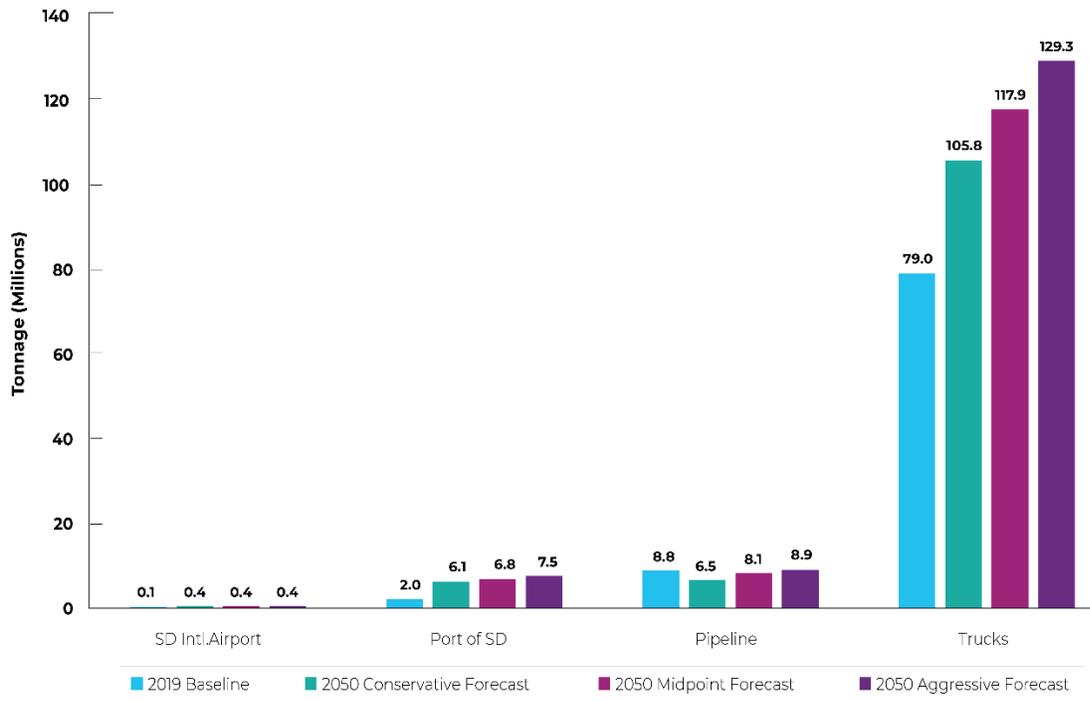
Figure 1.9: Summary of Freight Flows through the Region's International Gateways in Value: 2050 Forecast



Source: IHS Markit Transearch 2019

Similarly, as with tonnage, San Diego and Imperial Counties POEs overwhelmingly lead the region's gateways in combined import and export trade value (**Figure 1.9**). During 2019, the Otay Mesa POE accommodated nearly \$47 billion in total trade value. By 2050, the value of trade passing through this POE is anticipated to double or possibly more than triple. The San Diego Airport and Port of San Diego in 2019 accommodated freight valued at \$15.2 and \$8.3 billion, respectively for a combined share of 27 percent of the region's international trade value. The land POEs are anticipated to gain a larger share of the freight value by 2050 growing from a current combined share of 73 percent to a 2050 projection ranging from 74 to 79 percent.

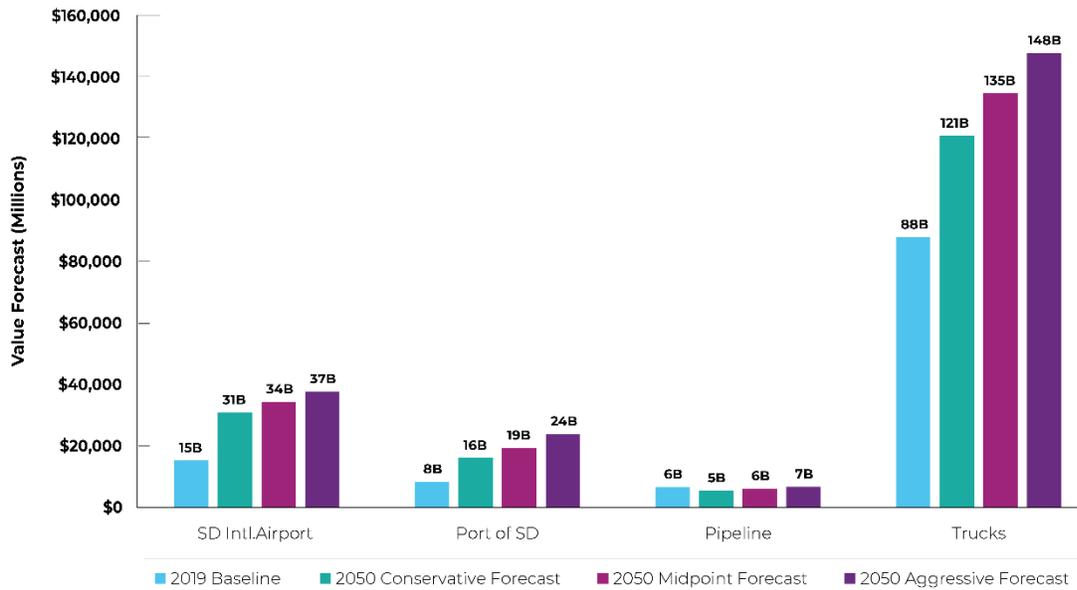
Figure 1.10: Domestic Freight Volumes by Mode in San Diego County: 2050 Forecast



Source: IHS Markit Transearch, Port of San Diego, San Diego International Airport, and SFPP, L.P. (2019)

As a mode, trucks carry approximately 80 percent of the total freight volume and approximately 70 percent in terms of value, more than the other modes (air, water, rail and pipeline) combined (**Figure 1.10** and **Figure 1.11**). This illustrates the economic importance of the roadway network and the critical need for continued infrastructure investments, including maintenance.

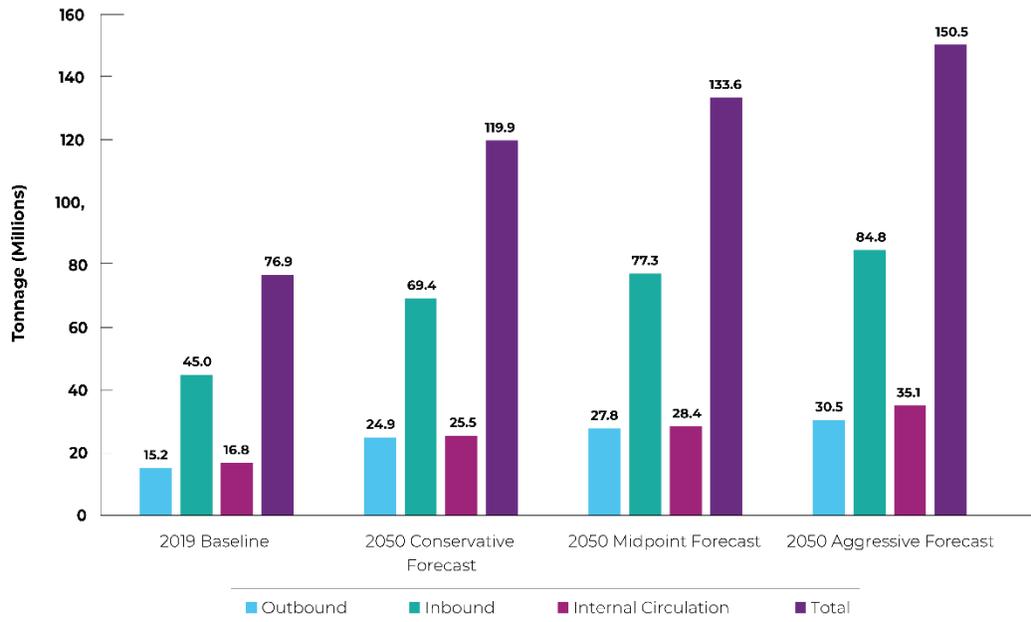
Figure 1.11: Value of Domestic Freight Flows by Mode in San Diego County: 2050 Forecast



Source: IHS Markit Transearch, Port of San Diego, San Diego International Airport, and SFPP, L.P. (2019)

Similar to the situation where the Otay Mesa and Calexico East international gateways are the highest generators in value, the truck mode substantially provides the highest amount of domestic freight flows moving within, from and to San Diego County of the modes of transport. This is depicted for 2019 and 2050 conservative and aggressive forecasts in **Figure 1.12**.

Figure 1.12: Comparison of International and Domestic Truck Freight Flows in San Diego County



Source: IHS Markit Transearch

For perspective on the composition of truck demand within, from and to San Diego County, understanding domestic freight tonnage (in contrast to international tonnage which is identified as Gateway tonnage) is an important part of the overall freight flow picture. The domestic tonnage is important for an understanding of all truck traffic in the region, whether it originates at a gateway or is simply the flow of goods to consumers in San Diego County.

Given the aggressive goals of the State and the Gateway Region to transition trucks to zero-emission, this data provides important insights into the challenge facing the Gateway Region to address these goals. It provides an understanding of how many trucks in the region traverse international and state borders. Continuing the binational federal, state, and local partnerships that were strengthened during the development of the 2021 California-Baja California Border Master Plan are needed to implement binational strategies that transition these fleets to zero-emission technologies.

Regional Freight Infrastructure Profile

Visuals or tables in this section that reference 2020 data reflect data from the period pre-COVID-19 and related economic closures.

2. Regional Freight Infrastructure Profile

Situated between major production, trade, and population centers, San Diego and Imperial Counties depend on an integrated transportation network to effectively move people and goods within and through the Gateway Region to the rest of the nation and around the world. Due to the interdependent nature of its binational economies, the Gateway Region's globally competitive business environment hosts a manufacturing sector that is one of the world's strongest crossborder supply chains, with a combined gross domestic product of approximately \$262 billion dollars for San Diego and Imperial Counties in 2019.

The Gateway Region therefore connects some of the largest supply chains in the nation by bridging the major goods movement hubs in Southern California—the California-Baja California Border Region, the Ports of San Diego, Los Angeles, and Long Beach, and the Inland Empire distribution centers. For these connections to thrive, the freight transportation system in the Gateway Region includes interstate and state highways, Class I freight rail operations, short line railroads (most freight operations occur on tracks shared with passenger rail services), airport cargo systems, the Port of San Diego (with two working marine terminals), the Otay Mesa, Tecate, and Calexico East commercial border crossings, and first/last mile connections to industrial warehousing facilities, which are described in detail in this chapter as an update to the 2016 Freight Gateway Study. The chapter is subdivided into three major sections: San Diego County Infrastructure, Imperial County Infrastructure, and the infrastructure for the northern portion of the State of Baja California, Mexico. Within each section, the freight infrastructure is broken down into five major categories: 1) roadways, 2) railways, 3) seaports, 4) airports, and 5) industrial warehouse facilities. Pipelines in San Diego County and Imperial County are also described in their respective sections.

2.1 San Diego County Freight Infrastructure

2.1.1 Land Ports of Entry

Most freight in the Gateway Region travels by truck across POE crossings and along freeways and highways. The highway system carries most of the goods that move in and out of the Region. San Diego County's key freight system assets are part of the multimodal State freight system, which consists of these existing and proposed commercial land border POEs between San Diego County and Mexico:

- Otay Mesa (SR 905)
- Otay Mesa East (SR 11) – a future commercial land border POE that is being developed
- Tecate (SR 188 and SR 94)
- San Ysidro rail crossing

2.1.1.1 Otay Mesa Port of Entry

Otay Mesa POE in San Diego County is one of the two main California-Mexico freight gateways. The Otay Mesa POE ranks second in terms of truck crossings on the U.S.-Mexico border and the busiest commercial land POE along the California-Baja California border.

- The facility includes ten total northbound truck lanes of which six are regular commercial lanes, three are commercial Free and Secure Trade (FAST) lanes, and one is an empty truck lane. The FAST program allows U.S./Canada and U.S./Mexico partnering importers expedited release for qualifying commercial shipments. Additionally, there are three southbound commercial lanes. Also, in the northbound direction, there are 13 passenger vehicle lanes with varying lane configurations dependent upon demand, including one to ten regular lanes, one to eight READY⁹ lanes, one to four Secure Electronic Network for Travelers Rapid Inspection (SENTRI)¹⁰ lanes and one bus lane. SENTRI cards are Western Hemisphere Travel Initiative (WHTI) compliant documents for entry into the United States by land or sea, and also provide expedited travel to approved members between the United States and Mexico Border. Additionally, there are three southbound passenger vehicle lanes. The Otay Mesa facility provides a full range of cargo processing functions, including inspection, data collection, and data verification.

Large-scale improvements are currently underway to expand the capacity of the Otay Mesa POE.

⁹ Ready Lanes are dedicated processing lanes for both vehicle passengers and pedestrians traveling with Ready Lane-eligible travel cards. <https://www.cbp.gov/travel/clearing-cbp/ready-lanes>.

¹⁰ SENTRI is a U.S. Customs and Border Protection program that allows expedited clearance for pre-approved, low-risk travelers upon arrival in the United States. <https://www.cbp.gov/travel/trusted-traveler-programs/sentri>.

- Expansion of pedestrian-processing facilities; doubling the processing facilities from 6 to 12 lanes and better connecting travelers to the nearby transit hub (Otay Mesa Transit Center)
- Construction of a commercial-annex building
- Relocation of Secure Electronic Network for Travelers Rapid Inspection (SENTRI) enrollment facilities
- Relocation of hazardous material commercial import processing
- Construction of surface and structured parking for employees and visitors
- Commercial import lot improvements; an increase from 9 to 16 U.S. Customs and Border Protection (CBP) primary inspection booths
- Improve commercial vehicle circulation
- Improve pedestrian-processing capacity¹¹

Major commodities transported between California and Mexico through the Otay Mesa POE include: plastic, rubber, pulp, paper, allied products, electronics, electrical machinery, automobiles, light duty trucks, food, grain products, and farm products. This POE is located approximately 15 miles south of Downtown San Diego and 14 miles inland from the Pacific Ocean.

San Diego County's roadway network supports flows from the freight gateways including other Southern California major gateways and industrial centers, as well as the internal distribution of goods. The regional highway network moves high volumes of passengers and cargo. On the U.S. side, the crossing connects with California State Route 905 (SR 905), providing links to SR 125, Interstate 805 (I-805) and I-5, and I-15.

2.1.1.2 Otay Mesa East Port of Entry

The SR 11/Otay Mesa East POE project is a joint effort between SANDAG and Caltrans, in collaboration with state and federal partners in the US and Mexican governments, to create a 21st century POE for the San Diego-Baja California region. A tolled highway (SR 11) will provide access to the future Otay Mesa East POE on the California side. Construction on the final segment of SR 11 is currently underway. This new POE will help reduce freight and passenger traffic congestion at the San Ysidro, Otay Mesa, and Tecate POEs, as well as provide additional capacity for future growth by providing a new alternative for freight operators traversing the California-Mexico border.

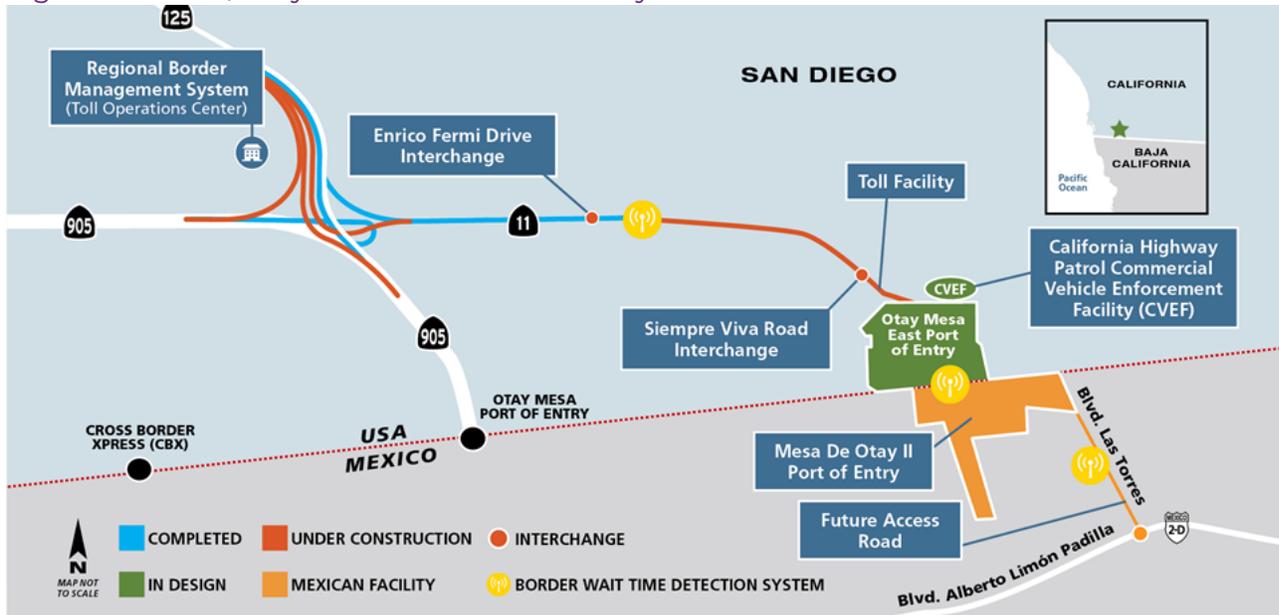
The completed, under construction, and currently being designed project components of SR 11/Otay Mesa East POE are shown in **Figure 2.2** and include:

- A regional border management system

¹¹ U.S. General Services Administration, Otay Mesa Land Port of Entry, Accessed March 15, 2021, <https://www.gsa.gov/about-us/regions/welcome-to-the-pacific-rim-region-9/land-ports-of-entry/otay-mesa-land-port-of-entry>.

- A toll facility and California Highway Patrol Commercial Vehicle Enforcement Facility (CVEF)
- A new interchange at Siempre Viva Road
- A connection from SR 125 southbound to SR 905 southbound
- Southbound connections between SR 125 and SR 11
- Connection of the existing segment of SR 11 to the new Otay Mesa East POE¹²

Figure 2.2: SR 11/Otay Mesa East Port of Entry Overview



2.1.1.3 Tecate Port of Entry

Tecate is a minor full-service POE located approximately 40 miles east of San Diego and serving rural San Diego County. The port provides service for pedestrians, passenger vehicles, commercial vehicles, and rail (the rail line crosses at Campo, located east of the port). It currently includes two northbound commercial lanes. It connects with California SR 188, a 2-mile road providing access to SR 94.

2.1.1.4 San Ysidro Rail Port of Entry

Finally, the POE at San Ysidro in San Diego County (which connects directly to I-5) is not intended for commercial vehicle traffic, but it does have a commercial rail line operation. The San Ysidro rail yard was expanded to increase storage capacity to 196 railcars. This expansion is expected to support the equivalent of four daily freight trains. In the second quarter of 2021, the San Ysidro rail yard moved 1,099 rail carloads, or an equivalent of 3,297 truck trips.¹³

¹² SANDAG, SR 11/ Otay Mesa East Port of Entry, Accessed March 15, 2021, https://www.sandag.org/uploads/projectid/projectid_56_27817.pdf.

¹³ SD&AE Board Periodic Report, July 1, 2021.

2.1.1.5 U.S. Border Security Programs

California and Baja California share over 140 miles of international border. The border is a vital economic gateway for international trade and a key contributor to the economic well-being of both countries. The CBP and Mexican Customs (Aduana/SAT) are the two agencies in charge of operating land POEs. CBP's Trade Office mission is to facilitate legitimate trade, enforces law, and protect the American economy to ensure consumer safety and to create a level playing field for American businesses.¹⁴

Commercial vehicles entering the U.S. from Mexico are required to go through vehicle safety inspections that are conducted by the Federal Motor Carrier Safety Administration (FMCSA) at the federal compound and by the California Highway Patrol once trucks leave the federal compound.

2.1.1.6 Trusted Trader Partnership Program

CBP has developed several trusted traveler programs that provide modified screening for pre-approved members, improve security by being more efficient during screenings, and facilitate legitimate trade and travel. In particular for land trade, CBP has developed the Customs-Trade Partnership Against Terrorism (C-TPAT) and the FAST Programs.

C-TPAT is a voluntary cargo security program with a partnership between CBP and the trade community. Private sector companies eligible to join C-TPAT for crossborder operations include U.S. importers of record; U.S./Mexico highway carriers; licensed U.S. customs brokers; third party logistics providers; U.S. freight consolidators; Mexican manufacturers; and Mexican long-haul highway carriers.

C-TPAT importers enjoy certain incentives based on their tier status within a three-tier structure. Tier I incentives are afforded to those importer partners that have been certified; Tier II level to those that have been certified and validated; and Tier III incentives to those that have exceeded the program's requirements and exhibit best practices. Long Haul Carrier in Mexico can join C-TPAT demonstrating excellence in supply chain security practices and who have had no significant security related events.¹⁵ More than 10,000 companies world-wide are certified C-TPAT members.

The **FAST** Program is a commercial clearance program for known low-risk shipments entering the United States from Canada and Mexico. The FAST Program allows expedited processing for commercial carriers who have completed background checks and fulfill certain eligibility requirements.

C-TPAT-certified shipments have access to the FAST Lanes at land POEs, and participation in FAST requires that every link in the supply chain, from manufacturer to carrier to driver to importer, is certified under C-TPAT Program.

¹⁴ U.S. Customs and Border Protection, Trade. <https://www.cbp.gov/trade>.

¹⁵ U.S. Customs and Border Protection, C-TPAT Long Haul Carriers Mexico. <https://www.cbp.gov/border-security/ports-entry/cargo-security/ctpat/security-guidelines/long-haul-carrier-mexico>.

Among the key benefits of FAST enrollment are:

- Access to dedicated lanes for greater speed and efficiency in processing transborder shipments;
- Reduced number of inspections, resulting in reduced delays at the border;
- Priority, front-of-the-line processing for CBP inspections; and
- Enhanced supply chain security while promoting the economic prosperity of the U.S., Canada and Mexico.¹⁶

2.1.2 Roadway Network

There are three major north-south corridors handling goods movement in San Diego County: I-5, I-805, and I-15. In addition, a toll road, SR 125, connects to the Otay Mesa POE via SR 905 to other major corridors. These routes carry significant volumes of truck traffic through San Diego County and further north to Orange and Riverside counties.

San Diego has one major east- west freeway, I-8, connecting San Diego County with Imperial County, to SR 94, and continuing east toward Arizona. Other State Routes in the Region, such as SR 78, SR 15, and SR 98, also provide critical connections for goods movement. In addition to truck routes shown in **Figure 2.3**, there are roadways not shown on the map that provide STAA truck access in the region.¹⁷

In general, the east-west corridors are not as prominent for freight movement as the north-south freeways. The importance of the north-south corridors stems from their connectivity to major POEs along the county's southern border with Mexico as well as connectivity to the Ports of Los Angeles/Long Beach and major commercial warehousing in Los Angeles and the Inland Empire.

As a result, truck traffic¹⁸ is highest on the I-5, I-15, and I-805 corridors. Both I-5 and I-15 are unique in that they each contain a merge/diverge point where truck traffic significantly changes. For I-5 this occurs at the I-805 merge, and for I-15, this occurs at the SR 163 merge. I-8 provides access for freight to central San Diego and then beyond to rural eastern San Diego County, Imperial County and Arizona, while SR 905 is the primary connection between San Diego, Los Angeles, and the Inland Empire to the Otay Mesa POE for trade with Mexico.

The Region's agencies have also been some of the first to integrate innovative intelligent transportation system (ITS) efforts into their roadway projects. Caltrans District 11, in partnership with SANDAG, Imperial County Transportation Commission, SCAG, and other

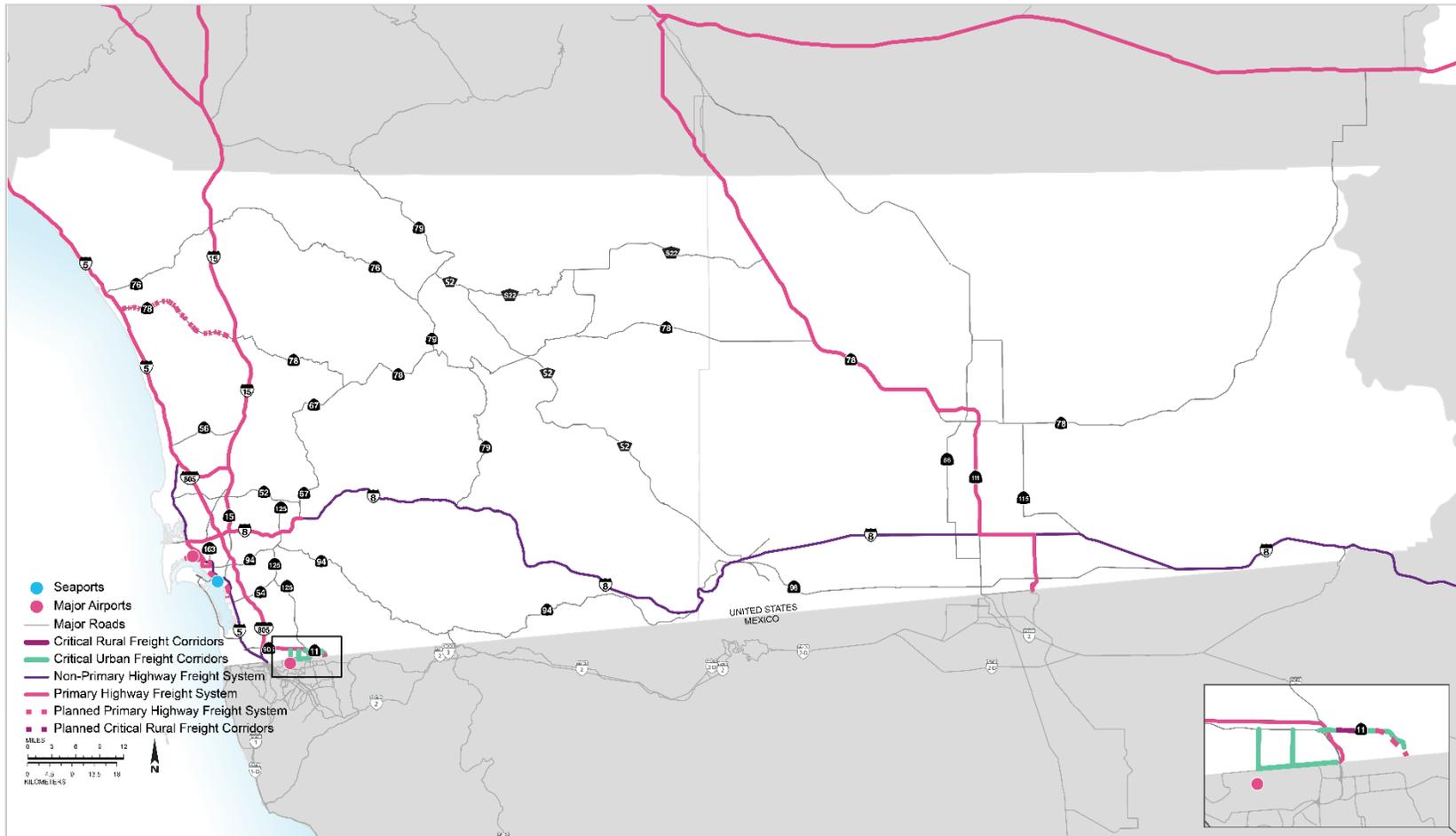
¹⁶ U.S. Customs and Border Protection, Free and Secure Trade. <https://www.cbp.gov/sites/default/files/documents/FAST%20Fact%20Sheet%20-%20FINAL%20%28web%20ready%29.pdf>.

¹⁷ Caltrans STAA Map for District 11 accessed on August 29, 2021, at: <https://dot.ca.gov/-/media/dot-media/programs/traffic-operations/documents/trucks/truckmap-d11-a1ly.pdf>.

¹⁸ The freight analysis in this study is based upon freight tons, derived truckloads, total trade value, and trade value per ton, not average annual daily vehicle traffic data from Caltrans. Source: <https://dot.ca.gov/programs/traffic-operations/census>.

stakeholders, is making progress in implementing the initial phases of their Advanced Technology Corridors at Border Ports of Entry pilot project. These initial phases focus on installing equipment to measure southbound border wait times and displaying this information through an advanced traveler information system in order to better manage commercial and passenger vehicle traffic at the border. In addition, the San Diego Port Tenants Association, through a California Energy Commission grant, recently transitioned some of their fleet to near-zero/zero emission vehicles and is currently implementing a freight signal prioritization (FSP) pilot project along Harbor Drive. The Port of San Diego is hoping to expand this FSP project to adjacent areas of Harbor Drive and is currently working with local communities on strategies to improve air quality in the surrounding communities.

Figure 2.3: Major Truck Routes in the Gateway Region



2.1.2.1 Gaps in Existing Road Infrastructure

The increasing travel demand across the region is illustrated by the increase in the Texas Transportation Institute's (TTI) travel time index for San Diego, which increased from 1.23 in 1997 to 1.37 in 2007 and dropped to 1.32 in 2012 during the Great Recession. Since the recession, travel times have continued to increase to a travel time index of 1.35 in 2017. For trucking, San Diego congestion was estimated by TTI to have imposed costs of \$306 million on the industry in 2017 from over 6 million hours of delay to trucks that year. For San Diego, which increased from 1.23 in 1997 to 1.37 in 2007 and dropped to 1.32 in 2012 during the Great Recession. Since the recession, travel times have continued to increase to a travel time index of 1.35 in 2017. For trucking, San Diego congestion was estimated by TTI to have imposed costs of \$306 million on the industry in 2017 from over 6 million hours of delay to trucks that year.

While a low ratio of freeway lane-miles to vehicle miles traveled is a contributing factor to recurring congestion and longer travel time, demand side pressures are also significant due to population growth and increases in trade.

Some of the more noticeable gaps and constraints in the San Diego County system include the following:

- Severely congested local roads around the Otay Mesa POE
- Lack of a direct freeway connection between the Port of San Diego Marine Terminals at Tenth Avenue Marine Terminal (TAMT) and National City, placing pressure on Harbor Drive as the main truck connection to both marine terminals
- Lack of direct freeway connections to the airport cargo terminal (San Diego International Airport)
- Lack of direct freeway connections to rail yards and intermodal facilities
- Lack of dedicated truck lanes, passing lanes, and truck bypass routes across the region
- Segments of I-5, I-805, and I-15 in San Diego County experience high levels of truck traffic at certain peak periods
- Extremely high land use costs throughout the County, but especially around the working waterfront coupled with no land use protections for freight-related infrastructure, inhibit freight-related investments
- Lack of secure, dedicated truck parking, staging and queuing facilities near freight activity centers throughout the region

2.1.3 Rail Infrastructure

Rail carries a smaller percentage of total regional freight than trucks, but the rail yards and mainline infrastructure are both important and strategic. In 2019, the value of freight transported by rail in the region amounted to less than two percent of overall freight flows; while this sounds like a small percentage, it is an important portion of rail traffic

that both “de-congests” the region’s highways and keeps the Port of San Diego competitive, especially for the automobile traffic moving through the Port. Existing rail services include Burlington Northern Santa Fe (BNSF) Railway’s automotive and “manifest” trains from San Diego to the north, and San Diego County and Imperial Valley (SD&IV) short line trains from San Diego to the south and the east.

2.1.3.1 Existing Rail Lines

San Diego County is served by several rail companies that own and/or operate rail facilities within the County.

In the northern part of the County along the I-5 corridor, BNSF Railway operates on the Los Angeles-San Diego-San Luis Obispo (LOSSAN) corridor owned by North County Transit District (NCTD) and Metropolitan Transit System (MTS), which connects Santa Fe Depot in Downtown San Diego with the Orange County line to the north. Specifically, BNSF operates on the segment of the system from Oceanside to Downtown San Diego and to the National City Marine Terminal (NCMT) (this segment is owned by BNSF). The LOSSAN corridor is designated as a Strategic Rail Corridor Network (STRACNET) by the Department of Defense, which indicates that this rail line is critical for national defense.

BNSF also operates freight trains on the 22-mile Escondido Branch between Oceanside and Escondido. The branch was purchased by NCTD in 1992. Freight service was contracted out to the Pacific Sun Railroad in 2008, but reverted to BNSF in October 2020.

SD&IV Railroad, a subsidiary of Genesee & Wyoming Inc., operates freight service on the 16-mile La Mesa Branch between downtown San Diego and El Cajon. The branch is also used by the San Diego Trolley Orange Line.

In the southern portion of the County, SD&IV Railroad, a subsidiary of Genesee & Wyoming Inc., operates two short lines on track both owned and shared with MTS. One line connects the Santa Fe Depot in Downtown San Diego with the San Ysidro border crossing and freight yard; another with the City of Santee, to the east.

Additionally, the Baja California Railroad (BJRR) owns the rights to operate limited service between the Mexican border at San Ysidro/Tijuana through Mexico to Division (near the Mexican border at Tecate, BC). The section between Tijuana and Tecate is owned by the Mexican government. BJRR also has operating rights from Division and on to Plaster City in the western part of Imperial County. The section between Division and Plaster City is owned by MTS. However, the portion between Division and Plaster City is currently closed due to bridge repairs.

Figure 2.4: Rail Lines in the Gateway Region

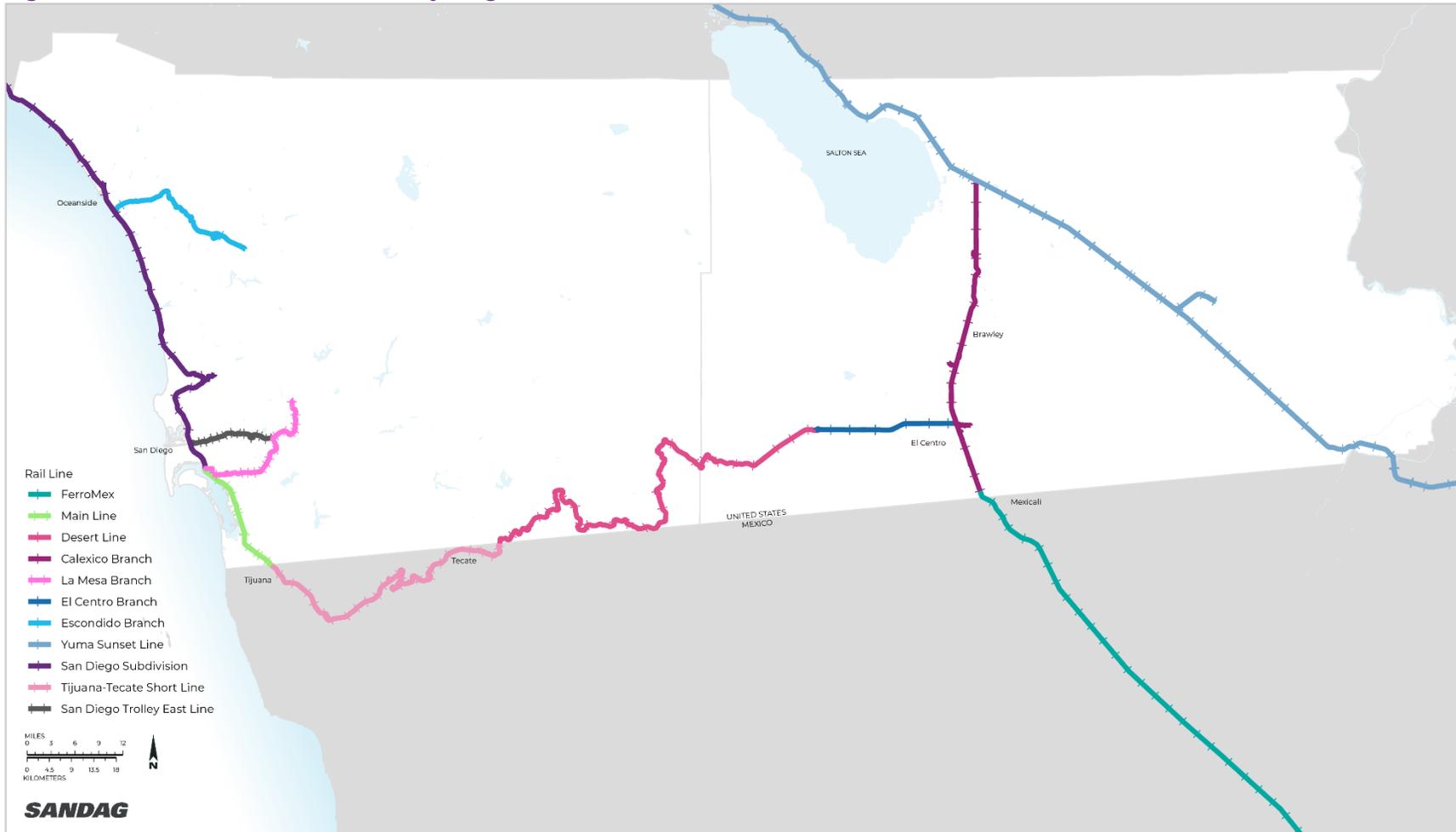


Figure 2.5: Gateway Region Rail Line Ownership Map

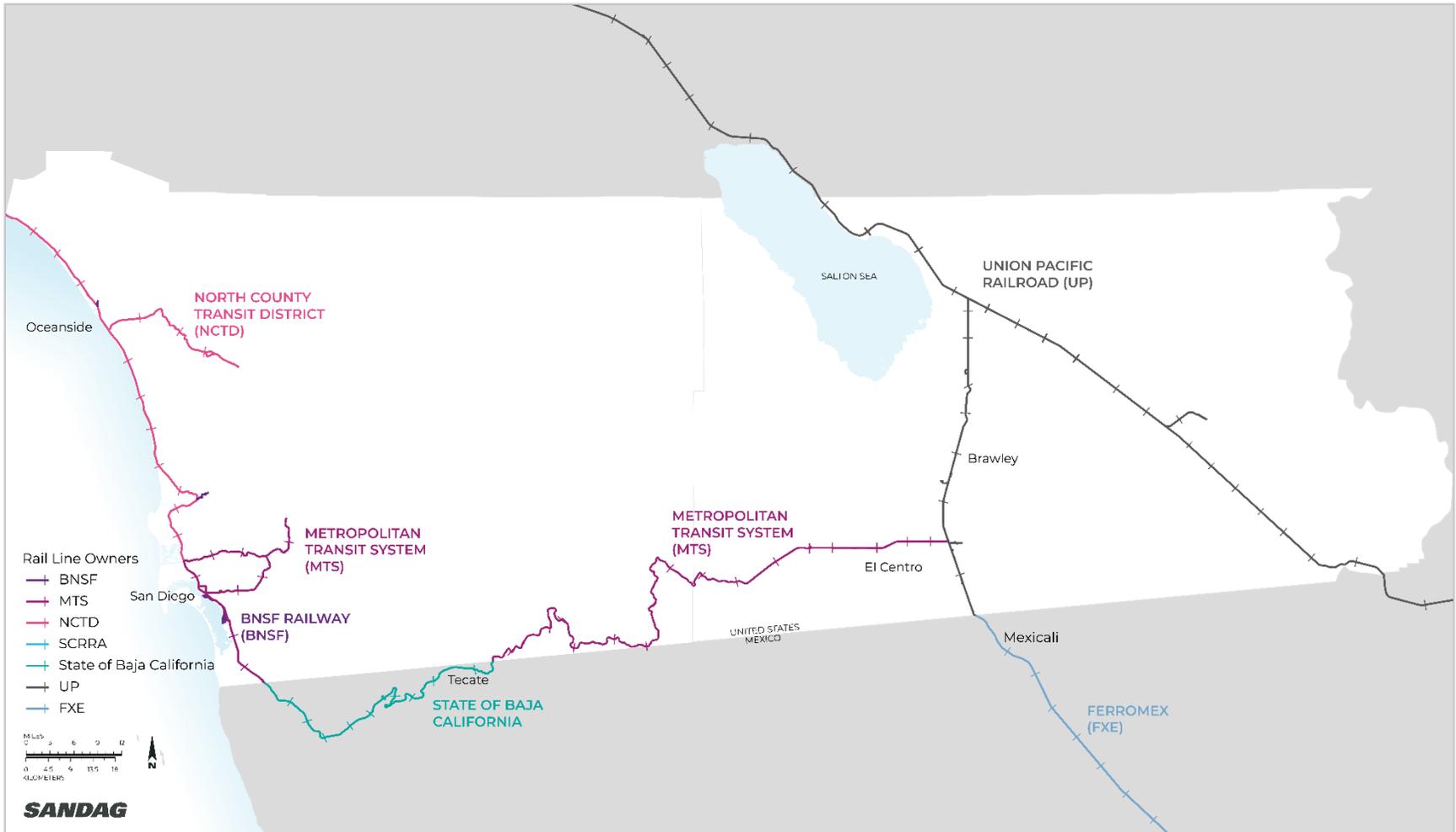
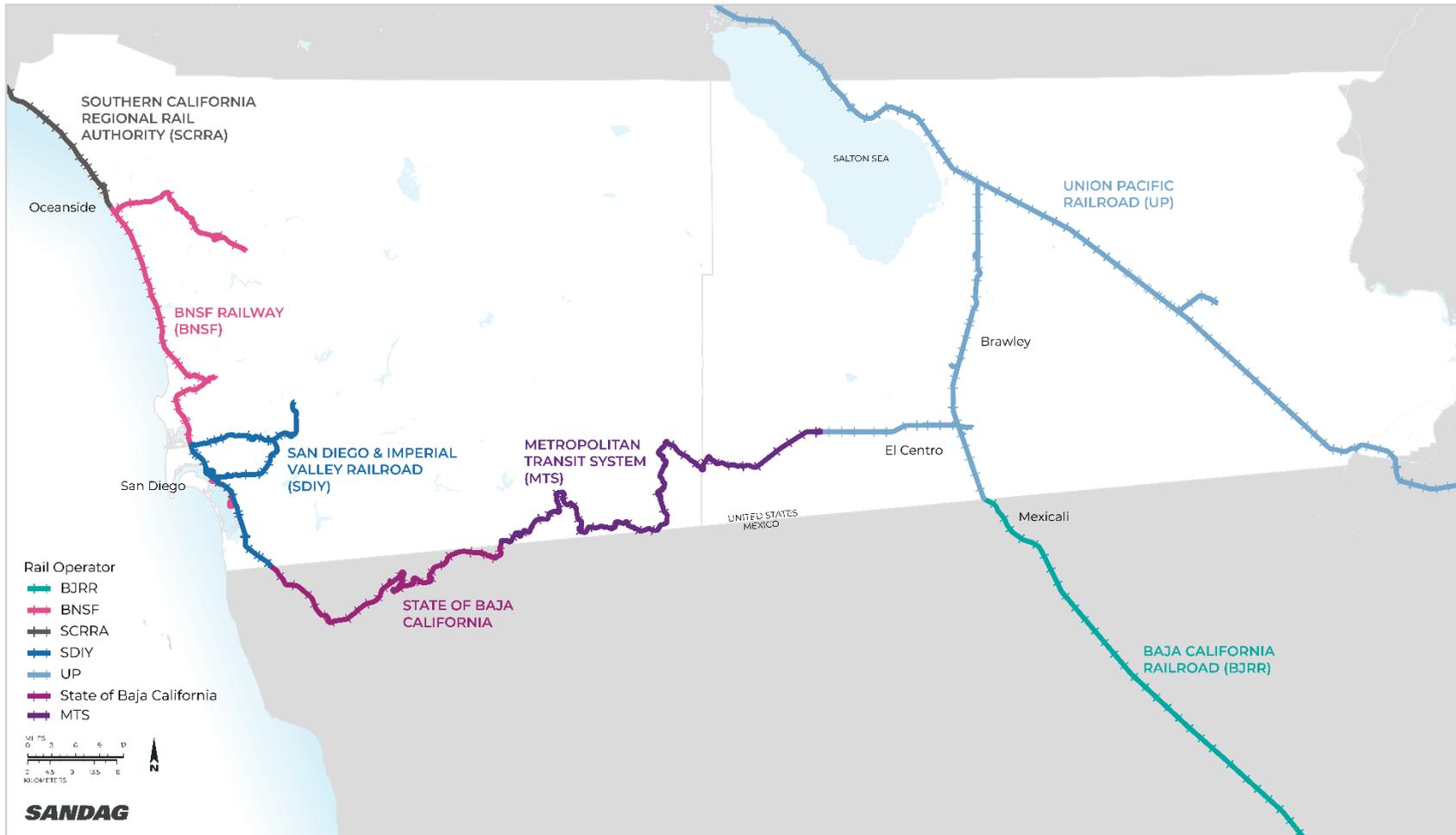


Figure 2.6: Gateway Region Rail Line Operators Map



2.1.3.2 Gaps in Existing Rail Infrastructure

Freight trains in San Diego County move along corridors shared with multiple transit agencies. Thus, BNSF freight trains share the heavily utilized LOSSAN Corridor with commuter rail COASTER and Metrolink and with intercity passenger rail operated by Amtrak. BNSF also shares tracks with light rail service SPRINTER between Oceanside and Escondido. Similarly, SD&IV freight trains share the South Line, from Downtown San Diego to San Ysidro, with Trolley services operated by MTS.

The dual use of tracks, often in very congested urban areas with limited ability to lay new tracks, is a major constraint on existing operations and a challenge for future growth. Freight rail service on the South Line, for example, is currently restricted by federal regulations to two trains operating each night within a window specified by San Diego Trolley, Inc. Furthermore, this operating window is often impacted by routine maintenance activities.

Double-tracking the LOSSAN Corridor, the primary north-south route for BNSF Railway, is currently underway and will provide expanded service potential for both freight and passenger rail service. Although there are projects planned to increase mainline throughput, carload capacity is primarily limited by the capacity of the rail yards. The BNSF San Diego rail yard has an estimated manifest cargo capacity of around 1.75 million tons per year, while auto handling capacity is estimated at 500 thousand tons per year. In terms of crossborder rail movement, current capacity is estimated at about 1.6 million tons per year.

To summarize, a number of gaps—or deficiencies—within the existing system are evident. They include:

- Non-dedicated freight rail lines on MTS-owned facilities from Downtown San Diego to the Mexican border and to the City of Santee, resulting in short operating windows which limit freight rail car throughput
- Non-dedicated freight rail lines on NCTD-owned facilities from mid-county San Diego to the Orange County border resulting in short operating windows which limit freight rail car throughput
- Single track sections for freight on the LOSSAN corridor
- Limited roadway access to the San Ysidro rail yard facilities to stage trains near the Mexican border at San Ysidro

Proposed rail improvements in the County could improve the performance of the network in the short-term. These proposed projects include:

- Finalize double track projects along the LOSSAN Corridor
- Del Mar Bluffs Stabilization – currently underway but the ultimate plan is currently being evaluated by SANDAG and its regional and state rail partners.

- Miramar Curve – this project will realign curves and increase speeds.
- Grade Separations – the grade crossings on the Corridor are seen as risks to the overall Corridor.
- Central Mobility Hub – a multimodal transportation hub near the San Diego International Airport adjacent to the LOSSAN Corridor.

2.1.4 Seaport Infrastructure

2.1.4.1 Existing Seaport Infrastructure

The San Diego Unified Port District is located approximately ten miles from the Mexican border and is the first port in the United States for vessels sailing north from the west coasts of Mexico, and Central and South America.

The Port's activity is split between Tenth Avenue Marine Terminal (TAMT) and National City Marine Terminal (NCMT), both located within the San Diego Bay. The port is designated by the Department of Defense as a strategic port, which may be called upon to support military activities.

TAMT is a 96-acre cargo complex located near Downtown San Diego, south of the Convention Center and north of the San Diego-Coronado Bay Bridge. It houses 23 acres of warehouses and transit sheds, eight berths, and another 25 acres of paved open space for lay down of steel and project cargo. Tenants at TAMT handle containerized produce and dry bulk cargos, including sand and cement, petroleum products, and various break-bulk and project cargos. The theoretical maximum capacity of TAMT is approximately 4.9 million metric tons per year.

Figure 2.7: Tenth Avenue Marine Terminal, 2020



NCMT is further inside San Diego Bay, south of TAMT and approximately ten nautical miles from the harbor entrance. The terminal is located at the end of Bay Marina Drive in the City of National City. It covers 125 acres and houses eight berths. Automobile imports, lumber, and domestic goods are the primary cargos currently moving through NCMT.

Figure 2.8: National City Marine Terminal, 2020



Goods move in and out of the Port by road or by rail. TAMT and NCMT both have on site rail. TAMT rail assets are owned and maintained by the Port of San Diego, rail assets at NCMT are owned by the Port of San Diego but maintained by BNSF Railway. All rail services to and from the two terminals are operated by BNSF Railway.

SR 15/I-15 and I-5 are in close proximity of the TAMT and NCMT. SR 54 and SR 94 are also near the Port but are rarely used as long-haul trucking routes. Harbor Drive provides the first and last mile roadway access to the terminals. SANDAG, Caltrans, the City of San Diego, the City of National City, and the Port of San Diego work closely to manage Harbor Drive and make improvements to benefit the community through emissions and congestion reduction, while also supporting the efficient movement of goods and people. In October 2020, SANDAG signed a *“Memorandum of understanding between the San Diego Unified Port District, the San Diego Association of Governments, and the California Department of Transportation regarding cooperative work on improving accessibility, sustainability, and economic vitality to the Port of San Diego’s working waterfront without compromising the health of local communities.”* The purpose of the MOU is to facilitate collaboration on projects, such as “Harbor Drive 2.0”, and regional plans, such as the *San Diego Forward: the 2021 Regional Plan* and the *South Bay to Sorrento Comprehensive Multimodal Corridor Plan*. These efforts include integrating Harbor Drive and the Port terminals into regional ITS systems, reorganizing right-of-way to provide some dedicated truck and transit lanes along Harbor Drive and working with the U.S. Navy to advance the Vesta Bridge concept to reduce local traffic congestion.

2.1.4.2 Marine Highway – 5 (M-5)

In 2014, the West Coast Corridor Coalition sponsored a study of Marine Highway – 5 (M-5) to determine the market and operational feasibility of short-sea shipping between multiple pairs of West Coast ports, including the following:

- Port of San Diego → San-Pedro Bay
- Ports (Ports of Los Angeles and Long Beach)
- San-Pedro Bay Ports (Ports of Los Angeles and Long Beach) → Port of Hueneme
- Port of Oakland → Port of Redwood City
- San-Pedro Bay Ports (Ports of Los Angeles and Long Beach) → Port of Oakland
- San-Pedro Bay Ports → Pacific Northwest Ports (Ports of Seattle and Tacoma)
- Port of Humboldt Bay → Port of Crescent City
- Port of Oakland → Pacific Northwest Ports

The plan also identified the following key challenges to implementing this type of service:

- Shortage of efficient, right-sized vessels eligible to transport U.S. domestic cargoes
- Shortage of credible market data to identify cargoes available for Marine Highway services
- Lack of maritime entrepreneurs willing to take the risk of starting up a new service

Preliminary discussions regarding a barge service from Seattle to Portland occurred in 2018, and that same year, the Port of San Diego also received some interest from barge operators to provide a short-sea shipping alternative. These discussions culminated with Caltrans, Port of San Diego, and the Port of Bellingham (WA) submitting an application to MARAD for a project in January 2021. In August 2021, the designation of the West Coast Marine Highway 5 (M-5) Coastal Connector was approved. The service could support lumber, automobiles to/from Hawaii, and repositioning of empty containers from San Diego to southern Oregon for U.S. agricultural exports.

2.1.4.3 Recently Implemented and Planned Improvements

The TIGER grant funded TAMT Modernization Project, completed in 2020, included rail improvements, upgraded pavement, and improved lighting¹⁹. The NCMT Optimization Study (September 2015) identified the following improvements:

- Reactivation of the BNSF National City Rail Yard and addition of a connector to the loop track.

¹⁹ TAMT Modernization Project Status Summary Report, August 2018. <https://www.portofsandiego.org/sites/default/files/media/resources/2018/08/TIGER%20Modernization%20Project%20Status%20Report%20-%20August%202018.pdf>.

- Expansion of the National City Logistics Park.
- Expansion of Wharf/Quay Streets.
- Implementation of new Centralized Gate complex to accommodate the development of a new Intermodal Rail Terminal (IRT). The IRT will require the closure of Bay Marina Drive and provide new access and egress from I-5 and Harbor Blvd at Civic Center Drive.²⁰

2.1.4.4 Gaps in Existing Seaport Infrastructure

The San Diego Unified Port District is currently finalizing the Port Master Plan Update. The Revised Draft Port Master Plan Update (October 2020) identifies several policies that support the goods movement industry. Supporting plans and studies, including the NCMT Tank Farm Final EIR (August 2016), TAMT Redevelopment Plan EIR (December 2016), South Harbor Drive Multimodal Corridor Study (January 2020), and draft Maritime Clean Air Strategy (April 2021) address gaps in the current infrastructure and identify the following goods movement improvements:

- Port electrification for shorepower, electric cargo handling equipment, and zero-emission trucks;
- Truck queueing management to improve efficiency;
- Off-peak dedicated lanes that segregate trucks from other vehicles to increase safety;
- Separated dedicated truck lanes that can also be used for transit and military vehicles;
- Freight Signal Priority to prioritize movement of freight vehicles;
- Gate Operating System to manage the flow through the terminals' gates;
- Geofencing that monitors the location and path of freight vehicles and can incentivize trucks to follow designated or alternative freight routes;²¹
- Parking garages near NCMT for additional storage;
- Connector rail tracks;
- Additional tracks for storing tri-level rail cars; and,
- Truck parking.

