APPENDIX I PORT OF OAKLAND TRUCK QUEUING STUDY

FEHR PEERS

Draft Memorandum

Date: May 14, 2025

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Subject: Port of Oakland Truck Queuing Study

OK24-0574

Executive Summary

Fehr & Peers has prepared this truck queuing study memorandum on behalf of the Port of Oakland (Port) for the proposed Oakland Harbor Turning Basins Widening Project (Project). Fehr & Peers modeled and assessed the extent of forecasted marine terminal truck queuing under two future scenarios in 2050: a future with completed construction of the Project (With Project) and a future without Project (No Project) with the objective of determining if truck queues would remain within the Seaport roadways.

The Project proposes widening the existing Inner and Outer Harbor turning basins to better accommodate larger vessels that are currently calling the Port. Due to economies of scale and environmental stewardship, such larger vessels are expected to call the Port in greater frequency to best accommodate forecasted cargo demand. In the future scenarios, vessel fleet mixes would differ between the two future scenarios. The forecasted fleet mix With Project includes fewer total vessels with a greater proportion of larger vessels while the forecasted No Project fleet mix includes more total vessels with a lower proportion of larger vessels. Since larger vessels are already calling the Port, marine terminal operators have adapted to servicing them and managing the variable cargo volume between all size classes of vessels, thus existing conditions provides a reasonable baseline for analyzing future conditions.

Fehr & Peers evaluated existing data and modeled 2050 truck demand forecasts for each international container terminal and their respective truck gate complexes.[1] Fehr & Peers then analyzed the extent of forecasted truck queuing in relation to the roadway network serving each international terminal (collectively, the Seaport) to determine if the Seaport could continue to contain truck queues or if truck queues would extend outside the Seaport in either future scenario. To ensure a conservative analysis (i.e., worst-case queuing conditions as defined as the 95th percentile queues[2] in the future scenarios), the analysis assumes that under future conditions marine terminal truck gate complexes would have the same infrastructure, processes, and capacities as today (existing conditions).

Based on the analysis, the Seaport roadway network would contain the forecasted 2050 truck queues under both future scenarios and no truck queuing would occur on the streets outside of the Seaport. Due to fewer vessels moving the same forecasted cargo volumes under the future With Project scenario, the analysis found minor differences in peak hour truck demand (i.e., the hour with the highest truck demand), and queue lengths between the two future scenarios. Specifically, these minor differences resulted in peak hour truck demand to be about 1 to 2% higher and queue lengths to be about 2 to 3% longer under the 2050 With Project scenario than the 2050 No Project scenario as described in more detail in the remainder of this memorandum.

Memorandum Sections

1. ***Background and Methodology*** (page 3) – provides context for the analysis and reviews background documents used in this analysis.
2. ***Baseline Conditions*** (page 4) – describes Baseline Conditions (2023-2024) at the Seaport including truck volumes and operations at the terminal gates.
3. ***Queuing Model Development*** (page 9) – describes the methodology and assumptions used to estimate the future truck queue lengths.
4. ***Analysis Results*** (page 10) – presents the queue extents under year 2050 conditions.
5. ***Potential Improvements*** (page 19) – discusses potential strategies that could reduce queue lengths at the terminal gates.
6. ***Conclusion*** (page 20) – summarizes the analysis findings.

[1] Truck gate complexes analyzed include one at TraPac, one at Everport Terminal Services, and two at Oakland International Container Terminal (OICT) – East and West Gates. These gates have the highest truck volumes and combined service approximately 95% of daily average truck transactions. Due to low truck volumes (demand), the domestic container terminal (Matson Terminal) and OICT Back Gate were not included in the analysis.

[2] The 95th percentile queue is defined as the queue length that has only a 5% probability of being exceeded during the analyzed peak hour

1. Background and Methodology

In the year 2050, according to an independent seaport cargo forecast,[3] the Port is projected to process about 5.2 million twenty-foot equivalent units (TEU) based on moderate growth forecast. Total annual TEUs is dependent on factors such as global demand for goods and economic conditions that are unrelated to the Project. Therefore, the forecasted TEU throughput is expected to occur regardless of the Project and is expected to be the same under both future scenarios.

However, consistent with the federal integrated feasibility report completed for the Project[4] and historical patterns from similar commercial waterway improvement projects, the Project is expected to change the mix and total amount of vessels calling the Port. Specifically, the future No Project would include more total vessels (lower proportion of larger vessels; more smaller vessels), whereas the future With Project would include fewer total vessels (greater proportion of larger vessels) to service the same forecasted TEU volumes as summarized in **Table 1** below.

Table 1: Vessel Class and Mix Forecast—2050 No Project and 2050 With Project

Vessel Class	2050 No Project	2050 With Project	Difference
Smaller Vessels	793	170	-623
Larger Vessels	1,633	1,779	+146
Total	**2,426**	**1,949**	**-477**

Source: Oakland Harbor Turning Basins Widening Integrated Feasibility Report and Environmental Assessment, Final Report, 2024.

As outlined in the Draft Environmental Impact Report (Draft EIR)[5] prepared for the Project, larger vessels are expected to call the Port for various reasons that are unrelated to the Project. These reasons include: anticipated economic growth, other west coast port waterway improvement design criteria, fleet turnover, and projected world fleet production. As generally the second port of call on the West Coast, vessels that call the Port have been shown to only have an average call utilization of 25.9%, meaning 25.9% of a vessel's total capacity is serviced (i.e., includes both empty and full containers). For the year 2023, the average call utilization of smaller vessels was 37% and larger vessels 26%. Such call utilization values are not expected to change dramatically under the future scenarios.

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[3] The Tioga Group and Hackett Associates, 2019-2050 Bay Area Seaport Forecast dated May 22, 2020. Available at: https://www.bcdc.ca.gov/wp-content/uploads/sites/354/2023/09/2019-2050-Bay-Area-Seaport-Forecast.pdf

4 Oakland Harbor Turning Basins Widening Integrated Feasibility Report and Environmental Assessment, Final Report dated May 14, 2024. Available at: https://www.spn.usace.army.mil/Missions/Projects-and-Programs/Current-Projects/Oakland-Harbor-Turning-Basins-Widening/

[5] Draft Environmental Impact Report for the Proposed Oakland Harbor Turning Basins Widening Project dated October 2023. Available at: http://www.oaklandseaport.com/turningbasins

With fewer larger ships, the future With Project could change the number of containers processed at a truck gate complex on a weekly and daily basis; however, on an annual basis no change is expected as the same amount of truck trips are required with both future scenarios since cargo throughout is expected to be the same.

