Appendix H-4
LAX SPECIFIC PLAN AMENDMENT STUDY REPORT

Analysis of LAX North Airfield Alternatives

May 2007

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Los Angeles World Airports Authority

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Introduction

This document presents results of a study performed by Seth Young, Ph.D., C.M., President of the International Aviation Management Group, Inc., and Associate Professor of Airport Operations and Management at Embry-Riddle Aeronautical University's College of Business in Daytona Beach, Florida, to analyze the feasibility and suitability of studying a series of alternatives for north airfield development at the Los Angeles International Airport, as requested by the Los Angeles World Airports Authority (LAWA) as part of their LAX Specific Plan Amendment Study process.

The purpose of this study is to provide LAWA with an expert and objective analysis for further study of alternatives for North Airfield development at LAX, as they pertain to operational safety, aircraft compatibility, capacity, and environmental considerations. As such, this report provides no specific recommendations for any particular alternative. This report simply provides guidance towards further study of each presented alternative.

To accomplish this goal, extensive research and analysis was performed to understand the history and issues associated with the planning process at LAX. In addition, knowledge of current and future aircraft and navigational technologies, airfield operational policies, and environmental issues were applied to the analysis.

This report begins with a background of the recent LAX master planning process, followed by a comparative analysis of the various alternatives for North Airfield redevelopment based on a series of safety, efficiency, technological, and environmental considerations. This report provides a brief conclusion towards justifying the appropriateness of further study of each proposed alternative.

Background

Since 1994, the Los Angeles World Airports Authority (LAWA) has been engaged in efforts to create a comprehensive improvement and expansion plan for Los Angeles International Airport (LAX). The result of these efforts included the publication by the Los Angeles City Council of a Master Plan for LAX in December 2004, which was followed by a published Record of Decision (ROD)

and master plan approval by the Federal Aviation Administration (FAA) in May 2005.

The LAX Master Plan and associated ROD defined a series of capital expansion plans to accommodate year 2015 forecast demand in commercial passenger enplanements (78.9 Million Annual Passengers), air carrier, and general aviation operations (2,300 daily operations), and cargo transport (3.1 million annual tons), as well as to address issues of operational safety and environmental impacts associated with expansion.

Specifically, the ROD described FAA's unconditional approval of the Airport Layout Plan (ALP) for LAX, which depicts the proposed capital improvements as described in Alternative D of the LAX Master Plan, with the exception of what had been determined as "collateral" landside development of vacant land near the airport's northern property border. Specific capital improvements approved include the creation of center taxiways between both the north and south pairs of parallel runways, designing north runways and taxiways to aircraft design group (ADG) VI standards to handle new large aircraft such as the Airbus A-380, expanding the length of north runways, increased taxiway spacing, along with reconfigurations of Terminals 1, 2, 3, and the Tom Bradley International Terminal (TBIT), and landside improvements including the construction of a ground transportation center, intermodal center, consolidated rental car facility, and automated people mover system.

In 2005, a series of lawsuits were brought against LAWA and the City of Los Angeles, among others, challenging the approval of the LAX Master Plan and the ROD, based on issues associated with environmental mitigation. In 2006, the mayor of Los Angeles and the Los Angeles City Council approved a settlement to these lawsuits, by, in part, agreeing to re-evaluate controversial (known as "yellow light") projects within the plan. This re-evaluation process has come to be known as the LAX Specific Plan Amendment Study.

As part of the LAX Specific Plan Amendment Study, the mayor called for a re-evaluation of North Airfield capital projects as described in Alternative D of the master plan, citing the need to consider public opposition to the approved future north runway reconfiguration, based on community perception that the Alternative D North Airfield runway configuration offers no significant benefits

to operational safety or efficiency, and imposes unnecessary environmental impacts, particularly in the form of added noise to neighborhoods of Westchester and Playa Del Ray, located north of the airport property.

Within the LAX Specific Plan Amendment Study, LAWA has begun to reconsider airfield development options for the airport's North Airfield. In addition to the design described in Alternative D of the LAX master plan, five additional alternatives, including a minimal change alternative, has been presented for evaluation.

Current Airfield

As illustrated in Figure 1, the LAX airfield is comprised of two sets of parallel runways separated by a midfield complex of nine airline passenger terminal facilities. The airport commonly describes the runways south of the terminal complex as the "South Airfield" and those runways north of the terminals as the "North Airfield".

Figure 1: Aerial View - Los Angeles International Airport, North Airfield and South Airfield (source: Google Earth)

South Airfield

Runways on the South Airfield are identified as RWY 7L-25R and RWY 7R-25L. Inboard runway RWY 7L-25R is 12,091 feet in length by 150 feet in width. Outboard runway RWY 7R-25L is 11,096 feet in length by 200 feet in width. Each

runway is rated for a weight bearing capacity of 1,250,000 pounds and capable of handling long-haul heavy aircraft and with the exception of RWY 25L, each are equipped with Category I instrument landing systems in each direction. RWY 25L is equipped with a Category IIIB instrument landing system. RWY 7L-25R and RWY 7R-25L are accessed from the terminal and ramp areas by parallel taxiways C and B and a series of entrance and exit taxiways (U, T, ST, P, N, M,K, J, H, G, WG, WF, and F). In addition, a south parallel taxiway A connects the runways to the general aviation facilities located on the south side of the airport property. RWY 7L-25R is used primarily for departing aircraft. RWY 7R-25L is used primarily for arriving aircraft. Both runways are capable of departing and landing long-haul heavy aircraft. Approximately 53% of all operations[1] and 75-80% of all long-haul heavy[2] aircraft operations occur on the South Airfield.

As approved in the LAX Master Plan and ROD, the South Airfield is currently undergoing redevelopment, which includes relocating RWY 7R-25L 55 feet to the south and constructing a 75 foot wide center parallel taxiway. The purpose of this redevelopment project is to minimize the potential for runway incursions by reconfiguring the existing high speed taxiways that directly intersect RWY 7L-25R. Arriving aircraft on relocated RWY 7R-25L will be able to taxi onto the new parallel center taxiway and hold prior to crossing RWY 7L-25R. Currently, aircraft arriving onto RWY 7R-25L must hold on the high-speed exit taxiways prior to crossing RWY 7L-25R. This project is scheduled for completion in 2008.

