



# **SAN DIEGO AND IMPERIAL COUNTIES SUSTAINABLE FREIGHT IMPLEMENTATION STRATEGY**

## **FINAL INNOVATIVE STRATEGIES SCREENING MEMORANDUM**

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# 1. PURPOSE AND SCOPE

As part of the San Diego and Imperial Counties Sustainable Freight Implementation Strategy, this Innovative Strategies Screening Memorandum provides an overview of existing freight-related projects and project types in the regional plans within the study area. It describes how different types of projects may score under the Screening Framework developed as part of Task 3 - Existing Conditions and Sustainable Freight Best Practices. Specifically, this memorandum provides an initial screening of different existing project types under three primary goal areas: Environment, Equity and Economy. While a detailed scoring won't be completed until later in the project, Table 1 sets forth the criteria that are generally considered at this stage.

Table 1: Scoring of Benefits

Areas	Criteria	Scoring	Weighting
<b>Environment</b>	Impact on reducing emissions of GHGs	1 - 10	35%
	Impact on reducing emissions of criteria pollutants (particulate matter, NO <sub>x</sub> , VOC, etc.)	1 - 10	
<b>Equity</b>	Degree to which benefits accrue to most vulnerable communities (Top 25% of CalEnviroScreen 4.0 scores, or AB 617), and vulnerable communities (Top 50% of CalEnviroScreen 4.0 scores, or Tribal Land), including safety considerations	1 - 10	35%
<b>Economy</b>	Improves efficiency (speeds and reliability) of freight transportation system	1 - 10	30%
	Improves capacity of freight system to accommodate expected increases in freight	1 - 10	

Source: Existing Conditions and Sustainable Freight Best Practices

This memorandum also builds upon the best practices analysis conducted in Task 3 by suggesting innovative strategies that may be appropriate for each of the project categories in the San Diego Association of Governments (SANDAG) and Southern California Association of Governments (SCAG) regional plans and for the overall San Diego and Imperial Counties study area.

The memorandum suggests best practices in each of three categories: Technology Solutions, Fleet Management and Operations, and Infrastructure Improvements, with specific intention of providing innovative strategies relevant to both improve projects in existing regional plans and to augment those plans with new sustainable freight initiatives.

## 2. EXISTING FREIGHT CONDITIONS

Table 2 below summarizes the anticipated performance of various types of projects in current regional plans against the criteria from Task 3. The project types and their sustainability characteristics are further described in the remainder of this section.

Table 2: Summary of Existing Projects in the Screening Framework

Types of Existing Projects	Proposed Screening Framework		
	Equity	Environment	Economic
Complete Corridor	Moderately favorable	Moderately favorable	Moderately favorable
Marine Terminals	More favorable	More favorable	More favorable
Port of Entry Projects	More favorable	More favorable	More favorable
Truck Parking	Moderately favorable	More favorable	More favorable
Rail Projects	Less favorable	More favorable	More favorable
Grade Separation	More favorable	More favorable	Moderately favorable
Airport Projects	Moderately favorable	Moderately favorable	More favorable

### 2.1 Complete Corridor and Highway Projects

Complete Corridors provide a variety of travel choices and use technology to manage how highways and major roads are used in real time. They provide a balance of dedicated, safe space for everyone, including freight vehicles and people who walk, bike, drive, ride transit, and use Flexible Fleets. These projects include managed lanes, alternative fuel corridor improvements, truck climbing lanes and freight signal prioritization projects. Specifically, freight-related Complete Corridor projects across San Diego and Imperial Counties have potential to score favorably in the freight sustainability framework to the degree that they improve the fluidity and operations of traffic, reduce negative externalities resulting from trucks idling in congestion (primarily from emissions), and improve the capacity of the system to accommodate expected increases in truck traffic.

The California Transportation Commission (CTC) is developing a Clean Freight Corridor Efficiency Assessment as mandated by Senate Bill (SB) 671. Priority Clean Freight Corridors have been identified by the SB 671 workgroup as priority candidates for zero-emission infrastructure. Corridors in the study area include the following:

- Interstate (I-) 5, I-805, State Route (SR) 905, and SR 11 between the Orange County/San Diego County line and the Otay Mesa and future Otay Mesa East Ports of Entry (POEs)
- I-15 between the Riverside County/Orange County line and I-5 in San Diego
- I-8 between I-5 in San Diego and the California/Arizona line
- SR 86, SR 78, SR 111, and SR 7 between the Riverside County/Imperial County line and the Calexico East POE

These corridors have the most significant interregional truck traffic and should be prioritized for zero-emission infrastructure capable of supporting medium- and heavy-duty vehicles. Any additional segments designated as alternative fuel corridors through the Federal Highways Administration are likely to be included in the CTC's Clean Freight Corridor Efficiency Assessment.

From an equity standpoint, many of the Complete Corridor and highway projects are likely to score moderately favorably, as they are in, or potentially serve, vulnerable communities. These include communities in El Cajon, La Mesa, San Diego, National City, and Chula Vista in San Diego County and Calexico, Heber, El Centro, and Westmorland in Imperial County. Complete Corridor projects may improve traffic flows and reduce congestion on these corridors, which in turn could decrease pollutant emissions into these vulnerable communities. They may also avoid diversion of traffic onto local roads that can occur when traffic is backed up. Improving the design, geometrics, and operations could likely reduce crashes and benefit adjacent communities that use these corridors. To the extent that they add lanes, however, they may increase impacts on these communities through increased noise, right-of-way, and emissions impacts. Thus, it will be important to consider the particular characteristics of the projects to determine the benefits and impacts for vulnerable communities.

From an environmental standpoint, the improvement of traffic flows and reduction in congestion achieved through Complete Corridor and highway projects will have a positive near-term effect on emissions. Projects that encourage alternative fuels usage and increase operational efficiency may reduce the emissions of greenhouse gas (GHG) and criteria pollutants. However, induced demand from improvements in capacity will, over time, lead to an increase in general purpose traffic and truck volumes and result in increased emissions. Therefore, it is important that improvements to vehicle technology compensate for these increases in travel and ensure that overall emissions do not increase. Section 3 of

this memorandum includes several ideas for how to accelerate these improvements in technology.