According to the Port staff, the Seaport would expect the following truck trips on a peak day in 2050:

- 2050 No Project = 10,900 daily truck trip
- 2050 With Project = 10,960 daily truck trips

Under 2050 conditions, the Project would result in about 0.5% additional truck trips on the peak day.

The above truck trip forecasts are presented on a daily basis for the Seaport (i.e., all Port terminals combined). To evaluate truck queuing at individual marine terminal truck gates, the truck trip Seaport forecasts were distributed between existing terminals based on current truck trip distributions and translated to an hourly basis for each terminal gate, consistent with historical and existing trends. Hourly truck trips at each terminal were developed based on current traffic volumes at the terminals as described in the following sections of this memorandum.

2. Baseline Conditions

This section discusses the current (Baseline) truck volumes trips entering the Seaport container terminals based on data provided by the Port's Freight Intelligent Transportation System (FITS) and data collected by Fehr & Peers regarding terminal gate operations.

Baseline Truck Volumes

The Port recently implemented FITS in partnership with Alameda County Transportation Commission. FITS consists of information technology improvements to add transparency and efficiencies for traffic management at the Seaport and includes a comprehensive system of communications infrastructure and uses camera and radio frequency identification (RFID) scanner data installed at the terminal gates and at key locations along the Seaport roadways.

The FITS data collected from September 2023 to September 2024 was utilized to estimate truck volumes entering the terminal truck gates under current conditions (referred to as Baseline conditions in this memorandum). **Table 2** presents the daily truck trips on an average and peak day entering the 6 existing international container terminal truck gate complexes and for the entire Seaport under Baseline conditions.

Table 2: Daily Truck Trips at Terminal Truck Gates under Baseline Conditions

Terminal Truck Gate	Average Day (# of Trucks)	Peak Day (# of Trucks)
Everport	850	1,291
Matson	204	568
OICT – East Gate	1,707	2,350
OICT – West Gate	1,232	1,675
OICT – Back Gate	58	243
TraPac	784	1,169
All Seaport Terminals	**4,835**	**6,508**[1]

1. Peak day at the Seaport between September 2023 through September 2024. Since each terminal operates independently and activity at each terminal peaks on a different day of the week, the total peak day volume for all terminal gates combined is different from the peak day volume for the Seaport as a whole.

Source: FITS data from September 2023 to September 2024 and summarized by Fehr & Peers.

Approximately 95% of the trucks use the 4 international terminal gates: Everport, Oakland International Container Terminal (OICT) East and West Gates, and TraPac. Therefore, this analysis focuses on these 4 terminal truck gates.

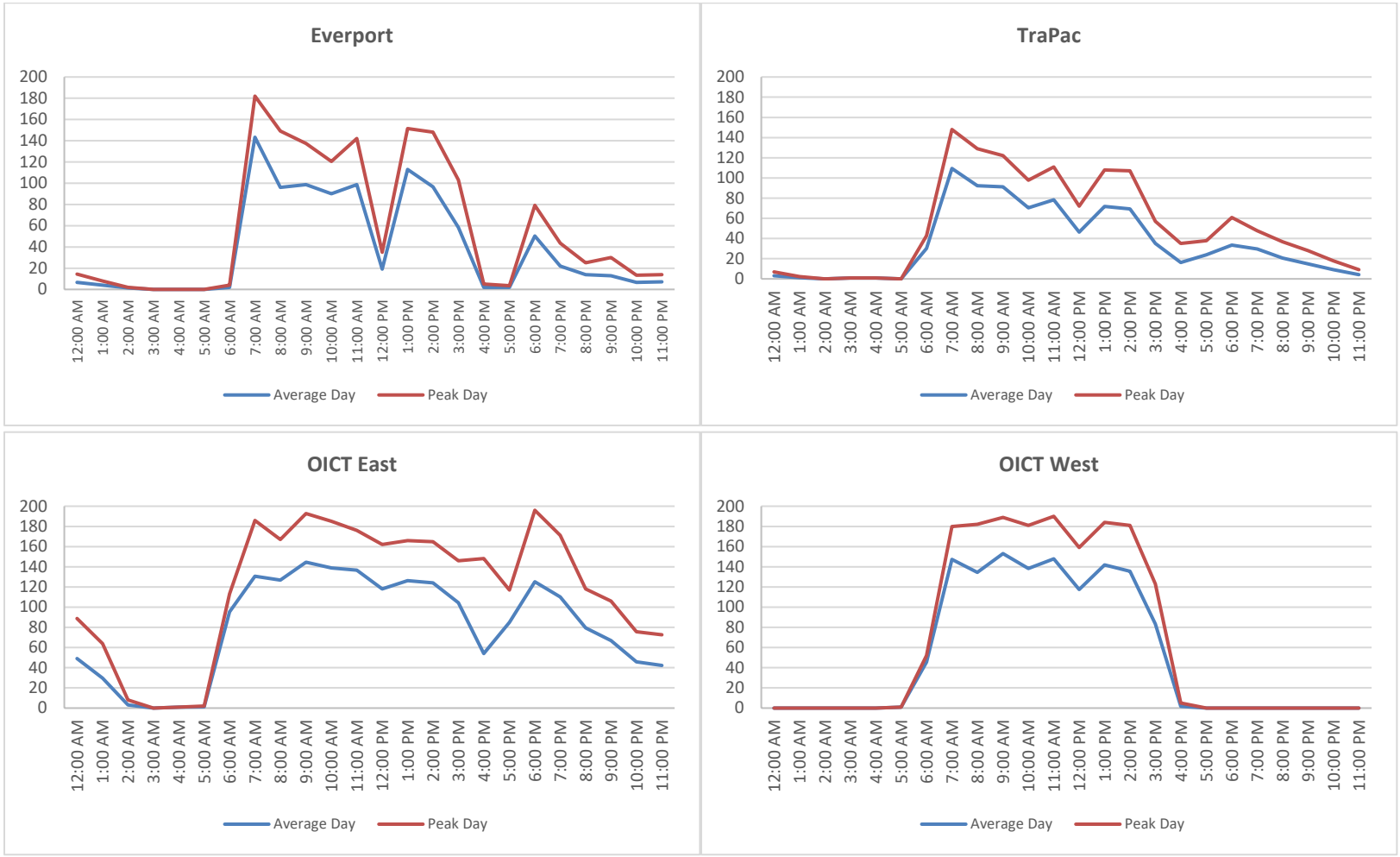
Figure 1 shows the number of trucks entering the 4 major terminal truck gates by hour on an average and peak day under Baseline conditions. The number of trucks entering the terminal gates during the peak hours on the peak days are generally about 27% to 36% higher than during the peak hours on average days. Truck activity generally peaks during the morning hours on both average and peak days at the 4 major terminal truck gates.