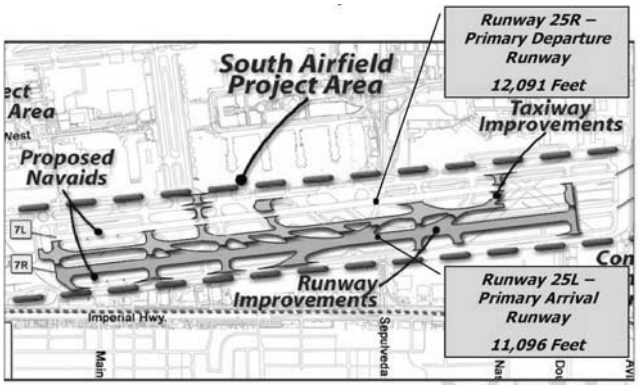

Figure 2: South Airfield Improvement Project (Source: LAWA)

[1] An operation is defined as a takeoff or a landing. "Total operations" is defined as the sum of all takeoffs and landings.
[2] A *heavy* aircraft is defined as an aircraft with maximum gross takeoff weight of 255,000 lbs. or greater.

North Airfield

Runways on the North Airfield at LAX are identified as RWY 6L-24R and RWY 6R-24L. RWY 6R-24L, the inboard runway, is 10,285 feet in length by 150 feet in width and rated for a weight bearing capacity of 900,000 lbs. Each end of RWY 6R-24L and RWY 6L-24R is equipped with Category I instrument landing systems. Access to and from these runways is provided by a series of high-speed and low-speed taxiways E17, BB, AA, Z, E13, Y, W, E10, E8, V and parallel Taxiway E. RWY 6R-24L is primarily used for departing aircraft.

Outboard runway 6L-24R, located approximately 700 feet to the north of 6R-24L is 8,925 feet in length by 150 feet in width and rated for a weight bearing capacity of 900,000 lbs. As with RWY 6R-24L, RWY 6L-24R is considered a precision instrument runway, equipped with Category I instrument landing systems. Access to and from RWY 6L-24R is provided via high speed and low speed taxiways BB, AA, Z, Y, W, and V. At this time there is no parallel taxiway associated with RWY 6L-24R. All access to RWY 6L-24R requires crossing RWY 6R-24L with the exception of access via taxiway D7 to E7, a "wrap-around" taxiway located on the far east side of RWY 6R-24L. This wrap-around taxiway is used primarily for aircraft departing from RWY 6L-24R. RWY 6L-24R, however, is primarily used for arriving aircraft, limiting the use of this wrap-around taxiway.

Both RWY 6R-24L and 6L-24R are designed for ADG V aircraft, with wingspans up to but not including 214 feet and tail heights up to but not including 66 feet. The close separation of the two parallel runways preclude independent operations during weather conditions where cloud ceilings are less than 1000 feet and visibility is less than 3 miles.

Currently, the north airfield at LAX handles approximately 47% of the airports total operations and approximately 20-25% of all operations of long-haul heavy aircraft. Longer runways on the airport's South Airfield allow it to accommodate the majority of the long-haul heavy aircraft operations due to its longer runways.

Figure 3: Total Operations vs. Heavy Aircraft Operations (Source: LAWA)

Proposed North Airfield Alternatives

The LAX Master Plan has called for North Airfield improvements similar to the improvements currently being constructed on the South Airfield. Similar to the goals for the South Airfield, these improvements were intended to improve operational safety by mitigating the potential for runway incursions, as well as to allow for a more balanced distribution of long-haul heavy aircraft operations between the North and South Airfields.

Alternative D

Specifically, LAX Master Plan Alternative D called for the extension of RWY 6L-24R 1,495 feet to the west to a total length of approximately 10,420 feet, and for the relocation of RWY 6R-24L 340 feet to the south of the existing runway centerline and extensions of 135 feet to the west and 1,280 feet to the east for a total length of approximately 11,700 feet. RWY 6R-24L would also be widened to 200 feet, as per ADG VI standards. A 75 foot wide parallel taxiway would be constructed between extended RWY 6L-24R and extended/relocated RWY 6R-24L.

To accommodate the southerly relocation of RWY 6R-24L, significant modifications to Terminals 1, 2, 3, and the Tom Bradley International Terminal (TBIT) would be required, resulting in an overall reduction of aircraft gates in the terminal complex. To make up for this reduction, a satellite concourse west of the TBIT has been included in the overall Alternative D Master Plan.

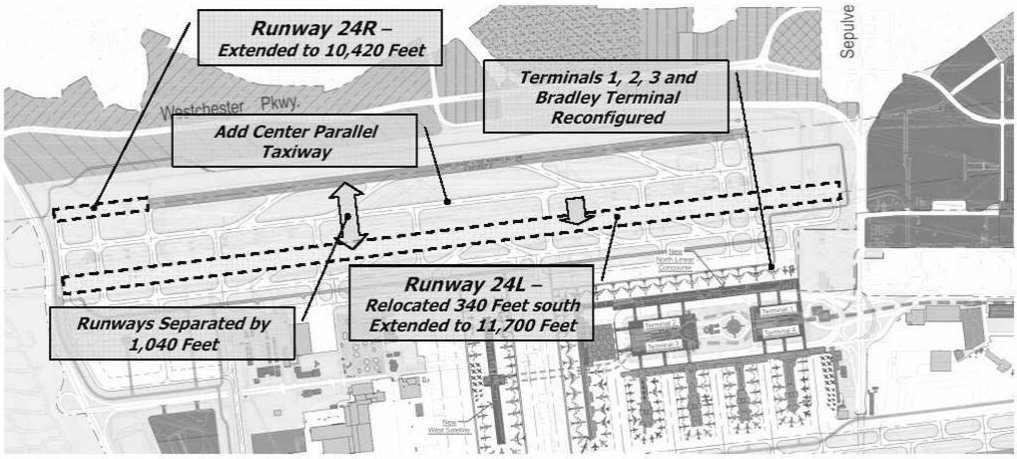

Figure 4: LAX North Airfield: Master Plan Alternative D (Source: LAWA)

LAX Specific Plan Amendment Study Alternatives

The LAX Specific Plan Amendment Study describes five additional North Airfield concepts. They are the following:

Concept One: Shift RWY 6L-24R 340 feet north, extend RWY 6L-24R 1,495 feet to the west for a total length of 10,420 feet, extend a displaced threshold to RWY 6R-24L 1,415 feet to the east, providing 11,700 feet for departing aircraft, and adding a center parallel taxiway between the runways. This concept separates the two runways by 1,040 feet.

