



CHAPTER 4

AIRPORT DEVELOPMENT ALTERNATIVES

In the previous chapter, aviation facilities required to satisfy airside and landside demand through the planning period of the master plan were identified. In addition, various Federal Aviation Administration (FAA) standards that apply to airfield design were discussed. The next step in the planning process is to evaluate reasonable ways these facilities can be provided and the design standards can be met. The purpose of this chapter is to formulate and examine rational development alternatives that address the short-, intermediate-, and long-term planning horizon levels. Because there are several possibilities and combinations, it is necessary to focus on those opportunities that have the greatest potential for success. Each alternative provides a differing approach to meet existing and future facility needs, and these layouts are presented for purposes of evaluation and discussion.

Some airports become constrained due to limited availability of space, while others may be constrained due to adjacent land use development. Careful consideration should be given to the layout of future facilities and impacts to potential airfield improvements at Floyd W. Jones Lebanon Airport (LBO). Proper planning at this point in the master plan process can ensure the long-term viability of the airport for aviation and economic growth.





The primary goal of this planning process is to develop a feasible plan for meeting the needs resulting from the projected market demand over the next 20 years. The plan of action should be developed in a manner that is consistent with the future goals and objectives of the City of Lebanon, airport users, the local community, and the surrounding region, all of whom have a vested interest in the development and operation of LBO.

The master plan builds an underlying rationale which supports the final recommended concept. Through this process, an evaluation of the highest and best uses of airport property will be made, while also weighing local development goals, efficiency, physical and environmental factors, capacity, and appropriate safety design standards.

The alternatives presented in this chapter have been formulated as potential means to meet the overall program objectives for the airport in a balanced manner. Through coordination with the City of Lebanon, airport management, the Airport Advisory Board, the Missouri Department of Transportation (MoDOT) Multimodal Operations – Aviation Section, and the public, an alternative (or combination thereof) will be refined and modified as necessary into a recommended development concept. Therefore, the planning considerations and alternatives presented in this chapter can be considered a starting point in the evolution of a recommended concept for the future of LBO.

REVIEW OF PREVIOUS AIRPORT PLANS

The previous master plan for LBO was updated in 2003, and the Airport Layout Plan (ALP) was most recently updated in 2006. The existing Airport Layout Drawing (ALD) is shown on **Exhibit 4A**. The ALD graphically depicts airside and landside recommendations based on previous airport planning, including:

- Shifting the existing runway 645 feet to the south.
- Extending Runway 18-36 1,500 feet to the south for an ultimate length of 6,500 feet.
- Installing PAPI-4s and REILs to both runway ends.
- Hangar development along east end of airfield.

The analysis presented in this chapter will revisit elements presented on the ALD and in the previous master plan. Since completion of the last plan, the FAA has made significant modifications to the design standards as outlined in the previous chapter. As such, some elements of the previous plan may carry over to this master plan, others may be changed or removed from further consideration, while others have already been implemented, such as the upgraded visual approach aids (PAPI-4s and REILs).

NO ACTION/NON-DEVELOPMENT ALTERNATIVE

The City of Lebanon is charged with managing the airport for the economic benefit of the community and region. In some cases, alternatives may include a “no action” option; however, for LBO, this would effectively reduce the quality of services being provided to the public, affect the aviation facility’s ability to meet FAA design standards, and affect the region’s ability to support aviation needs. The ramifications of a no-action alternative extend into impacts on the economic well-being of the region. **An analysis of the economic benefit of the airport, completed in 2012, found that LBO generates approximately \$2.3**



RUNWAY	EXISTING				ULTIMATE			
	TORA	ASDA	LDA	RDZ	TORA	ASDA	LDA	RDZ
18	5,000'	5,000'	5,000'	5,000'	18	6,500'	6,500'	6,250'
36	5,000'	5,000'	5,000'	5,000'	36	6,500'	6,500'	6,500'

DECLARED DISTANCE INFORMATION OBTAINED FROM THE AERONAUTICAL DATA SHEET (11/05/99). DECLARED DISTANCES IN ACCORDANCE WITH AC 150/5300-13, CHANGE #9.

- ### GENERAL NOTES
- THIS AIRPORT LAYOUT DRAWING REFLECTS "AS BUILT" CONDITIONS FOLLOWING THE CONSTRUCTION OF THE RUNWAY 18-36 FULL-PARALLEL TAXIWAY (TAXIWAY "B") AND CONNECTORS.
 - NO FUTURE OBSTRUCTIONS:
NO FUTURE OBSTACLE FREE ZONE (OFZ) OBJECT PENETRATIONS
NO FUTURE THRESHOLD SITING SURFACE (TSS) OBJECT PENETRATIONS
 - SURVEYED ELEVATIONS ARE SHOWN TO ONE-TENTH FOOT ACCURACY (0.0'). NON-SURVEYED INFORMATION SHOWN TO THE NEAREST FOOT.
 - DURING EXTENSION OF RUNWAY 18-36 AND/OR PARALLEL TAXIWAY, ALL TREES/BURSH SHOULD BE REMOVED FROM THE RUNWAY AND TAXIWAY SAFETY AREAS. ANY TREES FOUND TO PENETRATE THE EXISTING/ULTIMATE FAR PART 77 (PRIMARY, TRANSITIONAL AND APPROACH) SURFACE SHOULD BE TOPPED/REMOVED.
 - HANGAR ON NORTH END OF AIRPORT IS CURRENTLY A VIOLATION TO THE EXISTING TRANSITIONAL SURFACE FOLLOWING THE RELOCATION OF THE RUNWAY 18 THRESHOLD, THE HANGAR IN QUESTION WILL NO LONGER BE A VIOLATION TO THE FAR PART 77 AIRSPACE.
 - RECOMMEND REMOVAL OF UNUSED TAXIWAY PAVEMENT FOLLOWING CONSTRUCTION OF NEW TAXIWAY AND CONNECTORS.
 - APPROXIMATELY 500 FEET OF THE EXISTING AND PROPOSED TAXIWAY IS SITUATED 4 FEET ABOVE THE EXISTING RUNWAY 18-36. A NOTICE OF AIRSPACE DETERMINATION (AIRSPACE CASE NO. 2003-ACE-130-NRA) WAS COMPLETED AND DETERMINED THAT THE TAXIWAY WOULD NOT EXCEED FEDERAL AVIATION ADMINISTRATION (FAA) OBSTRUCTION STANDARDS AND WOULD NOT BE A HAZARD TO AIR NAVIGATION.
 - IT IS RECOMMENDED THAT THE CITY OF LEBANON PURCHASE THE ENTIRE RUNWAY 18 RPZ, INCLUDING EXISTING IMPROVEMENTS, IN FEE SIMPLE AS IT BECOMES AVAILABLE.

