CHAPTER 4: FORECAST FACILITY REQUIREMENTS

4.1 INTRODUCTION

Estimates of the airside, terminal, landside, general aviation, cargo, and support facilities required to accommodate forecast levels of air passengers and aircraft operations as well as non-forecast related needs were calculated. The requirements take into account the TIA Master Plan Update Goals and Objectives.

Planning Activity Levels

Aircraft operations and passengers for the baseline year (2011) and each of the forecast years, 2015, 2020, 2025, and 2030, were documented in ***Chapter 3: Aviation Activity Forecast***. As economic conditions change passenger levels may grow faster or slower than anticipated, and for planning purposes, the forecasts were assigned to planning activity levels (PALs) which represent the level of passengers and operations at four milestones and will act as trigger points for new development. The forecast of passengers and operations associated with the four PALs are summarized in **Table 4-1** and form the basis for the facility requirements analysis.

Table 4-1: Planning Activity Levels

	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Passengers (Air Carrier)					
Enplanements	1,835,350	2,032,875	2,310,385	2,626,320	2,986,075
Million Annual Passengers (MAP)	3.7	4.1	4.6	5.3	6.0
Operations					
Air Carrier	58,665	63,985	71,325	79,500	88,620
General Aviation	74,835	78,955	84,450	90,340	96,675
Military	30,695	30,695	30,695	30,695	30,695
TOTAL	**164,195**	**173,635**	**186,465**	**200,540**	**215,990**

Source: HNTB Analysis
Notes: Annual operations are fiscal year
PAL = Planning activity level

4.2 AIRSIDE FACILITY REQUIREMENTS

4.2.1 Airfield and Airspace Capacity

Airfield capacity refers to the level of aircraft activity, as defined by hourly or annual aircraft operations that can be accommodated by the existing airfield system at an acceptable level of delay.

The FAA specified metric used for estimating annual airfield capacity is the annual service volume (ASV). The annual service volume methodology is described in ***Federal Aviation Administration Advisory Circular 150/5060-5: Airport Capacity and Delay***, published on September 23, 1983.

The ASV for TIA was determined, in part, using the peak hour fleet mix breakdown from the forecast. This fleet mix or operational breakdown is split according to the FAA's aircraft weight classifications:

- **A:** Single engine aircraft weighing 12,500 lbs. or less (e.g. Cessna 172)
- **B:** Twin engine aircraft weighing 12,500 lbs. or less (e.g. Beechcraft King Air)
- **C:** Large aircraft weighing greater than 12,500 lbs. but less than 300,000 lbs. (e.g. Boeing 737)
- **D:** Heavy jet aircraft weighing greater than 300,000 lbs. (e.g. Boeing 747)

TIA's mix index is expressed by the mathematical sum of the percentage of large aircraft operations weighing between 12,500 and 300,000 pounds and three times the percentage of heavy aircraft operations weighing more than 300,000 pounds. **Table 4-2** below presents the breakdown of operations by aircraft classification for the average day of the peak month (ADPM). Based on the fleet mix, the TIA mix index for both Visual Flight Rule and Instrument Flight Rule conditions is 29 (26% + 3x1%).

Table 4-2: ADPM Aircraft Operations

Aircraft Classification		VFR Mix		IFR Mix	
Aircraft Description	**Weight Class**	**Number of Operations**	**Percentage of Operations**	**Number of Operations**	**Percentage of Operations**
Single-engine	A	176	34%	176	34%
Twin prop	B	198	39%	198	39%
Large	C	136	26%	136	26%
Heavy	D	4	1%	4	1%
Total		**514**	**100%**	**514**	**100%**

Source: HNTB Analysis
Notes: Data shown above are reflective of operations on an average day of the peak month in the baseline year 2011.

Operations during any given hour at TIA are approximately balanced between departures and arrivals, and it is assumed for the purposes of the capacity calculation, that the percent of arrivals at the TIA is 50 percent.

This analysis also assumes that there are some touch-and-go operations occurring at TIA. Touch-and-go operations take place when a pilot lands and departs without coming to a full stop. Touch-and-go operations are generally used for instructive purposes to expose a student pilot to multiple take offs and landings in a relatively short amount of time. Officially, a touch-and-go is recorded as two operations by Air Traffic Control. The visual meteorological conditions touch-and-go factor at the TIA is 1.03. It is assumed that touch-and-go procedures would be prohibited during instrument meteorological conditions, and therefore, during IMC conditions, the touch-and-go factor is 1.00.

Another important contributor to runway capacity is the location, number, and adequacy of exit taxiways. The location of exit taxiways directly correlates with runway occupancy time. The higher the runway occupancy time, the lower the runway capacity, as it takes longer for aircraft to clear the runway. TIA's exit taxiways are not located in positions that allow aircraft to efficiently clear the runway, which increases runway occupancy time. Runway exit taxiways should be located approximately 5,000 to 8,000 feet past the arrival threshold for air carrier aircraft. Based on the guidance provided by *Figures 3-14 and 3-57 of AC 150/5060-5* for runway exit factor, the VMC exit factor is 0.93 and the IMC exit factor is 0.90 for both east and west flow operations.

Figure 3-14 of the AC shows that TIA's hourly runway capacity base is approximately 105 aircraft operations during VMC. Applying the 1.03 touch-and-go factor and the 0.93 runway exit factor, the adjusted hourly VMC capacity is 100.68 aircraft operations. *Figure 3-57* of the AC shows that TIA's hourly runway capacity base is approximately 57 operations during IMC. Applying the 1.00 touch-and-go factor and the 0.90 runway exit factor, the adjusted hourly capacity during IMC is 51.3 aircraft operations. These runway capacities are the maximum or ideal runway capacities that can be accomplished under optimal conditions. In practice, the actual runway capacity achieved will be less, and can often be in the range of 80% of the optimum capacity. However, for consistency, the numbers produced by the AC are carried forward.

The weighted runway capacity is a function of the different runway-use configurations used over the course of a year, the percent of time each runway-use configuration is used, the hourly capacity for each runway-use configuration, and the ASV weighting factor. The weighted capacity expression is:

$$c_w = \left(\frac{(p_1 \cdot c_1 \cdot w_1) + (p_2 \cdot c_2 \cdot w_2) + \cdots + (p_n \cdot c_n \cdot w_n)}{(p_1 \cdot w_1) + (p_2 \cdot w_2) + \cdots + (p_n \cdot w_n)}\right)$$

Cw = weighted hourly capacity
p = percent of time each configuration is used
c = hourly capacity of each configuration
w = ASV weighting factor (based on the percent of maximum capacity)

Since the southeast and northwest flow hourly capacities are approximately equivalent, only VMC and IMC operations are applied to the weighted capacity expression. The resultant weighted hourly capacity is 99.9 aircraft.

Annual Service Volume is the mathematical multiplication of the weighted hourly capacity, the ratio of annual demand to average daily demand during the peak month, and the ratio of average daily demand to average peak hour demand during the peak month. The latter two metrics are determined from the TIA forecast. The average daily demand forecast during the peak month is approximately 514 operations per day. The forecast operations total for FY 2010 is 168,593 operations. The ratio of annual demand to average daily demand during the peak month is 330. The ratio of average daily demand to average peak hour demand during the peak month is 10. **The resultant ASV is approximately 330,000 operations (99.9 x 330 x 10)**.

An ASV is highly dependent on current aviation activity and layout of the airfield. The ASV for TIA should be used only as a benchmark for operational characteristics and should be recalculated periodically. It is not intended to be identified as the maximum theoretical capacity of the airfield at TIA or as the trigger point for the development of additional airfield capacity. An FAA approved airfield and airspace simulation model, such as Simmod, may be used to better approximate the capacity of an airport. The total forecast operational demand of 215,988 aircraft operations through 2030 is well within the range of the ASV estimation.

