ABSTRACT

The San Pedro Bay Ports of Long Beach and Los Angeles are the primary gateway to international trade, and together with the Class I railroads, they serve the freight transportation needs of the country. The railroads have invested significant capital to ensure their inland routes have capacity to handle future cargo volumes, while the Alameda Corridor establishes an excellent link from downtown Los Angeles to the Ports. Now, the Ports must ensure that their local rail network and rail yards will efficiently handle the projected train traffic.

The Rail Enhancement Program (REP) sets forth rail improvements within the Ports that will be necessary to maintain performance as cargo volumes grow through the year 2035. Detailed simulation modeling has been applied to understand the impacts of increasing cargo volumes on the rail system and to investigate infrastructure and operating improvements required to address deficiencies and to determine improvements to efficiently handle projected traffic. Implementation of the $2 billion REP has faced hurdles including environmental permitting, funding and disparate stakeholder concerns. Conditions affecting the REP have continued to change, as addressed by on-going planning efforts over the past 12 years. Cargo growth eased since 2007, but the timing of proposed infrastructure improvements remains critical.

This paper describes the development process with a summary of the analysis methods, resulting proposed rail projects, implementation process and current status of implementation. The REP provides significant benefits in operating efficiencies and sustainability, but implementation has been challenging and illustrates the myriad obstacles facing public infrastructure development.
INTRODUCTION

The San Pedro Bay Ports (SPB) of Long Beach and Los Angeles (POLB/POLA) not only provide a reliable supply of goods to the local community and the nation, but they are vital to the economic health of the southern California region and the country. The goods movement system that funnels through SPB generates one of every 10 jobs in the region, with $30 billion in regional wages and salaries. The Ports are economic powerhouses that directly affect the quality of life for residents in the neighboring communities, the region and throughout the country. Utilizing rail to transport freight also has environmental benefits including extensive reductions in roadway traffic congestion and air emissions. The State of California’s Goods Movement Action Plan (2007) agrees, stating, “The State’s economy and quality of life depend upon the efficient, safe delivery of goods to and from our ports and borders. At the same time, the public health and environmental impacts from goods movement activities must be reduced to ensure protection of public health.” In spite of evidence showing significant environmental and economic benefits, implementation of the REP has been challenging. Obtaining environmental clearances, garnering funding, and building stakeholder consensus have all been impediments to expeditious implementation.

The Rail Enhancement Program was initially developed in 2000 with continuous planning updates through 2012. Until 2007, the cargo forecast indicated that demand would quickly exceed capacity at SPB Ports, straining infrastructure that could be developed to accommodate the mounting traffic volumes. Now, forecasts have been adjusted due to an enduring worldwide recession. A revised schedule of project implementation has been developed to reflect the reduced cargo demand and account for project delays.
The latest forecast data is presented in Figure 1, along with the preceding cargo forecast for comparison purposes. The latest forecast indicates about a 10-year delay in reaching critical cargo volumes, compared to previous forecasts.

![Figure 1 – SPB Ports Cargo Forecasts](image)

The goal of the SPB Ports rail planning efforts has been to evaluate the rail system performance and recommend enhancements to Port infrastructure. The planning efforts have incorporated changed market conditions, revised Port development plans, and modified cargo forecasts based on the latest available information. The objectives of the planning efforts are as follows:

- Establish current infrastructure, market and operating conditions.
- Identify rail system deficiencies and propose necessary improvements based on yard capacity from the Maximum Practical Capacity (MPC) Model, and rail network train delays from Rail Traffic Controller (RTC) Model.
- Develop rail designs for mainline track, rail yards, operations and systems.
- Substantiate the actions required to meet rail yard demand and provide acceptable levels of service for trains on the rail network in by years 2015, 2020, 2025 and 2030.
- Develop a Rail Enhancement Program providing improvements through a phased implementation plan with a schedule and cost estimate for each project.

**BACKGROUND**

The rail system serving the SPB Ports is instrumental in enabling the efficient transportation of cargo, since rail service is both economically and environmentally beneficial. Maximizing use of on-dock rail yards is part of the SPB Ports Clean Air Action Plan (2006). Without on-dock rail, intermodal cargo would be hauled by truck to be loaded onto trains at inland rail yards, adding to local highway congestion and diesel truck emissions. The Ports have developed and are continuing to pursue development of on-dock rail yards so that cargo can be loaded onto trains at the marine terminals without generating truck trips on the local roadways and freeways. While on-dock rail yards are dedicated to a single marine terminal, near-dock rail yards have logistical advantages due to their ability to serve numerous marine terminals. Near-dock facilities are typically within five miles of the port and are able to provide needed intermodal capacity with greatly reduced trucking impacts, compared to more remote off-dock facilities. Other advanced technologies that could be applied to the transport of containers to near-dock or off-dock facilities in lieu of trucks are being considered by POLA/POLB as well.

