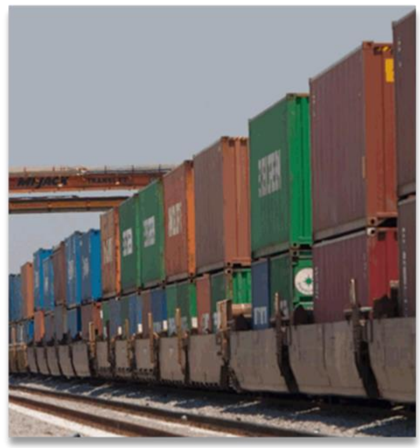
California Inland Port Feasibility Analysis

Preliminary Business Model



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Central Valley Community Foundation
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Summary - A compelling proposition to utilize intermodal rail for a portion of the products moving from ports to and from the Central Valley region and the Bay Area can be made after analyzing the size of the market and reviewing underlying truck versus rail transportation cost. This analysis reviewed the underlying viability for establishing a port-to-Central Valley/Bay Area intermodal rail system, at least in-part replacing the current all-truck transport system. The market region included a 425 mile-long district, stretching from Sacramento in the north to Bakersfield in the south, and into the Bay Area to the west.

This analysis modelled the potential for the introduction of intermodal rail service from the San Pedro ports in the Los Angeles region to/from the market region. Approximately 72% of the cargo that moves to/from the market area currently transits through the Ports of Long Beach and Los Angeles and practically all of this volume is moved by truck along Los Angeles region and Central Valley highways. The Los Angeles region ports were modelled following the current cargo logistics pattern which has a large majority of the cargo volume using these ports. If this intermodal model is shown to be viable, then it would likely make sense to test how an intermodal rail service may later be expanded to include service to/from the Port of Oakland. By some margin, the Ports of Long Beach and Los Angeles are the busiest container ports in North America, and they represent the primary gateway for most goods into the US and California markets.

Shifting truck movements to rail can reduce the number of heavy trucks on I-5, SR 99, SR 101 and connecting routes, and will reduce criteria pollutants, fuel use and GHG emissions. To be successful, a rail logistics option must meet the needs of shippers in terms of reliability, transit time, shipment size, frequency, access, and cost. The intermodal service analyzed could provide a cost effective, viable transportation alternative to the existing single-mode (truck) transport system. There is an opportunity to develop the Central Valley as a nationally significant inland port, with seamless connectivity to key foreign markets.

Through this work, there has been communication with the two Class One railroad companies, the Union Pacific and BNSF. Both have indicated that they are very interested to review the market analytics and the results of the business modelling. This communication is ongoing and would continue if the project were to advance to the next stage of development.

Key Findings of the Market and Operating Cost Analysis

- The current shipper market is quite robust, larger than most in the industry realized
- There are relatively balanced volumes for inbound and outbound cargos
- The northern portion of the Market Shed is very large
- The Preliminary Business Model suggests that a California inland port rail system can be feasible; but it is important to note that this is dependent on a range of critical factors and assumptions
- A significant number of issues need to be addressed for the project to advance and this needs to be reviewed in the context of a Developed Business Model
- The project requires close collaboration with the railroad companies and close coordination with the State of California
- The Inland Port would produce significant public policy benefits: 1) increased economic competitiveness, especially in the Central Valley region, 2) significantly reduced greenhouse gas air emissions, and 3) reductions in congestion and wear and tear of roadways
- The Inland Port will require public policy leadership from State government, air quality districts, counties and cities and seaports
- In the end, the Inland Port project would have a range of rather substantial economic and environmental impacts for markets and populations throughout the State.

By taking a certain portion of trucks off the road from this region, significant emissions reductions can be realized. Based upon the analysis done for this study, NOx emissions would be reduced by up to 83% while greenhouse gas emissions would be reduced by up to 93%. Moving large quantities of freight via rail provides significant benefits to the air quality of the region, as shown by the emissions reduction analysis section of this report. Additionally, by taking some of these trucks off the road, congestion on key transportation corridors such as Highway 101 and 99 would be reduced, thereby improving the flow of traffic and the safety of the roadways in this region.

Background and Project Definition – In recent years, there has been considerable interest in better connecting the San Joaquin Valley to the international seaport gateways in Southern California. These efforts have the potential to enhance economic opportunity in the Central Valley while simultaneously reducing air pollution. This has included an effort by the Port of Los Angeles and Merced County to develop the Mid-California International Trade District, a growing logistics and manufacturing hub in Merced County. Building on this effort, a group of business leaders and the Central Valley Community Foundation initiated the California Inland Port Feasibility Analysis (CIPFA) which set out to determine whether it would be feasible to establish a rail-served inland port project in California. The proposition reviewed was for the creation of intermodal rail service to/from the Ports of Long Beach and Los Angeles northward through the Central Valley, terminating in Sacramento. There is currently no rail intermodal service from the Ports to intra-California markets. At present, practically all containerized cargo transiting through the seaports to/from California markets travel by truck.

For the purpose of this evaluation, the Market Shed includes all of the Central Valley, including the following jurisdictions: Kern, Kings, Tulare, Fresno, Madera, Merced, Stanislaus, San Joaquin and Sacramento counties. Due to the current reliance on the Los Angeles ports, the Market Shed also includes the Bay Area counties of Santa Clara, Alameda, San Mateo, Contra Costa counties as well as the City of San Francisco.

Key Issues - The CIPFA was focused on two primary issues:

1. Project Viability: The feasibility of this project relies on several factors, including whether the project will generate enough value and interest by Valley businesses to be profitable for rail companies to build, operate, and maintain such a system.
2. Quantification of Emissions Reductions: It is vital to understand the level of emissions reduction that may be generated by the migration from truck movement to rail freight movement.

In launching a review of viability of a project of this scale and complexity, there are a variety of government and business constituencies that will be impacted, and most will need to play a role for the project to become a reality.

- Does the project as scoped demonstrate a level of core-feasibility? How do the project's economics compare for potential intermodal rail against existing trucking practices?
- What is the depth of the current shipper market in the Market Shed area? How will the market grow or reshape over the next 20 years? Will the project spur more economic growth in the region than would be the case otherwise?
- How does the project impact existing rail operations? Are the incumbent Class One railroad companies supportive of the project? What are the obstacles to the project from the railroad perspective?

- Especially in the early years, if there are business risk challenges how can the project be "de-risked" to support railroad investment and operational requirements while supporting the core public policy objectives?
- Is Government supportive? Is there a need for public policy or financial support to de-risk the project? Is Government willing to support the project with corresponding public investments in connecting or associated road and other infrastructure?
- What do main business shippers in the market think about the rail option? Will they demonstrate commitment to support the project prior to launching the project?
- Does this project support the objectives of the Air Quality Districts and Transportation Planning Organizations and if so, how will the project impact the planning and business strategy for each?
- If the project demonstrates core-level feasibility, what are the steps and who are the players that need to be involved?

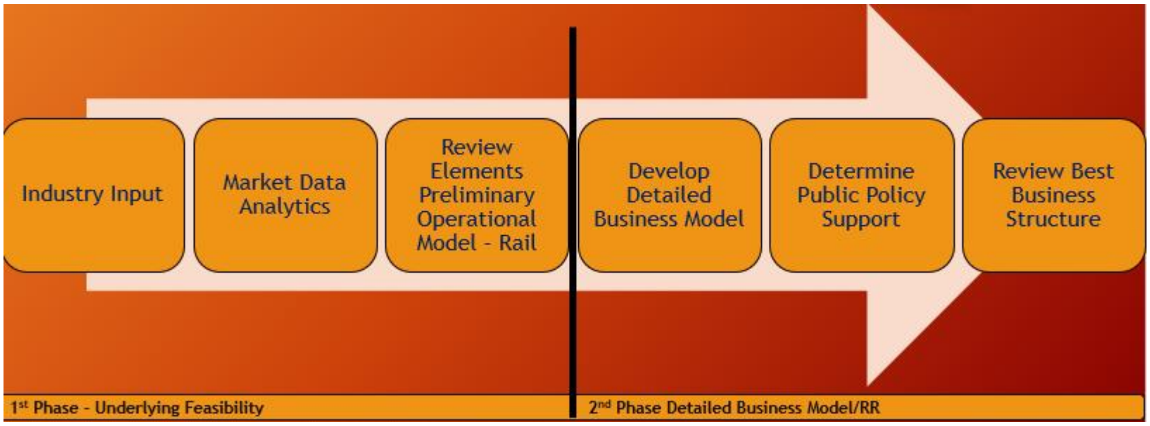
State and Local Objectives – If established, implementation of the inland port concept would support a range of State and local community objectives, including a significant improvement in economic competitiveness, a substantial decrease in greenhouse gas emissions and a sizable reduction in highway congestion, particularly along CA99. If this project went forward, given the scale of California's market, the vastness of its geography and through its seaports, the westward orientation toward Asia – the California Inland Port would become a nationally significant logistics and economic development project. More specifically, the CIPFA was undertaken with core objectives in mind:

1. To support new job creation and investment growth by fundamentally repositioning the economic competitiveness of the Central Valley region; with specific focus on high-value manufacturing sectors and a more robust and efficient distribution system; direct rail service to/from deep seaports would reduce shipping costs for shippers that manage global supply chains
2. To significantly reduce air pollution by reducing the number of truck trips from the seaports complex in the Los Angeles region to the Central Valley and the Bay Area
3. To reduce highway road congestion, with a parallel reduction in the requirement for road maintenance; this reducing cost and creating more capacity from existing infrastructure

Railroad Company Objectives – It is fundamentally critical that the public sector understand the needs and requirements of the incumbent Class One railroad companies. This project is being carried out with the following in-mind. Intra-California intermodal service:

1. Must not negatively impact the railroad's core long-haul business; it is understood that the core business for both railroad companies is carrying long-haul east-west cargo.
2. Must produce economics that allow for net-profitable operations, including both operational and capital cost considerations. It should be noted that the railroad companies likely have no current capital commitments to such a service, and that there are a complex matrix of associated operating costs including track maintenance, labor/crew costs, etc.
3. Must not create labor relations challenges.

Project Process - The feasibility evaluation was designed to be a two-stage process, with an off-ramp inserted after the first phase if the project did not prove to have underlying viability. As the first phase, analytics would develop a comprehensive understanding of the market and a corresponding Preliminary Business Model, which would measure whether the project showed underlying viability. If it was agreed that the project demonstrated fundamental viability, then a second phase would be undertaken which would develop market-level commitments and produce a fully Developed Business Model (DBM). The DBM would be led by public interests and would include a more detailed review of market segmentation, required rate thresholds, project operating financials, capital cost requirements for rolling stock (if any), intermodal locations, intermodal site improvements and any associated roadworks. The work would be carried out with further consultation with the railroad companies, and the final product would yield a detailed business proposition for review. Without this product in-place, it is likely that the concept of new intermodal rail service would be taken seriously and would not proceed.

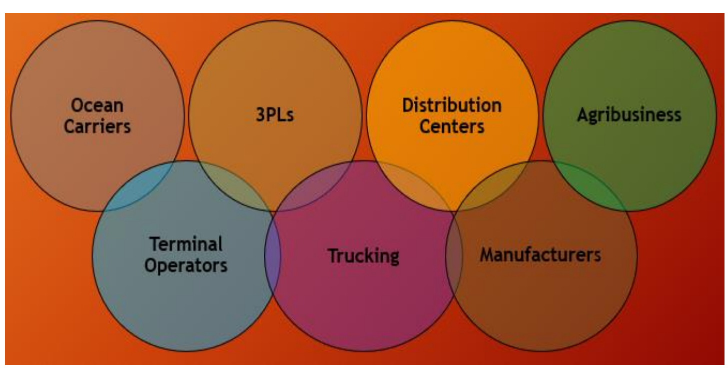


The project has completed the first phase of work and a determination needs to be completed whether there is consensus to proceed to the second phase.

