San Pedro Bay Ports Rail Study Update

Prepared for:

THE PORT OF LONG BEACH

THE PORT OF LOS ANGELES

Submitted by:

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December 2006

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ACKNOWLEDGEMENTS

The San Pedro Bay Ports Rail Study Update was commissioned by the Port of Long Beach with cost sharing provided by the Port of Los Angeles. The Port of Long Beach commissioned Parsons to perform the Study and prepare this report. The Study team included Port of Long Beach and Port of Los Angeles staff, Moffatt & Nichol collaborated on Pier B development plans and Washington Group provided rail network simulation modeling. The following individuals contributed to this Study:

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EXECUTIVE SUMMARY

I. Introduction

The San Pedro Bay Ports of Los Angeles and Long Beach (SPB) serve as the country's primary gateway to international trade. International trade is a key economic engine for the local region and the country. The Ports serve as a vital link in the goods movement chain providing products for our local market as well as those shipped by rail throughout the country.

No other port is as well positioned as the Ports of Long Beach and Los Angeles to serve our country's growing demand for international cargo. Bearing this responsibility, the SPB Ports are carefully planning the infrastructure necessary to accommodate demand while minimizing impacts to the surrounding communities. The landside transportation links are especially important since the resulting access issues have the highest potential to cause impacts to the local communities. Portions of the existing transportation system within and adjacent to the Ports are becoming constrained. Expected increases in cargo throughput will induce a considerable amount of rail and truck traffic onto this transportation system.

The Alameda Corridor opened April 15, 2002 and has generated significant improvements to the rail system's ability to efficiently carry trains from the Ports to the inland rail system with improved train speed and removal of at-grade crossings that had previously impacted traffic in the adjacent communities. Any cargo that is moved by train from the Port is a benefit to the transportation system by reducing the truck volumes and the associated congestion and diesel emissions.

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*. Without on-dock rail, intermodal cargo will add to local highway congestion and diesel truck emissions as it is hauled by truck to be loaded onto trains at inland rail yards. Therefore, 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 terminal without generating truck trips on the local roadways and freeways. Unlike on-dock rail yards that 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 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 in lieu of heavy rail or trucks are being considered under a separate study and are not considered by this "Rail Study Update".

II. Study Goal

The goal of this "Rail Study Update" (Rail Study) is to evaluate the rail system performance and recommend enhancements to Port infrastructure. The Port of Long Beach previously conducted a *Rail Master Planning Study* (POLB, 2002) and the Port of Los Angeles conducted a *Rail Capacity Analysis* (POLA, 2003) based on year 2000 conditions. This Study incorporates changed market conditions, revised Port development plans, and modified cargo forecast based on the latest information available in 2005.

The SPB Ports were concurrently conducting the *Truck Reduction Study* and this Rail Study is considered to be a component of the *Truck Reduction Study*.

The objectives of this "Rail Study Update" are as follows:

- Establish existing conditions in 2005.
- Identify rail system deficiencies and propose necessary improvements based on rail yard capacity analyses using MPC Model, and rail network train simulation using RTS Model.
- Develop conceptual 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 2010, 2015, 2020 and 2030.
- Develop a Rail Enhancement Program (REP) that coordinates conceptual improvements through a phased implementation plan with schedule and cost estimate for each project.

The goal for meeting rail yard demand is to maximize capacity and utilization of on-dock rail and supplement that capacity with near-dock facilities as necessary.

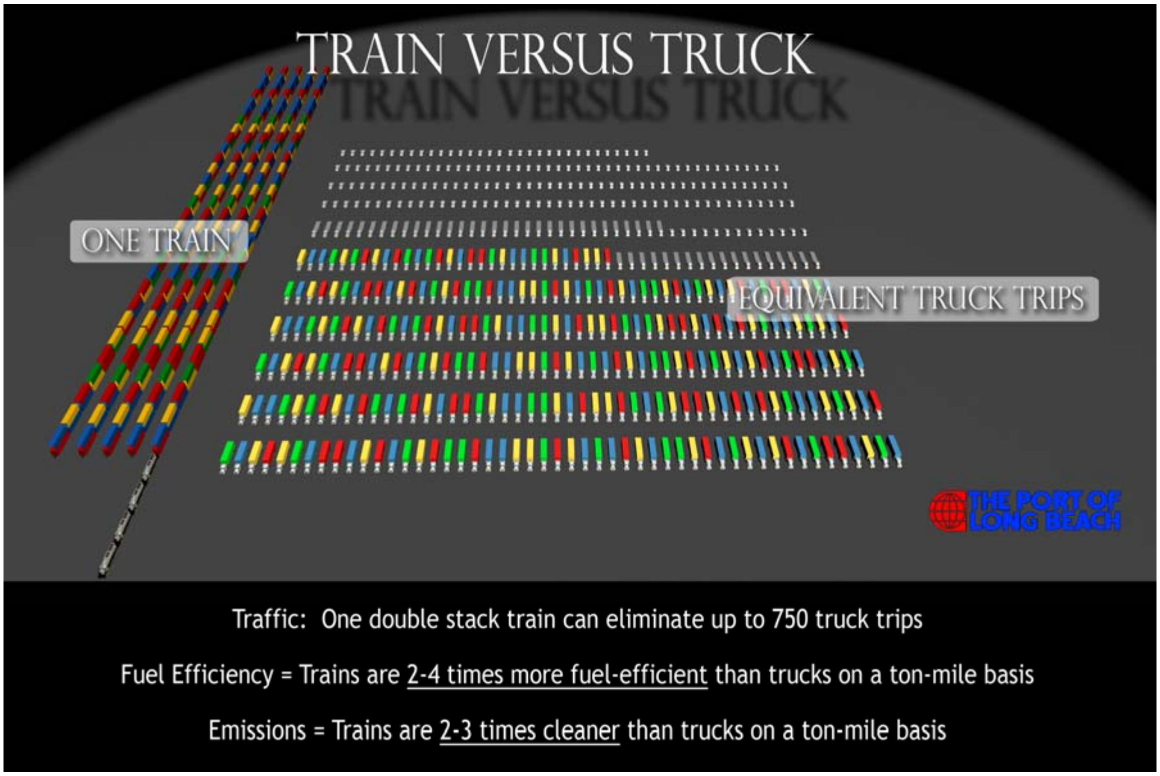
III. Benefits

Any cargo that is moved by train from the Port benefits the overall transportation system by reducing the truck trips and total truck mileage with the associated impacts. The graphic on the following page shows that each on-dock train can eliminate 750 truck trips and are at least twice as fuel efficient and clean as trucks on a ton-mile basis.

A single container ship may unload 5,000 twenty-foot equivalent units (TEU) to be delivered outside the Port boundaries by a fleet of trucks. However, the movement of cargo by trains loaded at on-dock rail yards is an effective method of reducing the truck traffic. Every train that is loaded on-dock can eliminate 750 truck trips from the highway, and a single ship call can generate five trains worth of intermodal cargo. In other words, on-dock rail can potentially eliminate 3,750 truck trips for every vessel call.

As a measure of the benefits of on-dock rail, consider the hypothetical situation where all of the REP projects are built and operating today: the level of on-dock throughput would be nearly double that of existing and would remove nearly 6,000 trucks a day from the local roadways. As cargo volumes increase, the benefits of on-dock rail will increase as well. Given 2030 cargo forecasts and full development of the REP, on-dock rail would remove nearly 29,000 truck trips daily.

Since there is currently no viable opportunity to accommodate the forecast intermodal cargo volumes elsewhere on the West Coast, a no action scenario, with regards to the REP, would result in extensive truck trips over long distances seeking out available locations for intermodal capacity. This would add millions of truck-miles to our local freeway system each day.



IV. Approach

The capacities of on-dock, near-dock and off-dock rail yards are analyzed for their ability to accommodate forecast intermodal demand. The maximum practical capacity (MPC) of existing and proposed rail facilities is estimated using a validated MPC Model. The demand for various rail yards considers cargo flow characteristics and specific requirements of direct intermodal, transload and domestic intermodal cargo.

The Port's rail system infrastructure is evaluated using the Rail Traffic Control (RTC) simulation model. Train volumes are estimated for each rail yard by the MPC Model and then the RTC Model dispatches these trains onto the Port rail network and through the Alameda Corridor. The RTC Model simulates train movements based on rail line characteristics and availability, and provides results including train transit times and train delays. Based on these results, infrastructure deficiencies are identified and engineered improvements are recommended.

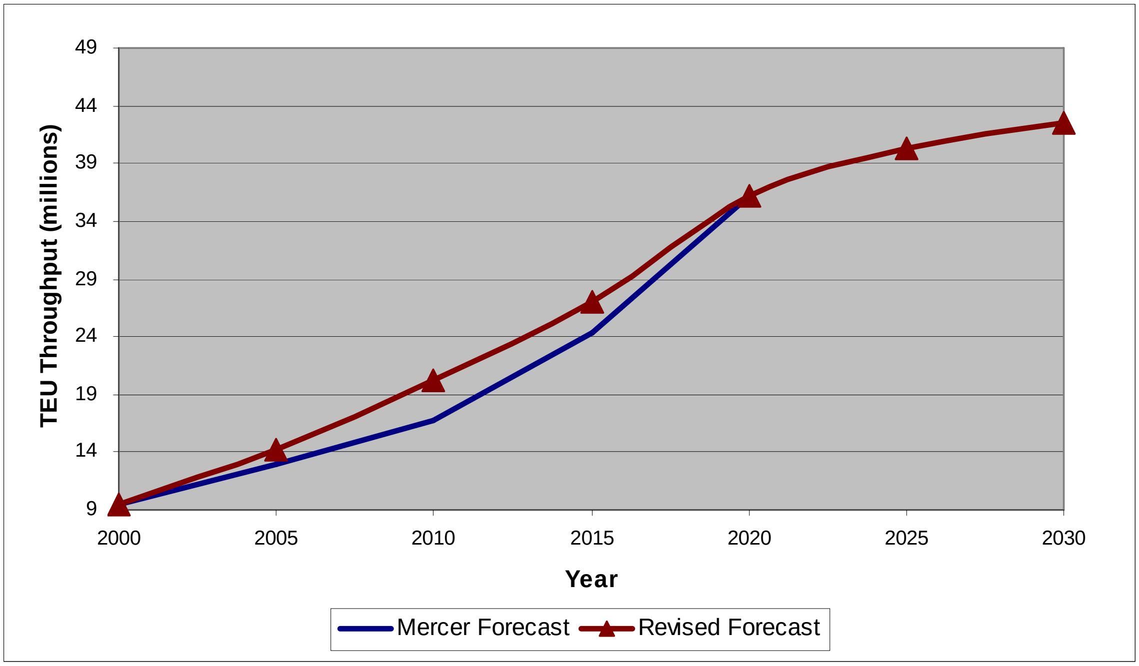
Rail yard expansion projects and infrastructure improvement projects recommended by this Study are compiled into a Rail Enhancement Program (REP) that establishes the schedule, cost and requirements of all projects in the REP. The information is also used to estimate the annual cost spread of the overall program. Finally, improvement projects are evaluated for their relative benefit/cost ratio.

The rail designs prepared by this study are conceptual. Each project design will subsequently be revised to address requirements that will be determined during environmental permitting, tenant negotiations and final engineering design.

V. Cargo Growth

The San Pedro Bay Ports Long-Term Cargo Forecast (Mercer Management, 1998) is tracking slightly lower than actual cargo volumes in 2005. The Mercer Forecast was adjusted to create a Revised Forecast based on the following: actual cargo throughput at the San Pedro Bay Ports during the period of 2000-2005. The Revised Forecast is also extended from 2020 out to 2030 considering expected continued growth rates and limited based on estimated marine terminal capacities. The Mercer Forecast and Revised Forecast are shown on **Figure 1**.

Figure 1 - SPB Ports Cargo Forecast



Values in millions of TEU	2005 Actual	2010	2015	2020	2030
Revised Cargo Forecast	**14.2**	**20.2**	**27.1**	**36.2**	**42.5**

Cargo Type

Port intermodal cargo is projected to account for at least half of the total Port throughput during the forecast horizon. The other half is destined for regional markets. Port intermodal cargo has two components, as follows:

Direct Intermodal: is moved directly between the Port and rail yards and can be handled on-dock, near-dock or off-dock. Direct intermodal is expected to account for 40 percent of Port cargo.

Transload Intermodal: is rehandled through a warehouse somewhere between the Port and rail yards. Transload cargo is never handled on-dock due to the requirement to be transported off the marine terminal to a warehouse.

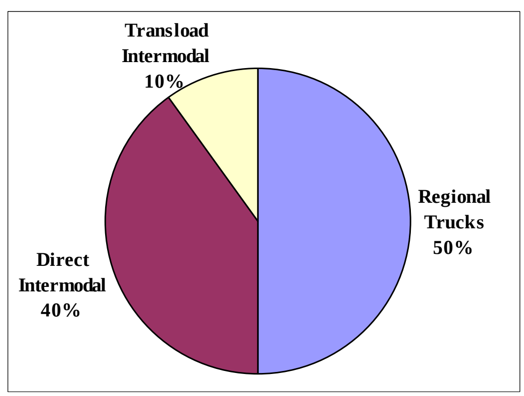


Figure 2 – SPB Ports Cargo Breakdown

Regional Cargo: is transported almost exclusively by truck, although there are proposals to use shuttle trains to transport some regional cargo to an inland distribution facility. **Figure 2** shows the breakdown of these cargos with intermodal on the left side of the pie and regional to the right.

VI. Rail Yards Supporting San Pedro Bay Ports

Port intermodal cargo can be transferred to trains at any of three types of rail yards:

On-dock Rail: On-dock is defined as a rail yard located within the marine terminal. A marine terminal also has wharf, container storage areas, administration and support buildings and truck processing gates. The on-dock rail yard allows cargo to be transported without any gate transaction and without dispatching trucks onto local roadways. One disadvantage is that the rail yard encroaches on the container yard acreage and impedes traffic flow within the marine terminal, potentially reducing the throughput capacity of the terminal. However, given environmental benefits and through careful planning to minimize capacity constraints, the Ports are pursuing on-dock rail to the fullest extent possible. On-dock throughput is increasing each year and handled 24% of the total San Pedro Bay cargo in 2006.

Near-dock Rail: Near-dock is defined as a rail yard located outside of the marine terminals that requires a short truck trip (within 5 miles). Their advantage is the ability to combine cargo from various marine terminals and build trains that efficiently transport cargo to specific destinations throughout the country. The only existing near-dock rail yard for the San Pedro Bay Complex is the Intermodal Container Transfer Facility (ICTF). It is operated by Union Pacific Railroad on Port of Los Angeles property located north of Sepulveda Boulevard and east of Alameda Street. The Ports are contemplating other near-dock facilities to help meet the demand for efficient rail transport. Currently, ICTF handles 8 percent of the total San Pedro Bay cargo in 2006.

Off-dock Rail: Off-dock rail yards are located more remotely (greater than 5 miles) from marine terminals. Currently, off-dock rail yards that handle containers from the San Pedro Bay Ports are located near downtown Los Angeles, approximately 25 miles away. Both the BNSF Railway and Union Pacific Railroad have off-dock facilities that handle Port containers. These rail yards contribute significant truck miles to some of the most congested roadways in the region. Off-dock rail yards handled approximately 11 percent of the total San Pedro Bay cargo in 2006, down from 15 percent and 14 percent in 2003 and 2004, respectively.

The recent history of on-dock, near-dock and off-dock throughput is provided in **Table 1**.

Table 1: SPB Direct Intermodal – Actual Throughput

(TEU)	2003	2004	2005	2006
On-Dock	**1,885,642**	**2,369,853**	**2,934,850**	**3,801,892**
Percent of Port Throughput	15.9%	18.1%	20.7%	24.1%
Near-Dock	**962,197**	**936,428**	**1,081,350**	**1,271,327**
Percent of Port Throughput	8.1%	7.1%	7.6%	8.1%
Off-Dock	**1,805,791**	**1,846,188**	**1,689,890**	**1,671,489**
Percent of Port Throughput	15.3%	14.1%	11.9%	10.6%
Total Direct Intermodal	**4,653,630**	**5,152,469**	**5,706,090**	**6,744,708**
Percent of Port Throughput	39.3%	39.3%	40.2%	42.8%
Total Port Throughput	***11,837,064***	***13,101,292***	***14,194,442***	***15,759,219***

Source: UPRR/BNSF

Table 1 includes only direct intermodal cargo, which excludes transload cargo. Transload cargo is estimated to be approximately 10 percent of total Port throughput volumes and all transload is handled off-dock.

The recent increases in rail throughput have been efficiently accommodated by the Port due to proactive construction of rail infrastructure improvements in the past. Additional investment will be needed to minimize impacts of continuing cargo growth. Development of on-dock/near-dock facilities and supporting rail infrastructure will improve intermodal efficiencies and reduce local and regional truck traffic.

On-Dock Development

On-dock rail yards are currently handling over 20 percent of Port cargo, but with cargo growth and the desire to maximize on-dock throughput, it has been proposed that these yards be expanded and new yards be developed over the next 20 years. This strategy aims to efficiently handle international cargo while minimizing environmental impacts. Recent actual on-dock throughput is provided in **Table 2a** and the projected on-dock throughput associated with planned improvements (as described in REP) is provided in **Table 2b**.

Table 2a: Actual SPB On-Dock Intermodal Throughput

(millions of TEU)	2003	2004	2005	2006
POLB	**0.51**	**0.86**	**1.09**	**1.40**
Percent of POLB Throughput	11.0%	14.9%	16.3%	19.2%
POLA	**1.37**	**1.51**	**1.84**	**2.40**
Percent of POLA Throughput	19.1%	20.6%	24.6%	28.3%
Total SPB	***1.88***	***2.37***	***2.93***	***3.80***
Percent of Port Throughput	*15.9%*	*18.1%*	*20.7%*	*24.1%*

Table 2b: Projected SPB On-Dock Intermodal Throughput

(millions of TEU)	2010	2015	2020	2030
POLB	**2.27**	**4.15**	**5.49**	**6.10**
Percent of POLB Throughput	23%	32%	32%	30%
POLA	**2.79**	**4.33**	**6.25**	**6.84**
Percent of POLA Throughput	27%	31%	33%	31%
Total SPB	***5.06***	***8.47***	***11.74***	***12.94***
Percent of Port Throughput	*25%*	*31%*	*32%*	*30%*

The locations of existing and proposed Port rail yards are shown in **Figure 3**.

Figure 3 - Existing and Proposed Port Rail Yards

LEGEND

POLB Rail Yards
1 – Pier J On-Dock [1]
2 – Pier G On-Dock [1]
3 – Middle Harbor Terminal (Piers DEF) On-Dock [1]
4 – Pier A On-Dock [1]
5 – Pier S On-Dock [2]
6 – Pier T On-Dock [1]
7 – Pier B Rail Yard [1]

POLA Rail Yards
8 – TICTF Shared On-Dock [1]
9 – Pier 300 On-Dock [1]
10 – Pier 400 On-Dock [1]
11 – WBICTF On-Dock [1]
12 – WB-East (TraPac) On-Dock [2]
13 – PHL Base/Support Rail Yard [2]

Notes:
1) *Reconfiguration/expansion of existing yard.*
2) *Construction of new rail yard.*

VII. Rail Yard Capacity/Demand

Capacity of planned off-dock, near-dock and on-dock rail yards will not meet projected demand for SPB intermodal cargo. However, the Ports are considering additional potential projects as described in the subsequent "Other Potential Projects" section.

The rail yard capacity/demand analysis indicates that demand for off-dock rail yards will outstrip the existing capacity. In fact, transload and domestic cargo alone (which cannot be handled at on-dock or near-dock rail yards) is expected to take up all existing off-dock capacity in the 2010-2015 timeframe, depending on domestic cargo growth rates (0% growth will leave capacity until 2015; 3% growth will take all capacity by 2010). Therefore, direct intermodal will need to be accommodated at on-dock or near-dock rail yards, which is also preferable from the standpoint of minimizing trucking impacts such as traffic congestion and diesel emissions.

Direct Intermodal: SPB intermodal cargo that is not transload.

Transload: SPB intermodal cargo that is processed through local warehouses prior to loading onto trains at off-dock rail yards.

Domestic: cargo transported between two points in the U.S., but unrelated to Ports.

Base and Alternative Rail Yard Capacity/Demand Scenarios

Several scenarios of on-dock development have been explored to understand their implications on rail yard capacity/demand. The MPC Scenario assumes all planned development occurs and is used as the basis for all further capacity/demand considerations in this report. The other scenarios are less optimistic and therefore result in greater capacity shortfall. The capacity shortfall, or latent demand, should be considered the amount of additional rail yard capacity needed to meet demand. The Ports are considering "Other Potential Projects" (described later) to provide this additional capacity.

MPC Scenario: This base capacity/demand analysis assumed that all projects in the REP are developed and that rail yards operate at their maximum practical capacity (MPC). The MPC Scenario assumes that on-dock rail yards use longshore labor to load and unload containers from trains. The assumption for working shifts when these operations are performed increase over time as follows: 1-shift in 2005; 2-shifts in 2010; 3-shifts in 2015 and 3-shifts with modified operating practices in 2020 and beyond. The modified operating practices assume that enhanced safety systems are implemented in all rail yards to allow loading trains while other trains are moving in the yard (when at least 30 feet away). The results from the MPC Scenario analysis are presented in **Table 3a**.

Two-Shift Scenario: The Two-Shift Scenario limits all future operating conditions to those modeled by MPC for 2010 (i.e. 1-shift in 2005 and 2-shifts in 2010 and beyond, with no change in labor practices). This assumption reduces the on-dock capacity and the ability to meet demand after 2010, as indicated in **Table 3b**. Note that this scenario still assumes all rail yard development as proposed by the REP.

No-Action Scenario: The No-Action Scenario limits all future development of on-dock rail yards, therefore retaining existing rail yard conditions. Rail yard loading is allowed to grow from 1-shift in 2005, to 2-shifts, in 2010 and 3-shifts in 2015; but no change in labor practices are assumed. This scenario further reduces the on-dock capacity and the ability to meet demand, as indicated in **Table 3c**.

Table 3a: Direct Intermodal Demand & Capacity – MPC Scenario

Direct Intermodal excludes Transload All values in millions of TEU	2005 Actual	2010	2015	2020	2030
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.09	2.27	4.15	5.49	6.10
POLA On-Dock Capacity [1,2]	1.84	2.79	4.33	6.25	6.84
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.84	1.84	1.84
SPB Variance (negative = shortfall)	**0.03**	**-0.97**	**-0.48**	**-0.90**	**-2.23**

Footnotes:

1 *Capacity (Forecast Throughput from MPC Model) assumes all REP projects.*

2. *2005 capacity reflects actual direct intermodal at on-dock, near-dock and off-dock.*

3. *Transload (10% of SPB Ports) + domestic (no growth) consume all off-dock capacity by 2015.*

4. *No expansion of near-dock facilities is assumed, except mini-ICTF at Pier B.*

Table 3b: Direct Intermodal Demand & Capacity – 2-Shift Scenario

Direct Intermodal excludes Transload All values in millions of TEU	2005 Actual	2010	2015	2020	2030
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.10	2.27	3.98	4.90	5.15
POLA On-Dock Capacity [1,2]	1.84	2.79	4.11	4.78	4.78
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.84	1.84	1.84
SPB Variance (negative = shortfall)	**0.04**	**-0.97**	**-0.87**	**-2.96**	**-5.24**

Footnotes: Same as Table 3a

Table 3c: Direct Intermodal Demand & Capacity – No-Action Scenario

Direct Intermodal excludes Transload All values in millions of TEU	2005 Actual	2010	2015	2020	2030
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.10	1.74	2.14	2.28	2.28
POLA On-Dock Capacity [1,2]	1.84	2.47	3.08	3.08	3.08
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.40	1.40	1.40
SPB Variance (negative = shortfall)	**0.04**	**-1.82**	**-4.18**	**-7.72**	**-10.25**

Footnotes:

1 *Capacity (Forecast Throughput from MPC Model) assumes existing infrastructure, no REP projects.*

2. *2005 capacity reflects actual direct intermodal for on-dock, near-dock and off-dock.*

3. *Transload (10% of SPB Ports) + domestic (no growth) consume all off-dock capacity by 2015.*

4. *No expansion of near-dock facilities is assumed.*

The Study uses the MPC Scenario as the basis to analyze SPB ability to meet demand for direct intermodal capacity.

The REP had included a near-dock facility located south of the existing UPRR ICTF, which would meet the demand for direct intermodal capacity to nearly 2030, and likely beyond. However, POLA is evaluating alternative developments to ensure that the most environmentally sensitive project is selected. The near-dock facility (SCIG) is still listed on the REP (Project II.5), but is now being evaluated through a comparative analysis with “Other Potential Projects” described in the next section.

VIII. Other Potential Projects

The capacity of on-dock and near-dock rail yards programmed in the REP (excluding II.5-New Near-Dock ICTF South of Sepulveda) will not meet demand in the 2010-2030 timeframe. Additional on-dock and near-dock facilities are being considered by the Ports to meet the latent demand. These additional developments will need to be pursued to avoid the significant impacts of intermodal cargo being trucked through the Southern California region. These “Other Potential Projects” are listed in **Table 4** and further considered for their ability to meet demand and fit efficiently into the SPB Port rail network.

Table 4: Other Potential Projects to Provide Rail Yard Capacity

Name	Type	Owner	Proposed Operator	Status	Annual MPC (TEU)
POLA Terminal Island Intermodal Facility	On-Dock	POLA	tbd	Conceptual	1,400,000
POLB Pier T Mole Expansion	On-Dock	POLB	tbd	Conceptual	1,100,000
Southern California International Gateway (SCIG)	Near-Dock	POLA	BNSF	Harbor Development Permit	1,800,000
Intermodal Container Transfer Facility (ICTF) Expansion	Near-Dock	JPA	UPRR	Conceptual	1,900,000

POLA Terminal Island Intermodal Facility

POLA is evaluating the development of additional intermodal facilities on Terminal Island. The primary area of focus is south of Seaside Avenue (SR-47), including the former LAXT site. Initial conceptual layouts have been developed. This facility has not been modeled for MPC throughput or simulated with RTC to understand train access issues.

The RTC simulations of existing and planned facilities indicate that the throat from Badger Bridge to Pier 300 (CP Mole) is constrained and any additional rail traffic should be carefully studied to understand how it would affect the stability of the rail network system. The RTC simulation was used to model increased train volumes associated with a surrogate Terminal Island facility (Pier T Mole at 1.1 million TEU) and found that the rail network system would become constrained, causing unacceptable Level of Service throughout the system. It is estimated that the rail network system would become gridlocked with Terminal Island rail yard expansion greater than approximately 1.5 million TEU beyond the REP expansions.

POLB Pier T Mole Expansion

POLB is also considering the development of additional intermodal capacity on Terminal Island. The primary area of focus is the Navy Mole. The expansion onto the Mole adjacent to Pier T would create unit-train length tracks, which would be efficient and provide high capacity. However, Pier T is a single-user, on-dock facility and it must be determined how the additional capacity would be utilized. Pier T would need to generate exceptionally high volumes of intermodal cargo, or the rail yard would need to accept containers from other marine terminals.

The RTC simulation was used to model increased train volumes associated with the expanded Pier T Mole concept (at 1.1 million TEU) and found that the rail network system became constrained, causing unacceptable Level of Service throughout the system..

An additional concern, if the rail yard were to be used as a multi-user facility, is that the marine terminals that are target users are located off of Terminal Island and will therefore generate truck traffic on the Gerald Desmond Bridge and Vincent Thomas Bridge. This traffic could exceed the volumes studied under current bridge analyses.

Southern California International Gateway (SCIG)

The Port of Los Angeles has evaluated and pursued development of property immediately south of the UPRR ICTF. This development has advanced to submittal of a Harbor Development Permit with BNSF as the proposed operator. BNSF refers to the project as Southern California International Gateway (SCIG). The site, north of Pacific Coast Highway, is bounded by Dominguez Channel and Terminal Island Freeway. The facility is estimated to have capacity in excess of 1.8 million TEU provided by a densified layout with large-gauge rail mounted cranes over six tracks. SCIG is ideally located adjacent to the Alameda Corridor for train access and adjacent to both Alameda Street and Terminal Island Freeway for truck access. BNSF has proposed to make this facility as “green” (environmentally friendly) as possible.

The SCIG project was included in the REP (Project II.5) based on prior development plans, but to facilitate comparative evaluation of “Other Potential Projects,” SCIG is not included in the capacity/demand analysis; instead it is being considered on equal footing with all “Other Potential Projects” described in this section.

ICTF Expansion

UPRR is considering plans to expand their existing ICTF facility north of Sepulveda Boulevard. The planning is in the conceptual development phase. The proposed facility could have a potential throughput capacity of 3.5 million TEU (1.9 million TEU over the existing 1.6 million TEU capacity). Since the rail access to ICTF occurs north of Thenard Junction, this expansion will not impact the constrained “Texaco Slot” portion of the Port rail network.

Summary of Other Potential Projects

The rail yard capacity expansion projects proposed in the REP (excluding SCIG) will not meet the forecast demand for intermodal facilities. As shown in **Table 3a**, latent demand for direct intermodal capacity is nearly one million TEU through 2020 and increases to at least two million TEU by 2030. The latent demand through 2020 could be met by any one of the “Other Potential Projects.”

Simulation modeling shows that development of one of the “Other Potential Projects” on Terminal Island will negatively impact the Port rail network performance (unacceptable Level of Service with less than 1.5 million TEU added to the REP), and the network will not support more than one of the “Other Potential Projects” on Terminal Island (more than 1.5 million TEU added to the planned Terminal Island throughput is expected to cause unstable rail system performance).

An additional concern with the development of multi-user rail facilities on Terminal Island is that the greatest needs for intermodal rail facilities are in other areas. Therefore, a project on Terminal Island will induce truck traffic over the Gerald Desmond Bridge and Vincent Thomas Bridge, both of which are critical to the Port transportation system.

Since only one of the “Other Potential Projects” can be accommodated on Terminal Island (and then with potentially unacceptable rail network performance), SCIG, ICTF Expansion or another project off Terminal Island would be required to meet the projected intermodal demand expected by 2030. Implementation of either SCIG or the ICTF Expansion project would, by itself, approach meeting all of the demand through 2030. The near-dock facilities (e.g. SCIG and ICTF) have the advantage of accommodating cargo from any of the marine terminals that need support; they are optimally located near the Port and adjacent to the Alameda Corridor; and the site configuration allows efficient track lengths, high productivity and “green” operating systems. SCIG has the benefit of providing competitively balanced near-dock facilities to the two Class I Railroads. ICTF has the advantage of rail access upstream of the Texaco Slot bottleneck, and it also has significant support track in Dolores Yard/ICTF Support Yard.

IX. Rail Simulation Model

Dynamic simulation modeling 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), but to assist in interpretation of the model results, a Level of Service (LOS) grade is assigned as defined in the adjacent inset.

Level of Service (LOS)
Definition for SPB Ports Area

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

LOS of C or better is considered desirable based on experience at similar rail terminal environments and on the length of delays that were experienced by individual trains during simulation runs with those delay ratios. LOS D is undesirable and LOS E or F is considered unacceptable. Trains still reach their destination under LOS D, E or F, but delays become high with associated costs; and the system is fragile such that it cannot quickly recover from conflicts causing backups. Track outage events and maintenance will cause lasting impacts to the system performance.

The RTC Model was run with projected train volumes for each of the forecast years. These runs were similar to the previous model runs (POLB 2002/POLA 2003) except for the following:

- Pier W is not included in the planned rail yard expansions as previously modeled in 2020, although a similar Pier T Mole expansion was tested in 2030 runs herein;
- Southern California International Gateway (SCIG) is modeled as a near-dock rail yard;
- Pier B is expanded as a mini-ICTF and support yard extending north of 9th Street;
- Texaco Slot track expansion was replaced with a by-pass along the Wilmington Wye; and
- The switching operations inside of rail yards were modeled more explicitly.

