

CHAPTER 5: ALTERNATIVES ANALYSIS

5.1 INTRODUCTION

Chapter 5 describes the development alternatives for each functional area studied.

5.2 AIRFIELD

Chapter 5 introduces several alternative airfield development scenarios that respond to the airfield safety, operational efficiency, and capacity goals described in Chapter 4. A narrative description of each airfield alternative is provided below and specifies the major enhancements and key operational and safety implications.

Within the alternatives development process, the criteria listed below will be considered within the evaluation of the alternatives compared to a no-build baseline.

- Effectiveness in eliminating, reducing, or mitigating safety risk
- Enhances capacity (or at least does not produce a negative impact)
- Provides operational efficiency / addresses operational issues (e.g. congestion)
- Conforms with design standards
- Considers impacts to navigational aids
- Creates potential for on-airport land development
- Accounts for off-airport land development
- Provides benefits that outweigh the costs
- Provides for redundancy during runway closure for maintenance or emergencies
- Is flexible to accommodate changes in fleet mix and design group or other operational changes

5.2.1 Airfield Alternative 1

Alternative 1 (**Figure 5-1**) does not include any physical safety or operational enhancements to TIA's airfield. The No Build alternative does not address the near-term implementable operational and safety enhancing goals. This alternative also does not address the need for a second parallel air-carrier capable runway. This alternative will be used as a baseline to compare with the build alternatives.

5.2.2 Airfield Alternative 2A

Alternative 2A (**Figure 5-2**) depicts operational and safety enhancing strategies. These strategies will largely minimize or eliminate GA operations from accessing Runway 11R-29L by crossing Runway 11L-29R, minimize or eliminate pilot confusion, and minimize direct access to existing air-carrier Runway 11L-29R. Alternative 2A and all subsequent alternatives include the following projects:

- Relocate the run-up ramp entrance to prevent aircraft leaving the run-up area with direct runway access,
- Round out the south end of Taxiway A to further distinguish it as a taxiway
- Demolish connector Taxiways A7 and A9 to prevent aircraft from directly entering Runway 11L-29R from the Terminal apron

- Demolish connector Taxiways A5 and A6 between the parallel runways to prevent arriving General Aviation aircraft with a direct routing across Runway 11L-29R,
- Construct a new connector taxiway north of Taxiway A17 to improve aircraft sequencing and queuing
- Construct a new connector taxiway south of Taxiway A4 to improve aircraft sequencing and queuing
- Demolish most of the Runway 3-21 connector taxiways in the vicinity of Runway 11L-29R and Runway 11R-29L to eliminate direct access to the parallel runways from the west ramp
- Reconstruct taxiway D2 as a perpendicular taxiway intersection across Runway 3-21
- Extend Taxiway D3 to the west across Runway 3-21 to intersect with the West Ramp

Alternative 2A depicts existing Runway 11R-29L and does not propose the addition of a second parallel air-carrier capable runway. The needed operational, safety, and capacity enhancements gained by a second air-carrier capable runway are not addressed by this alternative.

5.2.3 Airfield Alternative 2B

Similarly to Alternative 2A, Alternative 2B (**Figure 5-3**) proposes many of the same near-term implementable operational and safety enhancing strategies, but also reconstructs Runway 11R-29L into an ADG-IV capable Runway. In this configuration, the expanded Runway 11R-29L would be extended to the south to align its threshold with Runway 11L-29R and both runways would be extended north to intersect with Taxiway D. The expanded runway measures 11,330 feet long by 150 feet wide and has a runway centerline to runway centerline separation with Runway 11L-29R of 706.5 feet. This separation still provides for mostly independent operations on the parallel runways in VMC. In addition to widening the runway, new 40 foot wide stabilized runway shoulders would be constructed to meet D-IV standards. Runway 11R-29L would require full-depth pavement reconstruction to meet bearing strength requirements for D-IV aircraft (likely resulting in a thicker pavement section). Many of the taxiway connectors between the two parallel runways would be reconstructed to accommodate significantly larger aircraft than they are currently capable of. This alternative does not propose a center taxiway between the parallel runways, which would further enhance safety and operational efficiency at TIA. A minimum of 800 feet of centerline to centerline separation between the parallel runways would be required for a centerfield taxiway.

Review of Operational and Safety Enhancements

- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- Does not allow sufficient runway separation for a center parallel taxiway between the two runways. This taxiway would enhance safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly
- Improves safety by relocating both runways' thresholds to Taxiway D allowing positive identification of a runway by seeing the runway holdlines and wig-wags
- Taxiway connectors between the two runways are perpendicular to the runway to make pilots slow down as much as possible prior to turning off of a runway

5.2.4 Airfield Alternative 2C

Alternative 2C (Figure 5-4) proposes that the Runway 11L and Runway 11R arrival thresholds are displaced by approximately 1,378 feet. The runways thresholds are displaced to allow for B-II aircraft to taxi unrestricted on Taxiway D. The overall length of both runways would be 10,807 feet, which provides slightly less length than Runway 11L-29R currently provides today; however, the reduced length would not significantly impact aircraft operations at TIA. The displaced threshold on the north side of the runways reduces the Runways 11L and 11R landing distance available (LDA) to 9,618 feet from 10,996 feet. The LDA provided in this alternative is still sufficient to accommodate TIA's existing and forecast fleet mix. The north ends of the parallel runways align with a narrower Taxiway A4 in order to provide additional separation between Taxiways A4 and D. Runway 11R-29L would require reconstruction to meet bearing strength requirements for D-IV aircraft (likely resulting in a thicker pavement section). Many of the taxiway connectors between the two parallel runways would be reconstructed to accommodate significantly larger aircraft than they currently do. This alternative does not propose a center taxiway between the parallel runways, which would further enhance safety and operational efficiency at TIA. Additionally, the Runway 11L MALSR would require replacement and/or reconfiguration because of the arrival threshold shift. The shift also requires the relocation of the Runway 11L glide slope antenna and PAPI.

Review of Operational and Safety Enhancements

- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- Does not allow sufficient runway separation for a center parallel taxiway between the two runways. This taxiway would enhance safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly
- The displacement of the runways enables Taxiway D to function as an end around taxiway for B-II aircraft minimizing runway crossings by GA aircraft

5.2.5 Airfield Alternative 3A

Alternative 3A (Figure 5-5) proposes a more substantial reconstruction of the airfield by not only upgrading Runway 11R-29L to a D-IV capable-runway, but also by shifting the runway to have a runway centerline to runway centerline separation with Runway 11L-29R of 800 feet. The 800 foot separation allows for the construction of a center parallel taxiway for aircraft to queue prior to crossing the second parallel runway. The center taxiway minimizes the potential for pilots to cross an active runway by forcing them to first turn onto the taxiway and wait for ATCT clearance to cross the other runway. To allow for the placement of the Runway 11L glideslope on the northwest end and to visually distinguish it as a center taxiway as opposed to a runway, the center parallel taxiway does not extend the full length of the parallel runways. The addition of a parallel taxiway 400 feet southwest of Runway 11R-29L is proposed to provide additional access to Runway 11R-29L. Both parallel runways provide 10,996 feet of runway departure and arrival length and would have their north thresholds aligned at existing Taxiway A4.

Review of Operational and Safety Enhancements

- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- The proposed 800 feet separation between the parallel runways allows for the construction of a center parallel taxiway which enhances safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly
- Provides more efficient and safer access to Runway 11R-29L and facilities on the south side of the airport via the new outboard parallel taxiway
- No impacts to existing departure or arrival runway lengths

5.2.6 Airfield Alternative 3B

Alternative 3B (Figure 5-6) blends the recommendations of Alternatives 2C and 3A. Similarly to Alternative 3A, Alternative 3B proposes the reconstruction of Runway 11R-29L as a D-IV capable runway with an 800 foot runway centerline to runway centerline separation with Runway 11L-29R. The 800 foot separation allows for the construction of a center parallel taxiway between the two runways to allow aircraft to queue prior to crossing the second parallel runway. The center taxiway minimizes the potential for pilots to cross an active runway by forcing them to first turn onto the taxiway and wait for ATCT clearance to cross the other runway. The center parallel taxiway does not extend the full length of the parallel runways to allow for the placement of the Runway 11L glideslope on the northwest end and to visually distinguish it as a center taxiway as opposed to a runway. The arrival thresholds on the northwest end of the parallel runways would be displaced by approximately 900 feet to allow for B-II aircraft to taxi unrestricted on Taxiway D. The overall length of both runways remains 10,996 feet, however, only 10,096 feet of arrival runway length is provided in this alternative. Also proposed in this alternative is the addition of a parallel taxiway 400 feet southwest of Runway 11R-29L. This parallel taxiway provides additional access to Runway 11R-29L. This alternative also proposes to add a bypass taxiway west of the Runway 11L and 11R RPZs to allow for the unrestricted taxiing of aircraft (regardless of size) to access Runway 11R. Additionally, the Runway 11L MALSR would require replacement and/or reconfiguration

because of the arrival threshold shift. The arrival threshold shift results in an increase in average taxi time for aircraft arriving southeast flow.

