SAN DIEGO
International Airport

AIRPORT MASTER PLAN
SAN DIEGO INTERNATIONAL AIRPORT

SECTION 7.3

Ground Transportation

HNTB

SAN DIEGO INTERNATIONAL AIRPORT

MAY 2008

7.3 Ground Transportation

This section presents the ground transportation facility requirements estimated for San Diego International Airport (SDIA) to accommodate a projected air passenger activity of approximately 28.2 million annual passengers (MAP) by 2030. The initial sections describe the overall approach, key inputs, assumptions, and methodology for estimating the ground transportation facility requirements. Based on these elements, ground transportation forecasts were developed, forming the foundation for the facility requirements estimates. The following ground transportation facilities were included in the analysis:

- Terminal curbside
- Public parking
- Rental car
- Employee parking

The analysis presented in this section provides a detailed methodology of facility requirement evaluations. This analysis is more detailed than those employed in the 2001 Master Plan due to the availability of more detailed and updated information. In addition, HNTB collected and implemented new research technologies/information from recent project work at other airports, including Ontario and Seattle-Tacoma International Airports, after developing the 2001 SDIA Master Plan. Ontario International Airport provided an analogous example as it is expected to accommodate approximately 33 MAP in 2030 (approximately the same level of passenger activity projected at SDIA). The Seattle-Tacoma International Airport is currently operating at approximately 26.7 MAP and therefore provides an idea of the level of operations projected at SDIA in 2030.

7.3.1 Overall Approach

The general approach in estimating ground transportation facility requirements at SDIA is summarized in the flowchart shown in **Figure 7.3-1**. Key analytical steps are indicated in rectangular boxes. Key inputs and assumptions are indicated in trapezoidal boxes. The availability of the following information facilitated this approach: vehicle occupancies, peak-hour surge factors from traffic counts, vehicle dwell times, and average parking durations enabled the use of this approach.

The analytical steps below outline the overall approach to estimate the ground transportation facility requirements. The key inputs and assumptions are **highlighted** and discussed in more detail in the next section:

1. Develop the future Average Day Peak Month (ADPM) passenger activity **gated schedule**. The gated schedule shows the 24-hour profile of enplaning and deplaning activity based on projected flight schedules.
2. Apply a global **planning reserve factor** to the gated schedule to account for future uncertainties.
3. Determine **peak hour originations and terminations** from the forecast gated schedule.
4. Apply **mode share assumptions** to peak hour passenger originations and terminations to determine peak hour passenger volumes using different modes of transportation.
5. Apply **vehicle occupancy factors** to peak hour passenger volumes by mode to determine peak hour vehicle volumes for each mode. For vehicles operating on fixed schedules (e.g., public transit, airporters, etc.), peak hour volumes were based on **scheduled service frequency/headway**.
6. Apply **peak period surge factors** to peak period vehicle volumes to determine vehicle design volumes. For most of the facilities, the peak period is the peak hour. For long-term and remote parking where the average parking duration extends for more than a day, the peak period is one day.

7. Estimate curb stall requirements for each mode and type of activity (pick-up, drop-off, or combined pick-up and drop-off) by applying **vehicle dwell times** to peak hour design volumes. Parking stall requirements for short-term, long-term, and remote parking were estimated by applying average **parking duration** and **parking reserve capacity** assumptions to the estimated parking demand (transactions).
8. Estimate curb frontage requirements for each mode and type of activity (pick-up, drop-off, or combined pick-up and drop-off) by applying **curb stop** assumptions and corresponding **vehicle stall lengths**.
9. Determine the total facility requirements for each ground transportation facility by summarizing all modes using the facility. Total requirements were compared to available supply and surplus or deficits were calculated.

7.3.2 Key Inputs and Assumptions

Passenger Activity Gated Schedule

Passenger activity level gated schedules were estimated at SDIA for 2015 and 2030. These schedules were assumed to reflect the activity for the ADPM. For each enplaning or deplaning flight, the schedule indicated the expected gate to be used, the origin/destination airport, departure/arrival time, type of aircraft, load factor, connecting rate, and number of passengers enplaning/deplaning and originating/terminating.

Forecasts indicate that air passenger activity levels at SDIA would increase from approximately 16.5 MAP in 2004 (estimated) to 22.8 MAP in 2015 and 28.2 MAP in 2030. Connecting passengers constitute about four percent of the total passengers. Peak month activity is approximately 10 percent of the annual activity, and peak hour activity is about eight percent of the daily activity. These ratios are assumed to remain constant in the future.

The gated schedule demonstrates SDIA would accommodate approximately 93,700 total passengers during the 2030 ADPM or an equivalent of 89,800 originating and terminating (O&D or non-connecting)[5] passengers. **Figure 7.3-2** illustrates the hourly distribution of passenger activity.

Planning Reserve Factor

A global planning reserve factor of 15 percent was applied to peak hour passenger originations and terminations. This factor is intended to account for future uncertainties in long-term projections and other inputs used in the analysis.

Mode Shares

Each mode typically found at the airport would use each ground transportation facility component (curbside, Transit Plaza, public parking, rental car, etc.) respective to one of the following modes:

- Privately owned vehicles (POVs)
- Rental cars
- Taxis
- Limousines
- For-hire vans
- Courtesy vehicles (from off-site hotel/motel, rental car and remote parking facilities)
- Airporters (scheduled for-hire buses and vans)

[5] Based on approximately four percent connecting passengers.

