Appendix Y:

Goods Movement Planning and Draft 2021 San Diego and Imperial Counties Freight Gateway Study Update

Draft for Public Review
May 2021

Appendix Y: Goods Movement Planning

Why goods movement matters

Why goods movement is a key component of our lives and of 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. Across California, freight accounts for approximately one-third of the state's total gross domestic product.[2]

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, maritime port, and international airport. San Diego also enjoys a distinct competitive advantage from its proximity to the United States–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%.[3] As noted in Appendix J, our California–Baja California megaregion hosts one of the world's strongest crossborder supply chains. In 2019, more than 2 million trucks crossed bidirectionally through San Diego's Otay Mesa and Tecate ports of entry alone.[4]

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1 Why Goods Movement Matters, rpa.org/work/reports/why-goods-movement-matters.
2 California Sustainable Freight Action Plan, dot.ca.gov/programs/transportation-planning/freight-planning/california-sustainable-freight-action-plan.
3 U.S. Census Bureau, as of March 2021 (calculated on a nominal basis), census.gov/.
4 California-Baja California Border Crossing and Trade Statistics, sandag.org/index.asp?classid=19&projectid=451&fuseaction=projects.detail.

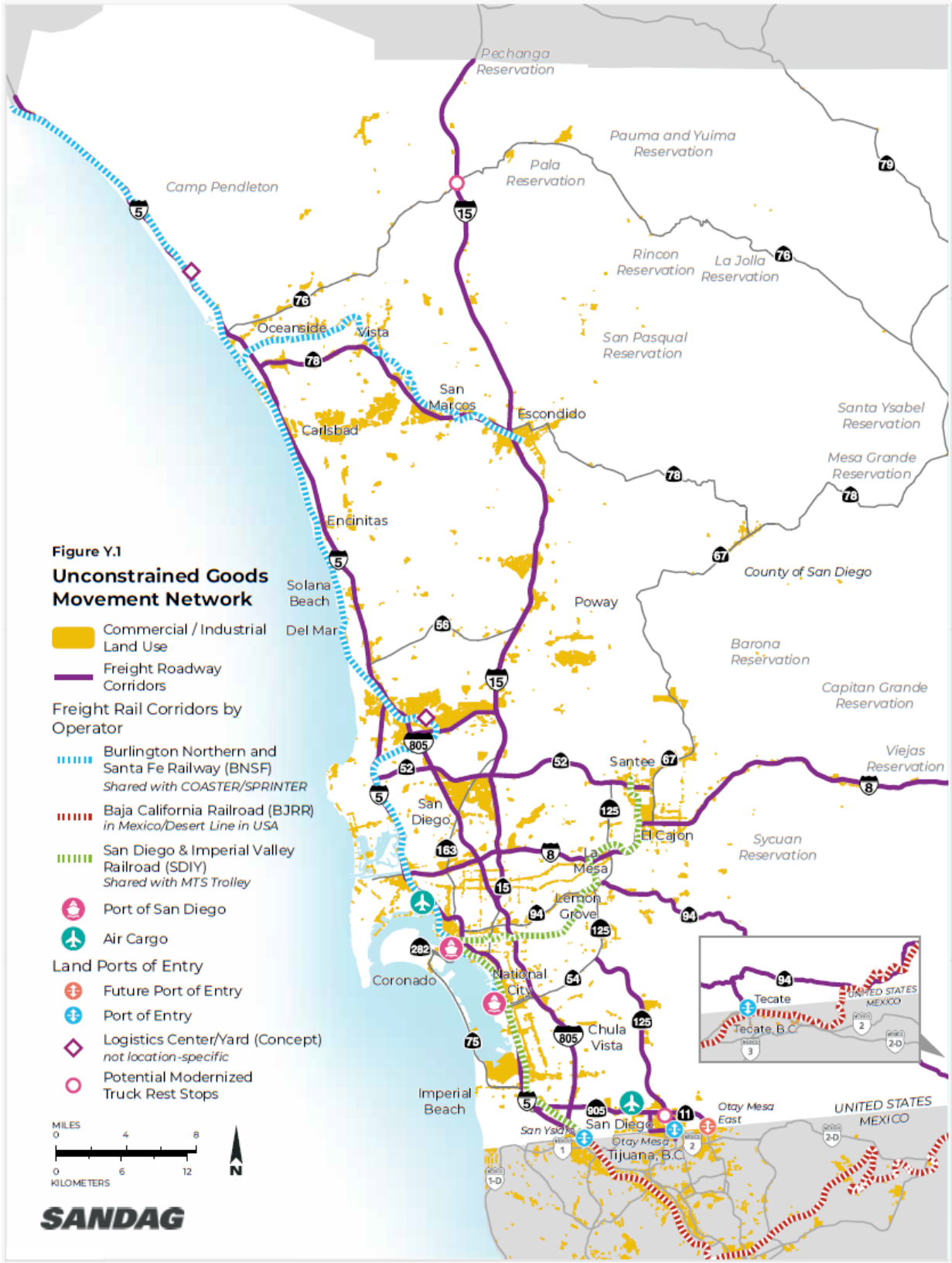
Much of San Diego's existing goods movement network is intertwined with the region's legacy of urban sprawl. Decades of low-density development patterns have increased dependency on the region's highways for both personal transportation and freight. Changes in land use patterns and increases in urban 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, SANDAG has identified a bold new Vision centering around 5 Big Moves for the 2021 Regional Plan.[5] 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] A Bold New Transportation Vision in 5 Big Moves, 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 preexisting 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.[6] To meet their unique needs, many e-commerce companies have turned to new forms of goods movement like contracting with transportation network companies (TNCs) for last-mile deliveries. Growth in e-commerce sales has outpaced traditional retail sales for well over a decade, a trend which was greatly accelerated by the COVID-19 pandemic. Across the U.S., e-commerce's share of total retail jumped from 11.8% in the first quarter of 2020 to 16.1% in the second quarter.[7] 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 emissions and 6% of total greenhouse gas 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