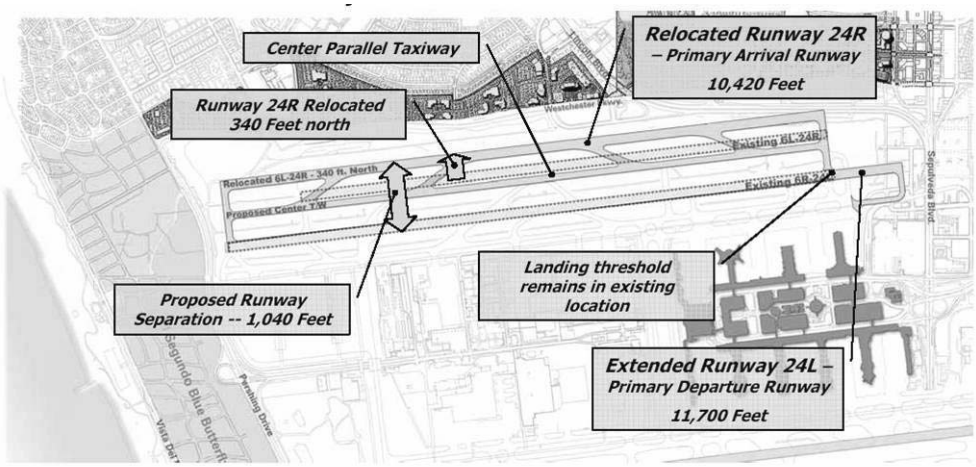

Figure 5: LAX Specific Plan Amendment Study: North Airfield Concept One (Source: LAWA)

Concept One allows for the preservation of the current terminal complex. It provides for a center parallel taxiway to allow arriving aircraft on RWY 6L-24R to exit prior to crossing RWY 6R-24L, as well as provides increased separation between runways. Concept One utilizes a portion of the currently undeveloped "collateral development area" property on north end of airfield.

Concept Two: Shift RWY 6R-24L 100 feet south and extend a displaced threshold 1,415 feet to the east, providing 11,700 feet for departing aircraft, extend RWY 6L-24R to 9,400 feet, and add a center parallel taxiway between the runways. This concept separates the two runways by 800 feet.

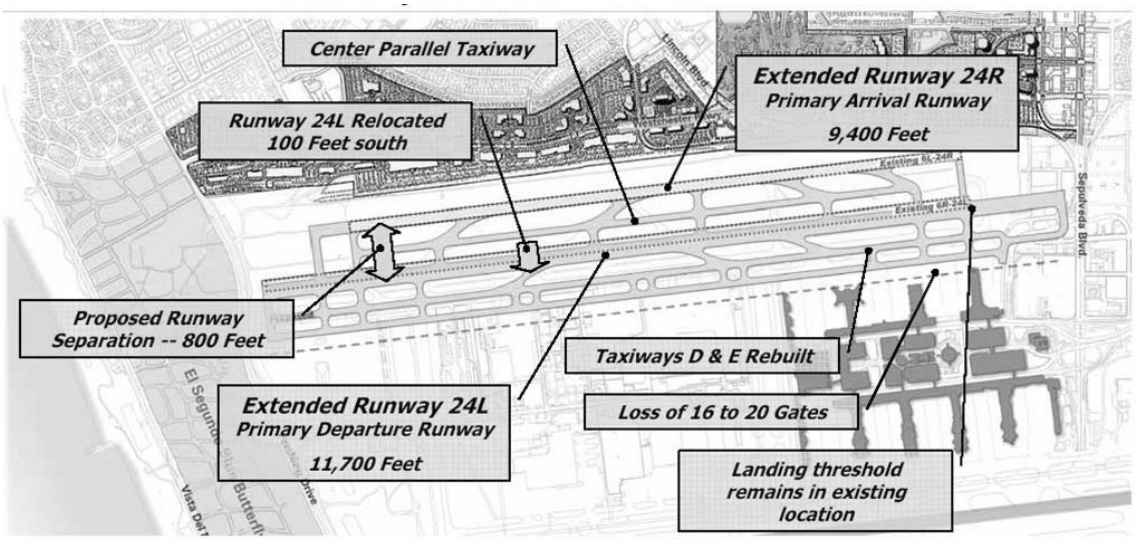

Figure 6: LAX Specific Plan Amendment Study: North Airfield Concept Two (Source: LAWA)

Concept Two results in the loss of 16 to 20 gates in terminals 1, 2, and 3, and the TBIT. It provides for a center parallel taxiway to allow arriving aircraft on RWY 06L-24R to exit prior to crossing RWY 06R-24L. Concept Two provides minimal increased separation between runways.

Concept Three: Shift RWY 6R-24L 100 feet south, with no runway extensions nor construction of a center parallel taxiway. High speed exit taxiways would be constructed between the two parallel runways. This concept separates the two runways by 800 feet.

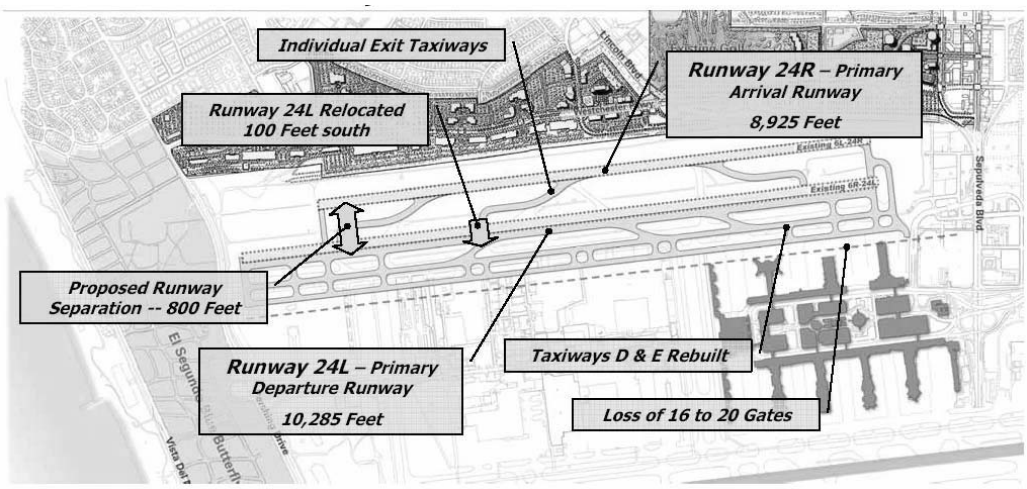

Figure 7: LAX Specific Plan Amendment Study: North Airfield Concept Three (Source: LAWA)

Concept Three results in what may be characterized as a minimal improvement over the current airfield. Concept Three results in loss of 16-20 gates in terminals 1, 2, 3, and TBIT and provides only minimal increased separation between runways.

Concept Four: Shift RWY 6L-24R 100 feet north, extend RWY 6L-24R to 10,420 feet, extend a displaced threshold to RWY 6R-24L 1,415 feet to the east, providing 11,700 feet for departing aircraft, and adding a center parallel taxiway between the runways. This concept separates the two runways by 800 feet.