**Benefits of Rail**

Any cargo that is moved by train from the Port benefits the overall transportation system by reducing truck trips and total truck mileage, which reduces the associated air emissions and traffic congestion. Figure 2 illustrates how each on-dock train can eliminate 750 truck trips
when considering inbound and outbound cargo, bob-tail moves, and chassis repositioning. Freight trains are two to four times more fuel efficient than trucks on a ton-mile basis and the US Environmental Protection Agency (USEPA) estimates that a typical truck emits roughly three times more oxides of nitrogen and particulates than a locomotive for every ton-mile.

**Figure 2 – Truck Reduction Benefits of On-dock Rail**

Class I railroads are purchasing Tier 3-compliant technology for all new equipment operating in California. Pacific Harbor Lines (PHL) is the third-party operator at the SPB Ports providing local train movements and yard switching support and has purchased an entire fleet of locomotives that are Tier 3-compliant or better. PHL was the recipient of the 2009 Short Line Railroad of the Year (Railway Age) and 2008 Environmental Excellence Award (USEPA) for replacing and expanding its entire locomotive fleet with 23 low-emission diesel-electric units.
SPB Ports Cargo Forecast

In 2009, the Port of Long Beach and Port of Los Angeles jointly developed a revised long-term cargo forecast (Tioga Group 2009). Actual historic SPB Port cargo volumes are shown below in Figure 3 and forecast cargo volumes are presented in Figure 4.

Figure 3 – Historic Cargo Volumes

![Figure 3 – Historic Cargo Volumes](image1)

Figure 4 – Forecast Cargo Volumes

![Figure 4 – Forecast Cargo Volumes](image2)
SPB Ports Mode Splits

The cargo moving through the SPB Ports has origins and destinations throughout the United States. A large local and regional population (Western Region) is one of the driving factors that lead shipping lines to select SPB Ports as their gateway to the country. The hinterland region east of the Rocky Mountains can be efficiently served through SPB Ports thanks to intermodal rail transportation. A portion of the intermodal cargo is processed through warehouses in the Los Angeles area before being loaded onto trains (Transload Intermodal). The remainder of intermodal cargo moves directly from the vessel to the train in the same container, and is referred to as Direct Intermodal, Intact Intermodal or Inland Points Intermodal (IPI). The pie chart in Figure 5 shows the approximate breakdown of cargo between these three modes. Western Region and Transload Intermodal cargo are moved to and from the Port by trucks. IPI cargo can be transported by trains at on-dock terminals.

Recent trends have indicated declines in percentage of IPI and increases in percentage of Transload cargo. In addition, approximately 5% of the Port cargo is IPI, but due to logistics influences including terminals having less-than-train loads of destination cargo and having high priority cargo, which are sent to off-dock rail yards where they can be combined with cargo from other terminals and expedited. The result of these cargo mode splits and logistics influences is that no more than 35% of SPB Port cargo can be moved by on-dock rail yards.

The goal of the Port is to maximize utilization of on-dock rail, however the facts related to cargo transport indicate that no more than 35% of SPB Port cargo can be moved on-dock.
SPB Ports On-Dock Rail Use

The historic record of on-dock volumes at SPB Ports are shown in Figure 6. The REP aims at providing each marine terminal with an on-dock rail yard that has capacity to handle at least 35% of the terminal’s throughput. The forecast of future on-dock volumes, assuming the REP expansion projects are achieved is presented in Figure 7.

Figure 6 – Historic On-dock Volumes at SPB Ports

PROGRAM DEVELOPMENT

POLB has made continuous efforts to plan for a rail system that maximizes cargo transport using on-dock rail. Several factors other than mode split affect utilization of on-dock rail. These include:

- The physical capacity of on-dock rail yards;
- Operating procedures that limit train movements; and
- Bottlenecks on the Port Rail Network.
On-dock Rail Yards

The first step in development of the Rail Enhancement Program was to determine potential for on-dock rail yards at SPB. The goal of the Ports is to maximize on-dock rail, however logistics prevent on-dock throughput from exceeding 30 to 35 percent of total marine terminal throughput. Factors limiting on-dock throughput include:

- 35 percent of forecast cargo volumes are destined to the local and regional market, which is more economically and practically served by truck;
- 25 to 30 percent of forecast cargo volumes will be transported by rail, but will first be trucked to local warehouses to be Transloaded, which achieves optimal container loads, regroup orders, inspect or repackage cargo, and perform value-added processes;
- 35 to 40 percent of forecast cargo is expected to be transported by rail in its international container and this Direct Intermodal cargo can be loaded at on-dock rail yards;
- 5 to 10 percent of the SPB cargo will be taken to off-dock rail yards due to less-than-trainload volumes for a destination, schedule cut-offs or other coordination issues.

On-dock Planning: The next step in the REP development was preparation of on-dock rail yard concepts to handle 35 percent of the total SPB cargo forecast. The on-dock yards may be limited by site constraints or relative position on the Port rail network. The intermodal rail yard throughput capacities at each of the on-dock rail yards are calculated using Parsons MPC throughput model to estimate maximum practical capacity, which reflects the highest throughput a facility could practically achieve on a continuous basis. The MPC Model considers the time required to perform a number of individual intermodal rail yard processes, including: landing trains, switching, loading and unloading containers, initial terminal air brake test and departing
trains. It considers the affects of storage tracks, arrival/departure tracks, rail yard configuration (track lengths, stub-end/double-end yard, end-to-end storage, etc) and labor practices. The model incorporates the affects of these indirect impacts based on studies of processing times sampled at numerous rail yards operating near their ultimate capacity, using a multi-variant regression analysis of the parameters and yard capacities from these yards.