Review of Operational and Safety Enhancements

- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- The proposed 800 foot separation between the parallel runways allows for the construction of a center parallel taxiway which enhances safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly
- Provides more efficient and safer access to Runway 11R-29L and facilities on the south side of the airport via the new outboard parallel taxiway
- The displacement of the runways enables Taxiway D to function as an end around taxiway for B-II aircraft. This minimizes runway crossings by GA aircraft
- The reduced arrival runway length would accommodate the existing and forecast fleet mix
- Increases the average taxi time for aircraft arriving in southeast flow
- The bypass taxiway allows all aircraft to independently cross the airfield and provides better segregation of military operations

5.2.7 Airfield Alternative 4

Alternative 4 (Figure 5-7) incorporates most of the recommendations from Alternative 3A including reconstructing Runway 11R-29L into a full D-IV capable runway with an 800 foot runway centerline to runway centerline separation with Runway 11L-29R. The main difference between this alternative and Alternative 3A is that the northwest thresholds of both parallels would be aligned with Taxiway D. By aligning the thresholds with Taxiway D, both runways will have a runway departure and arrival length of 11,330 feet. The downside to the alignment is that aircraft that desire to taxi across the length of Taxiway D will encounter two runway crossings. The south parallel taxiway in this Alternative proposes a smaller initial build-out mainly to service the Bombardier facility. This alternative also requires minor relocation of the MALSR and glide slope for Runway 11L because the arrival threshold will be shifted.

Review of Operational and Safety Enhancements

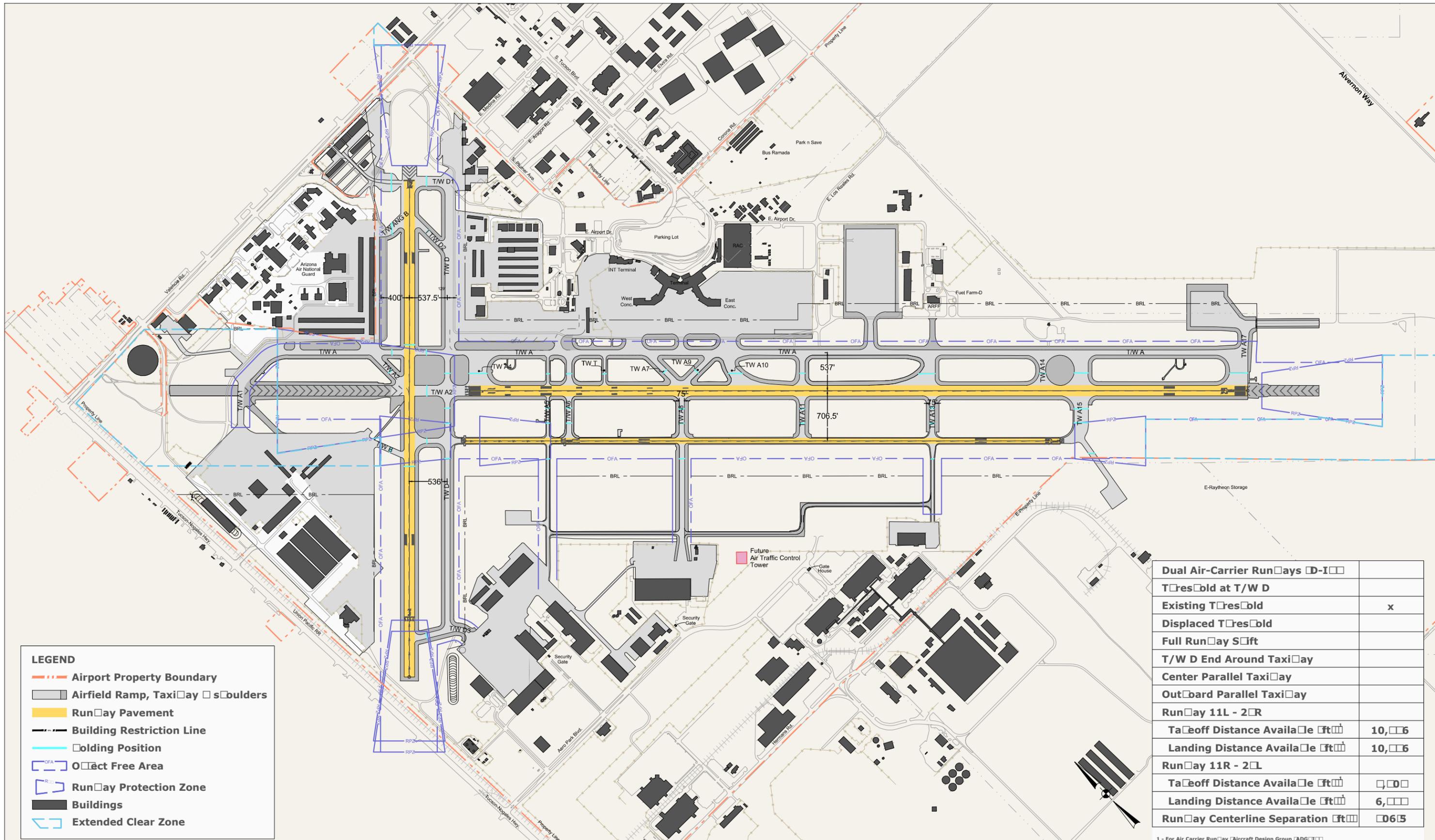
- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- The proposed 800 foot separation between the parallel runways allows for the construction of a center parallel taxiway which enhances safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly Provides more efficient and safer access to Runway 11R-29L and facilities on the south side of the airport via the new parallel taxiway
- Provides enhanced awareness of the runway environ for pilots transiting Taxiway D

5.2.8 Airfield Alternative 5

Alternative 5 (Figure 5-8) proposes the most substantial reconfiguration of TIA's airfield. In addition to upgrading Runway 11R-29L to a D-IV capable runway, both runways would be shifted to the southeast by approximately 2,700 feet to allow Taxiway D to function as an unrestricted end around taxiway. The southeast end of the parallel runways would be shifted by 2,700 feet to maintain 10,996 feet of runway length. Aircraft traversing Taxiway D would not need to hold short of arriving or departing aircraft on the parallel runways. The reconstructed runways would be separated by 800 feet to allow for the construction of a center parallel taxiway. Alternative 5 also proposes the construction of two partial length parallel taxiways south of Runway 11R-29L. The first partial length parallel taxiway would be located 400 feet south of that runway's centerline and provides access to facilities on the south side of the airport for aircraft arriving on Runway 11R-29L. The second partial length parallel taxiway would be located approximately 1,200 feet south of Runway 11R-29L and would serve the south ramp. Average taxi distances would be substantially increased for both arrivals and departures as a result of the shifting of both runways.

Review of Operational and Safety Enhancements

- Doubles large aircraft capacity at TIA
- Provides a dedicated arrival and departure runway or a dedicated/preferred military aircraft runway during periods of peak military activity
- The proposed 800 foot separation between the parallel runways allows for the construction of a center parallel taxiway which enhances safety and operational efficiency by acting as a buffer between the two runways and allowing aircraft to clear the runway quickly
- Provides more efficient and safer access to Runway 11R-29L and facilities on the south side of the airport via the new parallel taxiway
- The shifting of the runways enables Taxiway D to function as an unrestricted end around taxiway for all aircraft. This minimizes aircraft runway crossings
- Aircraft taxiing on Taxiway D while jet aircraft are departing on either parallel runway would not need to hold short of the runways
- Average taxi distances and times would be substantially increased for both arrivals and departures as a result of the shift



LEGEND

- Airport Property Boundary
- Airfield Ramp, Taxiway, Shoulders
- Runway Pavement
- Building Restriction Line
- Holding Position
- Object Free Area
- Runway Protection Zone
- Buildings
- Extended Clear Zone

Dual Air-Carrier Runways D-I	
Taxiway at T/W D	
Existing Taxiway	x
Displaced Taxiway	
Full Runway Sift	
T/W D End Around Taxiway	
Center Parallel Taxiway	
Outboard Parallel Taxiway	
Runway 11L - 20R	
Taxiway Distance Available (ft)	10,006
Landing Distance Available (ft)	10,006
Runway 11R - 20L	
Taxiway Distance Available (ft)	0,000
Landing Distance Available (ft)	6,000
Runway Centerline Separation (ft)	0615