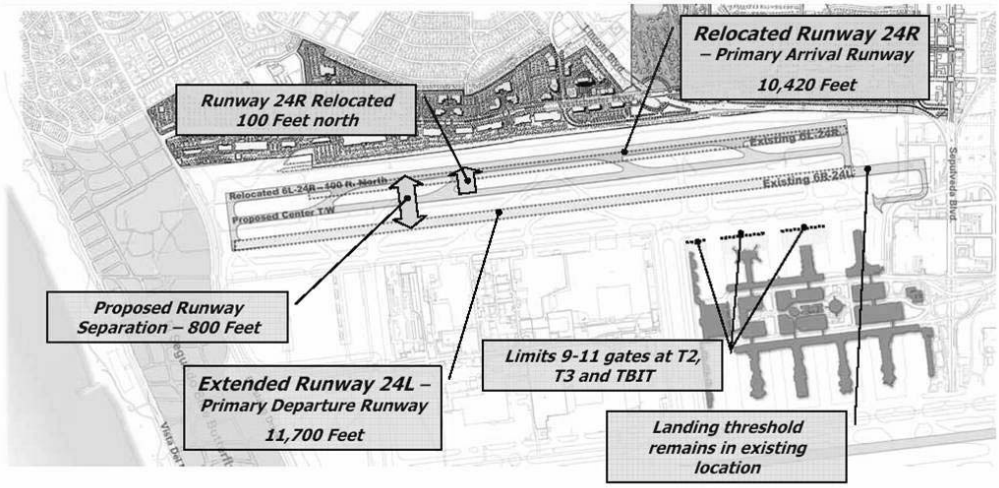

Figure 8: LAX Specific Plan Amendment Study: North Airfield Concept Four (Source: LAWA)

Concept Four allows for the preservation of the current terminal complex. It provides for a center parallel taxiway to allow arriving aircraft on RWY 6L-24R to exit prior to crossing RWY 6R-24L. Concept Four provides minimal increased separation between runways. While Concept Four does preserve the current terminal complex, expansion of Terminals 2, 3 and the TBIT is limited to maintain adequate taxi widths for ADG VI aircraft.

Minimal Change Concept: Minimally change the North Airfield, simply add a 45 degree exit taxiway to the end of existing RWY 6L-24R, and operational and technological improvements including ASDE-X surface detection equipment, runway status lights, and full air traffic control tower staffing.

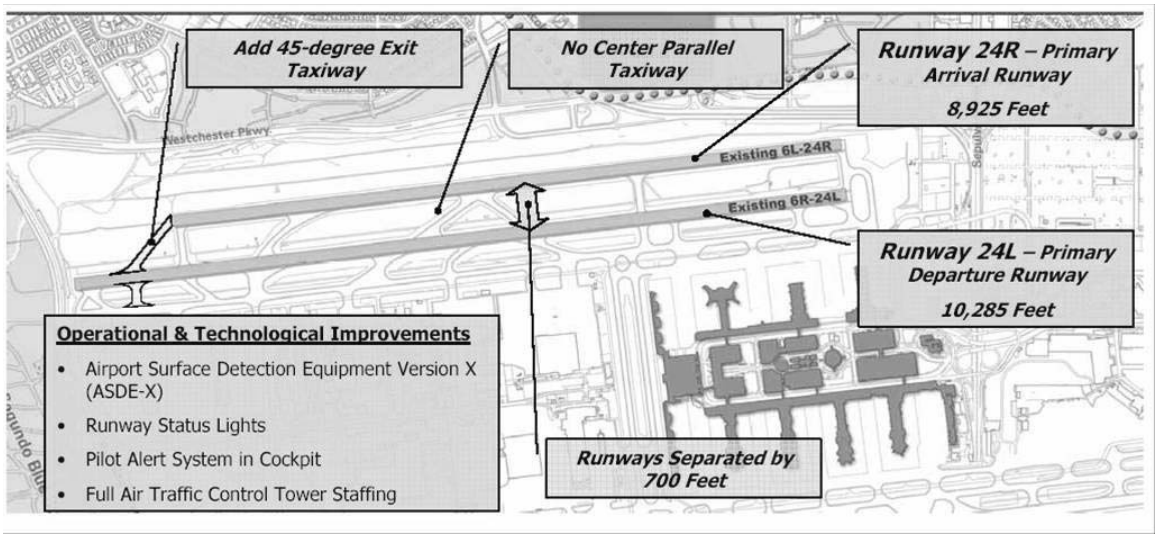

Figure 9: LAX Specific Plan Amendment Study: Minimal Change Concept (Source: LAWA)

The Minimal Change Concept provides minimal enhancement to the North Airfield. It maintains all runway lengths and runway separations. This concept does nothing to encourage more balanced operations of long-haul heavy aircraft between the North Airfield and the South Airfield. The Minimal Change Concept does not impact the terminal complex or any collateral land north of North Airfield.

Under each concept, runways stay at 150 feet in width but modifications to paved shoulder areas and movement on runway lighting and signage infrastructure are made in specific areas to accommodate ADG VI aircraft as per recent FAA approval.

Airfield Operational and Safety Considerations

Each of the above LAX North Airfield alternatives are being considered on the basis of a series of specific characteristics. Specifically, each airfield is under consideration for:

- Compatibility to accommodate very large aircraft, as defined by Aircraft Design Group (ADG) VI specifications.
- Potential to mitigate runway incursions
- Consideration of environmental impacts
- Contribution towards increasing airfield capacity and reducing operational delay
- Inclusion of new technologies

These considerations are further described below.

ADG VI Design Specifications

To accommodate a new breed of very large commercial service and cargo aircraft, the FAA has published airfield design standards to provide a safe operating environment. These design standards are known as "Aircraft Design Group (ADG) VI" design specifications. ADG VI design specifications pertain to those aircraft with wingspans of length 214 feet up to but not including 262 feet or tail heights from 66 feet up to but not including 80 feet.

The FAA requires runways designed to accommodate ADG VI aircraft to be at least 200 feet in width, with 40 foot shoulders, and a surrounding runway safety area (RSA) of 500 feet extending from the runway centerline. Taxiways designed for ADG VI aircraft are required to be at least 100 feet in width, with 40 foot shoulders, and taxiway safety areas of 262 feet from taxiway centerline, In addition, runways must be separated by parallel taxiways by at least 500 feet. Table 1 provides a comparison between ADG V and ADG VI design standards.

Table 1: Airport Design Standards for Aircraft Design Group V and VI Airfields

Design Feature	Airplane Design Group	
Runway Environment	**ADG V**	**ADG VI**
Width	150 ft	200 ft
Shoulder Width	35 ft	40 ft
Blast Pad Length	200 ft	200 ft
Blast Pad Width	220 ft	280 ft
Runway Safety Area Length	1000 ft	1000 ft
Runway Safety Area Width	500 ft	500 ft
Runway Object Free Area Length	1000 ft	1000 ft
Runway Object Free Area Width	800 ft	800 ft
Bridges and Culverts		
Maximum Taxiing Weights	877,000 lbs.	1,400,000 lbs.
Taxiway Environment		
Width	75 ft	100 ft
Shoulder Width	35 ft	40 ft
Taxiway Edge Safety Margin	15 ft	20 ft
Safety Area Width	214 ft	262 ft
Airfield Taxiway Object Free Area	320 ft	386 ft
Terminal Taxilane Object Free Area	276 ft	334 ft
Separations		
Holdline	280 ft	280 ft
Runway to Parallel Taxiway	400 ft	600 ft
Parallel Taxiways & Safety Margin	267 ft	324 ft
Parallel Taxilanes & Safety Margin	245 ft	298 ft

Source: FAA Advisory Circular 150/5300-13 *Airport Design Change 10*

Recently, the FAA has approved modifications to standards that allow for runway widths of 150 feet for ADG VI aircraft as long as modifications are made to runway shoulders, and locations of runway lighting and signage infrastructure is appropriately relocated.