Within the work of the first phase, the following steps were undertaken:

1. Market Assessment – A full review of the volumes and commodities moving into and out of the Market Shed was completed; including a review of inbound and outbound volumes, by sub-region within the Market Shed
2. Industry Input - A range of business constituent groups were engaged to measure their views about the inland port concept in terms of its potential value to their industry and their businesses
3. Environmental Assessment – The San Joaquin Valley Air Pollution Control District performed a review of the potential air quality benefits associated with reducing truck trips
4. Preliminary Business Model – Analytics that would assess whether the project showed an underlying viability; this in terms of operating cost feasibility over several different scenarios

Industry Input – Business groups were engaged on the basis that their views would be held in confidence but would be aggregated into an overall report. Generally, the input was received from two overarching groups, including shippers and companies involved in the logistics and transportation business. This work provided information about current and projected business and attitudes concerning the attractiveness and trigger-points for new and alternative cargo transportation services.



Input was received via personal interview discussions with the following interests:

- Large export agribusiness interests
- Key manufactured product exporters
- Inbound retail distribution
- Large 3PLs, trucking and ocean carriers

In general, the input strongly suggested that industry felt that the introduction of intermodal rail through the California market would be beneficial to their current business and would support increased business in the future. In terms of today's condition, there was an overwhelming desire for reductions in shipping costs and more surety about stable logistics solutions to support growth. The concern related to growth challenges is connected to the challenges of road capacity, trucking costs, driver shortages and environmental constraints and costs. There was a common belief that logistics via truck in California will only become more difficult in the future.

Due to the challenges of securing drivers for longer hauls, the trucking community reacted positively to the concept of increased rail service to key hubs in the Central Valley. They felt that an intermodal rail inland port would reduce their exposure to running longer haul trucks into the Los Angeles traffic zone and reduce their exposure to long wait times at the ports. Serving intermodal hubs in the Central Valley would allow them to substitute shorter and more profitable routes and would allow them to retain drivers.

Agricultural processors indicated a desire for far more efficient field-to-port logistics. They indicated that lower costs would increase their profit margins and support increased export production. Food producers are presently very concerned with increasing exposure to rising costs and service level challenges. Generally, the agriculture industry feels that transportation issues are becoming an increasing challenge and are concerned about the long-term impact to their growth.

Distribution center operators favorably consider rail as an added benefit if transloading operational issues are offset by shipping cost reductions and acceptable operational dynamics. Currently, most distribution centers are almost entirely truck served, with an overwhelming portion of their goods coming through the State's seaports and a large majority of that through the San Pedro ports complex in Los Angeles. Given the significant cargo volumes that are moved into these facilities, a robust new capacity of transport service would be necessary for intermodal terminal-to distribution center hubs.

The ocean carriers felt that equipment location and control would be paramount issues. This relates to the deployment of container boxes and the always challenging issues to the industry for maintaining efficiency discipline in terms of assuring a high-utilization rate. From a pure cost management perspective, the issues are a bit different. The carriers desire to keep container boxes as close to the port as possible. Except for some large-volume priority accounts, carriers have foisted most inland transport costs to importers and exporters, so they are not as concerned whether transport movement is by truck or rail. The imbalance of chassis at port terminals remains an ongoing issue and some felt that increased rail could provide some relief to this problem. Lastly, the carriers were focused on conditions for matching the timing for import and export loads due to seasonality issues.

From the perspective of the companies that operate the marine terminals at the seaports, they generally welcome increased rail volumes, but this varies from terminal to terminal. Terminals that are presently rail-constrained would provide priority to east-west unit trains over an intra-California intermodal service train. Key issues will revolve around which terminals have access and the specific loading point location. They indicated interest in whether there would be sufficient volumes to support unit trains from terminals or would the trains need to be broken. They also were very interested in the cost for the intra-ports complex dray if a central terminal in the ports complex were used.

Rail Infrastructure at the San Pedro Ports – Creating efficient rail interface at the seaports complex will be critical to the Inland Port's success. Both the Port of Los Angeles and the Port of Long Beach have extensive rail track infrastructure within their facilities. The Pacific Harbor Line provides rail dispatching and switching services inside the ports complex. PHL has been recognized as America's "greenest" railroad for converting its fleet to clean diesel locomotives that dramatically reduce pollution and save fuel.

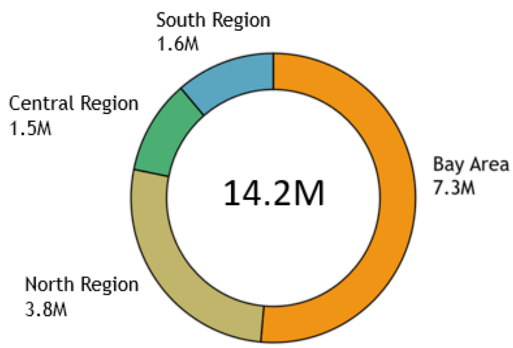
It should be noted that in work sessions with the seaports the Port of Long Beach described their plans for a new $870M rail classification yard. This project is known as The Pier B On-Dock Rail Support Facility, and it would reconfigure, expand and enhance the existing Pier B rail facility located along Anaheim Street and the 710 Freeway to support more efficient use of "on-dock" rail at the Port's shipping terminals, which will in turn ease roadway traffic congestion and improve air quality.

The existing Pier B rail facility is operated by Pacific Harbor Line (PHL) and serves as a storage and staging area for trains. The Pier B project adds five 10,000-foot long arrival/departure tracks and increases the amount of storage capacity by three-fold. The goal of the project is to streamline on-dock rail operations, remove bottlenecks, and reduce the need for local truck trips. The operating efficiencies that will be created by the implementation of the new Pier B classification yard would potentially contribute to making an inland port in the Central Valley a truly viable project. Business from both the Long Beach and Los Angeles ports would likely utilize this project.

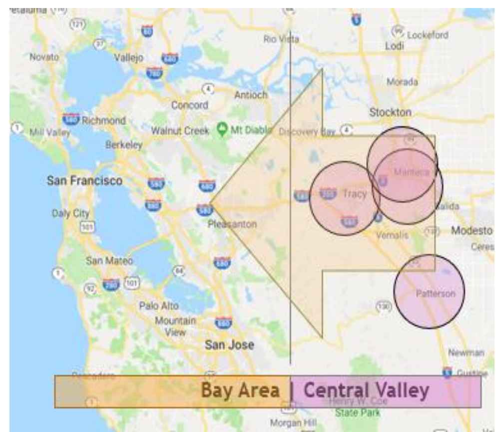
Market Shed – Resulting from the analytics associated with the market depth analysis, an Inland Port Market Shed area was clarified as the market region. This took into consideration the following: 1) current intra-California supply chain lanes that transit through the San Pedro ports, 2) the geographic location for current and projected consumption hubs, and 3) the location of the State's manufacturing and logistics/distribution hubs.

Generally, the Inland Port Market Shed is defined as including the entire Central Valley region, which includes the area ranging from Bakersfield to Sacramento. The Market Shed also includes the urbanized area of the Bay Area region. The Market Shed is bisected by the I-5 and CA99 highway corridors and the UP and BNSF rail tracks.

The Market Shed represents an extremely large consumption zone which includes a population base of over 14 million people, which is by itself larger than Pennsylvania (by 10%), Illinois (by 10%), or Ohio (by 21%). The region is projected to grow quite fast, with the Central Valley itself growing by 29% over the next 20 years.   As a sizable consumption area representing approximately 36% of the State's population, this region drives a huge inbound logistics flow.



Importantly, the Market Shed includes much of the Bay Area, this is justified for two reasons, 1) that a large portion of the cargo flow to and from the region moves through the San Pedro ports complex currently, and 2) because much of the region's distribution base is located in the Central Valley. The dynamic of a number of large-format distribution developments in the areas adjacent to the Bay Area is increasing its pace as the urban region is extraordinarily expensive and there is little available land available for such large-footprint uses. Much of this growth is occurring in the distribution triangle that been established between Tracy, Stockton and Patterson. Recent distribution center investment projects in that area include: Restoration Hardware, Amazon, Crate & Barrel, Kellogg's, CVS, Costco, etc.



The California Inland Port Market Shed has always been California's geographic and agricultural production center, and its main source of exports. It is the still the nation's number one agricultural producer, generating more than $50 billion annually which represents 13.4% of the US total. California's prime commodity exports are almonds, dairy products, rice, pistachios, wine, walnuts and table grapes and its top ten export markets are the EU, Canada, China/Hong Kong, Japan, Mexico, Korea, India, UAE, Turkey and Vietnam. Over the last 10 years exports have grown over 83% and represent 28% of the entire state production.

Commodity Analysis - Critically important to the California Inland Port analysis is an understanding of the actual dynamics of the market and the cargo that is being moved in and through the region. Over the past fifteen years there have been multiple studies and initiatives related to intermodal rail service moving north/south in the Valley and the primary aim of these proposals has been to take international container movements from the Ports of Oakland, Los Angeles, and Long Beach off the highways.

A consistent shortcoming of these previous studies is that there has never been any attempt to understand the market: both inbound and outbound movements, products/industry clusters, supply chains, volumes and transportation modes. All of the studies have concentrated on specific portions of the Market Shed, never tying the region together into one cohesive region where consumer products come through the valley for distribution into the Bay area and agricultural products flow south through the entire region for export throughout the world.

Much of the underlying data that is the basis of this commodity analysis was obtained from Transearch, a data product from IHS Markit the leading global intelligence company. The following freight movement information was used for all freight movement through the California Inland Port market area:

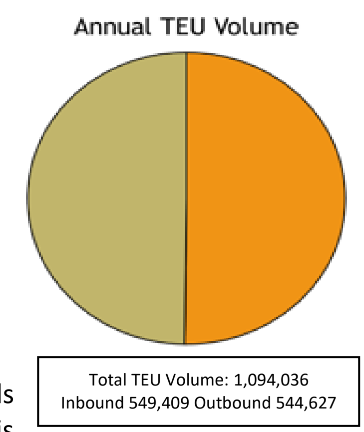
- Origin/Destination,
- Commodity Type,
- Mode,
- Tons, load and value

The data was designed to review point-to-point cargo/trade information throughout the market region, along corridors and to/from the San Pedro ports. The data is extremely deep and detailed and requires customizing to shape into an analytical tool with customized value to the California Inland Port market situation. This database is produced annually and contains U.S. county-level freight movement data which includes data flows for more than 450 individual commodities and seven modes of transportation: for-hire truckload, less-than-truckload, private truck, conventional rail, rail/truck intermodal, air, and water.

Volume is presented in terms of tonnage, and then translated to units (such as truck counts), value, vehicle-miles travelled (VMT) and ton-miles. For any given county, traffic coverage includes flows that are intra-market (internal), inbound and outbound (external-internal and internal-external), and overhead (external-external) or through traffic.

The database combines primary shipment data obtained from some of the nation's largest rail and truck freight carriers with information from public Freight Analysis Framework data as a base and then is layered with commercial and proprietary sources to generate a yearly estimate of freight flows at the county level. The NAICS commodities are converted to 4-digit Standard Transportation Commodity Codes (STCCs); and for each STCC, there is a price per ton, which is used to translate each commodity from nominal dollars into tonnage.

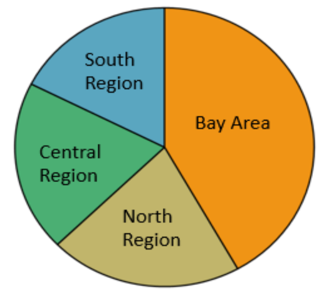
Using port-level census data, the database also identifies the volume of production that is domestically produced and consumed; that which is domestically produced and exported; and that which is imported and used for domestic production. Therefore, final county-level production numbers include imports and exports. The data analyzed was from 2017, which was the most current year that data was available. This data does not reflect any market disruptions from the on-going tariff disputes between the US and others, particularly China.



