D. Development Concepts and Alternatives Analysis
D. Development Concepts and Alternatives Analysis

The purpose of this chapter is to present development alternatives and development recommendations for Grand Junction Regional Airport in terms of concepts and reasoning. This chapter provides a description of the various factors and influences, which will form the basis for the Airport’s long-term development program.

In concert with the role of the Airport, and community input received in the planning process, several basic assumptions have been established that are intended to direct the development of the Airport in the future.

Assumption One. The Airport will be developed and operated in a manner that is consistent with local ordinances and codes, federal and state statutes, federal grant assurances, and Federal Aviation Administration (FAA) regulations.

Assumption Two. This assumption recognizes the role of the Airport. The Airport will continue to serve as a facility that accommodates commercial passenger service activity, along with general aviation activity and a small amount of military activity.

Assumption Three. This assumption relates to the size and type of aircraft that utilize the Airport and the resulting setback and safety criteria used as the basis for the layout of associated airport facilities.

Runway 11/29. As it has been in previous planning studies, the “Design Aircraft” for this runway is a combination of aircraft, specifically the Bombardier CRJ-200 and the Boeing 727-200. The CRJ-200 has an approach speed of 142 knots and the B-727/200 has a wingspan of 108 feet. This indicates that the Airport Reference Code (ARC) for Runway 11/29 is D-III. In accordance with future plans of air cargo carriers serving the Airport, the future “Design Aircraft” for this runway has been identified as the Boeing 757-300 with an approach speed of 143 knots and a wingspan of 124.8 feet. This indicates that the future ARC for Runway 11/29 is D-IV.
Runway 4/22. Past planning studies have identified this runway as one that mostly accommodates small- to medium-size general aviation aircraft (up to and including many of the business jets), along with the smaller turbo-prop commercial passenger service aircraft. The historic “Design Aircraft” fleet for this runway has been made up of turbo-props such as the Beech Super King Air 200, the Cessna Citation, the Beech 1900, etc. This indicates that this runway should be designed using ARC B-II dimensional criteria. Should Runway 4/22 be required to serve as the “air carrier” runway during maintenance and rehabilitation of Runway 11/29, an ARC upgrade may be required.

Assumption Four. The fourth assumption relates to the need for the Airport to accommodate aircraft operations with great reliability and safety. This indicates that the Airport’s runway system should be developed with instrument approach guidance capabilities, to accommodate the forecast operations as safely as possible under most weather conditions.

Assumption Five. Because the amount of landside development area at any airport is at a premium, the fifth assumption is that the plan for future airport development should strive to make most efficient use of the available area for aviation-related activities, including general aviation facilities and passenger terminal facilities. Aviation use areas should be developed to be compatible with surrounding land uses.

Assumption Six. The sixth assumption focuses on the relationship of the Airport to off-airport land uses and the compatible and complementary development of each. To the maximum extent possible, future facilities will be designed to enhance the compatibility of the operation of the Airport with the environs.

Assumption Seven. This assumption recognizes the on-going discussion concerning the location and operation of the ATCT. Alternative sites should be identified for future ATCT facilities in consideration of the airside and landside development recommendations.

Goals and Objectives for Development
Accompanying these assumptions are several goals and objectives, which have been established for purposes of directing the plan and establishing continuity in the future development of the Airport. These goals and objectives take into account several categorical considerations relating to the needs of the Airport, both in the short-term and the long-term, including safety, noise, capital improvements, land use compatibility, financial and economic conditions, public interest and investment, and community recognition and awareness. While all are project-oriented,
some obviously represent more tangible activities than others; however, all are deemed important and appropriate to the future of the Airport.