Terminal Truck Gate Operations and Capacity

Terminal truck gate inbound processes (transactions) for picking up and/or delivering containers are generally associated with on-street truck queues. All international terminal operators require trucks to have an appointment and while appointment parameters vary between terminals, appointments generally include a 2-3-hour window for trucks to arrive at the terminal. Each terminal truck gate provides one security gate which all trucks must utilize to enter the terminal. Most trucks roll or slowly drive through the security gate without stopping. As a result, the security gate is generally not the bottleneck at the terminal and not the main cause of on-street queuing under normal operating conditions.[6]

[6] Normal operating conditions represent conditions when all terminal gate components operate at their expected capacity with little or no delay caused by outside factors (such as computer malfunctions or a broken-down truck at the security gate that prevent other trucks from entering the terminal.)

Figure 1: Hourly Truck Entries at Terminal Truck Gates (Baseline Conditions)—Average and Peak Day



After driving through the security gate, trucks proceed to an available pedestal[7] to commence transaction processing. Under normal operations, processing at the pedestals results in truck queues that are accommodated within the terminal truck gate and can from time to time extend onto the Seaport roadways that serve each terminal, but never beyond the Seaport under normal conditions. The truck queue that can be accommodated within each terminal gate is based on the layout of the terminal gate, such as the number of pedestals, the distance between the pedestals and the security gate, and the distance between the security gate and the Seaport roadway serving the terminal. Each terminal gate provides between 8 and 12 pedestals, each pedestal provides queuing space for multiple trucks between the pedestals and the security gate, and some queuing space before trucks reach the security gate. These queuing capacities combined are referred to as internal queuing capacity and are shown in **Table 3**. Table 3 also shows the available on-street queuing capacity available for trucks based on current practices by trucks at the Seaport.[8]

Table 3: Truck Queuing Capacity at the Terminal Truck Gates

Terminal Truck Gate	Internal Queuing Capacity (# of Trucks)	On-Street Queuing Capacity (# of Trucks)	Total Queuing Capacity (# of Trucks)
Everport	32	262	294
OICT – East Gate	144	150	294
OICT – West Gate	56	153	209
TraPac	116	194	310

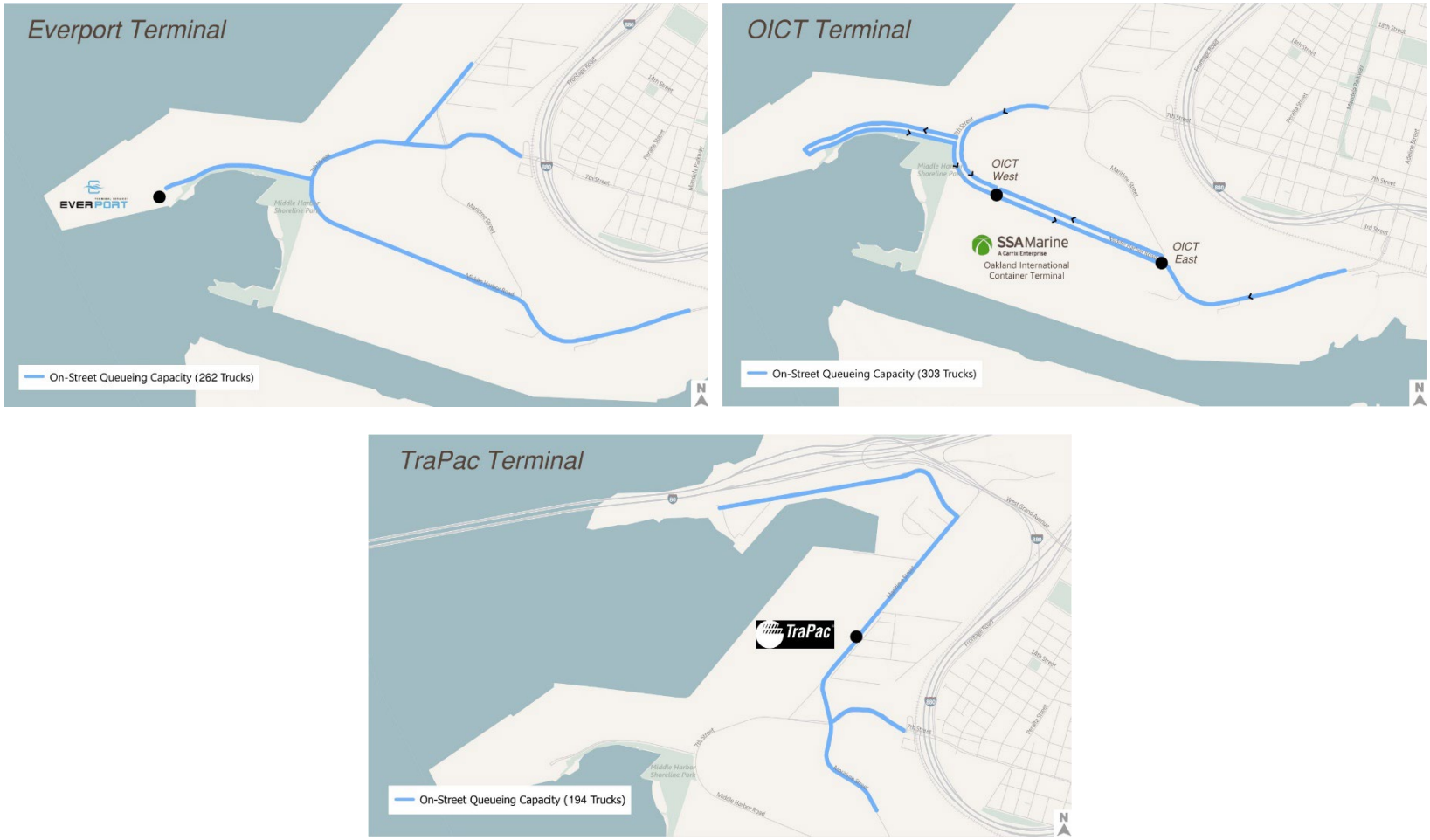
Source: Fehr & Peers, 2024.

