CHAPTER FOUR

ALTERNATIVES

In the previous chapter, airside and landside facilities required to satisfy the demand through the long range planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. There can be numerous combinations of design alternatives, but the alternatives presented here are those with the perceived greatest potential for implementation based on potential justification within the 20-year scope of this master plan.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by utilizing industry accepted statistical methodologies, unforeseen future events could impact the timing of the needs identified. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands for the next 20 years. However, no plan of action should be developed which may be inconsistent with the future goals and objectives of the City of Lawrence and its citizens, who have a vested interest in the development and operation of the airport.

The development alternatives for Lawrence Municipal Airport can be categorized into two functional areas: the airside (runways, taxiways, navigational aids, etc.) and landside (hangars, apron, and terminal area). Within each of these areas, specific capabilities and facilities are required or desired. In addition, the utilization of airport property to provide revenue support for the airport and to benefit the economic development and well-

being of the region must be considered.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas are examined individually and then coordinated as a whole to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors on the existing airport must be evaluated to determine if the investment in Lawrence Municipal Airport will meet the needs of the community, both during and beyond the 20-year planning period.

The alternatives considered are compared using environmental, economic, and aviation factors to determine which of the alternatives will best fulfill the local aviation needs. With this information, as well as input from various airport stakeholders, a final airport concept can evolve into a realistic development plan.

AIRPORT DEVELOPMENT OBJECTIVES

Prior to identifying objectives specifically associated with development of Lawrence Municipal Airport, non-development alternatives are briefly considered. Non-development alternatives include a "no-build" alternative, the transfer of services to another existing airport, or the development of a new airport at a new location.

The Lawrence Municipal Airport plays a critical role in the economic development of the region and plays an important role in the continuity of the national aviation network. There is significant public and private investment at the airport. Pursuit of a non-development alternative would slowly devalue these investments, lead to infrastructure deterioration, and potentially lead to the loss of significant levels of federal funding for airport improvements. Ultimately, the safety of aircraft, pilots, and persons on the ground could be jeopardized. Therefore, the non-development alternatives are not further considered.

It is the goal of this effort to produce a balanced airside and an appropriate landside aircraft storage mix to best serve forecast aviation demands. However, before defining and evaluating specific alternatives, airport development objectives should be considered. As owner and operator, the City of Lawrence provides the overall guidance for the operation and development of the airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. With this in mind, the following development objectives have been defined for this planning effort:

- To preserve and protect public and private investments in existing airport facilities.
- To develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- To develop a balanced facility that is responsive to the current and long term needs of all general aviation users.

- To be reflective and supportive of the long term planning efforts currently applicable to the region.

- To develop a facility with a focus on self-sufficiency in both operational and developmental cost recovery.

- To ensure that future development is environmentally compatible.

REVIEW OF PREVIOUS AIRPORT PLAN

The most recent set of aviation demand forecasts was developed for the airport in 2001. As discussed in the Forecast chapter of this master plan, there were 55 based aircraft in 2000. There were an estimated 31,350 operations in that same year. The Airport Layout Plan (ALP) was updated in late 2005 to reflect an extension of the primary runway and the construction of a parallel taxiway, Taxiway D, to Runway 1-19.

On the airside, the 2005 ALP considered a 400-foot extension to Runway 33 which would bring the total available runway length to 6,100 feet. The 2005 ALP also planned for the completion of parallel Taxiway D to the Runway 19 threshold. An additional exit taxiway was also planned between Taxiway A and Runway 15-33, approximately 1,900 feet from the current Runway 33 end.

On the landside, the 2005 ALP considered an expansion of the apron to the east that would parallel Runway 15-33. Facing this new apron are two large conventional hangars and two medium sized executive box hangars. Between the executive box hangars is an extension of the planned apron that would accommodate an additional six executive box hangars. Approximately 100,000 square feet of hangar space is shown. Additional T-hangar space was not shown on the ALP. The plan also provided space for potential expansion of the KU Aerospace Engineering hangar located in the west terminal area.

The 2005 ALP also identified areas of future property acquisition. This includes a portion of the future runway protection zone (RPZ) associated with Runway 33, once the runway is extended. The other areas of land acquisition are the current RPZs associated with both ends of Runway 1-19, for which the airport currently owns avigation easements. **Exhibit 4A** presents the 2005 ALP for the airport which will be updated based on the findings of this master plan.

AIRSIDE PLANNING CONSIDERATIONS

Generally, airside issues relate to those airport elements that contribute to the safe and efficient transition of aircraft and passengers from air transportation to the landside facilities at the airport. This includes the established design standard for the airport, the instrument approach capability, the capacity of the airfield, the length and strength of the runways, and the layout of the taxiways.