Projected train volumes are indicated in **Table 5** for peak day conditions. The RTC Model was run for a four-day simulated period with each day generating the peak day train volumes.

Table 5: Peak Day Train Volumes

Train Type	2005	2010	2015	2020	2030
On-Dock Intermodal	25	42	61	96	113
Non-intermodal	25	25	25	25	25
Light Engine/Switching	30	38	40	47	55
Pier B Rail Yard	0	0	2	2	2
UP ICTF	14	14	26	26	34
SCIG	0	16	16	16	18
Shuttle Trains (Typ.)	4	10	10	10	10
Total	**98**	**145**	**180**	**222**	**257**

Findings from the RTC Model runs are similar to the previous Rail Study, except that the need for triple track to Terminal Island south of Thenard Junction (including Badger Avenue Bridge) is not critical unless one of the “Other Potential Projects” is developed on Terminal Island. The model results still indicate that Badger Bridge needs to be locked down by 2010 to maintain desirable LOS. The model supports all other rail infrastructure improvements and shows that SCIG can be supported by the Port rail network. It should be noted that the RTC Model tends to provide optimistic results.

Table 6 presents LOS results from various model runs related to train access on Terminal Island. This table is presented to illustrate the use of simulation results in determining rail network infrastructure deficiencies and solutions. Desirable conditions are achieved by conditions below the bold line and in the shaded area. **Table 6** shows the following results:

- Current train volumes – the rail network performs within desirable LOS, even with Badger Bridge lifting for vessel passage.
- 2010 train volumes – LOS is undesirable unless Badger Bridge is raised for emergencies only.
- 2015 train volumes – LOS is undesirable unless an additional track is provided from W.Thenard to Terminal Island. The previous Rail Study had indicated that extension of CTC could postpone this project, but current modeling indicates that congestion around CP Mole creates a need for the additional mainline to Terminal Island.
- 2020 train volumes – even with the additional mainline to Terminal Island, the LOS is undesirable, but has not reached unacceptable.
- Development of one of the “Other Potential Projects” on Terminal Island will result in LOS in the unacceptable range when operated in addition to SCIG. However, when SCIG switching impacts are reduced, then LOS improves, but is still in the unacceptable range.

Table 6: Rail Network System Performance Results

	2005	2010	2015	2020	Other TI
Scenario *(Badger Bridge Up Time)*	**LOS *(Delay Ratio)***				
1. Bridge Lifts *(280 minutes/day)*	**C** ***(24%)***	***D****	**E** ***(38%)***		
2. Bridge Lifts for Emergency Only *(0 minutes/day)*		**C** ***(26%)***	**D** ***(34%)***	**D** ***(36%)***	
3. Scenario 2 plus Added Mainline to TI *(0 minutes/day)*			**C** ***(29%)***	**D** ***(35%)***	
4. Other Potential 1.1 MTEU Project on TI *(0 minutes/day)*					**F (44%)**
5. Scenario 4 plus reduced SCIG switching *(0 minutes/day)*					**E (37%)**
Conclusion – Badger Bridge reqmt for preferable LOS	***bridge lifts okay***	***no bridge lifts***	***triple track bridge***	***undesirable***	***unacceptable w/TI 1.1M***

*-Use previous Rail Study run data for this Bridge Lift case.
TI – indicates Terminal Island

The 2020 model results did not indicate LOS improvement with the additional track from W.Thenard to Terminal Island (including third track on Badger Avenue Bridge), which is likely due to an unidentified upstream bottleneck; it is intuitive to expect that the triple track to Terminal Island would provide significant benefits to the Port rail network performance by the 2015 to 2020 timeframe.

Terminal Island Line

The most important factors affecting Terminal Island performance are the mainline from CP W.Thenard to across Badger Bridge, and the configuration of main track crossovers and terminal leads at CP Mole. Improvements will be required for each of these to achieve acceptable rail system performance as intermodal cargo volumes increase to forecast 2015 volumes.

Allowing Badger Bridge to lift for vessel passage causes performance to decline significantly, compared with a locked-down bridge, even with the construction of second leads at terminals and some crossover reconfiguration. In 2010, lifting the bridge increases the delay ratio on Terminal Island by 35 percent.

Even with all the improvements shown in the Rail Enhancement Program list, the addition of another major rail facility, such as Pier T Mole expansion or a multi-user rail yard on the Los Angeles side of Terminal Island (“Other Potential Projects”), is shown by 2030 runs to result in a 73 percent increase in relative delays. The Level of Service under that condition is considered unacceptable.

Long Beach Line

In general, the Long Beach Line performs well through 2010. By 2015, Pier J, Pier G and Middle Harbor Terminal are significantly expanded and Pier B is providing support. The simulations indicated a need for the following improvements:

- Dual leads connecting the G/J support yard and Pier J;
- A new lead on the north side of the Pier J working tracks;
- Receiving tracks at Pier G should fully chamber unit trains off the mainline; and
- An additional track at CP Ocean Blvd from Pier F to Pier B yards.

West Basin Line

Improvements proposed to be made by 2015 improve West Basin operations, especially the lock-down of Badger Bridge. Because trains move more efficiently to and from Terminal Island, delays are less for West Basin trains. However, there may be some problems in comparing West Basin delays with those of other lines, because of the high number of PHL switch jobs competing for space at the PHL yard and on its leads. Half of all delay is incurred by PHL jobs. There are nine jobs per day using the PHL yard and leads, experiencing an average of 3.3 total hours of delay per day. There are 8 expedited trains per day, incurring only an average of one hour delay per day.

All of the West Basin planned improvements are necessary, including a second north leg of the Wye at CP Anaheim.

Grade Crossings

The RTC Model collects data on duration of roadway blockages by trains. Individual grade crossing blockage times are presented in the main report. In general, any at-grade crossing (traffic must stop when a train is present) on mainlines of the Port rail network should be grade separated or closed. The following at-grade crossings are of particular interest:

- Edison Avenue crosses the mainlines to Port of Long Beach and will experience increasing blockage times as intermodal cargo volumes grow. The road would be crossing the expanded Pier B rail yard. This crossing should be closed immediately, and is one of the REP projects.
- 9th Street crosses the mainlines to Port of Long Beach and will experience increasing blockage times as intermodal cargo volumes grow. This road would be displaced by the expanded Pier B rail yard. 9th Street should be closed and traffic rerouted onto Pier B Street, which should provide connections to Anaheim Road, the SR-47 freeway (requires new access ramps) and the SR-710 freeway.
- Rail access to Port of Los Angeles-West Basin crosses several roads in the area of Neptune Avenue and Fries Avenue. A grade separation is proposed to provide free flowing traffic over the rail in this area.
- Henry Ford Avenue in the vicinity of Dominguez Channel crosses two tracks: the south leg of the Anaheim Wye, and the Terminal Island Lead Track (TILT) on the east side of Dominguez Channel. These tracks are ancillary to the Alameda Corridor mainlines, which are grade separated on elevated structures in this area. Therefore, the blockage times caused by the lesser used at-grade tracks are not excessive. The crossing protection and traffic signal systems need to be upgraded at the Anaheim Wye.
- Reeves Avenue crossing at the Pier 400 lead tracks has significant impact on rail operations. The Ports of Long Beach and Los Angeles have a contract with PHL with a stipulation that trains will not occupy an at-grade crossing for more than 10 minutes including stopping and switching (compliant with CPUC requirements). This causes train arrivals at Pier 400 to be performed by shoving trains into the yard. This allows rail cars that do not fit on the first landing track to be disconnected and quickly pulled back to clear Reeves crossing. The remaining rail cars can then be shoved onto a second landing track after roadway traffic has cleared.

The maneuver to turn the train to enable the shove into Pier 400 (rather than pulling the train) typically involves pulling the train onto the Long Beach Lead, then up the Manual Siding; the train then reverses direction and is shoved down TILT to Pier 400. This maneuver is highly obstructive to the Port rail network and will create unacceptable Level of Service and excessive train delays by as soon as 2010. The closure of Reeves Avenue crossing would result in acceptable LOS for the rail system, along with safer operations.

X. Rail Enhancement Program

The rail yard expansion projects and rail infrastructure improvement projects that have been proposed and approved by the Ports are now developed into a Rail Enhancement Program (REP) with schedule and cost estimate for each project.

Meetings with industry stakeholders (marine terminal operators, shipping lines, and railroads) have concluded that the new rail infrastructure in the REP is needed. The industry stakeholders have requested that the REP projects be implemented to support their operations.

Pier B Rail Yard (Projects III.1 and III.2) is vital to rail operations in the Port of Long Beach and the entire SPB rail network system. The Pier B Yard currently provides storage tracks; the Phase I expansion will greatly improve its ability to perform this function, which supports many other POLB rail facilities. Phase II of the project is important because it develops unit-train length holding tracks, which can serve as a buffer for trains arriving off the Alameda Corridor or waiting to leave POLB. This buffer area will ease congestion on the Corridor as well as at on-dock rail yards. The Pier B Rail Yard-Phase II has also been evaluated for its ability to serve as a near-dock facility and this feature is recommended as beneficial to POLB marine terminals.

The rail yard expansion projects are listed in **Table 7** and rail infrastructure improvement projects are listed in **Table 8**. The projects locations are shown on **Figure 4**.

All of these REP projects are compiled together using the chart shown in **Figure 5**. The chart indicates the type of project (rail yard or rail network infrastructure); the responsible agency (Sponsor); development costs (in 2005 dollars); and development schedule. The development schedule is broken into three phases consisting of: 1) planning/environmental, 2) design/bid and 3) construction. Note that portions of the design may be performed during the planning/environmental period. Costs are also accumulated for all projects on an annual basis at the bottom of the schedule.

Rail Yard Projects

The Study proposes an ambitious program of rail yard capacity improvements including expansion of existing yards and development of new facilities. The projects are listed in **Table 7** and project locations are shown on **Figure 4**.

Table 7: List of On-Dock Rail Yard Projects

	Rail Yard Project	Sponsor	Development Cost ($ millions)
	Phase I Short-term (by end of 2007)		
	No Rail Yard Projects		
	Phase II Near-term (by end of 2010)		
II. 1	Pier A On-Dock Rail Yard Expansion to Carrack	POLB	19.6
II. 3	Pier S On-Dock Rail Yard	POLB	34.3
II. 5	New Near-Dock-South of Sepulveda (potential)	POLA	Na
II. 9	Pier G-New North Working Yard	POLB	14.1
II. 10	Pier G-South Working Yard Rehabilitation	POLB	40.7
II. 13	West Basin East-New ICTF (Phase I)	POLA	45.4
	Phase III Medium-term (by end of 2015)		
III. 5	Navy Mole Road Storage Rail Yard	POLB	10.0
III. 8	Middle Harbor Terminal Rail Yard	POLB	68.9
III. 9	Pier J On-Dock Rail Yard Reconfiguration	POLB	100.0
III. 10	Pier 400 On-Dock Rail Yard Expansion (Phase I)	POLA	33.4
III. 11	Pier 300 On-Dock Rail Yard Expansion	POLA	23.4
III. 12	Terminal Island ICTF Rail Yard Expansion	POLA	18.9
III. 13	West Basin ICTF Rail Yard Expansion (Phase I)	POLA	6.2
	Phase IV Long-term (beyond 2015)		
IV. 3	Pier A On-Dock Rail Yard East of Carrack	POLB	31.4
IV. 4	Pier 400 On-Dock Rail Yard Expansion (Phase II)	POLA	16.3
IV. 5	West Basin ICTF Rail Yard Expansion (Phase II)	POLA	12.5
IV. 6	West Basin East-ICTF Expansion (Phase II)	POLA	7.8
		Subtotal POLA Cost (millions)	$163.9
		Subtotal POLB Cost (millions)	$318.9
		Total Potential Rail Yard Cost (millions)	$482.8

Infrastructure Projects

Rail network improvement projects identified and validated through the RTC simulation efforts are listed in **Table 8** and project locations are shown on **Figure 4**.

Table 8: List of Rail Infrastructure Projects (Outside Marine Terminals)

	Rail Infrastructure Project	Sponsor	Development Cost ($ millions)
	Phase I Short-term (by end of 2007)		
I. 1	Closure of Edison Avenue Grade Crossing	POLB	0.3
I. 2	Expanded Control Points to POLB/POLA	ACTA	4.9
I. 3	Thenard Track Connection at Alameda Street/K-Pac	ACTA	4.6
	Phase II Near-term (by end of 2010)		
II. 2	Terminal Island Wye Track Realignment	POLB	3.6
II. 4	Pier B Street Realignment	POLB	12.6
II. 6	Constrain Badger Bridge Lifts	POLB/LA	1.0
II. 7	Track Realignment at Ocean Boulevard/ Harbor Scenic Drive	POLB	20.0
II. 8	Pier F Support Yard	POLB	3.4
II. 11	Double Track Access from Pier G to Pier J	POLB	1.7
II. 12	West Basin Rail Access Improvements	POLA	150.0
	Phase III Medium-term (by end of 2015)		
III. 1	Pier B Rail Yard Expansion (Phase I)	POLB	85.4
III. 2	Pier B Rail Yard Expansion (Phase II)	POLB	159.9
III. 3	Grade Separation for Reeves Crossing	POLB/LA	60.0
III. 4	Closure of Reeves At-grade Crossing	POLB/LA	1.0
III. 6	Pier 400 Second Lead Track	POLA	7.7
III. 7	Reconfiguration at CP Mole	POLB/LA	20.0
	Phase IV Long-term (beyond 2015)		
IV. 1	Triple Track Badger Bridge	ACTA	91.0
IV. 2	Triple Track South of Thenard Jct.	ACTA	16.5
	Subtotal ACTA Cost (millions)		$117.0
	Subtotal POLA Cost (millions)		$157.7
	Subtotal POLB Cost (millions)		$286.8
	Subtotal Shared POLB/LA Cost (millions)		$82.0
	Total Potential Infrastructure Cost (millions)		**$643.6**

<Figure 4-Project Location Map>

<Figure 5-REP Chart>

XI. Conclusions

Purpose

This Rail Study provides an update to the *Rail Master Planning Study* (POLB 2002) and *Rail Capacity Analysis* (POLA 2003). The Study identifies all rail related issues, including mainline track, storage capacities, operations and systems, and substantiates the actions required to provide acceptable levels of service for trains in 2005, 2010, 2015, 2020 and 2030. The study provides a Port Rail Enhancement Program (REP) that identifies necessary improvements and provides a phased implementation plan. This study was the first of the proposed 5 year updates, as recommended by the 2002 *Rail Master Planning Study* to incorporate revised cargo forecast, updated terminal plans and consider current operating conditions.

Benefits

As a measure of the benefits of on-dock rail, consider the hypothetical situation where all of the REP projects are built and operating today: the level of on-dock throughput would be nearly double that of existing and would remove nearly 6,000 trucks a day from the local roadways. As cargo volumes increase, the benefits of on-dock rail will increase as well. Given 2030 cargo forecasts and full development of the REP, on-dock rail would remove nearly 29,000 truck trips daily. Since there is currently no viable opportunity to accommodate the forecast cargo volumes elsewhere on the West Coast, the no action scenario would result in extensive truck trips over long distances seeking out available locations for intermodal capacity. This would add millions of truck-miles to our local freeway system each day.

Capacity & Demand

The San Pedro Bay Ports of Long Beach and Los Angeles will need to rely on their on-dock and near-dock facility plans to meet demand for intermodal capacity. Beginning in 2010, the current plans for on-dock rail yard expansion will not meet the projected demand. Additional capacity will be required and the Ports are evaluating other potential rail yard projects.

Potential near-dock expansion projects (e.g. SCIG or ICTF) appear to provide good opportunities for developing rail yard capacity to meet the projected demand. These facilities have ready rail access, efficient layout opportunities, good truck access and are committed to be “green.” Other potential rail yard development projects on Terminal Island (beyond the REP projects) are shown by simulation to increase train delays on the entire Port rail network.

Off-dock rail yards that handle transload cargo (10 percent of total Port throughput) and domestic cargo will run out of capacity by the 2010-2015 timeframe, depending on domestic cargo growth rates (0% growth will leave capacity until 2015; 3% growth will take all capacity by 2010). To meet this latent demand, new off-dock rail yards will need to be developed, and the most likely location for the new facilities is in the Inland Empire or further inland. Another potential for accommodating some of the transload cargo is to expand near-dock facilities and allow these to handle larger containers from warehouses in the Port vicinity.

Rail Network Performance

Rail simulation modeling indicates that all rail infrastructure projects in the Rail Enhancement Program are needed to provide a rail network that performs without unacceptable train delays and gridlock. This investment will accommodate projected train traffic through 2030. These projects will require significant investment, but the benefit to cost ratio appears favorable.

It should be noted that if one Other Potential Project (a rail yard not included in the REP) is developed on Terminal Island, then simulation modeling indicates that the rail system performance will degrade to an unacceptable Level of Service. Based on simulation results, any additional Terminal Island development (beyond the one Other Potential Project) will cause such congestion and train delays as to cause the rail network system to fail.

Recent Operational Changes

Efforts of the *Truck Reduction Study* (including this Rail Study) and the Rail Action Planning Committee have identified key issues affecting goods movement and resulted in operational changes, including:

- Rail crews report at SPB
- Railroad dispatchers stationed at PHL
- Standardized rail data maintained between terminals/railroads
- Increased railroad work force and equipment
- Longer trains to/from SPB
- Train fueling within SPB
- New PHL agreement

The Rail Action Planning Committee was created in January 2006 with the goal of maximizing utilization of existing rail infrastructure. The Rail Action Planning Committee includes representation from POLB, POLA, marine terminal operators, shipping lines, railroads and ACTA. The following strategies are proposed to maximize on-dock rail utilization:

- Utilize LAXT tracks
- Maximize train lengths
- Improve switching efficiencies
- Improve locomotive availability
- Reduce marine terminal operational constraints
- Provide in-ground air system for trains
- Improve container stowage on ships
- Provide better system for planning and coordination
- Improve railcar utilization and Customs holds

The Rail Action Committee is also in the implementation stage of a project known as the San Pedro Bay Ports Rail Business Exchange. This project has the goal of improving Port rail operations by facilitating communications, maximizing intermodal cargo velocity, streamlining administrative processes and providing visibility about how cargo is moving and fits into other traffic.

The SPB Rail Business Exchange is an internet based communication/planning tool with features including:

- Input vessel rotations and train schedules for advanced planning
- Input vessel manifest/stowage plan 72 hrs prior to arrival for tactical planning
- Provide eastbound train lineup, pull times and departure slots
- Provide westbound train consist and estimated time of arrival for vessel planning
- Make Switch Job plans available to railroads and marine terminals
- Optimize daily conference call with each railroad customer
- Coordinate Plan to avoid asset and resource congestion
- Provide message board to post changes in status and otherwise document events

Non-traditional Rail Concepts

Non-traditional rail concepts involve uses of trains that are not currently employed. These include the following concepts.

Inland Shuttle Train: Defined as rail transport to an "inland port" for distribution of local cargo. The inland port concept may prove beneficial due to the level of highway congestion and the potential value of truck traffic reductions as a mitigation measure. However, this concept will increase the demand on Port rail yard capacity as well as mainline rail capacity.

Inland Block-Swap: The concept of an inland rail yard to sort trains can provide several rail operating improvements that coincide with the recommendations of this Study. Features of this concept and associated benefits are described as follows:

- Provide the ability to build multi-destination trains by blocks at each on-dock rail yard. Trains can then be block-swapped at the inland yard to create single destination trains. This will increase the potential volume of on-dock cargo by alleviating the challenges with building long destination trains.
- Provide the ability to block-swap westbound trains at the inland yard to create Port-terminal specific trains. This will reduce inter-terminal switching movements at the Port.
- Provide dedicated regional shuttle engines that handle the train movements between the inland yard and the Port. These locomotives will be fueled for round trip, readily manage crew changes, and have the ability to drop a westbound train and pick-up an eastbound train without turning the locomotive (have both ends functional so locomotive can simply be reversed). This will significantly reduce the light engine traffic moving around the Port by eliminating the need to turn engines, reach crew change points and transit to engine services facilities. This concept could also facilitate application of green technologies to locomotives in the sensitive Southern California Air Basin.

The Ports should work closely with the Railroads to define and pursue these non-traditional concepts as well as near-dock rail yard capacity enhancements. This relationship should be expanded to include other area government agencies for a critical evaluation of regional mainline capacity.

XII. Summary

The cargo that is forecast to arrive at the San Pedro Bay Ports will create the need for significant improvements in terminal throughput capabilities. The increased cargo volumes will also require careful evaluation of the landside transportation system. The 2001 *Port of Long Beach/Los Angeles Transportation Study* defined highway congestion that would result from the increased cargo volumes and recommended that at least 30 percent of the cargo should be moved by on-dock rail. This "Rail Study Update" defines the rail yard, mainline, systems and operations improvements necessary to achieve and exceed this goal.

The goal of this "Rail Study Update" is to maximize capacity and utilization of on-dock rail, and to evaluate the rail system performance and recommend enhancements to Port infrastructure that are necessary to meet forecast cargo demands. This Study incorporates recent market conditions, revised Port development plans, and modified cargo forecast based on the latest information available in 2005.

The key points of this Study are as follows:

- Rail yards are conceptualized for each of the proposed terminals at the San Pedro Bay Ports of Long Beach and Los Angeles (SPB). These rail yards have the combined throughput capacity to handle at least 30 percent of the Port cargo during the forecast period 2015 to 2030. Rail concepts will be refined through the environmental process, tenant negotiations and engineering design.
- Even after maximizing the potential on-dock rail yards proposed in the REP, the **demand for intermodal rail service creates a shortfall in rail yard capacity by at least 2010**.
- In addition to maximizing on-dock rail, it is recommended that rail yard capacity be developed at near-dock facilities in the vicinity of the Alameda Corridor and south of the I-405 freeway.
- If additional on-dock or near-dock capacity is proposed on Terminal Island (beyond that already recommended by the REP), this capacity should not exceed 1.5 million TEU to avoid potentially severe train delays or gridlock to the entire SPB Port rail network.
- The train volumes generated by on-dock rail yards are forecast to exceed 100 trains per day. Total train volumes on the Port rail network will exceed 250 trains per day and those on the Alameda Corridor will approach 200 trains per day by the year 2030. Alameda Corridor traffic is averaging 50 trains per day in 2005.
- Various mainline, system and operational improvements will be required within SPB to accommodate the projected train volumes. These required projects are compiled into a phased Rail Enhancement Program (REP). The total cost of this program is over one billion dollars split nearly equally between rail yard projects and rail network infrastructure.
- Even with REP infrastructure improvements, the rail network will suffer increasing train delays that will increase operating costs and potentially disrupt cargo flow.

NOTABLE CONCLUSIONS

1. Implementation of the Rail Enhancement Plan (REP) is critical to support intermodal goods movement at the Port.

2. Planned rail yard expansions are not big enough to handle the cargo volumes that are forecast for 2010 and beyond. More rail yard capacity is needed and potential near-dock rail yards have beneficial features to complement the planned on-dock facilities.

3. Even with all planned rail network infrastructure improvements, cargo volumes forecast for 2020 and beyond will cause increased train delays and operating costs and could constrain intermodal throughput.

4. This Study evaluated the San Pedro Bay rail network and the Alameda Corridor to downtown Los Angeles. The Study did not evaluate the inland rail system beyond downtown Los Angeles, which could potentially present additional bottlenecks to Port intermodal throughput.

1.0 Introduction

The rail system serving the San Pedro Bay Ports of Los Angeles and Long Beach (SPB Ports or Ports) is essential to providing efficient transportation of cargo between the Ports and inland destinations throughout the country. No other port is better positioned than the Ports of Los Angeles and Long Beach to serve our country's growing demand for international cargo. Bearing this responsibility, the Ports are carefully planning the infrastructure necessary to successfully accommodate the anticipated demand. The landside transportation links are especially important since these road and rail access issues have the highest potential to impact the Ports' capabilities, as well as the surrounding communities.

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*. Without on-dock rail, intermodal cargo will add to local highway congestion and diesel truck emissions as it is hauled by truck to be loaded onto trains at inland rail yards. Therefore, 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 terminal without generating truck trips on the local roadways and freeways. Unlike on-dock rail yards that 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 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 in lieu of heavy rail or trucks are being considered under a separate study and are not considered by this "Rail Study Update".

The Port of Long Beach (POLB) previously prepared a *Rail Master Planning Study* (POLB, 2002) to determine future rail traffic demand, identify current and future rail system deficiencies, and develop a plan to implement improvements. The Port of Los Angeles (POLA) subsequently produced a companion document, *Rail Capacity Analysis* (POLA, 2003), which focused more specifically on POLA facilities. These studies were completed based on available data from year 2000.

This "Rail Study Update" (Rail Study or Study) evaluates the rail system performance and recommends enhancements to Port rail yard and rail network infrastructure with consideration for changed market conditions, revised Port development plans, and modified cargo forecast. These conditions are established based on the latest information available in 2005. The SPB Ports were concurrently conducting the *Truck Reduction Study* and this "Rail Study Update" is considered to be a component of the *Truck Reduction Study*.

This report is organized as follows:

Report Section	Description
Sections 1-4 provide overview information on the study and Ports' operations	
Section 1-Introduction	Introduces project purpose, goal, objectives and background
Section 2-SPB Goods Movement	Describes cargo forecast, intermodal cargo flow and transport options
Section 3-Intermodal Facility Demand	Analyzes demand and capacity at off-dock, near-dock and on-dock facilities
Section 4-Port Intermodal Rail Yard Developments	Describes the individual rail yard developments proposed by POLB and POLA
Sections 5-8 look at the specific rail operations required for intermodal flow	
Section 5-Port Rail Operations	Provides an overview of rail operations by railroad and cargo type
Section 6-Rail Traffic Simulation Model	Summarizes the train simulation modeling approach and findings, including a list of rail infrastructure improvement projects
Section 7-Portwide Rail Enhancement Program	Describes the overall rail enhancement program proposed to provide rail yard capacity and to enable efficient train performance
Section 8-Conclusions	Summarizes findings including a comparison of individual project benefits and costs

1.1 Project Goal

The goal of this "Rail Study Update" is to evaluate the rail system performance and recommend enhancements to Port infrastructure. The Port of Long Beach previously conducted a *Rail Master Planning Study* (POLB, 2002) and the Port of Los Angeles conducted a *Rail Capacity Analysis* (POLA, 2003) based on year 2000 conditions. This Study incorporates changed market conditions, revised Port development plans, and modified cargo forecast based on the latest information available in 2005.

The SPB Ports are concurrently conducting the *Truck Reduction Study* and this Study is considered to be a component of the *Truck Reduction Study*. The objectives of this "Rail Study Update" are as follows:

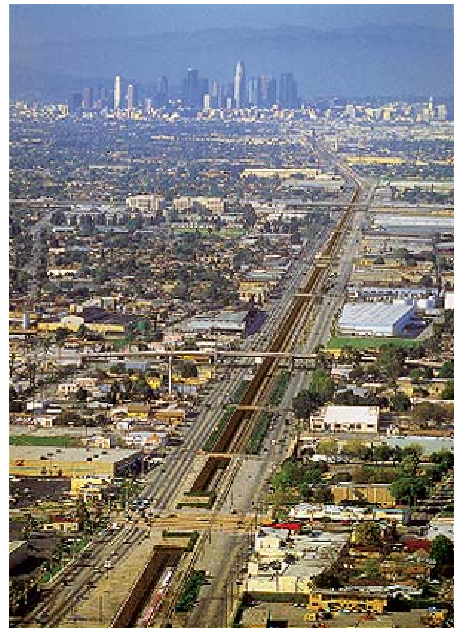
- Establish existing conditions in 2005.
- Identify rail system deficiencies and propose necessary improvements based on rail yard capacity analyses using the MPC Model, and rail network train simulation using the RTS Model.
- Develop conceptual rail designs for mainline track, rail yards, operations and systems.
- Substantiate the actions required to meet rail yard demand and provide acceptable levels of service for trains on the rail network in 2010, 2015, 2020 and 2030.
- Develop a Rail Enhancement Program (REP) that coordinates conceptual improvements through a phased implementation plan with conceptual plans, estimated development costs and schedule for each project. All plans are conceptual and predecisional, and will be designed in further detail during the environmental process, tenant negotiations and final engineering.

The goal for meeting rail yard demand is to maximize capacity and utilization of on-dock rail and supplement that capacity with near-dock facilities as necessary.

Parsons Scope of Work for this "Rail Study Update" is defined by the following tasks:

- On-Dock Terminal Developments: Review on-dock rail yard concepts developed for the *Rail Master Planning Study* to determine any changes in the proposed projects caused by institutional or market conditions. Several projects have progressed into conceptual planning and EIR preparation; associated modifications are incorporated into the Study. Existing and proposed terminal characteristics will be documented by Rail Inventory Sheets for each rail yard.
- Pier B Rail Yard Development: POLB is considering expansion of the Pier B Rail Yard northward to 9th Street and possibly further to Anaheim Street. The requirements for Port-wide storage tracks are evaluated incorporating the development of Pier B Rail Yard. Alternative plans for Pier B Rail Yard will consider the benefits of storage yard versus the benefits of a near-dock intermodal loading rail yard. This task is performed with collaboration from Moffatt & Nichol.
- Rail Yard Capacity Analysis: Evaluate the rail yard capacity of each port terminal in each of the forecast years. The rail yard concepts should consider storage track requirements and should also balance the competing need for space by both the rail yard and the container yard.
- Develop Future Rail Volumes: Develop an estimate of train volumes from each of the Port terminals in each of the forecast years 2005, 2010, 2015, 2020 and 2030. These volumes are used to simulate train movements and include intermodal, non-intermodal, local Pacific Harbor Line (PHL) jobs and light engine moves.
- Simulation Modeling: Oversee the analyses of mainline system performance using dynamic simulation modeling (performed by Willard Keeney of Washington Group). The model shall consider track network characteristics, train volumes, train performance, and train control system implications. The simulation will be used to establish existing conditions in 2005, and analyze train operations in incremental years 2010, 2015, 2020 and 2030.
- Port Rail Enhancement Program: Develop a program of potential rail enhancement projects to include a list of all proposed on-dock/near-dock intermodal rail yards developments and expansions, rail network infrastructure improvements, and rail system improvements. The program shall schedule the planning, environmental permitting, property acquisition, engineering design, bidding and construction of each project on the list. The program shall estimate planning, design and construction costs for each project on the list.
- Project Description Sheets: Develop individual descriptions with graphics for each of the projects on the Port Rail Enhancement Program. Sheets will provide project description, location, purpose and need, benefits, development costs and development schedule.
- Port Rail Maps: Develop Port Rail Maps showing rail development projects at both Ports for each of the forecast years.

1.2 Benefits of Rail Transport



The existing highway transportation system serving the Ports of Los Angeles and Long Beach is becoming constrained. Potential increases in cargo throughput in the next five to twenty years would induce a considerable amount of rail and vehicular traffic onto the transportation system. The Alameda Corridor has introduced significant improvements to the rail system's ability to efficiently carry trains from the Ports to the transcontinental rail system with greatly improved train speed and the removal of at-grade crossings that previously impacted traffic in the adjacent communities.

With the opening of the Alameda Corridor on April 15, 2002 and plans for major on-dock rail yard construction, the Ports of Los Angeles and Long Beach are poised to efficiently handle the projected intermodal cargo growth through 2030 while minimizing environmental impacts. To accomplish this, it is critical to ensure that all of the infrastructure and railway systems are in place to move trains efficiently from the Alameda Corridor, through the San Pedro Bay rail network, to the marine terminals of the Port, and back out again.

Any cargo that is moved by train from the Port benefits the overall transportation system by reducing the truck trips and total truck mileage with the associated impacts. The graphic on the following page shows that each on-dock train can eliminate 750 truck trips and is at least twice as fuel efficient and clean as trucks on a ton-mile basis.