	EXISTING	ULTIMATE
AIRPORT REFERENCE POINT	NORTH LATITUDE 37° 38' 53.0"	37° 38' 40.1"
COORDINATES	WEST LONGITUDE 92° 39' 08.8"	92° 39' 09.3"
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH	89° F (JULY)	89° F (JULY)
AIRPORT ELEVATION - MEAN SEA LEVEL (MSL)	1,320.5'	1,318.1'
AIRPORT ELECTRONIC NAVIGATIONAL AIDS	LOC/NDB/GPS/DME	LOC/NDB/GPS/DME
AIRPORT REFERENCE CODE (ARC)/NPAS ROLE	B-II	C-II
TAXIWAY LIGHTING	MARKERS	MILT/MARKERS

AIRPORT REFERENCE POINT COORDINATES REFLECT THE LORAN C PROGRAM SURVEY (11/05/99) FROM THE AERONAUTICAL DATA SHEET, IN NORTH AMERICAN DATUM (NAD83).
ULTIMATE ARP COORDINATES REFLECT GE083A GEODETIC CALCULATION PROGRAM IN NORTH AMERICAN DATUM (NAD83).

RUNWAY END	LAT/LONG	EXISTING	ULTIMATE
RUNWAY 18	NORTH LATITUDE	37° 39' 18.66"	37° 39' 12.24"
	WEST LONGITUDE	92° 39' 07.83"	92° 39' 08.07"
RUNWAY 36	NORTH LATITUDE	37° 38' 29.28"	37° 38' 08.01"
	WEST LONGITUDE	92° 39' 09.68"	92° 39' 10.48"

EXISTING RUNWAY END COORDINATES REFLECT THE LORAN C PROGRAM SURVEY (11/05/99) FROM THE AERONAUTICAL DATA SHEET, AND ULTIMATE RUNWAY END COORDINATES REFLECT GE083A GEODETIC CALCULATION PROGRAM, IN NORTH AMERICAN DATUM (NAD83).

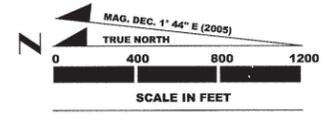
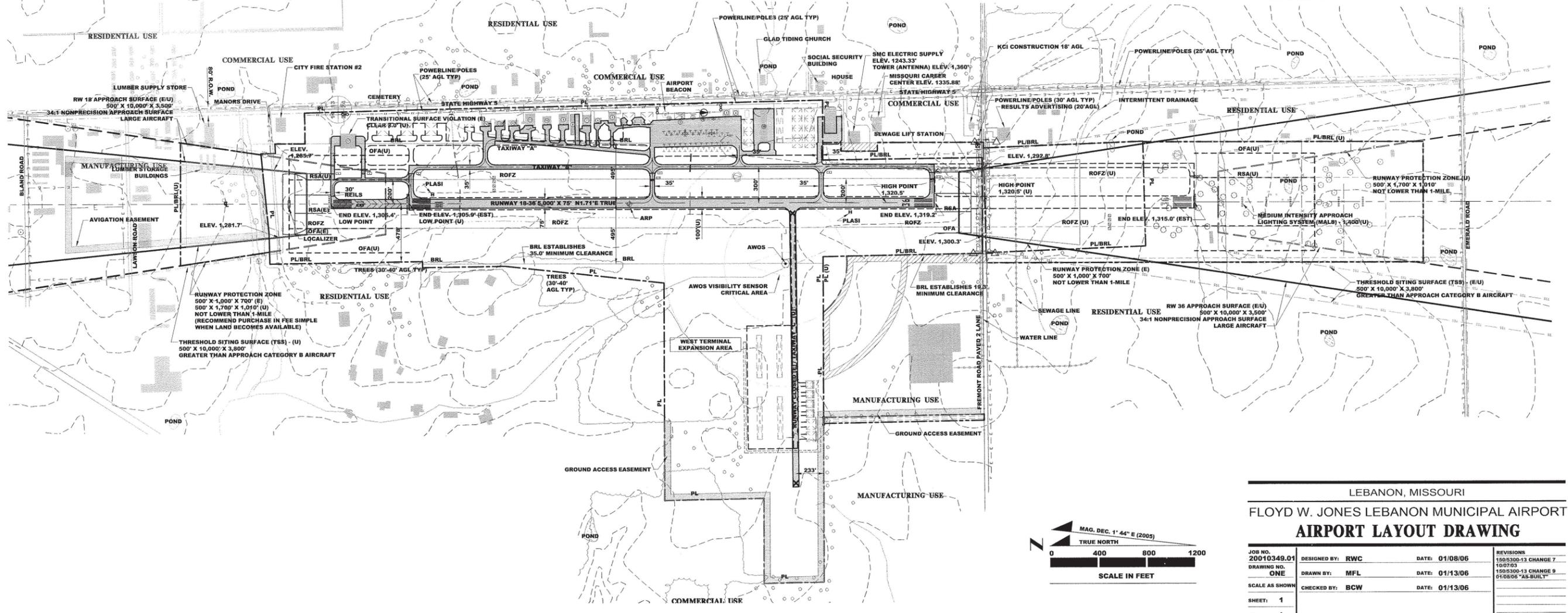
"NONE REQUIRED"

	RUNWAY 18-36	
	EXISTING	ULTIMATE
APPROACH CATEGORY/DESIGN GROUP	B-II	C-II
RUNWAY LENGTH/WIDTH	5,000' X 75'	6,500' X 100'
RUNWAY LIGHTING	MIRL	MIRL
RUNWAY TYPE/MARKINGS	NPI	NPI
EFFECTIVE RUNWAY GRADIENT (%)	0.3%	N/A
PAVEMENT MATERIAL	ASPHALT	ASPHALT
PAVEMENT STRENGTH (000 LBS)	33.0 (S)/54.0 (D)	60.0 (D)
RUNWAY SAFETY AREA (RSA) LENGTH	5,600'	6,500'
RUNWAY SAFETY AREA (RSA) WIDTH	150'	400'
OBJECT FREE AREA (OFA) LENGTH	5,000'	800'
OBJECT FREE AREA (OFA) WIDTH	500'	800'
OBSTACLE FREE ZONE (OFZ) LENGTH	400'	6,900'
OBSTACLE FREE ZONE (OFZ) WIDTH	400'	400'
HOLDING POSITION	125' (NSTD)	250'
TAXIWAY WIDTH	33'40"	35'

	18	36	18	36
INSTRUMENT APPROACH AIDS	GPS	LOC/NDB/GPS/DME	GPS	LOC/NDB/GPS/DME
VISUAL APPROACH AIDS	PLASIREIL	PLASIREIL	PAPI(4L)REIL	PAPI(4L)MALS
RUNWAY VISIBILITY MINIMUMS	1-MILE	1-MILE	1-MILE	1-MILE
FAR PART-77 APPROACH SLOPE	34:1	34:1	34:1	34:1
TOUCHDOWN ZONE ELEVATION (TDZE)	1,315.9'	1,320.5'	1,317.0'(EST.)	1,318.1'(EST.)