1 - For Air Carrier Runway Aircraft Design Group ADG

Master Plan Update

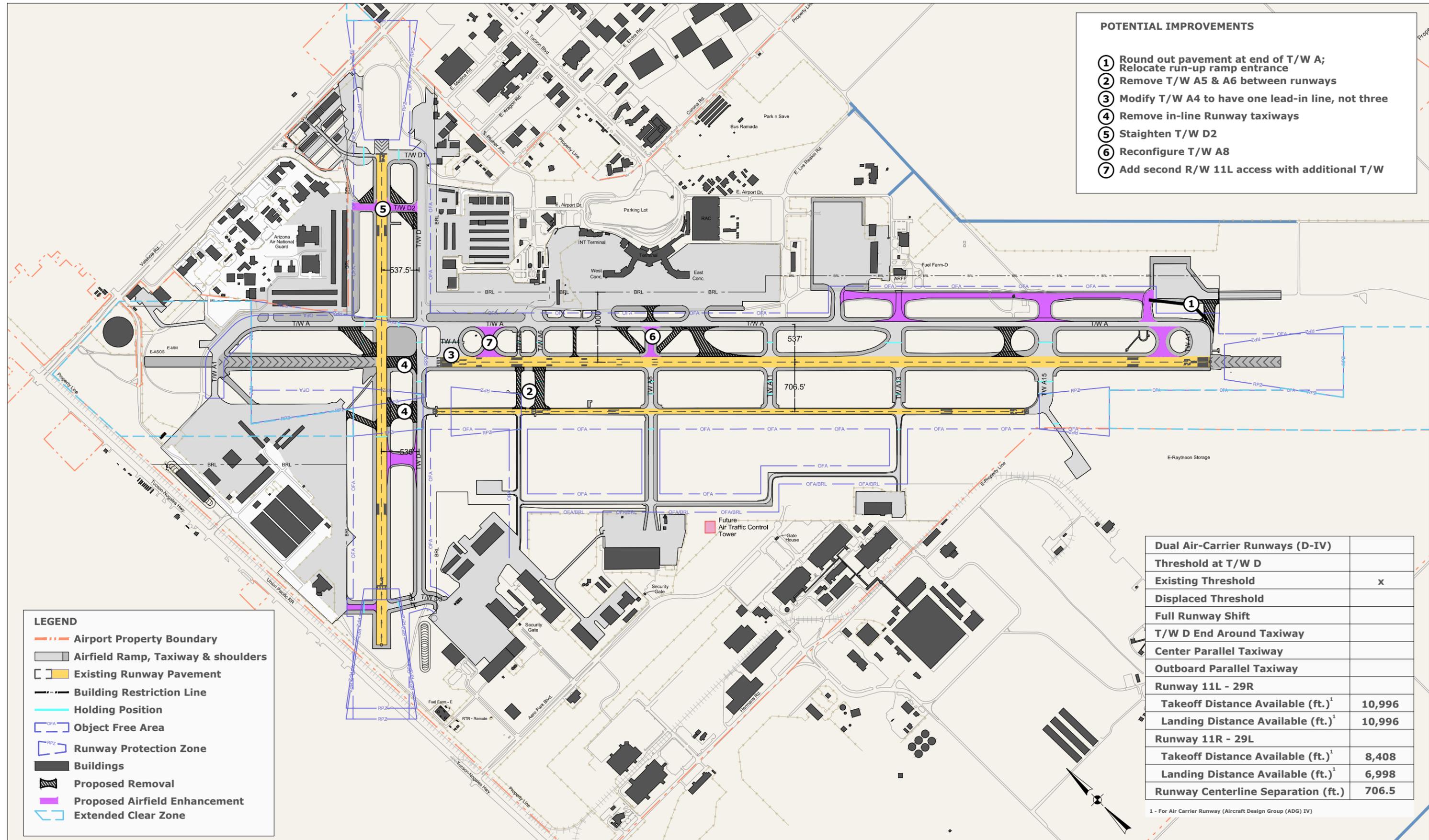
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DRAWING SCALE: 1" = 1250'
DATE: May, 2013

Alternative 1 - No Build

FIGURE 5-1

- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A; Relocate run-up ramp entrance
 - ② Remove T/W A5 & A6 between runways
 - ③ Modify T/W A4 to have one lead-in line, not three
 - ④ Remove in-line Runway taxiways
 - ⑤ Straighten T/W D2
 - ⑥ Reconfigure T/W A8
 - ⑦ Add second R/W 11L access with additional T/W



LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- Building Restriction Line
- Holding Position
- ▭ Object Free Area
- ▭ Runway Protection Zone
- ▭ Buildings
- ▨ Proposed Removal
- ▭ Proposed Airfield Enhancement
- ▭ Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	
Threshold at T/W D	
Existing Threshold	x
Displaced Threshold	
Full Runway Shift	
T/W D End Around Taxiway	
Center Parallel Taxiway	
Outboard Parallel Taxiway	
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	10,996
Landing Distance Available (ft.) ¹	10,996
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	8,408
Landing Distance Available (ft.) ¹	6,998
Runway Centerline Separation (ft.)	706.5

1 - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

Master Plan Update

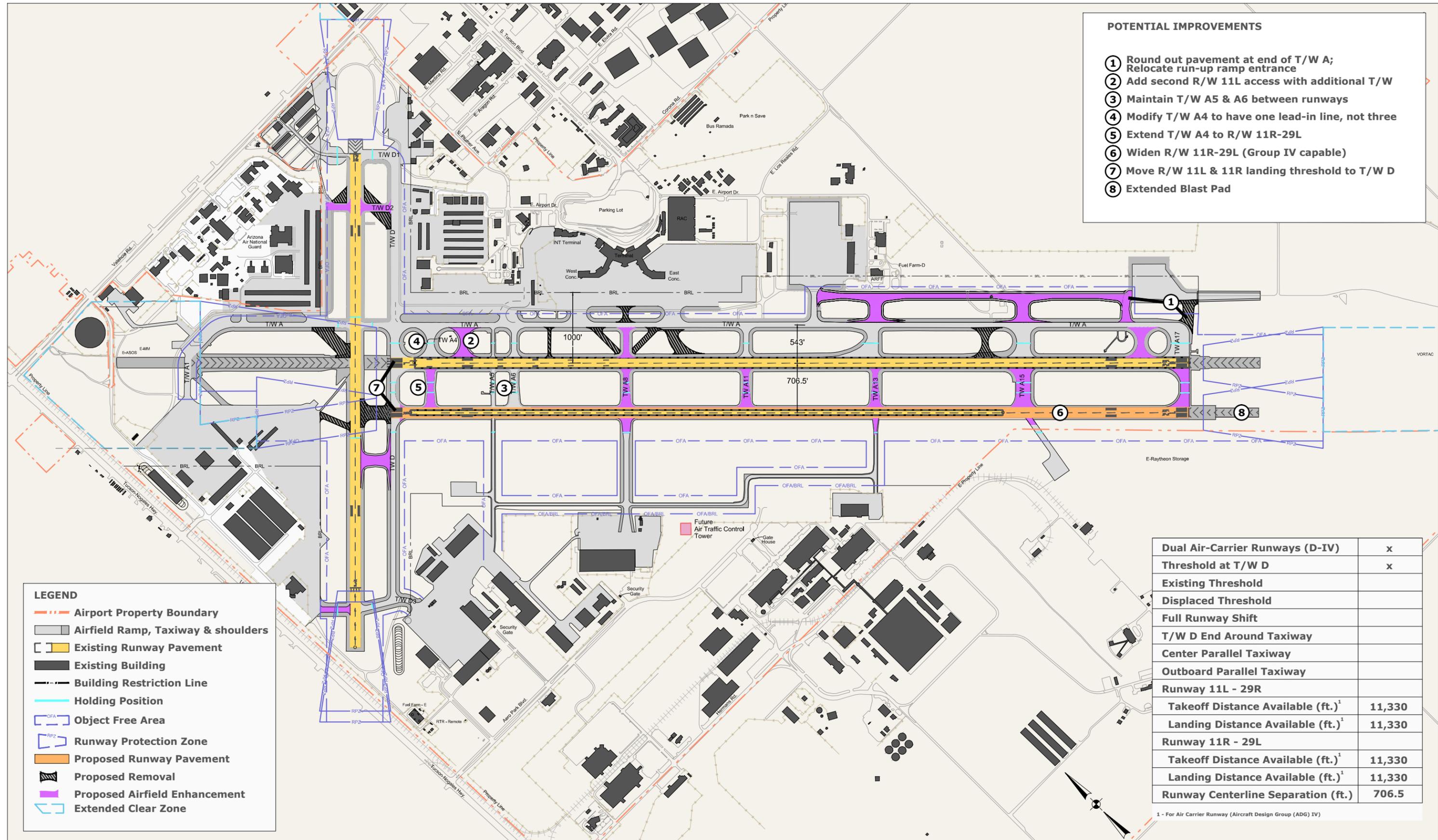
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Alternative 2A