Lastly, from an economy and competitiveness perspective, Complete Corridor and highway projects could score favorably in their ability to improve efficiency of freight transportation systems by potentially expanding capacity for freight. This will likely depend on whether the managed lanes reduce congestion or provide other freight benefits. However, it is important to note that under current California laws, trucks aren't allowed in managed lanes themselves. Therefore, managed lanes improvements might offer operational efficiencies for freight only indirectly, i.e., if they redirect other traffic towards managed lanes. Additional discussion is included in the Infrastructure Improvements section.

## 2.2 Marine Terminal Projects

The Port of San Diego (Port) is the southern terminus of the Marine Highway M-5 Coastal Connector, designated through the United States Maritime Administration's America's Marine Highway Program. The short sea transportation route between the Port of San Diego, Southern Oregon Port, and the Port of Bellingham, Washington is an extension of the surface transportation system and will support barge service of lumber, refrigerated and non-refrigerated containers, rolling stock, and household goods along the West Coast of the United States.

The Port has two marine terminals, the Tenth Avenue Marine Terminal and the National City Marine Terminal. Proposed improvements to both terminals are likely to score favorably in the sustainability prioritization framework because they improve the connectivity between water and rail infrastructure, reducing the region's reliance on trucks for most freight transportation. The marine terminal projects include components to accelerate the electrification of freight infrastructure and adoption of zero- or near-zero-emission vehicles for on- and off-road applications.<sup>1</sup> Projects also include installing shore power systems, enabling vessels to turn off their engines while at berth and reduce emissions.

From an equity standpoint, marine projects that improve sustainability would score favorably because of their location. Both terminals are in, and are surrounded by, vulnerable communities.

From an environmental standpoint, sustainable marine projects score favorably. Since marine ports are a hub for many freight vehicles, technologies and improvements to fuel technology, idling reduction technologies, and practices to increase operational efficiency

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<sup>1</sup> Note that various zero- and near-zero technologies are encouraged within the state, and this effort is not attempting to prioritize one alternative fuel over another. For more information about requirements and incentives please see the California Air Resources Board (CARB) website: <https://ww2.arb.ca.gov/our-work/programs/alternative-fuels>

could have significant reductions in GHG and air pollutant emissions. Idling reduction technologies include Auxiliary Power Units (APU), either battery electric or powered by high-efficiency diesel generators, as well as electric and heating, ventilation, and air conditioning (HVAC) hook-ups.

Several of the sustainability best practices identified are already being implemented in the marine terminal projects. The Port of San Diego's Maritime Clean Air Strategy includes ambitious goals and strategies for reducing emissions at the port, including a goal that 100% of cargo trucks calling the port to be zero-emission and 100% of cargo handling equipment to be zero-emission by 2030. Progress towards these goals can be accelerated by investing in charging infrastructure, particularly in projects that include truck parking at or near the marine terminal.

## 2.3 Port of Entry Projects

Planned Port of Entry (POE) projects include the construction of the Otay Mesa East POE in San Diego County and expansion of the Calexico East POE in Imperial County. Improvements to nearby truck routes, such as Menvielle Road and SR 7, would also support cross-border commercial vehicle traffic. It is assumed that zero-emission charging/refueling stations would also be developed in the vicinity of the POEs to support cross-border drayage operations. These projects are intended to increase the capacity and efficiency of, and reduce emissions associated with, cross border trade. Therefore, they could potentially score favorably under the sustainability framework.

Planned POE projects are located in, and surrounded by, vulnerable communities. They would improve the efficiency of the freight transportation system and reduce delay and emissions in vulnerable communities.

From an environmental standpoint, POE projects could score favorably, as POEs are hubs for many commercial trucks and freight vehicles. Fuel technology improvements, idling reduction technologies, and practices to increase operational efficiencies could all have significant reductions in GHG and air pollutant emissions. Reducing idling at queues would also reduce the criteria pollutants emitted at these locations.

Lastly, from an economy and competitiveness prospective, POEs are likely to score favorably. Generally, improved POE operational efficiency could help with operations and logistics and therefore increase economic competitiveness.

## 2.4 Truck Parking Projects

Truck Parking projects would modernize existing truck parking areas for near-zero and zero-emission infrastructure truck plug ins. Locations especially suited to benefit from truck parking projects include those along intercity freight corridors, near marine ports, and those near the main commercial vehicle ports of entry: Otay Mesa in San Diego County and Calexico East in Imperial County. These are generally distant from residential and other sensitive land uses, mitigating the localized impacts of truck traffic, but can meet the needs of truck drivers by providing amenities and minimizing out-of-direction travel. Additional discussion is included in the Technology Solutions section of the memorandum.

Truck parking projects score favorably in the sustainability framework because they help facilitate the electrification of the truck fleet and improve the fluidity and operations of the freight sector.

From an equity standpoint, some of the truck parking projects are in vulnerable communities and are likely to score favorably, as they would reduce emissions impacts from existing truck parking facilities. If future projects were to add new truck parking spaces, they could reduce impacts from undesignated parking and out of direction truck travel that results when truck drivers cannot find appropriate parking. However, new parking spaces could raise concerns about other local impacts. Projects should be evaluated on a case-by-case basis to reflect pros and cons in the unique context of each site. They should also reflect the recommendations of the 2022 California Statewide Truck Parking Study.

From an environmental standpoint, since current projects focus on zero-emissions and renewable energy fuel options, they would score favorably.

Lastly, from an economy and competitiveness perspective, increased number of truck parking and modernization of truck parking facilities could lead to increased competitiveness and economic opportunities.

## 2.5 Rail Projects

Projects that improve the capacity and service of rail transportation can generate some of the largest improvements in sustainability, by taking trucks off the roads and shifting them onto a more sustainable mode. Moreover, rail is cost competitive for shipments of more than 500 miles. Rail technology is evolving and can be three to ten times more fuel efficient than trucking, per tonnage moved, which leads to lower greenhouse gas emissions and criteria pollutants.

