LEIGH FISHER ASSOCIATES
A Division of Jacobs Consultancy Inc.

Final Report

Terminal Access Study
Portland International Airport

Prepared for

The Port of Portland
Portland, Oregon

March 2005

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Main Office
555 Airport Blvd., Suite 300
Burlingame, CA 94010
Tel 650-579 7722
Fax 650-343 5220

Washington, D.C. Office
14900 Conference Center Drive, Suite 275
Chantilly, VA 20151
Tel 703-961 9000
Fax 703-961 9318

ACKNOWLEDGMENTS

The Terminal Access Study for Portland International Airport was prepared by Leigh Fisher Associates under the direction of Port of Portland staff with input and assistance from a team of subconsultants as well as representatives of the airlines and tenants serving the Airport. Port of Portland staff and Advisory Teams are identified below.

PORT OF PORTLAND

Scott King,
Senior Planner - Project Manager
Bill Allen,
Aviation Planning &
Development Manager
Mary Maxwell,
Aviation Director

Port Staff

Bill Allen
Bob Barnett
Dan Brame
Paul Brandes
John Curry
Duane Decker
Ed Herbert
Dawn Huddleston
Bob Inman
Robin Katz
Brian Kidd
Scott King
Steve Mrazek
Ryan Parker
Barbara Smolak
Ken Willhite

PROJECT ADVISORY TEAM

Ted Leybold, Metro
Michael Ray, Oregon Department of Transportation
Mark Rohden, TriMet
Stuart Gwin, City of Portland
Fred Stoval, Neighborhood Association, Airport Issues Roundtable (AIR) - Chair
Scott King, Port of Portland
Duane Decker, Port of Portland
Robin Katz, Port of Portland

TECHNICAL ADVISORY TEAM

Reggie Barnes, Southwest Airlines
Mitch Berck, Flightcraft, Inc.
Tom Bilic, Blue Star Charters
Steve Hext, Broadway Cab
Penny Jordahl, Alaska Airlines
Tom Rabus, First Transit
Dan Rheinauer, Hertz
Randall Thayer, Sheraton Hotel

LEIGH FISHER ASSOCIATES TEAM

The Leigh Fisher Associates Team included the following firms and key staff:

Leigh Fisher Associates

Joan Zatopek, Project Manager
Peter Mandle, Principal-in-Charge
Gavin Duncan
Jessica Wyatt
Ernest Rogers
George Teebay

David Evans & Associates

Cost Estimates and Transit Planning

Dwayne Hofstetter, P.E.
Steve Metz, P.E.

Browning-Shono Architects

Pedestrian and Bikeway Planning

Rick Browning

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EXECUTIVE SUMMARY

This report has been prepared to document the study process and analyses conducted in conjunction with the Terminal Access Study prepared for the Portland International Airport. The purpose of this study was to update the ***1994 Terminal Access Study,*** addressing all Airport access modes, including pedestrians, bicycles, buses/vans, light rail, private vehicles, and rental cars. Since completion of the 1994 Study, the Airport has experienced changes in activity and operations including (1) new mode choice patterns resulting from the opening of light rail service to the Airport; (2) changes in passenger time of arrival, re-circulation, and parking usage patterns due to stricter Federal security requirements as a result of September 11, 2001; and (3) changes resulting from the increased volume of low-fare airline passengers and reduction in international service. Additionally, since 1994, the Port of Portland has adopted the 2000 PDX Master Plan. This updated Terminal Access Study incorporates Phase 1 of the Decentralized Alternative as presented in the 2000 PDX Master Plan (which includes a new eastern terminal and concourse extending eastward from existing Concourse B). The proposed Phase 1 Decentralized Alternative assumes full build out of the existing terminal area at 23 million annual passengers (MAP). Subsequent phases of the Decentralized Alternative assume additional airline gates, terminal processing, and landside facilities would be located at a new site to the south of the existing terminal area.

STUDY PROCESS

The Terminal Access Study was conducted in close coordination with Port staff and other stakeholders. A Technical Advisory Committee (TAC) and Project Advisory Committee (PAC) were established to provide input and guidance throughout the course of the project. The TAC included representatives from Port staff (including Planning, Research, Operations, Security, Maintenance, Police, Properties, Environmental, Engineering, and Public Affairs), airlines, rental car operators, hotels, and commercial transportation operators; and primarily provided technical input. The PAC included representatives from the City of Portland, TriMet, Oregon Department of Transportation (ODOT), Metro, and the Neighborhood Association and primarily provided insight and input from a regional perspective. Port staff were included in both committees. Five workshops were held with the TAC and PAC at key project milestones and technical memoranda were distributed to all members of the TAC and PAC for comment. This report reflects the staff and stakeholder comments received on the technical memoranda and at the workshops.

SUMMARY OF FINDINGS

The Terminal Access Study was prepared by assessing the existing conditions, identifying site constraints, estimating future needs, developing and evaluating alternative plans, and refining alternatives.

Existing Conditions

In assessing existing conditions, previously prepared studies and documents, current data and information provided by Port staff, and field observations were used to revise and establish the updated baseline conditions. The existing baseline conditions considered recent historical trends, as well as the most recent available data. For the most part, the baseline was established using 2003 data. Parking demand and revenue data for the first quarter of 2004 were also considered.

Site Constraints

Site constraints that might affect the development of future access and parking facilities at the Airport were identified and described. These constraints included physical, operational, and regulatory conditions, including existing and future taxiways, existing terminal and access roadways, the existing parking garage, structures such as the Central Utility Plant (CUP) and Airport Traffic Control Tower (ATCT), general aviation facilities, and assumptions for the proposed new Terminal Expansion (TEE). This study acknowledges a major utility corridor that may affect the detailed design of new facilities in the terminal area; however, the cost or design impact of replacing and/or relocating these utilities has not been addressed in this study. Additionally, potential future security requirements have not been predicted or considered as part of this study.

Needs Analysis

Future requirements for the ground transportation components including the roadways, curbside, parking, and rental car facilities were estimated using the established baseline conditions. Airline passenger data were reviewed, showing an average growth of about 3.8% over the last 10 years. In developing the future requirements, a range of requirements was prepared for the public parking component in order to reflect a high, medium, and low range of growth given (1) the high month over month increase in demand during the first four months of 2004 and (2) the fact that parking demand was growing faster than passenger growth. The facility requirements were linked to passenger levels of 15 MAP, 17.5 MAP, 20 MAP, and 23 MAP. Although detailed forecasts were last developed in 1998, it is estimated that 23 MAP might be realized prior to 2020.

The estimated facility requirements for each access component are summarized in Table ES-1.

Table ES-1

FACILITY REQUIREMENTS SUMMARY
Terminal Access Study
Portland International Airport

	Existing supply	Future requirements			
		15 MAP	17.5 MAP	20.0 MAP	23.0 MAP
Curbside (linear feet)					
Departures	800	1,425	1,680	1,815	2,095
Arrivals	500	1,000	1,150	1,300	1,475
Roadways (lanes)					
Airport Way W/B	2	2	2	2	3
Airport Way E/B	2	2	2	2	3
Departures entrance	2 *(a)*	2	2	2	2
Arrivals entrance	2	2	2	2	2
Public parking (spaces) *(b,c)*					
Close-in	4,796	5,100	6,400	7,300	8,400
Economy	7,865	7,100	8,900	10,100	11,700
Rental cars (unconstrained)					
Ready/return (spaces)	981	1,300	1,500	1,700	2,000
QTA (sq. ft.)	62,139	126,000	157,000	161,000	166,000

QTA = quick turnaround area

(a) Driver behavior often limits this roadway to one usable lane.
(b) Does not include allowances for circulation.
(c) Assumes "mid-range" growth for public parking.

Source: Leigh Fisher Associates, June 2004.

Alternatives Development and Screening

Based on the needs assessment and identified site constraints, alternative facility development plans were developed that address various alternative access and circulation roadways, terminal building curbsides, rental car, public parking, commercial ground transportation, light rail, pedestrian and bicycle, and security

vehicle inspection areas. Assumptions were made relative to the position and layout of the TEE. Three families of alternatives were developed including:

- *TEE South*—TEE is located and oriented similar to the TEE identified in the 2000 PDX Master Plan, with the passenger processing facility on the south side of the terminal complex. TEE is served by an independent roadway system.

- *Single-Loop Roadway*—TEE is located and oriented similar to the TEE identified in the 2000 PDX Master Plan, but TEE is served by a single loop roadway that also serves the existing terminal building.

- *TEE Central*—The TEE terminal is (1) located perpendicular to Concourses B and E, (2) located east of the ATCT/CUP, and (3) served by an independent roadway system.

The alternatives were evaluated and it was determined that (1) an independent roadway system would be provided for the TEE terminal, (2) the TEE access roadways would be located east of the CUP and ATCT in order to maximize the footprint of P-2, and (3) the light rail realignment would maintain a terminus station at the existing terminal, similar to today.

Alternatives Refinement

Based on the initial evaluation of alternatives conducted, two alternatives were selected for further refinement—the TEE Southeast (the TEE South Alternative with the passenger processing building moved to the east to accommodate the independent access roadway system to the east of the CUP and ATCT), and TEE Central. The refinement included further modification of roadway, light rail, and pedestrian facilities, combining some preferred elements from several alternatives, and consideration of the timing of some improvements. Comparative order-of-magnitude cost estimates were prepared for both of the alternatives.

It was determined that both of these alternatives would be carried forward in anticipation of a Master Plan Update to be prepared for the Airport in the near future.

Comparison of Alternatives. **T**he primary physical differences between the two alternatives is the amount of elevated roadway (TEE Southeast has a three-level curbside, while TEE Central has a two-level curbside), and the light rail alignment (TEE Southeast has underground track and station at TEE, while the TEE Central terminal orientation allows the rail tracks to remain at grade). There were other differences in the pedestrian tunnel system and pedestrian connections to the TEE terminal building. The order-of-magnitude cost estimates prepared estimated the

TEE Southeast concept construction at about $330 million, as compared to $287 million for the TEE Central concept.

Another major difference between the TEE Central and the TEE Southeast concept is that the TEE Central concept has the potential to provide more capacity than originally identified for the TEE and the existing terminal area. Based on the 2000 PDX Master Plan, the TEE Southeast concept would accommodate about 5 MAP, with the existing terminal accommodating approximately 18 MAP, for a total of 23 MAP in the current terminal area. To expand beyond 23 MAP, the Master Plan recommends the development of a second terminal complex located on the south side of the airfield.

The TEE Central concept is expected to provide an opportunity to develop a TEE terminal that can accommodate more than 5 MAP. Any additional capacity that can be obtained in the existing terminal area will delay the need for the extensive investment associated with the development of a new terminal complex.

Phasing of Alternatives. **I**n developing the terminal access alternatives, it became clear that some components would fail before others. Figure ES-1 shows the estimated capacity limits of the various landside components. As shown, the public parking and rental car facilities have already reached, or will soon reach, their capacity limits. The rental car quick turnaround facilities are currently constrained and parking demand in the P-1 garage is beginning to exceed capacity on certain days. Both of the refined alternatives allow for expansion of the parking and rental car facilities without requiring major modification of the access roadway system. The requirement for new roadways, curbside, and light rail realignment will be driven by the need to construct the TEE terminal.

ORGANIZATION OF REPORT

The report, describing the analysis and findings of the study, is organized as follows:

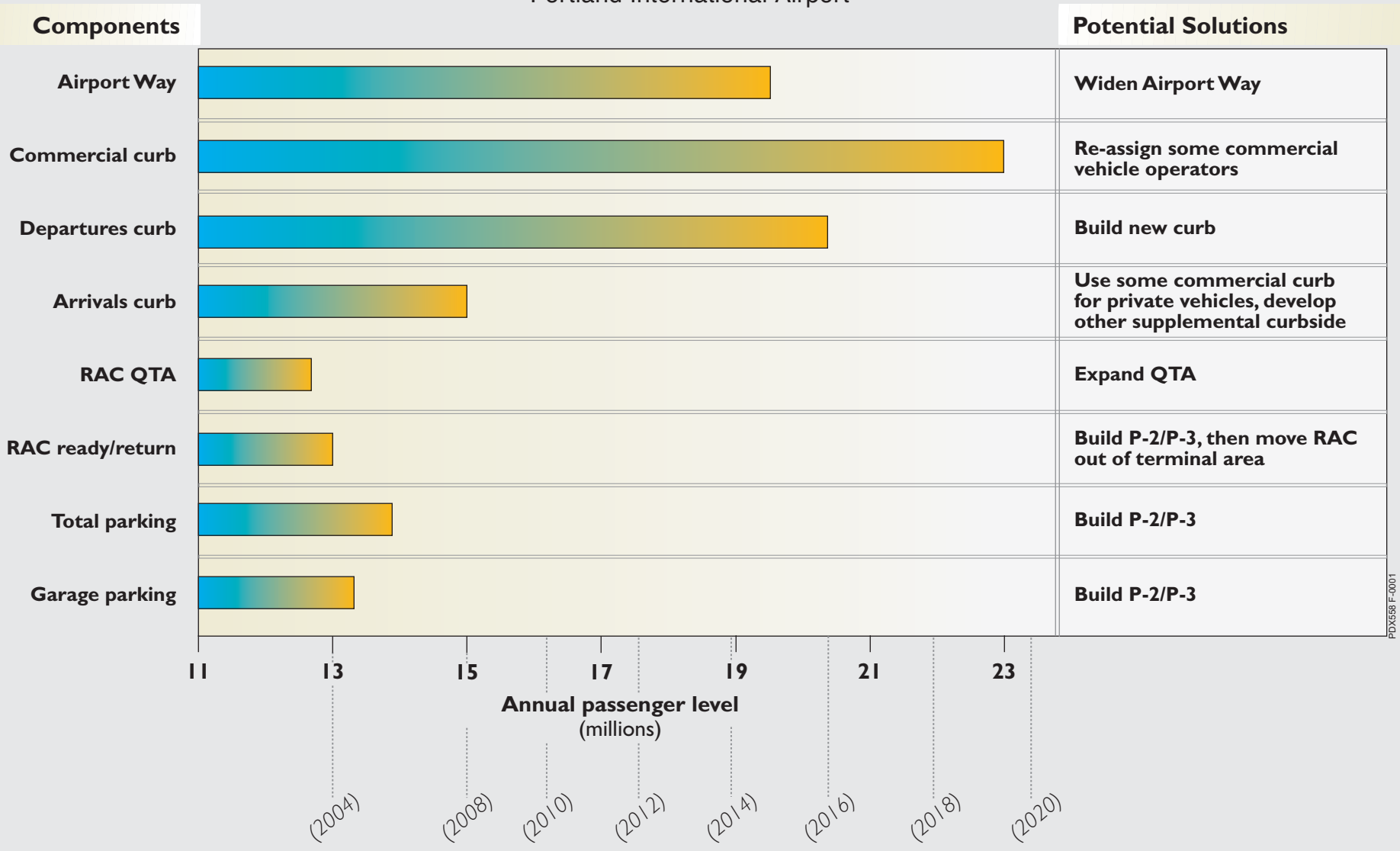
- Chapter 1—Existing Conditions
- Chapter 2—Site Constraints
- Chapter 3—Needs Assessment
- Chapter 4—Alternatives Development and Screening
- Chapter 5—Alternatives Refinement

Figure ES-1

TERMINAL AREA COMPONENTS CAPACITY LIMITS

Terminal Access Study

Portland International Airport



Note: Dates are approximate and could vary depending on passenger forecast assumptions.

The report also includes technical appendices that supplement the information contained in the main body of the report:

- Appendix A—Other Initial Alternatives
- Appendix B—P-2 Capacity Estimate
- Appendix C—Dimensional Confirmation
- Appendix D—Public Parking and Rental Car Facility Development Options
- Appendix E—TEE Central Validation

Chapter 1

EXISTING CONDITIONS

This chapter summarizes the assessment of existing conditions of the ground access facilities at Portland International Airport based on a review of previously prepared reports and studies, current data and information provided by the Port of Portland staff, and field observations. The following sections summarize the key findings of this assessment.

INTRODUCTION

The existing conditions baseline for the *Terminal Access Study* was established using mostly calendar year 2003 data. Additionally, the available first quarter data for 2004 were analyzed to assess the most recent growth trends. April 2003 data were compared to April 2004 data for passengers, public parking transactions and revenue, rental car revenue, and traffic volumes. As shown, while April 2004 total passengers were approximately 10% higher than April 2003 passengers, other measures of activity for ground access components were found to be as much as 30% higher in 2004 than in 2003. This recent disproportional increase in activity will be taken into consideration in assessing existing conditions and establishing the appropriate baseline, as discussed further in this chapter.

The existing passenger activity, mode choice, public and employee parking, roadways and terminal curbside, commercial roadway, pedestrians/bicycles, rental car, and transit facilities and operations are presented in this chapter.

Table 1-1 summarizes the month-to-month comparison of total passengers to activity for April 2003 and 2004. As shown, while April 2004 total passengers were approximately 10% higher than in April 2003, activity of key access facilities during April 2004 was up to 30% higher than the activity during April 2003.

Table 1-1

2003 TO 2004 COMPARISON OF KEY FACILITY ACTIVITY
Terminal Access Study
Portland International Airport

	Total passengers	Public parking transactions	Public parking revenue *(a)*	Rental car revenue	Hourly traffic volume, Upper Terminal Approach *(b)*	Hourly traffic volume, Lower Terminal Approach *(c)*
April 2003	922,035	164,786	$ 976,419	$5,905,431	543	538
April 2004	1,011,846	177,022	1,266,273	7,336,213	681	637
Percent change	9.7%	7.4%	29.7%	24.2%	25.5%	18.5%

(a) Airport parking rates increased April 12, 2004, eliminating the first ½-hour fee and increasing the total daily rate (from $16 to $18/day) in the parking garage.
(b) Based on average of peak hour for April 17 and 18, 2003 (Thursday and Friday), and April 1 and 2, 2004 (Thursday and Friday). Typically, Monday is the busiest day for the Upper Terminal Approach.
(c) Based on average of peak hour for April 17 and 18, 2003 (Thursday and Friday), and April 1 and 2, 2004 (Thursday and Friday). Typically, Thursday is the busiest day for the Lower Terminal Approach.

Source: Leigh Fisher Associates, from data provided by the Port of Portland.

PASSENGER ACTIVITY

Historical airline passenger activity was reviewed to assess the trends in passenger growth. Passenger trends for the 10-year period of 1993 through 2003 are shown in Table 1-2 and on Figure 1-1. As shown, total passengers experienced double-digit growth between 1993 and 1996, reflecting the introduction of service by Southwest Airlines in 1994, with fares as much as 30% lower than those of Alaska Airlines. A more modest growth was sustained through 2000. Passengers decreased significantly (by almost 8%) in 2001, after the events of September 11, and have since grown at a modest rate, with 2003 passengers approaching 1996 levels. The average annual growth rate over the last 10 years was about 3.8%.

Table 1-2

TOTAL ANNUAL PASSENGERS 1993-2003
Terminal Access Study
Portland International Airport

Year	Total annual passengers	Annual percent increase (decrease)
1993	8,532,878	
1994	9,905,588	16.1%
1995	11,212,189	13.2
1996	12,590,588	12.3
1997	12,810,540	1.75
1998	13,019,366	1.6
1999	13,721,684	5.4
2000	13,790,115	0.50
2001	12,703,676	(7.9)
2002	12,241,975	4.6
2003	12,395,938	1.3

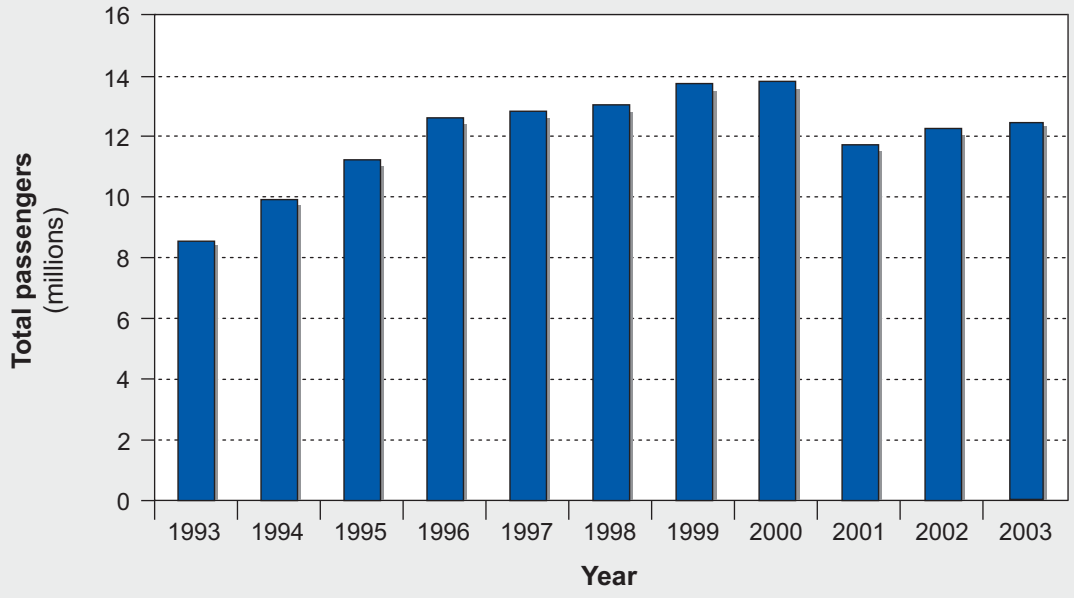
Source: Port of Portland.

Figure 1-1

ANNUAL PASSENGERS (CY 1993-2003)

Terminal Access Study

Portland International Airport



Monthly passenger totals for 2003 are shown in Table 1-3 and on Figure 1-2. Historically, monthly data indicate that the peak activity occurs during the summer months. In 2003, the peak months were July and August, with each month representing about 10% of the total year. Additionally, in Table 1-3, monthly activity for the available months of 2004 is compared to the same months of 2003. As shown, the monthly activity in February, March, April, and May of 2004 exceeded the same months of 2003 by 5.2%, 8.9%, 9.7%, and 3.9%, respectively. In comparing 2004 to 2003, there are several factors that should be considered, such as:

- The war in Iraq began in March of 2003, negatively affecting passenger levels in 2003.
- The Airport was closed several days due to ice and snowstorms, which is reflected by the lower January 2004 passenger volumes.
- 2004 is a leap year and February had 29 days.

Table 1-3

MONTHLY PASSENGERS 2003-2004
Terminal Access Study
Portland International Airport

Month	2003	2004	Change from previous year
January	850,418	796,412	(6.35%)
February	808,174	849,923	5.2
March	962,544	1,047,860	8.9
April	922,035	1,011,846	9.7
May	1,025,603	1,065,465	3.9
June	1,172,137		
July	1,271,831		
August	1,251,485		
September	1,013,704		
October	1,043,357		
November	979,583		
December	1,099,139		
Total passengers	12,400,010		

Source: Port of Portland.

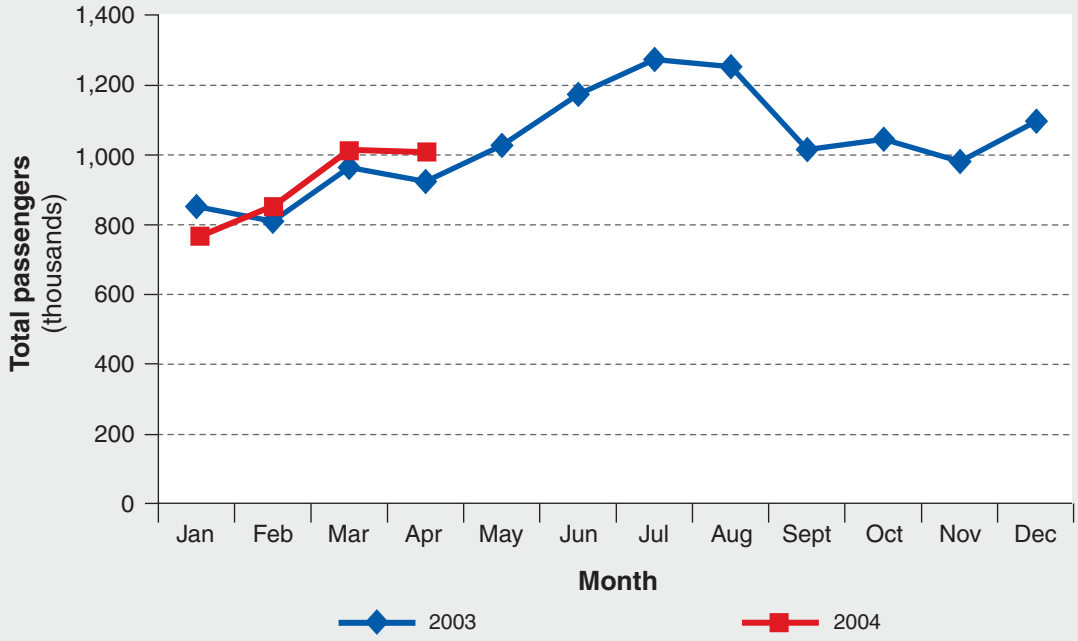
Scheduled arriving and departing seats were summarized based on information obtained from the *Official Airline Guide* (OAG) schedule for August 15, 2003, to assess passenger activity throughout the course of the day and to identify peak periods. The existing terminal building serves Concourses A, B, and C on the south side and Concourses D and E on the north side. Concourses A and B serve Alaska and Horizon airlines, while Concourse C serves Alaska, Frontier, Northwest, and Southwest airlines. Concourse D serves America West, American, Continental, Delta, Hawaiian, Lufthansa, Mexicana, and Sun Country airlines, while Concourse E serves Air Canada, Jazz, Sky West, United, and United Express airlines. To identify the distinction of airline passenger activity between the north and south sides of the terminal, the OAG data were summarized to represent the Concourse A, B, and C activity, and the Concourse D and E activity. Rolling 60-minute counts at 10-minute intervals are shown on Figures 1-3 and 1-4 for the departing and arriving peaks, respectively.

Figure 1-2

2003-2004 PASSENGERS BY MONTH

Terminal Access Study

Portland International Airport



As shown on Figure 1-3:

- Concourse A, B, and C (south side) activity constitutes about 55% of the total activity
- Both the north and south side airlines display an early morning departures peak period (5:00 to 7:00 a.m.) with about 2,000 seats available on the south side during the busiest 60-minute period (6:00 a.m. hour, as shown on Figure 1-3), and about 1,500 seats on the north side for a total of 3,500 seats.
- A secondary departure peak occurs around midday, with a more even distribution between south and north side (1,500 south, 1,000 north for a total 2,500 seats per hour).

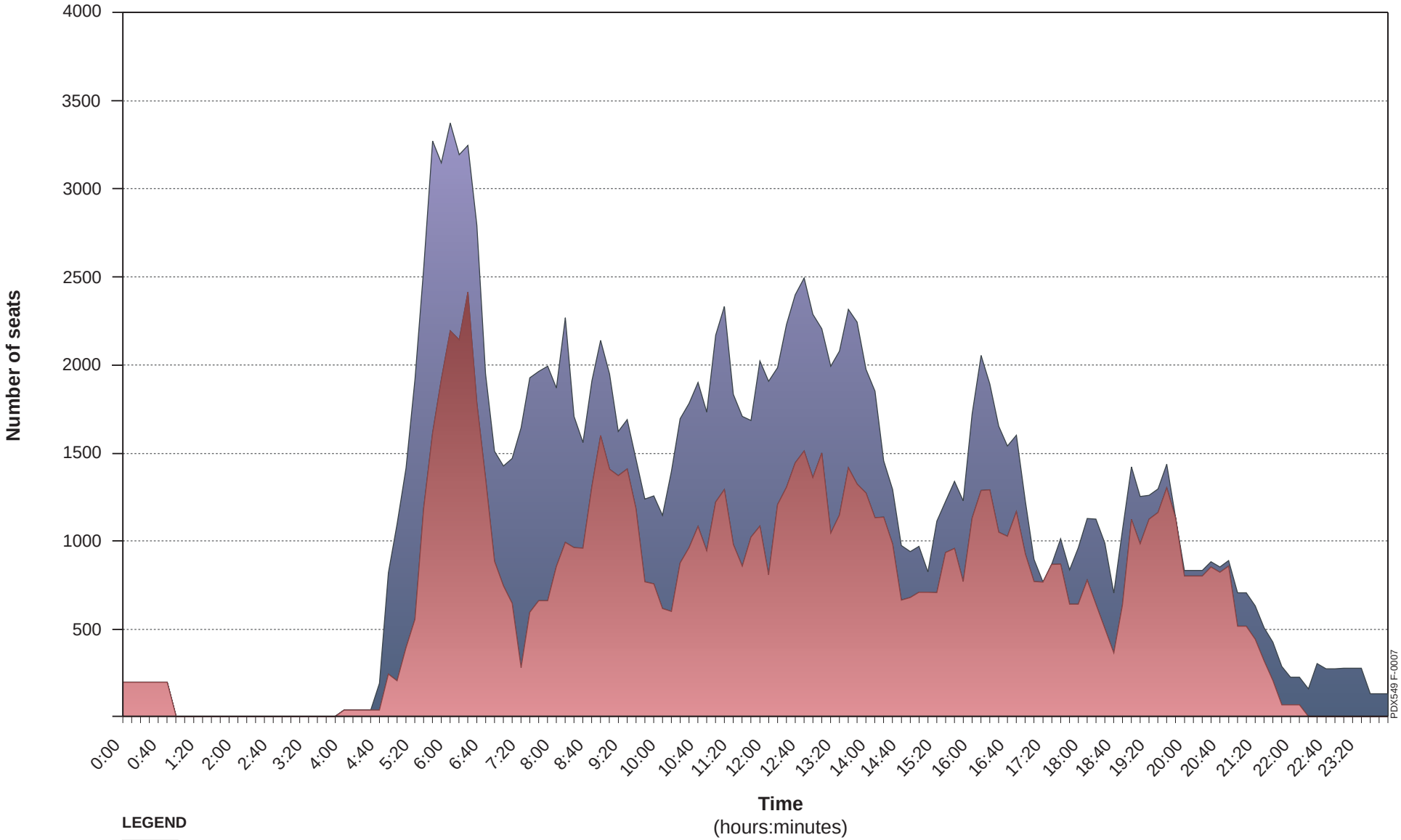


Figure 1-3

SCHEDULED DEPARTING SEATS–FRIDAY, AUGUST 15, 2003
ROLLING 60-MINUTE COUNT AT 10-MINUTE INTERVALS

Terminal Access Study
Portland International Airport

March 2005

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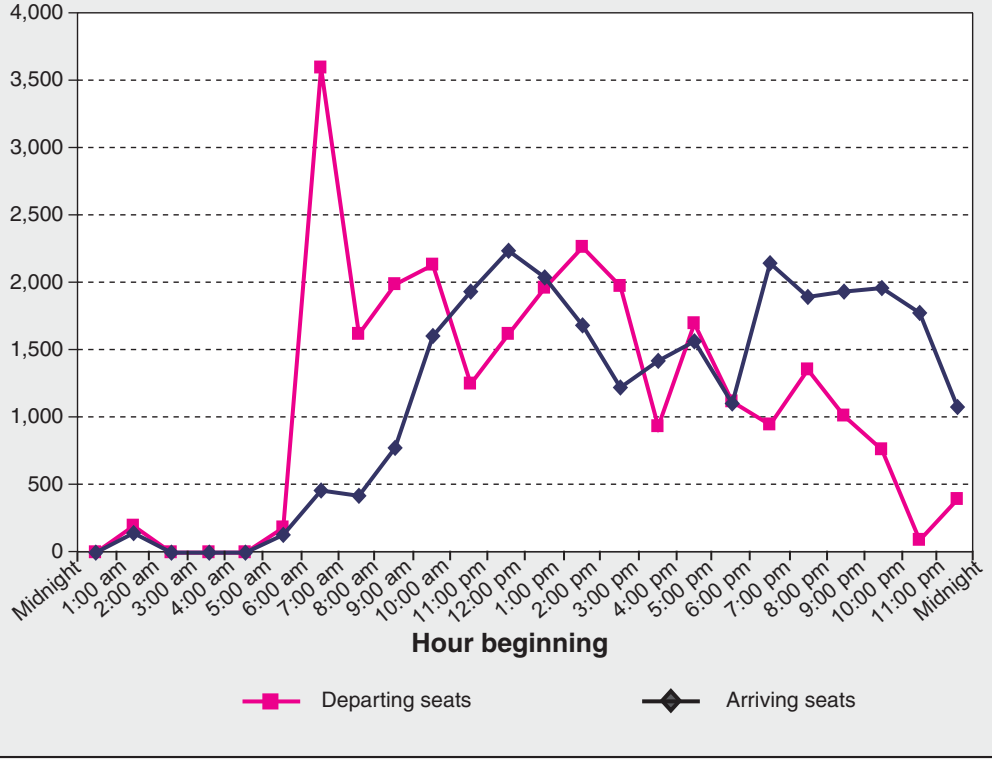
As shown on Figure 1-4:

- The arrivals peaks occur late morning to midday (11:00 a.m. to 1:00 p.m.) with about 1,400 seats on the south side and 1,000 seats on the north side for a total of 2,400 seats per hour.
- Another strong arrivals peak occurs during the evening peak between 6:00 and 10:00 p.m. with more than 2,000 total available seats per hour.
- Between about 9:00 and 10:00 p.m., more activity can be found on the north side with about 1,200 seats, and 1,000 seats on the south side for a total of about 2,200 seats per hour.

Figure 1-5 shows the hourly airline seat arrival and departure characteristics on one chart, illustrating the predominant early morning departures peak, the greatest combined arrivals and departures peak occurring around midday, and another arrivals during the evening. Comparing the 2003 airline activity patterns to those in 1993 (used in the last Terminal Access Study), the overall peaks appear to have flattened out during the course of the day (except for the early morning departures).

Figure 1-5
SCHEDULED HOURLY AIRLINE SEATS
Terminal Access Study
Portland International Airport



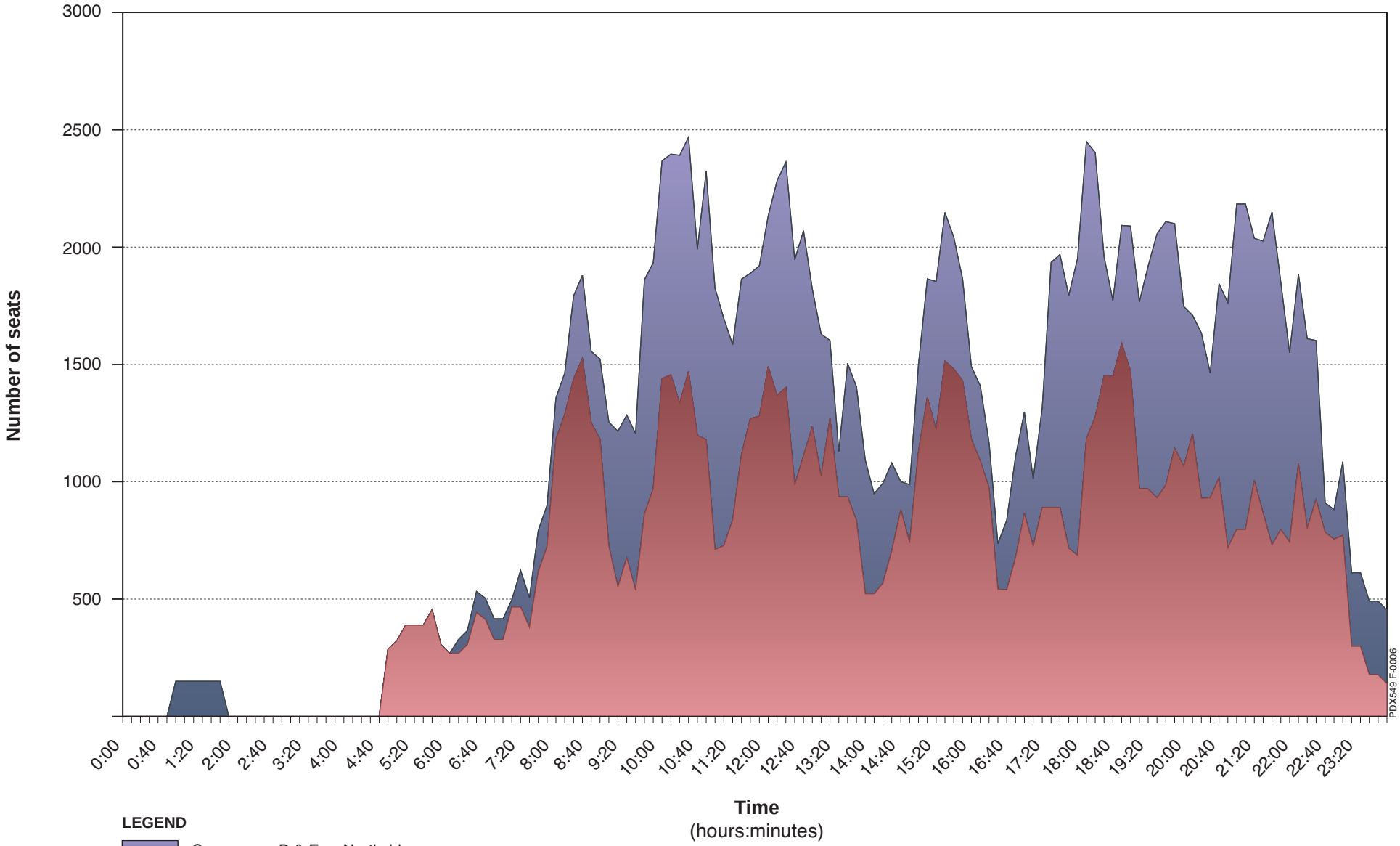


Figure 1-4

SCHEDULED ARRIVING SEATS–FRIDAY, AUGUST 15, 2003
ROLLING 60-MINUTE COUNT AT 10-MINUTE INTERVALS

Terminal Access Study
Portland International Airport

March 2005

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MODE CHOICE

Airport passenger mode choice data were obtained from periodic surveys conducted by the Port's Research and Marketing Department. Table 1-4 compares the historical mode choice data.

Table 1-4

HISTORICAL MODE CHOICE DATA
Terminal Access Study
Portland International Airport

Mode	1997/1998	2001	2003
Private vehicle	66%	54%	61%
Rental car	15	19	20
Taxi/limo	4	4	4
Shuttles	11	15	9
Tri-Met (MAX light rail transit after 2001)	1	5	6
Other	3	3	--

Source: Port of Portland, Research and Marketing Department.

PUBLIC AND EMPLOYEE PARKING

Public and employee parking facilities provided on-Airport are described below. The facility locations are illustrated on Figure 1-6. The parking space inventory is summarized in Table 1-5.

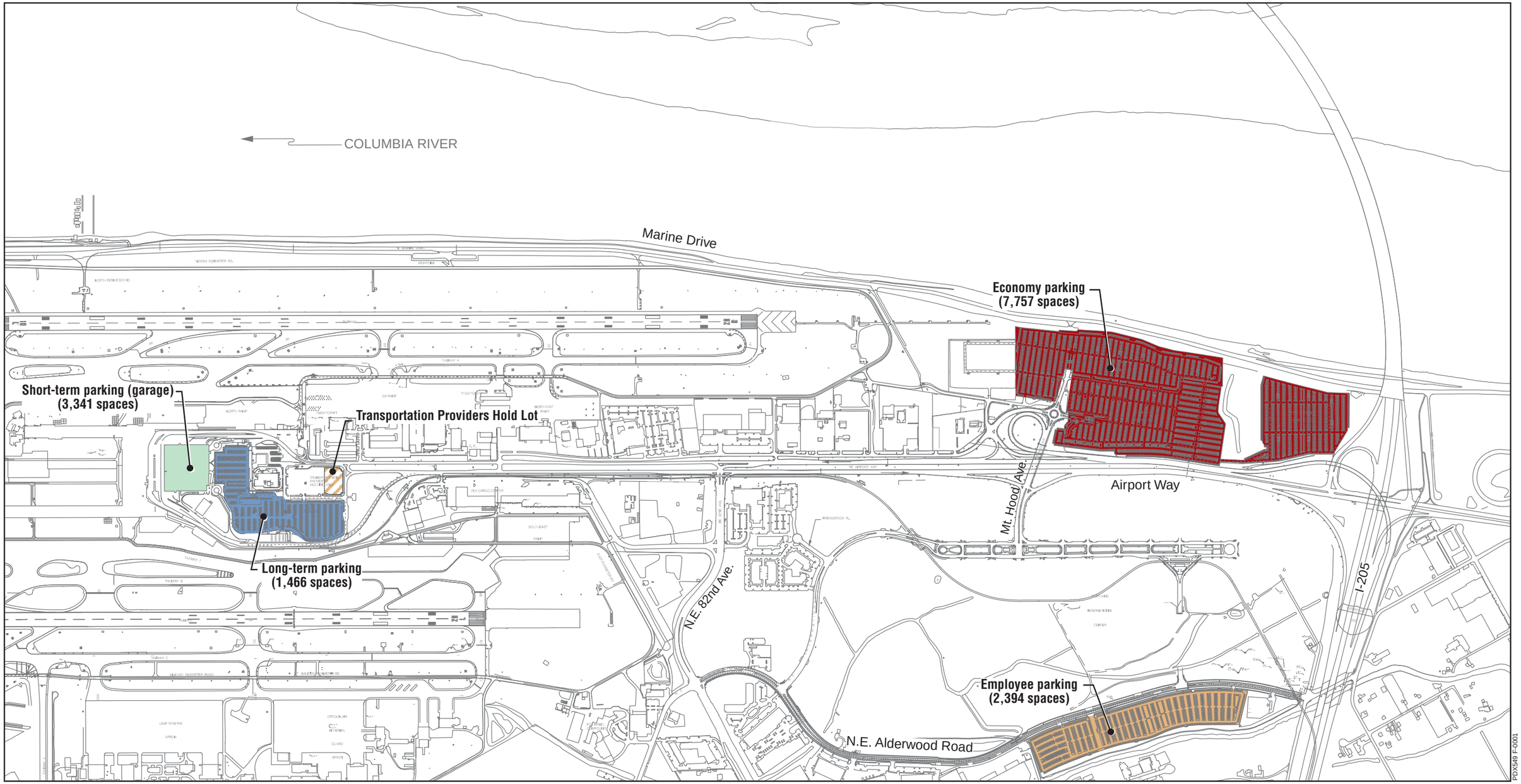
Table 1-5

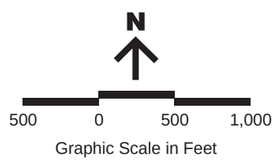
AUTOMOBILE PARKING SPACE INVENTORY
Terminal Access Study
Portland International Airport

Facility	Number of spaces
Garage	3,341
Long-term surface	1,466
Total close-in	4,807
Economy	7,757
Total public	12,564
Employee	2,394

Note: Parking spaces are also provided for motorcycles (70-feet), bicycle (8 spaces on north, 16 spaces on the south), and vendor (18 spaces on north and 4 spaces on airfield).