Each of these elements was introduced in the previous chapters. This chapter will examine airside issues specific to Lawrence Municipal Airport. These will then be presented in several airside development alternatives. **Exhibit 4B** presents a summary of the primary airside and landside elements to be considered in this alternatives analysis.

RUNWAY LENGTH

Runway 15-33 is 5,700 feet long and 100 feet wide. This length meets the Federal Aviation Administration (FAA) minimum recommended length of 5,500 feet to accommodate 75 percent of business jets at 60 percent useful load. As discussed in Chapter Three – Facility Requirements, additional runway length would be recommended if activity levels by certain types of business jets were to increase beyond the FAA threshold of 500 annual operations. For example, a runway length of 5,800 feet is recommended to accommodate 100 percent of business jets at 60 percent useful load. To accommodate 75 percent of business jets at 90 percent useful load, a runway length of 7,000 feet is recommended. Finally, an approximate runway length of 6,300 feet is recommended to accommodate business jets weighing more than 60,000 pounds. **Table 4A** presents a summary of the runway length demand indicators.

TABLE 4A
Runway Length Indicators
Lawrence Municipal Airport

Runway Length	FAA Demand Criteria*	Threshold	Example Aircraft Types
5,500'	75% of business jet fleet at 60% useful load	500 annual operations	Cessna 550, 560, 650; Beechjet 400; Falcon 50
5,800'	100% of business jet fleet at 60% useful load	500 annual operations	Cessna 750; Challenger 604; Hawker 800XP
6,300'	Business jets greater than 60,000 pounds	500 annual operations	Gulfstream II, IV, V; Global Express
7,000'	75% of business jet fleet at 90% useful load	500 annual operations	Cessna 550, 560, 650; Beechjet 400; Falcon 50

*FAA demand criteria must be documented to justify runway length.
Source: Coffman Associates analysis.

While the airport should plan for any reasonable increase in activity that would impact runway length, ultimately justification will be required before the airport would be eligible for FAA grant assistance for a runway extension. Planning for an extension of the runway will allow the airport sponsor to request a grant, should justification materialize, by having the extension on the approved ALP with the FAA. In addition, the airport sponsor will be able to more positively protect the long term viability of the airport by implementing appropriate land use controls based on the future airport configuration.

Runway 1-19 serves as the crosswind runway which is utilized approximately 30 percent of time. This runway is required to meet the FAA standard for providing at least 95 percent crosswind coverage at 10.5 knots for small aircraft in airport reference codes (ARC) A-I and B-I. At 3,901 feet in length, Runway 1-19 currently meets this requirement for 95 percent of these small aircraft. To accommodate 100 percent of small aircraft, a runway length of 4,000 feet is recommended.

As discussed in Chapter Three – Facility Requirements, there may be occasions when the primary runway is closed for an extended period of time. Typically, closure may occur due to runway rehabilitation or reconstruction. In an effort to limit the potentially negative economic consequences of closing the primary runway, a reasonable alternative is to consider a crosswind runway length that can accommodate a larger portion of airport traffic. A runway length of 4,400 feet would meet this potential need.

INSTRUMENT APPROACHES

Lawrence Municipal Airport has straight-in instrument approaches to both ends of Runway 15-33. Runway 33 has a CAT-I Instrument Landing System (ILS) approach that provides for visibility minimums as low as ½-mile and cloud ceilings as low as 200 feet. This is considered an all weather instrument approach. Associated with the ILS approach is a localizer approach with ½-mile visibility minimums and 429-foot cloud ceilings.

The ground-based equipment necessary for an ILS approach is significant and includes an approach lighting system, the localizer antenna, and a glide slope antenna. At Lawrence Municipal Airport, this equipment was installed and is maintained by the Facilities and Equipment (F&E) division of the FAA. With the advent of global positioning system (GPS) satellite navigation, F&E rarely funds new installations of ILS approaches.

What is more common is the development of GPS based instrument approaches that rely on the constellation of GPS satellites and not on expensive ground-based systems. The most sophisticated GPS approaches are LPV (localizer performance with vertical guidance) approaches. Lawrence Municipal Airport has a stand-alone LPV approach to Runway 33 that provides CAT-I minimums.

Runway 15 has a GPS instrument approach that provides visibility minimums of 1-mile and cloud ceilings of 509 feet. If feasible, a CAT-I LPV approach should be planned to the Runway 15 end.

The current instrument approaches to Lawrence Municipal Airport are approved for use by aircraft in approach categories A, B, and C, but not large business jets in approach category D. This category includes several Lear and Gulfstream jet models. These aircraft types do currently operate at the airport, presumably in visual conditions. Instrument approaches that include approach category D should be requested of the FAA by the airport sponsor.