FIGURE 5-2



- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A; Relocate run-up ramp entrance
 - ② Add second R/W 11L access with additional T/W
 - ③ Maintain T/W A5 & A6 between runways
 - ④ Modify T/W A4 to have one lead-in line, not three
 - ⑤ Extend T/W A4 to R/W 11R-29L
 - ⑥ Widen R/W 11R-29L (Group IV capable)
 - ⑦ Move R/W 11L & 11R landing threshold to T/W D
 - ⑧ Extended Blast Pad

LEGEND

- Airport Property Boundary
- Airfield Ramp, Taxiway & shoulders
- Existing Runway Pavement
- Existing Building
- Building Restriction Line
- Holding Position
- Object Free Area
- Runway Protection Zone
- Proposed Runway Pavement
- Proposed Removal
- Proposed Airfield Enhancement
- Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	x
Existing Threshold	
Displaced Threshold	
Full Runway Shift	
T/W D End Around Taxiway	
Center Parallel Taxiway	
Outboard Parallel Taxiway	
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	11,330
Landing Distance Available (ft.) ¹	11,330
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	11,330
Landing Distance Available (ft.) ¹	11,330
Runway Centerline Separation (ft.)	706.5

¹ - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

Master Plan Update

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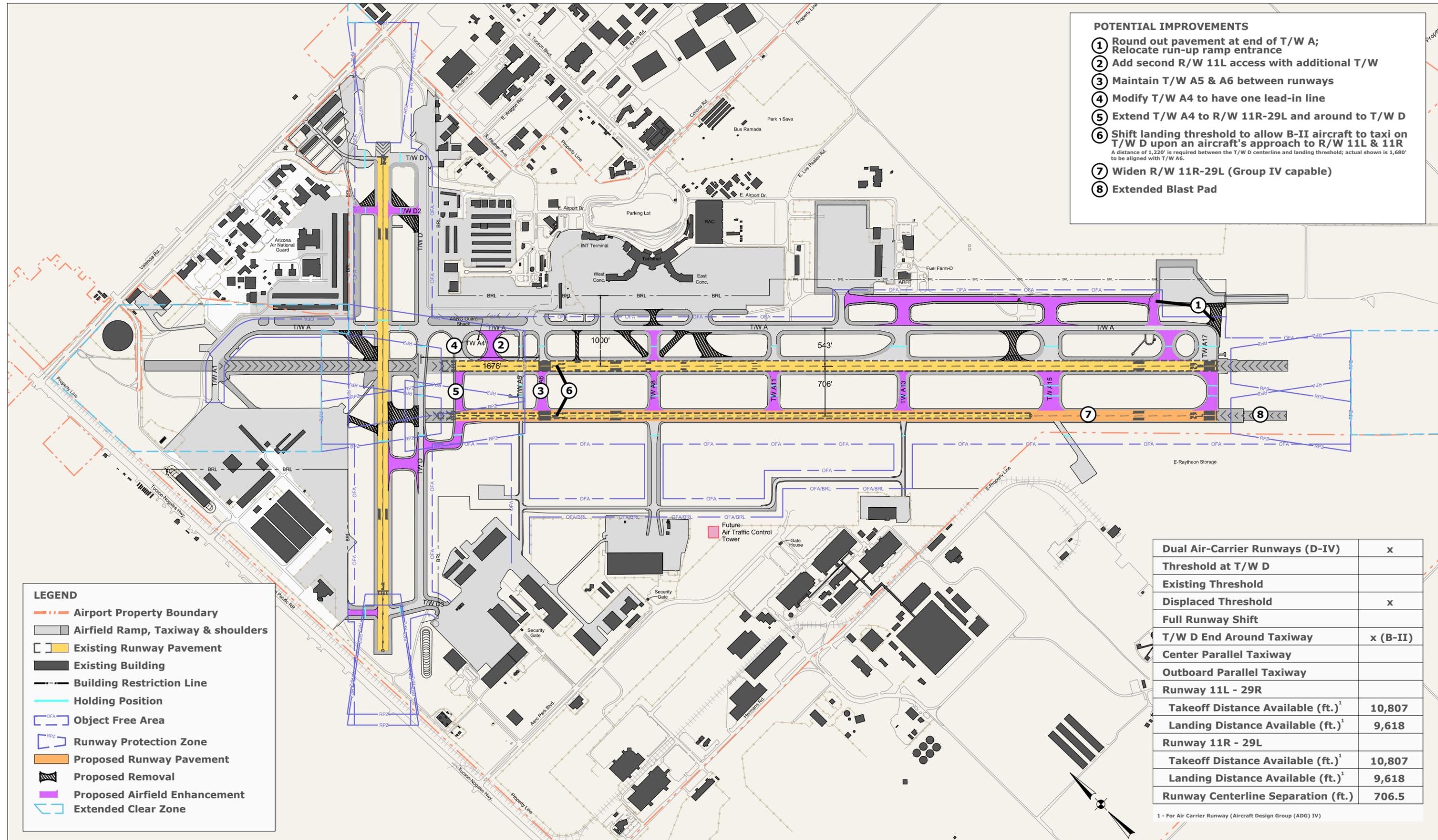
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Alternative 2B

FIGURE 5-3

- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A; Relocate run-up ramp entrance
 - ② Add second R/W 11L access with additional T/W
 - ③ Maintain T/W A5 & A6 between runways
 - ④ Modify T/W A4 to have one lead-in line
 - ⑤ Extend T/W A4 to R/W 11R-29L and around to T/W D
 - ⑥ Shift landing threshold to allow B-II aircraft to taxi on T/W D upon an aircraft's approach to R/W 11L & 11R
A distance of 1,220' is required between the T/W D centerline and landing threshold; actual shown is 1,680' to be aligned with T/W A6.
 - ⑦ Widen R/W 11R-29L (Group IV capable)
 - ⑧ Extended Blast Pad



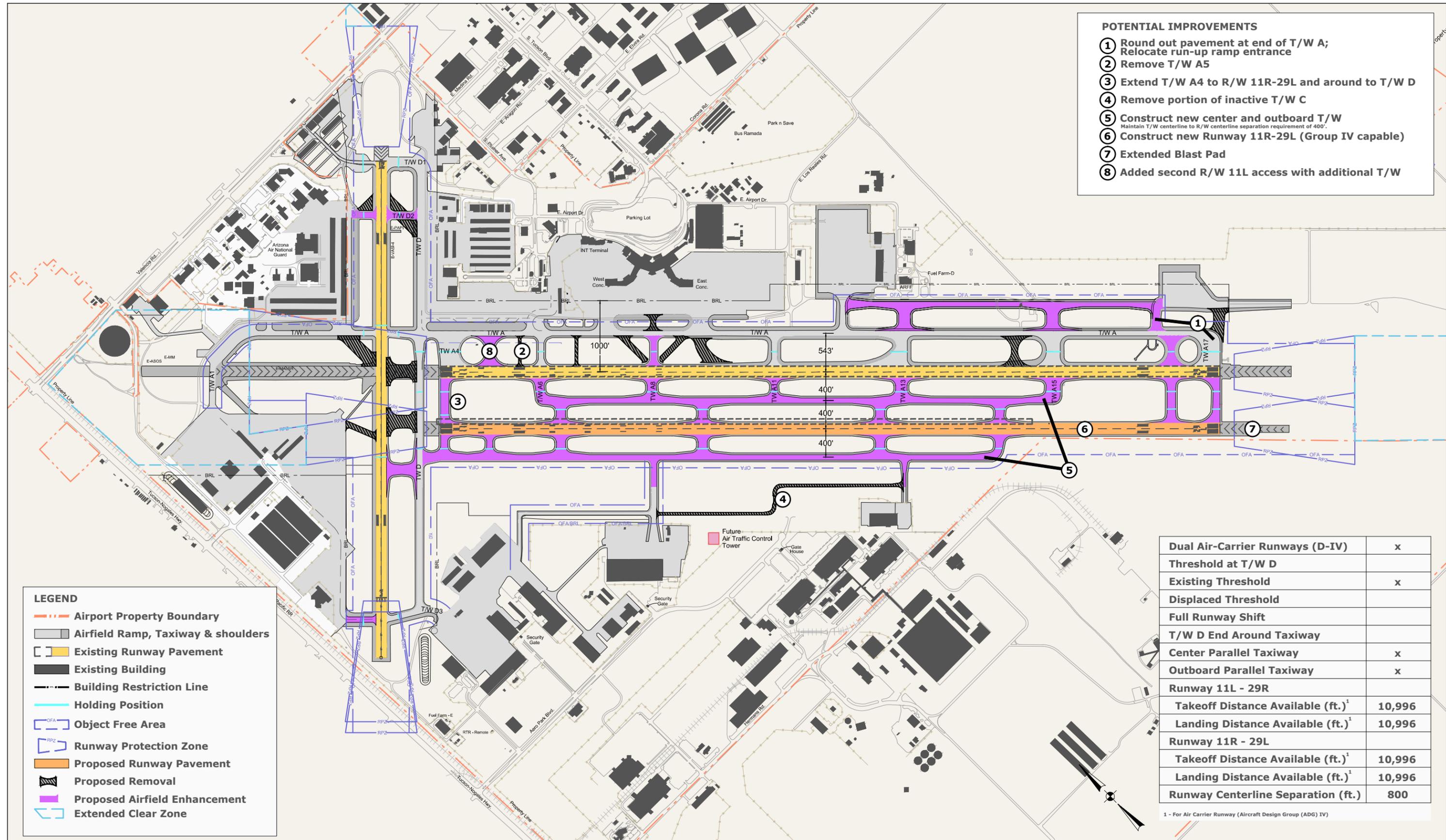
LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- ▭ Existing Building
- Building Restriction Line
- Holding Position
- ▭ Object Free Area
- ▭ Runway Protection Zone
- ▭ Proposed Runway Pavement
- ▭ Proposed Removal
- ▭ Proposed Airfield Enhancement
- ▭ Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	
Existing Threshold	
Displaced Threshold	x
Full Runway Shift	
T/W D End Around Taxiway	x (B-II)
Center Parallel Taxiway	
Outboard Parallel Taxiway	
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	10,807
Landing Distance Available (ft.) ¹	9,618
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	10,807
Landing Distance Available (ft.) ¹	9,618
Runway Centerline Separation (ft.)	706.5