4.2.2 Runway Requirements

Airfield capacity and safety/operational enhancement considerations are used to determine airside facility requirements, which include runway requirements. Runway design is based on the critical aircraft—the most demanding aircraft in terms of approach speed and wing span with 500 or more existing or forecast annual itinerant operations. The critical aircraft at TIA is the Airbus A300-600 flown by FedEx. It is a C-IV aircraft with an approach speed category of 135 knots and a wingspan of 147.1 feet. For runway length, approach categories C and D typically have the same standards. Runway 11L-29R and Runway 3-21 are currently designated as D-IV (established with a blend of approach category D aircraft [Boeing 737-800W] and aircraft design group IV aircraft [Airbus A300, Boeing 757]) and Runway 11R-29L is B-II (e.g. Beechcraft King Air).

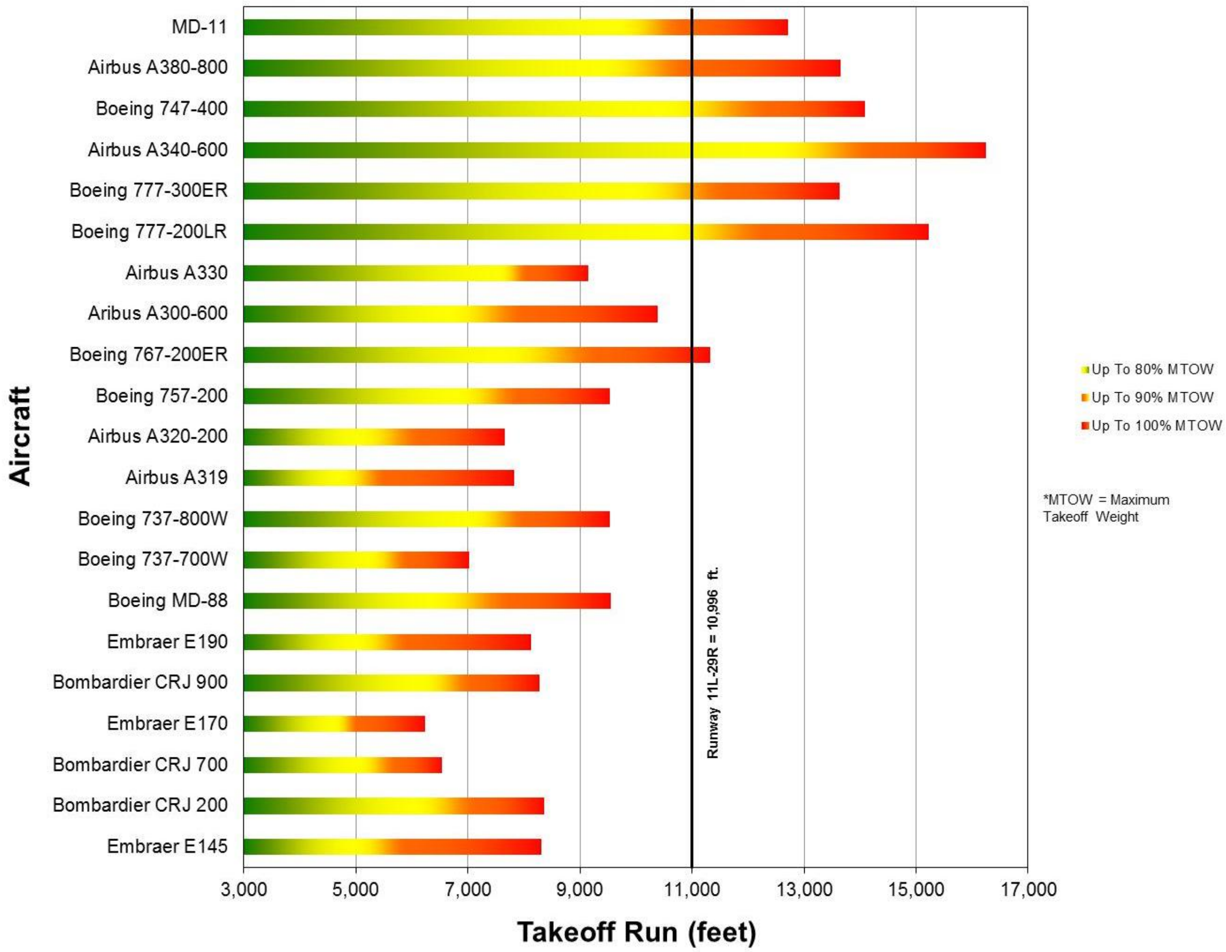
Runway Length

Runway length requirements are dependent upon aircraft type and maximum takeoff weight (e.g. aircraft, passengers, baggage, cargo, fuel) in the airport's fleet mix; runway elevation, grade, conditions and obstructions; air temperature; and wind.

Runway takeoff length requirements also depend on weather conditions and requirements are typically determined for a warm, summer day ("hot day"), which result in longer runway takeoff length requirements than on a typical day. **Figure 4-1** presents the takeoff length requirements at 82 degrees for a variety of aircraft in TIA's current and future fleet mix as well as a sampling of other aircraft that TIA could expect on rare occasions (Airbus A380, Boeing 747, etc). The graphic illustrates the runway takeoff length requirement for the fleet at various percentages of maximum takeoff weight (80%, 90%, and 100%). The runway take off length requirement for an Airbus A300-600, TIA's critical aircraft, is 10,387 feet at maximum take-off weight. The current and forecast fleet can operate at TIA largely without weight penalties except during the warmest months (June through September).

Aircraft landings generally require less runway length. For the Airbus A300-600, the runway landing length required is 5,200 feet. The existing runway lengths are sufficient to accommodate the aircraft fleet mix through 2030 (PAL 4).

Figure 4-1: Runway Take-off Distance Requirements



Source: HNTB Analysis

Runway to Taxiway / Runway Centerline Separation

Federal Aviation Administration Advisory Circular 150/5300-13A (September 2012) provides new standards for runway to taxiway separation for Approach Category D aircraft. Approach Category D aircraft are those that have "an approach speed of 141 knots or more but less than 166 knots." **TIA's airfield facility design standard, known as the Airport Reference Code, identifies Approach Category D aircraft as the approach category design group due to the large number of turbojet commercial and military operations.** The standard runway to taxiway separation for a Category D, Group IV (e.g. "D-IV") airfield is 400 feet. The current Runway 11L-29R separation to Taxiway A is currently 537 feet centerline to centerline. The two parallel runways are currently separated by 706 feet. Given that the TIA airfield operates in VFR conditions approximately 99.72% of the time, the minimum separation without a center taxiway consideration would be 700 feet. The separation requirements are considered in the development of alternatives and documented in Chapter 5.