After careful analysis, it was determined that the California inland port market region moved the equivalent of 1,094,036 TEUs of combined inbound and outbound cargo in 2017. This can be considered a sizable volume when compared to the comparable volumes moving through the Ports of Miami or Baltimore. In this regard this hinterland Market Shed is quite sizable, enough to support a major container port on its own volume.

These volumes represent cargo that are currently moved by truck but could easily be converted to containerized rail shipments. The inbounds goods are dominated by consumer goods while the outbound product is basically agriculture except for scrap waste. The total amount of product moving in and out of the Market Shed is very evenly balanced between import and export.

For this study, the Market Shed has been divided into four distinct regions; the Bay Area, the North Region, the Central Region and the South Region. Further detail is provided in Appendix A. The Bay area of the market is clearly the dominant destination for inbound consumer goods for distribution while the outbound shipments were much more evenly divided between the four sub-markets.



When analyzing the product mix of the three remaining submarkets (North, Central and South), the dominance of outbound agricultural products becomes very obvious. Another important consideration is the seasonality of the agricultural markets . The peak shipping season is June-August with December-January generally the lowest level, depending on the product. Fortunately, there is a variety of agricultural products coming from the region including cheese/dried dairy product, wine, and nuts which are shipped year-round.

	Inbound	Outbound	Total TEU Volume
Bay Area	316,902	171,322	488,224
North Region	104,340	138,551	242,891
Central Region	80,338	150,499	230,837
South Region	47,829	84,255	132,084
Total Market Shed	549,409	544,627	1,094,036

North Region Imports and Exports (TEUs)

Imports	104,340 TEUs	Exports	138,551 TEUs
Food and Food Prep Products	12,191	Misc Field Crops	55,973
General Industrial Products	7,449	Waste Paper	42,518
Household Goods Including Plastic	6,752	Nuts	21,431
Alcoholic Beverages	4,932	Food and Food Prep	15,145
Furniture	4,729	Alcoholic Beverages	10,291
Apparel and Shoes	4,505		
Motor Vehicle Parts, Accessories, Tires	4,373		
Bagged Fertilizer	3,055		
Soft Drinks and Water	2,447		

Items Are Representative of the Regional Product Mix

Central Region Imports and Exports (TEUs)

Imports	80,338 TEUs	Exports	150,499 TEUs
Motor Vehicle Parts, Assessories & Tires	9,864	Citrus	41,779
Household Goods and Plastics	5,343	Misc Field Crops	35,557
Food and Food Prep	4,058	Alcoholic Beverages	21,611
Assorted Paper Products	3,949	Waste Paper	16,726
Animal Feed	3,783	Food and Food Prep	9,471
Apparel	4,506	Cheese/Dairy Products	8,190
General Industrial Equipment	4,321		
Food and Food Prep	6,710		

Items are Representative of Regional Product Mix

South Region Imports and Exports (TEUs)

Imports	47,830 TEUs	Exports	84,250 TEUs
Bagged Fertilizer	6,003	Misc. Field Crops	29,518
Apparel/Shoes	5,695	Misc. Coal/Petro Products	24,445
Assorted Paper Products	4,508	Cheese and Dairy products	10,475
Household Appliances	3,357	Nuts	10,111
Motor Vehicle Parts/Tires	3,034	Soybean Oil	5,616
Industrial Equipment	2,739		
Furniture	2,800		
Food and Food Prep Items	1,926		

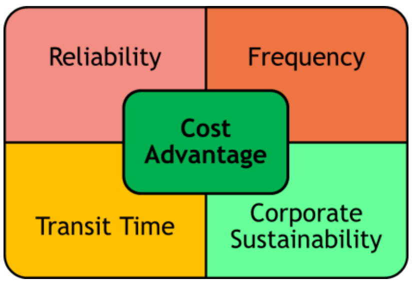
Items are Representative of the Regional Product Mix

In 2017, approximately 74% of all inbound and outbound products for the Market Shed were moved through the San Pedro seaports in Los Angeles and Long Beach. Even though the Port of Oakland identifies itself as the food port for California, there is also a large amount of agricultural product that is currently being moved through the San Pedro ports.

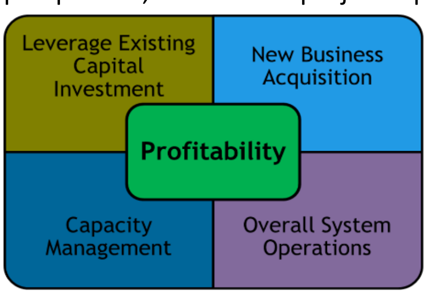
A very compelling proposition to utilize intermodal rail for a portion of the products moving in and out of the Central Valley region can be made when analyzing the current truck commodity movement in the Market Shed. Shifting truck movements to rail will reduce heavy truck movements on I-5, SR 99, SR 101 and connecting routes and will reduce criteria pollutants, fuel use, and GHG emissions. But a rail option must meet the needs of both shipper and receiver in terms of reliability, transit time, shipment size, frequency, access, and cost.

Shipper and Railroad Success Factors – It is critically important to recognize the factors that will produce a successful business proposition for both the shipper market and the railroad companies that would operate an intermodal system.

For the shipper community, the core consideration relates to cost. There must be a cost advantage as compared to the existing logistics system. A more environmentally friendly logistics alternative will be attractive to many shippers as they work to fulfill their increasing corporate sustainability goals – but we need to assume that the core cost, reliability frequency and transit time requirements must be met. There will be a variation among shippers/commodity types in terms of their focus on reliability and frequency requirements. Even with that, in the beginning there will be an element of inertia with supply chain managers making affirmative decisions to take risks that are associated with change.



For the railroad companies, there are a roster of very different considerations that are necessary for an intermodal system in California to be considered as successful. From an investment perspective, the project will need to meet internal risk and profitability hurdles. Railroad companies will likely be concerned about capital investment requirements that may be required to support the start of such a project, for rolling stock, for intermodal facility assets and for supporting transport and other infrastructure. It may be that the project could be seen as working effectively from an operational perspective, but that the project is perceived as too-risky in the early stages. It may be entirely appropriate for consideration of government or allied private co-investment to support and de-risk the project. If the project could operate as profitable, a range of operational considerations will be important; the ability to leverage existing capital investment, the confidence and pace of acquiring new business, the impact on overall system operations and methods for management capacity. In the end, the project must be seen as not negatively impact existing core transcontinental services.



Preliminary Business Model Feasibility Analysis – A Preliminary Business Model Analysis (PBM) was created to develop an understanding for whether there were the fundamental conditions to support an inland port project in California. The PBM was built to establish whether there could be project viability from a cost and mode transit time perspective. The PBM created a platform to compare the metrics for the current truck-dominated logistics system against a new intermodal rail system.

The Market Shed area covers a region that is about 425 miles long and about 100 miles wide, or a territory of over 40,000 square miles. Understanding that because of the long distances and the linear orientation of the Market Shed area, it may be challenging to serve all of the district with intermodal location, so for model testing purposes, the analysis tested three different scenarios 1) a system with one intermodal stop, 2) a system with two intermodal stops and 3) a system with three intermodal stops.

For each of the scenarios a range of costs were calculated to compare the costs for trucking against the cost for a new intermodal rail service. These calculations are produced with fact information and some assumptions, but it should provide a good guidepost of generally viability. As described above, a more developed business model would need to be produced if it were determined that there is justification to advance the project. These cost factors were considered in this comparison:

- **Port and Central Valley Intermodal Lift Cost**
- **Port Rail Switch and Alameda Corridor Fee**
- **Rail Line Haul Cost**
- **Provision for Operator/Investor Profit**
- **Cost of Local Dray to Intermodal Facility**
- **PierPass Cost**
- **Anticipated Clean Truck Fee**

> The modelled intermodal scenarios were produced only for general time and cost testing purposes and to demonstrate the best possible project economics, were based solely on proximity to the largest concentrations/volumes of both inbound and outbound cargo. Further detail on market concentrations is provided in Appendix A. No specific sites or properties were considered or reviewed at this stage evaluation as that would be inappropriate without first proving general viability. If the Inland Port project is proven to be viable, options for intermodal site locations would be reviewed by a combination of the following: 1) detailed market testing to assess cost advantage and pricing structure, and 2) a site selection process would be undertaken by the railroad company(ies) including a detailed site suitability analysis would be performed using a set of rail industry criteria to find the optimal sites, including access to existing rail infrastructure, site dimensions, approach road infrastructure, neighboring uses, etc. It should also be noted that the locations for such facilities would vary depending on which rail line (UPRR and BNSF) was under review. It may be that there could be various locations if there were assets developed on each rail line.

It should be noted that the scenarios/map positions modelled below are relatively the cargo epicenters of each respective cargo region area. As noted above, it is likely that in the case of the Inland Port project advancing to the next step, that a practical evaluation of specific sites would be undertaken. It is likely that specific intermodal locations would be reviewed somewhere within a 50-mile radius from the cargo epicenter, as indicated in this map.

The following summarizes the assumptions and test results from each of the scenarios. Further detail is provided in the Appendix B.

<u>Three-Stop Scenario</u> – With Intermodal Facilities in the North, Central and South Regions. In this scenario, the North Region model point was Lathrop which is the central point of the 50-mile radius cargo epicenter

which supports cargo coming from/to the Bay Area, the Sacramento region and the northern portion of the Central Valley. A Fresno-area model point was used in the Central Region and a Shafter-Bakersfield model point was used in the South Region. This provides for maximum distances from each facility which will be important to the railroad operator's project economics.
Intermodal Model Point Locations: Lathrop (Union Pacific) and Manteca (BNSF), Fresno and Shafter
Intermodal Facility Spacing: 120 miles Lathrop to Fresno; 110 miles Fresno to Shafter
Modelled Market Origin Point: Truck Dray – 70 Miles

	North Region	Central Region	South Region
Truck Cost/Box	$ 1635	$ 1044	$ 678
Rail-Related Cost/Box	$ 1084-1233	$ 939-1054	$ 831-970
Net Differential/Box	$ +402 - 551	$ -10 - +105	$ -153 - 292

Overall Performance – With the assumption of three intermodal facilities, this allows placement in locations that are geographically spaced (120 and 110 miles) and providing maximum market proximity and relatively short truck-to-intermodal distances. The Model demonstrates that the San Pedro to North Region route performs well, with a positive per container box net differential at $ +551 on the Union Pacific line and $ +402 on the BNSF line. Given the large geographic size of the North Region, economic performance would vary somewhat depending on exact location, but the net differential per box would remain positive within the 50-mile radius zone mentioned above. In this scenario, the Central Region produces a near-break-even performance $ +105 on the Union Pacific line and $ -10 on the BNSF line. In this model, the South Region does not perform well, with the per box container differential ranging from $ -153 (Union Pacific) to $-292 (BNSF). It is entirely possible though that the intermodal service operator would seek to compete for South Region business via load management and pricing.

Two-Stop Scenario – With Intermodal Facilities in the North and the South Regions. In this scenario, the North Region location remains due to the very high volumes in the North Region's market catchment area and the second facility location is moved south of Fresno to provide for an optimized consolidation of the South and Central Regions. It would be expected that there would be some market from the South Region markets (especially north of Bakersfield), but this would be tempered by the required northbound truck dray to the intermodal location.
Intermodal Model Point Locations: Lathrop (Union Pacific) and Manteca (BNSF), and Tulare
Intermodal Facility Spacing: 160 miles Lathrop to Tulare
Modelled Market Origin Point: Average Dray – 70 Miles (North Region); 120 Miles Central/South Region

	North Region	Central/South Region
Truck Haul Cost/Box	$ 1635	$1044
Rail-Related Cost/Box	$ 1084-1233	$892-1024
Net Differential/Box	$ +402 - 551	$ +20 - 152

Overall Performance – The Two-Stop Scenario requires that service planning place the intermodal facilities in strategic locations, so as to maximize the capture of cargo. In this scenario, the North Region's model point was maintained to assure maximum coverage for this rich market shed. For the second intermodal facility, the model assumed that the facility location moves southward from Fresno toward Tulare to provide a more comprehensive market coverage – allowing for a longer internodal facility-to-facility rail travel distance (160 miles) and for strategic acquisition of the Central and South Regions. In this scenario, the North Region performs well, and in the Central/South Region near breakeven or better with a per container box differential of $ +$20 (BNSF line) and $ +152 (Union Pacific line). As described above, the model points are references for this early analysis, but if the project were to advance to a detailed business model, substantial work would be undertaken to determine the most appropriate location from a market acceptance perspective and importantly from a practical siting perspective.