Source: Port of Portland





Source: Leigh Fisher Associates, February 2004.

Figure 1-6
PARKING FACILITIES
Terminal Access Study
Portland International Airport
March 2005

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Vendor parking is provided on the north corner of the terminal complex. These spaces are within 300 feet of the terminal building and vendors are required to remain with their vehicle.

Public Parking

Airport public parking is provided in a close-in parking garage (3,341 spaces) and an adjacent long-term surface lot (1,466 spaces). Shuttle bus service is provided in the long-term lot, providing transport between the parking lot (the Economy Lot) and terminal building. Remote parking also is provided in the 7,757-space surface lot located near the airport entrance, off Airport Way and Mt. Hood Avenue/Cascade Avenue. The Economy Lot also is served by shuttle buses. Shuttle buses serving both the Long-term and Economy lots run every 7 to 9 minutes during most hours of the day (4:00 a.m. to midnight), and every 15 minutes during off-peak periods (midnight to 4:00 a.m.). Of the total 12,564 public parking spaces provided on-Airport, 4,807 spaces, or 38%, are provided "close-in" within the terminal area.

As of April 12, 2004, parking rates are as follows:

Facility	Hourly rate	Daily rate
Garage	$3/hour	$18/day
Long-term Lot	$3/hour	$14/day
Economy Lot	$3/hour	$8/day, 7th day free

Notes:
1. Motorcycle and bicycle parking is free in designated areas.
2. As April 12, 2004, parking rates in the garage were changed to eliminate the first half hour free and to raise the daily rate from $16 to $18.

Parking Entries and Exits. Parking activity data were provided by Port staff, including parking entry and exit data, parking duration data, and parking occupancy data. These data were reviewed to assess the current parking operations and usage of facilities. Figures 1-7 and 1-8 illustrate the garage parking entries by hour for a typical weekday and weekend, respectively. As shown, the weekday entry and exit activity tends to be spread over the course of the day, as compared to the weekend entry and exits that tend to more peaked during the midday period, with higher peaks. A review of the entry and exit data for the Economy Lot indicated that the peak exits occurred on Sunday night between 8:00 and 10:00 p.m.

Figure 1-7
GARAGE ENTRIES AND EXITS BY HOUR—Typical Weekday
Terminal Access Study
Portland International Airport

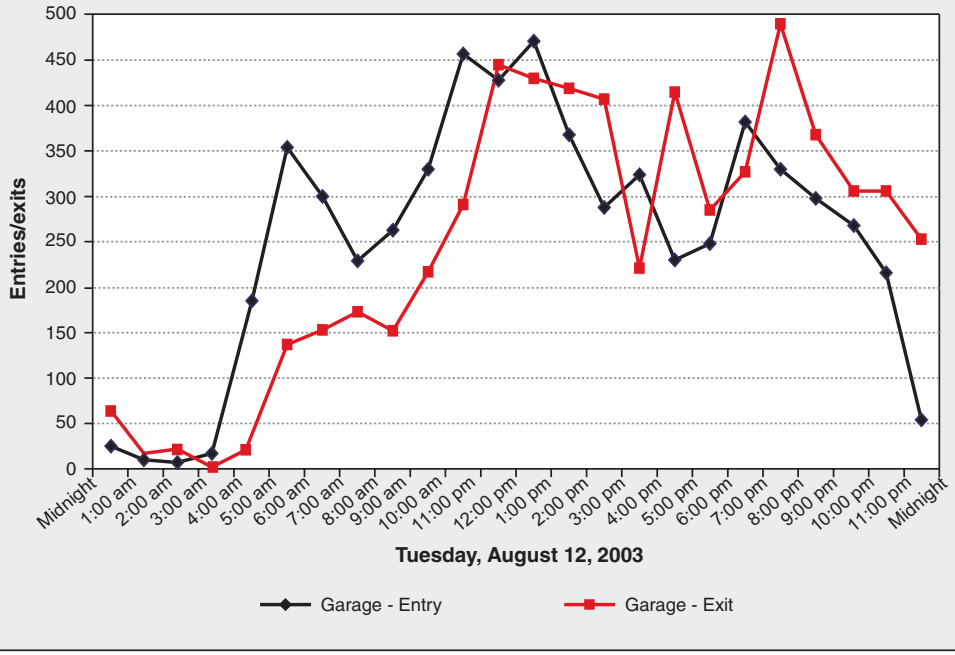


Figure 1-8
GARAGE ENTRIES AND EXITS BY HOUR—Typical Sunday
Terminal Access Study
Portland International Airport

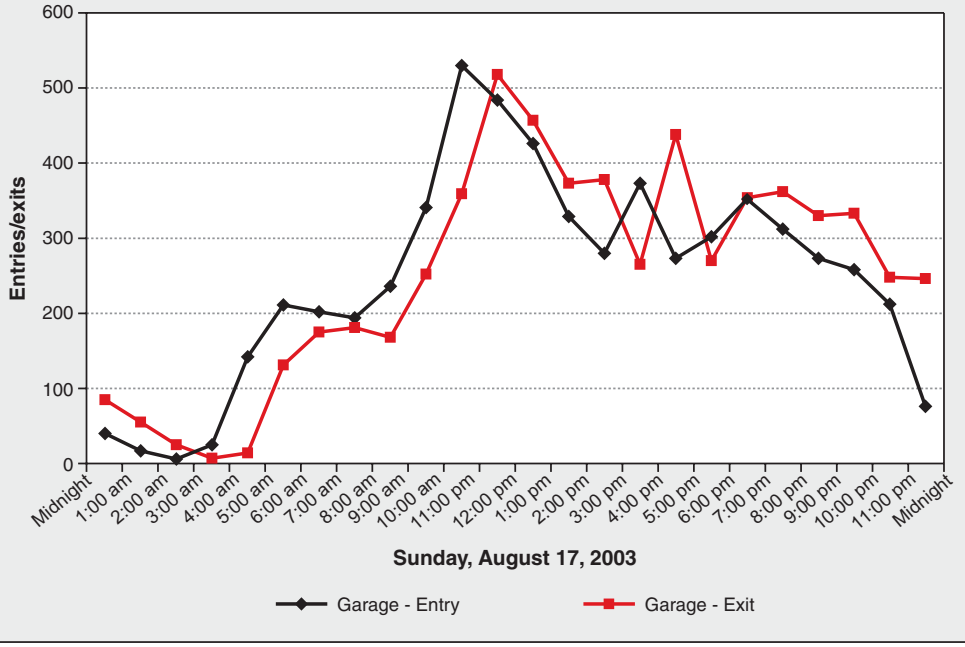
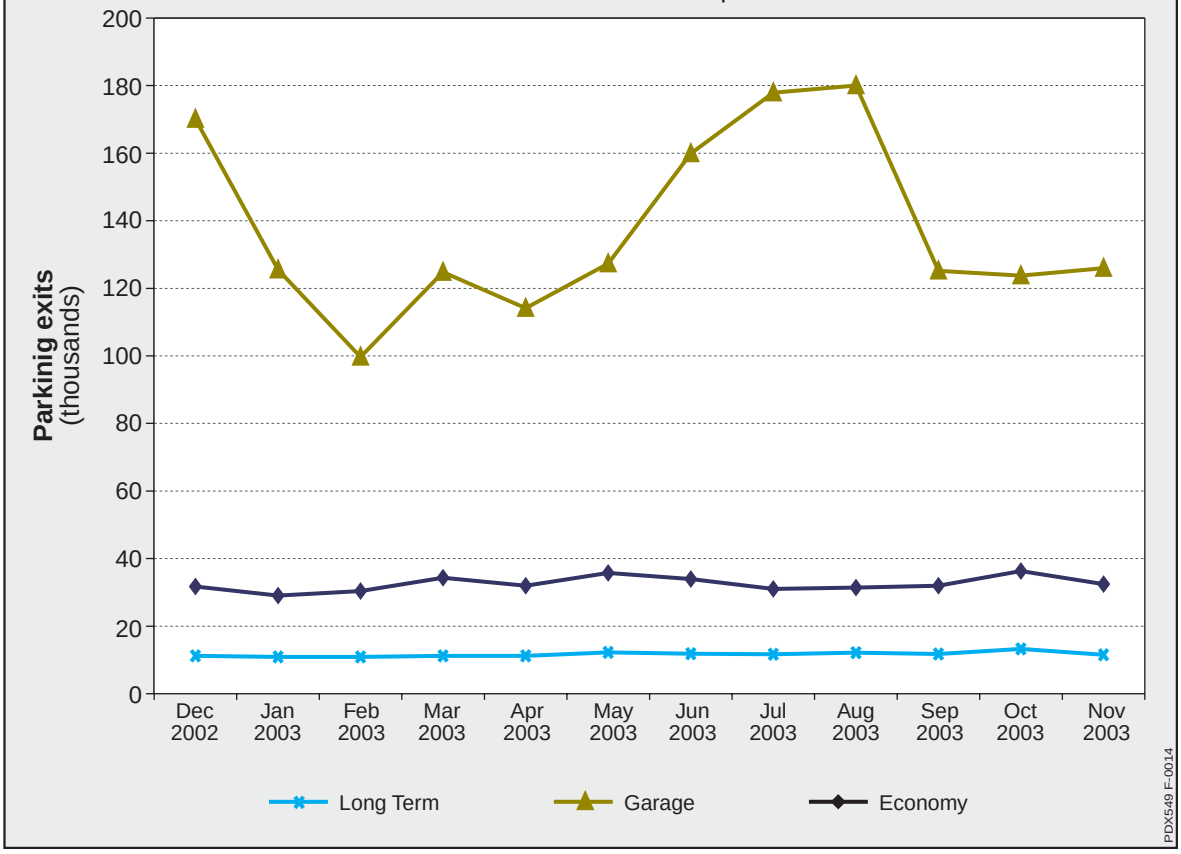


Figure 1-9 compares the parking exit activity by month for 2003, for the Garage, Long-term, and Economy parking lots. As shown, the peak months for exits in the garage were July and August. The Long-term and Economy lots had the highest level of transaction exit activity in October.

Figure 1-9
PARKING EXITS BY MONTH—ALL LOTS
Terminal Access Study
Portland International Airport



Parking Occupancy. Overnight and midday parking occupancy data were provided for 2003 and the available months of 2004 (through March). Occupancy data were reviewed to determine the space utilization in each lot and the variation of that utilization by month of year. Table 1-6 and Figure 1-10 summarize the occupancies for a representative busy day during each month, in each facility. Table 1-6 also shows month-to-month comparisons for the first 4 months of 2003 versus 2004. As shown, in 2003, the summer months were the busiest months for air passengers, but May, and October, as well as June represented the busiest months for parking. During these months, the garage was approximately 73% full, the Long-term lot was 85% full, and the Economy lot was 65% full. Higher utilization of the Economy lot occurred during the peak days of November and December.

PDX558

Table 1-6

MONTHLY PARKING OCCUPANCY FOR 2003-2004

Terminal Access Study
Portland International Airport

Month	Total passengers	Month as a percent of year	Garage		Long-term		Garage plus Long-term		Economy		Total	
			Occupied spaces	Occupied spaces per 1,000 passengers	Occupied spaces	Occupied spaces per 1,000 passengers	Occupied spaces	Occupied spaces per 1,000 passengers	Occupied spaces	Occupied spaces per 1,000 passengers	Occupied spaces	Occupied spaces per 1,000 passengers
2003												
January	850,418	6.9%	2,138	2.51	1,145	1.35	3,283	3.86	4,005	4.71	7,288	8.57
February	808,174	6.5	2,027	2.51	1,254	1.55	3,281	4.06	4,525	5.60	7,806	9.66
March	962,544	7.8	2,142	2.23	1,211	1.26	3,353	3.48	6,022	6.26	9,375	9.74
April	922,035	7.4	2,167	2.35	1,160	1.26	3,327	3.61	4,515	4.90	7,842	8.51
May	1,025,603	8.3	2,303	2.25	1,305	1.27	3,608	3.52	5,352	5.22	8,960	8.74
June	1,172,137	9.5	2,431	2.07	1,231	1.05	3,662	3.12	5,217	4.45	8,879	7.58
July	1,271,831	10.3	2,388	1.88	1,221	0.96	3,609	2.84	4,428	3.48	8,037	6.32
August	1,251,485	10.1	2,230	1.78	1,198	0.96	3,428	2.74	4,432	3.54	7,860	6.28
September	1,013,704	8.2	2,384	2.35	1,278	1.26	3,662	3.61	4,601	4.54	8,263	8.15
October	1,043,357	8.4	2,412	2.31	1,301	1.25	3,713	3.56	5,071	4.86	8,784	8.42
November	979,583	7.9	2,349	2.40	1,295	1.32	3,644	3.72	4,485	4.58 *(a)*	8,129	8.30
December	1,099,139	8.9	2,477	2.25	1,217	1.11	3,694	3.36	4,150	3.78 *(b)*	7,844	7.14
Total 2003	12,400,010	100.0%										
2004												
January	796,400		2,514	3.16	1,260	1.58	3,774	4.74	5,694	7.15	9,468	11.89
February	849,900		2,658	3.13	1,252	1.47	3,910	4.60	4,845	5.70	8,755	10.30
March	1,047,900		2,603	2.48	1,290	1.23	3,893	3.72	7,191	6.86	11,084	10.58
April	1,011,846		2,530	2.50	1,232	1.22	3,762	3.72	5,411	5.35	9,173	9.07
Change from 2003 to 2004												
January	(6.4%)		17.6%		10.0%		15.0%		42.2%		29.9%	
February	5.2		31.1		(0.2)		19.2		7.1		12.2	
March	8.9		21.5		6.5		16.1		19.4		18.2	
April	9.7		16.8		6.2		13.1		19.8		17.0	

Note: Occupied spaces are shown for a representative busy day (23rd busiest) in the month.

(a) Occupied spaces in Economy Lot for non-holiday period. Holiday period peak maximum is 6,444 spaces.
(b) Occupied spaces in Economy Lot for non-holiday period. Holiday period peak maximum is 7,590 spaces.

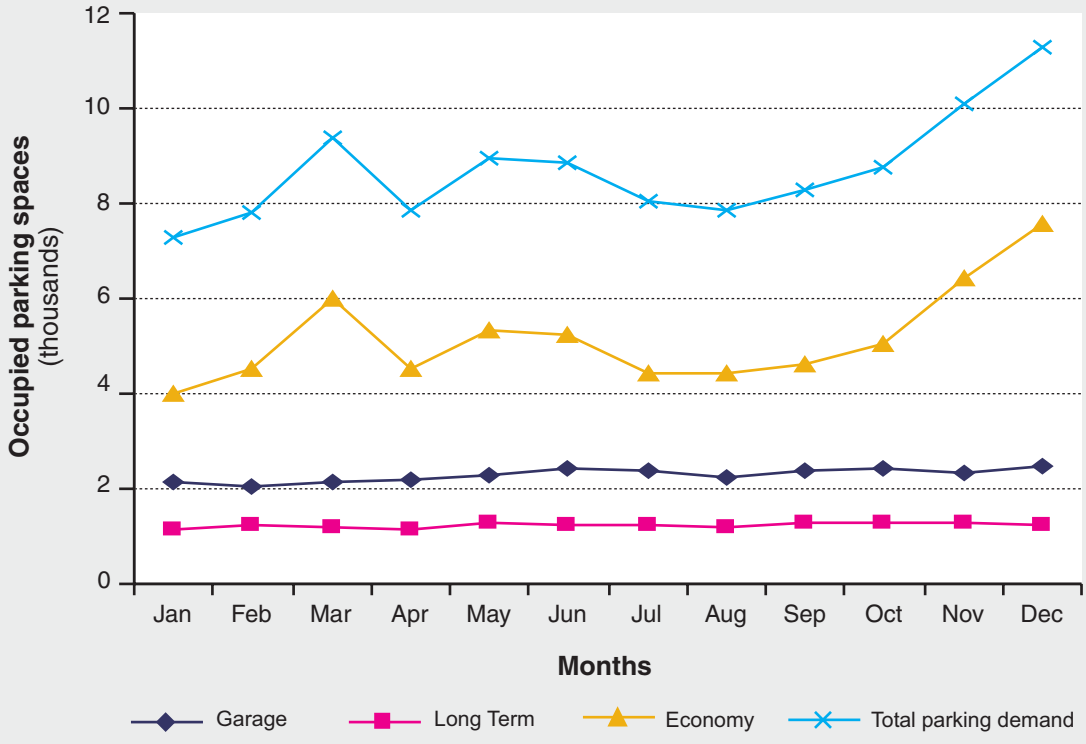
Source: Leigh Fisher Associates, May 2004, based on parking data provided by Port of Portland.

Figure 1-10

PUBLIC PARKING OCCUPANCY BY FACILITY—2003

Terminal Access Study

Portland International Airport



Transactions and Revenues. Monthly public parking transaction and revenue data for January 2003 through May 2004 are provided in Table 1-7. As shown, while transactions per passenger in all facilities have declined in 2004 compared with the same months in 2003, revenue per passenger has increased dramatically, especially in the Garage. This pattern reflects a trend toward longer durations, a pattern that is confirmed by the peak occupancy data summarized in Table 1-6 (peak occupancies in the parking facilities were significantly higher for January through April 2004 compared with the same months in 2003).

Employee Parking

Employee parking spaces (2,394 spaces) are provided in a surface lot located on Airport property in the Portland International Center (PIC) off Alderwood Drive. Shuttle bus service is provided to transport employees between the lot and the terminal building. Entry and exit data were provided for the employee lot for 2003. As shown on Figure 1-11, the entries peak (about 240 trips) around 4:00 a.m., while the exits peak (250 trips) between 2:00 and 3:00 p.m. and again with a more minor peak at 10:00 p.m., representing the shift changes.

Table 1-7

PUBLIC PARKING ACTIVITY, 2003 - 2004
Terminal Access Study
Portland International Airport

Month	Monthly passengers	Garage (3,341 spaces) Transactions	Garage Transactions per 1,000 passengers	Garage Revenue	Garage Revenue per passenger	Garage Revenue per space	Long term (1,446 spaces) Transactions	Long term Transactions per 1,000 passengers	Long term Revenue	Long term Revenue per passenger	Long term Revenue per space	Economy (7,757 spaces) Transactions	Economy Transactions per 1,000 passengers	Economy Revenue	Economy Revenue per passenger	Economy Revenue per space
2003																
January	850,418	129,252	151.99	$ 1,025,097	$1.21	$ 306.82	13,623	16.02	$ 335,537	$0.39	$ 232.04	29,989	35.26	$ 985,697	$1.16	$ 127.07
February	808,174	103,955	128.63	930,217	1.15	278.42	13,504	16.71	350,168	0.43	242.16	31,469	38.94	969,017	1.20	124.92
March	962,544	129,592	134.63	1,024,858	1.06	306.75	14,014	14.56	367,997	0.38	254.49	35,606	36.99	1,171,197	1.22	150.99
April	922,035	118,715	128.75	976,419	1.06	292.25	13,121	14.23	348,380	0.38	240.93	32,950	35.74	1,037,122	1.12	133.70
May	1,025,603	131,901	128.61	1,085,884	1.06	325.02	14,295	13.94	397,757	0.39	275.07	36,944	36.02	1,162,316	1.13	149.84
June	1,172,137	164,885	140.67	1,188,715	1.01	355.80	13,680	11.67	374,933	0.32	259.29	35,079	29.93	1,118,734	0.95	144.22
July	1,271,831	182,665	143.62	1,216,323	0.96	364.06	13,055	10.26	356,989	0.28	246.88	32,062	25.21	1,046,783	0.82	134.95
August	1,251,485	185,186	147.97	1,225,092	0.98	366.68	13,359	10.67	376,589	0.30	260.43	32,592	26.04	1,059,794	0.85	136.62
September	1,013,704	129,758	128.00	1,041,125	1.03	311.62	13,050	12.87	374,356	0.37	258.89	33,151	32.70	1,029,878	1.02	132.77
October	1,043,357	128,762	123.41	1,170,580	1.12	350.37	14,709	14.10	428,862	0.41	296.59	37,489	35.93	1,160,979	1.11	149.67
November	979,583	130,735	133.48	1,081,780	1.10	323.79	12,901	13.17	387,974	0.40	268.31	33,671	34.38	1,069,610	1.09	137.89
December	1,099,139	171,662	156.74	1,209,408	1.10	361.99	11,883	10.85	338,328	0.31	233.98	31,450	28.72	1,072,141	0.98	138.22
Total	12,400,010	1,707,068		$13,175,497		$3,943.58	161,194		$4,437,869		$3,069.07	402,452		$12,883,268		$1,660.86
2004																
January	796,412	121,725	152.84	$1,078,166	$1.35	$322.71	11,023	13.84	$ 327,079	$0.41	$ 226.20	26,629	33.44	$ 907,009	$1.14	$116.93
February	849,923	108,001	127.07	1,093,645	1.29	327.34	12,225	14.38	372,314	0.44	257.48	32,854	38.66	1,030,333	1.21	132.83
March	1,047,860	139,182	132.82	1,226,312	1.17	367.05	12,971	12.38	401,785	0.38	277.86	36,977	35.29	1,247,877	1.19	160.87
April	1,011,846	128,117	126.62	1,266,273	1.25	379.01	12,965	12.81	416,408	0.41	287.97	35,940	35.52	1,138,713	1.13	146.80
May		135,219		1,349,553		403.94	13,145		449,866		311.11	35,940		1,138,713		146.80
Percent change, 2003 to 2004																
January	(6.35%) *(a)*	(5.82%)	0.56%	5.18%	12.31%	5.18%	(19.09%)	(13.60%)	(2.52%)	4.09%	(2.52%)	(11.20%)	(5.18%)	(7.98%)	(1.74%)	(7.98%)
February	5.17 *(b)*	3.89	(1.21)	17.57	11.79	17.57	(9.47)	(13.92)	6.32	1.10	6.32	4.40	(0.73)	6.33)	1.10	6.33
March	8.86	7.40	(1.34)	19.66	9.91	19.66	(7.44)	(14.98)	9.18	0.29	9.18	3.85	(4.60)	6.55)	(2.13)	6.55
April	9.74	7.92	(1.66)	29.69	18.17	29.69	(1.19)	(9.96)	19.53	8.92	19.53	9.07	(0.61)	9.80)	0.05	9.80
May		2.52		24.28		24.28	(8.04)		13.10		13.10	(2.72)		(2.03)		(2.03)

(a) Airport was closed for 4 days due to ice.
(b) 2004 is a leap year.

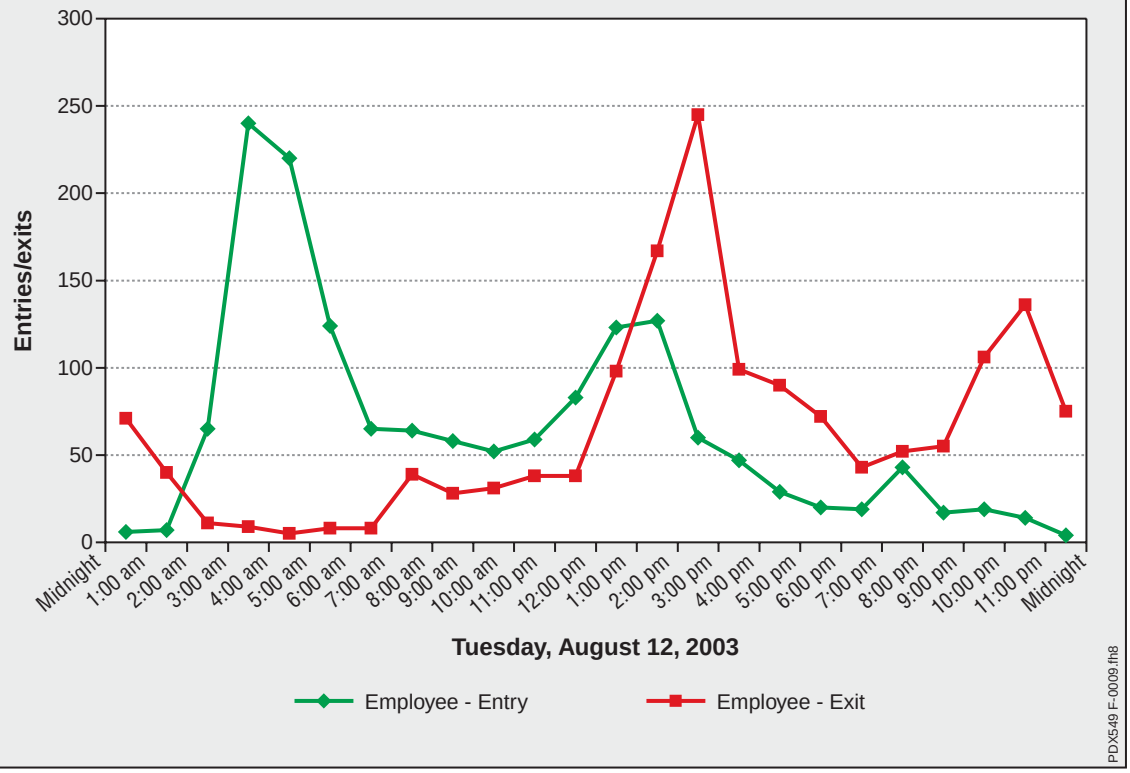
Source: Port of Portland

Figure 1-11

EMPLOYEE PARKING ENTRIES AND EXITS BY HOUR—TYPICAL WEEKDAY

Terminal Access Study

Portland International Airport



Peak occupancy data for the employee parking facility is available for January through April 2004. For each available month, peak occupancy was based on a typical busy day. As shown in Table 1-8, March was the busiest month in early 2004 with a peak occupancy of 1,526.

Table 1-8

EMPLOYEE PARKING LOT OCCUPANCY, 2004

Terminal Access Study

Portland International Airport

Month	Occupied spaces	Percent occupancy
January	1,429	59.7%
February	1,453	60.7
March	1,526	63.7
April	1,523	63.6
Capacity	2,394	

Source: Port of Portland, May 2004.

ROADWAYS AND TERMINAL CURBSIDE

The terminal area is served by Airport Way, an arterial street that provides access to the Interstate 205 (I-205) and the regional roadway system. A grade-separated interchange is provided at Cascade/Mt. Hood Avenue and Airport Way. The intersection with 82nd Street is currently signalized and the TriMet MAX tracks cross 82nd Avenue at-grade, just south of Airport Way. There are two through lanes in each direction on Airport Way between 82nd Avenue and the terminal curbsides.

Terminal Curbside

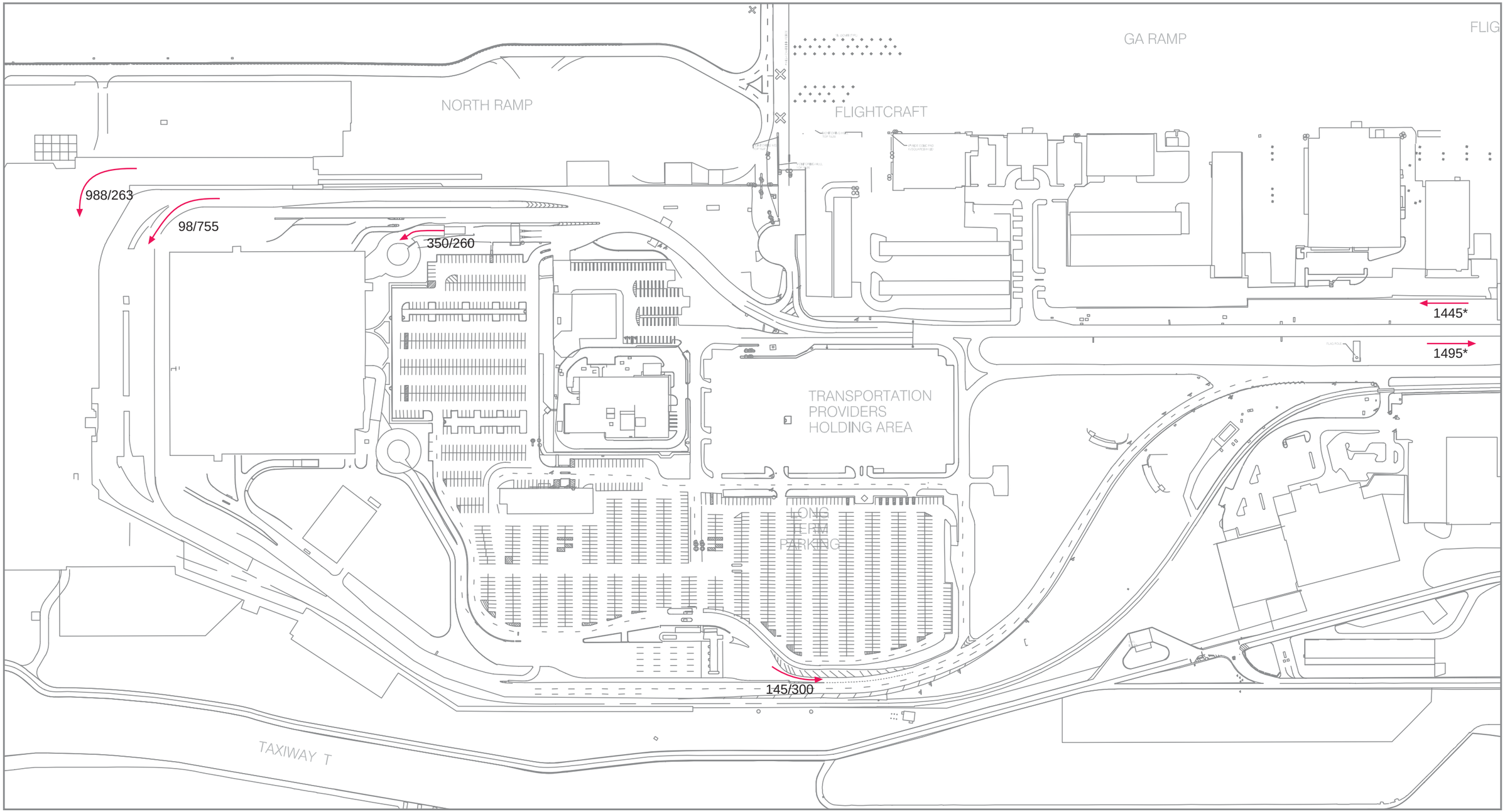
The roadway approaching the terminal building splits into an upper (departures) and lower (arrivals) level curbside. Two lanes provide access to the upper level curbside and two lanes provide access to the lower level curbside. However, as lane-by-lane traffic counts and field observations indicate, the inside lane serving each level is heavily traveled while the second lane is lightly traveled (due to driver preference to be adjacent to the curbside loading lanes as soon as possible). Thus, for the approaches to each level, heavy congestion frequently occurs in the first lane, which reduces the effective capacity of each roadway to that of a single lane.

The upper level roadway provides four curbside lanes on the inner roadway and four lanes on the outer roadway. These curbside lanes are used by both private and commercial vehicles, but the outer roadway is lightly used compared to the inner roadway. On the inner curb, the lane closest to the terminal building is striped and signed for passenger drop off, but vehicles also use the second lane for passenger loading. The third lane serves as a maneuver lane, and the fourth lane is marked for "thru traffic only." On the outer curb, the two lanes closest to the center are striped and signed for passenger loading.

The lower level roadway provides four lanes closest to the terminal building for private vehicle passenger pickup. The two inside lanes are striped and signed for passenger loading.

Traffic Volumes

Historical traffic count data were provided from 24-hour machine counts taken by the Port as part of their ongoing traffic count program and other sources for 1994-2003. Counts were taken for all years during the months of April and August, typically on Airport Way, 82nd Avenue, and the upper and lower level terminal roadways. More comprehensive data were collected in November of 2001, covering most driveways west of 82nd Avenue, parking entrances, and the commercial curb. Peak hour traffic volumes are shown on Figure 1-12.



XX/XX = AM/PM

XX* = Mid-day peak volumes (11am-Noon)

Notes: At curbside, AM peak = 5am-6am, PM peak = 10pm-11pm

Source: Leigh Fisher Associates, May 2004, based on traffic counts provided by the Port for August, 2003.

N

150 0 150 300

Graphic Scale in Feet

Figure 1-12

PEAK HOUR TRAFFIC VOLUME

Terminal Access Study
Portland International Airport

March 2005

LEIGH FISHER ASSOCIATES

Table 1-9 summarizes the 2003 traffic count data at the upper and lower terminal curbside and Airport Way for August 2003.

Table 1-9

TRAFFIC VOLUME SUMMARY AUGUST 2003
Terminal Access Study
Portland International Airport

	Average daily traffic	A.M. peak *(a)*	Midday peak *(b)*	P.M. peak *(c)*
Airport Way	21,490 WB 21,420 EB	1,337 WB 875 EB	1,445 WB 1,495 EB	741 WB 1,031 EB
Upper Level Terminal	8,225	998	614	263
Lower Level Terminal	7,565	98	678	755

(a) A.M. Peak from 5 a.m. to 6 a.m.
(b) Midday Peak from 11 a.m. to 12 p.m. (noon)
(c) P.M. Peak from 10 p.m. to 11 p.m.

Source: Leigh Fisher Associates using August 2003 data provided by the Port of Portland.

Figures 1-13 and 1-14 compare the lower and upper level traffic volumes for a typical August weekday and weekend, respectively.

Figure 1-13

LOWER VS. UPPER TERMINAL RAMPS: HOURLY TRAFFIC VOLUMES
TUESDAY AUGUST 12, 2003
Terminal Access Study
Portland International Airport

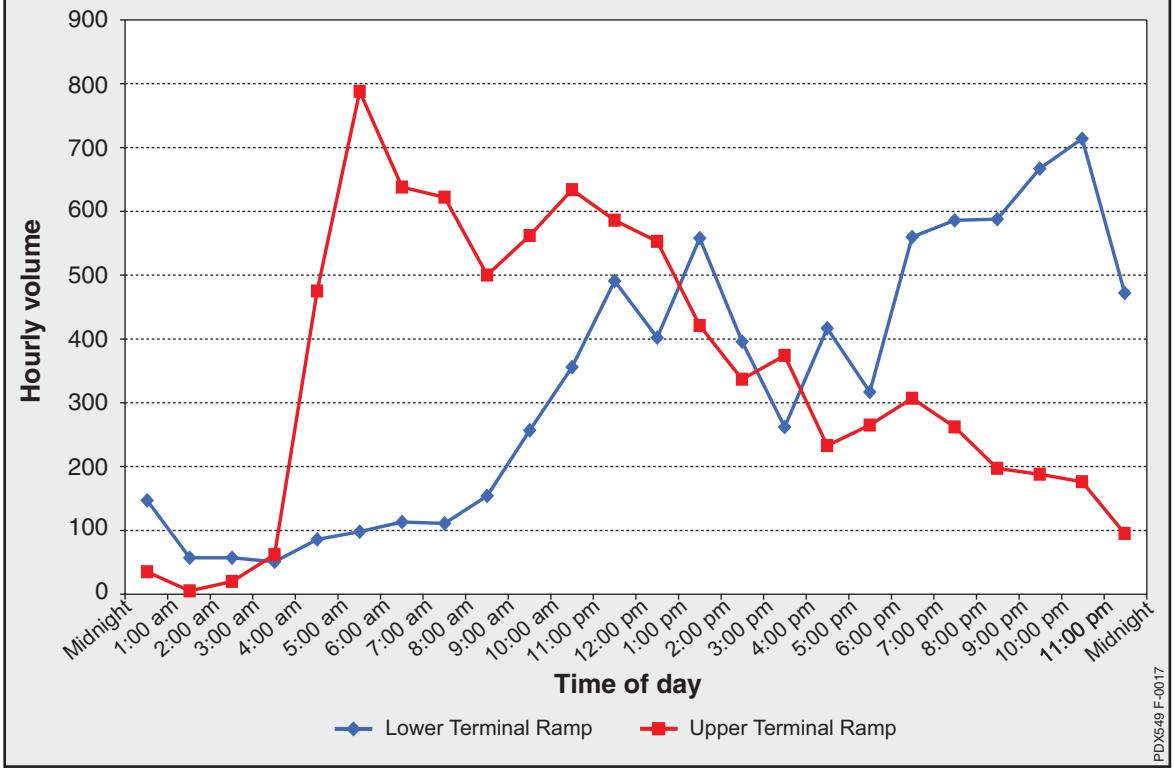
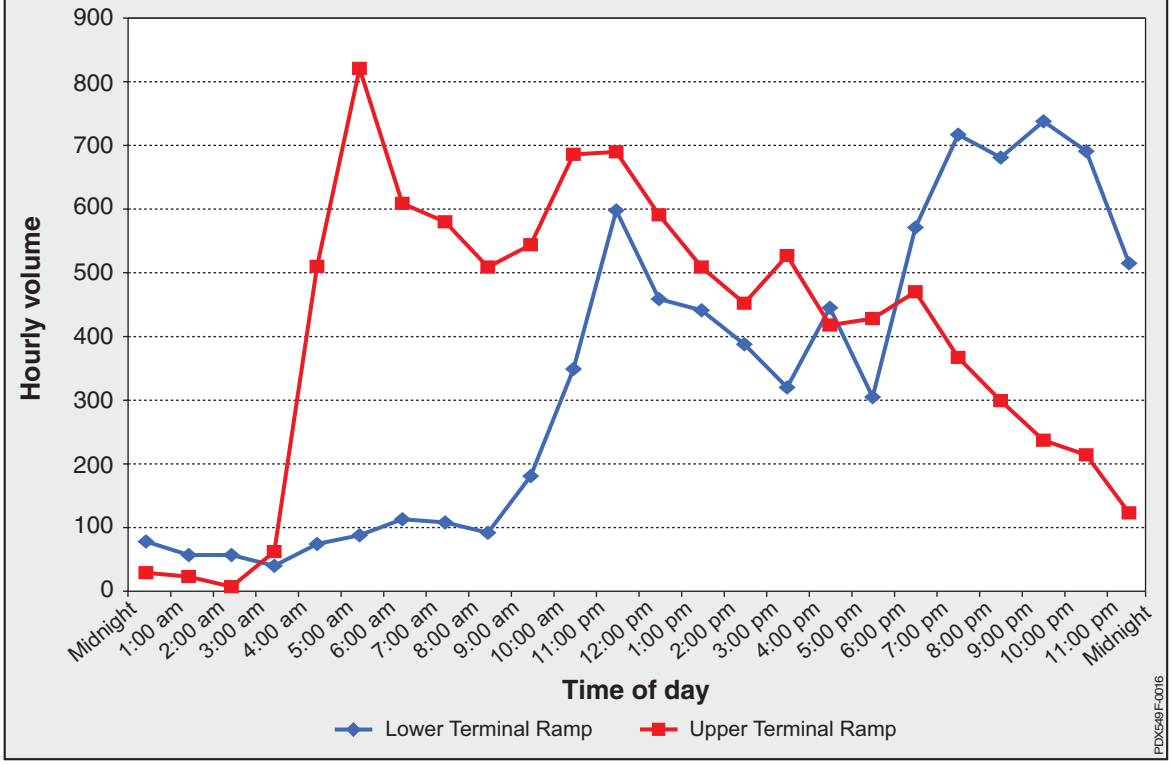


Figure 1-14
LOWER VS. UPPER TERMINAL RAMPS: HOURLY TRAFFIC VOLUMES
SUNDAY AUGUST 17, 2003
Terminal Access Study
Portland International Airport

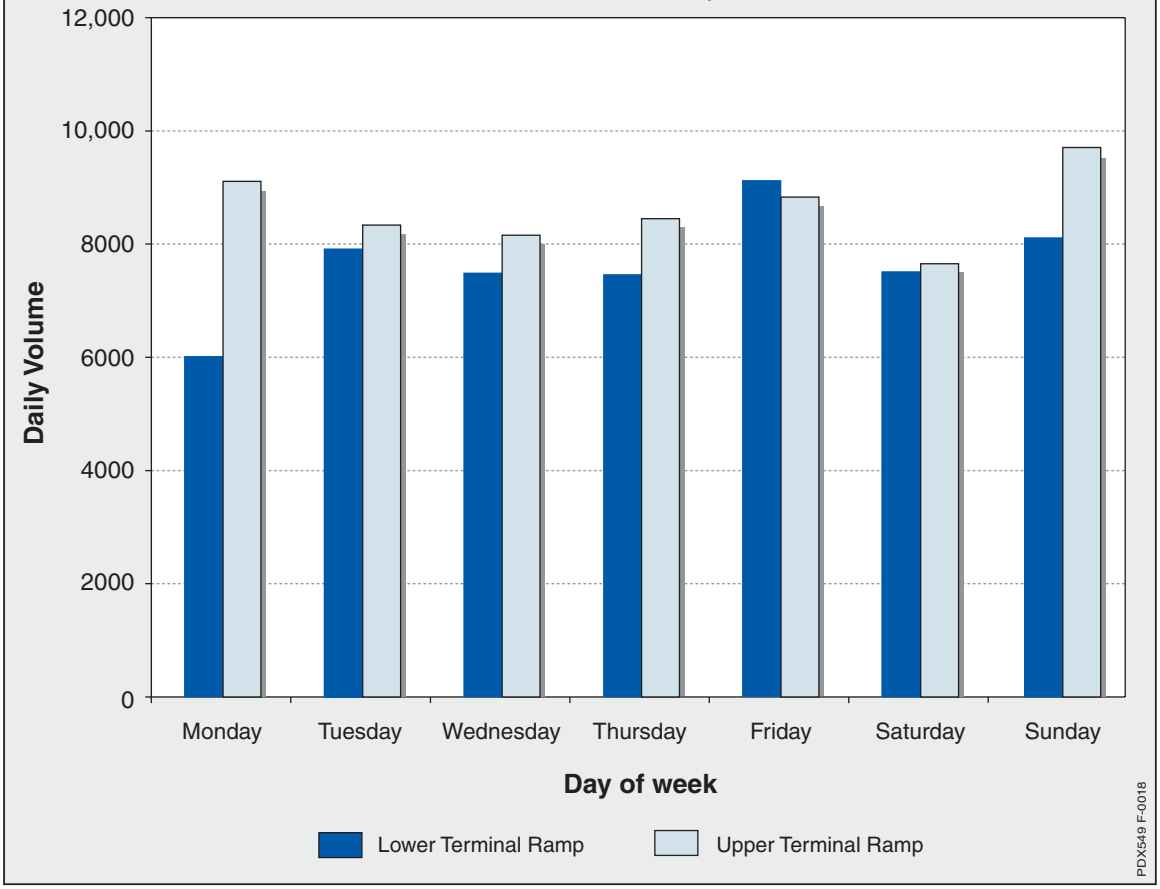


As shown, the upper level ramp (the departures roadway) peaks between 4:00 and 5:00 a.m., about one hour before the peak airline departures discussed previously. Similarly, the lower level ramp, (the arrivals roadway) is busy during the evening between 5:00 and 11 p.m., with the heaviest peak between 9:00 and 11:00 p.m. Figure 1-15 shows the upper and lower level roadway daily traffic volumes for a typical week in August, 2003. As shown, the upper level daily traffic volume counts are slightly greater than those on the lower level most days of the week. Friday represented the busiest day on the upper and lower level roadways.