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6 California Freight Mobility Plan 2020, dot.ca.gov/programs/transportation-planning/freight-planning/ca-freight-advisory-committee/cfmp-2020.

7 E-commerce in the time of COVID-19, 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.

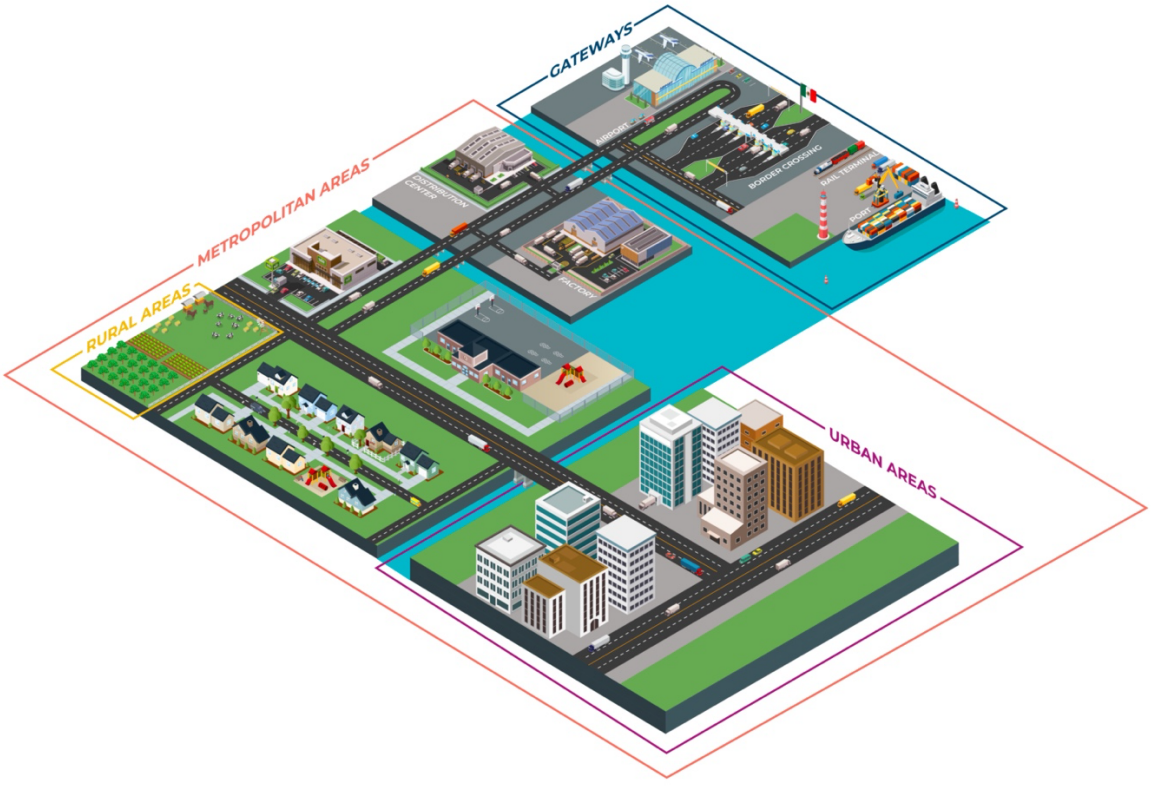
Economy and Goods Movement

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 dollars for San Diego County in 2019.[8]

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 engines 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



[8] California Freight Mobility Plan 2020: San Diego-Imperial Counties Border Corridor, dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/cfmp-2020-final/final-cfmp-2020-chapters-1-to-6-remediated-a11y.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 the NAFTA in 1994, trade between the United States and Mexico has grown sevenfold.[9] In 2019, Mexico became the United States' top overall trade partner. That year, the region's land ports of entry handled $48.3 billion, with the Otay Mesa Port of Entry being the second-busiest truck crossing along the U.S.–Mexico border.[4] 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).[10]

Rail

In addition to commercial truck crossings, San Diego also has a rail freight crossing at its San Ysidro Port of Entry, where the Main Line—owned by the San Diego Metropolitan Transit System (MTS) subsidiary San Diego and Eastern Arizona Railway Company (SDAE)— terminates. Freight on this short line is operated by the San Diego and Imperial Valley Railroad (SDIV). A defunct rail crossing, which would connect the SDAE Main Line through the Tijuana–Tecate short line to the currently non-operational Desert Line, also exists about five miles east of the Tecate Port of Entry. While accounting for only a small portion of total crossborder trade, approximately $88 million of goods pass through San Diego's rail crossings. These rail imports consist primarily of agricultural goods and raw materials like stone, iron, and steel.