The following goals and objectives are intended to guide the preparation of this Airport Master Plan Update and direct the future expansion of Grand Junction Regional Airport:

- Provide effective direction for the future development of Grand Junction Regional Airport through the preparation of a rational, reasonable, and implementable plan.
- Prepare a plan that allows the Airport to fulfill its mission to facilitate and enhance regional aviation services.
- Accommodate the forecast aviation activity levels in a safe and efficient manner by providing the necessary airport facilities and services.
- Ensure that the future development of the Airport will accommodate a variety of general aviation activities, ranging from small general aviation users to corporate aviation operators.
- Plan and develop the Airport to be capable of accommodating the future needs and requirements of the City of Grand Junction, Mesa County, and the larger surrounding service area and supporting regional economic development activity.
- Plan for potential property acquisition for approach protection and land use compatibility purposes.
- Encourage and protect the public and private investment in land and facilities.

**Airside Development Concepts and Alternatives**

**Introduction**

Because all other airport functions relate to and revolve around the basic runway/taxiway layout, airside development alternatives must first be carefully examined and evaluated. It is essential that the initial development recommendations for the Airport be commensurate with the anticipated needs and requirements of airport users; however, the long-term expansion of the facility must also be considered and planned for to ensure the capability to accommodate potential activity levels. The main objective of the planning recommendations presented herein is to identify future development that will result in a runway/taxiway system capable of accommodating the forecast aviation activity. The recommendations are described in the following text and in the illustration at the end of this chapter, entitled *CONCEPTUAL DEVELOPMENT PLAN.*
Following a review of these airside development alternatives, the purpose of which is to fulfill major facility requirements (basic runway configuration), recommendations for landside development are presented. For purposes of this study, landside facilities consist of aircraft parking aprons, hangar development areas, terminal area development, and airport access. Following review of the alternatives by the Study Committee, airport staff, other interested parties and the FAA, a conclusion for this chapter will be formulated that includes a generalized conceptual airport development plan, recommendations for runway and taxiway improvements, along with an on-airport land use plan.

**Airside Alternative One**

As explained in the previous chapter, the runway length requirements of those aircraft using the Airport on a regular basis are met with the existing length of Runway 11/29 and it is recommended that this runway length be maintained. The primary purpose of Alternative One is to correct the existing non-standard conditions associated with the excessive longitudinal and transverse gradients on Runway 11/29 and to resolve the non-standard condition associated with the crossing runways and the resulting Runway Visibility Zone (RVZ) penetrations.

**Shift Runway 11/29**

- The Airport’s main runway (Runway 11/29) will be shifted approximately 1,800 feet to the northwest (1,800 feet of additional pavement is added to the approach end of Runway 11 and 1,800 feet of pavement is removed/decommissioned at the approach end of Runway 29).

- Runway 11/29 is completely reconstructed and all longitudinal and transverse gradients are corrected to meet FAA design standards (estimated construction time frame is eight to ten months).

- Runway 4/22 is upgraded to ARC C-III standards including a widening of the runway to 150 feet, an extension of the runway to 7,000 feet, and a flattening of the runway to meet Category C gradient standards (allows the runway to be utilized by the air carriers during reconstruction/shifting of Runway 11/29).

- Runway 11/29 instrument approach visibility minimums will be programmed to remain at less than ¾-mile.

- Runway 4/22 instrument approach visibility minimums will be programmed for as low as ¾-mile.

- Parallel Taxiway “A” will be extended in accordance with the 1,800-foot shift of Runway 11/29.
• Parallel Taxiway “C” will be relocated to a C-III runway/taxiway separation of 400 feet.
• Additional parallel taxiways on opposite sides of each runway are protected for.
• A future parallel runway (Runway 11L/29R), as shown on historical plans for the Airport, is protected for at a standard runway/runway separation (4,300 feet) to allow for the potential of simultaneous IFR approaches.
• A north side airport access road, connecting the future 29 Road interchange with I-70 and both I Road, and 27 1/4 Road is planned to provide vehicular access to potential north side aviation-related development including the potential relocated ATCT.