Figure 1-15

LOWER AND UPPER TERMINAL ROADWAY DAILY VOLUMES–AUGUST 2003

Terminal Access Study
Portland International Airport

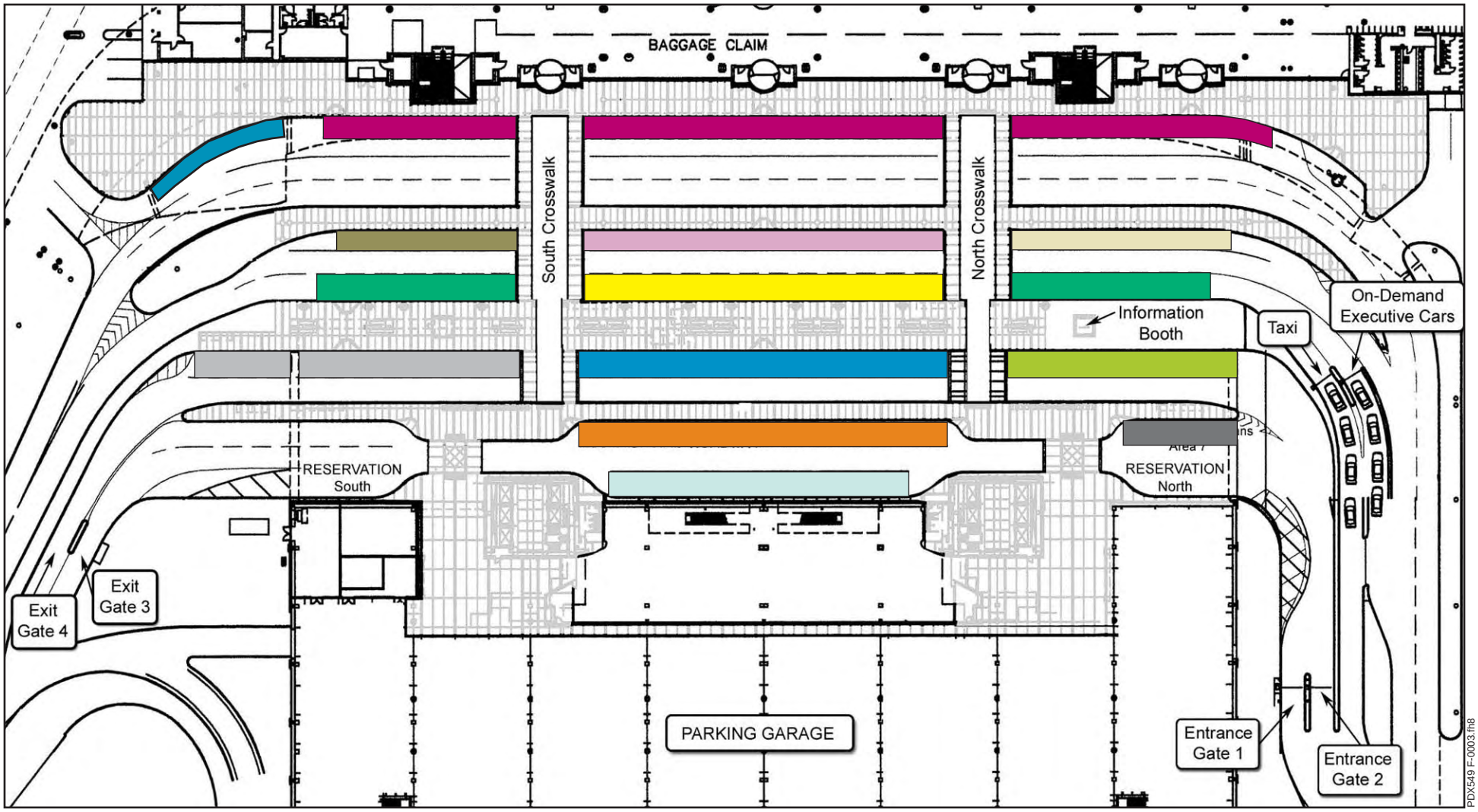


COMMERCIAL ROADWAY

A dedicated, access-controlled roadway and curbside are provided for commercial vehicles on the lower level between the arrivals roadway and the parking garage. The curbside is divided into three curbs, with wide islands provided for passenger loading and waiting. The curbside layout and allocation is shown on Figure 1-16.

Traffic Volumes

Monthly activity data for the commercial roadway were provided by vehicle type: courtesy vehicles (hotel/other); on-demand executive cars; door-to-door shuttles; off-airport parking/rental cars; reservation only; and taxi. Activity reported is based on the number of times that type of vehicle accesses the commercial curbside.



LEGEND

- Private vehicle pick-up
- Employee parking shuttle
- Economy parking shuttles
- Long-term parking shuttles
- On-demand executive town cars
- Taxicabs
- Charters
- Hotel shuttles
- Long haul shuttles
- Door to Door shuttles
- Off-Airport rental car shuttles
- Reservations
- Paratransit

Figure 1-16

COMMERCIAL CURBSIDE ALLOCATION

Terminal Access Study
Portland International Airport

March 2005

LEIGH FISHER ASSOCIATES

Table 1-10 summarizes the monthly number of trips in August and October, 2003 (peak months of activity). Also shown is the amount of curbside allocated to each class of vehicle.

Table 1-10

SUMMARY OF COMMERCIAL VEHICLE ACTIVITY AND CURB ALLOCATION
Terminal Access Study
Portland International Airport

Vehicle type	August 2003	October 2003	Allocated curbside length (feet)
Courtesy vehicles (hotel/other)	15,484	14,913	180
On-demand executive car	791	868	220
Door-to-door shuttles	3,571	3,597	180
Off-Airport parking/rental cars	8,286	8,363	40
Reservation only	6,140	6,484	80
Taxi	17,210	19,842	180
Total	54,482	54,067	880

Note: Additional curbside length (380 feet) provided for Airport-operated parking shuttles.

Source: Leigh Fisher Associates, May 2004, based on information provided by the Port of Portland.

Commercial Vehicle Rules and Regulations

Key rules and regulations governing commercial vehicles are summarized below:

Call-Up System. The Commercial Roadway currently is on a Call-Up System. This means that no provider is to be on the roadway unless called upon by Airport Ground Transportation Staff or their customer, or they are on a direct schedule (i.e., Scheduled Service Shuttles). Notification to the provider is done via telephone, readerboard messaging, or direct customer calls.

Since the Commercial Roadway is gated, no vehicle is allowed onto the roadway unless it is authorized by the Ground Transportation Department or its representatives. No commercial transportation provider/driver may leave their vehicle unattended for any length of time. Any provider that does is subject to immediate tow, and citation/fines.

Enforcement. Enforcement is provided by the Airport's Commercial Roadway Inspector, Ground Transportation Staff, and Port of Portland Police on the Commercial Roadway. Violations on the Public Roadway are typically handled by Parking Control Representatives, Port of Portland Police in consultation with the Commercial Roadway Inspector, and/or other Ground Transportation staff.

Customer Service Agent Responsibilities. Transportation Assistants on the Commercial Roadway assist passengers with their questions and transportation needs, and assist providers/drivers in gaining access to their customers. They also assist the Ground Transportation Staff by providing information on roadway performance. Direct supervision is handled by the Ground Transportation Department.

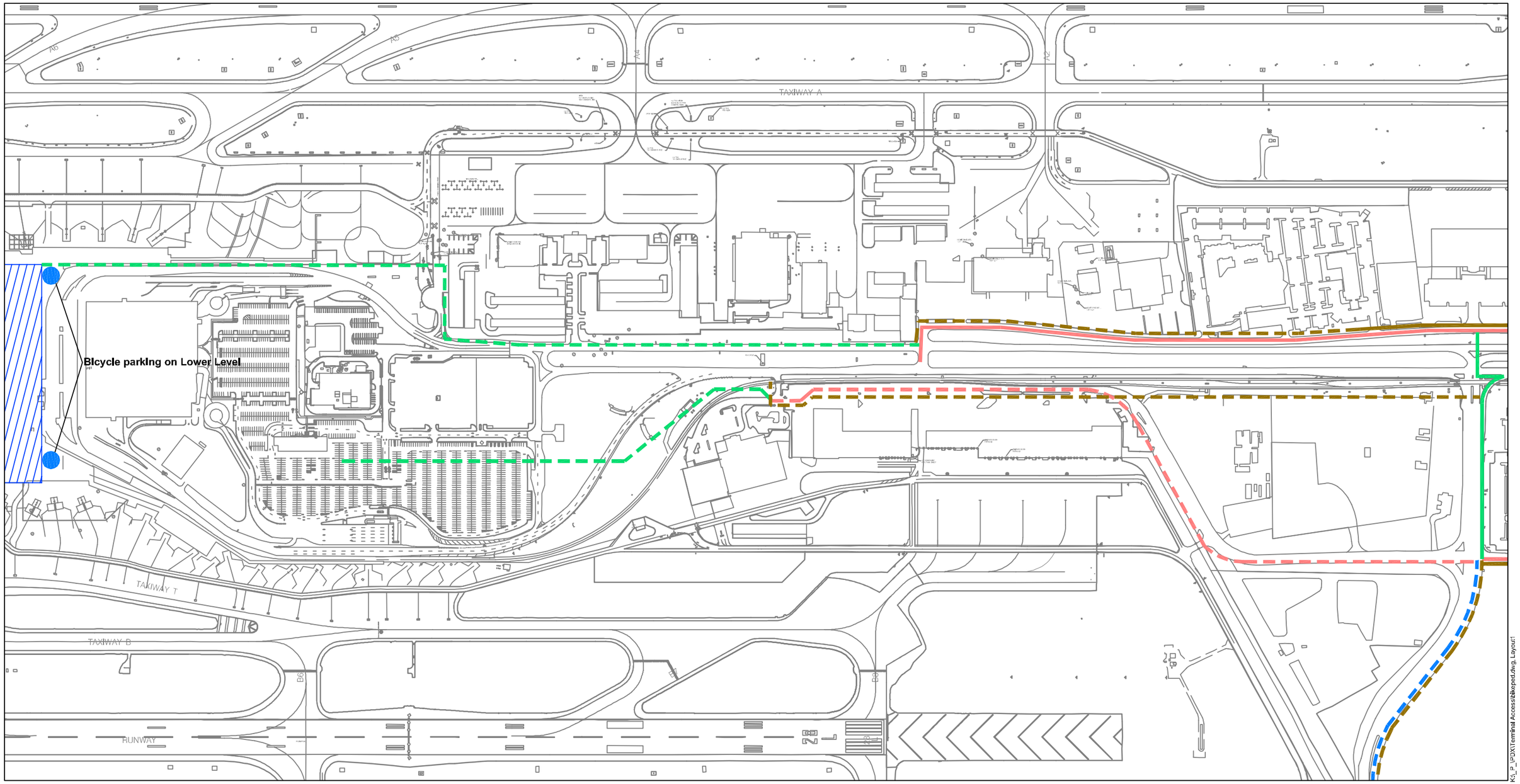
PEDESTRIANS/BICYCLES

The Airport has a bicycle and pedestrian plan that addresses facility and circulation needs on the landside of the Airport property. Existing and planned bicycle and pedestrian facilities, as proposed by the plan, are shown on Figure 1-17. As shown, identified access routes do not extend into the terminal area, though bicycle parking is provided at the terminal. Pedestrian and bicycle connectivity to the terminal area will be established as terminal-area projects are planned and developed.

Additional pedestrian facilities are provided in the terminal area to provide access to and from the parking garage. Circulation between the terminal and the garage is provided via two skybridges, two tunnels, and two crosswalks across the deplaning roadway. Additional crosswalks provide access between the outer curb of the enplaning roadway and the terminal. Figure 1-18 shows a daily profile (for July 2003) of combined pedestrian volumes crossing between the terminal and the garage using the skybridges, tunnels, and crosswalks. The July 2003 volumes are lower than those observed in August 1993.

RENTAL CAR

Currently, five companies (Avis, Budget, Dollar, Enterprise, and Hertz) lease space within the parking garage for customer facilities (ready/return parking spaces and customer service areas) and use the consolidated quick turnaround facility (QTA). Two other companies (Thrifty and Vanguard, which operates Alamo and National) provide customer service kiosks near the customer service area and shuttle patrons to off-Airport locations. Table 1-11 summarizes FY 2003 annual revenues and estimated market share for the eight major rental car operators at the Airport.



LEGEND

- Shared facility (bike) - existing
- Shared facility (bike) - planned
- Bike lane - planned
- Sidewalk - existing
- Sidewalk - planned
- Multi-use path (bike and pedestrian) - existing
- Multi-use path (bike and pedestrian) - planned

N

200 0 200 400

Graphic Scale in Feet

Figure 1-17

PEDESTRIAN / BICYCLE PLAN

Terminal Access Study
Portland International Airport
March 2005

LEIGH FISHER ASSOCIATES

Figure 1-18

PEDESTRIAN PROFILE IN TERMINAL AREA—July 2003

Terminal Access Study
Portland International Airport

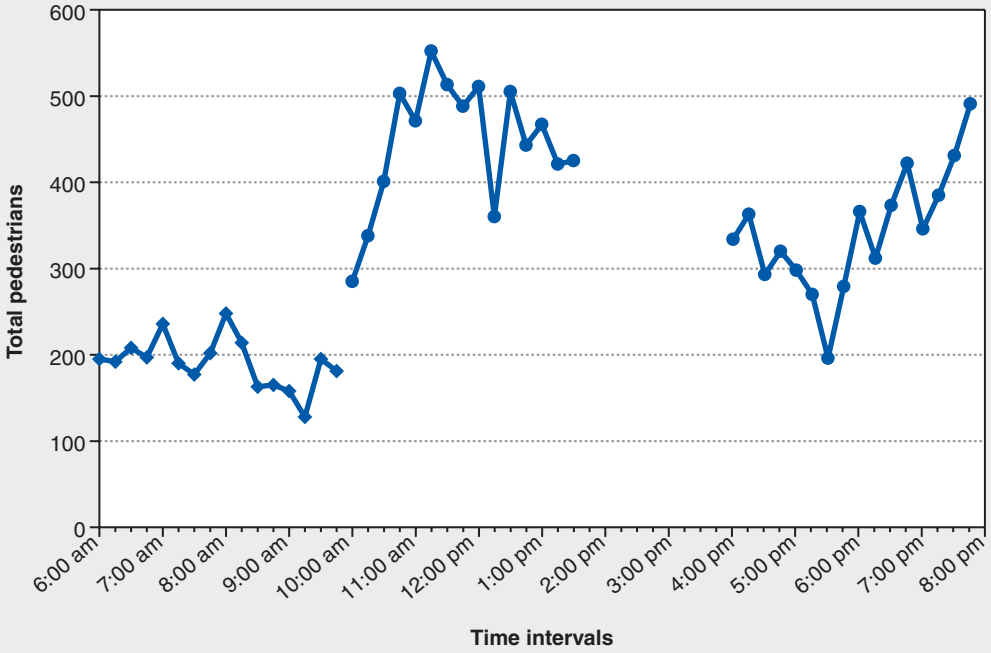


Table 1-11

RENTAL CAR REVENUE—2003

Terminal Access Study
Portland International Airport

Company	FY 2003 annual revenue	Estimated market share
Avis	$22,117,071	23.5%
Budget	9,872,622	10.5
Dollar	9,687,059	10.3
Enterprise	5,573,706	5.9
Hertz	25,615,427	27.2
National	9,696,998	10.3
Alamo	5,378,447	5.7
Thrifty	6,193,602	6.6
Others	negligible	negligible
Total	$94,134,932	100.0%

Source: Port of Portland.

Ready/Return Area. The ready/return area, located on the first and second floors of the parking garage, has an area of 283,520 square feet (981 parking spaces) divided among the five on-Airport companies, as follows:

Company	Ready/ return spaces
Avis	266
Budget	124
Dollar	173
Enterprise	134
Hertz	284
Total	981

Source: Port of Portland.

Customer Service Area. The consolidated customer service area, located at the west edge of the first floor of the parking garage, provides 12,826 square feet for counters, offices, and circulation. It is assumed that the five on-Airport companies divide this space up similarly to the market share captured by each.

Quick Turnaround Facility (QTA). The QTA, located immediately south of the parking garage, provides 104,387 square feet for fuel nozzles, car washes, and associated stacking and circulation space. The QTA provides 26 fuel nozzles and 5 car washes.

TRANSIT FACILITIES

The Airport is served by the TriMet light rail transit (LRT) system, MAX, via an extension of the Red line, which ties into the regional system at Gateway Transit Center along I-205. The transit line enters the airport property as a double-track alignment. Northwest of 82nd Avenue, the system transitions to a single track to enter the terminal area. The single-track portion of the system is considered a temporary configuration, and was built due to ongoing Airport planning efforts and the limited space available during the time of construction (1999 to 2001).

The existing alignment follows a circuitous route to the terminal. Because of the tight curvature of the track, the speed is limited to 30 mph and to 20 mph close to the terminal station. The Airport is served by one station located outside the south end of the baggage claim area. The station is a center platform configuration with a second track.

A signal and communication room was constructed as part of the Terminal Expansion South project. A manhole was constructed north of the station to serve the future double-track alignment.

Transit Service

TriMet's LRT system, MAX, provides the only public transit service to the Airport. The Airport is the northern terminus on for MAX Red line, which travels southward to the Gateway area and westward in the Interstate 84 (I-84) corridor before crossing the Willamette River, through the Central City, and to its western/southern terminus in Beaverton.

The MAX station is located near the baggage claim area on the lower level of the Airport. It is accessible to people with mobility devices. There are no bike lockers at the Airport station; however, secure bicycle parking is available.

Currently, there are no TriMet or C-Tran bus lines directly serving the Airport. TriMet bus service is provided by connecting to the MAX at Gateway Station or any of the MAX LRT stops near bus stops, such as at Pioneer Square on the transit mall in downtown Portland. C-Tran service is provided by connections at the Parkrose/Sumner Transit Center.

Operations

MAX's Red line operates with approximately 15-minute headways in either direction between the hours of 5:00 a.m. and 11:30 p.m. every day of the week. With four trains arriving and four departing each hour, approximately 75 round-trip trains serve the Airport each day.

The closest transit hub to the Airport is the Parkrose/Sumner Transit Center, located at the intersection of NE Sandy Boulevard and 95th Avenue. The MAX Red line is just across the "Fish/Bird" bridge in the I-205 median. Six bus lines serve this facility, including 12-Sandy Blvd., 15-Belmont, 71-60th Ave./122nd Ave., 86-Alderwood, 87-Airport Way/181st Ave., and C-Tran's 165-Parkrose Express. The transit center is accessible to persons with mobility devices and provides eight bike lockers. There also is a park and ride facility (24-hour parking limit).

Although the closest Transit Center to the Airport is Parkrose/Sumner, the Gateway Transit Center provides additional connection options. The Gateway Transit Center is located at the intersection of NE 99th Avenue and Pacific Street. The MAX Red line serves this facility along with the MAX Blue line, which travels between Gresham and Hillsboro, and six bus lines. The bus lines include 19-Glisan, 22-Parkrose, 23-San Rafael, 25-Glisan/Rockwood, 27-Market/Main, and 33-Fremont. The transit center is accessible to persons with mobility devices and includes bicycle racks for two bicycles and four bike lockers. There also is a park and ride facility.

In the future, the Rose Quarter Transit Center located at the intersection of N. Holladay and Wheeler will provide a connection to the new MAX yellow line (service north to the Expo Center).

Transit Ridership

The MAX Red line serving the Airport opened in September 2001. Ridership information has been collected for the MAX Red line since December 2001. In the first two years of operation, the average, monthly ridership is approximately 68,000, ranging between 54,500 and 84,000.

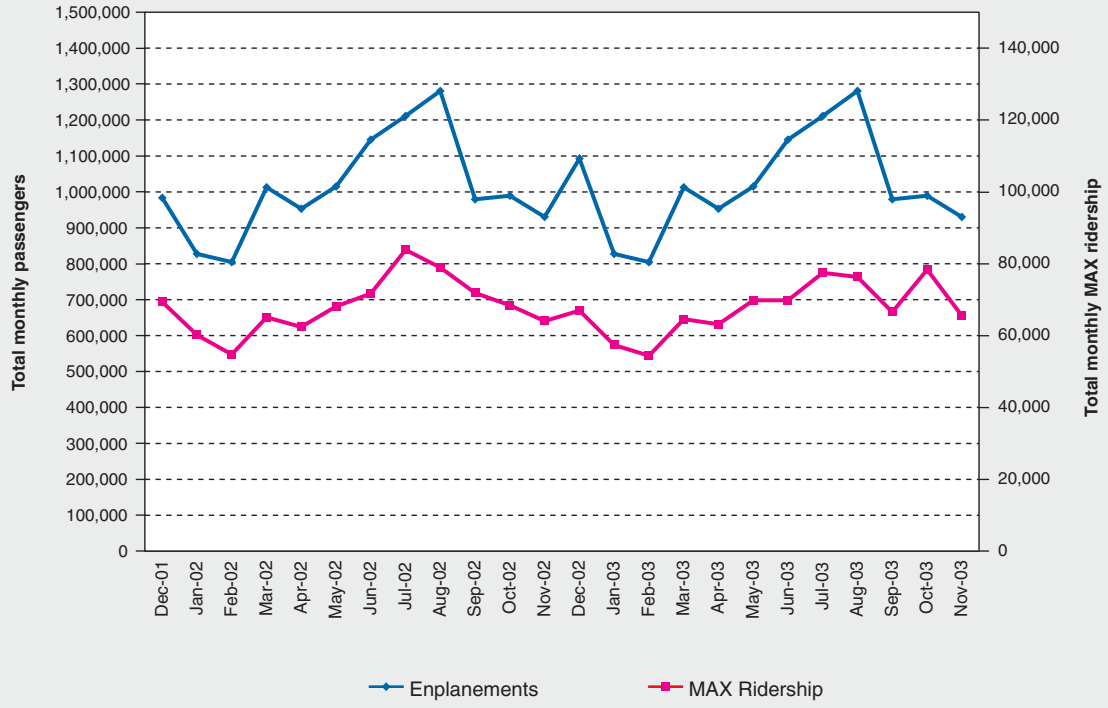
Although some of the Airport employees commute on MAX, the ridership correlates well with the average monthly passengers for the same two-year period. Monthly passengers averaged 1,015,000 between December 2001 and November 2003, ranging between 805,000 and 1,280,000. As shown on Figure 1-19, ridership parallels the passenger patterns during the peak season (July and August) and off-peak season (January through March).

Figure 1-19

HISTORICAL TOTAL PASSENGER AND MAX RIDERSHIP PATTERNS

Terminal Access Study

Portland International Airport



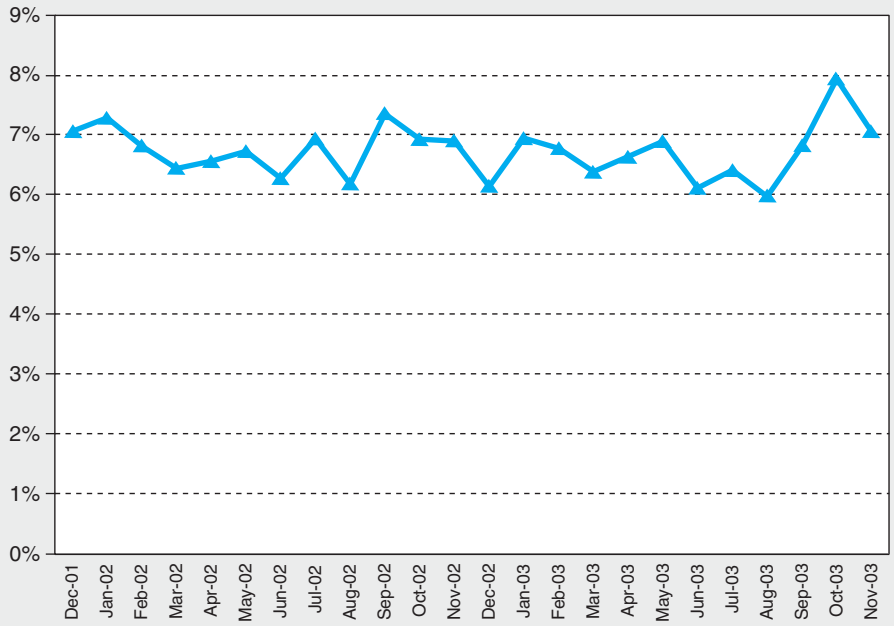
The ratio of MAX ridership to passengers averages 6.7%, ranging from 6.0% to 7.5% over the 2-year period, as shown on Figure 1-20.

Figure 1-20

HISTORICAL RATIO OF MAX RIDERSHIP TO TOTAL PASSENGERS

Terminal Access Study

Portland International Airport



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Chapter 2

SITE CONSTRAINTS

INTRODUCTION

The site constraints that might affect development of future access and parking facilities at Portland International Airport are identified and described in this chapter. These constraints include physical and operational conditions, some of which are the results of recent changes, while others are the same as those identified in the *1994 Terminal Access Study.*

Two major areas of constraint were beyond the scope of work for this study. First, the existing terminal area contains a broad range of buried utilities that cross the site. It is assumed that in most cases, as elements of terminal area expansion are constructed, utilities will be relocated as appropriate. It is acknowledged that in some cases, it may be necessary to adjust the general location of some of the elements of this plan to avoid utility impacts. Secondly, this study does not attempt to predict or consider future airport security requirements that could have a substantial impact on the layout of the terminal area. An example of a potential regulation that could have a serious impact but was not included in this study is the prohibition of all large vehicles in the terminal area.

TERMINAL EXPANSION EAST PLAN

The Terminal Expansion East (TEE) is included in the Phase 1 Decentralization Master Plan Alternative as the final build out of the existing passenger terminal complex prior to introducing a new decentralized terminal complex. With the TEE, the existing terminal complex area is expected to accommodate approximately 23 million annual passengers (MAP). As described in the 2000 PDX Master Plan, the TEE is an eastward extension of Concourse B on the same alignment as the south face of Concourse C, with a new passenger processing facility. The TEE will require relocation and realignment of the existing exit roadway system, light rail facilities (station and track), rental car QTA facilities, and parking exit plaza. This Terminal Access Study will include the development of alternatives to provide replacement and realigned facilities, as well as new curbside, roadway, parking, rental car, and transit facilities to accommodate the TEE.

To better define the development envelope required to accommodate the airside, terminal, and landside facilities, a planning charette was conducted on February 27, 2004, including key Port staff and consultants involved with previous planning of the TEE and 2000 PDX Master Plan. Previously prepared airfield options were presented. Based on assumptions regarding the required runway and taxiway separation (and design aircraft), and the desirable dimensions for the new TEE

concourse and terminal, the group reached an agreement about the planning footprint for the TEE. It was determined that extending the new concourse along the southern edge of existing Concourse C would provide adequate distance for future airfield, apron, and taxiway facilities. Assuming an 80- to 85-foot width for the concourse, and a 140-foot width for the terminal building, the remaining width between the face of the terminal building and the existing parking garage helix (approximately 100 feet to 105 feet) would be available for ground access facilities.

EXISTING TERMINAL ROADWAYS

Access roadways to the TEE will need to be connected to roadways serving the existing terminal although specific alignments will vary among various roadway alternatives. As noted above, the TEE will include an eastward extension of Concourse B along the same alignment as Concourse C. This extension will require the relocation of roadways departing the Upper and Lower level curbsides at the existing terminal.

AIRFIELD GEOMETRY AND FAR PART 77 CONSIDERATIONS

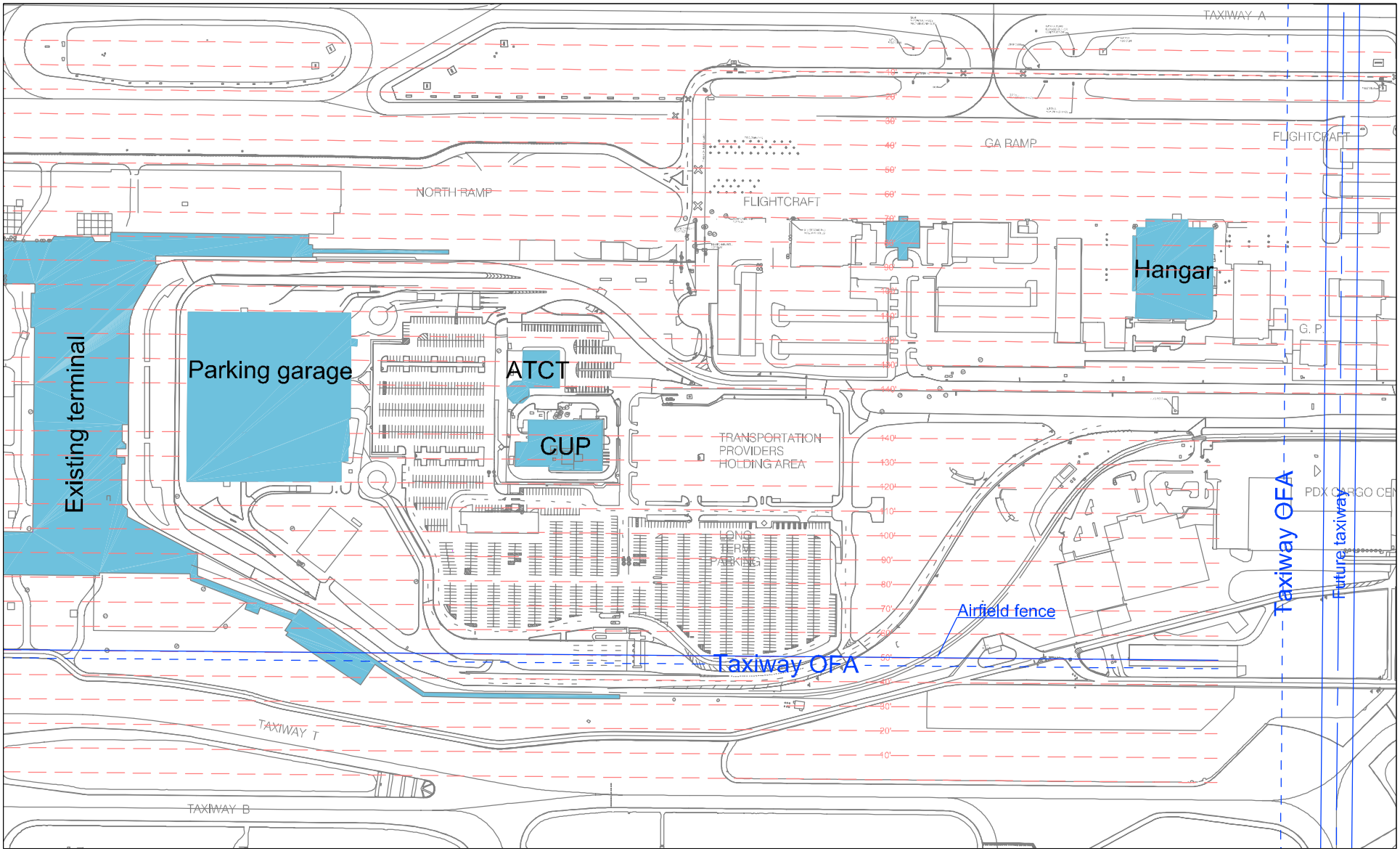
This section describes site constraints associated with existing and planned airfield elements. The locations of these constraints are depicted on Figure 2-1.

Taxiway T

Currently, Taxiway T generally runs parallel to Runway 10R-28L, between Taxiway B and Concourse C. East of Concourse C, Taxiway T turns toward Taxiway B, and intersects Taxiway B near Taxiway B6. As proposed in the 2000 PDX Master Plan, it is assumed that Taxiway T will be straightened to run parallel to Taxiway B for the entire length of the TEE. It is assumed that the taxiway object free area associated with the future alignment of Taxiway T, and a parallel, 24-foot-wide airfield service road, will dictate the location of the future airfield fence, which will, in turn, provide a southern boundary for roadways and parking facilities.

Future Cross-Field Taxiway

One of the recommendations of the 2000 PDX Master Plan is that a cross-field taxiway be constructed connecting the east ends of Runways 28L and 28R. The taxiway will extend perpendicularly from the east end of Runway 28L, bridge over the main Airport access roads, and intersect Taxiway A. Development to the east and west of the taxiway bridge will be limited by (1) the location of bridge support elements (e.g., columns, retaining walls, banked earth) and (2) the taxiway object free area.



Note: Basemap does not reflect 2004 realignment of Taxiway B

LEGEND

100'	Maximum object height, relative to elevation of nearest runway
ATCT	Airport Traffic Control Tower
CUP	Central Utility Plant
OFA	Object Free Area

N

200 0 200 400

Graphic Scale in Feet

Figure 2-1

PHYSICAL CONSTRAINTS

Terminal Access Study
Portland International Airport
March 2005

LEIGH FISHER ASSOCIATES

FAR Part 77 Surfaces

Federal Aviation Regulations (FAR) Part 77 surfaces, which are determined by the location and elevation of runways, determine the maximum height of Airport facilities located near the runways. Figure 2-1 shows the maximum height allowable at various locations, relative to the elevation of the nearest runway centerline.

EXISTING PARKING GARAGE

The existing parking garage (P-1) is proposed to remain. A new parking garage (P-2) may be constructed adjacent to P-1 in the current location of the Long-term surface lot. This new structure may be connected to the existing structure, and although it is desired to provide a separate entrance and vertical circulation for the P-2 structure, it would be possible to connect to P-1 and share the existing vertical circulation.

CENTRAL UTILITY PLANT

The Central Utility Plant (CUP) is located to the east of the existing P1 and Long-term parking lot, and is surrounded by the Long-term parking lot on the west and south sides. The CUP is intended to remain at its current location and therefore, the CUP represents the northern limit of the envelope available for terminal roadways associated with the TEE. The current site and building footprint for the CUP are adequate to serve 23 MAP. The CUP site also includes two large buried fuel tanks to the north of the building footprint. Both the CUP site and areas around it contain a number of utilities.

AIRPORT TRAFFIC CONTROL TOWER

The existing Airport Traffic Control Tower (ATCT) was constructed subsequent to the completion of the *1994 Terminal Access Study*. The ATCT and associated surface parking are located just north of the CUP. This is perceived as the permanent location and the ATCT is assumed to remain at this location through this planning horizon. As such, the CUP and ATCT facilities represent the eastern limit of a P-2 expansion, as well as a limit for circulation roadways providing direct access to the TEE.

FLIGHTCRAFT TERMINAL AND MAINTENANCE HANGAR

Flightcraft is a fixed-base operator at the Airport that operates business and general aviation services adjacent to the GA Ramp on the north side of the airfield. Two of their buildings, the terminal and maintenance hangar, are owned by Flightcraft and are under a long-term lease (see Figure 2-1). Terminal area improvements must not

affect these buildings. In addition to these buildings, it is assumed that the (1) existing vehicle parking area located on the south side of the hangar, (2) aircraft ramp located on the west side of the hangar, and (3) service dock area located on the east side of the hangar must be retained. If necessary, access to the vehicle parking and service dock areas may be modified, but landside vehicle access for these buildings must be accommodated.

HOMELAND SECURITY

New and evolving regulations relative to homeland security will affect the development of new facilities at the Airport. Given the evolving nature of the regulations, the laws, rules, and guidance regarding facility locations and characteristics in place during the facility planning process may be significantly different by the time the facility is programmed and designed.

New Parking Facilities

New parking facilities will be located with a minimum offset from any terminal building based on the current distance between the Main Terminal and the Parking Garage. Depending on the final design, parking facilities also may require a minimum offset distance from the ATCT and the CUP.

Unattended Vehicles and Inspections

It is assumed that the Port has prepared a blast analysis that determines where unattended vehicles are permitted to park, as per Transportation Security Administration (TSA) rules provided in November 2001. This analysis also determines the location of vehicle inspection stations used during threat levels "orange" and "red." When needed, inspections are currently done in the Transportation Providers Holding Area. Should this area be needed for future parking or roadway facilities, a new location will be required.

Any future inspection location will be governed by the TSA rules in place at the time. Based on February 2003 TSA guidance (which has not yet been made law), inspection stations should be located such that a blast from a large vehicle (e.g., semi-tractor trailer) will not cause catastrophic failure of a terminal building. For purposes of planning future facilities at the Airport, it is assumed that inspection stations will be at least 1,000 feet from the nearest terminal building.

As of October 2004, under threat level "orange," airport operators are no longer required by the TSA to inspect vehicles approaching the terminal. Under threat level "red," airport operators are now required by TSA to inspect randomly selected vehicles approaching the terminal. To date, TSA has never enacted or tested level "red" procedures and these requirements may change in the future.

To meet TSA's requirements for vehicle inspection under condition "red," inspection stations must allow the airport operator to (1) intercept 100% of vehicles approaching the terminal building and choose selected vehicles for inspection and (2) allow drivers to depart the airport if they prefer not to be inspected. To meet requirements under condition "orange," typically two to three inspection stations are required, though the Airport, to date, has used one inspection station.

OTHER PLANNING CONSIDERATIONS

This section summarizes planning and policy considerations, particularly as they relate to the light rail station and transportation plans, to be recognized during the development of alternatives.

Transit Facilities

TriMet's plans for the future re-construction of the airport light rail line call for a double track alignment extending to the existing terminal. The preliminary layout of the light rail corridor should allow for a 40-foot-wide right of way, with minimum 100-foot radii for curves. The track corridor will require fencing to restrict trespassing and enhance safety. Vertical space required would extend 20 feet above the top of rail and 6 feet below for electrical power and signal systems installation. The right of way width will need to widen to 54 feet at the center platform stations. The length for the station platforms should be 200 feet. The track alignment for the stations must be tangent, minimum tangent of 260 feet at the terminal station, and 300 feet at in-line stations. These values may be refined during detailed design per the requirements of the TriMet design criteria.