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.[11] 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.[12, 13] Both BNSF and SDIV must work around the operating times of popular passenger service routes.

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9 US-Mexico trade grew from $81.5 billion in 1993 to $614.5 billion in 2019, census.gov/foreign-trade/balance/c2010.html.

10 2016 Freight Gateway Study Update, sandag.org/uploads/projectid/projectid_437_21373.pdf.

11 San Diego Metropolitan Transit System – San Diego and Arizona Eastern Railway Company, sdmts.com/about-mts-meetings-and-agendas/sdae.

12 LOSSAN Rail Corridor Agency Fact Sheet, octa.net/pdf/LOSSAN_Agency_Fact_Sheet_11.2019.pdf.

13 NCTD & SANDAG Receive $106 Million Grant, 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.[14] 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 is currently seeking approval from the United States Maritime Administration for participation in the Marine Highway M-5. If approved, San Diego's ports could soon expand trade with the Southern Oregon Port and Port of Bellingham (Washington). This would alleviate commercial truck traffic along the Interstate 5 corridor, saving an estimated $240,000 in diesel fuel costs and $85,000 in road maintenance per round trip voyage.[15]

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.[16]

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 thousand tons of cargo in 2019.[17] 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 processes international goods, San Diego International Airport primarily handles domestic cargo.

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.

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14 USACE Waterborne tonnage for principal U.S. ports and all 50 states and U.S. territories, 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).

15 Port of San Diego M-5 Application.

16 Economic Impacts of the San Diego Unified Port District in 2017, pantheonstorage.blob.core.windows.net/administration/port-of-san-diego-economic-impact-report-2017.pdf.

17 San Diego International Airport Air Traffic Reports, san.org/news/air-traffic-reports.

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 **Error! Reference source not found.**, a recent SANDAG analysis found that delays to freight vehicles at California–Baja California border crossings cost the United States and Mexico economies more than 55,000 jobs, $256 million in labor income, and more than $1.2 billion in lost output.[18]

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.[19] Much of the region's trucking congestion is concentrated along certain segments of the highway network and during peak hours.

[18] 2021 Impacts of Border Delays at California-Baja California Land Ports of Entry, sandag.org/index.asp?classid=19&projectid=535&fuseaction=projects.detail.

[19] Congestion Data for your City, 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,[20] 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.[21] 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.[22] 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.[23] 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.[24]

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.[25]

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20 China Dominates Medical Supplies, in This Outbreak and the Next, nytimes.com/2020/07/05/business/china-medical-supplies.html.

21 As Coronavirus Empties the Sky of Passenger Planes, Air Cargo Marches On, theaircurrent.com/airlines/as-coronavirus-empties-the-sky-of-passenger-planes-air-cargo-marches-on/.

22 Immediate and Severe Air Cargo Capacity Crunch, iata.org/en/pressroom/pr/2020-04-28-01/.

23 Airfreight Rates – Baltic Exchange Airfreight Index, https://www.aircargonews.net/data-hub/airfreight-rates-tac-index/.

24 COVID-19's Impact on Freight: An Analysis of Long-Haul Freight Movement During a Pandemic, inrix.com/campaigns/impact-of-coronavirus-on-freight-movement-study/.

25 Charts: How the Coronavirus is Changing E-Commerce, 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.[26, 27]

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 through 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

[26] 4 Charts Show the Effects of West Coast Port Congestion and Supply Chain Delays, supplychaindive.com/news/california-port-congestion-los-angeles-long-beach-data/594715/.

[27] Carriers Eye Alternate Ports as Congestion at LA-Long Beach Tightens, theloadstar.com/carriers-eye-alternate-ports-as-congestion-at-la-long-beach-tightens/.

infrastructure impacts. Recent efforts through the AB 617 Portside Community look to address some of these impacts through community emission-reduction strategies.[28]

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 to 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 ports of entry resulted in an average of 182 metric tons of carbon dioxide (CO_2) 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.[29] 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.