Runway 1-19 is a visual runway meaning visibility must be above three miles and cloud ceilings must be above 1,000 feet for aircraft to operate to the runway. With advancements in avionics, it is common today for even small aircraft to have GPS capability. GPS instrument approaches with visibility minimums of 1-mile will be planned to both ends of Runway 1-19 whether this runway is maintained for small aircraft (ARC A-I and B-I) or if it is ultimately planned to accommodate ARC B-II aircraft as well.

AIRSIDE DEVELOPMENT ALTERNATIVES

The following section presents development alternatives for the runway and taxiway environment. Each runway is considered individually and any recommendations will be combined into a single master plan concept to be presented in Chapter Five.

RUNWAY 15-33 ALTERNATIVES

The primary airside consideration for Runway 15-33 is related to a runway extension. The Lawrence Municipal Airport receives activity from the full range of business jets, including some of the largest and heaviest in the national fleet. Justification for any runway extension must be documented by evidence of at least 500 annual operations by critical aircraft or critical family of aircraft. Currently, the airport does have documentation of 500 annual operations by business jets in the zero to 75 percent category, thereby justifying the current runway length.

Any planned extension of Runway 15-33 will likely have to be considered on the Runway 33 end only. An extension of Runway 15 would place the object free area (OFA) and runway safety area (RSA) (depending on extension length) over the Mud Creek levee. In order to meet the design standards for the OFA and RSA surrounding an extension, the levee would have to be shifted. An extension to the north would also make an improved instrument approach more problematic as the terrain could become a penetration to the approach surfaces. Therefore, planning for an extension will be considered for the Runway 33 end.

The first extension to be considered is adding 100 feet to the runway for a total length of 5,800 feet. This length would meet the recommended length to accommodate 100 percent of business jets at 60 percent useful load. While there is adequate space to add 100 feet to the Runway 15 end before the RSA encroaches upon the localizer antenna, the OFA would extend into the levee. Under certain conditions, the FAA will allow a non-standard OFA (but not RSA), but they would not support building into such a condition. Shifting the levee to accommodate a 100-foot extension would likely not meet a benefit-cost analysis. Therefore, even this modest extension of Runway 15 is not considered further.

A 100-foot extension of Runway 33 is more feasible as the RSA and OFA

would still meet design standard. The runway and taxiway extension could also be accomplished with minimal physical impact. The impacts that could outweigh the benefits of a 100-foot extension would be the potential wetland impact, cost to relocate the approach lighting system, and the cost and time to develop new instrument approaches. The benefit of an additional 100 feet on the Runway 33 end is likely minimal when compared to the cost of construction.

Exhibit 4C presents three potential extensions of Runway 33. Option One considers the maximum extension possible without impacting U.S. Highway 24/40. A 400-foot extension would provide a total length of 6,100 feet while maintaining the RSA and OFA to standard. The wetland would be impacted by the extension of Taxiway A to the new runway end. The approach lighting system would need to be shifted and new approaches would need to be developed. An additional 400 feet is more likely to meet a benefit-cost analysis than a 100-foot extension.

A 400-foot extension would push the RPZ further to the south by 400 feet. The southwest corner of the RPZ, approximately six acres, would then extend off airport property. This property would need to be acquired.

Option Two on the exhibit considers a 600-foot extension of Runway 33. This extension would meet the recommended length of 6,300 feet to accommodate business jets weighing more than 60,000 pounds. The RSA and OFA would extend over U.S. Highway 24/40, necessitating relocation of this road. As shown on the exhibit, the road is planned to then be shifted slightly to the south in order to remain outside the RSA and OFA. An extension of 600 feet would also impact the wetland and the approach lighting system would need to be relocated and new instrument approaches developed.

Option Three examines the impacts of extending Runway 33 by 1,300 feet for a total length of 7,000 feet, which is recommended to accommodate 75 percent of business jets at 90 percent useful load. As discussed previously, planning runway length around the 90 percent useful load category would require justification, such as regular cargo operations or frequent international flights. Neither of these scenarios are anticipated; nonetheless, the potential impacts are presented for informational purposes.

Approximately 4,800 feet of U.S. Highway 24/40 would need to be relocated outside the RSA and OFA. The road shift may need to be even greater as an oxbow pond would be impacted and possibly a designated wetland. One farmhouse would fall under the RPZ and the RPZ would extend slightly over Interstate 70. As with the other extension alternatives, the on-airport wetland would be impacted by the extension of Taxiway A.

RUNWAY 1-19 ALTERNATIVES

Runway 1-19 currently meets the design standards (ARC B-I), including runway length and safety areas for a

crosswind runway. This alternatives analysis presents the possibility of improving the crosswind runway to a length of 4,400 feet, which is intended to accommodate aircraft in ARC B-II. Planning to ARC B-II standards would allow this runway to serve a greater percentage of aircraft, including some business jets, during those times when the primary runway is closed.