Despite the general air quality benefits of rail compared to truck, significant opportunities to reduce air pollution in freight train operations exist. Switching operations at rail yards contribute to local air pollution; a [Health Risk Assessment](#) completed by the Port of San Diego in 2022 and limited to port-related emissions found that rail switching operations were the greatest contributor to local cancer risk in National City near the BNSF National City Yard. Converting switcher locomotives to hybrid, near-zero, or zero-emission technologies would be consistent with state priorities as outlined in the California State Transportation Agency's [Climate Action Plan for Transportation Infrastructure](#) (CAPTI) and reduce health risk in nearby communities.

SANDAG plans to double-track the Los Angeles-San Diego-San Luis Obispo (LOSSAN) rail corridor between the Orange County line and Downtown San Diego, increasing the capacity of the railroad for both freight and passenger operations. The railroads carry both freight and passenger trains, with freight train operations limited to defined scheduling windows. The proposed Batiquitos Lagoon Double Track project is particularly important for freight because it will allow for the storage of a freight train along the corridor without blocking at-grade crossings or stations. Another project awarded funds for right-of-way through the Trade Corridor Enhancement Program (TCEP) is Sorrento to Miramar Phase 2. This project will increase speed, capacity, and reliability on a steep, windy segment of track with a history of derailments. The full implementation of planned LOSSAN corridor improvements will increase freight rail capacity.

Proposed rail projects also include improvements to the Tijuana-Tecate Interurban Rail Line and the Desert Line. The Tijuana-Tecate Line is operated by Baja California Railroad (BJRR) and spans over 44 miles in length across Baja California, including the municipalities of Tijuana, Garcia, Valle Redondo, and Tecate. On the U.S. side of the border is the Desert Line, which stretches 70 miles from Tecate through the Jacumba Mountains to Plaster City near El Centro. This proposed project would help provide rehabilitation efforts to restore the Desert Line to the proposed basic and modern service levels, potentially leading to operational efficiencies and increased usage of freight rail. This could help alleviate some of the existing truck traffic that currently takes place, particularly truck traffic carrying cargo to US markets and ports from plants located in Tijuana.

From an equity standpoint, while the proposed rail lines do traverse vulnerable communities, it is unclear the degree to which the rail lines directly benefit local community members. While rail can remove trucks from the road and reduce emissions overall, it might increase pollutants at a local level. Additionally, increased rail frequency near at-grade crossings, particularly in vulnerable communities, is a significant concern for safety. Noise pollution, particularly when operations are staggered at off-peak times as with freight rail operations in the San Diego region, disproportionately impact these



communities as well. More discussion is included in the Grade Separation Projects section below.

From an environmental perspective, rail freight is much more energy efficient than trucking on a ton-mile basis, and these projects have a greater sustainable impact than projects that add roadway capacity. Improving the roadway accessibility to rail terminals and other infrastructure would further increase their utilization and competitiveness by ensuring capacity and adequate geometry to accommodate the associated truck traffic.

Passenger services along the LOSSAN corridor also stand to benefit from railroad improvements, and pollution and GHG emission reductions can be achieved through modal shift from vehicular traffic to transit.

From an economy and competitiveness perspective, improved rail lines and routes provide choices to shippers and increase their efficiency, thereby further enhancing regional competitiveness. There may also be opportunities for providing industrial businesses with new or expanded rail spurs. For example, there are existing spurs in the Miramar area of San Diego as well as industrial areas in El Cajon and Chula Vista. Direct rail access could allow businesses to deliver and receive certain goods via train rather than truck. Further study of candidate locations would be necessary to fully evaluate their benefits.

## 2.6 Grade Separation Projects

Grade separation projects under consideration in Imperial County are located near Calexico and up SR 86 towards El Centro and through Brawley. Grade separation projects under consideration in San Diego County are primarily on the LOSSAN corridor and on the South Line (Blue Line trolley and San Diego & Imperial Valley Railroad) between Downtown San Diego and San Ysidro.

Grade separations and other improvements, such as double tracking, provide benefits for freight and passenger travel. The sustainability of crossing separation projects could be improved by prioritizing those likely to result in the greatest benefits, such as where traffic volume and train crossing frequency are the highest and train speeds are the slowest. Grade-separating truck routes avoid long truck delays and reduce risk of crashes and disruptions at the crossings.

SANDAG's 2015 Regional Plan: Appendix M and the 2018 infrastructure Development Plan for the LOSSAN Rail Corridor in San Diego County each identified potential locations for grade separations, with various criteria used to determine priority. These evaluations did not consider the volume of trucks along the roadways, however. Preliminary analysis suggests that truck volumes on certain roadways may affect the prioritized list, but this would need to be verified by calculating truck delay. Future grade separation analysis with

a sustainable freight emphasis should explicitly include truck volumes and delay imposed by the crossings.

From an environmental standpoint, grade separation projects can generate significant reduction of emissions from the idling of trucks and general traffic. These reductions will be the greatest where the frequency of trains and the roadway volumes are high. Under these conditions, passenger vehicles, as well as trucks, can spend considerable time idling at a closed crossing while trains pass. Over the past decade, there has been a steady trend towards railroads operating longer trains to achieve greater economies of scale. These trains can take 10 minutes or more to clear the crossing, particularly if the crossing is located near a rail terminal and the train travels at a slow speed. Because of queue formation, it often takes considerably longer for all vehicles to clear a re-opened crossing than the time the crossing was closed. Over a day, this can amount to significant emissions of greenhouse gasses and criteria pollutants.

From an equity standpoint, the grade separation projects are in vulnerable communities. These projects have a clear and direct benefit to these communities by helping to increase safety conditions and reduce crashes at crossings. This makes active transportation modes, such as walking and biking, more attractive. Grade separation can also help reduce emissions of pollutants which can be specifically harmful to the local community members. Moreover, these grade separation projects can help reduce congestion in the local area, leading to an improvement of quality of life.

Lastly, from an economy and competitiveness perspective, improved grade separations on an important trade route can reduce congestion, thereby improving overall competitiveness. At-grade crossings on freight routes represent a key source of unreliability. A truck being caught by a closed crossing could be delayed significantly, potentially arriving late at its destination. In modern supply chains, on-time performance is critical, with truck drivers often given a delivery window that is just an hour or two, but sometimes much narrower. Being stopped behind a crossing could lead the driver to miss this delivery window.