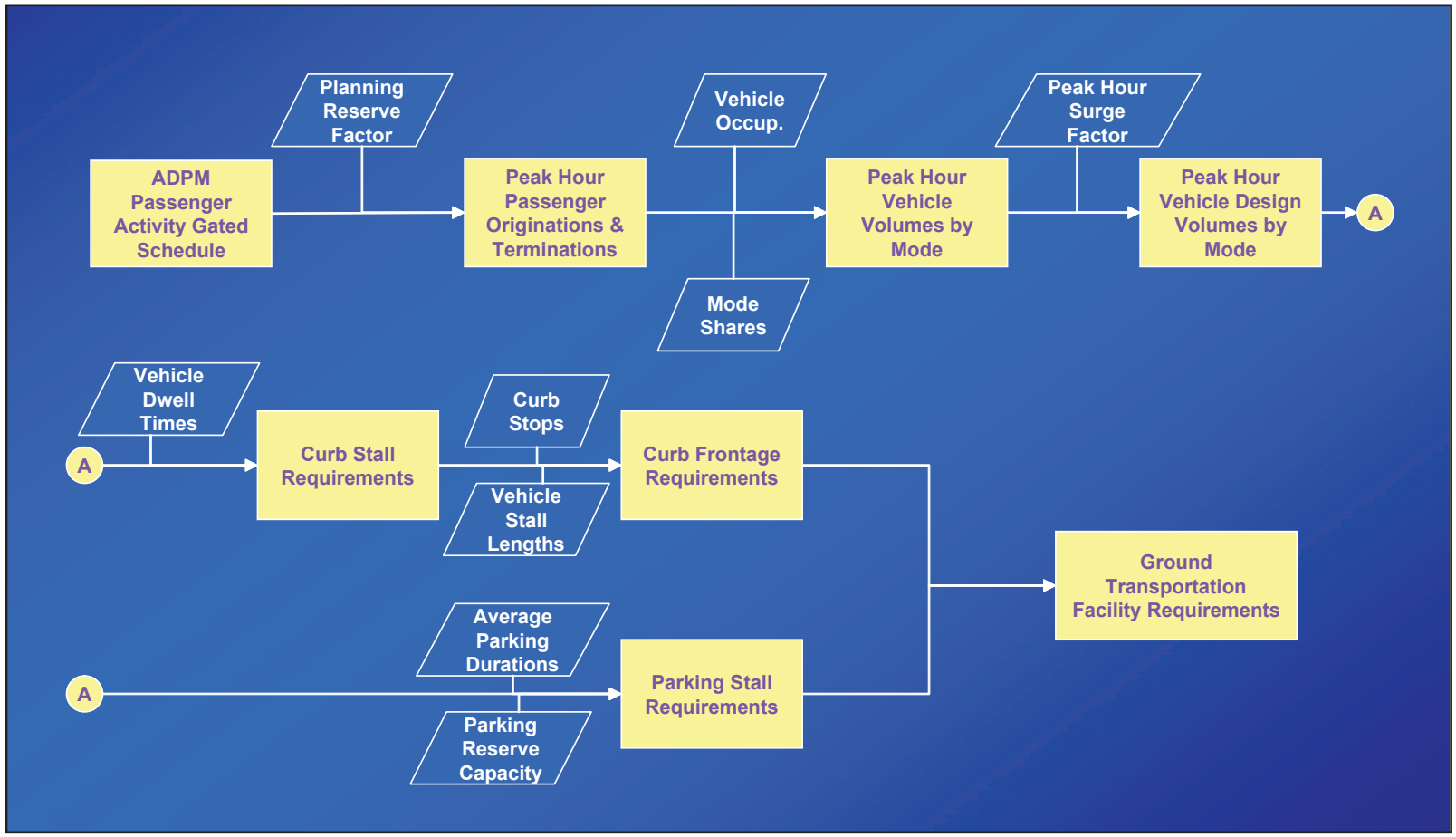

Figure 7.3-1

Overall Approach to Ground Transportation Facility Requirements Estimation

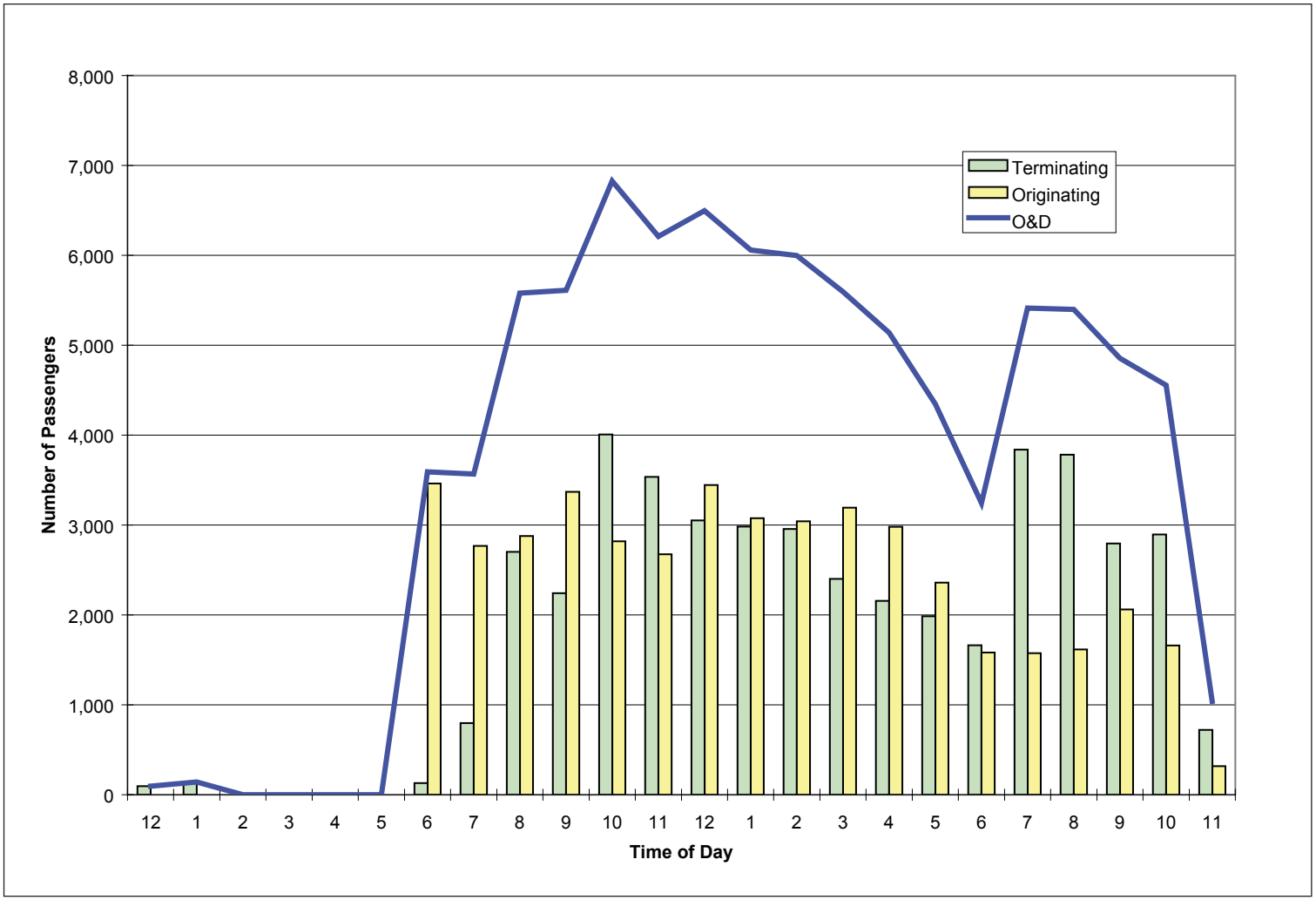

Figure 7.3-2

2030 Passenger Activity Gated Schedule

- Charter and tour buses
- Public transit buses
- Scheduled shuttle buses (Red Bus and Blue Bus)

These modes perform different types of activities (i.e., passenger drop-off, pick-up, or both) at various ground transportation facilities.

POVs are further classified into those using curbside, those using different parking facilities (short-term, long-term or remote), or both. Between the two groups of POV users are those using the curbside to drop off departing passengers and then proceeding to parking lots, as well as those parking for short-term and proceeding to the curbside to pick up arriving passengers. This group accounts for approximately five percent of O&D passengers who park their vehicles.[6]

Existing mode shares, or the relative proportion of air passengers using each of the available modes, were developed and calibrated using air passenger survey data, traffic counts, and transaction records provided by the Authority. O&D passengers were assumed to have the same mode shares. **Table 7.3-1** shows the assumed mode shares for O&D passengers. The mode shares and vehicle occupancies were developed from survey data and adjusted by calibrating against available traffic counts and transaction records. The calibration exercise indicated that recirculation traffic accounts for approximately 30 percent of deplaning traffic.

Table 7.3-1

Mode Shares and Vehicle Occupancy

Mode	Mode Share[1]	Vehicle Occupancy (Passengers per Vehicle)[1]
Private Vehicle		
Curbside	25.5%	1.2
Short-Term Parking	17.0%	1.3
Long-Term Parking	2.5%	1.3
Remote Parking[2]	-	1.3
Rental Car[3]	-	1.4
Ground Transportation		
Taxi	7.3%	1.5
Limousine	1.3%	1.5
For-Hire Shuttle	9.5%	4.0
Hotel/Motel Courtesy Shuttle	5.8%	2.6
Rental Car Courtesy Shuttle	19.1%	1.5
Remote Parking Courtesy Shuttle	10.0%	1.8
Public Transit	1.0%	5.0
Charter/Other Bus	1.0%	15.0
Total	**100.0%**	

1 Mode shares and vehicle occupancy based on HNTB calibration.
2 Uses the same mode share percentage as remote parking courtesy shuttles.
3 Uses the same mode share percentage as rental car courtesy shuttles.

Source: HNTB, 2005.

6 Technical Committee Meeting, October 21, 2004.

Vehicle Occupancy

Existing vehicle occupancies (the average number of passengers per vehicle) were assumed for each mode based on observed and survey data. Vehicle occupancies were assumed to be the same for O&D passengers, as shown in **Table 7.3-1**.

Scheduled Headways