**On-dock Rail Yard Projects:** On-dock rail yard enhancement projects are shown in Figure 7. The forecast of future on-dock volumes, assuming the REP expansion projects are achieved, is presented in Figure 8. Achieving these volumes requires that all on-dock facilities, operating procedures and rail network improvements recommended by the REP are implemented.

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**Figure 7 – SPB On-dock Rail Yard Locations**

**LEGEND**

1 – Pier J On-Dock
2 – Pier G On-Dock
3 – Pier E On-Dock
4 – Pier A On-Dock
5 – Pier S On-Dock
6 – Pier T On-Dock
7 – Pier B Rail Yard
8 – TICTF On-Dock
9 – Pier 300 On-Dock
10 – Pier 400 On-Dock
11 – WBICTF On-Dock
12 – TraPac On-Dock
13 – B200 Rail Yard

Notes:
1 Expansion of existing rail yard.
2 Construction of new rail yard.

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**Figure 8 – Forecast On-dock Volumes at SPB Ports**
The on-dock capacity analyses assume a unit-train-consist, comprised of 25 double-stack five-unit articulated rail cars (DS-cars) and up to 4 locomotive engines. Actual train sizes at the SPB Ports were expected to vary between 18 to 28 DS-cars. However, since 2007, UPRR and BNSF have been running tests of longer trains with 35 DS-cars. Longer trains offer significant benefits for line-haul efficiency and reduction of rail traffic on the Port rail network, but they also create challenges for train arrival/departure at the on-dock yards.

While the REP efforts have targeted on-dock rail yard capacity to handle 35% of Port cargo, constraints to several on-dock facilities caused the level achieved to be less. Examples of constrained facilities at POLB include Pier G-ITS and Pier S. Pier C does not have an on-dock rail yard, but its terminal throughput is included with the Port cargo used to calculate percent of on-dock rail. POLA has similar conditions with constrained terminals and a terminal without an on-dock rail yard.

Since the SPB Ports on-dock rails are forecast to handle at least 30% of the total containerized traffic, near-dock and off-dock rail yards will need to handle a maximum of 10% of the total Port
cargo in order to accommodate the 35-40% Direct Intermodal. Near-dock and off-dock rail facilities will also need to handle the Transload Intermodal cargo (25-30% of Port cargo). Additional near-dock developments will be beneficial to avoid the significant impacts of intermodal cargo being trucked long distances through the Southern California region.

**Support Rail Yard Projects:** Rail yards such as Pier B in POLB and TI Support Yard in POLA are vital to continuing growth of on-dock rail volumes. These support facilities offer several advantages:

- Long departure tracks for handling 10,000’ trains;
- Minimize impacts of switching on network;
- Staging tracks serve as buffer against mainline gridlock;
- Local fueling/crewing/maintenance of locomotives;
- Ready rolling stock storage for on-docks.

The Pier B Rail Yard project will directly improve on-dock rail yard capacities, remove a major bottleneck from the rail network at Long Beach Lead and enable improvements in operating procedures. The combined benefits of Pier B Rail Yard will enable up to 3 million TEUs of additional on-dock throughput by 2035. TI Support Rail Yard by POLA is also expected to provide significant benefits to congested Terminal Island rail operations.

**SPB Port Rail Operating Procedures**

On-dock rail operating procedures will need to be modified in order to achieve forecast throughput volumes. Following are several changes that have been recommended based on Rail
Traffic Controller (RTC) simulation modeling and subsequent simulation modeling performed for Pier B Rail Yard:

- **Unrestricted Access to Terminals** – currently, marine terminals allow train movements during labor breaks and shift changes; recommend that terminals receive/deliver trains at any time.

- **Adjacent Track Rule** – currently, some terminals will not work any track in the yard while a train is moving; recommend applying adjacent track rule so that labor stands down only from adjacent tracks.

- **Coordinated/Responsive Schedule** – Business Exchange (BEX) provides system to enable coordinated scheduling between railroads and marine terminals; railroads need to be responsive, and terminals need to meet schedules; terminals have stated that block stowage of vessels would help them to better meet schedules.

- **Westbound Unit Trains** – currently, westbound trains arrive in smaller blocks that are switched throughout the Port; recommend that railroads prepare terminal specific trains east of Port to reduce switching moves; Pier B could also assist by providing a local location to block-swap.

- **Minimize Light Engine Moves** – currently, locomotives move long distances through the SPB rail network to reach a fueling/crew change facility; recommend providing fueling facilities at several locations throughout the Port to reduce light engine traffic. Pier B will serve this purpose.
• Ready Supply of Rolling Stock – currently, empty railcars are stored throughout the region, perhaps hundreds of miles from the Port; recommend providing increased storage capacity to maintain local supply of rolling stock, e.g. at Pier B Rail Yard.