(S)-SINGLE WHEEL GEAR (D)-DUAL WHEEL GEAR
RUNWAY END AND TOUCHDOWN ZONE ELEVATIONS REFLECT AERONAUTICAL DATA SHEET (11/05/99).
* FAA/STATE ELIGIBLE RUNWAY

EXISTING	ULTIMATE	LEGEND
---	---	FACILITIES
---	---	BUILDINGS/STRUCTURES
---	---	AIRPORT PROPERTY LINE
---	---	NON-AIRPORT PROPERTY BOUNDARIES
---	---	AVIATION EASEMENTS
---	---	BUILDING RESTRICTION LINE (BRL)
---	---	RUNWAY SAFETY AREA (RSA)/OBJECT FREE AREA (OFA)
---	---	RUNWAY PROTECTION ZONE (RPZ)
---	---	OBSTACLE FREE ZONE (OFZ)
---	---	AIRPORT REFERENCE POINT (ARP)
---	---	BENCHMARK
---	---	ROTATING BEACON
---	---	PRECISION APPROACH PATH INDICATORS (PAPI)
---	---	PULSATING VISUAL APPROACH SLOPE INDICATORS (PLAS)
---	---	GUIDANCE/DIRECTIONAL/HOLD POSITION SIGN
---	---	HOLD POSITION MARKING
---	---	WIND CONE & SEGMENTED CIRCLE
---	---	RUNWAY THRESHOLD LIGHTS
---	---	RUNWAY END IDENTIFIER LIGHTS (REIL)
---	---	GROUND CONTOUR (USGS MAP)
---	---	FENCING
---	---	PAVED DIRT ROAD
---	---	CREEK/INTERMITTENT DRAINAGE
---	---	POWERLINES/POLES
---	---	TREES/WOODED AREA
---	---	AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)
---	---	ABOVE GROUND OIL/GAS WELL/PUMP STATION
---	---	STORM SEWER/DRAINAGE INLET SYSTEM
---	---	ROAD CLOSURE BARRICADES
---	---	AUTO ACCESS GATE
---	---	WATER LINE
---	---	SEWAGE LINE
---	---	LOCALIZER ANTENNA
---	---	MEDIUM INTENSITY APPROACH LIGHTING SYSTEM (MALS)
---	---	POND/BODY OF WATER
---	---	SECTION CORNER



LEBANON, MISSOURI			
FLOYD W. JONES LEBANON MUNICIPAL AIRPORT			
AIRPORT LAYOUT DRAWING			
JOB NO. 20010349.01	DESIGNED BY: RWC	DATE: 01/08/06	REVISIONS
DRAWING NO. ONE	DRAWN BY: MFL	DATE: 01/13/06	150/5300-13 CHANGE 7 10/07/03
SCALE AS SHOWN	CHECKED BY: BCW	DATE: 01/13/06	150/5300-13 CHANGE 9 01/08/06 "AS-BUILT"
SHEET: 1			
OF 1			

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million in annual economic impact and supports 27 jobs. If facilities are not maintained and improved so the airport can provide a pleasant experience for both leisure and business travelers, or if delays become unacceptable or aircraft storage is not available, aviation activities and business may shift elsewhere. The no-action alternative is also inconsistent with the long-term goals of both the FAA and MoDOT, which is to enhance local and interstate commerce. Therefore, a non-action alternative is not considered further in this master plan.

The purpose of this master plan is to examine aviation needs at LBO over the course of the next 20 years. Therefore, this master plan will examine the needs of the existing airport and present a program of needed capital improvement projects to cover the scope of the plan. The airport is a transportation facility and economic asset for the region. It can accommodate existing and future demand and should be developed accordingly in order to support the interests of residents and businesses which rely on it. Ultimately, the final decision regarding development rests with the City of Lebanon, MoDOT, and the FAA on an individual project basis. The analysis to follow considers airside and landside development alternatives that include an array of facility demands, including safety, capacity, access, and efficiency.

AIRSIDE ALTERNATIVES

Development alternatives are categorized into two functional areas: airside and landside. The airside alternatives are related to runways, taxiways, navigational aids, lighting and marking aids, etc., which require the greatest commitment of land area to meet the physical layout of an airport, as well as the required airfield safety standards. The design of the airfield also defines minimum set-back distances from the runway and object clearance standards. These criteria are defined first to ensure the fundamental needs of LBO are met. The landside alternatives are related to terminal services, hangars, aircraft parking aprons, as well as utilization of remaining property to provide revenue support for the airport and to benefit the economic development and well-being of the region. This section focuses on the airside facilities.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas must be examined individually, and then as a whole, to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors must be evaluated to determine if the investment in LBO will meet the needs of the surrounding area, both during and beyond the planning period of this master plan.

AIRSIDE PLANNING CONSIDERATIONS

Table 4A presents a summary of the primary planning considerations related to the airside alternatives analysis. Landside planning considerations are outlined later in the chapter. These considerations are the result of the findings of the aviation demand forecasts and facility requirements evaluations, as well as input from LBO management, the Airport Advisory Board, and the public. In addition to these considerations, the runway should continue to meet applicable Runway Design Code (RDC) standards.¹ Runway 18-36 is planned to meet RDC B-II-4000 standards.

¹ Applicable RDC standards are described in detail in Chapter 3: Facility Requirements.



TABLE 4A Airfield Planning Considerations			
#	Non-Standard/Deficient Condition	Applicable Design Standard	Proposed Action(s) to be Evaluated
1	Runway 18-36, at 5,000 feet long, is deficient in length to safely serve most business jet aircraft.	FAA AC 150/5325-4B, <i>Runway Length Requirements for Airfield Design</i> , Chapter 3.	Extend Runway 18-36.
2	Taxiways provide direct access from apron areas to the runways.	FAA AC 150/5300-13B, <i>Airport Design</i> , Paragraph 4.3.5.	Offset connecting taxiways to force pilots to make turns prior to entering a runway.
3	Northern section of parallel taxiway is 200 feet from the runway centerline and does not meet FAA taxiway-runway separation standard of 240 feet.	FAA AC 150/5300-13B, <i>Airport Design</i> , Paragraph 3.17, and Appendix G.	Shift non-standard pavement to follow existing correct parallel surface.

Source: Coffman Associates analysis

Consideration #1 – Runway Length

The runway at LBO, Runway 18-36, is currently 5,000 feet long and 75 feet wide. The existing width meets RDC B-II-4000 standards; however, the length is insufficient to safely accommodate most turbine powered aircraft, particularly during hot weather conditions and/or when aircraft operate with heavier loads. The current ALP for LBO includes shifting the runway 645 feet south and extending for a full-length of 6,500 feet. Analysis conducted in the previous chapter, however, found that an extension of just 900 feet to an ultimate length of **5,900 feet** would be sufficient in accommodating an increase in jet activity at the airport, including the Cessna Citation CJ1 and the Dassault Falcon 900EX. The Hawker 800XP, which is the established critical design aircraft, would be able to take off with up to 90 percent useful load during the hottest periods of the summer, as well as increase utility for landing operations. Constraints in the form of Fremont Road to the south and Manors Drive to the north provide challenges to any runway extensions. Different extension options, as well as mitigation strategies for these roadways and adjacent land use developments, will be explored in this chapter.