Public transit buses and airporters are assumed to operate at fixed schedules. Public transit buses are assumed to operate at 10-minute headways based on existing schedules. SDIA operates the Red Bus airport inter-terminal shuttle every 10 minutes and the Blue Bus employee shuttle every seven minutes. These schedules are assumed to remain the same in the future. The growth in ridership of these modes was assumed to be accommodated through increased passenger loading – more passengers being carried by each bus than currently observed.

Peak Hour Surge Factors

During the peak hour of any type of passenger activity (for example, enplaning activity), flights depart on specific times during the hour. In some cases, flights would depart at almost the same time. These simultaneous flight departures would result in a "surge" or instantaneous peaking of passenger activity. Peak hour surge factors (or peak hour factors, PHFs) are typically used in designing facilities to take into account this peaking phenomenon. Peak hour surge factors were assumed as follows, based on analysis of 15-minute traffic counts at these facilities:

- Curbside – 1.10
- All Parking Facilities – 1.40

Vehicle Dwell Times

The number of stalls required to accommodate a given mode depends on how long each vehicle occupies a stall (vehicle dwell time). Existing vehicle dwell times were based on observed data and mode share calibration as shown in **Table 7.3-2**. Future dwell times are assumed to be similar to existing dwell times.

Table 7.3-2

Vehicle Dwell Times and Stall Lengths

Mode	Vehicle Dwell Time (minutes)			Vehicle Stall Length (feet)
	Enplane	Enp & Dep Combined	Deplane	
Private Vehicle[1]	1.59	n/a	1.80	25
Taxi[1]	1.22	n/a	1.60	25
Limousine[2]	1.22	n/a	4.00	35
Charter/Other Bus[3]	15.00	n/a	15.00	50
Courtesy Shuttle[1]	n/a[5]	2.10	n/a	40
For-Hire Shuttle[1]	n/a	2.10	n/a	35
Public Transit[4]	n/a	2.10	n/a	40
Red Bus Airport Shuttle[4]	n/a	2.10	n/a	40
Blue Bus Employee Shuttle[4]	n/a	2.10	n/a	40

1 2004 Survey
2 Assumed the same as taxi for enplane; longer dwell time assumed for deplane.
3 Assumed.
4 Assumed the same as the courtesy shuttles.
5 n/a - not applicable

Source: HNTB, 2005.

Vehicle Stall Lengths

The total curb frontage requirement was estimated by multiplying the stall requirement by the effective vehicle stall length required for parallel parking, as shown in **Table 7.3-2**. POVs, rental cars,[7] and taxis are assumed to require 25-foot stalls. Limousines and for-hire shuttle vans are assumed to require 35-foot stalls, while courtesy shuttle vans and public transit buses are assumed to require 40-foot stalls. Full-size buses (scheduled buses and charter buses) would require 50-foot stalls.