2.1.5 Airport Infrastructure

The Gateway Region's airport infrastructure is somewhat limited with a single cargo airport in San Diego County and Imperial County respectively. With the rise in e-commerce experienced since 2016 and exacerbated by the desire to have goods delivered in one's home during the COVID-19 pandemic, air freight tonnage has

²⁰ NCMT Optimization Report, September 2015.
https://www.portofsandiego.org/sites/default/files/media/resources/2018/02/Vickerman_NCMT_Optimization_Report_September2016.pdf.

²¹ Revised Draft Port Master Plan Update, October 2020.
<https://pantheonstorage.blob.core.windows.net/waterfront-development/Revised-Draft-Port-Master-Plan-Update-10-2020.pdf>.

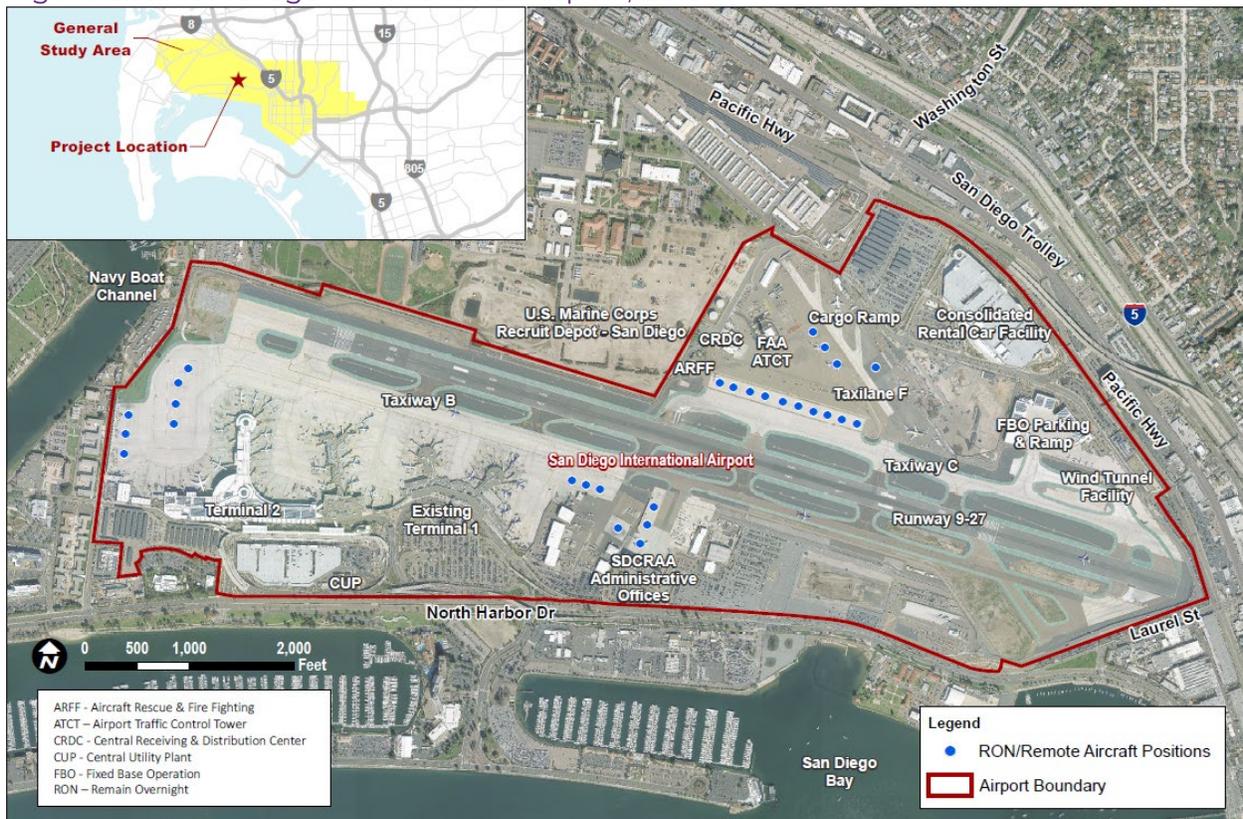
increased. This increase paired with the constraints of the San Diego International Airport may spur the need for improvements and increased issues such as:

- New technology platforms that employ solutions, such as blockchain, will improve the ease of streamlining online consumer orders across an omni-channel supply chain.
- Growth in air cargo from e-commerce will generate more truck trips to/from the air cargo terminals.
- Access to and from air cargo facilities will become a critical first/last mile issue for many airports in California.

2.1.5.1 Existing Airport Infrastructure

The San Diego International Airport, formerly known as Lindbergh Field, is located in the northwest portion of the downtown area, within the City of San Diego. The airport is bounded by North Harbor Drive and San Diego Bay to the south, the Navy water channel and Liberty Station to the west, the Marine Corps Recruit Depot to the north, and Pacific Highway and I-5 to the east. Land in the vicinity of the airport is densely developed and has high developable value, making any future airport expansion unlikely. **Figure 2.10** shows an Aerial photograph of the San Diego International Airport facilities.

Figure 2.10: San Diego International Airport, 2016



Source: San Diego International Airport Airfield Improvements and Terminal 1 Replacement Project Draft Environmental Assessment, June 2021

With just 661 acres, the San Diego International Airport is the smallest “major airport” site in the United States. It features a single 9,401-foot-long east-west runway supported by one full-length parallel taxiway on the south, and one partial-length parallel taxiway on the north. It is the busiest single runway commercial airport in the country and is managed by the San Diego County Regional Airport Authority. There are currently two main terminals, serving domestic and international passengers. Most support facilities are located north of the runway. They include general aviation facilities, air cargo facilities, related aviation support facilities and aircraft rescue and firefighting facilities. The most recent Airport Development Plan and associated Final Environmental Impact Report (January 9, 2020) focuses on improvements to the passenger services, including the redevelopment of Terminal 1.²²

The cargo facilities are used by a limited number of operators, including commercial airlines, courier services, cargo handling companies, and the U.S. Postal Service (USPS). The airport handled 167,785.6 tons of cargo and 24,565 tons of mail in 2018. In 2020, the airport handled 143,940.1 tons of cargo.^{23,24} The all-cargo carriers currently operate out of portable trailers next to the north cargo ramp. Cargo is trucked in and out of the airport, with sorting and loading performed offsite. The majority of cargo flights are by the major freight- only (integrated) carriers Federal Express (FedEx) and United Parcel Service (UPS).

Air cargo operational constraints were identified in the SAN 2013 Northside Improvements Environmental Assessment. To address air cargo capacity constraints, the Airport Authority is proposing a new SAN Northside Cargo Development project. The project would include a consolidated warehouse to fully accommodate onsite cargo sorting and staging, as well as expanded apron to accommodate additional cargo aircraft parking.²⁵

Additionally, the Airport Authority opened a new 93,000-square-foot Airline Support Building on North Harbor Drive in 2021, which provides more efficient processing of bulky cargo items shipped in the bellies of passenger jets.²⁶ Approximately 15 percent of SAN’s freight volume is transported as “belly cargo.”

The FAA approved the most recent SAN aviation activity forecast in June 2019. The forecast anticipates that the number of cargo aircraft operations (i.e., takeoffs or landings) will increase by nearly 71 percent by 2050, even with the Airport’s single-runway

²² Airport Development Program accessed March 15, 2021. <https://www.san.org/Airport-ADP>.

²³ San Diego International Airport, Air Traffic Reports, Accessed March 15, 2021. <https://www.san.org/news/air-traffic-reports>.

²⁴ As of July 2019, FedEx no longer reports mail tonnage to the Airport Authority. Mail tonnage for 2020 was estimated using data from 2017, 2018, and the first half of 2019.

²⁵ Final Environmental Assessment, Northside Improvements San Diego International Airport Master Plan, 2013. https://www.san.org/DesktopModules/Bring2mind/DMX/API/Entries/Download?EntryId=4005&Command=Core_Download&language=en-US&PortalId=0&TabId=183.

²⁶ San Diego County Regional Airport Authority Celebrates Airline Support Building Completion, 2021. <https://www.san.org/news/news-detail/san-diego-county-regional-airport-authority-celebrates-airline-support-building-completion>.

configuration. The forecast increase in tonnage over the same period is 74 percent.²⁷ Planned facility improvements will enable the airport to accommodate both air cargo and passenger demand within its maximum annual service volume.

Regional access to the airport is provided by I-5 and I-8 (interstate access is in close proximity to the airport, but there is no direct freeway access to or from the airport). Remaining airport traffic accesses the airport via local streets, North Harbor Drive, Pacific Highway, and Kettner Boulevard. I-5 runs adjacent to the north side of the airport and access to and from I-5 is provided from Grape and Hawthorne streets to the south and Laurel/India Streets, Pacific Highway, and Washington Street to the north. I-5 provides access to the local streets that bound the airport: North Harbor Drive to the south, which provides access to the terminal facilities, Pacific Highway to the northeast, which provides access to facilities in the north, and Rosecrans Street to the west.

2.1.5.2 Gaps in Existing Airport Infrastructure

Constrained by its urban core location, the San Diego International Airport faces many challenges to providing adequate goods movement through the region. Air cargo capacity used in this analysis is based on the Destination Lindbergh Study which identifies the following deficiencies:

- San Diego International Airport has a unique runway that accommodates both passenger and cargo services; passenger demand is likely to command the most capacity and will soon reach the limits of the single runway
- Limited warehousing space: UPS, USPS, and DHL all currently sort cargo off site, and FedEx sorts of cargo onsite at the terminal

The inherently constrained footprint of San Diego International Airport is contributing to air cargo deficiencies.

SANDAG is exploring creation of a future Central Mobility Hub (CMH) including sites at the Navy's Old Town Campus and the Intermodal Transportation Center, which is located on the north side of the airport, adjacent to Washington Street. The CMH would provide improved transit connectivity with a quick and comfortable ride directly to the airport terminals; bring together local, regional, and interregional transit services; as well as incorporate efficient freeway access and convenient pick-up and drop-off facilities.

2.1.6 Warehousing Infrastructure

San Diego County has three major districts that house significant warehousing facilities: Miramar–Sorrento Mesa, the Port District, and the Otay Mesa area. There are numerous other light industrial and commercial zones spread throughout the region that are microcosms of the larger major districts and that require truck service. Of the three major

²⁷ Draft Environmental Assessment: San Diego International Airport Airfield Improvements and Terminal 1 Replacement Project, June 2021. <https://www.san.org/Airport-Projects/Environmental-Affairs#1245341-draft-environmental-assessment>.

locations, two are directly served by rail (Miramar and the Port District) although the service is limited and direct connectivity is an issue to the Port of San Diego at the TAMT.

TAMT has 300,000 square feet of refrigeration and cold storage facilities. The terminal also has roughly 32.5 acres of open-air storage, which are currently occupied by Dole Fresh Fruit Company. NCMT has 174 acres of open-air storage for lumber and automobiles. It also has over 800,000 square feet of storage for dry and refrigerated cargos.

The Otay Mesa area is rapidly changing with development of both industrial and residential uses in the area. The development of the Otay Mesa East POE, improvements at Brown Field airport, the addition of the Cross Border Xpress (CBX) and the relatively unimpeded development of warehousing uses are expected to support the vision of Otay Mesa as a major employment center in the Gateway Region. The current tenants of the Otay Mesa area, which include Amazon, Bose, Panasonic, Sharp, General Dynamics, Honeywell, Tyson, and Johnson & Johnson, will help to spur increased demand of warehousing and cross-border movement of goods.^{28,29}

The Otay Mesa area has bonded warehouses and Foreign-Trade Zone warehouses that permit in- bond merchandise (i.e., merchandise considered to be under Customs jurisdiction because it has not entered U.S. commerce) to be stored, transferred, manipulated, and/or destroyed. These bonded facilities are closely tied to the maquiladora (or twin-plant) industry in Mexico. Trucks originating from—or destined for—the Otay Mesa border area move materials, intermediate goods, and finished products between assembly and advanced manufacturing plants in Mexico and storage or repackaging facilities in the San Diego region as well as to destinations outside of the County.

The Otay Mesa industrial submarket continues to densify due to growth in international trade with Mexico, the U.S.' top trading partner. The images below show the growth in industrial facilities that continues to fill in vacancies near the Otay Mesa and Otay Mesa East POEs on the both the U.S. and Mexican sides of the border.

²⁸ "Building Boom is Transforming Otay Mesa Into Economic Engine," LA Times, September 23, 2019. <https://www.latimes.com/california/story/2019-09-23/building-boom-is-transforming-otay-mesa-into-economic-engine>.

²⁹ "Amazon Facility in Otay Mesa Eyes Summer Completion," San Diego Union Tribune, February 12, 2021. <https://www.sandiegouniontribune.com/business/story/2021-02-12/amazon-facility-in-otay-mesa-eyes-summer-completion>.

Figure 2.11: Otay Mesa and Future Otay Mesa East Ports of Entry, 2020



Figure 2.12: Industrial Development in Tijuana near Otay Mesa Port of Entry



Source: Tijuana Economic Development Council

2.1.7 Pipeline System

There are two pipelines in San Diego, the Kinder Morgan Santa Fe Pacific Pipeline, L.P. (formerly SFPP, LP) for gasoline and aviation fuel, and the WestPac Pipelines, LLL, (formerly Buckeye Petroleum) pipeline for aviation fuel.

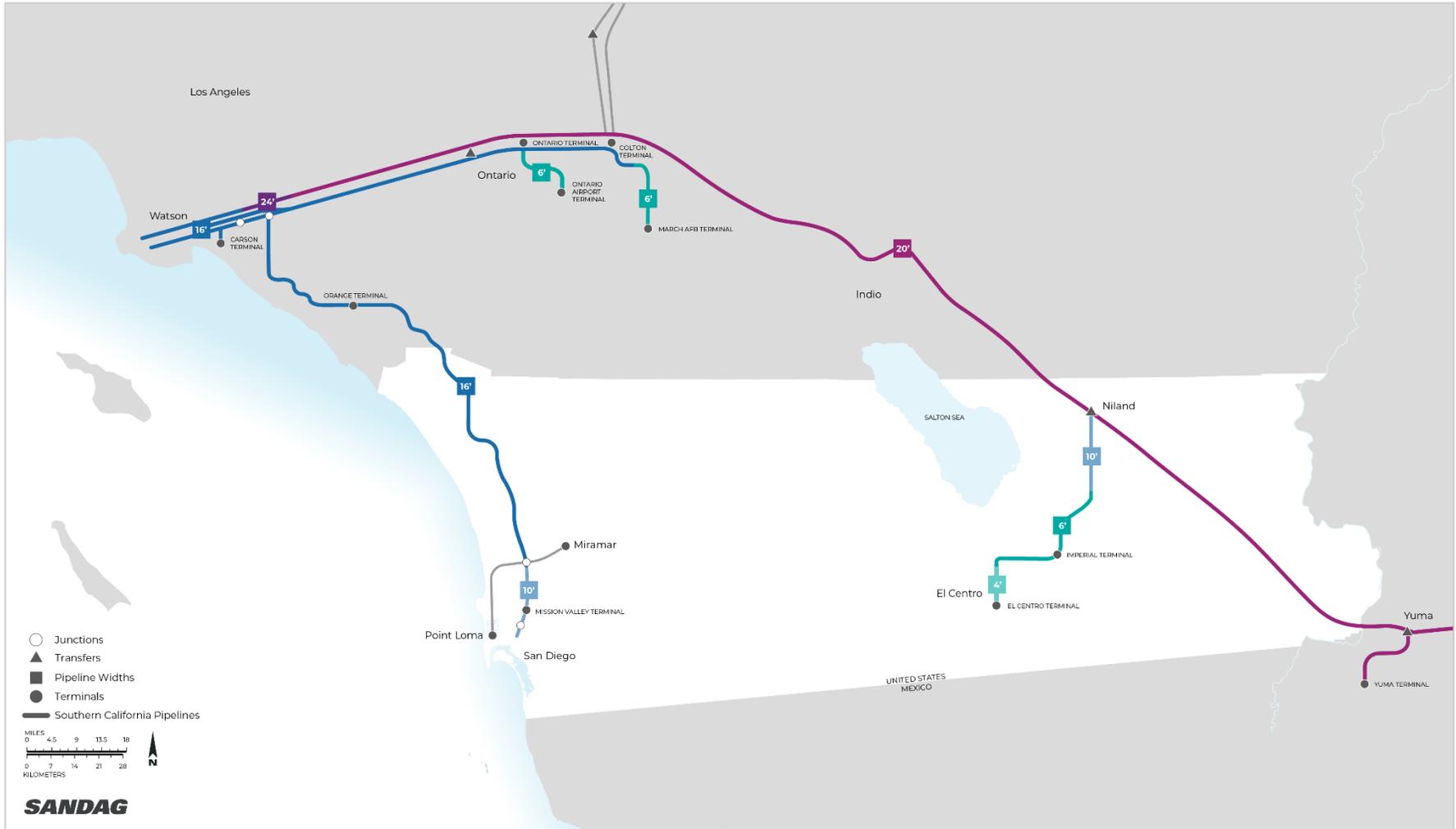
The Kinder-Morgan pipeline system (in **Figure 2.13**) extends south from the Los Angeles Basin through Orange County into San Diego, and also extends into Imperial County to serve the Naval Air Facility in El Centro.

The major Kinder-Morgan terminals are located in Mission Valley (which supplies the majority of the gasoline for San Diego County) and Imperial County. These terminals are the facilities where gasoline is blended and then loaded onto trucks for final distribution to service stations. The pipeline extends to central San Diego to supply the Chevron and Tesoro Logistics distribution terminals.

The 4.3-mile WestPac pipeline system extends from the TAMT to San Diego International Airport and supplies aviation fuel for the airport. WestPac has a sublease from the Jankovich Company, and it receives aviation fuel from the Kinder-Morgan pipeline.

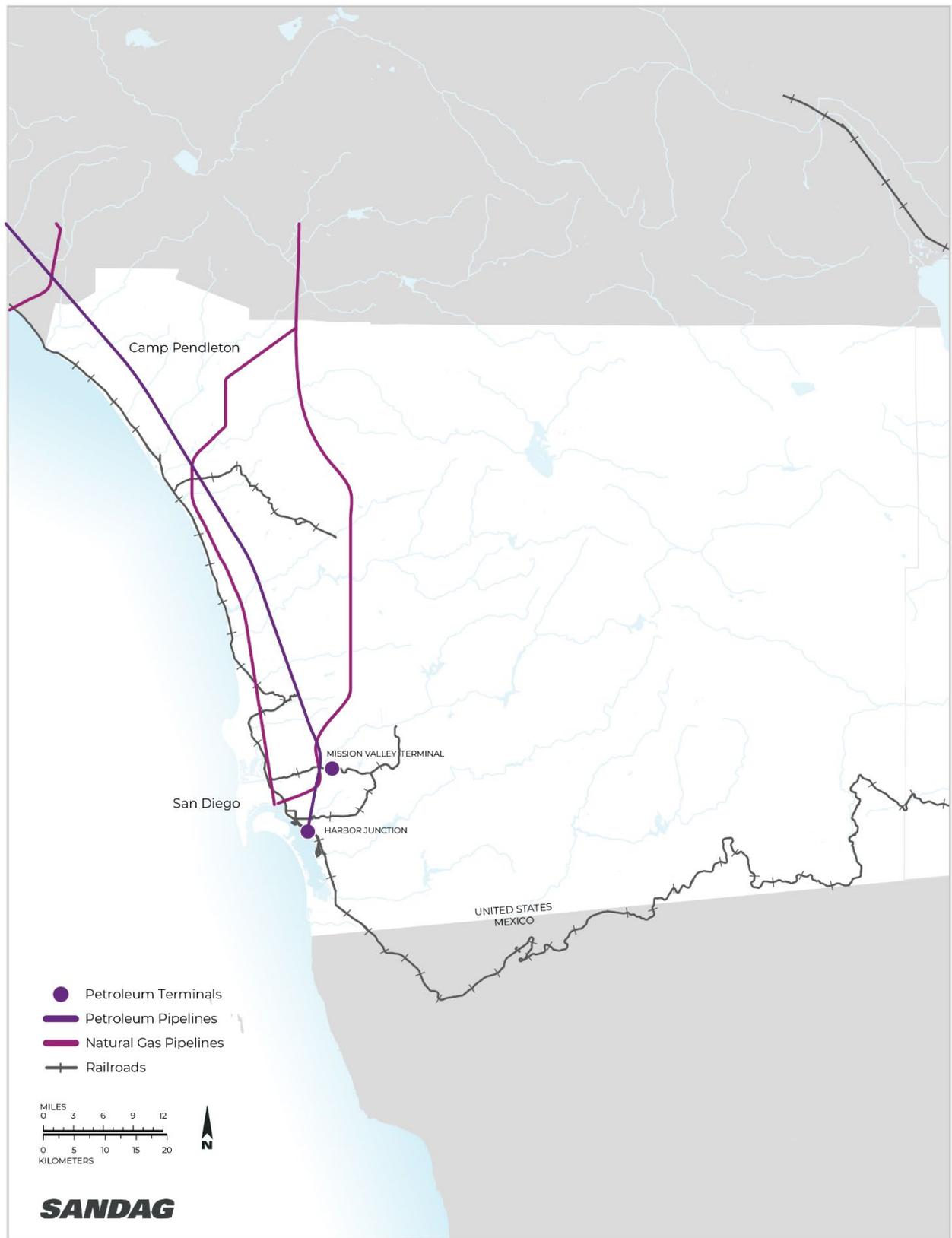
A 50-mile natural gas replacement, being completed by SDG&E, runs along the I-15 corridor from Rainbow in northern San Diego County and terminates just north of the I-15 interchange with I-8.

Figure 2.13: Kinder Morgan Pipeline System in Southern California (2021)



Source: Kinder Morgan Santa Fe Pacific Pipeline, L.P., 2021

Figure 2.14: Pipeline System in San Diego County



2.2 Imperial County Freight Infrastructure

2.2.1 Land Ports of Entry

The Imperial County freight highway network provides an interregional connection for shipping and logistics that handles over 90 percent of total commodity flows across the County. The Imperial freight highway system facilitates the movement of goods from the international border with Mexico, including agricultural products from Imperial County through to Coachella Valley in Riverside County with connections west to the Los Angeles/Long Beach Seaports and other key distribution centers throughout California. Imperial County has a well-developed roadway network which serves interregional, intraregional, and interstate travel for autos, commercial vehicles and recreational vehicles along I-8. Recent infrastructure improvements at the Mexicali POE support trade through this important gateway; however, additional improvements will be needed in the future to support projected growth in population and foreign trade. The County is connected to Mexico through three (land) POEs: Calexico West, Calexico East, and Andrade.

2.2.1.1 Calexico West/Mexicali Port of Entry

The Calexico West/Mexicali I POE is located in the City of Calexico and is the primary port for daily person crossings into the United States by car or as pedestrians. This POE is the third busiest border crossing in California with nearly 5 million northbound vehicles and 3.7 million northbound pedestrians crossing in 2019, and it is the critical economic engine for Imperial and Mexicali region.

The Calexico West POE is the main border crossing for farmworkers linking the agricultural industry in Imperial Valley (California) to the state of Baja California, Mexico. Additionally, the Calexico West POE serves as the only railroad crossing for imports and exports in Imperial County. Union Pacific Railroad (UPRR) operates on both sides of the border and owns the right of way on the US side of the POE.

An additional request of \$99.7 million was proposed in the President's Fiscal Year 2021 budget request to Congress for the final Calexico West POE Phase 2B construction of a new pedestrian processing building with an expanded number of northbound pedestrian inspection lanes, demolition of legacy facilities and significant earthwork. This builds up on the \$98 million Phase I improvements of the Calexico West POE Modernization and Expansion Project that constructed 10 northbound vehicle inspection lanes, the headhouse, and a bridge for southbound vehicular traffic. The planned replacement of the POE will be completed upon appropriation of additional dollars.

2.2.1.2 Calexico East/Mexicali II Port of Entry

The Calexico East/Mexicali II POE is a passenger and commercial port located seven miles east of the Calexico West POE. The Calexico East port is the principal gateway for trade by truck through Imperial County and Baja California, Mexico. It is located roughly 130 miles east of San Diego and 60 miles west of Yuma, Arizona. The port includes eight passenger

lanes, four pedestrian lanes, three commercial lanes, one FAST lane, one bus lane, one SENTRI lane, and one Ready lane that requires users to present Radio Frequency Identification (RFID) enabled cards. The FAST program allows U.S./Canada and U.S./Mexico partnering importers expedited release for qualifying commercial shipments. SENTRI cards are Western Hemisphere Travel Initiative (WHTI) compliant documents for entry into the United States by land or sea, and also provide expedited travel to approved members between the United States and Mexico Border. The Calexico East/Mexicali II POE is served by California SR 7, with direct connection to Interstate 8, about five miles to the north. Mexico is California's highest ranking trade partner and Imperial County processes an estimated 30 percent of this trade through Calexico East. In 2019, the Calexico East POE accommodated over 389,000 northbound trucks, transporting goods valued at \$17.2 billion (\$6.5 billion in exports and \$10.7 billion in imports).

The Calexico East Port of Entry Bridge Widening Project will add two new northbound truck lanes, two new northbound regular vehicle lanes, and improve the northbound pedestrian walkway. This design-build construction project kicks off in 2021 with an estimated completion in late 2022.

2.2.2 Roadway Network

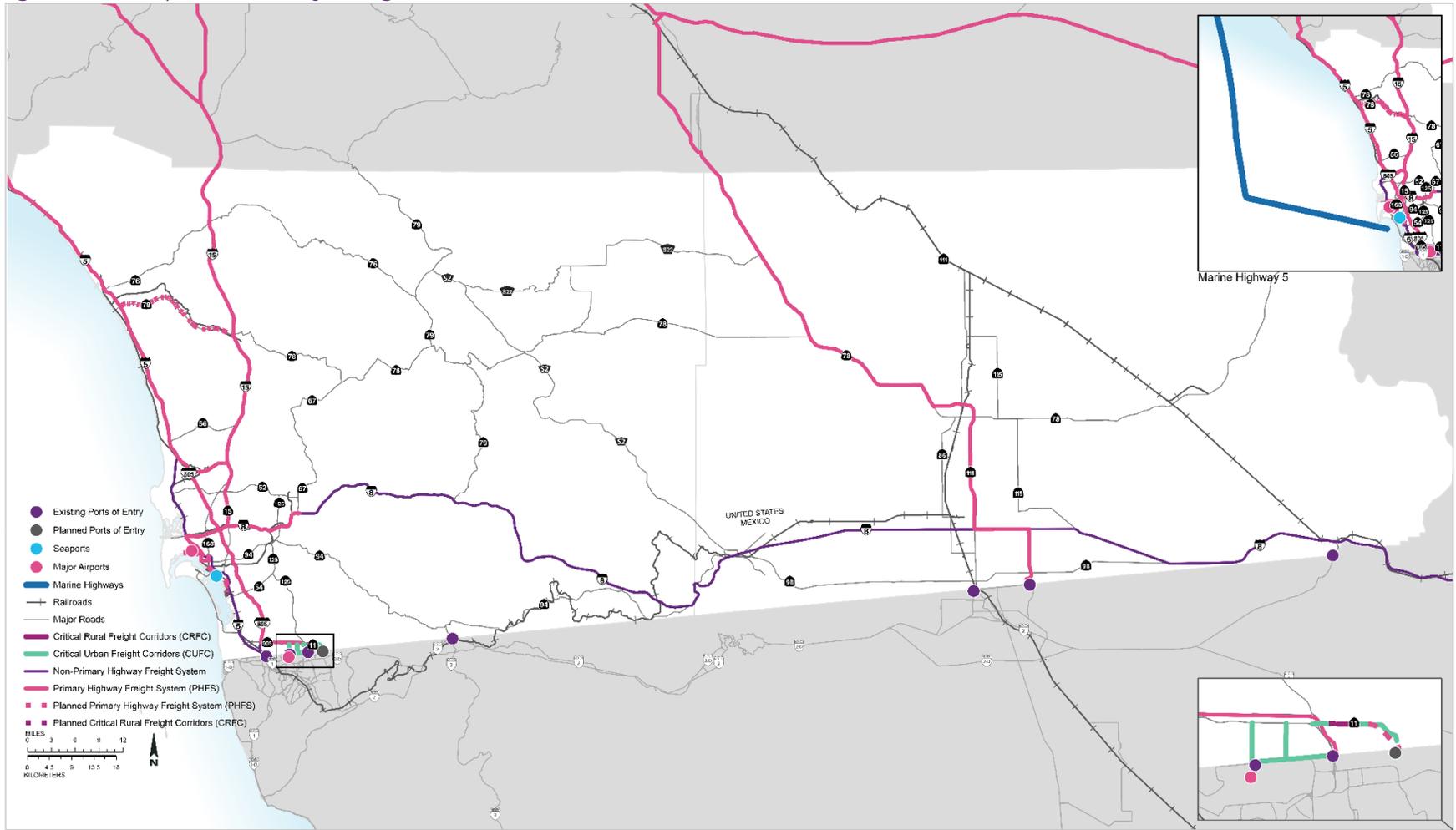
In 2020, over \$6.9 billion in goods were moved by trucks crossing through the international border with Mexico.³⁰

There are four major north-south corridors handling freight within the County: Forrester Road, from I-8 to SR 78/86 in Westmorland; SR 7 from the Calexico East POE to I-8; SR 111 from SR 98 to SR 86 in Riverside County; and SR 86 (portions of which have been relinquished), from SR 111 to Riverside County where it connects with I- 10. Additionally, there are two major east-west corridors for trucks: I- 8, which originates in San Diego County through Imperial to the California/Arizona Border; and SR 98 which parallels I-8 through most of the southern part of the County. Along with the east-west routes of I-8 and SR 98, these highways provide connections to the Calexico East POE which is the primary processor of all commercial truck traffic in Imperial County. These routes carry significant volumes of truck traffic through Imperial County and further north to Riverside and San Bernardino counties.

There are a series of connecting freeways and conventional highways which serve the goods movement industries and multi-billion-dollar agricultural sectors in Imperial County. They are depicted in **Figure 2.15** and outlined below.

³⁰ Bureau of Transportation Statistics.

Figure 2.15: Imperial County Freight Infrastructure



Interstate 8 (I-8) is an east-west interstate freeway facility beginning in San Diego County and extending 172 miles eastward to the California-Arizona State Line near Yuma, Arizona. I-8 continues into Arizona until it intersects with I-10 near Casa Grande, Arizona. Within Imperial County I-8 spans a distance of approximately 79 miles. There are two travel lanes in each direction throughout the Imperial County region. I-8 serves regional, crossborder, and interstate traffic, and provides access to desert recreational areas. The segment on I-8 from Forrester Road to SR 111 is planned to be widened to a six-lane freeway to accommodate increases in both auto and commercial truck traffic.

SR 98 is mostly a two-lane conventional highway, traversing the southern portion of Imperial Valley. The 56.9-mile route follows an east-west alignment through Imperial County parallel to I-8 and the U.S / Mexico International Border. SR 98 serves as an alternate route to I-8 and provides access to many agricultural areas in the southern part of the region. It is also an important component for crossborder traffic. Improvements were recently completed on the section of SR 98 (from Cesar Chavez Boulevard to Ollie Road) and Cesar Chavez Boulevard (from SR 98 to Calexico West POE) to accommodate the increases in traffic as a result of the expansion and renovation of the Calexico West POE. Near SR 111, SR 98 is currently being widened to a six-lane facility between Ollie Avenue and Rockwood Avenue to improve auto access to the newly expanded Calexico West POE and trucks to/from the Calexico East POE. This \$7 million improvement is anticipated to be completed in Spring 2022. In addition, a \$7.3 million pavement rehabilitation project on SR 111 between SR 98 and I-8 was completed in 2020.

Within Imperial County, SR 78 is 81.8 miles in length and extends from the San Diego County line to the north junction of SR 86. SR 78 is predominately a two-lane conventional highway; although the recently completed “Brawley Bypass” is a four-lane conventional/expressway highway and serves to move truck traffic out of the County and to markets in the Inland Empire and beyond to the Los Angeles/Long Beach Seaports. A similar project the “Westmorland Bypass” is proposed to relocate the State Highway to the south of its existing alignment to alleviate conflicts between local traffic in Westmorland and truck traffic passing through the City to various destinations.

SR 86 is a north-south State highway facility serving Imperial and Riverside Counties. SR 86 begins at SR 111 near the U.S./Mexico International Border and extends 90.8 miles northward (roughly parallel to SR 111) along the western shore of the Salton Sea, terminating at Avenue 46 in the City of Indio. This route is currently under study for relinquishment to the various jurisdictions; with the City of Imperial currently involved with final negotiations for relinquishment. As such, the portions of this route within the urbanized areas does not handle extensive interregional truck traffic. However, from the junction of SR 78 (Brawley Bypass) and north, SR 86 serves as a major truck corridor connecting to the Inland Empire and the Seaports of Los Angeles and Long Beach.

SR 111 begins at the U.S./Mexico POE in the City of Calexico and continues north 103.8 miles to I-10 near the City of Indio in Riverside County. From the Calexico West POE to SR 98, SR 111 functions primarily as a city street and provides access to many local

businesses. The existing congestion of this four-lane segment is projected to increase as the number of border crossings grows. North of SR 98, SR 111 is constructed as a four-lane expressway to the intersection at SR 86. North of the SR 111/78 Brawley By-Pass interchange, SR 111 is the original two-lane conventional highway that ultimately connects with I-10 in Riverside County, which provides access to Los Angeles to the west, and Arizona to the east. From SR 98 to I-8, SR 111 has been identified as needing to be widened from four to six lanes with interchanges at three major intersections. This improvement will facilitate the continued increases in goods movement and autos travelling across the U.S./Mexico border.

SR 7 is a north-south route from the Calexico East POE to I-8, covering a distance of approximately 6.7 miles. SR 7 is constructed as a four-lane highway with access control at the Calexico East POE, SR 98 and direct access to I-8. Extension of SR 7 to the intersection with Evan Hewes Highway is a planned improvement for this route.

SR 115 is primarily a north-south route covering a distance of 33.6 miles. SR 115 begins at the junction with Evan Hewes Highway east of Holtville and ends at the junction with SR 111 in Calipatria. It is typically constructed as a two-lane conventional highway. Widening of SR 115 from Evan Hewes Highway north to the junction with SR 78 is expected to accommodate increases in commercial truck traffic in the easterly north/south corridor of the County. A future extension of SR 115 south to I-8 is planned for the future.

SR 186 is a 2.1 mile north-south route from the Andrade POE in the easternmost portion of Imperial County connecting to the interchange with I-8. SR 186 is constructed as a two-lane conventional highway. Potential improvements are identified at the ramp and intersections of the interchanges and the completion of a new bridge structure south of the interchange.

Forrester Road is a key north-south arterial that runs parallel to SR 111 approximately seven miles west of SR 111. It covers approximately 30 miles from SR 98 to SR 78. It is presently constructed as a two-lane facility and is classified as a six-lane expressway in the Imperial County Circulation Element. A significant portion of the traffic on Forrester Road is trucks carrying agricultural products between I-8 and SR 86. A Project Study Report is being conducted by Caltrans and ICTC for the purposes of identifying alternative improvements to Forrester Road, with the ultimate potential improvements being upgraded to State Highway Standards and being incorporated into the State System.

2.2.3 Rail Infrastructure

Imperial County is served by rail connections from Mexico, Riverside County, and Arizona. According to 2019 IHS Market Transearch data, commodity flows by rail account for about 3 percent of total commodity flows in the County. This compares to 2 percent for San Diego County (and about 40 percent nationally).

Union Pacific Railroad (UPRR) owns and operates a line originating at the Calexico border crossing, extending north to El Centro and ultimately connecting with other UPRR tracks at Niland, heading north to Riverside County and southeast to Arizona (Sunset Line). UPRR also owns and operates the section between Plaster City and El Centro. That section is in service and connects with other UPRR lines at El Centro. Finally, MTS owns the rights to operate on a small section of tracks in the western portion of the County between the San Diego County line and Plaster City.

2.2.4 Seaport Infrastructure

Imperial County has no seaport, but the County does export products through the Ports of Los Angeles and Long Beach. Imperial County shippers and importers also utilize the San Diego Unified Port for inbound and outbound cargo shipments.

2.2.5 Airport Infrastructure

Imperial County has a small private passenger airport facility that is not capable of handling large volumes of freight. The Imperial County Airport is currently limited to air courier services such as FedEx and UPS. However, as originally identified in the Imperial County 2013 Long Range Transportation Plan, the County is now considering development of a regional cargo airport southeast of the City of Holtville and south of I-8. Current air cargo services in the County are provided through San Diego or airports in the Los Angeles area such as Los Angeles International Airport.

2.2.6 Warehousing Infrastructure

Imperial County has a number of warehousing facilities north of the Calexico West POE; adjacent to the Calexico East POE; and near the junction of the Union Pacific railroad tracks north of Brawley at Niland.

Trucks originating from and destined for the Calexico area move goods between the Maquiladora and agricultural industries located on both the United States and Mexican sides of the border at Calexico and Mexicali as well as to other destinations within Imperial County. From the warehouses, goods transported by truck to and from other California counties, other US states and international markets via intermodal transfers and the Los Angeles/Long Beach seaports.

Figure 2.16: Calexico West Port of Entry, 2019

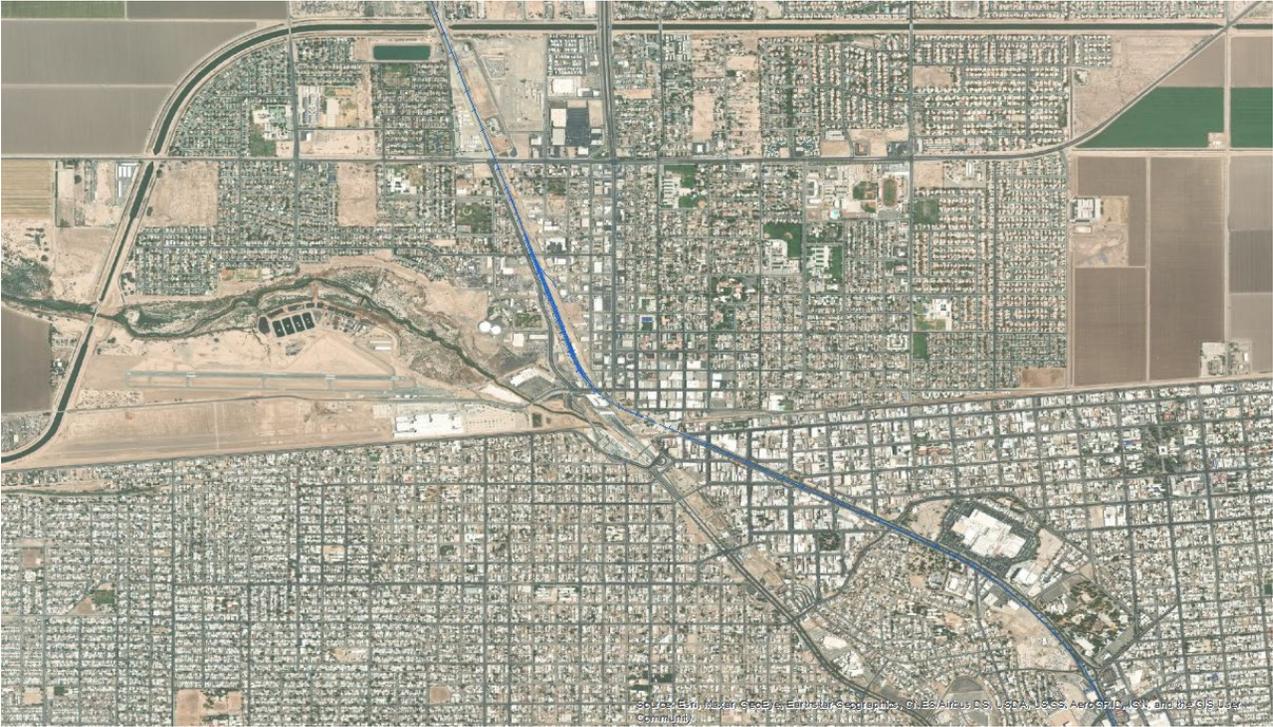


Figure 2.17: Calexico East Port of Entry, 2019



2.2.7 Pipeline Infrastructure

Imperial County has a major petroleum products pipeline extending from the Los Angeles Basin through the County to Yuma, Arizona. The main pipeline consists of a 20" diameter petroleum products pipeline from the Los Angeles Basin to Yuma, Arizona. From this main pipeline, there is also a 10" pipeline which extends southwest from a connection at Niland to a petroleum products terminal at Imperial. This pipeline also has an extension which provides aviation fuel to the El Centro Naval Air Facility. The County's pipeline system is depicted in **Figure 2.18** as part of the Southern California Pipeline System map (repeated from section 2.1 above.)

Figure 2.18: Kinder Morgan Pipeline System in Southern California (2021)

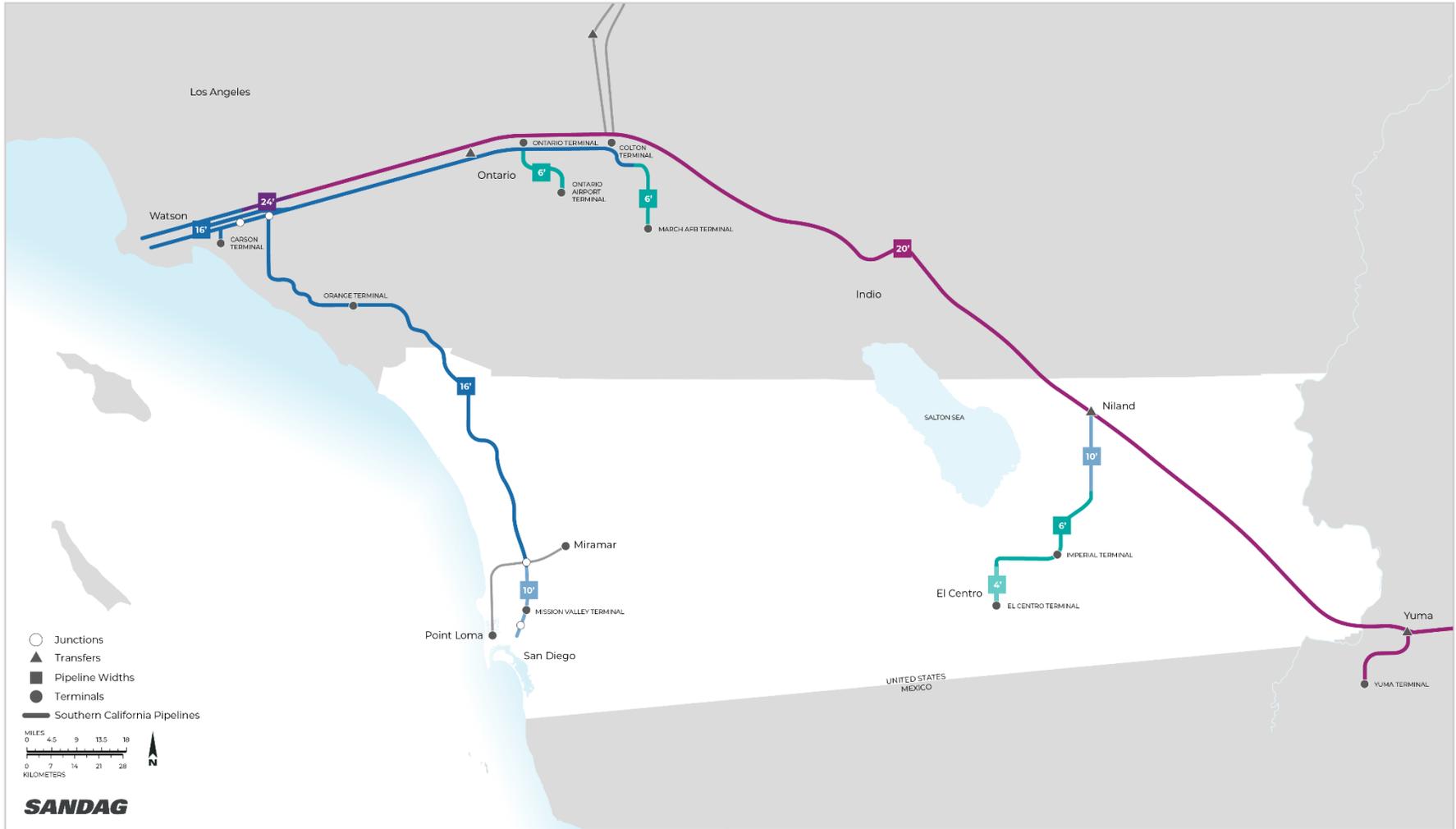
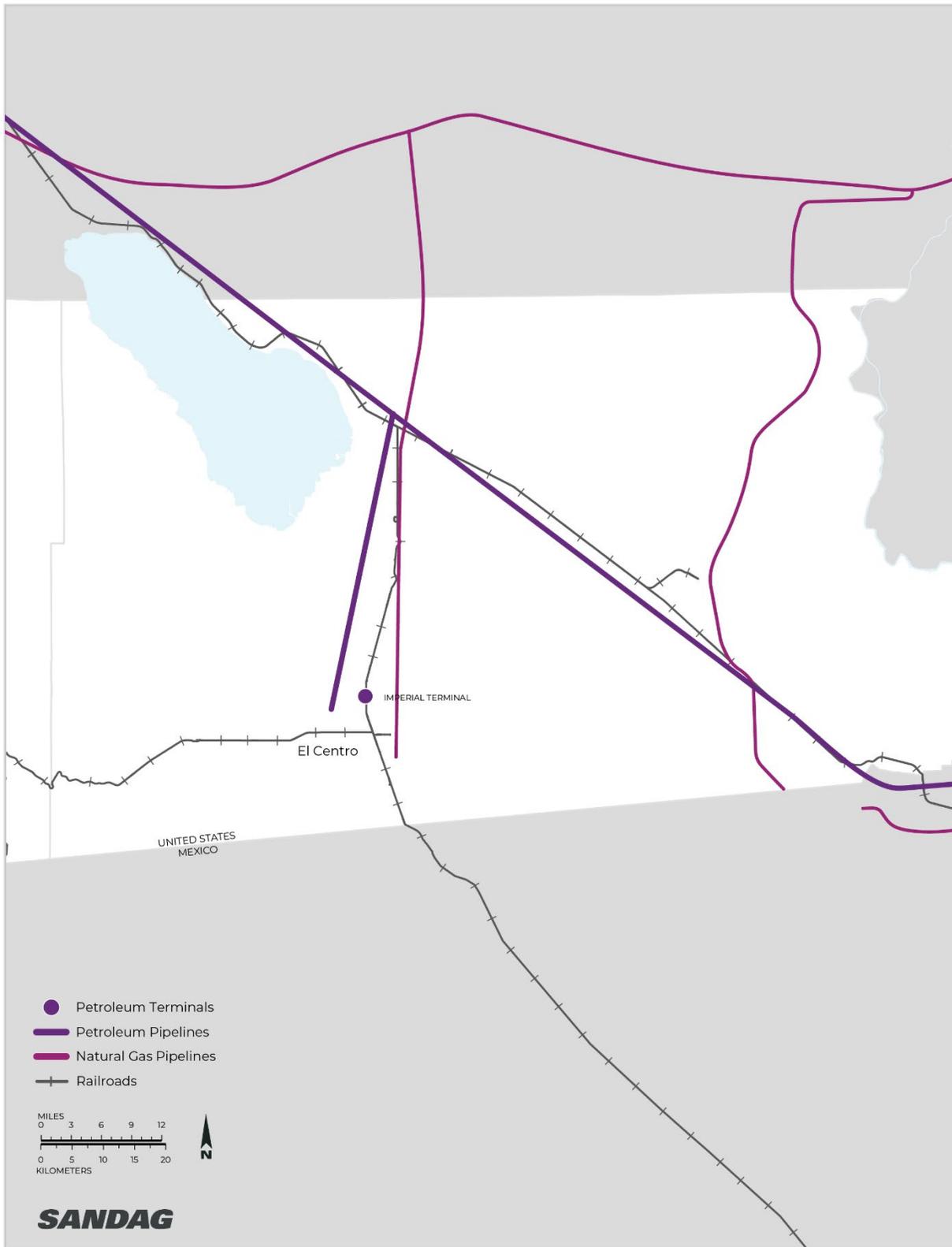


Figure 2.19: Pipeline System in Imperial County



2.3 Baja California Freight Infrastructure

2.3.1 Bi-National Efforts

Freight infrastructure serves the objectives of strengthening service and equipment networks for a competitive economy, providing better conditions for investments and job creation, and promoting economic development in the strategically located border states of California and Baja California.

Cross-border, regional, and interagency cooperation are important for the development and operation of multimodal logistics and transportation infrastructure by the United States and Mexico. The United States-Mexico Joint Working Committee (JWC) and United States-Mexico Binational Bridges and Border Crossings Group (BBBXG) are the primary bi-national efforts between the United States and Mexico to improve efficiency and effectiveness, align priorities of POEs, and facilitate transportation across the international border.

2.3.1.1 U.S.-Mexico Joint Working Committee on Transportation Planning

The U.S.-Mexico Joint Working Committee on Transportation Planning (JWC) facilitates efficient, safe, and economical crossborder transportation movements and cooperates on land transportation planning. The JWC promotes effective communication and coordination, analyzes current and future transportation infrastructure needs, and evaluates transportation demand and infrastructure impacts. The JWC is working with partner agencies to create border-wide regional master plans that encompass comprehensive and prioritized assessment of transportation needs along the border that include land POEs. The group is mostly comprised of transportation professionals from the Federal Highway Administration (FHWA), Mexico's Secretariat of Communications and Transportation (SCT) and includes representatives from the U.S. Department of State, Ministry of Foreign Affairs of Mexico (Secretaría de Relaciones Exteriores-SRE), four U.S. border states departments of transportation, and six Mexico border States. The California-Baja California 2021 Border Master Plan (BMP) update was finalized in February 2021 and will be used to improve binational planning and coordination of projects and programs along the California-Baja California border.

2.3.1.2 U.S.-Mexico Binational Bridges and Border Crossings Group

The U.S.-Mexico Binational Bridges and Border Crossings Group (BBBXG) is a forum for a bi-national effort to manage the planning, construction, and maintenance of planned, ongoing, or new border crossing projects and POEs along the 1,952-mile U.S.-Mexico border. The purpose of BBBXG's semi-annual meetings is to discuss operational matters involving existing and proposed bridges, border crossings, related infrastructure, and to exchange views on policy and technical information. Related issues involving facilitation of travel between the two countries, such as border region highways and other infrastructure projects are also discussed. The BBBXG is co-chaired by the Department of State and SRE in Mexico and is attended by federal agencies with an interest in border crossings. The ten U.S. and Mexican border states are active participants in these meetings.

2.3.1.3 California-Mexico Border Relations Council

The California-Mexico Border Relations Council (CMBRC) was created to fill a need for statewide oversight and coordination of multi-agency involvement with Mexico. As an independent Council, the CMBRC is mandated to: coordinate cross-border programs, initiatives, projects, and partnerships among California state agencies; establish California state agency policies for the collection and sharing of cross-border data; identify and recommend changes in law needed to achieve the goals of the CMBRC; and provide an annual report to the Legislature. The CMBRC has the potential to identify new border priorities and fundable projects in the areas of infrastructure, trade, environment, health, and security while supporting current and ongoing activities such as binational committees, trade missions, border workgroups, and coordination of specific future projects with Mexico.

The California Environmental Protection Agency Secretary chairs the CMBRC. Members include the Secretary of the California Environmental Protection Agency, the Secretary of the California Health and Human Services Agency, the Secretary of the California Transportation Agency, the Secretary of the California Natural Resources Agency, the Secretary of the California Department of Food and Agriculture, the Director of the California Office of Emergency Services, the Director of the California Governor's Office of Business & Economic Development, the Secretary of the Business, Consumer Services, and Housing Agency, and the United States Environment Protection Agency Region 9 (ex-officio member).

2.3.1.4 Borders Committee

In November 2001, the San Diego Association of Governments (SANDAG) Board of Directors authorized the creation of the Borders Committee as a Policy Advisory Committee. The Borders Committee membership consists of representatives from the cities in the San Diego region and the advisory members needed to fulfill its mission.

The Borders Committee provides oversight for planning activities that impact the borders of the San Diego region (Orange, Riverside and Imperial Counties, and the Republic of Mexico) as well as government-to-government relations with tribal nations in San Diego County. The preparation and implementation of SANDAG Binational, Interregional, and Tribal Liaison Planning programs are included under this purview. It advises the SANDAG Board of Directors on major interregional planning policy-level matters. Recommendations of the Committee are forwarded to the Board of Directors for action.