Figure 2 shows where on-street truck queuing capacity is available for each terminal gate based on current truck queuing practices without interfering with traffic circulation or extending outside the Seaport and its roadways. It also accounts for the completion of the 7th Street Grade Separation East Project, currently under construction, which will provide additional roadway length along 7th Street between Maritime Street and I-880.

[7] Pedestals, which may include a weigh scale, are where trucks are directed to after entering the terminal through the security gate to start their transaction. Trucks stop at the pedestal to communicate with a dispatch center to start processing and receive their assignment and destination within the terminal.

[8] Both the internal and on-street queuing capacities are determined by measuring the available queuing space in feet on an aerial map and dividing by the average length of a queued truck, which is 80 feet based on observations of queued trucks at the Port.

Figure 2: Available On-Street Queuing Capacity for each Terminal Truck Gate



To determine capacity at each terminal, Fehr & Peers subcontracted with a data collection firm to collect data at the 4 major terminal truck gates to document various characteristics of the gate operations. The data consisted of the time each truck passed through the security gate, entered the back of the pedestal queue, reached the pedestal, and departed the pedestal. The data was collected using video cameras for 3 consecutive days (Monday, October 21 through Wednesday, October 23, 2024). Based on the RFID data for the same 3 days, 6 representative hours at each terminal gate were selected for processing. As the capacity at the terminal truck gates are not expected to change, terminal capacity is expected to remain fixed. Based on the data collected, the terminal gates have the following capacity under normal operating conditions:

- Everport = 206 trucks per hour
- OICT – East Gate = 276 trucks per hour
- OICT – West Gate = 269 trucks per hour
- TraPac = 168 trucks per hour

3. Queuing Model Development

Fehr & Peers developed a queuing model to estimate the 95th percentile queue lengths for each terminal gate based on the current terminal capacity and the forecasted peak hour truck volume demand under normal operating conditions. For each analysis scenario, the queuing model uses the below steps to estimate the 95th percentile queue for each terminal gate.

A. **Forecast hourly truck demand.** Estimate the hourly truck volume that would enter the terminal gate under the analysis scenarios for both average and peak days based on the ratio of the total daily truck volumes forecasts provided by the Port (see page 4) to the Baseline conditions (see Table 2) and assume the same distribution by hour as the Baseline conditions (see Figure 1). Therefore, this forecast truck demand does not account for terminal gate capacity.

   Assume that the terminal truck gates would have the same truck processing times and the same hourly gate capacity as the Baseline conditions, because it is conservatively assumed that the terminal gates would continue to operate with the same physical infrastructure (i.e., the same number of pedestals and truck queuing spaces) and similar operating procedures (i.e., the same operating hours, truck appointment system, and truck processing) as the Baseline conditions.

B. **Adjust the forecast hourly truck demand based on terminal gate capacity to account for unserved demand during the previous hour.** The queuing model then considers the constraint of terminal gate capacity; trucks would not be able to enter the terminal gate when demand exceeds terminal gate capacity during that hour and would queue to enter the terminal gate in the next hour. In other words, the forecast truck demand that is above the terminal capacity is added to the forecast truck demand for the following hour. In

addition to accounting for the trucks that cannot be served during the previous hour, the queuing model accounts for the typical fluctuation in the truck arrivals during the peak hour, which can also result in queuing. The forecast hourly truck demand is adjusted for both average and peak days.

C. **Estimate 95th Percentile Queue.** The queuing model then estimates the 95th percentile queue during the peak hour (the hour with the highest adjusted hourly truck demand) for both average and peak days and determines if the number of queued trucks can be accommodated within the terminal truck gate complex and on-street within the Seaport (see Table 2).

Note that the queuing model estimates the 95th percentile queues at the 4 major international container terminal truck gates (Everport, OICT East and West Gates, and TraPac). Although trucks would continue to access the other two existing terminal truck gates (OICT Back Gate and Matson), as well as a potential new Outer Harbor container terminal, the 4 major terminal truck gates are expected to continue to have the highest truck volumes and are thus most likely to result in on-street truck queues under normal operating conditions. In addition, since each container terminal would continue to operate independently, activity at the terminal truck gates would likely continue to not peak at the same time. It is assumed that the peak activity at each terminal truck gate would occur on different days and at a different hour, similar to Baseline conditions.

4. Analysis Results

This section presents the hourly truck demand at the terminal truck gates and the corresponding 95th percentile queue lengths under 2050 No Project and 2050 With Project conditions followed by a summary of future conditions at the terminal truck gates.

Forecast Truck Demand and Adjusted Forecast Truck Demand

Considering forecast container growth from Baseline conditions, forecast truck demand is summarized below:

- Under 2050 No Project conditions, hourly truck volumes on both average and peak days are estimated to be about 67%[9] higher than the Baseline conditions.
- Under 2050 With Project conditions, hourly truck volumes on both average and peak days are estimated to be about 68%[10] higher than the Baseline conditions.

[9] Based on the ratio of forecasted total number of trucks per day under 2050 No Project conditions to Baseline Conditions: 10,900 / 6,508 = 1.67

[10] Based on the ratio of forecasted total number of trucks per day under 2050 With Project conditions to Baseline conditions: 10,960 / 6,508 = 1.68

Appendix A shows the forecast hourly truck demand and adjusted truck demand at the terminal truck gate under 2050 No Project and 2050 With Project conditions during both average and peak days.

Under both 2050 No Project and 2050 With Project scenarios on average days, the forecast truck demand and the adjusted forecast truck demand are generally the same because the forecast truck demands are generally below the hourly terminal capacities, except for a short period of time of about 2 to 3 hours at the Everport and TraPac Terminal gates that occur around 7:00AM. Therefore, under both scenarios on average days, there is little queuing on Seaport roadways outside of the terminal gates under normal operating conditions. In addition, the duration and occurrence of peak hours are generally the same between the two scenarios on average days.