Consideration #2 – Direct-Access Points

FAA taxiway geometry standards recommend offsetting taxiway connections between aprons and runways to avoid the potential of pilots unfamiliar with the airport layout unintentionally taxiing directly onto a runway inadvertently, resulting in a runway incursion. Certain taxiways provide direct access to the runway from their respective apron areas and are, therefore, a non-standard design (**Figure 4A**). The airfield alternatives present options for eliminating the direct-access points and forcing pilots to make turns, which increases a pilot’s situational awareness and reduces the likelihood of a runway incursion.

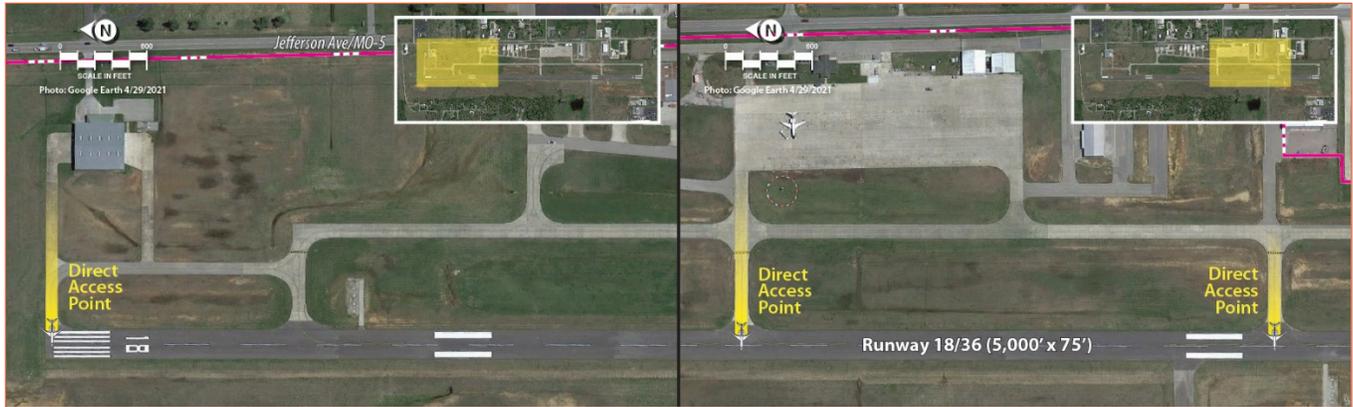


Figure 4A: Direct Access Points

Consideration #3 – Runway/Taxiway Separation

The separation between runways and taxiways is determined by the RDC and provides a margin for safety when aircraft are operating simultaneously on the runway and an adjacent taxiway. The existing parallel taxiway that serves Runway 18-36 is located 300 feet from the runway, measured from runway centerline to taxiway centerline, exceeding the 240-foot standard for B-II-4000 runways. However, the northernmost section of the taxiway shifts closer and is located only 200 feet from the runway. This non-standard condition should be corrected by relocating so it is in-line with the rest of the parallel taxiway surface in each alternative presented.

AIRSIDE ALTERNATIVE 1

Depicted on **Exhibit 4B**, the first airside alternative considers a split runway extension to the north and south. In this case, the 900 feet of new surface includes 100 feet to the north and 800 feet to the south for a total runway surface length of 5,900 feet. While the 100-foot extension to the north does not require the closure/reroute of Manors Drive, it does shift the RPZ further over incompatible land uses. In order to avoid additional incompatible areas, the Runway 18 instrument approach remains at 1-mile in this alternative. The existing Runway 18 RPZ is protected by an aviation easement, but any adjustment to the location and/or size of the RPZ would extend beyond the established easement. This would prompt the airport to obtain additional easements or physically acquire the property.

The 800-foot extension to the south is accompanied by a shift of the PAPI-4 assembly approximately 600 feet to the south to maintain the standard of keeping the visual approach aid 1,000 feet from a runway threshold. This alternative maintains the 1-mile instrument approach on Runway 36, also, so as to avoid displacing homes to the south of the airfield. However, due to the extension, Fremont Road would have to be rerouted along the southern border of the airport property. Non-standard taxiway conditions are also corrected in this alternative, as well as the addition of an Aircraft Design Code Group II sized holding apron at the Runway 36 provides for three separate runup/hold positions for aircraft. A bypass taxiway at Runway 18 provides an alternative entry point for aircraft looking to depart the airport on Runway 18. The extension of the runway will cause the Runway 36 RPZ to also be relocated, some of which would be beyond airport property. Approximately 4.1 acres of land would need to be acquired or easements established.



AIRSIDE ALTERNATIVE 2

Airside Alternative 2, shown in the center panel of **Exhibit 4B**, presents the same 900-foot runway extension from the previous alternative, but with the entire extension to the south. As in Airside Alternative 1, a 1-mile instrument approach is maintained for Runway 18; essentially the north end of the runway is unchanged. The PAPI-4 approach aid for Runway 36 is shifted 700 feet south to accommodate for the longer runway. In order to avoid closing and rerouting Fremont Road, a tunnel beneath the extension is proposed. The immediate strip of the road is between 15 to 27 feet below the runway grade. It is possible to plan for a grading and tunnel project that would allow the passage of vehicles below the runway and airport property.

The instrument approach for Runway 36 is shown in this alternative to be the recommended $\frac{3}{4}$ -mile approach. Approximately 34.6 acres of land beneath the RPZ would either have to be purchased or an aviation easement obtained to maintain control over the property beneath the RPZ. The larger RPZ does introduce some incompatible land uses within its footprint, specifically residential properties. Mitigation strategies would have to be evaluated and approved by the FAA, including keeping the houses within the RPZ or purchase and relocation of the residential properties. The holding apron from Airside Alternative 1 is used on both runway ends in this alternative as shown on the exhibit.

AIRSIDE ALTERNATIVE 3

The third airside alternative, which is presented on the lower panel of **Exhibit 4B**, introduces the concept of declared distances. Applying declared distances to a runway is an option to resolve any non-standard safety areas, such as incompatible land uses within an RPZ. Declared distances allow for modification to landing and departure surfaces without changing the physical dimensions of the surface; instead, they apply a set of published lengths that flight crews adhere to when operating on applicable runways. The distances are:

- **Takeoff Run Available (TORA):** The runway length declared available and suitable for the ground roll of a departing aircraft.
- **Takeoff Distance Available (TODA):** The TORA plus the length of any remaining runway and/or stopway beyond the far end of the TODA.
- **Accelerate-Stop Distance Available (ASDA):** The runway plus any stopway length declared available for the acceleration and deceleration of an aircraft that is aborting a takeoff.
- **Landing Distance Available (LDA):** The runway length declared available and suitable for landing.