<u>One-Stop Scenario</u> – In this scenario, the intermodal model point is located in the North region due to the disproportionally large market volumes that exist from/to the Bay Area, the Sacramento region and Central Valley metro markets including San Joaquin, Stanislaus and Merced Counties. Depending on final location, this scenario would be expected to capture market volume from as far as Fresno, but acquisition from locations in this direction would be tempered by the required northbound truck dray to the intermodal location.
Intermodal Model Point Location: Lathrop (Union Pacific) and Manteca (BNSF)
Intermodal Facility Spacing: N/A
Modelled Market Origin Point: Average Dray – 70 Miles (northern sub-market); 120 Miles (southern sub-market)

	North Region
Truck Haul Cost/Box	$ 1635
Rail-Related Cost/Box	$ 1084 – 1233
Net Differential/Box	$ +402 - 551

Overall Performance – In general, a One-Stop Scenario represents the practical and significant challenges for positioning an intermodal facility to serve the 425-mile-long Market Shed area. In order to acquire the largest volume flow, it would be logical to position the intermodal facility in the North Region area where the market is largest. In this location, the rail haul distances are long enough to provide for a highly competitive service versus truck. There is a question regarding how much volume acquisition could be expected from locations in the Central Region, given in the instance of inbound flows, that the cargo would need to travel north to the intermodal facility and then south toward San Pedro. In this scenario, cargo would be expected from at least portions of the Central Region, therefore the truck dray model demonstrates a longer 120-mile range. In this scenario no cargo would be expected from the South Region market as the distances would be too far to make economic sense. Given these parameters, in this scenario, the Model performs well with a per container box differential of $ +$402 (BNSF line) and $ +551 (Union Pacific line). As stated above, the precise location of an intermodal facility would be reviewed during the more detailed business modelling that would follow.

Summary of Scenario Analysis - In comparing the three scenarios, an interim conclusion can be reached that that the Two-Stop scenario with a market penetration rate of at least 20% could yield a viable project. With more refined analytics forthcoming in the Developed Business Model, we can provisionally assume that, from the perspective of market coverage and net cost per container box, the above analysis summary illustrates that the Two-Stop scenario represents the optimal strategy option. This scenario has the potential to demonstrate a substantial positive performance profile from a per-container box cost comparison perspective. As compared to the Three-Stop scenario, the Two-Stop scenario yields: 1) somewhat longer travel distances between intermodal stations which supports rail operational efficiency, and 2) by the ultimate siting of intermodal assets, can offer optimized market access to most or all of the Market Shed.

There are meaningful cost model differences between the BNSF and UPRR rail alignments, in that the BNSF route through Barstow is longer than the UPRR route via Mohave. This extra distance adds cost and time. With that said, the direct rail transport costs are but one element of an overall rate offering to the market, with fee and handling charges at the intermodal points.

Transportation Infrastructure Considerations – It is not envisioned that an intra-state intermodal service would require investment in wholly new railroad track rights-of-way, rather it is assumed that this service could be accommodated on the existing main line railroad tracks. With that said and acknowledging that no specific locations have been identified at this point, the Inland Port concept would require investment in new intermodal rail facilities in one or more locations. Correspondingly, there would be a requirement for some roadworks investment to provide for access to a(n) intermodal facility(ies). It is likely that the State would need to contribute funding projects to support this evolution in the overall transportation system.

Transit Time Comparison – Comparing the transit time between truck and rail, in this instance truck will outperform rail. Truck movements may see delays due to daily traffic congestion or in the case of a traffic accident. As traffic conditions are variable, these delays are sometimes unforeseen and can cause supply chain management challenges. In most cases though, in planning trucking movements supply chain managers build-in enough transit time cushion to allow for these delays, but generally all-in transit times will require between 4.5 hours and 9.5 hours, depending on the origin or destination point in the Central Valley or the Bay Area. These transit time calculations primarily include highway travel time and port dwell time at arrival/departure. In the case of an intermodal rail movement, the transit time is projected to require between 28 to 39 hours, depending on location and the number of intermodal stops. Rail transit times assume time at the intermodal station for loading and unloading cargo and time to maneuver through each railroad yard's yards at Mohave or Barstow. If there is potential for trains carrying all California-market intermodal cargo, there could be a possibility to reduce this time somewhat by reducing time at Mohave or Barstow, but that would depend on a range of railroad operational factors. Market migration from truck to rail would likely be oriented to shippers and cargo that are less sensitive to higher velocity transportation requirements and can tolerate some extra shipping time.

Train Frequency Potential – Below is an illustration of the volume and corresponding numbers of trains that would result from a range of market penetration levels. If 10% of the market were to switch from truck to intermodal rail, then there would be approximately 3 trains per week or 181 trains annually in each direction. If there were a 30% market penetration, then there would be demand for approximately 10 trains per week or 542 trains per year. The following table describes the potential train frequency that would be created in the three-stop scenario. These calculations assume scenarios that trains will run as full unit trains carrying 250 containers.

Market Penetration Scenario	**Import Container Volumes (Northbound)**	**Northbound Trains Per Year**	**Northbound Trains Per Week**	**Export Container Volumes (Southbound)**	**Southbound Trains Per Year**	**Southbound Trains Per Week**
Total	**253,099**	**Year**	**Week**	**219,525**	**Year**	**Week**
@30%	75,930	538	10	65,858	470	9
@20%	50,620	362	7	43,905	314	6
@10%	25,310	181	3	21,953	157	3

Going forward there is a significant work to do to develop a more detailed and refined Developed Business Model (DBM). This would consider a range of operational rail factors including: the location and the number of intermodal stop locations, rail system alignment/location, capacity, operational characteristics including headways, dwell times at the intermodal stop(s), equipment availability for chassis, container boxes, and intermodal well-cars. The function and existing and planned assets will need to be considered at the existing intermodal facilities and at Barstow, Delano, Mohave.

From a market and competitiveness requirement perspective, the Developed Business Model would factor in specific intermodal transit freight rates which would define the specific pricing comparison versus the existing truck system that exists currently. The DBM would consider how cost inputs and pricing would evolve over future years to account for cost trajectories in terms of labor, taxation/operating fees and fuel. The DBM would also illustrate a more detailed sensitivity analysis regarding train frequencies, transit times and match back coordination.

From a ports perspective, the DBM would need to have a fairly specific on-port rail system proposition to support an efficient system for the assembly of trains and for the offloading of containers for delivery to various marine terminals.

The DBM would yield a relatively firm pricing advantage proposition that would allow for the acquisition of definitive market commitments.

Emission Reduction Analysis - The emissions reduction analysis was based upon Transearch data which detailed 2017 volumes routed along truck corridors throughout the subject region. The mileage, number of trucks annually and corridors were broken out at the county level with start and end points as shown in Appendix B.

The San Joaquin Valley Air Pollution Control District (SJVAPCD) calculated the estimated emissions reductions that would result by the transfer of freight from truck to rail, made possible by the proposed central valley intermodal rail service. The emissions reduction was estimated using EMFAC2017 which is the latest emissions inventory model that calculates emissions inventories for motor vehicles operating on roads in California. EMFAC2017 represents the next step forward in the ongoing improvement process for EMFAC and reflects the CARB's current understanding of how vehicles travel and how much they pollute.

Truck Shipment Emissions
The following assumptions were modelled: 2010 or newer diesel trucks, model HHDT, travelling 55 miles per hour were selected for this analysis
Pollutants: The EMFAC model can be used to estimate emissions of criteria air pollutants, greenhouse gas emissions, and mobile source air toxics. For this analysis, the following pollutants were included: Particulate Matter (PM10), Carbon Monoxide (CO), Nitrogen Oxides (NOx), Volatile Organic Compounds (VOC), and Greenhouse Gases (GHG) including Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O). GHG emissions were provided in CO_2 equivalent (CO_2e). Refueling emissions were not included in the truck emissions calculations, since those emissions are typically assigned to fueling stations, rather than vehicles.

Rail Shipment Emissions

To estimate the emissions that might be associated with replacing truck trips with rail, line haul locomotive emission factors in terms of grams per gallon representative of the mix of the locomotive fleet in 2010 were used. The core assumptions for these calculations were for full trainloads of 250 truckloads per train, travelling at 55 miles per hour. EPA line haul emission factors for Tier 2 and 3 were used for this calculation. See Appendix C for the background data calculations.

Emissions Reduction

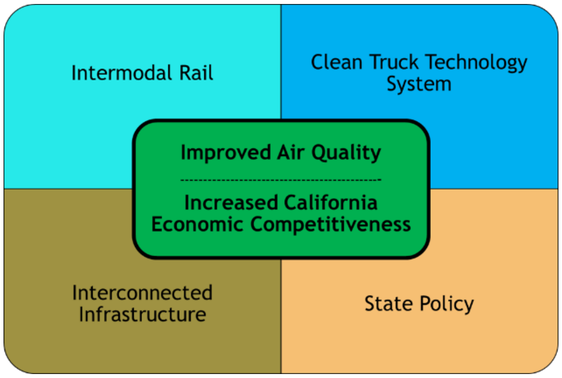
Based upon this analysis, NOx emissions would be reduced by up to 83% while greenhouse gas emissions would be reduced by up to 93%. Moving large quantities of freight via rail provides significant benefits to the air quality of the region and additionally, by removing some of these trucks from the public roadway, congestion on key transportation corridors such as Highways SR-101, SR-99 and I-5 will be reduced, thereby improving the flow of traffic and the safety of the roadways in this region. Based on the total annual reduction of emissions as shown below, the proposed central valley intermodal rail service would provide a significant reduction in annual emissions.

Pollutant	Reduction (tons)	Reduction (%)
NOx	960.88	84.13%
SOx	2.22	92.25%
VOC	18.42	79.47%
PM10	6.94	70.31%
CO	4.16	8.15%
CO2	215,229.49	93.01%
CH4	0.55	55.80%
N2O	35.04	96.35%
CO2e	225,686.51	93.16%

Interaction and Coordination with Railroad Companies – This project was initiated by public and civic organizations due to the dramatic public policy implications associated with more efficient and streamlined logistics. An inland port system would yield significant and positive impacts for improved air quality, improved economic development competitiveness and reduction in public roadway congestion and wear and tear. With that said, it is fully understood that the public does not own nor control rail infrastructure, nor does it operate logistics/transportation services. For an inland port project to succeed in California, the incumbent Class One railroad companies will need to support the concept and adopt it into their business strategy. In terms of this analysis, there was communication with both the Union Pacific and the BNSF Railroad companies.

Parties Involved in the Project To-Date – The CIPFA was directly supported by the following entities: Central Valley Community Foundation, San Joaquin Air Pollution Control District, South Coast Air Quality Management District, Port of Long Beach, Port of Los Angeles, Madera, Fresno and Merced counties, and the City of Fresno. A number of other jurisdictions participated in project overview consultations, including Sacramento, San Joaquin, Stanislaus and Kern counties.

Rail-Only or Multifaceted Model? – Understanding that the State of California and its local government partners have overall objectives to improve air quality and increase the viability for economic development in the Central Valley region, the Inland Port could be seen as the platform to support those objectives. Other states have initiated projects with wider inland port intentions – around sustainable development, and economic development. For example, the State of Utah has established an Inland Port Authority that is charged with developing infrastructure and supporting economic development throughout the state. Their work is being developed on a platform of supporting clean energy transportation, developing inland port facilities in a globally-leading environmentally friendly manner – all wrapped in an overall plan to support economic development.