4.2.3 Airfield Operational and Safety Enhancements

Although runway and airfield requirements are typically driven by capacity, other enhancements may also be required to maintain airfield safety and potentially improve aircraft flow and operations. Typical safety enhancement strategies include:

- Separating airfield and airspace routes for military, commercial, and general aviation aircraft traffic
- Clearly identified airfield signage, lights, pavement markings, and nomenclature
- Maintaining safe runway separation distances
- Eliminating or reducing runway crossings
- Aligning runway thresholds for ease of identifying runways
- Eliminating or reducing complex intersections

An Airfield Safety Enhancement (ASE) study was conducted in 2011, and comprehensively reviewed TIA's airfield geometry. The results of the ASE study included airfield geometry mitigation strategies generally designed to enhance safety and operational efficiency, but more specifically, to promote three clear goals:

- Minimize or eliminate GA aircraft from accessing Runway 11R-29L by crossing Runway 11L-29R
- Minimize the potential for pilots approaching from the south to misidentify the left and right runways
- Enhance awareness of the interaction between Taxiway D and Runways 11R and 11L

With regard to overall airfield design the ASE study recommended a center parallel taxiway be considered to prevent aircraft from crossing directly between the two parallel runways and allow aircraft to exit their arrival runway and cross the adjacent runway close to its end as recommended in *FAA Engineering Brief 75, Incorporation of Runway Incursion Prevention into Taxiway and Apron Design*. The ASE study also recommended that a new parallel air carrier runway be constructed to match the 11,000 foot length of the existing Runway 11L-29R in order to support both landing and take-off operations for the forecast fleet mix, providing true redundancy allowing the Runway 29L and 29R thresholds to be aligned for safety benefits by reducing the potential for wrong runway landings. Specifically, risk mitigation strategies identified that require more significant airfield changes and may address safety in a more comprehensive manner (e.g. focusing on the entire airfield as well as optimized airfield flow and usage) include:

- Adding a center parallel taxiway with staggered taxiways between the runways that would increase separation distances between the runways to create a safety buffer and prevent straight runway crossings
- Extending Runway 11R-29L to the southeast aligned with the Runway 29R end to prevent wrong runway landings
- Shifting the Runway 11L and 11R takeoff and landing thresholds to optimize aircraft flows and minimize congestion through geometry changes in the vicinity of Taxiway D and Runways 11R and 11L

A key operational and safety enhancement that is explored extensively in Chapter 5 is the implementation of a second air-carrier capable parallel runway. A second parallel D-IV capable runway is needed at TIA for several reasons.

Runway 11L-29R regularly accommodates a diverse fleet mix of commercial air-carrier, light general aviation, corporate general aviation, military, and cargo arrivals and departures. As a primary commercial airport within the National Airspace System, TIA's commercial operations can often be impacted with delays as a result of other airport users. The highly variable aircraft approach speeds of the different types of aircraft using TIA increase controller workload and require controllers to provide greater in-trail separation of aircraft.

A second parallel air-carrier runway would nearly double large aircraft capacity, including performance aircraft with large aircraft characteristics (e.g. F-16s) at TIA in VMC conditions by enabling Air Traffic Control to segregate arriving and departing aircraft on different runways. Segregating arriving and departing aircraft also enhances safety by minimizing mixed-mode operations on a single runway.

The runway would also provide Air Traffic Control with greater flexibility in sequencing departures and arrivals throughout the day as well as provide a dedicated touch-and-go runway for TIA users including Bombardier, AANG, general aviation, and Raytheon during less busy times of the day.

Upgrading Runway 11L-29R to a full D-IV runway will also minimize potential pilot confusion for wrong runway landings as the new runway would have its threshold aligned with Runway 11L-29R and have the same width which would clearly differentiate it from a parallel taxiway.

4.3 TERMINAL FACILITY REQUIREMENTS

Terminal requirements are determined to meet a specified level of service (LOS) which is a description of the effectiveness of facilities to accommodate demand. Level of service is indicated by lettered grades ranging from A to F. LOS A indicates an optimally performing terminal facility; for example, in the passenger ticketing lobby, a LOS A would indicate ample room for passengers to maneuver in the queue area, sufficient number of agent positions at the ticketing counters, and overall, ample space to allow for an expedient and efficient passenger ticketing and baggage check-in process even during peak periods. However, given operational realities such as limited building space, fluctuating patterns in how passengers use airports throughout the day and year, and the cost of operating and maintaining terminal facilities, terminal planning efforts typically aim to provide a LOS B or C during peak periods (off-peak time periods will operate at a higher level of service). The International Air Transport Association (IATA) describes a LOS B as a terminal facility that, "in a condition of stable flow, is characterized by very few delays and a high level of comfort".

Terminal requirements are determined by analyzing the capability of terminal facilities in handling existing and future peak passenger demand. Design day schedules were developed based on the TIA Master Plan Update Forecast for each PAL and a summary of the relevant passenger data for each PAL used in developing terminal requirements is shown in **Table 4-3**. Total passengers are comprised of enplaned and deplaned passengers and include originating, terminating and connecting passengers.

Table 4-3: Annual, Daily and Peak Hour Passenger Forecast Summary

Category	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Total Annual Passengers	3,670,705	4,065,750	4,620,770	5,252,640	5,972,150
Annual Enplanements	1,835,350	2,032,875	2,310,385	2,626,320	2,986,075
Annual Originations	1,706,860	1,890,575	2,148,660	2,442,480	2,777,050
ADPM[1] Enplanements	5,595	6,195	7,030	8,010	9,105
ADPM[1] Originations	5,200	5,760	6,540	7,450	8,470
Peak Hour Enplanements	695	830	935	1,125	1,255
Peak Hour Deplanements	640	830	935	1,125	1,255
Peak Hour Originations	645	775	870	1,050	1,170
Peak Hour Terminations	595	775	870	1,050	1,170

Source: HNTB Analysis

Note: [1]ADPM = Average Day Peak Month; Originations and termination (O&D) passenger percentage estimated as 93%; Originating passengers are passengers whose trips originate from the Tucson airport service area. Terminating passengers are passengers whose trips end in the TIA service area. ADPM deplanements assumed to be equivalent to ADPM enplanements; Peak hour passenger data is based on the ADPM passenger data, and is sometimes referred to as the peak hour average day of the peak month (PHADPM).

4.3.1 Gate Requirements

Gate requirements are a function of passenger aircraft operations and average gate utilization. Base year gate requirements are calculated using the March 2011 flight schedule from the OAG and in general assume a twenty-minute buffer between a departing aircraft and the next arriving aircraft at any given gate. The 2011 gate requirements indicate that there is excess gate capacity at this time. Since airlines are not always on schedule, additional spare gate capacity is included to allow for off-schedule flights. This additional spare gate capacity is assumed to be approximately 8 percent of the requirements calculated based on schedule.

Gate requirements in each category (wide-body, narrowbody and regional) are assumed to increase at the same rate as aircraft departures in that category. For the purpose of calculating gate requirements, however, it is assumed that mainline aircraft will be able to use any gate sized to accommodate their type or larger. Therefore, a new narrowbody Boeing 757-200 (B757) class gate requirement is not assumed if there is available wide-body gate capacity. Consistent with industry practice, regional jet gate requirements are calculated separately from mainline aircraft gate requirements. The estimated gate requirements reflect the anticipated additions of new airlines and new service to an air carrier's hub. In general, gate requirements are expected to increase more if new aircraft departures are the result of flights by new airlines to new hubs rather than increased frequencies by existing airlines to existing hubs.

The Boeing 757-200 (B757) aircraft is the only Group IV narrowbody aircraft in service in the United States due to its larger wingspan as compared to other Group III aircraft such as the B737 or Airbus A320 families. Currently seven gates at TIA can accommodate B757 aircraft. Delta Airlines is the only air carrier operating the B757 at TIA, which is operated on a daily seasonal basis, and according to the forecast will continue to be the only airline through the planning horizon. The B757 has been out of production since 2004 and airlines have started retiring older airframes from their fleets. Airlines looking for similar capacity and range utilize Boeing 737-900 or the Airbus A321, both of which are Group III aircraft. As such, the current B757-capable gates will be sufficient to handle the anticipated B757 traffic during the planning period.