The North Airfield at LAX is currently designed for ADG V aircraft, with maximum wingspans of up to but not including 214 feet and tail heights up to but not including 66 feet. As such, Runways 6L-24R and 6R-24L and associated taxiways fall below design standards for new very-large aircraft.

Alternative D of the LAX Master Plan as well as the concepts described in the LAX Specific Plan Amendment Study consider design specifications to accommodate ADG VI aircraft to varying degrees. Alternative D provides the greatest level of accommodation by widening RWY 6R-24L to 200 feet and providing a center taxiway and associated spacing in accordance with ADG VI design standards. Concepts One, Two, and Four partially accommodate ADG VI

aircraft by providing adequate taxi spacing for certain taxiing paths on the airfield and accommodate ADG VI runway operations by modifying runway lighting and signage infrastructure while maintaining a runway width of 150 feet. Concepts Three and the Minimal Change concept provide minimal accommodations to ADG VI aircraft by providing limited taxiway improvements and spacing on the airfield.

The ability to allow for balanced operations of heavy aircraft between the North and South Airfields at LAX are directly correlated to the degree of design to accommodate ADG VI aircraft on the North Airfield. As such, Table 2 summarizes the potential for each alternative to encourage a balanced use of heavy aircraft between the North and South Airfield at LAX.

Table 2: Potential to Balance Heavy Aircraft Operations

			Alternative Concepts			
Characteristic	Alternative D	Concept One	Concept Two	Concept Three	Concept Four	Minimal Change Concept
Encourages Balanced Use Between South and North Airfield for Heavy Aircraft	High	High	Medium	Low	Medium	Low

Runway Incursions

The Los Angeles World Airports Authority has in recent history ranked among the highest of the nation's commercial service airports in runway incursions, leading the nation in incursions from 2000 through 2003. Following a trend of decreasing numbers of runway incursions from 1998 through 2002, total runway incursions have steadily increased through 2006. Throughout this period, annual rate of runway incursions has minimally reduced from 1.42 incursions per 100,000 operations in 1998 to 1.37 incursions per 100,000 operations in 2006, as illustrated in Figure 10. This result implies that efforts to reduce the rate of runway incursions through policy and technology implementation are minimized without appropriate infrastructure improvements. This hypothesis is soon to be tested as improvements to the South Airfield come online.

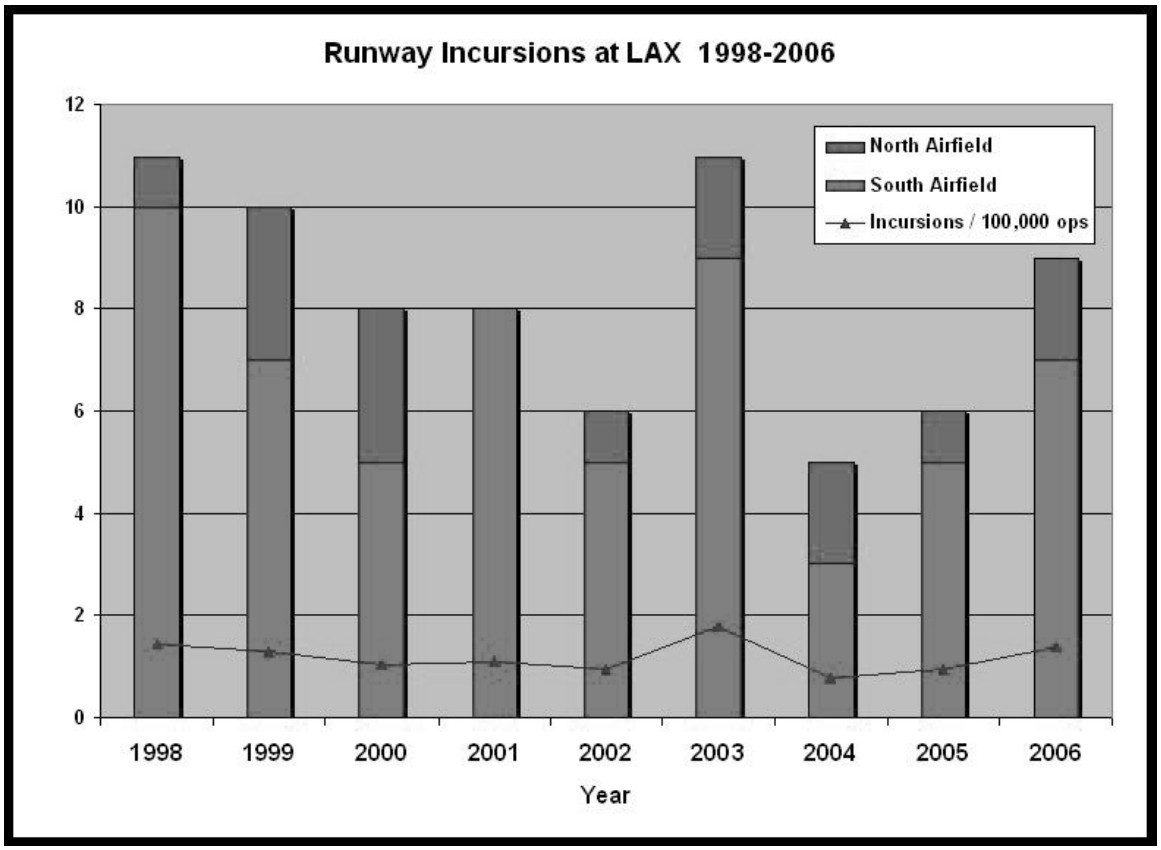

Figure 10: Runway Incursions at LAX 1998-2006 (Source Data: LAWA / FAA)

As illustrated in Figure 11, approximately 74% of runway incursions at LAX have occurred on the airport's South Airfield, the majority of which occurring on inboard RWY 7L-25R, in the area immediately south of terminal four, near the high speed exit taxiways from RWY 7R-25L. In addition, a cluster of runway incursions have occurred at the eastern end of RWY 7L-25R. Current modifications to the South Airfield are in part to mitigate the potential of future runway incursions.