Under both 2050 No Project and 2050 With Project scenarios on peak days, truck demands are higher than terminal capacity, which results in a different adjusted forecast from forecast truck demand at each of the terminal gates. This occurs for periods of between 4 to 6 hours during the day; truck queuing would occur on Seaport roadways during these times. Similar to average days, the duration and occurrence of peak hours are generally the same between the two scenarios on peak days.

The primary difference between 2050 No Project and 2050 With Project on average and peak days is that the peak hours occur about 2 hours later in the morning on peak days than on average days. This is due to accumulation of trucks queued on-street because the truck demand is above the hourly terminal capacity.

Truck Demand

Figure 3 compares the hourly adjusted truck demand on an average day between the 2050 No Project and 2050 With Project scenarios. In general, the hourly adjusted truck demands on an average day under the 2050 With Project conditions are about less than 1% higher than under 2050 No Project conditions. **Figure 4** compares the hourly adjusted truck demand on a peak day between the 2050 No Project and 2050 With Project scenarios. In general, the hourly adjusted truck demands on a peak day under the 2050 With Project conditions are about 1 to 2% higher than under 2050 No Project conditions.

Queuing Results

The queuing model was used to estimate the 95th percentile queue lengths for the 4 terminal truck gates under the following scenarios:

- 2050 No Project conditions—average day and peak day
- 2050 With Project conditions—average day and peak day

Figure 3: Hourly Truck Demand and Terminal Truck Gate Capacity—Average Day—2050 No Project and 2050 With Project

Figure 4: Hourly Truck Demand and Terminal Truck Gate Capacity—Peak Day—2050 No Project and 2050 With Project

Table 4 compares the peak hour 95th percentile queue lengths at the terminal truck gates on an average day between the 2050 No Project and 2050 With Project scenarios. In general, the peak hour 95th percentile queue lengths on an average day under the 2050 With Project conditions are about 1% longer than under 2050 No Project conditions. Although the adjusted peak hour truck demand under both 2050 No Project and 2050 With Project scenarios at the two OICT gates are forecasted to be below the hourly terminal capacities on average days (see Figure 3), some truck queuing, with minimal on-street queuing (9 trucks under 2050 with Project conditions) is expected to occur at the OICT gates due to fluctuations in truck arrivals during the peak hour.

Table 5 compares the 95th percentile queue lengths at the terminal truck gates on a peak day between the 2050 No Project and 2050 With Project scenarios. In general, the peak hour 95th percentile queue lengths on a peak day under the 2050 With Project conditions are about 1 to 2% longer than under 2050 No Project conditions.

Figure 5 shows the 95th Percentile on-street queue lengths under the 2050 No Project and 2050 With Project conditions.

The peak hour volumes under 2050 With Project conditions are less than 1% higher than under 2050 No Project conditions on average days. The peak hour volumes under 2050 With Project conditions are about 1 to 2% higher than under 2050 No Project conditions on peak days. As a result, the 95th percentile queue lengths under 2050 With Project conditions are about 1 to 2% longer than under 2050 No Project conditions on average days, and the 95th percentile queue lengths under 2050 With Project conditions are about 2 to 3% longer than under 2050 No Project conditions on peak days.

The 95th percentile queues during the peak hours on peak days under 2050 With Project conditions represent the typical worst case under normal operating conditions.

Table 4: 2050 No Project and 2050 with Project Conditions – Average Day Queue Lengths

Terminal/ Scenario		Peak Hour Truck Demand	Peak Hour Estimated Time[1]	95th Percentile Queue Length					
				Within Terminal		On-Street		Total	
				# of trucks	% Occupied	# of trucks	% Occupied	# of trucks	% Occupied
Everport									
2050 No Project		239	Monday, 7:00 AM	32	100%	127	48%	159	54%
2050 with Project		241		32	100%	129	49%	161	55%
Difference		*+2*		*0*	*0%*	*+2*	*+1%*	*+2*	*+1%*
OICT									
2050 No Project	East Gate[2]	241	Tuesday, 9:00 AM	22	15%	4	1%	82	16%
	West Gate[2]	256		56	100%				
2050 With Project	East Gate[2]	243		23	16%	9	3%	88	17%
	West Gate[2]	257		56	100%				
Difference	*East Gate*[2]	*+2*		*+1*	*+1%*	*+5*	*+2%*	*6*	*+1%*
	West Gate[2]	*+1*		*0*	*0%*				
TraPac									
2050 No Project		183	Tuesday, 7:00 AM	116	100%	2	1%	118	38%
2050 With Project		184		116	100%	4	2%	120	39%
Difference		*+1*		*0*	*0%*	*+2*	*+1%*	*+2*	*+1%*

1. Under normal operating conditions, truck demand entering all terminal truck gates is estimated to peak during the 4-week peak period (July to August). Truck demand at each terminal truck gate would peak on a different day of the week and time of the day.
2. Since trucks can use either the East or West gates to enter OICT depending on which gate has a lower overall wait time and the two gates share the same Seaport roadways for queuing, the on-street queuing for the two gates are combined.