As shown in **Table 4-4**, 21 total gates are required by PAL 4. Of these, twelve will be required to accommodate narrowbody aircraft, and seven will be required to accommodate regional aircraft. Two gates are required for off-schedule or special low-frequency airline operations. However, there are several factors that could impact future gate requirements at TIA including:

- Changes in forecast activity
- Change in airline hub-schedules
- Adjustments in the spare gate percentage
- Increased future gate utilization among the carriers
- Changes from preferential use to common use gate lease arrangements
- Use of hardstands
- Introduction of international service from locations without pre-clearance which would require sterile facilities for international arrivals processing limiting which gates can be used

New gates are not anticipated to be needed at TIA within the planning horizon on the condition that gate utilization is increased to four turns per gate per day starting in PAL 1, and five turns starting in PAL 4. Turns per gate are highly dependent on airline schedules, however, five turns per gate is a reasonable goal given TIA's current and forecast flight schedule. It is unlikely that the majority of gates, with the exception of those operated by Southwest Airlines, will see more than five turns per day because of the limited number of evening departures. In the long-term, many factors can influence the need for additional gates, and if passenger enplanements and operations at TIA grow faster than anticipated, new gates may be required at an earlier time.

Table 4-4: Forecast of Gate Requirements

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Average Day Peak Month Operations						
Widebody		0	0	0	0	0
Narrowbody		37	41	45	50	56
Regional		26	27	28	31	32
Total		63	68	73	81	88
Gate Requirements[1]						
Widebody	0	0	0	0	0	0
Narrowbody	18	9	10	11	12	12
Regional	1	7	6	7	7	7
Spares[2]	3	2	2	2	2	2
Total	22	18	18	20	21	21

Source: HNTB Analysis and as noted.
Notes: 1 - Existing requirements based on March 2011 airline schedules. Gate requirements are assumed to increase at same rate as projected aircraft departures with some minor adjustments to reflect the number of airlines and hubs being served.
2 - Estimated at 8% of gate requirements without spares. Existing Spare gates are two positions at the International Terminal and a ground loaded regional gate at Concourse A

4.3.2 Passenger Processor

Ticketing and passenger check-in area requirements are based on the forecast peak hour originating passengers from the forecast gated design day flight schedule. For passenger processing purposes, an arrivals distribution was estimated to account for the variance in time each passenger actually arrive at an airport prior to their scheduled flight departure. Based on data from similar airports, the following passenger arrivals distribution, shown in **Table 4-5**, was applied to the forecast peak hour originating passengers within the gated design day flight schedule.

Table 4-5: Passenger Arrivals Distribution

Passengers Arrival Time Prior to Scheduled Flight Departure (minutes)	Percentage of Passengers
x < 30	1%
30 ≤ x < 60	5%
60 ≤ x < 90	29%
90 ≤ x < 120	37%
x > 120	28%

Source: HNTB Analysis

The ticket counter linear frontage requirements considered the variety of check-in options available, including self-service kiosks with and without bag drop, internet / mobile device with and without bag drop , curbside, and full-service traditional airline counters . Planning factors used to determine linear feet of counter and ticketing position requirements are shown in **Table 4-6**.

Table 4-6: Ticketing and Bag Drop Area Planning Factors

Check-in Process	Linear Feet of Counter Frontage	Passenger Check-in Utilization	Passenger Processing Time (sec)	Passengers Processed per Hour
Internet/Mobile Device Check-In and No Bags	0	12%	0	∞
Airline Kiosk Check-In and No Bags	3	8%	100	36
Internet/Mobile Device Check-In and Bag Drop	3	20%	108	33
Airline Kiosk Check-In and Bag Drop	6	30%	138	26
Full Service Check-In and Bag Drop	7	20%	180	20
Curbside Check-In and Bag Drop	-	10%	120	30

Source: HNTB Analysis

The planning factors in **Table 4-6** were applied to each designated airline space to determine the required linear frontage and number of positions. Linear frontage requirements do not include outside curbside check-in areas. The existing ticket counter area depth is 16 feet which is assumed to be maintained through the planning horizon. The counter check-in requirements are summarized in **Table 4-7**. The existing allocated ticketing counter frontage and area are sufficient to accommodate forecast passenger demand through the planning horizon. By PAL 4, the ticket counter frontage will have a surplus of 167 linear feet and the total counter check-in area will have a surplus of 3,380 square feet of space.

Table 4-7: Passenger Counter Check-in Area Requirements

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Linear Counter Frontage (feet) (excludes curbside check-in areas)	495	194	233	293	310	328
Linear Counter Frontage Surplus (Deficiency) (feet)		*301*	*262*	*202*	*185*	*167*
Airline Kiosk Check-In Positions						
With Bag Drop Areas	12	12	14	18	19	21
Without Bag Drop Areas	7	7	8	10	10	10
Internet / Mobile Device Check-in Positions (with bag drop)	8	8	10	12	12	13
Full Service Check-in (with bag drop)	11	11	13	17	18	19
Subtotal Positions (excludes curbside check-in areas)	**38**	**38**	**45**	**57**	**59**	**63**
Curbside Check-in (with bag drop)	8	8	9	11	11	11
Total Counter Check-in Area (square feet)	8,630	3,105	3,730	4,690	4,960	5,250
Total Counter Check-in Area Surplus (Deficiency) (square feet)		*5,525*	*4,900*	*3,940*	*3,670*	*3,380*

Source: HNTB Analysis

Airline ticket office requirements were determined based on counter check-in requirements, and assumes the same linear feet of ticketing counter space is used for the ATOs. The existing depth of the ATO offices is 30 feet. The required depth will be reduced to 20 feet for calculation of future requirements to account for the underutilization of airline ticketing offices today. Total ticketing queue area requirements were calculated similarly to ATO requirements with an assumed queue depth of 15 feet. ATO and queue area requirements are shown in **Table 4-8**. The existing ATO and queue area are sufficient to accommodate passenger demands through the planning horizon.

Table 4-8: Airline Ticket Office and Ticketing Queue Requirements

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
ATO (square feet)	11,120	5,820	5,840	5,860	6,200	6,560
ATO Surplus (Deficiency) (square feet)		*5,300*	*5,280*	*5,260*	*4,920*	*4,560*
Ticket Counter Queue (square feet)	15,120	2,910	3,495	4,395	4,650	4,920
Ticket Counter Queue Surplus (Deficiency) (square feet)		*12,210*	*11,625*	*10,725*	*10,470*	*10,200*

Source: HNTB Analysis
ATO = Airline ticket office

4.3.3 Outbound Baggage

Once passengers check-in baggage, it is transported on conveyers to five designated baggage screening pods, totaling approximately 7,800 square feet. Each baggage screening area is equipped with two EDS machines used to screen baggage. A standard planning factor of 7.13 square feet per peak hour originating passenger was used to determine baggage screening area requirements summarized in **Table 4-9**. Additional space will be needed prior to PAL 4, unless TIA moves to an in-line screening system. It is anticipated that with some reorganization of existing equipment and potential expansion of one of the screening areas, this deficiency could be addressed. Alternatively, if TIA were to implement common-use passenger check-in and bag drop, the outbound system would require substantially rebuilding and reconfiguration to allow baggage to be transported to the appropriate outbound carousel from any screening module.

Once baggage is screened, it is sorted by airline personnel in the baggage make-up area, which currently totals 12,730 square feet. Baggage make-up area requirements are determined by airline and assumes a 14 square feet per peak hour originating passenger planning factor. Baggage make-up area requirements are summarized in **Table 4-9**. By PAL 1, there will be a deficiency of 1,645 square feet, which will grow to 8,870 square feet by PAL 4.