Airside Alternative 3 applies declared distances as a method to establish a $\frac{3}{4}$ -mile instrument approach procedure on Runway 18, including a 1,000-foot displaced threshold, in order to minimize the impact on incompatible land uses within the RPZ. With this adjustment, only Manors Drive and the fire station adjacent to the airport would fall within the RPZ. The displaced threshold does, however, reduce the landing length available when landing on Runway 18. To counter this effect, the runway is extended 1,400 feet to the south, for an ultimate runway length of 6,400 feet. Therefore, the LDA for Runway 18 is 5,400 feet. However, the additional runway length does provide for additional takeoff distances in both directions, as well as landing length when using Runway 36.



ALTERNATIVE 1/RDC: B-II-5000



ALTERNATIVE 2/RDC: B-II-4000

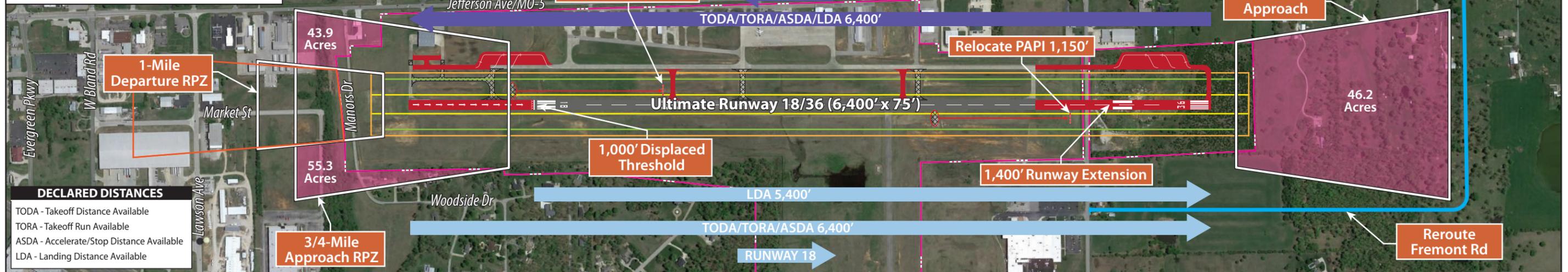


LEGEND

	Airport Property Line		Pavement to be Removed
	Runway Safety Area (RSA)		Ultimate Roads
	Runway Object Free Area (ROFA)		Acquire/Obtain Easement
	Runway Obstacle Free Zone (ROFZ)		Avigation Easement
	Runway Protection Zone (RPZ)		



ALTERNATIVE 3/RDC: B-II-4000



DECLARED DISTANCES

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

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The increased takeoff runway lengths allow for the maximum use of the Hawker 800XP, as well as the Citation CJ1 and Dassault Falcon 900EX, two popular business jets that have increased use of the airport in the past few years. For landing operations, the 5,400-foot declared distance applied to Runway 18 would limit the Hawker 800XP during wet runway conditions, as well as the Citation CJ1 and the Falcon 900EX. The Runway 36 landing distance of 6,400 feet, however, would provide additional wet runway operations to Hawker, Citation, and Falcon, as well as several other common business jets. Even larger aircraft, such as the Global 5000 and Falcon 7X would be unrestricted on both wet and dry landing conditions. Ultimately, the additional runway length provides a marginal increase in operational capabilities at the airport. The primary purpose of declared distances is to alleviate non-standard conditions, such as incompatible land use within an RPZ, rather than provide an increased operational capacity.

A $\frac{3}{4}$ -mile instrument approach for Runway 36 is presented in this alternative, as well, and would require approximately 46.2 acres of either aviation easements or property acquisition to maintain control over the area and prevent future incompatibilities. This includes three residential properties that may have to be relocated. The PAPI-4 is shifted 1,200 feet south to align with the extended pavement. Fremont Road is rerouted to the south to avoid conflict with the extension. The holding bays proposed in the previous alternative are carried forward to this option, with the southern bay shifted further south in conjunction with the extended taxiway and runway.

AIRFIELD SUMMARY

The section above outlined planning considerations for LBO and three alternatives designed to address them. The primary issues include extending a runway currently restricted by roadways on both ends, as well as some non-standard geometry. While extending a runway seems simple enough, it is crucial to consider any consequences with changing local roads and land uses, as well as impacts to existing residential and commercial properties. For this reason, it is important that the Advisory Board, airport/city management, and the public offer their feedback so that the best course of action is selected.

LANDSIDE ALTERNATIVES

Landside issues are related to those facilities necessary or desired for the safe and efficient parking and storage of aircraft, movement of pilots and passengers to and from aircraft, airport support facilities, and overall revenue support functions. To maximize airport efficiency, it is important to locate facilities together that are intended to serve similar functions. The best approach to landside facility planning is to consider the development to be like that of a community where land use planning is the guide. For airports, the land use guide in the terminal area should generally be dictated by aviation activity levels. Consideration will also be given to non-aviation uses that can provide additional revenue support to the airport and support economic development for the region.



LANDSIDE CONSIDERATIONS

Landside planning considerations, summarized in **Table 4B**, will focus on strategies to improve efficiency and separate activity levels, as well as improve user services and experience. Landside facility development at LBO is exclusively on the east side of the airport and includes a terminal building, aprons, and a variety of hangars. There is considerable land on the west side of airport property where a crosswind runway has been abandoned. Each of these areas will be addressed in the landside alternatives below.

TABLE 4B Landside Planning Considerations			
#	Landside Component	Existing Capacity/Condition	Consideration
1	Terminal Service	Terminal size of approx. 2,660 sf	Consider expansion of terminal with additional FBO/GA amenities to accommodate future demand.
2	Hangars	64,650 sf (T-hangars, executive, and conventional hangars)	Increase total capacity to at least 94,000 sf, with additional hangars of all types.
3	Vehicle Parking	Approximately 26 total parking spaces, 15 at the terminal	Increase total vehicle parking to at least 52 spaces, including 34 at the terminal and dedicated parking at hangar facilities.
4	Land Use	Approx. 45 acres of undeveloped land at the west end of airport property.	Consider non-aeronautical uses for land not planned for aeronautical uses.

Source: Coffman Associates analysis

Consideration #1 – Terminal Services

Operations at LBO are projected to continue to increase over the course of the next 20 years. As operations grow, so will the need for more terminal service space, which includes passenger and pilot lounges, flight planning equipment, concessions, and storage space. The existing terminal building, housing both FBO spaces and airport management offices, will become undersized and outdated over time. For the airport to attract new high-end clientele, consideration should be given to expanding and modernizing the existing terminal building with all appropriate amenities to provide a first-class aviation experience. The airport and its terminal services are an important link to the entire region, whether it is for business or pleasure. Consideration to aesthetics should be given a high priority in all public areas, as the terminal will serve as the first impression a visitor may have of the community.