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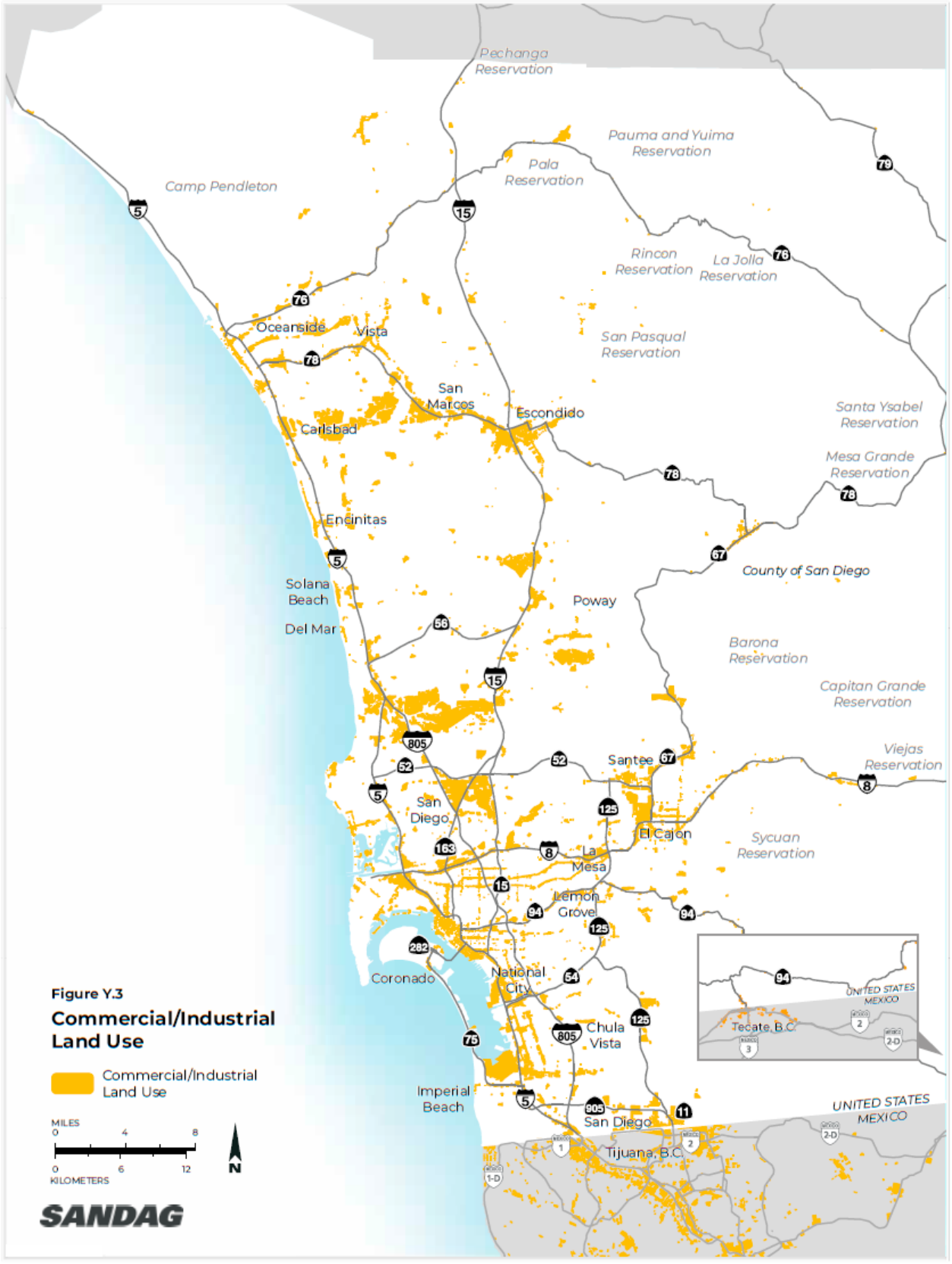
[28] AB 617 Community Air Protection Program, sandiegocounty.gov/content/sdc/apcd/en/community-air-protection-program--ab-617-.html.

[29] Border Health Equity Transportation Study: A Case Study of the San Ysidro Community, 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.[30] 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.

[30] Rural America Is the Next E-Commerce Frontier, ECommerce Times, October 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. 84% of trucking companies operate very small fleets (from one to six trucks).[31] 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.[32] Many current truck drivers are among the "baby boomer" generation (with the 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 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 larger 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.

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[31] Proposition 1B: Goods Movement Emissions Reduction Program December 2020 Semi-Annual Status Report, ww2.arb.ca.gov/sites/default/files/2020-12/Proposition%201B%20-%20Goods%20Movement%20December%202020%20Semi-Annual%20Report.pdf

[32] Truck Driver Shortage Analysis 2019, trucking.org/sites/default/files/2020-01/ATAs%20Driver%20Shortage%20Report%202019%20with%20cover.pdf.

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 month[33]—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,[34] 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 regional safe and convenient 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 U.S. 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 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).[35]

According to a 2017 Samsung enterprise mobility trends study[36] 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.

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

34 California Highway Patrol (CHP) Cargo Theft Interdiction Program, chp.ca.gov/programs-services/programs/cargo-theft-interdiction-program.

35 The Future of Trucking Is Built on Smartphone Technology, 2017; insights.samsung.com/2017/08/01/the-future-of-trucking-is-built-on-smartphone-technology/

36 Samsung Enterprise Mobility Trends Study, insights.samsung.com/2017/06/26/new-study-shows-growing-role-of-cellphones-at-work/

Eighty-seven percent (87%) 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%[37]

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 OS section below, support for trucking information systems is another potential function of the 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.