Option One on **Exhibit 4D** shows a 500-foot extension of Runway 1. The extension would extend onto property not owned by the airport, necessitating acquisition of the property. Threshold taxiways are then planned to each side of the new runway end. The RSA surrounding the runway would increase from 120 feet wide to 150 feet wide, and the length beyond the runway ends would increase from 240 feet to 300 feet.

Option Two considers placing the 500-foot runway extension on the north end of the runway. Initial analysis indicates that the approach surface leading the new runway end would clear any potential obstructions, including the Mud Creek levee.

Taxiway D is the partial parallel taxiway to Runway 1-19, extending from the Runway 1 threshold and terminating at the intersection with Runway 15-33. Approximately 900 feet of Runway 19 is accessible only by back-taxiing. Back-taxiing, or utilizing the runway for taxiing purposes, is discouraged as aircraft remain on the active runway for a longer period of time, thereby increasing the potential for runway incursions. The remaining 1,000 feet of Taxiway D is planned to be constructed to alleviate this potential safety issue.

AIRSIDE SUMMARY

The airside alternatives presented are those that could possibly be justified within the 20-year planning scope of this master plan. At a minimum, the airport should plan for an extension of Runway 15-33 to the southeast. An extension of 400 feet would maintain the RSA and OFA on airport property and would not impact U.S. Highway 24/40. Approximately six acres of RPZ property would need to be acquired.

Any extension beyond 400 feet would require U.S. Highway 24/40 to be shifted. A 600-foot extension was considered, but would only be justified if the critical design aircraft transitioned to a business jet weighing more than 60,000 pounds. These types of aircraft do currently operate at the airport, but on a very infrequent basis.

Runway 1-19 currently meets design standards for a crosswind runway. The alternatives considered improvements to this runway, including a 500-foot extension to accommodate a larger percentage of aircraft, including some smaller business jets. This improvement may be desired in order to lessen the economic impacts of the primary runway being closed for a period of time, typically due to reconstruction. This runway would still be intended for aircraft weighing less than 12,500 pounds.

LANDSIDE PLANNING CONSIDERATIONS

Generally, landside issues relate to those airport facilities necessary, or desired, for the safe and efficient parking and storage of aircraft, movement of passengers and pilots to and from aircraft, airport land use, and overall revenue support functions. In addition, elements such as fueling capability, availability of services, and emergency response are also considered in the landside functions.

Landside planning issues, summarized on **Exhibit 4B**, will focus on facility locating strategies following a philosophy of separating activity levels. To maximize airport efficiency, it is important to locate facilities intended to serve similar functions. For example, it makes sense to plan T-hangar structures in a designated area rather than haphazardly building them as needed on the next available spot at the airport. It is also important to plan for facilities that are desired and to group those facilities together, whether they be T-hangars, executive box hangars, or larger conventional hangars.

The orderly development of the airport terminal area (those areas parallel to the runway and along the flight line) can be the most critical, and probably the most difficult, development to control on the airport. A development approach of "taking the path of least resistance" can have a significant effect on the long term viability of an airport. Allowing development without regard to a functional plan can result in a haphazard array of buildings and small ramp areas, which will eventually preclude the most efficient use of valuable space along the flight line.

Activity in the terminal area should be divided into three categories at an airport. The high-activity area should be planned and developed as the area providing aviation services on the airport. An example of a high-activity area is the aircraft parking apron, which provides outside storage and circulation of aircraft. In addition, large conventional hangars housing fixed base operators (FBOs), other airport businesses, or that used for aircraft storage would be considered high-activity uses. A conventional hangar structure in the high-activity area should be a minimum of 6,400 square feet (80 feet by 80 feet). If space is available, it is more common to plan these hangars for up to 200 feet by 200 feet. The best location for high-activity areas is along the flight line near midfield, for ease of access to all areas of the airfield.

The medium-activity category defines the next level of airport use and primarily includes corporate aircraft operators that may desire their own executive or conventional hangar storage on the airport. A hangar in the medium-activity use area should be at least 50 feet by 50 feet, or a minimum of 2,500 square feet. The best location for medium-activity use is set back from the immediate flight line, but still with ready access to the runway/taxiway system. Typically, these areas will be adjacent to the high-activity areas. Parking and utilities such as water and sewer should also be provided in this area.

The low-activity use category defines the area for storage of smaller single and twin-engine aircraft. Low-activity users are personal or small business aircraft owners who prefer individual space in T-hangars or small executive box hangars. Low-activity areas should be located in less conspicuous areas or to the ends of the flight line. This use category will require electricity, but may not require water or sewer utilities.