Source: *Fehr & Peers, 2024.*

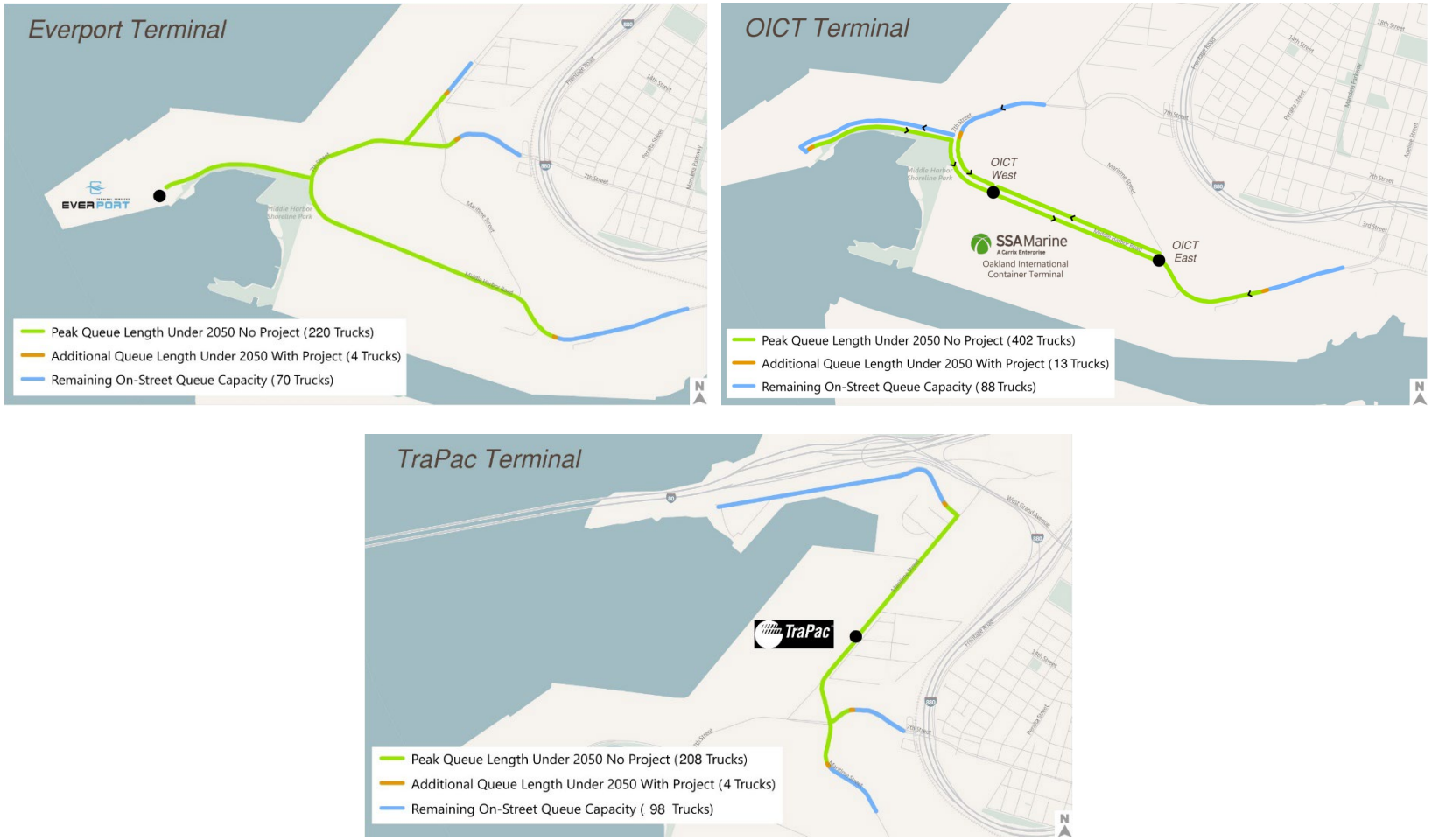
Table 5: 2050 No Project and 2050 with Project Conditions – Peak Day Queue Lengths

Terminal/ Scenario		Peak Hour Truck Demand	Peak Hour Estimated Time[1]	95th Percentile Queue Length					
				Within Terminal		On-Street		Total	
				# of trucks	% Occupied	# of trucks	% Occupied	# of trucks	% Occupied
Everport									
2050 No Project		300	Monday, 9:00 AM	32	100%	188	72%	220	75%
2050 with Project		304		32	100%	192	73%	224	76%
Difference		*+4*		*0*	*0%*	*+4*	*+1%*	*+4*	*+1%*
OICT									
2050 No Project	East Gate[2]	290	Tuesday, 11:00 AM	144	100%	202	67%	402	80%
	West Gate[2]	325		56	100%				
2050 With Project	East Gate[2]	295		144	100%	215	71%	415	83%
	West Gate[2]	333		56	100%				
Difference	*East Gate*[2]	*+5*		*0*	*0%*	+13	*+4%*	+13	+3%
	West Gate[2]	*+8*		*0*	*0%*				
TraPac									
2050 No Project		272	Tuesday, 9:00 AM	116	100%	92	47%	208	67%
2050 With Project		276		116	100%	96	49%	212	68%
Difference		*+4*		*0*	*0%*	*+4*	*+2%*	*+4*	*+1%*

1. Under normal operating conditions, truck demand entering all terminal truck gates is estimated to peak during the 4-week peak period (July to August). Truck demand at each terminal truck gate would peak on a different day of the week and time of the day.
2. Since trucks can use either the East or West gates to enter OICT depending on which gate has a lower overall wait time and the two gates share the same Seaport roadways for queuing, the on-street queuing for the two gates are combined.

Source: *Fehr & Peers, 2024.*

Figure 5: 95th Percentile On-Street Queue Lengths and Remaining On-Street Queue Capacity (2050 No Project and 2050 With Project Conditions)



Summary of Results

The peak hour truck volumes and corresponding 95th percentile queues at each terminal truck gate under the 2050 No Project and 2050 With Project conditions are described in more detail below.

Everport

The peak hour is estimated to occur on a Monday during the 4-week peak period (July to August) at around the 9:00 AM hour, when the peak hour truck demand would be 300 trucks under the 2050 No Project conditions and increase to 304 trucks under 2050 With Project conditions (1% increase). The 95th percentile queue is estimated to be about 220 trucks under the 2050 No Project conditions and increase to about 224 trucks (2% increase) under the 2050 With Project conditions. The estimated 95th percentile queue under 2050 No Project conditions corresponds to a 75% occupancy of the total available queuing space, which would increase by about 1% to 76% under 2050 With Project conditions.

OICT

The peak hour is estimated to occur on a Tuesday during the 4-week peak period July to August) at around the 11:00 AM hour, when the peak hour truck demand for the east and west gates combined would be 615 trucks under the 2050 No Project conditions and increase to 628 trucks under 2050 With Project conditions (2% increase). The 95th percentile queue is estimated to be about 410 trucks under the 2050 No Project conditions and increase to about 422 trucks (3% increase) under the 2050 With Project conditions. Trucks are expected to use either the East or West gates to enter OICT depending on which gate has a lower overall wait time. The estimated 95th percentile queue under 2050 No Project conditions corresponds to an 80% occupancy of the total available queuing space, which would increase by about 3% to 83% under 2050 With Project conditions.

TraPac

The peak hour is estimated to occur on a Tuesday during the 4-week peak period (July to August) at around the 9:00 AM hour, when the peak hour truck demand would be 272 trucks under the 2050 No Project conditions and increase to 276 trucks under 2050 With Project conditions (1% increase). The 95th percentile queue is estimated to be about 208 trucks under the 2050 No Project conditions and increase to about 212 trucks (2% increase) under the 2050 With Project conditions. The estimated 95th percentile queue under 2050 No Project conditions corresponds to a 67% occupancy of the total available queuing space, which would increase by about 1% to 68% under 2050 With Project conditions.