2.3.1.5 Committee on Binational Regional Opportunities

The Committee on Binational Regional Opportunities (COBRO) was formally established in 1996. In 2002, COBRO began serving as a working group to the SANDAG Borders Committee to facilitate a better understanding of binational border-related issues and needs of the California-Baja California region.

COBRO advises the SANDAG Borders Committee concerning both short and long-term binational related activities, issues and actions; provides recommendations regarding

binational border-related planning and development; and identifies ways to assist and coordinate with existing efforts in the binational area. The membership consists of elected officials and staff representatives of academia, business, community organizations, and the Mexican government.

2.3.1.6 Imperial-Mexicali Binational Alliance

The Imperial-Mexicali Binational Alliance (IMBA) seeks to work together on issues pertaining to logistics and international crossings, economic development, and environmental issues in the Imperial-Mexicali border region. The objective of the Alliance is not to replace existing organizations or agencies but instead to increase local participation and cooperation focused on regional growth and development. IMBA is an advisory entity with various goals and objectives. Regarding border infrastructure, IMBA addresses action and information items related to optimizing and expanding capacity at Ports of Entry and collaborating to promote funding opportunities.

For economic development, IMBA seeks to develop a true binational external marketing initiative and implement a twin plant concept promotion campaign. Finally, IMBA addresses the environment by collaborating to improve air quality in the binational region and developing strategies to implement environmental coordination efforts.

2.3.1.7 Unified Cargo Processing

The Unified Cargo Processing (UCP) concept consists of Mexican Customs officers working side by side with their CBP counterparts in the U.S. to jointly inspect and process cargo shipments destined for the United States. Under UCP both CBP and SAT receive advance information from the trade community about the shipments from Mexico to the U.S. This information is reviewed to ensure there are no merchandise admissibility issues.

UCP designated shipments bypass the SAT primary processing in Mexico and enter the dedicated FAST lane on the U.S. side allowing the shipment to proceed unencumbered to CBP primary inspection. All FAST traffic is automatically enrolled to participate in the UCP program.

Under UCP, CBP and SAT Officers usually operate jointly within the same primary inspection booth. While at primary, CBP and SAT officials review the appropriate documentation and determine if the shipment may proceed directly into United States or if further examination is necessary. If no issues exist, the driver and truck are released and the commodity is allowed to enter the commerce of the United States directly.

If an issue is discovered, the shipment is sent for a secondary examination. CBP and SAT conduct joint inspections of all UCP shipments that have been targeted for examination. SAT officials will notify CBP immediately if during their exam they locate any prohibited or restricted merchandise like narcotics, chemical precursors, weapons, munitions, cash or monetary instruments. Once the examination is completed and no issues are identified

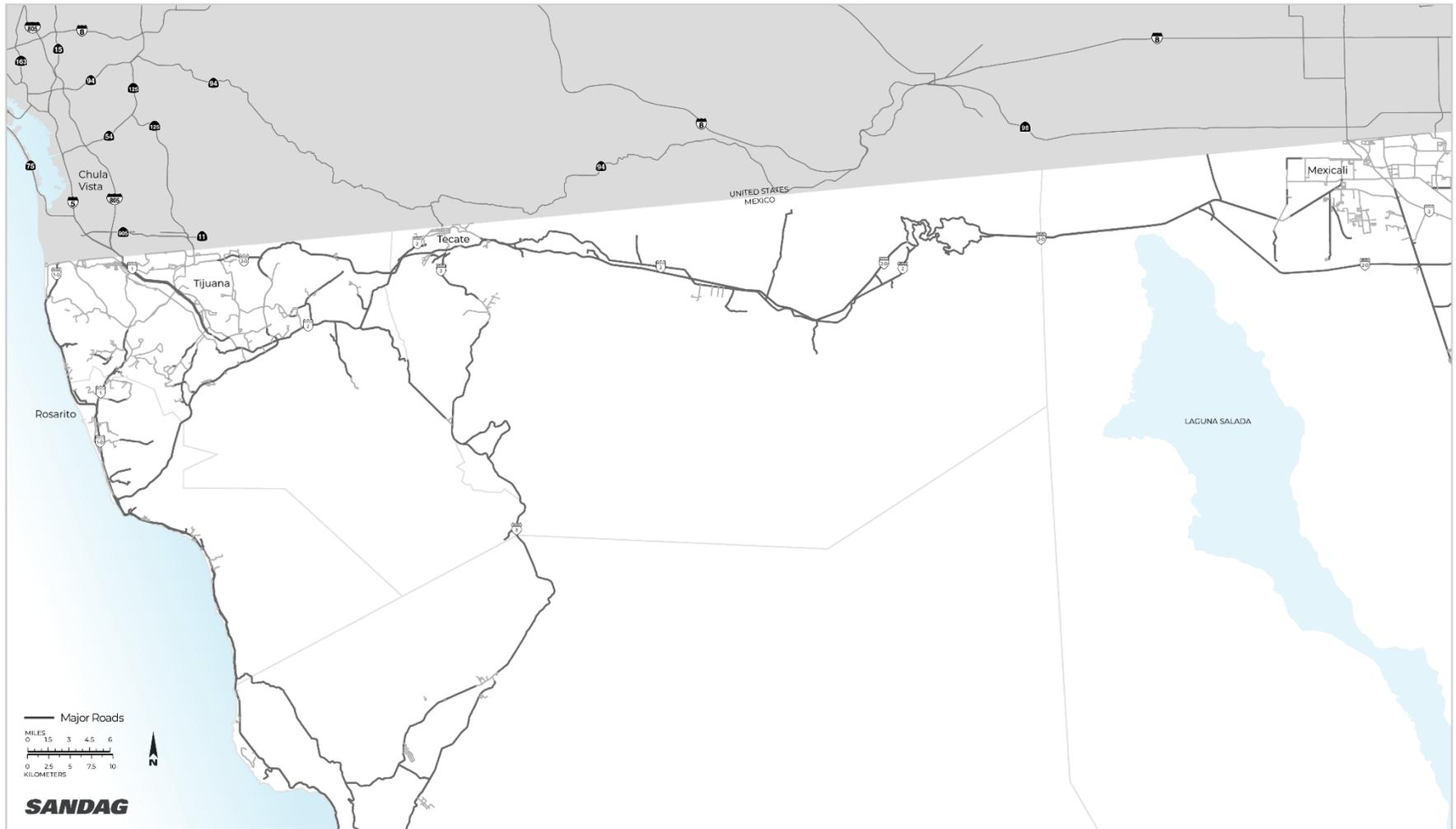
the merchandise is released into the commerce of the United States.³¹ The UCP program is currently operating at Otay Mesa.

2.3.2 Road Network

According to Mexico's Secretariat of Communications and Transportation (SCT), Baja California has approximately 11,000 kilometers (6,836 miles) roads, 2,770 kilometers (1,721 miles) of which are paved, and 15 percent of which are four-lane facilities. Most of the four-lane segments are concentrated in the populated areas of the state's five municipalities (Mexicali, Tecate, Tijuana, Playas de Rosarito, and Ensenada). Major roads are typically managed under either state or federal jurisdiction.

³¹ Unified Cargo Processing (UCP). U.S. Customs and Border Protection, 2017.
<https://www.cbp.gov/newsroom/video-gallery/video-library/unified-cargo-processing-ucp>.

Figure 2.20: Major Roads in Baja California



There are four major highways in the state. Highway 2 stretches east-west and connects the Tijuana, Tecate, and Mexicali POEs along the border with California. From Mexicali, Highway 2 continues east, to San Luis Rio Colorado in Sonora, and the POE there. Highway 1 is a north-south corridor connecting Tijuana with coastal cities and the Port of Ensenada. Highways 3 and 5, also north-south, provide connections to the border crossings at Tecate and Mexicali, respectively.

The current Baja California administration included three major mobility projects in the state plan: the Tijuana-Ensenada bypass, the Tijuana-Rosarito 2000 corridor, and a connection from the Tijuana Airport to Playas de Tijuana. The Tijuana-Ensenada bypass is in the process of securing funding. The 42-km (26-mile) Tijuana-Rosarito corridor improvements were initiated in 2018, restarted in 2020, and continued into 2021 with pavement reconstruction and marking.

The Tijuana Airport-Playas de Tijuana project is planned as an elevated viaduct as part of the national infrastructure program.³²

2.3.3 Rail Infrastructure

There is a total of approximately 220 kilometers (137.5 miles) of rail trackage in Baja California. The state is connected to the U.S. rail network at three separate crossings: one at San Ysidro, one at Division near Tecate, and one at Calexico.

The San Ysidro and Tecate crossings are part of the Tijuana-Tecate Short Line, managed by Baja California Railroad (BJRR), working in collaboration with ADMICARGA, a decentralized entity of the Government of the State of Baja California, which since 1999 has held the concession of the short line by the Federal Government. The 71.48 kilometer (44.42 mile) line connects to the SD&IV line in San Diego County at San Ysidro, and to the non-operating Desert Line leased to Baja Rail, extending from Division to Plaster City in Imperial County.

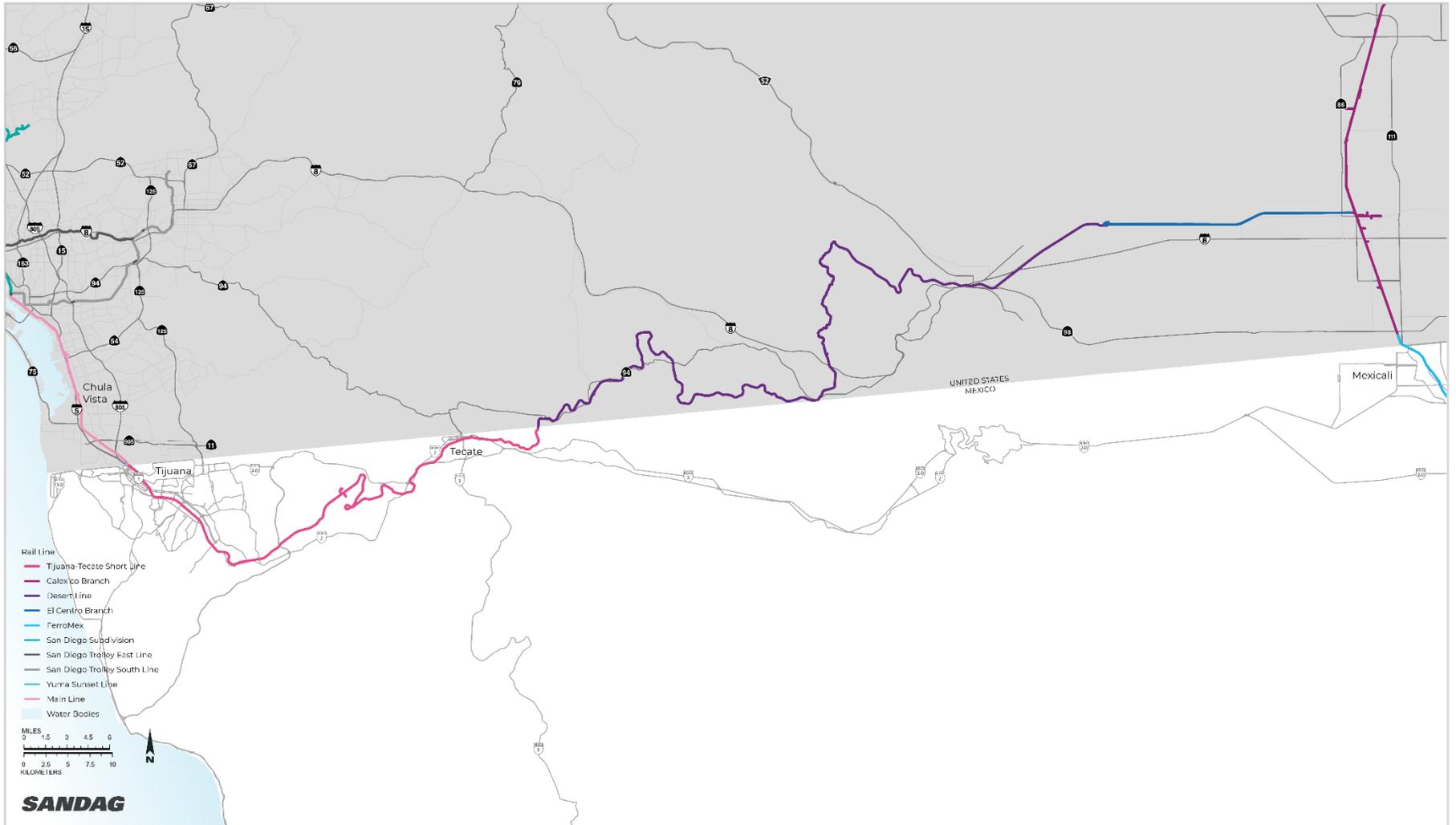
In 2019, ADMICARGA handled 100,000 metric tons of cargo, with 44.1 percent being agricultural products, followed by 18.9 percent of petroleum products.³³

The Calexico/Mexicali rail crossing connects north with Union Pacific Railroad, and in Mexico with Ferromex (FXE), heading southeast out of Mexicali connecting in Benjamin Hill, Sonora to the Nogales-Guadalajara-Mexico City line.

³² Bajo la lupa: los proyectos de infraestructura en Baja California, Bnamericas, July 27, 2020. <https://www.bnamericas.com/es/reportajes/bajo-la-lupa-los-proyectos-de-infraestructura-de-baja-california-en-mexico>.

³³ Anuario Estadístico Ferroviario 2019, Secretaría de Comunicaciones y Transportes. https://www.gob.mx/cms/uploads/attachment/file/574090/Anuario_Estadistico_Ferroviano_2019_2_.pdf.

Figure 2.21: Tijuana – Tecate Short Line



2.3.4 Seaport Infrastructure

Baja California enjoys a strategically important location for seaport infrastructure in Mexico, with a strong focus on tourism (cruise ships) and a secondary focus on commercial cargo shipping including containerized cargo, and dry bulk materials such as limestone, rock, and sand.

Baja California currently has five seaports: Puerto de Ensenada, Puerto El Sauzal de Rodríguez (for cabotage); Puerto de Rosarito (used primarily for PEMEX- related petrochemicals); Puerto Isla de Cedros (an island off of Baja California's coast specializing in mineral exports, primarily salt); and Puerto de San Felipe (used primarily for tourism, personal boating, and fishing).

Figure 2.22: Container Ship at Puerto de Ensenada



Source: Administración Portuaria Integral de Ensenada

Ensenada Port: The port's location is an excellent tourist attraction and has great connectivity for cargo shipments with the Baja California/California border 110 kms (68 miles) away on Highway 1. The port serves more than 1,200 maquiladora factories and more than 1,400 producers and exporters in the region.

The Port of Ensenada has infrastructure and equipment to handle multiple cargo types, including: containerized cargo, grains, oversize cargo, shipyards, cruise vessels, and commercial and sport Fishing. Terminals and facilities at the port include the following:³⁴

- **Shipyards**
 - Astilleros Progreso
 - Grupo Peredia e Hijos
 - Productos Procesados del Puerto

³⁴ Puerto de Ensenada. <https://www.puertoensenada.com.mx/esps/0000147/terminales-e-instalaciones>.

- Gran Península
- Baja Naval
- **Containerized and General Cargo**
 - Multiple use terminal
 - Ensenada’s maritime customs office
 - Transfer dock and Free Trade Zone (Recinto Fiscalizado API Ensenada)
 - Public docks
 - Transportation center
- **Bulk and mineral terminal**
 - CEMEX Terminal
 - Petroleum products terminal
- **Fishing**
 - Pier 240
 - Fueling facility
 - Fish product processing
- **Tourism facilities**
 - Cruise terminal
 - Service center
 - Sport fishing zone
 - Boardwalk

The Port of Ensenada handled 3 million metric tons of cargo in 2019, and 3.28 million metric tons in 2020, a 10 percent increase, despite the Covid-19 impacts. However, tourism was heavily impacted by the pandemic, handling 134, 647 passengers in 2020, compared to 674,459 in 2019, and only 65 vessel arrivals in 2020, down from 270 in 2019.

2.3.5 Airport Infrastructure

Airport infrastructure in Baja California comprises four main airports, only two of which (Tijuana and Mexicali) are currently able to accommodate larger aircraft.³⁵

Figure 2.23: Tijuana – General Abelardo L. Rodriguez International Airport (TIJ)



Source: Grupo Aeroportuario del Pacifico

Tijuana – General Abelardo L. Rodriguez International Airport (TIJ): the largest and busiest of Baja California's airports, TIJ is located in the Mesa de Otay region of Tijuana, directly across the border from San Diego. The airport covers an area exceeding 900 acres, with a main terminal of approximately 230,000 square feet, including 23 gates and 169 commercial spaces. TIJ's runway is 9,711 feet long, making it the largest runway in the region after Miramar. In 2019, TIJ handled 48,335 aircraft movements and approximately 8.9 million passengers, up 29 percent from 2018 figures.³⁶ In addition, 30,707 tons of cargo were handled in 2019.³⁷

In 2018, a new Air Cargo and Logistics Park (Matrix) was developed adjacent to the Tijuana Airport. This facility serves air cargo companies such as FedEx, UPS, DHL, Aeromexico and

³⁵ In addition to these four airports, there are also 86 smaller, less-used, and/or more-informal airstrips distributed across the state. These air strips are used by local residents, farmers, tourists, or the military (given limited road infrastructure and low density in Baja California's rural areas).

³⁶ Data from Grupo Aeroportuario del Pacifico. <https://www.aeropuertosgap.com.mx/es/reporte-de-traffic-gap.html>.

³⁷ Cámara Nacional de Aerotransportes. <http://canaero.org.mx/dashboard-aeropuertos/ranking-de-aeropuertos-nacionales/>.

Volaris Cargo, and includes on-site Mexican customs authorities, a bonded warehouse, office space for freight forwarders, customs agents, banking services, and the Mexican Postal Service.

The Cross Border Xpress (CBX) provides a transit link between the Tijuana International Airport and San Diego. In 2019, the CBX handled 2.9 million passengers, up 41 percent from 2018 figures.

Mexicali – General Rodolfo Sanchez Taboada International Airport (MXL): located approximately three miles south of the border with the United States, MXL is designated as an international airport, but is only served by three Mexican airlines (with, occasionally, international charter flights and some crossborder general aviation). The entire airport property is approximately 1,400 acres, but only a small portion of this area is occupied by airport facilities (the main terminal is approximately 50,000 square feet). MXL's runway is 8,530 feet. In 2019, the airport handled 12,450 operations, approximately 1.2 million passengers,³⁸ and approximately 2,100 tons of cargo (all domestic).

San Felipe – San Felipe International Airport (SFH): significantly smaller than the other two airports, SFH operates during limited hours (generally during daylight) and is used for general aviation and charter flights. It has an asphalt runway that is 4,850 feet long.

Ensenada – Base Aérea El Ciprés (ESE): the airport in Ensenada has been used primarily as a military base for the Mexican Air Force as well as for general aviation (no commercial airline currently serves the airport). Like SFH, it has an "international" designation to allow for incoming flights from the United States to check in with customs and immigration officials. Its runway is 4,892 feet long.

2.3.6 Warehousing Infrastructure

According to the Mexican Association of Private Industrial Parks (AMPIP), there are 45 sites in Baja California (25 in Mexicali, 17 in Tijuana and 3 in Tecate). The following table shows the square footage statistics for Tijuana and Mexicali as of the second quarter of 2019.³⁹

³⁸ Data from Grupo Aeroportuario del Pacífico. <https://www.aeropuertosgap.com.mx/es/reporte-de-traffic-gap.html>.

³⁹ Asociación Mexicana de Parques Industriales Privados AC. <https://www.ampip.org.mx/en/interactive-map>.

Table 2.1: Private Industrial Sites in Tijuana and Mexicali

Private Industrial Sites in Tijuana and Mexicali			
	Inventory¹	Available	Under Construction
Tijuana	6,460.89	324.80	330.50
Mexicali	2,263.27	116.76	34.38

¹ Thousand Square Meters

Source: Asociación Mexicana de Parques Industriales Privados – AMPIP, 2Q 2019

Gateway Region: Freight Flows

Visuals or tables in this section that reference 2020 data reflect data from the period pre-COVID-19 and related economic closures.

3. Gateway Region: Freight Flows

The truck mode dominates overall freight tonnage for both international and domestic flows in the Gateway Region. Public agencies play a key role in understanding the importance of this critical mode for freight and ensuring that adequate highway infrastructure is in place. Railways, pipelines, and oceangoing vessels are other important modes for transporting goods, however, the vast majority of freight in the Gateway region travels by truck. For this reason, this chapter focuses primarily on truck flows with attention to internal-to-the-region freight flows, as well as the highway and rail networks that connect the Gateway region to the rest of the United States and Mexico. Truck corridors are important for the region's connectivity to global supply chains. The Gateway Region freight flow presented in this chapter focus on the importance of truck corridors for both San Diego and Imperial Counties. Tonnages of both domestic and international commodities transported by trucks from, to, or through San Diego and Imperial County are analyzed herein. In addition, this chapter provides the top commodity categories, geography of freight activity, and for cross-border flows, the direction of trade moving through San Diego and Imperial Counties.

This chapter is organized as follows:

- Approach to the analysis and data sources
- Key truck corridors
- Domestic freight flows
- International freight flows
- Air cargo activity

3.1 Approach to the Gateway Region Freight Flow Analysis

The freight flow analysis in this chapter is based on Transearch commodity flow data (a proprietary data source from IHS Markit) and other public sources of freight flow data, by mode of transport, origin and destination of commodities, including international. The adoption of the USMCA trade agreement, replacing NAFTA in July 2020, is incorporated into the economic models which drive the freight flow forecasts. For daily truck volume traffic on major corridors within Imperial County, the SCAG 2020 RTP/SCS adopted model was used. For corridors within San Diego County, the SANDAG ABM2+ model was utilized to evaluate truck traffic in 2020, 2035 and 2050.⁴⁰

This chapter is an update to the 2016 Freight Gateway Study Update, which had a base year of existing flows from 2012 (following the recovery from the Great Recession of 2008-2009.) There are also other changes to the forecast assumptions compared with the 2015 study, including the growth in e-commerce and the recent history of trade policy changes between the U.S. and other trading partner countries. The forecasts take these influences into account and are reflected overall in the long-term forecasts of stronger growth in U.S.-Mexican trade than in the prior study.

The primary source for the truck flow data at the international border crossings, IHS Markit Transearch, is the same source used to develop the freight forecast. The IHS Markit Transearch baseline year is 2019. IHS Markit also produces the U.S. Department of Transportation's (U.S. DOT) Freight Analysis Framework (FAF) forecasts. The commodity flows in Transearch data are natively the Standard Transportation Commodity Classification (STCC), mapped to the Standard Classification of Transported Goods (SCTG) used by the U.S. Census Bureau Economic Census Commodity Flow Survey. Transport mode for domestic freight and international trade are identified for commodities moving to, from, within, and through the United States. The import and export flows by commodity and mode are detailed by country/region trading partner, including Mexico. The newly-released historic data consistent with published FAF data, is for base year 2017. The version 5.1 of the FAF historical regional data was released on April 16th, 2021 with additional future year forecasts expected to be published in Fall/Winter 2021.

Within San Diego and Imperial Counties, the resulting updated truck corridor flows for the Gateway Region capture the influences of regional industry growth, population, and employment growth and composition of trade growth before and through the pandemic.

Below is a listing of historical data sources used to update truck corridor flows⁴¹:

- U.S. DOT, Federal Highway Administration's Freight Analysis Framework (FAF)

⁴⁰ SANDAG Activity Based Model: ABM2+, Series 14 DS38, 2021 Draft RP Networks.
<https://www.sandag.org/index.asp?subclassid=119&fuseaction=home.subclasshome>.

⁴¹ Additional detail on freight data sources used can be found in Appendix A.

- Data on border crossings and cross-border freight flows from the U.S. Customs and Border Protection and U.S. DOT, Bureau of Transportation Statistics
- Port commodity tonnage data from the U.S. Army Corps of Engineers Waterborne Commerce Statistics
- San Diego International Airport statistics from the San Diego County Regional Airport Authority
- Commodity-specific data sources, including databases maintained by the County Agricultural Commissioners (statistics on agricultural production), the California Department of Resources, Recycling, and Recovery, formerly the California Integrated Waste Management Board (data on waste production from recycling centers and landfills), and pipeline companies
- IHS Markit Transearch modal commodity flow data and forecasts
- Various planning documents previously prepared for and provided by SANDAG

Analysis of the truck corridor flow data also involves input from regional freight stakeholders and subject matter experts, who were consulted during the course of the study.

The IHS Markit Transearch forecast accounts for potential disruptions in supply chains that may result from climate change, extreme weather events, sea level rise, humanitarian crises, or other significant events impacting the Gateway Region's freight infrastructure. Impacts such as increases in the cost of electricity, changes or reductions in petroleum trade due to changing environmental regulations, changing agricultural patterns, and more are considered in the Transearch forecast. However, actual impacts may differ from projected with thoughtful resilience planning. Future efforts should consider critical and redundant supply routes for the production and movement of essential goods within, through, in, and out of the region in the event of a major disruption.

3.2 Overview of Freight Activities and Related Land Use

The interstate and highway corridors in the Gateway region provide critical infrastructure for transporting freight. The regional highway network supports the efficient movement of freight and provides connectivity and access for moving goods to and from industries and consumers in the region. Truck traffic volumes within San Diego and Imperial Counties were obtained from the respected MPO's travel demand model. Major freight clusters are presented based on inventory of establishments obtained from proprietary Data Axle Data base.⁴²

⁴² <https://www.data-axle.com/>

The truck network is made up of the key highway segments, such as the interstates and state routes that trucks use to reach the Region's seaport, airport, railyards, warehouse facilities, and border Ports of Entry. **Figures 3.1** through **3.3** display the existing and future daily truck flows in 2020, 2035, and 2050, respectively. Truck flows on these maps display the combined directional flows on each segment. This data indicates that the Region will experience significant growth in truck flows. Truck flow is expected to grow 32 percent by 2035 and 58 percent by 2050. This growth is spread out across the Gateway Region with the high-flow truck corridors anticipated to maintain their rankings into the future. While these primary roadways carry the most significant volumes of trucks, the locations of truck-generating facilities as displayed in **Figure 3.4**, illustrate the importance of the local roadway network in providing truck access.

Figure 3.1: 2020 Daily Truck Flows

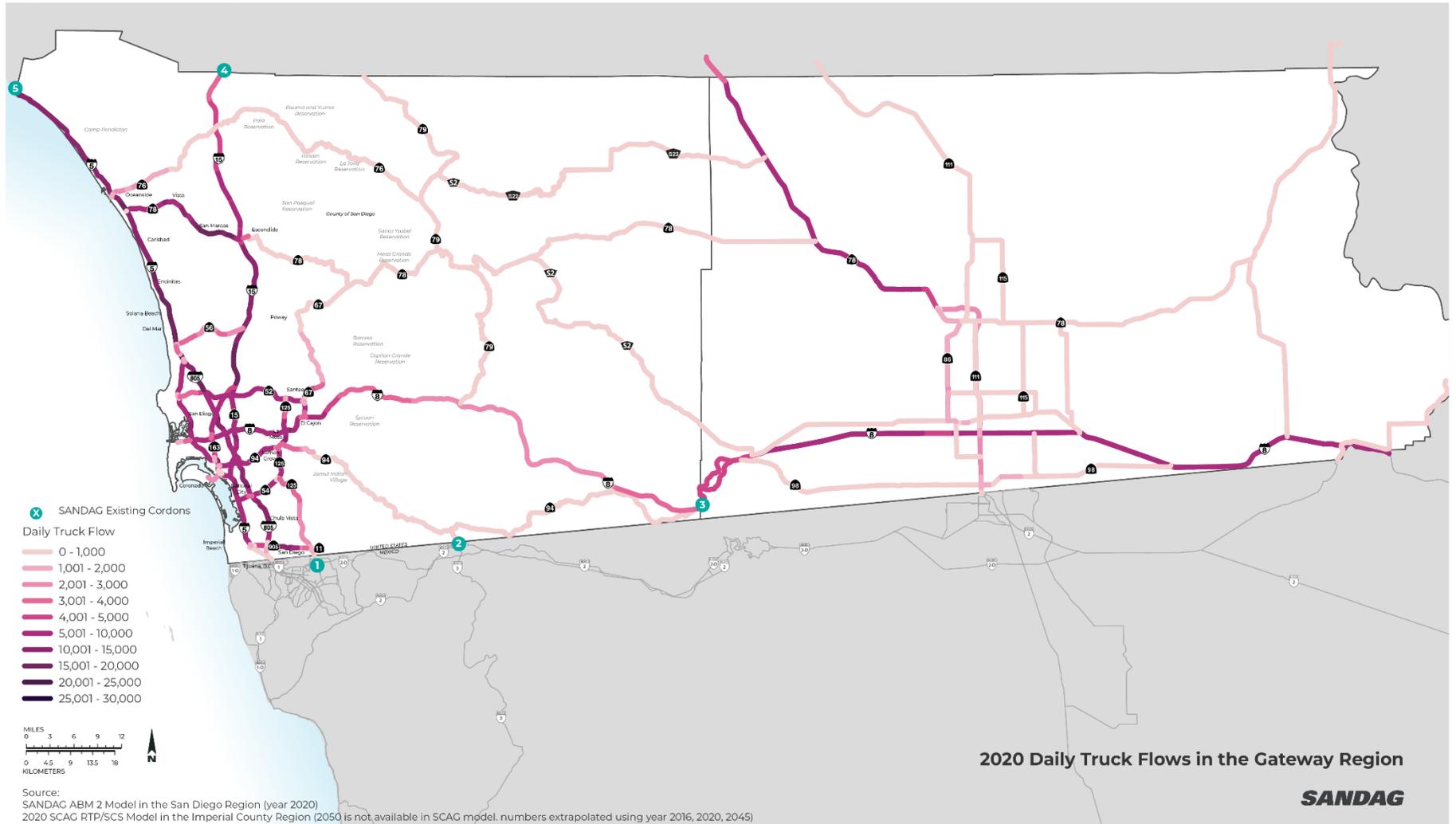


Figure 3.2: 2035 Daily Truck Volume

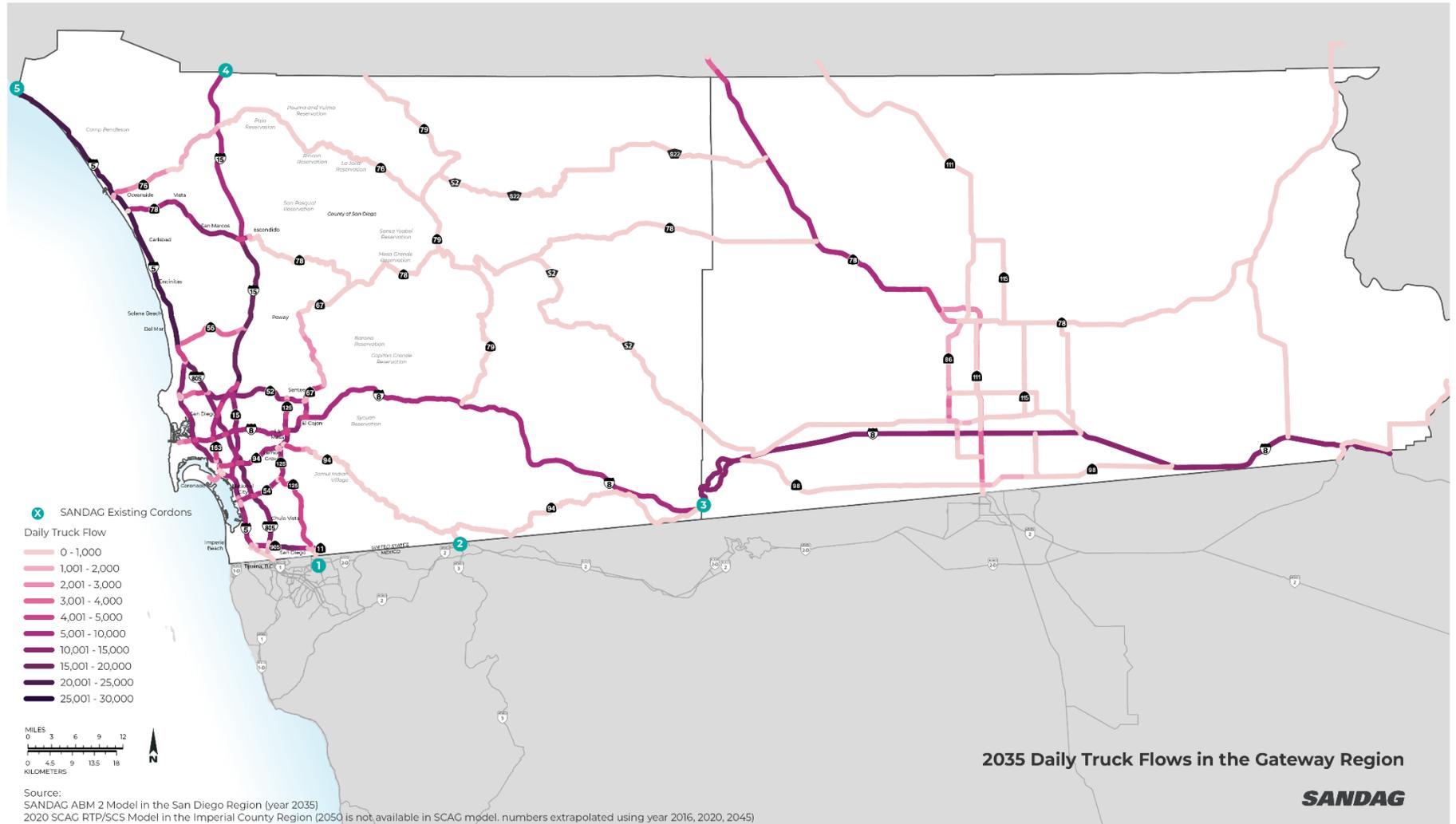


Figure 3.3: 2050 Daily Truck Volume

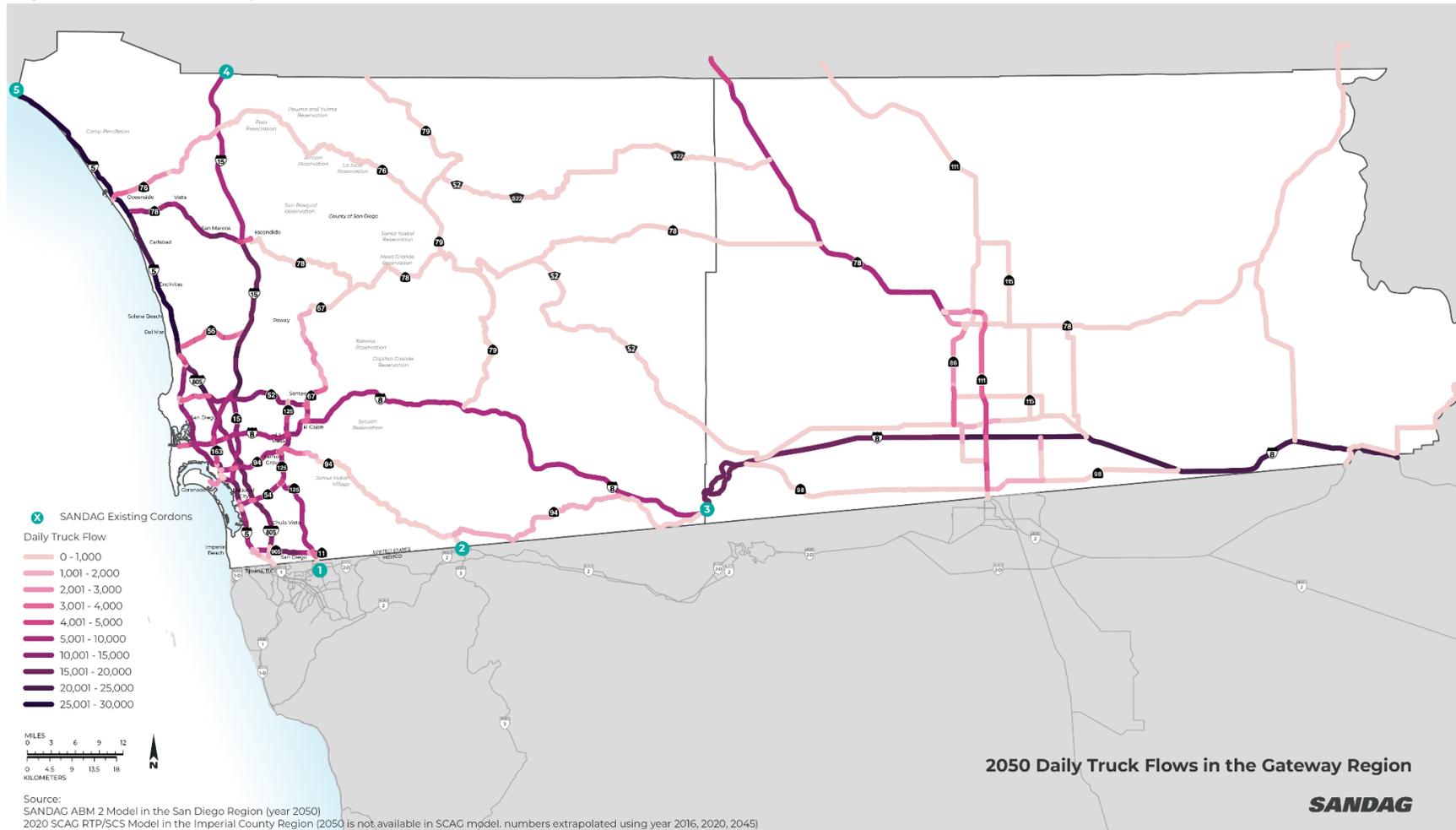


Figure 3.4: Industrial Land Use in San Diego and Imperial Counties

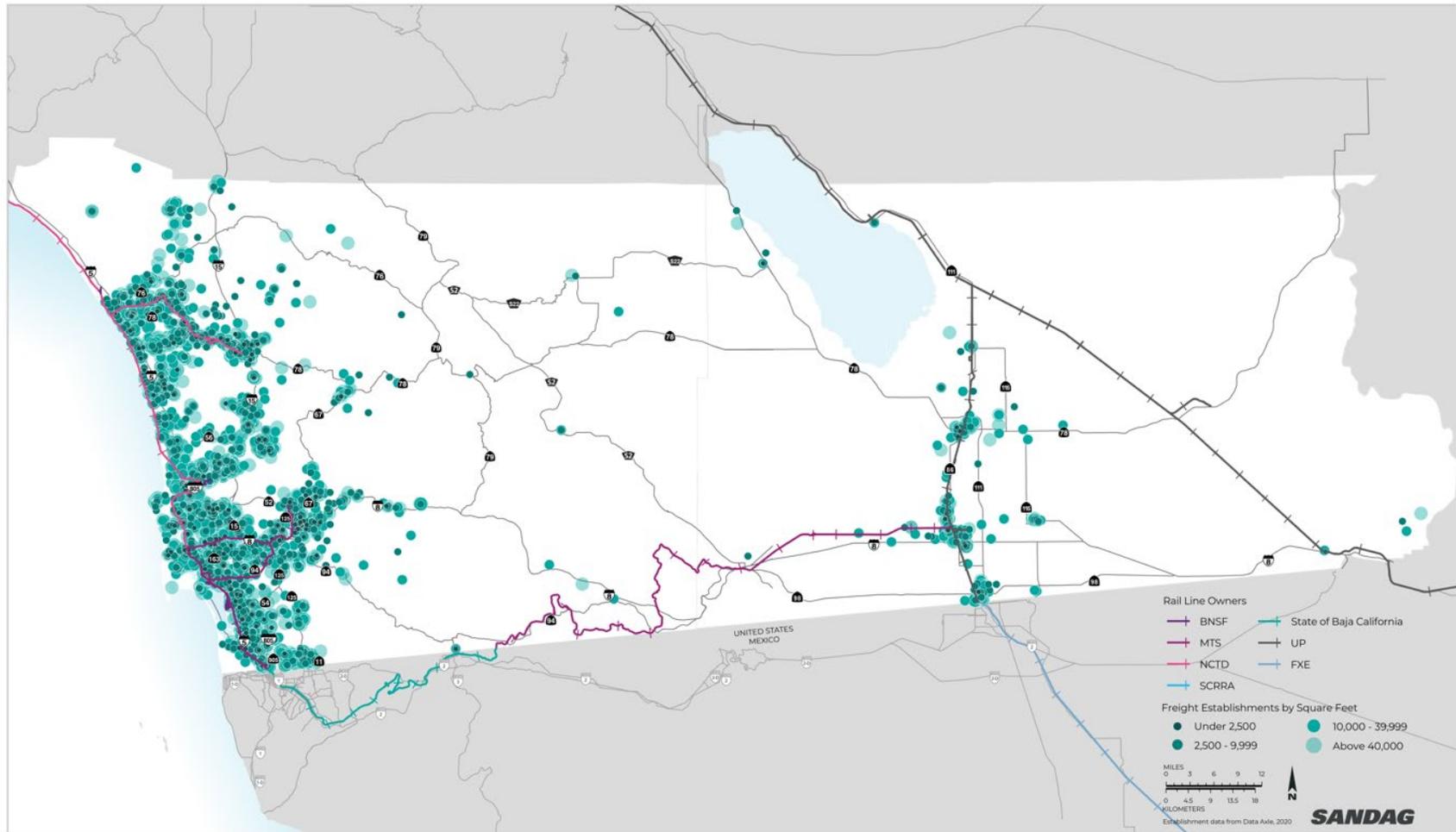


Figure 3.5, illustrates truck freight flows that are internal (within the region), inbound (to the region), outbound (from the region), and passing through the region (does not start or stop in the region) from the Transearch Commodity flow database. Additionally, airport and marine port freight flows are provided. The color of the arrows reflects land POE, airport, and marine port flows by tonnage.

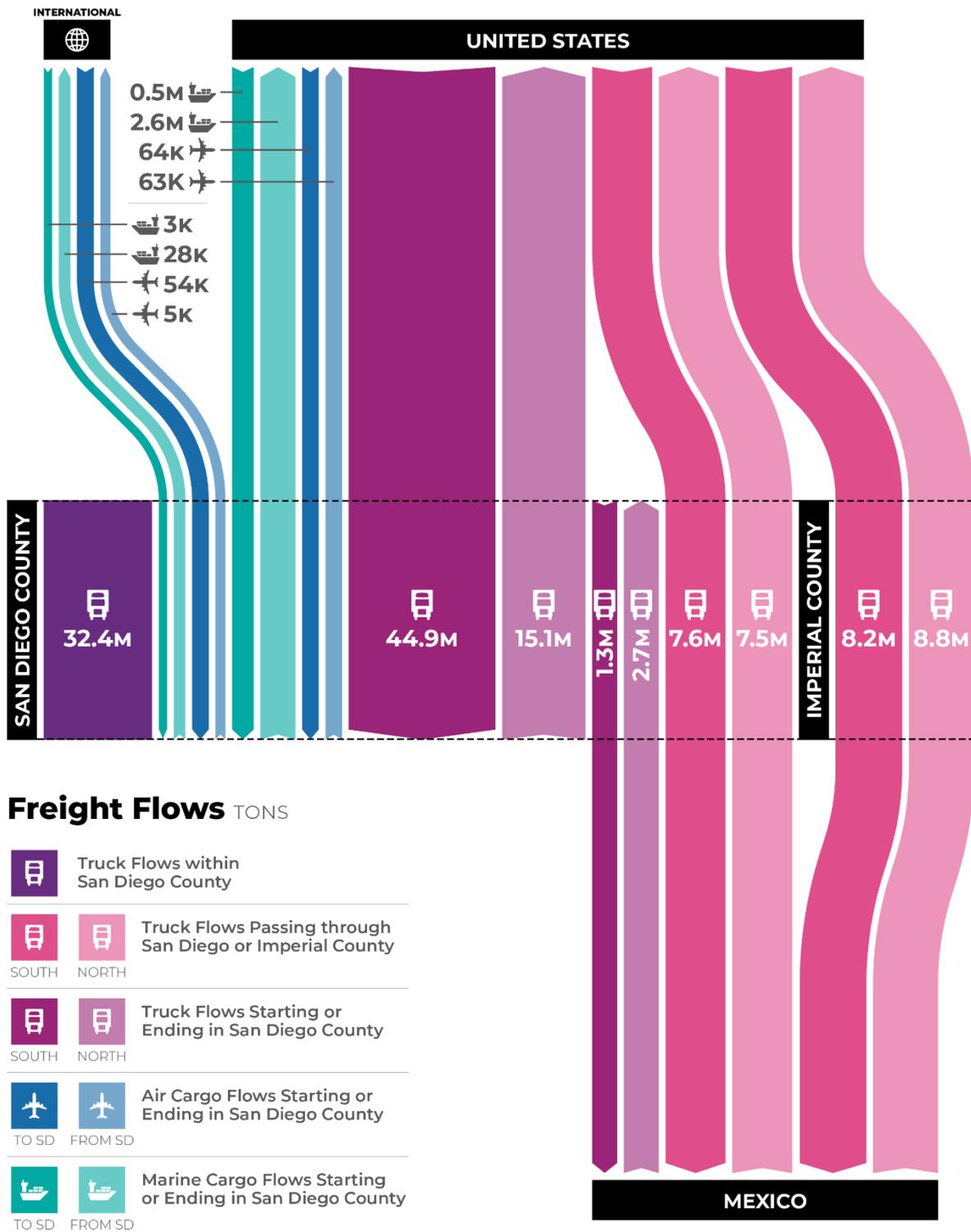
The north-south orientation of the truck flow arrows in **Figure 3.6** mirror the dominant origins and destinations for freight external to the region, whether in Mexico to the south across the border or to the north into Riverside and Orange counties and continuing into Los Angeles and San Bernardino counties. The large seaports of Long Beach and Los Angeles, plus the extensive warehousing and intermodal rail container yards of Los Angeles and the Inland Empire, are reached to the north via the Interstate 5 (I-5) and the I-15 corridors, as illustrated in **Figure 3.3**. There is also freight moving to/from the east on the I-8 corridor, but the dominant flows are the north-south truck corridors which provide access to major east/west highways and rail lines.

The Port of San Diego generates a substantial volume of tonnage related to international imports. The majority of the cargo consists of passenger automobiles (Asia), bananas (Central America), and plantains (South America).

For the San Diego International Airport, domestic air cargo accounts for the majority of cargo tonnage with a fairly even split between inbound and outbound destinations.

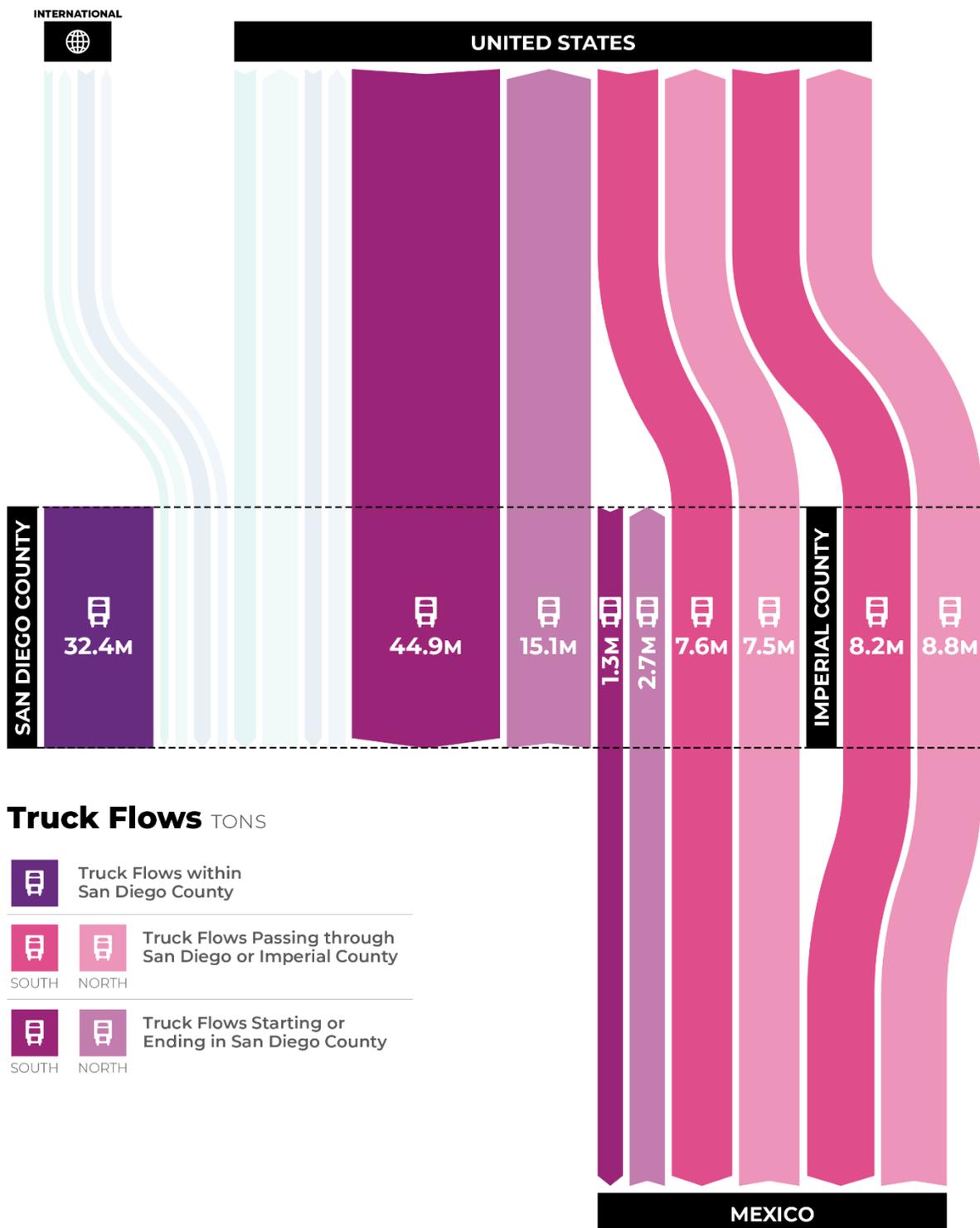
Figure 3.7 highlights these marine and air cargo flows.

Figure 3.5: Freight Gateway Flows (in Tons) in the San Diego/Imperial County Region



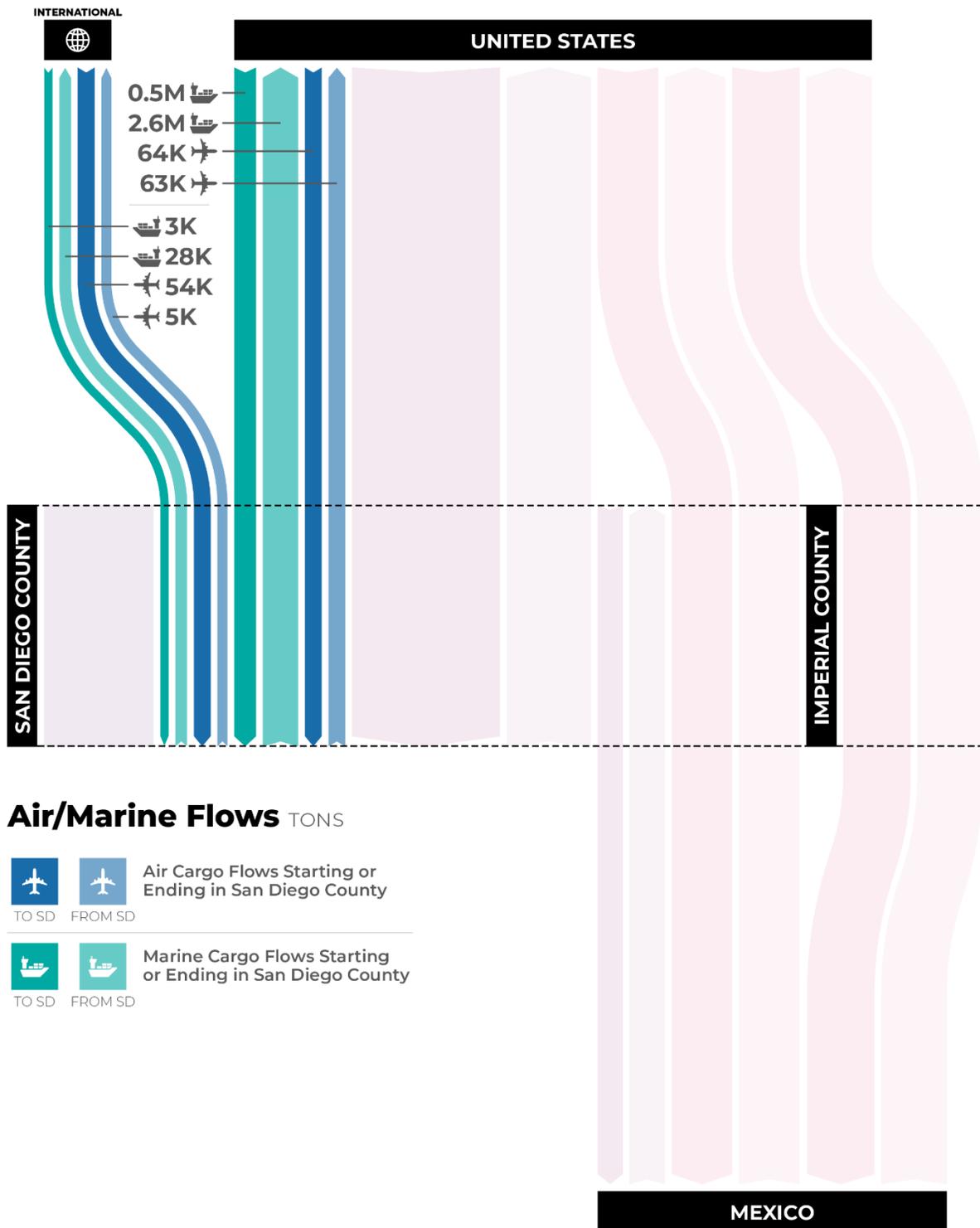
Source: Transearch 2019, Port of San Diego, San Diego International Airport

Figure 3.6: Truck Gateway Flows (in Tons) in the San Diego/Imperial County Region



Source: Transearch 2019, Port of San Diego, San Diego International Airport

Figure 3.7: Aircraft and Marine Cargo Gateway Flows (in Tons) in the San Diego County Region



Source: Transearch 2019, Port of San Diego, San Diego International Airport

3.3 Domestic Freight: Major Truck Corridors Overview

The internal movement of trucks within San Diego itself represents about 17 percent of the truck tonnage on the road network. Domestic truck freight tonnage on the primary north/south corridors in and out of the Gateway region comprises more than half of the total regional truck tonnage as illustrated in **Table 3.1**.