A single container ship may unload 5,000 twenty-foot equivalent units (TEU) to be delivered outside the Port boundaries by a fleet of trucks. However, the movement of cargo by trains loaded at on-dock rail yards is an effective method of reducing the truck traffic. Every train that is loaded on-dock can eliminate 750 truck trips from the highway, and a single ship call can generate five trains worth of intermodal cargo. In other words, on-dock rail can potentially eliminate 3,750 truck trips for every vessel call.

As a measure of the benefits of on-dock rail, consider the hypothetical situation where all of the REP projects are built and operating today: the level of on-dock throughput would be nearly double that of existing and would remove nearly 6,000 trucks a day from the local roadways. As cargo volumes increase, the benefits of on-dock rail will increase as well. Given 2030 cargo forecasts and full development of the REP, on-dock rail would remove nearly 29,000 truck trips daily.

Since there is currently no viable opportunity to accommodate the forecast intermodal cargo volumes elsewhere on the West Coast, a **No-Action Scenario**, with regards to the REP, would result in extensive truck trips over long distances seeking out available locations for intermodal capacity. This would add millions of truck-miles to our local freeway system each day.

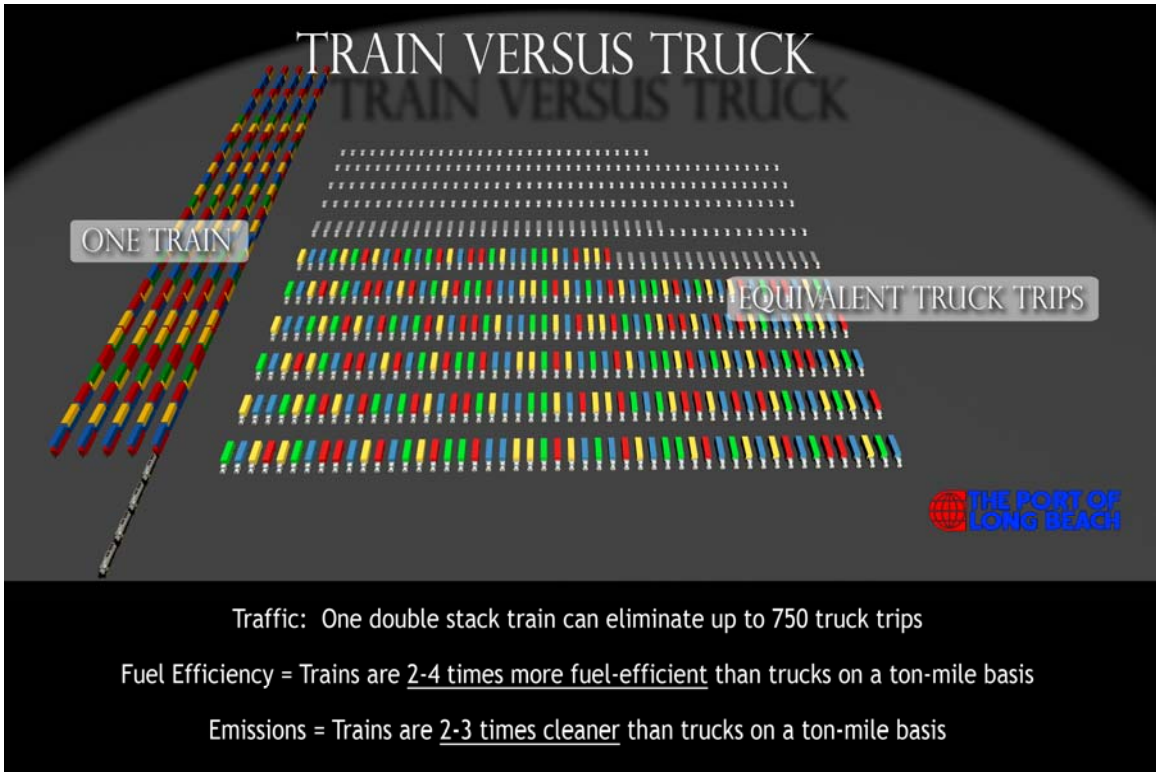


Figure 1.1 – Benefits of On-Dock Rail

1.3 Background

Containerization and the intermodal revolution have changed our world dramatically. The resulting efficiency in global goods movement has ignited the world economy and we have seen rapid evolution of production capabilities throughout the world. The efficiencies are largely governed by the huge economies of scale gained by ocean vessels that are able to carry thousands of containers at a time. In addition, efficiencies are achieved by handling a large package of cargo inside a container, and having the ability to readily transfer that package between truck, ship and train.

The San Pedro Bay Ports of Long Beach and Los Angeles recognized the importance of the transportation links provided by the Port facilities, and have actively planned terminals, roadways and rail infrastructure to ensure that cargo can be moved efficiently, with consideration for the surrounding communities. Following are a sample of reports prepared for transportation planning:

1992 – *Trucksim/Grade Separations*, POLB

2001 – *Ports of Long Beach/Los Angeles Transportation Study*, POLB

2002 – *Rail Master Planning Study*, POLB

2003 – *Rail Capacity Analysis*, POLA

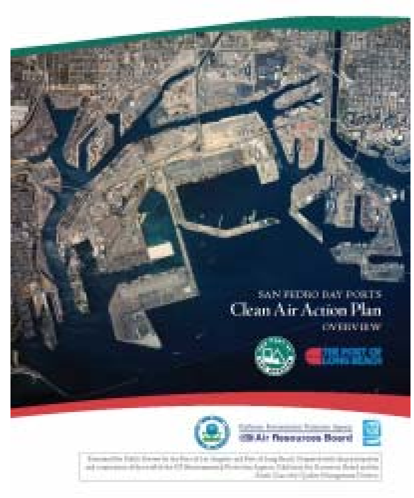
2004 – *Port-Wide Transportation Master Plan*, POLA

2005 – *Integrated Truck Reduction Study*, POLB/POLA/ACTA

The Port of Long Beach *Rail Master Planning Study* was identified as a complementary study to the *Ports of Long Beach/Los Angeles Transportation Study*, and the *Port of Long Beach Facilities Master Plan*.

The SPB Ports are currently pursuing improvements to operations and infrastructure through the following programs:

San Pedro Bay Ports Clean Air Action Plan



Taking an unprecedented joint action to improve air quality in the South Coast Air Basin, the ports of Long Beach and Los Angeles have adopted the *San Pedro Bay Ports Clean Air Action Plan*, a sweeping plan aimed at significantly reducing the health risks posed by air pollution from port-related ships, trains, trucks, terminal equipment and harbor craft.

The *San Pedro Bay Ports Clean Air Action Plan* was created with the cooperation and participation of the South Coast Air Quality Management District, California Air Resources Board and U.S. Environmental Protection Agency.

The Plan proposes hundreds of millions of dollars in investments by the Ports, the local air district, the state, and port-related industry to cut particulate matter (PM) pollution from all port-related sources by at least 47 percent within the next five years. Measures to be implemented under the plan also will reduce smog forming nitrogen oxide (NOx) emissions by more than 45 percent, and will also result in reductions of sulfur oxides (SOx) by at least 52 percent. NOx is a precursor of smog; SOx contributes to particulate matter; and PM has been shown to lead to health problems.

Rail Action Plan

The **Rail Action Planning Committee** was created in January 2006 with the goal of maximizing utilization of existing rail infrastructure. The Rail Action Planning Committee includes representation from POLB, POLA, marine terminal operators, shipping lines, railroads and ACTA. The following strategies are proposed by the Committee to maximize on-dock rail utilization:

- Utilize LAXT tracks
- Maximize train lengths
- Improve switching efficiencies
- Improve locomotive availability
- Reduce marine terminal operational constraints
- Provide in-ground air system for trains
- Improve container stowage on ships
- Provide better system for planning and coordination
- Improve railcar utilization and Customs holds

The Rail Action Committee is also in the implementation stage of a project known as the **San Pedro Bay Ports Rail Business Exchange**. This project has the goal of improving Port rail operations by facilitating communications, maximizing intermodal cargo velocity, streamlining administrative processes and providing visibility about how cargo is moving and fits into other traffic.

The SPB Rail Business Exchange is an internet based communication/planning tool with features including:

- Input vessel rotations and train schedules for advanced planning
- Input vessel manifest/stowage plan 72 hrs prior to arrival for tactical planning
- Provide eastbound train lineup, pull times and departure slots
- Provide westbound train consist and estimated time of arrival for vessel planning
- Make Switch Job plans available to railroads and marine terminals
- Optimize daily conference call with each railroad customer
- Coordinate operating plan to avoid asset and resource congestion
- Provide message board to post changes in status and otherwise document events

Alameda Corridor Transportation Authority Expanded Mission

The Alameda Corridor has accomplished significant benefits since opening in April 2002:

- Support the flow of international trade which contributes to our regional and national economies.
- Provide traffic relief by removing thousands of trucks from the roads.
- Improve traffic flow and safety by eliminating more than 200 road-rail at-grade crossings and saving more than 15,000 hours daily of passenger delay that resulted from vehicles waiting at rail crossings.
- Remove thousands of tons of emissions due to benefits of rail versus truck and reduced idling at rail crossings.

The Alameda Corridor is now a vital part of the region's goods distribution network, and can provide even more congestion relief by further shifting truck trips to rail wherever possible. Recognizing this, the Alameda Corridor Transportation Authority (ACTA) adopted an Expanded Mission in 2004 intended to implement a series of congestion relief initiatives aimed at optimizing the use of existing railway and highway infrastructure assets.

ACTA's Expanded Mission generally supports the SPB Port programs, but specifically allows the agency to implement several projects, including:

- Shuttle Train Pilot Program
- SR-47 Port Access Expressway
- Inland Truck Depots
- Virtual Container Yard

2.0 San Pedro Bay Ports Goods Movement

2.1 Cargo Forecast

The *Rail Master Planning Study* used a forecast of future container volumes developed for the *San Pedro Bay Ports Long-Term Cargo Forecast* (1998, Mercer Management Consulting, Inc.). To be conservative, the "High-Growth" scenarios for 2010 and 2020 were taken from the Mercer Forecast. The containerized forecasts were increased by the Port of Long Beach Planning Department to account for recent changes in empty container logistics that have occurred since the container forecasts were developed. Specifically, the empty return factors for local and intermodal containers were increased. The intermediate years were interpolated and distributed among the container terminals that are planned to be available. The actual cargo volumes in 2005 exceeded forecasts, as shown in **Figure 2.1**.

Containers are counted in units of **lifts** (a container lifted onto or off a train or vessel); a lift is the unit of an individual container of any size. An alternative unit used to count containers is **twenty-foot equivalent units** (TEU). A 20-foot long container equals one TEU, while a 40-foot container equals two TEU. The current conversion from lift to TEU is the factor 1.8, which reflects 20 percent of containers being twenty-footers and the balance being forty-footers or larger.

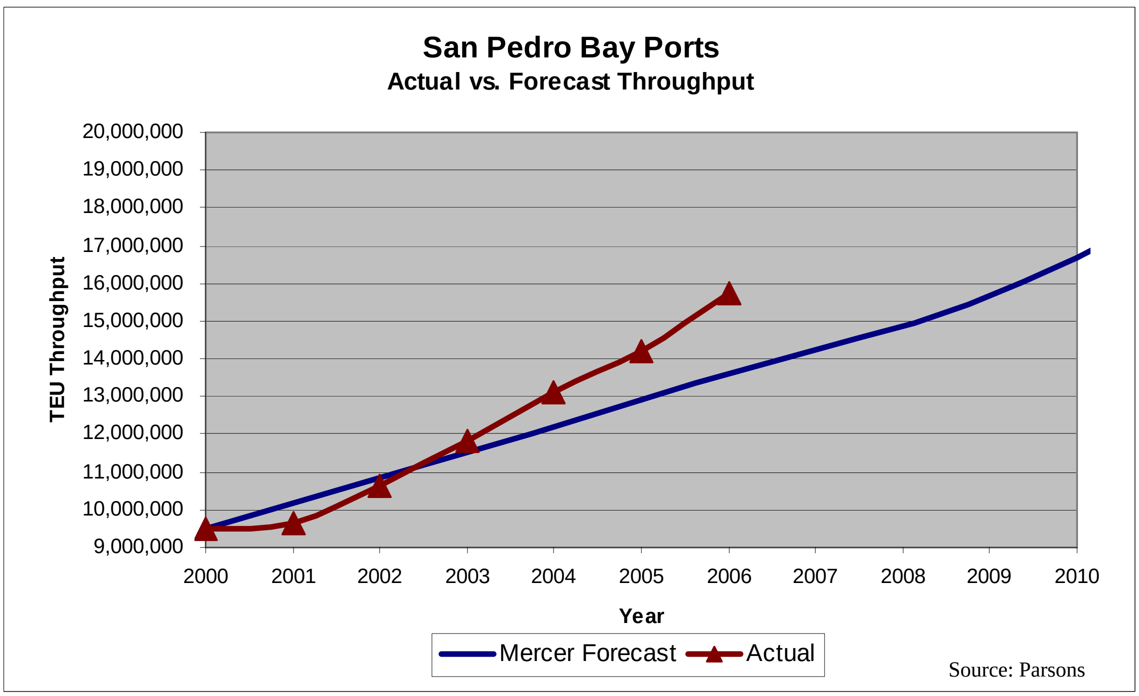


Figure 2.1 – Actual versus Forecast SPB Port Throughput (TEU)

There have been no subsequent macroeconomic forecasts performed for the San Pedro Bay Ports. However, the Ports have expended significant effort to establish the expected maximum throughput capacity of all container terminals. The Mercer Forecast was then extrapolated beyond 2020 until the throughput reached a theoretical Port capacity (based on potential terminal expansions). The revised forecast extended to 2030 is presented in **Table 2-1** and **Figure 2.2**.

Table 2-1: Revised SPB Cargo Forecast Data

Port Throughput in millions of TEU			
Year	**POLB**	**POLA**	**Total**
2005	6.71	7.47	14.18
2010	9.84	10.41	20.25
2015	13.09	14.00	27.09
2020	17.41	18.79	36.20
2025	18.86	21.46	40.32
2030	20.31	22.21	42.52

The revised cargo forecast considers contributions of other West Coast ports. It is estimated that even with implementation of ambitious plans by every West Coast port, the SPB Ports will remain the primary gateway required to handle international trade to the United States, as reflected by this cargo forecast.

The SPB Ports periodically updates their cargo forecast to reflect current economic trends. The effort to update the 1998 cargo forecast is expected to commence shortly after the completion of this Rail Study.

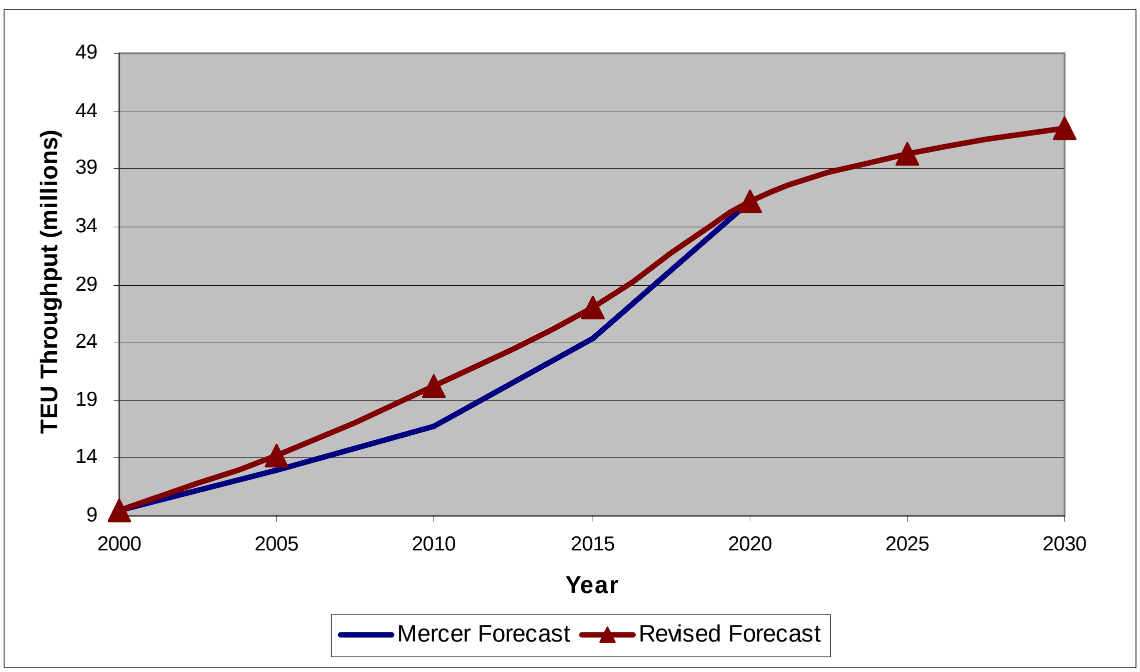
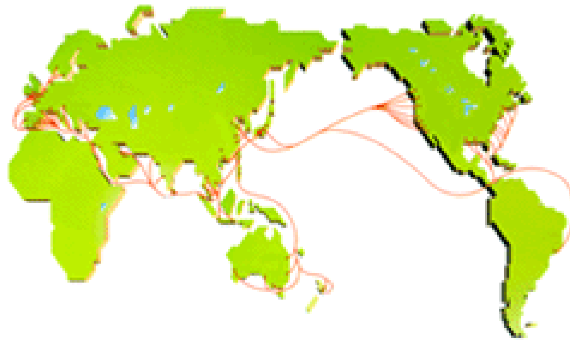


Figure 2.2 - Revised SPB Ports Cargo Forecast

2.2 Intermodal Cargo Flow



Top U.S. trading partners today are China, Hong Kong, Japan, Taiwan, and South Korea. Pacific Rim countries account for 70 percent of U.S. imports and 60 percent of U.S. exports. Southern California and the San Pedro Bay Ports provide a unique gateway for Pacific Rim cargo.

The San Pedro Bay Port Complex, comprised of the Port of Los Angeles and the Port of Long Beach, serves as the country's primary gateway for international trade. Of all waterborne container freight imported to the United States, 40 percent flows through these two ports. Those goods are supplied, in equal share to the Southern California region and to other destinations throughout the United States.

Cargo Type

The intermodal demand used for Port studies is based on the 1998 Mercer Forecast assumption that half of Port cargo has destinations east of the Rocky Mountains, and this cargo will be handled primarily by rail. The rail cargo is referred to as **intermodal** and cargo destined west of the Rocky Mountains is referred to as **regional**. Regional cargo is transported almost exclusively by truck. **Figure 2.3** shows the breakdown of cargos with intermodal on the left side of the pie and regional to the right.

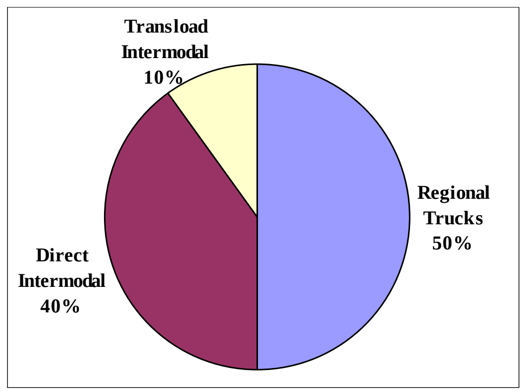


Figure 2.3 – SPB Cargo Breakdown

Intermodal Cargo Type

Port intermodal cargo is projected to account for at least half of the total Port throughput during the forecast horizon. The other half is destined for regional markets. Port intermodal cargo has two components, as follows:

Direct Intermodal: is moved directly between the Port and rail yards and can be handled on-dock, near-dock or off-dock. Direct Intermodal is expected to account for 40 percent of Port cargo.

Transload Intermodal: is rehandled through a warehouse somewhere between the Port and rail yards. Transload cargo is never handled on-dock due to the requirement to be transported off the marine terminal to a warehouse.

Regional Trains

The basis of the assumption that 50 percent of SPB cargo volume will be handled by rail is that all cargo with origin/destination beyond about 1,000 miles (the shaded states on **Figure 2.4**) will be intermodal. Double-stack rail traditionally begins to compete well with trucks when transport distances go beyond 500 miles. This indicates that there is potential for developing direct intermodal service to population centers such as Salt Lake City, Utah; Denver, Colorado; and Albuquerque, New Mexico. The percentage of intermodal cargo could rise higher if markets in the 500 to 1,000-mile range were to have dedicated intermodal service to transport cargo by rail.

There are also regions of population centers even closer to San Pedro Bay that could be served by rail. As traffic congestion increases, the corresponding rise in the cost of trucking may improve the competitiveness of rail for handling cargo destined for markets within 500 miles. In addition to the direct cost of congestion, the value of mitigating congestion and emissions should be added to the relative economic value of intermodal shuttles compared to trucks. The greatest potential for this non-traditional shift of cargo to rail is associated with a concept known as **shuttle trains**.

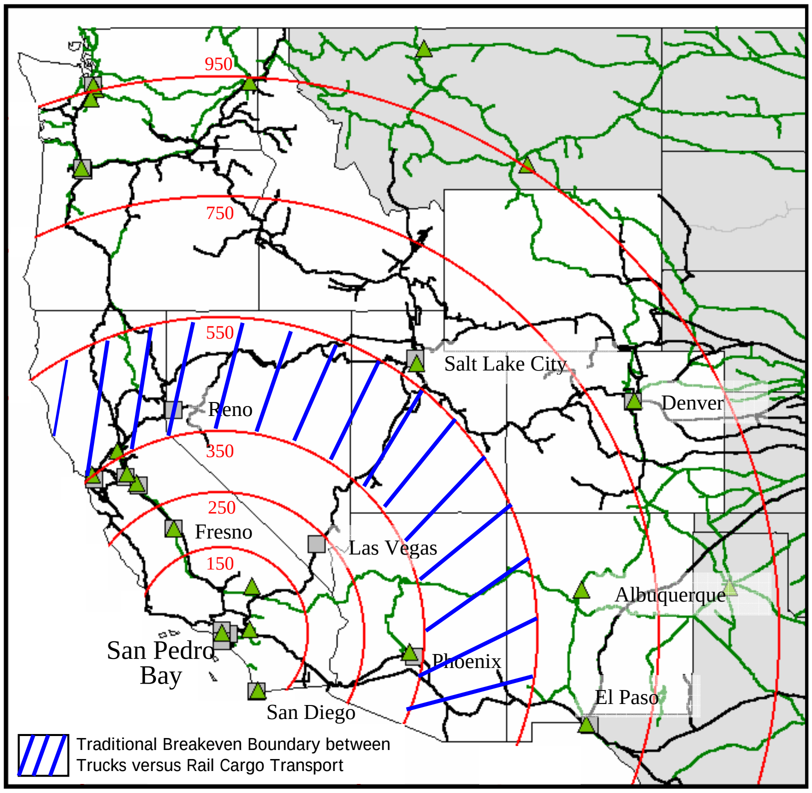


Figure 2.4 – Range of Intermodal Markets

Shuttle Trains

Intermodal service to the local region has been envisioned to provide multiple benefits including transport of cargo for the local region and improvement of on-dock operations through consolidation of cargo at an inland terminal. This concept has been referred to as **California Inter-Regional Intermodal System (CIRIS)** in Oakland, **Port Intermodal Distribution Network (PIDN)** in New York, and also as **Inland Ports**. None have proven to be financially feasible.

There are numerous transportation markets that can be associated with shuttle trains including:

- Truck distribution from an inland rail terminal to local destinations, avoiding the most congested roadways in the Southern California five county regions (e.g. I-710, I-10, I-15, I-91, I-405, SR-60).
- The inland rail terminal can also be incorporated into a multi-model center with adjacent warehousing for transloading or value-added processing and air freight capability to round out the multi-modal capabilities. Proposed inland shuttle train terminal locations are very desirable for warehousing due to lower property costs and reduced labor costs.

Shuttle train operations can improve the marine terminal and rail operating conditions at the Port through off-dock consolidation of destination specific cargo from/to various on-dock terminals. Another significant benefit to the Port is the reduction of dwell time on marine terminals. Import cargo that is currently stored at the marine terminal for up to 14 days can be moved to the inland terminal, and empties and exports can be held-out at the inland terminal until the marine terminal is ready for vessel loading. These off-dock storage capabilities would greatly reduce the marine terminal dwell time. This is a significant benefit to the efficient use of valuable Port property.

Inland Block-Swap

The concept of an inland rail yard to sort trains can provide several rail operating improvements that coincide with the recommendations of this Study. Features of the **inland block-swap** concept and associated benefits are described as follows:

- Provide the ability to build multi-destination trains by blocks at each on-dock rail yard. Trains can then be block-swapped at the inland yard to create single destination trains. This will increase the potential volume of on-dock cargo by alleviating the challenges with building long destination trains.
- Provide the ability to block-swap westbound trains at the inland yard to create Port-terminal specific trains. This will reduce inter-terminal switching movements at the Port.
- Provide dedicated regional shuttle engines that handle the train movements between the inland yard and the Port. These locomotives will be fueled for round trip, readily manage crew changes, and have the ability to drop a westbound train and pick-up an eastbound train without turning the locomotive (have both ends functional so locomotive can simply be reversed). This will significantly reduce the light engine traffic moving around the Port by eliminating the need to turn engines, reach crew change points, and transit to engine services facilities. This concept could also facilitate application of green technologies to locomotives in the sensitive Southern California Air Basin.

2.3 Intermodal Transport Options

Cargo is transported to and from the San Pedro Bay Ports by various modes and processes, as shown in **Figure 2.5**. For simplicity, note that **Figure 2.5** and the discussions herein describe import cargo. Export cargo and westbound empty containers have similar patterns, but in reverse. Evaluating cargo flow modes and processes is the basis for analyzing the volumes of rail and truck cargo to be considered in transportation planning. Currently, trucks are required to transport containers from marine terminals for all cargo except on-dock rail cargo. It is the Ports' goal to maximize the use of on-dock rail.

Cargo flow is divided into two types of shipments – regional and national. Cargo destined for Southern California (local) and the region west of the Rocky Mountains (western) is referred to as **Regional Shipment**. Cargo destined for the hinterland east of the Rocky Mountains is referred to as **National Shipment** and is depicted in the inset pie chart by slices other than western and local.

Regional Shipment

Regional shipment modes and processes are described as follows:

Local Transport: Cargo is transported from the Ports to its final destination by truck. This transport process serves the local Los Angeles region, as well as the region west of the Rocky Mountains (U.S. Western Region). This mode is estimated to handle roughly 30 percent of the import cargo from the San Pedro Bay Ports.

Transload Truck: This transport process is similar to local transport, but cargo is transloaded at a warehouse or distribution center as part of the process. Transload cargo is removed (or unloaded) from international containers at a warehouse to be processed, repackaged, labeled, resorted and reloaded into larger domestic containers, and then trucked to its final destination. Approximately half of the transload warehouses are located within 25 miles of the Ports. Other large warehouses are located in the Inland Empire area (Ontario to Riverside). This mode is estimated to handle roughly 20 percent of the import cargo from San Pedro Bay Ports.

Shuttle Train (proposed): This transport mode is currently being studied to supplement the previous two local delivery methods. This concept involves transporting cargo from the Ports by train to a regional destination. It requires cargo to be directly loaded onto railcars at either on-dock or near-dock rail facilities. The trains are then pulled to an inland destination where the containers can be unloaded, staged, interchanged to trucks and transported to their final destination. The principle of this concept is to utilize rail through the most congested areas of the region and thereby alleviate some of the traffic demand. The shuttle train mode should target final locations in the Inland Empire and beyond to minimize backhauling into congested areas. The shuttle train mode would also allow containers to be quickly moved from the marine terminals and allow more time at an inland location for consignees to schedule truck transport for just-in-time delivery. Although the shuttle train concept is not currently in operation, a pilot program is being pursued as part of ACTA's expanded mission.

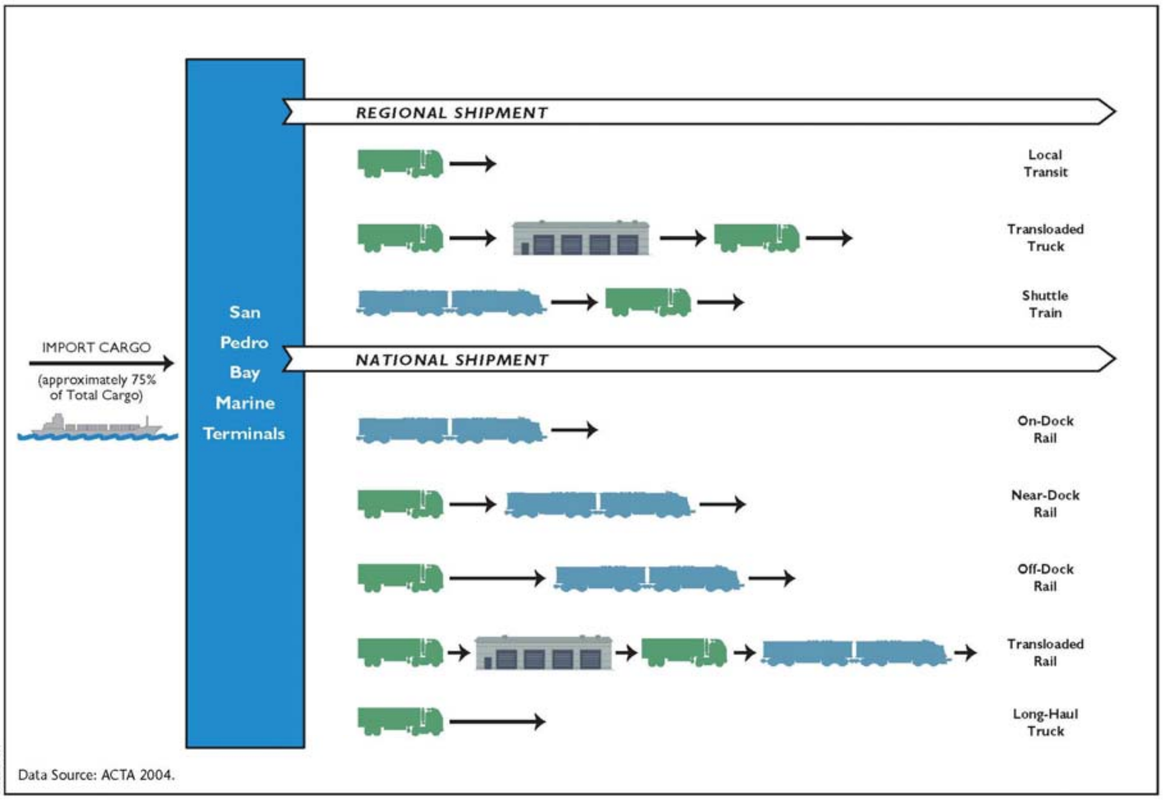


Figure 2.5 - Cargo Flow-Modes & Processes

National Shipment

National shipment involves cargo that is destined for points east of the Rocky Mountains, is predominantly transported by rail, and is known as **intermodal, landbridge** or **Inland Points Intermodal (IPI)** cargo. The following modes and processes apply.

On-Dock Rail: Intermodal cargo is directly loaded onto trains at a rail yard located within the marine terminal. This allows cargo to be loaded without any gate transaction and without being transported by truck on any local roadways. One disadvantage is that on-dock rail yards encroach on the container yard acreage and can disturb the flow of the marine terminal, potentially reducing the throughput capacity of the terminal. However, given its environmental benefits and through careful planning to minimize capacity constraints, the Ports are pursuing on-dock rail.

Near-Dock Rail: Near-dock rail yards are similar to on-dock rail, but are located outside of the marine terminals and require a short truck trip (within 5 miles). Their advantage is the ability to combine cargo from various marine terminals and build trains that efficiently transport cargo to specific destinations throughout the country. The only existing near-dock rail yard, accommodating the San Pedro Bay Complex, is the Intermodal Container Transfer Facility (ICTF). It is operated by Union Pacific Railroad (UPRR) on Port of Los Angeles property, located north of Sepulveda Boulevard and east of Alameda Street. The Ports are contemplating other near-dock facilities to help meet the demand for efficient rail transport. Near-dock usage has remained relatively flat due to the availability of only one rail yard. Currently, ICTF handles approximately 8 percent of the total San Pedro Bay cargo.