Positive Qualities of Alternative One
• Increases safety by correcting the RVZ without having to relocate the landside facilities that penetrate the RVZ. Correction of the RVZ will also increase the utility of the Airport by allowing Runway 4/22 to remain open during evening hours when the ATCT is closed.
• Increases safety by correcting the non-standard longitudinal and transverse gradients associated with Runway 11/29.
• In consideration of other alternatives, Alternative One will minimize new construction and capital improvement costs.
• Maintains the operational capability of the Airport to serve the air carriers and cargo carriers during reconstruction of Runway 11/29.
• Allows for the expansion of the existing aircraft maintenance run-up area northeast of Taxiway “A7”.

Negative Qualities of Alternative One
• This alternative would correct all of the existing non-standard conditions with the notable exception of the longitudinal gradient on the connector taxiways between Runway 11/29 and Taxiway “A”.
• Requires a significant amount of embankment off the approach end of Runway 11 to accommodate the runway shift.
• Requires the relocation of 27 ¼ Road around the shifted RPZ to the approach end of Runway 11.

• Requires a significant investment to upgrade and extend Runway 4/22. It is likely that the cost/benefit of this investment is very low as the upgraded runway will serve large turbo-prop and regional jet aircraft for only an eight-to ten-month period during reconstruction of Runway 11/29.

• The extension of the approach end of Runway 22 will require excavation of rising terrain and may require additional excavation to the northeast to meet Threshold Siting Surface (TSS) requirements. This rising terrain may also prevent the implementation of approach visibility minimums as low as 3/4-mile to this runway end.

• Requiring air carrier and cargo aircraft to depart via Runway 22 would add additional air traffic and noise over residential areas off the departure end of Runway 22. These same aircraft would also overfly noise sensitive land uses on approach to Runway 4.
Airside Alternative Two

As in Alternative One, the primary purpose of Alternative Two is to correct the existing non-standard conditions associated with the excessive longitudinal and transverse gradients on Runway 11/29 and the penetrations of the Runway Visibility Zone (RVZ) between the two runways. The secondary purpose of Alternative Two is to also correct the non-standard taxiway longitudinal gradients associated with a number of the connector taxiways between Runway 11/29 and parallel Taxiway “A” and also correct the positioning of the runway “crown” or the lateral runway high point, which is currently located 25 feet from the northeasterly edge of the runway. While technically not a non-standard condition, it is generally accepted engineering practice to design a runway with the “crown” centered in the middle of the runway. The non-centered runway “crown” is likely the result of multiple runway widening projects that placed the additional runway pavement on only one side of the runway, rather than an equal placement of additional pavement on both sides of the runway.

New Runway 11/29 (Minimum Separation)

- The Airport’s main runway (Runway 11/29) will be laterally relocated 650 feet to the northeast and longitudinally relocated 1,000 feet to the northwest.
- The new Runway 11/29 will be designed and constructed to meet all FAA design standards in accordance with the current and planned ARC for this runway.
- Runway 4/22 will be maintained to its existing B-II design standards; however, an extension of the approach end of Runway 22 providing a total length of 6,300 feet will be protected for. This is considered the ultimate runway length requirement for this runway, assuming it is not needed to serve the air carriers, and, this extension will accommodate 100 percent of the small aircraft fleet (aircraft less than 12,500 pounds). In this alternative, Runway 4/22 will not need to be upgraded to ARC C-III standards.
- Aircraft run-up areas/holding bays are programmed for all four runway ends and bypass taxiways are programmed for each end of Runway 11/29.
- Runway 11/29 instrument approach visibility minimums will be programmed at less than 3/4-mile.
- Runway 4/22 instrument approach visibility minimums will be programmed for as low as 3/4-mile.
- Parallel Taxiway “A” will be relocated to the “crown” of the existing Runway 11/29 (600-foot separation from the new Runway 11/29).
- Parallel Taxiway “C” will be maintained in its current location.
- Additional parallel taxiways on opposite sides of each runway are protected for.
- A future parallel runway (Runway 11L/29R), as shown on historical plans for the Airport, is protected for at a standard runway/runway separation (4,300 feet) to allow for the potential of simultaneous IFR approaches.
- A north side airport access road, connecting the future 29 Road interchange with I-70 and both I Road and 27 ¼ Road, is planned to provide vehicular access to potential north side aviation-related development including the potential relocated ATCT.