In addition to the functional compatibility of the terminal area, the proposed development concept should provide a first-class appearance for Lawrence Municipal Airport. Consideration to aesthetics should be given high priority in all public areas, as the airport can many times serve as the first impression a visitor may have of the community.

The existing terminal area at Lawrence Municipal Airport has, for the most part, followed the separation of activity levels philosophy. The terminal building faces a central ramp area with hangar areas located to the sides. Larger, high-activity hangars are immediately adjacent to the main apron, and lower-activity executive box and T-hangars are set farther to the sides.

Ideally, terminal area facilities at general aviation airports should follow a linear configuration parallel to the runways. The linear configuration allows for maximizing available space, while providing ease of access to terminal facilities from the airfield. Each landside alternative will address development issues, such as the separation of activity levels and efficiency of layout. Each of the landside alternatives will address the forecast needs from the previous chapter of this plan.

VEHICULAR ACCESS AND PARKING

A planning consideration for any airport master plan is the segregation of vehicles from aircraft operational areas (AOA). This is both a safety and security consideration for the airport. Aircraft safety is reduced and accident potential increased when vehicles and aircraft share the same pavement surfaces. Vehicles contribute to the accumulation of debris on aircraft operational surfaces, which increases the potential for foreign object debris (FOD) damage, especially for turbine-powered aircraft. The potential for runway incursions is increased, as vehicles may inadvertently access active runway or taxiway areas if they become disoriented. The greatest concern is for public vehicles, such as delivery vehicles and visitors, which may not fully understand the operational characteristics of aircraft and the markings in place to control vehicle access. The best solution is to provide dedicated vehicle access roads to each landside facility that is separated from the aircraft operational areas with security fencing.

The segregation of vehicle and aircraft operational areas is supported by FAA guidance established in June 2002 and amended in March 2008. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states, "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states, "An airport operator should limit vehicle

operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport."

The landside alternatives for Lawrence Municipal Airport have been developed to reduce the need for vehicles to cross apron or taxiway areas. Dedicated vehicle parking areas, which are outside the airport fence line, are considered for all potential hangars. Nested T-hangars, which do not traditionally have dedicated vehicle parking, should, at a minimum, be planned with dedicated and secure vehicle access points to reduce the potential for a vehicle to be diverted onto the aprons or runway/taxiway system.

BUILDING RESTRICTION LINE

The building restriction line (BRL) identifies suitable building areas on the airport. The BRL encompasses the RPZs, the OFA, the runway visibility zone, navigational aid critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight requirements.

Two primary factors contribute to the determination of the BRL: type of runway (utility or other-than-utility) and the capability of the instrument approaches. As a general aviation airport supporting business jet operations, Runway 15-33 is classified as "other-than-utility," while Runway 1-19 is a utility runway intended for aircraft weighing less than 12,500 pounds. The instrument approach provides for CAT-I visibility minimums for Runway 15-33 and visual conditions for Runway 1-19.

The BRL is the product of F.A.R. Part 77 transitional surface clearance requirements. These requirements stipulate than no object be located in the primary surface, defined as being no closer than 250 feet from a visual runway and no closer than 500 feet to a runway served by a non-precision or precision instrument approach. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizontal feet. Traditionally, the BRL is set at a point where the transitional surface is 35 feet above runway elevation. For a visual runway, this distance is 495 feet from the centerline. For a non-precision and precision instrument runway, this dimension is 745 feet from the runway centerline. It should be noted that structures can located between the BRL and the primary surface as long as the highest point of the structure is not a penetration to the 7:1 transitional surface.

TERMINAL BUILDING

The existing terminal building is a significant asset for the airport. The facility is ideally located facing the transient aircraft apron. The FBO leases the service counter and office space in the terminal building providing visitors with quick and immediate access to airport services. The terminal building is in excellent condition, as the City has made continuous maintenance investments since the building's construction in 1986.

The Facility Requirements chapter of this master plan indicated that the terminal building meets the minimum standard for square footage. A large atrium area provides plenty of natural light and lounge space. There does not appear to be a need to redesign the layout of the interior of the facility.

The main FBO offices and hangar are located to the immediate west of the terminal building. Aircraft operators doing business with the FBO will often walk outside between the two buildings. An amenity that might be considered is the construction of a covered walkway or enclosed hallway to connect the two facilities.

Some communities are able to support additional services, such as a restaurant within terminal buildings. When successful, an airport restaurant can drive additional transient aviation traffic and can become a destination for community residents. Goodwill with the community tends to develop as people who might not otherwise have a reason to come to the airport begin to visit more often.

The existing terminal building is not designed to accommodate a modern restaurant facility. A logical location for expansion would be to the east. An expansion of the terminal building (or construction of any non-aviation business at the airport) cannot occupy space that is necessary for aviation related purposes. Expansion of the terminal building to the east for a restaurant must be compatible with the planned location of future aviation facilities. Basically, the airport sponsor cannot construct a non-aviation related facility on property reserved for aviation purposes.

