APPENDIX G2

SCIG Rail Simulation Modeling Study

Introduction

The San Pedro Bay Ports of Los Angeles and Long Beach (SPB Ports) provide a necessary service supporting goods movement throughout the region and nation, but also recognizes its responsibility to minimize impacts on surrounding communities. The rail system serving the SPB Ports is essential to providing efficient transportation of cargo between the Port and inland destinations throughout the country. Rail service is economically and environmentally beneficial compared to transport by truck. Further, if cargo were not loaded at port intermodal facilities, it would need to be loaded onto trains at distant inland rail yards, which would add to highway congestion and truck emissions. Therefore, the Ports have developed and are continuing to pursue development of rail yards so cargo can be loaded onto trains at the marine terminal or near the port without generating truck trips on regional roadways and freeways.

On-dock Rail Yards

The SPB Ports have developed the world's leading capability in on-dock rail with existing capacity to handle 25 percent of port cargo at on-dock rail yards, and with plans for on-dock expansion to accommodate over 30 percent of port cargo (12 million on-dock out of 40 million TEUs forecast through SPB Ports in 2035). The SPB Ports on-dock rail yards are shown in the following graphic.

LEGEND

1 – Pier J On-Dock [1]
2 – Pier G On-Dock [1]
3 – Pier E 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 On-Dock [1]
9 – Pier 300 On-Dock [1]
10 – Pier 400 On-Dock [1]
11 – WBICTF On-Dock [1]
12 – TraPac On-Dock [2]
13 – B200 Rail Yard [2]

Notes:

[1] Expansion of existing rail yard.

[2] Construction of new rail yard.

SPB Ports On-dock & Support Rail Yards

Study Purpose and Goals

The SCIG Rail Simulation Modeling Study will analyze rail operations throughout the San Pedro Bay rail network from the rail yards to the north end of the Alameda Corridor to determine rail system performance under various development scenarios. The primary focus of development will be on the proposed Southern California International Gateway (SCIG) and supporting rail network infrastructure. The modeling will analyze 2035 conditions for rail traffic volumes. Rail network infrastructure will be considered in two conditions: 1) only funded and approved improvements; and 2) full development as proposed in the Rail Study Update (POLB/POLA, 2006).

The work will be performed by a team of rail operations experts who have extensive knowledge and experience in the Ports of Los Angeles and Long Beach, and with the applied rail simulation modeling tools. The objectives of this work are to understand affects of rail traffic growth, operating practices and infrastructure improvements on the rail network performance. Rail network performance is primarily measured by total train delay and delay ratio (delay time/running time), but will also consider train crew hours of service limitations. Results of these model runs will be comparable to previous RTC modeling efforts performed for the Port.

Rail Yard Capacity and Demand

Macroeconomic studies indicate that more than half of Port cargo has and will continue to have destinations east of the Rocky Mountains, and that this cargo will be handled primarily by rail. The rail cargo is referred to as intermodal. Direct Intermodal is moved directly between the Port and rail yards and can be handled at on-dock, near-dock or off-dock facilities. 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.

The forecast volume of Direct Intermodal cargo is 15.74 million TEUs. Assuming all planned on-dock rail yard development occurs and that rail yards operate at their maximum practical capacity (MPC[i]), there will be a 2.68 million TEU shortfall of annual rail yard capacity by 2035 considering only on-dock rail yards. The on-dock MPC assumes that the yards are operated near their peak for 3-shifts daily and that operating practices are modified similar to Class I facilities to allow loading trains while other trains are moving in the yard (when tracks are separated by at least 30 feet). If on-dock yards continue to operate with restrictions, then the shortfall in capacity will be even greater.

Near-dock rail yards are located 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. 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 because of their ability to serve numerous marine terminals. The demand for Direct Intermodal capacity exceeds the capacity of planned on-dock facilities in year 2020 and that latent demand grows to 2.68 million TEU per year by 2035.

The need for intermodal capacity could be even greater considering Transload cargo and regional intermodal cargo. Use of near-dock rail yards for Transload cargo from warehouses in the Port vicinity would reduce truck miles in the region with a net environmental benefit. Other intermodal cargo serving regions west of the Rocky Mountains might also be accommodated at near-dock rail yards.