Re-construction of the light rail line will need to protect and avoid, or relocate the numerous utilities in the vicinity of the terminal. The rail line design will also need to recognize that the groundwater elevation at the Airport is generally close to the existing ground elevations.

Space near the terminal is at a premium. The location of the future light rail station and alignment will require close coordination with the roadway and parking facilities.

Planning Framework

State, regional, and local transportation plans and policies provide a planning framework that may impact transportation plans for the Airport. The hierarchy of these plans and policies is summarized below:

State of Oregon
- Statewide Planning Goals
- Transportation Planning Rule (TPR)
- Oregon Transportation Plan

Regional (Metro)
- Region 2040 Growth Concept
- Regional Framework Plan
- Urban Growth Management Functional Plan
- Regional Transportation Plan

City of Portland
- Comprehensive Plan
- Transportation Element of the Comprehensive Plan
- Transportation System Plan

The Transportation Planning Rule (TPR) was first adopted in 1991 to implement statewide planning Goal 12: Transportation. It requires state, regional, and local jurisdictions to develop transportation system plans (TSPs) that comply with provisions to reduce reliance on the automobile. Key provisions include reducing vehicle miles traveled per capita by 10% over the next 20 years, reducing parking spaces per capita, and improving opportunities for alternatives to the automobile.

Metro prepared the 2000 Regional Transportation Plan (RTP) to comply with TPR requirements and other documents, such as the 2040 Growth Concept and Regional Framework Plan. This plan focuses on streets and corridors of regional significance with a 20-year functional plan for the region, including a list of major system improvements. It is consistent with the requirements of the TPR and the Oregon Transportation Plan.

The Portland TSP was completed in October 2002 and serves as the City's 20-year plan for transportation improvements. It includes performance measures and benchmarks that will be used to monitor the impacts of implementing the plan.

Policy elements of these three documents that could affect transportation plans for the Airport are as follows:

- *Interagency Coordination*—Transportation system planning and funding should be coordinated between affected state and federal agencies, local governments, special districts, and providers of transportation services

- *Transportation System Management*—Preference should be given to projects that improve the efficiency and safety of the transportation system

- *Transportation Demand Management*—Projects that reduce the reliance on the automobile should be implemented and given preference in project

selection. Carpooling, vanpooling, bicycling, flexible work hours, transit incentives, and telecommuting should be encouraged.

- *Project Coordination*—Coordination between land use and transportation should be considered when developing projects.
- *Project Selection*—Priority consideration should be given to transportation projects that will contribute to a reduction in vehicle miles traveled per capita while supporting economic vitality and sustainability.
- *Reduced Reliance on Automobile*—Vehicle miles traveled should be reduced by 10% within 20 years of plan adoption and an additional 5% within 30 years (Year 2040) of plan adoption per Metro TPR. Single-occupancy vehicles should account for no more than 55% to 60% of total modal share for intermodal facilities such as the Airport, per the Metro RTP.
- *Pedestrian and Bicycle Facilities*—Bicycle and pedestrian systems should be expanded to provide connectivity, especially to transit facilities. At the Airport, this means sidewalks and bikeways should be provided on arterials and collectors and bicycle parking facilities should be provided at key destinations.
- *Freight Facilities*—Develop and maintain intermodal freight facilities. Develop a system of truck streets to facilitate freight movement through the region and between freight districts.

Although the plans and policies described above may include desirable goals, the actual planning requirements for the Airport are set forth in a Conditional Use Master Plan Permit prepared by the Port. The permit is granted by the City of Portland under Title 33, Section 820, of the Land Use Review Process (chapter 33.820). A key component of the permit is that it allows up to 2,400 parking spaces in the P-2 location and up to 2,000 parking spaces in P-3, defined as the area immediately east of the CUP and ATCT. The transportation facility recommendations in the Conditional Use Permit are being considered in this study, but this study will identify which components of the permit require updates.

In addition to the state, regional, and local transportation plans and policies, Federal Aviation Administration (FAA) rules and guidance regarding the funding of airport projects will be a significant consideration in the development of transportation facilities, including facilities that may generate income or be used by nonairport or nonauto users. Local, state, and regional goals of developing multimodal (e.g., nonauto) facilities could potential be in conflict with the FAA's typical priorities for funding aviation and traditional ground access facilities.

Chapter 3

NEEDS ANALYSIS

INTRODUCTION

This chapter summarizes the analysis of future requirements for the ground transportation components, including the parking, roadways, terminal curbside, commercial roadway, and rental car facilities, building on the assessment of existing conditions and site constraints identified for Portland International Airport. Requirements have been quantified relative to passenger levels, meeting the ultimate level of 23 million annual passengers (MAP).

OVERVIEW

Air Passenger Forecasts

As presented in Chapter 1—Existing Conditions, and provided below in Table 3-1, air passenger trends over the last 10-year period averaged a growth of about 3.8% per year, increasing from 8.5 MAP in 1993 to 12.4 MAP in 2003.

Table 3-1

TOTAL ANNUAL PASSENGERS 1993-2003
Terminal Access Study
Portland International Airport

Year	Total annual passengers	Average annual percent increase (decrease)
1993	8,532,878	
1994	9,905,588	16.1%
1995	11,212,189	13.2
1996	12,590,588	12.3
1997	12,810,540	1.75
1998	13,019,366	1.6
1999	13,721,684	5.4
2000	13,790,115	0.50
2001	11,703,676	(15.1)
2002	12,241,975	4.6
2003	12,395,938	1.3

Source: Port of Portland.

The last 10 years included double-digit increases influenced by the introduction of service by Southwest Airlines, as well as double-digit losses after the events of September 11, 2001. The 10-year high was 13.8 MAP in 2000, which dropped to 11.7 MAP in 2001. Since 2001, traffic has slowly increased, with the current levels of 12.4 MAP approaching 1996 levels. The 2004 year-to-date (January through April) passenger total of 3,706,041 is a 4.6% increase over the previous year January through April passenger total of 3,543,171. Other airports across the country have also experienced similar growth during the first quarter of 2004.

Detailed passenger forecasts were last developed for the 2000 PDX Master Plan, prepared in 1998. The estimated design passenger level of service for Phase 1 of the Decentralized Alternative Master Plan is 23 MAP. Given the lack of updated forecasts tied to design years, the facility requirements are linked to passenger levels instead of years.

Mode Choice

Historical mode choice data, provided below in Table 3-2, were obtained from surveys conducted by the Port's Research and Marketing Department.

Table 3-2

HISTORICAL MODE CHOICE DATA
Terminal Access Study
Portland International Airport

Mode	1997/1998	2001	2003
Private vehicle	66%	54%	61%
Rental car	15	19	20
Taxi/limo	4	4	4
Shuttles	11	15	9
Tri-Met (MAX light rail transit after 2001)	1	5	6
Other	3	3	--

Source: Port of Portland, Research and Marketing Department.

As shown in Table 3-2, the mode splits in 2001 reflect a slight shift from private vehicles to shuttles and MAX. However, by 2003, many passengers using shuttles had shifted back to private vehicles. To provide a conservative basis for estimating future roadway requirements, 2003 mode splits will be assumed since high usage of private vehicles typically results in the highest number of vehicles using the roadways.

PARKING REQUIREMENTS

This section describes parking requirements for public and employee parkers.

Public Parking

Future public parking requirements were estimated based on historical and more recent growth in parking demand and occupancies. Typically, parking is estimated to grow in proportion to the growth in originating passengers; however, based on the most recent parking activity, parking demand is growing much faster than passengers. A comparison of passenger and parking activity during the first 3 months of 2004 to the same in 2003 are summarized in Table 3-3. As shown, during the first 3 months of 2004, the parking occupancies grew far faster than the passenger activity. For the purpose of this analysis, a new 2004 baseline was estimated, based on the available data for 2004, assuming a 15% increase in the Garage, a 5% increase in the Long-term lot, and a 10% increase in the Economy lot over summer 2003. Then to estimate future parking requirements, different growth rates were assumed in order to develop a high, middle, and low range of requirements. Since public parking facilities are often developed in phases, projections for interim passenger levels of 15, 17.5, and 20 MAP are provided in addition to projections for 23 MAP.

As summarized in Table 3-4 (and shown on Figures 3-1 through 3-3), for each passenger level, a projection is provided for a low, medium, and high growth scenario. The low growth scenario assumes that following 2004, parking demand will grow at 3.8%, the average passenger growth rate at the Airport over the last 10 years. The medium growth scenario assumes that parking grows at 6.5% per year through 15 MAP, then 5% per year through 17.5 MAP, and 4% per year thereafter. The high growth scenario assumes that parking grows at 10% per year through 15 MAP, then 7.5% per year through 17.5 MAP, and 5% per year thereafter.

As shown, by 15 MAP, demand for the Garage and Long-term lots is expected to approach or exceed capacity under all growth scenarios and the Remote lot will approach capacity under the high growth scenario. Under all other growth scenarios, the Remote lot will approach or exceed capacity by 17.5 MAP.

Table 3-3

COMPARISON OF PARKING ACTIVITY FOR JANUARY THROUGH APRIL, 2003 and 2004

Terminal Access Study
Portland International Airport

	January			February			March			April			Total change first 3 months		
	2003	2004	% Change	2003	2004	% Change	2003	2004	% Change	2003	2004	% Change	2003	2004	% Change
Passenger (total monthly)	850,418	796,412	(6.4%)	808,174	849,923	5.2%	962,544	1,047,860	8.9%	922,035	1,011,846	9.7%	3,543,171	3,706,041	4.6%
Parking occupancy															
Garage	2,138	2,514	17.6%	2,027	2,658	31.1%	2,142	2,603	21.5%	2,167	2,503	15.5%	8,474	10,278	21.3%
Long-term	1,145	1,260	10.0%	1,254	1,252	(0.2%)	1,211	1,290	6.5%	1,232	1,290	4.7%	4,842	5,092	5.2%
Economy	4,005	5,694	42.2%	4,525	4,845	7.1%	6,022	7,191	19.4%	4,515	5,411	19.8%	19,067	23,141	21.4%
Total	7,288	9,468	29.9%	7,806	8,755	12.2%	9,375	11,084	18.2%	7,914	9,204	16.3%	32,383	38,511	18.9%

Note: In comparing 2004 to 2003, several factors should be considered such as:

- The war in Iraq began in March of 2003, negatively affecting passenger levels in 2003.
- The Airport was closed several days due to ice and snowstorms, which is reflected by the lower January 2004 passenger volumes.
- 2004 is a leap year and February had 29 days.

Source: Leigh Fisher Associates, June 2004.

PDX558

Table 3-4

ESTIMATED PUBLIC PARKING DEMAND
Terminal Access Study
Portland International Airport

Parking facility	Supply	2003 actual *(a)*	2004 estimated	2005	2006	2007	2008	2009	Future planning activities levels (million annual passengers)		
Passenger level (million annual passengers)		12.4	13.0	13.5	14.0	14.5	15.0	15.5	17.5	20.0	23.0
Garage	3,330	2,430	2,800 *(b)*								
High growth				3,100	3,400	3,700	3,800	4,100	5,400	6,500	7,800
Mid-range growth				3,000	3,200	3,400	3,500	3,600	4,400	5,000	5,700
Low growth				2,900	3,000	3,100	3,200	3,300	3,800	4,500	5,100
Long-term	1,466	1,230	1,300 *(c)*								
High growth				1,400	1,600	1,700	1,800	1,900	2,500	3,000	3,600
Mid-range growth				1,400	1,500	1,600	1,600	1,700	2,000	2,300	2,700
Low growth				1,300	1,400	1,500	1,500	1,500	1,800	2,100	2,400
Remote	7,865	5,215	5,700 *(d)*								
High growth				6,300	6,900	7,600	7,800	8,300	11,000	13,100	15,800
Mid-range growth				6,100	6,500	6,900	7,100	7,300	8,900	10,100	11,700
Low growth				5,900	6,100	6,400	6,600	6,600	7,700	9,100	10,500
Total Parking	12,661	8,875	9,800								
High growth				10,800	11,900	13,000	13,400	14,300	18,900	22,600	27,200
Mid-range growth				10,500	11,200	11,900	12,200	12,600	15,300	17,400	20,100
Low growth				10,100	10,500	11,000	11,300	11,400	13,300	15,700	18,000

Note: Estimates for future demand do not include circulation factors.

(a) Based on June 2003 data.
(b) Assumes summer 2004 demand is approximately 20% greater than 2003, based on month over last year's month to-date.
(c) Assumes summer 2004 demand is approximately 5% greater than 2003, based on month over last year's month to-date.
(d) Assumes summer 2004 demand is approximately 20% greater than 2003, based on month over last year's month to-date.

Source: Leigh Fisher Associates, June 2004.

Figure 3-1

GARAGE PARKING
Terminal Access Study
Portland International Airport

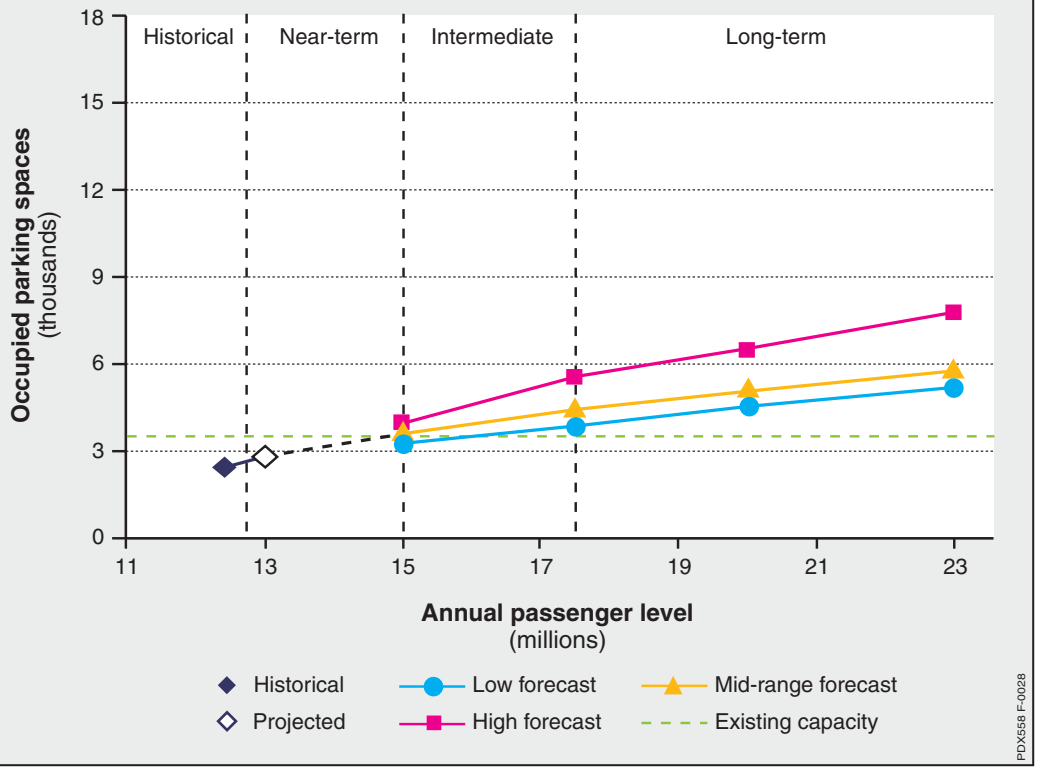


Figure 3-2

LONG-TERM PARKING
Terminal Access Study
Portland International Airport

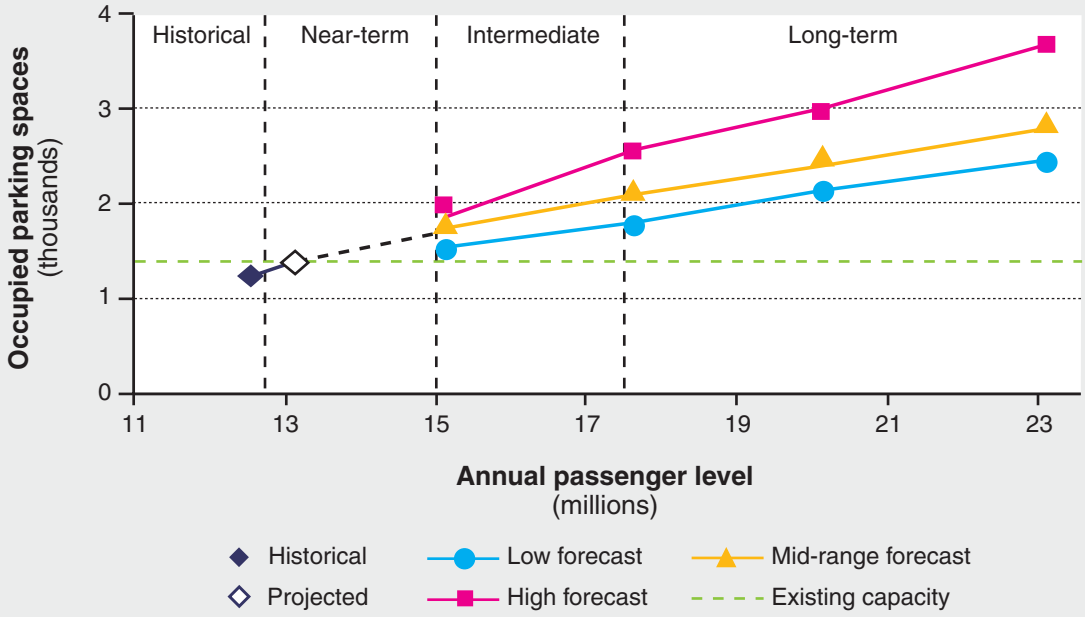
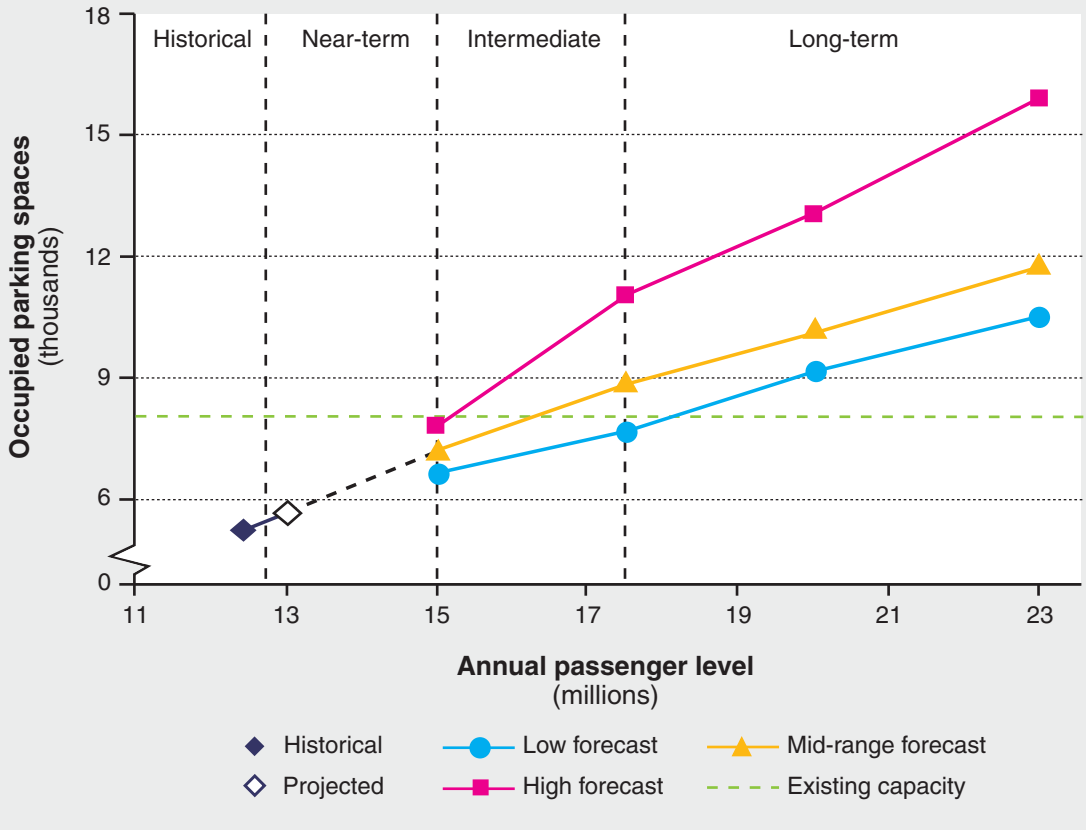


Figure 3-3

REMOTE PARKING
Terminal Access Study
Portland International Airport



During the December holiday period, the Economy lot experiences significantly higher demand than during the rest of the year. Based on December 2003 observations, peak Economy lot occupancy during the holiday period was approximately 7,600 vehicles. Table 3-5 summarizes estimated peak holiday period demand for the Economy lot through 23.0 MAP. As with Table 3-4, a projection is provided for a low, medium, and high growth scenario using the same growth assumptions described above.

Employee Parking

Employee parking spaces (2,394 spaces) are provided in a surface lot located on Airport property in the Portland International Center (PIC) off Alderwood Drive. Shuttle bus service is provided to transport employees between the lot and the terminal building. Based on hourly entry and exit data (summarized in Chapter 1—Existing Conditions), surveys conducted in February 2002 (for the Port of Portland Conditional Use Permit Transportation Review) and visual inspection, it is estimated that up to 1,700 vehicles are parked in the lot during peak periods.

PDX558

Table 3-5

ESTIMATED HOLIDAY-PERIOD PUBLIC PARKING DEMAND IN ECONOMY LOT
Terminal Access Study
Portland International Airport

Parking facility	Supply	2003 actual *(a)*	2004 estimated	2005	2006	2007	2008	2009	Future planning activities levels (million annual passengers)		
Passenger level (million annual passengers)		12.4	13.0	13.5	14.0	14.5	15.0	15.5	17.5	20.0	23.0
Economy parking	7,865	7,600	8,300 *(a)*								
High growth				9,100	10,000	11,000	11,400	12,200	16,000	19,100	23,000
Mid-range growth				8,800	9,400	10,000	10,300	10,700	13,000	14,700	17,000
Low growth				8,600	8,900	9,300	9,600	9,600	11,200	13,200	15,200

Note: Estimates for future demand do not include circulation factors.

(a) Based on December 2003 data.

Source: Leigh Fisher Associates, June 2004.

Typically, employee parking grows in proportion to a combination of growth rates in passengers and aircraft operations. Since updated forecasts are unavailable, it is assumed that employee parking requirements will increase in direct proportion to total passengers. Thus, when the Airport serves 23 MAP, approximately 3,300 employee parking spaces will be required (including a 5% allowance for circulation). The existing employee lot contains about 2,400 spaces and would need to be expanded to accommodate the 23 estimated MAP.

ROADWAYS

Existing and historical traffic volumes from Airport Way and the enplaning and deplaning roadways were analyzed to establish a baseline roadway capacity. The existing baseline peak hour traffic volumes were estimated to increase in proportion to the growth in passengers. Roadway capacity was assumed to be 1,200 vehicles per hour per lane on the entrance and exit roadways. The future peak hour traffic volumes are compared to the existing estimated capacity in Table 3-6.

Table 3-6

ESTIMATED ROADWAY CAPACITY
Terminal Access Study
Portland International Airport

Parking facility	Number of lanes	Capacity *(a)*	2003 baseline	Future planning activity levels (million annual passengers)			
Passenger level (million annual passengers)			12.4	15.0	17.5	20.0	23.0
Airport Way							
Westbound (vph)	2	2,400	1,445	1,750	2,040	2,330	2,680
Eastbound (vph)	2	2,400	1,495	1,810	2,110	2,410	2,770
Upper level entry	2	2,400	1,000	1,210	1,410	1,610	1,850
Lower level entry	2	2,400	760	920	1,075	1,230	1,415

(a) Capacity assumed to be 1,200 vehicles per lane per hour.

Source: Leigh Fisher Associates, May 2004.

As described in Chapter 1—Existing Conditions, congestion in the inside lane of each curbside entry roadway effectively reduces the capacity to that of a single-lane road (1,200 vehicles per lane per hour). If congestion continues to occur in the inside lane of each curbside entry roadway, by 15 MAP, demand will exceed capacity on

the entry to the Upper level and by 20 MAP, demand will exceed capacity on the Lower level.

TERMINAL CURBSIDE

The upper level (departures) terminal roadway provides an inner and outer curbside, both of which are configured for two drop-off lanes and two travel lanes. The departures roadway is used by both private and commercial vehicles. On the lower level (arrivals) roadway there are four lanes with the two inside lanes marked for passenger loading and two travel lanes. Commercial vehicle pickup is provided on the commercial roadway described in the following section. The curbside requirements for the arrivals and departures terminal roadways are shown in Table 3-7. These requirements were calculated using the observed peak hour volumes, dwell times, average vehicle length, and a Poisson arrival of vehicles. Curbside dwell times were assumed to be 2.0 minutes for private vehicles on the arrivals curb, and 1.8 minutes on the departures curb. Commercial vehicles on the departures curb were assumed to have a 1.5-minute dwell time.

As shown, based on these assumptions, both the arrivals and departures level curbside currently operate below capacity (volume to capacity ratio of 1.65, and 1.54, respectively), assuming that two lanes are used for unloading passengers. However, between 17.5 and 20 MAP, the arrivals curbside is expected to exceed 2.0 volume-to-capacity ratio, which means that passenger loading may begin to occur in the third traffic lane during the busiest peak periods.

COMMERCIAL ROADWAY

Commercial roadway operations were analyzed using data provided by the Port, including access information by type of vehicle (courtesy vehicles (hotels and other), on-demand-executive cars, door-to-door shuttles, off-Airport parking and rental car, reservation only, and taxicabs). Data provided included number of times vehicles in each category accessed the commercial roadway on a monthly basis, as well as time spent on roadway and minutes over grace period. Data were provided for September 2001 through December of 2003. Hourly counts from November of 2001 were also provided and were used to estimate hourly traffic volumes accessing the commercial roadway.

Based on the total hourly counts, an average dwell time of 2.5 minutes, and an average vehicle length of 35 feet, the future, 23 MAP commercial vehicle demand can be accommodated on the existing commercial curb except for the reservation limousines, which would require more space between 15 and 17.5 MAP. This is primarily due to the operational procedures in place today and the location of the hold lot (within 2 minutes of the commercial curb), requiring all commercial vehicles to first go to a hold lot, then be dispatched to the curb when the passengers have

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Table 3-7

TERMINAL ROADWAY CURBSIDE CAPACITY
Terminal Access Study
Portland International Airport

Passenger level (MAP)	Curb location		Peak hour volume	Dwell time (minutes)	Curbside stall requirements	Design stall requirements	Stall length	Design length required	Existing curb length	Demand / capacity
12.4	Departure level	Private vehicles	750	1.80	23	31	25	775		
		Commercial vehicles	250	2.00	8	13	35	455		
		Total	1,000					1,230	800	1.54
	Arrival level	Private vehicles	760	2.00	25	33	25	825	500	1.65
15	Departure level	Private vehicles	908	1.80	27	36	25	900		
		Commercial vehicles	303	2.00	10	15	35	525		
		Total	1,210					1,425	800	1.78
	Arrival level	Private vehicles	920	2.00	31	40	25	1,000	500	2.00
17.5	Departure level	Private vehicles	1,058	1.80	32	42	25	1,050		
		Commercial vehicles	353	2.00	12	18	35	630		
		Total	1,410					1,680	800	2.10
	Arrival level	Private vehicles	1,075	2.00	36	46	25	1,150	500	2.30
20	Departure level	Private vehicles	1,208	1.80	36	46	25	1,150		
		Commercial vehicles	403	2.00	13	19	35	665		
		Total	1,610					1,815	800	2.27
	Arrival level	Private vehicles	1,230	2.00	41	52	25	1,300	500	2.60
23	Departure level	Private vehicles	1,388	1.80	42	53	25	1,325		
		Commercial vehicles	463	2.00	15	22	35	770		
		Total	1,850					2,095	800	2.62
	Arrival level	Private vehicles	1,415	2.00	47	59	25	1,475	500	2.95

Source: Leigh Fisher Associates, May 2004.

arrived. The curbside, for the most part is used for active passenger loading, with no vehicles staging at the curb. Vehicle queues are provided for the taxicabs and executive cars. The estimated curb space requirements by class of vehicle are summarized in Table 3-8. As shown, high volume-to-capacity ratios are projected for off-Airport parking/rental car courtesy vehicles due to the current amount of space allocated for this mode and assuming that vehicle trips increase at the same rate as enplanements. As demand increases, management measures can be used to allow efficient operations within the allocated curb areas.

Currently, ground transportation operators waiting for dispatch to the curbside to meet passengers dwell in the Transportation Providers Holding Area, located east of the ATCT and CUP. This area is approximately 65,000 square feet. For planning purposes, it is assumed that when the Airport is serving 23 MAP, this area will need to be approximately 125,000 square feet. To meet operational requirements of the operators using the area, the area should be located so that any passenger pickup area can be reached within 5 to 10 minutes. The future location of the hold area and the travel distance between the hold lot and the terminal will affect the amount of commercial curbspace required.

RENTAL CAR FACILITIES

This section summarizes requirements for Airport rental car facilities to meet demands at 23 MAP.

Projections for rental car requirements generated by 23 MAP are based on an estimated existing unconstrained demand, increased in direct proportion to the increase in annual passengers (resulting in increase of approximately 140%). Future requirements were estimated based on this unconstrained baseline, as shown in Table 3-9.

- *Customer service facility*—As shown, to accommodate 23 MAP, the customer service facility should be approximately 32,000 square feet. It is assumed that services and functions currently occurring in this facility will continue to do so.
- *Ready/return area*—It is estimated that by 23 MAP, approximately 2,000 ready/return stalls will be required, resulting in a ready/return area of approximately 544,000 square feet.
- *Quick turnaround facility*—To meet the requirements of a 2,000-space ready/return area, approximately 166,000 square feet are required for the 56 fuel nozzles, 10 car washes, associated maintenance and storage, vehicle stacking areas, and circulation.
- *Staging/storage*—Approximately 1,817,000 square feet is required for staging/storage operations to support the ready/return and QTA operations.

Table 3-8

COMMERCIAL ROADWAY CAPACITY ANALYSES
Terminal Access Study
Portland International Airport

Class of vehicle	Peak hour volume	Dwell time (minutes)	Curbside stall requirement	Design stall requirements	Stall length (feet)	Design length required (feet)	Existing curb length (feet)	Demand/ capacity
12.4 MAP—2003								
Courtesy vehicles	50	2.00	2	5	30	150	180	0.83
On demand-Executive cars	10	2.00	1	3	25	75	220	0.34
Door-to-door shuttles	15	2.5	1	3	25	75	180	0.42
Off-Airport parking/ rental cars	30	2.00	1	3	35	105	40	2.63
Reservation only	25	20.00	8	8	20	160	160	1.00
Taxicab	55	1.00	1	3	20	60	180	0.33
15 MAP								
Courtesy vehicles	60	2.00	2	5	30	150	180	0.83
On demand-Executive cars	10	2.00	1	3	25	75	220	0.34
Door-to-door shuttles	20	2.50	1	3	25	75	180	0.42
Off-Airport parking/ rental cars	40	2.00	1	3	35	105	40	2.63
Reservation only	30	20.00	10	10	20	200	160	1.25
Taxicab	70	1.00	1	3	20	60	180	0.33
17.5 MAP								
Courtesy vehicles	70	2.00	2	5	30	150	180	0.83
On demand-Executive cars	10	2.00	1	3	25	75	220	0.34
Door-to-door shuttles	20	2.50	1	3	25	75	180	0.42
Off-Airport parking/ rental cars	50	2.00	2	5	35	175	40	4.38
Reservation only	40	20.00	13	13	20	260	160	1.63
Taxicab	80	1.00	1	3	20	60	180	0.33
20 MAP								
Courtesy vehicles	80	2.00	3	7	30	210	180	1.17
On demand-Executive cars	10	2.00	1	3	25	75	220	0.34
Door-to-door shuttles	20	2.50	1	3	25	75	180	0.42
Off-Airport parking/ rental cars	60	2.00	2	5	35	175	40	4.38
Reservation only	50	20.00	17	17	20	340	160	2.13
Taxicab	90	1.00	2	5	20	100	180	0.56
23 MAP								
Courtesy vehicles	90	2.00	3	7	30	210	180	1.17
On demand-Executive cars	10	2.00	1	3	25	75	220	0.34
Door-to-door shuttles	20	2.50	1	3	25	75	180	0.42
Off-Airport parking/ rental cars	70	2.00	2	5	35	175	40	4.38
Reservation only	60	20.00	20	20	20	400	160	2.50
Taxicab	100	1.00	2	5	20	100	180	0.56

Source: Leigh Fisher Associates, June 2004.

Table 3-9

RENTAL CAR REQUIREMENTS
Terminal Access Study
Portland International Airport

	2003 (existing)		2003 (unconstrained) *(a)*		15 MAP		17.5 MAP		20.0 MAP		23 MAP	
Facility component	Units	Square feet	Units	Square feet	Units	Square feet	Units	Square feet	Units	Square feet	Units	Square feet
Customer facilities												
Ready/return spaces *(b)*	981	283,520	1,075	292,000	1,300	365,000	1,500	426,000	1,700	462,000	2,000	544,000
Customer service area		12,826		17,000		21,000		24,000		27,000		32,000
Subtotal		296,346		309,000		386,000		450,000		489,000		576,000
Quick Turnaround Area (QTA) *(c)*												
Fueling nozzles	26		34		38		52		54		56	
Car washes	5		10		10		10		10		10	
Subtotal		62,139		117,000		126,000		157,000		161,000		166,000
Staging/storage *(d)*		44,666		979,000		1,185,000		1,383,000		1,583,000		1,817,000

(a) Includes area for companies currently not accommodated in the facility (Alamo, National, and Thrifty).

(b) Includes area for counter workstations.

(c) Includes stacking stalls and queuing / maneuvering area.

(d) Currently located within the fuel/wash area.

Source: Leigh Fisher Associates from data provided by the Port of Portland.

Chapter 4

ALTERNATIVES DEVELOPMENT AND SCREENING

INTRODUCTION

This chapter summarizes the alternative facility development plans prepared to meet the needs identified in Chapter 3—Needs Assessment while also addressing the site constraints identified in Chapter 2—Site Constraints. These development plans include facility plans for:

- Access and circulation roadways
- Terminal building curbsides
- Rental cars
- Public parking
- Commercial ground transportation
- Light rail
- Pedestrians and bicycles
- Security (vehicle inspection area)

This chapter also describes the screening process used to identify which facility development plans would be refined further leading to the evaluation and selection of a final comprehensive plan. These refinements are discussed in the next chapter.

SUMMARY OF SITE CONSTRAINTS

As described in Chapter 2—Site Constraints, there are several physical and operational constraints that affect development of future access and parking facilities at the Airport. The key constraints, depicted on Figure 2-1, governing the location of access and parking facilities include:

- *Existing and future taxiways and FAR Part 77 considerations*—New terminal access facilities must not infringe on the imaginary surfaces associated with taxiways and runways.
- *Existing terminal and access roadways*—New roadways must maintain access between the existing terminal curbside roadways and Airport Way, which connects to Interstate 205.
- *Existing parking garage*—New facilities must allow for continued use of the existing P-1 parking garage and operate with independent access.
- *Central utility plant*—New facilities must not limit the expansion of the CUP and provide for vehicle and truck access to the CUP.

- *Airport Traffic Control Tower*—New facilities must allow the continued operation of the ATCT as well as provide for access and parking for ATCT staff.
- *Selected general aviation facilities*—New facilities must allow the continued operation of two existing general aviation buildings located north of Airport Way.

The key assumptions associated with the TEE plan are described in the following section.

TERMINAL EXPANSION EAST ASSUMPTIONS

As described in the 2000 PDX Master Plan, the TEE is an eastward extension of Concourse B on the same alignment as the south face of Concourse C, with a new passenger processing facility centered on the concourse and located south of the CUP. It was determined that the TEE concourse component should be 80 to 85 feet wide and the TEE terminal should be approximately 300 feet long and 140 feet wide. Furthermore, it was determined that the terminal should have three levels with ticketing functions on the top level, baggage claim on the middle level, and baggage processing on the lower level.

As a result of a series of alternative analyses, an alternative proposal was developed subsequent to the charette (described in Chapter 2) that places the TEE terminal perpendicular to the concourse and east of the CUP and ATCT. The building size would be similar to that identified in Chapter 2, but it would have two levels (ticketing functions on the top level and baggage functions on the bottom level), consistent with the existing terminal. Other features, including ability to expand beyond the 23 MAP level, are described below.

DESIGN ASSUMPTIONS

All designs were prepared consistent with a conceptual level of planning, including use of conservative geometric and dimensional standards (e.g., standards for weave and merge distances, turning radii, vertical clearances, and shoulder and lane width assumptions) as described in this section. This level of detail is adequate to confirm that the facilities can fit in the available space. As specific terminal area projects are taken into the next level of development, detailed engineering analysis will be conducted and design plans will be prepared.

This section summarizes design assumptions used during the development of the initial access alternatives.

Access and Circulation Roadways

Each terminal access alternative includes three types of roadways: terminal access roadways, curbside roadways, and service roadways. For major roadways, the number of lanes assumed for each roadway segment was determined based on facility requirements provided in Chapter 3—Needs Assessment. For all other roadway segments, lane assumptions are based on analysis of circulation requirements. Roadway alignments were developed using the following design assumptions, based on (1) *A Policy on Geometric Design of Highways and Streets, 5th Edition*, American Aviation of State Highway and Transportation Engineers, and (2) standards typically used at airports.:

- Terminal access roadways
  - All access roadways are one-way
  - Lane width: 12 feet
  - Shoulders: at-grade roadway—8-foot right shoulder, 4-foot left shoulder; elevated roadway—4-foot left and right shoulders
  - Minimum curve radii: 300 feet (design speed 30 mph)
  - Minimum weaving distance: 400 feet (roadways dedicated for commercial vehicles or predominately serving commercial vehicles may have shorter weaving distances)
  - Minimum distance between successive decision points: 400 feet (roadways dedicated for commercial vehicles or predominately serving commercial vehicles may have less distance between successive decisions)
  - Maximum average grade: 5%
  - Minimum vertical separation between roadway surfaces: 20 feet (assumes minimum of 15.5 feet of clearance)
- Curbside roadways
  - All curbside roadways are one-way
  - Lane width: drop-off and maneuvering lanes—10 feet; all other lanes—12 feet
  - Minimum curve radii approaching and departing the curbside: 75 feet (consistent with existing terminal)
  - Maximum average grade: 0%

- Service roadways
  - Two-way service road width: 30 feet—two 12-foot-wide lanes with 3-foot shoulders
  - One-way service road width: 18 feet—one 12-foot-wide lane with 3-foot shoulders
  - Minimum curve radii: 100 feet (design speed 15 mph)
  - Service roadways designated for multi-use access may have wider shoulders to accommodate bicycle and/or pedestrian paths, or have 14-foot wide travel lanes to accommodate shared motor vehicle and bicycle travel combined with a 6-foot-wide curb tight sidewalk)
  - Maximum average grade: 5%

Public Parking

Public parking facilities in each terminal access alternative assume the following:

- A new seven-level parking garage (P-2) will be located between P-1 and the ATCT/CUP. Each floor in P-2 will be at the same elevation as the corresponding floor in P-1.
- A new public parking facility (P–3) (surface lot or garage) must be located near the TEE.
- Each new parking space requires approximately 350 square feet (to account for circulation, structural elements, and vertical core).
- The Airport will install pay-on-foot revenue control equipment at all close-in public parking facilities.

Rental Cars

Rental car facility components of each alternative assume:

- The existing QTA around facility is relocated to accommodate roadway and light rail realignments and may be expanded to accommodate up to the full market share.
- Ready/return facilities remain on the first two levels of P-1 and can expand into P-2.
- Ready/return facilities are connected to the QTA by a two-way, access road reserved for use by rental shuttlers.

- The QTA must be connected to a service road to allow vehicle and materials deliveries.

Light Rail

Light rail line relocation, which is required to accommodate the new TEE, assumes the following:

- Minimum right-of-way for a single track: 12 feet
- Parallel track centerline minimum separation: 15 feet
- Minimum curve radii: 450 feet (design speed 30 mph)
- Maximum average grade: 4%
- Minimum vertical clearance of 20 feet

INITIAL ALTERNATIVES

This section presents the initial terminal access alternatives. Many alternatives were developed during the preparation of this Terminal Access Study. The alternatives are organized into three families:

- *TEE South*—These alternatives are based on the 2000 PDX Master Plan assumptions for the location and orientation of the TEE on the south side of the terminal complex and assume that the TEE is served by an independent access roadway system.

- *Single-Loop Roadway*—These alternatives assume the 2000 PDX Master Plan location and orientation for the TEE, but assume that the TEE is served by the same loop roadway serving the existing terminal building.