Table 4-9: Baggage Make-up Area Requirements

	Capacity	**Baseline 2011**	**PAL 1 2015**	**PAL 2 2020**	**PAL 3 2025**	**PAL 4 2030**
Baggage Screening Area (square feet)	7,804	4,350	4,885	5,655	6,680	7,890
Baggage Screening Area Surplus (Deficiency) (square feet)		*3,455*	*2,920*	*2,150*	*1,125*	*(85)*
Baggage Make-up Area (square feet)	12,728	11,630	14,020	17,705	19,390	21,240
Baggage Make-up Area Surplus (Deficiency) (square feet)		*740*	*(1,645)*	*(5,330)*	*(7,020)*	*(8,870)*

Source: HNTB Analysis

4.3.4 Baggage Claim

Baggage claim requirements include the baggage claim devices and circulation areas where passengers wait to retrieve their checked baggage (not including the general passenger circulation and meeter-greeter area). The existing baggage claim area totals 47,094 square feet, with 38,123 square feet used for circulation and the remaining 8,970 square feet occupied by baggage claim devices.

Currently, TIA has six baggage claim devices, with 132-linear-feet of frontage each and one baggage claim device with 194-linear-feet of frontage. The total baggage claim frontage provided is 986 feet. The 2003 Terminal Capacity Analysis Study determined that the baggage claim has sufficient capacity to accommodate passenger activity up to 7 MAP. Since the forecast estimates that TIA will reach approximately 6 MAP by PAL 4, additional baggage claim capacity will not be required through the planning horizon.

4.3.5 Concessions

Concessionaires within the terminal building currently comprise approximately 33,386 square feet including storage. This is comprised of food service and retail concessions space, along with back-of-house, small offices and storage areas.

Of the total concessions space, 22,837 square feet are used for food service and retail concessions that passengers come into contact with. The existing utilization rate for concessions in the baseline 2011 year is 12.44 square feet per 1,000 enplaned passengers (based on 1,835,352 enplaned passengers). Based on the utilization rates at comparable airports, the 12.44 utilization rate was maintained for future planning purposes at TIA. **Table 4-10** provides a summary of the concession requirements.

With regards to the remaining 10,559 square feet of back-of-house, office and storage spaces, which represents approximately 1/3 of the total concessions area, this growth is not solely correlated to passenger enplanements, but also considers factors such as customer exposure, air service characteristics, and flight schedules. Assuming these factors do not change significantly throughout the planning horizon, up to approximately 17,275 square feet are required for the back-of- house, office, and storage areas by PAL 4. This represents a total of approximately 54,615 square feet of total concessions space.

Table 4-10: Concessions Requirements

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Food Service / Retail Area (square feet)	22,827	22,827	25,285	28,735	32,665	37,140
Food Service / Retail Area Surplus (Deficiency) (square feet)			*(2,455)*	*(5,910)*	*(9,840)*	*(14,310)*
Back-of- House, Storage, Office Area (square feet)	10,559	10,559	11,760	13,365	15,190	17,275
Back-of-House, Storage, Office Area Surplus (Deficiency) (square feet)			*(1,200)*	*(2,805)*	*(4,635)*	*(6,715)*
Total Concessions (square feet)	33,386	33,386	37,045	42,100	47,855	54,415
Total Concessions Surplus (Deficiency) (square feet)			*(3,655)*	*(8,715)*	*(14,475)*	*(21,025)*

Source: HNTB Analysis

4.3.6 International Facilities

TIA currently has no scheduled international service, but five international flights are forecast to be added during the planning horizon (only one of these flights is anticipated to require CBP clearance at TIA). As early as 2020, there will be a maximum of three international arriving flights (one requiring CBP clearance at TIA) between 1:00 PM and 1:45 PM. There is adequate capacity to accommodate the international flights through 2030. It is recommended that international gates and processing facilities be retained as common use facilities to maximize the flexibility of the facilities. **Table 4-11** summarizes the number of forecast international flights during the average day of the peak month at TIA.

Table 4-11: International Flights

	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Guadalajara	0	1	1	1	1
Calgary	0	0	1	1	2
Vancouver	0	1	1	1	1
Edmonton	0	0	0	0	1
Total	0	2	3	3	5

Source: HNTB Analysis

Note: Of the origination cities listed above, only Guadalajara does not have U.S. CBP preclearance services.

4.4 LANDSIDE FACILITY REQUIREMENTS

This section presents the landside requirements for the airport roadways, terminal curbside and parking facilities necessary to accommodate the forecast passenger activity levels. Landside requirements are determined based on the peak hour O&D passenger forecast, which excludes connecting and non-revenue passengers. Currently, approximately 93% of all passengers at TIA are O&D.

4.4.1 Airport Access Road

The primary access route to and from TIA is along Tucson Boulevard, a six-lane arterial roadway. Southbound Tucson Boulevard turns into Airport Drive, the terminal access roadway, at Corona Road. The terminal access roadway consists of three lanes with an estimated capacity of 900 vehicles per hour per lane, for a total maximum throughput capacity of 2,700 vehicles per hour.

The ADPM peak hour estimate for the baseline (2011) year is 815 vehicles. The share of O&D passengers and passenger access modes is assumed to remain constant through the planning horizon. **Table 4-12** shows the projected future traffic volumes on the airport terminal access roadway. The associated volume / capacity ratios are also shown in **Table 4-12**. Through the planning horizon, no terminal access roadway improvements are required as the projected volume / capacity ratio does not exceed 0.70, or LOS C.

Table 4-12: Terminal Access Roadway Peak Hour Demand and Capacity

	Baseline 2011	**PAL 1 2015**	**PAL 2 2020**	**PAL 3 2025**	**PAL 4 2030**
Airport Loop Road Peak Hour Traffic Volume Demand	815	1,070	1,535	1,820	1,890
Airport Loop Road Capacity	2,700	2,700	2,700	2,700	2,700
Volume / Capacity Ratio	0.30	0.40	0.57	0.67	0.70
LOS	A	A	B	C	C

Source: HNTB Analysis

4.4.2 Terminal Curbside

Terminal curbside requirements are developed based on peak hour passenger activity levels, peak hour traffic volumes, vehicle dwell times, vehicle classifications, and the degree of double parking at the terminal curbside. **Table 4-13** shows the space allocation and capacity of the existing terminal curbside. The existing terminal curbside configuration is described in Chapter 2.

Table 4-13: Existing Terminal Curbside Allocations

	Existing Allocated Curb Length (feet)	Standard Stall Length (feet)	Approximate Number of Parking Stalls
Upper Level Departure (Drop-off) Curb			
Total	**740**	**25**	**30**
Lower Level Arrivals (Pick-up) Curb			
Inner Curb			
Private Vehicles	690	25	28
Airport Operations / TAA Vehicle	50	25	2
Total	**740**		**30**
Outer Curb – Inner Commercial Vehicle Curb			
Coach	75	25	3
Taxi	200	25	8
Shared Ride Van	125	35	4
Executive / Luxury Sedan	75	25	3
Airport Operations / TAA Vehicle	25	25	1
Total	**500**		**20**
Outer Curb – Outer Commercial Vehicle Curbs[1]			
Coach / Minis / Tour Bus	75	60	1
TIA Economy Parking Shuttle	35	35	1
Off-Airport Parking Lot Shuttle	70	35	2
Hotel and Resort (load and go's only)	70	35	2
Limos / Minis	50	25	2
Airport Operations / TAA Vehicle	25	25	1
Other	175	25	16
Total	**500**		**27**
Other			
City Bus (Located prior to the Terminal Curbside)	n.a.	n.a.	2
Rental Car Shuttle (Located after the Terminal Curbside)	n.a.	n.a.	1