Off-Dock Rail: Currently, off-dock rail yards that handle containers from the San Pedro Bay Ports are located near downtown Los Angeles, approximately 25 miles away, where both the BNSF Railway and Union Pacific Railroad have off-dock facilities. These rail yards contribute significant truck miles to some of the most congested roadways in the region. Off-dock rail yards handled approximately 12 percent of import cargo in 2005 and their share of the Port cargo has been declining.

Transload Rail: As with transload truck, cargo is trucked to a warehouse or distribution center, where it is removed from international containers then processed, repackaged, labeled, resorted and reloaded into larger domestic containers. The transloaded cargo is then trucked primarily to downtown rail yards and loaded onto trains for shipment to the hinterland. This mode is estimated to handle roughly 10 percent of the import cargo from San Pedro Bay Ports.

Long Haul Truck: Cargo is transported by truck directly from the Ports to its final destination beyond the Rocky Mountains. Most long haul truck cargo is transloaded at local warehouses; this will avoid backhaul of the international container and allow more efficient truck haul with a larger domestic container or truck. This transport mode is estimated to handle less than 1 percent of the import cargo from San Pedro Bay.

3.0 Rail Yards Supporting San Pedro Bay Ports

It is important to establish the capacity and demand for on-dock, near-dock and off-dock rail yards in order to plan appropriately-sized facilities within the Ports. The rail system is complex and has three major factors that have the potential to constrain the system's throughput: 1) the operations at the marine terminal, 2) operations at the rail yard, and 3) train movement through the rail network. This section of the report will focus on the rail yards.

There are several considerations that affect the decision to use on-dock versus near-dock versus off-dock rail yards. These include: available capacity, critical mass of containers to a given hinterland destination (to enable building a unit-train), and the need to process containers through an off-dock warehouse prior to loading on a train. Cargo that is processed through a warehouse before being loaded onto a train is known as transload intermodal" (transload); all other intermodal cargo from the Port is known as direct intermodal.

Subsequent sections will individually address on-dock, near-dock and off-dock demand and capacity. A recent history of throughput at these types of facilities is provided in **Table 3-1**.

Table 3-1: SPB Direct Intermodal – Actual Throughput

(TEU)	2003	2004	2005	2006
On-Dock	**1,885,642**	**2,369,853**	**2,934,850**	**3,801,892**
Percent of Port Throughput	15.9%	18.1%	20.7%	24.1%
Near-Dock	**962,197**	**936,428**	**1,081,350**	**1,271,327**
Percent of Port Throughput	8.1%	7.1%	7.6%	8.1%
Off-Dock	**1,805,791**	**1,846,188**	**1,689,890**	**1,671,489**
Percent of Port Throughput	15.3%	14.1%	11.9%	10.6%
Total Direct Intermodal	**4,653,630**	**5,152,469**	**5,706,090**	**6,744,708**
Percent of Port Throughput	39.3%	39.3%	40.2%	42.8%
Total Port Throughput	***11,837,064***	***13,101,292***	***14,194,442***	***15,759,219***

Source: UPRR/BNSF

Table 3-1 lists only direct intermodal cargo, which excludes transload cargo. Transload cargo is estimated to be approximately 10 percent of total Port throughput volumes and all transload is handled off-dock.

The recent increases in on-dock rail throughput have been efficiently accommodated by the Port due to proactive construction of rail infrastructure improvements in the past. Additional investment will be needed to minimize impacts of continuing cargo growth. Development of on-dock and near-dock facilities and supporting rail infrastructure will improve intermodal efficiencies, reduce local and regional truck traffic and reduce diesel emissions.

3.1 Off-Dock Rail Yards

The existing off-dock rail yards that serve the local five-county region are estimated to have an annual capacity of over 3 million lifts (5.87 million TEU). These facilities are listed in **Table 3-2** with their total maximum practical capacity (MPC) and their locations are shown on **Figure 3.1**.

Table 3-2: Current Off-Dock Rail Yard Capacities

Off-Dock Facility	Total MPC (Lifts)	Total MPC (TEU)
UP LATC	340,000	612,000
UP East LA	510,000	918,000
UP City of Industry	220,000	396,000
BNSF Hobart	1,500,000	2,700,000
BNSF Commerce	200,000	360,000
BNSF San Bernardino	660,000	1,188,000
TOTAL	3,260,000	6,174,000

The existing off-dock capacity at the rail yards in downtown Los Angeles (depicted on the map shown in **Figure 3.1**) can handle approximately 5.0 million TEU per year; another 1.2 million TEU are handled at the San Bernardino rail facility, which is much more remote, but does handle transload rail cargo.

The railroads have stated that domestic rail cargo will be growing and competing for the available off-dock intermodal capacity. Transload volumes are also expected to grow and absorb off-dock capacity. Transload and domestic cargo are described below.

Transload and Domestic Cargo

Transload and domestic cargo are processed through facilities away from the Port and typically use larger containers than will fit on container ships, which dictates that this cargo must be handled at off-dock rail yards. Transload operations involve the unpacking of international port containers at local warehouses to then be resorted, processed, and/or transferred into larger domestic containers and trailers. Since the containers must be taken to warehouses outside of the container terminal, the ultimate rail yard destination of the transload cargo is exclusively an off-dock facility. Therefore, Port intermodal cargo that is transloaded would not be handled on-dock.

It is difficult to accurately track and estimate the volumes of transload cargo since the marine terminals release the containers as local deliveries, while the rail yards receive the cargo in domestic boxes. The previous estimates of transload volumes have ranged from 5 percent to 10 percent of total Port throughput. Since transloading occurs primarily on the import move, the percent of imports should range from 10 percent to 20 percent. Recent studies, as part of the *Integrated Truck Reduction Study*, have suggested the transload volumes are 20 percent of import volumes.

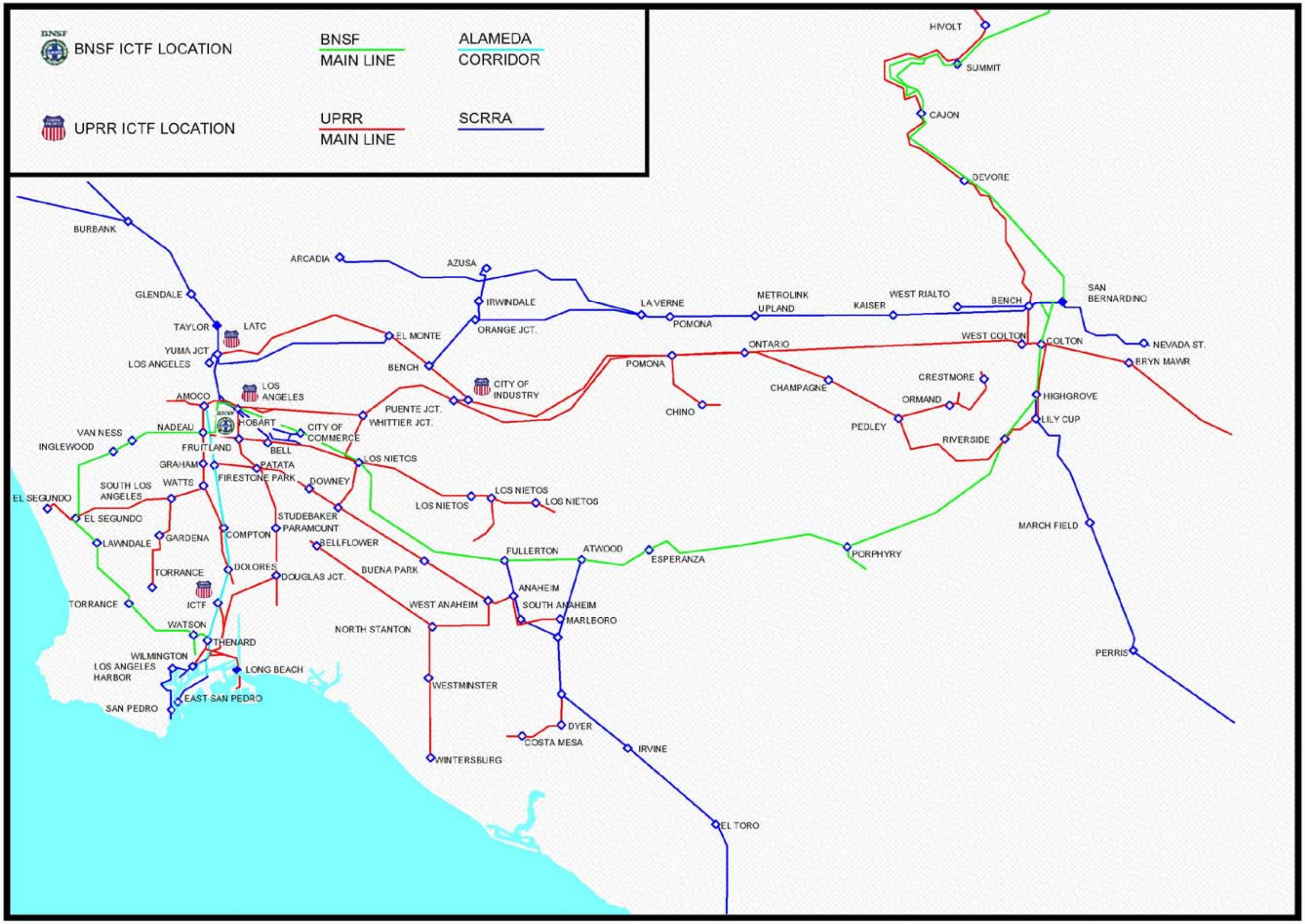


Figure 3.1 – Regional Off-Dock Facilities

Domestic cargo is defined as cargo that is moved by rail from one location in North America to another, and will not subsequently be shipped overseas.

The allocation of off-dock rail yard capacity to domestic cargo, transload cargo and international cargo has been estimated based on actual (2005) data. The following data analysis considers allocation of off-dock capacity to domestic and transload cargo, only. If additional capacity is available at the off-dock rail yards, then this can be utilized to handle direct intermodal cargo from the Ports. **Table 3-3** estimates the demand for off-dock rail yards assuming that the transload cargo volumes remain at 10 percent of total SPB Port throughput and domestic does not grow above existing volumes. The assumption on domestic growth is inconsistent with statements made by the Railroads, but it ensures that the IPI demand for on-dock/near-dock facilities is not overstated.

Table 3-3: Off-Dock Rail Yard Demand (Domestic & Transload Cargo)

(millions of TEU)	2005	2010	2015	2020
Domestic	3.00	3.00	3.00	3.00
Transload	1.42	2.20	2.83	3.67
TOTAL	**4.42**	**5.20**	**5.83**	**6.67**
Demand excludes Direct Intermodal (IPI) cargo				

Comparing demand in **Table 3-3** to the estimated off-dock capacity of 5.87 million TEU (**Table 3-2**) indicates all available capacity will be absorbed by transload and domestic between 2015 and 2020. Notice that **Table 3-3** assumes there will be no growth in domestic cargo over the 15-year period, which as stated above is not consistent with Railroad expectations. If domestic cargo were to grow at an annual rate of 3 percent, then all off-dock capacity would be consumed by 2010, precluding direct intermodal cargo from the off-dock yards.

The demand of **Table 3-3** indicates a shortfall of 500,000 TEU by 2020 (assuming no growth in domestic). If off-dock capacity were available in excess of the demand for domestic and transload cargo, then the surplus capacity could be utilized to handle direct intermodal cargo from the Ports.

Near-dock and on-dock capacities are evaluated in the next sections, followed by discussion of overall unmet demand for intermodal capacity.

3.2 Near-Dock Rail Yards

Near-dock facilities are primarily dedicated to serving the Ports' direct intermodal cargo and are therefore considered separately from off-dock facilities. Near-dock rail yards are located in the vicinity of the Port (typically within 5 miles), so truck impacts are minimized compared to off-dock facilities. Unlike on-dock facilities, near-docks are not dedicated to a single marine terminal. Their ability to serve any shipping line in the Port enables the near-dock yard to build full-length destination trains since they can combine cargo from throughout the Port.

The only near-dock facility currently serving the San Pedro Bay Ports is the Intermodal Container Transfer Facility (ICTF), which is governed by a Joint Powers Authority (JPA) comprised of POLB, POLA and UPRR. The ICTF project was originally conceptualized by the Ports of Long Beach and Los Angeles. The original concept of the Ports was to involve all three railroads (UPRR, ATSF and Southern Pacific) in a joint facility. The UPRR declined to participate in the Ports' project believing that their downtown facilities had enough capacity while underestimating the Ports' growth potential. SP was encouraged by their soon-to-be merger partners, ATSF, to participate in the ICTF project based on ATSF's vision of strong intermodal growth. Subsequently, the SP-SF merger was denied by the Surface Transportation Board. Years later, UPRR and SP would merge into the UPRR, who thereby inherited the visionary facility after it had proven its value.

The JPA authorized a bond issue to finance the construction of the ICTF. A requirement of the bond issue is a gate charge for all containers entering or leaving the ICTF, currently $30.00 for each container. The facility is on POLA property and is managed and operated by UPRR. The ICTF is located north of Sepulveda Boulevard between SR-47 and Alameda Street. The facility can be accessed by trucks using the SR-47 or Alameda Street truck routes, which are not over-burdened or critical commuter routes like the I-710 and I-110.

The ICTF has maintained a throughput, as shown in **Figure 3.2**, fluctuating around 600,000 lifts (1,080,000 TEU) although its maximum practical capacity (MPC) is estimated to be 778,000 lifts (1,400,000 TEU). The lower actual throughput numbers may reflect continual diversion to increasing on-dock throughput, and it may also reflect the preference to operate at a sustainable capacity level rather than the more difficult and costlier MPC level. MPC is estimated to be the absolute maximum the facility can handle in a year.

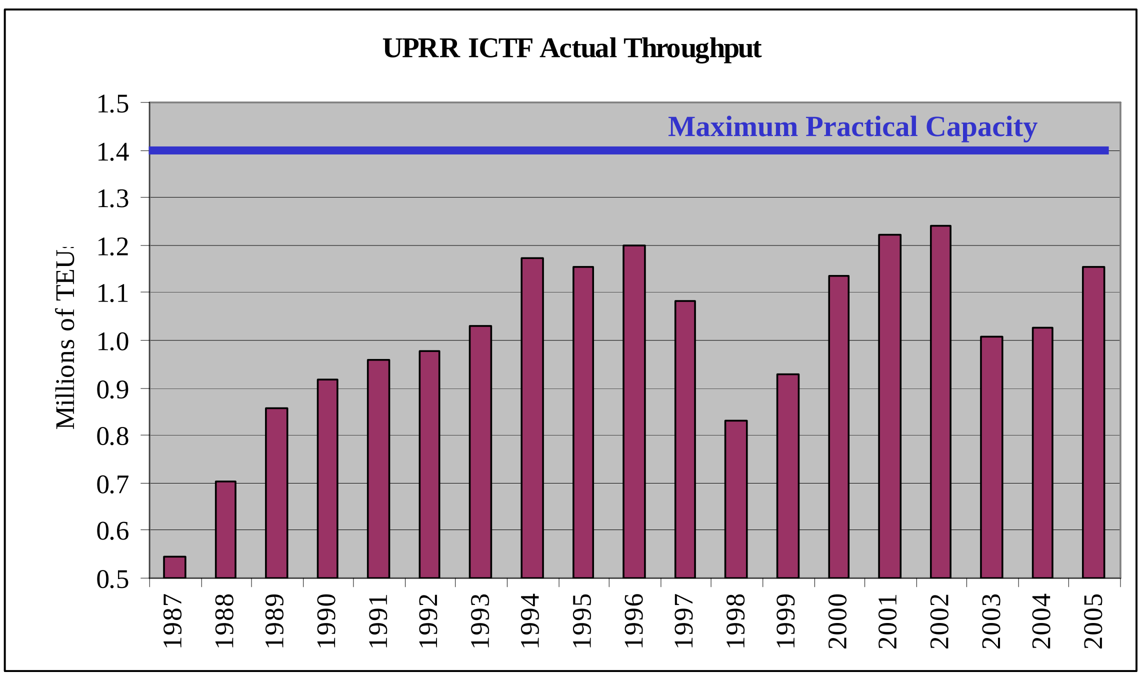


Figure 3.2 – UPRR ICTF Actual Throughput

Other near-dock capacity expansion projects are being considered for development to meet intermodal demand, as described in **Section 3.4**.

3.3 On-Dock Rail Yards

The maximum on-dock rail yard throughput is determined based on two factors: operational issues and physical capacity constraints.

Operational Issues

Operational issues limit the volume of intermodal cargo that can be handled by on-dock rail. Major operational issues include: 1) availability of cargo to build full destination trains, and 2) cargo requiring transloading at off-terminal warehouses.

Full destination trains can be built if the volume of cargo destined to a particular hinterland destination (e.g. a train is loaded entirely with containers destined for Chicago). Otherwise, the containers are trucked to a near-dock or off-dock facility where containers from multiple Port terminals can be combined. An alternative to trucking to an off-dock yard is to build smaller blocks (less than unit length train) and pull various blocks from the on-dock rail yard to a near-dock or off-dock rail yard to be combined with blocks from other terminals, creating a full destination train. This process of block swapping is operationally less desirable to the Railroads than destination trains.

Another operational issue that precludes intermodal cargo from using on-dock rail yards is transloading at local warehouses. Transload cargo is removed from international containers at warehouses where it can be processed, repackaged, labeled, resorted and reloaded into larger domestic containers. Transload cargo is trucked from the Ports to a warehouse where it is processed, then trucked from the warehouse to the nearest rail yard, and then delivered by train to its hinterland destination.

Transload cargo is estimated to comprise at least 10 percent of the total Port volume. Since 50 percent of the total forecasted Port cargo is intermodal, the most intermodal cargo that could be handled on-dock is 40 percent. However, the practical limit of intermodal cargo that can use on-dock rail yards (without implementation of block swapping) is estimated to be 35 percent of total Port throughput; this is based on an analysis of building unit-destination trains given intermodal volumes, freight origins and destinations, and transload volumes.

Capacity Constraints

The second factor affecting on-dock throughput is rail yard capacity. In the long-term, on-dock rail yards are anticipated to be built as large as feasible with consideration for marine terminal operations, site constraints and railroad track network limitations.

On-dock rail yards are currently handling over 20 percent of Port cargo, but with cargo growth and the desire to maximize on-dock throughput, it has been proposed that these yards be expanded and new yards be developed over the next 20 years. This strategy aims to efficiently handle international cargo while minimizing environmental impacts.

The future on-dock capacity is planned to be maintained at approximately 25-30 percent of total Ports' throughput after 2010. During the period from 2005 to 2030, it is anticipated that on-dock rail capacity at the San Pedro Bay Ports will more than quadruple as a result of improved efficiencies and proposed expansions.

Recent actual on-dock throughput is provided in **Table 3-4a.** The projected on-dock throughput associated with planned improvements (as described in REP) is provided in **Table 3-4b**.

Table 3-4a: Actual SPB On-Dock Intermodal Throughput

(millions of TEU)	2003	2004	2005	2006
POLB	**0.51**	**0.86**	**1.09**	**1.40**
Percent of POLB Throughput	11.0%	14.9%	16.3%	19.2%
POLA	**1.37**	**1.51**	**1.84**	**2.40**
Percent of POLA Throughput	19.1%	20.6%	24.6%	28.3%
Total SPB	***1.88***	***2.37***	***2.93***	***3.80***
Percent of Port Throughput	*15.9%*	*18.1%*	*20.7%*	*24.1%*

Table 3-4b: Projected SPB On-Dock Intermodal Throughput

(millions of TEU)	2010	2015	2020	2030
POLB	**2.27**	**4.15**	**5.49**	**6.10**
Percent of POLB Throughput	23%	32%	32%	30%
POLA	**2.79**	**4.33**	**6.25**	**6.84**
Percent of POLA Throughput	27%	31%	33%	31%
Total SPB	***5.06***	***8.47***	***11.74***	***12.94***
Percent of Port Throughput	*25%*	*31%*	*32%*	*30%*

This section shows that capacity of planned off-dock, near-dock and on-dock rail yards will not meet projected demand for SPB intermodal cargo. However, the Ports are considering additional potential projects as described in the subsequent **Section 3.4 - Other Potential Projects**.

The rail yard capacity/demand analysis indicates that demand for off-dock rail yards will outstrip the existing capacity. In fact, transload and domestic cargo alone (which cannot be handled at on-dock or near-dock rail yards) is expected to take up all existing off-dock capacity in the 2010-2015 timeframe, depending on domestic cargo growth rates (0 percent growth will leave capacity until 2015; 3 percent growth will take all capacity by 2010). Therefore, direct intermodal will need to be accommodated at on-dock or near-dock rail yards, which is also preferable from the standpoint of minimizing trucking impacts such as traffic congestion and diesel emissions.

Direct Intermodal: SPB intermodal cargo that is not Transload.

Transload: SPB intermodal cargo that is processed through local warehouses prior to loading onto trains at off-dock rail yards.

Domestic: cargo transported between two points in the U.S., but unrelated to Ports.

Base and Alternative Rail Yard Capacity/Demand Scenarios

Several scenarios of on-dock development have been explored to understand their implications on rail yard capacity/demand. The MPC Scenario assumes all planned development occurs; this scenario used as the basis for all further capacity/demand considerations in this Study. The other scenarios are less optimistic and therefore result in greater capacity shortfall. The capacity shortfall, or unmet demand, should be considered the amount of additional rail yard capacity needed to meet demand. The Ports are considering “Other Potential Projects” to provide this additional capacity.

MPC Scenario: This base capacity/demand analysis assumed that all projects in the REP are developed and that rail yards operate at their maximum practical capacity (MPC). The MPC Scenario assumes that on-dock rail yards use longshore labor to load and unload containers from trains. The assumption for working shifts when these operations are performed increase over time as follows: 1-shift in 2005, 2-shifts in 2010, 3-shifts in 2015, and 3-shifts with modified operating practices in 2020 and beyond.

The modified operating practices assume that enhanced safety systems are implemented in all rail yards to allow loading trains while other trains are moving in the yard (when at least 30 feet away). The results from the MPC Scenario analysis are presented in **Table 3-5**.

Table 3-5: Direct Intermodal Demand & Capacity – MPC Scenario

Direct Intermodal excludes Transload All values in millions of TEU	2005 Actual	2010	2015	2020	2030
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.09	2.27	4.15	5.49	6.10
POLA On-Dock Capacity [1,2]	1.84	2.79	4.33	6.25	6.84
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.84	1.84	1.84
SPB Variance (negative = shortfall)	**0.03**	**-0.97**	**-0.48**	**-0.90**	**-2.23**

Footnotes:

1 *Capacity (Forecast Throughput from MPC Model) assumes all REP projects.*

2. *2005 capacity reflects actual direct intermodal at on-dock, near-dock and off-dock.*

3. *Transload (10% of SPB Ports) + domestic (no growth) consume all off-dock capacity by 2015.*

4. *No expansion of near-dock facilities is assumed, except mini-ICTF at Pier B.*

Two-Shift Scenario: The Two-Shift Scenario limits all future operating conditions to those modeled by the MPC Scenario for 2010 (i.e. 1-shift in 2005 and 2-shifts in 2010 and beyond, with no change in operating practices). This assumption reduces the on-dock capacity and the ability to meet demand after 2010, as indicated in **Table 3-6**. Note that this scenario still assumes all rail yard development as proposed by the REP.

Table 3-6: Direct Intermodal Demand & Capacity – 2-Shift Scenario

Direct Intermodal excludes Transload All values in millions of TEU	2005 Actual	2010	2015	2020	2030
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.09	2.27	3.98	4.90	5.15
POLA On-Dock Capacity [1,2]	1.84	2.79	4.11	4.78	4.78
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.84	1.84	1.84
SPB Variance (negative = shortfall)	**0.03**	**-0.97**	**-0.87**	**-2.96**	**-5.24**

Footnotes: Same as Table 3-5

No-Action Scenario: The No-Action Scenario limits all future development of on-dock rail yards, therefore retaining existing rail yard conditions. Rail yard loading is allowed to grow from 1-shift in 2005, to 2-shifts in 2010, and 3-shifts in 2015 but, no change in operating practices are assumed. This scenario further reduces the on-dock capacity and the ability to meet demand, as indicated in **Table 3-7**.

Table 3-7: Direct Intermodal Demand & Capacity – No-Action Scenario

Direct Intermodal excludes Transload All values in millions of TEU	**2005 Actual**	**2010**	**2015**	**2020**	**2030**
SPB Cargo Forecast (Demand)	14.2	20.2	27.1	36.2	42.5
SPB Direct Intermodal (Demand)	5.67	8.10	10.84	14.48	17.01
POLB On-Dock Capacity [1,2]	1.09	1.74	2.14	2.28	2.28
POLA On-Dock Capacity [1,2]	1.84	2.47	3.08	3.08	3.08
SPB Off-Dock Capacity [2, 3]	1.69	0.67	0.04	0.00	0.00
SPB Near-Dock Capacity [4]	1.08	1.40	1.40	1.40	1.40
SPB Variance (negative = shortfall)	**0.03**	**-1.82**	**-4.18**	**-7.72**	**-10.25**

Footnotes:

1 *Capacity (Forecast Throughput from MPC Model) assumes existing infrastructure, no REP projects.*

2. *2005 capacity reflects actual direct intermodal for on-dock, near-dock and off-dock.*

3. *Transload (10% of SPB Ports) + domestic (no growth) consume all off-dock capacity by 2015.*

4. *No expansions of near-dock facilities are assumed.*

The Study uses the MPC Scenario as the basis to analyze the SPB Ports' ability to meet demand for direct intermodal capacity.

Note that the preceding capacity shortfall is not overstated considering the following assumptions:

- Availability of off-dock rail yards for IPI is assumed under an optimistic scenario of no domestic cargo growth. If domestic cargo volumes grow, as anticipated by the Class I Railroads, then demand for on-dock/near-dock facilities will be higher than stated.
- The on-dock throughput projections stated in **Table 3-4b** are based on maximum practical capacity that are in themselves higher than typical sustainable throughputs; but also assume that, by year 2020, on-dock work rules and practices have evolved to emulate the efficiencies of Class I Railroad operations.
- All planned on-dock developments are assumed to be constructed on schedule without delays from environmental process, funding, contracting or construction.

The REP had included a near-dock facility located south of the existing UPRR ICTF, which would meet the demand for direct intermodal capacity to nearly 2030, and likely beyond. However, POLA is evaluating alternative developments to ensure that the most environmentally sensitive project is selected. The near-dock facility (SCIG) is still listed on the REP (Project II.5), but is now being evaluated through a comparative analysis with "Other Potential Projects" described in the next section.

3.4 Other Potential Projects

The capacity of on-dock and near-dock rail yards programmed in the REP (excluding II.5-New Near-Dock ICTF South of Sepulveda Blvd.) will not meet demand in the 2010-2030 timeframe. Additional on-dock and near-dock facilities are being considered by the Ports to meet the unmet demand. These additional developments will need to be pursued to avoid the significant impacts of intermodal cargo being trucked through the Southern California region. These "Other Potential Projects" are listed in **Table 3-8** and further considered for their ability to meet demand and fit efficiently into the SPB Port rail network.

Table 3-8: Other Potential Projects to Provide Rail Yard Capacity

Name	Type	Owner	Proposed Operator	Status	Annual MPC (TEU)
POLA Terminal Island Intermodal Facility	On-Dock	POLA	tbd	Conceptual	1,400,000
POLB Pier T Mole Expansion	On-Dock	POLB	tbd	Conceptual	1,100,000
Southern California International Gateway (SCIG)	Near-Dock	POLA	BNSF	Harbor Development Permit	1,800,000
Intermodal Container Transfer Facility (ICTF) Expansion	Near-Dock	JPA	UPRR	Conceptual	1,900,000

POLA Terminal Island Intermodal Facility

POLA is evaluating the development of additional intermodal facilities on Terminal Island. The primary area of focus is south of Seaside Avenue (SR-47), including the former LAXT site. Initial conceptual layouts have been developed. This facility has not been modeled for MPC throughput or simulated with RTC to understand train access issues.

The RTC simulations of existing and planned facilities indicate that the throat from Badger Bridge to Pier 300 (CP Mole) is constrained and any additional rail traffic should be carefully studied to understand how it would affect the stability of the rail network system. The RTC simulation was used to model increased train volumes associated with a surrogate Terminal Island facility (Pier T Mole at 1.1 million TEU) and found that the rail network system would become constrained, causing an unacceptable Level of Service throughout the system. It is estimated that the rail network system would become gridlocked with Terminal Island rail yard expansion greater than approximately 1.5 million TEU beyond the REP expansions.

POLB Pier T Mole Expansion

POLB is also considering the development of additional intermodal capacity on Terminal Island. The primary area of focus is the Navy Mole. The expansion onto the Mole adjacent to Pier T would create unit-train length tracks, which would be efficient and provide high capacity. However, Pier T is a single-user, on-dock facility and it must be determined how the additional capacity would be utilized. Pier T would need to generate exceptionally high volumes of intermodal cargo, or the rail yard would need to accept containers from other marine terminals.

The RTC simulation was used to model increased train volumes associated with the expanded Pier T Mole concept (at 1.1 million TEU) and found that the rail network system became constrained, causing an unacceptable Level of Service throughout the system..

An additional concern, if the rail yard were to be used as a multi-user facility, is that the marine terminals that are target users are located off of Terminal Island and will therefore generate truck traffic on the Gerald Desmond Bridge and Vincent Thomas Bridge. This traffic could exceed the volumes studied under current bridge analyses.

Southern California International Gateway (SCIG)

The Port of Los Angeles has evaluated and pursued development of property immediately south of the UPRR ICTF. This development has advanced to submittal of a Harbor Development Permit with BNSF as the proposed operator. BNSF refers to the project as Southern California International Gateway (SCIG). The site, north of Pacific Coast Highway, is bounded by Dominguez Channel and Terminal Island Freeway. The facility is estimated to have capacity in excess of 1.8 million TEU provided by a densified layout with large-gauge rail mounted cranes over six tracks. SCIG is ideally located adjacent to the Alameda Corridor for train access and adjacent to both Alameda Street and Terminal Island Freeway for truck access. BNSF has proposed to make this facility as “green” (environmentally friendly) as possible.

The SCIG project was included in the REP (Project II.5) based on prior development plans, but to facilitate comparative evaluation of “Other Potential Projects,” SCIG is not included in the capacity/demand analysis, but is being considered on equal footing with all “Other Potential Projects” described in this section.

ICTF Expansion

UPRR is considering plans to expand their existing ICTF facility north of Sepulveda Boulevard. The planning is in the conceptual development phase. The proposed facility could have a potential throughput capacity of 3.3 million TEU (1.9 million TEU over the existing 1.4 million TEU capacity). Since the rail access to ICTF occurs north of Thenard Junction, this expansion will not impact the constrained “Texaco Slot” portion of the Port rail network.

Summary of Other Potential Projects

The rail yard capacity expansion projects proposed in the REP (excluding SCIG) will not meet the forecast demand for intermodal facilities. As shown in **Table 3-5**, unmet demand for direct intermodal capacity is nearly one million TEU through 2020 and increases to at least two million TEU by 2030. The unmet demand through 2020 could be met by any one of the “Other Potential Projects.”

Simulation modeling shows that development of one of the “Other Potential Projects” on Terminal Island will negatively impact the Port rail network performance (unacceptable Level of Service with less than 1.5 million TEU added to the REP), and the network will not support more than one of the “Other Potential Projects” on Terminal Island (more than 1.5 million TEU added to the REP is estimated to cause unstable system performance).

An additional concern with the development of multi-user rail facilities on Terminal Island is that the greatest needs for intermodal rail facilities are in other areas. Therefore, a project on Terminal Island will induce truck traffic over the Gerald Desmond Bridge and Vincent Thomas Bridge, both of which are critical to the Port transportation system.