Table 3.1: Truck Tons by Type of Movement, San Diego County

Truck Tons by Type of Movement, San Diego		
Truck Flow Type	2019 Tons (Thousands)	Percent Share
Internal ⁴³	16,787	17%
Domestic ⁴⁴	62,188	62%
Border ⁴⁵	20,858	21%
Total	99,833	100%

Source: Transearch 2019

Table 3.2 illustrates the truck freight flow tonnage by direction, which is another reflection of how trucks (and the tonnage they carry) utilize the region's highway network and the nature of how truck flows serve businesses in the region, including truck travel through the freight gateways in the region. The inbound domestic truck tonnage on the network is substantially greater than domestic outbound truck tonnage, and through truck tonnage (defined as import, export, and domestic tonnage not originating or stopping within San Diego County) exceeds domestic outbound and internal truck tonnage.

⁴³ Internal is defined as having an O/D in San Diego County, including LTL and small package shipment to residents from distribution centers within San Diego County.

⁴⁴ Domestic is defined as having an O/D in the United States other than San Diego County.

⁴⁵ Border is defined as having an O/D through the international land POE.

Table 3.2: Truck Tons by Direction, San Diego

Truck Tons by Direction, San Diego		
Truck Flow Type	2019 Tons (Thousands)	Percent Share
Internal	16,787	17%
Inbound	44,967	45%
Outbound	15,173	15%
Pass-Through	22,906	23%
Total	99,833	100%

Source: Transearch 2019

The most significant proportion of overall truck traffic is inbound truck movements (45%); whereas inbound and outbound flows together represent 60 percent of the total truck tonnage. The fact that nearly 80 percent of regional truck flows can be attributed to trucks moving goods internally in the region or in/out of the region is an indication of the importance of the highway truck corridor connections and how the interstates and highways connect San Diego consumers and end markets elsewhere to goods. Additionally, if the 60 percent inbound/outbound truck tons are combined with the 23 percent of truck tonnage moving through the region across the border, about 83 percent of the truck tonnage is dependent on the external freight highway corridor connections, with a substantial majority utilizing the I-5 and I-15 corridors.

Long-term growth forecasts for overall inbound and outbound freight tonnage carried by truck averages just under two (2) percent per year. This rate of increase in truck freight corridor tonnage is not dramatic in the short run, but over the long-term, this growth will require sustained attention to ensure freight corridor capacity. Alternative modal transportation options may be limited as truck demand continues to grow. Alternative capacity for the rail freight and domestic sea freight networks may not necessarily be feasible due to competing uses for valuable land that would be needed for such rail terminal or seaport terminal expansion. Nonetheless, planning for adequate future freight capacity on the rail network and at the seaport must be kept in focus. Additionally, there are competing demands for additional passenger rail service from the same shared-use regional rail track network. Additional space at the two port terminals may be needed for the potential M-5 Marine Highway (formerly called Short Sea Shipping or Coastwise) services to handle north-south (I-5 or I-15) freight diverted from truck.

Table 3.3: Inbound Domestic Freight by Mode of Transportation

Inbound Domestic Freight by Mode of Transportation		
Domestic Inbound	2017 Tons (Thousands)	Percent Share
Truck	18,136	64%
Pipeline	9,015	32%
Multiple Modes and Mail ⁴⁶	970	3%
Rail	128	<1%
Air (including truck-air)	9	<1%
Total	28,258	100%

Source: FAF 5.1

Table 3.3 illustrates the dominance of truck tonnage (64%) when specifically focusing on domestic freight compared to all other modes. Total domestic inbound tonnage also has a very substantial tonnage component that is shipped through the pipeline network (32%) into San Diego from the Los Angeles Basin to the north (pipeline infrastructure is privately managed). Multiple modes and mail, rail, and air constitute the remaining five percent of domestic freight.

Table 3.4: Outbound Domestic Freight by Mode of Transportation

Outbound Domestic Freight by Mode of Transportation		
Domestic Outbound	2017 Tons (Thousands)	Percent Share
Truck	11,948	97%
Multiple Modes and Mail ⁴⁷	371	3%
Air (including truck-air)	8	<1%
Total	12,326	100%

Source: FAF 5.1

The outbound domestic freight tonnage in **Table 3.4** also is dominated by truck tonnage (97%). As with the inbound direction, no one other mode comes close to matching the dominance of the truck mode; the other modes only account for three percent of the tonnage volume handled by truck, consisting primarily of multiple modes and mail.

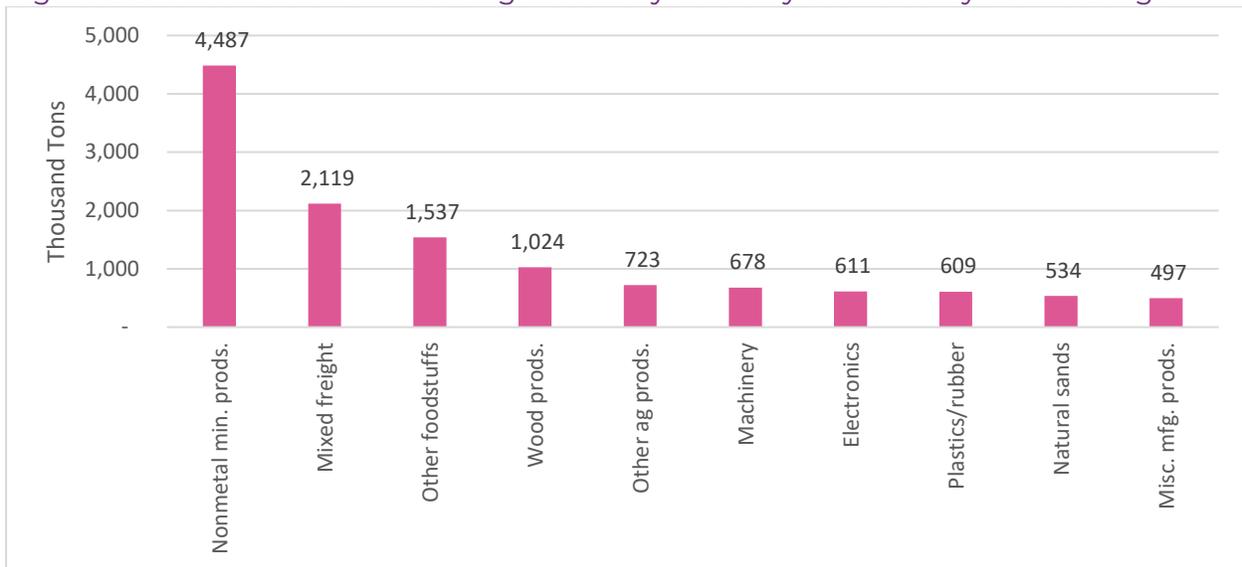
⁴⁶ A Description of the FAF 5.1 Regional Database and how it is constructed: <https://faf.ornl.gov/faf5/>

⁴⁷ Ibid.

The FAF dataset also indicates that San Diego County handles 35,301 thousand tons of domestic freight flow internally, with 34,779 thousand tons (96%) carried by truck. The balance is split among rail, water, and multiple modes and mail.

Figure 3.8 examines the domestic inbound commodity composition for freight tonnage in the San Diego region. This information is useful to understand the relationship of freight to the economy, and it illustrates the potential for changes and the variation of change by freight type in the future. Use of the interstate and highway networks for shipments also vary by different commodities, which is tied to inbound/outbound freight corridor use and internal truck flows within the Gateway Region.

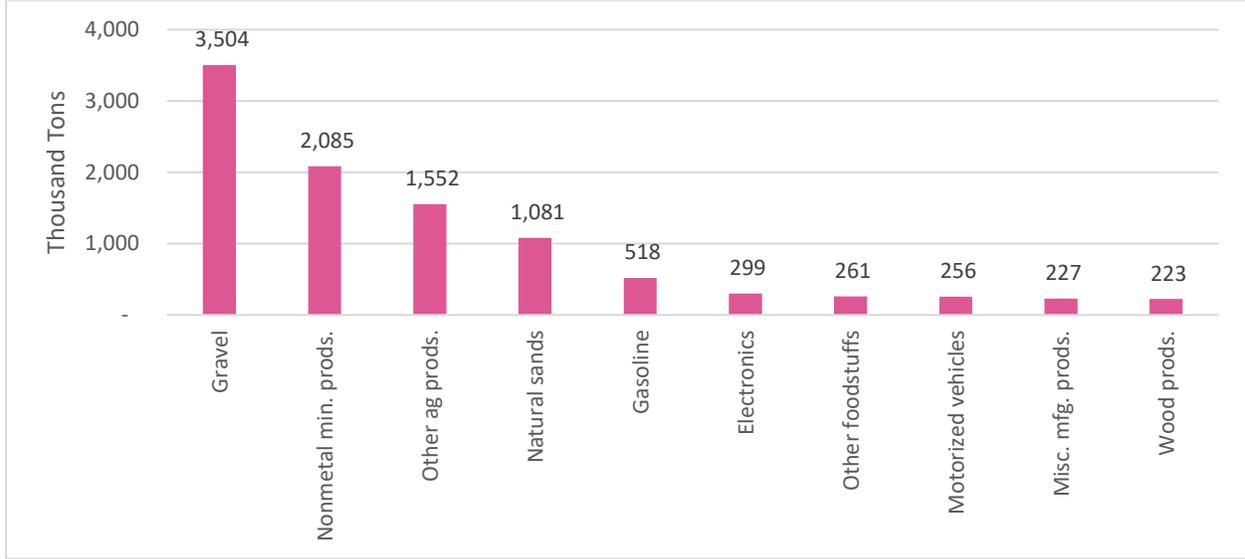
Figure 3.8: Inbound Domestic Freight Tons by Truck by Commodity to San Diego



Source: FAF 5.1, 2017 Data

From an inbound commodity shipment perspective, nonmetal mineral products and mixed freight are the highest tonnage domestic commodities shipping into San Diego from elsewhere in the United States. Mixed freight includes a wide variety of goods distributed to retail stores for local consumption. The other foodstuffs category includes commodities primarily for retail sale. Wood products are commonly construction materials, but given the U.S. production geography, are often shipped in from much greater distances, including from the Pacific Northwest.

Figure 3.9: Outbound Domestic Freight by Tons by Truck by Commodity from San Diego



Source: FAF 5.1, 2017 data

Figure 3.9 illustrates a mix of products, with gravel, nonmetal mineral products, other agricultural products, and natural sands most represented in outbound domestic truck shipments from San Diego County.

Table 3.5: Top Inbound Origins of Domestic Flows by Truck to San Diego

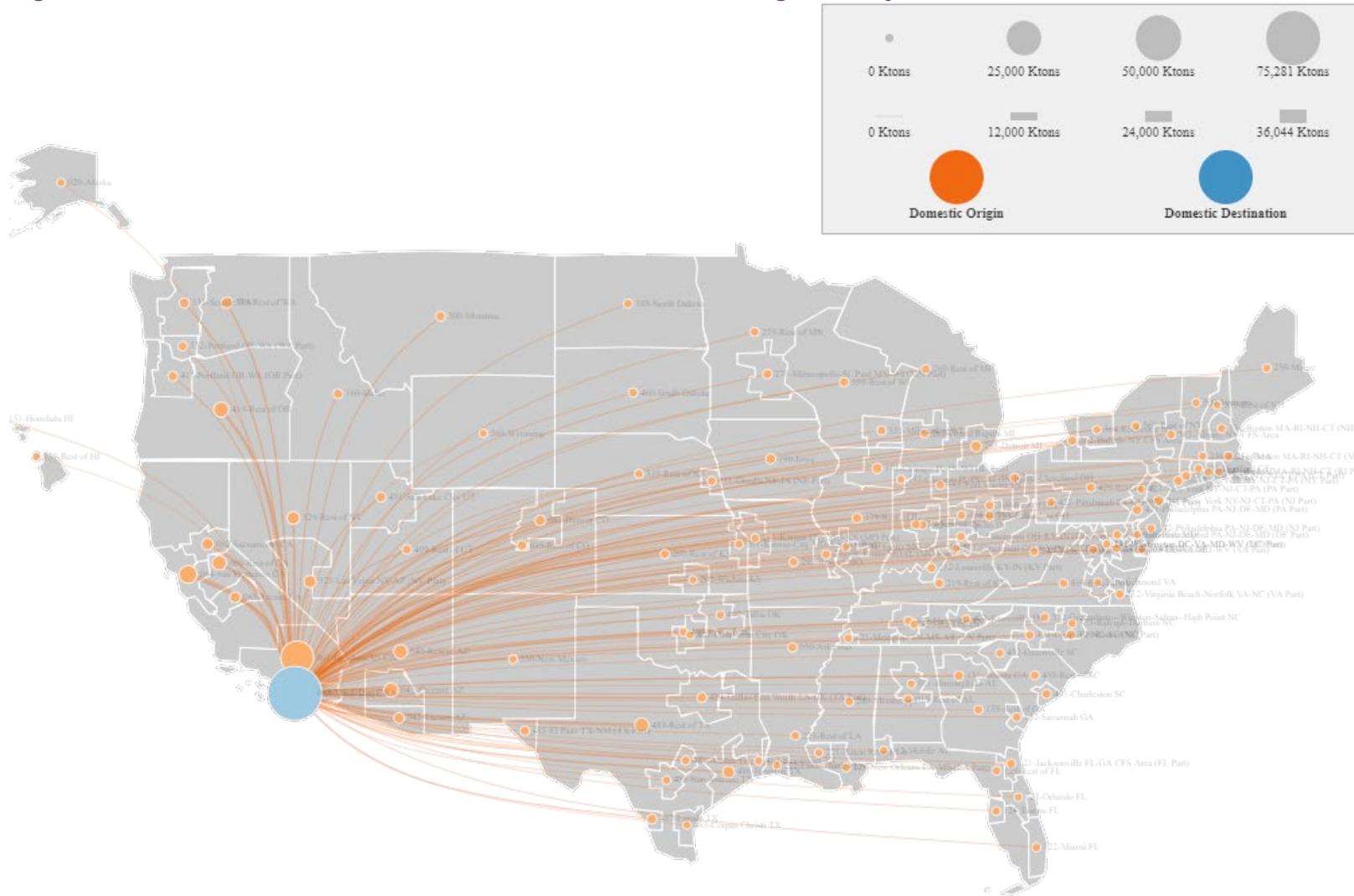
Domestic Inbound⁴⁸	2017 Tons (Thousands)
San Diego CA (Internal Flows)	34,779
Los Angeles CA	11,942
Rest of TX	1,251
Rest of CA	899
Phoenix AZ	564
San Francisco CA	379
Houston TX	282
Sacramento CA	261
Fresno CA	193
Rest of OR	164

Source: FAF 5.1

Los Angeles is by far the largest domestic origination point for freight flowing into San Diego. The rest of Texas and the Rest of California along with Phoenix and San Francisco also are ranked near the top. These origin points again clearly emphasize the importance of the I-5 and I-15 corridors for regional inbound flows. However, origins from the east with access provided by I-8 are also important, most notably from Arizona and Texas.

⁴⁸ "Rest of" is a term used to refer to specific geographic areas within FAF 5.

Figure 3.10: Inbound Destinations of Domestic Flows to San Diego County



Source: FAF 5.1, 2017 database

These inbound origins of domestic flows to San Diego reflect freight shipments based upon the FAF survey instrument. This instrument utilizes waybill information that does not include all supply chain links of a beneficial cargo owner (manufacturer/shipper), where a shipment may transfer between freight equipment and/or freight modes. As a result, the higher proportion of inbound origins from California to San Diego may not be representative of the true origin of the shipment.

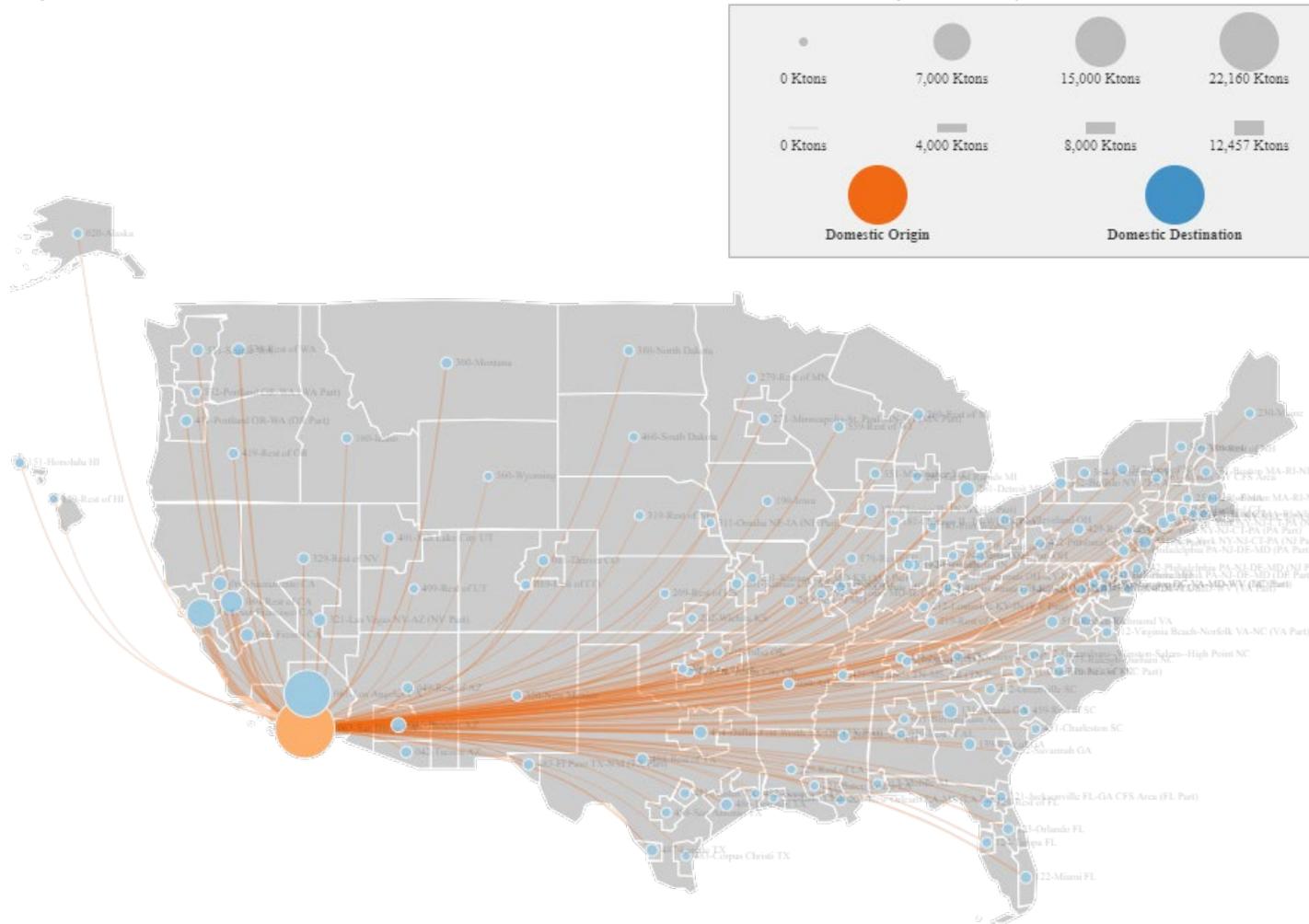
Table 3.6: Top Outbound Destinations of Domestic Flows by Truck from San Diego

Top Outbound Destinations of Domestic Flows by Truck from San Diego	
Domestic Outbound	2017 Tons (Thousands)
San Diego CA	34779
Los Angeles CA	8669
Rest of CA	1174
San Francisco CA	276
Fresno CA	143
New York NY-NJ-CT-PA (NJ Part)	130
Phoenix AZ	119
Dallas-Fort Worth TX-OK (TX Part)	103
Las Vegas NV-AZ (NV Part)	95
Salt Lake City UT	70

Source: FAF 5.1

For **Figure 3.11** and **Table 3.6**, Los Angeles continues to be the largest destination point by tonnage flowing out from San Diego. The rest of the State, plus San Francisco and Fresno also are ranked near the top. To the east, there is much less tonnage exiting the region.

Figure 3.11: Outbound Destination of Domestic Flows from San Diego County



Source: FAF 5.1, 2017 Data base

3.4 International Freight: Imports and Exports Corridors

The international trade originating, terminating, and moving through San Diego is fairly balanced in terms of tonnage, with a higher proportion of imports terminating in San Diego than exports originating there. Through tonnage is also greater for exports. In both directions of trade, the through traffic dominates, demonstrating just how much of a gateway role San Diego plays in international trade for the rest of the United States.

Table 3.7: Total International Trade Flows to, from, and through Gateway Region⁴⁹

Total International Trade Flows to, from, and through Gateway Region				
Region	Direction of Trade	2017 Local Demand Tons (Thousands)	2017 Pass-Through Tons (Thousands)	
San Diego County	Imports	526	8,438	
	Exports	437	6,977	
Imperial County	Imports	-	26	
	Exports	-	2,882	

Source: FAF 5.1 Data base, 2017

While San Diego trades with the world by sea and by air, truck is the dominant mode of transport; 72 percent of import tonnage moves into the region from Mexico and 96 percent of export tonnage moves by truck from the region to Mexico. The exports via Imperial County gateways are mainly by pipeline and contain petroleum and gas products.

⁴⁹ Detailed tables for each freight Gateway, can be found in Appendix B.

Table 3.8: U.S./Mexico Trade Flows by Truck to, from, and through San Diego

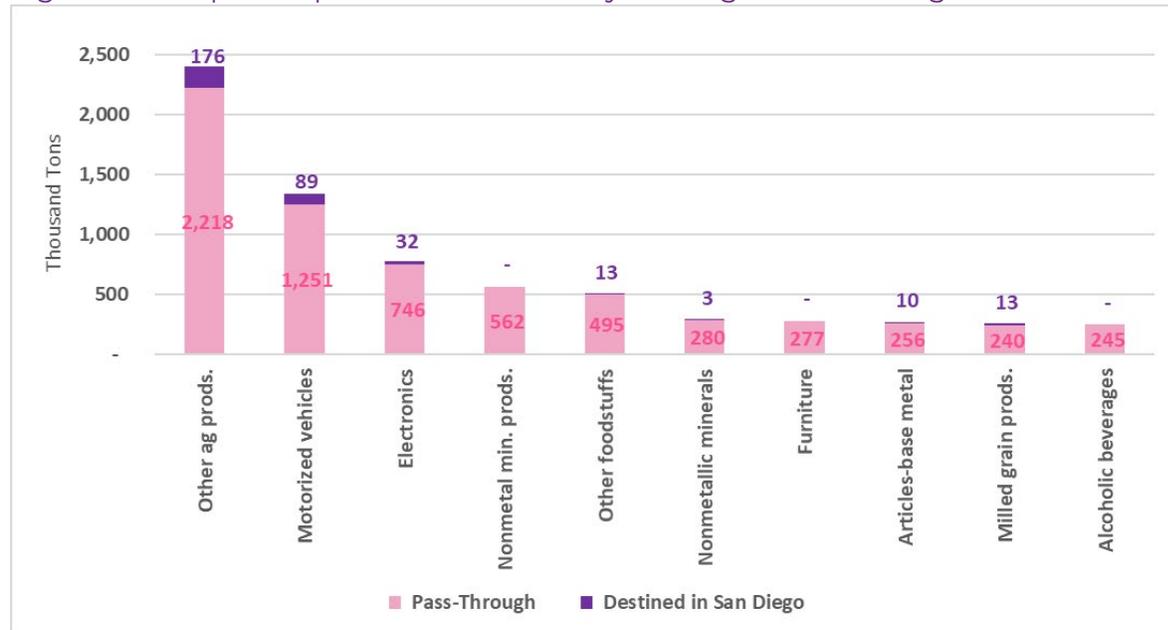
U.S./Mexico Trade Flows by Truck to, from, and through San Diego

Direction of Trade	2017 San Diego (To-From) Tons (Thousands)	2017 Through Tons (Thousands)
Imports	416	7,281
Exports	421	6,455

Source: FAF 5.1 Data base, 2017

Table 3.8 shows that the Mexico trade by truck to, from, and through San Diego is similarly, fairly balanced versus overall international trade to, from, and through of San Diego. This balance contrastingly extends to more San Diego origin exports than imports, which is partly a reflection of goods handling practices and partly a reflection of the commodity types moved as imports versus exports. Mexico through traffic similarly dominates local San Diego traffic. FAF data base does not show any truck flows via gateways at Imperial County.

Figure 3.12: Top 10 Import Commodities by Tonnage Via San Diego



Source: FAF 5.1 Data base, 2017

Figure 3.12 shows that the top commodity categories by tonnage imported through San Diego are: other agricultural products, motorized vehicles, electronics, alcoholic beverages, and furniture. Beer makes up a substantial portion of the alcoholic beverage

category. The other agriculture products dominate the local imports from Mexico, reflecting the strong local market handling of these Mexican agricultural goods.

Figure 3.13: Top 10 Export Commodities by Tonnage via San Diego

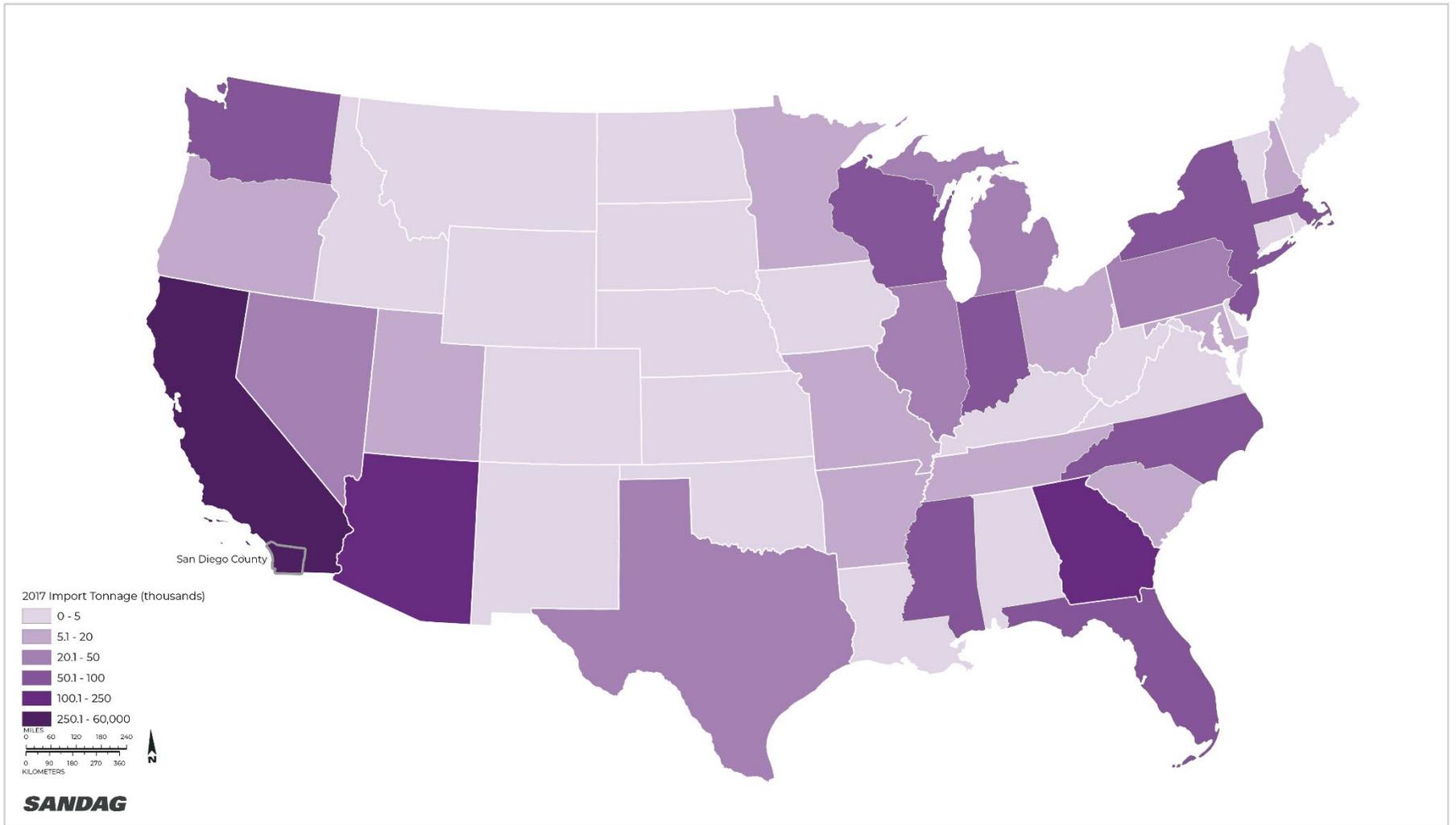


Source: FAF 5.1 Data base, 2017

Figure 3.13 shows the top 10 commodity categories exported through San Diego, including plastics/rubber, base metals, wood products, other foodstuffs, nonmetal mineral products, and newsprint/paper. This diversified mix of commodity categories reflects the integration of the Baja California economy with goods sourced from the United States and exported to Mexico through San Diego.

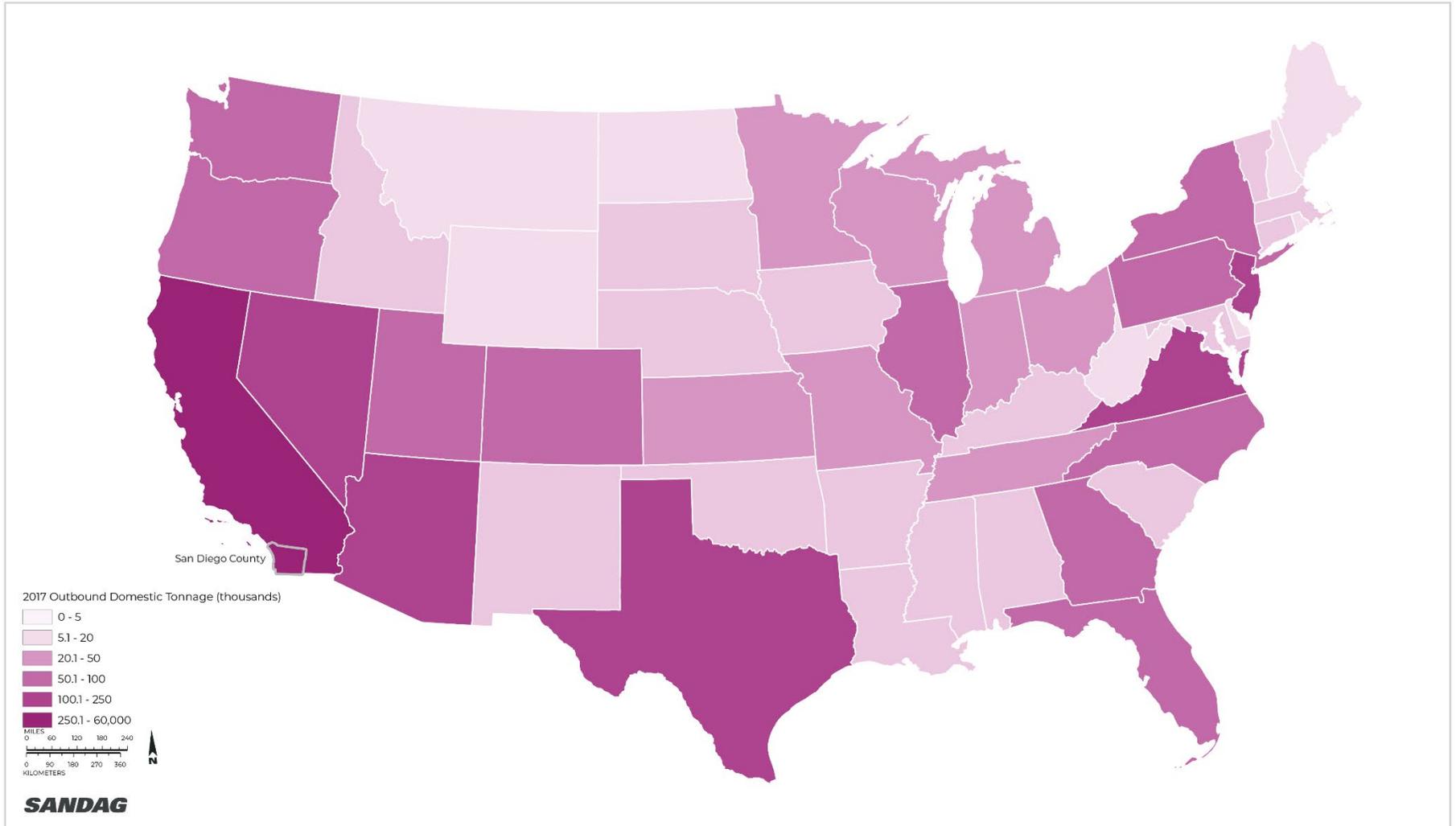
The fact that San Diego is the origin of diversified mix of commodity categories reflects the important role of regional freight networks, which facilitate both northbound and southbound trade moving from/to Baja California. Goods of many types sourced from across the United States are exported to Mexico through San Diego. Some of these exports to Mexico are then used as inputs to Mexican manufacturing, which become finished products then exported by Mexico. Some of these finished products are then destined for export back to the United States.

Figure 3.14: Import Tonnage from Mexico to the United States (Passing through San Diego County)



Source: FAF 5

Figure 3.15: Export Tonnage from the United States to Mexico (Passing through San Diego County)



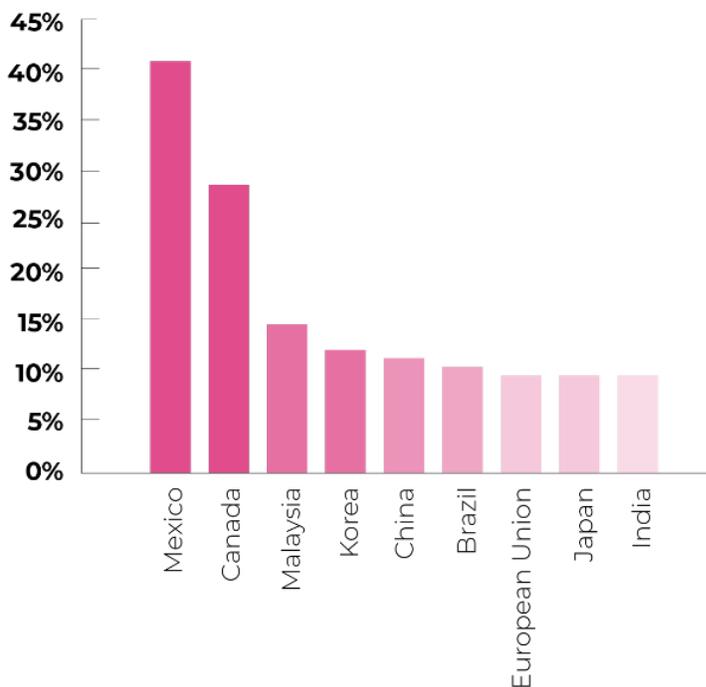
Source: FAF 5

When considering exported tonnage from the United States to Mexico passing through San Diego County by truck, 88 percent of the volume comes from California and 12 percent from the rest of the United States. Other states in the United States with significant exported tonnage through San Diego County include Texas (2%).

When considering imported tonnage from Mexico to the rest of the United States passing through Imperial County by truck, 59 percent of the volume is initially destined to California and the remaining 41 percent to the rest of the United States. Other states in the United States with significant imported tonnage through Imperial County include Texas (14%), Missouri (7%) and Arizona (6%).

When considering exported tonnage from the United States to Mexico passing through Imperial County by truck, 73 percent of the volume originates in California and 27 percent from the rest of the United States. Other states in the United States with higher exported tonnage through Imperial County to Mexico include Tennessee (4%), Illinois (2%), Arizona (2%), Georgia (2%) and Texas (2%).

Figure 3.16: Value of U.S. Content in Imports



Source: National Bureau of Economic Research: NBER Working Paper Series Give Credit Where Credit is Due: Tracing Value Added in Global Production Chains

As mentioned above, **Figure 3.16** provides an illustration of the relative percentage of U.S. content provided within imports from top U.S. trading partners. Mexico, at 40 percent, clearly provides the highest value of U.S. content contained within imports when compared to the top U.S. trading partners. Canada is second at 25 percent, with all other trading partners being below 10 percent.

3.5 Port of San Diego Import and Export Flows

Table 3.9: Port of San Diego Top Imported Commodities

Port of San Diego Top Imported Commodities		
Port of San Diego Top Imported Commodities	2019 Short Tons (Thousands)	Percent of Total
Bananas & Plantains	567	32%
Vehicles & Parts	325	22%
Kerosene	164	11%
Aluminum Ore	124	8%
Fruits & Nuts	118	8%
Other	281	19%
Sum	1,486	100%

Source: U.S. Army Corps of Engineers

Roughly a third of imported short tons into the Port of San Diego were bananas and plantains. Vehicles and vehicle parts were the second most significant imported commodities at about 22 percent in 2019. Kerosene represented roughly 11 percent of important goods while aluminum ore and fruit and nuts reflected about 8 percent each of the Port's imported commodity tonnage.

Table 3.10: Port of San Diego Top Exported Commodities

Port of San Diego Top Exported Commodities		
Port of San Diego Top Imported Commodities	2019 Short Tons (Thousands)	Percent of Total
Metallic Salts	5.5	27%
Unknown or NEC	2.1	11%
Vegetables & Produce	1.9	10%
Vehicles and Parts	1.8	9%
Manufactured Products	21.7	9%
Other	6.9	34%
Sum	39.9	100%

Source: U.S. Army Corps of Engineers

The majority of exported short tons included metallic salts during 2019. Other notable exported commodities included vegetables and produce, vehicles and parts, and manufactured products. When compared to imported short ton totals, exported short tons represent 1.3 percent proportional volume during 2019.

3.6 San Diego International Airport Cargo and Mail Operation

Table 3.11: San Diego International Airport Domestic and International Cargo

San Diego International Airport	Domestic Cargo		International Cargo	
	2017 Tons	Percent of Total	2017 Tons	Percent of Total
Enplaned⁵⁰	72,979	46%	2,118	30%
Deplaned⁵¹	86,218	54%	4,820	70%
Total Tons	159,196	100%	6,938	100%

Source: San Diego County Regional Airport Authority

In 2017, 46 percent of domestic air cargo tonnage was enplaned and shipped out of the county, while 54 percent was deplaned within the county as the shipping destination. Compared to international and mail air cargo, domestic total tonnage represents 84 percent⁵² of all air cargo tonnage (air cargo does not include U.S. mail traffic).

During 2017, 30 percent of international air cargo tonnage was enplaned and shipped out of the County, while 70 percent was deplaned within the county as the shipping destination. Compared to domestic and mail air cargo, international total tonnage represents less than 4 percent⁵³ of all air cargo tonnage.

⁵⁰ Modified definition from the Port of Seattle Airport Statistics Glossary, “Enplaned cargo is defined as the total number of tons of air freight by airline, being loaded.”

⁵¹ Modified definition from the Port of Seattle Airport Statistics Glossary, “Deplaned cargo is defined as the total number of tons of air freight by airline, being unloaded.”

⁵² The 84% is calculated by combining the 2017 total air cargo tonnage (166,135.2) and total mail cargo tonnage (23,431.7) equaling 189,566.9 tons. Total domestic air cargo tonnage (159,196.4) is divided by 189,566.9 tons.

⁵³ The 4% is calculated by combining the 2017 total air cargo tonnage (166,135.2) and total mail cargo tonnage (23,431.7) equaling 189,566.9 tons. Total international air cargo tonnage (6,938.8) is divided by 189,566.9 tons.

Table 3.12: San Diego International Airport Mail Cargo

San Diego International Airport Mail Cargo		
San Diego International Airport Air Cargo and Mail	2019 Tons	Percent of Total
Air Cargo	162,231	87%
Mail	24,238	13%
Total Tons	186,469	100%

Source: San Diego International Airport, Fiscal Year 2019

By 2019, 87 percent of air cargo and mail tonnage enplaned and deplaned at San Diego International Airport was cargo, while 13 percent was comprised of mail. Compared to domestic and international air cargo, mail total tonnage represents less than 12 percent⁵⁴ of all air cargo tonnage.

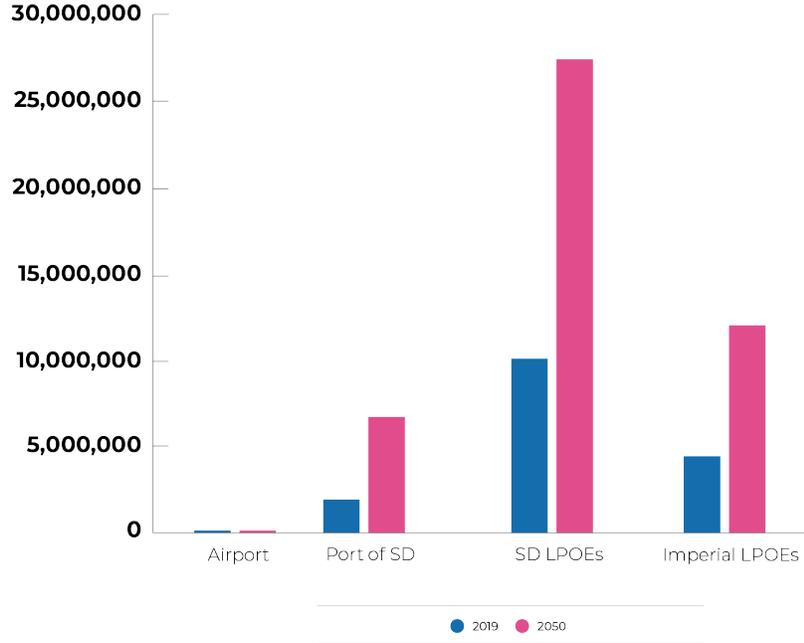
Combined, the 186,469 tons for domestic, international, and mail air cargo have a corresponding relationship with the trucks carrying the cargo and packages which are enplaned and deplaned at the airport. The Transearch forecast total air cargo and mail handled through the airport is for 403,391 tons by 2050, at an average annual growth of over 3.7 percent. This growth in demand reflects continued growth in E-commerce and for goods moved by air. As air cargo tonnage demand increases long-term, truck volumes picking up and dropping off shipments will continue to grow.

3.7 Border-Crossing Forecast Flows for Year 2050

Figure 3.17 below provides a comparison of the 2019 base year versus the 2050 forecast for the region's international gateways. It is clear that the truck mode dominates the amount of tonnage moving through the region's gateways, and forecasts are for growth of 47 million tons for the San Diego and Imperial County Gateways.

⁵⁴ The 13% is calculated by combining the 2019 total air cargo tonnage and total mail cargo tonnage and calculating the share of the total.

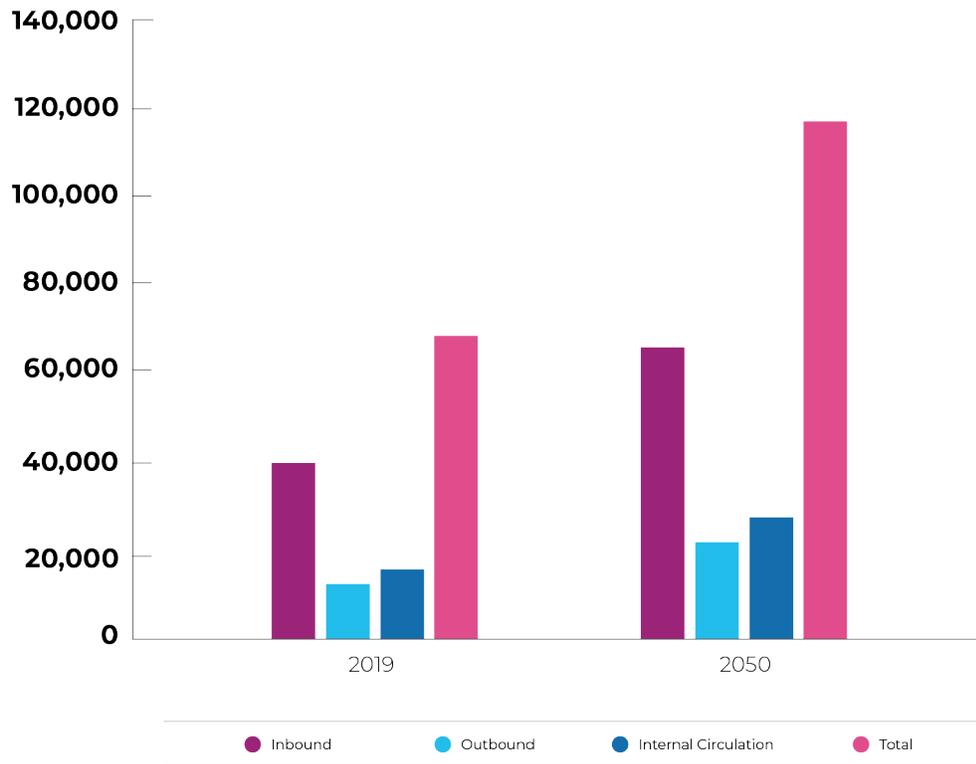
Figure 3.17: Summary of Freight Flows through the Regions International Gateways by Modal Volume: 2050 Forecast



Source: Transearch 2019, U.S. Army Corps of Engineers, and San Diego International Airport

Figure 3.18 depicts the amount of tonnage moving through the San Diego region either internally or domestically (inbound and outbound). During the 2019 base year, nearly 70 million tons were generated with 58 percent of those tons being inbound. By 2050, the internal and domestic tonnage is forecasted to reach 117 million tons with nearly 57 percent of those tons being inbound.

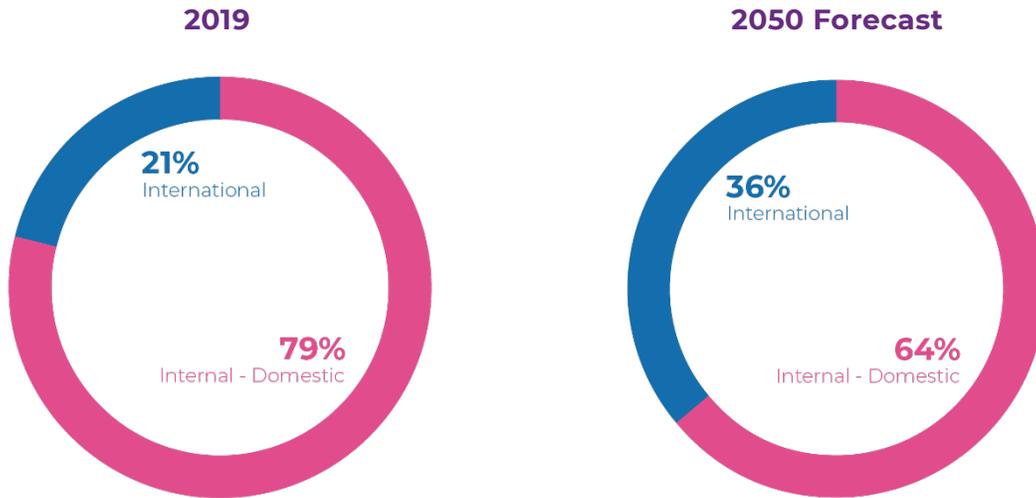
Figure 3.18: Domestic Truck Circulation: 2050 Forecast



Source: Transearch 2019

When considering the internal and domestic commodities traversing the San Diego region, and also factoring in international gateway flows, the case becomes clear regarding the importance of the I-5 and I-15 freeway corridors as the primary trucking arteries carrying the substantial majority of this tonnage. Whether looking at domestic or international goods movement flows, the majority of origin and destination pairs are between the Los Angeles metropolitan area and San Diego. This is most notably illustrated by the development of significant industrial clusters in Los Angeles and the Inland Empire which provide warehousing and distribution nodes that supply consumer-based product demand to San Diego County; as well as intermediary and value-added production of finished goods throughout Southern California and the rest of the United States.

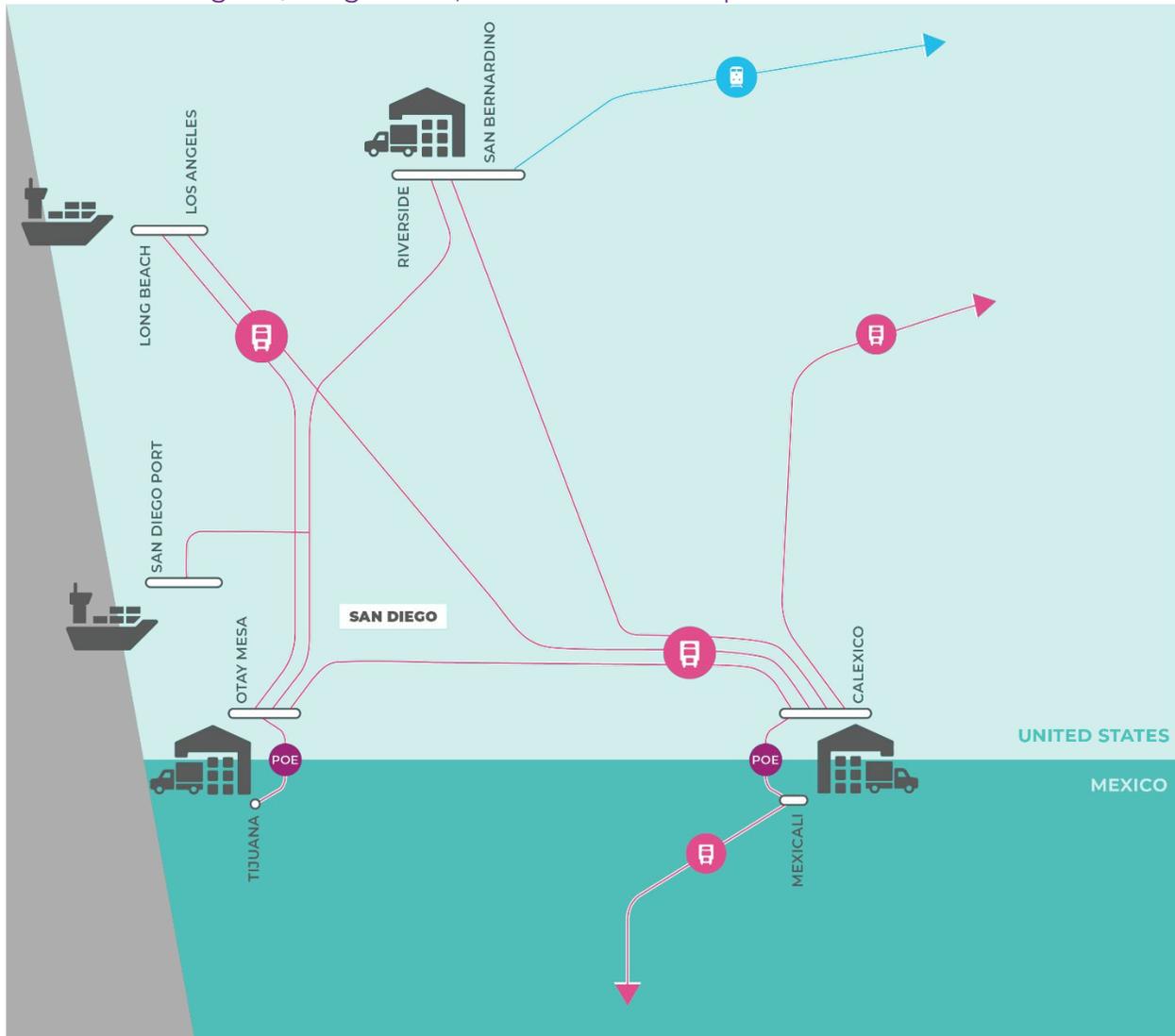
Figure 3.19: San Diego Region Truck Tonnage Breakdown in 2019 and 2050



Source: Transearch, 2019

Internal and domestic tonnage compared with international tonnage for 2019 as depicted in **Figure 3.19** illustrates the fact that the region's consumption patterns generate a substantial majority of tonnage flows. In 2050, international tonnage is expected to significantly outpace the portion of tonnage moved through the region internally and domestically. This dynamic greatly solidifies the statements made throughout this report that the importance of the I-5 and I-15 freeway corridors will be paramount as the region's truck tonnage continues to grow.