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

[37] The Future of Trucking Is Built on Smartphone Technology, 2017; insights.samsung.com/2017/08/01/the-future-of-trucking-is-built-on-smartphone-technology/

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 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, 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

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[38] Compliance Requirement Summary Based on the Voided 2014 Amendments of the Truck and Bus Regulation, ww3.arb.ca.gov/msprog/onrdiesel/documents/fspre14.pdf

[39] CARB Rules | 2020 Trucking Safety and Compliance Conference, arb.gov/truckstop

[40] Tractor-Trailer Greenhouse Gas Regulation, CARB, ww3.arb.ca.gov/msprog/truckstop/trailers/trailers.htm

trailer vans, rail cars, and domestic shipping containers. The regulation also applies to TRU generator sets (gen sets), 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.[41] 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 International 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 nitrogen oxide (NOx) emissions, 50% of GHG emissions from fuel production, and more than 95% of diesel particulate matter (DPM) emissions in California.[42] 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 utilizes fuels such as diesel that negatively contribute to the climate and air quality. The use of these fuels leads to emissions such as CO_2, NOx, sulfur oxides (SOx), a variety of PM, and other air 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.[43]

To mitigate these issues, CARB established the Goods Movement Emissions Reduction Program throughout various districts in the state of California. In 2020, CARB estimated that $PM_{2.5}$ and NOx levels within the San Diego Air Pollution Control District (SDAPCD)

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41 Transport Refrigeration Unit (TRU or Reefer) Regulation, CARB, ww3.arb.ca.gov/msprog/truckstop/trus/trus.htm
42 Advanced Clean Trucks Regulation, ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-fact-sheet
43 San Diego, 2050 is calling. How will we answer?, catcher.sandiego.edu/items/usd/2050.pdf

have been reduced by 128,000 pounds and 4,522,300 pounds, respectively, since the implementation of this program in 2008.[44] 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 NOx per day.[45] 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 ports of entry, 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 ports of entry resulted in an average of approximately 182 metric tons of CO_2 emitted per day.[46]

Rail

Rail freight operations makes 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 expected to exceed 60,000 carloads by 2030.[47] 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 Port of Entry, meaning future strategies must comply with the recently enacted USMCA trade agreement where applicable.

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44 Proposition 1B: Goods Movement Emissions Reduction Program December 2020 Semi-Annual Status Report, ww2.arb.ca.gov/sites/default/files/2020-12/Proposition%201B%20-%20Goods%20Movement%20December%202020%20Semi-Annual%20Report.pdf

45 2020 Community Emissions Reduction Plan, sandiegocounty.gov/content/dam/sdc/apcd/PDF/AB_617/Portside%20Environmental%20Justice%20DRAFT%20CERP%20Oct%202020.pdf

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

47 2016 Freight Gateway Study Update, sandag.org/uploads/projectid/projectid_437_21373.pdf

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.[48]

In 2014, the Port of San Diego implemented a new shore-power system at the TAMT.[49] 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.[50] 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.[51] When combined with the rate at which trucks produce emissions per day, neighborhoods in close proximity to the airport are put at a higher risk.

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48 2020 Community Emissions Reduction Plan, sandiegocounty.gov/content/dam/sdc/apcd/PDF/AB_617/Portside%20Environmental%20Justice%20DRAFT%20CERP%20Oct%202020.pdf

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

50 2016 Freight Gateway Study Update, sandag.org/uploads/projectid/projectid_437_21373.pdf

51 2020 Plan for Attaining the National Ambient Air Quality Standards for Ozone in San Diego County, sandiegocounty.gov/content/dam/sdc/apcd/PDF/Air%20Quality%20Planning/Att%20A%20(Attainment%20Plan)_ws.pdf.