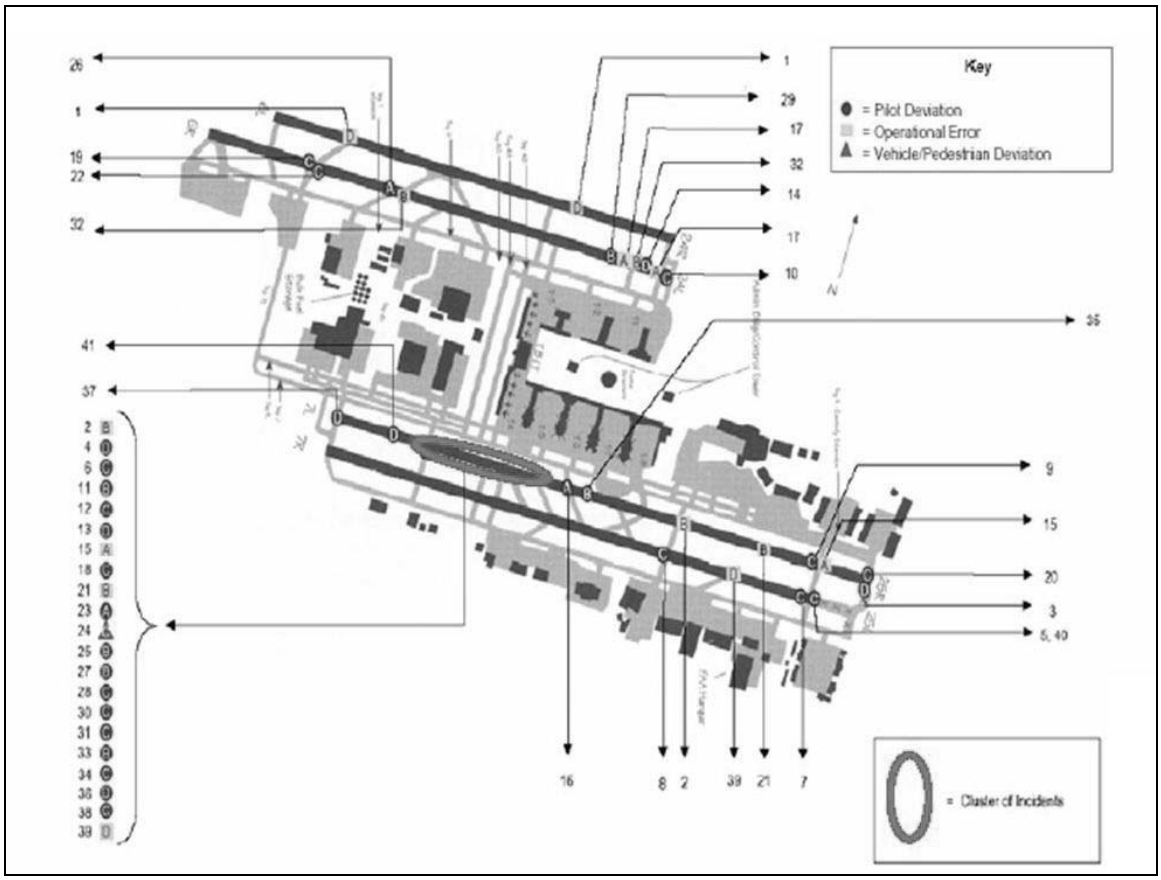

Figure 11: Location of LAX Runway Incursions 1998-2006 (Source: LAWA)

Similar to the South Airfield, on the airport's North Airfield, the locations of recent runway incursions have tended to occur in two general areas on RWY 6R-24L, specifically the east side of RWY 6R-24L and near the high speed exits from RWY 6L-24R.

The locations of incursions on the east side of RWY 6R-24L suggest incursions due to encroachment of aircraft and ground vehicles onto the runway from the adjacent ramp and taxiway system immediately north of Terminals 1, 2, and 3. These incursions occur in part due to the close proximity of the ramps, taxiways, and runway in this area. Short distances between these critical areas leave little room for error for vehicles moving within this environment. Disoriented vehicles, due to unfamiliarity of the environment, limited visibility conditions, or simply human error, have little time to correct wayward mistakes, often resulting in runway incursions. The potential for mitigating incursions in this area lie in part within increasing the distance between the terminal environment and RWY

6R-24L, as suggested in alternative Concepts One and Four. Conversely, reducing the distance between the runway and the adjacent taxiway environment will do little to mitigate the potential of runway incursions, and may be a factor in aggravating this issue.

The locations of incursions on RWY 6R-24L near the high speed exits from RWY 6L-24R suggest incursions due to the encroachment of aircraft exiting RWY 6L-24R. These incursions occur perhaps in part due the close proximity of the two closely separated parallel runways, and the fact that aircraft utilizing these high-speed exits must exit directly onto RWY 6R-24L. The potential for mitigating incursions in this area lies in part within increasing the distance between the two runways, as well as to add a center parallel taxiway. These implications are illustrated in Figure 12.