Where grade separation projects are not feasible, Advanced Train Detection Systems are a strategy to mitigate the impact of long trains and delays at at-grade crossings. Non-intrusive train detection systems can provide warnings via changeable message signs and freight routing systems so truck drivers can adjust travel if possible.

## 2.7 Airport Projects

Projects that improve roadway accessibility to airports have potential to score moderately favorably under the freight sustainability prioritization framework.

From an economy and competitiveness perspective, airport projects are likely to score favorably. They improve the reliability of accessing the airport, benefiting high-value goods and industries that rely on air cargo service.

From an equity standpoint however, it is unclear at this point how airport projects will score. The San Diego International Airport (SAN) is neither located in nor directly serves any of the designated vulnerable communities.

Improved nearby roadways and cargo facilities could provide sustainability benefits due to increased efficiency and reduced idling, although the volume of trucks and associated emission impacts are likely to be minor. Limited options exist to improve the sustainability of airport projects because they involve a relatively small number of trucks. Trucks carrying goods to the airport from within the region may be potential targets for a fleet electrification, as they may be smaller and travel shorter distances. This strategy would need to be explored in consultation with the airport and regional air cargo carriers.

Finally, while freight that moves by air has GHG impacts, there are limited modal diversion opportunities. Aircraft manufacturers are working with the airlines to develop more sustainable aircraft. Their adoption would depend on international private sector research and development efforts beyond the scope of this study.

### 3. STRATEGIES AND PILOT PROJECTS

The previous section of this document described at a high level the extent to which project types contribute to freight sustainability in terms of equity, environment, and economy. The next section of this memorandum will focus on potential innovations for new or refined projects and locations for implementation.

Strategies are presented in the context of three key categories of sustainable freight best practices identified by the project team during the development of the Existing Conditions and Sustainable Freight Best Practices memorandum. These include Technology Solutions, Fleet Management and Operational Solutions, and Infrastructure Improvements. There is significant overlap, and many of the described strategies could be alternatively classified in other categories. The strategies and relevant examples are briefly described here, but more detail may be found in the Existing Conditions and Sustainable Freight Best Practices report.

#### 3.1 Technology Solutions

While the technology exists today that allows electric or hydrogen-fueled locomotives to pull freight over short distances, freight rail locomotives are rarely purchased for switching yards. Locomotives have long useful lives in switching yards, and rebuilding them is more cost effective than buying new ones. Public agencies and private rail operators could potentially partner to replace these locomotives and provide the necessary supporting infrastructure, such as battery electric charging stations or hydrogen refueling stations. For example, San Bernardino County Transportation Authority (SBCTA) is piloting **zero-emission technology**—a hybrid hydrogen fuel cell and battery technology—on the Metrolink Arrow passenger line between San Bernardino and Redlands. While freight trains are heavier and travel longer distances than most passenger trains, limiting technology options, hybrid technology has immediate relevance for freight yards and is being piloted in Europe for longer distances.

A future Pacific Surfliner maintenance facility is anticipated to be built in the San Diego region to serve the popular Amtrak route operating along the LOSSAN corridor. The possibility of this new facility serving as a zero-emission locomotive fueling hub for both passenger and freight trains should be explored, even though there would likely be operational challenges to overcome.

**Electric charging** technology for on-road vehicles like trucks is likely to continue evolving quickly over the coming years, in terms of capabilities and standards. Therefore, it is critical that recent developments be tracked to ensure that infrastructure meets long-term needs. Moreover, developments in wireless electric vehicle charging potentially have long-term

applications in the trucking sector. If successful, this technology could enable vehicles to charge in motion, reducing the frequency and duration of charging stops. Pilot locations in San Diego County could include Harbor Drive, Bay Marina Drive (entrance to National City Marine Terminal), and Crosby Road (entrance to Tenth Avenue Marine Terminal). Public agencies should also look to develop publicly accessible infrastructure for small and owner-operator trucking companies. The San Diego Regional Medium- and Heavy-Duty Zero-Emission Vehicle (ZEV) Blueprint, a project led by SANDAG and currently underway, will develop reports with critical planning information, such as a ZEV market study, infrastructure siting criteria, and implementation strategies.

The Port of San Diego has released a request for information and will be releasing a request for proposals to develop public charging/fueling stations to support zero-emission trucks at several sites in the San Diego region. Some of these sites are owned by Caltrans, while others are on Port of San Diego tidelands. It will be important to have zero-emission charging/fueling infrastructure near the Port's marine cargo terminals to support drayage truck fleets in anticipation of adoption of the proposed Advanced Clean Fleets regulation by CARB.

Developments in truck parking electrification should follow the needs identified in the California Statewide Truck Parking Study, the Truck Parking Feasibility Guide Supplement – District 11 Site Assessment, and the statewide vehicle electrification plan. Examination of Caltrans' and other publicly owned properties across District 11 identified seven sites that might be feasible, and which were used as examples with possible parking layouts in the Guidelines. SANDAG and the Imperial County Transportation Commission (ICTC) are recommended to work with Caltrans District 11 to explore the development of truck parking on these and other sites. Combining zero-emissions infrastructure at truck parking sites, rest stops, and private truck stops should also be a strategy for consideration to reduce idling and support the achievement of zero-emission vehicle goals. In addition, on-site electrical storage should be considered to balance energy demand load. There are opportunities for public private partnerships in the truck charging and parking space that could facilitate implementation.

Working with local jurisdictions to explore truck parking solutions, both on- and off-street, in and near Barrio Logan and other industrial areas where parking is insufficient, is recommended. This should be done in collaboration with the local jurisdictions. On-street parking could relate to loosening truck parking restrictions where roadway geometry permits in industrial zones. **Off-street truck parking** strategies involve working with shippers and carriers to allow parking for staging and short breaks on site. Working with local jurisdictions to determine and require adequate truck parking in new industrial sites, per [FHWA's Truck Parking Development Handbook](#), is a best practice. This would improve

working and safety conditions for truck drivers, reduce emissions from out-of-direction travel, and improve operational efficiencies.

To mitigate queues at both the port's marine terminals and land POEs, **commercial vehicle appointment window systems** could be considered. This strategy is referenced in the [2021 California-Baja California Border Master Plan](#) and the Sustainable Freight Action Plan Pilot Project Work Plan for Advanced Technology Corridors at Border Ports of Entry.