Consideration #2 – Hangars

In the previous chapter, it was determined that there is a need for additional hangar space through the next 20 years. Although the majority of that demand involves T-hangar development for smaller aircraft, all types of hangar sizes should be planned through the planning period, including T-hangars, executive/box hangars, and large-span conventional hangars. This will ensure that there will be ample parking for all types of aircraft that the airport serves, as well as providing space for additional aviation specialty businesses, such as flight schools and maintenance facilities, to operate.



Consideration #3 – Vehicle Parking

Vehicle parking at the airport is limited in its current capacity. There are only 15 parking spaces at the terminal building, including those used by employees, and there are no dedicated parking areas for any other general aviation facilities. While pilots do park their vehicles in/around their hangars, this provides an increased chance of an accident on an aircraft movement area. It is recommended that automobiles and airplanes are kept separate; options to expand vehicle parking at the airport are presented in the alternatives.

Consideration #4 – Land Use and Development

The landside alternatives present development and redevelopment areas on the airport for aviation related and non-aviation related uses, considering highest and best use potential. Aeronautical-related uses are typically reserved for property with direct access to the airfield. For property that is segregated from the airfield, an airport should consider non-aeronautical related development. The FAA typically requires airports to receive approval through a land-use release to lease airport-owned land for non-aeronautical related purposes. The FAA stipulates that all land with reasonable airside access should be used or reserved for aeronautical purposes.

An area of focus at LBO is the westerly extension of the airport property, following the abandoned crosswind runway. This area, although technically providing airside access, may be planned for non-aviation uses or even sold to the city. Airport land that was acquired with federal funds is obligated for airport purposes in perpetuity. If the federally acquired land is no longer necessary for airport purposes, it may be released from obligation and used for other, non-aeronautical purposes, if agreed upon by the federal government (FAA). In some cases, airport land may be sold, with the revenue returning to the airport or the federal government.

LANDSIDE ALTERNATIVES

The following section describes the landside alternatives as they relate to considerations detailed above. Variations of hangar developments and land uses are presented to help visualize what future facility developments could look like. The alternatives provide potential development plans aimed at meeting the needs of general aviation through the 20-year planning period and beyond.

On each landside alternative, consideration is given to the FAA-required Building Restriction Line (BRL). The BRL is the Part 77 transitional surface at an airport and provides guidance on the height of structures relative to the distance from the runway centerline and the instrument approach visibility minimums established at the airport. The BRL is derived from a formula that uses the lowest available instrument approach minimum and the desired building height; often, a 25-foot height is utilized. The standard sets a location to which structures within the BRL should not exceed the allowable height of the BRL at that location. Currently, the airport has a 1-mile approach as its lowest visibility minimum; a 25-foot BRL is set 425 feet from the runway centerline. No building closer than 425 feet should exceed 25 feet. If an instrument approach is established with a $\frac{3}{4}$ -mile or lower visibility minimum, then the 25-foot BRL



would be located 675 feet from the runway centerline. Each landside alternative displays both BRLs for comparison purposes. It should be noted that a structure can exceed the BRL height, so long as proper mitigation steps are employed, such as the use of an obstruction light.

The alternatives to be presented are not the only reasonable options for development. In some cases, a part of one alternative could be intermixed with another. Also, some development concepts could be replaced with others. The overall intent of this exercise is to outline basic development concepts to spur collaboration for a final recommended plan. The final recommended plan only serves as a guide for the airport, which will aid the City of Lebanon in the strategic planning of airport property. Many times, airport operators or developers change their plan to meet the needs of specific users. The goal in analyzing landside development alternatives is to focus future development so that airport property can be maximized, and aviation activity can be protected.

Landside Alternative 1

Presented on **Exhibit 4C**, the first landside alternative includes the addition of three T-hangar buildings at the south end of the apron. The 28 new T-hangar units will add 41,850 square feet (sf) to the available T-hangar space. Four larger, conventional hangars are planned to the north of the primary apron. Two 6,400-square-foot hangars and two hangars, 100 feet by 125 feet, add 37,800 sf to the larger hangar parking space available at the airport. The taxilane that provides access to the northern hangars is adjusted to be parallel to the adjacent taxiway with a centerline-to-centerline separation distance of 197 feet. Approximately 6.6 acres of additional aeronautical land use are reserved at the far north end of the airport property. In this alternative, the terminal is maintained at its existing size with the potential for a remodel to improve the use and aesthetic of the building. The utility vault is also relocated adjacent to the radio tower and airport beacon facilities to accommodate for the hangar development.

Landside Alternative 2

Landside Alternative 2, shown in the center panel of **Exhibit 4C**, provides for a total of 81,746 sf of additional hangar space at LBO. This includes two 10-unit T-hangar and one 4-unit box hangar assemblies at the south end of the development area, as well as four 3,750-square-foot executive/box hangars along the edge of the primary apron. A second 4-unit box hangar is immediately north of the primary apron, followed by an additional 50-foot by 75-foot hangar and a 10,000-square-foot conventional hangar. New taxilanes and aprons connect each area, and the parallel taxilane from the previous alternative is maintained in this alternative, as well as the 6.6 acres of aeronautical land use reserve. An extension to the terminal is also proposed, 500 square feet to the north wall, in order to provide additional office space and pilot services. The utility vault is relocated to the same location as proposed in Landside Alternative 2.

Landside Alternative 3

The third landside alternative, seen on **Exhibit 4C**, follows similar T-hangar development as in the previous alternative: two 10-unit structures and one 4-unit structure. However, in this alternative, the south end of the ramp is bordered by the 4-unit box hangar facility instead of the 3,750-square-foot



ALTERNATIVE 1

Jefferson Ave/MO-5



ALTERNATIVE 2

Jefferson Ave/MO-5



LEGEND

Airport Property Line	Aeronautical Land Use	50' x 75' Executive Hangar
Taxiway Designator	Non-Aeronautical Land Use	80' x 80' Executive Hangar
Ultimate Pavement	4-Unit Box Hangar	100' x 100' Conventional Hangar
Ultimate Roads/Parking	8-Unit T-Hangar	100' x 125' Conventional Hangar
Pavement to be Removed	10-Unit T-Hangar	125' x 230' Conventional Hangar

ALTERNATIVE 3

Jefferson Ave/MO-5

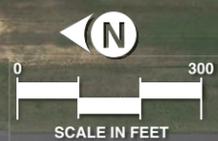


Photo: Google Earth 4/29/2021

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hangars. Two executive hangars, measuring 50 feet by 75 feet, sit on the north end of the primary apron. A smaller ramp is proposed just north of the terminal apron with access provided by a parallel taxiway, 177 feet from the runway parallel taxiway. The new apron is bordered by four 50-by-75 executive hangars, as well as three 80-foot-square conventional hangars. Additional large-span hangars are proposed at the far north end of the airport, including a 12,500-sf and a 28,750-sf hangar. These would provide the opportunity for soliciting of new specialized aviation service operators (SASOs), such as a flight school or maintenance facility, to the airport. The total hangar space available in this alternative is 124,298 sf, including 41,348 sf of T-hangar/box space and 82,950 sf of executive/conventional hangar space. Approximately 3.6 acres are also reserved for aeronautical land use. The terminal is expanded approximately 500 sf to the south to expand on the open area already existing in the terminal, allowing for flexible floor planning to accommodate whatever needs are deemed necessary to address pilot and passenger expectations. Once again, the utility vault is proposed to be relocated near the radio tower and airport beacon structures to allow for expanded hangar development.