Figure 3.20: Supply Chain Relationships Between: International Ports of Entry, the Ports of Los Angeles/Long Beach, and the Inland Empire



Source: Fehr & Peers

As shown in **Figure 3.20**, international, domestic and internal truck flows are all interrelated. The Ports of Los Angeles and Long Beach, the intermodal railyards, warehousing and distribution of Los Angeles and the Inland Empire, and the land ports of Otay Mesa and Calexico East form the key network nodes which generate truck flows throughout southern California. Based on these circumstances, the San Diego region should continue to prioritize the I-5 and I-15 freeway corridors along with the future Otay Mesa East land POE when considering freight project needs.

Table 3.13: Otay Mesa Port of Entry Top Five Commodities by Trade Value and Tons

Otay Mesa POE Commodities	2019 Trade Value (millions)	2019 Short Tons
Electrical Equipment	\$7,481	581,689
Motor Vehicles	\$4,786	767,709
Surgical or Medical Instruments	\$2,238	-
Truck Trailers	\$1,489	485,251
Misc. Manufacturing Products	\$865	237,577
Misc Fresh Vegetables	-	643,744

Source: Transearch, 2019.

The top five commodities by trade value imported and exported through the Otay Mesa POE are listed in **Table 3.13** above. Notable products from these commodity categories included flat screen TVs and pick-up trucks, as well as medical devices. Many of the plastics and articles as well as parts from the other commodity categories are used as inputs to the manufacturing process.

The import information is telling in that the top trade value commodities are not all equally related to the top tonnage commodities crossing the border. Vegetables, fruit and nuts were some of the highest tonnage goods entering the United States through the Otay Mesa POE during 2019.

Table 3.14: Calexico East Port of Entry Top Five Commodities by Trade Value

Calexico East POE Commodities	2019 Trade Value (Millions)
Electrical Equipment	\$2,353
Motor Vehicles	\$1,503
Misc. Aircraft Parts	\$813
Surgical or Medical Instruments	\$343
Food or Kindred Products	\$307

Source: Transearch, 2019.

The top five commodities by trade value imported and exported through the Calexico East POE are listed in **Table 3.14** above. The majority of these commodities are similar to Otay Mesa; however, with some proportional differences. Similarly, parts from the other commodity categories are used as inputs to the manufacturing process.

Table 3.15: Calexico East Port of Entry Top Five Imported Commodities by Tons

Calexico East Port of Entry Top Five Imported Commodities by Tons	
Calexico East POE Commodities	2019 Short Tons
Clay, Concrete, Glass or Stone	215,659
Glass Containers	199,335
Bulbs, Roots or Tubers	198,929
Flour or Other Grain Mill Products	167,981
Electrical Equipment	165,225

Source: Transearch, 2019.

Glass and glassware, as well as bulbs, roots, or tubers, included some of the highest tonnage goods entering the United States through the Calexico East POE during 2019.

Freight Trends

Visuals or tables in this section that reference 2020 data reflect data from the period pre-COVID-19 and related economic closures.

4. Freight Trends

This chapter of the Gateway Study provides in depth analysis three current goods movement trends that are relevant to the 2021 Regional Plan.

4.1 Urban Freight and Last Mile Delivery

4.1.1 Introduction

Cities and regional agencies can no longer afford to ignore freight and how it interacts with the built environment. The urban freight sector, which includes product deliveries to businesses and residents as well as service activity, is often perceived as a major contributor to congestion and traffic problems in urban areas, but little is understood about the underlying supply chain characteristics that form the livelihood of retail and commercial centers. An improved understanding of urban freight activity would help planners better cater for freight vehicles through improved design and use of facilities and infrastructure, as well as investigate the potential feasibility and benefits that could arise from various freight initiatives. Over the past decade, there have been significant changes in urban freight operations, particularly related to the exponential increase in 'on-line' retail (or e-commerce) and the move to just-in-time operations, less-than-truck loads, and local stores acting as origin points for both home delivery as well as a traditional shopping outlet. This trend was then accelerated to the status of the "new normal" during the Covid-19 pandemic and lock-down period.

The following section focuses on the potential impacts of e-commerce, technology and innovations, and curb space challenges and solutions on first- and last-mile delivery operations.

4.1.2 Case Study: Urban Core Mobility Hub

Mobility Hubs, which is one of the 5 Big Moves, are places of connectivity where different modes of transportation converge. They include features that support safer walking and biking, bikeshare, carshare, neighborhood electric vehicles (NEVs), microtransit services, package delivery, mobile retail services, autonomous vehicles, and smart parking. A Mobility Hub can span one, two, or few miles to provide on-demand travel choice for short trips around a community. Through engagement with community members and staff from local jurisdictions, the SANDAG/ICTC team developed the Regional Mobility

Hub Strategy to guide mobility hub implementation around existing and future transit services, including “right-sizing” mobility hubs near major residential, job, and activity centers.

Mobility Hubs are communities with high concentrations of people, destinations, and travel choices. They incorporate both existing and planned on-demand travel options and supporting infrastructure that enhance connections to high-quality transit services for longer trips and local mobility options such as flexible fleets for shorter trips. Mobility Hubs vary in size and are based on community characteristics, sense of place, and similarities in transportation needs. By 2050 it is anticipated that the regional Mobility Hub network will serve approximately half of the region’s population and more than two-thirds of the region’s jobs.

Even though Mobility hubs concepts are developed based on people activities, they cannot survive without an effective urban goods movement system. The health of the community depends on its ability to accommodate the movement and delivery of goods. The livability of the community is directly affected by the congestion and environmental impacts of trucks, the backbone of urban freight system. Therefore, a successful transportation plan for Mobility Hubs must consider accommodating commercial pickup and deliveries and how they interact with the built environment.

Portions of the Urban Core Mobility Hub were analyzed as an example to understand truck trip making patterns in the areas surrounding Downtown San Diego.⁵⁵ Analysis focused on identifying percent of local truck deliveries vs. regional and pass-through truck traffic and most common origins or destinations for local truck trips in the study area.

The Urban Core Mobility Hub includes higher density residential and commercial areas, employment centers, and popular activity centers and tourist attractions. The Urban Core Mobility Hub also includes the Central Mobility Hub where several planned transit services will converge to provide people with rapid and convenient access to and from the airport.

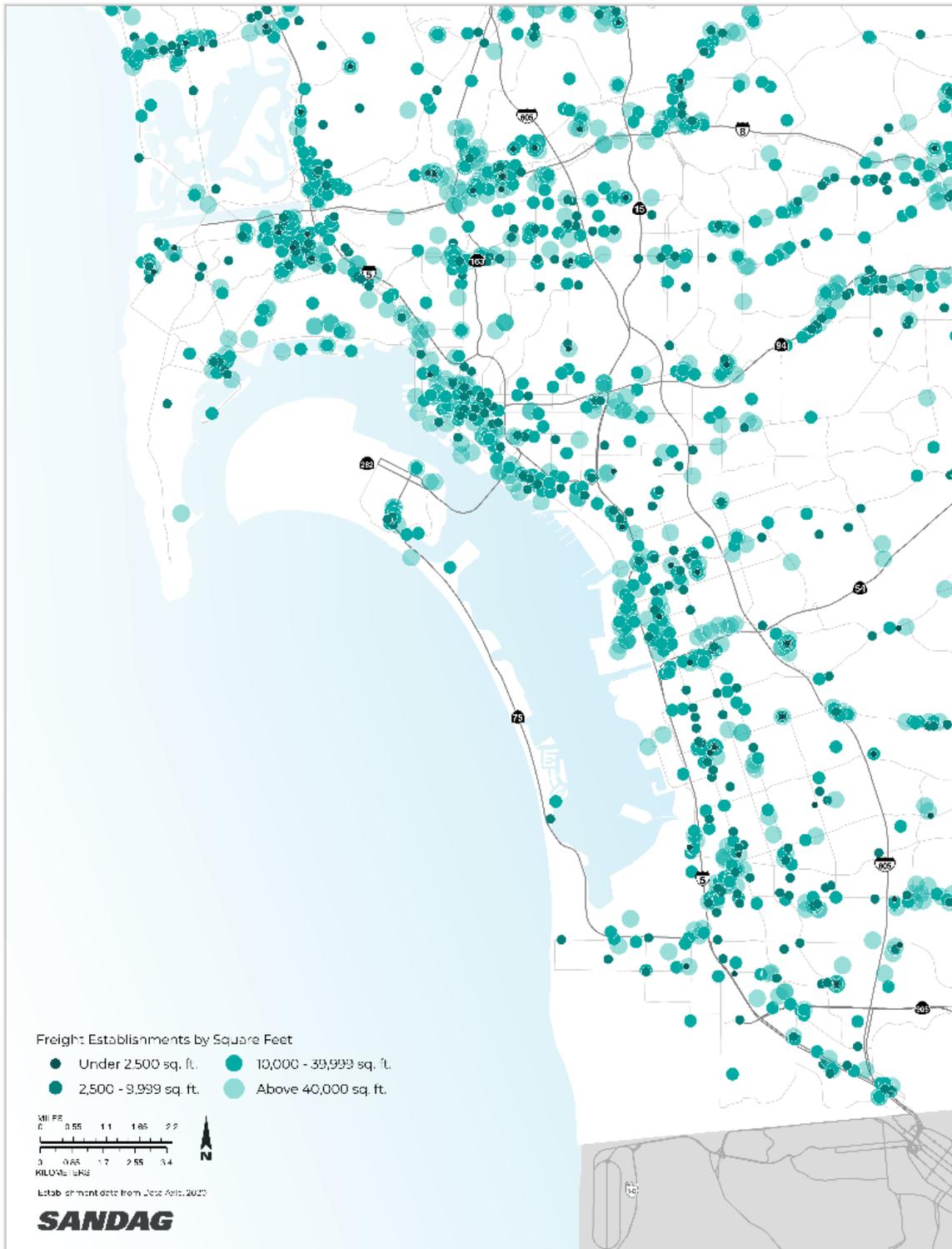
The size and location of the Urban Core Mobility Hub reflects the fact that the area is a transportation and economic center for the region as well as the fact that a large proportion of trips within the Urban Core Mobility Hub are short trips. Demand for short trips within the mobility hub isn’t limited to passenger vehicles and transit. Land uses in the urban core, including San Diego International Airport, Port of San Diego facilities, major entertainment and tourist attractions, industrial sites, and distribution facilities all generate demand for short commercial vehicle trips within the area.

⁵⁵ A Transformative Transportation Vision for the 2021 Regional Plan.
<https://sandag.maps.arcgis.com/apps/Cascade/index.html?appid=897af882e8c14b1e996c33e48bc15347>.

Figure 4.1 shows the size and density of employment centers in the vicinity of the Urban Core Mobility Hub. Downtown San Diego and communities immediately north and south, including the Midway District and Barrio Logan, have significant employment centers that generate demand for local and regional commercial vehicle trips.

Since Mobility Hubs are intended to facilitate both inter-community transportation and transportation between communities across the region across mode types and trip purposes, it is important to understand the existing trip making patterns of trucks and freight in the Urban Core Mobility Hub. New technologies, innovations, and changes in first mile and last mile delivery, e-commerce, and curb space present challenges and opportunities when planning infrastructure and facilities for Mobility Hubs. Analyzing existing truck trip patterns provides a basis for understanding what technology and infrastructure can best serve truck and freight demand within San Diego's urban core while embracing the goals and vision for Mobility Hubs in the region.

Figure 4.1: Freight Establishments in Central San Diego



4.1.3 Big Data Applications

StreetLight Data truck GPS and Location Based Services (LBS) Data from cell phone applications were used for this case study.⁵⁶ StreetLight Data provides a broad range of travel pattern data for select study locations. Travel patterns are identified both using cell phone and GPS devices, and can be joined with other data sources to describe trip maker characteristics and trip purpose. In particular, StreetLight Data can provide origin, destination, route, duration, and stop data specifically for medium-duty truck (with gross vehicle weight [GVW] between 26,000 lb. and 33,000 lb.) trips and heavy-duty truck (GVW greater than 33,000 lb.) trips as well as all vehicle trips based on cell phone data.

To describe the travel patterns in Urban Core Mobility Hub, 29 geographic zones were created between the Midway District, San Diego International Airport, Little Italy, Bankers Hill, Downtown San Diego, Golden Hill, Sherman Heights, Logan Heights, and Barrio Logan, mostly west of Interstate 5; these 29 zones define the study area for this case study. Origin-destination data between each of the zones and zone activity data was then collected from StreetLight Data.

4.1.4 Characteristics of Truck Trips in Urban Core

Figure 4.2 shows the concentration of truck activity within the study area, as well as the percentage of truck trips which are heavy-duty trucks. The San Diego International Airport and Working Waterfront areas generate the largest amounts of truck trips. Approximately 11 percent of truck trips related to land uses in the study area are generated by the airport, and approximately 20 percent are generated by the zones containing the port facilities.

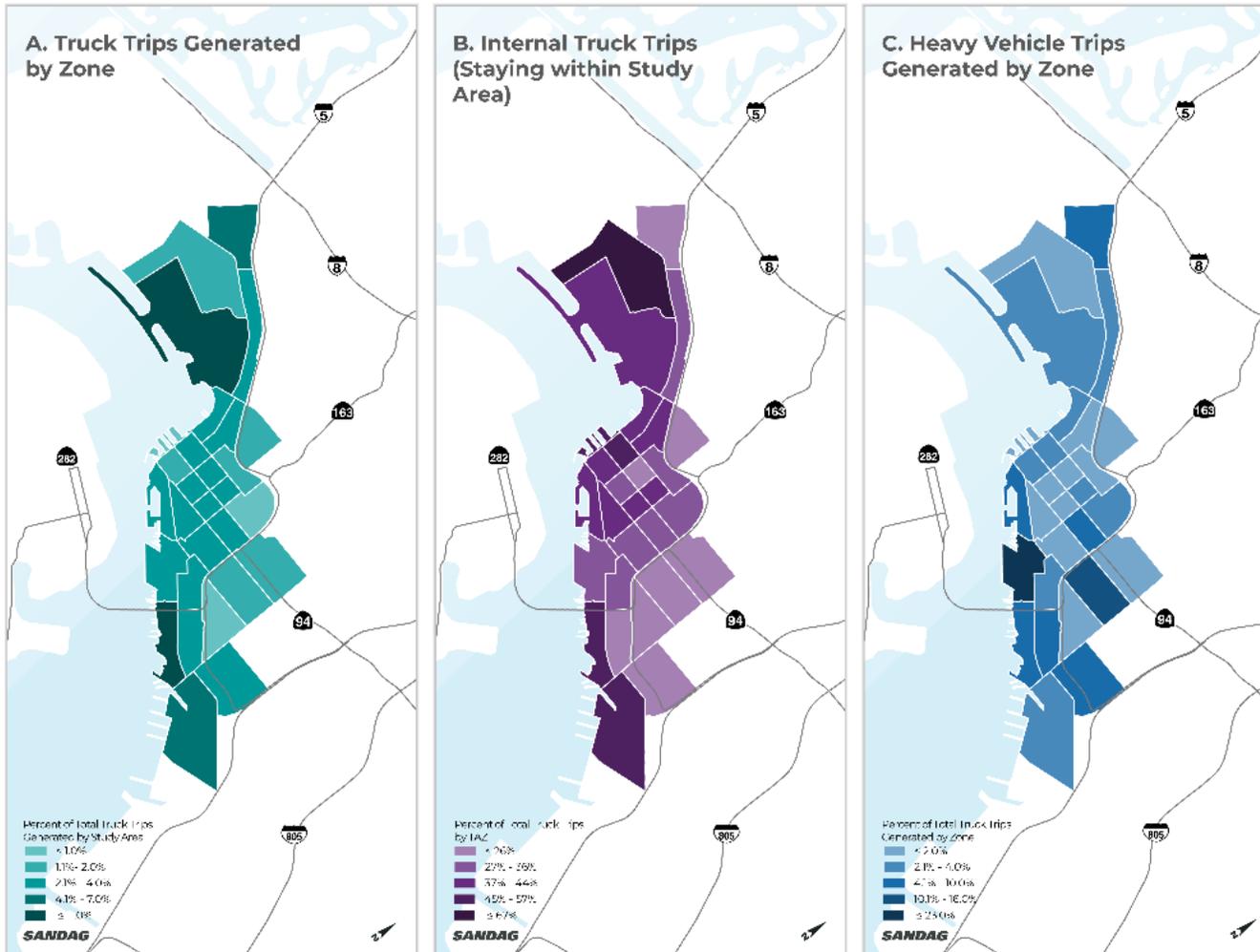
These same zones also have higher percentages of truck trips which are heavy-duty trucks, reflecting that the types of freight activities occurring at the airport and port facilities require truck fleets with greater proportions of heavy-duty trucks.

Within Downtown, Little Italy, the southern Gaslamp area, and Barrio Logan all have more truck trips (medium duty and heavy duty) recorded than neighboring urban downtown zones. In Little Italy and the Gaslamp, this is likely due to the high mix of land uses and concentration of restaurants and eateries. In Barrio Logan, this is likely due to the presence of industrial sites around the neighborhood and proximity to the Port's working waterfront facilities.

Figure 4.2 also shows the percent of truck trips generated by each zone from/to other zones within the study area. Most zones are within 25 percent and 50 percent, reflecting a high degree of internalization of truck trips within the study area. This suggests that trucks making tours within the study area with multiple stops at different destinations, and/or that certain land uses within the study area generate significant demand for short local truck trips.

⁵⁶ StreetLight Data. <https://www.streetlightdata.com/>.

Figure 4.2: Characteristics of Urban Core Truck Trips



Given the significant demand for both local truck deliveries and regional distribution at the airport and port facilities to the rest of the region, additional improvements to the freight system in the urban core will facilitate the efficient distribution of goods both locally while recognizing the role of major facilities in the area for regional goods distribution.

The next section provides further analysis of these trip making patterns by looking specifically at four zones within the study area.

4.1.5 Origin-Destination Analysis

4.1.5.1 San Diego International Airport

Fifteen percent of all truck trips generated by the zone containing the San Diego International Airport and Harbor Island remain within the zone, reflecting that the airport generates many short truck trips related to its daily operations of landside facilities, rental car facilities, and movement of goods between locations within the airport property.

Table 4.1 shows that over half of trips generated by the zone are under five miles, and that many of the truck trips related to the airport are local and onsite.

Table 4.1: Weekday Truck Trip Lengths for San Diego International Airport

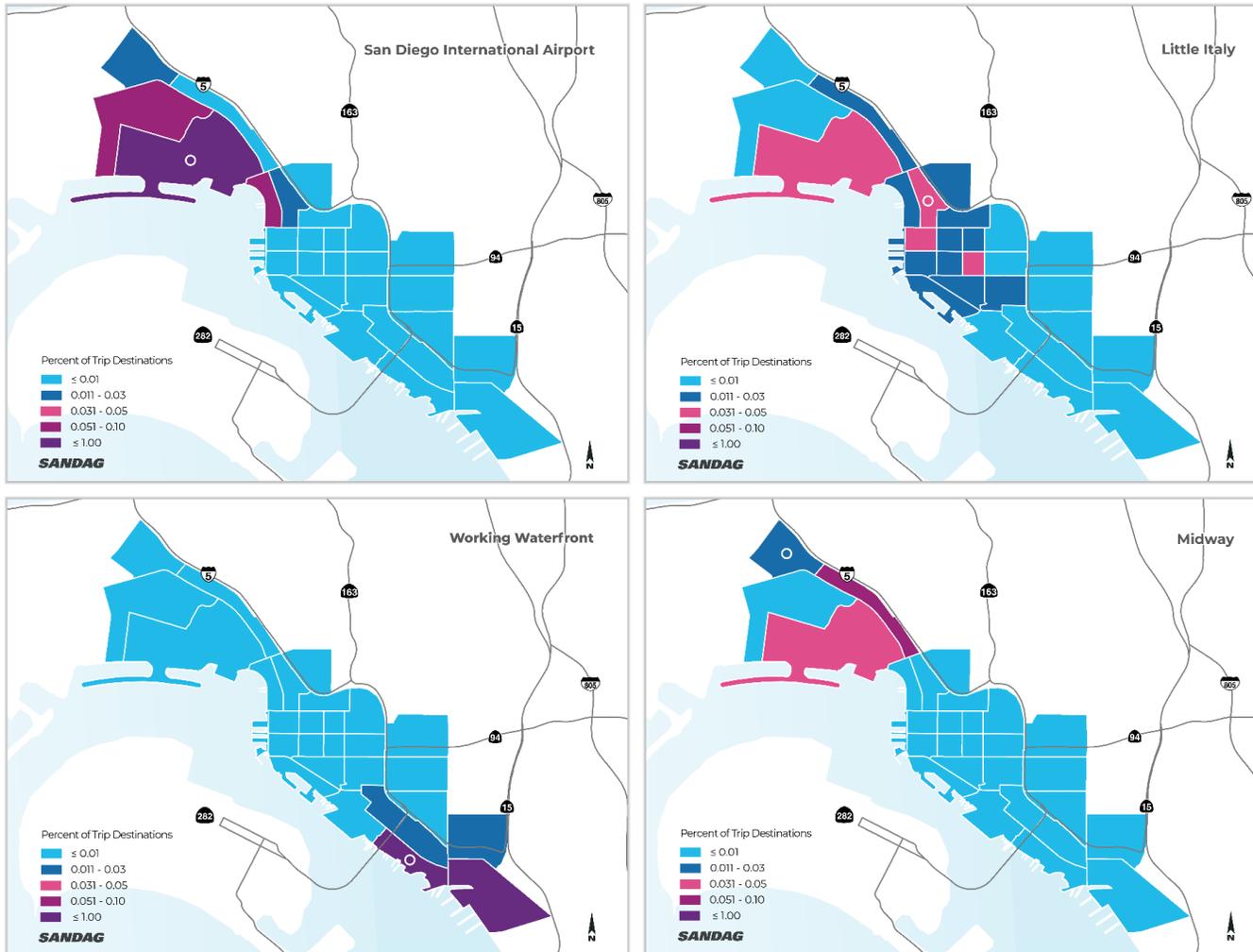
Weekday Truck Trip Lengths for San Diego International Airport						
Distance	0-1 mi	1-2 mi	2-5 mi	5-10 mi	10-20 mi	20+mi
Percent	20%	12%	20%	17%	14%	18%

Source: Streetlight Data/Fehr & Peers

As shown on **Figure 4.3**, zones immediately adjacent to the airport, such as Little Italy, Marine Corps Recruit Depot, southern Midway district, and Middletown are the most common origin-destination (O-D) pairs for the airport zone. The concentration of hotels, smaller industrial uses, businesses, and rental facilities in these areas likely contributes to this. Given that 40 percent of truck trips related to the airport remain in the study area, much of the effects of truck traffic related to the airport remains localized.

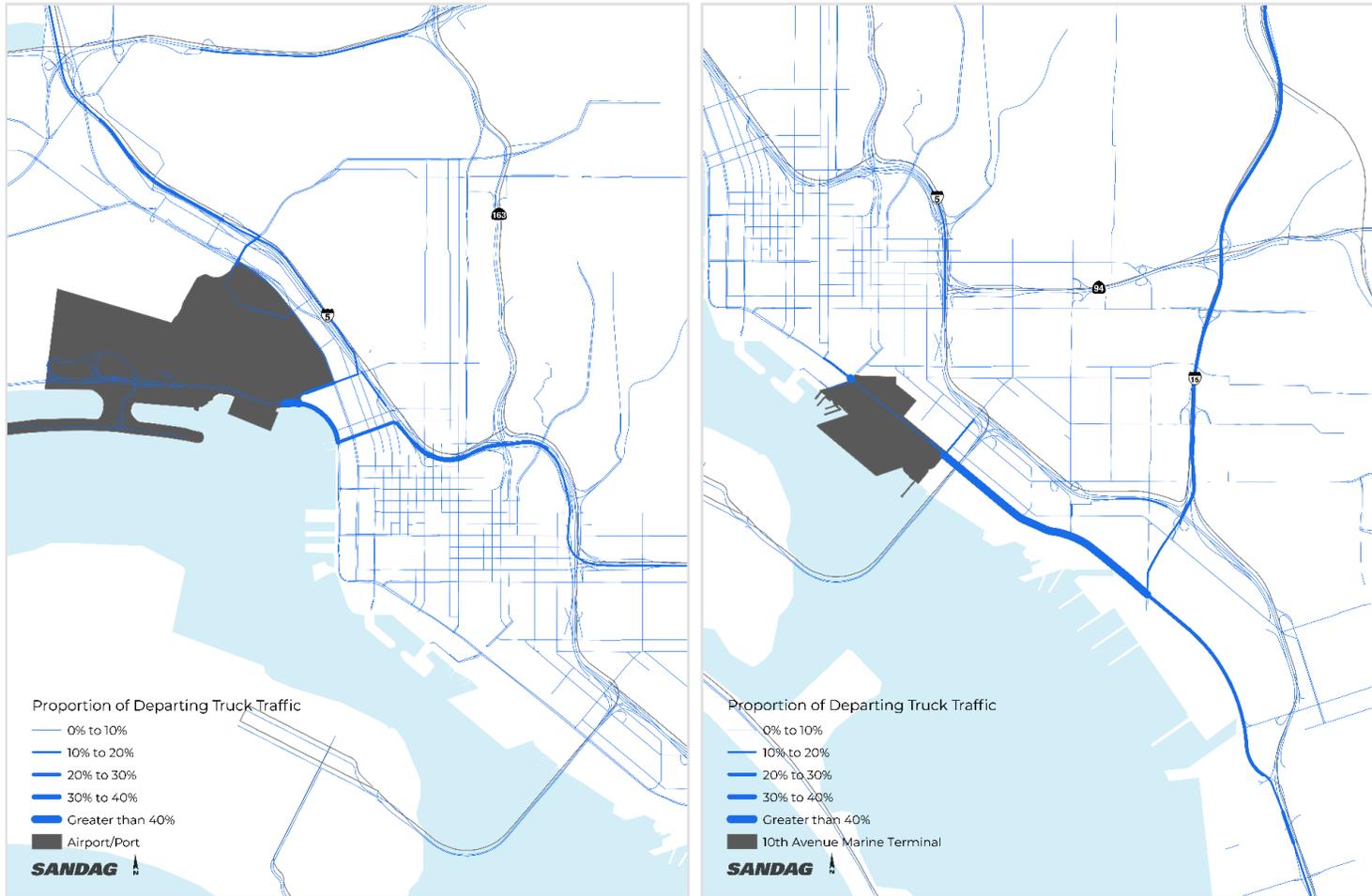
Figure 4.4 shows the top routes of truck trips originating at the airport. Harbor Drive, Grape Street, Washington Street, and Pacific Highway are the heaviest used routes for outbound truck trips not on freeway facilities. The magnitude and dispersal of traffic from these facilities to the freeway and local street network downtown show their importance for local truck traffic as well as more regional truck traffic.

Figure 4.3: Origins and Destinations of Truck Trips Internal to the Study Area



Source: Streetlight Data/Fehr & Peers

Figure 4.4: Top Routes of Truck Trips (Medium- and Heavy-Duty) Departing the Airport and Working Waterfront (Excludes National City Marine Terminal)



Source: Streetlight Data/Fehr & Peers

The movement of trucks through downtown and the urban core for both local and regional trips may impact air quality and noise in the surrounding communities. Near-zero/zero emission commercial vehicles may be suited to accommodate demand for goods movement in the area to minimize these potential impacts. When one end of an O-D pair is a major freight gateway and located close by, such as the airport being near downtown, smaller vehicles and near-zero/zero emission vehicles can provide greater flexibility in how deliveries are made and would reduce emissions within the urban core.

4.1.5.2 Little Italy

Many truck trips generated by zones within Downtown San Diego originate or are destined for other zones within the study area. Those zones are usually near or adjacent to each other. For the zone containing the portion of Little Italy east of the railroad tracks, 40 percent of truck trips generated by the zone are internal to the study area, and 5 percent remain within the zone. As shown on **Figure 4.3**, the most common O-D pairings in the study area with this zone are adjacent and nearby zones downtown, as well as the airport.

Table 4.2 shows that over half of trips generated by the zone are under five miles, and that many of the truck trips are made within the neighborhood and are local.

Table 4.2: Weekday Truck Trip Lengths for Little Italy

Weekday Truck Trip Lengths for Little Italy						
Distance	0-1 mi	1-2 mi	2-5 mi	5-10 mi	10-20 mi	20+mi
Percent	13%	18%	21%	18%	16%	13%

Source: Streetlight Data/Fehr & Peers

Given the concentration of restaurants, businesses, and residents in the area, it is likely that trucks are making multiple stops in the vicinity when travelling downtown, and that downtown land uses generate demand for shorter truck trips between locations within downtown, likely making up almost half of the truck trips generated by these areas. The density of deliveries and short trips in this area, as well as other downtown neighborhoods with similar characteristics such as the Gaslamp, suggest that downtown neighborhoods and shopping/restaurant districts may be good candidates for zero emission (ZE) delivery zones. ZE vans or cargo bikes may be able to accommodate demand for goods movement in the area when one end of an O-D pair is a major goods hub and located close by, such as the airport being near downtown. Smaller vehicles and electric vehicles could provide greater flexibility in how deliveries are made and would reduce emissions within the urban core. However, additional data collection would be needed to determine the existing curb management uses.

Downtown may also be suited for dynamic curb management where deliveries mix with heavier mixed-use traffic, such as along streets Little Italy, where deliveries for restaurants and businesses must often compete with parking and sidewalk demand produced by those restaurants and businesses. However, additional data collection efforts would be needed to determine the existing curb management uses.

4.1.5.3 Working Waterfront

San Diego's Working Waterfront is the area of Harbor Drive that includes Navy Base San Diego, the shipbuilding and repair yards, and the two Port of San Diego marine terminals. However, this study's analysis is limited to a zone south of Cesar Chavez Parkway, west of Harbor Drive, and north of Naval Base San Diego, with the areas near National City Marine Terminal excluded. Analysis of the data shows that 57 percent of medium-/heavy-duty truck trips remain in the study area, with 24 percent remaining within the zone. 27 percent of truck trips related to the zone are made to/from the adjacent zone containing the Navy facilities and the part of the ship manufacturing section of the Port just north of Chollas Creek. A significant amount of this traffic is likely the result of the fact that the zones were based on census blocks, and the General Dynamics area where ship manufacturing occurs was split between the two zones north to south from the end of 28th street. The need for short truck trips in and around the Port facilities explains the high degree of internalization of trips to this area.

Table 4.3 shows that 77 percent of trips generated by the zone are under five miles, with 33 percent under one mile, further suggesting that many of the truck trips captured in this analysis are local and onsite.

Table 4.3: Weekday Truck Trip Lengths for Working Waterfront

Weekday Truck Trip Lengths for Working Waterfront						
Distance	0-1 mi	1-2 mi	2-5 mi	5-10 mi	10-20 mi	20+mi
Percent	33%	15%	29%	9%	7%	7%

Source: Streetlight Data/Fehr & Peers

As shown on **Figure 4.3**, most other truck trips that remain in the study area are between the port facilities and neighborhoods in Barrio Logan. The neighborhood does contain industrial uses, some of which are likely integrated with and economically tied to the port, which may be generating some of this demand.

Figure 4.4 shows the top routes of truck trips originating at the port. Harbor Drive, 32nd Street, 28th Street, and Main Street all handle larger volumes of inbound/outbound trucks to/from the port facilities, acting as the most convenient access routes to I-5 and SR 15 and consistent with the City of San Diego's truck routes. Similar to the airport, the magnitude and dispersal of traffic from these facilities to the freeway and local street network downtown shows that they serve both local and regional truck traffic.

As was suggested for the airport, ZE vans and trucks may be suited to accommodate demand for goods movement in the area while reducing air quality and noise impacts.

4.1.5.4 Midway District

A portion of the Midway district, including the NAVWAR site, was included in the analysis because of the concentration of industrial uses, warehouses, and businesses. Of all the zones in the study area, this zone has the lowest percent of trips remaining in the study area, at 20 percent. This is not unexpected given that the zone is on the edge of the study area and that other areas of Midway outside of the study area near the Sports Arena likely attract many of the trips to and from this zone as well. As shown in **Figure 4.3**, while only 1.4 percent of truck trips generated by the zone remain in the zone, 8 percent are made between the zone and the adjacent zone covering industrial and mixed-use areas between I-5 and Pacific Highway, and trips to and from the airport account for 4 percent of trips. This suggests that, while areas of Midway maintain much higher truck demand to areas outside the study area, likely to the north, the corridor along Pacific Highway between Midway and Downtown is a significant connection for freight coming to and from the Midway area.

Table 4.4 shows that trips generated by the zone are more often longer than the other zones analyzed, illustrating that truck trip generators in this zone serve areas often outside of the immediate Midway neighborhood.

Table 4.4: Weekday Truck Trip Lengths for Midway District

Weekday Truck Trip Lengths for Midway District						
Distance	0-1 mi	1-2 mi	2-5 mi	5-10 mi	10-20 mi	20+mi
Percent	8%	16%	20%	21%	21%	15%

Source: Streetlight Data/Fehr & Peers

The Midway District is the site of a potential Central Mobility Hub where several planned transit services will converge to provide people with rapid and convenient access to and from the airport. The presence of existing distribution sites, industrial sites, and commercial areas in Midway are examples of how the area already acts as a central location for many land uses. Given the area’s location within the Urban Core, mix of land uses, and the proposed Central Mobility Hub, it is likely an ideal area for newer innovations in goods distribution to take root. A small parcel hub and rapid fulfillment center in this area is analyzed in the next section.

4.1.6 Distribution Center Origin-Destination Analysis

Three existing distribution centers were analyzed to understand their trip making patterns in the Urban Core mobility hub and to Greater San Diego:

- A shipping/service Center in the Mt. Hope neighborhood of San Diego

- A rapid fulfillment center in the Midway area of San Diego
- A food distribution center located between Pacific Highway and I-5 north of San Diego International Airport

4.1.6.1 Shipping/Service Center

Figure 4.5 shows that truck trips to and from shipping and service center are largely to and from San Diego International Airport, the Kearny Mesa area, and the Otay Mesa/Border area. Truck trips are also shown to be spread out across neighborhoods in the urban core, but not nearly as concentrated as the areas mentioned earlier. While no major distribution centers exist within the study area, shipping centers like this service the study area and serve as a hub for packages from the major industrial areas and gateways nearby. While more major distribution centers are located further away from the urban core of San Diego, smaller centers such as this one serve as a local hub for packages and a distribution point between larger freight hubs and the consumer.

4.1.6.2 Rapid Fulfillment Center

This location fulfills customer orders on items they purchase within hours. As shown in **Figure 4.6**, many of the trips made to and from this facility to fulfill customer orders are not made by trucks but a wider range of vehicles. Trips are also spread throughout the urban core, with larger concentrations around the airport and downtown San Diego.

While much of this study has focused on truck traffic, with changes in consumer behavior and digital platforms, it is increasingly more common in urban areas for rapid deliveries to be made. Because of the quick turnaround and local nature of these trips, vehicles smaller than trucks appear to be the mode of choice. The concentration and density of land uses within the urban core and downtown areas lend themselves well to this type of service, since they are near the hub and generate enough demand for a rapid fulfillment center to handle items frequently ordered by customers.

4.1.6.3 Food Distribution Center

Figure 4.7 shows that the food distribution center serves much of the Urban Core Mobility Hub, with trips focused around areas with higher concentrations of grocers and eateries. Little Italy, Balboa Park, and the Midway area all have significant truck traffic to and from the site, although Hillcrest, North Park, and Downtown San Diego also have significant traffic.

Truck trips to and from the site also extend further up the coast into La Jolla, but the higher concentration in the Urban Core Mobility hub suggests that there is significant demand for the center's service in the area, and that it is convenient for the center to be located in the study area and near neighborhoods in the urban core.

Figure 4.5: Distribution of Trips to and from the Mount Hope Shipping and Service Center

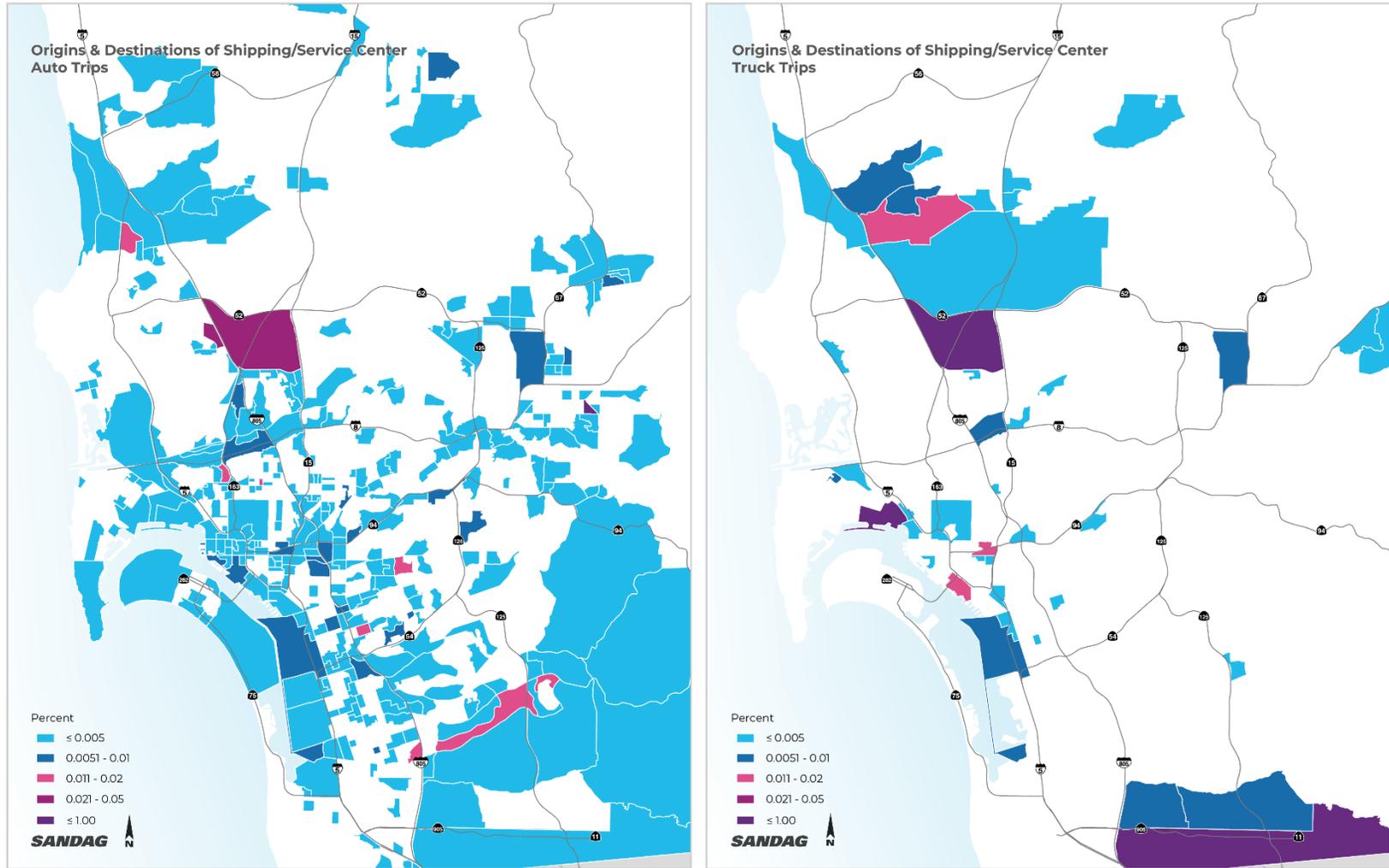
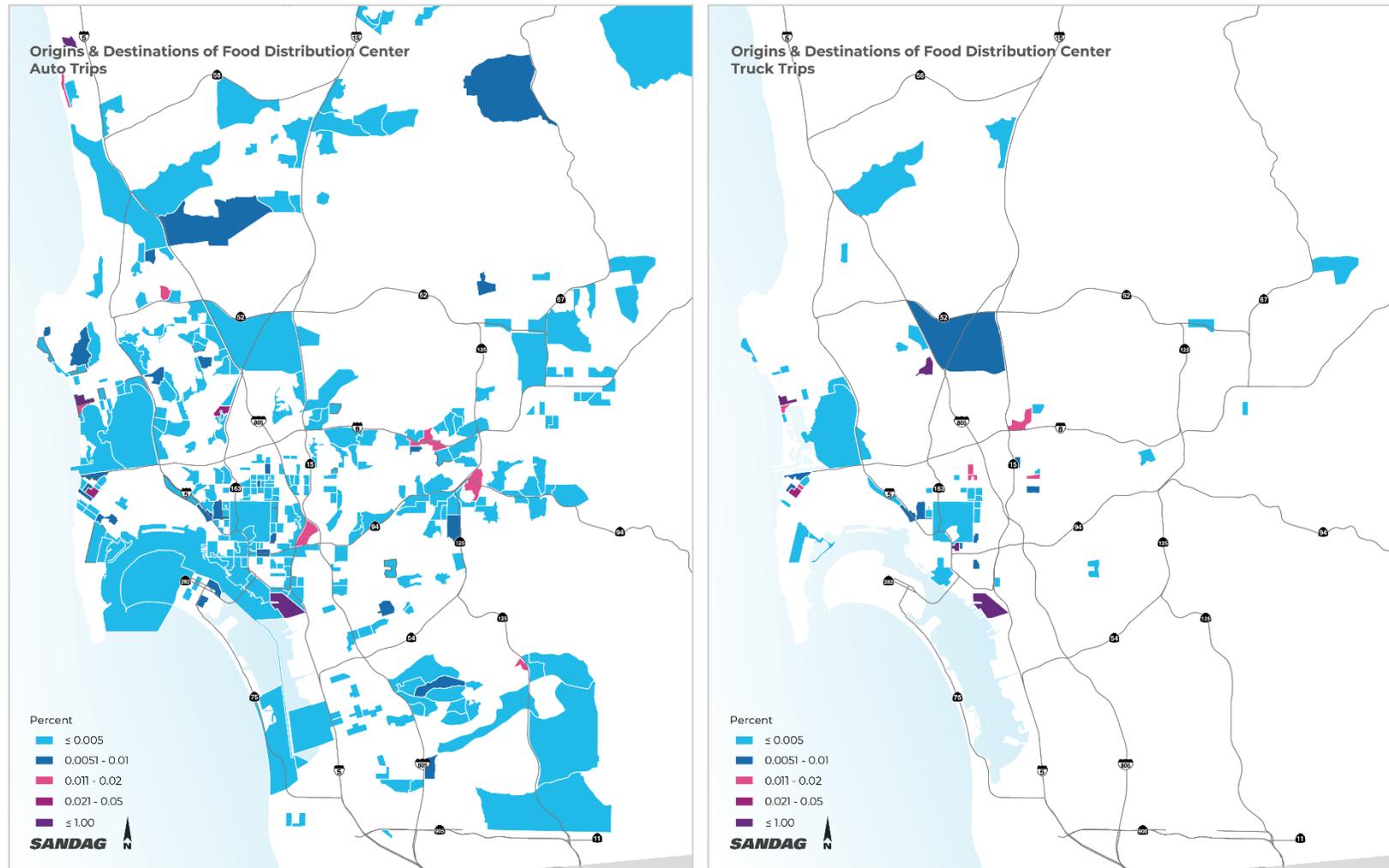


Figure 4.7: Distribution of Trips to and from the Food Distribution Center near Washington Street Station



4.1.7 Analysis of Replica Data

Data from Replica, an enterprise data platform, was also analyzed to better understand travel patterns within the study area. Data from 2019, aggregated at the census tract level, was studied to provide additional context to the Streetlight Data analysis. Replica data uses a wide range data sources that include the US Census, land use regulations, mobile devices, credit transactions, and real estate transactions to calculate its mobility metrics.

In 2019, there were approximately 295,000 weekday trips per month that originated in the study area. On average, 30 percent of all weekday trips that started within the study area also finished in the same geography. Within the study area, private auto trips consisted of approximately 72 percent of all trips taken in 2019, which includes trucks. Replica's data does not distinguish truck or freight-related trips from auto trips, thus limiting direct comparisons to the Streetlight Data analysis. After home-related trips, work-related trips were the 2nd highest trip purpose category (approximately 24 percent), which include trips to jobsites and trips made as a part of work. Again, Replica's data was limited to broad categories, which did not allow for more nuanced analysis that could better identify freight-related activity patterns.

Within the study area, the census tract which encompasses Old Town, had the highest percentage of trips starting and finishing in its own geography (17%), as compared to other parts of the Mobility Hub (it also contained the highest population). The airport census tract had the second highest percentage of trips (7%) staying within its geography; this showcases the large amount of activity contained in or around San Diego International Airport. Outside of airport census tract boundaries, the areas containing the Gaslamp Quarter/Seaport Village had the highest percentage of trips in the study area that terminated within the airport census tract. These trips are likely related to tourism, recreational and industrial activity concentrated in the area. In the census tract containing Little Italy, most trips stayed within its boundaries or finished in nearby downtown zones, which includes the airport and nearby port areas. For the census tract containing the Working Waterfront, most trips were limited to the Port facilities and adjacent neighborhoods, which is likely due to freight distribution needs.

While Replica's data does not provide information regarding how freight trips specifically are moving through and in the study area, this analysis showcases the concentrated nature of most trips, regardless of type, in the Urban Core Mobility Hub. Considering this, these findings broadly mirror those of the Streetlight Data analysis and show the importance and scale of local activity.

4.1.8 Urban Freight and Last Mile Delivery Conclusions and Next Steps

- Mobility Hubs: New technologies, innovations, and changes in first mile and last mile delivery, e-commerce, and curb space present challenges and opportunities when planning infrastructure and facilities for Mobility Hubs. Analyzing existing truck trip patterns provides a basis for understanding what technology and infrastructure can

best serve truck and freight demand within San Diego's urban core while embracing the goals and vision for Mobility Hubs in the region.

- **Big Data:** StreetLight Data and Replica data platforms were utilized to assess travel patterns of freight activity in the study area. The airport and port areas generate the largest amounts of truck trips; especially heavy-duty trucks. Approximately 11 percent of truck trips related to land uses in the study area are generated by the airport, and approximately 20 percent are generated by the zones containing the port facilities. Most of the other zones analyzed show a high degree of internalization of truck trips within the study area. This suggests that trucks making tours within the study area make multiple stops at different destinations, and/or that certain land uses within the study area generate significant demand for short local truck trips. Additional improvements to the freight system in the urban core will facilitate the efficient distribution of goods locally while recognizing the role of major facilities in the area for regional goods distribution.
- **San Diego International Airport:** ZE vehicles can provide greater flexibility in how deliveries are made and would reduce emissions within the urban core.
- **Little Italy:** The density of deliveries and short trips in this area, as well as other downtown neighborhoods with similar characteristics such as the Gaslamp, suggest that downtown neighborhoods and shopping/restaurant districts are good candidates for zero emission (ZE) delivery zones, including the use of cargo bikes.
- **Working Waterfront:** ZE vans and trucks may be suited to accommodate demand for goods movement in the area while reducing air quality and noise impacts, given the volume of local truck trips and improvements in ZE technologies.
- **Midway District:** Given the area's location within the Urban Core, mix of land uses, and the proposed Central Mobility Hub, it is likely an ideal area for newer innovations in goods distribution to take root such as a small parcel hub and/or a rapid fulfillment center.

4.2 Near-Zero and Zero-Emissions Technologies Trend

This trend describes the status of alternatively fueled freight vehicles in the San Diego and Imperial Counties Gateway Region, identifies gaps in accelerating the adoption of these vehicles, and identifies roles for the Region to advance these technologies. As a starting point, this section will cover the latest Federal, State, and local regulations and policies affecting freight zero-emissions (ZE) adoption in the Gateway Region. Next, this section will provide an overview of the state of the technology followed by a discussion about industry adoption and deployment and a case study demonstrating the potential benefits of early deployment. Lastly, this section will explore gaps in infrastructure, opportunities for targeting investment, and strategies for advancing deployment of ZE freight vehicles.

4.2.1 Federal Regulations and Policies

Zero-emission freight transportation requires the involvement and coordination of multiple federal agencies, including U.S. Environmental Protection Agency (US EPA), U.S. Department of Transportation (US DOT), U.S. Department of Energy (US DOE), and the U.S. Department of Commerce (US DOC). Each branch plays a role. From a regulatory compliance standpoint, US EPA has been driving the move towards ZE for the past decade through its authority to set federal emissions standards and air quality attainment thresholds.

4.2.1.1 U.S. International Climate Change Commitment

In 2021, the United States re-entered the Paris Agreement—a legally binding international treaty on climate change with a goal to limit global warming to 1.5 degrees Celsius, compared to pre-industrial levels. On April 22, 2021, President Biden announced a new climate target for the United States to achieve a 50 percent reduction in greenhouse gases (GHGs) from 2005 levels by year 2030, which is even more aggressive than California’s goal of a 40 percent reduction by 2030. The primary GHG reductions targeted by the current administration are transportation and energy production. The regulations necessary to achieve this are still in progress.

4.2.1.2 Federal Fuel Efficiency and Emissions Standards

The National Highway Traffic Safety Administration (NHTSA) regulates fuel efficiency while the US EPA regulates emissions. NHTSA’s Corporate Average Fuel Economy (CAFE) standards regulate how far vehicles must travel on a gallon of fuel, while the US EPA focuses on emission reductions. Jointly on March 31, 2020, NHTSA and EPA announced the latest CAFE and carbon dioxide emissions standards for years 2021-26 named the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule. The rule, which was finalized in July 2020, ratchets up fuel efficiency requirements by 1.5 percent per year through 2026. On August 10, 2021, NHTSA released its intention to amend the CAFE standards set in 2020 for passenger cars and light trucks manufactured in model years 2024-2026, so that standards would increase in stringency at a rate of 8 percent per year rather than the 1.5 percent approved last year. As of the time of this report, NHTSA was seeking public comment. NHTSA’s proposal responds to President Biden’s directive in Executive Order 13990 for NHTSA to reconsider the CAFE standards finalized in 2020. The following standards are currently in place:

Medium-Duty Trucks/Heavy-Duty Trucks (MDT/HDT)

- NHTSA Fuel standards:
 - Tier 2 gasoline = 30 parts per million (ppm) of sulfur
 - Tier 3 gasoline = 10 ppm of sulfur, and Ultra-Low Sulfur Diesel (ULSD) = 15 ppm of sulfur
- Heavy-duty Highway Engine and Vehicle Standards:
 - Diesel particulate filter (DPF) and selective catalytic reduction (SCR) technologies

Locomotives

- Tier 4 freight switcher locomotives offer a 90 percent reduction in both PM and NOx, and without the limitations of more challenging fuel and/or technologies

Cargo Handling Equipment

- Tier 4 non-road mobile equipment (the emissions source category that includes cargo handling equipment) can be as much as 90 percent cleaner than Tier 1 equipment. Measures that encourage and/or require use of Tier 4 non-road cargo equipment can achieve much of the emissions reduction benefits of zero-emission equipment without many of the limitations of the latter technologies

Model Year 2027 Emissions and Fuel Consumption Standards for Commercial Trailers/Vans

- Dry Van
- Long trailer:
 - EPA CO2 Emissions standard of 75.7 g/ton-mile
 - NHTSA Fuel Consumption standard of 7.43615 gal/1,000 ton-mile
- Short trailer:
 - EPA CO2 Emissions standard of 119.4 g/ton-mile
 - NHTSA Fuel Consumption standard of 11.7288 gal/1,000 ton-mile

Truck Refrigeration Units (TRU or reefers)

- Long trailer:
 - EPA CO2 Emissions standard of 77.4 g/ton-mile
 - NHTSA Fuel Consumption standard of 7.60314 gal/1,000 ton-mile
- Short trailer:
 - EPA CO2 Emissions standard of 123.2 g/ton-mile
 - NHTSA Fuel Consumption standard of 12.10216 gal/1,000 ton-mile

4.2.2 State Regulations and Policies

In the Gateway Region, the most influential agency governing air quality and greenhouse gas regulations, policies, and funding is the California Air Resources Board (CARB). CARB regulations are often more stringent than federal regulations established by the US EPA, and the agency provides significantly more funding to public agencies and private industries pursuant to its emissions reductions targets.