Conclusions and Next Steps - Historically there has been an acknowledgement that there is a critical need for a more effective goods movement system for the Central Valley of California. Current container-on-truck method used to transport goods between Valley consumption and production centers and seaports is highly inefficient, resulting in increased costs and air pollution.

- I-5 and SR-99 carry up to 80,000 trucks per day, many traveling to San Pedro port's complex
- Lack of local Valley container storage facility necessitates empty containers be picked up from and returned to seaport locations (doubles needed trips)
- Regulations on truck operators limit shipping distance

Development of an inland port near the agricultural and industrial hubs of Valley could greatly reduce amount of truck traffic and associated emissions on Valley highways, by allowing goods to be shipped via railway instead of on heavy-duty trucks.

A Central Valley inland port would also support new job creation and investment growth by fundamentally repositioning the economic competitiveness of the Central Valley region. With a more robust and efficient distribution system and direct rail service to and from the deep-water seaports, shipping costs for shippers that manage global supply chains would be reduced and the Central Valley would become much more attractive to high-value manufacturing sectors.

This study builds upon past studies but expands that view to reflect the large amount of consumer distribution activity that emanates to and from the North Central Valley Market Shed of the Bay area counties of Alameda, San Francisco, Santa Clara and San Mateo.

Key conclusions include:

- A robust inbound and outbound Market Shed exists with volumes that could support intermodal rail service
- There would be significant environmental benefits for the region
- A preliminary business model that suggests a California inland port rail system is viable; but dependent upon a range of issues, a more detailed analysis is needed for the project to move forward
- It is important to more substantially engage the railroad companies to jointly assess and review options

- This is a complex project that would have a range of positive impacts throughout the State of California
- To support project implementation and to fully support State environmental, transportation and economic objectives, it is important that the State of California be an active participant in the project. It would be expected that the following State agencies would be involved: 1) the California Air Resources Board (CARB), 2) the Governor's Office of Business and Economic Development, 3) the California Department of Transportation (DOT), Caltrans and the Governor's Office of Planning and Research.

Next Steps: To advance the Inland Port business model, additional analyses will be required with two channels of work which would occur simultaneously: 1) proceed to the next stage on the Inland Port Developed Business Model, and supporting that 2) work to refine and develop the user-market; resulting in clarity about specific-user commitments and user class interest in the intermodal rail option. This would be done in coordination with the two Class One railroad companies and when complete would provide the basis to launch a formal project proposition with the railroad companies. Specifically, the next stage of work will:

- Define shipper-sector market requirements and specific user interest and business commitments for an intermodal rail service; this will be done by setting parameters for a myriad of factors including: intermodal locations, freight haul rates, service frequency and transit time.
- Via a market location sensitivity analysis, define optimal locations for intermodal locations to provide for the highest level of market acquisition
- Assess the level of direct capital cost requirements for intermodal ramps and associated track requirements, and for indirect capital costs for associated road and utility works at and to/from the site(s)
- Develop a detailed operational financial model, taking into consideration costs and revenues
- Produce a transportation system and environmental impact evaluation, taking into consideration more specific projected levels of truck traffic reduction
- Prepare specific recommendations in the context of a business proposition for both the railroad companies and the State for actions and investment

Given the size of the State and recognizing the complexity of a project like this, it is also important to coordinate with the many government and civic bodies that have a stake in the outcome. The next stage of work must produce a formal interface between these players, to share information and gain feedback. It is recommended that an Inland Port Executive Advisory Committee be established to provide for contribution and interface with counties, air quality districts and councils of governments.

Going forward from this point, the main objectives will be to have advanced the project to a stage where the railroad companies can react to a specific business proposition, with allied demonstrations of business support. Given that we have now developed a clear understanding of the extent and shape of the market envelope and tested the cost comparisons rail versus truck, we can proceed to the Developed Business Model stage.

The initial work on this project has been funded and led by a consortium of regional and local government and civic entities, business leaders and port organizations. It is an appropriate time for the State to begin to play a leadership role. By changing the way that freight moves in California, a successful California Inland Port will have dramatic statewide economic and environmental implications. Over several decades, systemic goods movement change has been studied and debated with no resolution. The situation has become critical for both the issues of emissions and congestion, all of which is affecting the economic competitiveness of the State and particularly in portions of the State that have lagged in economic growth. The California Inland Port offers a viable option but requires the support and influence of the State to move it forward. By the very nature of the situation, there is no party in charge of bringing a project like this together. Due to the size and complexity of California, the Inland Port will not occur without State leadership and involvement.

Track 1

Brief State of California Leadership and Achieve Common Plan/Approach

Create Developed Business Model

Parties Involved: State of California, Ports, Railroads, Ocean Carriers, 3PLs, GLDPartners

Objective: Produce business model for working Inland Port project

Duration: 9-12 months

- Complete Developed Business Model
  - In partnership with railroads and ports
  - Rail operational requirements including equipment
  - Haul-rate refinement
  - Sites, location modelling and due diligence, future hub(s)
- Create Project Delivery Plan
  - Define State role
  - Develop project financial plan
    - Define and create support for State/Federal funding
    - Recommend PPP options as required
- Environmental
  - Produce final impact analysis
  - Develop SMART inland port environmental delivery plan
- Define Needed State Policy/Legislative Initiatives
- Create Executive Advisory Committee to provide for contribution and interface with counties, air quality districts and councils of governments

Track 2

Launch Market Development Plan

Parties Involved: Ports, GLDPartners, GoBiz

Objectives: Gain user-specific soft commitments and developed user-class interest in products-specific Inland Port service

Duration: 5-6 months

- Focus on both inbound and outbound markets
- Main markets: agricultural products, food products, and consumer goods distribution

Appendix A – Market

Appendix A-1 Import/Export TEUs by County

Loaded Import & Export TEUs Via PoLB/PoLA and Oakland to Bay Area & Central Valley

Region	Import TEUS		Export TEUs		Total TEUs		Total 3 Ports
	LA/LB	Oakland	LA/LB	Oakland	LA/LB	Oakland	
Bay Area	210,219	106,683	149,018	22,304	359,237	128,987	**488,224**
North Valley	79,037	25,303	101,867	36,684	180,904	61,987	**242,891**
Middle Valley	61,829	18,509	107,683	42,816	169,512	61,325	**230,837**
South Valley	42,541	5,288	54,569	29,686	97,110	34,974	**132,084**
Total	**393,626**	**155,783**	**413,137**	**131,490**	**806,763**	**287,273**	**1,094,036**

Loaded Import & Export TEUs Via PoLB/PoLA and Oakland to Bay Area & North Valley

County	Import TEUS		Export TEUs		Total TEUs		Total 3 Ports
	LA/LB	Oakland	LA/LB	Oakland	LA/LB	Oakland	
Alameda	41,749	36,540	38,556	9,072	80,305	45,612	125,917
San Francisco	25,549	26,041	24,115	4,279	49,664	30,320	79,984
San Mateo	41,837	12,328	28,859	3,823	70,696	16,151	86,847
Santa Clara	101,084	31,774	57,488	5,130	158,572	36,904	195,476
Total Bay Area	**210,219**	**106,683**	**149,018**	**22,304**	**359,237**	**128,987**	**488,224**
Sacramento	39,361	15,061	22,541	7,054	61,902	22,115	84,017
San Joaquin	18,157	3,886	49,468	7,690	67,625	11,576	79,201
Stanislaus	21,519	6,356	29,858	21,940	51,377	28,296	79,673
Total North Valley	**79,037**	**25,303**	**101,867**	**36,684**	**180,904**	**61,987**	**242,891**
Total North Region	**289,256**	**131,986**	**250,885**	**58,988**	**540,141**	**190,974**	**731,115**

Loaded Import & Export TEUs
Via PoLB/PoLA and Oakland to Middle & South Valley Zones

County	Import TEUS		Export TEUs		Total TEUs		Total 3 Ports
	LA/LB	Oakland	LA/LB	Oakland	LA/LB	Oakland	
Merced	8,240	2,749	16,621	2,716	24,861	5,465	30,326
Madera	5,346	1,013	12,031	3,593	17,377	4,606	21,983
Fresno	31,813	11,363	29,322	16,126	61,135	27,489	88,624
Tulare	16,430	3,384	49,709	20,381	66,139	23,765	89,904
Total Central Valley	**61,829**	**18,509**	**107,683**	**42,816**	**169,512**	**61,325**	**230,837**
Kings	7,108	3,168	23,600	8082	30,708	11,250	41,958
Kern	35,433	2,120	30,969	21,604	66,402	23,724	90,126
Total South Valley	**42,541**	**5,288**	**54,569**	**29,686**	**97,110**	**34,974**	**132,084**

Appendix B – Preliminary Business Model

Appendix B-1 Assumptions

For Truck vs. Rail Per Container Cost Comparisons:

Modelled Stop Locations:	Scenario	Locations
	3 Stop	Lathrop/Manteca + Fresno + Shafter
	2 Stop	Lathrop/Manteca + Tulare
	1 Stop	Lathrop/Manteca

- Rail linehaul cost @ $1.00 per mile
- Port terminal & CV intermodal rail ramp costs combined into one line - item
- Alameda Corridor & PHL rail switch costs combined into one line-item
- Trucking costs include chassis rental @ $35 per day and fuel surcharge @ 25% (this item can vary greatly from day to day)
- Assumed 70 mi. and 120 mi. (in 1-stop example) truck rate radius
- Assumed 20% profit margin additive to rail-related operational costs; trucking rates are inclusive of profit

For Truck vs. Rail Transit Time Cost Comparisons:

- For rail transit time: assumed UP and BNSF track miles @25 mph avg.(conservative) + conservative 10 hrs switching into individual port terminals + full 8-hour shift to load/unload trains @ individual port terminals (this last may vary if less than 250 containers/train)
- Added 2hrs to rail transit time for each additional stop to assume switch and hook container well car volumes onto unit train
- For truck transit time assumed 45 mph avg.(conservative, incl road congestion) + 1.5 hours avg. waiting/processing at port terminals

Appendix B-2 Preliminary Business Model – Three Stop Scenario

3-Stop Scenario: Central Valley Market Areas	North Region			Middle Valley			South Valley		
Cost Items Per Container:	Truck	Rail UP	Rail/BNSF	Truck	Rail UP	Rail BNSF	Truck	Rail UP	Rail BNSF
Port + Central Valley Intermodal Rail Lifts		$210	$210		$210	$210		$210	$210
Port Rail Switch + Alameda Corridor Fee		58	58		58	58		58	58
Rail Line Haul Cost $1/mile (Lathrop/Manteca + Fresno + Shafter)		414	538		293	364		203	319
Subtotal: Rail Cost		682	806		561	632		471	587
Subtotal + 20% Profit		$818	$967		$673	$758		$565	$704
Local dray to/from Central Valley Rail Ramp (70 mi)		266	266		266	266		266	266
Total CV by Rail to LA/LB Terminals		**$1,084**	**$1,233**		**$939**	**$1,024**		**$831**	**$970**
Trucking Rate From to LA/LB Terminals (from N-San Jose/M-Tulare/S-Shafter)	1473			882			$516		
PierPass Charge (where applicable)	142			142			142		
Clean Truck Fee (Placeholder)	20			20			20		
Total CV by Truck to LA/LB Cost	**$1635**			$1,044			**$678**		
Cost Advantage Rail vs. Truck		**$551**	**$402**		**$105**	**$20**		**$153**	**$292**