Since only one of the “Other Potential Projects” can be accommodated on Terminal Island (and then with potentially unacceptable rail network performance), SCIG, ICTF Expansion or another project off Terminal Island would be required to meet the projected intermodal demand expected by 2030. Implementation of either SCIG or the ICTF Expansion project would, by itself, approach meeting all of the demand through 2030. The near-dock facilities (e.g. SCIG and ICTF) have the advantage of accommodating cargo from any of the marine terminals that need support; they are optimally located near the Port and adjacent to the Alameda Corridor, and the site configuration allows efficient track lengths, high productivity and "green" operating systems. SCIG has the benefit of providing competitively balanced near-dock facilities to the two Class I Railroads. ICTF has the advantage of rail access upstream of the Texaco Slot bottleneck, and it also has significant support track in Dolores Yard/ICTF Support Yard.

3.5 Summary of Intermodal Facility Capacity/Demand

The following conclusions have been obtained from this intermodal facility capacity/demand analysis:

- Direct intermodal cargo (intermodal cargo that is not transloaded) should be handled at on-dock or near-dock facilities to minimize local/regional truck impacts also, off-dock facilities will be fully utilized by domestic and transload cargo.
- Planned on-dock facilities fall short of meeting IPI demand beginning in 2010.
- Additional on-dock and near-dock rail yard capacity expansion projects described in **Table 3-8** should be considered and detailed simulation modeling of the rail operations performed. It appears that near-dock developments will need to have a role in meeting SPB Port intermodal demand.
- The Railroads will need all of the downtown/regional rail yards and substantial new construction to accommodate domestic and transload cargo.

In order to meet the projected demand for direct intermodal cargo, the Ports will need to develop all planned on-dock facility expansions as well as one of the "Other Potential Projects," as listed in **Table 3-8**.

4.0 Port Intermodal Rail Yard Developments

4.1 Overview

The San Pedro Bay Ports have changed drastically since the beginning of the last Rail Master Plan. Several new on-dock rail facilities are in place and throughout the Ports, rail utilization is increasing rapidly. The Ports are shown in 2005 conditions on **Figure 4.1** with each of the on-dock and support rail yards labeled. It has been proposed that these yards be developed and expanded over the next 20 years in order to efficiently handle international cargo while minimizing environmental impacts.

Figure 4.1 - Existing and Proposed On-Dock Rail Yards

LEGEND

1 – Pier J On-Dock [1]
2 – Pier G On-Dock [1]
3 – Middle Harbor Terminal (Piers DEF) On-Dock [1]
4 – Pier A On-Dock [1]
5 – Pier S On-Dock [2]
6 – Pier T On-Dock [1]
7 – Pier B Rail Yard [1]
8 – TICTF Shared On-Dock [1]
9 – Pier 300 On-Dock [1]
10 – Pier 400 On-Dock [1]
11 – WBICTF On-Dock [1]
12 – WB-East (TraPac) On-Dock [2]
13 – PHL Base/Support Rail Yard [2]

Notes:

1) *Reconfiguration/expansion of existing rail yard.*
2) *Construction of new rail yard*

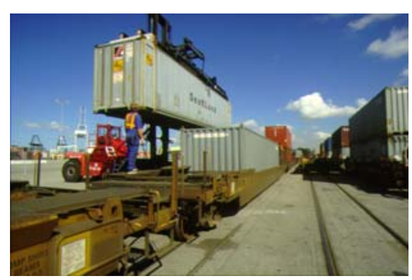
4.2 Rail Yard Development Goals

The on-dock rail yard concepts were developed based on the following general principles. The yards are only planned to a conceptual level to gain an understanding of the potential intermodal capacity, the operating characteristics to be included in the mainline simulation model, and the lead track requirements to receive a train into the yard.

The environmental permit process will influence individual rail yard designs and the shipping line/terminal operator will have input to modify these concepts during the design process, but these principles are consistent with Port goals and will represent the average terminal.

- Rail yards must be able to receive and build an 8,000-foot unit train into the yard without stopping on the mainline; this can be accomplished using dedicated leads, yard tracks and tail tracks
- Long tracks in yards - minimum one-third train length (2,700 feet), preferred one-half train length (4,000 feet)
- Spacing of working tracks shall be no less than 15 feet. Space between tracks for lift operations and truck circulation shall be no less than 65 feet (80 feet preferred). Space for lift operations/truck circulation is typically provided between every two or three tracks, although concepts are emerging for up to six closely spaced tracks being served under large rail mounted cranes. Typical examples of track spacing and the respective potential operating modes are presented in **Figure 4.2**

- The on-dock rail yard should have at least one 8000-foot long departure track for every 23,000 feet of working track (this will allow departure tracks to hold a prepared train for two hours without impacting terminal production while waiting for road power)
- Track grades shall be flat within the rail yard (less than 0.1 percent)
- Tracks can have horizontal curvature, but should be limited to greater than 9 degrees
- Mainline turnouts shall be #14 or #10
- Mainline turnouts leading to yard shall be #10



- Turnouts in yard ladders should be no tighter than #8 where space is extremely constrained
- Each rail yard is to include: train-in-motion warning system and compressed air system, and where possible rail car repair tracks and locomotive tie-down tracks.

The preceding guidelines must be augmented with all directives presented in the latest version of the POLB Rail Design Standards and the POLB Consultant Guidelines.

Figure 4.2: Possible Rail Yard Cross Sections

4.3 Storage Track Requirements

This section makes recommendations for optimal use and development of storage track. A key finding of the Rail Study is that one of the best ways that the Port can assist customers to achieve the goal of moving more cargo by on-dock rail is to develop adequate storage track to support the on-dock rail yards.

The Port of Long Beach should develop on-dock rail yards that provide storage to working track ratio of at least 1:1 and preferred 2:1. As described below, the storage track should be developed at the on-dock rail yard in order to prevent excess switching moves on the congested port track network.

Both UP and BNSF have expressed concerns about storage capabilities for Westbound intermodal trains within the Port area. The railroads need to stage bare railcars between Oakland and Los Angeles and as Far East as Barstow in order to meet the current “just in time” requirements of the marine terminals, which want to receive railcars simultaneously with arrival of the vessel. Westbound and southbound empty railcars are staged throughout the railroad system on any available siding. This is an obvious burden on the regional rail system. It is also likely part of the cause of some of the railroad service problems mentioned by the marine terminals (i.e. late delivery of rail equipment). The problem can be reduced by increasing the amount of storage track in the San Pedro Bay Ports, which will provide a buffer of equipment to supply intermodal yard operations.

Simulation modeling of the Port rail network indicated that, from the perspective of rail operations in the San Pedro Bay Ports, it will be important to maximize the use of **unit trains** that deliver bare railcars or westbound containers to a specific marine terminal. The goal will be to discourage switching cuts from terminal to terminal, which adds traffic to the Port rail network, which is projected to be running at capacity by 2010. This goal can only be achieved if there are adequate storage tracks at each of the on-dock intermodal rail yards to receive these trains. Achieving this goal will also require railroads to orchestrate their inbound trains to be Port-terminal specific. The Port will need to provide adequate storage tracks at each terminal so that these terminal specific trains can be received and stored. The inbound trains will be greater than the immediate need to fulfill eastbound equipment demands (unlike today’s “just-in-time” operations); however, the large volume of eastbound trains will keep the buildup of equipment from becoming excessive.

Storage Track Influence

The ability to turn tracks at an intermodal yard is highly influenced by the amount of available storage track. An analysis of storage track effects has been modeled with the results presented at the right. It can be seen from this analysis that the turns per day (number of times a track can receive a train, unload, load and depart the train) can range from 1.8 to 2.8 for storage to working track of 0:1 and 2:1, respectively.

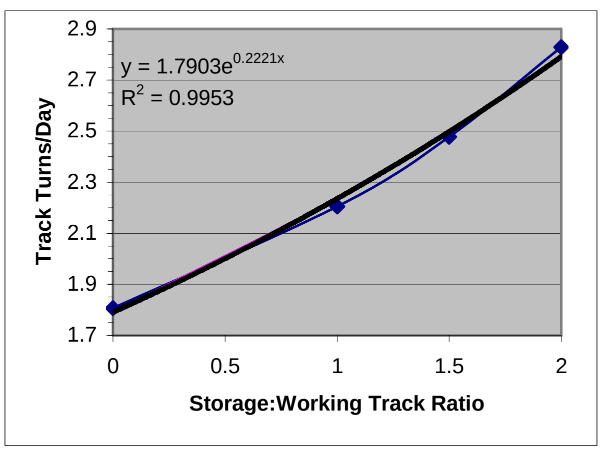
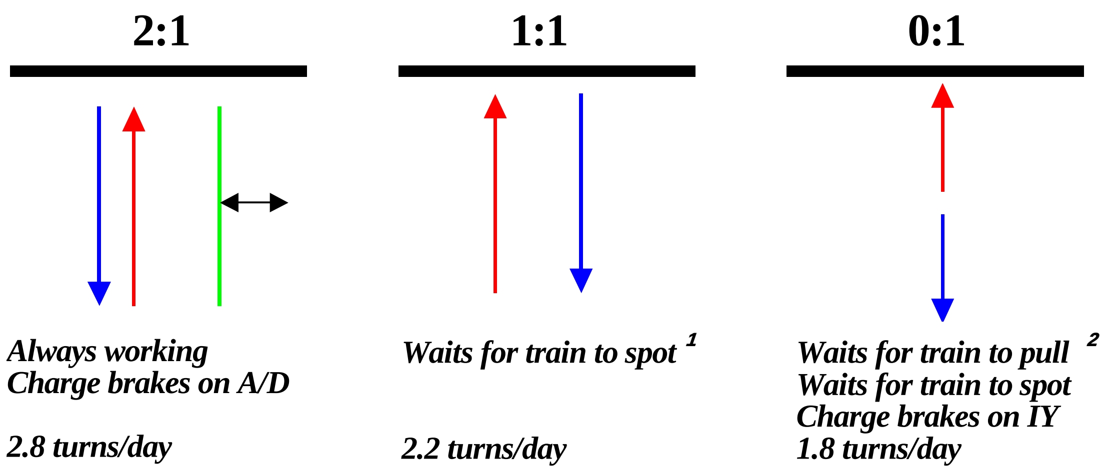


Figure 4.3 depicts the operational differences between 2:1, 1:1 and 0:1 storage to working track ratios. Based on this analysis, which confirms the industry rule of thumb, the Port should provide at least 1:1 and preferred 2:1 ratio of storage to working track at each of their on-dock rail yards.

Figure 4.3 – Influence of Rail Yard Storage Tracks



1 – This operation considers a situation with limited storage track; the train is ready to depart, but since open track must be available to land a train, track is held until a locomotive arrives to spot the arriving train and then depart with the loaded train.

2 – This element of the operations analysis describes a situation with no storage track. Because a train must take the loaded cars away before it can deliver the next set of cars, the track is not only held while waiting for road power to pull away the loaded cars, but the track is now empty waiting for a train to be able to bring in the next set of cars.

4.4 Storage Track Inventory

Port On-Dock Storage Tracks

The Rail Study conceptual plans show storage tracks at each of the on-dock rail yards. Some of the rail yards have specific storage yards immediately adjacent to the loading tracks. However, additional storage capacity can be allotted by using working tracks for storage, which provides the flexibility to load or store on any of these tracks. The tables in Section 4.6 show the length of storage track and working track at each on-dock intermodal rail yard as it is expected to typically operate on average (i.e. if working track is used for storage, it is represented as storage in the table). The Maximum Practical Capacity (MPC) Model used to analyze the throughput potential of each on-dock rail yard was run using the concept track lengths. If a rail yard did not have the desired dedicated storage track, then a portion of the working track was assigned as storage in order to fulfill the 1:1 storage to working track minimum goal. The resulting on-dock rail yard capacities are presented in Section 4.6. Total Port on-dock working and storage track lengths are provided in **Table 4-1**. The top portion of the table identifies the working track and storage track lengths (numbers of double stack cars @ 309 feet each) and the ratio of storage-to-working track at the on-dock rail yards themselves. The bottom portion of the table identifies the Port storage track at other yards in the Port (as described following **Table 4-1**) and the storage-to-working track ration for all yards in the Port.

Table 4-1: SPB Working and Storage Track Summary

No. DS Railcars & Ratios	2005	2010	2015	2020	2030
POLB On-Dock					
Working	143	265	438	452	521
Storage	29	289	447	497	580
On-Dock Ratio (S:W)	**0.21**	**1.09**	**1.02**	**1.10**	**1.11**
POLA On-Dock					
Working	242	289	399	478	478
Storage	379	379	439	447	447
On-Dock Ratio (S:W)	**1.57**	**1.31**	**1.10**	**0.94**	**0.94**
Total SBP On-Dock	***1.06***	***1.21***	***1.06***	***1.02***	***1.03***
Other Storage Tracks					
Pier B-POLB	33	54	162	162	162
Pier F Lead-POLB	0	0	38	38	38
Navy Mole-POLB	25	25	25	25	25
Transfer Yard-POLA	0	52	52	52	52
Total POLB Ratio (S:W)	**1.39**	**1.39**	**1.53**	**1.60**	**1.55**
Total POLA Ratio (S:W)	**1.57**	**1.49**	**1.23**	**1.04**	**1.04**
Total SPB Ratio (S:W)	***1.49***	***1.44***	***1.39***	***1.31***	***1.31***

Other Port Storage Tracks

In addition, to the terminal specific storage tracks there are proposals for storage tracks located in the Port for general use. These include Pier B, Pier F Lead (adjacent to Pico Avenue), POLA Transfer Yard and Navy Mole Road Storage Yard. These storage facilities are described below and the use of these storage tracks by individual on-dock yards is described in Appendix A. Total Port storage track lengths outside the on-dock yards are provided in **Table 4-1**. All of the following facilities are described with concept plans in Appendix B. Larger format concept plans are provided in Appendix C.

<u>POLB Storage Yards</u>

Pier B Mini-ICTF/Support Yard: This rail yard is central within POLB and is planned to support Toyota, carload operations, and the on-dock rail yards. The Pier B Rail yard currently has 25,000 feet of track for storage. This rail yard is scheduled for expansion, to be completed by 2015, as described in Appendix A and Appendix B. In Phase 1 of the Pier B expansion 8,000 foot-long staging tracks could be provided by extending the northern most four tracks in the Pier B Rail yard to continue past 9th Street crossing and along the east side of Pico Avenue. This will increase the total track length of the yard by another 12,000 feet, but the functional gain is even greater than the cumulative track length suggests. In Phase 2, Pier B is proposed to be expanded north of 9th Street (requiring closure of 9th Street) which creates room for more tracks that are even longer. Phase 2 has been analyzed with two alternatives: 1) inclusion of a mini-ICTF, and 2) maximum build-out of support storage tracks. It has been shown that both of these alternatives provide benefits to the Port, and the selection depends on the specific needs that the Port wants to address. The mini-ICTF alternative will support intermodal demand by providing approximately 400,000 TEU of capacity annually. This capacity can be used by any marine terminal and would be especially valuable to terminals without on-dock rail yards.

The second Pier B alternative, the support storage yard, enhances the capabilities of proposed on-dock rail yards by optimizing the storage to working track ratios. The enhancement to on-dock intermodal capacity is estimated to be slightly more than the throughput capacity of the Pier B mini-ICTF. However, the switching moves between on-dock rail yards and the Pier B support yard is shown by RTS modeling to cause train delays to the overall Port rail network. The Pier B development proposed by the Rail Enhancement Program has the mini-ICTF located north of 9th Street, and some support track located south of 9th Street. There are also several long storage tracks to chamber inbound and outbound trains from the Alameda Corridor north of 9th Street.

Pier F Lead Tracks: This trackage is associated with the proposed Ocean Boulevard Track Realignment project are available for general on-dock support. For MPC modeling purposes, the Pier F lead tracks have been dedicated to the on-dock operations of Middle Harbor Terminal (Piers D-E-F). But, other on-dock rail yards and the Pier G Metro bulk rail yard could also use this trackage.

Navy Mole Road Storage Yard: This yard would be developed on the footprint of the Navy Mole Road after the Reeves Avenue at-grade crossing is closed and a grade separation is built at the south end of Pier 400 Way. The proposed track on Terminal Island at the Navy Mole is modeled for the future use of Pier S; however, Pier T could also use the track for general support.

POLA Storage Yards

POLA Transfer Yard: There is existing trackage on the San Pedro Subdivision near Berth 200 that is used to support rail operations throughout POLA West. The yard is managed by PHL and used to support Pasha automobile and various carload operations. This rail yard currently has a total track length of approximately 12,000 feet. POLA is considering expansion of this facility to a major rail yard that will serve as the new home-base for PHL, provide significant support track to on-dock rail yards at Berth 101-131 and the proposed Berth 136-147, and continued support of Pasha automobiles.

POLA Pier A rail yard is currently used by PHL as their home-base of operations, which provides carload storage tracks, engine tie-ups and maintenance facilities. These functions are proposed to be moved to the new facility at Berth 200, located south of Alameda Street and Harry Bridges Boulevard. The Pier A rail yard will likely be demolished to make way for container terminal expansion and a new on-dock rail yard at Berth 136-147.

Non-Port Storage Tracks

There are several Class I Railroad facilities in the Port vicinity that support rail operations. However, none of these facilities have been incorporated into the MPC Modeling or the RTS Modeling since use of the yards is at the discretion of the Railroads.

UPRR Mead Yard: This rail yard is located south of Anaheim Street with westerly access to the Terminal Island Lead Tracks and easterly to Pier B Rail Yard. Mead Yard has eight tracks with the following characteristics:

- Track lengths vary from 2,380 feet to 3,440 feet.
- Total clear point length = 23,900 lf.
- Track 8 has an unloading dock and a hay pellet pit/conveyor.
- Tracks 1, 2 and 4 through 8 are used for Toyota automobile rack cars (cleaning, maintenance, prepping and staging.
- Track 3 is used for industrial staging.

ICTF Support Yard/UPRR Dolores Yard: This facility is located adjacent to the westerly side of Alameda Street and stretches from Thenard Junction (north of Pacific Coast Highway) to Compton Creek.

The UPRR ICTF Support Yard is used for storage and staging of rail cars for the ICTF Yard, which is located east of Alameda Street.

UPRR has pursued block-swapping where PHL will pull a less than complete unit train from the Port terminals to the Support Yard to be combined with blocks from the UPRR ICTF yard.

Dolores Yard (located between 223rd Street and Carson Street) supports UPRR carload business (approximately 100 cars per day) to the Ports. It is an interchange point for the UPRR and PHL and serves as a base for road crews. Dolores has 13 classification tracks and a three track locomotive servicing and fueling facility to meet the needs of the local areas.

Manual Sidings: These Support Tracks are located easterly and parallel to the UPRR ICTF Yard, northerly of Sepulveda Boulevard and south of the I-405 San Diego Freeway, and another pair of tracks are located west of Terminal Island Freeway between Sepulveda Boulevard and Pacific Coast Highway. There are three tracks siding tracks (in addition to the Manuel Subdivision/San Pedro Branch mainline track) with the following characteristics:

- Each track is approximately 5,200 feet in length.
- Total clear point length = 15,600 feet (when the Manuel Subdivision Track is included).

Storage Track Conclusions

The Port of Long Beach should develop on-dock rail yards that provide storage to working track ratio of at least 1:1 and preferred 2:1. This goal may be achieved through construction of specific storage track that is not designed to allow train loading, or by understanding that some working track may be used to serve both purposes of loading and storage. Having dual-purpose tracks is operationally efficient, but it is less space efficient than closely placed storage tracks.

Throughput potential has been calculated for each of the on-dock rail yards using the MPC Model. The model was run using the actual working and storage track lengths. If a rail yard did not have the desired dedicated storage track, then a portion of the working track was assigned as storage in order to meet practical requirements and fulfill the minimum storage track goal.

The other Port rail yards provide storage that is dedicated to bulk and merchandise cargo. These storage tracks can also be used to accommodate empty double-stack railcars during peak overload conditions.

In addition, Pier B Rail yard is being designed with staging tracks. This report has pointed out that these tracks need to be 8,000 feet long in order to chamber intermodal unit trains. These staging tracks are not considered as storage, since they are meant to operate more as sidings within the Port mainline system. These staging tracks are important to rail operations, but until the staging tracks are extended to 8,000 feet, they are only suitable for storage during peak overload conditions. The current set of RTS Model runs did not consider the Pier B rail yard staging tracks in support of mainline train movements.

4.5 Rail Yard Capacity Analysis

The intermodal rail yard throughput capacities at each of the on-dock rail yards are calculated using a throughput model. Capacities are expressed as Maximum Practical Capacity (MPC) which reflects the highest throughput a facility could practically achieve on a continuous basis. Maintaining MPC throughput will require exceptional effort and high operating cost by the terminal operator and most facilities prefer to operate at a lower throughput level. The MPC Model is a proprietary tool that considers the time required to perform a number of individual intermodal rail yard processes, including: switching, loading and unloading trains, testing and departing trains. It considers the affects of storage tracks, arrival/departure tracks, and rail yard configuration (track lengths, stub-end yard, end-to-end storage, etc). The model incorporates the affects of these indirect impacts based on studies of operating times sampled at numerous railroad operations. This analysis assumes a unit-train-consist, comprised of 25 DS-cars and up to 4 locomotive engines. Actual train sizes at the SPB Ports are expected to vary between 18 to 28 DS-cars, and the MPC Model will provide accurate results for this range of train sizes.

Basic Rule-of-Thumb Capacity Calculation

For a less robust alternative to the MPC Model, a general rule-of-thumb for rail yard capacity estimating is to assume that working tracks unload and load railcars twice a day (2 turns/day). The calculation would be as follows:

*Peak Day Eastbound Capacity (TEU) = Track Length (ft) / 309 (ft/DS railcar) *20 (TEU/DS railcar) * 0.9 (railcar utilization) * 2 (turns/day)*

The above calculation will provide an approximate theoretical maximum capacity. The MPC Model makes additional adjustments for east/west imbalance, peaking and plant utilization, as well as consideration for track lengths and other factors affecting switching times and influence of storage track.

For on-dock facilities, the MPC Model assumes that containers will be available from the marine container yard (CY) and that this interface will not reduce the productivity of the train loading equipment. This is a reasonable assumption, especially as the typical operating mode in San Pedro Bay is buffering the intermodal cargo in the container yard. If terminals used direct quay to rail transfer, the operating logistics would need to be honed to ensure that the rail yard is steadily supplied with containers.

Likewise, the model assumes that rail equipment will be available to regularly feed the facility. The model assumes that the rail yard operates 360 days per year, up to three-shifts per day with a maximum working time of 20 hours each day. The on-dock yards are typically working one shift per day presently, so the MPC analysis assumes an evolution of the operations to two shifts per day in 2010, and then three shifts per day in 2015 and beyond. There are also work rules and practices in place that currently constrain productivity, including the practice of stopping train loading activity when switching operations occur anywhere in the yard. The MPC analysis assumes that in 2020 and thereafter, on-dock rail yards will be enhanced, track protection systems established and on-dock operations evolved to the point where only tracks adjacent to moving trains are taken out of service.

For lift operations, the MPC Model assumes four cranes are assigned to each 25 DS-car train and each crane is assumed to have an average production rate of 25 lifts/hour. The level of staffing for an on-dock rail yard is estimated for 4-cranes assigned to each 25 DS-car train. Each set of 4 cranes are typically assigned the following longshore workers for train loading operations: 12 crane drivers/spotters and 20 hostler drivers. In addition, there may be crane drivers at the CY if the containers are staged in stacks. There are also managers for the lift operations and there may be a Yardmaster or Supervisor with crew for rail operations.

The MPC Model analyzes the throughput assuming utilization of the rail yard assets to their fullest potential. If the vessel schedule or some other influence causes the rail yard to be less utilized during certain days of the week or periods of the month, then the long-term throughput will be reduced. However, the results of the model are used to determine peak day operations and train volumes. A Plant Utilization Factor accounts for the effect of downtime, limited working shifts and other operating practices that typically occur.

As the size of the on-dock facilities increase, the numbers of hostlers required to deliver containers to trackside could grow to a point where terminal traffic congestion affects operations. The analysis of this condition would require a dynamic simulation model of the terminal operations. However, the purpose of the rail yard capacity analysis is to estimate the maximum practical capacity in order to understand the relative volumes of trains that could be generated by the container terminals. These volumes of trains will then be used in a mainline simulation model to test the port rail network to ensure that it can support these volumes of trains. If the on-dock rail yards were constrained by terminal traffic congestion, or vessel operations, or rail equipment delivery, or plant utilization, then the effect would be an over-estimate of the train traffic on the mainline rail.

While the purpose of estimating MPC in the initial Rail Master Plan was primarily to quantify train traffic generated onto the rail network, this Rail Master Planning Update is also using the MPC results to understand the ability of planned intermodal facilities to meet demand. This application of MPC will yield a scenario indicating the highest practical on-dock throughput volumes, and therefore, the lowest likely demand for additional on-dock/near-dock facilities.

MPC Model Validation

The MPC Model has been validated through consideration of numerous off-dock rail yards that are operating near their maximum practical capacity. For off-dock facilities, the model uses the same assumptions of available container and railcar supply to the intermodal yard, working shifts and production rates. In addition, the storage capacity of the container parking area is considered in the overall throughput analysis.

The analysis of inland rail yards provides extremely good correlation to the railroad companies' stated capacities. These are very good validation cases since the subject rail yards are operating near capacity. It is expected that the model represents on-dock rail yard capacities equally well; however, there are very few good validation cases where these types of facilities are being used to their full potential. As noted earlier, the model does not reflect the impacts of marine terminal operations that could constrain the flow of containers to the rail yard, nor does it address the supply of rail equipment to the rail yard. These influences can only decrease the throughput achievable at an on-dock rail yard from those stated in the model.

MPC Calculation

A description of the MPC Model logic is provided below:

<u>Basic Track Throughput Calculation</u>

The basic track throughput calculation considers the number of containers and railcars that will fit on the available working track (considering track utilization and railcar utilization), and calculates the number of containers to be de-ramped and ramped. This lift count is then multiplied by the number of times the available track can be "turned" each day.

Turning the track requires receiving a train, de-ramping, ramping, and delivering the railcars for a departing train. The factors affecting rail yard throughput are lift rate, switching efficiency and ramp versus de-ramp volumes. The resulting throughput calculation is termed, "Maximum Practical Capacity" or MPC.

MPC is considered the highest throughput that a facility can practically achieve; in comparison to actual operations MPC would typically be associated with a short duration, such as a peak month. The steps in calculating MPC are described by the following equations.

> ***Peak Day Eastbound MPC =*** *(Working Track Length in DS Cars) * (Track Utilization Factor) * (20 TEU/DS Car) * (Railcar Utilization Factor) * (Track Turns/Day) * (Switching Efficiency Factor)*
>
> ***Monthly Eastbound MPC =*** *Peak Day EB MPC *360 / 12*** *(Plant Utilization Factor)*
>
> ***Total Monthly MPC =*** *(Monthly Eastbound MPC) * (2 for east + west)* (Export/Import Factor)*
>
> ***Total Annual MPC =*** *(Total Monthly MPC)*12*

Track Lengths

Track lengths are input for total working tracks and total storage tracks, in units of "DS Cars" (309' five-unit articulated railcars).

Track Utilization Factor

Rail yard tracks are not typically fully utilized due to the varying mixes of railcar types and resulting unpredictable lengths of train cuts. Train cuts may also spill over onto a track with a small remaining number of cars that leaves a portion of the track unoccupied. The Track Utilization Factor is typically set between 75 percent and 90 percent. The MPC Model assumes track utilization of 80 percent.

Railcar Utilization Factor

Railcars are not typically fully utilized to the slot capacity of 20 TEU per 5-unit articulated DS Car. There are occasions when the loading operations, weight limits or types of boxes being loaded do not allow fully loading every slot on a train. For example, stacking containers does not allow 20-foot containers to be stacked on top of 40-foot containers. There is also consideration for the type of railcar; 3-unit articulated cars and single-well cars can only hold 90 percent and 85 percent, respectively, or as many containers as 5-unit cars within the same train length. The Railcar Utilization Factor is typically set between 70 percent and 90 percent. The MPC Model assumes railcar utilization at 85 percent in 2005-2010, and 87 percent in 2015-2030.

Plant Utilization Factor

The Plant Utilization Factor takes into account the variance in plant utilization due to maintenance or other downtime. The plant utilization factor can also be used to account for restrictions on working shifts. This is done for the 2005 MPC analysis to depict the current operating mode of only working one shift per day. The MPC Model Plant Utilization Factor is assumed to be 0.5 for existing conditions and increases to 0.65 by 2015, as facilities bring on multiple shifts per day. By 2020, the 0.83 factor indicates that all facilities are operating three daily shifts with minimal downtime and work rules/practices similar to Class I intermodal facilities.

Storage Track Influence

The ability to turn tracks is largely affected by the amount of available storage track. An analysis of storage track effects has been analyzed at numerous rail yards. This analysis shows that the turns per day range from 2.8 to 1.8 for storage to working track ratios of 2:1 and 0:1, respectively.

Switching Impacts

The rail yard throughput calculation also considers impacts to rail operations due to the rail yard configuration and its impact on switching operations. Switching impacts include the following:

Working track lengths: factor accounts for switching time required to double or triple over a train when landing. The factor ranges from 1.0 to 0.78 for track lengths of 25 to 5 DS cars, respectively.

Other switching parameters that affect the rail yard throughput include:

- presence of arrival/departure (A/D) tracks,
- stub-end vs. tail/run-around track,
- end-to-end vs. parallel storage-to-working yards, and
- universal working as storage tracks (storage tracks are spaced and paved to allow loading).

Ramp/De-Ramp Imbalance

Finally, the throughput model considers the relative volumes of the ramp compared to the de-ramp operations. The ratio of de-ramp to ramp volume has an affect on the throughput capability. An operation where de-ramp equals ramp gets the most lifts out of the necessary railcar switching operations. An operation with less de-ramp requires the same switching operations for less lifts, but also requires less time to de-ramp the railcars. An analysis of this ratio (referred to as export-import ratio) shows that the efficiency, e = 1.0 for balanced export=import, and e = 0.78 for one-way import-only operations.

On-Dock Throughput Limits

The preceding discussions addressed the physical rail yard capacity. The Maximum Practical Capacity (MPC) is an estimate of the most that a rail yard can be expected to produce over a given time.

There are other factors that affect rail yard throughput, which are categorized under the title, "On-Dock Limit". This limiting factor considers topics including:

- Total intermodal volumes handled at the Port;
- Intermodal volumes transloaded at off-dock warehouses; and
- Intermodal cargo that cannot be loaded on a unit-train due to inadequate volumes of destination specific containers.

The results of these combined influences generally indicate that no more than 35 percent of total Port volumes can be handled at on-dock rail yards.

Therefore, the rail yard throughput estimates consider both MPC and On-Dock Limit, and the more constraining number will govern the rail yard throughput.

Alternative Yard Operating Concepts

Non-traditional rail concepts involve uses of train operations that are not currently employed. These include the following concepts.

Inland Shuttle Train: Defined as rail transport to an “inland port” for distribution of local cargo. The inland port concept may prove beneficial due to the level of highway congestion and the potential value of truck traffic reductions as a mitigation measure. However, this concept will increase the demand on Port rail yard capacity as well as mainline rail capacity.

Inland Block-Swap: The concept of an inland rail yard to sort trains can provide several rail operating improvements that coincide with the recommendations of this Study. Features of this concept and associated benefits are described as follows:

- Provide the ability to build multi-destination trains by blocks at each on-dock rail yard. Trains can then be block-swapped at the inland yard to create single destination trains. This will increase the potential volume of on-dock cargo by alleviating the challenges with building long destination trains.
- Provide the ability to block-swap westbound trains at the inland yard to create Port-terminal specific trains. This will reduce inter-terminal switching movements at the Port.
- Provide dedicated regional shuttle engines that handle the train movements between the inland yard and the Port. These locomotives will be fueled for round trip; readily manage crew changes; and have the ability to drop a westbound train and pick-up an eastbound train without turning the locomotive (have both ends functional so locomotive can simply be reversed). This will significantly reduce the light engine traffic moving around the Port by eliminating the need to turn engines, reach crew change points and transit to engine services facilities. This concept could also facilitate application of green technologies to locomotives in the sensitive Southern California Air Basin.