4.2.2.1 California Air Resources Board

The following California Air Resources Board (CARB) rules and statewide goals for greenhouse gas emissions reduction are currently in place but amendments are being pursued pursuant to Executive Order N-79-20 (described later in this section):

- Meet federal health-based ambient air quality standards by 2023 and 2031, respectively;
- Achieve a 40% reduction in greenhouse gases (GHGs) by 2030;
- Achieve an 80% reduction in GHGs by 2050; and,
- Achieve a 50% reduction in the use of petroleum by 2030

CARB is currently developing regulations to implement the 100 percent zero emission truck sales mandate pursuant to EO N-79-20 by 2045, and it is also considering a zero-emission sales mandate for drayage trucks by 2035.

4.2.2.2 Advanced Clean Trucks Rule

In June 2020, CARB adopted their first zero emission vehicle (ZEV) requirements for heavy-duty trucks. California's groundbreaking Advanced Clean Trucks rule (ACT) and the corresponding fleet regulations require zero-emission purchases now in development in California. ACT—the first such policy globally—calls on truck manufacturers to sell increasing percentages of zero-emission trucks beginning in 2024. Policies like ACT provide clear market direction for manufacturers through regional and state-level.

The Advanced Clean Truck Regulation has two main components: a manufacturers zero emission vehicle sales requirement and a one-time reporting requirement for large entities and fleets [5082]. The ZEV sales requirements are applicable to manufacturers of Class 2b-8 trucks beginning from 2024.

Early in the regulatory process, a fleet rule requirement was proposed that would have required fleets to gradually increase ZEV purchases when replacing vehicles starting in 2020. However, this was rejected because it was believed that ZEV availability and support was insufficient to meet state commitments. A ZEV fleet rule is planned for the near future.

4.2.2.3 Executive Order N-79-20

Most recently on September 23, 2020, Governor Newsome signed Executive Order (EO) N-79-20 into law, which requires all heavy-duty trucks sold in California to be zero-emission by 2045, ten years after a similar passenger vehicle requirement is set to go into effect. The order also requires state agencies, in partnership with the private sector, to accelerate deployment of affordable fueling and charging options. To further advance the deployment of ZE trucks, Governor Newsome also signed an MOU with 14 other states to advance and accelerate the market for electric medium- and heavy-duty vehicles creating economies of scale that drive the purchase costs down.

The manufacturers Zero Emission Vehicle sales requirement requires truck manufacturers to transition from diesel trucks and vans to electric zero-emission trucks beginning in 2024. However, early credits can be generated starting in model year 2021. The rule encourages development of ZEV Class 7 and 8 tractors and requires that by 2045, every new truck sold in California be zero-emission.

The adopted rule is meant to enforce a large-scale transition of zero-emission medium- and heavy-duty vehicles from Class 2b to Class 8. Manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines will be required to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. By 2035, zero-emission truck/chassis sales would need to be 55 percent of Class 2b-3 truck sales, 75 percent of Class 4-8 straight truck sales, and 40 percent of truck tractor sales.

The ZEV sales schedule, **Table 4.5**, contains the truck sales schedule requirements for Class 7-8 tractor group (GVWR above 26,000 lbs.). Compliance will be determined by first calculating a deficit based on the manufacturer’s annual sales volume of on-road vehicles produced and delivered for sale in California. Credits generated from ZEVs and NZEV sales will then be used to offset this deficit.

The deficit is calculated as the product of the model year percentage requirement from **Table 4.5**, and the appropriate weight class modifier for each vehicle from **Table 4.6**. Every model year, the deficits generated by each vehicle are summed for each vehicle group.

Table 4.5: California Zero-Emission Vehicle Credits

California Zero-Emission Vehicle Credits	
Class 7-8 Tractor Group	
Credit Type	Credit Amount
NZEV	Up to 50% of deficit
NZEV	To meet Classes 2b-3 and 4-8 deficits
ZEV	To meet Class 7-8 deficits
ZEV	To meet Classes 2b-3 and 4-8 deficits

Source: ACT 15-Day Notice Attachment B accessed on May 11, 2021, at: <https://ww3.arb.ca.gov/regact/2019/act2019/30dayattb.pdf>

Table 4.6: California Zero-Emission Vehicle Truck Sales Schedule

California Zero-Emission Vehicle Truck Sales Schedule	
Class 7-8 Tractor Group	
Model Year	Percent of Sales
2024	5%
2025	7%
2026	10%
2027	15%
2028	20%
2029	25%
2030	30%
2031	35%
2032 and Beyond	40%

Source: ACT 15-Day Notice Attachment B accessed on May 11, 2021. at: <https://ww3.arb.ca.gov/regact/2019/act2019/30dayattb.pdf>

Starting with model year 2021, manufacturers generate compliance credits that can be used to offset their deficit by selling zero emission vehicles (ZEV) and partial credits for selling near-zero emission vehicles (NZEV). ZEVs are vehicles with no tailpipe emissions. The ZEV credit generated for each vehicle sold is equal to the value of the appropriate weight class modifier in **Table 4.6**. NZEVs are defined as plug-in hybrid electric vehicles with a minimum all-electric range and these vehicles can generate credits until the end of the 2035 model year. The NZEV credit generated for each vehicle sold is calculated as the product of the appropriate weight class modifier in **Table 4.6** and the NZEV factor value [$0.01 \times$ all-electric range (AER)]. The NZEV factor value is capped at 0.75 which is obtained for a vehicle with an AER of 75 miles (120 km). To qualify for NZEV credits, a minimum AER is required. ZEV and NZEV credits can be banked, traded, sold or otherwise transferred between manufacturers. NZEV credits must be accounted for separately from ZEV credits. Class 7-8 tractor group credits must be accounted for separately from other credits.

Compliance is achieved when the manufacturer's Class 7-8 tractor credits offset their Class 7-8 tractor deficits and when the manufacturer's total credits offset their total deficits. Except for manufacturers with low tractor volumes (25 or fewer Class 7-8 tractor deficits per year), annual deficits accrued in the Class 7-8 tractor group can only be met with Class 7-8 tractor credits.

Manufacturers with annual state sales less than 500 units are exempt from the ZEV mandate. At the end of 2020, the companies above the sales threshold were Daimler (Freightliner, Thomas Built Buses, Western Star), Paccar (Kenworth, Peterbilt), Navistar

(International, IC Bus), Ford, GM (Chevrolet, GMC), Fiat Chrysler (Dodge), Nissan, Isuzu, Toyota (Hino), and Volvo Group.

4.2.2.4 Assembly Bill 617 Community Air Protection Program

In response to Assembly Bill 617 (AB 617), CARB established the Community Air Protection Program which aims to reduce air pollution in environmental justice communities that are most impacted. Using criteria established by the State for identifying environmental justice communities, the San Diego and Imperial Counties Air Pollution Control Districts identified the following communities (the footnotes provide links to each community's Community Emissions Reduction Plan [CERP]), which details the context-specific mitigation strategies that have been developed):

- Portside Environmental Justice Community⁵⁷
- El Centro-Heber-Calexico Corridor⁵⁸

For each environmental justice community, the corresponding CERP details actions to reduce air pollution emissions or exposures that are specific to the community. Many CERPs include strategies highlighting the desire to transition truck fleets over to ZE technologies. For a comprehensive list of emission-reduction strategies, please refer to the applicable CERP.

Programs and policies adopted in CERPs can complement regional and localized strategies being implemented by entities like SANDAG and others. Approaches identified, implemented, and found to be successful in the CERPs can be investigated for broader implementation.

4.2.3 Funding and Testing Zero-Emissions Technologies

President Biden's new 'American Jobs' plan, which includes \$174 billion in investments in the U.S. electric vehicle (EV) market, would help accelerate the drive to zero emission vehicles. The plan proposes a number of market-driving measures including point-of-sale rebates and tax incentives to buy American-made EVs, as well as grant and incentive programs to build a national network of 500,000 EV chargers by the year 2030. It also calls for the electrification of 50,000 diesel transit vehicles and at least 20 percent of school buses across the nation. All of these actions would send clear market signals to manufacturers, investors, and fleets that zero-emission vehicles and their components will enjoy a growing market in the United States. The funding for ZE freight vehicles could come through a variety of established funding programs described in the following section.

⁵⁷ Portside Environmental Justice Neighborhoods "Community Emissions Reduction Plan." sandiegocounty.gov/content/sdc/apcd/en/community-air-protection-program--ab-617-.html.

⁵⁸ AB 617 Imperial County: Calexico, Heber, El Centro Corridor. <https://www.icab617community.org/>.

4.2.3.1 U.S. Department of Energy

SuperTruck3

The U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE) initially launched the SuperTruck initiatives⁵⁹ in 2009 with a goal of improving improve heavy-duty truck freight efficiency by 50 percent, followed by SuperTruck 2 in 2016, which aimed to double fuel efficiency for Class 8 trucks. The initiatives attracted the participation of nearly 100 percent of the U.S. truck market. Within seven years, Volvo, Daimler, Cummins/Peterbilt, and Navistar had exceeded the first SuperTruck goal.

EERE's Vehicle Technologies Office (VTO) and Hydrogen and Fuel Cell Technologies Office (HFTO) are now partnering on the "SuperTruck 3" Funding Opportunity Announcement (FOA) released in April 2021 to offer up to \$100 million in funding over four years—subject to appropriations—to pioneer electrified medium- and heavy-duty trucks and freight system concepts that achieve even higher efficiency and lower emissions. The funding focuses on a range of approaches to electrification from all-electric or hydrogen fuel cell technologies to renewable biofuels and hybrids.

Low Greenhouse Gas Vehicle Technologies Funding Opportunity

VTO also announced in early 2021 the availability of \$62.75 million as part of its "Low Greenhouse Gas Vehicle Technologies Research, Development, Demonstration, and Deployment". The funding is targeted for innovative solutions to reduce emissions and increase efficiencies of on- and off-road vehicles. This funding can be used to support expansion of EV infrastructure and charging and for developing advanced engines and fuels that operate with lower emissions.

4.2.3.2 U.S. Environmental Protection Agency

Diesel Emission Reduction Act

The U.S. Environmental Protection Agency's (EPA's) Office of Transportation and Air Quality solicits annual proposals from eligible states and territories for participation in Diesel Emission Reduction Act (DERA) funding. EPA anticipates nearly \$90 million available for all fiscal year 2021 DERA programs. Formula-based funding can support grant and rebate programs administered by eligible states or territories that are designed to achieve significant reductions in diesel emissions. Eligible diesel vehicles, engines and equipment may include buses, Class 5–Class 8 heavy-duty highway vehicles, marine engines, locomotives and nonroad engines, equipment or vehicles such as those used in construction, handling of cargo, agriculture, mining or energy production. Eligible diesel emissions reduction solutions include verified retrofit technologies such as exhaust after-treatment technologies, engine upgrades, and cleaner fuels and additives, verified idle reduction technologies, verified aerodynamic technologies, verified low rolling resistance

⁵⁹ DOE SuperTruck Initiative accessed on May 11, 2021. <https://www.energy.gov/articles/energy-department-announces-137-million-investment-commercial-and-passenger-vehicle>.

tires, certified engine replacements and conversions, and certified vehicle or equipment replacement.

The San Diego County Air Pollution Control District (APCD) was awarded \$2 million in 2020 as part of DERA to replace one diesel port tugboat with a zero-emission electric vessel.

Congestion Mitigation and Air Quality Improvement Program

The Congestion Mitigation and Air Quality (CMAQ) Improvement Program was first established by the 1991 Federal Intermodal Surface Transportation Efficiency Act (ISTEA). Funds are directed to transportation projects and programs which contribute to the attainment or maintenance of National Ambient Air Quality Standards (NAAQS) in nonattainment or air quality maintenance areas for ozone, carbon monoxide, or particulate matter (PM) under provisions in the Clean Air Act. The City of Salt Lake and the Utah Inland Port Authority secured CMAQ funding for a newly proposed truck parking/plug-in facility in the inland port area. The region has a history of truck idling (especially overnight hoteling activity) -which can contribute to poor air quality given the level of emissions. The new plug-in facility would allow trucks to avoid relying solely on their onboard auxiliary power units (APUs), which tend to run on diesel fuel.

4.2.3.3 California Air Resources Board

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

California Air Resources Board (CARB) launched the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project in 2009. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) supports the early deployment of zero-emission and near-zero-emission technologies by off-setting the higher cost of ZE and near-ZE heavy-duty vehicles that are being developed, tested and improved. HVIP responds to two critical market challenges by making clean vehicles more affordable for fleets through point-of-purchase price reductions, and off-setting concerns like limited range and service-proven data. HVIP is the earliest model of its kind in the U.S. and has had great success with testing function, flexibility, and effectiveness of these new technologies. HVIP is administered by CALSTART, a national clean transportation nonprofit consortium, on behalf of CARB.

4.2.3.4 California Energy Commission

GFO-20-606 – Zero-Emission Drayage Truck and Infrastructure Pilot Project⁶⁰

The Clean Transportation Program (initially named the Alternative and Renewable Fuel and Vehicle Technology Program, 2008) allocates up to \$100 million annually for accelerating the adoption and deployment of advanced transportation and fuel technologies. The California Energy Commission leverages public and private investments to support adoption of cleaner transportation powered by alternative and renewable fuels. Public funds are derived from vehicle and vessel registration fees, license

⁶⁰ Clean Transportation Program. California Energy Commission. <https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program>.

plates, and smog abatement fees. The program provides for the following types of investments:

- ZE and near-ZE fueling infrastructure
- Testing, advancement and deployment of ZE and near-ZE technologies
- ZE and near-ZE manufacturing
- ZE and near-ZE workforce development

The program plays an important role in achieving California's ambitious goals on climate change, petroleum reduction, and adoption of zero-emission vehicles, as well as efforts to reach air quality standards. The program also supports the state's sustainable, long-term economic development.

4.2.3.5 San Diego County and Imperial County Air Pollution Control Districts

The Gateway Region's air districts and San Diego and Imperial Counties currently offer the following grant programs for Heavy-Duty Trucks, which are statewide programs managed by the air districts. Please click on the Program links below to find out more information about grant availability and eligibility requirements:

- Carl Moyer Program and Other Related Programs⁶¹
- Proposition 1B Goods Movement Emission Reduction Program (GMERP)⁶²
- Voucher Incentive Program (VIP)⁶³
- California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)⁶⁴
- California Air Resources Board Truck Loan Assistance⁶⁵

4.2.4 Original Equipment Manufacturers' Advancements (Trucks)

There are several original equipment manufacturers that are far along in the development of ZE and near-ZE heavy-duty trucks. Notably, as described in the DOE's SuperTruck program, four manufacturers have successfully demonstrated technologies and others are close. The cost remains much higher for these new vehicles than for traditional diesel-powered trucks. The technology is also relatively young, and as it matures, costs will come down, range will increase, and the technicians will be available to work on these new high-tech vehicles.

⁶¹ Clean Air For All: Moyer/FARMER/CAPP Grants. San Diego County Air Pollution Control District. <https://www.sdapcd.org/content/sdc/apcd/en/grants-and-incentives/carl-moyer-program.html>.

⁶² Proposition 1B Goods Movement Emission Reduction Program (GMERP). San Diego County Air Pollution Control District. <https://www.sandiegocounty.gov/content/sdc/apcd/en/grants-and-incentives/proposition-1b-goods-movement-emission-reduction-program--gmerp-.html>.

⁶³ Voucher Incentive Program (VIP). San Diego County Air Pollution Control District. <https://www.sdapcd.org/content/sdc/apcd/en/grants-and-incentives/voucher-incentive-program--vip-.html>.

⁶⁴ California HVIP. <https://californiahvip.org/>.

⁶⁵ Truck Loan Assistance Program. California Air Resources Board. <https://ww2.arb.ca.gov/our-work/programs/truck-loan-assistance-program>.

4.2.5 Freight Industry Adoption

4.2.5.1 Implementation Trends

With the growth of online shopping and its acceleration during the COVID-19 pandemic, some experts believe the recent e-commerce boom will speed up zero emission truck adoption. One major factor is the improvement in battery technology, coupled with increases in mass production. Battery costs for certain classes of commercial vehicles are declining so rapidly that some applications already, or soon will, boast a better business case when compared to their diesel counterparts. For example, a Class 6 battery-electric truck (BEV) that Amazon has purchased from Lion Electric to complete its zero-emission deliveries. When compared to a comparable diesel Class 6 delivery truck, this BEV application can hypothetically cost considerably less to own and operate when fuel, maintenance, and insurance costs are taken into account over the life of the delivery vehicle—even without purchase incentives or clean fuel credits.

4.2.5.2 Electric Vehicle Adoption Projections

With minimal electric vehicle (EV) truck experience to date, projections of EV truck adoption are assumption-driven. One recent available EV projection suggests a U.S. fleet of 54,000 EV trucks by 2025. The U.S. had about 4.7 million trucks in fleets as of 2019, making EV penetration roughly one percent by 2025.

Based on DMV estimates, there are about 488,000 trucks registered in San Diego County and 49,000 in Imperial County. If the region follows the national pattern, there could be around 5,000-5,500 regional EV trucks by 2025.

A March 2021 projection by ResearchAndMarkets.com calls for a 51.6 percent compound annual growth rate (CAGR) in the electric truck market between 2020 and 2030. However, most of this demand is attributed to light duty trucks, specifically pickups. Applying a 51.6 percent CAGR between the 1 percent estimate for 2025 would yield an EV market share of around 8 percent by 2030. An eight percent market share would imply a regional fleet of about 43,000 EV trucks by 2030. If that growth rate continued, the regional fleet would reach 50 percent EV share by about 2035.

A Mordor Intelligence forecast for the worldwide EV truck market suggests a 14.3 percent CAGR from 2020-2026. On that basis, starting from a one percent share in 2025, EV adoption would reach two percent in 2030, and 28 percent by 2050.

4.2.5.3 Electric Vehicle Adoption Barriers

Freight industry adoption of EV trucks is proceeding slowly due to several factors:

- **Diesel truck durability.** Diesel engines and trucks are very durable, commonly lasting up to 15 years. Diesel tractors, in particular, are often resold into less-demanding service after 3-5 years. This “cascading” practice makes used tractors with a substantial remaining life available to owner-operators or local operators at attractive prices.

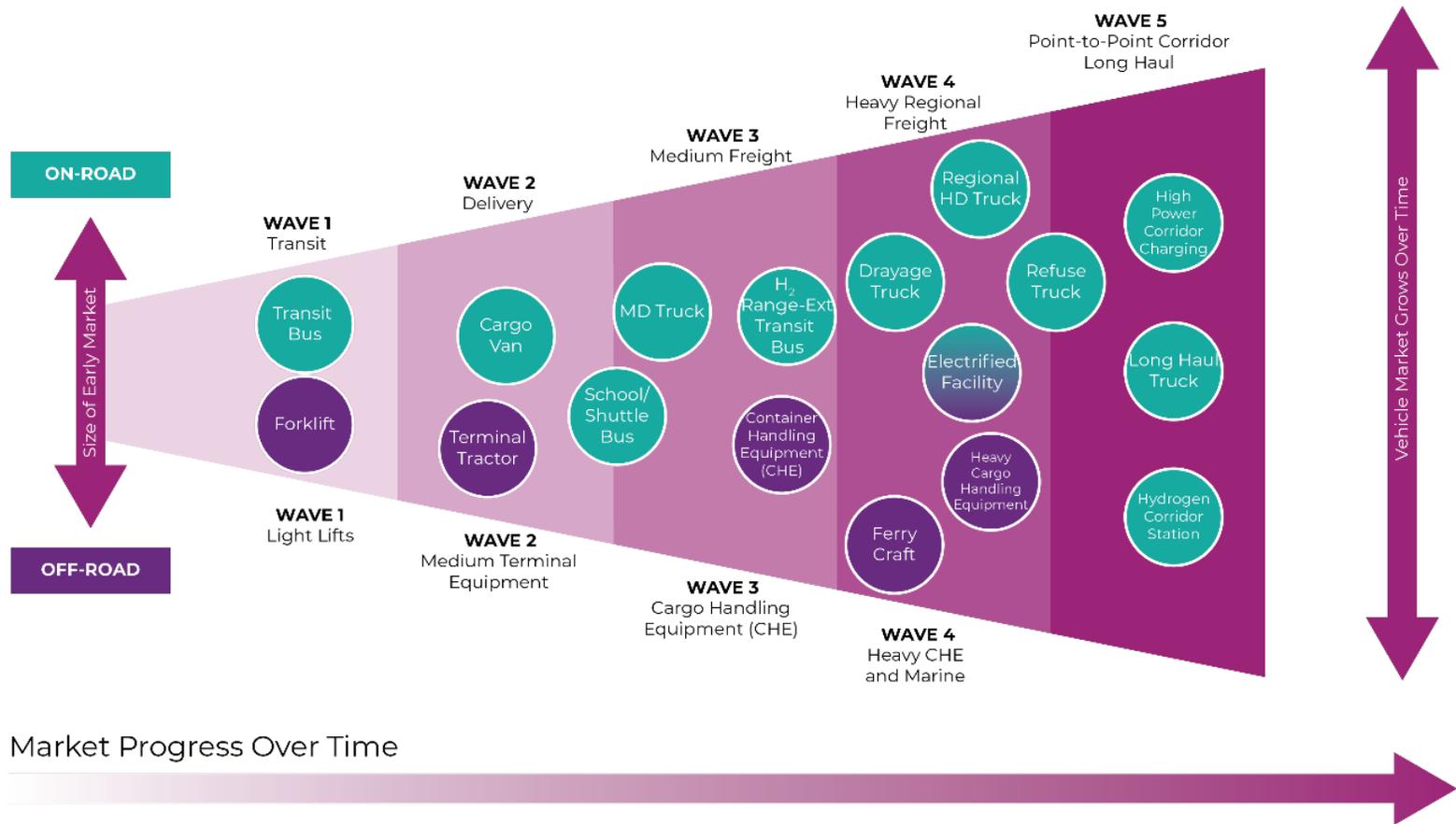
- **High initial cost.** At present, an EV truck can cost roughly twice as much as a diesel equivalent. The margin is being reduced and should narrow further as battery prices fall. At present, however, essentially all electric truck purchases must have public subsidies of some kind.
- **OEM offerings.** The range and supply of EV trucks is extremely limited, and focused largely on light-duty delivery vans and local-service truck tractors.
- **Charging infrastructure.** Most commercial buildings and trucking facilities lack the electric power capacity to recharge multiple trucks simultaneously. Commercial or public recharging sites are few, and not configured for commercial vehicles. Charging equipment is only now becoming standardized.
- **High electric power costs.** California has exceptionally high electric power costs, which decrease the long-term advantages of EVs. The average industrial electricity rate in San Diego is reported to be about 17 percent higher than the national average.⁶⁶
- **Charging time.** The time currently required to charge EV truck battery packs is a major barrier to adoption. The Freightliner eM2 Class 6-7 box truck, for example, has a claimed range of 230 miles and a charging time of 60 minutes to 80 percent. The Freightliner Class 8 eCascadia tractor has a claimed range of 250 miles and a charging time of 90 minutes to 80 percent. The potential loss of productivity restricts adoption to uses such as business-hour deliveries that allow for overnight charging.
- **Business case.** The high initial cost of EV trucks and charging infrastructure make it difficult for commercial customers to establish a clear business case for adoption without support from public grants or subsidies.
- **Payload range impacts.** EV range can decline sharply with increased payload. Delivery route applications are advantageous as the payload declines over the route. Heavy payload applications will be more resistant to EV adoption.

4.2.5.4 Promoting Electric Vehicle Adoption

CALSTART's Global Commercial Vehicle Drive to Zero Program is built on a "Beachhead" model of change (**Figure 4.8**). The aim of this strategy is to target the most receptive industry segments and catalyze adoption through local supply chains and technology transfer.

⁶⁶ San Diego, CA Electricity Statistics. Electricity Local, 2021. <https://www.electricitylocal.com/states/california/san-diego/>.

Figure 4.8: Beachhead Model



Regional adoption of ZE and alternative fuel trucks is likely to build outward from the “beachhead” established in local delivery fleets such as UPS, FedEx, Amazon, and Frito-Lay. Adoption will be quickest where:

- Vehicles are based to a central location with fueling/charging.
- Short distances and light weights allow drivers to complete a full shift on a single charge.
- Grants or tax incentives are available to offset initial vehicle and charging/fueling costs.
- Available terminals or other facilities have adequate electrical capacity.
- A high public profile encourages “green” initiatives that can generate favorable public recognition.
- EVs and alternative fuel vehicles are initially a small part of a larger fleet, reducing risk.

Adoption will be slowest where:

- Long hauls and heavy loads tax battery capacity.
- Battery weight reduces available payload.
- Vehicles do not always return to a base location.
- Vehicles are used for more than a single shift.
- Fleets are small, increasing risk.
- Facilities have low electrical capacity.
- Adoption must be self-funded.
- Operators and uses are out of the public eye.

As **Figure 4.9** suggests, EV adoption will likely progress from smaller, locally based trucks to larger, widely ranging trucks.

Figure 4.9: Truck Types and Applications

Trip Type	Autos, SUVs, Minivans	Pickups, Vans	Light Trucks	Medium Trucks			Heavy Trucks	
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
Local Pickup & Delivery								
Construction & MSW								
Regional								
Long Haul								

The best targets for near term benefits in the region will thus be local fleets of smaller trucks, followed by local fleets of medium-duty trucks. Municipal solid waste (MSW) trucks are also a good candidate, as they follow fixed routes to/from central locations.

A regional SANDAG strategy can build upon the beachhead concept by identifying candidate beachhead applications, sectors, and bringing a range of incentives to bear. There are a number of grant, subsidy, and incentive programs to encourage EV and alternative fuel adoption. SANDAG’s role would include:

- Periodic review of new and existing programs.
- Targeted outreach and communication with the freight industry to promote available incentives.
- Feedback to sponsoring agencies and legislators regarding the effectiveness of incentive programs in the region.

This work would complement the planned development of a Blueprint for Medium-/Heavy-Duty (MD/HD) ZEV Infrastructure Program. This is discussed in more detail in Section 4.2.7: Infrastructure Needs and Gaps in ZE Truck Deployment below.

The California requirement for ZEV sales does not affect Class 7 and 8 sales in other states. In the absence of either a nationwide rule or a compelling business case for ZEV heavy-duty trucks, this rule is likely to shift diesel truck sales to other states. Regional trucking companies may find it advantageous to purchase new diesel trucks in Las Vegas or Phoenix, for example.

For most fleet operators long-term or life-cycle Total Cost of Operation (TCO) is the critical factor in adoption choices. TCO is influenced by:

- Capital acquisition of lease costs
- Financing terms and interest rates
- Fuel/electric power costs
- Other operating costs
- Duty cycle
- Maintenance costs
- Operating life
- Residual value

Capital costs and fuel/electric power costs are the most obvious differences, but all of these factors can be affected by electrification.

Fleet operators may be unaware of differential electric power rates for EV users, for example. Bringing that knowledge to potential adopters can be a pivotal step in promoting adoption.

The Drive to Zero Policy and Action Tool Kit (<http://toolkit.globaldrivetozero.org/policies-actions-incentives/>) catalogs public policy and incentive options from U.S. and global sources, including:

Controlled dues and procurement.

- Manufacturing, regulation, and stakeholder enabling.
- Financial incentives.
- Non-financial incentives.
- This tool kit can provide a starting point for SANDAG's efforts.

Comparison of large, medium and small business perspectives on adoption and deployment

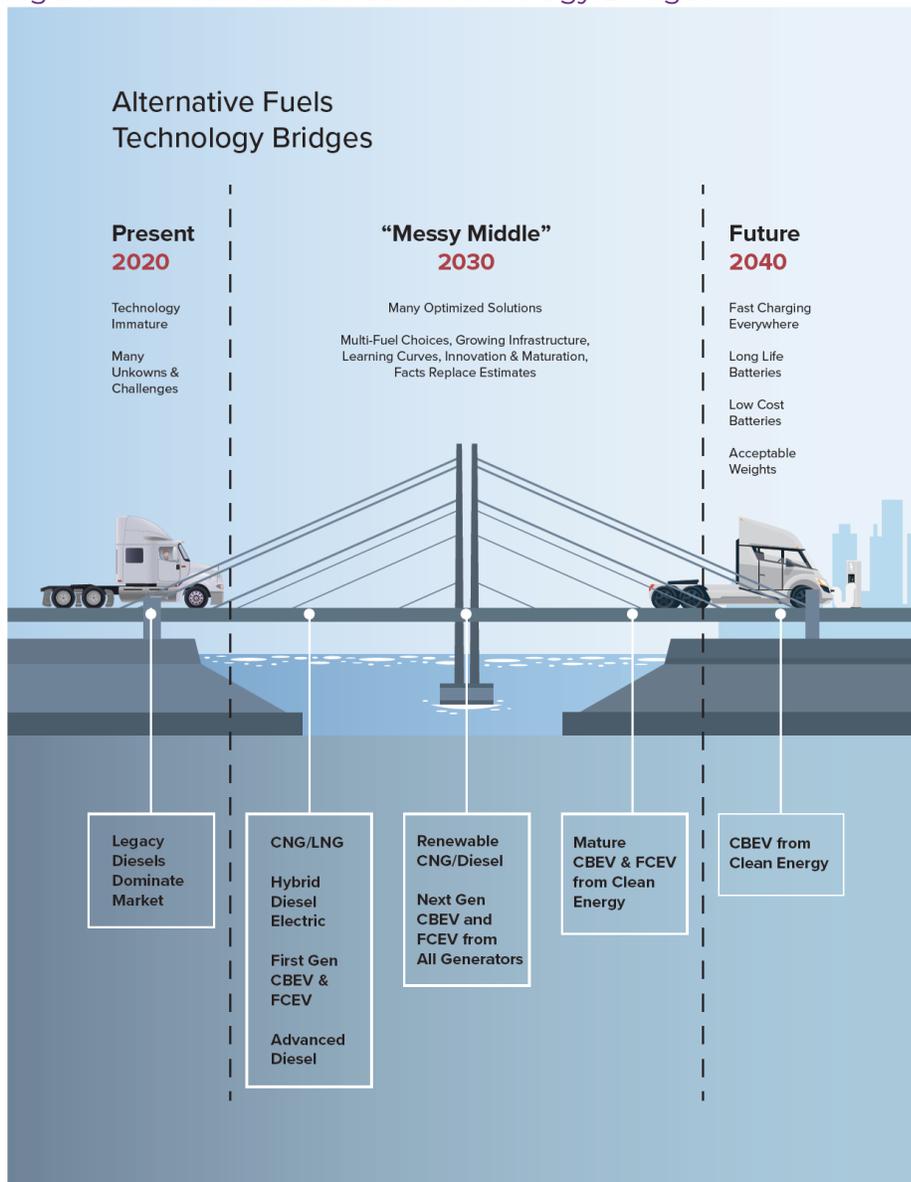
The number of different zero emission commercial vehicles (ZECV) is also increasing. By the end of 2021, there will be more than 300 ZECV models commercially available for purchase in the United States, Canada and Europe. Transit/school buses and medium-duty delivery formats are leading model availability growth in an already robust market. Despite the positive business case for these vehicles in many applications as well as the healthy and growing selection of makes/models, the high upfront sticker price remains a threshold barrier—particularly for small and medium-sized businesses. The private sector can also support small- and medium-businesses by advancing several promising innovative “as a service” business models by animating third-party capital to close the upfront cost gap, which could also help grow the ZECV segment as a whole. The new charging-as-a-service, infrastructure-as-a-service, and electrification-as-a-service models keep front-end costs low for new zero-emission truck adopters and they allow fleets to grow at their own pace. Under the new “as a service” models, vehicle operators pay fees over

a service period that are competitive with or lower than the cost of operating a conventional vehicle. Vehicle manufacturers, infrastructure and power providers, and independent service providers are exploring some versions of these tools specifically for ZECVs.

4.2.6 Zero-Emissions Truck Deployment Timeframe

For ZE trucks to become a reality, it is important to understand the likely deployment timeframe and correlating demand for electric charging and hydrogen fueling of freight vehicles in the Region. This demand will be based on availability, reliability, truck weights and travel distance competitiveness (with diesel), and equipment cost.

Figure 4.10: Alternative Fuels Technology Bridges



Source: North American Council for Freight Efficiency, Viable Class 7/8 Electric, Hybrid, And Alternative Fuel Tractors, December 2019, <https://nacfe.org/emerging-technology/electric-trucks-2/viable-class-7-8/>, p. 16.

4.2.7 Case Study: Advancing the Deployment of Zero-Emissions Trucks in the Region

The objective of the case study is to understand the emissions reduction's potential of two ZE truck deployment and market penetration scenarios. The case study compares potential emissions reductions from near the US/Mexico border to the northern County line via I-5 and I-805/I-15. Trip lengths are estimated to/from key freight generators near these two major corridors, such as Port of San Diego, San Diego Airport air cargo facilities, and industrial warehousing hubs, to estimate average truck trip lengths based on origin-destination (OD) pairs. These scenarios include the estimated emissions effects of converting heavy duty truck (HDT) diesel vehicles to zero emission vehicles (ZEVs) considering both complete and incomplete fleet conversion. Additionally, the analysis uses CalEnviroScreen data to identify adjacent Environmental Justice (EJ) communities that would benefit from the conversion to clean trucks.

According to the Bureau of Transportation Statistics (BTS), in 2019 there were approximately 4,200 truck trips per day crossing the border from the gateway points at Otay Mesa and Tecate Ports of Entry. Based on the SANDAG regional travel demand model, 24 percent of these truck trips leave the San Diego County line and head north to Los Angeles, Orange, and Riverside counties with an average trip distance of 75 miles. This results in 75,600 total daily truck VMT.

The following two conversion scenarios were analyzed to assess the potential Greenhouse Gas (GHG) and air pollution reduction benefits using CARB's Emission FACTor (EMFAC2021), a model that estimates the official emissions inventories of onroad mobile sources in California.⁶⁷

1. Scenario 1: All daily trucks entering the gateway points and leaving the San Diego County line are zero-emission, electric trucks.
2. Scenario 2: Half of the daily trucks entering the gateway points and leaving the San Diego County line are zero-emission, electric trucks.

In summary, Scenario 1 (100% electric trucks) would have a daily GHG savings of 130.61 Metric Tons of CO₂ per day. For Scenario 2 (50% electric trucks), the daily GHG savings would be 65.31 Metric Tons of CO₂ per day—essentially one-half of Scenario 1. The amount of GHGs saved per year (assuming a 365 factor) would be 47,673 Metric Tons CO₂ (Scenario 1) and 23,837 Metric Tons CO₂ (Scenario 2). To put these values into perspective, it is less than one percent of the total annual on-road emissions in the entire State of California (which is 174.25 million metric tons CO₂ equivalent in 2018, see **Figure 4.11** below) but significant with respect to regional air quality and equity in the Gateway region. According to the “County of San Diego 2014 GHG Emissions Inventory[1],” on-road transportation accounted for 45 percent of the total GHG emissions in the County -or

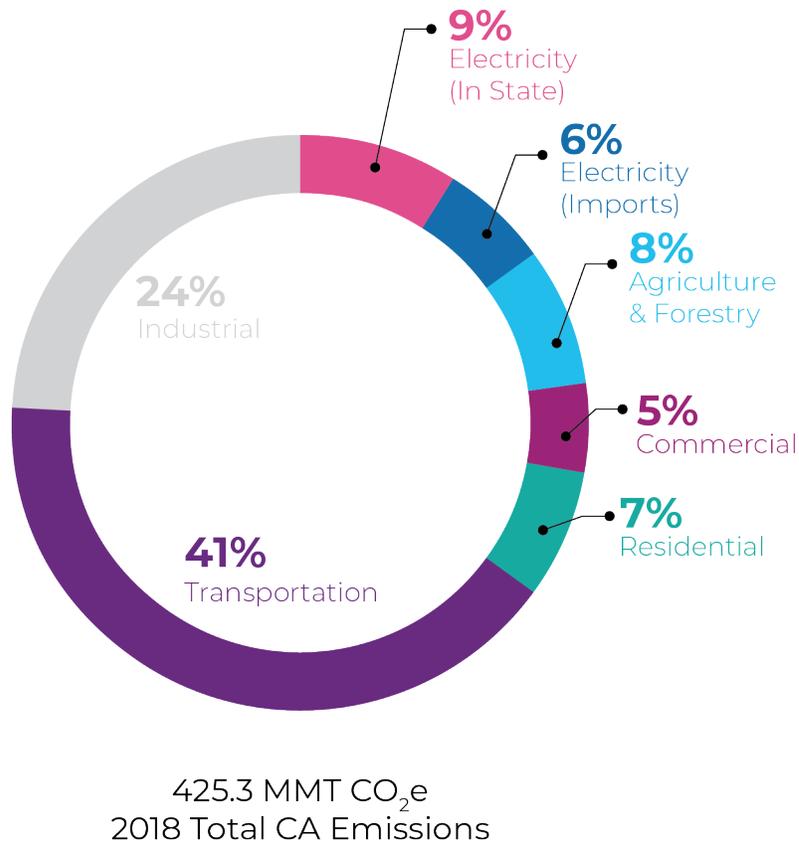
⁶⁷ The feasibility of these scenarios would rely on coordination of similar vehicle requirements between Mexico and California or a change of equipment would occur (e.g. at a warehouse in Otay Mesa) after a truck crosses the border northbound.

1,456,060 metric tons of CO2 equivalent: the largest share of all energy sectors. As a result, Scenario 1 would save approximately 3.2 percent of total on-road GHG emissions in the County per year, while Scenario 2 would save approximately 1.6 percent of total on-road GHG emissions.⁶⁸

The results for each conversion scenario are summarized below in **Table 4.7**. The selected parameters for the CARB Emfac2021 emission factor model including the following:

- Engine model years: Aggregated (diesel)
- Model region: San Diego County
- Calendar year: 2019

Figure 4.11: California Emissions by Economic Sector



Source: CARB, 2020

⁶⁸ County of San Diego 2014 Greenhouse Gas Emissions Inventory and Projections. <https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/CAPfilespublicreview/Appendix%20A%20Greenhouse%20Gas%20Emissions%20Inventory%20and%20Projections.pdf>.

Table 4.7: SANDAG Gateway Truck Vehicle Miles Traveled Scenarios Emissions Reduction (Total Metric Tons of GHG and Grams of Air Pollutants Saved per Day in 2019)

**SANDAG Gateway Truck Vehicle Miles Traveled Scenarios Emissions Reduction
(Total Metric Tons of GHG and Grams of Air Pollutants Saved per Day in 2019)**

Scenario	Heavy Truck Daily VMT to LA/OC/SB Counties in 2019	NOx Reduction ¹	PM2.5 Reduction ¹	PM10 Reduction ¹	VOC Reduction ¹	CO Reduction ¹	GHG Reduction ² (Metric Tons)
1 (100% electric)	75,600	(354,943)	(6,195)	(6,475)	(11,502)	(37,244)	(130.61)
2 (50% electric)	(0.24*4,200*75 miles)	(177,472)	(3,098)	(3,238)	(5,751)	(18,622)	(65.31)

Source: Fehr & Peers

Notes: Assumes aggregate model year engines, heavy duty diesel trucks, using CARB's Emfac2021 engine running exhaust emission factors; Using LA County model region.

¹ In total grams

² For CO2 greenhouse gas only, in metric tons

CO = Carbon Monoxide

VOC = Volatile Organic Compound

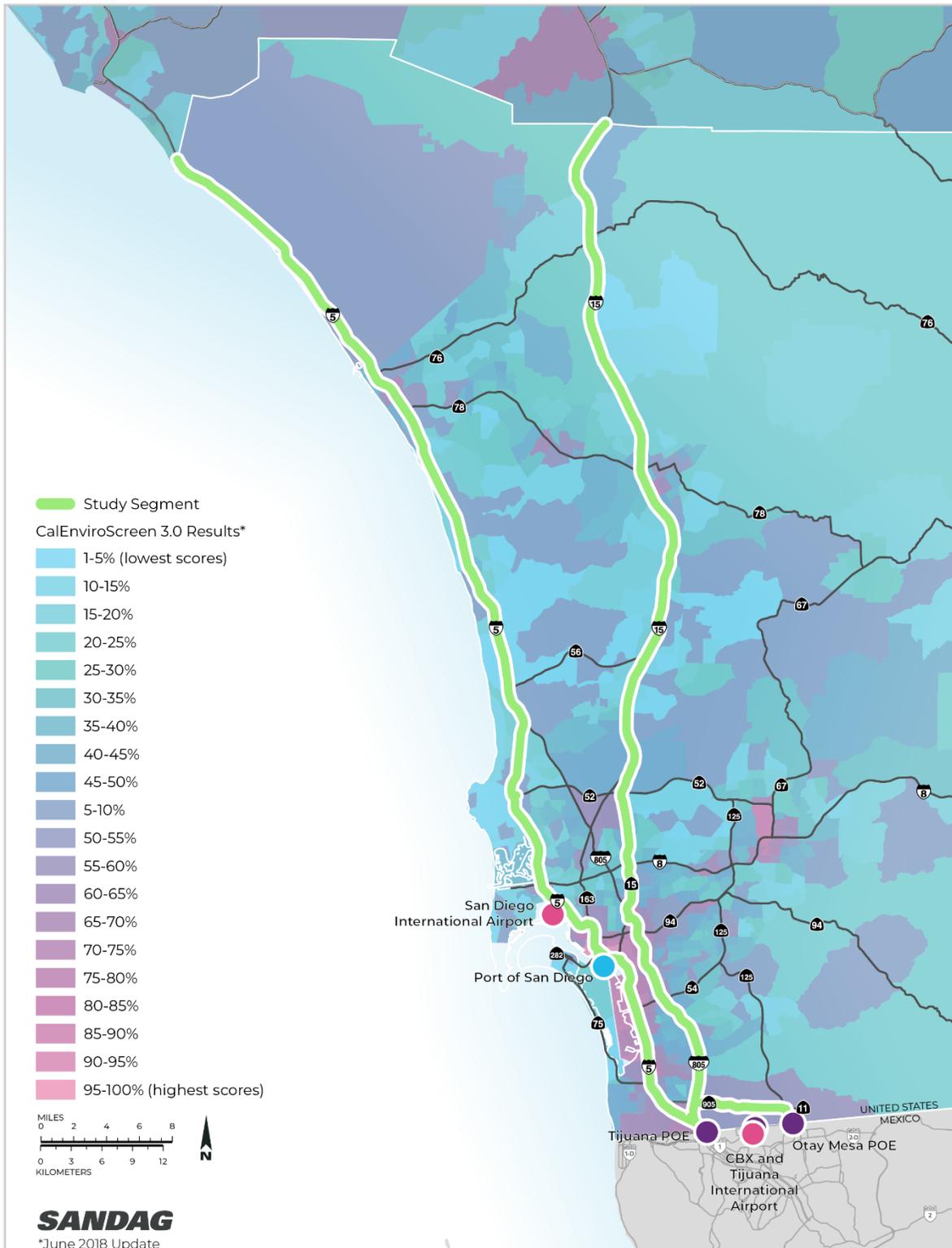
Heavy duty diesel engine running exhaust emissions reductions for air pollutants: NOx, PM2.5, PM10, VOC, & CO; in grams per day.

Using San Diego County region in Emfac2021.

Approximately 1,340,000 people along the I-5 and I-805/I-15 corridors would experience air quality benefits under both of the ZE truck conversion scenarios. A one-mile buffer along the corridors was used to estimate the total population benefiting from the conversion scenarios, based on literature of near roadway emissions in California.⁶⁹ As shown in the figure below, the southern end of I-5 passes through areas that score the highest in the Region in the CalEnviroScreen tool. As defined by the State, Disadvantaged communities are the top 25 percent scoring areas shown in CalEnviroScreen.

69 ScienceDirect. <https://www.sciencedirect.com/science/article/abs/pii/S1352231012007753?via%3Dihub>.

Figure 4.12: Case Study Area: Advancing the Deployment of ZE Trucks in the Region



4.2.8 *Infrastructure Needs and Gaps in Zero-Emissions Truck Deployment*

Infrastructure and fast charging will be critical for accelerating the adoption of ZE trucks. At present, electric trucks have ranges of about 300 miles, and fully recharging a heavy-duty electric truck takes several hours. California is well ahead of most states in terms of planning for electric charging, and in the Gateway region, San Diego Gas & Electric is already working to identify gaps in its power infrastructure that will need to be closed to accommodate the coming deployments of ZE vehicles, most notably heavy-duty trucks. On the manufacturers side of the equation, OEMs are working to develop faster charging, but the heat involved in faster charging currently exceeds the tolerance of the metal chargers. Both of these challenges are being met by multiple funding programs aimed at building out the charging infrastructure and investing in research and development to improve the vehicle and charging technologies.

In addition, SANDAG is listed as a proposed awardee for the California Energy Commission's Blueprints for Medium-/Heavy-Duty (MD/HD) ZEV Infrastructure Program and anticipates officially receiving the award in late Summer 2021. If this grant is formally awarded, SANDAG and the Port of San Diego will work to develop a regionally accepted MD/HD ZEV Blueprint that will help the region assess existing MD/HD fleets and infrastructure, identify barriers (e.g. workforce development, technology, communities of concern, etc.), and develop near- and long-term strategies that will help the San Diego region navigate the barriers and challenges the region must overcome to transition to MD/HD ZEVs. As part of Blueprint development, a stakeholder working group will be developed to gather input from the diverse population that makes up the San Diego region.

4.2.9 *Opportunities and Implementation Strategies*

The following opportunities and implementation strategies can be considered by the Gateway Region's public agencies and private stakeholders when seeking to transition fleets to ZE:

- Identify opportunities and strategies to speed-up industry adoption and deployment of cleaner freight vehicles.
- Technology demonstration/pilot programs for alternative fueled vehicles and charging infrastructure.
- Financial incentives/subsidies for purchasing alternative fueled vehicles with specific focus on aiding small companies and independent owner-operators with the purchasing process.
- Infrastructure planning, financing and construction.
- Identify charging/hydrogen fueling generation and distribution for ZE trucks and cargo handling equipment; Working with local governments and utilities to develop design standards for medium- and heavy-duty vehicle/equipment electrical infrastructure for new warehouse projects.

- Support and encourage the development of green infrastructure (e.g., electric charging and solar power).
- Invest in additional workforce development programs for EV technologies through State partnerships with the Department of Labor Employment and Training Administration, technology developers, manufacturers, freight operators, universities, labor unions, and others.
- Expand the State’s Employee Training Panel program to provide more workforce development investment for companies that are ten years old ranging in size from 19-100.⁷⁰
- Apprentices pay to companies employing trainees in alternative fuel technologies, especially in all-electric vehicles.
- Revisit federal and State tax credits and identify opportunities for increasing credits to firms who provide systematic retraining and upskilling programs for workers at their firms, specifically workers who are at-risk of displacement due to conversion from combustion powered to ZE vehicles. Larger tax credits can be directed to smaller firms to ensure that they have the incentive to participate.
- Continue to provide opportunities for partnering with local high schools, colleges, trade schools and universities to connect with industry partners to revise and/or develop coursework to align with skills needed for the ZEV future.

⁷⁰ Marian Negoita and Annelies Goger. *State-level Policies to Incentivize Workplace Learning: Impact of California’s Incumbent Worker Training Program*. Economic Studies at Brookings. July 2020.

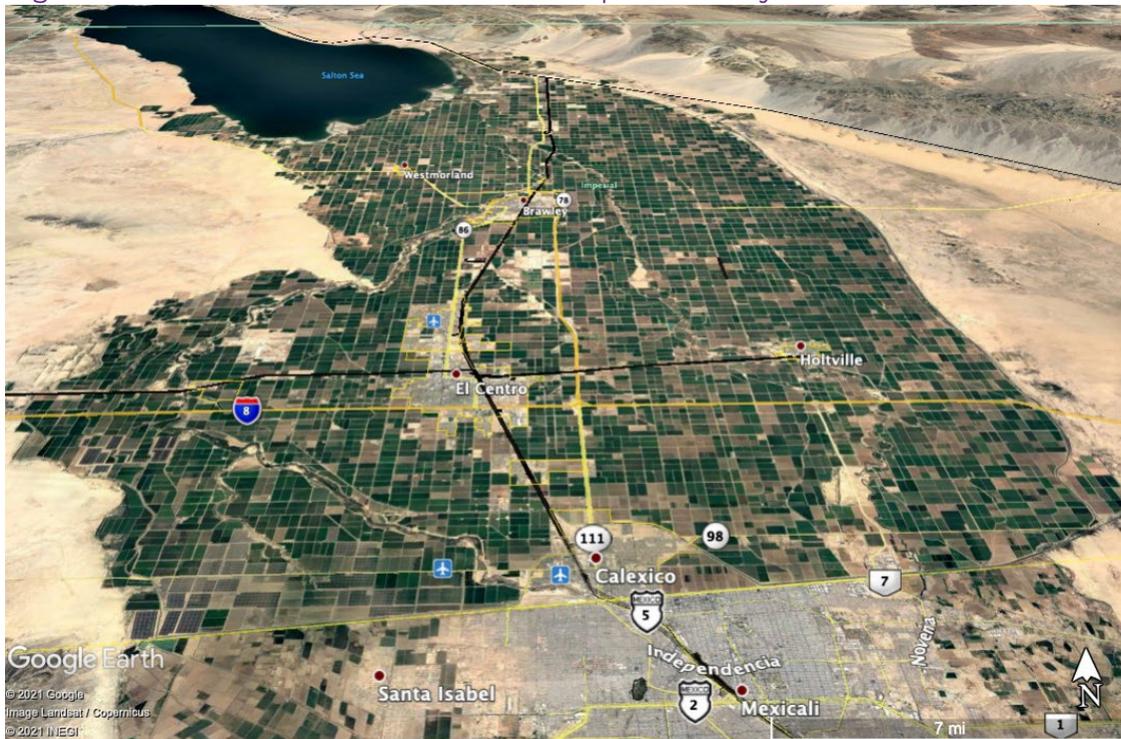
4.3 E-Commerce Case Study for El Centro and Imperial Valley

4.3.1 Existing Conditions and Environment

4.3.1.1 El Centro and Imperial County Demographics and Location

Imperial County, located in the Imperial Valley, lies to the east of and adjacent to San Diego County and borders Arizona to the east and the U.S.- Mexico border to the south. Imperial County covers 4,482 square miles and has an estimated population of 190,624 (2019, SCAG Local Profiles, El Centro/Imperial County). The San Diego and Imperial counties are about the same geographic size, but differ greatly in their environment, economy and population. Imperial Valley is a desert community, much of it below sea level, with average annual rainfall of about three inches and high summer temperatures. Imperial County's economy is primarily based on agriculture with over \$1 billion in annual (as of 2017) crop production supported entirely by irrigation supplied by the Colorado River via the All-American Canal and an extensive network of smaller canals and pipelines. Government and agriculture accounts for the majority of the county's employment.

Figure 4.13: Aerial of El Centro and the Imperial Valley



Source: Google Earth

El Centro is the Imperial county's largest city and commercial center and has 24.3 percent of the county's population. There are many interdependencies between the counties and residents of Imperial and San Diego County. Imperial County residents frequently travel to San Diego County to shop, work and play. About 4.1 percent of commuters are

destined for San Diego County for work, and 40.9 percent live and work in the City of El Centro.⁷¹

Like most other metropolitan areas, El Centro has a population that is increasingly dependent on e-commerce as an increasingly desirable option to in-store shopping, with this trend partially fueled by the COVID-19 pandemic. The efficiency and effectiveness of e-commerce and its ability to serve the El Centro consumers is dependent on a network of roadways, distribution and fulfillment centers, along with last-mile delivery services. This review discusses some of the unique aspects of El Centro and Imperial Valley, distribution and fulfillment, rural considerations, trends and opportunities for e-commerce.

El Centro and the Imperial Valley are uniquely positioned to be served by distribution and fulfillment centers located in San Bernardino, Riverside, and San Diego counties. The roadway network between these regions is well established by cross-border trade goods destined for intermodal facilities in the three aforementioned counties. Interstate 8 and State Route 78 (SR 78), SR 86 and SR 111 are major truck routes in and out of the region. Except for slight peak period increases, overall average daily traffic (ADT) is low during most hours in the region, therefore Class 8 (5 or more axles) truck access to the area is not impeded by significant congestion. However, because of the diverse population densities throughout Imperial County, last mile delivery options, of which e-commerce related deliveries are highly dependent, vary significantly depending on where in the county that the consumer resides.