Curb Stops

The length of the curb frontage and the relative location of terminal doors make it necessary for vehicles serving passengers on different flights to stop several times on a given roadway. For example, public transit bus, the Red Bus, and the Blue Bus services make two stops each at Terminals One and Two, and one stop at the Commuter Terminal, for a total of five stops. Courtesy vehicles and for-hire shuttles are assumed to make one stop at each terminal for a total of three stops. All other vehicles are assumed to make one stop per trip. The total number of curb stalls was estimated by multiplying the stall requirement by the number of curb stops.

7 Rental cars are not expected to use the curbs because they are rented at and returned to off-airport sites. For those that end up using the curb, they are assumed to have the same dwell times and stalls as private vehicles.

Parking Duration

Based on analysis of existing parking transaction data provided by the Authority, average parking duration for different parking facilities is assumed as follows:

- Short-Term Parking – 1.24 hours
- Long-Term Parking – 1.76 days
- Remote Parking – 2.5 days

Parking Reserve Capacity

A parking reserve capacity was added to the estimated parking requirements to account for the effective capacity of most parking facilities, which occurs before the full capacity is reached. This is due to the fact that it becomes increasingly difficult to find a vacant stall as the parking facility approaches capacity. Based on industry standards, parking reserves were assumed to be 15 percent for short-term parking and 10 percent for long-term and remote parking.

7.3.3 Ground Transportation Forecasts

Airport Trip Generation

SDIA generated approximately 72,400 vehicle trips per day (VPD) based on traffic counts conducted in April 2004.[8] This volume included traffic related to the terminals (curbside, terminal parking and Transit Plaza), employee parking, long-term parking at SAN Park Pacific Highway, freight and other traffic on Washington Avenue; it did not include traffic associated with rental car activity on Rental Car Access Road. Rental car traffic activity was estimated from the rental car operator survey data to be approximately 3,920 VPD. Total airport trip generation, including rental car activity, reached approximately 76,300 VPD. Adjusting for the peak month (July 2004) using the ratio of monthly air passengers for July versus April 2004 (approximately 1.127), the average day peak month (ADPM) airport trip generation at SDIA was estimated to be approximately 86,000 VPD. Of these, about 74,800 VPD were trips associated with the three terminals. One-way curbside traffic accounted for approximately 31,300 VPD.

Trip generation forecasts typically use standard trip generation rates developed and published by the Institute of Transportation Engineers (ITE).[9] However, airport trip generation rates published by ITE are based on a small sample size. Trip generation rates for SDIA were, therefore, developed using airport-specific data.

Surface transportation activity at airports is more appropriately related to the number of O&D passengers, rather than to the total number of passengers. The latter includes connecting passengers who are not likely to use ground transportation facilities. Approximately four percent of the total passengers at SDIA are connecting passengers.

The ADPM O&D passenger level at SDIA was estimated to be approximately 51,300 O&D passengers per day.[10] Relating the ADPM airport trip generation to the O&D passenger level yields a trip generation rate of approximately 1.68 VPD per O&D passenger.

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8 SDCRAA, *Update of Traffic Data for San Diego International Airport*, July 2004.

9 ITE, *Trip Generation – 6th Edition*, 1997.

10 HNTB, 2004 gated schedule.

The relationship between terminal-related traffic and O&D passenger activity, based on a survey of 39 commercial airports in the U.S.[11], is expressed by the following formula (hereinafter referred to as the ITE model):

$$\textit{Average Daily Traffic (In + Out)} = 7.395 \textit{ (Daily O\&D Passengers)}^{0.8526}$$

Using the ITE model, the estimated terminal trip generation at SDIA was approximately 76,700 VPD, corresponding to a trip rate of 1.49 VPD per O&D passenger. The ADPM terminal trip generation at SDIA based on traffic counts was approximately 74,800 VPD, corresponding to a trip rate of 1.46 VPD per O&D passenger. This represents about 2.5 percent difference between the ITE model estimate and actual trip generation, which is within acceptable limits (±10 percent) typically used for planning purposes.

The ITE model also depicts the declining trip generation rate as airport passenger activity level increases, which is shown by the slight flattening of the slope of the line from left to right. This is generally attributed to the increased use of transit vehicles as the airport size increases, since these services become more viable at higher passenger levels. Future SDIA trip generation rate was assumed to follow the pattern suggested by the ITE model.

Table 7.3-3 summarizes the trip generation forecasts for SDIA. As shown in the table, the ADPM airport trip generation is expected to increase from approximately 86,000 VPD in 2004 to 115,600 VPD in 2015 and to 138,500 VPD in 2030.

Table 7.3-3

Traffic Forecasts

Facility	Traffic Forecasts 2004	2015	2030
Airport Activity Level			
Million Annual Passengers (MAP)	16.5	22.8	28.2
Million O&D Passengers	15.9	21.8	27.0
Daily O&D Passengers	51,334	72,595	89,758
Airport Trip Generation			
Average Daily Traffic (ADT)	86,024	115,600	138,500
Trip Rate - ADT/O&D Passenger	1.68	1.59	1.54
Peak Hour Traffic	5,592	7,514	9,003
Peak Hour Ratio	6.5%	6.5%	6.5%
Terminal Trip Generation			
Average Daily Traffic (ADT)	74,836	100,561	120,506
Trip Rate - ADT/O&D Passenger	1.46	1.39	1.34
Peak Hour Traffic	4,864	6,536	7,833
Peak Hour Ratio	6.5%	6.5%	6.5%

Source: HNTB, 2004.

The existing ratio of peak hour to daily trip generation at SDIA is approximately 6.5 percent. This ratio is assumed to remain constant in the future.

[11] Terry Ruhl and Boris Trnavskis, "Airport Trip Generation," *Institute of Transportation Engineers (ITE) Journal*, May 1998, pages 24-31. The *ITE Journal* is a publication for traffic engineers and transportation planning professionals.

The *Update of Traffic Data for San Diego International Airport* conducted traffic counts, vehicle classification counts, vehicle occupancy survey, vehicle dwell time survey, and other related traffic surveys from which mode share information was estimated. In addition, the Authority provided Automated Vehicle Identification (AVI) trip data that were used in the mode share calibration. **Table 7.3-1** presents the result of the mode share calibration based on April 2004 data. These mode shares and vehicle occupancies were used to translate ADPM peak hour passenger originations and terminations into peak hour vehicle trips that were subsequently used to estimate curbside facility requirements.