GLDPARTNERS

Appendix B-3 Preliminary Business Model - 2 Stop Scenario

2-Stop Scenario: Central Valley Market Areas	North Region			Middle Valley		
Cost Items Per Container:	Truck	Rail UP	Rail/BNSF	Truck	Rail UP	Rail BNSF
Port + Central Valley Intermodal Rail Lifts		$210	$210		$210	$210
Port Rail Switch + Alameda Corridor Fee		58	58		58	58
Rail Line Haul Cost $1/mile (Lathrop/Manteca+Tulare)		414	538		254	364
Subtotal: Rail Cost		682	806		522	632
Subtotal + 20% Profit		$818	$967		$626	$758
Local dray to/from Central Valley Rail Ramp (70 mi)		266	266		266	266
Total CV by Rail to LA/LB Terminals		**$1,084**	**$1,233**		**$892**	**$1,024**
Trucking Rate From to LA/LB Terminals (from N-San Jose/M-Tulare)	1473			882		
PierPass Charge (where applicable)	142			142		
Clean Truck Fee (Placeholder)	20			20		
Total CV by Truck to LA/LB Cost	**$1635**			$1,044		
Cost Advantage Rail vs. Truck		$551	$402		$152	$20

Appendix B-4 Preliminary Business Model – 1 Stop Scenario

1-Stop Scenario: Central Valley Market Areas	North Region		
Cost Items Per Container:	Truck	Rail UP	Rail/BNSF
Port + Central Valley Intermodal Rail Lifts		$210	$210
Port Rail Switch + Alameda Corridor Fee		58	58
Rail Line Haul Cost $1/mile (Lathrop/Manteca)		414	538
Subtotal: Rail Cost		682	806
Subtotal + 20% Profit		$818	$967
Local dray to/from Central Valley Rail Ramp (120 mi)		416	416
Total CV by Rail to LA/LB Terminals		**$1,234**	**$1,383**
Trucking Rate From to LA/LB Terminals (from N-San Jose)	1,473		
PierPass Charge (where applicable)	142		
Clean Truck Fee (Placeholder)	20		
Total CV by Truck to LA/LB Cost	$1,635		
Cost Advantage Rail vs. Truck		$401	$252

Appendix B-5 – Train Frequency – 3 Stop Scenario

North Region Intermodal Train Frequency Potential Market Penetration Sensitivity Analysis (3-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 140 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 140 containers per train	
Total	253,099	year	week	219,525	year	week
@30%	75,930	542	10	65,858	470	9
@20%	50,620	362	7	43,905	314	6
@10%	25,310	181	3	21,953	157	3

Central Valley Region Intermodal Train Frequency Potential Market Penetration Sensitivity Analysis (3-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 70 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 70 containers per train		
Total	54,100	year	week	94,223	year	week	
@30%	16,230	232	4	28,267	404	8	
@20%	10,820	155	3	18,845	269	5	
@10%	5,410	77	1	9,422	135	3	

South Valley Region Intermodal Train Frequency Potential Market Penetration Sensitivity Analysis (3-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 40 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 40 containers per train		
Total	37,224	year	week	49,498	year	week	
@30%	11,167	279	5	14,849	286	5	
@20%	7,445	186	4	9,890	247	5	
@10%	3,722	93	2	4,950	124	2	

Appendix B-6 – Train Frequency – 2 Stop Scenario

North Region Intermodal Train Frequency Potential Market Penetration Sensitivity Analysis (2-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 150 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 150 containers per train	
Total	260,309	year	week	234,068	year	week
@30%	78,093	521	10	70,220	468	9
@20%	52,062	347	7	46,814	312	6
@10%	26,031	174	3	23,407	156	3

South Region Intermodal Train Frequency Potential
Market Penetration Sensitivity Analysis (2-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 100 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 100 containers per train	
Total	84,114	year	week	129,178	year	week
@30%	25,234	252	5	38,753	388	7
@20%	14,150	142	3	25,836	258	5
@10%	8,411	84	2	12,918	129	2

Appendix B-7 – Train Frequency – 1 Stop Scenario

Intermodal Train Frequency Potential
Market Penetration Sensitivity Analysis (1-Stop Scenario)

Market Penetration	Import Container Volumes (Northbound)	Northbound Trains per year & week @ 250 containers per train		Export Container Volumes (Southbound)	Southbound Trains per year & week @ 250 containers per train		
Total	234,259	year	week	216,201	year	week	
@30%	70,278	281	5	64,860	259	5	
@20%	46,852	187	4	43,240	173	3	
@10%	23,426	94	2	21,620	86	2	

Appendix C – Emissions Analysis - Reduction Data

Summary and comparison information prepared by the San Joaquin Air Pollution Control District can be viewed via this link:

Truck v Train
10312019 - BHP Base

Assumptions - Blue cells are editable

Emission Fact	g/bhp-hr	Source
NOx	4.95	EPA-42
SOx	0.0051	Mass B
VOC	0.13	EPA-42
PM10	0.08	EPA-42
CO	1.28	EPA-42
CO2	487	Table 5
CH4	0.013	Table 5
N2O	0.04	Table 5

Conversion Factors	
grams to tons	1.10E-06
grams to metric t	1.00E-06

Pollutan	GWP	Source
CO2	1	40 CFR Part 98 Subpart A, Table A-1; 1(
CH4	25	40 CFR Part 98 Subpart A, Table A-1; 1(
N2O	298	40 CFR Part 98 Subpart A, Table A-1; 1(

Parame	Value
Train Sp	60
No. of l	3
Engine	4000
Load Fa	0.28
Total Tr	3360
Trucks l	250
Locomo	Tier 2+ and Tier 3, Large Line-Haul
Referei	http://www.pc

Calculated Emissions (criteria = tons; GHG = metric tons)

County	Transaction	Entry	Exit	Avg Mi	Trucks/yr	Trains/yr	VMT	Hrs Travel	NOx	SOx	VOC	PM10	CO	CO2	CH4	N2O	CO2e
Sacramento	Exports from OAK	US-50	I-680	93	3,919	16	1,458	24	0.45	0.00	0.01	0.01	0.12	39.76	0.00	0.00	40.76
	Imports thru OAK	I-680	US-50	93	8,367	33	3,113	52	0.95	0.00	0.02	0.02	0.25	84.88	0.00	0.01	87.02
	Exports from LA/LB	US-50	US-101	391	12,522	50	19,584	326	5.98	0.01	0.16	0.10	1.55	534.11	0.01	0.04	547.54
	Imports thru LA/LB	US-101	US-50	391	21,867	87	34,200	570	10.45	0.01	0.27	0.17	2.70	932.70	0.02	0.08	956.15
San Joaquin	Exports from OAK	I-5	I-580	58	4,272	17	991	17	0.30	0.00	0.01	0.00	0.08	27.03	0.00	0.00	27.71
	Imports thru OAK	I-580	I-5	58	2,159	9	501	8	0.15	0.00	0.00	0.00	0.04	13.66	0.00	0.00	14.00
	Exports from LA/LB	I-5	US-101	336	27,482	110	36,936	616	11.29	0.01	0.30	0.18	2.92	1,007.31	0.03	0.08	1,032.64
	Imports thru LA/LB	US-101	I-5	336	10,087	40	13,557	226	4.14	0.00	0.11	0.07	1.07	369.72	0.01	0.03	379.02
Stanislaus	Exports from OAK	S-99	I-580	69	12,189	49	3,364	56	1.03	0.00	0.03	0.02	0.27	91.75	0.00	0.01	94.05
	Imports thru OAK	I-580	S-99	69	3,530	14	974	16	0.30	0.00	0.01	0.00	0.08	26.57	0.00	0.00	27.24
	Exports from LA/LB	S-99	US-101	307	16,588	66	20,370	340	6.22	0.01	0.16	0.10	1.61	555.53	0.01	0.05	569.50
	Imports thru LA/LB	US-101	S-99	307	11,954	48	14,680	245	4.49	0.00	0.12	0.07	1.16	400.34	0.01	0.03	410.41
Merced	Exports from OAK	S-99	I-580	103	1,508	6	621	10	0.19	0.00	0.00	0.00	0.05	16.94	0.00	0.00	17.37
	Imports thru OAK	I-580	S-99	103	1,526	6	629	10	0.19	0.00	0.01	0.00	0.05	17.15	0.00	0.00	17.58
	Exports from LA/LB	S-99	US-101	277	9,234	37	10,231	171	3.13	0.00	0.08	0.05	0.81	279.03	0.01	0.02	286.04
	Imports thru LA/LB	US-101	S-99	277	4,578	18	5,072	85	1.55	0.00	0.04	0.03	0.40	138.34	0.00	0.01	141.81
Madera	Exports from OAK	S-99	I-580	144	1,996	8	1,150	19	0.35	0.00	0.01	0.01	0.09	31.35	0.00	0.00	32.14
	Imports thru OAK	I-580	S-99	144	561	2	323	5	0.10	0.00	0.00	0.00	0.03	8.81	0.00	0.00	9.03
	Exports from LA/LB	S-145	US-101	247	6,684	27	6,604	110	2.02	0.00	0.05	0.03	0.52	180.10	0.00	0.01	184.63
	Imports thru LA/LB	US-101	S-145	247	2,970	12	2,934	49	0.90	0.00	0.02	0.01	0.23	80.03	0.00	0.01	82.04
Fresno	Exports from OAK	S-180PI	I-580	165	8,959	36	5,913	99	1.81	0.00	0.05	0.03	0.47	161.26	0.00	0.01	165.31
	Imports thru OAK	I-580	S-180PF	165	6,313	25	4,167	69	1.27	0.00	0.03	0.02	0.33	113.63	0.00	0.01	116.49
	Exports from LA/LB	S-41	US-101	217	16,289	65	14,139	236	4.32	0.00	0.11	0.07	1.12	385.59	0.01	0.03	395.29
	Imports thru LA/LB	US-101	S-41	217	17,673	71	15,340	256	4.69	0.00	0.12	0.08	1.21	418.36	0.01	0.03	428.88
Tulare	Exports from OAK	S-63	I-580	215	11,322	45	9,737	162	2.98	0.00	0.08	0.05	0.77	265.55	0.01	0.02	272.22
	Imports thru OAK	I-580	S-63	215	1,879	8	1,616	27	0.49	0.00	0.01	0.01	0.13	44.07	0.00	0.00	45.18
	Exports from LA/LB	S-137	US-101	178	27,615	110	19,662	328	6.01	0.01	0.16	0.10	1.55	536.22	0.01	0.04	549.70
	Imports thru LA/LB	US 101	S-137	178	9,128	37	6,499	108	1.99	0.00	0.05	0.03	0.51	177.24	0.00	0.01	181.70
Kings	Exports from OAK	S-198	I-580	191	4,499	18	3,437	57	1.05	0.00	0.03	0.02	0.27	93.74	0.00	0.01	96.10
	Imports thru OAK	I-580	S-198	191	1,760	7	1,345	22	0.41	0.00	0.01	0.01	0.11	36.67	0.00	0.00	37.59
	Exports from LA/LB	S-41	US-101	193	13,111	52	10,122	169	3.09	0.00	0.08	0.05	0.80	276.04	0.01	0.02	282.98
	Imports thru LA/LB	US-101	S-41	193	3,949	16	3,049	51	0.93	0.00	0.02	0.02	0.24	83.14	0.00	0.01	85.23
Kern	Exports from OAK	S-58	I-580	269	12,002	48	12,914	215	3.95	0.00	0.10	0.06	1.02	352.19	0.01	0.03	361.05
	Imports thru OAK	I-580	S-58	269	1,178	5	1,268	21	0.39	0.00	0.01	0.01	0.10	34.57	0.00	0.00	35.44
	Exports from LA/LB	S-58	US-101	115	17,205	69	7,914	132	2.42	0.00	0.06	0.04	0.63	215.84	0.01	0.02	221.27
	Imports thru LA/LB	US-101	S-58	115	19,684	79	9,055	151	2.77	0.00	0.07	0.04	0.72	246.94	0.01	0.02	253.15