EQUIPMENT STORAGE

By their very nature, airports encompass large areas of property that must be properly maintained in order to promote safety. Grass must be mowed in order to maintain visibility and to reduce the potential to attract wildlife. In the winter, the airport operations area needs to be plowed to allow the airport to remain open.

Currently, equipment used to maintain the airport is stored in several aircraft hangars at the airport. These hangars should be made available for lease if possible. Construction of dedicated maintenance buildings is eligible for grant funding from the FAA. Such a facility will be planned in the alternatives for the airport.

EMERGENCY RESPONSE

As discussed in Chapter One – Inventory, the closest fire station is located near downtown Lawrence south of the Kansas River, a distance of approximately 3.5 miles. If a new north Lawrence fire station is planned, a location on or near the airport would allow this firehouse to serve both the community and the airport. If an on-airport location is considered, it should have ready access to both the runway/taxiway system as well as the street network.

LANDSIDE DEVELOPMENT ALTERNATIVES

As presented in Chapter Three – Facility Requirements, additional aircraft hangar storage area is recommended to accommodate forecast growth in based aircraft. An additional 46,100 square feet of space is recommended for T-hangars and executive box hangars. Conventional hangar space appears adequate to meet the needs of the airport, but a change in functional use of conventional hangars could indicate an additional need here as well. For example, if aircraft maintenance increases, then additional conventional hangar space could be needed for this purpose. Specialty hangars could also be needed to satisfy the needs of new airport businesses.

Each of the landside alternatives will present a future facility layout that may exceed the total hangar storage necessary to meet forecast demand over the next 20 years. This is important in order to allow maximum flexibility within the master plan to allow the airport to adjust to unforeseen growth. In fact, the airport is currently in negotiations with two aviation businesses to locate at the airport in the short term. Between these two businesses, a total of 10 new aircraft (three helicopters and seven fixed wing) could be based at the airport. In addition, the airport board is planning to present a business plan to the Lawrence City Council in early 2011 to justify the construction of up to 20 additional T-hangar units.

EXISTING FACILITY LAYOUT

The existing facility layout provides easy access to the surface transportation system with an airport access road connecting to U.S. Highway 24/40. It also provides quick airside access to Runways 33 and 1. The airside access to Runways 19 and 15 requires pilots to taxi the length of the airfield. With the terminal area located between Runway 33 and Runway 1, the potential areas of development are limited. Nonetheless, the forecast growth of the airport (based aircraft and operations) indicated that the available undeveloped land in the terminal area can accommodate planned growth.

There are two primary development areas available in the terminal area; the first is to the west of Airport Road and the second is east of the road. The east side has the advantage of potentially being physically connected to the existing terminal area ramp. The west side currently supports two T-hangar structures. Since T-hangars are forecast to be in demand, future T-hangars should be co-located with these existing structures in order to create a complex of similar hangar types and similar activity levels.

The east side of Airport Road offers possibilities for the full range of aviation hangar types. Conceptually, when planning this area, high activity conventional hangars should be planned closest to the runway/taxiway system. Executive box and other me-

dium and low activity hangars should be planned to be set back from these larger conventional hangars.

There are some constraints to planning for development of both of these areas. On the east side is an oxbow lake remnant that bisects the area. The oxbow has previously been identified as a wetland by the U.S. Army Corps of Engineers. The Environmental Assessment associated with the 2002 runway extension (400 feet to the south and 300 feet to the north) included this determination and the mitigation, which was a 1½ to 1 wetland replacement project. Any planning that would consider disturbing the wetland will likely require additional environmental documentation and mitigation.

LANDSIDE ALTERNATIVE I

In this first alternative, shown on **Exhibit 4E**, the west side of Airport Road is planned for several additional nested T-hangar units. As shown, there are three 8-unit structures and five 10-unit structures for a total of 74 aircraft storage units. To the south of this planned T-hangar complex are three rows of development parcels. Development parcels have become increasingly popular with aircraft owners because they sign a long term land lease with the airport and then construct a custom hangar to meet their specific needs.

When planning hangar complexes, access to the airfield should be given priority consideration. Currently, taxilane access to the airfield from the two newest T-hangars is on either side of T-hangar Block A. These taxilane access points are separated by 130 feet, meaning they essentially serve the same functional purpose. While these taxilane access points may be adequate currently, when new T-hangars are constructed, efficiency of aircraft movements may be compromised. As a result, a new taxilane access point is considered in this alternative.

The planned new taxilane would extend from the intersection of Taxiway C and D and south into the development area west of Airport Road. This taxilane would provide a new primary access point to the development area. The taxilanes adjacent to T-hangar Block A should be maintained to provide some long term relief to the new access taxiway.