Regional agencies should consider encouraging and studying opportunities for **truck platooning** for long distance or high-speed truck movements and **Connected and Autonomous Vehicles (CAVs)**. Caltrans District 11, SANDAG, and the City of Chula Vista have established the San Diego region as an [AV Proving Ground](#). This allows for streamlined permitting and closing roads for demonstrations. It would be necessary to establish partnerships and secure funding to take advantage of this existing proving ground. SR 905, with its significant truck traffic, would be a candidate location for demonstrating CAV technologies.

**Radio-frequency integrated circuit (RFIC)** technology enables data to be transmitted securely at very fast speeds and can provide operational efficiencies for freight-related projects. Applications specific to freight and logistics include Radio Frequency Identification (RFID) technology which can reduce labor intensive tasks of scanning and approving vehicles through checkpoints.

SANDAG is planning to implement various **real-time travel information** communications capabilities through the development of the NextGen 511 Concept of Operations. There is an opportunity to coordinate the dissemination of real-time information with devices inside truck cabs. Public agencies elsewhere are demonstrating the effectiveness of notifications pushed to these devices when there is an immediate safety need. Following are several functionalities that can be considered.

- Truck drivers could receive a notification according to their location. Upon entering a work zone, they could be alerted to the presence of construction workers, uneven surfaces, or unmarked lanes. Drivers could also be given guidance regarding temporary lane configurations such as truck-only lanes.
- Truck safety warning systems could reflect real-time truck operations. Rollover warning alerts would be appropriate for drivers entering tight curves at high speeds, such as freeway interchanges. Downhill speed and over-height warnings could provide similar notifications to drivers for steep grades and low overpasses.
- Monitoring traffic conditions and the locations of traffic queues could enable notifications to drivers to slow down proactively and safely.
- Weigh station bypass service applications already offer pre-clearance for qualified trucks and avoid the requirement for trucks to enter weigh stations. These improve

truck route efficiency and avoid the safety risks of trucks slowing down to exit the freeway and speeding up to re-enter. Their use could be promoted for more widespread benefits.

- Data on hard braking could be used to study the effectiveness of these alerts.
- The monitoring of weather conditions and road closures to support dynamically re-assigned lanes or reduce speed limits to avoid crashes would be critical in an extreme weather event. Additionally, road closures on key truck routes could be coordinated with directing drivers to emergency truck parking facilities.
- After traffic crashes, distress messages could be broadcast quickly using vehicle-to-vehicle and vehicle-to-infrastructure technology.

## 3.2 Fleet Management and Operations

Toll-collecting agencies could consider providing **toll discounts** to cleaner/greener trucks to accelerate adoption of new technologies. For example, electric trucks and hydrogen trucks could be exempt from tolls, or provided a significant discount, to accelerate their adoption in the region. Similarly, trucks with Fuel Saving Technologies (FST) beyond California regulations could be given preferential pricing on these corridors. Incentives could be phased out as California regulations are tightened in the coming decades.

Clean truck toll discounts could be piloted in areas most impacted by on-highway vehicle emissions, such as the Assembly Bill (AB) 617-designated Portside, International Border, and Calexico-El Centro-Heber Communities. This strategy suggests air quality improvements, but the loss of revenue from commercial vehicles should be weighed carefully. In cases where the repayment of construction bonds relies on toll revenues, it may not be financially feasible for regional toll collection agencies to offer significant discounts. An alternative means could be the use of toll subsidies financed by a state-level agency with a mandate to achieve air quality improvements.

Policymakers should consider that toll discounts may be preferable to exemptions since discounts can be changed over time according to the needs of the incentive program. For example, it could be acceptable to grant near-zero-emission trucks toll discounts in the near term, but those discounts could be reduced or eliminated as zero-emission trucks become the focus of incentives and discounts.

Enforcement of established truck routes in vulnerable communities is a strategy with equity benefits. Truck routes in the Barrio Logan community of San Diego have been established along arterials connecting between the Working Waterfront and highway network. When properly observed, these routes keep trucks off residential streets and avoid safety, noise, and air pollution concerns. **Freight geofencing** is an intelligent transportation systems strategy that tracks vehicles to determine where they are traveling.

Determining when freight vehicles enter prohibited areas can assist with the enforcement of route restrictions.

An **off-peak pick-up and delivery program** would encourage freight activity during less congested times of the day. Implementing this would face challenges with labor constraints. Additionally, communities adjacent to participating businesses or freight routes could experience undesirable, freight-related noise at off-peak times. A program of this type has been used at the Ports of Los Angeles and Long Beach, so an example exists in the broader region. The potential benefits in emission reductions and safety would be tangible, but they would need to be weighed against the potentially disruptive noise impacts.

This strategy would be most useful in areas with high truck volumes and truck-related congestion. The Port of San Diego's marine terminals do not experience the same level of congestion as the Ports of Los Angeles and Long Beach. However, the Otay Mesa POE is one of the largest freight bottlenecks in the region. The hours of operation at the POE are limited by the availability of staff at Customs and Border Patrol and California Highway Patrol's Commercial Vehicle Enforcement Facility. It is expected that the future Otay Mesa East POE will relieve congestion for cross-border truck traffic, but an off-peak system is a strategy to consider in the future.

**Urban consolidation and mobility hubs** at intermodal facilities and urban areas 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, such as those provided by Amazon hubs. Providing incentives for **delivery lockers** in Mobility Hubs could help reduce delivery vehicle trips and reduce emissions and congestion.

San Diego offers potential locations for urban consolidation centers in the Midway/Pacific Highway area near the San Diego International Airport. This primarily warehouse, industrial, and commercial area is close to the densely populated and mixed-use downtown San Diego area. This proximity could enable quick deliveries and limit commercial vehicle miles traveled.

Encouraging the use of **cargo bikes** in denser urban areas would complement urban consolidation centers. The [B-Line](#) in Portland, Oregon is an operating example. Providing incentives and amending bike infrastructure design standards and regulations to allow larger cargo bikes, particularly battery assisted ones, would be helpful implementation actions. Downtown San Diego and close-in neighborhoods such as Hillcrest and North Park are potential locations for the use of cargo bikes, as the combination of destination density and protected bike infrastructure can make it feasible and attractive. However, the use of cargo bikes for commercial trips also depends on appropriate origins—urban consolidation



centers—where goods can be loaded. These sites should have good regional transportation access but also be close to destinations.