- *TEE Central*—These alternatives assume the TEE passenger processing facility is (a) oriented perpendicular to Concourses B and E, (b) located east of the ATCT/CUP, and (c) served by an independent roadway system.

One representative alternative for each family is presented in this section. Additional alternatives developed during this phase of the project are provided in Appendix A.

TEE South

Figure 4-1 depicts one alternative incorporating the TEE location and roadway alignments proposed in the 2000 PDX Master Plan. To accommodate the TEE concourse, the roadway exiting the terminal area is relocated north, as is a section of the roadway entering the terminal area (to increase the area available for parking and other uses).

Traffic enters the terminal area on Airport Way and splits into a road bound for the existing terminal and a road bound for the TEE terminal. Traffic bound for the existing terminal uses the existing approach ramps and curbsides and exits the curbsides via a realigned exit road. The realigned exit road bypasses the TEE before rejoining existing Airport Way.

Traffic bound for the TEE exits Airport Way and ascends prior to diverging into the enplaning and deplaning levels of the TEE. West of the ATCT/CUP, the roadways turn south (between the ATCT/CUP and the P-2 parking garage) and drivers bound for the enplaning level of TEE continue to ascend. Immediately west of TEE, drivers turn east to reach the enplaning and deplaning curbsides. After departing the curbsides, the TEE enplaning and deplaning roads merge and then descend to merge with the roadway exiting the existing terminal. Commercial vehicles bound for the TEE commercial vehicle level (located on the first level of the building) go through the commercial vehicle areas at the existing terminal, merge with the realigned exit road, exit to the TEE commercial vehicle level, then rejoin the realigned exit road.

Recirculating traffic from the realigned exit road and the roads departing TEE merges together, then joins westbound Airport Way.

Access to all public parking facilities is provided from Airport Way, west of the exit to the TEE roadways. Traffic exiting parking, uses a common exit plaza, which leads to the realigned exit road. Access to the ATCT, CUP, rental car QTA, and other non-public areas is via a service road connecting to the frontage road running north of Airport Way.

The existing light rail station and track would be relocated to accommodate the TEE and new roads exiting the existing terminal. The tracks and station would be located under the TEE terminal but at-grade elsewhere in terminal area.

P-1
Public spaces: 3,341
RAC spaces: 981
Total spaces: 4,322

P-2
Levels 1 - 7: 2,640 spaces
(Public parking and RAC)

Rental Car QTA
166,000 square feet

P-3
270,000 square feet
(approx. 770 spaces per level)

GT Hold Lot
122,000 square feet

QTA road

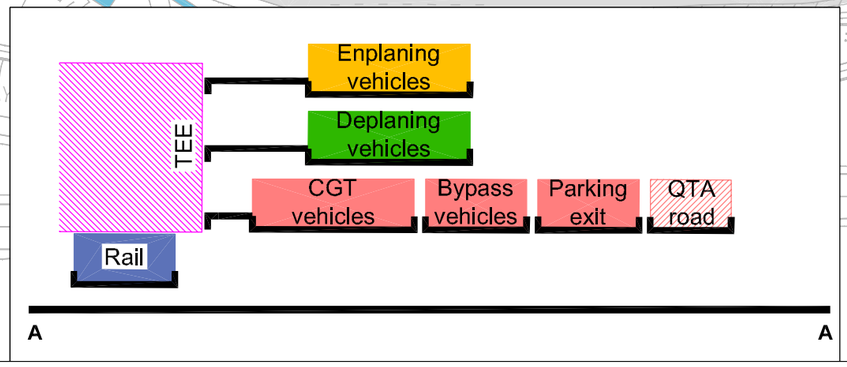
TEE

A

A

Future taxiway

TAXIWAY B



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LEGEND

- Ground level
- Second level
- Third level
- Service road
- Rail
- Multi-use access route
- Future terminal
- New parking garage / surface lot
- Rail station

N

125 0 125 250
Graphic Scale in Feet

Figure 4-1

TEE SOUTH ACCESS ALTERNATIVE

Terminal Access Study
Portland International Airport
March 2005

LEIGH FISHER ASSOCIATES

Single-Loop Roadway (Non-Bypass)

Figure 4-2 depicts one alternative that assumes the 2000 PDX Master Plan TEE location and orientation but uses a single-loop roadway to serve both the existing terminal and the TEE. Similar to the TEE South alternative described above, the roadway entering the terminal area is relocated north, as is a section of the roadway exiting the terminal area.

Traffic enters the terminal area on Airport Way and chooses among the three public parking areas or continues to the existing terminal. Prior to the existing terminal, traffic diverges into the enplaning and deplaning levels. Both levels circulate past the existing terminal and TEE curbsides before merging together and joining the existing alignment of eastbound Airport Way. Prior to the TEE, both curbside roadways ascend one level to match the TEE ticketing and baggage claim levels.

Commercial vehicles proceed through the commercial vehicle area at the existing terminal and remain at ground level to reach the commercial vehicle area at the TEE (the lowest level of the building). Commercial vehicles then merge with vehicles exiting parking before merging with eastbound Airport Way.

Recirculating traffic uses ramps provided at the east end of the terminal area (just west of the future taxiway).

Similar to the TEE South alternatives, access to the ATCT, CUP, and other non-public areas is via a service road connecting to the frontage road running north of Airport Way.

Also similar to the TEE South alternatives, the existing light rail station and track would be relocated to accommodate the TEE location and new roads exiting the existing terminal. However, instead of a having a terminus station at the existing terminal, the plan includes an elevated one-way loop around the terminal area with stations located near the midpoint of the existing terminal and at the TEE terminal.

TEE Central

Figure 4-3 depicts an alternative that assumes the TEE terminal is located in the infield area, perpendicular to the TEE concourse and east of the ATCT/CUP. As with the TEE South Plan and Single-Loop alternatives, sections of the roadways entering and exiting the terminal area are relocated north to accommodate the TEE concourse while maximizing the area available for parking and the new concourse.

P-1
Public spaces: 3,341
RAC spaces: 981
Total spaces: 4,322

P-2
Levels 1 - 7:
2,500 spaces
Public parking
and RAC

P-3

A

A

Future taxiway

TAXIWAY B

TEE

Enplaning vehicles

Bypass vehicles

Deplaning vehicles

Bypass vehicles

Rail

CGT vehicles

Bypass vehicles

Parking exit

A

A

LEGEND

Ground level

Second level

Third level

Rail

Multi-use access route

Future terminal

New parking garage / surface lot

Rail station

N

125 0 125 250

Graphic Scale in Feet

Figure 4-2

SINGLE-LOOP ROADWAY ACCESS ALTERNATIVE

Terminal Access Study
Portland International Airport
March 2005

LEIGH FISHER ASSOCIATES

K:_P_\PDX\Terminal Access\Concepts\Report figures\Figure 4-2.dwg, 300

P-1

Public spaces: 4,322

P-2

Levels 1 - 7: 3,500 spaces
(Public parking)

Rental Car QTA

P-3

Levels 1 - 7: 3,300 spaces

Future taxiway

TAXIWAY B

Service road

Terminal

Pedestrian bridge

Enplaning vehicles

Enplaning vehicles

Deplaning vehicles

CGT vehicles

P-3

Pedestrian tunnel

K:_P_\PDX\Terminal Access\Concepts\Report figures\Figure 4-3.dwg, 11x17

LEGEND

- Ground level road
- Second level road
- Third level road
- Service road, ground level
- Rail
- Multi-use access route
- Future terminal
- New parking garage / surface lot
- Rail station

N

125 0 125 250

Graphic Scale in Feet

Figure 4-3

TEE CENTRAL ACCESS ALTERNATIVE

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Traffic enters the terminal area on Airport Way and splits into a road bound for the existing terminal and a road bound for the TEE. Traffic bound for the existing terminal uses the existing approach ramps and curbsides and exits the curbsides via a realigned exit road. The realigned exit road passes between the TEE passenger processing facility and TEE concourse before rejoining existing Airport Way. Traffic bound for the TEE exits Airport Way, and diverges into the enplaning and deplaning curbsides. At the south end of the curbsides, the curbside roadways turn east and the enplaning and deplaning roadways join before merging with the realigned exit road.

Recirculating traffic travels east on Airport Way and uses the recirculation ramp provided at the future interchange at Airport Way and 82nd Street.

Access to the ATCT/CUP is provided via a service road that exits from Airport Way, travels south between the ATCT/CUP and the TEE, and joins the parking exit roadway prior to joining the roadway exiting the main terminal. This service road also provides access to the TEE for deliveries and other service vehicles.

The existing light rail track would be relocated to accommodate the TEE concourse and new roads exiting the existing terminal. The tracks would be on the south side of the roadways exiting the main terminal and would serve an at-grade station located between the Airport exit road and the TEE concourse (beneath the bridge connecting the TEE terminal to the concourse).

ALTERNATIVES SCREENING

It was determined that alternatives selected for refinement should have the following key elements:

- *Independent terminal roadway systems*—To minimize traffic on the existing terminal curbside roadways, traffic bound for one terminal should not be required to travel past the curbsides of the other terminal. This plan would reduce the traffic volumes at the TEE and would allow the existing terminal roadways to operate at a higher level of service.

  Impact*:* The Single-Loop Roadway alternatives were not considered for further refinement.

- *Maximized P-2 parking facility footprint*—In recent years, demand for public parking close to the terminal has increased at a faster rate than originating passengers. Since P-2 is an opportunity to provide public parking within walking distance of the existing terminal building, the footprint should fully utilize the area bounded by P-1, the ATCT/CUP, the existing entrance roadway, and the realigned exit roadway, while maintaining independent access into P-2.

Impact: Any refinement of the TEE South roadway alternative should locate TEE access roads to the east of the ATCT/CUP. Appendix B provides an analysis of the additional P-2 capacity allowed by locating the TEE access roads to the east of the ATCT/CUP.

- *Terminus light-rail station at the existing terminal*—The light-rail alignment allowed by a terminus station at the south side of the existing terminal provides the least-expensive opportunity to maintain light-rail service at the existing terminal while allowing a second station at the TEE. The one-way light rail loop would require extensive elevated track and very tight horizontal curves.

  Impact: Any refined alternative should assume that the light-rail line has a straight alignment that ends in a terminus station at the south side of the existing terminal.

Based on these element requirements, it is recommended that refined alternatives be prepared for the TEE South alternative and the TEE Central alternative.

Chapter 5

ALTERNATIVES REFINEMENT

INTRODUCTION

Using the process described in Chapter 4, two initial facility development alternatives were selected for further refinement. This chapter describes the refinement process, presents the resulting final development alternatives, and provides recommendations for next steps.

REFINEMENT PROCESS

Through a series of workshops with stakeholders and Airport staff, two refined alternatives were developed based on the two selected initial alternatives. Refinements typically resulted from:

- Facility-specific requirements identified during the alternatives screening process (see Chapter 4)
- Combining preferred elements from several alternatives
- Refinement of roadway, light-rail, and pedestrian facility alignments to a greater level of detail, especially in areas with limited space
- Policy decisions regarding the timing of certain facility improvements

As part of the refinement process, pedestrian facilities were developed for each alternative and the light-rail components were refined as described below.

Pedestrian Facilities

To address the Port's desire to provide pedestrian connectivity between the existing terminal, the TEE, and the close-in public parking facilities, alternative-specific pedestrian facility plans were prepared responding to the location and dimensions of key terminal and parking facilities included in the two refined alternatives.

Key assumptions governing the pedestrian facility plans included:

- Non-secure paths should be provided connecting the existing terminal, the TEE, and all close-in public parking facilities.
- Similar to the existing terminal, both pedestrian bridges and tunnels should connect the TEE terminal with nearby parking facilities
- At-grade path width: 10 feet

- Bridge width: 20 feet
- Tunnel width: 30 feet

Light Rail

Additional dimensional design details for the light-rail track alignments and stations were addressed in the refined alternatives due to the limited space available between the TEE concourse and P-1. These details were applied to confirm the feasibility of locating the light-rail tracks and stations within the same constrained corridor as multiple roadways (a drawing developed to confirm this feasibility is provided in Appendix C). The design details for light-rail include:

- End-of-line stations must have a nearby switch to allow trains to transfer between tracks
- Track overrun at end-of-line station: 30 feet
- Center-platform station: 200 feet long and 30 feet wide
- Side-platform station: 200 feet long and 15 feet wide

In addition, during the workshops with Airport staff and stakeholders, workshop participants recommended that a non-secure at-grade path be provided between the light-rail stations serving the existing terminal and the TEE. This path would provide redundancy with the light-rail system and would allow pedestrian circulation between the TEE terminal and the light-rail station at the existing terminal should the TEE open prior to the station serving the TEE (or if no TEE station is provided). It was also recommended that both stations use side platforms so that a path could connect the stations without crossing one or more light-rail tracks.

As the alternatives were defined, some components became common among the two alternatives, such as the proposed parking garage and rental car facilities, whereas other components, such as the roadways and curbsides, are alternative-specific. The components for each are described in the following paragraphs.

TEE SOUTHEAST ALTERNATIVE DESCRIPTION

Figures 5-1 through 5-3 depict key elements of the refined TEE Southeast alternative and Figure 5-4 presents a combined image of all key elements as well as a cross-section of the TEE terminal and key access elements. The TEE Southeast alternative is based on the TEE South alternative presented in Chapter 4—Alternatives Development and Screening, but to maximize the footprint of P-2, the TEE terminal (the passenger processing facility) is located farther east than originally proposed in the 2000 PDX Master Plan, which allows the TEE access

P-1
Public spaces: 3,341
RAC spaces: 981
Total spaces: 4,322

P-2
Levels 1 - 7 : 3,500 spaces
(Public parking and RAC)

ATCT

CUP

Rental Car QTA
166,000 square feet

P-3
Levels 1 - 7: 3,300 spaces

Future taxiway

TAXIWAY T

TAXIWAY B

K:_P_\PDX\Terminal Access\Concepts\Report figures\Fig 5-1 to 5-4.dwg, 11 x 17 parking

LEGEND

Buildings and parking

- Existing terminal / service facility
- Future terminal
- Existing parking garage
- New parking garage
- Future QTA

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-1

TEE SOUTHEAST ALTERNATIVE PARKING FACILITIES

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P-1
P-2
ATCT
CUP
QTA road
Rental Car QTA
P-3
GT Hold Lot
122,000 square feet
Future taxiway
TAXIWAY T

LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways
- Ground level road
- Second level road
- Third level road
- Service road, ground level

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N
125 0 125 250
Graphic Scale in Feet

Figure 5-2
TEE SOUTHEAST ALTERNATIVE ROADWAYS
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Portland International Airport
March 2005

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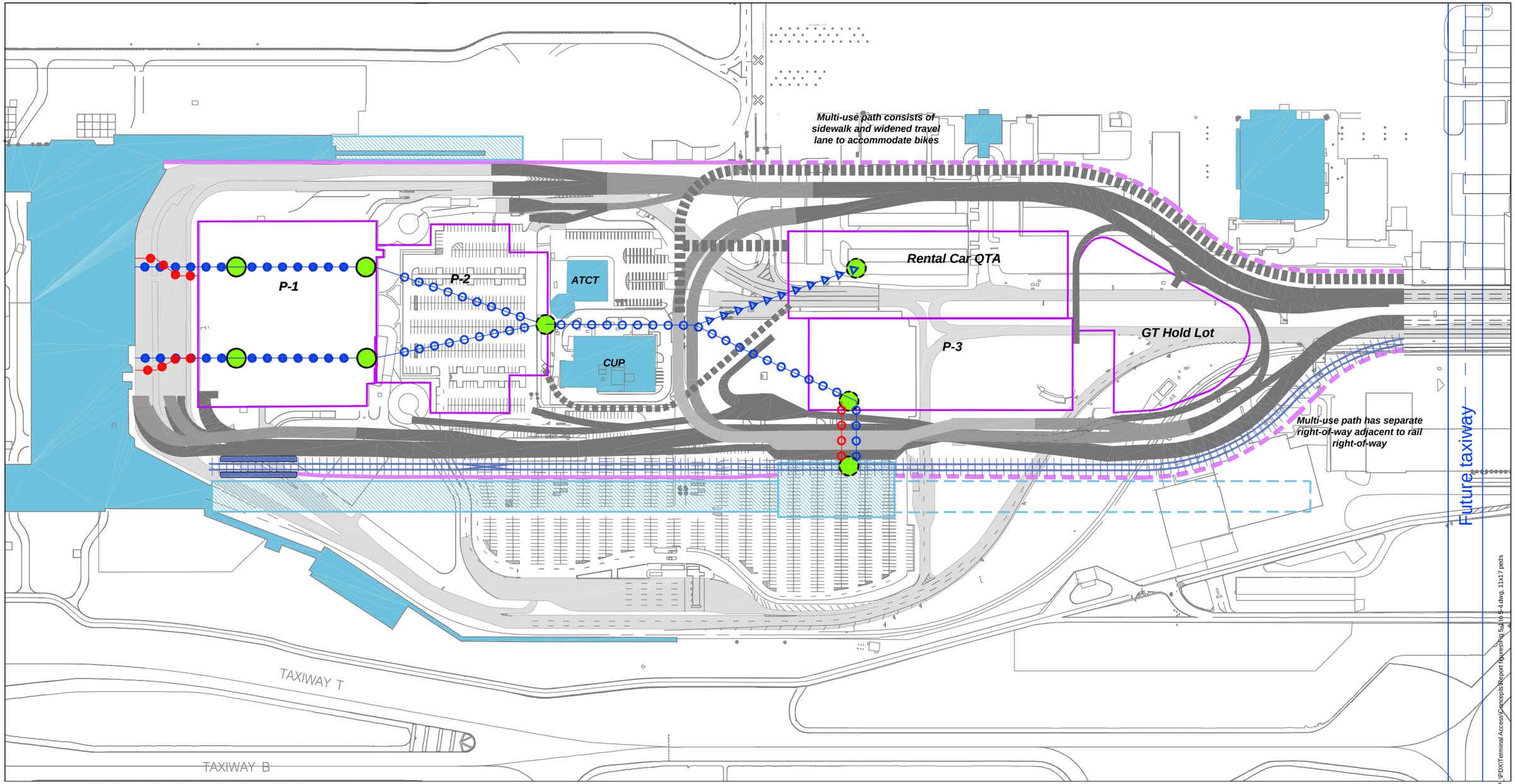

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LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Pedestrian elements
- Existing tunnel
- New tunnel
- Potential tunnel extension
- Existing bridge
- New bridge

Rail and multi-use elements
- New at-grade path
- Existing vertical core
- New vertical core
- Rail
- Rail station
- Multi-use access route

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-3
TEE SOUTHEAST ALTERNATIVE PEDESTRIAN CIRCULATION AND RAIL ELEMENTS

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Portland International Airport
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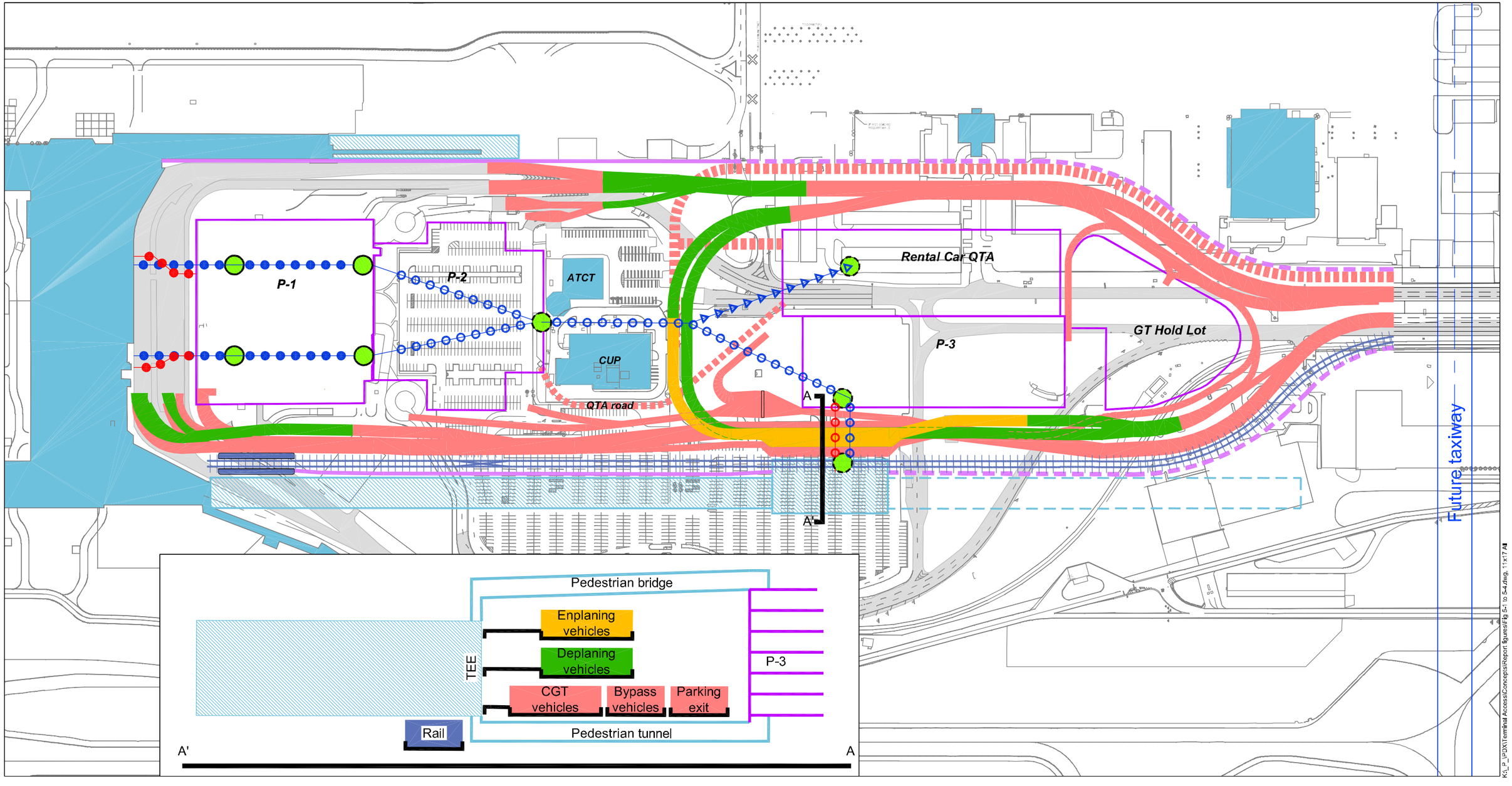

LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways
- Ground level road
- Second level road
- Third level road
- Service road, ground level

Pedestrian elements
- Existing tunnel
- New tunnel
- Potential tunnel extension
- Existing bridge
- New bridge

Rail and multi-use elements
- New at-grade path
- Existing vertical core
- New vertical core
- Rail
- Rail station
- Multi-use access route

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-4

TEE SOUTHEAST ALTERNATIVE ALL ELEMENTS

Terminal Access Study
Portland International Airport
March 2005

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roadways to be located east of the ATCT/CUP. Long-term eastward expansion of the TEE concourse, which would occur beyond the planning period considered as part of this study, is also shown.

Descriptions of each key access element follow.

Parking

Short- and long-term parking, economy and employee parking, vendor parking, and motorcycle parking are described in the following paragraphs.

Short-Term and Long-Term Parking. As shown on Figure 5-1, the TEE Southeast alternative includes two new public parking facilities:

- P-2, located immediately east of P-1, provides approximately 3,500 spaces on seven levels. The spaces will be used exclusively for long-duration public parking (serving the existing terminal) until demand for rental car ready/return facilities exceeds the space allocated in P-1. Long-term, P-2 could provide rental car ready/return on the first two floors. Though the capacity provided in P-2 exceeds the capacity assumed in the Conditional Use Master Plan Permit (see Chapter 2), Port staff will use the results of this study to identify components of the permit that require updates.
- P-3, located east of the CUP and directly north of the TEE terminal, provides approximately 3,300 spaces on seven levels. The spaces will be used for public parking (serving the short-duration parking demand for TEE passengers as well as long-duration parking demand for both TEE and the existing terminal). Depending on the longer-term future of rental cars, it is possible that P-3 could be used for rental car ready/return facilities. As with P-2, though the capacity provided in P-3 exceeds the capacity assumed in the Conditional Use Master Plan Permit (see Chapter 2), Port staff will use the results of this study to identify components of the permit that require updates. (A description of various options for the development of public parking and rental car facilities is provided in Appendix D.)

The location and footprint of P-2 allows its construction with minimal impact on existing roadways and service facilities and no impact on the future location of the TEE. Similarly, P-3 can be constructed with minimal disruption to existing facilities—only the existing recirculation road will need to be relocated. P-3 can also be constructed independently from the TEE in the event that more close-in parking capacity is required before more terminal capacity is required.

It is assumed that all public parking facilities will employ pay-on-foot revenue control equipment. Exit plazas for these facilities are sized assuming that over 85% of patrons will elect to use pay-on-foot parking equipment.

Economy and Employee Parking. All identified future needs for economy and employee parking cannot be accommodated in the terminal area. It is assumed they will be accommodated at remote locations outside the study area.

Vendor Parking. Two options are available for service deliveries to the TEE. Deliveries could occur in courtyards located on either side of the TEE commercial vehicle level (the lower level of the building). Deliveries could also be made at a "commissary" located elsewhere on the Airport. At the commissary, deliveries would be inspected, repackaged, and loaded onto smaller vehicles. These vehicles could then travel through secure Airport areas (e.g., across the airfield) to service docks located in secure sections of the TEE and existing terminal building.

Motorcycle Parking. Motorcycle parking currently is provided on the north corner of the terminal building off the lower level curbside. In the future motorcycle parking could be provided in new courtyards adjacent to the TEE (in the proposed vendor parking area). Alternatively, space could be designated in P-2 and /or P-3 and could be considered as these plans are developed.

Roadways

Figure 5-2 depicts the roadway system associated with the TEE Southeast alternative. Airport Way, widened to three lanes, provides the entrance to and exit from the terminal area. West of the future taxiway, westbound Airport Way has been realigned to the north, which increases the infield area for public parking and other uses. Following the turn to the west, the entry road divides between the existing terminal and roads leading to the TEE.

Traffic bound for the existing terminal ascends to allow a service road to pass beneath the roadway and then returns to grade. On the downhill grade, traffic bound for the curbsides stays to the right while traffic bound for P-1 and P-2 exits to the left. Curbside-bound vehicles proceed on existing roadways past the enplaning drive, deplaning drive, and commercial vehicle area. At the south end of the curbsides, the curbside roadways turn to the east and the enplaning drive descends to merge with the deplaning drive. Prior to this merge, the commercial vehicle roadway merges with the deplaning drive so that commercial vehicles wishing to travel to the TEE have adequate time to maneuver to the right-hand lanes without weaving across enplaning drive traffic. The roadway proceeds east, bypassing the TEE, and proceeds east to the existing alignment of eastbound Airport Way.

Traffic bound for the TEE exits from westbound Airport Way on the left and ascends to the diverge between the enplaning and deplaning levels of the TEE. As the roadways turn south, traffic bound for the enplaning level of TEE continues to climb to Level 3 of the building while traffic bound for the deplaning level remains at the elevation of the TEE deplaning level (the second level of the building). At the east

end of the curbsides, the TEE enplaning and deplaning roads merge and then descend to merge with the roadway exiting the existing terminal. Commercial traffic bound for the TEE commercial lanes (located on the ground level) travel through the commercial lane at the existing terminal, merge with the realigned exit road, exit to the TEE commercial lanes, and then rejoin the realigned exit road.

To reach P-3, the public parking garage serving the TEE, traffic would exit westbound Airport Way to the left immediately west of the future taxiway onto a frontage road. This frontage road allows access to P-3 as well as other land uses in the infield area (e.g., commercial ground transportation hold, rental car QTA) before reconnecting with westbound Airport Way.

Recirculating traffic from the existing terminal would exit the outbound roadway and pass underneath the TEE roadways on a return-to-terminal road that connects to the frontage road (described above), which merges with westbound Airport Way. Recirculating traffic from the TEE would exit to the left (prior to the merge with Airport Way) and join the return-to-terminal road.

Access to the ATCT and CUP is provided via a service road passing underneath the approach to the existing terminal and connecting to the frontage road running north of Airport Way. This service road, which could be restricted to authorized traffic, also provides access to other non-public infield areas (see "Rental Cars," below).

Terminal Curbside

As shown on the cross-section provided on Figure 5-4, the TEE Southeast Alternative assumes a three-level curbside. Though the interior configuration of the TEE terminal has not been designed, it is assumed that ticketing functions would occur on the upper level and would be served by the enplaning curbside. Baggage claim functions occur on the middle level and are served by the deplaning curbside.

The commercial vehicle curbside would be adjacent to the ground level roadway, serving the lower level of the terminal and is used by commercial vehicles picking up passengers (commercial vehicles are assumed to drop off passengers on the enplaning level). Additional lanes on the ground level roadway would serve bypass traffic and traffic exiting parking. As described above, unlike the enplaning and deplaning curbsides which have direct access from the inbound roadway to the TEE curbsides, the commercial vehicle curbside can only be reached by passing through the curbsides serving the existing terminal.

Rental Cars

As stated in Chapter 4, it is assumed that rental car ready/return facilities will continue to be provided in P-1 with provision for expansion into P-2. As demand requires, rental car ready/return facilities could also be provided in P–3.

As stated in Chapter 3, the existing on-Airport rental car operation is constrained by the limited capacity of the QTA. Figure 5-2 identifies an area for a new QTA that meets the requirements of the rental car companies through 23 MAP. The QTA, located between P-3 and westbound Airport Way, is connected to the ready/return facilities in P-1 and P-2 by a dedicated roadway to allow rental car companies to shuttle vehicles to and from the QTA without using public roadways. Offsite access to the QTA (for vehicle and materials deliveries) is via the same service road providing access to the ATCT and CUP.

Commercial Ground Transportation Hold Lots

The TEE Southeast alternative includes a Ground Transportation Hold Lot. This lot will serve the same function as the existing hold lot by providing an area for commercial vehicles to wait until they proceed to the terminals for passenger pick up. It has been sized at 122,000 square feet to accommodate needs through 23 MAP. The hold lot is located at the east end of the infield area, between P-3 and the QTA and the return-to-terminal road. Vehicles enter the hold lot via the frontage road providing P-3 access and, using the same frontage road, merge with westbound Airport Way to reach the commercial vehicle passenger pickup areas at each terminal.

Pedestrian Facilities

Figure 5-3 depicts the pedestrian facilities providing connectivity between the public facilities in the terminal area. As shown, the TEE terminal has a bridge and tunnel connection to P-3 (similar to the bridges and tunnels provided at the existing terminal). However, no at-grade crossings are recommended due to the high traffic volume expected on the grade-level roadway (including all exiting traffic from the Existing Terminal). The existing tunnels underneath P-1 extend to the east underneath P-2, merging into a single tunnel near the midpoint of the east edge of P-2. From this point, a single tunnel continues east, then southeast to connect the TEE terminal to P-3. If, beyond the planning period addressed in this study, the QTA is converted to public parking, the new public parking could also be connected to the tunnel network. To allow access to the public parking facilities, vertical circulation cores are provided at key locations.

Figure 5-3 also shows the multi-use paths providing pedestrian and bicycle access into the terminal area. On the north side of the terminal area, the multi-use path runs parallel to the frontage road to join a new at-grade path that continues west into the existing terminal. The configuration of the northside path would include a widened outside travel lane (14-foot) to be shared with bicycles and an adjacent sidewalk for pedestrians. On the south side, the multi-use path runs south of the relocated light-rail tracks (discussed below) until it reaches the TEE terminal. The southside multi-use path is proposed to include a bikeway/pedestrian way that is

physically separated from the rail tracks. West of the TEE terminal, a new at-grade path runs between the TEE concourse and the light-rail tracks.

Light Rail

Figure 5-3 also depicts the realigned light-rail tracks and new station location. As shown, the TEE Southeast alternative assumes that there will be one airport station (located at the existing terminal). This alternative reflects the possibility that Tri-Met and others may conclude that the ridership generated by the TEE does not justify a second Airport station. Immediately west of the future taxiway, the light-rail tracks turn southeast, running adjacent to eastbound Airport Way. East of the TEE, the tracks descend underground to pass underneath the TEE terminal. West of the TEE terminal, the tracks return to grade and end at the existing terminal at a station having side platforms. East of the station, a switch is provided to allow trains to transfer between tracks.

Should a station be required (or desired) at TEE, a side platform could be accommodated underneath the TEE terminal on the north and south side of the tracks.

TEE CENTRAL ALTERNATIVE DESCRIPTION

Figures 5-5 through 5-7 depict key elements of the refined TEE Central alternative and Figure 5-8 presents a combined image of all key elements as well as a cross-section of the TEE terminal and key access elements. In this alternative, the TEE terminal is located east of the ATCT/CUP and is oriented parallel to the existing terminal. The location and orientation of the TEE terminal allows for its potential expansion to the north and thus, a connection to aircraft gates located on the north side of the terminal areas. As part of the alternatives refinement process, the TEE Central alternative terminal building was subjected to a validation process to determine (1) the terminal functions could be accommodated on two levels within the available area (previous planning work assumed a three-level TEE terminal) and (2) the likely length and depth of a two-level terminal. Appendix E contains drawings prepared as part of that validation process.

Descriptions of each key access element follow.

Parking

As shown on Figure 5-5, the TEE Central alternative includes two new public parking facilities: P-2 and P-3. These parking garages are identical in size and location to those included in the TEE Southeast alternative. Therefore, P-2 and P-3 could be constructed prior to any decision on the location of TEE and the roadways associated with this terminal. As in the TEE Southeast alternative, it is assumed that

P-1
Public spaces: 3,341
RAC spaces: 981
Total spaces: 4,322

P-2
Levels 1 - 7: 3,500 spaces
(Public parking)

ATCT

CUP

Rental Car QTA
166,000 square feet

P-3
Levels 1 - 7: 3,300 spaces

Future taxiway

TAXIWAY T

TAXIWAY B

K:\...\P_1\PDX\Terminal Access\Concepts\Report figures\Fig 5-5 to 5-8&A-1.dwg, 11x17 parking

LEGEND

Buildings and parking

- Existing terminal / service facility
- Future terminal
- Existing parking garage
- New parking garage
- Future QTA

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-5
TEE CENTRAL ALTERNATIVE PARKING FACILITIES

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P-1
P-2
ATCT
CUP
QTA road
GT Hold Lot
Rental Car QTA
Interim GT Hold Lot
P-3
Future taxiway
TAXIWAY T

K:\L_P_\PDX\Terminal Access\Concepts\Report figures\Fig 5-5 to 5-8&A-1.dwg, 11x17 roads

LEGEND

Buildings and parking

- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways

- Ground level road
- Second level road
- Service road, ground level
- Service road, tunnel

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-6
TEE CENTRAL ALTERNATIVE ROADWAYS

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Future taxiway

Original 82nd Street interchange plan

Second level roadway (added to original interchange plan)

LEGEND

Buildings and parking

- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways

- Ground level road
- Second level road
- Service road, ground level
- Service road, tunnel

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250

Graphic Scale in Feet

Figure 5-6a

TEE CENTRAL ALTERNATIVE ROADWAYS (East section)

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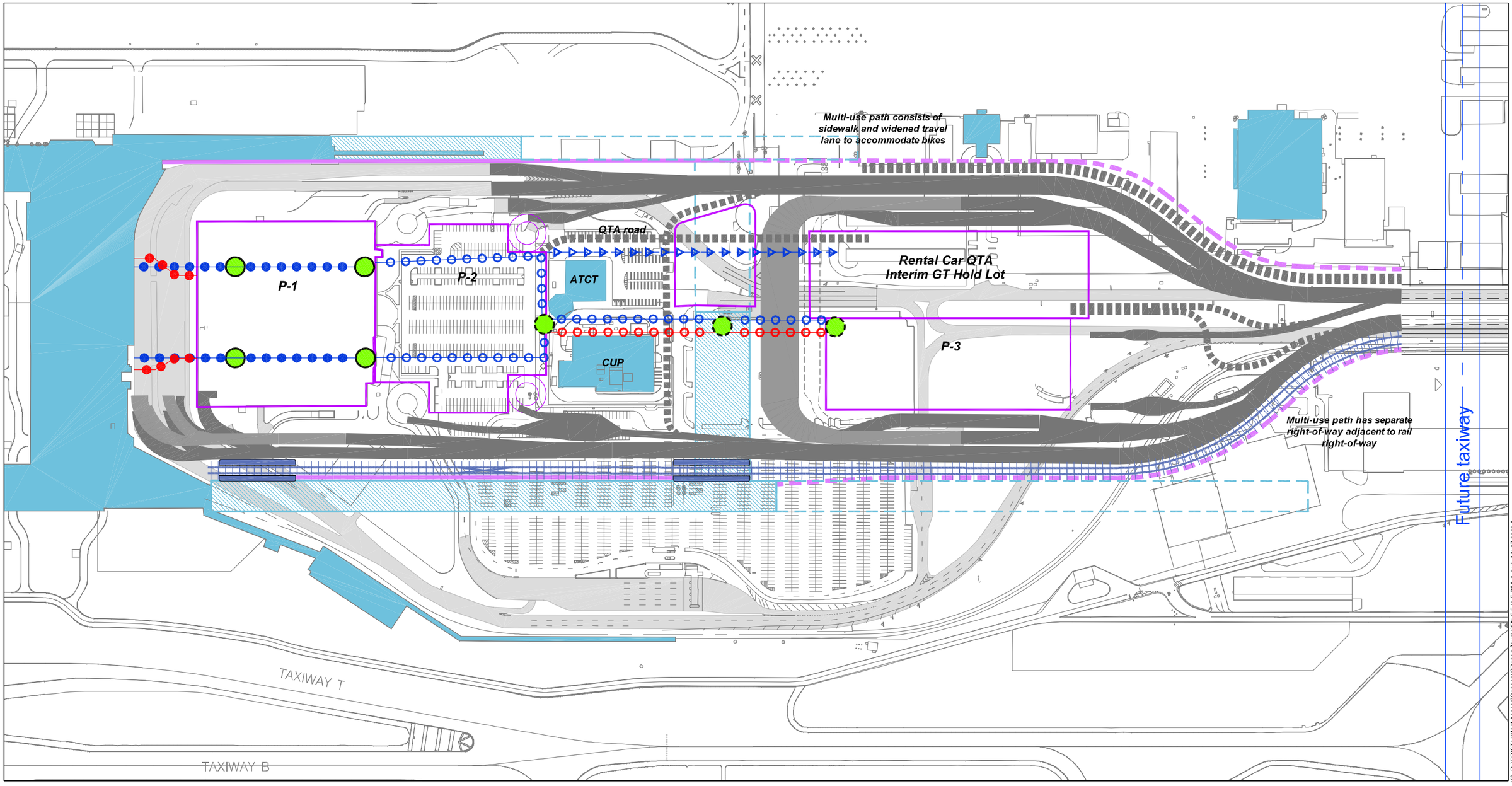

LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Pedestrian elements
- Existing tunnel
- New tunnel
- Potential tunnel extension
- Existing bridge
- New bridge

Rail and multi-use elements
- New at-grade path
- Existing vertical core
- New vertical core
- Rail
- Rail station
- Multi-use access route

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-7
TEE CENTRAL ALTERNATIVE
PEDESTRIAN CIRCULATION AND RAIL ELEMENTS

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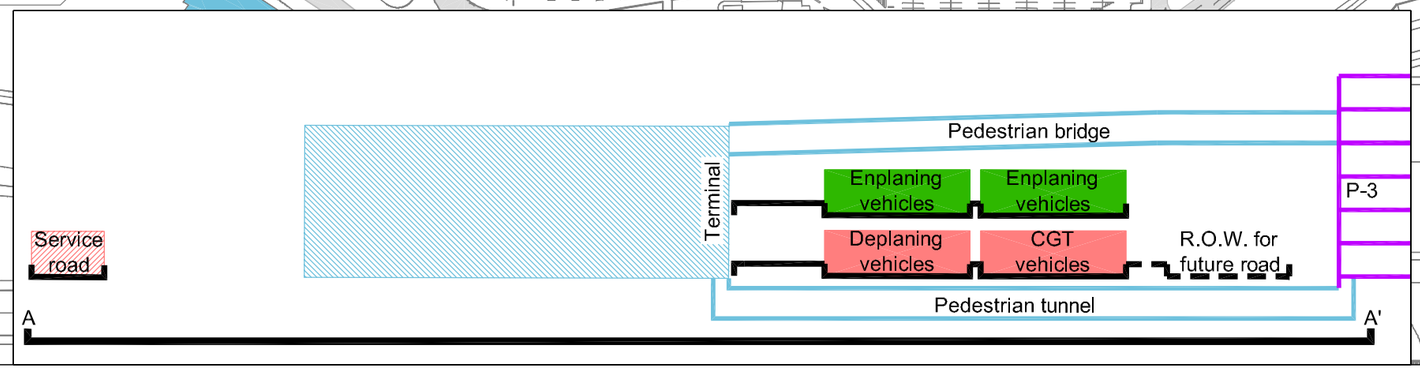
P-1
P-2
ATCT
CUP
QTA road
GT Hold Lot
A
A'
Rental Car QTA
Interim GT Hold Lot
P-3
Future taxiway



K:_P_\PDX\Terminal Access\Concepts\Report figures\Fig 5-6 to 5-8&A-1.dwg, 11x17 All

LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways
- Ground level road
- Second level road
- Service road, ground level
- Service road, tunnel

Pedestrian elements
- Existing tunnel
- New tunnel
- Potential tunnel extension
- Existing bridge
- New bridge

Rail and multi-use elements
- New at-grade path
- Existing vertical core
- New vertical core
- Rail
- Rail station
- Multi-use access route

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure 5-8
TEE CENTRAL ALTERNATIVE ALL ELEMENTS

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all public parking facilities will employ pay-on-foot revenue control equipment, and thus the exit plazas were sized in the same manner.