On the east side of Airport Road, or the east terminal area, a development concept is presented that provides for conventional and executive box hangars since the west side logically should support continued T-hangar development. The east side development area includes potential flight line property as well as area set back from the flight line.

In this alternative, a large conventional hangar is planned to the immediate east of the terminal building. For this to be possible, the airport beacon and an electrical vault would need to be relocated. Given the value of development space facing the terminal area apron, the cost of relocating the beacon and vault should be considered. A second conventional

hangar is then planned facing the main apron.

The main apron is planned to be expanded to the east and southeast, parallel to Runway 15-33. Four larger hangars are then planned to face the runway and the planned new apron. A taxilane is extended from the east side apron to allow for a variety of executive box hangars.

West Terminal Area

There may be some opportunities for development in the west terminal area. On Landside Alternative I, depicted on **Exhibit 4E**, a development layout is presented that considers airport acquisition of approximately 36 acres to the southwest of the airport. This property is then planned for multiple uses. First, the Runway 1 RPZ would be maintained undeveloped in order to meet RPZ design standards. The portion of this property adjacent to the west terminal area is then planned for aviation uses.

Low activity aviation uses are planned for the west terminal area. Access is planned from a new taxilane that would extend from Taxiway C. The first four rows of hangars are fronted by a single 80-foot by 80-foot executive box hangar. A 10-unit T-hangar facility then extends from the back of the executive box hangars. Three additional T-hangar structures, each with an 8-unit capacity, are then planned at the end of the access taxilane. This development concept provides 80,600 square feet of T-hangar space and 29,600 square feet of executive box hangar space.

The remaining portion of property, approximately 15 acres, is then planned for future aviation uses. Future aviation uses could include a potential extension to Runway 1-19 or additional hangars.

LANDSIDE ALTERNATIVE II

The development area to the west of Airport Road continues to be planned for lower activity facilities such as nested T-hangars and connected box hangars. To the immediate east of T-hangar Blocks B and C are three 10-unit T-hangar structures. The nested T-hangars planned would occupy an identical footprint to those of the existing T-hangars, placing them at the edge of Bryant Way. Therefore, to provide taxilane access, Bryant Way would be converted to a taxilane. The entrance to the T-hangar complex could then be secured with an access gate near the corner of Bryant Way and Airport Road.

Landside Alternative II, as shown on **Exhibit 4F**, also plans for a new primary access taxilane that extends from the intersection of Taxiway D and C. Set to the south of the planned T-hangar complex is a group of connected box hangars. As shown, there are 48 box hangars measuring 50 feet by 65 feet. This executive box hangar complex would have dedicated vehicle access and parking extending from Airport Road.

Planning for the east side of Airport Road maintains this area for larger conventional or corporate hangars to face the flight line, and stand alone executive box hangars set farther back. Two large conventional hangars would face Runway 15-33. As shown on the exhibit, these would not impact the existing airport beacon.

Aircraft access to the development area would be from a taxilane that would extend from the currently closed Taxiway B. A portion of taxiway B would need to be rehabilitated in order to provide access to Taxiway A. That portion of the closed taxiway extending to the main apron is planned to be removed. Adjacent to the two large conventional hangars is a taxilane extending to the west. This taxilane extension would open up additional area for three executive box hangars.

On the south side of the taxilane extending behind the two conventional hangars is an area proposed for development parcels. Development parcels have become increasingly popular for general aviation airports. Aircraft owners are provided an opportunity to sign a land lease with the airport and then proceed with the construction of a custom hangar that suits their specific needs. This public/private partnership benefits both parties in that the airport is able to save the expense of constructing hangars, while still promoting growth by allowing development.

Another feature to this alternative is the potential extension of the access taxilane over the oxbow wetland. Additional development parcels are then made available. Development parcels in this location, adjacent to U.S. Highway 24/40, may be especially desirable as aviation businesses would have airfield access and roadside visibility.

West Terminal Area

Development of the west terminal area in Landside Alternative II considers a layout that remains on existing airport property. As shown on **Exhibit 4F**, three rows of 10-unit nested T-hangars are planned for a total of 37,950 square feet of additional hangar space.

LANDSIDE ALTERNATIVE III

In Landside Alternative III on **Exhibit 4G**, the west side of Airport Road is planned for additional nested T-hangars. Three structures are shown, with each having 10 individual storage units. These T-hangars are identical to T-hangar Blocks B and C. The three hangar structures are situated to the south of the existing T-hangars and are spaced to allow aircraft movement between the existing and future buildings.