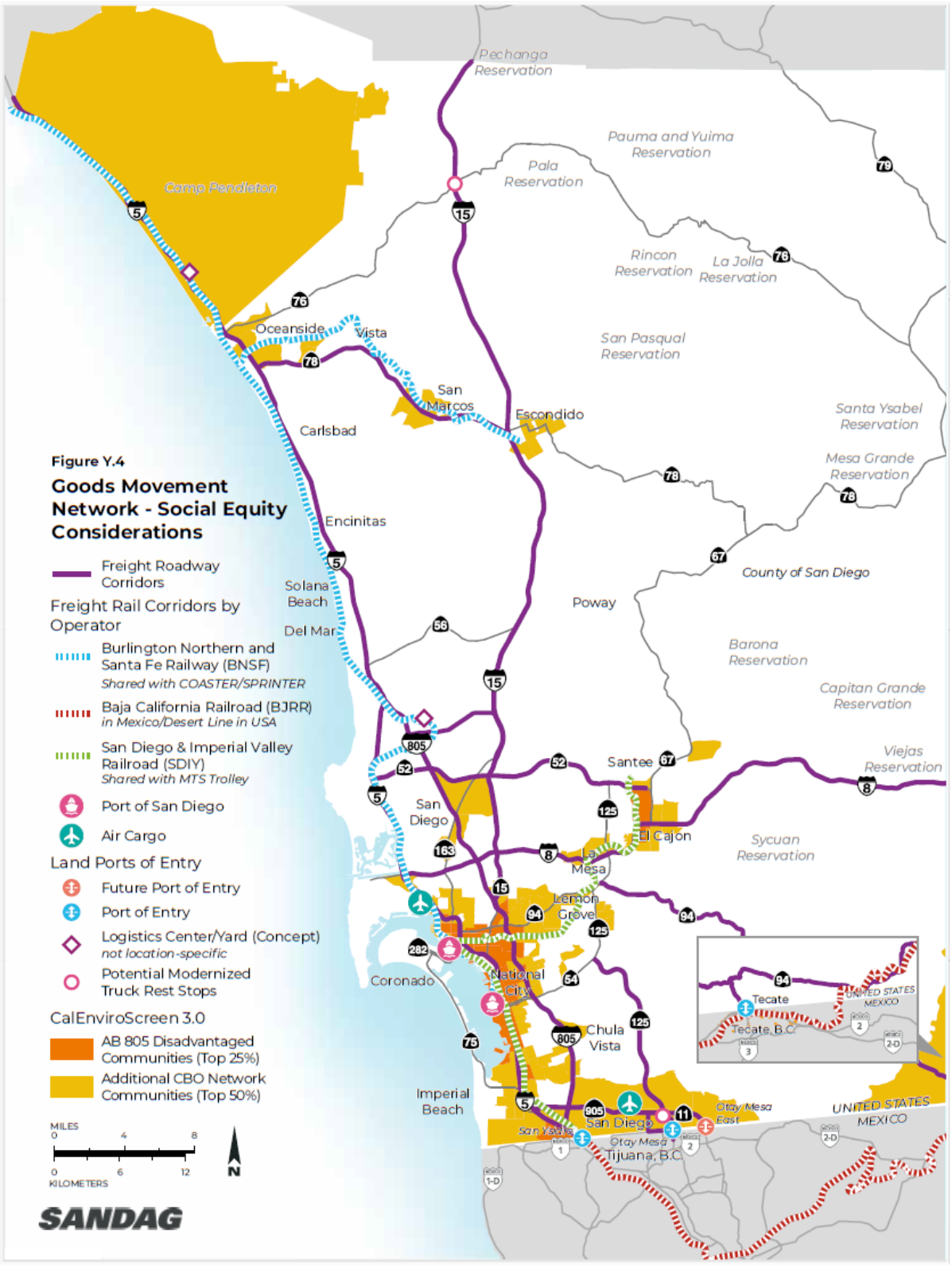
Affected Communities

The environmental effects of goods movement have historically disproportionately affected disadvantaged and low-income communities. As shown in Figure Y.4, the California Environmental Protection Agency's 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 ports of entry, communities in El Cajon situated near Gillespie Field Airport, and communities in Kearny Mesa near Montgomery Field. [52] 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.[53]

[52] CalEnviroScreen 3.0, oehha.ca.gov/calenviroscreen/sb535

[53] San Diego's Changing Climate: A Regional Wake-Up Call, sdfoundation.org/wp-content/uploads/2015/10/2009-Focus2050glossySDF-ClimateReport.pdf

Figure Y.4: Goods Movement: Social Equity Considerations



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.[54] The Portside Community includes the 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.[55] 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.[56] 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).[57]

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

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54 2020 Community Emissions Reduction Plan, sandiegocounty.gov/content/dam/sdc/apcd/PDF/AB_617/Portside%20Environmental%20Justice%20DRAFT%20CERP%20Oct%202020.pdf

55 Truck and Bus Regulation Program, ww2.arb.ca.gov/our-work/programs/truck-and-bus-regulation/about

56 Truck Loan Assistance Program, ww2.arb.ca.gov/our-work/programs/truck-loan-assistance-program

57 Voucher Incentive Program, sdapcd.org/content/sdc/apcd/en/grants-and-incentives/voucher-incentive-program--vip-.html

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 technologies are being implemented in a variety of SANDAG and statewide plans, including San Diego Forward: The 2021 Regional Plan, 2021 Freight Gateway Study Update (under development), California Sustainable Freight Action Plan, California Freight Mobility Plan 2020, and the 2021 California–Baja California Border Master Plan Update.

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 44% nationally, reaching the highest annual growth of U.S. e-commerce in the past two decades.[58] 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 that 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. As a result of same-day shipping practices, there are fewer opportunities to consolidate orders traveling to similar locations, leading to more trips and more vehicle miles traveled. 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.

[58] Data collected from Digital Commerce 360's January 2021 analysis of the U.S. Department of Commerce data. digitalcommerce360.com/article/us-ecommerce-sales/

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.[59]

The movement of goods has to be planned and managed so 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. 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.[60]

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.[61] 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.[62] 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 feature 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.[63]

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59 sandiegouniontribune.com/business/story/2021-02-12/amazon-facility-in-otay-mesa-eyes-summer-completion

60 Drone delivery services provide much-needed supplies to rural communities, prnewswire.com/news-releases/drone-delivery-services-provide-much-needed-supplies-to-rural-communities-301071196.html

61 Urban fulfillment centers: Helping to deliver on the expectation of same-day delivery, www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-urban-fulfillment-centers.pdf.