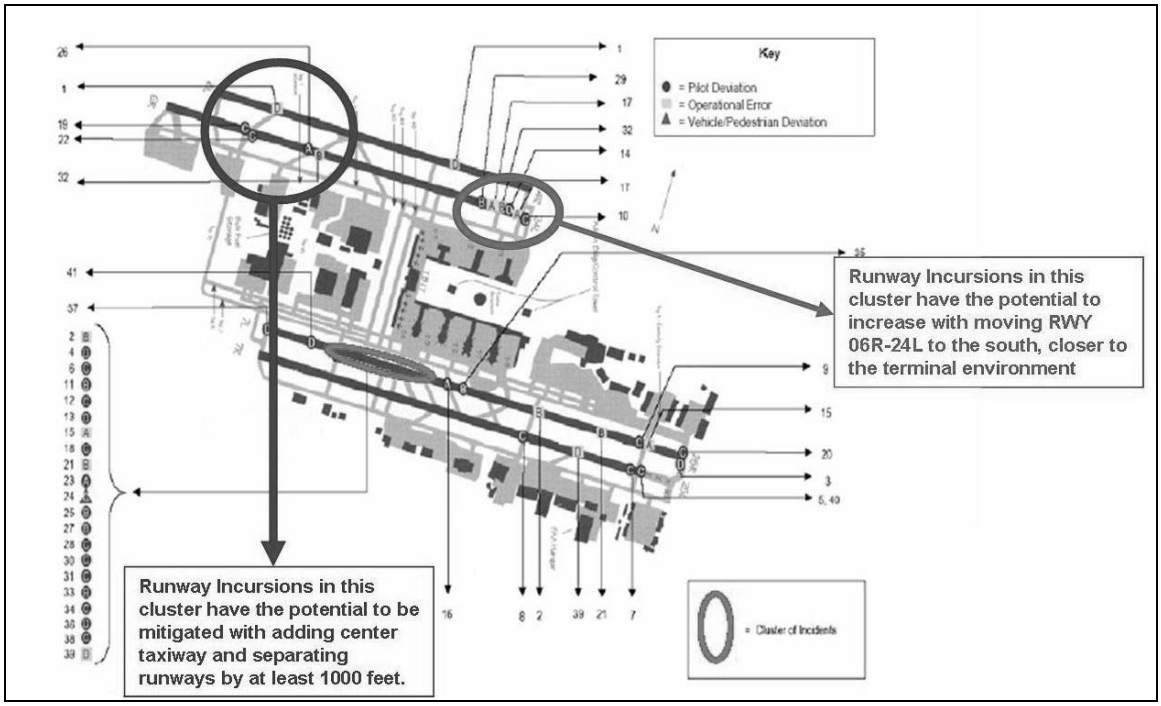

Figure 12: Potential runway incursion mitigation options

A 2002 study by NASA[3] using virtual reality simulation to evaluate how various operational alternatives could contribute to reduced runway incursions, in the absence of significant infrastructure enhancement. These alternatives included

[3] Dorighi & Rabin, NASA Ames Research Center, "NASA Uses Virtual Reality to Target Runway Incursions at LAX" Presented for the 2002 FAA Technology Transfer Conference.

"swapping" runways by using the inboard runways (6R-24L and 7L-25R) for arrivals and the outboard runways (6L-24R and 7R-25L) for departures, and employing extra air traffic controllers in the tower. The result of this study concluded that airfield safety does not improve significantly with operational improvements alone, and that only significant improvements to airfield geometry will have the greatest potential to reduce runway incursions.

Based on this analysis, Table 3 summarizes the potential of each alternative to mitigate the potential for runway incursions on the North Airfield at LAX.

Table 3: Potential to Mitigate Runway Incursions

			Alternative Concepts			
Characteristic	Alternative D	Concept One	Concept Two	Concept Three	Concept Four	Minimal Change Concept
Potential to Mitigate Runway Incursions	High	High	Medium	Low	Medium	Low

Operational Efficiency and Delay Considerations

One of the primary intentions of the LAX Master Plan has been to develop an airfield and terminal environment capable of efficiently accommodating up to 79 million annual air passengers and approximately 2,300 daily aircraft operations. To accommodate this level of demand, alternatives for airfield development focus primarily on improving the movement of aircraft on the ground through enhanced taxiways and ramp movement areas. Throughout each of the alternatives considered in the LAX Master Plan and subsequent LAX Specific Plan Amendment Study, the runway environment remains as two sets of closely separated parallel runways capable of handling ADG group V aircraft, with a portion of each airfield able to accommodate ADG group VI aircraft. As such, the differences in overall operational efficiency between each alternative is less significant than if additional runways were constructed or current closely separated runways were separated by greater than 2,500 feet.

However, there is the potential for modification of the North Airfield to provide some increases in operational efficiency. These potential effects on airfield efficiency at LAX due to modification of north airfield runways include:

Increased capacity for long-haul heavy aircraft operations as a result of the extension of runway lengths on the north airfield: Increasing runway lengths and improving associated taxiways will provide additional runway capacity for long-haul heavy ADG VI aircraft. In addition, the ability to further separate operations of ADG VI aircraft from other smaller aircraft will improve the operational efficiency of the entire airfield.

Increased airfield ground movement efficiency under alternatives that provide for a center parallel taxiway, as well as provide room for dual taxi lanes between the terminal complex and runways: Improving the taxiway and ramp environment will provide potential to remove current bottlenecks on the airfield, thereby improving overall operational efficiency. It is to be noted that some alternatives do not provide for a center taxiway, while others in fact reduce the amount of ramp and taxi lane areas near the terminals.

In some alternatives, overall operational efficiency is threatened to decrease. Specifically, modifications in gate capacity, particularly in alternatives that shift RWY 6R-24L to the south, which would result in the necessary removal of aircraft gates at Terminals 1, 2, 3 and the TBIT.

Based on this analysis, Table 4 summarizes the potential of marginal operational efficiency implications for each alternative.

Table 4: Potential to marginally increase airfield operational efficiency

			Alternative Concepts			
Characteristic	Alternative D	Concept One	Concept Two	Concept Three	Concept Four	Minimal Change Concept
Potential to marginally increase airfield efficiency	Medium	Medium	Medium	Low	Medium	Low

Environmental Considerations

Figure 13 illustrates the 1st quarter 2006 noise contours surrounding LAX. The northern edge of the 65 CNEL contour currently extends to the north of the airport to approximately 500 feet south of Manchester Avenue and west into the neighborhood of Inglewood. The current Collateral Development Area lies within the 65 CNEL contour.

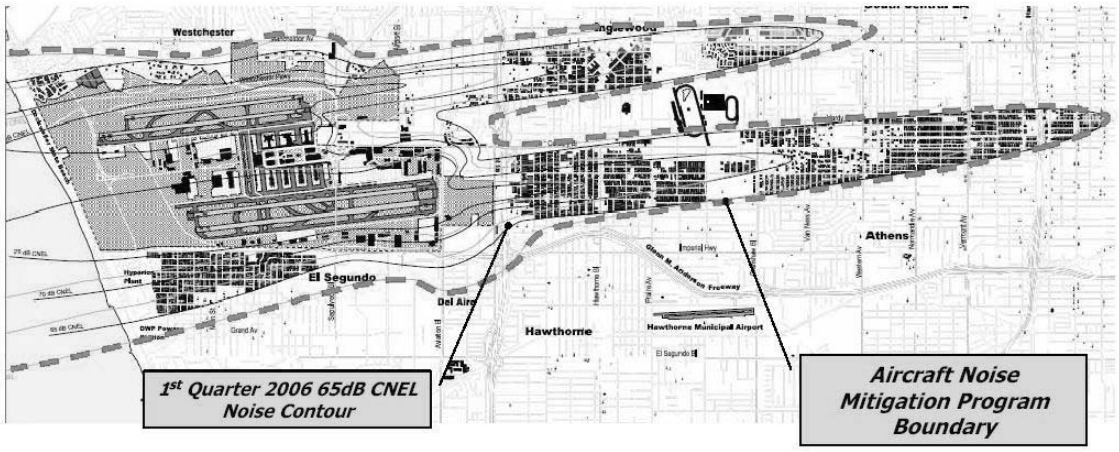

Figure 13: LAX 65 CNEL Contour Q1 2006 (Source: LAWA)

The current 65 CNEL contour also lies entirely within the current airport noise mitigation program boundary. This program boundary was defined by an historical 65 CNEL noise contour.

It is understood that, in general, modifications to airfields, particularly in the form of runway extensions and increasing lateral runway separations have the potential of reshaping noise contours to include greater areas of land, including noise sensitive areas not currently considered within a noise mitigation program boundary. This is due, in part, to the fact that such modifications not only increase the physical boundaries of the airfield, but also tend to encourage an increase in aircraft operational activity.