The Ports should work closely with the Railroads to define and pursue these non-traditional concepts as well as near-dock rail yard capacity enhancements. This relationship should be expanded to include other area government agencies for a critical evaluation of regional mainline capacity.

4.6 Rail Yard Throughput Estimates

The MPC Model was run and On-Dock Limits established for each of the proposed rail yard development projects. The rail yard expansion projects are described in Section 4.7. **Table 4-2** provides the throughput estimates for each horizon year from 2005 through 2030.

Table 4-2: On-Dock Throughput Estimates

San Pedro Bay Ports
Rail Master Plan
2005 Railyard Capacities

2005 Conditions Terminal	On-dock Working Track Length (DS Cars)	On-dock Storage Track Length (DS Cars)	Modeled Intermodal Capacity "MPC" (TEU/yr)	Forecast Marine Terminal Throughput (TEU/yr)	Intermodal MPC as Percentage of Marine Throughput	On-dock Limit as Percentage of Marine Throughput	Adjusted Monthly EB Intermodal MPOT (TEUs)	Intermodal Forecast as Percentage of Marine Throughput	**Intermodal Forecast (TEU/yr)**	Maximum Total Trains per Day (25-car Trains)
Pier J (PCT @ 2 IYs)	51	43	377,023	1,286,485	29%	25%	16,751	25%	**320,000**	2.5
Pier G (ITS)	13	63	119,415	1,091,146	11%	25%	6,220	11%	**120,000**	0.9
Pier F (LBCT)	26	29	187,157	715,552	26%	25%	9,317	25%	**180,000**	1.4
Pier DE (CUT)				649,103						
Pier A (MSL)	44	25	258,086	790,686	33%	25%	10,295	25%	**200,000**	1.5
Pier S (not operating)	0	0	00	0						
Pier T (Hanjin)	59	108	571,526	1,841,158	31%	25%	23,973	25%	**460,000**	3.5
Pier C (Matson)				335,688						
POLB Subtotal	193	268	1,513,207	6,709,818	23%	21%	66,557	19%	**1,280,000**	10
Pier 300 (APL)	66	73	614,022	1,281,568	48%	40%	26,699	40%	**510,000**	3.9
TICTF(YTI/Evergreen)	55	123	613,645	2,197,134	28%	35%	31,961	28%	**610,000**	4.7
Pier 400 (APM)	93	127	747,602	1,733,585	43%	40%	36,116	40%	**690,000**	5.3
WB West (YML/CSL)	26	54	262,207	1,279,300	12%	35%	13,657	20%	**260,000**	2.0
WB East (Trapac)				977,044						
POLA Subtotal	240	377	2,237,477	7,468,631	30%	32%	108,433	28%	**2,070,000**	16
Total San Pedro Bay	433	645	3,750,683	14,178,449	26%	27%	174,990	24%	**3,350,000**	26
						Terminal Island Total			**2,270,000**	

San Pedro Bay Ports
Rail Master Plan
2010 Railyard Capacities

2010 Conditions Terminal	On-dock Working Track Length (DS Cars)	On-dock Storage Track Length (DS Cars)	Modeled Intermodal Capacity "MPC" (TEU/yr)	Forecast Marine Terminal Throughput (TEU/yr)	Intermodal MPC as Percentage of Marine Throughput	On-dock Limit as Percentage of Marine Throughput	Adjusted Monthly EB Intermodal MPOT (TEUs)	Intermodal Forecast as Percentage of Marine Throughput	**Intermodal Forecast (TEU/yr)**	Maximum Total Trains per Day (25-car Trains)
Pier J	51	43	437,346	1,856,242	24%	30%	22,778	24%	**440,000**	3.5
Pier G	35	103	372,943	1,526,209	24%	30%	19,424	24%	**370,000**	3.0
Pier F	26	29	217,102	684,451	32%	30%	10,695	30%	**210,000**	1.6
Pier DE				982,495						
Pier A	52	57	433,929	1,232,813	35%	30%	19,263	30%	**370,000**	2.9
Pier S	40	24	274,091	905,000	30%	25%	11,784	25%	**230,000**	1.8
Pier T	59	108	662,970	2,284,703	29%	30%	34,530	29%	**660,000**	5.3
Pier C				368,637						
POLB Subtotal	263	364	2,398,381	9,840,550	24%	25%	118,473	23%	**2,280,000**	18
Pier 300	66	73	712,265	1,666,308	43%	35%	30,375	35%	**580,000**	4.6
TICTF	55	123	711,829	3,276,516	22%	35%	37,074	22%	**710,000**	5.7
Pier 400	93	127	867,219	2,506,385	35%	35%	45,168	35%	**870,000**	6.9
WB West	26	67	321,954	1,732,451	19%	25%	16,768	19%	**320,000**	2.6
WB East	47	38	394,247	1,223,516	32%	25%	15,931	25%	**310,000**	2.4
POLA Subtotal	287	428	3,007,514	10,405,176	29%	32%	145,317	27%	**2,790,000**	22
Total San Pedro Bay	550	792	5,405,895	20,245,726	27%	29%	263,790	25%	**5,070,000**	40
						Terminal Island Total			**3,050,000**	

Table 4-2 (continued): On-Dock Throughput Estimates

San Pedro Bay Ports
Rail Master Plan
2015 Railyard Capacities

2015 Conditions Terminal	On-dock Working Track Length (DS Cars)	On-dock Storage Track Length (DS Cars)	Modeled Intermodal Capacity "MPC" (TEU/yr)	Forecast Marine Terminal Throughput (TEU/yr)	Intermodal MPC as Percentage of Marine Throughput	On-dock Limit as Percentage of Marine Throughput	Adjusted Monthly EB Intermodal MPOT (TEUs)	Intermodal Forecast as Percentage of Marine Throughput	**Intermodal Forecast (TEU/yr)**	Maximum Total Trains per Day (25-car Trains)
Pier J	101	186	1,471,822	2,597,154	57%	35%	47,344	35%	**910,000**	6.9
Pier G	35	103	474,003	2,055,132	23%	35%	24,688	23%	**470,000**	3.6
MHT	91	119	1,181,278	2,211,747	53%	35%	40,318	35%	**770,000**	5.9
Pier A	79	94	707,729	1,833,275	39%	35%	33,419	35%	**640,000**	4.9
Pier S	40	63	410,842	1,019,473	40%	35%	18,584	35%	**360,000**	2.7
Pier T	89	104	990,495	2,942,538	34%	35%	51,588	34%	**990,000**	7.6
Pier C				428,802						
POLB Subtotal	435	669	5,236,169	13,088,121	40%	34%	215,941	32%	**4,140,000**	32
Pier 300	84	73	986,580	2,166,549	46%	40%	45,136	40%	**870,000**	6.6
TICTF	80	136	1,054,441	4,335,286	24%	35%	54,919	24%	**1,050,000**	8.0
Pier 400	148	163	1,738,662	3,623,681	48%	40%	75,493	40%	**1,450,000**	11.1
WB West	38	77	504,224	2,346,110	21%	30%	26,262	21%	**500,000**	3.8
WB East	47	38	452,225	1,532,176	30%	30%	23,553	30%	**450,000**	3.5
POLA Subtotal	397	487	4,736,132	14,003,802	34%	36%	225,364	31%	**4,320,000**	33
Total San Pedro Bay	832	1,156	9,972,301	27,091,923	37%	35%	441,305	31%	**8,460,000**	65
						Terminal Island Total			**4,720,000**	

San Pedro Bay Ports
Rail Master Plan
2020 Railyard Capacities

2020 Conditions Terminal	On-dock Working Track Length (DS Cars)	On-dock Storage Track Length (DS Cars)	Modeled Intermodal Capacity "MPC" (TEU/yr)	Forecast Marine Terminal Throughput (TEU/yr)	Intermodal MPC as Percentage of Marine Throughput	On-dock Limit as Percentage of Marine Throughput	Adjusted Monthly EB Intermodal MPOT (TEUs)	Intermodal Forecast as Percentage of Marine Throughput	**Intermodal Forecast (TEU/yr)**	Maximum Total Trains per Day (25-car Trains)
Pier J	101	186	1,879,404	3,633,802	52%	35%	66,241	35%	**1,270,000**	9.7
Pier G	35	103	605,265	2,767,341	22%	35%	31,524	22%	**610,000**	4.6
MHT	91	119	1,508,401	2,845,330	53%	35%	51,868	35%	**1,000,000**	7.6
Pier A	94	145	1,641,446	2,726,209	60%	35%	49,697	35%	**950,000**	7.3
Pier S	40	63	524,613	1,148,418	46%	35%	20,935	35%	**400,000**	3.1
Pier T	89	104	1,264,786	3,789,780	33%	35%	65,874	33%	**1,260,000**	9.7
Pier C				498,791	0%					
POLB Subtotal	450	720	7,423,915	17,409,670	43%	34%	286,139	32%	**5,490,000**	42
Pier 300	84	73	1,259,786	2,800,096	45%	45%	65,614	45%	**1,260,000**	9.6
TICTF	80	136	1,346,440	5,717,272	24%	35%	70,127	24%	**1,350,000**	10.3
Pier 400	185	163	2,642,847	5,207,671	51%	40%	108,493	40%	**2,080,000**	15.9
WB West	63	77	893,079	3,158,102	28%	35%	46,515	28%	**890,000**	6.8
WB East	62	46	700,546	1,907,195	37%	35%	34,767	35%	**670,000**	5.1
POLA Subtotal	474	495	6,842,699	18,790,336	36%	38%	325,515	33%	**6,250,000**	48
Total San Pedro Bay	924	1,215	14,266,614	36,200,006	39%	36%	611,654	32%	**11,740,000**	90
						Terminal Island Total			**6,350,000**	

Table 4-2 (continued): On-Dock Throughput Estimates

San Pedro Bay Ports
Rail Master Plan
2030 Railyard Capacities

2030 Conditions Terminal	On-dock Working Track Length (DS Cars)	On-dock Storage Track Length (DS Cars)	Modeled Intermodal Capacity "MPC" (TEU/yr)	Forecast Marine Terminal Throughput (TEU/yr)	Intermodal MPC as Percentage of Marine Throughput	On-dock Limit as Percentage of Marine Throughput	Adjusted Monthly EB Intermodal MPOT (TEUs)	Intermodal Forecast as Percentage of Marine Throughput	**Intermodal Forecast (TEU/yr)**	Maximum Total Trains per Day (25-car Trains)
Pier J	101	186	1,879,404	4,240,000	44%	35%	77,292	35%	**1,480,000**	11.3
Pier G	35	103	605,265	3,229,000	19%	35%	31,524	19%	**610,000**	4.6
MHT	91	119	1,508,401	3,320,000	45%	35%	60,521	35%	**1,160,000**	8.9
Pier A	94	145	1,641,446	3,181,000	52%	35%	57,987	35%	**1,110,000**	8.5
Pier S	40	63	524,613	1,340,000	39%	35%	24,427	35%	**470,000**	3.6
Pier T	89	104	1,264,786	4,422,000	29%	35%	65,874	29%	**1,260,000**	9.7
Pier W	68	82	00	0			57,395		**0**	8.4
Pier C				582,000	0%					
POLB Subtotal	518	802	7,423,915	20,314,000	37%	34%	375,020	35%	**6,090,000**	55
Pier 300	84	73	1,259,786	3,310,000	38%	45%	65,614	38%	**1,260,000**	9.6
TICTF	80	136	1,346,440	6,758,407	20%	35%	70,127	20%	**1,350,000**	10.3
Pier 400	185	163	2,642,847	6,156,000	43%	45%	137,648	43%	**2,640,000**	20.2
WB West	63	77	893,079	3,733,198	24%	35%	46,515	24%	**890,000**	6.8
WB East	62	46	700,546	2,254,505	31%	35%	36,487	31%	**700,000**	5.3
POLA Subtotal	474	495	6,842,699	22,212,110	31%	39%	356,391	31%	**6,840,000**	52
Total San Pedro Bay	992	1,297	14,266,614	42,526,110	34%	37%	731,411	33%	**12,930,000**	107
						Terminal Island Total			**6,980,000**	

4.7 Rail Yard Expansion Projects

The planned on-dock rail yard expansions for the Ports include reconfigurations and phased growth of existing facilities, as well as proposed construction of new rail yards. Existing facilities and their capacities are discussed first, followed by proposed expansions in each of the forecasted years. The rail yard expansion projects are listed and located on **Figure 4.1**, while **Figure 4.4** presents the on-dock rail yard elements of the Rail Enhancement Program in Gantt chart form with schedule and cost data.

< Figure 4.4 - On-Dock Rail Yard Improvement Summary >

Existing Facilities

The Ports have been actively developing container terminals and support infrastructure for dozens of years and currently have 2,500 acres of container terminal. The Port of Long Beach has recently developed Pier A and Pier T (200 acres and 350 acres, respectively), each with its own on-dock rail yard. Some of the most recent POLA developments include Pier 300 and Pier 400 container terminals (290 acres and 484 acres, respectively), as well as the West Basin and Terminal Island on-dock intermodal yards. By the year 2020, the San Pedro Bay (SPB) Ports plan to have created terminal space totaling nearly 4,800 acres.

Nearly all of the existing on-dock rail yard facilities and some near-dock facilities have projects planned for the future that will expand and/or favorably reconfigure the tracks in single or multiple phases. In the Port of Long Beach, this includes Pier A; Pier B, Pier G, Pier J and Middle Harbor Terminal. Port of Long Beach proposed to develop new rail yards at Pier S and the Navy Mole Road Storage Rail Yard. Within the Port of Los Angeles on/near-dock improvements are planned at Pier 300, Pier 400, West Basin (WBCTF), West Basin – East (TraPac), Terminal Island ICTF (TICTF), and the New Near-Dock ICTF – South of Sepulveda (SCIG).

The rail yard expansion projects are described below in the order that they would be developed, in five-year increments between 2005 and 2030.

2007 Rail Yard Expansion Projects

There are no proposed on-dock rail yard expansion projects proposed to be implemented by the end of 2007.

2010 Rail Yard Expansion Projects

The Phase II near-term on-dock projects (depicted in **Table 4-3**) that are planned for completion by the end of 2010 are:

- Pier A On-Dock Rail Yard Expansion to Carrack
- Pier S On-Dock Rail Yard
- Pier G-New North Working Yard
- Pier G-South Working Yard Rehabilitation
- West Basin East-New ICTF (Phase I)

Each of these on-dock projects is shown on the **Figure 4.1**.

Table 4-3: San Pedro Bay Ports On -Dock Projects by 2010

On-Dock Rail Yard Improvement Projects	Sponsor	Development Costs ($ Millions)
Pier A On-Dock Rail Yard Expansion to Carrack	POLB	19.6
Pier S On-Dock Rail Yard	POLB	34.3
New Near-dock ICTF-South of Sepulveda	POLA	200.0
Pier G-New North Working Yard	POLB	14.1
Pier G-South Working Yard Rehabilitation	POLB	40.7
West Basin East-New ICTF (Phase I)	POLA	45.4

Table 4-4 provides an overview of the rail yards' throughput in 2010.

Table 4-4: San Pedro Bay Ports Rail Yard Throughput in 2010

Terminal	On-Dock Working Track Length (DS Cars)	On-Dock Storage Track Length (DS Cars)	Intermodal Forecast (TEU/yr)
Pier J	51	43	440,000
Pier G	35	103	370,000
Pier F	26	29	210,000
Pier DE			
Pier A	52	57	370,000
Pier S	40	24	230,000
Pier T	59	108	660,000
Pier C			
POLB Subtotal	**263**	**364**	**2,280,000**
Pier 300	66	73	580,000
TICTF	55	123	710,000
Pier 400	93	127	870,000
WB West	26	67	320,000
WB East	47	38	310,000
POLA Subtotal	**287**	**428**	**2,790,000**
Total San Pedro Bay	***550***	***792***	***5,070,000***

Rail yard inventory sheets were developed and are provided in Appendix A for the on-dock projects. The inventory sheets display a site map, throughput projections for working yards, a table showing allocation of any off-site storage tracks, existing and proposed rail yard acreage, and existing and proposed track lengths.

2015 Rail Yard Expansion Projects

The Phase III medium-term projects that are planned to be completed by the end of 2015 are shown in **Table 4-5**, and include:

- Navy Mole Road Storage Rail Yard
- Middle Harbor Terminal Rail yard
- Pier J On-Dock Rail Yard Reconfiguration
- Pier 400 On-Dock Rail Yard Expansion (Phase I)
- Pier 300 On-Dock Rail Yard Expansion
- Terminal Island ICTF Rail Yard Expansion (Phase I)
- West Basin ICTF Rail Yard Expansion (Phase I)

The project locations were provided on **Figure 4.1**. This medium-term time frame represents the greatest expansion of rail yard projects compared to all of the other forecast years. Phase III Rail Yard Inventory Sheets, included in Appendix A, illustrate the extent of new development.

Table 4-5: San Pedro Bay Ports On-Dock Projects by 2015

On-Dock Rail Yard Improvement Projects	Sponsor	Development Costs ($ Millions)
Navy Mole Road Storage Rail Yard	POLB	10.0
Middle Harbor Terminal Rail Yard	POLB	68.9
Pier J On-Dock Rail Yard Reconfiguration	POLB	100.0
Pier 400 On-Dock Rail Yard Expansion (Phase I)	POLA	33.4
Pier 300 On-Dock Rail Yard Expansion	POLA	23.4
Terminal Island ICTF Rail Yard Expansion	POLA	18.9
West Basin ICTF Rail Yard Expansion (Phase I)	POLA	6.2

Table 4-6 provides an overview of the of the rail yards' throughput in 2015.

Table 4-6: San Pedro Bay Ports Rail Yard Throughput by 2015

Terminal	On-Dock Working Track Length (DS Cars)	On-Dock Storage Track Length (DS Cars)	Intermodal Forecast (TEU/yr)
Pier J	101	186	910,000
Pier G	35	103	470,000
MHT	91	119	770,000
Pier A	79	94	640,000
Pier S	40	63	360,000
Pier T	89	104	990,000
Pier C			
POLB Subtotal	**435**	**669**	**4,140,000**
Pier 300	84	73	870,000
TICTF	80	136	1,050,000
Pier 400	148	163	1,450,000
WB West	38	77	500,000
WB East	47	38	450,000
POLA Subtotal	**397**	**487**	**4,320,000**
Total San Pedro Bay	***832***	***1,156***	***8,460,000***

Rail Yard Expansion Projects Beyond 2015

The on-dock and near-dock Phase IV long-term projects that are planned for years beyond 2015 are:

- Pier A On-Dock Rail Yard East of Carrack
- Pier 400 On-Dock Rail Yard Expansion (Phase II)
- West Basin ICTF Rail Yard Expansion (Phase II)
- West Basin East-ICTF Expansion (Phase II)

The six Phase IV long-term project locations were depicted as **Figure 4.1** and shown in **Table 4-7.** Rail Yard Inventory Sheets are included in Appendix A for each of the on-dock and near-dock projects.

Table 4-7: Phase IV Long-Term Projects

On-Dock/Near-dock Rail Yard Improvement Projects	Sponsor	Development Costs ($ Millions)
Pier A On-Dock Rail Yard East of Carrack	POLB	31.4
Pier 400 On-Dock Rail Yard Expansion (Phase II)	POLA	16.3
West Basin ICTF Rail Yard Expansion (Phase II)	POLA	12.5
West Basin East-ICTF Expansion (Phase II)	POLA	7.8

Table 4-8 provides an overview of the of the on-dock rail yards' throughput for years beyond 2015.

Table 4-8: San Pedro Bay Ports Rail Yard Throughput Beyond 2015

Terminal	On-Dock Working Track Length (DS Cars)	On-Dock Storage Track Length (DS Cars)	Intermodal Forecast (TEU/yr)
Pier J	101	186	1,270,000
Pier G	35	103	610,000
MHT	91	119	1,000,000
Pier A	94	145	950,000
Pier S	40	63	400,000
Pier T	89	104	1,260,000
Pier C			
POLB Subtotal	**450**	**720**	**5,490,000**
Pier 300	84	73	1,260,000
TICTF	80	136	1,350,000
Pier 400	185	163	2,080,000
WB West	63	77	890,000
WB East	62	46	670,000
POLA Subtotal	**474**	**495**	**6,250,000**
Total San Pedro Bay	***924***	***1,215***	***11,740,000***

5.0 Port Rail Operations

5.1 Regional Rail Access

The San Pedro Bay Ports have superior connections to the intercontinental railroad system. Both Class I Railroads (Union Pacific Railroad [UPRR] and Burlington Northern Santa Fe [BNSF]) serving the western U.S. have multiple routes from Los Angeles to regions across the country. In addition, the mountain passes are lower with almost no tunnels or canyons to challenge track alignment. In comparison, the UPRR Central Route out of Northern California has tunnel clearance issues, canyons and high summits.

The mainline rail access to Los Angeles includes transcontinental and major north-south rail connections carrying freight traffic to and from the Southern California region via: Northern California (UPRR and BNSF lines to the Pacific Northwest); Southern Nevada (UPRR lines to Salt Lake and points east); Northern Arizona (BNSF lines to the Midwest and all points east); and Southern Arizona (UPRR lines to the Southwest, Midwest, and all points east). These routes converge in downtown Los Angeles and utilize the Alameda Corridor for access to the Ports.

The Alameda Corridor, which began service in April 2002, consolidated mainline intermodal freight operations from four separate lines onto a single, consolidated freight rail corridor. One of these four rail lines (the former Southern Pacific San Pedro Branch) was removed and then rebuilt to become the route of the Alameda Corridor mid-corridor trench. The other three rail lines remain in service under various ownership and conditions which will be explained later. The Alameda Corridor Rail Operating Agreement substantially governs freight railroad operations over the Alameda Corridor, along with the other remaining rail lines connecting the Port. **Figure 5.1** illustrates these routes.


"Texaco Slot"

Utilization of the Alameda Corridor has grown steadily since its opening, as indicated in **Figure 5.2**, and simulation modeling has shown the corridor to have capacity for continued growth. One identified bottleneck on the Corridor is located immediately south of West Thenard Jct. through an area known as "Texaco Slot". The area is named for the former owner of the adjacent refinery that constrains the track right-of-way expansion.

Since the Texaco Slot is projected to be constrained in the future, it would be reasonable to ask whether some train could take either the former BNSF Harbor Subdivision (now owned by the MTA) or the former UP San Pedro Branch (now owned by the Ports of Long Beach and Los Angeles) rather than the Alameda Corridor. Access via these routes may be physically possible since the tracks are largely in place to support such a movement, and local rail service and switching are presently taking place on these lines. However, such connections are currently prohibited under the terms of the Alameda Corridor Operating Agreement. The former San Pedro Branch may be used only under emergency conditions and the former Harbor Subdivision can not be used for such movements even in an emergency.

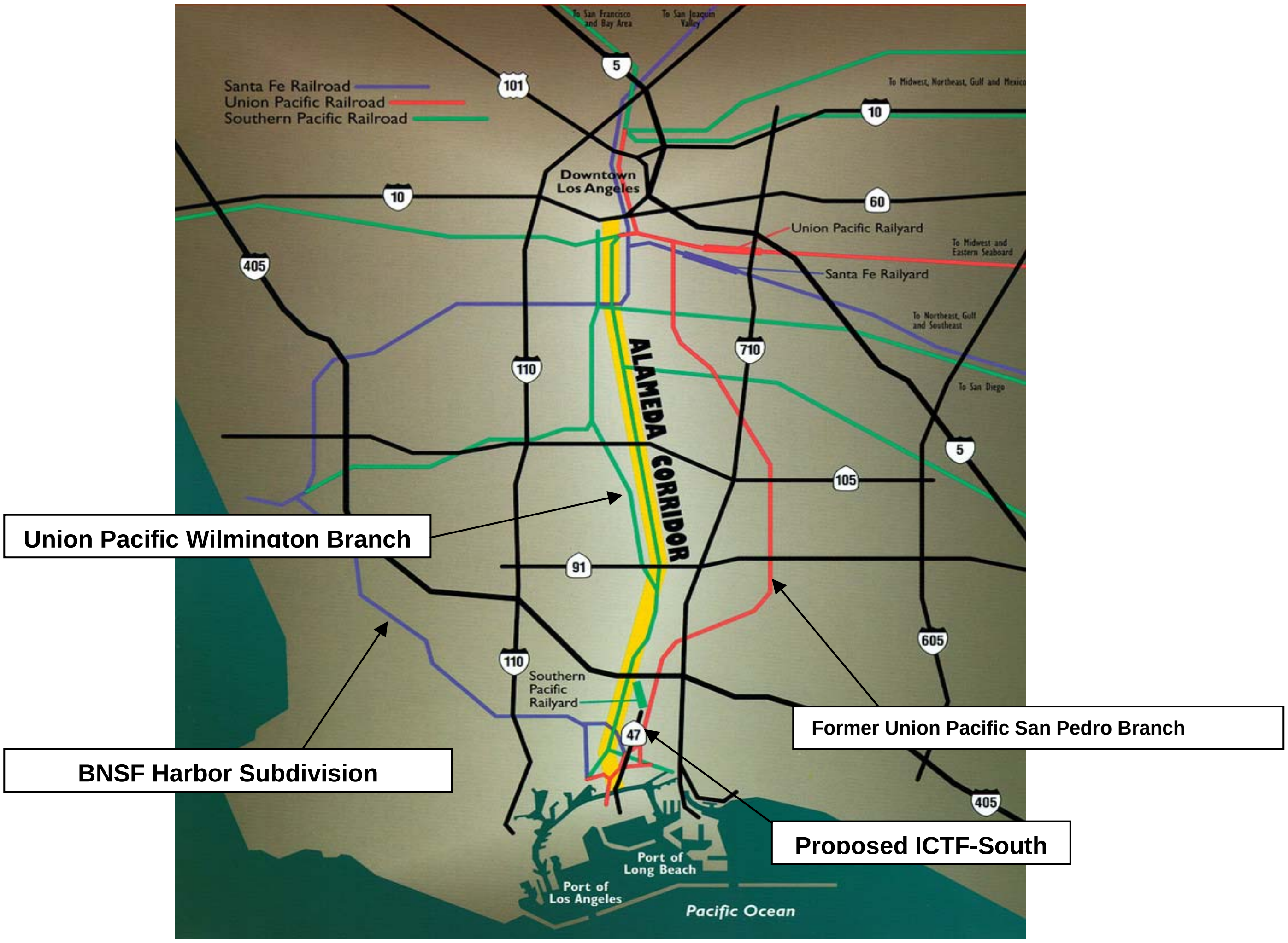


Figure 5.1 – SPB Ports Rail Access Map

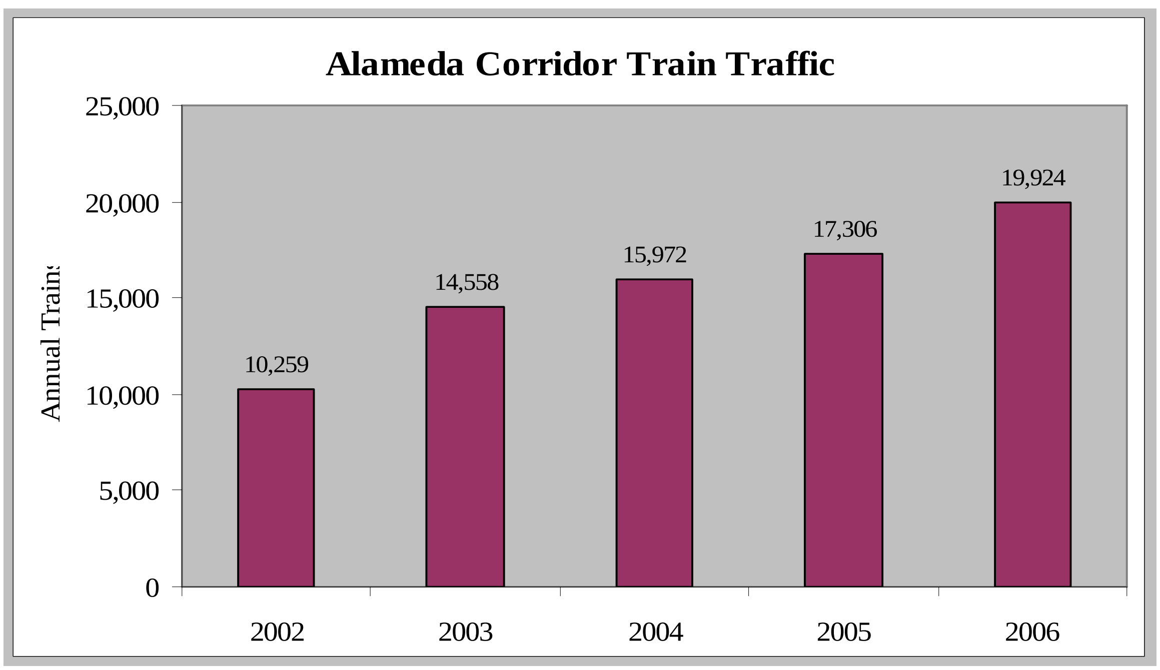


Figure 5.2 – Annual Alameda Corridor Train Traffic

5.2 Port Rail Operations

Train Dispatching

BNSF/UPRR dispatch trains along the Alameda Corridor north of West Thenard from their control center in San Bernardino. PHL is responsible for dispatching all train moves south of CP West Thenard. PHL has implemented a Centralized Train Control (CTC) system within the Port that is interconnected with the BNSF/UPRR CTC system. Only a portion of the Port rail network is under CTC, and the remainder is dispatched by Yard Limits and Number Track Authority (similar to Track Warrant Control). As part of their authority, PHL manages utilization of Pier B Rail Yard and Pier G (Metro) Rail Yard in POLB, and POLA Transfer Yard (formerly UP Transfer Yard) and Pier A Rail Yard in POLA.

Pacific Harbor Line (PHL) Operations

PHL is currently the third party rail operator serving both Ports. They provide support to the two Class I Railroads, namely Union Pacific Railroad (UP) and BNSF Railway (BNSF). They also provide services to individual terminal operators and perform maintenance on rail infrastructure jointly owned by the Port of Los Angeles and Port of Long Beach. PHL provides the following services:

- Dispatch all train moves on the Port Rail Network,
- Coordinate with Class I Railroads on dispatching trains onto/out of the south end of the Alameda Corridor,
- Manage all manifest traffic within the Port Complex (except Pasha by BNSF),
- Handle some intermodal trains using PHL equipment, or PHL crews on Class I equipment,
- Handle automobile trains (except some Toyota handled by UP),
- Switch intermodal cars within terminals on request of the marine terminals, and
- Perform track maintenance of common Port rail infrastructure and some terminals.

PHL currently operates with a base at 340 Water Street Pier A Yard in POLA, although this facility will need to be relocated in the future to make room for TraPac terminal expansion and on-dock rail yard. PHL's manifest switching totals 35,000 carloads annually, not including empties; 85 percent of this carload business is with POLA, and most occurs in the South Wilmington/San Pedro area. Pier A Yard serves as classification yard, crew on-duty point and minor locomotive service facility. PHL handles six beltline jobs every weekday:

1) Morning - Pier A to San Pedro (Borax, Avalon Team Track, PAC 10, Amerigas, classify inbounds, build trains for night delivery);
2) Noon - Pier A to POLB (Toyota/Lexus, Chemoil, Baker, GP Gypsum, National Gypsum);
3) Evening - Pier A to West Basin (Westway, Conoco Philips, Air Liquide and Certaineed Roofing);
4) Evening – Pier A to Manuel Yard (interchange at Manuel Sidings; LA Grain, SP Forklift, Cal Cartage) and Terminal Island (Del Monte, Fremont Lumber, and PC Recycling);
5) Night – Pull DAS Loads to Pier A; Pier A to UP Interchange at Dolores and return;
6) Midnight – Spot auto racks at DAS; Pier A to BNSF Interchange at Watson.