7.3.4 Curbside Requirements

Curb length requirements for each vehicle mode were estimated separately by terminal as well as by curb location (enplaning, deplaning and Transit Plaza). For each curb location, design hour volumes were estimated by applying a surge factor to peak hour volumes by mode. Peak hour vehicle volumes were estimated using the mode share and vehicle occupancies shown in **Table 7.3-1**. A peak hour surge factor of 1.10 was applied to peak hour volumes and a terminal-specific surge factor was applied to account for the specific peaking characteristics observed at each terminal.

Approximately five percent of parking and rental car traffic was assumed to use the curbs based on past air passenger surveys at SDIA. Approximately 30 percent of deplaning private vehicles were assumed to recirculate based on the mode share calibration. Total curbside vehicular traffic was distributed among the three terminals based on the observed proportion of curbside terminal traffic (Terminal One – 65 percent, Terminal Two – 25 percent, and Terminal Three – 10 percent). Curb traffic at Terminals One and Two was further distributed into the east and west sections of the curb based on July 2004 enplanements as follows:

- Terminal One East - 75 percent West - 25 percent
- Terminal Two East - 40 percent West - 60 percent

The number of stalls required for each vehicle mode was estimated by applying an average dwell time, shown in **Table 7.3-2**, for that mode to the calculated design hour volume. The curb length requirement for each mode was then estimated by multiplying the required number of stalls by the average vehicle curb length, shown in **Table 7.3-2**, and by the number of stops the mode is expected to make along the curb. **Table 7.3-4** summarizes the projected curbside requirements for 2004, 2015, and 2030.

7.3.5 Public Parking Requirements

Parking stall requirements for different types of public parking (short-term, long-term and remote) were estimated by applying average parking durations (short-term parking 1.24 hours, long-term parking 1.76 days, and remote parking 2.5 days) to the design "period" volume (transactions). The "period" used for short-term parking analysis represents the peak hour, while the long-term and remote parking analysis used a period of one day. Design volumes were estimated by applying peak period surge factors. The parking requirement estimates include parking reserves of 15 percent for short-term and 10 percent for long-term and remote parking. The peak surge factors incorporate seasonal and peak day of the week surges.

The following steps outline the approach used to determine the parking transaction ratio for SDIA:

(a) Estimate Daily Terminal Parking Transactions:

- Lots 1&2 Daily Terminal Parking Transactions: 6,868 (April 2004 Survey)
- Ratio of Lots 1&2 Parking Spaces to Total Terminal Parking Spaces: 62.9 percent
- Estimated Daily Terminal Parking Transactions: 10,920 (=6,868/0.629)

Table 7.3-4

Terminal Curbside - Inventory and Requirements

Terminal	Curb	Lanes	Existing Curb Frontage (feet)	2004 (16.5 MAP) Curb Req'mt (feet)	2004 (16.5 MAP) Surplus/ Deficit (feet)	2015 (22.8 MAP) Curb Req'mt. (feet)	2015 (22.8 MAP) Surplus/ Deficit (feet)	2030 (28.2 MAP) Curb Req'mt. (feet)	2030 (28.2 MAP) Surplus/ Deficit (feet)
Terminal 1	**Public**								
	Enplaning - East	4	405	480	-75	555	-150	630	-225
	Deplaning	4	405	555	-150	755	-350	905	-500
	Enplaning - West	4	405	185	220	210	195	235	170
	Sub-Total Public		**1,215**	**1,220**	**-5**	**1,520**	**-305**	**1,770**	**-555**
	Transit Plaza								
	Transit Plaza - For Hire		650	385	265	420	230	455	195
	Transit Plaza - Taxi		750	600	150	625	125	675	75
	Transit Plaza - Courtesy		510	600	-90	840	-330	1,040	-530
	Sub-Total Transit Plaza		**1,910**	**1,585**	**325**	**1,885**	**25**	**2,170**	**-260**
	Total Terminal 1		**3,125**	**2,805**	**320**	**3,405**	**-280**	**3,940**	**-815**
Terminal 2	**Public**								
	Deplaning - East	3	340	185	155	235	105	260	80
	Enplaning - East	2	140	160	-20	185	-45	210	-70
	Deplaning - West	4	500	330	170	405	95	455	45
	Enplaning - West	4	380	280	100	305	75	330	50
	Sub-Total Public		**1,360**	**955**	**405**	**1,130**	**230**	**1,255**	**105**
	Transit Plaza								
	Transit Plaza - For Hire		375	315	60	350	25	385	-10
	Transit Plaza - Taxi		585	550	35	575	10	600	-15
	Transit Plaza - Courtesy		500	480	20	680	-180	840	-340
	Sub-Total Transit Plaza		**1,460**	**1,345**	**115**	**1,605**	**-145**	**1,825**	**-365**
	Total Terminal 2		**2,820**	**2,300**	**520**	**2,735**	**85**	**3,080**	**-260**
Commuter Terminal	Enplaning	3	340	460	-120	525	-185	615	-275
	Deplaning	3	345	485	-140	575	-230	640	-295
	Total Commuter		**685**	**945**	**-260**	**1,100**	**-415**	**1,255**	**-570**

Table 7.3-4

Terminal Curbside - Inventory and Requirements

Terminal	Curb	Lanes	Existing Curb Frontage (feet)	2004 (16.5 MAP) Curb Req'mt (feet)	2004 (16.5 MAP) Surplus/ Deficit (feet)	2015 (22.8 MAP) Curb Req'mt. (feet)	2015 (22.8 MAP) Surplus/ Deficit (feet)	2030 (28.2 MAP) Curb Req'mt. (feet)	2030 (28.2 MAP) Surplus/ Deficit (feet)
All Terminals	Enplaning		1,670	1,565	105	1,780	-110	2,020	-350
	Deplaning		1,590	1,555	35	1,970	-380	2,260	-670
	Transit Plaza		3,370	2,930	440	3,490	120	3,995	-625
	Grand Total		**6,630**	**6,050**	**580**	**7,240**	**-610**	**8,275**	**-1,645**

Source: HNTB estimates, 2004.