Source: HNTB Analysis, 2007 Ground Transportation Needs Assessment Study (Jacobsen Daniels Associates)
Notes:
1 - The outer commercial vehicle curb includes stalls on both sides of the roadway. On the side furthest away from the terminal building and adjacent to the surface hourly parking lot, there are currently 16 back-in parking stalls that are used by hotel and resort shuttles that require a longer dwell time to meet arriving passengers and other vehicles that have prearranged with TAA staff to park in these spots. The total curb length of these 16 stalls is approximately 175 feet. These 16 spaces have been accounted for in the curbside inventory and listed under the "Other" vehicle category.
n.a. - not available

The demand for terminal curbside, measured in linear feet, is a function of peak hour vehicle demand, dwell times of each vehicle type (e.g. private vehicle, taxi, bus), and standard stall length of each vehicle type. The dwell time assumptions are summarized in **Table 4-14**. In the requirement calculation, adjustments were made to account for the slower growth in multi-party commercial vehicles, which do not grow as fast as single-party, demand driven vehicles. Single-party, demand driven vehicles, such as private vehicles, taxis and limos, are assumed to increase proportionally to the growth in peak hour terminating O&D passengers. For the remaining commercial vehicles, such as hotel and parking shuttles, it is assumed the vehicle occupancy will be increased prior to adding new vehicles. The growth rate for these commercial vehicles was assumed to be at half the O&D passenger growth rate.

A utilization factor of 150% was applied to the upper level departures curb and lower level inner private vehicle arrivals curb to account for a level of service C operation, where up to 50% of the curb may experience double parking during the peak period. The resulting terminal curbside length demand and LOS C requirements are shown in **Table 4-15**. The existing terminal curbside length is sufficient through PAL 4 with the exception of the inner commercial vehicle curb. There is a slight deficiency of 20 linear feet by PAL 3 which will grow to 45 linear feet by PAL 4. It is expected that the deficiency on the inner commercial curb can be accommodated on the outer curb, which has a surplus of 95 linear feet of curb space in PAL 4.

Table 4-14: Vehicle Dwell Times (Minutes)

	Upper Level Departures	**Lower Level Arrivals**
Private Vehicle	1.13	1.70
Taxi	0.90	N/A
Executive / Luxury Sedan	0.90	45.00
Rental Car Shuttle	0.67	n.a.
Hotel and Resort	1.28	5.22
Shared-Ride Van	1.22	5.00
Coach / Tour Bus	1.22	45.00
Limos / Minis	0.90	5.00
TIA Economy Parking Shuttle	0.70	5.00
Off-Airport Parking Lot Shuttle	n.a.	5.00
Other	1.00	n.a.
Airport Operations / TAA Vehicle	n.a.	N/A

Source: HNTB Analysis, 2007 Ground Transportation Needs Assessment Study (Jacobsen Daniels Associates), 2004 TIA Master Plan Update
Notes: n.a. - not available, N/A - not applicable

Table 4-15: Terminal Curbside Length Demand and LOS C Requirements

	2011 Estimated Peak Hour Vehicle Volume	Existing Curb Length (linear feet)	Curb Length Demand (linear feet)					Curb Length LOS C Requirement (linear feet)				
			Baseline (2011)	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030	Baseline (2011)	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Upper Level Departure (Drop-off) Curb												
Vehicle (drop-offs)	408	-	305	355	385	460	510	205	235	255	305	340
Airport Ops. / TAA Vehicle	3	-	50	50	50	50	50	50	50	50	50	50
Total	**411**	**740**	**355**	**405**	**435**	**510**	**560**	**255**	**285**	**305**	**355**	**390**
Surplus (Deficit)			**385**	**335**	**305**	**230**	**180**	**485**	**455**	**435**	**385**	**350**
Lower Level Arrivals (Pick-up) Curb												
Inner Curb												
Private Vehicles	279	690	325	400	425	500	550	225	275	275	325	375
Airport Ops. / TAA Vehicle	2	50	50	50	50	50	50	50	50	50	50	50
Total	**281**	**740**	**375**	**450**	**475**	**550**	**600**	**275**	**325**	**325**	**375**	**425**
Surplus (Deficit)			**365**	**290**	**265**	**190**	**140**	**465**	**415**	**415**	**365**	**315**
Outer Curb – Inner Commercial Vehicle Curb												
Coach	1	75	25	25	25	25	25	25	25	25	25	25
Taxi	21	200	200	200	200	200	200	200	200	200	200	200
Shared Ride Van	10	125	35	35	35	70	70	35	35	35	70	70
Executive / Luxury Sedan	6	75	125	150	175	200	225	125	150	175	200	225
Airport Ops. / TAA Vehicle	3	25	25	25	25	25	25	25	25	25	25	25
Total	**40**	**500**	**410**	**435**	**460**	**520**	**545**	**410**	**435**	**460**	**520**	**545**
Surplus (Deficit)			**90**	**65**	**40**	**(20)**	**(45)**	**90**	**65**	**40**	**(20)**	**(45)**
Outer Curb – Outer Commercial Vehicle Curbs												
Coach / Minis / Tour Bus	1	75	60	60	60	60	60	60	60	60	60	60
TIA Economy Parking Shuttle	9	35	35	35	35	35	35	35	35	35	35	35
Off-Airport Parking Lot Shuttle	19	70	70	70	70	70	70	70	70	70	70	70
Hotel and Resort	8	70	70	70	105	105	105	70	70	105	105	105
Limos / Minis	3	50	50	50	50	50	50	50	50	50	50	50
Airport Ops. / TAA Vehicle	1	25	25	25	25	25	25	25	25	25	25	25
Other	6	175	60	60	60	60	60	60	60	60	60	60
Total	**46**	**500**	**370**	**370**	**405**	**405**	**405**	**370**	**370**	**405**	**405**	**405**
Surplus (Deficit)			**130**	**130**	**95**	**95**	**95**	**130**	**130**	**95**	**95**	**95**

Source: HNTB Analysis

Note: Numbers may not add to totals due to rounding

4.4.3 Airport Parking

Airport parking requirements include the number of stalls and acreage required to meet parking demand for the 2011 baseline year and each PAL. Requirements for the TIA public parking areas were determined for the average day during the peak month of usage for each facility. The analysis assumes rates will remain constant and the allocation of demand among parking facilities will remain constant.

Historical parking transaction data was first assessed to determine the peak month for each public parking facility. The historical peak month for overall passenger activity is March. From an analysis of the historical parking transaction data, it was observed that the peak months for parking activity did not always align with the peak month for passenger activity. This is likely due to the times of the year that various passenger groups tend to travel (e.g. more cost conscious leisure passengers in March when families are traveling for spring break, resulting in fewer parked vehicles and increased business traveler in October resulting in more parked vehicles). The climate also plays a factor during hotter times of the year, such as in August, when passengers are more likely to park in covered parking areas. The peak month for each public parking facility is shown in **Table 4-16**.

Table 4-16: Historical Peak Month Parking Transactions by Facility

Parking Facility	Peak Month	Average Monthly Transactions[1]
Public Parking – Close-in		
Hourly / Short-Term (uncovered)	December	45,740
Daily / Long-Term (uncovered)	October	7,805
Garage – 2nd Floor (covered)	August	3,070
Public Parking – Remote		
Economy (uncovered)	October	7,410
Economy (covered)	August	1,490

Source: Tucson Airport Authority and HNTB Analysis;

Note: 1-The peak usage month was determined from an assessment of historical transaction data from October 2008 to February 2011. The transactions shown represent an average number of transactions for the peak usage month between 2008 and 2011.

Future requirements were determined based on maximum occupancy for each facility during the average day of the peak month and the growth in originating passengers. A search factor was also applied to ensure sufficient space availability. The resulting requirements are shown in **Table 4-17**.