Weekends typically have four to five jobs each day, dropping Job No. 2 and sometimes No. 5 or 6 from the weekday list.

PHL's intermodal switching typically involves ten switch jobs per day on a fairly regular schedule at the direction of the Class I Railroads. The weekly switching includes 50 starts, split nearly evenly between UP and BNSF. The Class I Railroads have contracts with the following San Pedro Bay Port marine terminals:

Table 5-1 Class I Railroad Contracts at SPB Ports

UPRR	BNSF
P300 - Global South (APL)	Pier 400 (APM)
TICTF (Evergreen/PO)	TICTF (YTI-NYK)
Pier G - ITS (K-Line)	WBICTF (YML/CSL)
Pier T (Hanjin)	Pier A (MSC)
	Pier F - LBCT (OOCL/NYK)
	Pier G - ITS (K-Line)
	Pier J - PCT (COSCO)
	Pier T (Hanjin)

BNSF Operations

The BNSF Watson Yard, located at 1302 Lomita Blvd in Wilmington, services general manifest traffic (including major petrochemical plants) in El Segundo, Torrance and the SPB Ports. With local freight traffic projected to increase approximately 2 percent per year, the facility does not have excess size or capacity capable of replacing PHL Pier A (if Pier A needs to be relocated for a future intermodal yard) and it is not ideally located to serve the major locations for industry traffic in the SPB Ports.

Until recently, BNSF used Watson as a fueling point for SPB Port locomotives. Direct-to-locomotive refueling (DTL) now takes place at two tie-up tracks on Terminal Island, where as many as 40 engines a day can be fueled by truck. BNSF directly services Port terminals and also interchanges with PHL throughout the Ports at points such as Pier 400, Manuel Sidings and along Pico Blvd North of Ocean Boulevard. The total volume handled on-dock by the BNSF was 978,000 containers (1,760,000 TEU) in 2005, with an average annual growth rate of 33 percent over the past two years.

UP Operations

The UP Dolores Yard is located at 2442 Carson Street in the City of Carson, on the westerly side of Alameda Street north of the I-405 (San Diego) Freeway. Dolores is a switch yard for area manifest trains and has a locomotive refueling and maintenance facility. The UP and the SPB Ports are currently studying additional locations in the SPB network for locomotive fueling. The main freight traffic serves petrochemical plants in Carson and Wilmington.

The UP Mead Yard is located along the southerly side of Anaheim Street east of the Dominguez Channel and serves mainly as an automotive rail car preparation and transfer facility.

The UPRR directly services SPB Port terminals and also interchanges with PHL throughout the SPB Ports at points – Dolores Yard, Mead Yard and Manuel Sidings. The total volume handled on-dock by the UPRR was 653,000 containers (1,175,000 TEU) in 2005, with an average annual growth rate of 22 percent over the past two years.

Refueling Facilities

Simulation modeling has indicated that light engine moves through the Port rail network will cause significant train delays in the future. The primary reason for light engine moves is to refuel, sand and stock the locomotives and change crews.

Grade Crossing Policy

General Order No. 135 of the Public Utilities Commission (CPUC) of the State of California states that each railroad corporation must observe the following regulations when operating on and across public grade crossings:

- Trains stopped or switching must open a crossing within ten minutes unless no vehicle or pedestrian is waiting at the crossing.
- There are no CPUC restrictions for crossing occupancy for a moving train continuing in the same direction.

The Ports of Long Beach and Los Angeles have a contract with PHL with a stipulation that trains will not occupy an at-grade crossing for more than 10 minutes including stopping and switching.

5.3 Summary of Train Traffic

In **Table 5-2**, three train volume sets summarize input to the RTC rail simulation model for the current effort and studies conducted over the past 5 years. Train volumes include all internal train movements occurring in the Port area, and along the Alameda Corridor (both inbound and outbound). The listed train volumes are for a peak 4-day period.

Table 5-2: Train Files for RTC Model
Unit Intermodal Trains per 4-day Period

	Train Type	2005	2010	2015	2020
Train Volume Set I	**2002 POLB Rail Master Planning Study**				
	On-Dock Intermodal	124	160	276	408
	Non-Intermodal	73	73	77	77
	Light Engine/Switching	66	66	66	66
	Total	263	299	419	551
Train Volume Set II	**2004 ACTA Train Simulation Study**				
	On-Dock Intermodal	122	159	283	402
	Non-Intermodal	89	89	89	89
	Light Engine/Switching	76	100	153	196
	ICTF	34	40	40	48
	Total	321	388	565	735
Train Volume Set III	**ITRS - 1 (MPT On-Dock + ICTF-South + Shuttle Trains)**				
	On-Dock Intermodal	100	168	242	385
	Non-Intermodal	100	100	100	100
	Light Engine/Switching	120	152	160	188
	Pier B Rail Yard	0	0	8	8
	UP ICTF	49	49	97	97
	SCIG	0	59	59	59
	Shuttle Trains (Typ.)	16	40	40	40
	Total	385	568	706	877

The on-dock intermodal volumes shown in the preceding table (**Table 5-2**) for Train Volume Set III (ITRS-1) are a summation of individual rail yard volumes. The individual rail yard train volumes for a 4-day design period are presented in **Table 5-3**.

Table 5-3: On-Dock Train Volumes
Unit Intermodal Trains per 4-day Period

Terminal	2005 Conditions	2010 Conditions	2015 Conditions	2020 Conditions	2030 Conditions
Pier J	10	10	21	42	42
Pier G	7	9	17	27	27
Pier DEF	5	5	15	32	32
Pier A	6	8	17	28	32
Pier S	0	8	10	14	16
Pier T	14	20	27	37	43
Pier W	0	0	0	0	43
Pier C	0	0	0	0	0
POLB Subtotal	41	61	107	180	235
Pier 300	15	23	29	38	38
TICTF	20	34	37	48	48
Pier 400	14	30	43	70	80
WB West	10	12	17	31	31
WB East	0	8	9	19	20
POLA Subtotal	59	107	135	206	217
Total SPB On-Dock	**100**	**168**	**242**	**385**	**452**
Pier B ICTF	0	0	7	7	7
UP ICTF	49	49	97	97	127
SCIG	0	59	59	59	65

6.0 Rail Traffic Simulation Model

6.1 Simulation Overview

Train operations on the Port rail network are simulated using the RTC (Rail Traffic Controller)[1] simulation model. The port-related rail network includes all tracks at the Port of Los Angeles and Port of Long Beach to the Alameda Corridor and ending at the Union Pacific Railroad (UP) and Burlington Northern Santa Fe Railway (BNSF) main lines at East Yard and Hobart, in East Los Angeles. Cases were developed and run using this network, the forecasted increases in demand, and proposed facility improvements during the 2010 to 2030 period. A Base Case was run with actual 2005 train activity as a benchmark.

This exercise is an update to that run in 2003, with revised traffic forecasts and proposed improvements. The primary changes in this set of simulation models include:

- The near-dock facility SCIG is included with access from the Long Beach Lead.
- Pier B is tested alternatively as a mini-ICTF, then as a central storage yard.
- Minor modifications are made to Pier G and Middle Harbor Terminal (MHT).
- An additional track is modeled at Ocean Boulevard between MHT and Pier B.
- Pier W is not included in 2020.

In addition, this set of simulations utilizes a more detailed description of the switching necessary to support certain yards and terminals, and uses different assumptions about the locations and movements associated with the servicing of locomotives.

A Base Case was run using a representation of actual train movements in January 2005. Data was used from the Alameda Corridor Transportation Authority [ACTA] and Pacific Harbor Line [PHL] that described actual train movements over their jurisdictions. A set of train movements was developed from this data that represented a design day for each day between noon Thursday and noon Monday. The Base case represents a benchmark that calculates performance of existing trains on the existing network, before any traffic increases or proposed track improvements.

RTC was run for a peak 4- "design day" period against the train demand forecast for 2010, 2015, 2020 and 2030. Each successive Case incorporates the physical changes to the railroad plant as well as the increased demand as foreseen by the Port planners for the Case date.

The demand numbers for intermodal trains and the specifics of the changes in port terminals, trackage, switches, and signals, were obtained from the San Pedro Bay Ports. Engineering data for the Alameda Corridor itself was obtained from ACTA, and for the connections to the UP and BNSF east of the Los Angeles River crossing, from the respective carriers. Information regarding non-intermodal trains, including locals and road-switchers, has come from Pacific Harbor Line and the two Class I railroads.

Description of RTC Model

RTC is a powerful computer program that serves as a dispatch model. As the simulation "dispatcher" flows trains across the railroad, it resolves conflicts between trains, in the same manner as would an actual railroad dispatcher. But it is doing so with the full knowledge of ALL

[1] Rail Traffic Controller © Berkeley Simulation Software, LLC

trains on the territory, and with the look-ahead capability available to a powerful computer program. Unless a train is badly delayed or nearing an hours-of-service limit, both actual railroad dispatchers and the simulation program "dispatcher" will generally give preference to expedited freight trains over lower priority manifest freight trains. These priorities are determined by the freight railroad and incorporated into the meet-pass logic used to resolve train conflicts.

A prerequisite to obtaining useful results from RTC is the accurate description of track and signal layouts. The minimum level of network detail in RTC requires nodes that represent switch points, foul points, signals, station stops, speed change locations and major grade change locations. The corresponding links connecting the nodes must have accurate lengths, speed limits and ruling grades. Users can, at their discretion, refine networks further with link curvature and tightly placed nodes to increase the accuracy of the train performance calculator's (TPC) computations. RTC's integrated TPC requires the availability of accurate locomotive data as well as train length, tonnage, number of loads and empties. The TPC takes this information in combination with tractive effort curves, dynamic brake curves and air brake characteristics to determine run times between locations.

The minimum level of detail needed to simulate a train in RTC includes specifying the train's origin, destination and intermediate station or crew change points (if any). Departure times for trains entering from the north or departing Port rail yards are input as an average rate (e.g. a train every 2 hours), but that rate is subject to statistical variation. Once trains arrive in a yard, they have a minimum dwell time specified to represent switching the train from arrival/departure tracks into the yard.

Model Output

Each model run refers to data shown in summary tables and graphs generated by RTC. The performance measures used, and displayed in the report, are:

Train Count – The number of trains operated and measured over the simulation period.

Simulation Period – For all the Port simulations, a 4-day period was sampled, from Thursday at noon through Monday at noon –the typically heavier days of the week.

Running Time – Total cumulative time of train movements through the rail network system.

Delay Hours – Time spent for meets and passes. Does not include Dwell or Wait on Schedule. For the entire network, Delay Hours also includes the time spent decelerating and accelerating from meet-pass delays. A decrease is considered "good".

Delay Ratio – The proportion of running time that a train is stopped for meets and passes with other trains, not for rail yard work (dwell) or waiting on schedule. A decrease is considered "good". This index should be used for case comparisons where different numbers of trains are operated. All else equal, more trains will mean more total Delay Hours. But if each train is dispatched with equal efficiency in both cases, the Delay Ratio will be unchanged.

Mainline Rail Simulation Analysis

Dynamic simulation modeling 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), but to assist in interpretation of the model results, a Level of Service (LOS) grade is assigned as defined in **Table 6-1**.

Table 6-1: Level of Service Definition

LOS for SPB Ports Rail Network

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

LOS of C or better is considered desirable based on experience at similar rail terminal environments and on the length of delays that were experienced by individual trains during simulation runs with those delay ratios. LOS D is undesirable and LOS E or F is considered unacceptable. Trains still reach their destination under LOS D, E or F, but delays become high with associated costs; and the system is fragile such that it cannot quickly recover from conflicts causing backups. Track outage events and maintenance will cause lasting impacts to the system performance.

The various simulation efforts that have been conducted over the past six years each of different extents of rail network coverage. The POLB efforts in 2002 did not include Alameda Corridor. The ACTA efforts in 2004 included Alameda Corridor and ICTF. The current model runs includes Alameda Corridor, ICTF and SCIG, but also delves further into the operations of each on-dock and near-dock rail yard. Therefore, the delay ratios calculated for the ACTA model runs can be 5 percent to 10 percent lower than the 2002 runs, and the current runs can be 5 percent to 10 percent higher than the ACTA runs due to added delays accounted for in the rail yards. To adjust for these differences, ACTA simulation runs can be rectified by adding 10 percent to the delay ratio results and applying the LOS definition in **Table 6-1**.

The RTC Model for this Rail Study was run with projected train volumes for each of the forecast years. These runs were similar to the previous model runs (POLB 2002/POLA 2003) except for the following:

- Pier W is not included in the planned rail yard expansions as previously modeled in 2020, although a similar Pier T Mole expansion was tested in 2030 runs herein;
- Southern California International Gateway (SCIG) is modeled as a near-dock rail yard;
- Pier B is expanded as a mini-ICTF and support yard extending north of 9th Street;
- Texaco Slot track expansion was replaced with a by-pass along the Wilmington Wye; and
- The switching operations inside of rail yards were modeled more explicitly.

Operating Assumptions

The general assumptions underlying the simulations of all cases after the 2005 Base Case are listed below in **Table 6-2**. These assumptions reflect conditions found necessary for a successful operation of the simulated network. They do impose certain restrictions and requirements on train operation outside the network, which the carriers will ultimately need to address. Relaxing these requirements would cause network performance to deteriorate.

One additional assumption is that locomotive crews change will occur at an Inland Empire location (e.g. Colton, San Bernardino, Barstow or Yermo), and that crews are therefore not on extremely short time when they enter the Port complex.

Table 6-2: Operating Assumptions

CARRIERS

Category	Assumption	Carrier rank
Inter-terminal switching	No inter-ramp PHL switch moves to distribute or assemble mixed destination trains.	1
Outbound trains	Power and crews available to run trains on time.	2
Outbound trains	Road crews are called to match the set time of outbound trains	2
Locomotive fueling	All road power fuels at pads.	3
Locomotive fueling	Road power operates light between ramp and pad.	3
Inbound trains	Trains may be spotted by switch crews, to avoid HOS relief, except at ICTF and SCIG.	4
Outbound trains	Trains are built by switch crews [except at ICTF and SCIG].	4
Outbound trains	Trains do not pick up at intermediate yards, except the two daily Inland Empire-Long Beach shuttles.	4
Inbound trains	Trains do not set out at intermediate yards, except the two daily Inland Empire-Long Beach shuttles.	4
Average Train size	450 TEU; 7200 feet per train.	5
Locomotive fueling	Shuttle power turns at ramp without fueling.	5

PORT TERMINAL OPERATORS

Category	Assumption	Port rank
Labor restrictions	Longshore labor does not affect train movements; trains can be loaded or stripped 24/7.	1
Inbound trains	Trains always have a terminal track on which to land, although they may be delayed by switching at the terminal.	2
Outbound trains	Trains are released from each ramp at a rate to reflect its capacity to turn trains.	2
Train Speeds	10 mph maximum on all tracks other than main tracks. Main tracks per PHL Time-table.	3
Inbound trains	Trains proceed directly to yard or ramp; no trains are turned and shoved into destination.	3
Yard air	Air service provided at all ramps and support yards so that initial terminal brake test can be made before train makeup and held until road power arrives.	4
Locomotive fueling	Pads or service tracks located at TICTF, Pier 300, PHL B200, Pier B, SCIG, and Dolores.	4
Inbound trains	Trains are landed on ramp tracks, but may leave a portion in receiving yard.	5
Outbound trains	Trains may originate at ramp and pick up a portion of train in support yard.	5

6.2 Model Runs

Throughout the study period (2005-2030), it is assumed that Manifest and PHL Industry traffic does not change to the point where additional trains would be run, except for the Long Beach Subdivision, which requires one additional job to complete all work.

Light Engines and PHL Double Stack trains are constrained assuming that inbound power consists must return to the nearest service track for fueling and servicing. Train arrival to rail yards and transfer to service track moves are characterized as separate train types, to keep their statistics separated from the main line moves made with trunk line crews.

Table 6-3 summarizes the number of trains dispatched and measured over each Case's 96 hours; it also shows the intermodal (double stack) component of the train volumes, and the delay ratios and delay hours obtained with each Case. The delay hours represent freight train hours in the conventional (industry) sense; the delay ratios are obtained by dividing delay time by the total elapsed time of trains on the network. This provides the measure that indicates the percentage of total time that is taken up by delay.

In addition to measures of delay, we also analyzed other typical indicators of railroad performance when reviewing each resolved case. These other indicators – which are not reflected in **Table 6-3** include comparing the number of individual trains that suffered excessive delay from case-to-case, analyzing the maximum delay suffered by the worst performing train (as opposed to normalized delay, which is what is measured by the delay ratio), and looking at the number of trains (if any) that required re-crews due to reaching the statutory limit of 12 hours on duty that is mandated by the Federal Hours of Service Act. Generally speaking, we believe all these performance–related factors have to be assessed to determine how well the network is handling the demand.

In general, network performance declines case-by-case as train volumes increase. This implies that increased demand is outrunning even the enhanced rail network plant. It also says that, were the improvements that are included in the successive cases NOT part of the ongoing development of the rail plant, it is likely that performance over each successive 5-year period would decay very substantially, and that ultimately the system would fail. Network delay ratios do not increase as quickly as train volumes: the increase in traffic is handled with some degree of success by the construction of numerous network and terminal improvements. The fact that Delay Ratios do not remain as they were in 2005, however, indicates that new network capacity is needed and is fully consumed by the increase in traffic.

If the proposed improvements were sufficient to handle all the projected traffic without any decline in service, the Delay Ratio would remain unchanged between all cases. If the Delay Ratio increases between cases, then the associated improvements were not sufficient to handle the projected traffic at the same level of service.

Results for the current set of model runs are provided in **Figure 6.1, Figure 6.2** and **Table 6-3.** Further description of the model runs and results are provided a separate simulation report.

Figure 6.1 - Network Delay Ratio

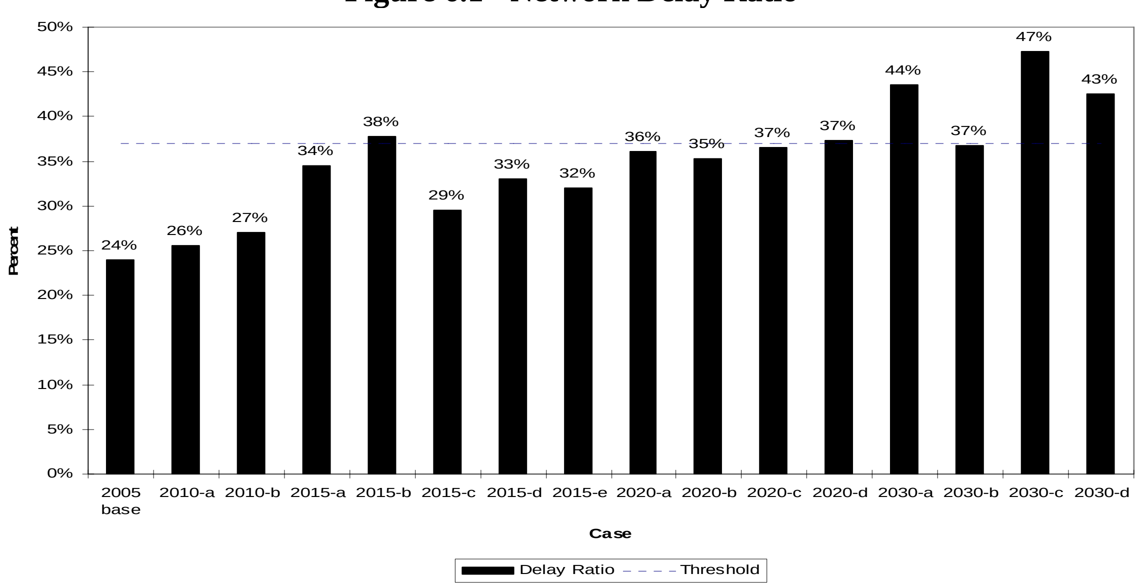


Figure 6.2 - Network Delay Hours Per Day

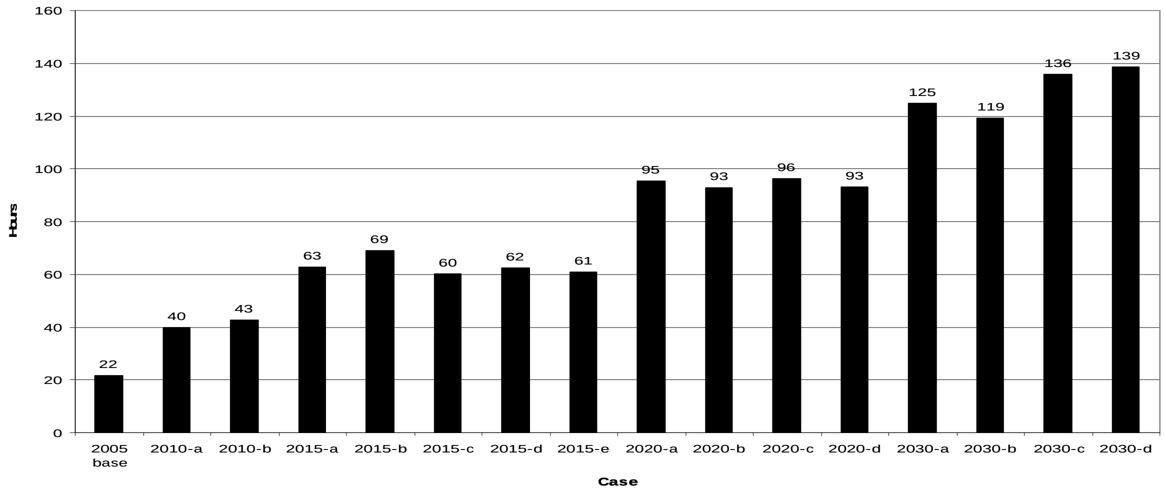


Table 6-3: Recent RTC Model Results

Case	Incremental Improvements	Bridge up down	Bridge tracks	Texaco slot bypass	Operating notes	Trains: Total per Day	Trains: Double stacks /Day	Delay Ratio: All Freight	Delay Hours/Day: Total Freight
NETWORK									
2005 base	1/1/2005	up	2	no	Inter-ramp	92	27	24%	22
2010-a	No intermodal trains on San Pedro Sub across Anaheim St.	down	2	no	No inter-Ramp	143	79	26%	40
2010-b	[as for 2010-a]	up	2	no	No inter-Ramp	143	79	27%	43
2015-a	Pier 400 2nd lead and storage tracks - Expansion Piers 300, 400, A, E, J, TICTF, WBW	down	2	no	Pier B an ICTF	201	112	34%	63
2015-b	[as for 2015-a]	up	2	no	[as above]	201	112	38%	69
2015-c	[as for 2015-a]; 3 tracks at Badger bridge	down	3	yes	[as above]	208	117	29%	60
2015-d	[as for 2015-b] Pier G/J changes	down	2	no	[as above]	208	112	33%	62
2015-e	[as for 2015-d] - No tail track at Pier E.	down	2	no	[as above]	208	112	32%	61
2020-a	Phase II expansion: Pier 400, WBE, WBW - 2nd leg of wye at CP Anaheim.	down	2	no	[as above]	266	154	36%	95
2020-b	3rd track Badger bridge	down	3	yes	[as above]	266	154	35%	93
2020-c	[as for 2020-b]	down	3	yes	Pier B as yard not ICTF	266	151	37%	96
2020-d	2020b - no tail track at Pier E.	down	3	yes	Pier B an ICTF	265	153	37%	93
2030-a	Pier W only - 2020 traffic for ICTF & SCIG	down	3	yes	[as above]	306	172	44%	125
2030-b	Pier W + SCIG, at 2030 traffic	down	3	yes	[as above]	315	182	37%	119
2030-c	Pier W only - 2020 traffic for ICTF & SCIG	down	2	no	[as above]	306	172	47%	136
2030-d	Pier W + SCIG, at 2030 traffic	down	2	no	[as above]	315	182	43%	139

Long Beach Line

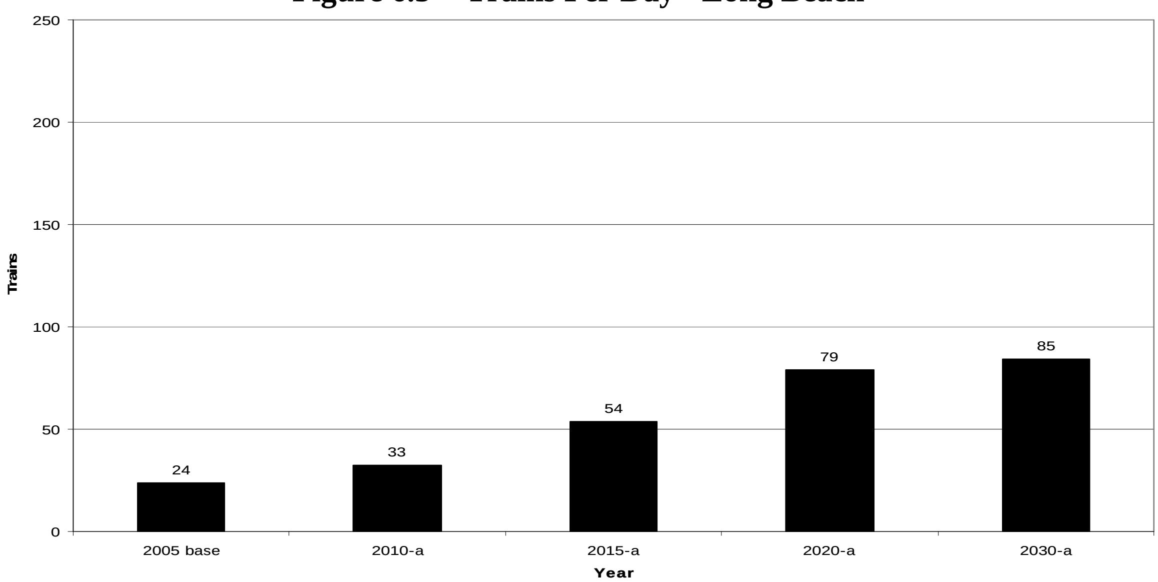
In general, the Long Beach Line performs well through 2010. By 2015, Pier J and Pier G are significantly expanded. The simulations indicated a need for the following improvements:

- Dual leads connecting the G/J support yard and Pier J;
- A new lead on the north side of the Pier J working tracks;
- Receiving tracks on Pier G to fully chamber unit trains off the mainline; and
- An additional track at CP Ocean from Pier F to Pier B yards.

The importance of these improvements is not fully reflected in the network statistics. The difference in network Delay Ratio between cases 2015-a / 2015-d [when improvements at Piers G/J are included] is but one percentage point. However, delay ratios calculated on the Long Beach line for these same cases shows improvements with a 41 percent reduction in delay ratio (dropped from DR=36 to DR=21).

By 2020, the Long Beach line has increasing Delay Ratios mainly because of a 45 percent increase in traffic between 2015 and 2020. The line's performance doesn't decline much beyond 2020, as traffic increases are modest.

Figure 6.3 - Trains Per Day - Long Beach



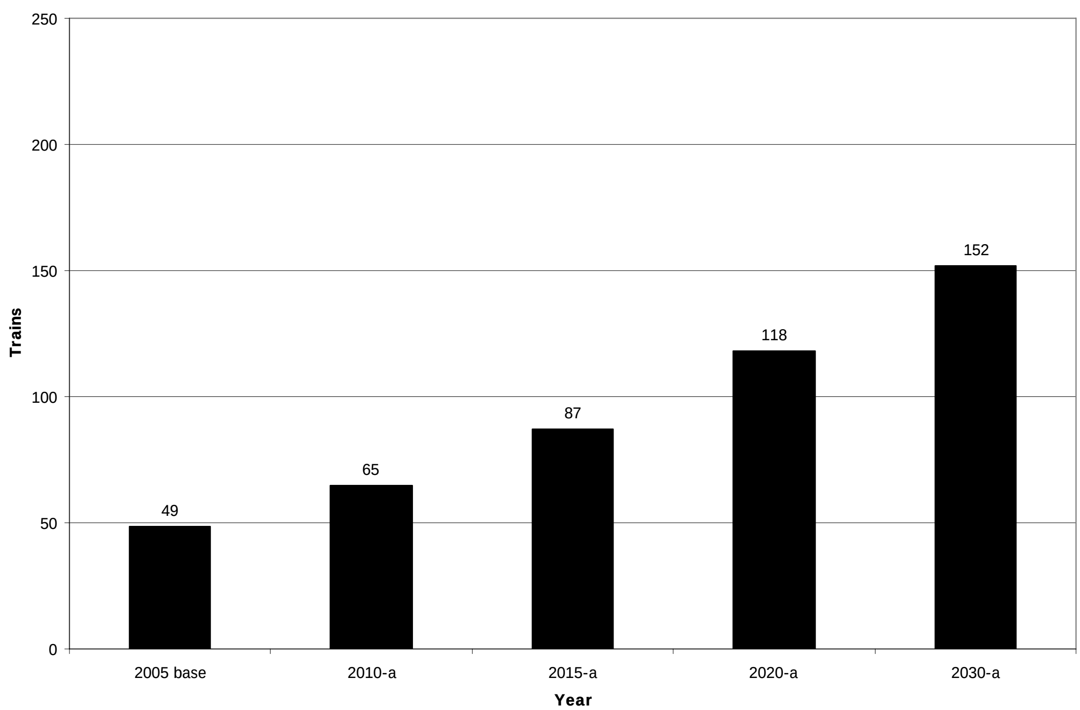
Terminal Island Line

The most important factors affecting Terminal Island performance are the mainline from Thenard Jct across Badger Bridge, the configuration of main track crossovers and terminal leads at CP Mole. Improvements will be required for each of these to achieve acceptable rail system performance.

Allowing the Bridge to lift for vessel passage causes performance to decline significantly, compared with a locked-down bridge, even with the construction of second leads at terminals and some crossover reconfiguration. In 2010, lifting the bridge increases the delay ratio on the Island by 35 percent, when comparing cases 2010-a and 2010-b.

Even with all the improvements shown in the Rail Enhancement Project list, the addition of another major rail facility (such as Pier T Mole expansion, or a multi-user rail yard on the Los Angeles side of Terminal Island), as modeled in 2030 runs, results in a 73 percent increase in Delay Ratio when comparing 2020-b (DR=23) and 2030-a, (DR=40).

Figure 6.4 - Trains Per Day - Terminal Island

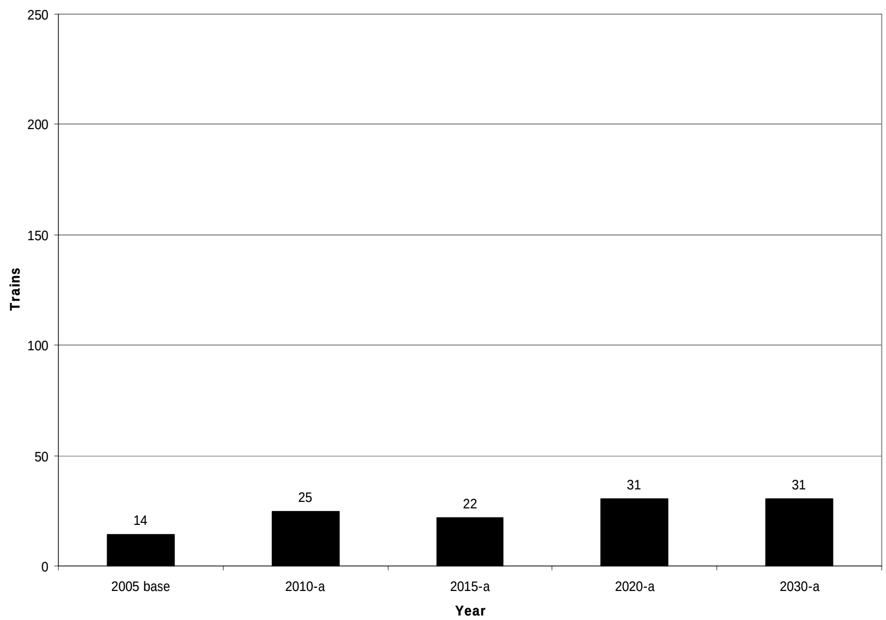


West Basin Line

Improvements made by 2015 improve West Basin operations, especially locking down the Badger Bridge. Because trains move more efficiently to and from Terminal Island, delays are less for West Basin trains. However, there may be some problems in comparing West Basin delays with those of other lines, because of the high number of PHL switch jobs competing for space at the PHL yard and on its leads. Half of all delay is incurred by PHL jobs. There are 9 jobs per day using the PHL yard and leads, experiencing an average of 3.3 total hours of delay per day. There are 8 expedited trains per day, incurring only an average of one hour delay per day.