(b) Estimate Daily Remote Parking Transactions:

- Off Airport Parking (SAN Park Pacific Highway & San Diego Airport Parking) Daily Transactions: 390 (April 2004 Survey)
- Ratio of SAN Park Pacific Highway & San Diego Airport Parking Spaces to Total Remote Parking: 26 percent
- Estimated Remote Parking Daily Transactions: 1,500 (=390/0.26)

(c) Estimate Total Daily Parking Transactions:

- Terminal (Short-Term + Long-Term) + Remote Parking Daily Transactions: 12,420 (=10,920+1,500)

(d) Estimate Total Daily Parking Transaction Ratio:

- SDIA Total Daily Parking Transactions: 12,420 (April 2004 estimate)
- Daily O&D Passengers: 43,760 (April 2004)
- Total Daily Parking Transactions per Daily O&D Passengers: 0.284 (=12,420/43,760)

The estimated parking transaction ratio is assumed to remain constant during the peak month of airport activity as well as in the future. SDIA parking transaction data further revealed the following distribution: 78 percent short-term terminal parking, 12 percent long-term terminal parking, and 10 percent remote parking. These ratios and distributions were used to estimate future parking transactions at SDIA, as shown in **Table 7.3-5**.

Table 7.3-5

Parking Transactions

Year	MAP	Daily O&D Passengers	Daily Short-Term Transactions[1]	Daily Long-Term Transactions[2]	Daily Remote Transactions[3]	Total Daily Parking Transactions[4]
2004	16.5	51,334	11,372	1,749	1,458	14,579
2015	22.8	72,595	16,081	2,474	2,062	20,617
2030	28.2	89,758	19,883	3,059	2,549	25,491

1 Assumes 78 percent of total transactions.
2 Assumes 12 percent of total transactions.
3 Assumes 10 percent of total transactions.
4 Based on 0.284 transactions per O&D passenger.

Source: HNTB estimates, 2004.

Parking requirements were estimated by type of parking (terminal vs. remote) based on the projected parking transactions and the average parking durations for each type. The assumed parking durations were discussed previously. It is assumed in this analysis that SDIA would accommodate 100 percent of the parking demand. **Table 7.3-6** shows the estimated parking requirements using this approach, as well as the parking surplus or deficit based on existing supply.

Table 7.3-6

Public Parking - Stall Requirements

		Terminal					Remote[1]			Total		
		Reqmt.										
Year	MAP	Short-Term	Long-Term	Total	Supply	Surplus (Deficit)	Reqmt.	Supply [2]	Surplus (Deficit)	Reqmt.	Supply [2]	Surplus (Deficit)
2004	16.5	1,270	4,742	6,012	4,085	(1,927)	5,613	9,357	3,744	11,625	13,442	1,817
2015	22.8	1,705	6,706	8,411	4,085	(4,326)	7,938	9,357	1,419	16,348	13,442	(2,906)
2030	28.2	2,243	8,291	10,534	4,085	(6,449)	9,814	9,357	(457)	20,348	13,442	(6,906)

[1] Includes all lots, both Authority-operated and privately-operated, requiring shuttle bus transport to terminals.
[2] Includes facilities currently planned or under construction.

Source: HNTB estimates, 2006.

7.3.6 Employee Parking Requirements

SDIA employee parking requirements were estimated based on the ratio of existing employee parking supply to the annual passenger activity level at SDIA, adjusted for observed parking occupancies. SDIA currently provides approximately 1,590 employee parking spaces. With an annual passenger activity level of 16.5 MAP in 2004, this translates to approximately 96 employee parking spaces per MAP. Parking occupancy surveys conducted at SDIA employee parking lots in May 2004 showed that all the lots are approximately 65 percent occupied during the peak hour. Using 80 percent occupancy as the target occupancy for employee parking and applying a surge factor of 1.40 to account for shift change, the current employee parking ratio translates to approximately 109 (= 96 x 1.40 x 0.65 / 0.80) spaces per MAP. This ratio was used for estimating future employee parking requirements at SDIA, as shown in **Table 7.3-7**.

Table 7.3-7

Employee Parking Requirements

Year	MAP[1]	Spaces per MAP[1]	Employee Parking Requirement (Spaces)	Existing Inventory (Spaces)	Surplus (Deficit) (Spaces)
2004	16.5	109	1,800	1,590	(210)
2015	22.8	109	2,490	1,590	(900)
2030	28.2	109	3,070	1,590	(1,480)

[1] MAP - Million Annual Passengers

Source: HNTB estimates, 2004.

7.3.7 Rental Car Facility Requirements

Rental car acreage requirements were estimated using acreage ratios observed at SDIA and other airports in the western United States. The existing rental car facility south of North Harbor Drive on Rental Car Access Road currently occupies an area of approximately 27.5 acres. Future acreage requirements were estimated for two scenarios: independent and consolidated rental car operations. Ready, return, and storage spaces were estimated based on the ratios derived from a survey of SDIA rental car operators conducted in 1997. That survey determined the existing (1997) inventory of ready, return, and storage spaces, as well as the future (2000) requirements, shown in **Table 7.3-8**. The 2000 requirements indicated by the survey were related to 2000 air passenger levels to derive appropriate space ratios that were used for estimating future (2015 and 2030) rental car space requirements. These ratios were adjusted to reflect the existing facility's capture rate of approximately 60 percent of the market share. Furthermore, it was assumed that SDIA would provide approximately 100 percent of the rental car demand.

Table 7.3-8

Rental Car Space Ratios (Survey Results)

	Existing (1997) Spaces				Future (2000) Space Requirements			
Company	**Ready**	**Return**	**Storage**	**Total**	**Ready**	**Return**	**Storage**	**Total**
Company 1	56	100	400	556	100	300	700	1,100
Company 2	250	100	300	650	350	175	500	1,025
Company 3	70	50	150	270	150	100	200	450
Company 4	30	10	100	140	50	20	200	270
Company 5	248	120	380	748	248	120	600	968
Total	**654**	**380**	**1,330**	**2,364**	**898**	**715**	**2,200**	**3,813**
Percent	**28%**	**16%**	**56%**	**100%**	**24%**	**19%**	**58%**	**100%**
Spaces/MOD[1]	**42**	**25**	**86**		**58**	**46**	**142**	
Adj. 100% demand					**97**	**77**	**237**	

[1] MOD – Million Annual O&D Passengers

Source: 1997 Rental Car Survey.