**Rail Network Infrastructure**

The rail yards in SPB Ports are reliant on the rail network that ties them to the Alameda Corridor and the continental railroads. If the rail network could not handle the train traffic generated by the rail yards, then the network capacity would become the constraining factor affecting intermodal throughput. To evaluate the rail network capacity, simulation modeling using the Rail Traffic Controller Model (RTC) was performed.

Once the on-dock yards and operating procedures are conceptualized, then future train traffic can be estimated. This forecast train traffic was used to simulate rail operations on the entire Port rail network from north of the Alameda Corridor to each of the Port rail yards. The dynamic simulation model RTC was used to analyze mainline system performance. Rail network system performance is typically evaluated based on delay ratio (train delay divided by unimpeded running time), excessive individual train delays and train crew hours of service issues.

To assist in interpretation of the model results, a Level of Service (LOS) grade was defined to incorporate these model outputs. This LOS definition is not an industry standard, but was developed to assist in communicating rail performance results to executive decision makers. The descriptions in the last column of Table 1 assist in assigning and interpreting the LOS definition for SPB Ports.
Los of C or better is considered desirable based on experience at similar rail terminal environments and on impacts of delays that were experienced by individual trains. Los D is undesirable and Los E or F is considered unacceptable. Trains may still reach their destination under Los D, E or F, but delays become excessive and the system cannot quickly recover from conflicts. Track outage events and maintenance will cause additional impacts to the system performance. The RTC Model was run with projected train volumes for each of the forecast years (2010, 2015, 2020, 2025, 2030 and 2035). Runs considered a four peak-day period with the switching operations inside of rail yards modeled explicitly.

When unacceptable performance is identified by simulation modeling, then the responsible bottleneck is located and the benefits of recommended improvement projects are quantified. Selected bottlenecks in the Port Rail Network and corresponding improvement projects are listed in Table 2 and shown in Figure 9. The rail simulation modeling and experience from peak traffic volumes in the 2007 timeframe showed that the existing SPB Port Rail Network will constrain on-dock throughputs as cargo volumes rebound. Prioritized rail network infrastructure

<table>
<thead>
<tr>
<th>LOS</th>
<th>Delay Ratio</th>
<th>Delay/Traffic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-11%</td>
<td>Minimal / Light Traffic</td>
</tr>
<tr>
<td>B</td>
<td>12-21%</td>
<td>Minor / Light-Moderate</td>
</tr>
<tr>
<td>C</td>
<td>22-29%</td>
<td>Moderate / Moderate</td>
</tr>
<tr>
<td>D</td>
<td>30-36%</td>
<td>High / Heavy</td>
</tr>
<tr>
<td>E</td>
<td>37-42%</td>
<td>Significant / Unstable</td>
</tr>
<tr>
<td>F</td>
<td>43%+</td>
<td>Severe / Very Unstable</td>
</tr>
</tbody>
</table>

Table 1: Level of Service (LOS)
improvement projects are listed in Table 2 and shown in Figure 9. These projects are required to avoid unacceptable delays and constraining on-dock throughput.

Table 2: SPB Ports Rail Network Infrastructure

<table>
<thead>
<tr>
<th>Bottleneck Location</th>
<th>Port Network Improvement Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ocean Blvd Leads</td>
<td>Reconfiguration of Track at Ocean Blvd</td>
</tr>
<tr>
<td>2 Pier J Lead</td>
<td>Pier G South Rail Yard and Second Pier J Lead</td>
</tr>
<tr>
<td>3 Long Beach Lead</td>
<td>Pier B Rail Yard</td>
</tr>
<tr>
<td>4 Badger Bridge</td>
<td>Lock Down Badger Bridge, Added Track</td>
</tr>
<tr>
<td>5 Terminal Island (TI) Access</td>
<td>CP Mole, Nimitz Grade Separation, TI Wye</td>
</tr>
</tbody>
</table>

Findings from the RTC Model runs indicate that Badger Bridge needs to be locked down by between 2015 and 2020 to maintain desirable LOS. The model indicates that all other rail infrastructure improvements included in the REP are required to maintain acceptable level of service for train operations. Even with the implementation of the proposed rail network improvements, the performance of the harbor-area railroad network declines as the on-dock volumes exceed 10 million TEUs and that the maximum capacity of the system is somewhere around 13 million TEUs (depending on where the traffic occurs).

**PROJECT STATUS**
The 2010 Update to the SPB Ports Rail Study has addressed the latest cargo forecast, trends in rail traffic and facility usage, larger train size, additional simulation studies of support rail facilities and delays to development caused by permitting or funding challenges. The delay in cargo growth and hurdles to development are reflected in the scheduling of projects reported in this paper.

**On-dock Rail Yard Projects**

The status of on-dock rail yard projects is summarized below:

**Pier G – POLB:** This marine terminal expansion project is being developed for ITS and includes a reconfiguration of their existing rail yard and a second new rail yard to the northwest. The on-dock capacity is increased by 400% from 120,000 to 600,000 TEU per year. The EIR is certified, and the engineering design and construction bid documents are completed. Construction is scheduled to begin in March 2010.