**Delivery robots** are emerging in prominence, with several commercial operations around the U.S. (as described in the best practices memorandum). However, questions remain about their wider applicability and impacts on sustainability. As part of the Flexible Fleets Strategy, SANDAG and regional partners should consider delivery robot accommodations at Mobility Hubs and in Active Transportation projects to ensure appropriate visibility and safety of people and robots.

The use of **crowd-sourced deliveries** is an area of exploration and research. With this strategy, a person ordering and receiving a package via an online order could also receive a neighbor's package. The expectation is that the person would deliver the neighbor's package, and both parties would receive a discount on their orders for their agreement. This can save on delivery time and expense for the carrier, but it invites additional risk.

Establishing a **Low-Emission Zone (LEZ)** in dense urban areas could catalyze investments in sustainable urban freight strategies. Regulations could be introduced to LEZ initiatives compatible with existing regulations and sustainability directives. Alternatively, this could be voluntary and rely on incentives, as is the case in [Santa Monica](#). The same communities where cargo bikes would be appropriate are also candidates for LEZs. In addition, the AB 617 communities already identified for disproportionate exposure to and burden from air pollution would be candidates for demonstrating this strategy.

**Advanced Air Mobility (AAM)** technologies can complement freight movement by providing flexible deliveries, including last mile deliveries, while removing trucks from the roadway system. To date, AAM technology integration has been limited due to the continued and evolving development of aircraft as well as regulation of National Air Space, land use, and local permitting practices. Roles and responsibilities among government, industry, non-profits have yet to be defined. However, early pilots have proven functional use case scenarios that may be applicable at a larger scale. In 2017, for example, the San Diego Economic Development Corporation (SDEDC) led a successful pilot leveraging funds from the Federal Aviation Administration's Unmanned Systems Integrated Pilot Program (FAA IPP). SDEDC, in partnership with Matternet, UPS, and UC San Diego Health's Jacobs Medical Center, were able to launch an aerial delivery service of Unmanned Aerial Systems (i.e., drones) to deliver medical specimens to San Diego healthcare providers, improving delivery speed, reliability, and costs. In efforts to augment pilots from the FAA IPP, SANDAG partnered with the San Diego County Regional Airport Authority to plan for and integrate Advanced Air Mobility (AAM) into the regional transportation system. Funding provided through a Caltrans Sustainable Transportation Planning Grant will help establish a uniform vision for AAM technologies and identify near-term pilot opportunities that will alleviate transportation demands on the ground, including goods movement. As part of the project,

a collaborative will serve as a forum for discussion and information-sharing to guide the development of an AAM Policy Framework and Implementation Strategy for local jurisdictions. Resources produced may be adapted by other regions and inform local permitting practices, state policy, and efforts spearheaded by Caltrans Division of Aeronautics.

### 3.3 Infrastructure Improvements

Public agencies could consider expanding deployment of **Intelligent Transportation Systems (ITS)** technologies. Border crossing management systems, with advance warning of potential wait times, would be especially helpful for cross-border drayage operators and the freight sector in general. SANDAG is implementing the Regional Border Management System (RBMS), a component of the Advancing Border Connectivity (ABC) project funded through the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program, to integrate several strategies enabled by ITS, such as dynamic lane management, traveler information, border wait time estimation, and variable tolling through the SR 11/Otay Mesa East Port of Entry project. Variable tolling will maintain consistent wait times for travelers by charging higher tolls when demand rises. This will limit congestion at the POE and generate revenue to support the necessary repayment of infrastructure bonds. Future implementation of similar technologies to benefit goods movement include Smart Intersection Systems, which can coordinate traffic signals to keep trucks moving smoothly, and Mobility Hub amenities, which can allocate curb space for efficient commercial vehicle pickups and deliveries. Additional implementation of freight routing and trip time information throughout the region could make these technologies more useful for carriers.

**Active Transportation and Demand Management** (ATDM) technology enables transportation operators to modify how infrastructure and services are used based on changing traffic conditions. This also allows operators to make more use of existing roads and offers an alternative to costly road expansion. Real-time travel information helps drivers decide how, where, and when to travel to avoid congestion and dangerous driving conditions. Other components of SANDAG's ABC project will implement Integrated Corridor Management System functions. These will include changeable message signs and adaptive signal timing to help with re-routing in response to incidents on SR 905. The displayed detour and adaptive timing will include consideration for freight routes.

SANDAG has developed an ATDM Concept of Operations study for the I-805 South Corridor that includes strategies applicable to freight. Examples include dynamic lane assignment, queue warning systems, speed harmonization, actionable event information, and active dynamic routing. All these strategies take advantage of real-time information and communication to improve safety and operational efficiency. These benefits are especially

pronounced for trucks. Trucks are among the largest vehicles on the road and inherently create safety concerns at higher speeds. In addition, commercial vehicle travel is heavily dependent on the cost of truck driver labor. Therefore, rerouting trucks to avoid delays reduces the cost of moving goods and improves regional economic competitiveness.

The Port of Los Angeles was awarded an ATCMTD grant for its Gateway Project in August 2022. This project will implement cloud-based, artificial intelligence applications to help streamline and schedule the staging of cargo and empty returns. The application introduces new means to help direct cargo owners, truckers and drayage drivers and reduce congestion at the port. This and other ATCMTD projects are developing strategies with significant potential benefits for freight operations that may be applicable to San Diego and Imperial Counties in the future.

**Dedicated truck lane** proposals for freight corridors may be worth considering. In theory, truck lanes have the potential to reduce conflicts with passenger vehicles, improving safety and efficiency of truck operations. While these types of projects have been difficult to implement as described in the Task 3 Memorandum, there are examples in the broader region, including I-5 at the SR 14 split in Los Angeles County, Southbound I-5 at the SR 99 Junction near the Grapevine in Kern County, and SR 60 in Riverside County. Additional opportunities for deploying these types of technologies should be considered, particularly in less congested locations where right-of-way (ROW) is less constrained, such as SR 905 and SR 52. Dedicated truck lanes can also be employed at interchanges with significant truck traffic. Dynamic lane assignment and dynamic junction control technology could allow for temporary truck lanes when desired to assist with merging and adjust to real-time traffic conditions. This could be useful at the SR 52 Westbound to I-805 Northbound interchange or several interchanges along SR 78.