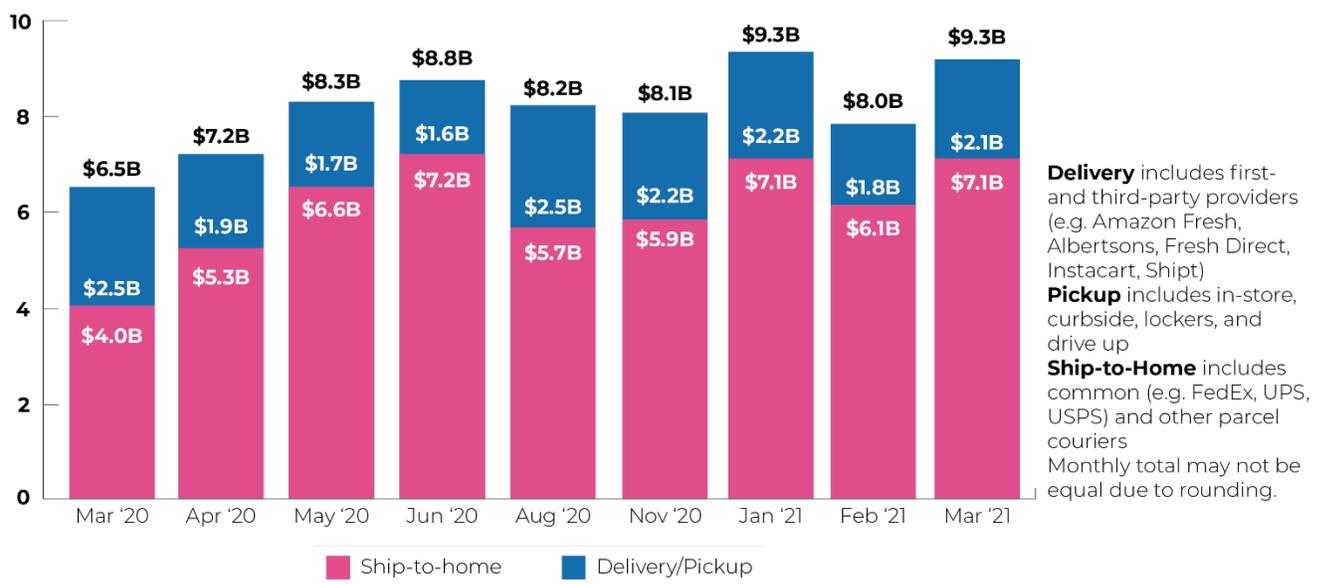
4.3.1.2 Unique E-Commerce Environment for El Centro and Imperial Valley

El Centro is a densely populated city with a few smaller outlying towns (Calexico, Brawley, Holtville, Westmoreland, etc.). The city and towns are surrounded by expansive agricultural fields and open deserts with a large number of rural residents. An e-commerce experience for rural vs. small town vs. larger city customers varies significantly, where rural and small-town customers have fewer choices for home deliveries than their urban/suburban counterparts. Also, as rural and local retailers and businesses consider competing with the convenience of larger mega-retailers, they will have to consider how to provide the same delivery options, perhaps through third-party parcel delivery services. In an interview with E-Commerce Times, Jim Salas, professor of marketing and economics at the Pepperdine Graziadio Business School said, "From a business perspective, rural areas suffer from gaps in human capital, distance, and low population challenges and overall, lower socioeconomic differences which often do not represent the 'low hanging' fruit that most businesses go after." Currently, even the large e-commerce retailers, like Amazon, rely on USPS and other third-party parcel carriers for last-mile delivery in rural areas or where they lack sufficient parcel delivery fleets.

⁷¹ LODES Data; Longitudinal-Employer Household Dynamics Program. U.S. Census Bureau, 2017. <https://lehd.ces.census.gov/data/lodes/>.

Groceries represent a large percentage of e-commerce sales. U.S. online grocery sales increased from \$1.2 billion in August 2019 to \$7.2 billion in June 2020. Online grocery sales growth represented a 43 percent increase at the on-year mark of the COVID-19 pandemic in March 2021 from \$6.5 billion in March 2020. Ship to home (via courier services, common or contract parcel carrier) represents 22.6 percent of the overall online grocery sales (**Figure 4.14**)⁷². The trend in El Centro is expected to follow the national average. However, grocery delivery is more challenging to obtain in rural areas of Imperial County outside of the city centers due to proximity to the retailers or fulfillment centers. Within the City of El Centro, there are also constraints due to the valley’s climate (average July temperature in El Centro is 106 degrees). There are grocery retailers that are offering delivery through third-party services nonetheless (e.g., Vons in El Centro uses InstaCart). Vons also indicated that it would be shifting from using the third-party service to providing their own fleet for their grocery delivery service in the near future. Other industries have overcome the harsh daytime summer temperatures by shifting some of their operations to nighttime hours; this is a potential opportunity for grocery delivery in El Centro (and may already be in place).

Figure 4.14: Total U.S. Online Grocery Sales: March 2021 (Ship to Home & Delivery/Pickup)



Source: Brick Meets Click/Mercatus Grocery Shopping Survey, March 2021, Brick Meets Click Grocery Survey Feb, Jan 2021; Nov, Aug, Jun, May, Apr and Mar 2020

The shift from “brick and mortar” retail sales to online (internet) sales in El Centro will be more apparent when data and statistics are available for the current and more recent years. El Centro is expected to be like most other regions with the growth of online sales outpacing in-store retail sales. Real (inflation adjusted) retail sales in the City of El Centro

⁷² Online Retail: Pickup, delivery growth spurs March online grocery sales. Supermarket News. <https://www.supermarketnews.com/online-retail/pickup-delivery-growth-spurs-march-online-grocery-sales>.

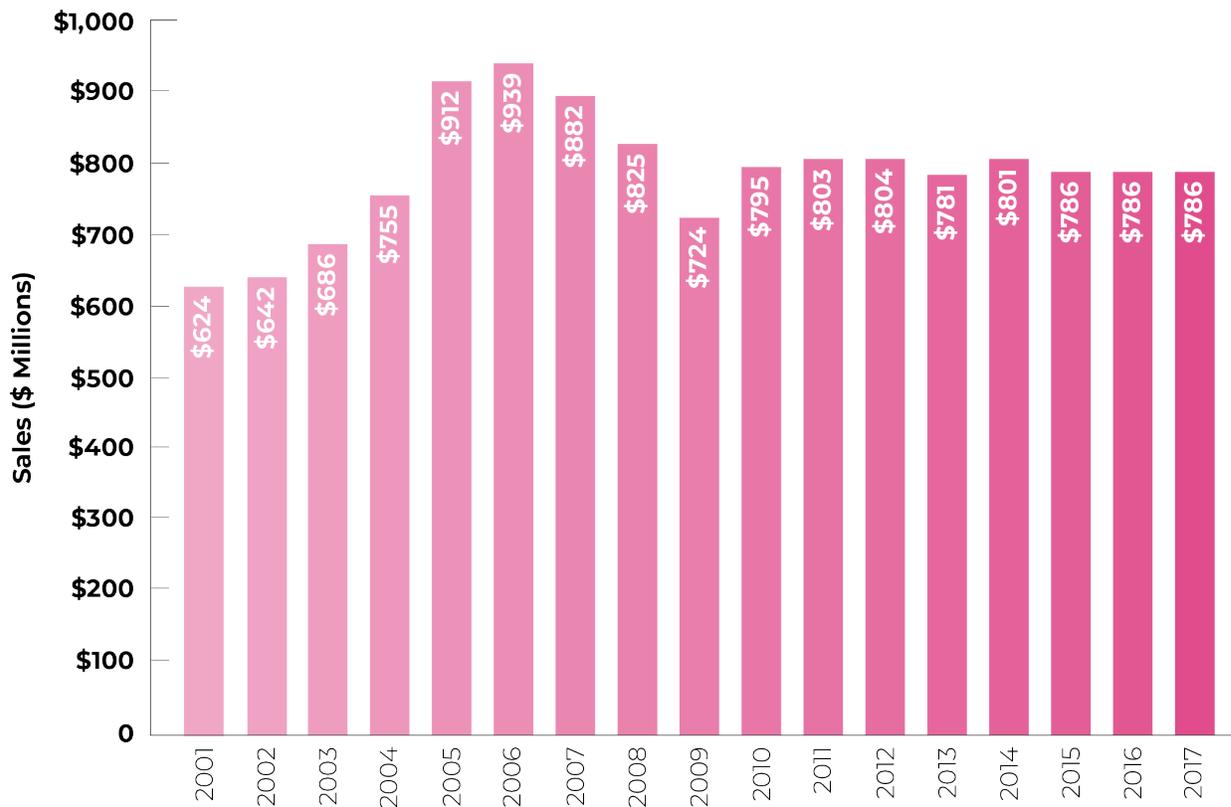
in 2017 was \$786 million.⁷³ Although, growth of in-store retail sales also remained stable through 2017, the pandemic-driven increase in e-commerce has continued to grow beyond the 2020 retail closures, making in-store sales volumes more uncertain.

For Imperial County as a whole, data for taxable transactions, provided by California Department of Tax and Fee Administration, was filtered using the “Internet Seller” attribute and included accounts that are identified as a Marketplace Facilitator (i.e., Etsy, eBay, Amazon) or a 3rd Party Internet Seller (i.e., Fulfillment by Amazon). But it must be noted that the data includes all sales allocated to Imperial County, including brick-and-mortar stores. CDTFA was unable to filter the data to only online sales. Overall, transactions attributable to internet sellers and marketplace facilitators rose from \$236,602,355 to \$344,179,256, a 68.7% increase from year-end 2019 to year-end 2020.

Another important note, is that these estimates must also take into account that not all retailers that are based outside the State of California charge sales tax to their out of state customers.

⁷³ Local Profiles, El Centro. Southern California Association of Governments. https://scag.ca.gov/sites/main/files/file-attachments/elcentro_localprofile.pdf?1605653707.

Figure 4.15: Real Retail Sales (City of El Centro) 2001-2017)



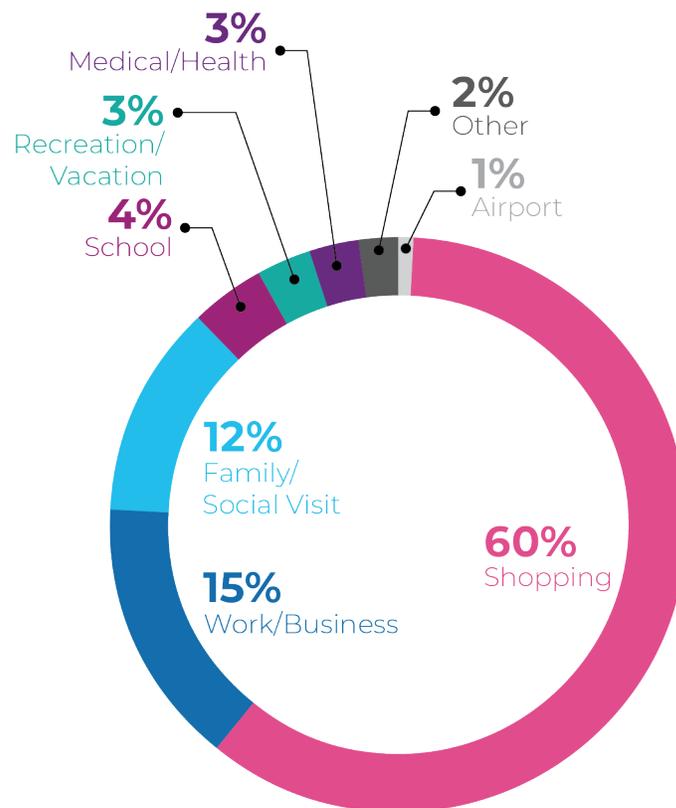
Source: California Board of Equalization, 2001-2017; Southern California Association of Governments, Local Profiles, El Centro; https://scag.ca.gov/sites/main/files/file-attachments/elcentro_localprofile.pdf?1605653707

4.3.1.3 Proximity and Influence of U.S.-Mexico Border

Imperial Valley has three border crossings—two at Calexico and one at Andrade. The Calexico crossings serve commercial vehicles at Calexico East and cars and pedestrians at Calexico West coming from or destined for Mexicali, BC, Mexico. Andrade is a car and pedestrian crossing for crossers coming from or destined for Los Algodones, BC, Mexico. Populations of the cities on the Mexican side of the international border are significantly higher with Mexicali at 1.033 million people compared with Calexico’s 39,950. Los Algodones has a population of 5,474 and Andrade has 59 people.⁷⁴ Based on this, there are significant numbers of Mexican citizens crossing the border every day at these locations primarily for shopping, work, or family/social visits. While shopping habits have been studied regarding border crossers purchases at retailers and other businesses in the U.S., the collection and analysis meaningful data and information to assist in understanding how the proximity of the international border influences e-commerce and retail sales is a complex and uncertain endeavor.

⁷⁴ U. S. Census Bureau, American Community Survey 5-Year Data (2009-2019).

Figure 4.16: Northbound Border Crossers Purpose of Visit to Imperial Valley



Source: Imperial County Community and Economic Development Dept., 2017 Imperial Valley Border Economic Impact Study Summary Report

Overall, the influences of the border and border crossers on e-commerce in particular are not well understood. In 2017, Imperial County published the Imperial Valley Border Economic Impact Study to quantify the impact and benefits of northbound border crossers in the Imperial County's retail industry with the goal of positioning the Imperial County as a prime location for investment. **Figure 4.16** indicates that shopping is the overwhelming reason that people cross the border a couple of times per week from Mexicali into Calexico and beyond to other parts of the Imperial Valley. Most of the shopping is for clothing and food and survey respondents to the study indicated that they were mainly motivated by better product quality, more variety of products and cheaper prices.

How border crossing habits are influenced by e-commerce is not clear, but there are some speculations regarding a couple of potential motivations: Retrieval of purchases from U.S.-based family or friends or from a secured commercial location. A recent way that online retailers, such as Amazon, have delivered goods to customers is by using lockers where customers can come to retrieve packages in a secure location based on a

code that is provided only to them via their website account. Currently there are no Amazon facilities of this type located in Imperial County. Thus, the former is the likely scenario. Specific surveys would need to be conducted to determine and confirm these activities among border crossers trip purposes.

The movement of trucks or parcel carriers across the border in either direction to support e-commerce activity is not known at this time based on available data sets.

4.3.2 Mode Split for E-Commerce

An understanding of how e-commerce related cargo is split among ground and air transportation is difficult due to carrier's competitive sensitivities with regard to origin-destination data. Some general information about movements of trucks in Imperial County and landed weights of planes at airports likely to serve as cargo airports for Imperial County gives us some indications of overall trends. How these trends relate to e-commerce in the region will need further exploration as data becomes available.

4.3.2.1 Truck

Trucks are the primary mode serving the Imperial Valley. Imperial County annual average daily truck traffic (AADTT) increased between 2017 and 2018 by 1.76 percent and is expected to continue trending along these lines. As traffic volumes are available for subsequent years, these can be compared to determine impacts on truck volumes based on COVID-19 in 2020. Since e-commerce activity escalated beyond the already rapid rate of increase during the pandemic time period, an analysis of truck volumes in relation to the e-commerce trends will be warranted in the future to determine if and how the rate of increase in truck volumes has changed.

4.3.2.2 Air

Once the first leg of an e-commerce-related cargo shipment is completed, the relevance of and use of air carriers drops; overall, use of air cargo as a viable mode for subsequent legs of the trip has fallen out of favor due to high cost, defaulting back to ground transportation.

According to Federal Aviation Administration's Final All-Cargo Landed Weights Reports, in 2018 the San Bernardino International Airport (SBD) located in San Bernardino, CA, landed weight increased in 2018 in the previous year from 20,098,000 to 181,970,000 lbs—an increase of 805.41 percent.⁷⁵ In 2019, SBD's landed weight continued to increase by at 93 percent to 351,500,970 lbs.⁷⁶ This increase is likely serving the distribution centers in the San Bernardino and Inland Empire region, especially with the new use of the SBD as Amazon Air's western hub. However, it is worth noting that San Bernardino is also in fairly close proximity to the Imperial Valley, approximately 3 hours from El Centro and provides another alternative to San Diego International Airport that is about 2 hours from El Centro. San Diego International Airport (SAN) landed weights during the 2018 period

⁷⁵ Federal Aviation Administration, CY 2018 Final All-Cargo Landed Weights, Rank Order, September 2019.

⁷⁶ Federal Aviation Administration, CY 2019 Final All-Cargo Landed Weights, Rank Order, September 2020.

decreased 4.70 percent. In 2019 SAN showed only a slight increase of 1.37 percent (613,068,450 lbs.).

4.3.3 Distribution and Fulfillment

4.3.3.1 E-Commerce Freight Movement

A conventional retail chain merchandise flow is shown in **Figure 4.17**. Goods move from a manufacturer or producer to a regional or national retail distribution center (DC). Goods are placed in inventory there, and then later picked and forwarded to retail stores. Customers typically visit the stores and transport the chosen goods themselves as the dotted line in **Figure 4.17** depicts.

E-commerce merchandise flows vary and are increasingly referred to as “omni-channel”, as shown in **Figure 4.17**. Manufacturers or producers deliver goods to a regional or national distribution or fulfillment center. Flows from a major e-commerce DC can be of two types:

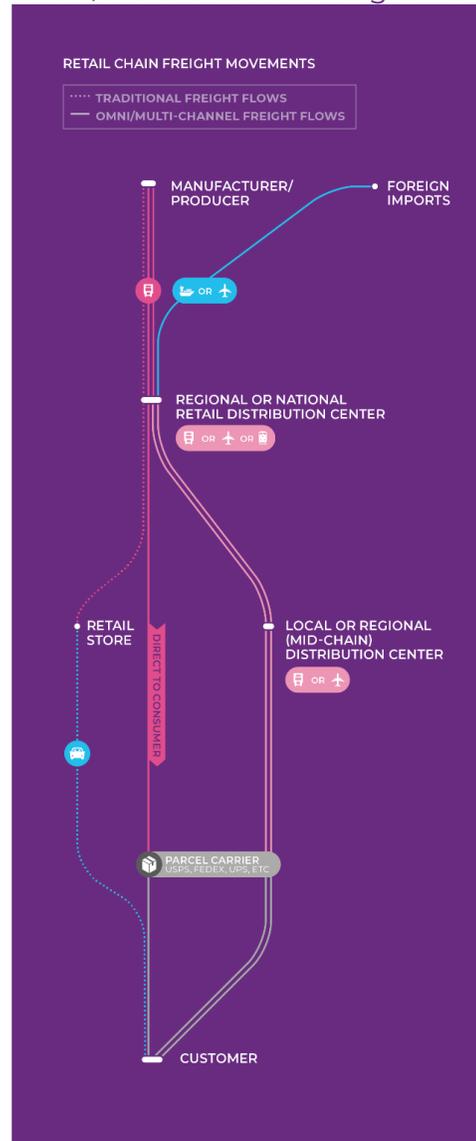
- Replenishment flows to other regional or local fulfillment centers, typically in consolidated truckloads.
- Order fulfillment for individual customers. These orders may move by surface or air via UPS, FedEx, USPS, a private fleet, or a number of other options.

E-commerce facilities may thus simultaneously function as mid-chain distribution centers feeding other downstream facilities, or as fulfillment centers delivering customer orders.

Import flows are typically handled differently in the two types of chains.

- Large retail chains such as Home Depot, Walmart, or Target are also importers, and receive goods directly from foreign sources (**Figure 4.17**).
- E-commerce firms typically receive imports from the U.S. DCs of the importing manufacturer. For example, Panasonic products sold by Amazon would usually be imported by Panasonic, and shipped first to a Panasonic DC, and then re-shipped to

Figure 4.17: Typical Retail Chain Freight Movements and Omni/Multi-channel Freight Flows



Source: Fehr & Peers, 2021. ATRI Study.

an Amazon DC. Amazon DCs and fulfillment centers typically receive imported goods in domestic equipment from U.S. vendor DCs rather than in international containers directly from ports. Although, this may be changing. In the future, Amazon is expected to import containers directly from Asia. The majority of the goods will be transloaded to domestic trailers and containers, and approximately one quarter to one third will move intact to Amazon DCs.

- There is also a difference in the **flow of returned goods**.
- In conventional retail chains, customers typically return goods to their retail store and then the goods are either re-sold or make their way upstream to retail DCs via “reverse logistics”—usually the return trips of company trucks.
- In e-commerce, customers typically return the package via USPS or a parcel company (UPS, FedEx), even if the goods were originally delivered by a company truck. This difference is significant in part because e-commerce sales have higher return rates than retail store sales, as much as 40 percent in some goods categories.

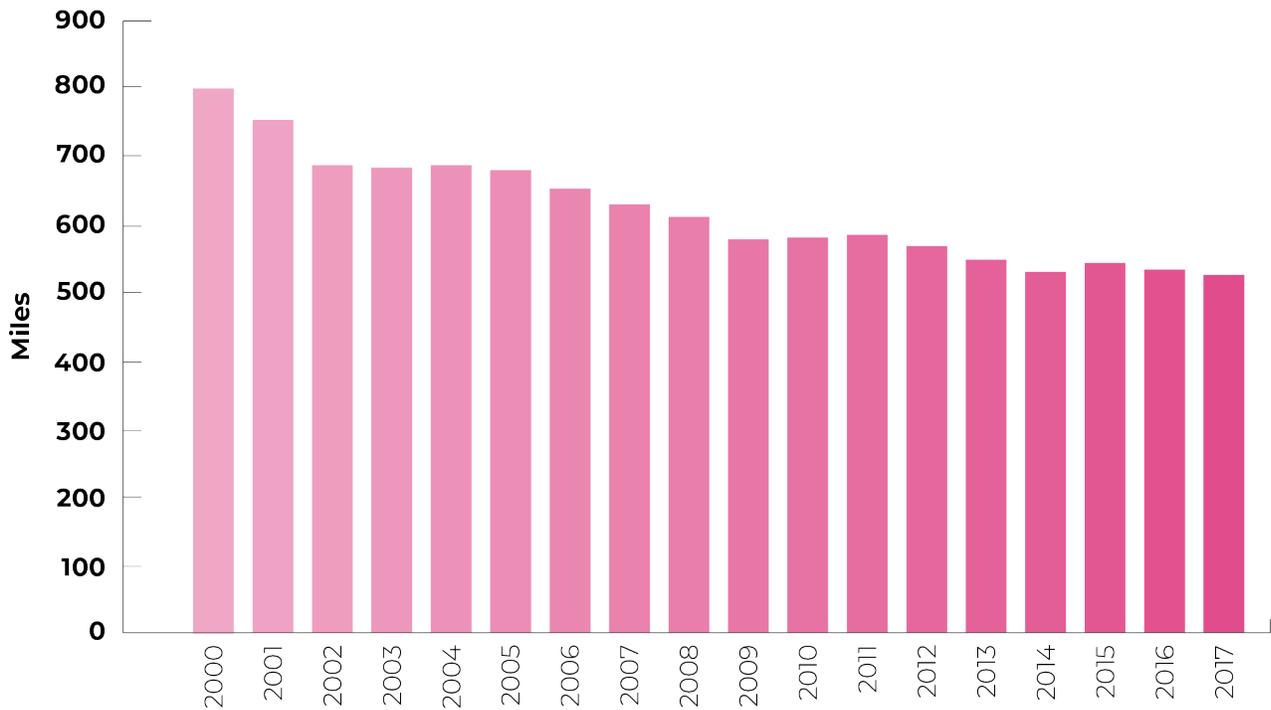
The overall impact of e-commerce on freight vehicle miles traveled (VMT) is mixed.

- Trips between e-commerce DCs and fulfillment centers take the place of trips between retail DCs and retail stores, although there may be fewer e-commerce facilities than retail stores. For example, there are about 20 Target stores in San Diego County and one in Imperial County. Including the new Amazon DC in Otay Mesa, there are reportedly about seven Amazon facilities in the two counties.
- Delivery trips to customers may be more efficient than customer store trips when part of a multi-customer USPS, UPS, or Amazon Prime route. They may be less efficient, however, than customer multi-stop trips or if customers combine multiple retail purchases instead of individual e-commerce orders.

E-commerce has unquestionably resulted in a large increase in parcel deliveries, both outbound merchandise and inbound returns. The convenience of one-stop shopping via Amazon, Wayfair, or others combined with quick free delivery has led consumers to order items as needed or desired rather than the previous practice of consolidating purchases to minimize errand trips or mail order shipping charges.

The addition of more local and regional truck trips to accommodate this growth in e-commerce has resulted in a dilution of the average length of haul for dry van truckloads such that the current average is now at or below 500 miles as of 2018 (**Figure 4.18**). This does not mean that there are fewer long-distance trips, as these have remained stable; there are more short distance trips to serve distribution and fulfillment centers.

Figure 4.18: Average Dry Van Truckload Length of Haul, 2000-2018 (ATRI study)



Source: ATRI Study

It is widely thought that the COVID pandemic has driven recent rapid e-commerce growth based on the following:

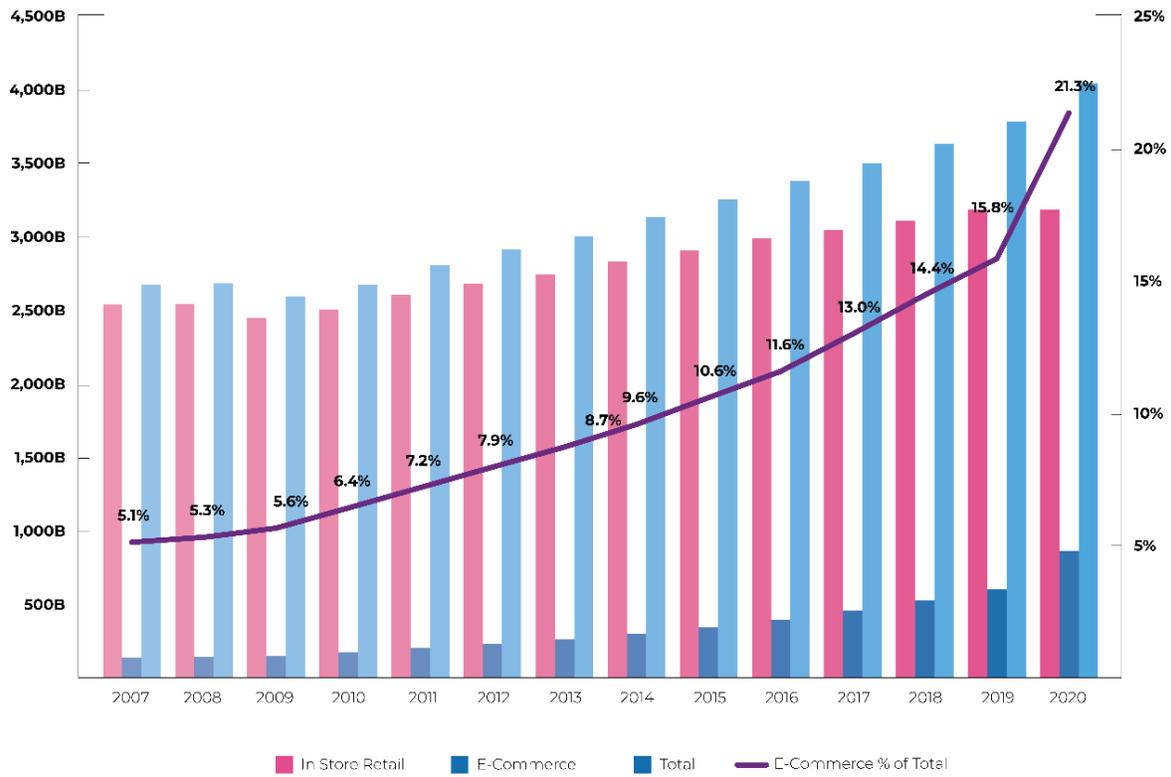
- Restrictions on travel and shipping led consumers to expand their use of e-commerce.
- Limitations on restaurants, theaters, amusement parks, etc. led consumers to buy more goods as a substitute for those activities.
- Forced time at home led consumers to add or upgrade home entertainment, computer systems, furnishings, appliances, etc.

Opinions differ on what share of the post-pandemic retail market will be retained by e-commerce. Some of the new shopping habits are expected to remain, and the widespread closure of both small businesses and retail chain stores has reduced the conventional alternatives.

4.3.3.2 E-Commerce Establishments and Employment

Rapid growth and change in the e-commerce field has made it difficult to track the industry with precision. Even before the pandemic, e-commerce was growing rapidly and gaining share within the retail sector.

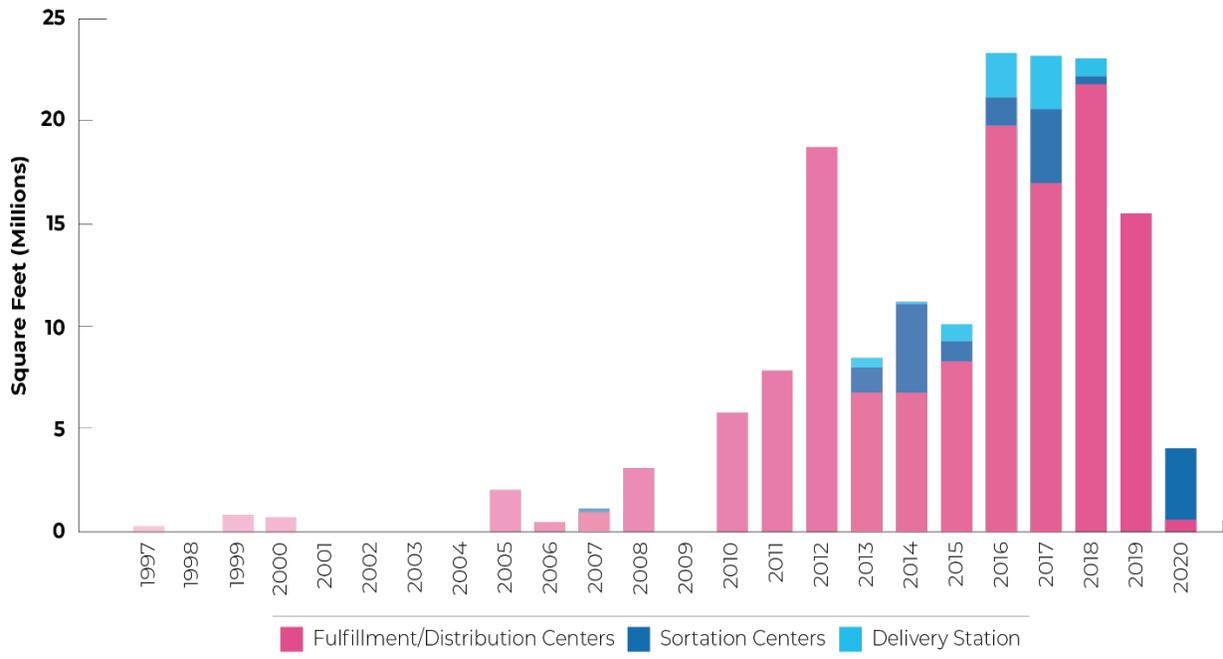
Figure 4.19: U.S. Retail Sales, 1999-2017



Source: Department of Commerce

There has also been a strong upward trend in Amazon facility investment, with increasing development of local sortation and delivery centers to supplement major fulfillment and distribution centers (**Figure 4.20**).

Figure 4.20: Amazon Fulfillment Center Investment, 1997-2020 (ATRI study)



Source: ATRI Study

Table 4.8 summarizes available data from the Bureau of Labor Statistics regarding “Non-store Retailers” that include e-commerce firms as well as mail-order firms and other firms outside the “brick and mortar” retail field.

Table 4.8: E-Commerce Employment and Establishments

E-Commerce Employment and Establishments											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR
Employees											
National	440,800	458,100	486,100	506,800	534,700	561,300	565,200	567,500	580,100	610,800	3.7%
San Diego	2,448	2,872	3,137	3,375	4,011	3,647	3,794	4,311	4,189	4,313	6.5%
Imperial	25	25	23	14	16	16	18	18	19	19	-3.0%
Establishments											
National	38,055	39,084	40,622	42,242	43,793	45,512	47,216	49,340	52,779	55,327	4.2%
San Diego	252	260	263	281	317	334	354	420	520	540	8.8%
Imperial	5	5	6	5	5	7	6	6	6	6	2.0%
Employees/Establishment											
National	12	12	12	12	12	12	12	12	11	11	-0.5%
San Diego	10	11	12	12	13	11	11	10	8	8	-2.2%
Imperial	5	5	4	3	3	2	3	3	3	3	-4.9%

Source: Quarterly Census of Employment and Wages: NAICS 454 Non-store retailers

As **Table 4.8** shows, non-store retail employment grew at about 3.7 percent annually at the national level, and at about 6.5 percent in San Diego County. Reported employment actually declined by 3.0 percent in Imperial County. Establishments grew at about 4.2 percent annually on the national level, and at about 8.8 percent in San Diego County. Imperial County gained slightly by about 2.0 percent.

The 2019 data do not, of course, account for the pandemic-driven e-commerce growth in 2020. The expectation is that e-commerce-related statistics will show an increase in all regions. The numbers for Imperial County may also change dramatically with completion of the Amazon Otay Mesa facility.

Table 4.8 also shows that as of 2019 the average number of employees per establishment is actually quite low and has fallen slightly. The average indicates that there are a large number of small facilities that offset the smaller number of very large ones. The declining average likely reflects Amazon's strategy of supplementing large regional distribution facilities with multiple local Prime fulfillment and sortation centers (**Figure 4.20**).

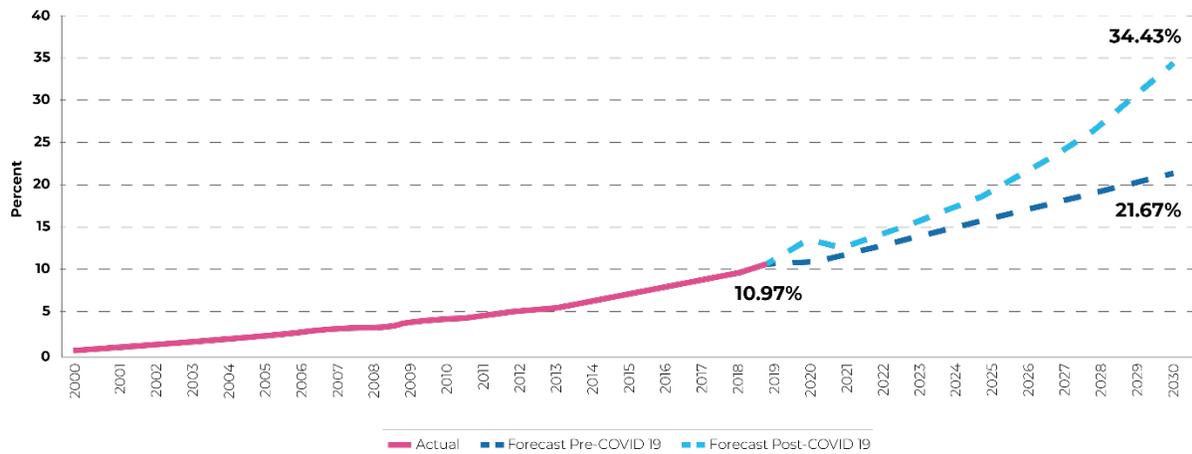
4.3.4 Local Land Use Conflicts and Land Use Availability for Freight

As e-commerce continues to grow and visits to local retail stores continue to decline, the Gateway region will be faced with a mismatch of commercial/industrial zoning and demand for retail/warehousing land uses. This is already occurring as indicated in by Costar data. Current occupancy rates for industrial space are at an all-time high, whereas retail vacancies are growing.

With the San Diego region's population expected to grow by nearly 437,000 people between 2016 and 2050,⁷⁷ and e-commerce as a percent of all retail sales anticipated to reach as high as 35 percent by 2030, the Gateway region will lack the necessary industrial land to meet the consumer e-commerce demand.

⁷⁷ SANDAG Series 14 Regional Growth Forecast.

Figure 4.21: US E-Commerce Penetration: Pre-COVID 19 Vs. Post-COVID 19 Estimates



Note: Forecasted figures starting in 2020 based on Bass Model and annualized e-commerce sales figures from confirm first half of 2020 (\$368.8 billion first half 2020 - Adobe).

Source: Global X ETFs, US Census Bureau, Adobe. Accessed at: <https://seekingalpha.com/article/4373491-e-commerce-entering-next-wave-of-growth>

Industrial land uses needed to meet this projected demand in e-commerce may be pushed out of the urban core areas and cause negative transport system and environmental impacts. Industrial land use conflicts, availability, and development costs will likely present major challenges for meeting consumer e-commerce demand, especially in coastal San Diego County. The region continues to grapple with “not in my back yard” (NIMBY) issues related to existing and new freight projects. To compound the land use conflict and land price issues, currently there are inadequate land use regulatory protections for freight and freight-related facility land use. As freight-related facilities get driven away from the urban core, which is also the commodity consuming core of a region, the phenomena of freight sprawl already observed will only increase along with and additional truck miles of travel.

Freight Policy, Constraints, Market Conditions, and Regulatory Issues

Visuals or tables in this section that reference 2020 data reflect data from the period pre-COVID-19 and related economic closures.

5. Freight Policy, Constraints, Market Conditions, and Regulatory Issues

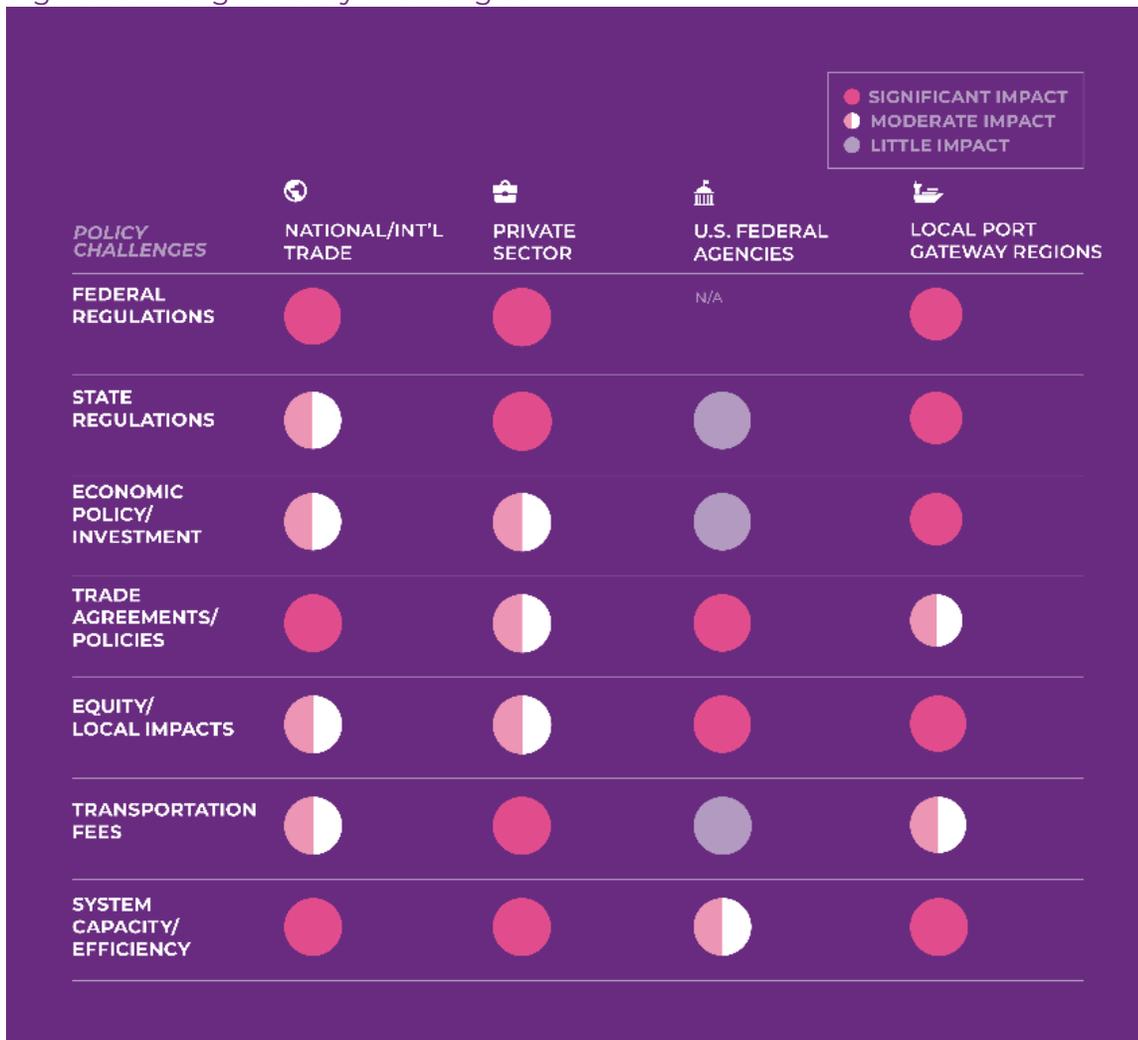
5.1 Freight Policy

5.1.1 *Freight Policy Issues*

In addition to the underlying economic forces driving the forecasts, there are policy, market, and regulatory issues that can significantly affect regional freight movement. The interplay of these issues cannot be fully captured in the quantitative forecasts, so freight planning agencies must regularly monitor developments and speak with industry stakeholders to consider the forecasts in context.

The complexity of policy, market, and regulatory influences on freight planning is represented in **Figure 5.1**. Each of the policy challenges has a variable impact on the different entities involved in freight planning.

Figure 5.1: Freight Policy Challenges



Source: SANDAG, 2021

Economic growth, equity, and environmental justice are tightly linked, and balancing the three in a “triple bottom line” is SANDAG’s major policy challenge. Since early 2020, economic issues have been dominated by COVID-19 pandemic impacts. Within the freight transportation sphere, economic issues include:

- Planning for safe, sustainable, and efficient goods movement to support the regional economy.
- Balancing the need for transition to a ZE future with the need for regional competitiveness.
- Priority in funding targets to minimize net long-term economic benefits consistent with equity and environmental justice goals.

This report section highlights freight policy, market, and regulatory issues (inclusive of federal, state and local regulatory issues) that should be monitored. Each issue is presented individually, yet how they evolve will reflect their interdependencies. This list will continue to change over time, and regular monitoring of freight-related trends must accompany implementation of this updated Gateway Study.

5.1.2 Funding Availability and Funding Priorities

Freight planning in the public sector is receiving increasing attention from policymakers, yet it is still a developing discipline. The complexities of freight and logistics are driven by private sector entities, leaving public freight planners with challenges in both understanding the logistical decisions and attempting to adjust public planning responses accordingly. The growing attention to freight planning has initiated the first wave of national, regional, and/or local freight frameworks through national and state freight plans required by the Fixing America's Surface Transportation (FAST) Act. However, some freight projects clearly only have local dimensions. Other freight projects are regionally, nationally, or even internationally important, yet the institutional structure needed to consider them consistently, and to help local agencies to deal with them in their own planning, is still nascent. Freight planners work with varying freight performance measures related to international seaports and airports, international border crossings, state and local roadways, and rail operations that have both local and national benefits and impacts. Additionally, as most freight projects involve private interests, funding solutions often demand complex funding partnerships crafted on a case-by-case basis.

In December 2015, Congress passed the FAST Act, which authorized \$305 billion over fiscal years 2016 through 2020, including nearly \$11 billion in provisions focused on ensuring the safe, efficient, and reliable movement of freight. In September 2020, Congress passed a one-year extension of the FAST Act, which included \$1 billion in funding for the Infrastructure for Rebuilding America (INFRA) Program in 2021. Specifically, for freight, the Fast Act:

- *Establishes a National Multimodal Freight Policy* that includes national goals to guide decision-making.
- *Requires the Development of a National Freight Strategic Plan to implement the goals of the new National Multimodal Freight Policy.* The National Strategic Freight Plan will address the conditions and performance of the multimodal freight system, identify strategies and best practices to improve intermodal connectivity and performance of the national freight system, and mitigate the impacts of freight movement on communities.
- *Creates a new discretionary freight-focused grant program that will invest \$4.5 billion over five years.* This new program allows States, Metropolitan Planning Organizations (MPOs), local governments, tribal governments, special purpose districts and public authorities (including port authorities), and other parties to apply for funding to complete projects that improve safety and hold the greatest promise to eliminate freight bottlenecks and improve critical freight movements.

- *Establishes a National Highway Freight Program.* The Act provides \$6.3 billion in formula funds over five years for States to invest in freight projects on the National Highway Freight Network. Up to 10 percent of these funds may be used for intermodal projects.
- *Includes new authorities and requirements to improve project delivery and facilitate innovative finance.* The FAST Act includes provisions intended to reduce the time it takes to break ground on new freight transportation projects, including by promoting best contracting practices and innovating financing and funding opportunities and by reducing uncertainty and delays with respect to environmental reviews and permitting.
- *Collects performance measures for leading U.S. maritime ports.* The FAST Act requires the Bureau and Transportation Statistics (BTS) to collect and annually report performance measures for the nation's top 25 ports, as measured by three methods (total tonnage, containers, and dry bulk tonnage).

Consistent with the evolving federal freight initiatives, the State of California published a statewide Freight Mobility Action Plan (FMAP) in response to the Moving Ahead for Progress in the 21st Century Act (MAP-21), which was recently updated with the 2020 Statewide Freight Mobility Plan in accordance with the FAST Act. Despite the national attention to freight planning and recent provisions for federal freight funding availability, state and local public sector agencies remain challenged to effectively address all freight mobility and sustainability financing needs. Local public agencies that tackle large scale freight projects must overcome inherent challenges of funding sources, funding priorities, and the need to develop unique funding partnerships.

Public planners face several challenges when advancing public freight improvement projects including: competition from non-freight projects for public funds; limited community support in the freight planning process; building consensus among various government entities and private sector stakeholders; land use challenges; and limited or restricted availability of funds for freight transportation. Since the recovery from the 2009 Great Recession, however, a set of competitive federal grant-based awards have been available from U.S. DOT for major infrastructure projects:

- **TIGER/BUILD/RAISE:** Initially known as Trade Investment Generating Economic Recovery (TIGER) under President Obama, renamed to Better Utilizing Investments to Leverage Development (BUILD) under President Trump, and renamed to Rebuilding American Infrastructure with Sustainability and Equity (RAISE), this program mirrors the Projects of Regional and National Significance program from prior ISTE and TEA-21 transportation bills. SANDAG was awarded \$20.2 million in TIGER 2009 funds for the I-805/SR-905 Interchange Project, the Port of San Diego was awarded \$10 million in TIGER 2015 funds for the Tenth Avenue Marine Terminal Modernization Project, and ICTC was awarded \$20 million in BUILD I funds for Calexico East Port of Entry Bridge Widening Project. The RAISE program has been continued with grant funding of \$1 billion available in 2021 which can fund freight projects but are open to all major infrastructure projects.

- **FASTLANE/INFRA:** The Infrastructure for Rebuilding America (INFRA), formerly called Fostering Advancements In Shipping And Transportation For The Long-Term Achievement Of National Efficiencies (FASTLANE), focuses on funding projects that improve freight efficiencies. In 2016, Caltrans and SANDAG received \$49 million in FASTLANE funding for the SR-11 Project. The INFRA program has been continued with grant funding of \$889 million for 2021, which may prove a source of support for the Region's project needs. As of the time of this report, the Senate had just passed the Infrastructure Investment and Jobs Act (IIJA), which pending House approval, authorizes up to \$77.9 billion for freight system improvements
- **PIDP:** In addition, the Federal Maritime Administration also administered a new funding program for port-related infrastructure through its Port Infrastructure Development Program (PIDP). On January 1, 2021, the National Defense Authorization Act appropriated \$230 million for the 2021 PIDP.
- **ATCMTD:** The Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) provides funds for Intelligent Transportation Systems. In 2020, SANDAG received \$9 million in ATCMTD funds for deploying intelligent transportation solutions at the US-Mexico Border and neighboring communities.

Although the Gateway Region has been successful in receiving many federal discretionary grant awards as noted above, there are still freight infrastructure needs that the region's partners will seek to fund through federal discretionary or formula funding. For example, San Diego and Imperial Counties have had access to federal Coordinated Border Infrastructure Improvement funds, but the funding allocations to date have been insufficient to address all border freight needs in the region.

In addition to federal funding, the State of California created discretionary funding programs for freight and other infrastructure projects. The State created the Trade Corridor Infrastructure Fund, which was followed by a more permanent transportation funding source created by the adoption of Senate Bill 1 (SB1). Within SB1, the legislature established the Trade Corridor Enhancement Account to fund corridor-based freight projects nominated by local agencies and the State. Implementing legislation was enacted with the approval of SB 103 (Chapter 95, Statutes of 2017) which directs the California Transportation Commission (Commission) to allocate the Trade Corridor Enhancement Account funds and the federal National Highway Freight Program funds to infrastructure improvements along corridors that have a high volume of freight movement. The Commission oversees the SB1 Trade Corridor Enhancement Program (TCEP), a discretionary funding program that allocates these federal and state freight funds and provides a funding source for freight projects throughout the state. In total, the Gateway Region has received over \$280 million in SB1 TCEP funds for border improvements, rail projects, seaport enhancements, and freight roadway improvements. Even with these substantial awards, there are still significant freight infrastructure needs throughout the Gateway Region that would greatly benefit from a dedicated funding source.

5.1.3 Technology and Innovation

Within this plan, technology advancement and innovation are treated as means to pursue broader goods movement goals rather than as goals themselves. Stakeholder workshops surfaced multiple perspectives on information technology (IT) in goods movement:

- Management systems for border crossings and curb access.
- Anticipating the needs of self-driving autonomous trucks and delivery vehicles.
- Compilation and use of GPS vehicle origin, destination, and route data.
- Truck parking apps.
- Appointment systems for port terminals and other applications.

These suggestions imply the need for high level innovation and technology policies to allow and encourage beneficial developments while retaining flexibility:

- Encouraging innovation and technology research, development, and testing.
- Seeking opportunities to apply innovation and technology in pursuit of regional goals.
- Using technology to improve utilization and productivity of existing and future physical infrastructure.

5.2 Market Issues

5.2.1 Changing Market Conditions and Supply Chain Drivers

As a result of the relative shifts in total delivered costs following the Great Recession in 2009, shippers have re-examined sourcing practices to optimize their supply chains, reduce risk, and add flexibility. In some cases, this is resulting in U.S. manufacturers reconfiguring their supply chains to move plant operations and sourcing suppliers closer to home or elsewhere within Asia because of free trade agreements, lower North American energy costs, exchange rate shifts, and rising labor and production costs in Asia. Mexico has increased its share of U.S. imports, as China appears to have peaked as a source country for manufactured goods. U.S. Census Foreign Trade Statistics reported growth of 66 percent in the value of U.S. goods imported from Mexico between 2008 and 2019, from \$216 billion to \$358 billion.

A more recent example of shifts in supply chains that impact the trade and transportation systems is the COVID-19 pandemic. It revealed the vulnerability of supply chains that are highly dependent on intermediate and final products sourced predominantly from Asia. As Asian shipments were stopped, cross-Pacific supply chains were grounded. The automotive, electronics, and pharmaceutical industries were significantly impacted since these supply chains depend on components from China.

COVID-19 has highlighted the risk of reliance on a single, specialized source and the lack of redundancy in supply chains resulting from just-in-time (JIT) manufacturing processes. It is anticipated that COVID-19 and associated uncertainty will result in companies reevaluating and minimizing risks to their supply chain and building in redundancy into the supply chain.⁷⁸ The pandemic, together with trade tensions around the world, will therefore most likely result in multinational industries reevaluating current sourcing patterns, “shortening” supply chains to increase control and diversifying parts and finished product sources. According to the South China Morning Post, a poll of 200 companies with global supply chains conducted in June 2020 found that 95 percent of respondents in the United States planned to change suppliers away from China due to the confluence of current issues and the uncertainty of future trading patterns.⁷⁹

The increases in delivered costs from China and policies from trade agreements may result in a concentrated shift of U.S. sourcing to Mexico (referred to as “nearshoring”). Mexico has increasingly attracted foreign investment in manufacturing for the North American market and for export to the U.S. market. There are others who point to additional emerging factors that suggest a more profound, long-term change in supply chain strategy. This thinking holds that the massive outsourcing to China over the past 20 years represented a single-minded goal of achieving only the lowest-cost manufacturing. Now evidence indicates that the pendulum is swinging toward a more sophisticated and complex supply chain management paradigm—one that is prompting major shifts in where goods are manufactured taking into account supply chain risk and the value of time-to-market. These factors are embedded into calculations of total delivered cost. This is an area for constant monitoring for regional planning agencies in San Diego and Imperial Counties due to the great importance of cross-border trade.

Optimizing around these supply chain management objectives incorporates a variety of additional factors, including transportation costs, environmental footprint, security costs, currency fluctuations, inventory costs, the cost of credit, and risks of supply chain disruption. For producers, shippers, and carriers, this approach incorporates the value of diversification of supply sources to mitigate risk. It also increases the emphasis on flexibility and responsiveness because demand forecasting has become more difficult, especially for those goods sold through multiple channels including e-commerce where consumer behavior in use of “Omnichannel”⁸⁰ retailing is becoming more sophisticated. When all those issues are considered, manufacturers may conclude that Mexico, or some other near source location, is preferable to Asian-country sources. A broader view of supply chain strategy has people thinking in terms of best-cost sourcing. This means looking at labor rates, but also other supply chain metrics such as worker productivity,

⁷⁸ W.C. Shih. 2020. Global Supply Chains in a Post-Pandemic World. Harvard Business Review. September–October. <https://hbr.org/2020/09/global-supply-chains-in-a-post-pandemic-world>.