62 The electric bike that could change delivery as we know it, depts.washington.edu/sctlctr/news-events/in-the-news/electric-bike-could-change-delivery-we-know-it

63 sdapcd.org/content/sdc/apcd/en/grants-and-incentives/carl-moyer-program.html

CARB's *Proposition 1B: Goods Movement Emissions 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.[64]

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

Emissions Reductions by California Air Resources Board Program (SDAPCD)			
Funding Year/Category	**Project Description / Grant Number**	**Emission Reductions (Pounds)**	
		$PM_{2.5}$	**NOx**
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 Emissions 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.[42] 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-NOx 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-CO_2 emission standards, reflective of a 15% CO_2 reduction relative to a 2017 baseline engine, through the 2027 MY

[64] Proposition 1B: Goods Movement Emission Reduction Program December 2020 Semi-Annual Status Report, ww2.arb.ca.gov/sites/default/files/2020-12/Proposition%201B%20-%20Goods%20Movement%20December%202020%20Semi-Annual%20Report.pdf

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).[65] As of January 1, 2020, the limit for sulfur in fuel oil used on board vessels operating outside 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.[66] 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 the 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 take advantage of economies of scale and share data and information when appropriate.

Freight Gateway Study: The Freight Gateway Study (Study), which is under development, 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 will be initiated under evolving circumstances related to the impacts of COVID-19 on the transportation system, the Study will provide 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 will also provide 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:

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65 CARB Ocean-Going Vessel Fuel Regulation, ww2.arb.ca.gov/sites/default/files/2020-01/Marine%20Notice%202020-1_final_rev_ADA.pdf

66 March 2018 CARB Board Meeting, ww2.arb.ca.gov/resources/documents/evaluation-and-potential-development-regulations-reduce-emissions-locomotives

- 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)
- 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: Comprehensive Multimodal Corridor Plans (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 Update: The California–Baja California Border Master Plan (BMP) helps resolve a number of challenges to border planning and brings a number of benefits. Challenges that it helps resolve include inconsistencies in port of entry (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. Caltrans, in partnership with the State of Baja California Secretariat of Infrastructure, Urban Development, and Territorial Reorganization, consultant assistance from SANDAG Service Bureau, subconsultant assistance from the IBI Group Team, and technical support from HNTB Corporation, developed the 2021 BMP.

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 sustainable 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.[67] 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.

[67] Sustainable Freight Action Plan Pilot Project Work Plan: Advanced Technology Corridors at Border Ports of Entry, 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.[68] 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 conventions[69]
- More than 88,000 jobs lost, which is approximately as many jobs as 15 Fashion Valley malls[70]
- Border delays resulted in an average of 457 metric tons of CO_2 each day, which is equivalent to making about 200 round trips between downtown San Diego and New York City in an average car[71]

The study shows that without additional enhancements to the region's ports of entry, 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 State Route 11/Otay Mesa East–Mesa de Otay II Port of Entry.

State Route 11/Otay Mesa East Port of Entry: 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 State Route 11/Otay Mesa East Port of Entry, 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 Port of Entry. 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 State Route 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 currently is implementing a

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

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

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

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

freight signal prioritization (FSP) pilot project along Harbor Drive.[72] The FSP pilot will operate for a year, with results anticipated to be released in winter 2021.

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, San Diego Metropolitan Transit System, 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.[73] SANDAG and its regional rail partners are currently studying potential alternatives for realigning LOSSAN segments near the Del Mar Bluffs.

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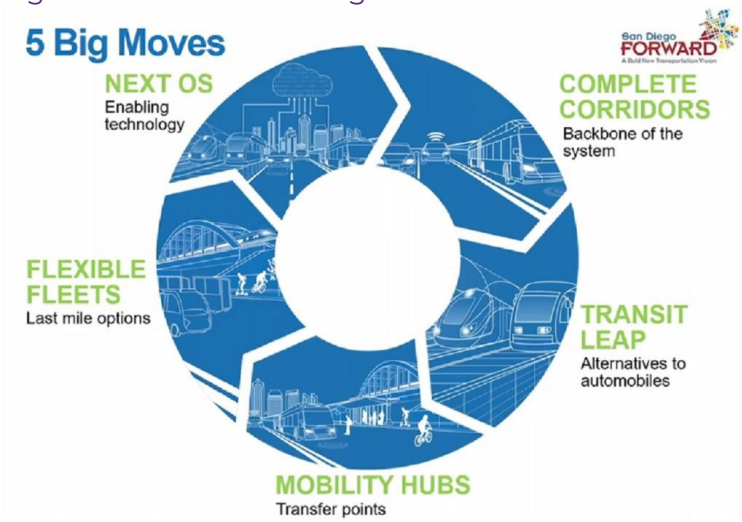
[72] Cleaning the Air: San Diego Port Tenants Association Zero-Emission Freight Project, youtube.com/watch?v=RC0HGs86YHs

[73] Bluff repairs could restrict beach access, 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.5: SANDAG 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). 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 and Imperial County's region (coinciding with Caltrans District 11).[74] 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

[74] Caltrans Surface Transportation Assistance Act (STAA) State Truck Routes Map: dot.ca.gov/programs/traffic-operations/legal-truck-access/truck-network-map

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.