1 - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A;
Relocate run-up ramp entrance
 - ② Remove T/W A5
 - ③ Extend T/W A4 to R/W 11R-29L and around to T/W D
 - ④ Remove portion of inactive T/W C
 - ⑤ Construct new center and outboard T/W
Maintain T/W centerline to R/W centerline separation requirement of 400'
 - ⑥ Construct new Runway 11R-29L (Group IV capable)
 - ⑦ Extended Blast Pad
 - ⑧ Added second R/W 11L access with additional T/W



LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- ▭ Existing Building
- Building Restriction Line
- Holding Position
- Object Free Area
- Runway Protection Zone
- ▭ Proposed Runway Pavement
- ▭ Proposed Removal
- ▭ Proposed Airfield Enhancement
- Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	
Existing Threshold	x
Displaced Threshold	
Full Runway Shift	
T/W D End Around Taxiway	
Center Parallel Taxiway	x
Outboard Parallel Taxiway	x
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	10,996
Landing Distance Available (ft.) ¹	10,996
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	10,996
Landing Distance Available (ft.) ¹	10,996
Runway Centerline Separation (ft.)	800

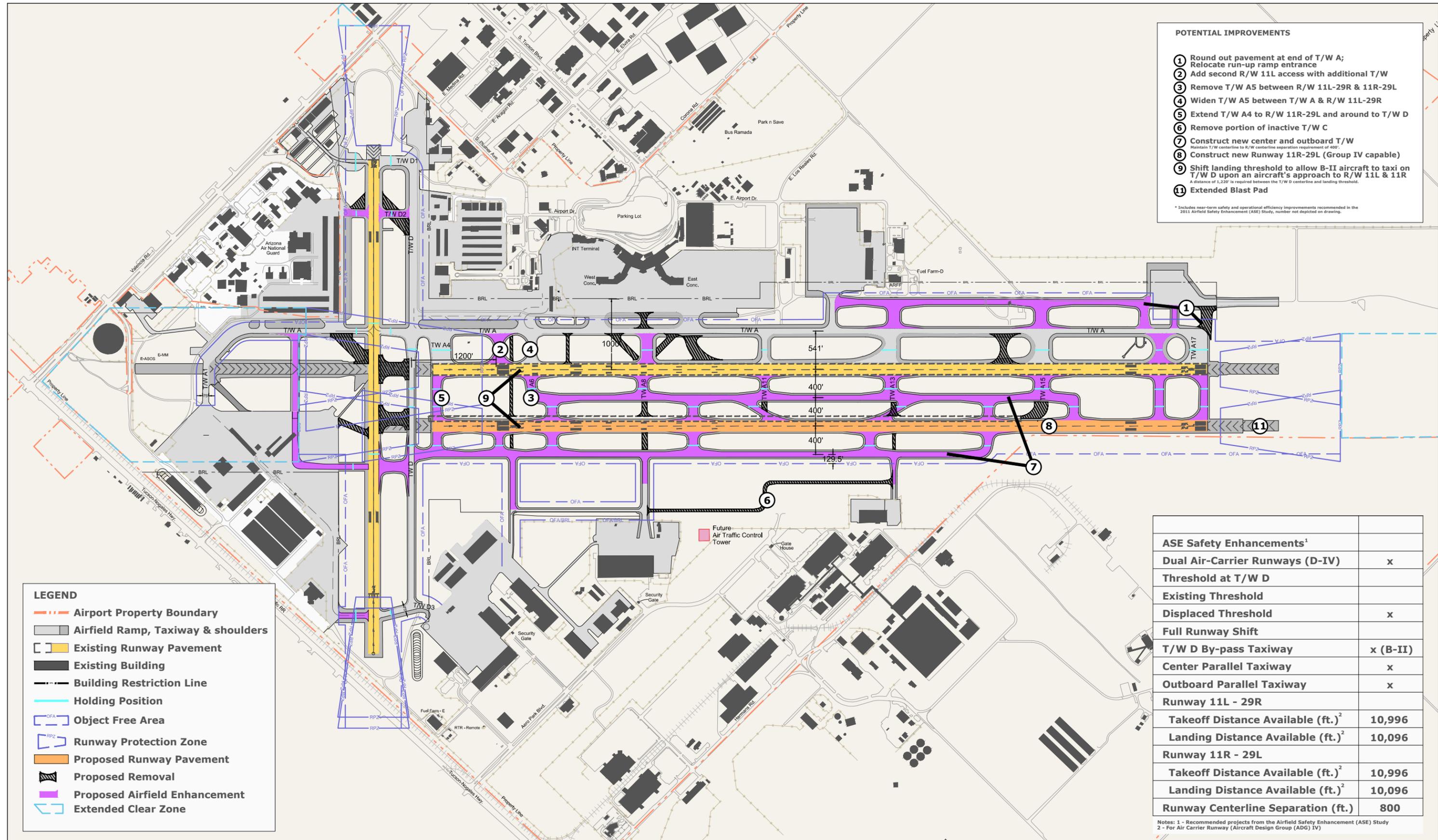
¹ - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

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Alternative 3A

FIGURE 5-5



- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A; Relocate run-up ramp entrance
 - ② Add second R/W 11L access with additional T/W
 - ③ Remove T/W A5 between R/W 11L-29L & 11R-29L
 - ④ Widen T/W A5 between T/W A & R/W 11L-29L
 - ⑤ Extend T/W A4 to R/W 11R-29L and around to T/W D
 - ⑥ Remove portion of inactive T/W C
 - ⑦ Construct new center and outboard T/W
Maintain T/W centerline to R/W centerline separation requirement of 400'
 - ⑧ Construct new Runway 11R-29L (Group IV capable)
 - ⑨ Shift landing threshold to allow B-II aircraft to taxi on T/W D upon an aircraft's approach to R/W 11L & 11R
A distance of 1,220' is required between the T/W D centerline and landing threshold.
 - ⑩ Extended Blast Pad
- * Includes near-term safety and operational efficiency improvements recommended in the 2011 Airfield Safety Enhancement (ASE) Study, number not depicted on drawing.

LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- ▭ Existing Building
- - - Building Restriction Line
- Holding Position
- ▭ Object Free Area
- ▭ Runway Protection Zone
- ▭ Proposed Runway Pavement
- ▭ Proposed Removal
- ▭ Proposed Airfield Enhancement
- ▭ Extended Clear Zone

ASE Safety Enhancements ¹	
Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	
Existing Threshold	
Displaced Threshold	x
Full Runway Shift	
T/W D By-pass Taxiway	x (B-II)
Center Parallel Taxiway	x
Outboard Parallel Taxiway	x
Runway 11L - 29L	
Takeoff Distance Available (ft.) ²	10,996
Landing Distance Available (ft.) ²	10,096
Runway 11R - 29L	
Takeoff Distance Available (ft.) ²	10,996
Landing Distance Available (ft.) ²	10,096
Runway Centerline Separation (ft.)	800

Notes: 1 - Recommended projects from the Airfield Safety Enhancement (ASE) Study
2 - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