5. Potential Improvements

The queuing analysis summarized above assumes that the terminal truck gates would continue to have similar operational and physical characteristics under 2050 conditions as under Baseline conditions. Implementing one or more of the following changes could improve the efficiency of the terminal truck gates and reduce queue lengths:

- **Improve truck efficiencies and processing times at pedestals** –Improving the truck processing times at the pedestals would result in more trucks being serviced through each pedestal per hour. For example, reducing the truck processing times by about 10% (which corresponds to about 10 to 20 seconds per truck) could increase the hourly terminal capacity by about 10%, which would reduce the 95th percentile queue lengths on peak days under 2050 With Project conditions by about 4 to 8%, depending on the terminal gate.
- **Add pedestals to existing terminal gates** – Adding new pedestals at the terminal gates would result in more trucks serving through each terminal gate per hour and may increase the on-site queuing space within the terminal depending on the configuration. A new pedestal could allow each terminal gate to process an additional 15 to 30 trucks per hour and increase the hourly terminal capacity by 8 to 14%, which would reduce the 95th percentile queue lengths on peak days under 2050 With Project conditions by 3 to 8%, depending on the terminal gate.
- **Increased use of afternoon and night appointments** – Assuming that the terminals would operate similar to current conditions, they would experience the highest truck volumes and corresponding queue lengths during the morning hours. Reducing the number of morning appointments and increasing the number of appointments at other times would result in a more consistent truck demand throughout the day. Accommodating additional evening or night appointments may require increasing staffing, extending the operation hours for the night shift, or increasing the number of days with night shifts, but could reduce the estimated peak queue lengths depending on the number of trucks that can shift from the morning to other times.
- **Provide new gates for existing terminals** – Construction of a new truck gate complex to access existing terminals would increase the capacity of the terminal. A new gate would increase the number of trucks that each terminal can process. The ability of a new gate to increase the number of trucks served and reduce on-street queue lengths depends on the gate configuration and the number of pedestals provided.

The feasibility of implementing these changes is not known at this time.

6. Conclusion

Based on the analysis conducted by Fehr & Peers, the current configuration and capacity of the Seaport roadways could accommodate the forecasted 95th percentile truck queues in the year 2050, with or without the completed construction of the proposed Oakland Harbor Turning Basins Widening Project. This means that truck queuing would not occur outside Seaport roadways. The proposed Oakland Harbor Turning Basins Widening Project would increase the peak hour truck volumes on peak days by about 1 to 2%, and result in about 2 to 3% longer 95th percentile queues.

The queuing analysis shows that on a peak day under 2050 With Project conditions, assumed to be the worst case under normal operating conditions, trucks would occupy about 76% of the available queuing capacity at Everport, 84% at OICT, and 68% at TraPac. Improvements such as increasing processing efficiency at terminal pedestals, adding pedestals to existing gates, increasing the utilization of evenings and night appointments, increasing hours of gate operations, or adding new truck gates to existing terminals could reduce the incidence and size of the on-street queues within the Seaport.

Attachment:
Appendix A: Forecasted Hourly Truck Demand at Terminal Truck Gates

Appendix A: Forecasted Hourly Truck Demand at Terminal Truck Gates

Figures A-1 and A-2 show the hourly truck demand at the terminal truck gates under 2050 No Project conditions on an average day and on a peak day, respectively, and **Figures A-3 and A-4** show the hourly truck demand at the terminal truck gates under 2050 With Project conditions on an average day and on a peak day, respectively.

These hourly volume figures show the following:

- ***Forecast truck demand (red)*** – The hourly truck demand forecast based on the Baseline hourly profile at each terminal without accounting for the terminal gate capacity.
- ***Adjusted forecast truck demand (green)*** – The forecast truck demand constrained to account for the hourly terminal gate capacity, which assumes that the truck demand above the hourly capacity would not be able to enter the terminal gate during that hour and would be queued to enter the terminal in the following hour. In other words, the forecast truck demand that is above the terminal capacity is added to the forecast truck demand for the following hour.
- ***Terminal capacity (purple)*** – The existing hourly capacity of each terminal gate as listed in Section 2 of this memorandum. When adjusted forecast truck demand is above terminal capacity, trucks would be expected to start queuing within the Seaport along its roadways.

Figure A-1: Hourly Truck Demand and Terminal Capacity at Terminal Truck Gates under 2050 No Project Conditions—Average Days