**Pier E (Middle Harbor Terminal) – POLB:** This marine terminal expansion is being developed for the current tenants at Piers E and F (LBCT). The rail yard element of the expansion provides a major reconfiguration from an existing total track length of 10,000 feet to over 65,000 feet provided by the project. The on-dock capacity is increased by 400% from 200,000 to over 1,000,000 TEU per year. The concept for this rail yard has been modified from the 2005 Rail Study Update; it is now proposed as a state-of-the-art facility with eight tracks under wide-span rail mounted gantry crane with four additional tracks for storage. The EIR is certified, and the engineering design and preparation of construction bid documents are underway. Rail yard construction is scheduled to be completed between 2015 and 2020.
**B136-147 – POLA:** This marine terminal expansion is being developed for TRAPAC and includes a new on-dock rail yard for a terminal that currently has none. The proposed rail yard has 40,000 feet of track providing a capacity of 720,000 TEU per year. The EIR is certified and the engineering design and preparation of construction bid documents are underway.

**Developing Projects:** Other on-dock projects that are being engineered and working through the environmental process (EIR/EIS) include Pier A and Pier S at POLB, and B100-131 for CSL-YML at POLA. Pier A includes a phased expansion of the rail yard, while Pier S is a new terminal and B100-131 is an expansion project.

**Future Projects:** On-dock projects that are planned for the future, but are not the focus of current implementation efforts include expansions at TICTF, Pier 300 and Pier 400 at POLA, and potential new rail yards at Pier 500 and Berth 236. The planned expansion of TICTF supports B212-225 (YTI) and B226-236 (Evergreen), however, an alternative is being evaluated with a separate rail yard near Seaside Avenue (Berth 236). TICTF could also serve B206-209 in the future. Pier 300 and Pier 400 both have rail yard expansion plans that will be implemented through tenant lease negotiations. Pier 500 is a proposed marine terminal that will be entirely on new landfill.

In summary, the on-dock rail yard elements of the Rail Enhancement Program are conceptualized and scheduled to maximize on-dock throughput and will be implemented as environmental process and tenant lease negotiations allow. The REP provides for a 250 percent increase in on-dock capacity and maintains the potential for at least 30 percent of total Port throughput to be handled by on-dock rail yards.
Support Rail Yard Projects

In addition to on-dock rail yards, the REP identified several support rail yards that will be vital to the SPB Port operations. These include Pier B Rail Yard in POLB, as well as B200 Rail Yard and Terminal Island Support Yard in POLA. Support rail yards should have Arrival/Departure tracks that are long enough to chamber trains coming off of and waiting to leave on the Alameda Corridor, as well as storage tracks to hold shorter portions of trains (blocks or cuts of railcars). The Rail Enhancement Program has always identified the need for support rail yards and assumed their contribution in the calculation of capacity estimates.

There are a number of reasons that the support yards are vital to on-dock operations.

- Trains longer than the on-dock yard tracks will utilize the support yard to chamber the train and only deliver to on-dock the length that can be received or delivered.

- Trains made up of blocks for multiple on-dock yards can be classified at the support yard for distribution to the individual on-docks (note that as volumes grow, this practice will cause disproportionate congestion on mainlines).

- Store blocks of outbound railcars from various terminals to be combined into a destination specific train (block swapping).

- Hold bare tables (empty DS rail cars) at the storage tracks allowing management of the individual bare table inventories of each Class I railroad.

- A locomotive service facility at or near each of the support yards would be an efficient location to provide the requisite fueling and crew change capability.

The B200 Rail Yard has a certified EIR, and engineering design is underway with construction expected to be completed by 2012. The Pier B Rail Yard has had preliminary engineering design
and additional simulation modeling performed to support on-going EIR efforts. The TI Support Yard is in the initial stages of conceptual engineering design and additional simulation modeling is underway.

**Rail Infrastructure Projects**

Rail infrastructure projects are classified as those projects that directly benefit the SPB Port rail network. These projects include additional mainlines, added cross-overs, signal system improvements and grade crossing improvements. The status of rail infrastructure projects is summarized below:

**Edison Avenue At-Grade Crossing:** This project was the first on the REP and while the permits took longer than expected, the crossing was closed in 2008.

**Extended CTC:** In 2008, the centralized train control (CTC) signal system within the SPB Ports was been extended east to Ocean Boulevard in POLB, west to B200 in POLA, and south to CP LAXT on Terminal Island.

**Automated Turnout Control:** Additional turnouts beyond the CTC system in POLA/POLB were automated to allow remote control by locomotive engineers. This improvement expedites train movements since the train does not need to stop and have a switchman walk to the manual switch before proceeding. The automated turnouts were completed in 2009.
Terminal Island Locomotive Service: The BNSF is operating a fueling/supply/crew change facility on siding tracks at a location adjacent to TICTF. Since 2010, UPRR performs similar services on LAXT tracks. Local locomotive service prevents light engine moves from competing for capacity on the Port rail network.