The various alternatives suggested for the North Airfield at LAX all have the potential to increase the volume of aircraft operations, particularly by long-haul heavy aircraft. However, while operations of long-haul heavy aircraft may increase, the overall percentage of operations on the North Airfield is projected

to remain as it is currently. Therefore, no significant increase in the size of noise contours based on increased volumes is expected, other than that would be expected from growth in aircraft operational demand regardless of any airfield enhancement. There perhaps could be a slight increase in contours based on aircraft size.

Conversely, any potential increase in noise contours may be mitigated by the introduction of quieter aircraft engine and airframe technologies. In addition, any impacts to air quality may be in part mitigated by improved engine performance technologies, as well as reduced aircraft airfield delays.

It should be noted that a more comprehensive technical analysis of potential noise impacts, employing standard accepted computer models, should be considered for each of the LAX North Airfield enhancement options, to determine a more accurate representation of future noise impacts to the surrounding land uses.

Based on this analysis, Table 5 summarizes the potential of negative environmental impacts for each alternative.

Table 5: Potential Level of Environmental Impacts

			Alternative Concepts			
Characteristic	Alternative D	Concept One	Concept Two	Concept Three	Concept Four	Minimal Change Concept
Potential of Environmental Impacts to Areas North of Airport	Low	Medium	Low	Low	Medium	Low

Technological Considerations

While it is assumed that the future of airfield operations at LAX will consider newly developed technologies to enhance the safety and efficiency of airfield operations, the Minimal Change Concept for the North Airfield in the LAX Specific Plan Amendment Study explicitly describes the use of technology as a primary dependent element in improving operations on the airfield, to the point where the concept implies that technological implementations will provide equal or better results as far as reducing runway incursions than physical infrastructure enhancement. Specifically, the implementation of *ASDE-X* airfield surface detection equipment is suggested to be the primary consideration within the minimal change concept.

Enhanced airport surface detection equipment (*ASDE*) is generally considered in the aviation industry as an emerging technology that has great potential to increase safety and efficiency of airfield usage, and, upon system maturation, will be a recommended addition to any airfield, particularly in its ability to assist air traffic controllers with identifying the movement of aircraft on the ground during low-visibility conditions and in areas on the airfield blocked by direct visual sight by buildings or other physical obstructions. As such, some form of *ASDE* should be applied regardless of the North Airfield concepts considered. Such equipment has the potential to provide added safety benefit particularly in poor visibility conditions regardless of airfield design. However, recent reports suggest that due to certain shortcomings in ASDE-X technology implementation in particular, such equipment should not be considered a sole solution.

Specifically, recent investigative reports have revealed that ASDE-X technologies fall short of accurately detecting all vehicular movement, and in particular fails to detect the movement of ground-based vehicles not equipped with the same transponder equipment found on aircraft. As ASDE-X relies primarily on transponder emitted signals to detect and determine movement, the technology will fall short in accurately detecting any motion not transponder equipped.

While additional investment in equipping ground based vehicles with transponder technology is feasible, if not cost-significant, recent studies by the Federal Aviation Administration state that equipping too many non-aircraft with such transponders could cause excessive interference with air traffic control, the primary user of transponder-based aircraft identification technology. Furthermore, the presence of other potential movements on the airfield impossible to equip with transponders, such as persons or wildlife, prevent ASDE-X and other detection technologies from being a sole solution to preventing safety threats such as runway incursions.

Summary and Conclusions

This report has presented an objective evaluation of the alternatives for North Airfield Development at LAX presented in the LAX Master Plan (Alternative D) and the LAX Specific Plan Amendment Study (Concepts One through Four and Minimal Change Concept). The evaluation considered the varying physical characteristics of each alternative, as well as their implications for accommodating long-haul heavy (ADG VI) aircraft, contributions to mitigating runway incursions, and enhancing capacity, while minimizing environmental impacts. In addition, the study considered the use of suggested technologies in each of the alternatives, with technology being the primary enhancement described in the Minimal Change Concept.

Based on the above evaluation, the results of this study reports that while each of the presented alternatives are acceptable for further study, the appropriateness of further study varies by alternative, based on their contributions to the characteristics for consideration. Specifically, this study finds that Alternative D and Concept One are most appropriate for further consideration, Concepts Two and Four are less appropriate, while Concept Three and the Minimal Change Concept are least appropriate for further consideration. These results were determined by evaluating the impacts of each alternative on the study's characteristics for consideration as found in Tables 1 through 5. It should be noted that this study does not make a preference as to which of the alternatives is preferred, but simply those which are most appropriate for further study.

Table 6 summarizes the characteristics and potential impacts of each alternative, and this study's findings of appropriateness for further consideration.

Table 4: North Airfield Alternatives Comparison Matrix

North Airfield Alternatives: Comparison Matrix						
			Alternative Concepts			
Characteristic	Alternative D	Concept One	Concept Two	Concept Three	Concept Four	Minimal Change Concept
Runway Widths to 200'	Yes	No	No	No	No	No
Departure Runway 11,500'	Yes	Yes	Yes	No	Yes	No
Arrival Runway 10,000'	Yes	Yes	No	No	Yes	No
Runway Separations 1,000'	Yes	Yes	No	No	No	No
Center Taxiway	Yes	Yes	Yes	No	Yes	No
Preserves Terminal Gates	No	Yes	No	No	Yes*	Yes
Use of collateral land**	No	Yes(1)	No	No	Yes(2)	No
Enhanced Technologies	No	No	No	No	No	Yes
Encourages Balanced Use Between South and North Airfield for Heavy Aircraft	High	High	Medium	Low	Medium	Low
Potential to Mitigate the Potential of Runway Incursions	High	High	Medium	Low	Medium	Low
Potential to marginally increase airfield efficiency	medium	Medium	medium	Low	medium	Low
Potential of Environmental Impacts to Areas North of Airport	Low	Medium	Low	Low	Medium	Low
Overall Appropriateness for Further Consideration	HIGH	HIGH	MEDIUM	LOW	MEDIUM	LOW

* However expansion of Terminals 2, 3, and TBIT is limited to maintain adequate taxi widths for ADG VI aircraft

(1) Uses all collateral land south of Westchester Parkway

(2) Uses partial collateral land up to approximately 200 feet south of Westchester Parkway

** It is understood that opinons on the appropriateness of the use of collateral land varies widely among interested parties.

It is clear that tremendous amounts of time and resources have been dedicated over a multi-year period to determine a preferred plan for the Los Angeles International Airport that accommodates the area's demand for air transportation while minimizes risks to operational safety and environmental impacts. It is hoped that this brief study will provide further focus towards determining a preferred plan for the North Airfield which meets this mission of the Los Angeles World Airports Authority.