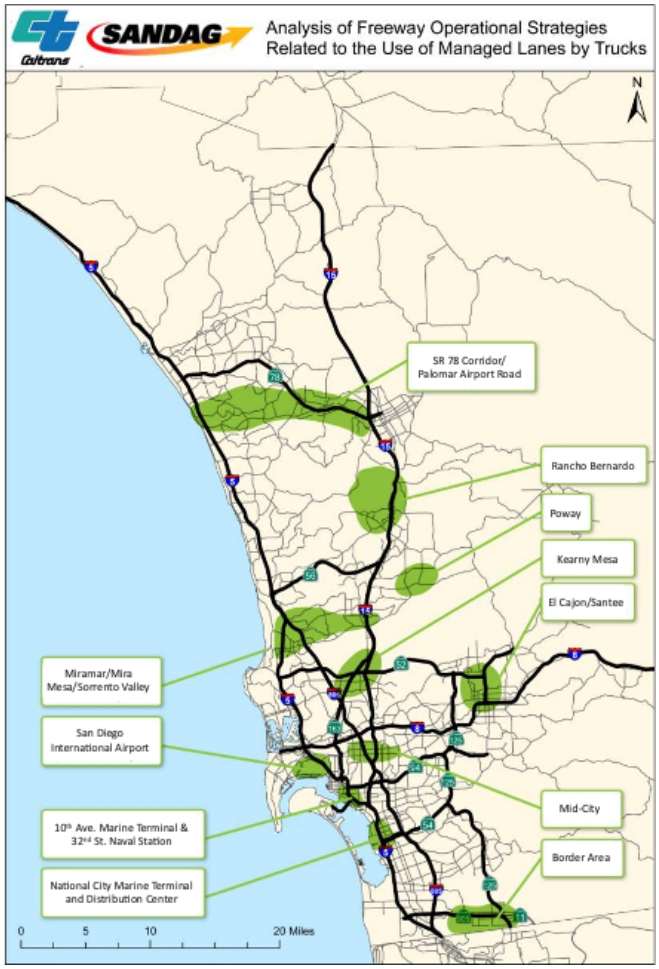
All types of freight conveyances have the need for access to intermodal facilities to transfer freight from one type of conveyance to another, consolidate freight into a larger shipment, or break down shipments for further distribution via smaller vehicles. Access routes are often a source of delay for 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 trucker's 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 of 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, and the number of lanes that would be available on the facility and the potential cost.[75] The study also identified the potential truck management strategy application locations shown in the map in Figure Y.6.

[75] SANDAG, Analysis of Freeway Operational Strategies Related to the Use of Managed Lanes by Truck, 2013

Figure Y.6: 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 regions 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 International Border, San Diego International Airport, and numerous small airports, along with various manufacturing facilities, warehouse, 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 plays 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 the 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 numbers 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 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 ZEV by 2035 and all medium- and heavy-duty vehicles shall be ZEV by 2045.[76] 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.

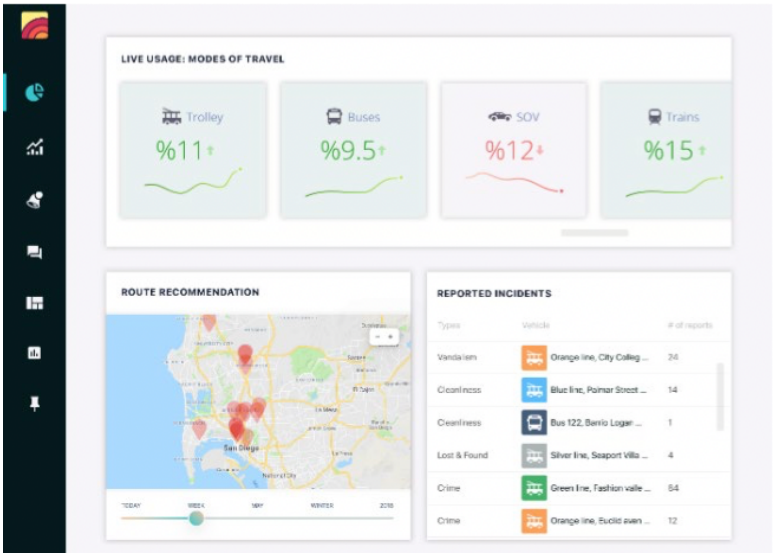
Finally, unmanned aerial systems (UAS) or drones are on the horizon for small package or parcel deliveries, depending on a variety of operational issues that are being resolved by those interested in their use. Some considerations for UASs include safe co-operation with conventional aircraft, other air 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 how they will access parcels for delivery, and will likely be part of the future mobility hubs strategies.

[76] Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20), ww2.arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20

Next OS

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 the 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.3: 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.6). 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.[77] 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 Signal Priority systems, to support freight throughput along congested arterial corridors.

[77] San Diego Forward: Next OS Concept White Paper, 2020

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 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.[78] 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 June 2020.[79] This regulation builds upon Executive Order N-79-20 by requiring truck manufacturers to sell ZEV trucks as an increasing percentage of their annual California sales and requiring large companies to report on their existing

[78] San Diego Forward, Vision for the 2021 Regional Plan: Flexible Fleets: sdforward.com/mobility-planning/flexible-fleets

[79] California Air Resources Board, Advance Clean Trucks: ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks

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 towards 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.[80]

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 and commercial vehicle–specific permit programs offer the possibility of better

[80] Frequently Asked Questions about Flexible Fleets: sdforward.com/docs/default-source/2021-regional-plan/faqs-flexible-fleets-final.pdf?sfvrsn=408bf865_2

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 and 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 support 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.