The Harbor Drive 2.0 project, which is advancing into environmental study, extends the dedicated truck lane concept to arterial streets through dedicated lanes and complementary ITS strategies such as **freight signal priority**. Additional arterial and POE strategies for truck prioritization can improve terminal access using RFID and other technologies. For example, a gate operating system and truck reservation system can decrease wait times at freight origins and destinations. Arterial strategies would be useful on other roads throughout the region with high truck volumes. Examples include Washington Street and Miramar Road in San Diego, Scripps Poway Parkway in Poway, and Palomar Airport Road in Carlsbad. Examples in Imperial County include SR 111, SR 78, SR 115, SR 98, and Forrester Road. The hardware and software infrastructure components necessary for these improvements should be identified for simplified and integrated implementation.

Financing dedicated, truck-only toll lanes would be reliant on high truck volumes and drivers' willingness to pay, so the option might be viable only in limited areas, primarily the

system bottlenecks on freight corridors. Some of the corridors identified are SR 905/I-805 Interchange, I-5/SR 163 Interchange, and I-5 from SR 54 to the SR 15 interchange. Implementation could be through the addition of standard highway lanes, or a “truck on shoulder” concept could be developed as a variation of the “bus on shoulder” service provided by the South Bay *Rapid* project on I-805 and SR 94. Once the Otay Mesa East POE is open to commercial vehicle traffic, there may be an opportunity for demonstrating truck-only toll lanes in the Otay Mesa area. Although many trucks crossing the border northbound are anticipated to have destinations in Otay Mesa, trucks destined for points further north could benefit from reliable through travel. A potentially significant truck route for the future is from Otay Mesa East POE to the Port of San Diego’s marine terminals and adjacent rail yards via SR 11, SR 905, and I-5, and Harbor Drive. Safe and reliable travel achieved through truck-only toll lanes between these gateways could encourage greater use of the route. Charging truck drivers for these toll lanes would be a simple means of implementation, but a public-private partnership involving shippers and receivers could also be explored. Finally, achieving the authority to implement this concept would be an important impediment to overcome.

Another consideration for public agencies and elected officials is to **expand managed lane** access to trucks. Although there would be hurdles to overcome, as documented in the 2013 SANDAG study “Analysis of Freeway Operational Strategies Related to the Use of Managed Lanes by Trucks,” a pilot project along I-15 could test the feasibility of this strategy in the San Diego region. Enabling this permanently would require hardware, infrastructure, and policy changes at the state level. Assuming the success of this pilot, the design of near-term managed lane projects on I-5 and SR 78 could incorporate lessons learned.

In the absence of managed lane access for trucks, there could still be a direct freight benefit to the expansion of managed lanes. SBCTA has proposed using excess toll revenues generated from managed lanes to create a Clean Truck Program with incentives for businesses to purchase clean (likely near-zero or zero-emission) trucks. This would provide a freight justification for managed lane projects and generate revenue for the desired conversion of truck fleets to zero-emission technologies. Prioritizing the use of excess revenue for incentives of this type would need to be weighed against funding transit operations and the expansion of the managed lane network.

A similar concept proposed by the Los Angeles County Metropolitan Transportation Authority (LA Metro) as part of its 2021 Goods Movement Strategic Plan is a Countywide Clean Truck initiative. This initiative calls for establishing a working group, developing an information clearinghouse, establishing revenue streams, developing criteria and metrics, and implementing the program on the I-710 corridor.

A strategy with potentially significant safety benefits is the reconsideration of existing **truck operations in work zone** plans and activities. The implementation of the Complete

Corridor projects will entail significant construction activities that will cause temporary disruptions to traffic. Some of these disruptions could be severe, and last many years, negatively affecting freight moving through the corridor and nearby communities. Traffic Control Plans for managing work zones typically do not explicitly accommodate the needs of trucks, leading to potentially dangerous conditions as lanes are narrowed and restriped and shoulders are eliminated. It is recommended that these plans be amended to consider the degree of freight traffic on corridors and associated needs. In addition, it is recommended that Caltrans implement smart technologies in these zones to allow real-time communications with the vehicle operators.

**Freight Clusters**, where transportation-dependent industries locate proximate to freight infrastructure, are an opportunity to achieve efficiencies and scale. The Imperial Valley Economic Development Corporation (IVEDC) is planning a zero-emissions inland port in the northern portion of Imperial County. Located on 5,000-6,000 acres, it would include a cluster of distribution centers with the ability to serve 11 western states within 24 hours. The facility would also include some light to medium manufacturing. IVEDC is in the process of land acquisition and would then move to environmental review with a targeted opening in approximately 5 years.
















Similar opportunities to develop **intermodal facilities** in northern Imperial County and near Calexico could also be explored. These could support lithium extraction and other industries in the border region by presenting alternative and more efficient transportation options. However, more detailed study of commodities, origins, destinations, and infrastructure would be needed.

The impacts of climate change on transportation infrastructure critical for goods movement will be especially important for the future. Climate stressors such as storm surge, erosion, tsunamis, flooding, and sea level rise are likely to impact vulnerable facilities like Harbor Drive in San Diego Bay. SANDAG's [Military Installation Resilience Transportation Corridor Report](#) will provide project recommendations specific to the San Diego region's military installations, but certain projects are also likely to be applicable for goods movement. This is because marine terminals, rail yards, arterials, and highways are located close to the military installations and near the water. [Comprehensive Multimodal Corridor Plans](#) (CMCPs) are also being developed along each corridor in the region to identify specific projects to address **climate adaptation**. There should be special attention paid to implementing improvements on goods movement routes to ensure resilience in the event of disruptions.