The primary drawback to this layout is the continued use of the taxilanes adjacent to T-hangar A. As discussed previously, the access point could lead to congestion as the airport adds more based aircraft. This T-hangar layout may prevent a logical secondary access point extending from Taxiway C. Constructing the westernmost of these three T-hangar buildings would pre-

vent the future construction of another access taxilane.

This alternative considers the possibility of building a large hangar that would face the small apron located between the FBO hangars. This location could be an expansion opportunity for the FBO operator.

The east side layout presented generally follows the theme of reserving development for higher activity uses. Two conventional hangars are situated on an apron expansion which faces Runway 15-33. Extending from the planned apron are two taxilanes providing access to executive box hangar development areas.

The apron expansion shown in the exhibit provides for a taxliane to run along the apron edge. The apron edge taxilane precludes a hold apron at the end of Taxiway A. This alternative could be adjusted to make space for a hold apron at the end of Taxiway A, as was shown in Landside Alternative I.

West Terminal Area

West terminal area facility planning for Landside Alternative III considers infill opportunities for executive box hangars, as well as the addition of two 10-unit nested T-hangars. As depicted, the University of Kansas hangar currently housing the Mal Harned Propulsion Lab is planned to be replaced with a larger 16,500 square foot hangar. A second stand alone hangar is also planned adjacent to the Don's Diesel hangar, fronting an expansion of the apron.

LANDSIDE SUMMARY

The landside facility layout should follow basic industry standards, such as locating high activity hangars on or near the main terminal area apron. Medium activity executive box or connected box hangars should then be set back from the flight line, and low activity T-hangars should be the farthest from the flight line.

Each of the three landside alternatives follows these basic airport planning principles primarily by utilizing the potential development areas located to the east and west of Airport road. These areas are large enough to easily accommodate forecast growth in based aircraft at the airport. In fact, each of the alternatives considers a long term vision that would extend beyond the 20-year scope of the master plan. Only under some unpredictable circumstances, such as the addition of hundreds of new aircraft to the airport, would this full build-out be necessary within 20 years. Nonetheless, it is beneficial to provide a long term vision for the airport for future generations.

As discussed in Chapter Three – Facility Requirements, the airport is forecast to need approximately 46,100 square feet of new hangar space over the next 20 years. **Table 4B** presents a summary of the total hangar area and parcel acreage proposed for each alternative.

While the long term vision far exceeds the forecast need, the potential layouts presented allow hangar development to follow a phased approach for each hangar type. For example,

there are designated areas for each hangar type that are in close proximity to existing facilities. Therefore, if a T-hangar facility becomes the next priority, then it can be constructed immediately at the designated location with minimal extraneous costs.

TABLE 4B
Landside Summary
Lawrence Municipal Airport

	Alternative I		Alternative II		Alternative III	
Hangar Type	**Square Feet**	**Storage Units**	**Square Feet**	**Storage Units**	**Square Feet**	**Storage Units**
	MAIN TERMINAL AREA					
T-Hangar	93,250	74	37,950	30	37,950	30
Executive Box	9,000	4	19,200	8	134,400	54
Connected Box	58,600	12	190,900	54	0	0
Conventional	93,800	38	33,800	14	58,200	23
Subtotal	254,650	128	281,850	106	230,550	107
Parcel Acres	7.48	32	11.33	49	0	0
	WEST TERMINAL AREA					
T-Hangar	80,600	64	37,950	30	25,300	20
Executive Box Hangar	29,600	9	0	0	23,700	9
Subtotal	110,200	73	37,950	30	49,000	29
Total	364,850	233	319,800	185	279,550	136

Assumptions:
Executive Box and Conventional Hangars: Approximately 2,500 (sf^2) per aircraft
Parcels: Approximately one aircraft for every 10,000 (sf^2)
T-Hangars and Connected Box Hangars: One aircraft per unit

Source: Coffman Associates

ALTERNATIVES SUMMARY

Several development alternatives related to both the airside and the landside have been presented. On the airside, potential extensions of 100 feet, 400 feet, 600 feet, and 1,300 feet were considered for Runway 33. For the airport to move forward with plans for design and construction of any of these extension alternatives, further justification would be required. Specifically, 500 annual operations by the critical aircraft would need to be documented.

Runway 1-19 currently meets the design standards for a crosswind runway at Lawrence Municipal Airport. The potential to add 500 feet to the runway, thereby increasing its capability to serve as a backup runway for a larger percentage of operations, was examined. Either end of the runway could support such an extension or the extension could be split between the two ends. It should be noted that improving Runway 1-19 as considered would be a low priority for FAA participation.

Taxiway D is the partial parallel taxiway to Runway 1-19. This taxiway should be planned to connect to the Runway 19 threshold, thereby elimi-

nating the need to back taxi on the runway.

After review by the Planning Advisory Committee (PAC) and interested local citizens, a recommended concept will be presented in the next chapter.