For close-in parking facilities, a deficiency exists in the long-term parking lot (65 stalls) and garage (40 stalls) by PAL 3. This deficiency grows to 200 and 135 stalls, respectively, by PAL 4. Additional close-in parking facilities will be needed as early as PAL 3 to accommodate parking deficiencies. Economy parking facilities show deficiencies of 15 stalls in the covered portion of the lot as early as PAL 1, and increases to 215 stalls by PAL 4. To offset the covered economy parking deficiencies, portions of the uncovered economy lot can be converted to covered parking. Additional stalls would also be required to accommodate growing passenger demand in the cell phone lot as early as PAL 1 growing to 30 stalls by PAL 4.

Table 4-17: Public Parking Stall Requirements

	Capacity	Existing ADPM Maximum Occupancy[1]	2010	Parking Stalls Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Stall Requirement								
Hourly / Short-Term (uncovered)	422	42%	195	200	225	255	290	330
Daily / Long-Term (uncovered)	917	66%	665	685	760	865	985	1,120
Garage – 2nd Floor (covered)	631	65%	455	470	520	590	670	765
Close-in Parking Subtotal	**1,970**			**1,360**	**1,505**	**1,710**	**1,945**	**2,210**
Economy (uncovered)	5,500	21%	1,250	1,295	1,435	1,630	1,855	2,105
Economy (covered)	303	92%	310	320	350	400	455	520
Remote Parking Subtotal	**5,803**			**1,615**	**1,785**	**2,030**	**2,310**	**2,625**
Meeter-Greeter / Cell Phone	28	-	-	30	35	40	50	55
Stall Surplus (Deficiency)								
Hourly / Short-Term (uncovered)	*422*			*220*	*200*	*170*	*135*	*95*
Daily / Long-Term (uncovered)	*917*			*230*	*155*	*55*	*(65)*	*(200)*
Garage – 2nd Floor (covered)	*631*			*160*	*110*	*40*	*(40)*	*(135)*
Close-In Parking Subtotal	***1,970***			***610***	***465***	***260***	***25***	***(240)***
Economy (uncovered)	*5500*			*4,205*	*4,065*	*3,870*	*3,645*	*3,395*
Economy (covered)	*303*			*(15)*	*(50)*	*(95)*	*(155)*	*(215)*
Remote Parking Subtotal	***5,803***			***4,190***	***4,015***	***3,775***	***3,495***	***3,180***
Meeter-Greeter / Cell Phone	*28*			*0*	*(10)*	*(15)*	*(20)*	*(30)*

Source: HNTB Analysis

Notes: 1 - ADPM is the average day of the peak month for the specific parking facility. The percentage reflected is based on the maximum occupancy percentage on an average day of the peak month for each parking facility in 2010.

Numbers may not add to total due to rounding.

4.4.4 Rental Car Facilities

Currently, each rental car company in the TIA ConRAC has a car wash and fueling station but several companies have approached TAA about additional facilities. The QTA area can be expanded to the north, and as needs warrant, an off-site storage area could be constructed allowing more space adjacent to the garage for QTA. As ready-return needs grow the 2nd and 3rd floors of the garage could also be converted to ready-return spaces. This would require a relocation of employee and public parking.

4.5 GENERAL AVIATION FACILITY REQUIREMENTS

Total GA operations at TIA decreased between 2006 and 2011 by approximately 53%, from 160,000 to 75,000 operations respectively. The decline was greatest between 2008 and 2009 with a decrease of 27%. Much of this decrease has been in the leisure general aviation market due in large part to the 2008 economic downturn. However, looking forward GA operations are forecast to grow from 5% to 7% annually to approximately 96,700 operations by PAL 4, particularly in the corporate market.

TIA has a total of 230 based GA aircraft. The number of based aircraft is expected to grow at the same rate as general aviation operations ranging from 5% to 7% annually. A summary of the GA operations and based aircraft forecast is presented in **Table 4-18**.

Table 4-18: General Aviation Forecast

	2011	**PAL 1 2015**	**PAL 2 2020**	**PAL 3 2025**	**PAL 4 2030**
Annual GA Operations	74,833	78,954	84,447	90,342	96,675
Based Aircraft					
Single Engine	167	176	188	202	216
Multi Engine	31	33	35	37	40
Jet	11	12	12	13	14
Helicopter	21	22	24	25	27
Total Based Aircraft	**230**	**243**	**260**	**278**	**297**

Source: HNTB Analysis

Baseline and future requirements were determined for covered aircraft storage areas comprised of conventional hangars, T-Hangars, and shade hangars.

Covered Aircraft Building / Maintenance Requirements

To estimate requirements for each type of hangar, the general aviation aircraft owner storage preferences provided in the ***1998 TIA General Aviation Strategic Plan*** and stated in the ***2004 Master Plan Update*** were reviewed. However, the owner preferences stated in the strategic plan have changed since the economic downturn. Updated estimated storage preferences by aircraft for each type of storage were developed with TAA staff input based on current T-hangar occupancy rates of approximately 57% and are presented in **Table 4-19**.

Table 4-19: Percent of Covered Storage by Aircraft Type

	Recommended Master Plan Covered Storage Percentage		
	Conventional Hangars	**T-Hangar Positions**	**Shade Hangars**
Single Engine	57%	25%	18%
Multi Engine	65%	25%	10%
Jet	75%	25%	0%
Helicopter	75%	25%	0%

Source: Tucson Airport Authority

As summarized on **Table 4-20**, 257,100 square feet of conventional hangar, 11,500 square feet of T-hangar and 31,900 square feet of shade hangar space are provided today. The conventional hangar space is assumed to be broken out with approximately 80,800 square feet dedicated to aircraft storage, 128,500 square feet to general storage, and 47,700 square feet to maintenance / shop.

Estimates of future conventional hangar space assumed the total required storage area would be cross utilized for aircraft and general storage and required maintenance / shop space equals either 25% of the conventional hangar storage area (20% of the total building footprint) or 175 square feet per total based aircraft, whichever is greater.

The following storage ratios for each type of aircraft were used to determine the future requirements for hangar space.

- Conventional hangars
  - Single Engine Aircraft 1,250 square feet
  - Multi-Engine Aircraft 2,500 square feet
  - Corporate Jet 2,500 square feet
- Helicopter 1,250 square feet
- T-hangar 1,250 square feet
- Shade hangar 1,000 square feet

Table 4-20: Covered Aircraft Hangar Requirements (square feet)

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Requirements						
Conventional Hangars						
Aircraft Storage	80,800	95,900	101,200	108,200	115,800	123,900
General Storage	128,500	95,900	101,200	108,200	115,800	123,900
Sub-total conventional storage	**209,300**	**191,800**	**202,400**	**216,500**	**231,600**	**247,800**
Maintenance / Shop	47,700	47,955	50,600	54,120	57,895	61,955
Conventional Hangar Total	**257,100**	**239,755**	**253,000**	**270,520**	**289,495**	**309,755**
T-Hangars	111,500	64,000	67,600	72,300	77,300	82,700
Shade Hangars	31,900	28,700	30,200	32,300	34,600	37,000
Total Area (square feet)	**400,500**	**332,455**	**350,800**	**375,120**	**401,395**	**429,455**
Total Area (acres)	**9.19**	**7.63**	**8.05**	**8.61**	**9.21**	**9.86**
Surplus (Deficiency)						
Conventional Hangars						
Aircraft Storage		*(15,100)*	*(20,400)*	*(27,400)*	*(35,000)*	*(43,100)*
General Storage		*32,600*	*27,300*	*20,300*	*12,700*	*4,600*
Sub-total conventional storage		***17,500***	***6,900***	***(7,100)***	***(22,300)***	***(38,500)***
Maintenance / Shop		*(255)*	*(2,900)*	*(6,420)*	*(10,195)*	*(14,255)*
Conventional Hangar Total		***17,345***	***4,100***	***(13,420)***	***(32,395)***	***(52,655)***
T-Hangars		*47,500*	*43,900*	*39,200*	*34,200*	*28,800*
Shade Hangars		*3,200*	*1,700*	*(400)*	*(2,700)*	*(5,100)*
Total Area (square feet)		***68,045***	***49,700***	***25,380***	***(895)***	***(28,955)***
Total Area (acres)		***1.56***	***1.14***	***0.58***	***(0.02)***	***(0.66)***

Source: HNTB Analysis

4.6 CARGO FACILITY REQUIREMENTS

Facility requirements for integrated and belly cargo were determined for buildings, aircraft ramp, and landside areas. The future forecast assumes cargo activity will remain constant throughout the planning horizon.