Santa Clara	Exports from OAK	I-880	S-238	35	2,850	11	399	7	0.12	0.00	0.00	0.00	0.03	10.88	0.00	0.00	11.16
	Imports thru OAK	S-238	I-880	35	17,652	71	2,471	41	0.76	0.00	0.02	0.01	0.20	67.40	0.00	0.01	69.09
	Exports from LA/LB	I-280	US 101	338	31,938	128	43,180	720	13.19	0.01	0.35	0.21	3.41	1,177.61	0.03	0.10	1,207.22
	Imports thru LA/LB	US-101	I-280	338	56,158	225	75,926	1,265	23.20	0.02	0.61	0.37	6.00	2,070.64	0.06	0.17	2,122.71
Alameda	Exports from OAK	N/A	N/A	16	5,040	20	323	5	0.10	0.00	0.00	0.00	0.03	8.80	0.00	0.00	9.02
	Imports thru OAK	N/A	N/A	16	20,300	81	1,299	22	0.40	0.00	0.01	0.01	0.10	35.43	0.00	0.00	36.32
	Exports from LA/LB	I-580	US-101	356	21,420	86	30,502	508	9.32	0.01	0.24	0.15	2.41	831.85	0.02	0.07	852.77
	Imports thru LA/LB	US-101	I-580	356	23,194	93	33,028	550	10.09	0.01	0.27	0.16	2.61	900.75	0.02	0.07	923.39
San Francisco	Exports from OAK	US-101	I-580	19	2,377	10	181	3	0.06	0.00	0.00	0.00	0.01	4.93	0.00	0.00	5.05
	Imports thru OAK	I-580	US-101	19	14,467	58	1,099	18	0.34	0.00	0.01	0.01	0.09	29.99	0.00	0.00	30.74
	Exports from LA/LB	US-101	US-101	382	13,397	54	20,471	341	6.26	0.01	0.16	0.10	1.62	558.27	0.01	0.05	572.31
	Imports thru LA/LB	US-101	US-101	382	14,195	57	21,690	361	6.63	0.01	0.17	0.11	1.71	591.53	0.02	0.05	606.40
San Mateo	Exports from OAK	S-92	S-238	21	2,123	8	178	3	0.05	0.00	0.00	0.00	0.01	4.86	0.00	0.00	4.99
	Imports thru OAK	S-238	S-92	21	6,489	26	545	9	0.17	0.00	0.00	0.00	0.04	14.87	0.00	0.00	15.24
	Exports from LA/LB	I-280	US 101	371	16,033	64	23,793	397	7.27	0.01	0.19	0.12	1.88	648.88	0.02	0.05	665.20
	Imports thru LA/LB	U-101	I-280	371	23,243	93	34,493	575	10.54	0.01	0.28	0.17	2.73	940.68	0.03	0.08	964.33

Assumptions - Blue cells are editable

Emission Factors (g/mi)		Source
NOx	6.988265456	EMFAC2017
SOx	0.014745457	EMFAC2017
VOC	0.141857415	EMFAC2017
PM10	0.060356483	EMFAC2017
CO	0.312146807	EMFAC2017
CO2	1560.778001	EMFAC2017
CH4	0.00658891	EMFAC2017
N2O	0.245332567	EMFAC2017

Conversion Factors	
grams to tons	1.10E-06
grams to metri	1.00E-06

Global Warming Potentials		Source
CO2	1	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia
CH4	25	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia
N2O	298	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia

EMFAC2017 Inputs	
Datatype	Emission Rates
Region	Statewide
Calendar Year	2019
Season	Annual
Vehicle Category	Heavy Heavy Duty Trucks
Model Year	2010
Speed	55
Fuel	Diesel

Calculated Emissions (criteria = tons; GHG = metric tons)

County	Transaction	Truck Entry	Truck Exit	Average Miles	# of trucks annually	VMT	NOx	SOx	VOC	PM10	CO	CO2	CH4	N2O	CO2e
Sacramento	Exports from OAK	US-50	I-680	93	3,919	364,467	2.81	0.01	0.06	0.02	0.13	568.85	0.00	0.09	595.56
	Imports thru OAK	I-680	US-50	93	8,367	778,131	5.99	0.01	0.12	0.05	0.27	1,214.49	0.01	0.19	1,271.51
	Exports from LA/LB	US-50	US-101	391	12,522	4,896,102	37.72	0.08	0.77	0.33	1.68	7,641.73	0.03	1.20	8,000.48
	Imports thru LA/LB	US-101	US-50	391	21,867	8,549,997	65.86	0.14	1.34	0.57	2.94	13,344.65	0.06	2.10	13,971.14
San Joaquin	Exports from OAK	I-5	I-580	58	4,272	247,776	1.91	0.00	0.04	0.02	0.09	386.72	0.00	0.06	404.88
	Imports thru OAK	I-580	I-5	58	2,159	125,222	0.96	0.00	0.02	0.01	0.04	195.44	0.00	0.03	204.62
	Exports from LA/LB	I-5	US-101	336	27,482	9,233,952	71.13	0.15	1.44	0.61	3.18	14,412.15	0.06	2.27	15,088.76
	Imports thru LA/LB	US-101	I-5	336	10,087	3,389,232	26.11	0.06	0.53	0.23	1.17	5,289.84	0.02	0.83	5,538.18
Stanislaus	Exports from OAK	S-99	I-580	69	12,189	841,041	6.48	0.01	0.13	0.06	0.29	1,312.68	0.01	0.21	1,374.30
	Imports thru OAK	I-580	S-99	69	3,530	243,570	1.88	0.00	0.04	0.02	0.08	380.16	0.00	0.06	398.01
	Exports from LA/LB	S-99	US-101	307	16,588	5,092,516	39.23	0.08	0.80	0.34	1.75	7,948.29	0.03	1.25	8,321.44
	Imports thru LA/LB	US-101	S-99	307	11,954	3,669,878	28.27	0.06	0.57	0.24	1.26	5,727.86	0.02	0.90	5,996.77
Merced	Exports from OAK	S-99	I-580	103	1,508	155,324	1.20	0.00	0.02	0.01	0.05	242.43	0.00	0.04	253.81
	Imports thru OAK	I-580	S-99	103	1,526	157,178	1.21	0.00	0.02	0.01	0.05	245.32	0.00	0.04	256.84
	Exports from LA/LB	S-99	US-101	277	9,234	2,557,818	19.70	0.04	0.40	0.17	0.88	3,992.19	0.02	0.63	4,179.61
	Imports thru LA/LB	US-101	S-99	277	4,578	1,268,106	9.77	0.02	0.20	0.08	0.44	1,979.23	0.01	0.31	2,072.15
Madera	Exports from OAK	S-99	I-580	144	1,996	287,424	2.21	0.00	0.04	0.02	0.10	448.61	0.00	0.07	469.67
	Imports thru OAK	I-580	S-99	144	561	80,784	0.62	0.00	0.01	0.01	0.03	126.09	0.00	0.02	132.01
	Exports from LA/LB	S-145	US-101	247	6,684	1,650,948	12.72	0.03	0.26	0.11	0.57	2,576.76	0.01	0.41	2,697.73
	Imports thru LA/LB	US-101	S-145	247	2,970	733,590	5.65	0.01	0.11	0.05	0.25	1,144.97	0.00	0.18	1,198.72
Fresno	Exports from OAK	S-180PR	I-580	165	8,959	1,478,235	11.39	0.02	0.23	0.10	0.51	2,307.20	0.01	0.36	2,415.51
	Imports thru OAK	I-580	S-180PR	165	6,313	1,041,645	8.02	0.02	0.16	0.07	0.36	1,625.78	0.01	0.26	1,702.10
	Exports from LA/LB	S-41	US-101	217	16,289	3,534,713	27.23	0.06	0.55	0.24	1.22	5,516.90	0.02	0.87	5,775.90
	Imports thru LA/LB	US-101	S-41	217	17,673	3,835,041	29.54	0.06	0.60	0.26	1.32	5,985.65	0.03	0.94	6,266.66
Tulare	Exports from OAK	S-63	I-580	215	11,322	2,434,230	18.75	0.04	0.38	0.16	0.84	3,799.29	0.02	0.60	3,977.66
	Imports thru OAK	I-580	S-63	215	1,879	403,985	3.11	0.01	0.06	0.03	0.14	630.53	0.00	0.10	660.13
	Exports from LA/LB	S-137	US-101	178	27,615	4,915,470	37.87	0.08	0.77	0.33	1.69	7,671.96	0.03	1.21	8,032.13
	Imports thru LA/LB	US 101	S-137	178	9,128	1,624,784	12.52	0.03	0.25	0.11	0.56	2,535.93	0.01	0.40	2,654.98
Kings	Exports from OAK	S-198	I-580	191	4,499	859,309	6.62	0.01	0.13	0.06	0.30	1,341.19	0.01	0.21	1,404.16
	Imports thru OAK	I-580	S-198	191	1,760	336,160	2.59	0.01	0.05	0.02	0.12	524.67	0.00	0.08	549.30
	Exports from LA/LB	S-41	US-101	193	13,111	2,530,423	19.49	0.04	0.40	0.17	0.87	3,949.43	0.02	0.62	4,134.84
	Imports thru LA/LB	US-101	S-41	193	3,949	762,157	5.87	0.01	0.12	0.05	0.26	1,189.56	0.01	0.19	1,245.40
Kern	Exports from OAK	S-58	I-580	269	12,002	3,228,538	24.87	0.05	0.50	0.21	1.11	5,039.03	0.02	0.79	5,275.60
	Imports thru OAK	I-580	S-58	269	1,178	316,882	2.44	0.01	0.05	0.02	0.11	494.58	0.00	0.08	517.80
	Exports from LA/LB	S-58	US-101	115	17,205	1,978,575	15.24	0.03	0.31	0.13	0.68	3,088.12	0.01	0.49	3,233.09
	Imports thru LA/LB	US-101	S-58	115	19,684	2,263,660	17.44	0.04	0.35	0.15	0.78	3,533.07	0.01	0.56	3,698.94

Santa Clara	Exports from OAK	I-880	S-238	35	2,850	99,750	0.77	0.00	0.02	0.01	0.03	155.69	0.00	0.02	163.00
	Imports thru OAK	S-238	I-880	35	17,652	617,820	4.76	0.01	0.10	0.04	0.21	964.28	0.00	0.15	1,009.55
	Exports from LA/LB	I-280	US 101	338	31,938	10,795,044	83.16	0.18	1.69	0.72	3.71	16,848.67	0.07	2.65	17,639.66
	Imports thru LA/LB	US-101	I-280	338	56,158	18,981,404	146.22	0.31	2.97	1.26	6.53	29,625.76	0.13	4.66	31,016.60
Alameda	Exports from OAK	N/A	N/A	16	5,040	80,640	0.62	0.00	0.01	0.01	0.03	125.86	0.00	0.02	131.77
	Imports thru OAK	N/A	N/A	16	20,300	324,800	2.50	0.01	0.05	0.02	0.11	506.94	0.00	0.08	530.74
	Exports from LA/LB	I-580	US-101	356	21,420	7,625,520	58.74	0.12	1.19	0.51	2.62	11,901.74	0.05	1.87	12,460.49
	Imports thru LA/LB	US-101	I-580	356	23,194	8,257,064	63.61	0.13	1.29	0.55	2.84	12,887.44	0.05	2.03	13,492.47
San Francisc	Exports from OAK	US-101	I-580	19	2,377	45,163	0.35	0.00	0.01	0.00	0.02	70.49	0.00	0.01	73.80
	Imports thru OAK	I-580	US-101	19	14,467	274,873	2.12	0.00	0.04	0.02	0.09	429.02	0.00	0.07	449.16
	Exports from LA/LB	US-101	US-101	382	13,397	5,117,654	39.42	0.08	0.80	0.34	1.76	7,987.52	0.03	1.26	8,362.51
	Imports thru LA/LB	US-101	US-101	382	14,195	5,422,490	41.77	0.09	0.85	0.36	1.87	8,463.30	0.04	1.33	8,860.63
San Mateo	Exports from OAK	S-92	S-238	21	2,123	44,583	0.34	0.00	0.01	0.00	0.02	69.58	0.00	0.01	72.85
	Imports thru OAK	S-238	S-92	21	6,489	136,269	1.05	0.00	0.02	0.01	0.05	212.69	0.00	0.03	222.67
	Exports from LA/LB	I-280	US 101	371	16,033	5,948,243	45.82	0.10	0.93	0.40	2.05	9,283.89	0.04	1.46	9,719.74
	Imports thru LA/LB	U-101	I-280	371	23,243	8,623,153	66.43	0.14	1.35	0.57	2.97	13,458.83	0.06	2.12	14,090.68