Accommodating these intermodal volumes above the Direct Intermodal forecast would further increase the demand for near-dock facilities.

Rail Network Performance

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

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 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. Parsons developed accurate track and signal layouts for this purpose and the railroads provided data on locomotive characteristics.

Data 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 two 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 A/D tracks into the yard. In general, a mix of train sizes was used to represent 33% of trains being 10,000 feet long and 67% of trains being 8,000 feet long. Parsons developed train traffic data based on MPC Model results and user interviews. Modeled trains specifically associated with SCIG were assumed to average 8,000 feet long with 16 trains daily (eight trains arriving and eight trains departing). Other train traffic includes 45 on-dock intermodal trains in POLB, 45 on-dock intermodal trains in POLA, 10 trains at ICTF and over 100 train moves daily for non-intermodal and rail support activity.

The initial model condition (Run 2010-1) considered full build-out of on-dock rail yards (11.66 million TEU/year), SCIG (2.8 million TEU/year) and ICTF (1.6 million TEU/year), but with no improvements to the existing rail network beyond those funded and approved. The SCIG operations assumed that trains would not use the tracks north of Sepulveda Boulevard for train arrival and departure operations. For this case, the average performance yields about 94 hours of train delay per operating day, which equates to delay ratio of 39.6%. This is a very high level of train delay, but represents an unlikely scenario where all future rail yard projects are completed, but only the approved and funded rail network infrastructure projects are accomplished. Even under this worst case scenario, the trains dispatched successfully and no instances where train crews exceeded their hours of service limits were seen.

An additional RTC run was made with the same rail traffic volumes, but with enhanced rail network infrastructure as proposed by the SPB Ports Rail Study Update (POLB/POLA, 2006). The results for this run indicate that network performance improved to 71 hours of train delay per day, and the delay ratio improved to 31.9%. These delays are within the range deemed acceptable by the SPB Ports.

Conclusion

Even after maximizing the potential on-dock rail yards proposed in the Rail Study Update, the demand for intermodal rail service creates a shortfall in rail yard capacity by 2020. To accommodate this shortfall, it is recommended that rail yard capacity be developed at near-dock facilities near the Ports and adjacent to the Alameda Corridor. Near-dock facilities provide needed intermodal capacity, logistics benefits that supplement on-dock capabilities and have significantly less impacts compared to more remote off-dock rail yards.

Train operations on the Port rail network were simulated using the RTC simulation model. The Port-related rail network includes all tracks at the POLA and POLB, including the Alameda Corridor and ending at the main lines at East Yard and Hobart, in East Los Angeles. The number of delay hours per operating day tells us how much total delay is being experienced. Delay ratios represent normalized delay; it is essentially a measure of how much delay any given train is likely to experience or the average delay per train. By that measure, the network successfully dispatches in RTC, but the delay ratios at the 2035 traffic volumes are very high in case 2010-1 when improvements to the rail network infrastructure are not included. The SPB Ports have established an acceptable limit for delay ratios with the goal of ensuring reliable rail system performance and reasonable operating costs. The unlikely 2010-1 case, where none of the rail network infrastructure improvement projects are built, exceeds the delay ratio limit, but the model showed that trains would dispatch and there were no reported hours of service issues.

Modeling the 2035 traffic conditions with improvements to the rail network infrastructure indicated results within the acceptable level of delays. Data results and observations of the model performance through animations did not indicate that SCIG contributed to rail network delay disproportionately from any of the on-dock rail yards. In fact, many of the on-dock yards are affected by local bottlenecks (e.g. confluence of yards in eastern POLB, Terminal Island, West Basin of POLA), none of which affect SCIG.

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[i] Rail Yard Capacity is estimated by the MPC Model described in the San Pedro Bay Ports Rail Study Update (POLB/POLA 2006).

[ii] Rail Traffic Controller © Berkeley Simulation Software, LLC. RTC modeling by Willard Keeney for POLA in 2010.