Roadways

Figure 5-6 depicts the roadway system associated with the TEE Central alternative. Airport Way, widened to three lanes, provides the entrance to and exit from the terminal area. West of the future taxiway, westbound Airport Way turns northwest then back to the west to allow increased infield area for public parking and other uses. As the road turns to the northwest, the road splits into roads bound for the existing terminal and roads bound for the TEE.

Traffic bound for the existing terminal uses the existing roadways that lead to the existing terminal curbsides. East of the ATCT, traffic bound for the existing curbsides stays to the right while traffic bound for P-1 and P-2 exits to the left. Curbside-bound traffic proceeds on existing roadways to the enplaning drive, deplaning drive, or commercial vehicle area. At the south end of the curbsides, the curbside roadways turn to the east and the existing enplaning drive descends to merge with the deplaning drive. Prior to this merge, the commercial vehicle roadway merges with the deplaning drive. The roadway proceeds east, merging with the public parking exit and passing between the TEE terminal and concourse, before turning northeast and then east to the existing alignment of eastbound Airport Way.

Traffic bound for the TEE exits Airport Way, and, after the road turns back to the west, splits into the enplaning and deplaning curbsides. Once the enplaning roadway is directly above the deplaning roadway, both roadways turn south to run parallel to the TEE terminal. If demand warrants, a separate commercial vehicle curbside could run adjacent to the deplaning curbside. At the south end of the curbsides, the curbside roadways turn east and the enplaning and deplaning roadways join before merging with the roadway leading from the existing terminal.

To reach P-3, the public parking garage serving the TEE, traffic exits to the left immediately west of the future taxiway. This exit also provides service vehicle access to the rental car QTA (described below).

Traffic recirculating to both terminals uses a return-to-terminal ramp located at the future interchange at 82nd Street and Airport Way (depicted on Figure 5-6a). Recirculating traffic will use the eastbound off-ramp towards 82nd Street, and then turn onto the return-to-terminal ramp before reaching 82nd Street. The ramp will turn back to the west and join the westbound onramp connecting 82nd Street to westbound Airport Way.

Access to the ATCT, CUP, and service areas of the TEE is provided via a service road that exits from westbound Airport Way prior to the exits for P-1 and P-2. This

service road travels south, between the ATCT/CUP and the TEE, merges with the public parking exit, and subsequently merges with the roadway leading from the existing terminal. This service road could be restricted to authorized traffic.

Terminal Curbsides

As shown on the cross-section provided on Figure 5-8, the TEE Central alternative assumes a two-level curbside. It is assumed that ticketing functions would occur on the upper level and would be served by the enplaning curbside. Baggage claim functions would occur on the lower level and would be served by the deplaning curbside.

The commercial vehicle curbside, would be similar to the commercial roadway currently serving the existing terminal. It would serve the lower level of the terminal, and would be adjacent to the deplaning curbside. The commercial roadway would be used by commercial vehicles picking up passengers (commercial vehicles are assumed to drop off passengers on the enplaning level). Between the commercial curbside and P-3 sufficient area is provided to allow for further widening of the commercial roadway.

Rental Cars

As in the TEE Southeast alternative, the TEE Central alternative identifies an area for a new QTA that meets the requirements of the rental car companies through 23 MAP (shown on Figure 5-6). The QTA, located between P-3 and westbound Airport Way, is connected to the ready/return facilities in P-1 and P-2 by a dedicated roadway to allow rental car companies to shuttle vehicles to and from the QTA without using public roadways. To avoid conflicts with the TEE curbsides and service road, portions of this QTA road will be grade-separated. Offsite access to the QTA (for vehicle and materials deliveries) is via the same road providing access to P-3. Vehicles exiting the QTA would cross the P-3 entrance at an at-grade intersection before joining eastbound Airport Way.

Commercial Ground Transportation Hold Lots

The TEE Central alternative provides for several small facilities rather than a single large hold lot. Certain modes, such as charter buses and scheduled buses, may be accommodated in areas east of the future taxiway. Given that until 23 MAP, demand for public parking and rental car facilities will not require 100% of areas allocated for P-3 and the rental car QTA, commercial ground transportation modes requiring quicker response times to the terminals, such as taxicabs and door-to-door vans, could be accommodated in smaller hold lots (i.e., north of the TEE) or within unused area allocated for other uses (e.g., the QTA or P-3).

Pedestrian Facilities

Figure 5-7 depicts the pedestrian facilities providing connectivity between the public facilities in the terminal area. As shown, the TEE terminal has a bridge, tunnel, and at-grade connections to P-3 (similar to the bridges and tunnels provided at the existing terminal). The existing tunnels underneath P-1 extend to the east underneath and to the east edge of P-2 before merging to a single tunnel near the midpoint of the east edge of P-2. From this point, a single tunnel continues east to the TEE terminal. To provide redundancy, a pedestrian bridge is also provided between the TEE terminal and P-2. To allow access to the public parking facilities, vertical circulation cores are provided at key locations.

If, beyond the planning period addressed in this study, the QTA is converted to public parking, the new public parking could be connected to the tunnel network. This connection would allow a direct link from the east side of the infield area to the existing terminal and could eventually accommodate an automated people mover.

Figure 5-7 also shows the multi-use paths providing pedestrian and bicycle access into the terminal area. On the north side of the terminal area, the multi-use path runs parallel to the frontage road to join a new at-grade path that continues west into the existing terminal. The configuration of the northside path would include an widened outside travel lane (14-foot) to be shared with bicycles and an adjacent sidewalk for pedestrians. On the south side, the multi-use path runs south of the relocated light-rail tracks (discussed below) until it reaches the TEE light-rail station. The southside multi-use path is proposed to include a bikeway/pedestrian way that is physically separated from the right rail tracks. West of the TEE station, a new at-grade path runs between the TEE concourse and the light-rail tracks.

Light Rail

Figure 5-7 also depicts the realigned light-rail tracks and new station locations. As shown, the TEE Southeast alternative assumes that there will be two stations—one located at the existing terminal and a second located at the TEE between the terminal and concourse. Immediately west of the future cross-field taxiway, the light-rail tracks turn southwest, extending adjacent to eastbound Airport Way. The tracks continue parallel to eastbound Airport Way until they reach the existing terminal.

The TEE station will have two side-platforms each platform having vertical circulation cores connecting to the enplaning level of the TEE terminal. The tracks terminate at the existing terminal at a station having side platforms. East of the station, a switch is provided to allow trains to transfer between tracks.

VEHICLE INSPECTION FACILITIES

As stated in Chapter 2, new and evolving federal regulations relative to homeland security will affect the development of new facilities at the Airport. Existing regulations require an area to inspect vehicles during threat levels "orange" and "red." During threat level "orange," airport operators are currently required to restrict parking within 300 feet of the terminal or implement alternative procedures (e.g., inspect vehicles entering parking) approved by the TSA. Under threat level "red," airport operators are currently required to conduct random, non-discriminatory inspections of vehicles (including all large vehicles) approaching the terminals (to date, threat level "red" has not been enacted). Since threat level "red" will likely be enacted on a site-specific basis and for a limited duration, it is assumed that the Airport will not provide vehicle inspection facilities to meet demand under threat level "red."

Both refined alternatives provide for a vehicle inspection area located at the inter-change of Airport Way and 82nd Street. Inbound vehicles selected for inspection would be directed to exit Airport Way at 82nd Street. Vehicles would cross 82nd Street and inspections would occur on the on-ramp leading to westbound Airport Way. Drivers preferring not to be inspected would turn left onto 82nd Street and exit via eastbound Airport Way. If necessary, the inspection area could be expanded to capture vehicles using the frontage road located north of Airport Way.

COMPARATIVE ASSESSMENT OF REFINED ALTERNATIVES

Table 5-1 presents a comparative assessment of key features of the two refined alternatives. This assessment applies only to the facilities associated with the TEE. The evaluation measures addressed in the assessment include:

- *Capacity provided in the terminal area (as compared to demand)*—This measure compares the terminal area capacity for roadways, curbsides, public parking, rental cars, commercial vehicle hold facilities, and light rail facilities. Where an alternative satisfies the demand requirements, the alternative is rated acceptable (yellow). Where an alternative provides capacity exceeding the requirements, the alternative is rated highly (green) due to its ability to accommodate growth beyond the planning period as well as respond to unanticipated changes in demand. Where an alternative does not meet requirements, the alternative receives a poor rating (red).

Table 5-1
COMPARATIVE EVALUATION OF TERMINAL AREA ACCESS ALTERNATIVES
Terminal Access Study
Portland International Airport

Evaluation measure	TEE Southeast	TEE Central
Capacity provided within terminal area (as compared to demand)		
Roadway	meets	meets
Public curbside	meets	exceeds
Parking	exceeds	exceeds
Rental Car	meets	meets
Ground Transportation		
Commercial curbside	meets	exceeds
Hold lot	meets	does not meet
TriMet LRT	meets	meets
Implementation		
Ease of phasing	fair	good
Constructibility	fair	fair
Ability to expand	poor	good
Cost	$$$$	$$$
Operational consideratios		
Curbside flexibility	fair	good
Commercial vehicle operations	good	fair
Pedestrian connections between TEE and		
P2 parking structure	fair	good
P3 parking structure	good	good
TriMet LRT	fair	good
Existing terminal	fair	good
Vehicular connections provided		
Approaching TEE	fair	good
Return-to-terminal	good	fair
To/from support areas	good	fair
To/from rental car QTA (shuttlers only)	fair	fair
Other access modes to/from Airport		
TriMet LRT	fair	good
Multi-Use Path (bicycles and pedestrians)	good	good

Source: Leigh Fisher Associates Team, March 2005.

As shown, the TEE Southeast alternative exceeds requirements for public parking and meets requirements for the other elements. The TEE Central alternative exceeds requirements for curbside and public parking, but, by 23 MAP, the ground transportation hold lot may require that some facilities be located east of the terminal area.

- *Implementation*—These measures assess the ease of implementation of the two refined alternatives in the following areas:

  - *Ease of phasing*. This measure rates the ability to develop the alternative in a phased manner. In each alternative, the location of the TEE terminal and concourse will primarily displace existing surface roadways and surface parking. It is anticipated that these facilities can be relocated to their ultimate location without requiring significant investment in temporary facilities. Thus, both alternatives receive a high rating.

  - *Constructibility*. This measure rates the ability to construct each alternative. The three-level TEE terminal, associated roadways, and underground light-rail section that constitute the TEE Southeast alternative will likely present more construction challenges than the two-level building and roadway system and at-grade light-rail alignment proposed for the TEE Central alternative. Therefore, the TEE Southeast alternative is rated acceptable and the TEE Central alternative is rated higher.

  - *Ability to expand*. This measure rates each refined alternative's ability to expand to accommodate demands beyond the planning period. As shown, the TEE Southeast alternative is rated poorly reflecting the alternative's inability to provide additional passenger processing facilities beyond those provided in the TEE footprint. The TEE Central alternative receives a high rating since the TEE location allows future expansion to the north and the eventual connection to gates on the north side of the terminal area.

  - *Cost*. Cost estimates for the two alternatives indicated that the TEE Central alternative would cost less than the TEE Southeast alternative by about $44 million. The cost estimates are described at the end of this chapter.

  - *Operational considerations.* These measures compare each alternative's ability to accommodate curbside and commercial vehicle operations.

  - *Curbside flexibility.* This measure rates each alternative's ability to adjust curbside usage in response to unanticipated changes in demand. Since the TEE Central alternative allows both a wider and longer curbside than that

provided by the TEE Southeast alternative, as well as additional curbside expansion capability, it warrants a higher rating.

- *Commercial vehicle operations.* This measure rates each alternative's ability to allow for efficient management of commercial vehicle operations. The TEE Southeast alternative receives a high rating because it incorporates a ground transportation hold lot within the terminal area that allows commercial vehicles quick and easy access to the commercial vehicle areas at each terminal and allows the Airport to continue its existing commercial vehicle management program. The TEE Central alternative (a) requires multiple hold facilities and (b) does not ensure the same response times between the hold facilities and the curbside areas. Thus, the TEE Central alternative without signals receives a lower rating.

• *Pedestrian connections between TEE and other terminal area facilities*—This measures rates the level of pedestrian connectivity between the TEE terminal and other terminal area facilities. Where an alternative provides redundant, direct connections, it receives a high rating. Where a alternative provides the connection but the connection may be circuitous or does not allow an alternate route, it receives an acceptable rating. If a connection is not provided (i.e., no at-grade connection), the alternative receives a poor rating.

  As shown, the TEE Southeast alternative provides acceptable connections between the TEE and P-3, the light-rail station, and the existing terminal. This rating is based on the single tunnel connecting the TEE terminal to P-2 as well as the longer walking distances resulting from the TEE location. The TEE Central alternative receives a high rating for the pedestrian connections due to the presence of a pedestrian bridge and tunnel between the TEE terminal and P-2, as well as the presence of a light-rail station at the TEE.

• *Vehicular connections*—These measures assess the quality of selected vehicular movements provided in each alternative.

  - *Approach to the TEE curbsides.* The measure rates each alternative's ability to provide an intuitive path for drivers to find the TEE curbsides. The TEE Central alternative receives a higher rating because (a) drivers bound for the TEE can see the terminal at the decision point for TEE versus the existing terminal and (b) the roadway and curbside configuration is consistent with that provided at the existing terminal. Conversely, the TEE Southeast alternative requires drivers to make the TEE versus existing terminal decision without being able to see either terminal.

  - *Return-to-terminal path.* This measure rates the quality of the return-to-terminal (recirculation) path provided in each alternative. The TEE Southeast alternative receives a high rating because the return-to-terminal

path is provided within the terminal area, which allows shorter travel times for recirculating vehicles. The TEE Central alternative receives an acceptable rating because the return-to-terminal path is provided east of the terminal area and requires longer travel times (approximately 3 additional minutes) than the TEE Southeast alternative.

- *Access to infield support areas (e.g., ATCT and CUP).* This measure rates the quality of each alternative's connection to the ATCT and CUP. The TEE Southeast alternative is rated highly because the service road allows vehicles to reach the ATCT and CUP without using the main Airport entrance and exit roads. The TEE Central alternative receives an acceptable rating because access to the ATCT and CUP requires vehicles to use the main Airport entry and exit roads.

- *Rental car access to the QTA*. This measure evaluates the connection provided between the rental car ready/return facilities and the QTA. Both alternatives receive an acceptable rating since a dedicated connection is provided, but the QTA is not immediately adjacent to the ready/return facility.

• *Connectivity of other access modes to/from the Airport*—These measures rate the level of connectivity provided to non-traditional access modes.

- *Light-rail.* The TEE Southeast alternative receives an acceptable rating because light-rail service is provided to the terminal area, but only to the existing terminal. The TEE Central alternative receives a high rating because a light-rail station is provided at both terminals.

- *Multi-use (bicycles and pedestrians) access*. Both alternatives designate corridors for multi-use access to both terminal buildings. Both alternatives are rated highly because this level of connectivity exceeds that offered at almost all airports in the United States

The most significant benefits of the TEE Central alternative is that it provides (1) the best opportunity for additional expansion of access facilities within the terminal area and (2) a less-expensive, easily constructible access system. However, to date, there has been no analysis of the impacts of the TEE Central location on overall Airport operations. Therefore, since the TEE Southeast alternative presents an acceptable access system, it is suggested that both alternatives could be carried forward into the master planning effort anticipated for 2005.

COST ESTIMATES

Order-of-magnitude cost estimates were developed for each of the two refined terminal access alternatives, based on plans described earlier in this chapter. These estimates were prepared primarily for the purpose of comparing the relative cost of

the two alternatives. Estimates were developed for each component of the proposed access alternative including parking structures; surface lots; pedestrian bridges, tunnels, and pathways; light-rail track and stations; roadways; and curbsides using quantity take-offs from alternative plans and unit costs described in this section. Using contingencies, costs were adjusted to reflect (1) the level of uncertainty of the design, (2) construction management costs, and (3) the Port's standard soft costs (i.e., Project Development Costs including consultant design fees and Port management and support services).

Given the conceptual nature of the Terminal Access Study, the focus on the access components, and the necessary lack of detailed definition of the TEE complex, some items were specifically not included from the cost estimates as outlined in this section. For instance, the cost of utility relocation is excluded from the estimates. Although it is known that there are major utility corridors that cross the central core of the terminal area complex, it is not readily apparent, and beyond the scope of this study to determine the extent to which the proposed alternative designs might affect existing utilities and the cost of their replacement or relocation. For these reasons, the costs of any utility relocation or replacement have not been included in these cost estimates. Such costs need to be accounted for in the next update of the master plan for the Airport.

This section provides a summary of the comparative cost estimates, as well as documentation of the key assumptions and cost estimating parameters.

Summary of Costs

Table 5-2 summarizes the cost estimates prepared for both alternatives. As shown, the estimated costs for all key elements, including contingencies and project development costs, are $330 million for the TEE Southeast Alternative and $287 million for the TEE Central Alternative. The cost difference is primarily due to the (1) increased amount of elevated roadway and (2) underground light-rail station and associated below-grade track in the TEE Southeast Alternative.

Key Assumptions

This section describes the key assumptions used in developing the cost estimates including project limits, excluded items, unit costs, and contingencies.

Project Limits. The order-of-magnitude cost estimates were developed for the terminal area generally defined by an area bounded by the existing terminal on the west, the airfield on the north, the future cross-field taxiway on the east, and the TEE concourse on the south. The one exception to these project limits is the TEE Central Alternative's return-to-terminal ramp, which is located at the future interchange of Airport Expressway and 82nd Street.

Table 5-2

COMPARATIVE ORDER-OF-MAGNITUDE COST ESTIMATES
Terminal Access Study
Portland International Airport

Item	TEE Southeast	TEE Central
P-2 Parking Garage	$43,250,000	$43,250,000
P-3 Parking Garage	41,387,000	41,387,000
Rental Car QTA lot	2,490,000	2,490,000
Ground transportation hold lot	1,423,000	1,423,000
Pedestrian Bridges	788,000	3,375,000
Pedestrian Tunnels	21,060,000	20,844,000
TriMet LRT	28,153,000	14,435,000
Roadways/curbsides *(a)*	39,632,000	27,398,000
Construction cost subtotal	$178,183,000	$154,602,000
Construction Management Fee – 10%	17,819,000	15,461,000
Construction contingency – 40% *(b)*	$ 71,274,000	$ 61,841,000
Construction cost total	$267,276,000	$231,904,000
Project development costs – 35% *(c)*	$ 62,365,000	$ 54,111,000
Total estimated project cost *(d)*	$330,000,000	$287,000,000

Notes:
(1) Estimates are in 2004 dollars. Inflation for future years is not included.
(2) Costs of impacts to and relocation of existing utilities are not included and could be significant. See text for other exclusions.

(a) Includes pedestrian and multi-use paths.
(b) Construction contingency includes construction management, design variation and uncertainty of material costs.
(c) Includes Port management, engineering, and other support fees, as well as design fees and permits.
(d) Totals rounded.

Source: Leigh Fisher Associates using cost estimates prepared by David Evans and Associates and information provided by the Port of Portland, February 2005.

Items Excluded from Cost Estimates. The cost estimates presented in this section exclude the following:

- The cost of the TEE terminal and concourse
- Relocation, replacement, or capacity modification of existing utilities
- Modification to structural elements of facilities to remain
- Temporary facilities that may be required to maintain operations during construction
- Allowance for additional costs required to maintain operations during construction
- Allowance for phasing complications due to site constraints
- The cost of the future cross-field taxiway, including the cost of lowering roadways passing beneath the taxiway
- The cost of the future interchange of Airport Expressway and 82nd Street, except for the incremental cost of modifying the interchange to accommodate a return-to-terminal ramp, if applicable
- Escalation from 2004 to future year dollars
- Landscaping

Unit Costs. The basis for each unit cost used in the cost estimate is described below.

Parking elements

- Parking structures: $32.61 per square foot, as per *R.S. Means Square Foot Costs 2004*. Unit cost includes vehicular and pedestrian vertical circulation elements and parking revenue control equipment.
- Rental car QTA: $15.00 per square foot, based on typical surface parking lot cost ($10.00 per square foot) plus allowance for infrastructure to support rental car-specific improvements (e.g., car washes, fueling system, canopies).
- Ground transportation hold lot: $11.67 per square foot, based on typical surface parking lot cost ($10.00 per square foot) plus allowance for hold lot-specific improvements (e.g., restrooms, message sign).

Pedestrian elements

- Pedestrian bridge: $300 per square foot, based on David Evans and Associates.
- Pedestrian tunnel: $360 per square foot, based on David Evans and Associates and cost estimates for pedestrian tunnels at other airports.
- Pedestrian at-grade path: $2.78 per square foot, based on unit cost for concrete sidewalk.
- Multi-use at-grade path: $2.27 per square foot, based on Virginia Department of Transportation data.

Light rail elements (Using TriMet unit costs)

- Light rail at-grade double track: $631 per route foot, assuming ballasted track construction with concrete ties.
- Light rail below grade double track: $10,050 per route foot, assuming open trench, two retaining walls, and 6-foot concrete bottom.
- Light rail station: $700,000 each.
- Light rail track double cross-over: $350,000 each.
- Light rail signals and electrification: $340 per route foot.

Roadway elements (Based on recent construction cost trends in Portland area.)

- At-grade roadway: $10 per square foot.
- Elevated roadway, one level above grade: $120 per square foot.
- Elevated roadway, two levels above grade: $200 per square foot, adjusted for increased column and foundation requirements.
- Below grade rental car roadway: $100 per square foot, using cost estimates for rental-car-only tunnel at another airport, assuming low-profile tunnel and non-public use.
- Roadway lighting: $60 per linear foot.
- Signage: $750,000 lump sum, including variable message signs and sign bridges, based on David Evans and Associates experience in the Portland area.

Contingencies and Project Development Costs. The assumptions relative to the contingencies and project development costs used in the cost estimates are described below.

- Construction Management Fee: 10%
- Construction contingency: 40%. This contingency is applied to address (a) design variations due to the conceptual nature of plans being costed (25%), and (b) uncertainty regarding costs for raw materials, West Coast labor, fuel, and energy (15%).
- Project Development Costs
- Project development costs (as a percentage of the construction cost) were provided by the Port of Portland engineering staff, based on their standard practices and adjusted by David Evans and Associates as appropriate. The total estimated project development cost was assumed to be 35% of the construction cost subtotal.
    - Design management—Port of Portland: 5%
    - Design fees—consultant: 10%
    - Construction administration and bidding: 10%
    - Permits: 2%
    - Port engineering support during construction: 2%
    - Operating department support: 2%
    - Community affairs support: 1%
    - Environmental support: 3%

Detailed Cost Estimate Summary

The detailed cost estimate summary providing quantities and unit costs by component is shown in Table 5-3 for both alternatives.

TEE Southeast Alternative. Table 5-3 summarizes the quantities and unit costs assumed for the TEE Southeast Alternative. The quantities are based on the alternative depicted on Figure 5-4 . As shown, construction costs are estimated to be approximately $267 million and project development costs are estimated to be approximately $62 million, for a total cost of $330 million. Of the total construction cost, parking facilities (including the rental car QTA and commercial vehicle hold lot) constitute approximately 50% of the cost, roadways constitute approximately 22% of the cost, light rail facilities constitute approximately 16% of the cost, and pedestrian facilities constitute approximately 12% of the cost.

Table 5-3

ORDER-OF-MAGNITUDE COST ESTIMATES
Terminal Access Study
Portland International Airport

No.	Item	Unit cost	Unit	TEE Southeast Quantity	TEE Southeast Cost	TEE Central Quantity	TEE Central Cost
	Parking Facilities						
1	Parking Structure P-2	$32.61	Sq. ft.	1,326,270 SF	$ 43,249,665	1,326,270 SF	$ 43,249,665
2	Parking Structure P-3	$32.61	Sq. ft.	1,269,160 SF	41,387,308	1,269,160 SF	41,387,308
3	Parking lot RAC QTA	$15.00	Sq. ft.	166,000 SF	2,490,000	166,000 SF	2,490,000
4	GT Hold Lot	$11.67	Sq. ft.	122,000 SF	1,423,333	122,000 SF	1,423,333
	Subtotal *(a)*				$88,550,400		$88,550,400
	Pedestrian Facilities						
5	Pedestrian Bridges	$300.00	Sq. ft.	2,625 SF	787,500	11,250 SF	3,375,000
6	Pedestrian Tunnels	$360.00	Sq. ft.	58,500 SF	21,060,000	57,900 SF	20,844,000
7	Pedestrian At-Grade Path	$2.78	Sq. ft.	12,580 SF	34,972	9,880 SF	27,466
8	Multi-use At-Grade Path	$2.27	Sq. ft.	14,310 SF	32,484	17,280 SF	39,226
	Subtotal *(a)*				$21,915,000		$24,285,700
	LRT						
9	At-grade double track	$631.00	Route ft.	1,270 RF	$ 801,370	2,470 RF	$ 1,558,570
10	Below grade double track	$10,050.00	Route ft.	2,190 RF	22,009,500	990 RF	9,949,570
11	Below TEE double track	$10,050.00	Route ft.	310 RF	3,115,500	0 RF	--
12	Double cross-over	$350,000.00	Each	1 EA	350,000	1 EA	350,000
13	LRT Stations	$700,000.00	Each	1 EA	700,000	2 EA	1,400,000
14	Signals and Electrification	$340.00	Route ft.	3,460 RF	1,176,000	3,460 RF	1,176,400
	Subtotal *(a)*				$ 28,152,800		$ 14,434,500
	Roadways and paths						
15	Turn-around at 82nd Ave.	$120.00	Sq. ft.	0 SF	$ --	7,982 SF	$ 957,840
16	Roadway Lighting	$60.00	Linear ft.	21,250 LF	1,275,000	23,300 LF	1,398,000
17	Signage	$750,000.00	Lump sum	1 LS	750,000	1 LS	750,000
	Subtotal *(a)*				$ 2,025,000		$ 3,105,900
	Entry Roadways						
18	Elevated	$120.00	Sq. ft.	63,049 SF	$ 7,565,880	0 SF	$ --
19	At-grade	$10.00	Sq. ft.	121,318 SF	1,213,180	169,181 SF	1,691,810
	Subtotal *(a)*			184,367 SF	$ 8,779,100	169,181 SF	$ 1,691,900

Table 5-3 *(page 2 of 2)*
ORDER-OF-MAGNITUDE COST ESTIMATES
Terminal Access Study
Portland International Airport

No.	Item	Unit cost	Unit	TEE Southeast Quantity	TEE Southeast Cost	TEE Central Quantity	TEE Central Cost
	TEE Roadways						
20	Elevated – 2 levels	$120.00	Sq. ft.	109,420 SF	$ 13,130,400	105,149 SF	$ 12,617,880
21	Elevated – 3 levels	$200.00	Sq. ft.	42,260 SF	8,452,000	0 SF	--
22	At-grade	$10.00	Sq. ft.	128,262 SF	1,282,620	226,549 SF	2,265,490
23	Rental vehicle tunnel	$100.00	Sq. ft.	0 SF	--	19,920 SF	1,992,000
	Subtotal *(a)*			279,942 SF	$ 22,865,100	351,618 SF	$ 16,875,400
	Exit Roadways						
24	Elevated	$120.00	Sq. ft.	31,607 SF	$ 3,792,840	30,887 SF	$ 3,706,440
25	At- grade	$10.00	Sq. ft.	210,264 SF	2,102,640	195,123 SF	1,951,230
	Subtotal *(a)*			241,871 SF	$ 5,895,500	226,010 SF	$ 5,657,700
26	Construction cost subtotal				$178,183,000		$154,602,000
27	Construction magnitude fees	10%			17,819,000		15,461,000
28	Construction contingency *(b)*	40%			$ 71,274,000		$ 61,841,000
29	Construction cost total				$267,276,000		$231,904,000
30	Project development costs *(c)*	35%			$ 62,365,000		$ 54,111,000
	Totals *(a)*				$330,000,000		$287,000,000

Notes:
(1) Estimates are in 2004 dollars and inflation for future years is not included.
(2) Costs of impacts to and relocation of existing utilities are not included and could be significant. See text for other exclusions.

(a) Totals and subtotals have been rounded.
(b) Construction contingency includes, design variation and uncertainty of material costs.
(c) Includes Port management, engineering, and other support fees, as well as design fees and permits.

Source: Leigh Fisher Associates using cost estimates prepared by David Evans and Associates and information provided by the Port of Portland, March 2005.

TEE Central Alternative. Table 5-3 summarizes the quantities and unit costs assumed for the TEE Central Alternative. These quantities are based on the alternative depicted on Figure 5-8 (*verify)*. As shown, construction costs are estimated to be approximately $232 million and project development costs are estimated to be approximately $54 million, for a total cost of $287 million. Of the total construction cost, parking facilities (including the rental car QTA and commercial vehicle hold lot) comprise approximately 57% of the cost, roadways comprise approximately 18% of the cost, light rail facilities comprise approximately 9% of the cost, and pedestrian facilities comprise approximately 16% of the cost.

NEXT STEPS

The current 2000 PDX Master Plan assumes the current terminal area can accommodate approximately 23 MAP—18 MAP in the existing terminal and 5 MAP in the TEE. To expand beyond 23 MAP, the 2000 PDX Master Plan recommends the development of a second terminal complex located on the south side of the airfield. Any additional capacity that can be obtained in the existing terminal area will delay the need for the extensive investment associated with the development of a new terminal complex.

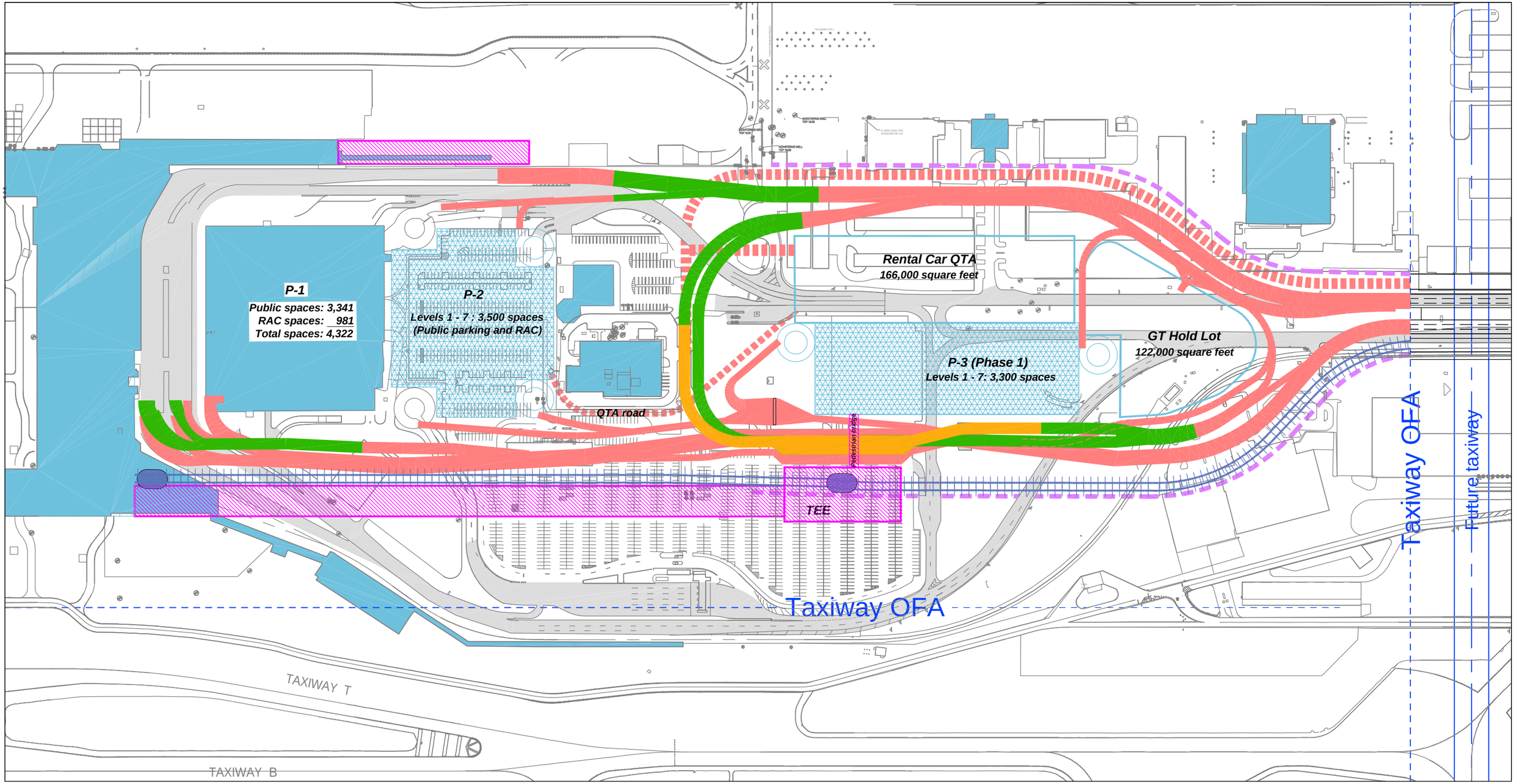
While the location of the TEE terminal in the TEE Central alternative provides an opportunity to develop a terminal that can accommodate more than 5 MAP, there may be other terminal or airfield elements that limit the capacity of the current terminal area. In anticipation of the forthcoming Master Plan Update, it is recommended that the Port analyze the capacity of individual terminal areas and airfield elements (e.g., ticket counters, baggage devices, gates) to identify the limiting element (or elements). The analysis would incorporate capacity gains that could be provided by the TEE Central to determine the ultimate capacity of the terminal area.

APPENDICES

Appendix A

OTHER INITIAL ALTERNATIVES

This appendix contains depictions of other initial alternatives developed during the conduct of the Terminal Access Study. In many cases, individual elements of these alternatives were incorporated into the refined alternatives presented in Chapter 5.



NOTE: It is assumed that TEE RAC patrons are bused to the P-1 / P-2 facility.

LEGEND

- Ground level road
- Second level road
- Third level road
- Service road, ground level
- Rail
- Multi-use access route
- Future terminal
- New parking garage
- Rail station

N

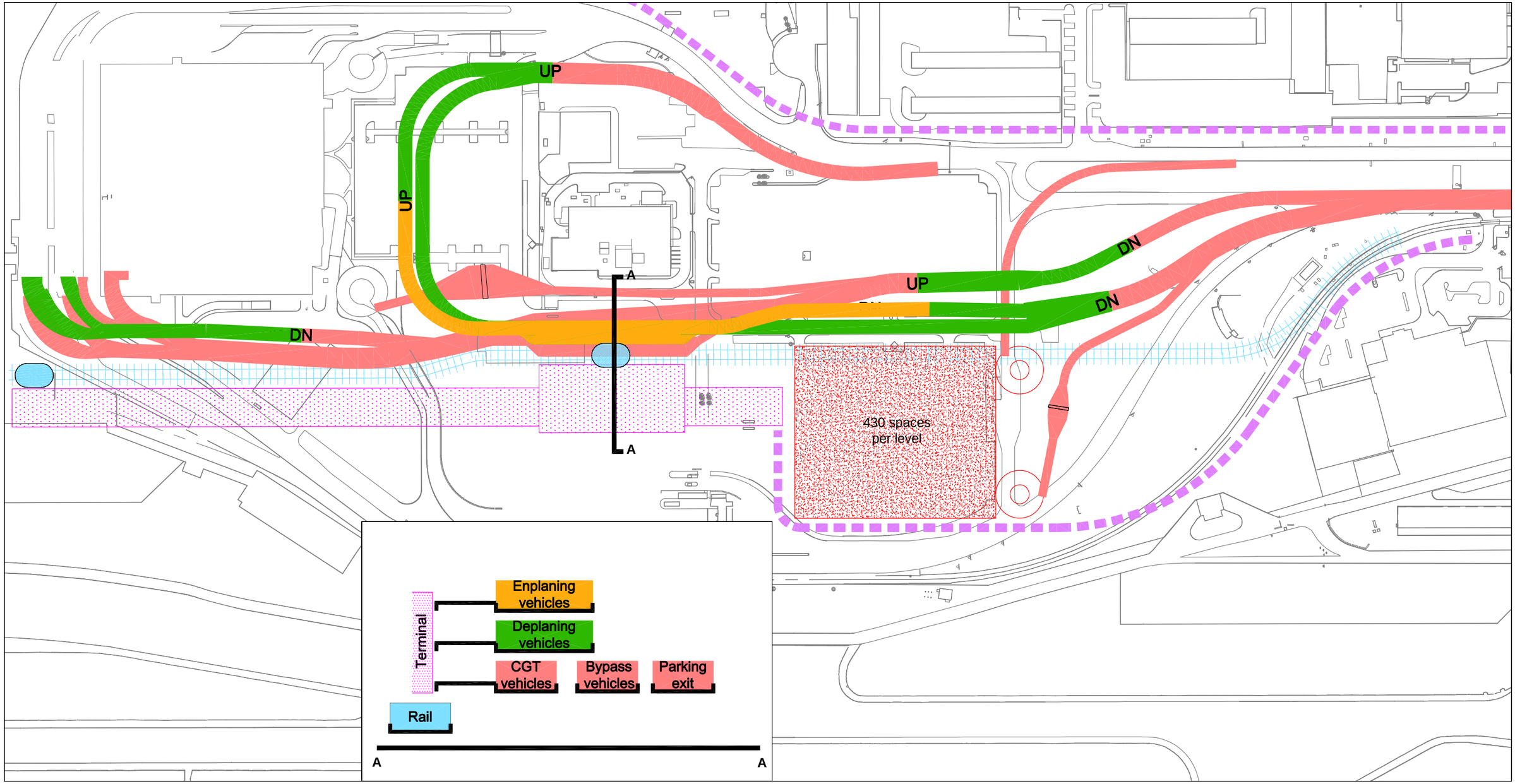
125 0 125 250

Graphic Scale in Feet

CONCEPT 2

Terminal Access Study
Portland International Airport
September 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Ground level
- Second level
- Third level
- Rail
- Bicycle access route
- Future terminal
- New parking garage
- Rail station - center platform

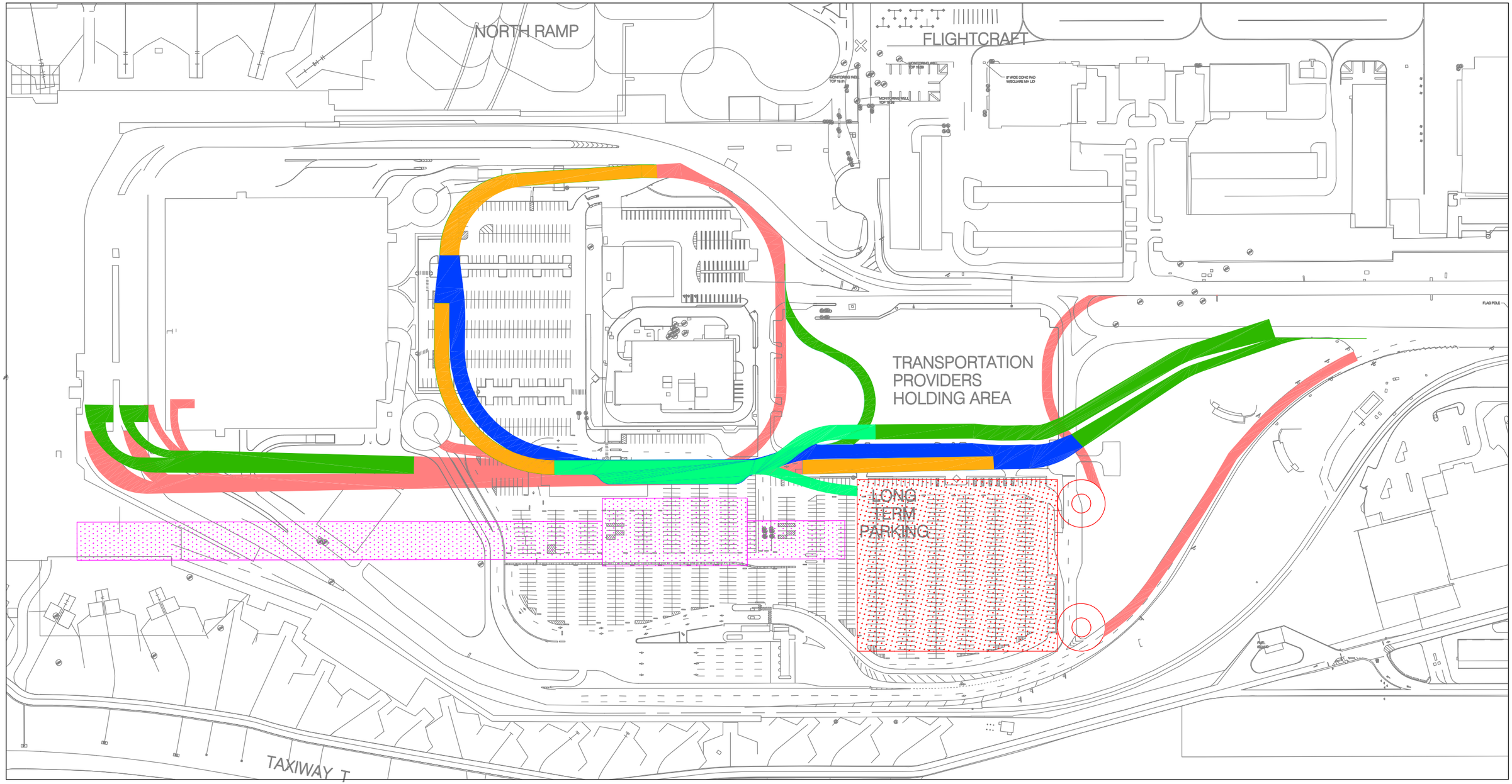
N

100 0 100 200
Graphic Scale in Feet

Figure 3
CONCEPT 3

Terminal Access Study
Portland International Airport
April 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Enplaning level
- Deplaning level
- Ground level
- Future terminal
- Up ramps
- Down ramps
- New parking garage