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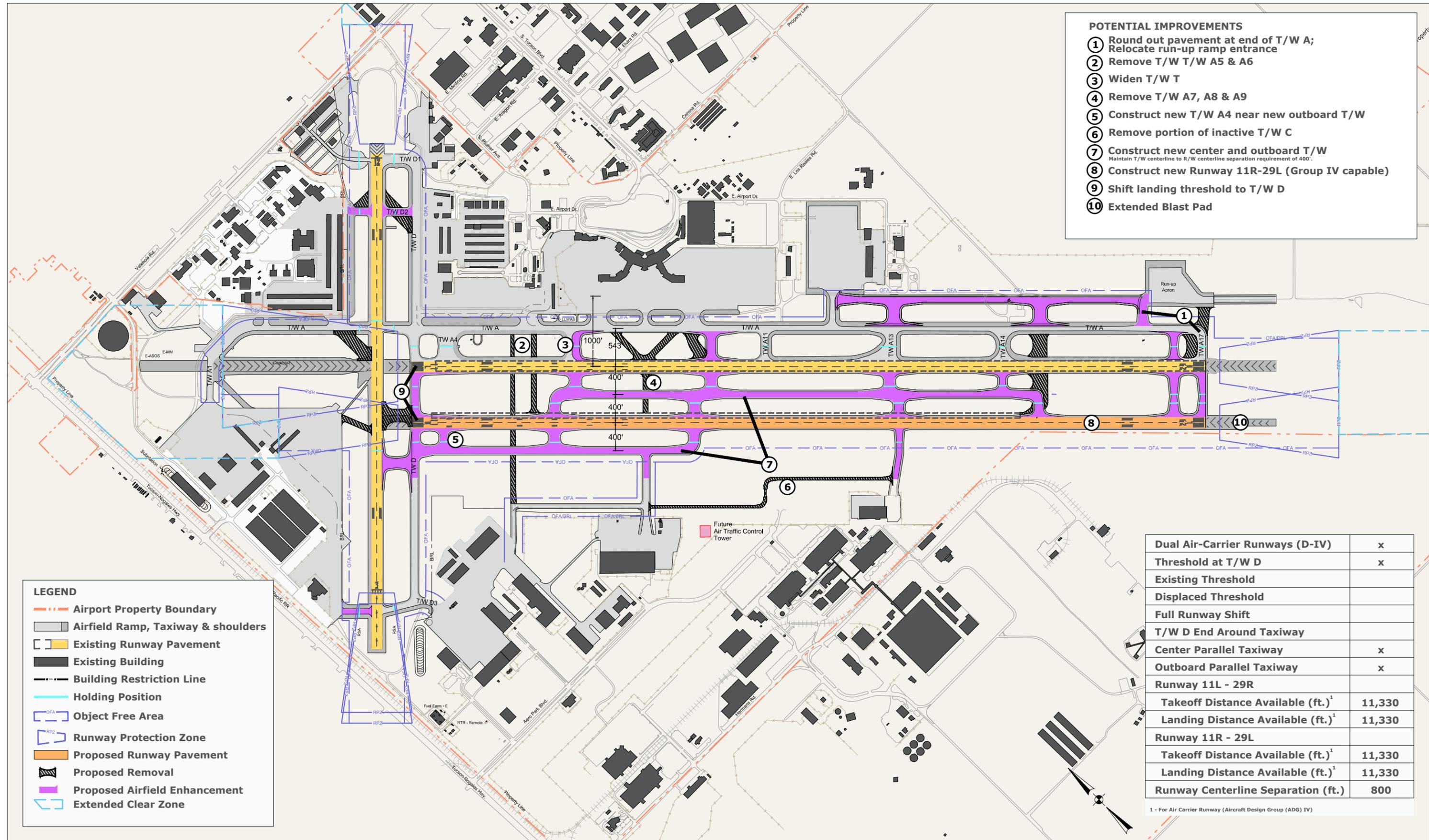
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Alternative 3B

FIGURE 5-6

- POTENTIAL IMPROVEMENTS**
- ① Round out pavement at end of T/W A; Relocate run-up ramp entrance
 - ② Remove T/W T/W A5 & A6
 - ③ Widen T/W T
 - ④ Remove T/W A7, A8 & A9
 - ⑤ Construct new T/W A4 near new outboard T/W
 - ⑥ Remove portion of inactive T/W C
 - ⑦ Construct new center and outboard T/W
Maintain T/W centerline to R/W centerline separation requirement of 400'
 - ⑧ Construct new Runway 11R-29L (Group IV capable)
 - ⑨ Shift landing threshold to T/W D
 - ⑩ Extended Blast Pad



LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- ▭ Existing Building
- Building Restriction Line
- Holding Position
- Object Free Area
- Runway Protection Zone
- ▭ Proposed Runway Pavement
- ▭ Proposed Removal
- ▭ Proposed Airfield Enhancement
- Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	x
Existing Threshold	
Displaced Threshold	
Full Runway Shift	
T/W D End Around Taxiway	
Center Parallel Taxiway	x
Outboard Parallel Taxiway	x
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	11,330
Landing Distance Available (ft.) ¹	11,330
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	11,330
Landing Distance Available (ft.) ¹	11,330
Runway Centerline Separation (ft.)	800

¹ - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

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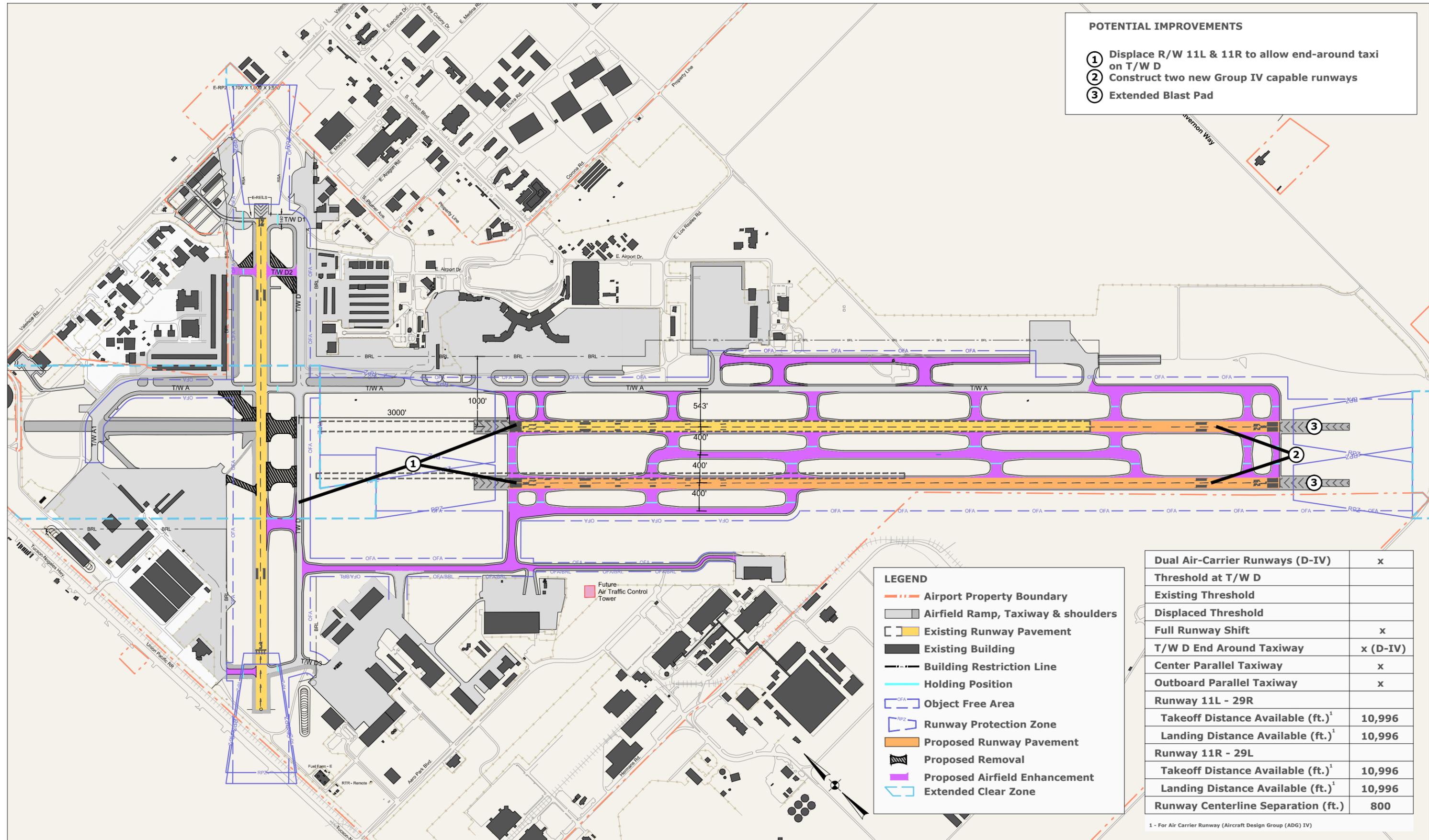
DRAWING SCALE: 1" = 1250'

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Alternative 4

FIGURE 5-7

- POTENTIAL IMPROVEMENTS**
- ① Displace R/W 11L & 11R to allow end-around taxi on T/W D
 - ② Construct two new Group IV capable runways
 - ③ Extended Blast Pad