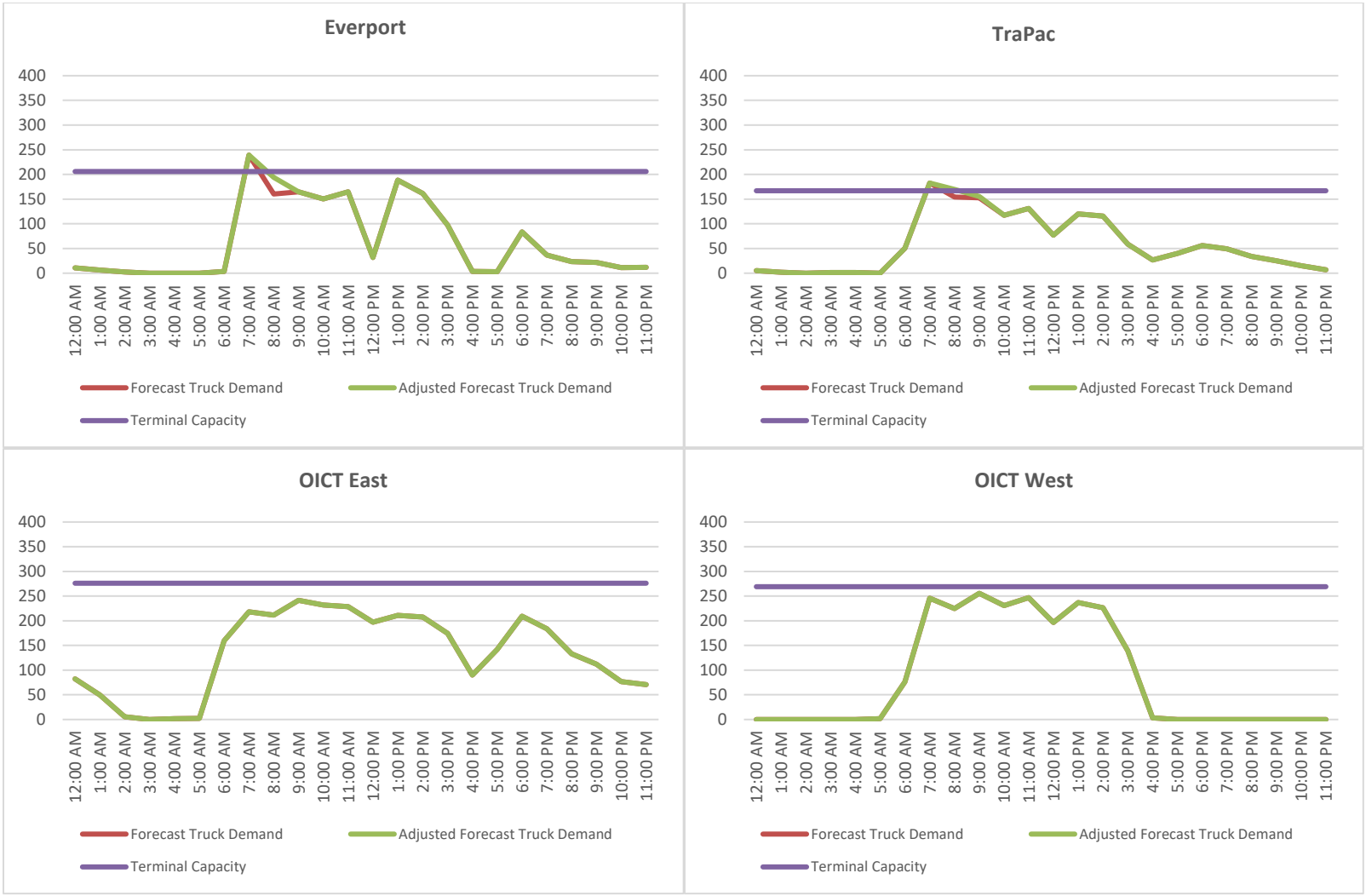


Figure A-2: Hourly Truck Demand and Terminal Capacity at Terminal Truck Gates under 2050 No Project Conditions—Peak Days

Figure A-3: Hourly Truck Demand and Terminal Capacity at Terminal Truck Gates under 2050 With Project Conditions—Average Days

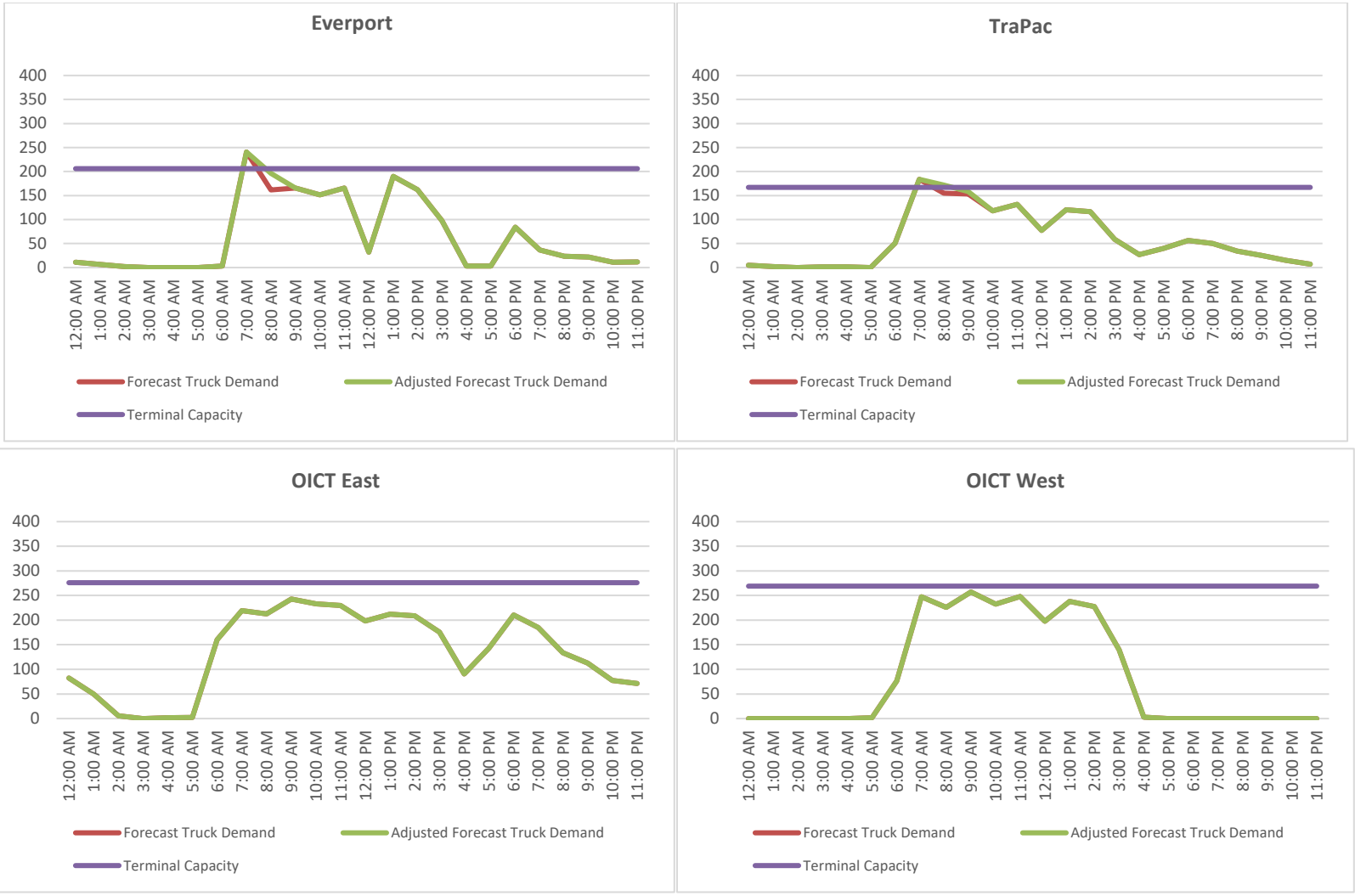


Figure A-4: Hourly Truck Demand and Terminal Capacity at Terminal Truck Gates under 2050 With Project Conditions—Peak Days