West Side Land Use Alternatives

LBO also has undeveloped land to the west of the runway. This area includes the AWOS and the abandoned, unmaintained crosswind runway. Three alternate uses for this land area were also prepared and may be used in conjunction with any landside/hangar development alternative discussed previously. In each alternative, land use is shown to end approximately 500 feet from the AWOS, an FAA recommendation to ensure the weather sensors remain unobstructed. It is possible to develop closer to a weather reporting device, but additional steps may need to be taken to ensure proper operation of the device. **Exhibit 4D** presents the three alternatives that are described below.

- **Alternative 1** – The first alternative for the west side land use involves dedicating approximately 44.6 acres to future aeronautical uses. This may include additional hangars or aviation businesses, such as a flight school or maintenance shop. Access to Runway 18-36 is provided by the abandoned crosswind runway, which would have to be rehabilitated to a useable condition. Another option, discussed amongst the Advisory Board and airport, is the eventual possibility of having a grass/turf runway at the airport. Additional studies and approval by the FAA/MoDOT would have to be completed before such an event, but reserving the land use at this stage would be appropriate.
- **Alternative 2** – In conversations with the airport and PAC, the possibility of having a “fly-in community” along the defunct runway was discussed. A fly-in community, also known as a residential airpark, is a residential development that allows for airplane owners to own a home and aircraft hangar on the same lot. This is an appealing living situation for pilots who like the immediacy of the airport in their backyard. The airpark shown on **Exhibit 4D** is just one possible layout of such a community. The remaining land to the west may be reserved for non-aeronautical use or an expanded residential development. In this alternative, the land would have to be released from federal obligation and sold to a developer. Releasing airport land requires an application process to the FAA and possible repayment of monies used in developing the land in question. Airports are obligated to maintain land acquired with federal funds for the purposes of aviation uses, and that land which an airport seeks to release for non-aviation purposes must be approved by the FAA, and any revenue generated from the sale of the land must be repaid back to the federal government, with any excess returned to the airport’s fund.



- **Alternative 3** – A third option for the west side land is to reserve the entirety of the 44.2 acres for non-aeronautical uses, such as industrial or commercial development purposes, with the land leases providing additional revenue streams to the airport.

Vehicle ground access to the developments proposed in the last two alternatives may be provided by a road extending from Coach Road to the north, Fremont Road to the south, or both. The current ALP reflects an existing ground access easement along the western boundary of the airport property that may be used to construct an access road. The road extension from Coach Road would require the removal of several trees, grading, and access through the adjacent subdivision.

Just as in the airside and hangar/landside alternatives, it will be up to the airport and the City to select one or a combination of these land use alternatives in order to maximize the revenue and efficient operation of the airport property. It should be noted that any property planning on being released to the City for other development possibilities will have to follow a land use release process through FAA.

LANDSIDE SUMMARY

The landside alternatives presented look to accommodate an array of aviation activities that either currently occur or could be expected to occur at LBO in the future. There is demand for new facilities at the airport, and with an increase in operations of larger, turbine aircraft, airport management will need to determine how to develop its property in an organized and thoughtful way. Each of the development options considers a long-term vision that would, in some cases, extend beyond the 20-year scope of this master plan. Nonetheless, it is beneficial to provide a long-term vision for the airport for future generations.

SUMMARY

This chapter is intended to present analysis of various options that may be considered for specific airport elements. The need for alternatives is typically spurred by projections of aviation demand growth and/or by the need to resolve non-standard airport elements. FAA design standards are frequently updated with the intent of improving the safety and efficiency of aircraft movement on and around airports, which can lead to certain pavement geometries now being classified as non-standard when previously they qualified to meet standard.

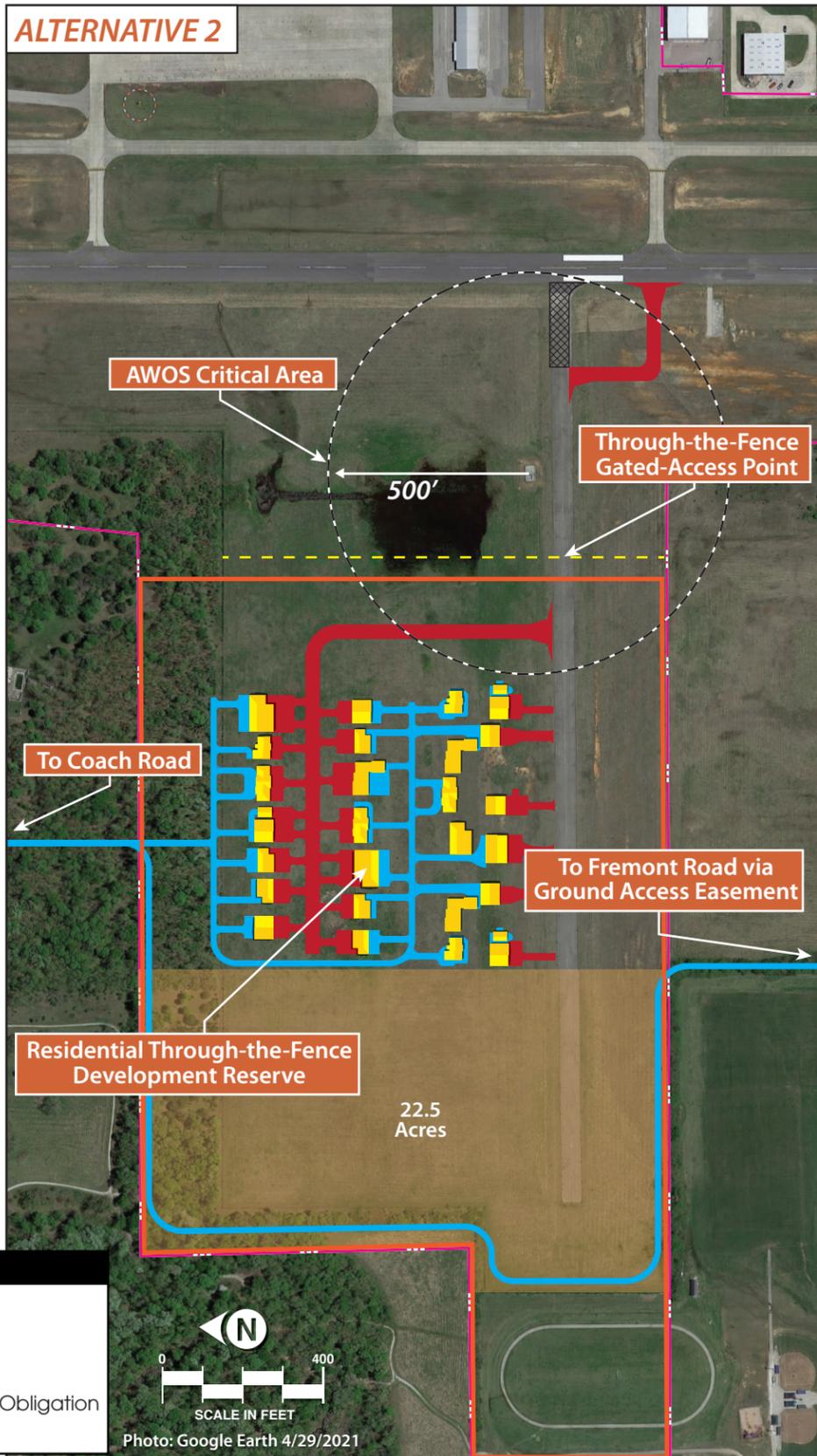
Three development alternatives related to both the airside and landside each have been presented. On the airside, considerations include correcting non-standard conditions and extending Runway 18-36. For the landside, alternatives were presented that include new hangar development and land uses. As the airport's fleet mix transitions to include more jets and turboprops, it will be important to clearly delineate development areas for facilities to accommodate those aircraft. Segregating turbine aircraft from smaller piston aircraft operators contributes to operational safety and presents a more organized and efficient airport.