Track Realignment at Ocean Boulevard: This mainline track project improves access for Pier E, Pier G and Pier J rail yards. The project provides major improvements to the current operation of bulk trains at Pier G-Metro. The project will be complimented by the proposed Pier B Rail Yard project along Pico Avenue. Lead tracks for Pier E are an integral part of the Track Realignment at Ocean Boulevard. The track realignment project has a certified EIR, and the engineering design and preparation of construction documents are completed with construction expected in 2012 and 2013.

Double Track to Pier J: This project has been incorporated into the Pier G-ITS terminal project and will provide a second mainline track past Pier G to Pier J. The project has a certified EIR, and the engineering/construction documents are complete. Construction is anticipated in 2013.

West Basin Access Improvements: This project includes added mainlines, sidings and crossovers from the Alameda Corridor at CP Anaheim to B100-131 rail yard. The project also includes closure of several at-grade crossings. The project will benefit rail operations throughout West Basin and will enhance on-dock operations at B100-131 and B136-147 Rail Yards. The project has a certified EIR, and the engineering design and preparation of construction documents is underway. The project will be phased with construction of initial implementation in 2013.

Badger Bridge Lock Down: Bridge lift operations for vessel passage have been shown by simulation modeling to have a significant impact on SPB rail network performance. To avoid
unacceptable train delays, RTC findings indicate that the bridge should be locked down by 2015-2020. This project is being lead by POLA and supported by POLB and ACTA. Coast Guard approval has not yet been obtained.

**Additional Track from Thenard Jct to Terminal Island:** This project provides additional mainline and cross-overs through a critical area where there is confluence of trains from Terminal Island, POLA West Basin and POLB East. ACTA is leading the effort on this project, which includes: added track from Thenard Jct. to Badger Bridge; additional track across Cerritos Channel; and an additional track into CP Mole. Engineering design has not proceeded beyond conceptual plans and environmental documents have not been started. The need for this project has been established previously, but it is being reinvestigated under the updated conditions.

**Reconfiguration at CP Mole:** This project provides added mainline, cross-overs and extended CTC at CP Mole and CP LAXT. The project includes selection of dwarf, bridge or cantilever signals depending on site constraints. The project also includes a second lead track into Pier 400 and a second track along the south side of the Terminal Island Wye. The project is being led by POLB and supported by POLA and ACTA. The environmental document is certified and engineering design is completed. The project will proceed once funding is allocated.

**Reeves Avenue At-Grade Crossing:** Reeves Avenue at-grade crossing is located south of CP Mole on the Pier 400 lead tracks. The proposed project provides a grade separation that will allow Pier 400 rail yard to operate efficiently and improve safety and accessibility for users located on Navy Mole. The project also provides additional storage tracks on Navy Mole, which will be important to future on-dock rail yard operations. The engineering design and environmental process are underway for this large infrastructure improvement project.

**CONCLUSIONS**
The goal of the Rail Enhancement Program is to maximize utilization of on-dock rail. The planning efforts have evaluated the rail system performance and recommended enhancements to Port infrastructure that are necessary to meet forecast cargo demands. This planning incorporates recent market conditions, revised Port development plans, and modified cargo forecast based on the information available in 2012.

The cargo that is forecast to arrive at the SPB Ports will create the need for significant improvements in on-dock terminal throughput capabilities. The increased cargo volumes will also require careful evaluation of operating procedures and the SPB Ports rail network. The POLB rail system showed signs of reaching capacity in 2007 and on-dock throughputs are expected to be constrained again, unless improvements are implemented.

Key rail findings described above are as follows:

- On-dock rail yards are conceptualized for each of the proposed marine terminals at POLB and POLA. These rail yards have the combined throughput capacity to handle approximately 30 percent of the Port cargo during the forecast period 2015 to 2035.

- The on-dock capacities presented by the REP assume the development of Pier B Rail Yard (9th Street Alternative by 2015 and 12th Street Alternative by 2020). Pier B provides significant benefits to on-dock rail capacity. The capability to handle the forecast on-dock rail demand without Pier B Rail Yard will constrain on-dock growth at approximately 2015 cargo volumes. This would result in up to 3 million TEUs per year reduction in on-dock rail capacity by 2035.
• Terminal Island projects are vital to the entire SPB Port and should be jointly pursued by POLA and POLB, as finances show fit, with processing of environmental clearances and applications for funding support.

• Alameda Corridor traffic is averaging 40 trains per day in 2010. The train volumes generated by on-dock rail yards are forecast to exceed 80 trains per day by 2035. In addition to corridor trains, other train traffic associated with carload delivery, switching and light engine moves on the Port rail network will exceed 200 trains per day by the year 2035. This traffic will fully utilize the capacity of the Port Rail Network.

Utilization of on-dock rail is an important part of the Ports Clean Air Action Plan. As cargo volumes increase, the benefits of on-dock rail would increase as well. Given 2035 cargo forecasts and full development of the REP, on-dock rail would remove over 25,000 truck trips daily. Near-dock rail yards will be an important augmentation to the Port intermodal system. While near-dock rail yards generate local truck trips, they greatly reduce the truck miles traveled through the region.