EMFAC2017 (v1.0.2) Emission Rates
Region Type: Statewide
Region: California
Calendar Year: 2019
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for VMT, g/mile for RUNEX, PMBW and PMTW

Region	Calenda	Vehicle (	Model Year	Speed	Fuel	VMT	ROG_RUNEX	TOG_RUNEX	CO_RUNEX	NOx_RUNEX	SOx_RUNEX	CO2_RUNEX	CH4_RUNEX	PM10_RUNEX	PM2_5_RUNEX	N2O_RUNEX
Statewic	2019	HHDT	2010	55	DSL	156462.223	0.14185742	0.16149387	0.31214681	6.98826546	0.01474546	1560.778	0.0065889	0.060356483	0.057745488	0.24533257

EPA Document EPA-420-F-09-025: Emission Factors for Locomotives

Table 1 - Line-Haul Emission Factors (g/bhp-hr)

	PM_{10}	HC	NO_x	CO
UNCONTROLLED	0.32	0.48	13.00	1.28
TIER 0	0.32	0.48	8.60	1.28
TIER 0+	0.20	0.30	7.20	1.28
TIER 1	0.32	0.47	6.70	1.28
TIER 1+	0.20	0.29	6.70	1.28
TIER2	0.18	0.26	4.95	1.28
TIER 2+ & TIER 3	0.08	0.13	4.95	1.28
TIER 4	0.015	0.04	1.00	1.28

+ INDICATES THAT THESE ARE THE REVISED STANDARDS IN 40 CFR PART 1033

Assumptions - Blue cells are editable

Emission Factors (g/mi)		Source
NOx	6.988265456	EMFAC2017
SOx	0.014745457	EMFAC2017
VOC	0.141857415	EMFAC2017
PM10	0.060356483	EMFAC2017
CO	0.312146807	EMFAC2017
CO2	1560.778001	EMFAC2017
CH4	0.00658891	EMFAC2017
N2O	0.245332567	EMFAC2017

Conversion Factors	
grams to tons	1.10E-06
grams to metric	1.00E-06

Global Warming Potentials		Source
CO2	1	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia
CH4	25	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia
N2O	298	40 CFR Part 98 Subpart A, Table A-1; 100 yr potentia

EMFAC2017 Inputs	
Datatype	Emission Rates
Region	Statewide
Calendar Year	2019
Season	Annual
Vehicle Category	Heavy Heavy Duty Trucks
Model Year	2010
Speed	55
Fuel	Diesel

Calculated Emissions (criteria = tons; GHG = metric tons)

County	Transaction	Truck Entry	Truck Exit	Average Miles	# of trucks annually	VMT	NOx	SOx	VOC	PM10	CO	CO2	CH4	N2O	CO2e
Sacramento	Exports from OAK	US-50	I-680	93	3,919	364,467	2.81	0.01	0.06	0.02	0.13	568.85	0.00	0.09	595.56
	Imports thru OAK	I-680	US-50	93	8,367	778,131	5.99	0.01	0.12	0.05	0.27	1,214.49	0.01	0.19	1,271.51
	Exports from LA/LB	US-50	US-101	391	12,522	4,896,102	37.72	0.08	0.77	0.33	1.68	7,641.73	0.03	1.20	8,000.48
	Imports thru LA/LB	US-101	US-50	391	21,867	8,549,997	65.86	0.14	1.34	0.57	2.94	13,344.65	0.06	2.10	13,971.14
San Joaquin	Exports from OAK	I-5	I-580	58	4,272	247,776	1.91	0.00	0.04	0.02	0.09	386.72	0.00	0.06	404.88
	Imports thru OAK	I-580	I-5	58	2,159	125,222	0.96	0.00	0.02	0.01	0.04	195.44	0.00	0.03	204.62
	Exports from LA/LB	I-5	US-101	336	27,482	9,233,952	71.13	0.15	1.44	0.61	3.18	14,412.15	0.06	2.27	15,088.76
	Imports thru LA/LB	US-101	I-5	336	10,087	3,389,232	26.11	0.06	0.53	0.23	1.17	5,289.84	0.02	0.83	5,538.18
Stanislaus	Exports from OAK	S-99	I-580	69	12,189	841,041	6.48	0.01	0.13	0.06	0.29	1,312.68	0.01	0.21	1,374.30
	Imports thru OAK	I-580	S-99	69	3,530	243,570	1.88	0.00	0.04	0.02	0.08	380.16	0.00	0.06	398.01
	Exports from LA/LB	S-99	US-101	307	16,588	5,092,516	39.23	0.08	0.80	0.34	1.75	7,948.29	0.03	1.25	8,321.44
	Imports thru LA/LB	US-101	S-99	307	11,954	3,669,878	28.27	0.06	0.57	0.24	1.26	5,727.86	0.02	0.90	5,996.77
Merced	Exports from OAK	S-99	I-580	103	1,508	155,324	1.20	0.00	0.02	0.01	0.05	242.43	0.00	0.04	253.81
	Imports thru OAK	I-580	S-99	103	1,526	157,178	1.21	0.00	0.02	0.01	0.05	245.32	0.00	0.04	256.84
	Exports from LA/LB	S-99	US-101	277	9,234	2,557,818	19.70	0.04	0.40	0.17	0.88	3,992.19	0.02	0.63	4,179.61
	Imports thru LA/LB	US-101	S-99	277	4,578	1,268,106	9.77	0.02	0.20	0.08	0.44	1,979.23	0.01	0.31	2,072.15
Madera	Exports from OAK	S-99	I-580	144	1,996	287,424	2.21	0.00	0.04	0.02	0.10	448.61	0.00	0.07	469.67
	Imports thru OAK	I-580	S-99	144	561	80,784	0.62	0.00	0.01	0.01	0.03	126.09	0.00	0.02	132.01
	Exports from LA/LB	S-145	US-101	247	6,684	1,650,948	12.72	0.03	0.26	0.11	0.57	2,576.76	0.01	0.41	2,697.73
	Imports thru LA/LB	US-101	S-145	247	2,970	733,590	5.65	0.01	0.11	0.05	0.25	1,144.97	0.00	0.18	1,198.72
Fresno	Exports from OAK	S-180PR	I-580	165	8,959	1,478,235	11.39	0.02	0.23	0.10	0.51	2,307.20	0.01	0.36	2,415.51
	Imports thru OAK	I-580	S-180PR	165	6,313	1,041,645	8.02	0.02	0.16	0.07	0.36	1,625.78	0.01	0.26	1,702.10
	Exports from LA/LB	S-41	US-101	217	16,289	3,534,713	27.23	0.06	0.55	0.24	1.22	5,516.90	0.02	0.87	5,775.90
	Imports thru LA/LB	US-101	S-41	217	17,673	3,835,041	29.54	0.06	0.60	0.26	1.32	5,985.65	0.03	0.94	6,266.66
Tulare	Exports from OAK	S-63	I-580	215	11,322	2,434,230	18.75	0.04	0.38	0.16	0.84	3,799.29	0.02	0.60	3,977.66
	Imports thru OAK	I-580	S-63	215	1,879	403,985	3.11	0.01	0.06	0.03	0.14	630.53	0.00	0.10	660.13
	Exports from LA/LB	S-137	US-101	178	27,615	4,915,470	37.87	0.08	0.77	0.33	1.69	7,671.96	0.03	1.21	8,032.13
	Imports thru LA/LB	US 101	S-137	178	9,128	1,624,784	12.52	0.03	0.25	0.11	0.56	2,535.93	0.01	0.40	2,654.98
Kings	Exports from OAK	S-198	I-580	191	4,499	859,309	6.62	0.01	0.13	0.06	0.30	1,341.19	0.01	0.21	1,404.16
	Imports thru OAK	I-580	S-198	191	1,760	336,160	2.59	0.01	0.05	0.02	0.12	524.67	0.00	0.08	549.30
	Exports from LA/LB	S-41	US-101	193	13,111	2,530,423	19.49	0.04	0.40	0.17	0.87	3,949.43	0.02	0.62	4,134.84
	Imports thru LA/LB	US-101	S-41	193	3,949	762,157	5.87	0.01	0.12	0.05	0.26	1,189.56	0.01	0.19	1,245.40
Kern	Exports from OAK	S-58	I-580	269	12,002	3,228,538	24.87	0.05	0.50	0.21	1.11	5,039.03	0.02	0.79	5,275.60
	Imports thru OAK	I-580	S-58	269	1,178	316,882	2.44	0.01	0.05	0.02	0.11	494.58	0.00	0.08	517.80
	Exports from LA/LB	S-58	US-101	115	17,205	1,978,575	15.24	0.03	0.31	0.13	0.68	3,088.12	0.01	0.49	3,233.09
	Imports thru LA/LB	US-101	S-58	115	19,684	2,263,660	17.44	0.04	0.35	0.15	0.78	3,533.07	0.01	0.56	3,698.94
Santa Clara	Exports from OAK	I-880	S-238	35	2,850	99,750	0.77	0.00	0.02	0.01	0.03	155.69	0.00	0.02	163.00
	Imports thru OAK	S-238	I-880	35	17,652	617,820	4.76	0.01	0.10	0.04	0.21	964.28	0.00	0.15	1,009.55
	Exports from LA/LB	I-280	US 101	338	31,938	10,795,044	83.16	0.18	1.69	0.72	3.71	16,848.67	0.07	2.65	17,639.66
	Imports thru LA/LB	US-101	I-280	338	56,158	18,981,404	146.22	0.31	2.97	1.26	6.53	29,625.76	0.13	4.66	31,016.60
Alameda	Exports from OAK	N/A	N/A	16	5,040	80,640	0.62	0.00	0.01	0.01	0.03	125.86	0.00	0.02	131.77
	Imports thru OAK	N/A	N/A	16	20,300	324,800	2.50	0.01	0.05	0.02	0.11	506.94	0.00	0.08	530.74
	Exports from LA/LB	I-580	US-101	356	21,420	7,625,520	58.74	0.12	1.19	0.51	2.62	11,901.74	0.05	1.87	12,460.49
	Imports thru LA/LB	US-101	I-580	356	23,194	8,257,064	63.61	0.13	1.29	0.55	2.84	12,887.44	0.05	2.03	13,492.47
San Francisco	Exports from OAK	US-101	I-580	19	2,377	45,163	0.35	0.00	0.01	0.00	0.02	70.49	0.00	0.01	73.80
	Imports thru OAK	I-580	US-101	19	14,467	274,873	2.12	0.00	0.04	0.02	0.09	429.02	0.00	0.07	449.16
	Exports from LA/LB	US-101	US-101	382	13,397	5,117,654	39.42	0.08	0.80	0.34	1.76	7,987.52	0.03	1.26	8,362.51
	Imports thru LA/LB	US-101	US-101	382	14,195	5,422,490	41.77	0.09	0.85	0.36	1.87	8,463.30	0.04	1.33	8,860.63
San Mateo	Exports from OAK	S-92	S-238	21	2,123	44,583	0.34	0.00	0.01	0.00	0.02	69.58	0.00	0.01	72.85
	Imports thru OAK	S-238	S-92	21	6,489	136,269	1.05	0.00	0.02	0.01	0.05	212.69	0.00	0.03	222.67
	Exports from LA/LB	I-280	US 101	371	16,033	5,948,243	45.82	0.10	0.93	0.40	2.05	9,283.89	0.04	1.46	9,719.74
	Imports thru LA/LB	U-101	I-280	371	23,243	8,623,153	66.43	0.14	1.35	0.57	2.97	13,458.83	0.06	2.12	14,090.68