LEGEND

- Airport Property Boundary
- ▭ Airfield Ramp, Taxiway & shoulders
- ▭ Existing Runway Pavement
- ▭ Existing Building
- Building Restriction Line
- Holding Position
- ▭ Object Free Area
- ▭ Runway Protection Zone
- ▭ Proposed Runway Pavement
- ▭ Proposed Removal
- ▭ Proposed Airfield Enhancement
- ▭ Extended Clear Zone

Dual Air-Carrier Runways (D-IV)	x
Threshold at T/W D	
Existing Threshold	
Displaced Threshold	
Full Runway Shift	x
T/W D End Around Taxiway	x (D-IV)
Center Parallel Taxiway	x
Outboard Parallel Taxiway	x
Runway 11L - 29R	
Takeoff Distance Available (ft.) ¹	10,996
Landing Distance Available (ft.) ¹	10,996
Runway 11R - 29L	
Takeoff Distance Available (ft.) ¹	10,996
Landing Distance Available (ft.) ¹	10,996
Runway Centerline Separation (ft.)	800

¹ - For Air Carrier Runway (Aircraft Design Group (ADG) IV)

HNTB Master Plan Update
TUCSON INTERNATIONAL AIRPORT

DRAWING SCALE: 1" = 1250'
DATE: May, 2013

Alternative 5

FIGURE 5-8

5.2.9 Airfield Alternatives Evaluation / Summary

A summary of the primary components of each airfield alternative is provided in **Table 5-1**.

Table 5-1: Airfield Alternatives Summary

Features	Airfield Alternatives							
	1 -No Build	2A	2B	2C	3A	3B	4	5
Near-Term Safety and Operational Efficiency Improvements		✓	✓	✓	✓	✓	✓	✓
Dual Air-Carrier Runways (D-IV) (provides redundancy)			✓	✓	✓	✓	✓	✓
Runway 11L & 11R Threshold at Taxiway D			✓				✓	
Runways 11L & 11R Threshold at Existing Runway 11L Threshold	✓	✓			✓			
Runways 11L & 11R Threshold is Displaced				✓		✓		
Full Runway Shift								✓ 11L - 2,700'
Taxiway D End Around Taxiway				✓ (B-II)		✓ (B-II)		✓ (D-IV)
Center Parallel Taxiway					✓	✓	✓	✓
Outboard Parallel Taxiway					✓	✓	✓	✓
11L-29R								
Takeoff Distance Available ¹ (feet)	10,996	10,996	11,330	10,807	10,996	10,996	11,330	10,996
Landing Distance Available ¹ (feet)	10,996	10,996	11,330	9,618	10,996	10,076	11,330	10,996
11R-29L								
Takeoff Distance Available ¹ (feet)	8,408	8,408	11,330	10,807	10,996	10,996	11,330	10,996
Landing Distance Available ¹ (feet)	6,998	6,998	11,330	9,618	10,996	10,076	11,330	10,996
Separation Distance between Runway Centerlines (feet)	706.5	706.5	706.5	706.5	800	800	800	800

Notes:

1 - For Air Carrier Runway ADG IV

The goal of the airfield development program is to enhance the safety and operational efficiency of TIA's airfield. Alternatives 1 and 2A do not provide a second parallel air-carrier capable runway that is needed to segregate traffic at TIA. While alternatives 2B and 2C do provide for a second parallel air-carrier runway, these alternatives do not address the need to have increased runway separation between the two parallel runways to accommodate a center taxiway. The center taxiway minimizes the potential for pilots to cross an active runway by forcing them to first turn onto the taxiway and wait for ATCT clearance to cross the other runway. The remaining alternatives (3A, 3B, 4, and 5) provide for a second parallel air-carrier capable runway and a center taxiway. Taxiway D is one of the busiest taxiways at TIA. Alternatives 3A and 4 inhibit flow along Taxiway D while aircraft are arriving and/or departing Runways 11L-29R and 11L-29L. Alternative 3B allows B-II aircraft to taxi unrestricted on Taxiway D while aircraft are on approach to Runways 11L and/or 11R because the arrival thresholds are displaced. Having the landing threshold displaced further enhances safety in the rare occurrence that a pilot instructed to hold short of Runway 11L or 11R on Taxiway D overshoots the runway holdline. While Alternative 5 shifts departing and arriving aircraft away from Taxiway D and other busy taxiways, it requires the most amount of airfield reconstruction. It requires the reconstruction of both parallel runways as opposed to only Runway 11R-29L and also negatively impacts aircraft taxi times. Alternative 3B best meets all of the criteria for enhancing TIA's safety and operational efficiency.

5.3 TERMINAL

The Facility Requirements highlight spatial deficiencies and surpluses in future terminal processing capacity. To meet future demands and to continue to provide customers with a high level of service, TAA initiated a focused Terminal Optimization Study (TOS) in late 2011 to evaluate options for reconfiguring and reusing space within the passenger terminal complex. The TOS examines the following functional areas within the terminal:

- Detailed terminal space inventory and TAA/tenant relocation study
- Mechanical, electrical, and plumbing systems review
- Concessions programming and allocation within the Terminal and Concourses
- Security Screening Checkpoint and Ticketing Modifications
- Outbound baggage system review

The recommendations for near to mid-term terminal redevelopment are included in this section from the TOS report. In addition, this Master Plan Update evaluates the opportunities for longer-term terminal development.

5.3.1 Terminal Optimization Study Alternatives

Many areas within the Terminal and Concourses are underutilized spaces. To better utilize space and enhance the passenger experience and level of service, a reconfiguration and renovation of the existing Terminal is necessary. Specific elements include relocation and expansion of the passenger security screening checkpoint, renovation of the ticketing lobby, redeveloping the mezzanine level to accommodate administrative office space, opportunities for reallocation of concessions, and enhancements to the outbound baggage system.

Relocation and Expansion of the Security Screening Check Points

TIA's two SSCPs are currently located in the throats of each concourse. Both checkpoints are constrained by the width of the concourse throats and only provide room for three screening lanes each. The width of the lanes does not meet current TSA design standards and do not have adequate room to accommodate whole body imagers (WBI). Facility requirements for the SSCPs show an existing deficiency in the Concourse A checkpoint growing to a deficiency of three lanes in PAL 4. Concourse B will require one additional lane by PAL 4. To meet future requirements, five potential configuration/location options for the SSCPs have been identified, including:

Option 1

Preliminary Option 1 proposes to relocate the SSCPs to the middle quadrants of the Terminal. The configuration of Option 1 allows passenger check-in processing to occur in all four quadrants. Passengers using Concourse A will intuitively be able to walk to the right side of the concourse to enter and exit, however, passengers using Concourse B will have to walk on the left side of the concourse to enter and exit.

Option 2

Preliminary Option 2 proposes to relocate the SSCPs to the outer quadrants of the Terminal. The configuration of Option 2 centralizes passenger check-in to the two central quadrants and eliminates ticketing on the outer quadrants. Passengers using Concourse B will intuitively be able to walk to the right side of the concourse to enter and exit, however, passengers using Concourse A will have to walk on the left side of the concourse to enter and exit.

Option 3

Preliminary Option 3 is a hybrid option of Options 1 and 2. This option proposes to relocate the Concourse A SSCP on the inner quadrant and the Concourse B SSCP on the outer quadrant. The configuration of Option 3 provides ticketing in three of the four quadrants in the Terminal. Passengers using either concourse will intuitively be able to walk to the right side of the concourse to enter and exit.

Option 4

Preliminary Option 4 proposes to relocate the SSCPs to the outer edges of the outer quadrants of the Terminal. The configuration of Option 4 provides for passenger check-in to continue to be provided in all four quadrants. Passengers using Concourse B will intuitively be able to walk to the right side of the concourse to enter and exit, however, passengers using Concourse A will have to walk on the left side of the concourse to enter and exit.

Option 5

Preliminary Option 5 proposes to relocate the SSCPs to the middle quadrants with the SSCP queue areas placed where the current back-of-house offices are located. The queues for both SSCPs converge toward the middle of the Terminal. The configuration of Option 5 provides for passenger check-in to continue to be provided in all four quadrants. Passengers using Concourse A will intuitively be able to walk to the

right side of the concourse to enter and exit, however, passengers using Concourse B will have to walk on the left side of the concourse to enter and exit.

Renovation of the Ticketing Lobby

Each of the five options presented above result in a loss of existing ticketing positions. There are sufficient ticketing positions to serve the airport well into the future. To mitigate the ticketing frontage reduction and get passengers to use more self-service check-in options, converting the existing one-step ticketing process into a two-step segregated ticketing process may be necessary.

A one-step ticketing and check-in process involves combining the check-in and bag drop processes in a single location. Typically, a check-in kiosk is located next to a bag drop position. Passengers will check-in for their flight, make applicable changes to their reservation, and pay airline baggage check fees. Passengers that do not need to check a bag can proceed directly to the SSCP. Passengers that need to check a bag will wait for an agent to apply bag tags, check their ID, and place the bag on a conveyor for screening and sortation.