The recommended on-dock rail yard, support rail yard and rail infrastructure improvements included in the Rail Enhancement Program will accommodate increasing on-dock rail traffic up to 13 million TEU per year by 2030. Each of the three elements of the REP (on-dock yards, support yards, infrastructure) are part of a system, and all three are required to achieve the targeted results.

Moving cargo by train is generally accepted as a preferred mode of transportation due to benefits in emissions and traffic congestion compared to trucks. Additional trains can have impacts due to noise/vibration and traffic delays at at-grade crossings; however, the alternative to increased
volumes at on-dock rail yards is for cargo to be trucked to existing rail yards in downtown Los Angeles, and, therefore, increased train traffic only occurs within the SPB Port and along the Alameda Corridor. There are no significant at-grade crossings within this area and the Alameda Corridor project was permitted to carry the projected volumes with mitigated impacts.

The REP comprises 35 individual projects totaling more than $2 billion of investment and spanning over 20 years of development. The REP developed a complete schedule including planning, permitting, design and construction timelines for each project. Development costs were estimated and cost-loading summarized to assist the Ports in capital planning and funding pursuits.

Full development of the REP will accommodate nearly 12 million TEU per year at on-dock rail yards, or 30 percent of the total SPB Port throughput projected for the planning horizon. Since approximately 40 percent of the total port throughput is expected to be transported directly by rail (this Direct Intermodal excludes Transload cargo), there are approximately 4 million TEU per year of Direct Intermodal cargo that need to be handled at near-dock and off-dock rail facilities. Utilization of near-dock rail yards will minimize impacts caused by truck congestion and emissions. The UPRR currently has capacity to handle 1.5 million TEU per year at their near-dock ICTF, leaving 2.5 million TEU per year of additional capacity needed. There are two proposed projects that could contribute the needed capacity: the ICTF Modernization by UPRR, and the Southern California International Gateway (SCIG) by BNSF.

In consideration of demand for near-dock facilities, it would be prudent to not expect every on-dock and near-dock rail yard to operate at MPC levels used to report capacities herein. The Class I Railroads use a term, “sustainable capacity,” which is estimated to be 10 to 20 percent
below the MPC level of throughput. Using sustainable capacity for all the on-dock and near-dock rail yards, it is found that both the ICTF Modernization and SCIG developments are warranted. In addition to the 4 million TEU of Direct Intermodal demand, there is another 10 million TEU of Transload Intermodal demand that will be handled by the near-dock and off-dock rail facilities.

Acknowledgements

The authors would like to acknowledge the valuable contributions by the following individuals:

- Ron Groves, Port of Los Angeles
- Michael DiBernardo, Port of Los Angeles
- Kerry Cartwright, PE, Port of Los Angeles
- Larry Cottrill, Port of Long Beach
- Matt Plezia, Port of Long Beach
- Charlie Tsai, PE, Port of Long Beach
- Kathryn Grack, PE, PARSONS
- Nathan deSousa, PE, PARSONS

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Ports of Long Beach and Los Angeles Rail Enhancement Program

Carlo Luzzi
Parsons

Michael Leue
Parsons

Larry Godbold
Parsons

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Introduction

• Largest US Port Complex
• Jobs Creation
• Tax Revenues
• Rail Cargo Generator
Port Railroads

- Class I – BNSF Railway and Union Pacific Railroad
- Terminal Switching Railroad: Pacific Harbor Lines (PHL)
Alameda Corridor

- $2.4 billion project completed 2002
- Provides Transcontinental Rail Network Connection
- 200+ street-level crossings eliminated
- Capacity: 200 trains per day

**Average Daily Corridor Volumes**

- 2002: 39
- 2006: 55
- 2010: 39
- 2020: 100
- 2035: 200
Pacific Harbor Line (PHL)

- San Pedro Bay Rail Operator (1998 – 2024)
- Train Dispatcher, Switcher and Maintainer for the Ports
- Twenty-three New Clean Tier 3+ Locomotives
- Awards include:
  - SmartWay Excellence (2008)
  - Shortline RR of the Year (2009)
  - CAAP Air Quality (2009, 2012)
  - Harriman Special Commendation (2011)
- Pacific Harbor Line is an Anacostia & Pacific Company
Port Rail Dispatching Center
On-dock Container to Rail
Bulk Cargo – Bottom Dump
Bulk Cargo – Rotary Dump
Automobiles
Specialty Cargo
Rail Enhancement Program

- Purpose
- Need
- Benefits
- Status
- Conclusion
Purpose

• Reduce Truck Traffic – Emissions/Congestion
• Improve Port Efficiency
• Accommodate Future Cargo Volumes
Cargo Forecast

- 2001 Forecast
- 2009 Forecast

10 YR DELAY
Cargo Mode Splits

- Western Region Mostly Truck Transport
- Transload Moves Off Port for Warehousing
- Only IPI Uses On-dock

- Logistics Influences
  Drive at least 5% of IPI Off-dock

- Capacity Goal for On-dock Rail is 35%

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Benefits of On-dock Rail

• One On-dock Train Can Eliminate up to 750 Truck Trips
• Trains are 2-3 times more Fuel Efficient and Cleaner
Program Development