N

100 0 100 200

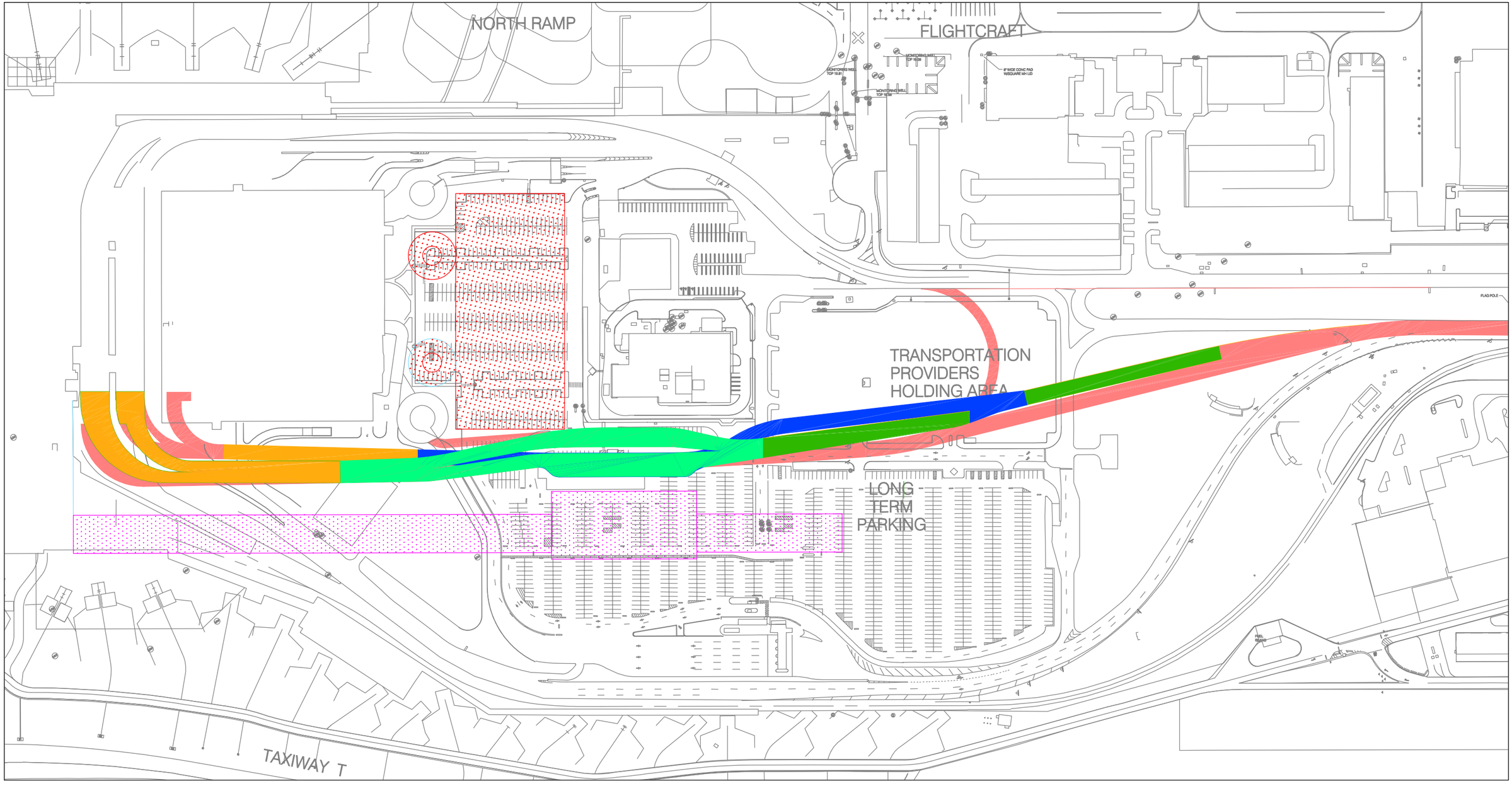
Graphic Scale in Feet

Figure 3

CONCEPT 3

Terminal Access Study
Portland International Airport
April 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Enplaning level
- Deplaning level
- Ground level
- Future terminal
- Up ramps
- Down ramps
- New parking garage

N

100 0 100 200

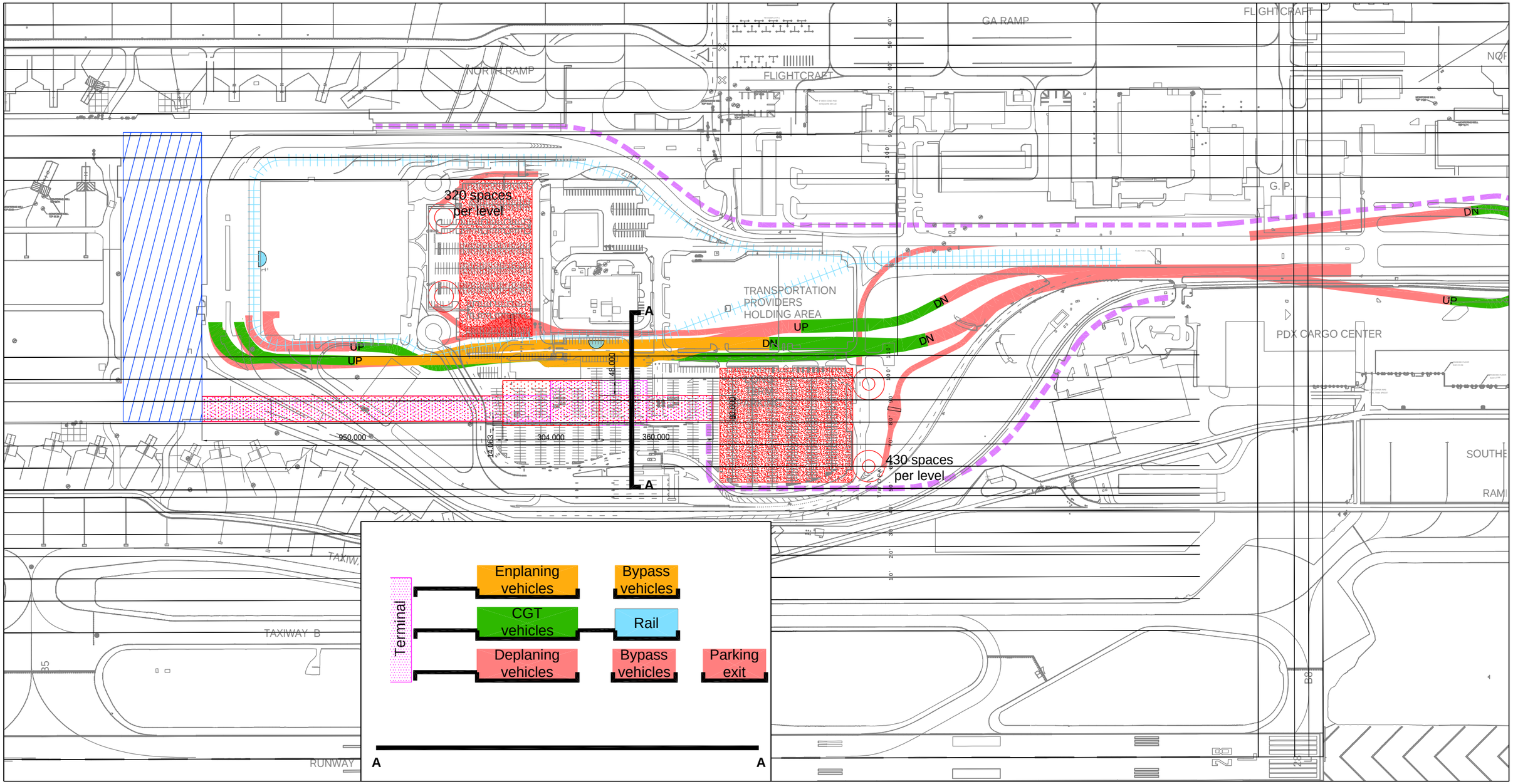
Graphic Scale in Feet

Figure 2

CONCEPT 2

Terminal Access Study
Portland International Airport
April 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Ground level
- Second level
- Third level
- Rail
- Bicycle access route
- Future terminal
- New parking garage
- Rail station - side platform

N

100 0 100 200

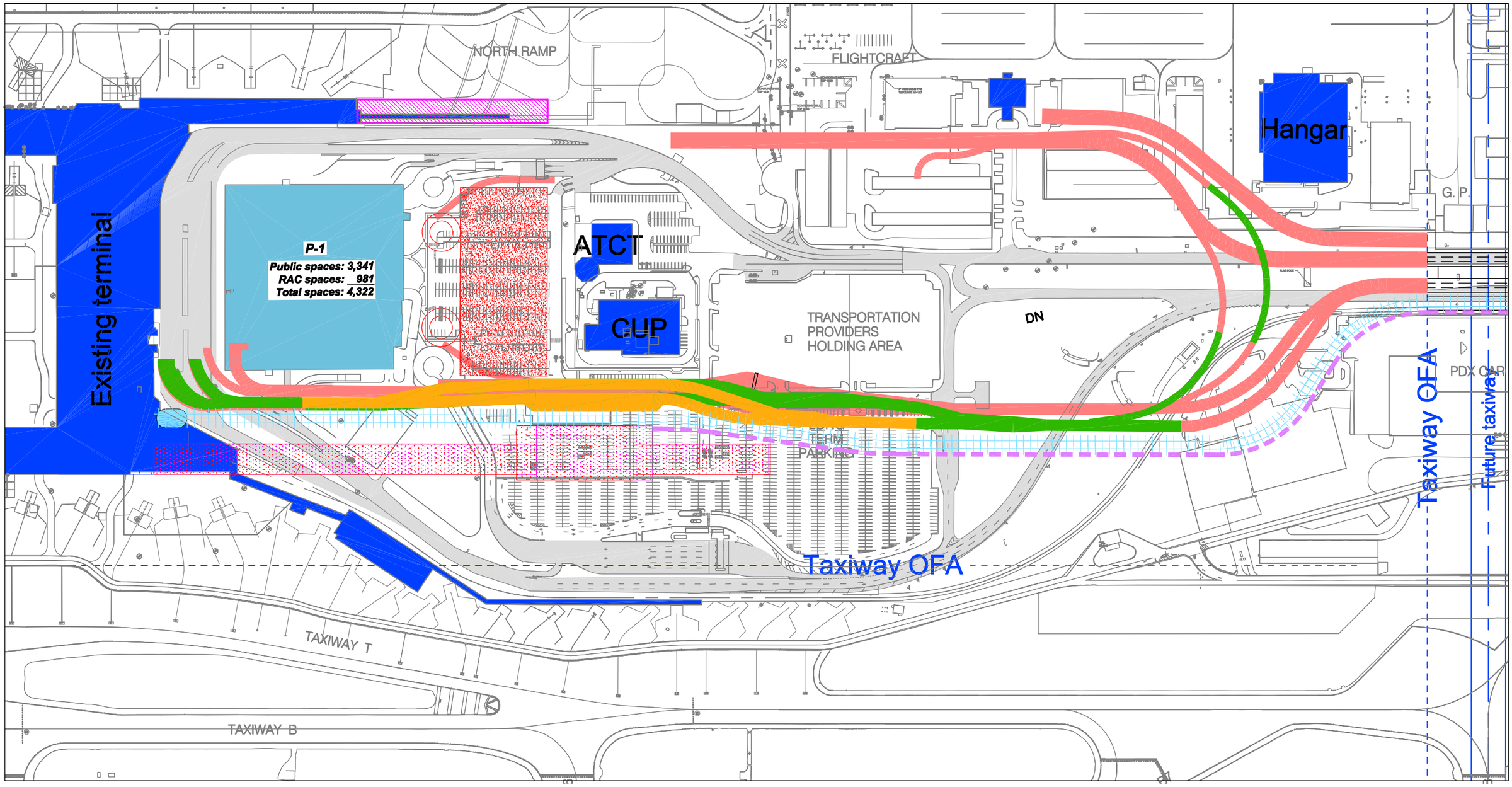
Graphic Scale in Feet

Figure 2

CONCEPT 2

Terminal Access Study
Portland International Airport
April 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Ground level
- Second level
- Third level
- Rail
- Multi-use access route
- Future terminal
- New parking garage

N

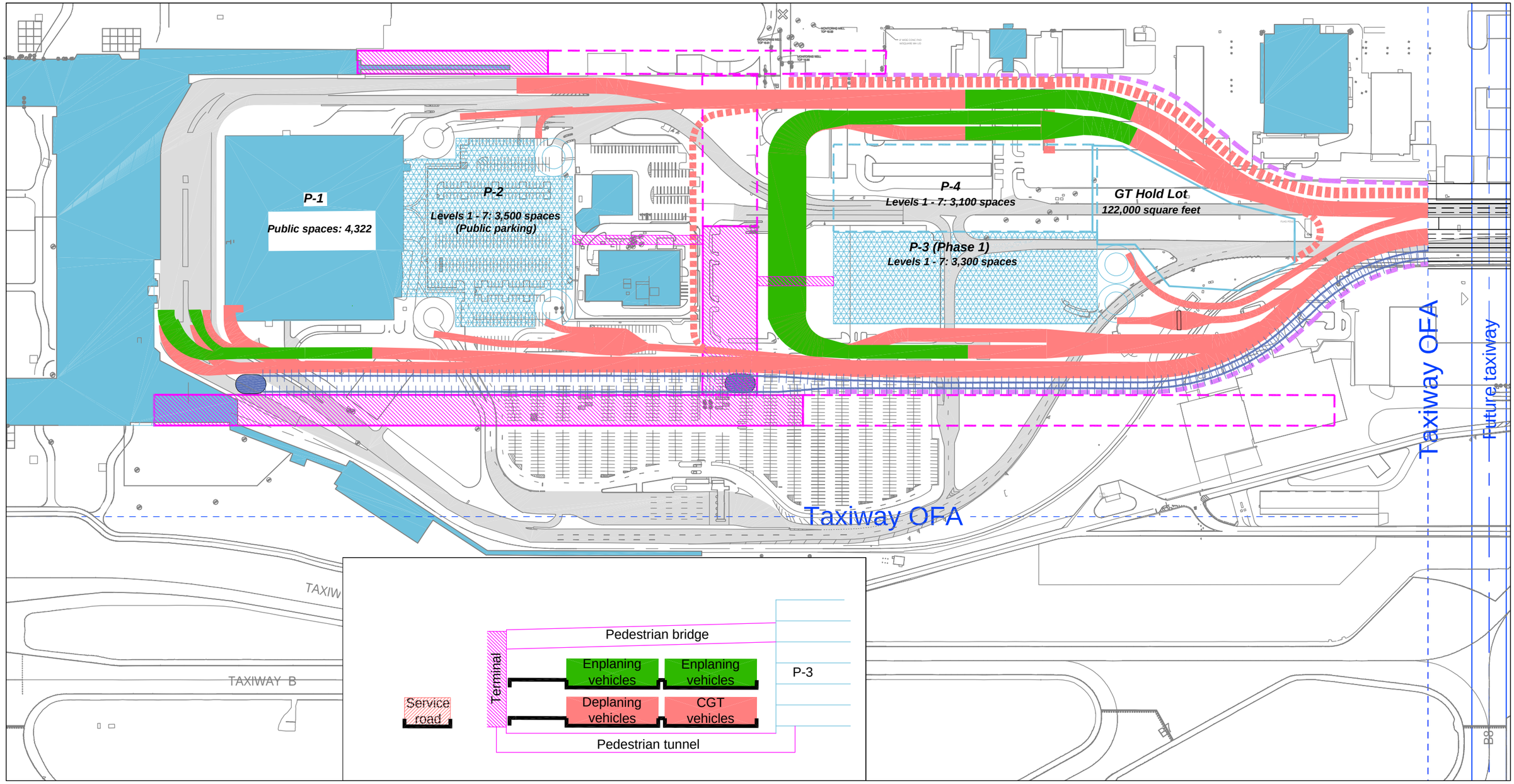
125 0 125 250

Graphic Scale in Feet

Terminal Access Study

Terminal Access Study
Portland International Airport
June 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Ground level road
- Second level road
- Third level road
- Service road, ground level
- Rail
- Multi-use access route
- Future terminal
- New parking garage
- Rail station

N

125 0 125 250

Graphic Scale in Feet

CONCEPT 3B
ROADWAYS

Terminal Access Study
Portland International Airport
November 2004

LEIGH FISHER ASSOCIATES

P-1
Public spaces: 3,341
RAC spaces: 981
Total spaces: 4,322

P-2
Levels 1 - 7: 3,500 spaces
(Public parking and RAC)

QTA road

QTA road in tunnel

TEE

Rental Car QTA
166,000 square feet

GT Hold Lot
114,000 square feet

P-3 (Phase 1)
Levels 1 - 7: 3,300 spaces

A A

Taxiway OFA

Future taxiway

TAXIWAY

TAXIWAY B

B8

Enplaning vehicles

Deplaning vehicles

CGT vehicles

Terminal

Service road

A A

LEGEND

- Ground level
- Second level
- Third level
- Service road
- Rail
- Multi-use access route
- Future terminal
- New parking garage

N

125 0 125 250
Graphic Scale in Feet

CONCEPT 3

Terminal Access Study
Portland International Airport
September 2004

LEIGH FISHER ASSOCIATES

UP
UP
UP
DN
DN
DN
A
A
620 spaces
per level

Terminal
Enplaning vehicles
Deplaning vehicles
Rail
CGT vehicles
Garage
A
A

LEGEND

- Ground level
- Second level
- Third level
- Rail
- Bicycle access route
- Future terminal
- New parking garage
- Rail station - center platform

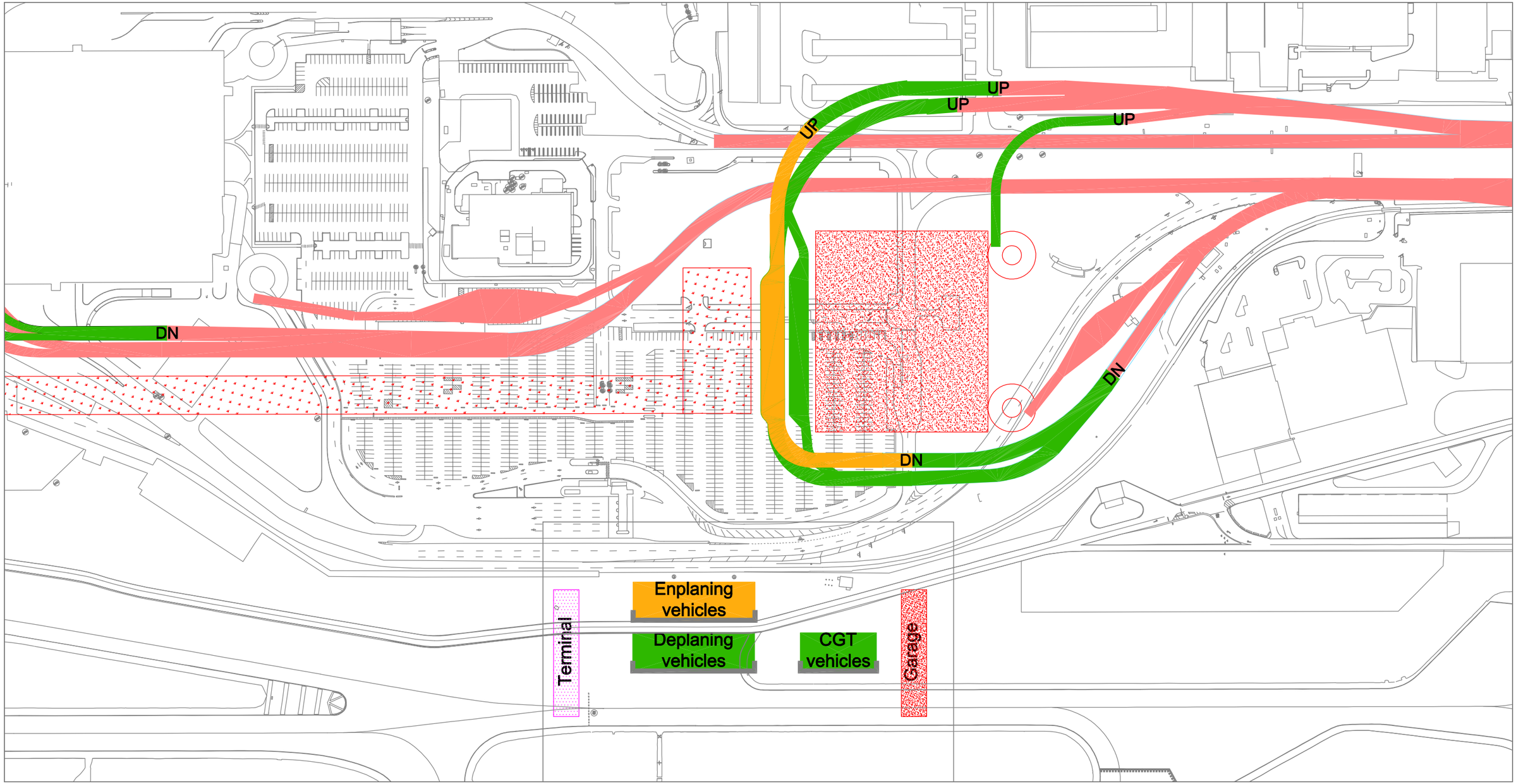
N

100 0 100 200
Graphic Scale in Feet

Figure 4
CONCEPT 4

Terminal Access Study
Portland International Airport
April 2004

LEIGH FISHER ASSOCIATES



LEGEND

- Ground level
- Second level
- Third level
- Rail
- Bicycle access route
- Future terminal
- New parking garage

N

100 0 100 200

Graphic Scale in Feet

Figure 5

CONCEPT 5

Terminal Access Study
Portland International Airport
April 2004

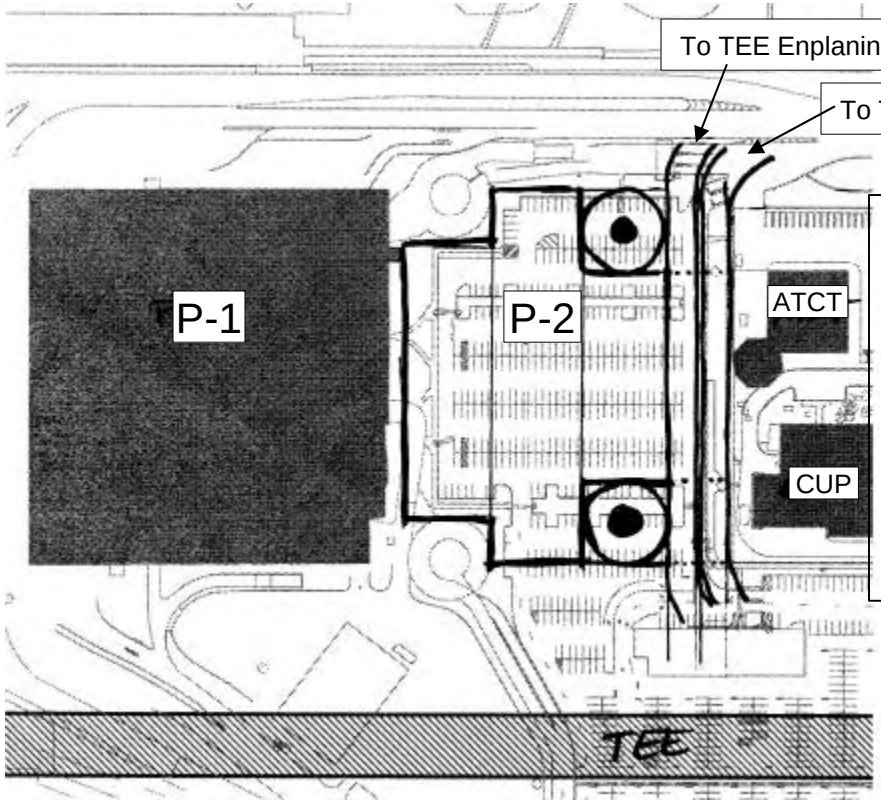
LEIGH FISHER ASSOCIATES

Appendix B

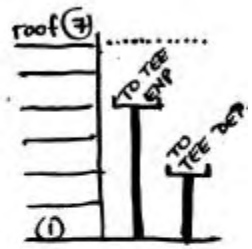
P-2 CAPACITY ESTIMATE

This appendix presents a brief analysis prepared to determine the additional parking capacity available in P-2, if the Terminal Expansion East access roadways were located on the east side of the Airport Traffic Control Tower and Central Utility Plant, as shown in the 2000 Airport Master Plan.

Option A



Level 2-7 = 134,000 sq. ft. / level
= 383 spaces / level
Level 1 = 150,000 sq. ft.
= 429 spaces / level
Total: 6 levels @ 383 spaces
1 level @ 429 spaces
2,727 spaces

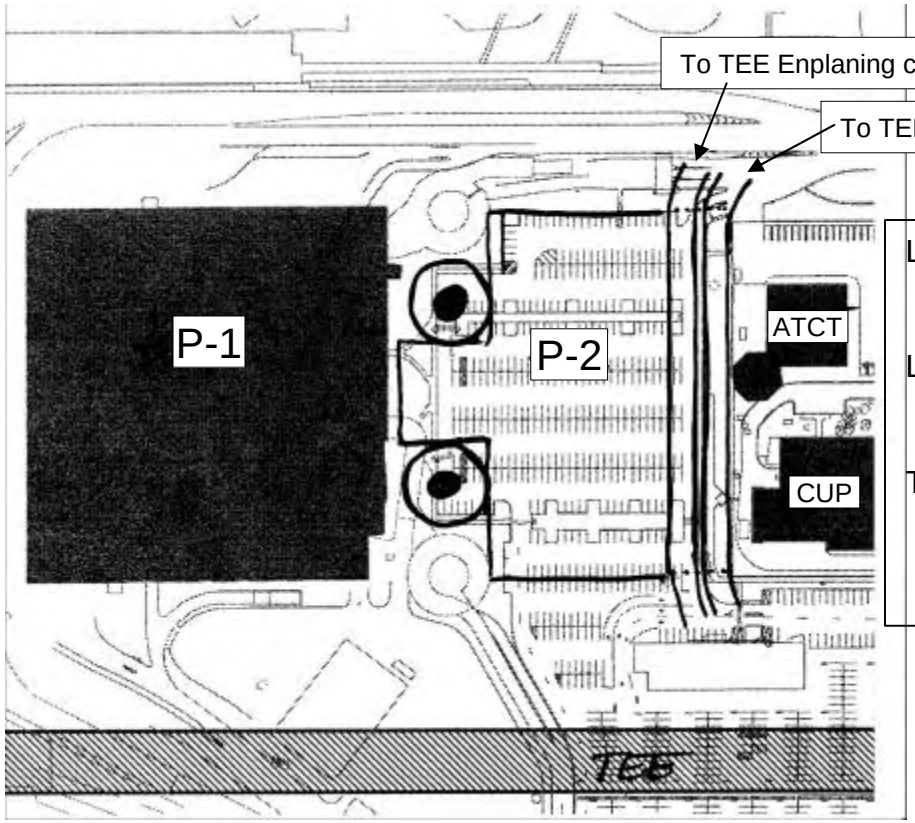


Could park under ramps, but not over ramps (tall columns allow extensions to level 7 only)

Note: if roads are stacked, floor area can increase by about 17,000 sq. ft. for levels 2 – 7 (total of 431 spaces per level and garage capacity of 2,895 spaces).

Note: if P-2 precedes TEE, construction of ramps between P-2 and ATCT/ CUP could be difficult.

Option B



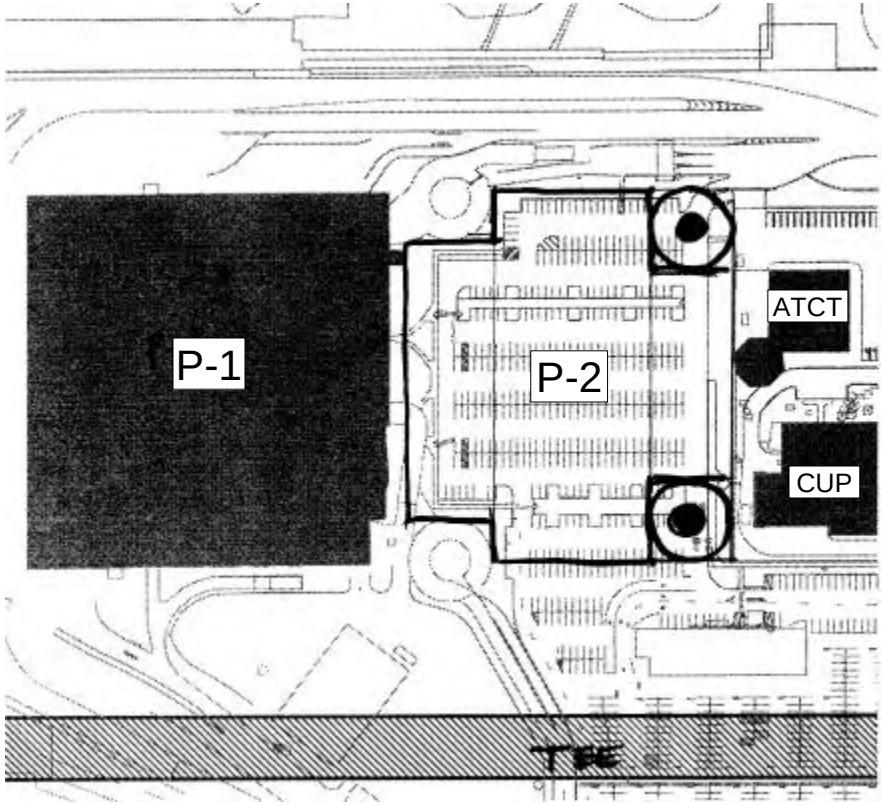
See Option A for cross-section

Level 2-7 = 129,000 sq. ft. / level
= 369 spaces / level
Level 1 = 159,000 sq. ft.
= 454 spaces / level
Total: 6 levels @ 369 spaces
1 level @ 454 spaces
2,668 spaces

Note: with stacked roads, area of levels 2 – 7 becomes 146,000 sq. ft., / level which allows 417 spaces / level, for a total garage capacity of 2,956 spaces.

Note: Since Option B is a 'squarer' structure than Option A, it will likely have a more efficient parking stall layout than Option A.

Option C



Assume TEE access roads are east of ATCT & CUP

Level 1-7 = 174,000 sq. ft. / level

= 497 spaces / level

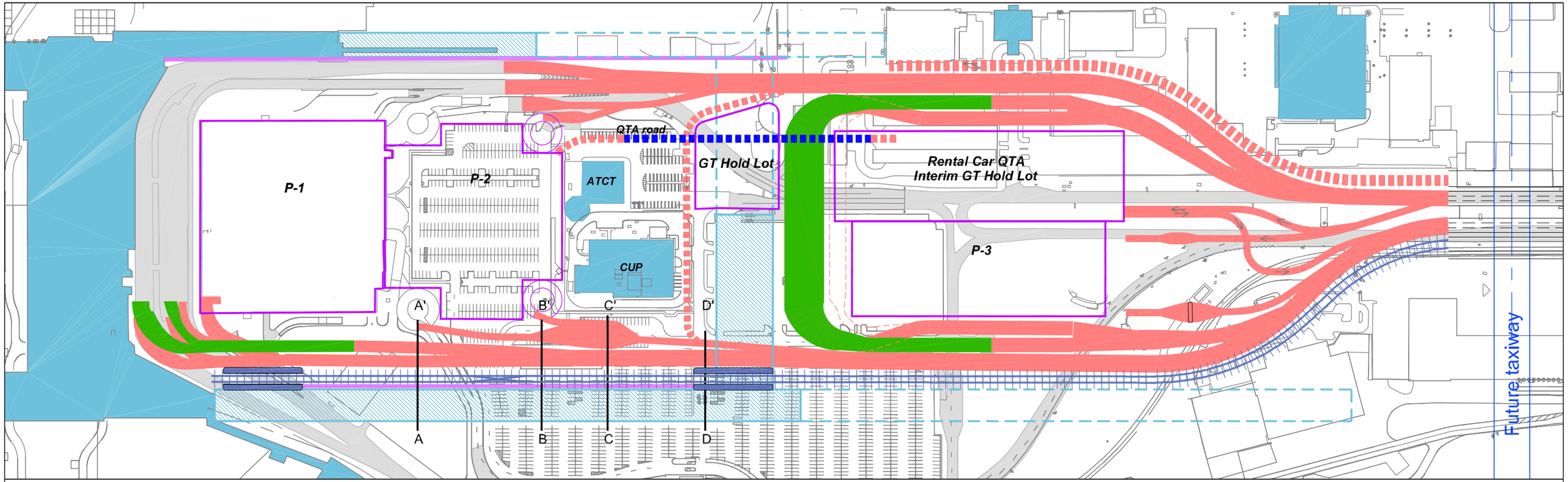
Total: 7 levels @ 497 spaces

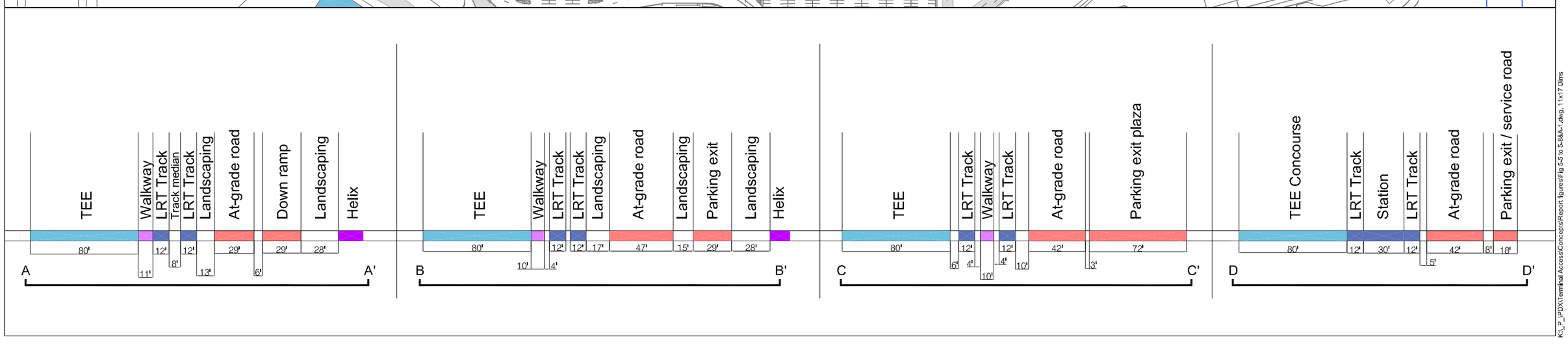
3,479 spaces

Option C allows 17% to 20% more parking than Option A or B

APPENDIX C
DIMENSIONAL CONFIRMATION

This appendix presents the results of a series of analyses prepared to confirm the ability to accommodate the individual road, light-rail, and pedestrian elements between the TEE concourse and P-1/P-2. As shown, while space is limited, the required elements can be accommodated.





K:_P_\PDX\Terminal Access\Concepts\Report figures\Fig 5-5 to 5-8&A-1.dwg, 11x17 Dims

LEGEND

Buildings and parking
- Existing facility to remain
- Future terminal
- Existing / future parking / RAC facility

Roadways
- Ground level road
- Second level road
- Service road, ground level
- Service road, tunnel

Rail and multi-use elements
- New at-grade path
- Rail
- Rail station

ATCT = Airport traffic control tower
CUP = Central utility plant
QTA = Quick turn-around facility

N

125 0 125 250
Graphic Scale in Feet

Figure C-1
TEE CENTRAL ALTERNATIVE DIMENSION STRINGS

Terminal Access Study
Portland International Airport
March 2005

LEIGH FISHER ASSOCIATES

APPENDIX D
PUBLIC PARKING AND RENTAL CAR FACILITY DEVELOPMENT OPTIONS

A September 10, 2004, workshop included a presentation of three public parking and rental car development strategies. The workshop materials presented in this appendix demonstrated:

- If rental car ready/return facilities continue to be available in the terminal area, the P-2 public parking garage will be required in 2005 or soon after.
- If rental car ready/return facilities are relocated to a remote site, the P-2 public parking garage will be required by 2007.
- If full rental car market share is accommodated on-Airport (by expanding or relocating the QTA), the P-3 parking facility will be required by 2009, before the TEE terminal is complete.
- If the current rental car market share is retained until the existing QTA is dislocated by TEE concourse construction, the P-3 parking facility will be required at the same time the TEE terminal opens.

PUBLIC PARKING AND RENTAL CAR FACILITY DEVELOPMENT OPTIONS

Terminal Access Study
Portland International Airport

Workshop #3

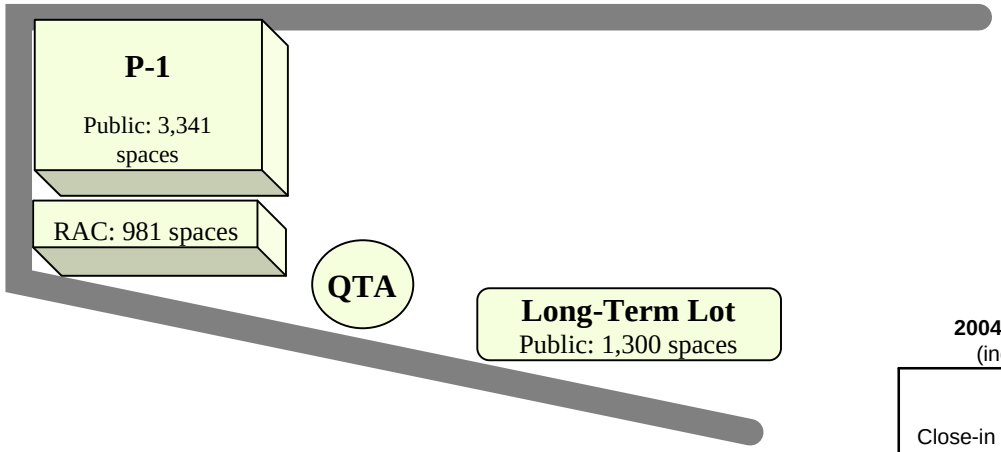
September 10, 2004

LEIGH FISHER ASSOCIATES
A Division of Jacobs Consultancy Inc.