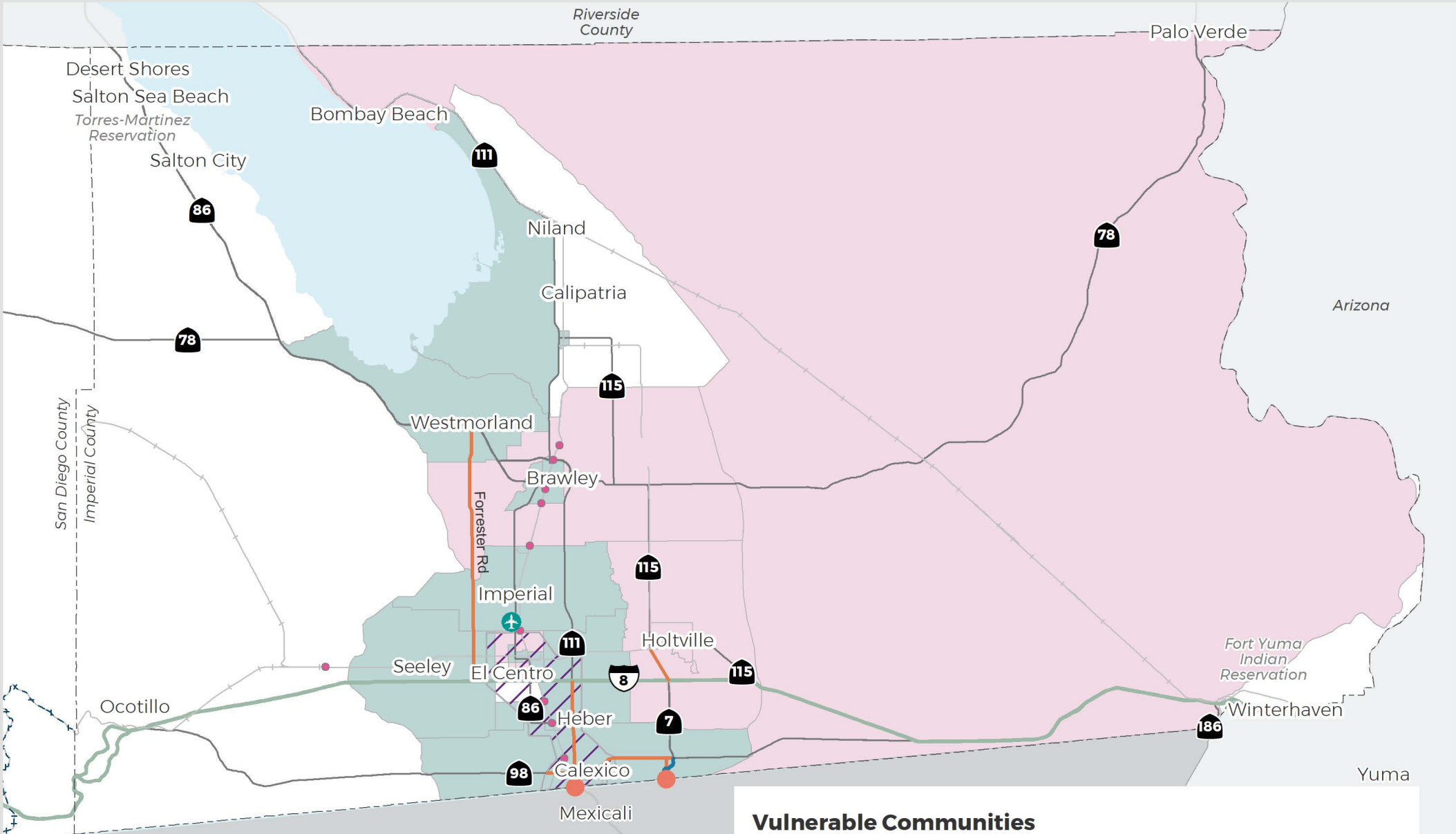
## 4. APPENDIX: PROJECT MAPS
















### Vulnerable Communities

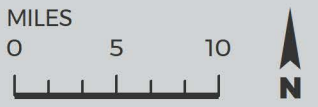
-  AB 617 Communities
-  Most Vulnerable Communities
-  Vulnerable Communities
-  Goods Movement
-  Complete Corridors
-  Transit Leap
-  Rail Projects
-  Road Projects
-  Seaport
-  Airport
-  Port of Entry
-  Railroads
-  Study Area County Boundaries
-  Interstate
-  State Route





### Vulnerable Communities

-  AB 617 Communities
-  Most Vulnerable Communities
-  Vulnerable Communities
-  Goods Movement
-  Roadway Access
-  Grade Separations
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-  Airport
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# ADDENDUM TO SAN DIEGO AND IMPERIAL COUNTIES SUSTAINABLE FREIGHT IMPLEMENTATION STRATEGY: FINAL INNOVATIVE STRATEGIES SCREENING MEMORANDUM

This addendum reflects a modification to the Final Innovative Strategies Screening Memorandum. On Table 1 – Scoring of Benefits, the scoring scale was originally 1 – 10. This approach was developed by the Project Development Team (PDT), presented to the Freight Stakeholders Taskforce, and included in the Final Existing Conditions and Sustainable Freight Best Practices Memorandum. While working through the process of assigning scores, the project development team noted that a smaller scale would be more appropriate, given the conceptual nature of projects, programs, and policies being evaluated. The updated range for scoring, as indicated below, is between 1 and 3. The weighting of areas are unchanged.

Modified text is shown as underlined.

## Changes to p. 2

Table 1: Scoring of Benefits

Areas	Criteria	Scoring	Weighting
<b>Environment</b>	Impact on reducing emissions of GHGs	1 - <u>3</u>	35%
	Impact on reducing emissions of criteria pollutants (particulate matter, NO <sub>x</sub> , VOC, etc.)	1 - <u>3</u>	
<b>Equity</b>	Degree to which benefits accrue to most vulnerable communities (Top 25% of CalEnviroScreen 4.0 scores, or AB 617), and vulnerable communities (Top 50% of CalEnviroScreen 4.0 scores, or Tribal Land), including safety considerations	1 - <u>3</u>	35%
<b>Economy</b>	Improves efficiency (speeds and reliability) of freight transportation system	1 - <u>3</u>	30%
	Improves capacity of freight system to accommodate expected increases in freight	1 - <u>3</u>	