A two-step ticketing and check-in process involves segregating the processes of obtaining a boarding pass and dropping a bag. Typically, a check-in only kiosk will be located separately from the baggage drop area. Passengers utilize step one at the check-in kiosk to print their boarding pass, make changes to their reservation, and pay airline baggage check fees. Passengers that do not need to check a bag can proceed directly to the SSCP. Passengers that need to check a bag will proceed to an open bag drop position, scan their boarding pass, and wait for an agent to apply bag tags, check their ID, and place the bag on a conveyor for screening and sortation.

The advantage of a two-step process is that it reduces the ticket frontage requirement by allowing the first step to take place away from the linear ticket counters. It also provides another metering step for passengers in the check-in process. It allows passengers only needing to receive a boarding pass to use dedicated devices that have a separate queue from the bag drop devices.

Another way to maximize the linear ticketing frontage is to take advantage of the depth of the Terminal. The existing linear ticket counters could be built out in an island configuration by extending the outbound feed out towards the ticketing area circulation. Baggage drop positions could be located along the sides of the island. By implementing this kind of bag drop configuration, TIA can meet forecast ticketing linear frontage requirements with only three islands.

SSCP Enhancement Recommendation

Option 2 meets the forecast SSCP lane requirement with 6 lanes for Concourse A and 4 lanes for Concourse B. The option continues to provide ticketing in all four quadrants and maintains the existing baggage takeaways for the busiest airlines. This option minimizes disruption to tenants and existing airline ticket office space. The existing lower-level access is maintained in both concourses and the CBP arrival area is undisturbed.

Mezzanine Level Redevelopment

The existing TAA offices are spread throughout the Terminal, Concourses, Planning and Development (P&D) building (B-232a) and main Administration building (B-304). TAA is examining the possibility of relocating and consolidating the majority of these offices to the mezzanine level of the Terminal, as well as utilizing vacant spaces in the former international building (B-232b) and former Sky Chefs building (B-300).

Concessions Reallocation

The reorganization of space within the Terminal provides TAA with the opportunity to enhance TIA's concessions program by relocating concessions based on new passenger flow patterns. The TOS determined that the current allocation of pre-security concessions has approximately 20-40% more space than what can be realistically supported. There are potential areas within a reconfigured terminal to better site concessions. The major opportunity is to locate concessions in the concourse throats once the SSCPs are relocated elsewhere in the Terminal. Concessions planning take the following principles into account:

- Customer exposure—citing concessions near the majority of passenger flows
- Local characteristics—developing the right mix of retail and food concepts for residents
- Visitor characteristics—developing the right mix of retail and food concepts for visitors
- Air service characteristics—select offerings based on the average flight stage length
- Flight schedule—few flights depart Tucson in the evening which negatively impacts food sales
- Revenue Philosophy—determines how the revenue generated by the concessions program is evaluated

Outbound Baggage System Upgrade

An inventory of the existing outbound baggage system was performed and the inventory determined that the majority of the existing physical baggage system infrastructure is in satisfactory to good condition. Components of the existing outbound system could be upgraded and/or expanded to provide additional outbound area.

5.3.2 Long-Term Terminal Development

Beyond PAL 4, TIA will likely need additional gates. The future gate expansion should begin with Concourse A because of the available area to expand to the east. Concourse B could also be expanded, however, the site constraints result in limited expansion opportunities and the site requires significant grading enhancements and relocation of the truck fueling area.

5.4 LANDSIDE

Roadway and other landside facility improvements were considered in the alternatives analysis to meet the forecast facility requirements through the planning horizon. Regional access improvements are addressed in *Section 7: Land Use*.

5.4.1 Access Roadways

The facility requirements analysis indicated that the level of service of Airport Drive along the terminal loop roadway would remain at LOS C or better throughout the planning horizon and no capacity improvements are required.

Access to the cargo, ARFF and fueling facilities on the southeast side of the airfield is provided from Country Club Road. Improvements to the Country Club Road and East Los Reales Road intersection were considered to improve the connection to these facilities. Future industrial aviation / maintenance development along Taxiway G (expansion) would also require landside access and Country Club Road is proposed to be upgraded and extended to Aeronautical Way. This would connect Country Club Road to Alvernon Way and could be completed as these sites are developed. As part of the improvements, Airport Drive would also be extended to Country Club Road.

5.4.2 Curbside

The facilities requirements analysis indicated no deficiencies on the upper and lower level private vehicle curbside. The commercial inner curbside shows deficiencies beginning in PAL 3 but it is anticipated that these deficiencies can be mitigated through re-allocation of the commercial vehicle zones on the inner and outer curbs.

5.4.3 Parking Facilities

TAA operates several types of parking at TIA: short-term, long-term uncovered, long-term covered (second floor of garage) and economy covered and uncovered. A deficit of economy covered parking currently exists and will grow to 215 spaces by PAL 4; however, the demand may be even greater as the current shortage may result in latent demand that could be accommodated with additional covered parking spaces. In contrast, there is a surplus of uncovered economy parking today. Portions of the uncovered economy parking lot can be covered to fulfill the demand for covered economy parking.

By PAL 2, the long-term parking areas in both the surface lot across from the terminal and in the second floor of the garage are nearing capacity while the short-term lot has an excess of up to 170 parking spaces. The conversion of short-term parking spaces to long-term spaces in the parking area across from the terminal would accommodate the shortage of long-term parking through PAL 3. TAA is implementing a solar energy canopy project in the lots across from the terminal that will provide additional covered spaces.

By PAL 4, the shortage of close-in parking (short- and long-term) would exceed total supply by 240 parking spaces. The excess demand could be mitigated by demand management such as raising parking rates in the close-in lots to shift parkers to the economy parking area or shifting employees to remote facilities.

5.4.4 Rental Car Facilities

In the near term, the QTA could be enhanced by adding one more car wash and one more fueling station. In addition, an area along Country Club Road at Corona Road has been identified for the expansion of rental car storage and maintenance facilities. It is desirable for the quick-turn-around facilities to remain adjacent to the ready-return facilities to limit the turn time between vehicle rentals and reduce the liability associated with moving vehicles off-site. However, long-term storage and heavy maintenance is suitable for sites further from the ready-return area as not all vehicles will require use of this facility between rentals. Long-term storage could be shifted to the new site allowing space for expanded QTA and ready-return facilities. As the ready-return space needs grow employee parking should be shifted to another location to allow rental car to expand in place.

5.5 GENERAL AVIATION

The Master Plan Update analysis identified a need for additional conventional hangar space by PAL 4; however, TAA's upcoming *General Aviation Strategic Plan* will revisit these requirements and conduct surveys of hangar usage to refine requirements for space.

Areas for industrial aviation / aircraft maintenance development along the north end of Runway 29L were identified and would require the extension of Taxiway G.

TAA and the General Aviation users and tenants identified potential improvement areas to TIA's GA facilities that will be considered in greater detail in the *General Aviation Strategic Plan*. Areas to address include:

- Inefficient layout of existing facilities – optimizing building, apron, and taxiway/taxilane layouts to enhance safety, optimize efficiency, and stimulate growth
- Common use aircraft maintenance facility – hangar/maintenance facility space to accommodate diverse GA aircraft repair needs
- Potential restaurant at/near the existing air traffic control tower upon relocation to the new tower
- Replacing T-hangar and tie-down parking with conventional hangars to better accommodate current and future fleet mix
- Reconstruction of the west ramp pavement to continue to allow aircraft to access the area
- Consolidated helicopter landing and service area

5.6 CARGO

TIA does not require any new air cargo facilities within this Master Plan Update's planning horizon. Existing cargo facilities currently have surplus capacity to accommodate forecast demand. The extension of Taxiway G and connection of Country Club Road to Aeronautical Way will create opportunities for a range of aeronautical industrial activity including cargo expansion, if necessary.

5.7 SUPPORT / MILITARY

5.7.1 Airport Traffic Control Tower

A site for a new ATCT was selected prior to the initiation of this Master Plan Update and was carried through alternatives analysis to the preferred plan. The site, south of the primary Runway 11L-29R, will allow air traffic controllers a full view of the airfield and the orientation south of the primary airfield will allow them to look north and not directly into the sun.

5.7.2 Aircraft Rescue and Fire Fighting

The existing ARFF facility meets the response time requirements for the existing runway configuration and for all of the proposed airfield alternatives. TAA is considering replacing and/or supplementing the existing ARFF station with a station in the vicinity of the new ATCT.

5.7.3 Fueling Facilities

TAA is preserving space within reserve land area on Los Reales Road to construct a consolidated fuel farm to replace all of the existing fuel farms around TIA. The future fuel farm would accommodate approximately 1.5 million gallons of fuel (mixture of Jet A and Avgas to be determined). The fuel farm will serve the airport with new hydrant fuel lines. These improvements are not expected to be necessary within the planning horizon.