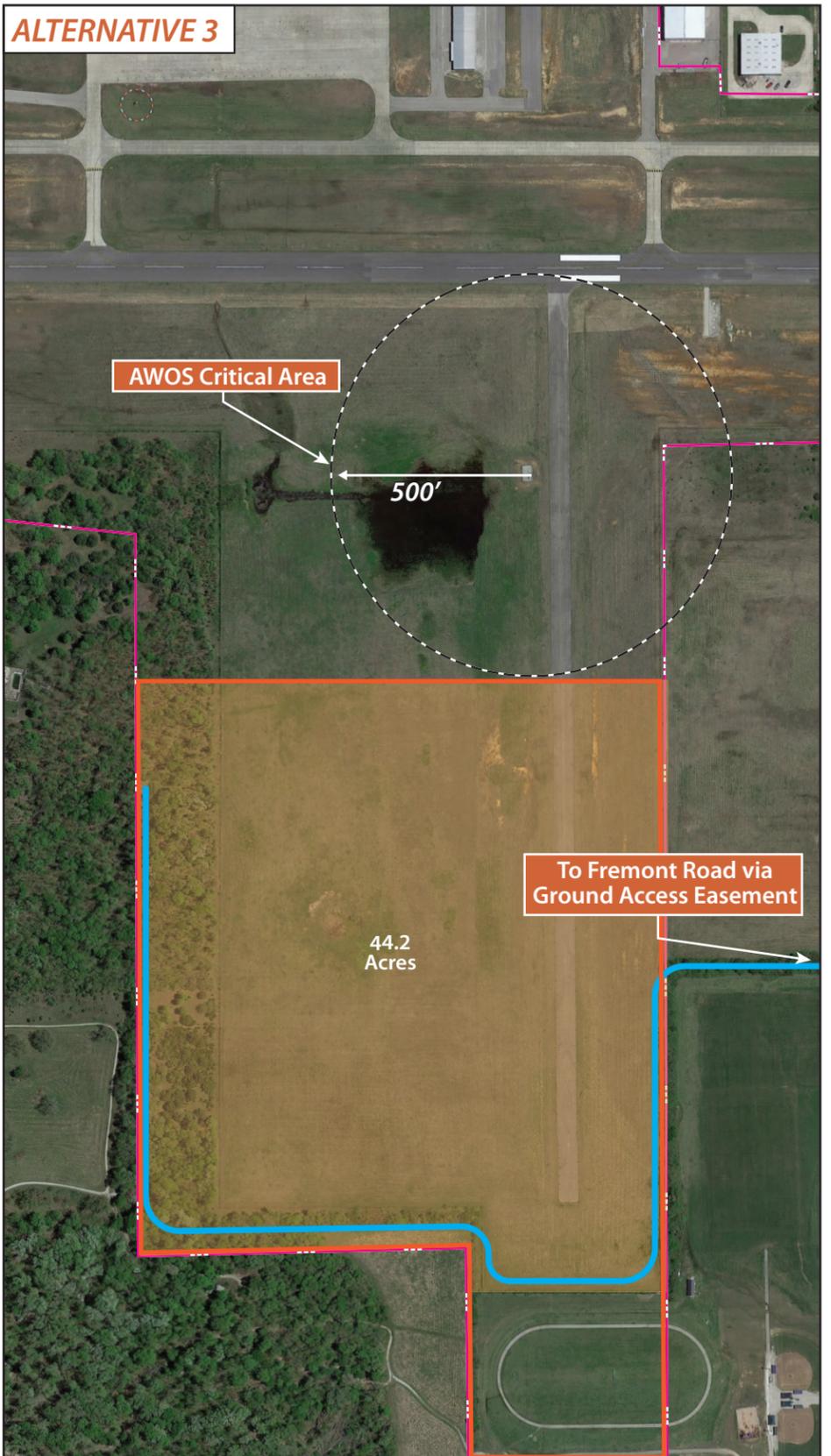
ALTERNATIVE 1



ALTERNATIVE 2



ALTERNATIVE 3



LEGEND

Airport Property Line	Pavement to be Removed
Taxiway Designator	Aeronautical Land Use
Ultimate Pavement	Non-Aeronautical Land Use
Ultimate Roads/Parking	Property to be Released from Federal Obligation
Ultimate Fencing	

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SCALE IN FEET
Photo: Google Earth 4/29/2021

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The next step in the master plan process is to arrive at a recommended development concept. Participation of the Airport Advisory Board and the public will be important considerations. While it might be simple enough to choose one alternative, it is important to consider these alternatives as options in a virtually endless combination of airside and landside features. It will be the collaboration of the Advisory Board, the public, the City, and the Consultant that will ultimately determine the best combination of airside and landside facilities that will best serve the airport in the future. Additional consultation with MoDOT and the FAA may also be required. Once a consolidated development plan is identified, a 20-year capital improvement program, with a list of prioritized projects tied to aviation demand and/or necessity, will be presented. Finally, a financial analysis will be presented to identify potential funding sources and to show airport management what local funds will be necessary to implement the plan.