The following ratios were developed for use in estimating the rental car stall requirements:

- 97 ready spaces per Million Annual O&D Passengers (MOD)
- 77 return spaces per MOD
- 237 storage spaces per MOD

Table 7.3-9 summarizes the SDIA rental car stall requirements. The acreage requirement was increased by 10.0 acres to accommodate the customer service building, Quick Turn-Around (QTA) facilities, and service/maintenance areas.

Table 7.3-9

Rental Car Stall Requirements

Year	MOD[1]	Rental Car Stall Requirements						
		Ready[2]	Return[3]	Storage[4]	Total Stalls	Acres[5]	Others[6]	Total Acres
2004	15.7	1,520	1,210	3,720	6,450	36.2	10.0	46.2
2015	21.8	2,110	1,680	5,170	9,960	50.3	10.0	60.3
2030	27.0	2,620	2,080	6,400	11,100	62.4	10.0	72.4

Note: Based on accommodating 100 percent demand.

1 MOD - Million Annual O&D Passengers
2 97 ready stalls per MOD.
3 77 return stalls per MOD.
4 237 storage stalls per MOD.
5 350 square feet per ready stall, 250 square feet per return stall, 200 square feet per storage stall.
6 Includes customer service building, Quick Turn-Around (QTA) area, and service/maintenance areas.

Source: HNTB estimates, 2004.

7.3.8 On-Airport Roadway Requirements

On-airport (terminal area) roadway lane requirements were estimated based on peak hour roadway volumes. Existing and future roadway requirements were analyzed by comparing peak hour roadway volumes to the existing roadway capacity. On-airport roadways (excluding curb roadways) were assumed to have a per-lane capacity of 900 vehicles per hour per lane.[12] The Highway Capacity Manual provides level of service criteria for roadways with design speeds of 25 mph or higher but does not provide level of service criteria for low speed roadways such as airport roadways, which typically operate at speeds less than 20 mph. Therefore, the level of service criteria, defined as volume to capacity ratios, used in this analysis were based on extrapolation of Highway Capacity Manual criteria to airport roadway conditions.

Corresponding on-airport roadway level of service criteria is presented **Table 7.3-10**.

Table 7.3-10

On-Airport Road Level of Service Criteria

Level of Service (LOS)[1]	Volume-to-Capacity Ratio (V/C)[2]
A	0.26
B	0.44
C	0.64
D	0.82
E	1.00
F	>1.00

1 LOS = level of service
2 V/C = volume-to-capacity ratio

Source: Highway Capacity Manual 2000.

12 FHWA and FAA, Intermodal Ground Access to Airports – A Planning Guide, Final Report, December 1996.

Existing on-airport, terminal area roads were assessed to determine if they met an acceptable level of service based on the criteria defined in **Table 7.3-10**. A roadway segment is considered to operate acceptably and have a sufficient number of lanes if it operates at level of service D or better, defined as having a volume-to-capacity ratio of 0.86 or less. The volume-to-capacity ratio of each segment was calculated by dividing the observed peak hour volume of that segment (shown in **Table 7.3-11**) by the total roadway capacity (900 vehicles per lane times the number of lanes). **Table 7.3-11** summarizes the existing number of lanes, peak hour volumes, calculated volume-to-capacity ratio, and level of service for each on-airport roadway segment. The on-Airport roadway segments are identified in **Figure 7.3-3**, the link ID key map. The peak hour volumes show in **Table 7.3-11** represent the peak hour for each roadway segment. The peak hour of all segments occur during the PM peak period with the exception of Links 22 through 28 which occur during the AM peak period. As shown in **Table 7.3-11**, all terminal roadways would operate at acceptable LOS D or better during peak hours; and therefore, the existing number of lanes is sufficient.

Table 7.3-11

On-Airport Roadway Peak Hour Operations

		2005				2015				2030			
		AM		PM		AM		PM		AM		PM	
Link ID[1]	Lane	Volume (vph[2])	LOS[3]	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS
1	2	355	A	236	A	464	A	386	A	512	B	430	A
2	2	250	A	145	A	388	A	332	A	439	A	378	A
3		Not Used				Not Used				Not Used			
4		Not Used				Not Used				Not Used			
5	2	105	A	91	A	76	A	54	A	73	A	52	A
6	9	0	A	0	A	0	A	0	A	0	A	0	A
7	9	0	A	0	A	0	A	0	A	0	A	0	A
8	3	322	A	196	A	494	A	422	A	585	A	503	A
9		Not Used				Not Used				Not Used			
10		Not Used				Not Used				Not Used			
11	1	119	A	125	A	210	A	234	A	244	B	274	B
12		Not Used				Not Used				Not Used			
13	9	0	A	0	A	0	A	0	A	0	A	0	A
14	1	63	A	56	A	91	A	79	A	105	A	91	A
15	4	441	A	321	A	704	A	656	A	829	A	777	A
16	1	0	A	0	A	12	A	12	A	12	A	12	A
17	4	503	A	374	A	783	A	723	A	922	A	856	A
18	2	386	A	288	A	611	B	574	B	703	B	665	B
19		Not Used				Not Used				Not Used			
20		Not Used				Not Used				Not Used			
21		Not Used				Not Used				Not Used			
22		Not Used				Not Used				Not Used			
23		Not Used				Not Used				Not Used			
24		Not Used				Not Used				Not Used			
25		Not Used				Not Used				Not Used			
26	1	70	A	112	A	46	A	99	A	46	A	99	A
27	2	63	A	42	A	82	A	69	A	119	A	100	A
28	3	117	A	86	A	171	A	149	A	219	A	191	A
29		Not Used				Not Used				Not Used			
30	2	449	A	330	A	693	B	643	B	822	C	765	B
31	3	519	A	442	A	740	B	742	B	868	B	865	B
32	1	19	A	16	A	13	A	10	A	17	A	12	A