⁷⁹ “Coronavirus, US-China trade war see 95 per cent of American firms wanting to ditch Chinese suppliers.” South China Morning Post, July 10, 2020. <https://www.scmp.com/economy/china-economy/article/3092640/coronavirus-us-china-trade-war-see-95-cent-american-firms>.

⁸⁰ Omnichannel retailing is using e-commerce, physical stores, call centers, and direct-to-home or direct-to-residential delivery in combination by the same retailer, in attempts to capture purchasing behavior through all available retail channels at the same time.

production quality, transportation alternatives, emissions footprint, inventory costs, and improved speed and savings available from near-sourcing in Mexico.

Mexico is well positioned to attract multinational companies with a well-developed industry base and a good road and rail transportation network connecting to the U.S.-Mexico border. The nearshore alternative can deliver significant cost efficiencies. Some of the key reasons why Mexico could be the preferred alternative for U.S. companies aiming at further diversifying intermediate and final product sources are:

- Time and geographic proximity. The time zone and physical proximity of Mexico to the United States provide a significant advantage over more distant locations, such as Asia.
- Cultural similarities. The similarity in culture between the United States and Mexico enables the establishment of binational teams.
- Labor pool. Mexico has a large and qualified labor pool that brings productivity gains. Cities close to the U.S.-Mexico border, such as Ciudad Juarez, Monterrey, and Tijuana, have a large, high-quality labor force.
- Cost attractiveness. Some Asian locations continue to be the lowest labor cost alternative globally. Mexico, however, still enjoys significantly lower labor and operating expenses compared to the United States.

Additionally, the newly implemented United States-Mexico-Canada Agreement (USMCA) supports North American manufacturing and mutually beneficial trade, creating a more balanced, reciprocal trade that supports economic growth in the region. The trade deal requires more locally sourced inputs for tariff-free exports to the United States. The official implementation of USMCA removes uncertainty for multinational companies, allowing them to develop supply chain plans that could include sourcing in Mexico.

5.2.2 Growth of E-Commerce and Merchandise Flow Shifts

E-commerce has unquestionably resulted in a large increase in parcel deliveries, both outbound merchandise and inbound returns. The convenience of one-stop shopping via Amazon, Wayfair, or others combined with quick free delivery has led consumers to order items as needed or desired rather than the previous practice of consolidating purchases to minimize errand trips or mail order shipping charges. Shifts in merchandise flow due to this growth affect domestic vehicle miles traveled and change how imported and domestically produced goods are handled and distributed.

In a conventional retail chain merchandise flow, goods move from a manufacturer or producer to a regional or national retail distribution center (DC). Goods are placed in inventory there, and then later picked and forwarded to retail stores. Customers typically visit the stores and transport the chosen goods themselves.

In a typical e-commerce merchandise flow, manufacturers or producers deliver goods to a regional or national distribution or fulfillment center. Flows from a major e-commerce DC can be of two types:

- Replenishment flows to other regional or local fulfillment centers, typically in consolidated truckloads
- Order fulfillment for individual customers, which may move by surface or air via UPS, FedEx, USPS, a private fleet, or a number of other options

E-commerce facilities may simultaneously function as mid-chain DCs feeding other downstream facilities or as fulfillment centers delivering customer orders.

Import flows are typically handled differently in the two types of chains. Large retail chains, such as Home Depot, Walmart, or Target are also importers, and receive goods directly from foreign sources. E-commerce firms typically receive imports from the U.S. DCs of the importing manufacturer. For example, Panasonic products sold by Amazon would usually be imported by Panasonic, shipped first to a Panasonic DC, and then re-shipped to an Amazon DC. Amazon DCs typically receive imported goods in domestic equipment from U.S. DCs rather than in international containers directly from ports. In some markets, however, Amazon has begun receiving imports directly and transloading imports from international containers to domestic trailers at the ports.

There is also a difference in the flow of returned goods. In conventional retail chains, customers typically return goods to their retail store and then the goods are either re-sold or make their way upstream to retail DCs via “reverse logistics”—usually the return trips of company trucks. In e-commerce, customers typically return the package via USPS or a parcel company (UPS, FedEx), even if the goods were originally delivered by a company truck. This difference is significant in part because e-commerce sales have higher return rates than retail store sales, as much as 40 percent in some goods categories.

The overall impact of e-commerce on freight vehicle miles traveled (VMT) is mixed. Trips between e-commerce DCs and fulfillment centers take the place of trips between retail DCs and retail stores, although there may be fewer e-commerce facilities than retail stores. For example, there are about 20 Target stores in San Diego County and one in Imperial County. Counting the new Amazon DC in Otay Mesa, there are reportedly about seven Amazon facilities in the two counties.

Delivery trips to customers may be more efficient than customer store trips when a delivery is part of a multi-customer USPS, UPS, or Amazon Prime route. They may be less efficient, however, than customer multi-stop trips or if customers combine multiple retail purchases instead of individual e-commerce orders.

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buy more goods as a substitute for those activities. Forced time at home led consumers to add or upgrade home entertainment, computer systems, furnishings, appliances, etc.

Opinions differ on what share of the post-pandemic retail market will be retained by e-commerce. Some of the new shopping habits are expected to remain, and the widespread closure of both small businesses and retail chain stores have reduced the conventional alternatives.

5.2.3 Modal Shift Potential

With congestion affecting the ability of California's freeway system to accommodate expected growth and mounting concern over diesel emissions, there is interest in shifting freight shipments to non-highway modes. Modal shifts from truck to rail have the potential to reduce demand for highways. However that potential is limited for the following reasons:

- A shift from long-haul trucking to rail intermodal typically reduces the need for interstate truck moves but still requires local and regional trucking for pick-up and delivery
- Conversion of truck moves to pure rail carload service eliminates the need for any trucking, but is usually only available to high-volume shippers with direct rail service.
- Conversion of truck moves to rail transload moves likewise reduces the need for long-haul trucking but still requires local or regional truck service

Modal shift is an intuitively attractive strategy to optimize freight efficiency and minimize its adverse regional impact, yet modal shift strategies have had little success to date in the U.S. Modal shift is a realistic option only under narrow circumstances. The pandemic was one recent example where temporary modal shifts occurred due to supply chain delays. The pandemic caused certain low-value commodities that traditionally move by rail or ship to suddenly become in-demand, high-value commodities that temporarily moved by air cargo. Technical, economic, and market factors all determine or limit modal choice, although there are some tools and strategies agencies can use to influence future modal shift. The practical potential for truck-to-rail modal shift depends on technical, economic, and market factors as follows:

- Technical – The rail option must be operationally feasible in terms of customer access, rail network connectivity, rail equipment supply, and commodity compatibility with rail movement.
- Economic – The door-to-door option must be cost-competitive with trucking while yielding an acceptable profit margin to the railroad and other involved parties. Customers expect to pay substantially less for a rail option.
- Market – The rail option must meet the needs of both shipper and receiver in terms of reliability, transit time, shipment size, frequency, access, and cost.

- If these criteria are met, customers can choose between roughly equivalent rail and truck options.

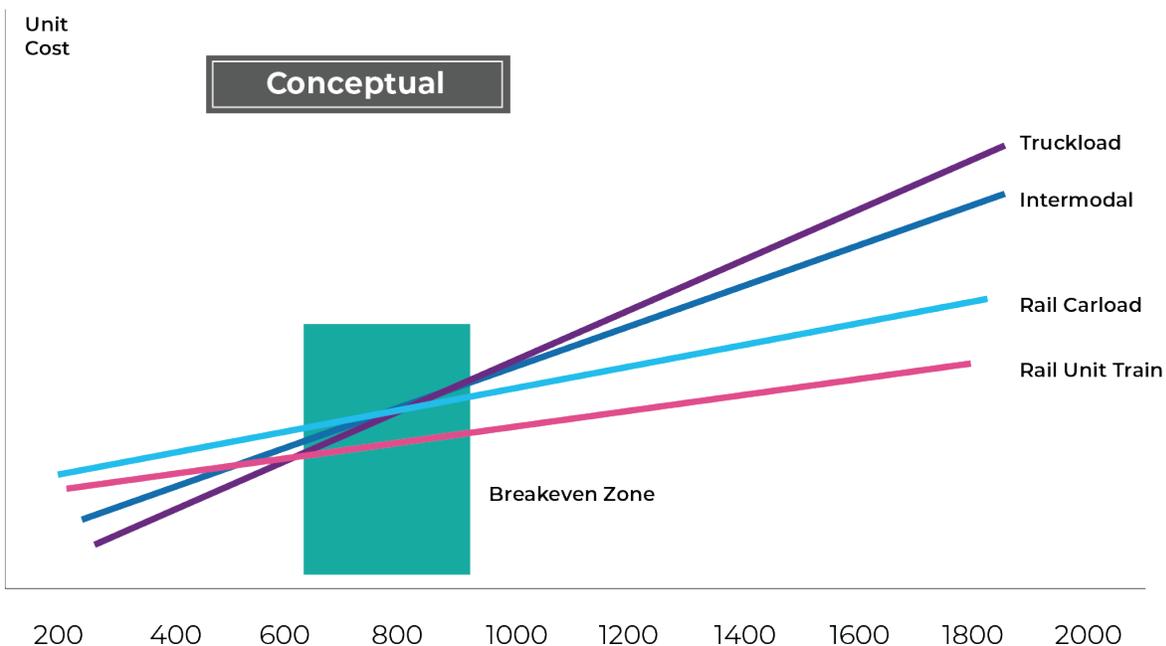
5.2.3.1 Truck to Intermodal Shifts

Rail intermodal service is an increasingly competitive alternative to long-distance over-the-road trucking. Intermodal service moves trailers or domestic containers between terminals by rail. Trucks bring the units to the origin terminal and deliver the units from the destination terminal. The ability of intermodal options to compete with highway service depends heavily on distance. Multi-step intermodal service entails substantial cost and time at terminals, but offers unit cost savings on the line-haul move between the terminals. To be cost-competitive and service-competitive with door-to-door truckload service, the rail line-haul move must be long enough for the line-haul cost savings to offset the pickup, terminal, and delivery costs. Not surprisingly, most active U.S. rail intermodal corridors are in excess of 500 miles.

Because initial pickup and final delivery must still be made by truck, intermodal rail service is not an alternative to urban trucking. Depending on the relative locations of rail intermodal terminals, shippers, and consignees, the impact on urban congestion and truck VMT could be positive, negative, or neutral.

Rail intermodal service is not ordinarily cost-competitive or service competitive with over-the-road trucking for distances less than 600–900 miles as illustrated in Figure 5.2. The distances involved limit commercial rail intermodal service to long-haul trips.

Figure 5.2: Truck-Intermodal “Breakeven” Zone



Source: Fehr & Peers, 2021.

5.2.3.2 Rail Intermodal Terminals

There are no existing intermodal rail terminals in the study area. The nearest terminals are in Long Beach (UP), Los Angeles (BNSF and UP), and San Bernardino (BNSF).

In the early days of intermodal operations, there were many more terminals than at present. A steady push for consolidation reduced the system to a much smaller number of hubs serving major markets by the 1980s. Intermodal volume growth has been accommodated mostly by expanding existing major hubs with new terminals established only in selected major markets. Most of the intermodal volume growth has come from international container shipments. Most of the terminal expansion has therefore occurred at ports or at major inland import/export points.

There are multiple considerations in intermodal terminal development decisions.

- **Volume revenue and balance potential.** A rail intermodal terminal is a multi-year, multi-million-dollar investment. The railroad must be able to identify sufficient volume and revenue potential to justify the investment. The balance of inbound and outbound business has a dramatic impact on profitability since imbalanced traffic forces the railroad to move empty cars and containers or trailers.
- **Site and location.** A large, modern intermodal facility will require a level 100- to 300-acre site in a rectangular shape aligned with the main rail line. Such sites are rarely found in developed urban areas, so railroads tend to either redevelop old freight yards or locate on the fringes.

- **Scale economics.** Economies of scale favor incremental expansion of existing facilities where capital investments, such as structures and equipment, can be spread over growing business volume. Increased business volume can also help the contractors who operate rail intermodal terminals to improve labor productivity by reducing downtime.
- **Rail network fit.** Railroads prefer to locate intermodal facilities where they can serve multiple routes and origin/destination pairs.

Establishing additional rail intermodal terminals in the study region may split the regional traffic base between the new facility and existing terminals. This would be an undesirable outcome from the railroad perspective as additional terminal infrastructure and train operations would be required.

5.2.3.3 Truck to Rail Carload Shifts

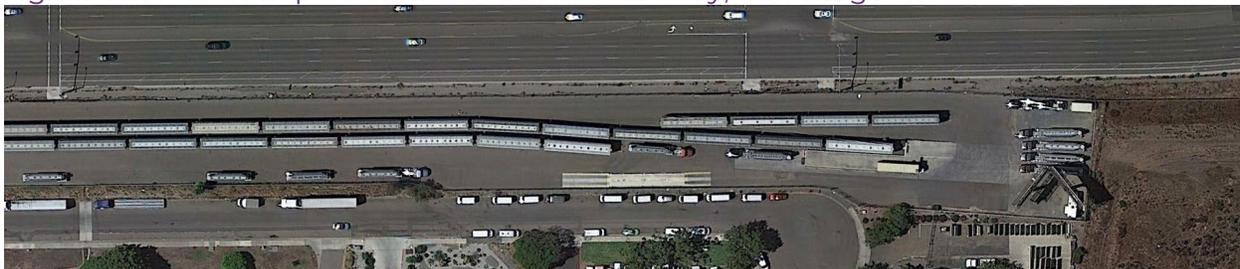
The potential benefits of shifts between over-the-road trucking and rail carload service are based on the ability of rail cars (boxcars, flat cars, tank cars, covered hoppers) to hold the equivalent of 3-5 truckloads of freight. A truck-to-carload shift would replace 3-5 highway truck trips with a single rail move to a regional transloading and distribution center. Local pickup and distribution would still be handled by truck, as in the intermodal case. Rail-to-truck transloading centers, however, are much easier to locate and build than intermodal terminals and do not require prohibitive economies of scale.

Transloading facilities require rail and/or truck access but may otherwise need only a few acres of low-cost industrial land. Many are located on brownfield sites or former industrial properties that have been adopted to the purpose.

The region has BNSF-served rail-truck transload facilities that can accept shipments in rail cars and transfer them to trucks for local delivery (or vice versa).

- Plastic Express, 7000 Consolidated Way, San Diego – handling polypropylene, polyethylene, polystyrene, polyvinyl chloride (**Figure 5.3**)

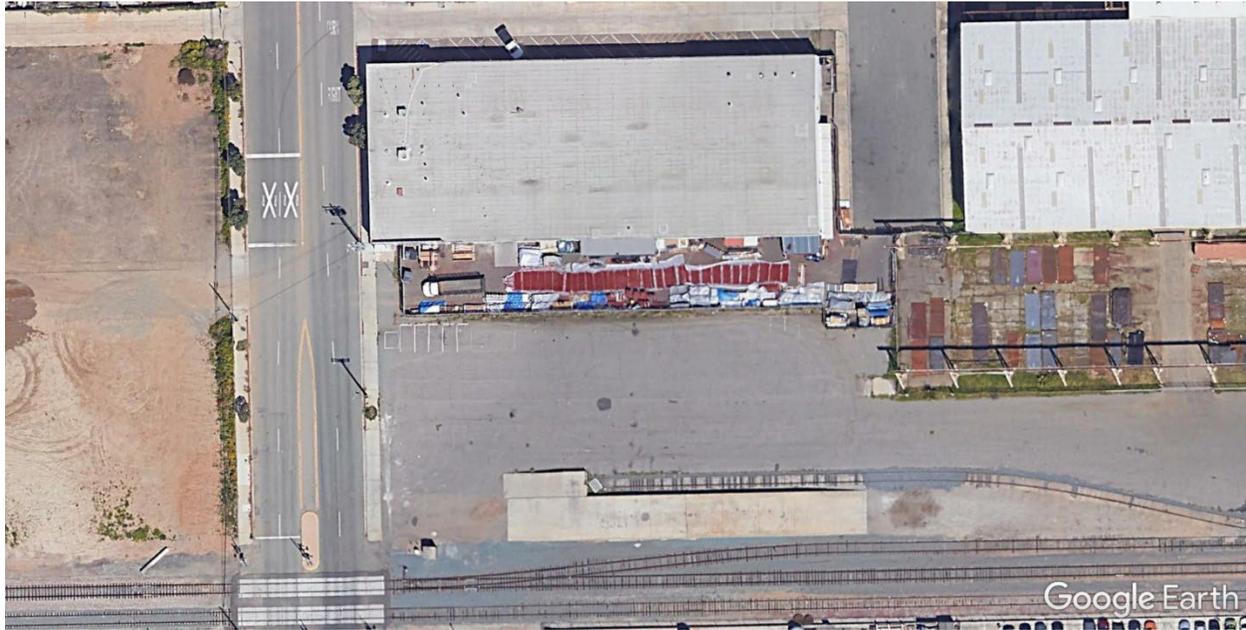
Figure 5.3: Plastic Express 7000 Consolidated Way, San Diego



Source: Google Earth, 2021

- Plastic Express, 840 West 19th Street, National City – handling bricks, railroad ties, insulation/siding, roofing materials, bars, ingots, pipe, machinery, government, generators/trans, polyethylene, polypropylene, polystyrene, polyvinyl chloride, bentonite, perlite, diatomaceous earth, sand, crushed stone, limestone, sand & gravel, granite, gypsum, lime, roofing granules, kaolin (**Figure 5.4**).

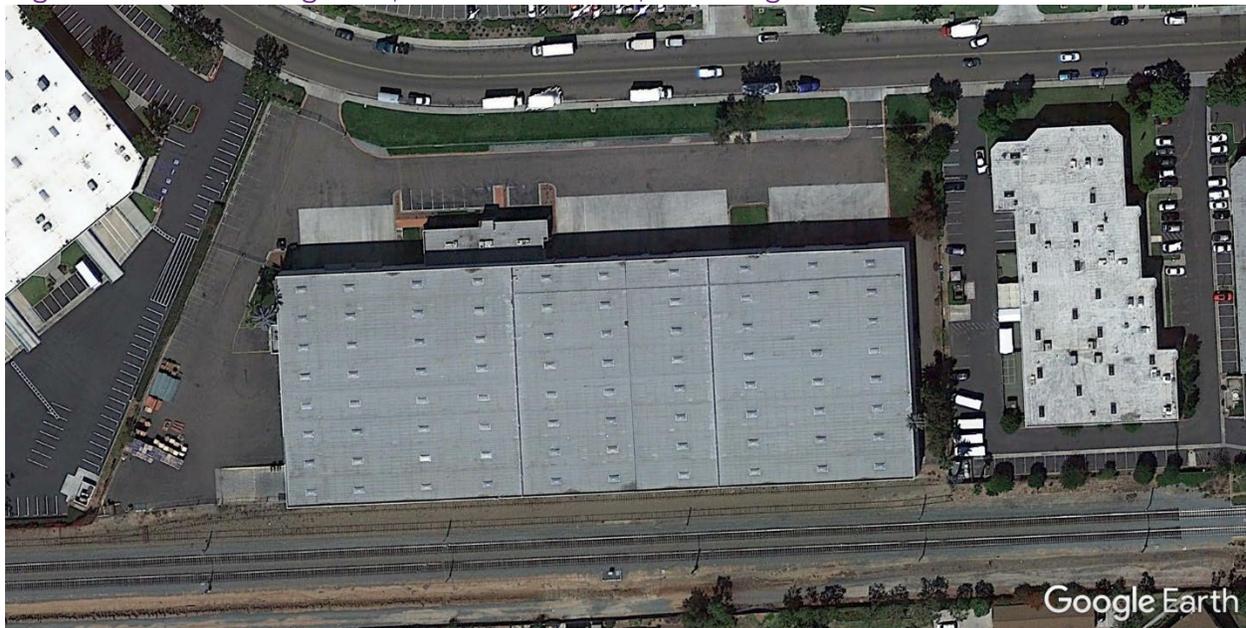
Figure 5.4: Plastic Express 840 West 19th Street, National City



Source: Google Earth, 2021

- Weber Logistics, 1366 30th Street, San Diego – handling lumber, bricks, insulation/siding, roofing materials, pipe, gypsum wallboard, poles & posts, printing paper, canned foods, beer, wine/other beverages, household appliances, tires, plywood, particle board, wood pulp, pulpboard, railroad ties, machinery, rail equipment, grocery products, cotton, grass seeds (**Figure 5.5**).

Figure 5.5: Weber Logistics, 1366 30th Street, San Diego



Source: Google Earth, 2021

Transloading is most effective for certain classes of commodities

- Bulk liquids, such as asphalt or corn syrup, which can usually be transferred from tank cars by gravity or pumps through piping and hoses to tank trucks. (**Figure 5.6**)

Figure 5.6: Rail-to-Truck Transfer of Asphalt



- Dry bulks, such as plastic pellets, aggregates, or minerals, that can also be easily transferred and do not require elaborate handling or storage. (**Figure 5.7**)

Figure 5.7: Rail-to-Truck Transfer of Minerals



- Building materials, including lumber, plywood, particle board, trusses, structural steel, cement blocks, paving stones, etc. that can be transferred in bundles or on pallets by forklifts and are easy to store. (**Figure 5.8**)

Figure 5.8: Rail-to-Truck Transfer of Building Materials



Facility requirements are minimal: paved or graded space for transfers, transfer equipment (fork lifts, conveyors, piping), and office space.

More elaborate facilities can have covered or racked storage, scales, and other additions. **Figure 5.9** shows a large-scale transload facility in Fontana, CA.

Figure 5.9: BNSF Transload Center, Fontana



Since pickups and delivery are still made by truck, rail-truck transloading is not a remedy for the overall volume of urban trucking. Strategic location of transloading facilities could, however, assist regional planning agencies in reducing long-haul trucking to, from, and through the region. The commodities best suited to transloading are heavy. Diversion of long-haul trips to rail would also reduce wear and deterioration on regional highways.

5.2.3.4 Drone Deliveries

Emerging technology in unmanned aircraft systems, commonly known as drones, has the potential to supplement existing goods movement modes, especially for last-mile, high-value, or low-weight products. A pilot program involving the City of San Diego, the U.S. Department of Transportation, and the Federal Aviation Administration has explored the use of drones for delivery of food, beverages, medical specimens, and packages. The future of drones for deliveries and other uses depends on technological capabilities, as well as the development of regulatory frameworks at the federal, state, and local levels.⁸¹

5.3 Regulatory Issues

There are many aspects of freight transportation system operations regulated by government agencies. Among the regulatory issues are U.S. DOT regulations affecting Mexican truck access and truck safety, and regulations affecting freight emissions. There

⁸¹ San Diego UAS Integration Pilot Program: Mid-Program Report. City of San Diego, 2019.

are a broad range of national level transportation regulations affecting equipment and their operators, most all of which affect available capacity of the system. The regulatory environment has been especially challenging for trucking, where changes to hours of service, driving record, and driver health testing have combined to reduce the available driver capacity. There are regulations imposed on trucking at the state and local levels of government as well, each with different ranges of impacts.

5.3.1 National: U.S. Department of Transportation Mexican Trucking Regulations

Expanded access to the U.S. market for Mexican trucks has remained an unresolved issue since 1994. This has been one of the most contentious U.S. transportation policy issues for over 25 years despite having been required by the North American Free Trade Agreement (NAFTA). Mexico-domiciled motor carriers can only operate within a 30-mile commercial zone along the United States-Mexico border, and more than 90 percent of the cross-border trucking business is performed by Mexican motor carriers. These crossborder shuttle trucks must have a US DOT number, FMCSA-assigned MX number, and a valid FMCSA Certificate of Registration for commercial-zone operations. Regardless of the type of authority the carrier obtains, no Mexico-domiciled carrier may make conduct point-to-point operations within the U.S.⁸²

There is a long-standing alternative available to trucking companies wanting to operate on both sides of the border, which is to register trucks in both Mexico and California. This 'dual plating' operation incurs higher costs as motor carriers must pay for registration in two states at the same time and are subject to laws and regulations on both sides of the border, but it is an alternative that pre-dated USMCA and continues today. The use of this alternative makes the cost of crossborder trucking more expensive ultimately raising the cost of crossborder trade; however, this continues to be the practical alternative.

5.3.2 State: Climate Change and Resiliency Regulations

California has implemented legislation to reduce greenhouse gas (GHG) emissions, including Assembly Bill (AB) 325 and Senate Bill (SB) 350. AB 32 established GHG emissions reduction target of 15 percent below 1990 levels by 2020. SB 350, SB 327 and Executive Order (EO) B-30-15 furthered the GHG reduction goal by setting a new target of 40 percent below 1990 levels by 2030. In addition, EO N-19-19 leverages California's pension investments, transportation systems and purchasing power to strengthen and advance the State's climate leadership and resiliency, with the objective to reduce greenhouse gas emissions and mitigate the effects of climate change. Two important bills were also signed into law to strengthen emission standards for medium- and heavy-duty trucks and other high-pollution vehicles. The first bill, SB 210 by Senator Connie Leyva requires CARB to develop and implement a Heavy-Duty Inspection and Maintenance Program for non-gasoline, heavy-duty trucks.¹⁰ This will be the first 'smog

⁸² Cross-Border Operating Requirements for Mexico-domiciled Motor Carriers. Federal Motor Carrier Safety Administration. <https://www.fmcsa.dot.gov/international-programs/cross-border-operating-requirements-mexico-domiciled-motor-carriers>.

check' program of its kind in the nation. The second bill, SB 44 by Senator Nancy Skinner (D-Berkeley) requires CARB to create a comprehensive plan for reducing greenhouse gas emissions from medium and heavy-duty vehicles. In addition to the statewide targets, many regional air districts and local agencies have their own GHG emissions thresholds for environmental review, as well as GHG emissions targets. These targets specifically focus on reducing carbon emitted from fossil fuels, as well as renewable natural gas. Arguably, renewable natural gas does not generate new carbon, but because it requires the release of naturally occurring carbon back into the atmosphere, CARB strategies focus on electricity and hydrogen as the future energy sources for transportation. The California Sustainable Freight Action Plan (CSFAP) indicates three targets to help achieve the GHG emissions reductions as summarized in **Table 5.1**.

Table 5.1: GHG Emissions Reductions Targets

GHG Emissions Reductions Targets			
Type	Description	Target/ Metrics	Target Date
System Efficiency	Improve freight efficiency relative to goods and services produced (NAICS 48-49)	25% efficiency gain Speed, reliability, delay reductions, etc. GDP/CO2	2030
Transition to Zero-Emission (ZE) Vehicles	Deploy ZE freight vehicles and equipment capable of ZE operations	100,000 pieces of ZE equipment	2030
Increased Competitiveness & Growth	Implement suite of competitiveness & growth metrics and models	To be developed by working group of industry, economists and experts	N/A

Source: California Sustainable Freight Action Plan, Cited in California Freight Mobility Plan, 2020

To further its commitment to meeting these emissions reductions goals, California, with the help of affected industries and other interested parties, has long been funding infrastructure projects and programs, such as technology advancement, that improve freight efficiencies while addressing the environmental impacts resulting from goods movement in California. The State's commitments are extensive and include the following regulations and incentives:

- **Proposition 1B – Goods Movement Emission Reduction Program** – the five-year-old partnership between CARB and local agencies (e.g., air districts, ports, and transportation agencies) has already substantially reduced air pollution emissions and health risk from freight movement along California's trade corridors. Local agencies

provided financial incentives to owners of equipment used in freight movement to upgrade to cleaner technology.

- **Goods Movement Planning** – California state agencies including Caltrans and the California Environmental Protection Agency (EPA) brought stakeholders together to discuss and address goods movement and the reduction of their environmental impacts in California.
- **Port Activities** – In an effort to reduce emissions for port-related sources, CARB has pursued regulatory activity on cargo handling, commercial harbor craft, port trucks, ship auxiliary and main engines, on-board incineration, shore power, and vessel speed reduction. CARB developed Health Risk Assessments for the Ports of Los Angeles, the Port of Long Beach, and the Port of Oakland used in measuring impacts of emissions reduction efforts.
- **Rail Yard Activities** – these efforts include agreements with Union Pacific and Burlington Northern Santa Fe (BNSF) Railways to reduce locomotive emissions near rail yards and the development of new regulations to address on- and off-road vehicles at rail yards. CARB approves major rail equipment fleet rules.
- **Truck Retrofitting and Replacement** – CARB’s detailed 2009 rules requiring retrofit or replacement of virtually the entire fleet of trucks operating in California plus mandated tire and aerodynamic-related specifications has been successful in reducing emissions. The statewide bus and truck rules required fleet owners to replace trucks operating in California or retrofit them with diesel exhaust filters by 2014. There is a remaining requirement that owners replace engines older than the 2010 model year under an implementation schedule running through 2022.

California freight warehouses and transportation companies are facing aggressive environmental regulations, notably the Indirect Source Rule,⁸³ which is influencing supply chain decisions. Clearly, these programs need to be understood and monitored by those planning freight projects as they impact market competitiveness and prices to move freight to/from/within/through California.

Since California freight regulations are more stringent than in other states, monitoring regulatory impacts and possible impacts to freight remain a challenge. Looking forward, the State will increasingly focus on reducing carbon from the freight supply chain. California, in the 1990s, was the center of efforts to reduce pollutants such as nitrogen oxide (NOx), sulfur oxide (SOx) and particulate matter (PM). NOx, SOx and PMs present health risks such as respiratory illnesses and cancer, while carbon dioxide emissions are associated with greenhouse gas (GHG) emissions that contribute to global climate change.

⁸³ The Industrial Source Rule, or Rule 2305, went into effect March 1, 2006, in California and requires developers of larger residential, commercial, or industrial projects to reduce emissions generated by their projects.

California regulations have been increasingly focused on the reduction of GHG emissions and carbon footprints, and most recently, the federal policy focus has shifted into alignment with California (see 4.2 of this report). The importance of transportation activity to the states' carbon footprint has made supply chains a primary target in California's carbon emission regulatory efforts.

On-and off-road vehicles remain a key area for meeting GHG reduction targets, but warehouses and distribution centers are also affected by state environmental regulations. Regulations mandate more efficient lighting, a move to electric forklifts, and other energy reduction measures. Southern California, with over 1.5 billion square feet of industrial real estate, is by far the largest distribution complex in the country and substantial investment is being made to improve the energy profile of this sector. The draft Indirect Source Rule would create more regulations to reduce the carbon footprints of these facilities.

CARB Truck and Bus Regulation

Light commercial vehicles (14K–26K gross vehicle weight rating [GVWR]) and heavy commercial vehicles (26.1K GVWR and greater) are subject to federal and state air quality and greenhouse gas (GHG) emissions regulations. As of 2020, all trucks must have 2010 model year or newer engines (based on the Emissions Control Label) by 2023 and most heavy trucks must have a particulate matter (PM) exhaust filter installed.

As of January 1, 2021, lighter commercial vehicles with 2006 model year and older engines are not allowed in California, with the only option to repower (i.e., replace the engine). For heavy commercial vehicles, trucks with 2004 or older engines must be replaced with a 2010 or newer model year engine as of January 1, 2021. Later model years have a sunset date continuing through 2023. Single truck owners will be able to delay the replacement of their trucks until 2023.

CARB introduced some flexibility options in 2014 to allow additional years to comply with the regulations, which was particularly helpful to small fleets and owner operators. These flexibility options were challenged by large trucking companies that invested in equipment retrofits to comply with the ruling when it was first enacted. CARB rolled back the flexibility options, and this decision affects owner–operators, small fleets, farmers, low-use truck operators, and those who invested in the installation of particulate filters early. Some counties in Northern California and along the Central Coast are only required to have a particulate filter and are instead exempt from meeting the 2010 model year engine standard.³⁸ Southern California, including San Diego County, is outside this Low NOx exemption area. Truckers based in the San Diego region, or based elsewhere and serving the San Diego region, still must comply with the CARB 2010 engine year regulation. One other exception (called the Low-Use Exemption) applies for trucks that operate less than 1,000 miles or less than 100 hours in California per year.³⁹ Additionally, vehicles will need to be in compliance with the Truck and Bus regulation to be registered with the Department of Motor Vehicles beginning in 2020. If subject to other regulations,

such as port drayage programs, then proof of compliance with the regulation will be accepted from these programs. Tampering with particulate systems results in heavy fines.

Tractor-Trailer Greenhouse Gas (GHG) Regulation (2008)

CARB approved the Tractor-Trailer GHG regulation in 2008. The purpose of the Tractor-Trailer GHG Regulation is to reduce GHG emissions from heavy-duty trucks and 53-foot box-type semitrailers that transport freight on a highway within California. This regulation includes dry-van, refrigerated van trailers, and the heavy-duty tractors that pull them. In order to reduce emissions, vehicles subject to the regulation will be required to use low-rolling resistance tires and meet SmartWay certified aerodynamic equipment requirements. Owners of tractors subject to the regulation must either purchase new SmartWay verified tractors or retrofit existing tractors with low rolling resistance tires. Owners of trailers must either purchase new SmartWay certified trailers or retrofit existing trailers with SmartWay verified aerodynamic technologies and low rolling resistant tires. This places an additional cost burden that affects small fleets and owner-operators increasing their investment in equipment to meet the regulation.⁴⁰

Transport Refrigeration Unit (Reefer) Airborne Toxic Control Measure Regulation

CARB staff proposed amendments to the transport refrigeration unit (TRU) Airborne Toxic Control Measure that CARB adopted on February 26, 2004, and that was last amended in 2010. The regulation was designed to reduce emissions of diesel particulate matter (PM) from diesel-powered engines used to refrigerate perishable goods in insulated truck and trailer vans, rail cars, and domestic shipping containers. The regulation also applies to TRU generator sets (gensets), which provide onboard electric power to electrically driven refrigeration systems used in shipping containers and trailers. A variety of amendments and compliance measures have been enacted by CARB to try to improve overall compliance, including increasing inspections at border crossings. This has particular significance to the San Diego regional truckers, including those crossing the border, in terms of cost to retrofit or replace equipment to meet the regulation. The regulation does not apply to drayage tractors and trailers that operate within a 100-mile radius of a port or intermodal rail yard.⁴¹ Therefore, this exemption does not assist crossborder drayage truckers destined for the Ports of Long Beach or Los Angeles

5.3.3 State: Equity and Environmental Justice

In 2021, President Biden issued an executive order (EO) on advancing racial equity for underserved communities through the federal government. Implementing this EO, U.S. DOT included “advancing racial equity and reducing barriers to opportunity” as a key objective in the INFRA 2021 notice of funding opportunity, indicating that federal freight discretionary funds would be awarded to projects that helped reduce impacts in underserved communities.

Similar to the federal government, the State has taken recent actions to implement policies that will advance equity through transportation programs and projects. In 2020, the California State Transportation Agency Secretary David Kim issued a statement on racial equity, justice, and inclusion in transportation networks, acknowledging the history of transportation decisions putting up barriers in communities. Later in 2020, Caltrans released a statement of commitment outlining actions that the agency will take to achieve equity through community engagement during the programs and projects development process, partnerships with minority-owned and disadvantaged business enterprises, climate resiliency actions, and workforce development strategies. In addition, applicants that submit SBI TCEP applications must describe how the proposed freight project's team engaged with community-based organizations, how the project addresses community identified needs, how any negative impacts will be mitigated, if the proposed project is located in a disadvantaged community, and how stakeholders will continue to be engaged throughout project implementation. This SBI TCEP criteria mirrors the goals outlined in the California Freight Mobility Plan 2020.

Locally, SANDAG acknowledges the negative impacts that communities of color and underserved communities experience in response to disparities in transportation decision-making, policy, planning, design, and construction. SANDAG has committed to implementing concrete actions to address equity concerns throughout the state's most vulnerable communities, regardless of race, socioeconomic status, identity, where they live, or how they travel. These actions will be carried through the agency's freight planning and project efforts.

5.3.3.1 California Sustainable Community Strategies Planning Requirements

Beyond California's air quality regulatory policy, there is a broader shift in state law toward implementation of steps toward environmental sustainability and equity in planning, integrating transportation as one element of sustainable communities. Assembly Bill 617 (AB 617) passed in 2017 established the Community Air Protection Program to reduce community exposure to freight activities. This program allows for the nominations of communities to participate in the development of a Community Emissions Reduction Plan (CERP). The CERPs develop strategies for implementing community air monitoring and community emissions reduction programs. AB 617 receives funding appropriated by the Legislature to support early actions for addressing localized air pollution. Targeted strategies include greater outreach and community engagement efforts, investments in cleaner technologies, land use buffers between industrial and residential areas, mandates for accelerating the retrofit of pollution controls on industrial sources, increased penalty fees, and collection of emissions data.

5.3.4 Local: Land Use Conflicts and Land Use Availability for Freight

With the San Diego region's population expected to grow from 3 million to over 4 million by 2050, it also is expected that there will be a further decrease in supply of available industrial land and that the continued conversion of commercial and industrial lands to residential uses will exacerbate land use conflicts between freight and non-freight uses. Industrial land uses may be pushed out of the urban core areas to rural areas accompanied by increased travel distances and times and associated environmental impacts. This is likely to be most acute for the Port of San Diego operations which are located along the region's working waterfront area, as well as the downtown rail yard for BNSF railway. Additionally, land use conflicts are emerging in the border region now, as the southern part of the county continues to develop.

Land use availability, land use cost for freight projects, and land use prices are additional major challenges for freight facilities, especially in coastal San Diego County. The region continues to grapple with "not in my back yard" (NIMBY) issues related to existing and new freight projects. To compound the land use conflict and land price issues, there are inadequate land use regulatory protections for freight and freight-related facility land use. As freight-related facilities are driven away from the urban core, which is also the commodity consuming core of a region, freight sprawl can increase. If freight facilities were put out of business or moved away from consumers, then additional truck miles can be expected so that goods can be delivered to consumers and businesses remaining in the core areas.

5.4 International Freight Developments

With the importance of international trade to the economy and freight demand of San Diego, international developments are of great and increasing importance to the future of the region. Among these are such once-in-a-lifetime events, such as the Panama Canal expansion and evolutions of transportation systems for railroads and ports in North America.

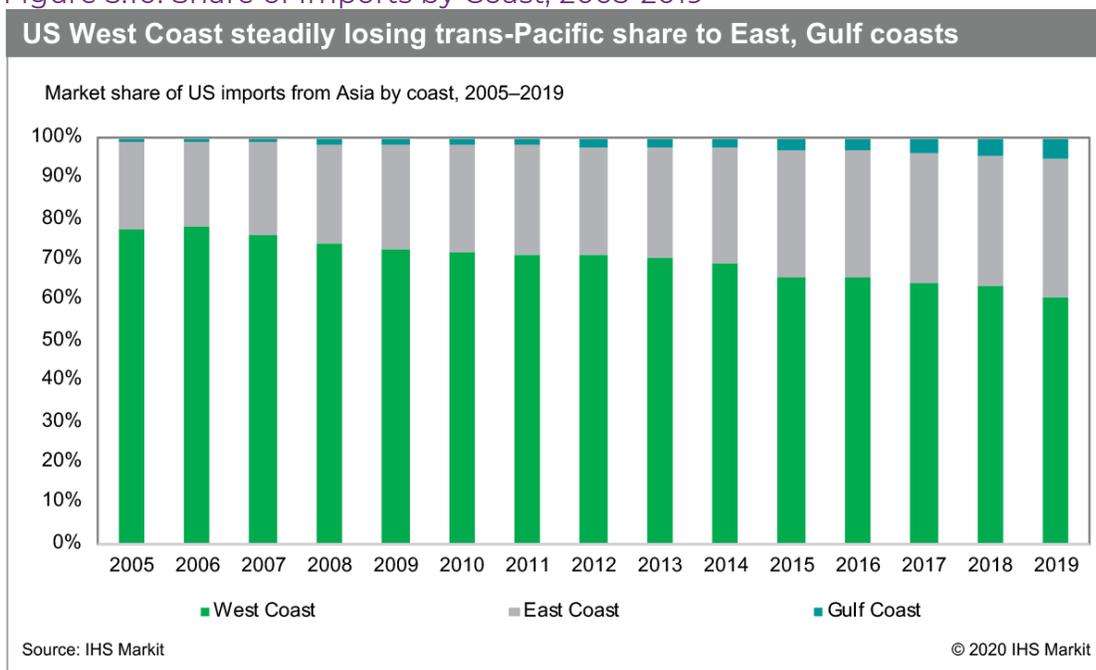
5.4.1 Expansion of Panama Canal

The Panama Canal expansion project was completed and opened for operation in June 2016. The new third set of locks, allow the canal to handle container ships with nominal capacities of up to about 13,000 20-foot equivalent container units (TEUs), more than double the approximately 5,000 TEUs capacity ships that were the largest that can fit through the previous locks (called 'Panamax' size ships). The prospect of the expansion of the Panama Canal has long drawn attention to potential for diversion from California and Mexican Pacific ports, particularly the Ports of Los Angeles and Long Beach. There remains the potential for Panama Canal shipping routes to affect the need for expansion in Southern California or alternative ports in Mexico. Among these shifts could be diversion of additional freight originating or destined for the Eastern portion of the United States, potential increases in Southern California port trade with the East Coast of Latin America, and/or potential increases in sea cargo handled by Baja California ports such as Ensenada. From these sea trade shifts there could be impacts to crossborder

truck traffic; or even more significantly consequences from consequential changes in global sourcing and shipping routes that could impact the growth forecast for cargos moving through California ports, thereby further altering supply chain patterns as we know them today.

As shown in the figure below, the West Coast ports have been losing market share to East and Gulf Coast ports for more than a decade due to labor instability on the West Coast, more stringent and costly environmental regulations, and to changes in retail sourcing from China to Southeast Asia and India. The expansion of the Panama Canal allowed more of this shift to occur, but it has also slightly increased the amount of all-water flows of cargo from these new sourcing locations to the East Coast ports.

Figure 5.10: Share of Imports by Coast, 2005-2019



East Coast ports have grown significantly the past decade and since the expanded Panama Canal opened in 2016. In 2017, U.S. East Coast ports surpassed West Coast ports in total container volume for the first time. Part of this growth could be attributed to the expanded Panama Canal, that opened in 2016. In 2017, East Coast ports handled 46 percent of containerized trade while the West Coast handled 45 percent and the Gulf Coast moved 9 percent. Similarly, 82 percent of volume from Asia moved via a West Coast gateway in 2000; that number was down to 64 percent in 2018.

East Coast/Asia import volume grew 32 percent comparing 2018 to the 12 months leading up to the delivery of the expanded Panama Canal. However, the ports of Los Angeles and Long Beach had a record volume in 2018, which could suggest that the expansion of the Panama Canal drove container volume to the East Coast ports, but this is not a cause effect relationship.

Other factors that are driving the growth of traffic through East Coast ports include: cost, risk mitigation, population growth and consumer demand for e-commerce. It is more effective and cheaper to deliver product to consumers on the East Coast from East Coast ports than handling them through the rail land bridge. The domestic transportation costs accounts for a large proportion of the overall costs. Shippers have learned to spread risks by not depending on one single route and port. Population growth is extremely important, and the southern U.S. is growing more than any other region in the country.⁸⁴

5.4.2 Intermodal Rail Service Growth

The North American intermodal rail business is continuing to receive investment totaling billions of dollars from the Class 1 railroads. With the major decline in coal shipping, the intermodal rail business is now the largest business segment for the railroads. The rail system investment is an international one across Mexico, United States, and Canada, with substantial growth in north-south intermodal traffic lanes, reducing border trucking issues and adding security while reducing costs. The influence on San Diego from the growth in international intermodal rail service is indirect for two reasons: there currently is no significant crossborder intermodal rail service between Baja California and the United States, and the Port of San Diego is not a large container port that requires intermodal rail service. Factories in Central Mexico linked to the U.S. market by efficient rail service can be more competitive than border factories, such as those in Baja California, which is still dependent on crossborder truck service for their freight needs. Continued north-south intermodal rail system investment to the east (Texas in particular) may grow cross border trade by rail faster than the Baja California-located production that moves by truck. This is due to the geography of production in Baja California, where the distance south of the border is less than 100 miles. The Desert Line rail route is often cited as a route to grow Baja California rail traffic moving eastward, with private interests suggesting that they will rehabilitate the line. In spite of freight rail economics generally more favorable for rail to be able to compete with truck over longer-distances, the relatively close proximity of the Maquiladoras in Baja California makes such rail service competing with truck more challenging. Ultimately, market forces will determine if and when such freight rail becomes a viable crossborder option for freight.

Limitations on U.S./Mexican rail capacity have another potential impact, already seen in the auto manufacturing business where finished vehicles made in Mexico are being shipped by vessel to U.S. ports, instead of using capacity-constrained north-south rail. It is likely there will be opportunities for existing auto handling ports, such as the Port of San Diego to capture some of the growing U.S./Mexican vehicle trade, at least in the medium-term, because most Mexican auto production is now in Central Mexico and the distances are long enough to make the ocean shipping cost competitive. Longer term, the cost and speed of the international intermodal rail service will be preferred by

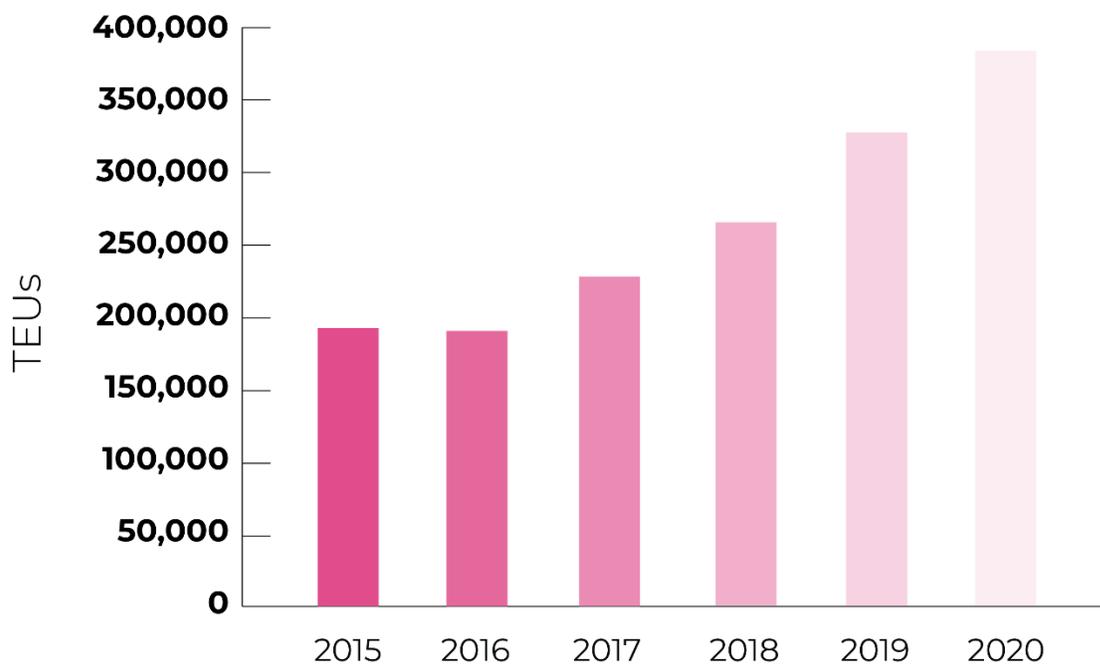
⁸⁴ Has the Panama Canal Expansion Been the Primary Driver for East Coast Port Growth? Colliers Knowledge Leader. <https://knowledge-leader.colliers.com/editor/panama-canal-expansion-primary-driver-east-coast-port-growth/>.

shippers for most manufactured products from Central Mexico where the shipping distances can justify use of rail service.

5.4.3 Port Developments in Baja California

Cargo trade at Ensenada has been growing dramatically, from 193,420 twenty-equivalent units (TEUs) in 2015 to 394,028 in 2020.⁸⁵ In 2020, Ensenada handled a total of 3.38 million tons, achieved through yard expansion, increased area at the multiple use terminal by 1.4 hectares, and higher number of cabotage shipments from the ports of Manzanillo and Lazaro Cardenas. Cabotage shipments include goods transported between two places in the same country by a transport operator from another country.

Figure 5.11: Container Traffic at the Port of Ensenada in Twenty-Foot Equivalent Units, 2015–2020



Source: Datos Abiertos de México – Estadísticas Generales del Puerto de Ensenada, Costa Azul y El Sauzal

⁸⁵ Datos Abiertos de México. Estadísticas Generales del Puerto de Ensenada, Costa Azul y El Sauzal.

In February 2019, the first car carrier arrived in Ensenada. The roll-on/roll-off ship, Asian Glory from South Korea, arrived with 120 natural gas buses bound for Tijuana.⁸⁶ In 2019, Hutchinson ports acquired four new Super Post Panamax cranes and two RTGs for the Ensenada International Terminal (EIT).

In February 2021, Hutchison Ports informed that it is investing \$31.2 million pesos in its Port Terminals in Ensenada. Investment will include dredging at the EIT container terminal and the cruise terminal, Ensenada Cruiseport Village (ECV). These works will allow to receive vessels with a greater draft, which leads to an increase in market opportunities, having a positive impact in the industrial and tourist sector of the region.

5.4.4 Port of San Diego

The international and domestic marine cargo operations at the San Diego Unified Port District (Port) face continued pressures due to the proximity of the marine terminals to other commercial waterfront property and issues such as gentrification.

The port is a public benefit corporation and special district government entity created in 1962 by an act of the California state legislature. The Port manages San Diego harbor and administers the public lands along San Diego Bay. The Port owns and operates two industrial marine cargo terminals on San Diego Bay.⁸⁷ These terminals, the Tenth Avenue Marine Terminal (TAMT) and the National City Marine Terminal (NCMT), serve as regional marine cargo facilities.

The Port is a specialized niche port that handles automobiles, containerized cargo (primarily fruit imported by Dole Fresh Fruit), break-bulk cargo, military cargo, oversized wind energy cargo, steel (primarily used by National Steel and Shipbuilding Company [NASSCO]), forest products, fertilizer, dry bulk cargo such as sand and cement, and petroleum products (primarily used by the San Diego International Airport and the cruise ship industry).

⁸⁶ Primer arribo de carga automotriz al Puerto de Ensenada.

<https://www.puertoensenada.com.mx/esps/0000710/primer-arribo-de-carga-automotriz-al-puerto-de-ensenada>.

⁸⁷ The San Diego Unified Port District also operates two maritime cruise passenger shipping facilities, B Street and Broadway Pier, which include the servicing and loading of supplies for the cruise ships when calling on San Diego.

Figure 5.12: Tenth Avenue Marine Terminal with Downtown San Diego in Background



Source: City of San Diego

There has been a focused effort to improve the operations of the Port's TAMT, and a TAMT Optimization Plan is being implemented by the Port. The intent of these improvements has included adoption of a strategy to produce sustainable benefits. As in other historic port cities, the Port has grappled with urban gentrification pressures, due to their historic locations on the waterfront in the urban core. Generally, ports were in place first and cities grew up around the port operations, producing today's gentrification pressures. TAMT in particular, is a case study in urban gentrification, with TAMT located on some of the most valuable waterfront property in the country. Due to the terminal's strategic location and the large fixed capital investment already made, port investment in sustainable in-terminal operational improvements is a key strategy. In addition to serving as a key element of the region's freight transportation system, sustainable in-terminal operational improvements also provide for military responsiveness and readiness and as an economic driver for the local, state, and national economy.

Sustainable port strategy at TAMT has led to the port pursuing two initiatives for the terminal: 1) optimizing internal terminal cargo operations so that more rail traffic can be accommodated and so that the community will experience less truck traffic; and 2) exploring options to develop Marine Highway connections to the terminal. Marine Highway cargo vessel operations serving TAMT have the potential to reduce local truck traffic by shifting some cargo to water from highway for transportation in and out of San Diego. The cargo optimization objective requires demolition of dockside sheds to maximize cargo layout areas and promote in-terminal rail car loading for both commercial and military cargo needs.

The TAMT Planning District is a developed, marine-related industrial area that directly abuts Barrio Logan, which is considered a disadvantaged community in San Diego. The TAMT Planning District, which includes the tidelands and uplands of this industrial area, provides over 40,000 jobs.⁸⁸ These jobs are important in the region's economy. More importantly, this is the only area in the San Diego region providing established waterfront industrial sites with railroad service, freeway access nearby, commercial port-related support functions, and deep-water berthing. The existing water depth of 42 feet near the marine terminal and 35 feet in the industrial area would be expensive and very difficult to replace elsewhere, so optimizing existing marine cargo operations is critical to the region.

5.5 Monitoring Progress and Updating the Freight Gateway Study

The principles on which this study is built are enduring, yet shifting development and logistics practices can change the ways in which those principles are applied. Transportation technology is changing quickly as well, and the opportunities and issues posed by self-driving vehicles and IT innovations are still largely unknown. Moreover, as of mid-2021, freight movements are still heavily influenced by the COVID-19 pandemic, and post-pandemic conditions are still speculative. There is thus a need to monitor progress toward SANDAG objectives, monitor emerging conditions and technology, and update the study as needed.

⁸⁸ San Diego Unified Port District.