• Yard Capacity Modeling
• Rail Network Modeling
• Develop Concepts to Address Constraints
• Program Projects
On-dock Intermodal System

- System Elements Sized for Target Throughput
  - Marine Terminal
  - On-dock Rail Yards
  - Operating Procedures
  - SPB Rail Network
  - Transcontinental Network

- Any Component Can Constrain Throughput
On-dock Rail Yard Projects

POLB On-Docks
1. Pier J
2. Pier G
3. Pier E - MHT
4. Pier A
5. Pier T
6. Pier S
On-dock Rail Yards

- On-dock Capacity Increases 3.5M TEU by 2035

![Graph showing capacity increase over time](image)

- Millions TEUs
- Recent Actual
- 2015
- 2020
- 2025
- 2030
- 2035

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Operating Procedures

Changes Required for Growth

– Unrestricted Access to Terminals
  • Application of Adjacent Track Rule

– Coordinated/Responsive Schedule
  • BEX provides system
  • RR-responsive
  • Terminals-responsible (block stowage)

– Westbound Unit Trains
  • Reduce switching moves within Port

– Minimize Light Engine Moves
  • Local fueling/crewing will reduce moves within Port

– Ready Supply of Rolling Stock
Port Rail Network Infrastructure

- Rail Network Performance
  - Simulation Modeling and 2007 Experience show existing rail network will constrain on-docks

- Key Rail Network Bottlenecks:
  - Long Beach Lead/Pier B Yard
  - Badger Bridge
  - TI Access
  - Ocean Blvd Leads
  - Pier J Lead
## Rail Network Priorities

<table>
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<tr>
<th>Infrastructure Project</th>
<th>Cost</th>
<th>POLB Portion of Benefit</th>
<th>Status</th>
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<tr>
<td>Ocean Boulevard Tracks</td>
<td>$84M</td>
<td>100%</td>
<td>Permitted, TCIF/TIGER 3 Funded, Bid Ready</td>
</tr>
<tr>
<td>Pier J Lead Track</td>
<td>$50M</td>
<td>100%</td>
<td>Permitted, Lease Approved, Bid Ready</td>
</tr>
<tr>
<td>Pier B Rail Yard-Full Build</td>
<td>$480M</td>
<td>90%</td>
<td>Environmental On-going</td>
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<tr>
<td>Badger Bridge Lock Down</td>
<td>tbd</td>
<td>30%</td>
<td>POLA Pursuing</td>
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<tr>
<td>Terminal Island Access</td>
<td>$130M</td>
<td>70%</td>
<td>On-hold</td>
</tr>
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</table>
Pier B Support Yard

Pier B is Vital to the Port’s Entire Rail System

- Long departure tracks for handling 10,000’ trains
- Minimize impacts of switching on network
- Staging tracks buffer against mainline gridlock
- Local fueling/crewing/maintenance of locomotives
- Ready rolling stock storage for on-docks

Pier B is Key to Maximizing On-dock Rail Yard Productivity
Total POLB On-Dock Volume = 2,320,000 TEU
15% Overall On-Dock Achieved

89%
11%
Pier B

88%
12%
Pier G

81%
19%
MHT

88%
12%
Pier A

90%
10%
Pier S

Existing Pier B Rail Yard

On-Dock Achieved with Existing Pier B Rail Yard

Pier B Support Yard

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Pier B Support Yard

On-Dock Achieved with Pier B Rail Yard Build-out

Total POLB On-Dock Volume = 4,690,000 TEU
(100% Increase over No-Build)
Summary – Future of On-dock

New Pier E On-dock:
- Expand on-dock rail from 10,000 to 75,000 track feet
- Take 1,000 trucks a day off the road
• 5 Wide-span Electrified RMG’s
• Spanning 8 Tracks
• 4 Support Tracks
• Bomb Cart Transfer Buffer from ASC Stack
• 2,150 Lifts per Day
Rail Network Infrastructure Projects

$700 Million

Thenard Jct. Realignment (ACTA)

Cerritos Channel Rail Bridge (ACTA)

CP Mole Expansion (POLB/POLA)

Closure of Reeves Crossing (POLB/POLA)

Reeves Grade Separation (POLB/POLA)

Navy Mole Storage Yard (POLB)

Wye Track Realignment (POLB)

Pier B Rail Yard (POLB)

Ocean Blvd. Track Realignment (POLB)

Pier F Support Yard (POLB)

Harbor Scenic Track Realignment (POLB)
Conclusions

- The Rail Enhancement Program will enable significant improvements in On-dock Capacity
Conclusions

• Port’s Goal: Maximize on-dock rail
• On-dock Growth requires terminal expansion and improvements in terminal operations.
• Operating Procedures need to transition as network congestion increases.
• Port Rail Network must be enhanced to avoid constraining on-dock volumes.
• Pier B is critical to the entire pipeline (On-dock, Ops and Network).
Conclusions

• Despite significant expansions in on-dock, additional intermodal capacity will be required.

• Near-dock Rail Yards offer capacity with reduced impacts compared to Off-dock.

• SPB Ports are pursuing environmental clearance for Near-dock Rail Yard expansion projects.