Table 7.3-11

On-Airport Roadway Peak Hour Operations

		2005				2015				2030			
		AM		PM		AM		PM		AM		PM	
Link ID[1]	Lane	Volume (vph[2])	LOS[3]	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS	Volume (vph)	LOS
33	3	500	A	426	A	727	B	732	B	851	B	853	B
34	4	124	A	107	A	89	A	64	A	90	A	64	A
35	2	427	A	375	A	621	B	642	B	705	B	727	B
36	1	73	A	51	A	106	A	90	A	146	A	125	A
37	1	363	B	306	B	550	C	568	C	625	D	642	D
38	1	64	A	68	A	71	A	74	A	80	A	85	A
39		Not Used				Not Used				Not Used			
40	2	533	B	561	B	670	B	618	B	777	B	724	B
41	1	92	A	96	A	68	A	48	A	65	A	46	A
42	2	441	A	465	A	602	B	570	B	712	B	677	B
43	1	86	A	88	A	96	A	80	A	145	A	122	A
44	3	527	A	553	A	698	A	650	A	857	B	800	B
45	1	32	A	29	A	42	A	35	A	49	A	42	A
46		Not Used				Not Used				Not Used			
47		Not Used				Not Used				Not Used			
48	4	559	A	579	A	740	A	685	A	906	A	842	A
49	2	440	A	454	A	530	B	451	A	662	B	568	B
50	1	62	A	119	A	41	A	89	A	41	A	89	A
51	3	502	A	573	A	571	A	540	A	703	B	657	A
52	2	406	A	466	A	468	A	446	A	550	B	516	B
53	1	96	A	108	A	103	A	95	A	153	A	140	A
54	1	50	A	47	A	55	A	44	A	65	A	54	A
55	1	18	A	18	A	13	A	9	A	16	A	12	A
56	4	110	A	114	A	81	A	57	A	81	A	58	A
57	2	770	B	772	B	1,018	B	1,014	B	1,175	C	1,159	C
58	2	110	A	129	A	119	A	124	A	168	A	172	A

[1] Refer to **Figure 7.3-3** for On-Airport Roadway Link ID Key Map.
[2] vph = vehicles per hour
[3] LOS = level of service

Source HNTB Corporation, 2007.

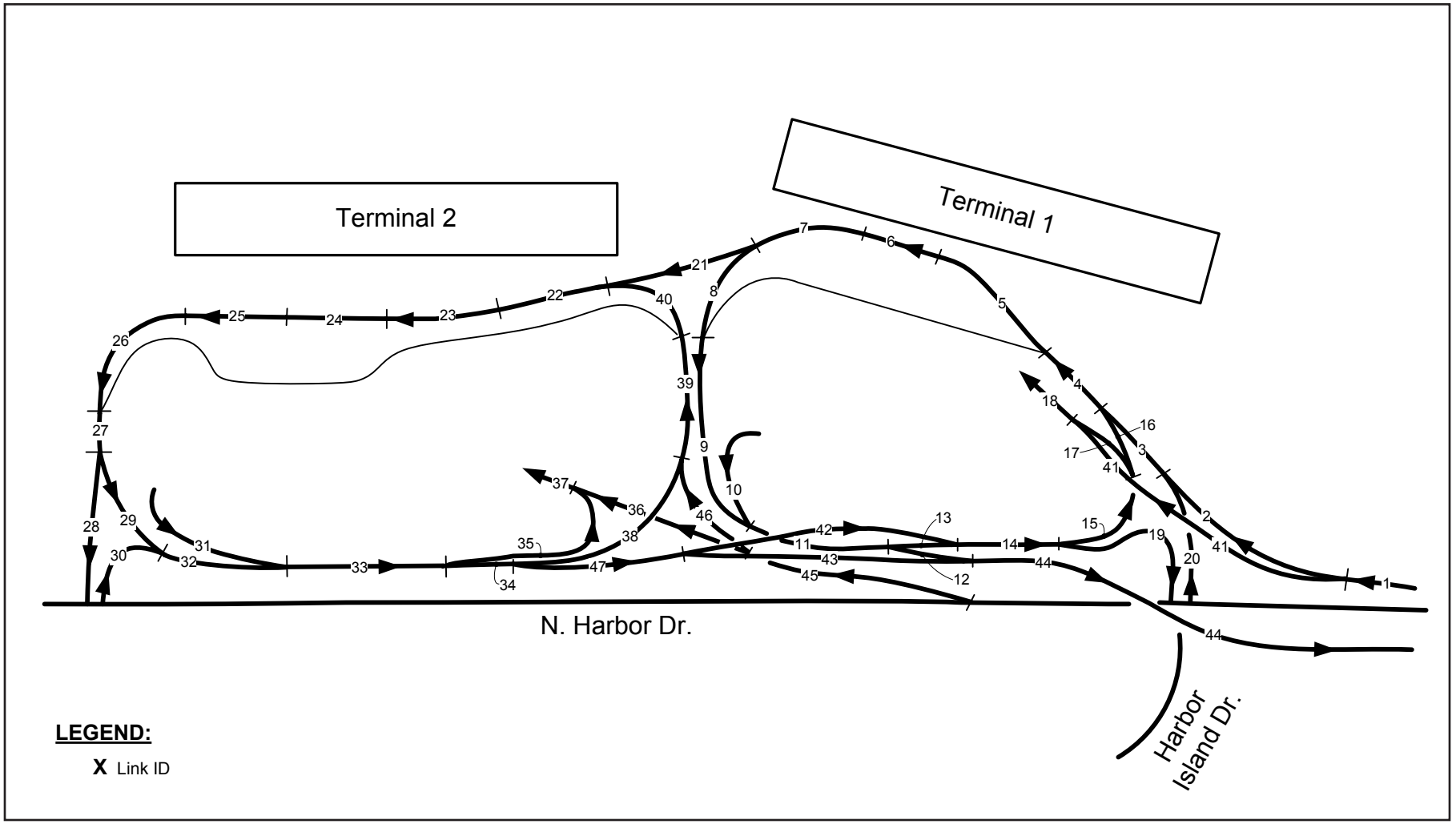

Figure 7.3-3

Not to Scale

On-Airport Roadway Link ID Map