All of the West Basin planned improvements are necessary, with the addition of a second north leg of the Wye at CP Anaheim.

Figure 6.5 - Trains Per Day - West Basin



Alameda Corridor

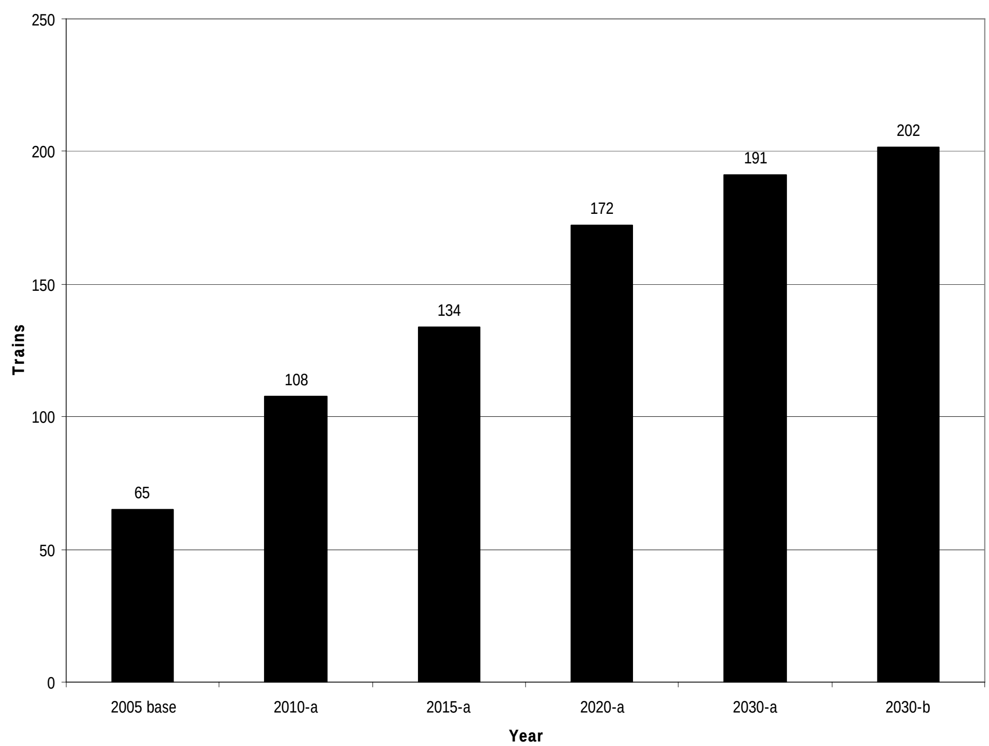
The Alameda Corridor is a three-track mainline between Long Beach Jct. and Redondo. It has the same pattern of performance as the overall network, with a similar pattern of delay ratios. The ratios are consistent with those observed in other mainline cases where the line doesn't experience severe congestion. The Alameda Corridor itself is robust under even the high traffic cases of 2030.

However, a bottleneck exists at the south end of the Alameda Corridor, south of Thenard Junction including an area known as the "Texaco Slot." The Texaco Slot has three tracks shoe-horned between densely developed refinery properties. Adding a track through the slot itself is thought to require investment in the hundreds of millions of dollars. An alternative to expanding the slot has been considered by ACTA and is simulated in this current set of model runs. The alternative is referred to as the Texaco Slot Bypass and comprises a connection from Alameda Corridor to industry siding north of the Wilmington Subdivision connection; the siding is connected to the former SP San Pedro Branch by a project known as the K-PAC connection; trains can then follow the San Pedro Branch to the Wilmington Wye and onto the Long Beach Lead; a proposed connection from the eastbound Long Beach Lead to the Alameda Corridor will complete the Bypass.

While the simulation results showed marginal benefits from the Bypass, it is longer than, and not as fast as, the 3-track main through the slot. No intermodal trains to and from the Long Beach Sub were allowed to use this route, due to possible conflicts on the diamonds at Long Beach Jct./Alameda Corridor. Trains to and from Terminal Island and the West Basin were allowed to use this route.

The south end of the Alameda Corridor leading to Terminal Island is one of the most critical sections of track on the Port network. Model results indicate that expanding this section of track from two dedicated tracks into three dedicated tracks from Thenard Jct. to across the Badger Bridge (including the bypass) will reduce delay ratios in 2015 by 17 percent (DR=34 reduced to DR=29). The model did not register the same improvement in 2020 or 2030, which indicates there is another bottleneck upstream in the Port rail network. The most likely cause of the unyielding high delay ratios in 2020 and 2030 is that trains are held out of congested areas in the Alameda Corridor. This makes the Corridor appear to be the bottleneck, but it is actually caused by constraints elsewhere in the system. The only change introduced for the 2030 run was to add a major rail yard expansion to Terminal Island. This addition, which could represent Pier T expansion or a new multi-user rail yard on the Long Beach or Los Angeles side of Terminal Island, pushes the rail network system to the brink of failure.

Figure 6.6 - Trains Per Day - Alameda Corridor



6.3 Summary of Simulation Findings

The number of delay hours per operating day tells us how much total delay is being experienced. Delay ratios represent normalized delay – it's essentially a measure of how much delay any given train is likely to experience, or the average delay per train. In the current set of cases, the delay ratios decay gradually from case-to-case, but they stay in the 32 to 37 percent range—at the high end of the "acceptable" scale. The cases with delay ratios in excess of 37 percent represent conditions that are likely to prove unacceptable.

The absolute number of hours of delay increases dramatically over time. But that's the effect of a very large increase in the number of trains. In the real world, the dependability of the system is more accurately reflected by the normalized delay, or Delay Ratio. By that measure, the network continues to successfully dispatch in RTC. This exercise confirmed that current planning is keeping pace with changing estimates of demand, and changes to terminal locations, sizes, and layouts.

Furthermore, while train delays increase, there are not a significant number of individual trains with unusually high delay, and the number of Hours of Service re-crews measured in the model never rises to unacceptable levels. In railroad terms, these findings are every bit as important as the quantified measures of delay and performance. The combination of all these measures tells us several things:

1. With the investments proposed by the Rail Enhancement Program, the SPB Port rail network plan just manages to keep up with increasing demand. In other words, all of the investment is required, during the time periods indicated. Additionally, other infrastructure and technology-related initiatives should be investigated further. A delay or failure to achieve these infrastructure improvements will result in serious adverse impacts on rail performance to and from the San Pedro Bay Ports.
2. Service levels under the modeled scenarios can be expected to decay over time, but the rail system isn't likely to reach total gridlock. Normalized delay is likely to remain within tolerable limits, but service reliability will not improve and operating costs will escalate.
3. The Trench is not a constraint on system capacity. The location and layout of near-dock and/or on-dock terminals is far more significant to system performance. (Note: Possible constraints at the north end of the Alameda Corridor are beyond the scope of this study).
4. The ability of the rail network to recover from a catastrophic interruption will deteriorate over time. On the other hand, the ability to perform normal maintenance stays the same or actually improves a bit over time (because more terminals end up with parallel leads or additional support trackage).

All of the operating assumptions used in the RTC will need to be implemented, including:

- No inter-terminal switching;
- Shorter and less frequent light engine moves for servicing;
- Adequate crews and power to handle departing trains when released;
- Trains arriving and departing as needed, without marine terminal restrictions; and
- A high level of communication between railroads and port terminal operators (e.g. insuring the ability of inbound trains to arrive/depart without delay);

This set of simulations indicates that the proposed Rail Enhancement Program will generally protect an acceptable level of rail service over the next 20 years. The bad news is that the system generally loses a little ground over each 5-year cycle.

The SPB Ports should make note of the findings that development of additional intermodal capacity on Terminal Island, beyond the planned rail yard expansions (e.g. expansion of Pier T, development of a new multi-user rail yard) by itself produced a marked decay in system performance, due principally to added congestion around CP Mole and south of Thenard Jct. All of the planned rail yard expansions on Terminal Island put the rail network near the limit of acceptable train delays. The addition of another significant rail yard (1 to 1.5 million annual TEU) will push the train delays beyond acceptable and into unstable conditions.

6.4 Recommended Rail Infrastructure Projects

Short-Term Projects

The short-term rail enhancements projects that are planned for completion by the end of 2006 are:

Capacity Improvement Project Description	Sponsor	Development Costs ($ Millions)
Closure of Edison Avenue Grade Crossing	POLB	0.3
Expanded Control Points to POLB/POLA	ACTA	4.9
Thenard Track Connection at Alameda Street/K-Pac	ACTA	4.6

Near-Term Projects

The near-term rail enhancements projects that are planned for completion by the end of 2010 are:

Capacity Improvement Project Description	Sponsor	Development Costs ($ Millions)
Terminal Island Wye Track Realignment	POLB	3.6
Pier B Street Realignment	POLB	12.6
Constrain Badger Bridge Lifts	POLB/LA	1.0
Track Realignment at Ocean Boulevard/ Harbor Scenic Drive	POLB	20.0
Double Track Access from Pier G to Pier J	POLB	1.7
West Basin Rail Access Improvements	POLA	142.3

Medium-Term Projects

The medium-term rail enhancements projects that are planned for completion by the end of 2015 are:

Capacity Improvement Project Description	Sponsor	Development Costs ($ Millions)
Pier B Rail Yard Expansion (Phase I)	POLB	85.4
Pier B Rail Yard Expansion (Phase II)	POLB	159.9
Grade Separation for Reeves Crossing	POLB/LA	60.0
Closure of Reeves At-Grade Crossing	POLB/LA	1.0
Pier 400 Second Lead Track	POLA	7.7
Reconfiguration at CP Mole	POLB/LA	20.0

Long-Term Projects

The long-term rail enhancements projects that are planned for completion beyond 2015 are:

Capacity Improvement Project Description	Sponsor	Development Costs ($ Millions)
Grade Separation for Reeves Crossing	POLB/LA	60.0
Closure of Reeves At-Grade Crossing	POLB/LA	1.0
Pier 400 Second Lead Track	POLA	7.7
Reconfiguration at CP Mole	POLB/LA	20.0

7.0 Port-Wide Rail Enhancement Projects

7.1 Overview

The proposed projects, which are described in this section, improve rail capacity and operations at on-dock and near-dock facilities as well as the overall San Pedro Bay rail network. The types of projects include rail yard expansions and reconfigurations, mainline connections and double or triple tracking, road improvements that benefit rail traffic (typically grade separations or at-grade crossing removal), and expanded control points for the CTC (centralized traffic control) system.

The projects are sorted by phases, based on a planned project completion date. Phase I projects are planned to be completed by the end of year 2007; Phase II projects by the end of 2010; Phase III projects by the end of 2015 and Phase IV projects will be completed beyond 2015. A summary of the projects, sponsor, type, cost and schedule can be found on **Figure 7.1.**

Several maps of the San Pedro Bay Rail Network with locations of the various REP projects are presented in the Exhibits after this section. The exhibits include:

- 2006 San Pedro Bay Railroad Network Map
- Rail Enhancement Project Location Map for years 2006 to 2030
- Project Location Maps for Years 2007, 2010, 2015, and Beyond 2015.

`

<Figure 7.1>

7.2 Short-Term Projects

A list of the short-term rail projects that are planned for completion by the end of 2007 is provided in **Table 7-1**, below.

Table 7-1: Short-Term Capacity Improvement Projects

	Capacity Improvement Project Description	On-Dock Projects	Infrastructure Projects	Sponsor	Development Costs ($ Millions)
	Phase I Short-term (by end of 2007)				
I. 1	Closure of Edison Avenue Grade Crossing		✓	POLB	0.3
I. 2	Expanded Control Points to POLB/POLA		✓	ACTA	4.9
I. 3	Thenard Track Connection at Alameda Street/K-Pac		✓	ACTA	4.6

A Project Description Sheet for each short-term rail infrastructure enhancement project was prepared and included in Appendix B. The project sheets display a site plan, project description, location information, the purpose and need, a summary of the benefits, the proposed schedule, the sponsor and any associated projects.

7.3 Near-Term Projects

A list of the near-term rail projects that are planned for completion by the end of 2010 is provided in **Table 7-2**, below.

Table 7-2: Near-Term Capacity Improvement Projects

	Capacity Improvement Project Description	On-Dock Projects	Infrastructure Projects	Sponsor	Development Costs ($ Millions)
	Phase II Near-term (by end of 2010)				
II. 1	Pier A On-dock Rail Yard Expansion to Carrack	✓		POLB	19.6
II. 2	Terminal Island Wye Track Realignment		✓	POLB	3.6
II. 3	Pier S On-dock Rail Yard	✓		POLB	34.3
II. 4	Pier B Street Realignment		✓	POLB	12.6
II. 6	Constrain Badger Bridge Lifts		✓	POLB/LA	1.0
II. 7	Track Realignment at Ocean Boulevard/ Harbor Scenic Drive		✓	POLB	20.0
II. 8	Pier F Support Yard		✓	POLB	3.4
II. 9	Pier G-New North Working Yard	✓		POLB	14.1
II. 10	Pier G-South Working Yard Rehabilitation	✓		POLB	40.7
II. 11	Double Track Access from Pier G to Pier J		✓	POLB	1.7
II. 12	West Basin Rail Access Improvements		✓	POLA	150.0
II. 13	West Basin East-New ICTF (Phase I)	✓		POLA	45.4

A Project Description Sheet for each near-term on-dock project and rail infrastructure enhancement project was prepared. The project sheets display a site plan, project description, location information, the purpose and need, a summary of the benefits, the proposed schedule, the sponsor and any associated projects. The sheets are included in Appendix B.

7.4 Medium-Term Projects

A list of the medium-term rail projects that are planned for completion by the end of 2015 is provided in **Table 7-3**, below.

Table 7-3: Medium-Term Capacity Improvement Projects

	Capacity Improvement Project Description	On-Dock Projects	Infrastructure Projects	Sponsor	Development Costs ($ Millions)
	Phase III Medium-term (by end of 2015)				
III. 1	Pier B Rail Yard Expansion (Phase I)	✓		POLB	85.4
III. 2	Pier B Rail Yard Expansion (Phase II)	✓		POLB	159.9
III. 3	Grade Separation for Reeves Crossing		✓	POLB/LA	60.0
III. 4	Closure of Reeves At-grade Crossing		✓	POLB/LA	1.0
III. 5	Navy Mole Road Storage Rail Yard	✓		POLB	10.0
III. 6	Pier 400 Second Lead Track		✓	POLA	7.7
III. 7	Reconfiguration at CP Mole		✓	POLB/LA	20.0
III. 8	Middle Harbor Terminal Rail Yard	✓		POLB	68.9
III. 9	Pier J On-dock Rail Yard Reconfiguration	✓		POLB	100.0
III. 10	Pier 400 On-dock Rail Yard Expansion (Phase I)	✓		POLA	33.4
III. 11	Pier 300 On-dock Rail Yard Expansion	✓		POLA	23.4
III. 12	Terminal Island ICTF Rail Yard Expansion	✓		POLA	18.9
III. 13	West Basin ICTF Rail Yard Expansion (Phase I)	✓		POLA	6.2

A Project Description Sheet for each medium-term on-dock project and rail infrastructure enhancement project was prepared; see Appendix B. The project sheets display a site plan, project description, location information, the purpose and need, a summary of the benefits, the proposed schedule, the sponsor and any associated projects.

7.5 Long-Term Projects

A list of the long-term rail projects that are planned for completion beyond 2015 is provided in **Table 7-4**, below.

Table 7-4: Long-Term Capacity Improvement Projects

	Capacity Improvement Project Description	On-Dock Projects	Infrastructure Projects	Sponsor	Development Costs ($ Millions)
	Phase IV Long-term (beyond 2015)				
IV. 1	Triple Track Badger Bridge		✓	ACTA	91.0
IV. 2	Triple Track South of Thenard Jct.		✓	ACTA	16.5
IV. 3	Pier A On-dock Rail Yard East of Carrack	✓		POLB	31.4
IV. 4	Pier 400 On-dock Rail Yard Expansion (Phase II)	✓		POLA	16.3
IV. 5	West Basin ICTF Rail Yard Expansion (Phase II)	✓		POLA	12.5
IV. 6	West Basin East-ICTF Expansion (Phase II)	✓		POLA	7.8

A Project Description Sheet for each long-term on-dock project and rail infrastructure enhancement project was prepared. See Appendix B for the Project Description Sheets.

7.6 Project Benefits Analysis

All of the proposed projects in the Rail Enhancement Program directly or indirectly increase rail capacity and throughput. By handling more intermodal throughput on-dock, the Ports will fulfill EIR (Environmental Impact Report) requirements and benefit from increased wharfage fees. Furthermore, additional on-dock rail capacity has truck reduction benefits including reduced air emissions, reduced traffic congestion, and improved safety. Each train handled by on-dock rail can eliminate 750 truck trips. Truck trips required at off-dock rail yards include bobtail moves associated with one-way trips, and chassis repositioning.

Each project in the REP is analyzed to determine the benefit-to-cost ratio. Annual costs are calculated with the total cost spread over a 5-year period. A higher benefit-to-cost ratio indicates a project that provides better return on investment. The resulting benefit-to-cost ratio is intended to provide a relative comparison between projects, and not as a rigorous economic analysis.

The construction of each and every proposed project in the Rail Enhancement Program is recommended. Simulation modeling indicates that all of the projects are required in order to maintain acceptable rail system performance, and none of the benefit-to-cost ratios for these projects are low. The Reeves Crossing project received the highest benefit ratio number and it provides benefits to the entire Port rail network by reducing the train turns at Manual Yard and shoves to Pier 400.

8.0 Conclusions

Purpose

This Rail Study provides an update to the *Rail Master Planning Study* (POLB 2002) and *Rail Capacity Analysis* (POLA 2003). The Study identifies all Port rail related issues, including on-dock rail yards, storage capacities, mainline track, operations and systems, and substantiates the actions required to provide acceptable levels of service for trains in 2005, 2010, 2015, 2020 and 2030. The study provides a Port Rail Enhancement Program (REP) that identifies necessary improvements and provides a phased implementation plan. This study was the first of the proposed 5 year updates, as recommended by the 2002 *Rail Master Planning Study* to incorporate revised cargo forecast, updated terminal plans and consider current operating conditions.

Benefits

The rail system serving the San Pedro Bay Ports is instrumental in enabling the efficient transportation of cargo, since rail service is both economically and environmentally beneficial compared to transport by truck. However, this intermodal cargo will add to local highway congestion and truck emissions if it is loaded onto trains at inland rail yards. Therefore, 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 terminal without generating truck trips on the local roadways and freeways. While on-dock rail yards are located on a marine terminal for the exclusive use by that terminal, **near-dock rail yards** have logistical advantages due to their ability to serve numerous marine terminals. Near-dock facilities that are within five miles of the Port are under consideration to provide needed capacity with greatly reduced trucking impacts. Any cargo that is moved by train from the Port is a benefit to the overall transportation system by reducing truck mileage and the associated congestion and diesel emissions.

As a measure of the benefits of on-dock rail, consider the hypothetical state where all of the proposed REP projects were built and operating today: the level of on-dock throughput would be nearly double that of existing conditions and would remove nearly 6,000 trucks a day from the local roadways. As cargo volumes increase, the benefits of on-dock rail will increase as well. Given 2030 cargo forecasts and full development of the REP, on-dock rail would remove nearly 29,000 truck trips daily. Since there is currently no viable opportunity to accommodate the forecast cargo volumes elsewhere on the West Coast, the no action scenario would result in extensive truck trips over long distances seeking out available locations for intermodal capacity. This would add millions of truck-miles to our local freeway system each day.

Cargo Growth

Cargo growth is tracking well with the Mercer forecast and is slightly ahead of the forecast volumes. The actual cargo throughput at the SPB Ports during the 2000-2005 period have been used to adjust the Mercer forecast, then the 2020 forecast is projected out to 2030 considering expected continued growth rates and estimated marine terminal capacities.

Rail Yard Capacity/Demand

The rail yard capacity analyses indicate that demand for off-dock rail yards will outstrip capacity. In fact, Transload and Domestic cargo alone (which cannot be handled at on-dock or near-dock rail yards) is expected to take up all existing capacity in the 2010-2015 timeframe. Therefore, Direct Intermodal will need to be accommodated at on-dock or near-dock rail yards, which is also preferable from the standpoint of minimizing trucking impacts such as traffic congestion, highway maintenance and emissions.

The San Pedro Bay Ports of Long Beach and Los Angeles will need to rely on their on-dock and near-dock facility plans to meet demand for intermodal capacity. Beginning in 2010, the current plans for on-dock rail yard expansion will not meet the projected demand. Additional capacity will be required and the Ports are evaluating other potential rail yard projects.

The capacity of currently planned/existing on-dock and near-dock rail yards will not meet demand in the 2010-2030 timeframe.

Additional on-dock and near-dock facilities are being considered by the Ports to meet the unmet demand. These additional developments will need to be pursued in order to avoid the significant impacts of additional intermodal cargo being trucked through the Southern California region. Several additional projects, beyond those currently planned, are considered for their ability to meet demand and fit efficiently into the SPB Port rail network. These projects include:

- a new on-dock facility on the POLA side of Terminal Island (1.4 million TEU),
- expansion of the Pier T on-dock rail yard on Terminal Island (1.1 million TEU),
- a new near-dock facility (SCIG) south of the existing ICTF (1.8 million TEU),
- expansion of the existing ICTF (1.9 million TEU added).

Simulation modeling shows that new rail development on Terminal Island will negatively impact the Port rail network performance. Also, the greatest needs for intermodal rail facilities are not on Terminal Island, but in Long Beach and POLA West Basin. Therefore, development of a multi-user facility on Terminal Island would induce additional traffic on the Gerald Desmond Bridge and Vincent Thomas Bridge.

The near-dock facilities (SCIG and ICTF) have the advantage of accommodating cargo from any of the marine terminals that have cargo in excess of their on-dock capacity or require some destination cargo to be combined with other terminals to make a unit train. These near-dock facilities are optimally located near the Port and adjacent to the Alameda Corridor; and the site configuration allows efficient track lengths, high productivity and green operating systems. SCIG has the benefit of providing competitively balanced near-dock facilities to the two Class I Railroads. ICTF has the advantage of accessing the Alameda Corridor upstream of the Texaco Slot bottleneck, and it also has significant support track in the ICTF Support Yard.

Off-dock rail yards that handle Transload cargo (10 percent of total Port throughput) and Domestic cargo will run out of capacity by the 2010-2015 timeframe, depending on domestic cargo growth rates (0% growth will meet demand until 2015; 3% growth will consume all capacity by 2010). To meet this unmet demand, new off-dock rail yards will need to be developed, and the most likely location for the new facilities is in the Inland Empire or further inland.

Rail Network Performance

Rail simulation modeling indicates that all rail infrastructure projects in the Rail Enhancement Program are needed to provide a rail network that performs without unacceptable train delays and risk of gridlock. This investment will accommodate projected train traffic through 2030. These projects will require significant investment, but the benefit to cost ratio appears favorable.

It should be noted that if one "Other Potential Project" (a rail yard not included in the REP) is developed on Terminal Island, then simulation modeling indicates that the rail system performance will degrade to an unacceptable Level of Service. Based on simulation results, any continuing Terminal Island development (beyond the one "Other Potential Project") will cause such congestion and train delays as to cause the rail network system to become congested to the point of gridlock.

The RTC Model was run with projected train volumes for each of the forecast years. The latest set of runs was similar to the year 2000 runs except for the following:

- Pier W is not included in the planned rail yard expansions;
- Southern California International Gateway (SCIG) is modeled as a near-dock rail yard;
- Pier B is expanded as a mini-ICTF and support yard north of 9th Street;
- Track expansion in the Texaco Slot was replaced with a by-pass along the Wilmington Wye; and
- Switching movements inside the rail yards were modeled more explicitly.

Findings from the RTC Model runs are similar to the previous Rail Master Planning Study (POLB 2002), except that the need for triple track to Terminal Island south of Thenard Junction (including Badger Avenue Bridge) is not needed until a new rail yard is developed on Terminal Island. The model supports all other rail infrastructure improvements and shows that SCIG can be supported by the Port rail network.

Recent Operational Changes

Efforts of the *Truck Reduction Study* and the Rail Action Planning Committee have identified key issues affecting goods movement and resulted in implementation of operational changes, including:

- Rail crews report at SPB
- Railroad dispatchers stationed at PHL
- Standardized rail data maintained between terminals/railroads
- Increased railroad work force and equipment
- Longer trains to/from SPB
- Train fueling within SPB
- New PHL agreement

The Rail Action Planning Committee was created in January 2006 with the goal of maximizing utilization of existing rail infrastructure. The Rail Action Planning Committee includes representation from POLB, POLA, marine terminal operators, shipping lines, railroads and ACTA.

The following strategies are proposed to maximize on-dock rail utilization:

- Utilize LAXT facility as storage tracks to support on-dock operations
- Maximize train lengths
- Improve switching by building terminal specific trains before arriving at the Port
- Improve locomotive availability
- Reduce marine terminal operational constraints
- Provide in-ground air system for trains at all terminals
- Improve container stowage on ships to optimize the delivery of container to trains
- Provide a better system for planning and coordination between railroads and marine terminals
- Improve railcar utilization and Customs holds

The Rail Action Committee is also in the implementation stage of a project known as the **San Pedro Bay Ports Rail Business Exchange**. This project has the goal of improving Port rail operations by facilitating communications, maximizing intermodal cargo velocity, streamlining administrative processes and providing visibility about how cargo is moving and fits into other traffic.

Non-Traditional Rail Concepts

Non-traditional rail concepts involve uses of trains that are not currently employed. These include the following concepts.

Inland Shuttle Train: Defined as rail transport to an "inland port" for distribution of local cargo. The inland port concept may prove beneficial due to the level of highway congestion and the potential value of truck traffic reductions as a mitigation measure. However, this concept will increase the demand on Port rail yards and mainline tracks.

Inland Block-Swap: The concept of an inland rail yard to sort trains can provide several rail operating improvements that coincide with the recommendations of this Study. Features of this concept and associated benefits are described as follows:

- Provide the ability to build multi-destination trains by blocks at each on-dock rail yard. Trains can then be block-swapped at the inland yard to create single destination trains. This will increase the potential volume of on-dock cargo by reducing the volume of destination specific cargo that must be collected prior to releasing a train. This alleviates one of the biggest challenges to maximizing on-dock utilization.

- Provide the ability to block-swap westbound trains at the inland yard to create Port-terminal specific trains. This will reduce inter-terminal switching movements at the Port.

- Provide dedicated regional shuttle engines that handle the train movements between the inland yard and the Port. These locomotives will be fueled for round trip, readily manage crew changes, and have the ability to drop a westbound train and pick-up an eastbound train without turning the locomotive (have both ends of the motive power functional so locomotives can simply be reversed). This will significantly reduce the light engine traffic moving around the Port by eliminating the need to turn engines, reach crew change points and transit to engine services facilities. This concept could also facilitate application of green technologies to locomotives in the sensitive Southern California Air Basin.

The Ports should work closely with the Railroads to evaluate and pursue these non-traditional concepts as well as near-dock rail yard capacity enhancements. This relationship should be expanded to include other area government agencies for a critical evaluation of regional mainline capacity.

Summary

The cargo that is forecast to arrive at the San Pedro Bay Ports will create the need for significant improvements in terminal throughput capabilities. The increased cargo volumes will also require careful evaluation of the landside transportation system. The 2001 *Port of Long Beach/Los Angeles Transportation Study* defined highway congestion that would result from the increased cargo volumes and recommended that at least 30 percent of the cargo should be moved by on-dock rail. This "Rail Study Update" defines the rail yard, mainline, systems and operations improvements necessary to achieve and exceed this goal.

The goal of this "Rail Study Update" is to maximize capacity and utilization of on-dock rail, and to evaluate the rail system performance and recommend enhancements to Port infrastructure that are necessary to meet forecast cargo demands. This Study incorporates recent market conditions, revised Port development plans, and modified cargo forecast based on the latest information available in 2005.

The key points of this Study are as follows:

- Rail yards are conceptualized for each of the proposed terminals at the San Pedro Bay Ports of Long Beach and Los Angeles (SPB). These rail yards have the combined throughput capacity to handle at least 30 percent of the Port cargo during the forecast period 2015 to 2030. Rail concepts will be refined through the environmental process, tenant negotiations and engineering design.
- Even after maximizing the potential on-dock rail yards proposed in the REP, the demand for intermodal rail service creates a shortfall in rail yard capacity by at least 2010.
- In addition to maximizing on-dock rail, it is recommended that rail yard capacity be developed at near-dock facilities in the vicinity of the Alameda Corridor and south of the I-405 freeway.
- If additional on-dock or near-dock capacity is proposed on Terminal Island (beyond that already recommended by the REP), this capacity should not exceed 1.5 million TEU.
- The train volumes generated by on-dock rail yards are forecast to exceed 100 trains per day by 2020. Total train volumes on the Port rail network will exceed 250 trains per day and those on the Alameda Corridor will approach 200 trains per day by the year 2030. Alameda Corridor traffic is averaging 50 trains per day in 2005.
- Various mainline, system and operational improvements will be required within SPB to accommodate the projected train volumes. These required projects are compiled into a phased Rail Enhancement Program (REP). The total cost of this program is over one billion dollars split nearly equally between rail yard projects and rail network infrastructure.

The Ports of Long Beach and Los Angeles will need to rely on their on-dock and near-dock facility plans to meet demand for Direct Intermodal capacity. The current plans for on-dock rail yard expansion will not meet the projected demand, beginning in 2010. Additional capacity will be required and the Ports are evaluating additional rail yard projects.

Transload cargo is estimated to grow to a level exceeding the capacity at off-dock rail yards from 2010 to 2015. To meet unmet demand, new off-dock rail yards will need to be developed, and the most likely location for the new facilities is in the Inland Empire or beyond. Another potential for handling Transload cargo is to expand near-dock facilities and allow these to handle larger containers from warehouses in the Port vicinity.

The proposed rail yard expansion projects and rail infrastructure improvement projects have been developed into a Rail Enhancement Program with schedule and cost for each project. Rail simulation modeling indicates that all rail infrastructure projects in the Rail Enhancement Program are needed to provide a rail network that performs without unacceptable train delays. This investment will accommodate projected train traffic through 2030 if no new facilities are developed on Terminal Island. These projects will require significant investment, but the benefit to cost ratio appears favorable.

NOTABLE CONCLUSIONS

1. Implementation of the Rail Enhancement Plan (REP) is critical to support intermodal goods movement at the Port.

2. Planned rail yard expansions are not big enough to handle the cargo volumes that are forecast for 2010 and beyond. More rail yard capacity is needed and potential near-dock rail yards have beneficial features to complement the planned on-dock facilities.

3. Even with all planned rail network infrastructure improvements, cargo volumes forecast for 2020 and beyond will cause increased train delays and operating costs and could constrain intermodal throughput.

4. This Study evaluated the San Pedro Bay rail network and the Alameda Corridor to downtown Los Angeles. The Study did not evaluate the inland rail system beyond downtown Los Angeles, which could potentially present additional bottlenecks to Port intermodal throughput.