Currently, the building area dedicated to processing and warehouse of cargo totals approximately 31,000 square feet. Based on an estimated 33,250 short tons of cargo processed (95% of all cargo), the existing utilization rate is 0.93 square feet per ton. This building utilization rate is low compared to other airports which typically have an average of 1.50 to 1.75 building square feet per cargo ton. A building utilization rate of 1.0 square feet per ton typically results in a well utilized building. Since there is no anticipated increase in demand, the building capacity through PAL 4 is sufficient.

Per the aviation forecast the volume of belly cargo is anticipated to remain constant throughout the planning horizon. Belly cargo tonnage processed in 2011 was 1,600 tons, resulting in a building utilization rate of 19.33 square feet per ton, which indicates a large surplus in capacity compared to the target utilization factor of 1.0 building square foot per ton.

Ramp and landside areas for integrated and belly cargo are shared and therefore discussed together. The required cargo ramp area is dependent upon aircraft size, tenant requirements, and the number of aircraft that are expected to be on the ground at one time during an average day of the peak month. At TIA, generally no more than four aircraft are parked on the cargo ramp at the same time. Although current cargo ramp parking positions are sized for ADG III aircraft (e.g. Boeing 737), ADG IV aircraft (e.g. Airbus A300 or Boeing 757) can be accommodated if alternating parking positions are utilized. The ramp can accommodate 10 ADG IV aircraft or 18 ADG III aircraft and is sufficient through PAL 4. Landside areas for integrated and belly cargo total 5 acres or 217,800 square feet. Landside areas are anticipated to accommodate landside integrated cargo demand through PAL 4. A summary of the cargo requirements is shown in **Table 4-21**.

Table 4-21: Cargo Facility Requirements

	Capacity	Baseline 2011	PAL 1 2015	PAL 2 2020	PAL 3 2025	PAL 4 2030
Integrated Cargo Building (square feet)	31,000	31,000	31,000	31,000	31,000	31,000
Belly Cargo Building (square feet)	49,400	49,400	49,400	49,400	49,400	49,400
Cargo Ramp (acres)	23	23	23	23	23	23
Cargo Landside (acres)	5	5	5	5	5	5
Total (acres)	30	30	30	30	30	30

Source: HNTB Analysis

4.7 SUPPORT / MILITARY FACILITY REQUIREMENTS

4.7.1 Airport Traffic Control Tower

Construction of a new ATCT is planned south of the existing parallel runway system. The new 225 foot ATCT will be oriented so air traffic controllers will be able to look north and not directly into the sun.

4.7.2 Aircraft Rescue and Fire Fighting

Determination of the appropriate amount of ARFF equipment for an airport is based on the airport ARFF Index. The five ARFF indices and associated requirements are presented in **Table 4-22**.

Table 4-22: ARFF Index Classifications

Airport Index	Required No. of Vehicles	Aircraft Length (feet)	Schedule Daily Departures	Agent Plus Water for Foam
A	1	< 90 ≥ 90, < 126	> 1 < 5	500# Sodium-based DC or Halon 1211 or Clean Agent; or 450# Potassium-based DC plus water to produce 100 gal of AFFF.
B	1 or 2	≥ 90, < 126 ≥ 126, < 159	≥ 5 < 5	Index A plus 1,500 gal Water
C	2 or 3	≥ 126, < 159 ≥ 159, < 200	≥ 5 < 5	Index A plus 3,000 gal Water
D	3	≥ 159, < 200 ≥ 200	≥ 5 < 5	Index A plus 4,000 gal Water
E	3	≥ 200	≥ 5	Index A Plus 6,000 gal Water

Source: 14 CFR Part 139
Notes: DC = Dry Chemical; AFFF = Aqueous Film Forming Foam

TIA has an Index D level ARFF facility located southeast of the air cargo area. The ARFF facility has three vehicles. Two vehicles have a capacity of 3,000 gallons and one vehicle has a capacity of 1,500 gallons. This number of vehicles is adequate for TIA. The apron for the ARFF facility is located adjacent to the intersection of Taxiway A and Taxiway A13 and, based on its location to the airfield and the mid-point, provides adequate response times.

4.7.3 Fueling Facilities

The Jet A fuel storage demand and requirement is shown in **Table 4-23**. The 110LL AVGAS fuel storage demand and requirement is shown in **Table 4-24**. The existing fuel farm has adequate capacity until PAL 3 when departure aircraft operations reach 85 operations per day. The analysis assumes the utilization will remain constant throughout the planning horizon.

Table 4-23: Jet A Fuel Storage Demand and Requirements

	2011	**PAL 1 2015**	**PAL 2 2020**	**PAL 3 2025**	**PAL 4 2030**
Storage Capacity (gallons)	240,000	240,000	240,000	240,000	240,000
Fuel utilization (gallons / ADPM departure operation)[1]	1,050	1,050	1,050	1,050	1,050
Estimated ADPM Departure Commercial Aircraft Operations	63	68	75	81	88
Jet A Fuel Demand (gallons)	66,150	71,400	78,750	85,050	92,400
Jet A Fuel 3-Day Requirement (gallons)	198,450	214,200	236,250	255,150	277,200
Jet A Fuel Surplus (Deficiency) (gallons)	*41,550*	*25,800*	*3,750*	*(15,150)*	*(37,200)*

Source: HNTB Analysis
Notes: 1 - The fuel utilization is based on 2002 Jet A fuel utilization during the peak month of March, determined based on the estimated ADPM fuel usage of 110,704 gallons per approximately 105 departing aircraft operations..

Table 4-24: 110 Low Level AVGAS Fuel Storage Demand and Requirements

	2011	**PAL 1 2015**	**PAL 2 2020**	**PAL 3 2025**	**PAL 4 2030**
Storage Capacity (gallons)	40,000	40,000	40,000	40,000	40,000
Fuel utilization (gallons / ADPM departure operation)[1]	50	50	50	50	50
Estimated ADPM Departure General Aviation Aircraft Operations[2]	55	59	65	70	76
110LL AVGAS Fuel Demand (gallons)	2,730	2,950	3,250	3,510	3,810
110LL AVGAS Fuel 3-Day Requirement (gallons)	8,190	8,850	9,750	10,530	11,430
110LL AVGAS Fuel Surplus (Deficiency) (gallons)	31,810	31,150	30,250	29,470	28,570

Source: HNTB Analysis
Notes: 1 - The fuel utilization is based on 2002 110 AVGAS fuel utilization during the peak month of March, determined based on the estimated ADPM fuel usage of 21,369 gallons per approximately 427 departing GA aircraft operations.
2 - General Aviation aircraft operations comprise approximately 87% of commercial operations.