PORT OF PORTLAND

OPTION A: Close-In RAC, Full Market Share

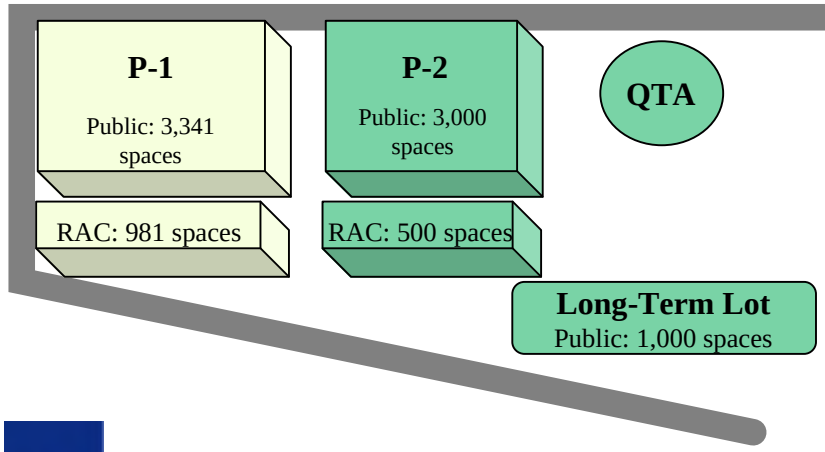
Existing conditions



2004 Parking Space Requirements
(includes circulation allowances)

	Required	Existing
Close-in parking	4,500	4,641
RAC ready/return	1,120	981

2005



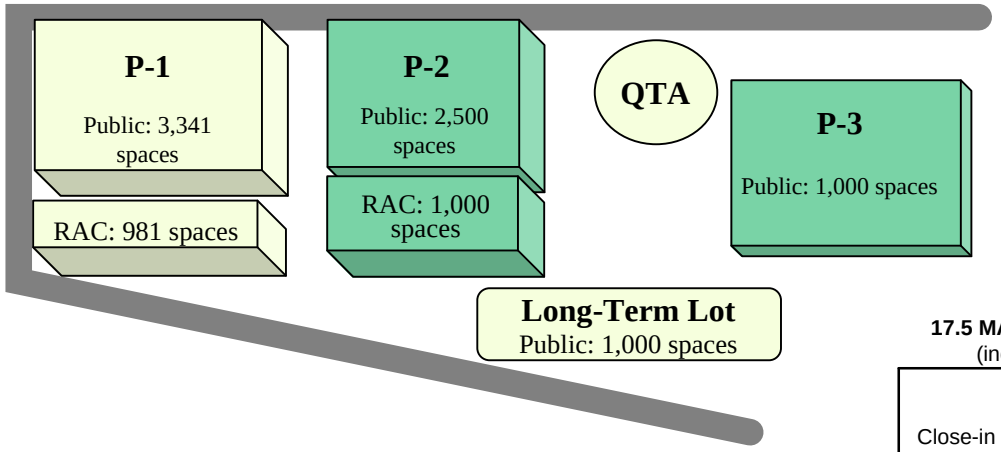
- Relocate and expand QTA
- Reduce Long-Term Lot to 1,000 spaces
- Build P-2 (3,500 spaces), RAC on one level

Notes: Assume increased on-Airport RAC market share.
Economy lot reaches capacity prior to 2008.

2005 Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	4,800	7,341
RAC ready/return	1,170	1,481

OPTION A: Close-In RAC, Full Market Share (cont'd)

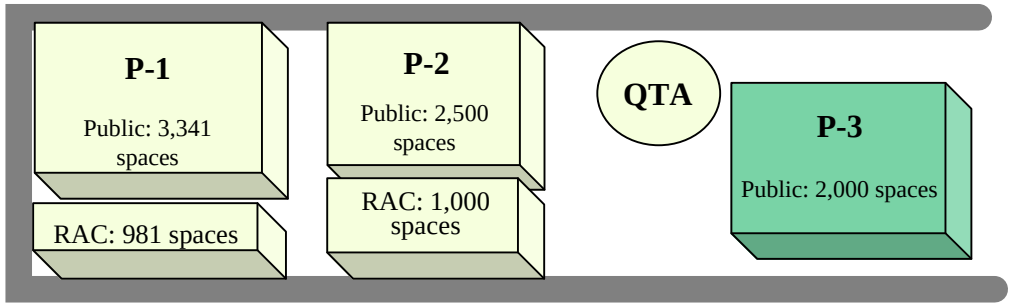


2009 to 17.5 MAP

- Expand RAC in P-2 to 2 levels
- Build P-3 (1,000 spaces)

17.5 MAP Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	7,000	7,841
RAC ready/return	1,520	1,981



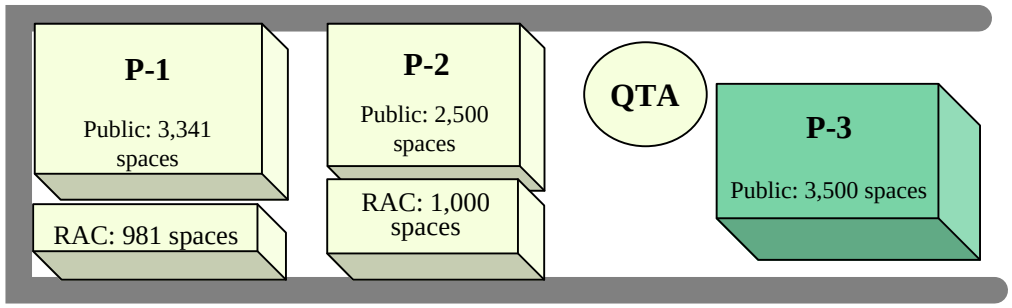
17.5 to 18.0 MAP

- Construct TEE
- Remove Long-Term Lot
- Expand P-3 to 2,000 spaces

18.0 MAP Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	7,200	7,841
RAC ready/return	1,560	1,981

OPTION A: Close-In RAC, Full Market Share (cont'd)



Meets requirements through planning period

18.0 to 23.0 MAP

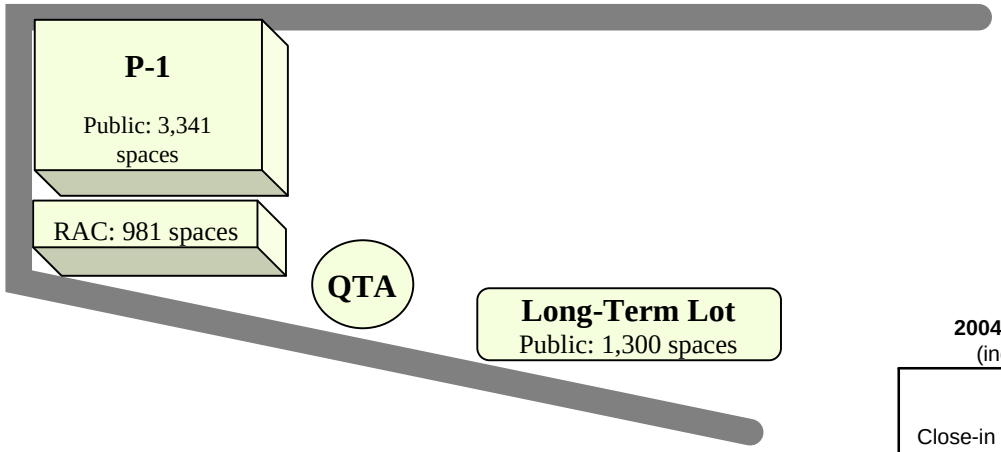
- Expand P-3 (as needed) to 3,500 spaces

23.0 MAP Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	9,200	9,341
RAC ready/return	2,000	1,981

OPTION B: Close-In RAC, Limited Near-Term Market Share

Existing conditions

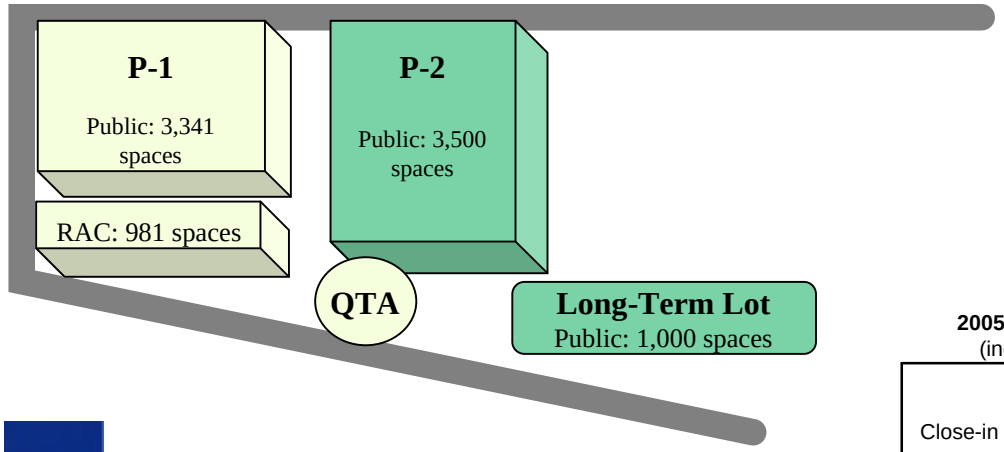


2004 Parking Space Requirements
(includes circulation allowances)

	Required	Existing
Close-in parking	4,500	4,641
RAC ready/return	< 981	981

2005

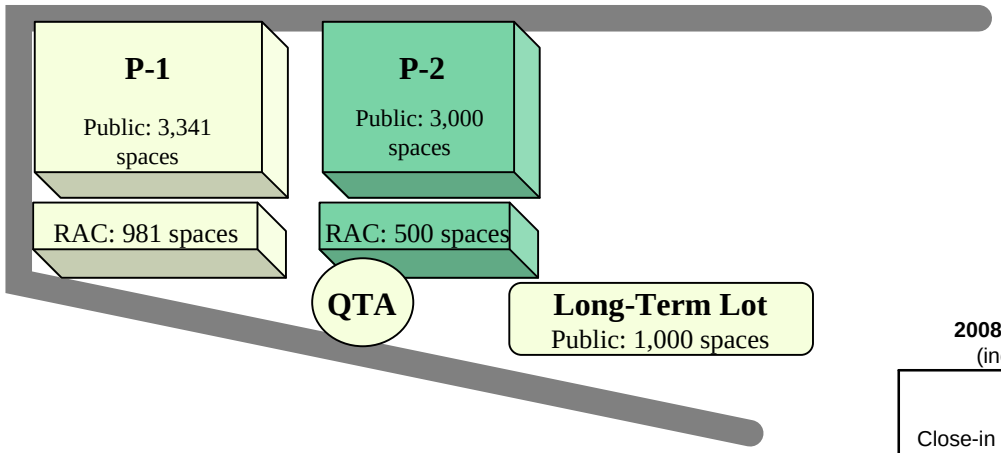
- Reduce Long-Term Lot to 1,000 spaces
- Build P-2 (3,500 spaces)



2005 Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	4,800	7,841
RAC ready/return	< 981	981

OPTION B: Close-In RAC, Limited Near-Term Market Share (cont'd)



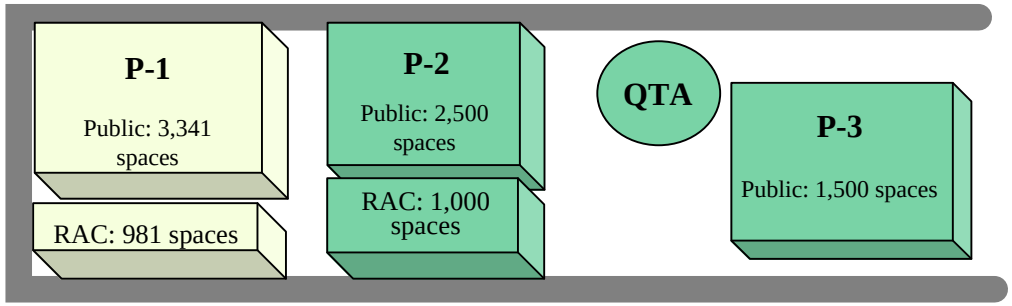
2007 to 2008

- Expand RAC to first level of P-2

Note: Economy lot reaches capacity prior to 2008.

2008 Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	5,600	7,341
RAC ready/return	1,010	1,481



17.5 to 18.0 MAP

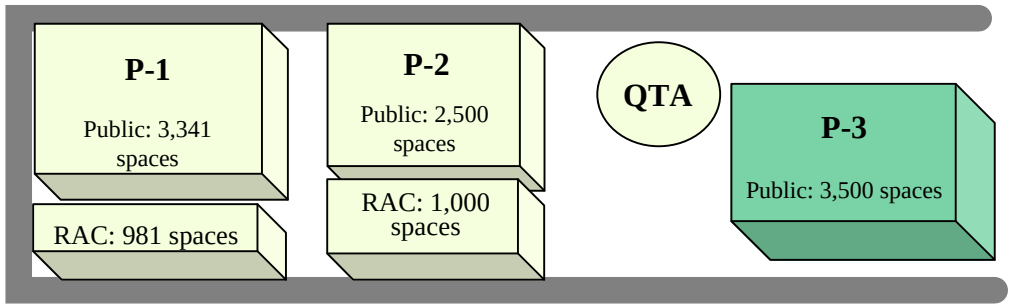
- Construct TEE
- Remove Long-Term Lot
- Relocate and expand QTA
- Expand RAC to second level of P-2
- Build P-3 (1,500 spaces)

Note: Assume increased on-Airport RAC market share.

18.0 MAP Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	7,200	7,341
RAC ready/return	1,560	1,981

OPTION B: Close-In RAC, Limited Near-Term Market Share (cont'd)



Meets requirements through planning period

23.0 MAP Parking Space Requirements
(includes circulation allowances)

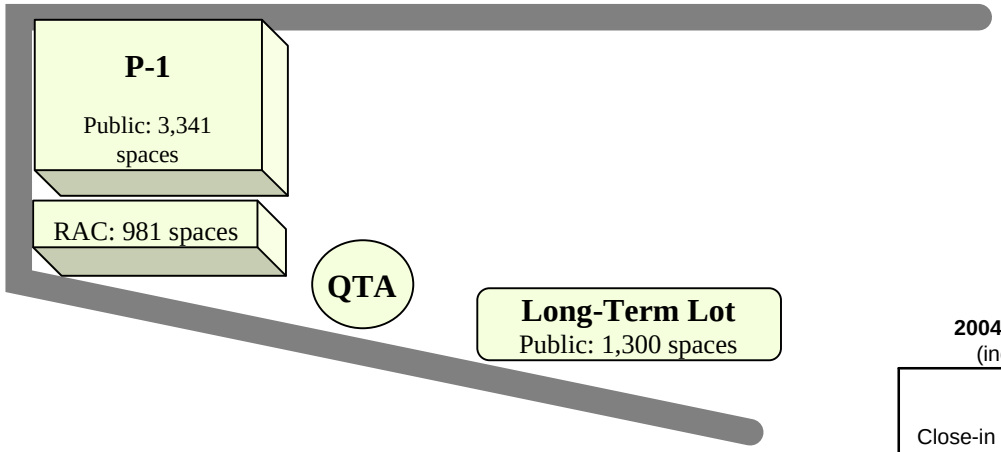
	Required	Planned
Close-in parking	9,200	9,341
RAC ready/return	2,000	1,981

18.0 to 23.0 MAP

- Expand P-3 (as needed) to 3,500 spaces

OPTION C: Remote RAC Facilities

Existing conditions

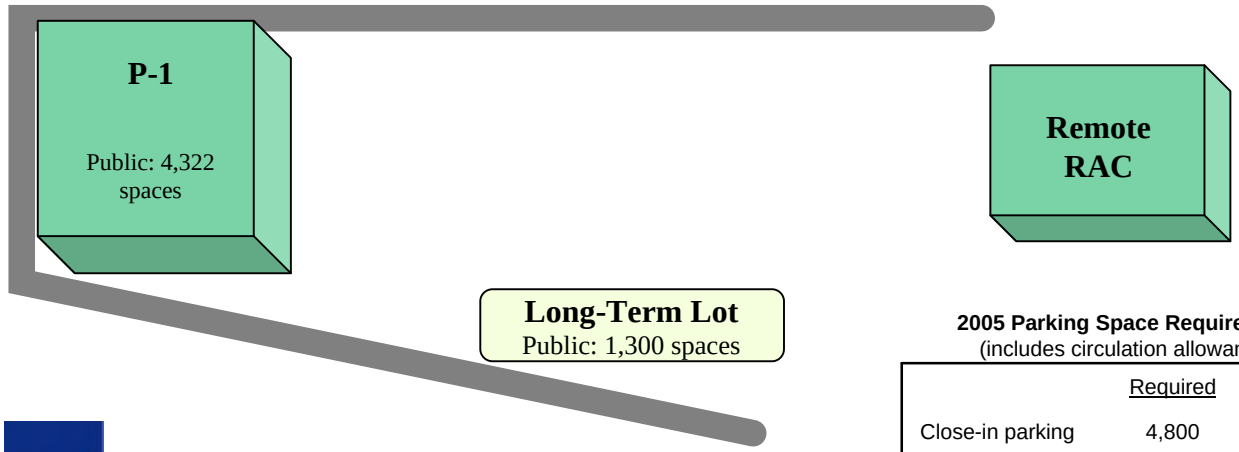


2004 Parking Space Requirements
(includes circulation allowances)

	Required	Existing
Close-in parking	4,500	4,641
RAC ready/return	1,120	981

2005

- Construct remote RAC facility
- Remove existing QTA
- Expand public parking in P-1



Note: Assume increased on-Airport RAC market share.

2005 Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	4,800	5,622
RAC ready/return	1,170	TBD

LEIGH FISHER ASSOCIATES
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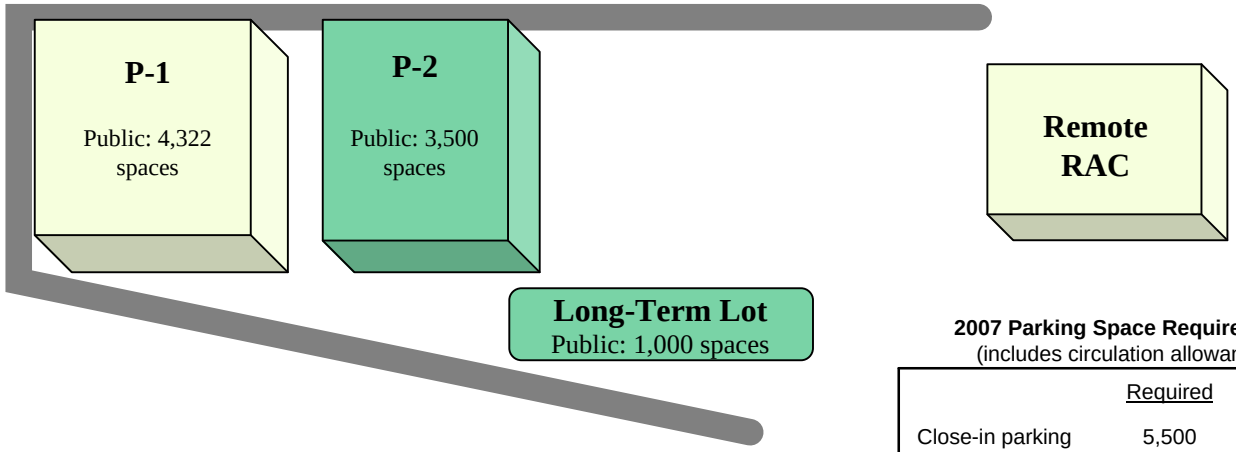
PORT OF PORTLAND

OPTION C: Remote RAC Facilities (cont'd)

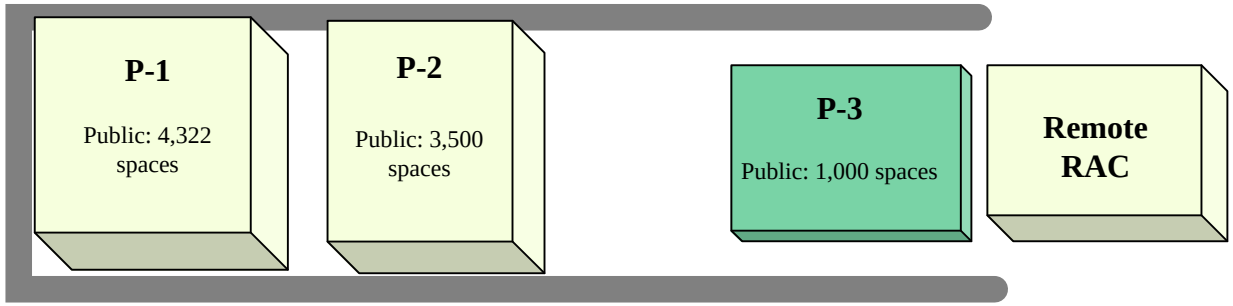


2007 Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	5,500	8,822
RAC ready/return	1,250	TBD

2005 to 2007

- Reduce Long-Term Lot to 1,000 spaces
- Build P-2 (3,500 spaces)



18.0 MAP Parking Space Requirements
(includes circulation allowances)

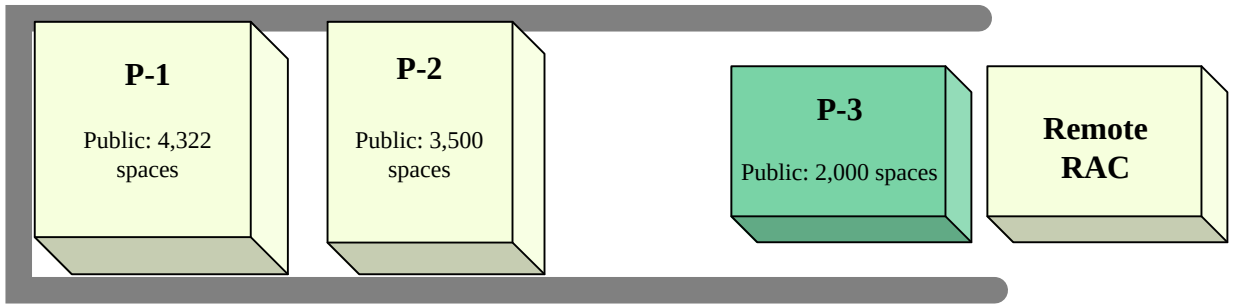
	Required	Planned
Close-in parking	7,200	8,822
RAC ready/return	1,560	TBD

17.5 to 18.0 MAP

- Construct TEE
- Remove Long-Term Lot
- Build P-3 (1,000 spaces)

Note: Economy lot reaches capacity prior to 2008.

OPTION C: Remote RAC Facilities (cont'd)



Meets requirements through planning period

23.0 MAP Parking Space Requirements
(includes circulation allowances)

	Required	Planned
Close-in parking	9,200	9,822
RAC ready/return	2,000	TBD

18.0 to 23.0 MAP

- Expand P-3 to 2,000 spaces (to meet TEE parking demand)

APPENDIX E
INFIELD TERMINAL VALIDATION

To demonstrate the viability of the terminal concept assumed in the Infield Terminal concept, Leigh Fisher Associates prepared a series of sketches (provided in this appendix) to show how passengers and baggage could be transported between the TEE terminal and the TEE concourse.

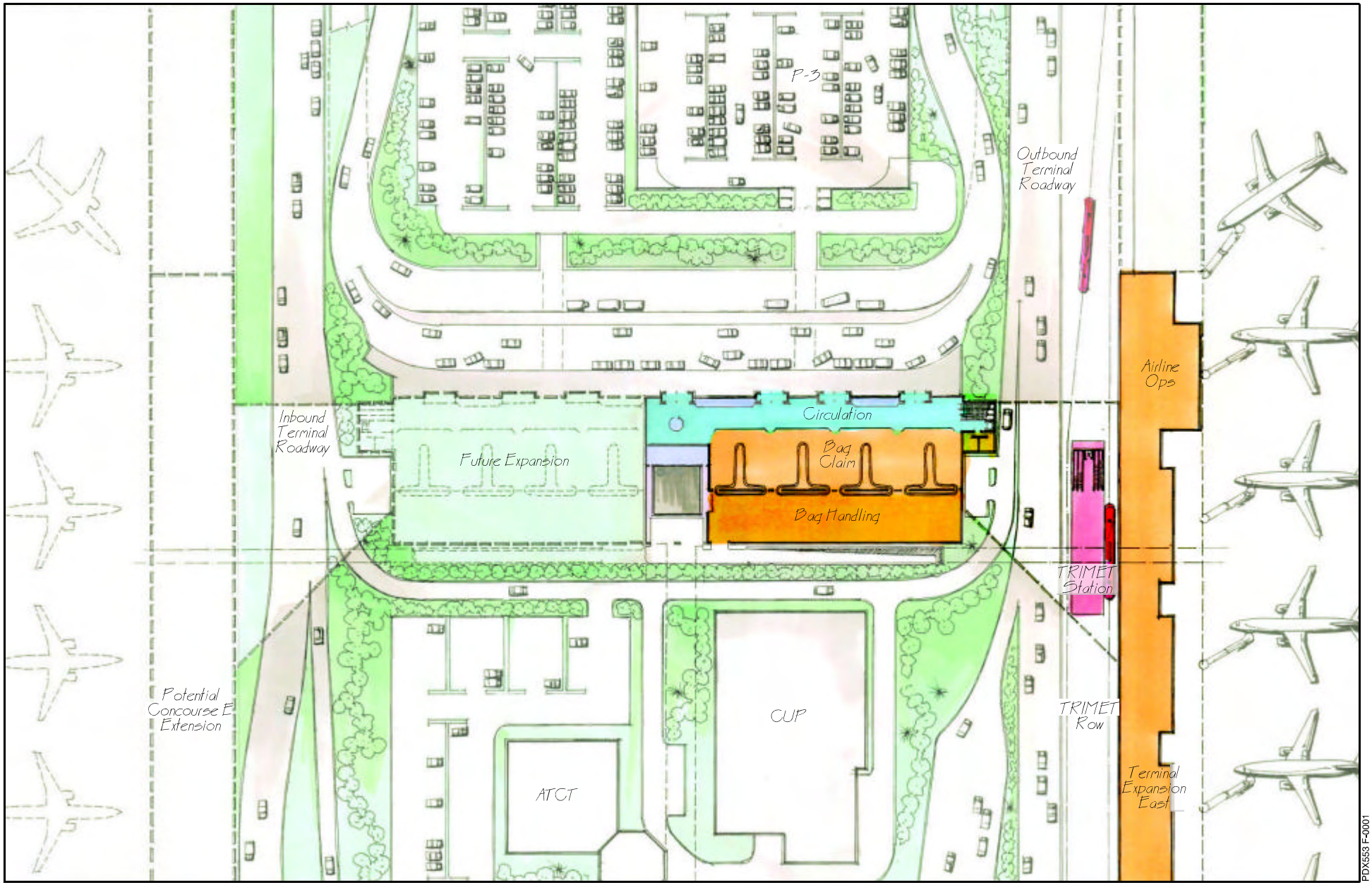


Figure 1

TEE CONFIGURATION VALIDATION—LOWER LEVEL PLAN

Portland International Airport

November 2004

LEIGH FISHER ASSOCIATES

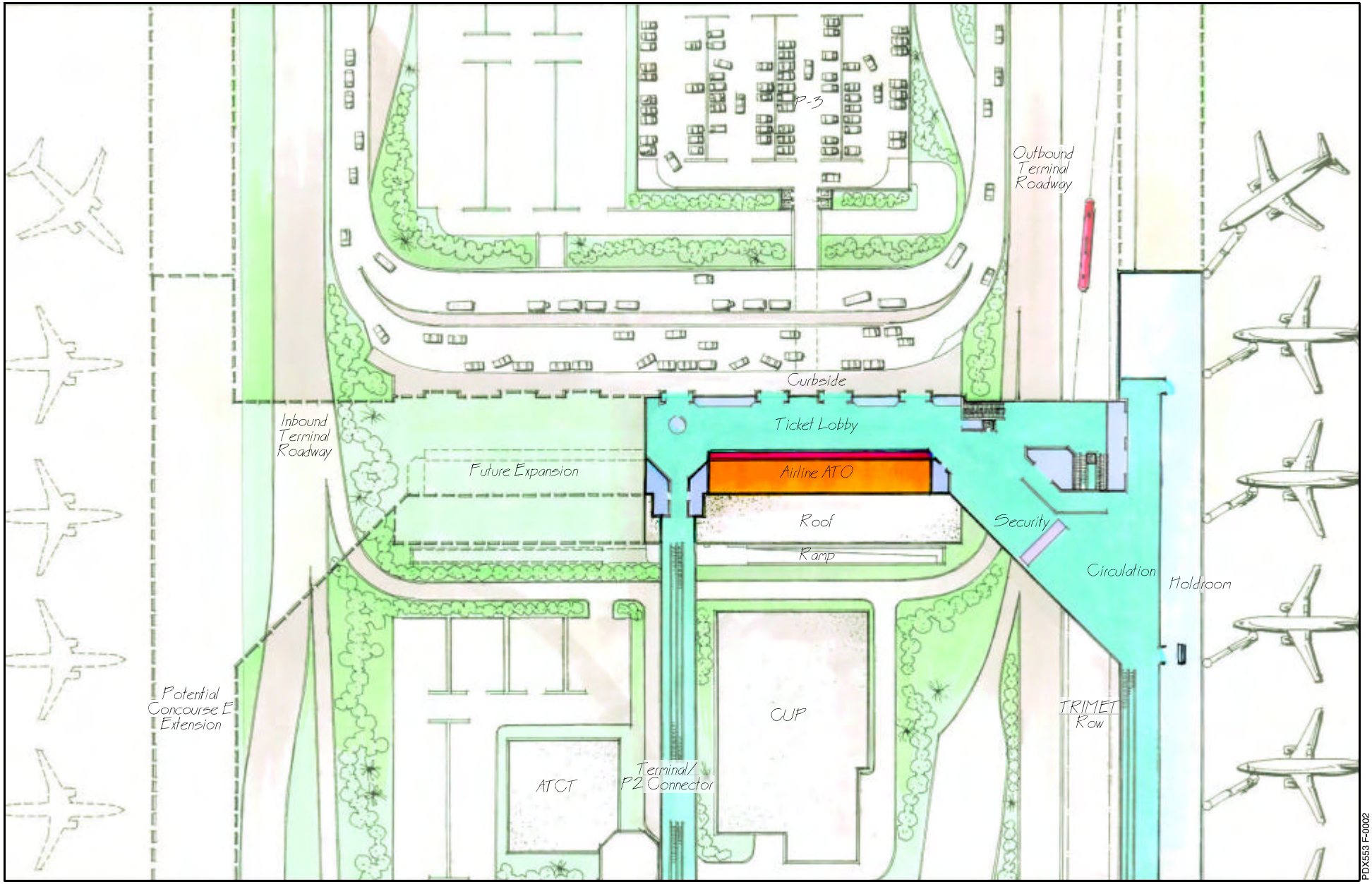


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Figure 2

TEE CONFIGURATION VALIDATION—UPPER LEVEL PLAN

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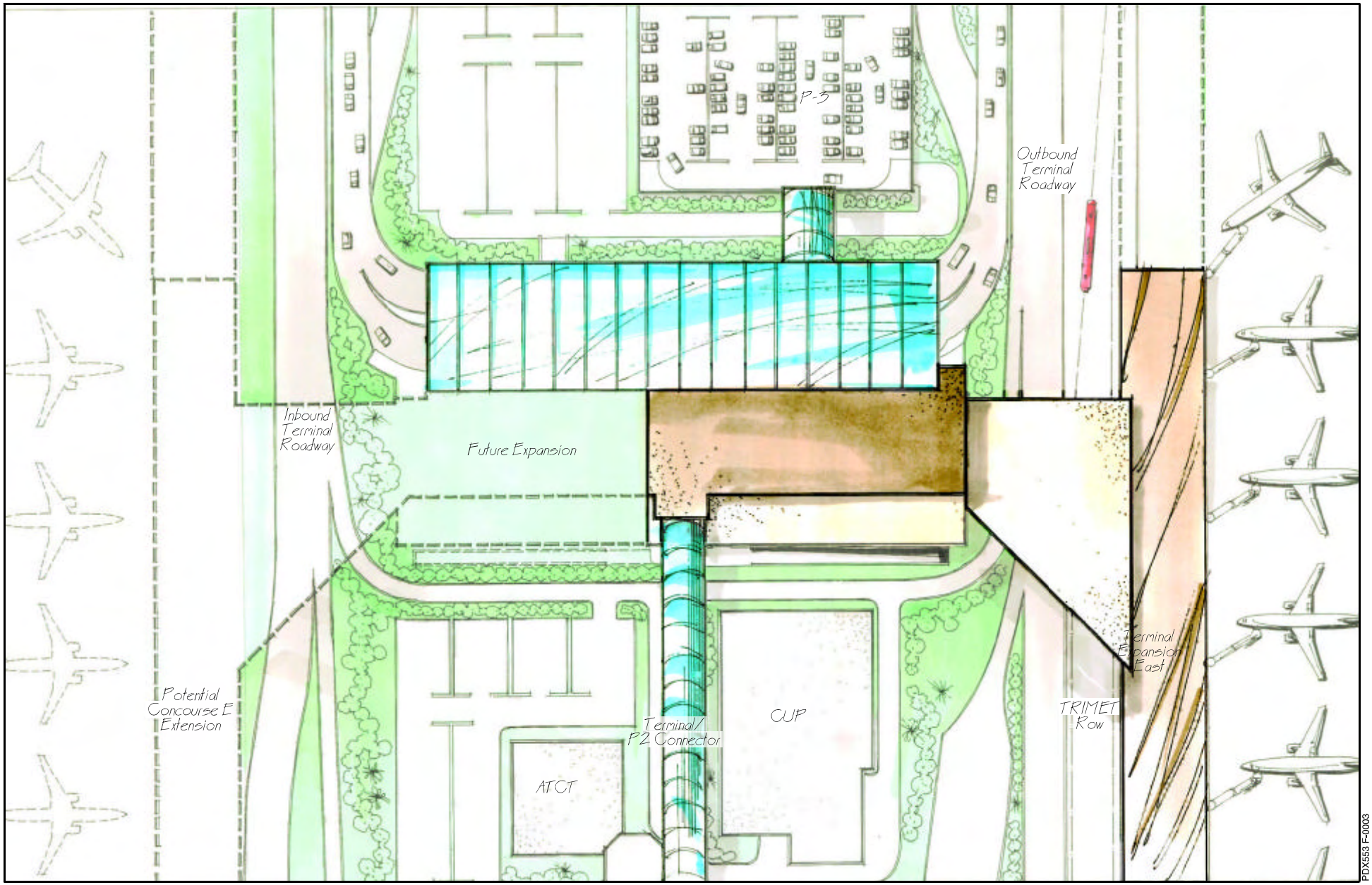

Figure 3

TEE CONFIGURATION VALIDATION—ROOF PLAN

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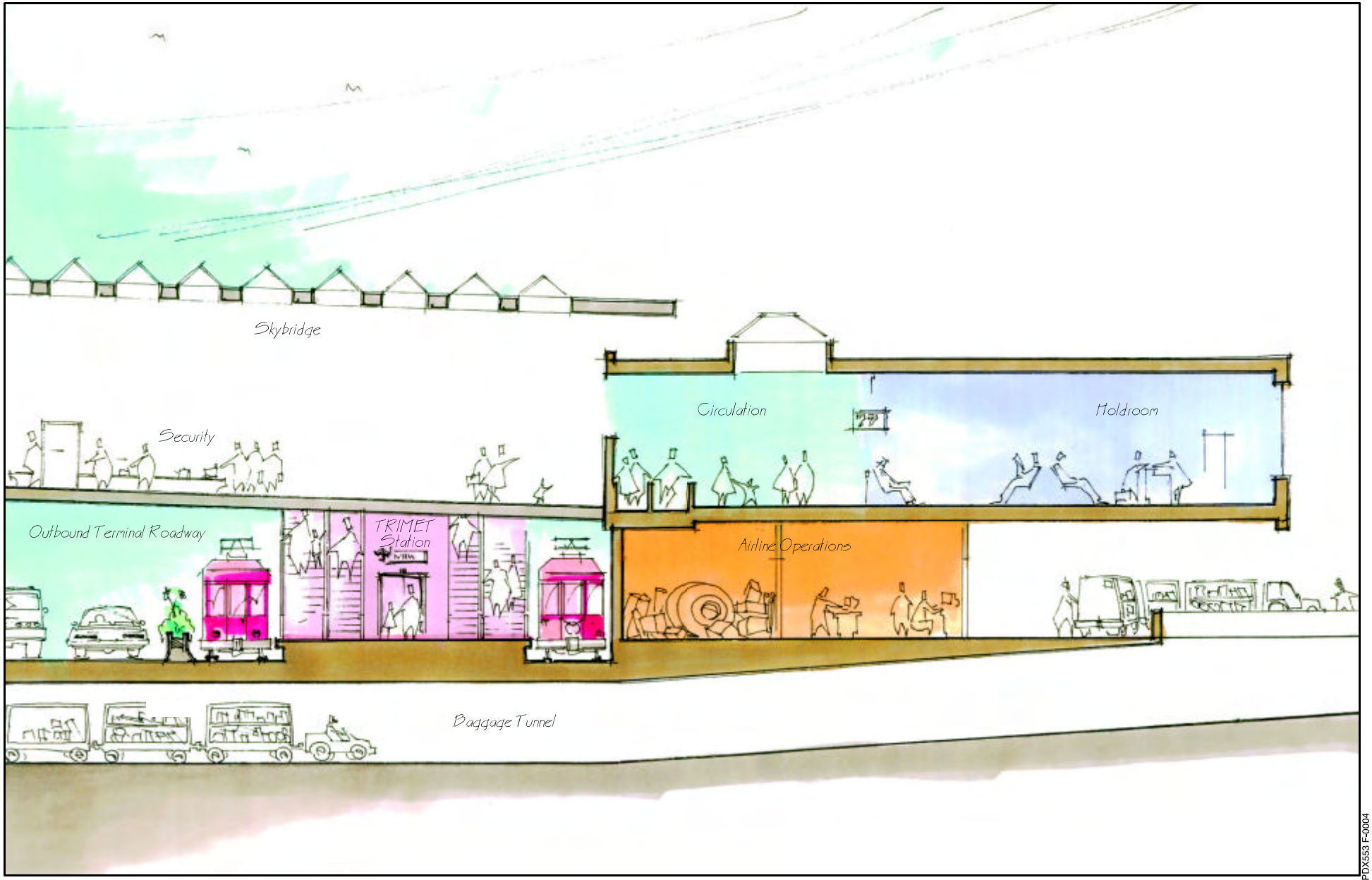

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Figure 4

TEE CONFIGURATION VALIDATION—CROSS SECTION

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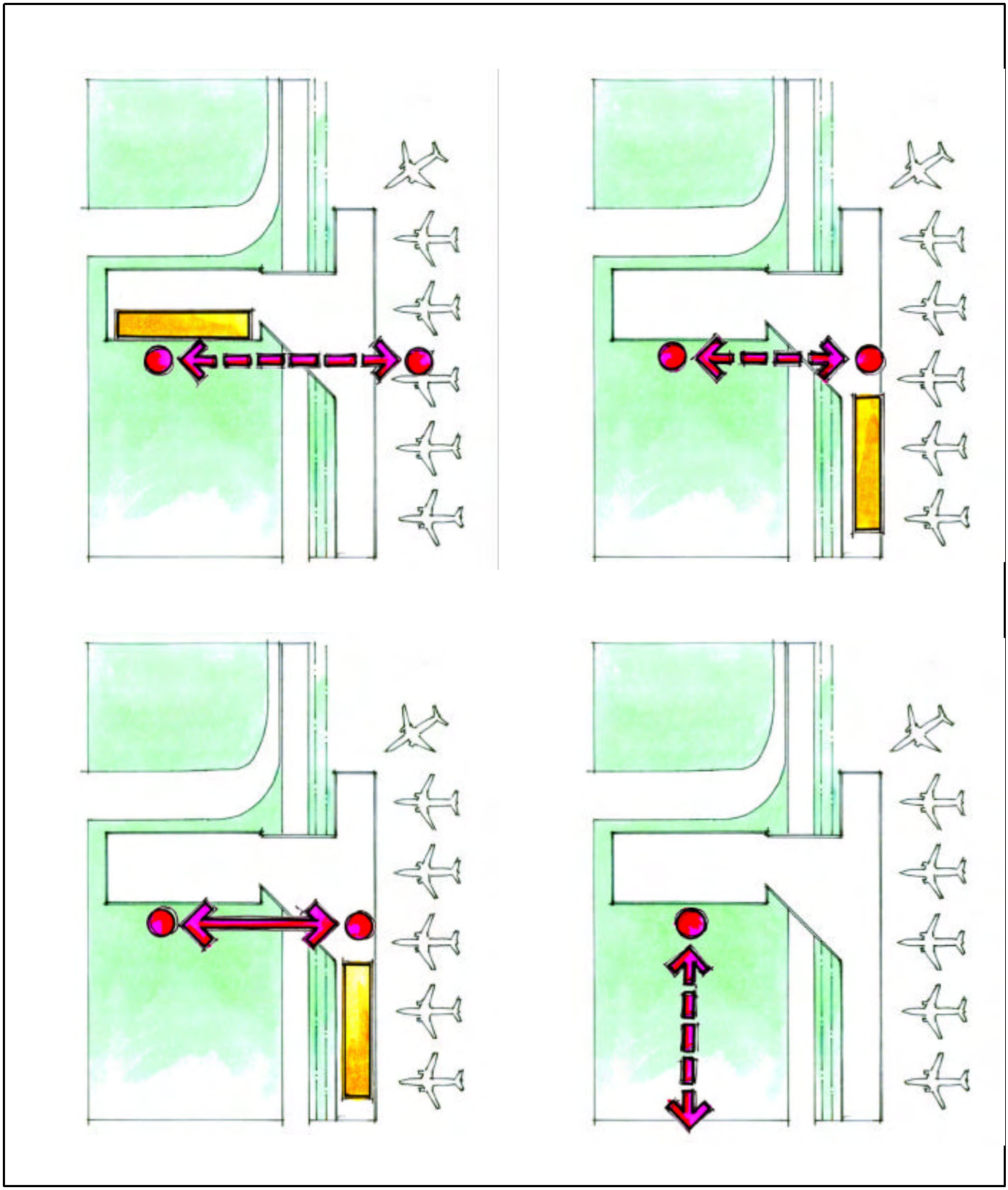

Figure 5

TEE CONFIGURATION VALIDATION—
BAG HANDLING OPTIONS

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