**Positive Qualities of Alternative Two**
- The existing Runway 11/29 will remain operational during construction of the new Runway 11/29, and, the operational capability of the Airport to fully serve the air carriers and cargo carriers will not be diminished.
- Does not require an ARC upgrade of Runway 4/22.
- Increases safety by correcting the RVZ without having to relocate the landside facilities that penetrate the RVZ. Correction of the RVZ will also increase the utility of the Airport by allowing Runway 4/22 to remain open during evening hours when the ATCT is closed.
- Increases safety by correcting the non-standard longitudinal and transverse gradients associated with Runway 11/29.
- Allows for the correction of the non-standard longitudinal gradients on the connector taxiways between Runway 11/29 and the relocated Taxiway “A”.
- Increases safety by correcting the non-centered runway “crown”.
- Increases the hourly capacity of the runway system by allowing for the construction of high speed exit taxiways with reverse double-back curves.

**Negative Qualities of Alternative Two**
- Does not minimize construction and capital improvement costs.
- Requires the relocation of 27 ¼ Road around the shifted RPZ to the approach end of Runway 11.
• The extension of the approach end of Runway 22 will require excavation of rising terrain and may require additional excavation to the northeast to meeting Threshold Siting Surface (TSS) requirements. This rising terrain may also prevent the implementation of approach visibility minimums as low as ¾-mile to this runway end.

• Requires the relocation of the existing aircraft maintenance run-up area northeast of Taxiway “A7”.

• Would result in FAR Part 77 imaginary surface penetrations during construction of the new Runway 11/29, and will require construction and phasing solutions to maintain the operational capability of existing Runway 11/29 during construction of the new runway.
Airside Alternative Three

As in Alternative Two, the primary purpose of Alternative Three is to correct the existing non-standard conditions associated with the excessive longitudinal and transverse gradients on Runway 11/29 and the penetrations of the Runway Visibility Zone (RVZ) between the two runways. The secondary purpose of Alternative Three is to also correct the non-standard taxiway gradients associated with a number of the connector taxiways between Runway 11/29 and parallel Taxiway “A” and also correct the positioning of the runway “crown”. One further objective of Alternative Three is to allow construction equipment associated with the new Runway 11/29 to entirely avoid penetrating the FAR Part 77 imaginary surfaces associated with existing Runway 11/29 during the phased construction period.

New Runway 11/29 (Maximum Separation)

- The Airport’s main runway (Runway 11/29) will be laterally relocated 938 feet to the northeast and longitudinally relocated 500 feet to the northwest. The purpose of the 938-foot relocation is to allow for construction equipment (up to 20 feet tall) to operate within the entire runway safety area (RSA) surrounding the new Runway 11/29 without penetrating the FAR Part 77 transitional surface of the existing Runway 11/29.
- The new Runway 11/29 will be designed and constructed to meet all FAA design standards in accordance with the current and planned ARC for this runway.
- Runway 4/22 will be maintained at its existing length and width and will not need to be upgraded to ARC C-III standards.
- Aircraft run-up areas/holding bays are programmed for all four runway ends and bypass taxiways are programmed for each end of Runway 11/29.
- Runway 11/29 instrument approach visibility minimums will be programmed at less than ¾-mile.
- Runway 4/22 instrument approach visibility minimums will be programmed for as low as ¾-mile.
- Parallel Taxiway “A” will be relocated to the “crown” of the existing Runway 11/29 (888-foot separation from the new Runway 11/29).
- Parallel Taxiway “C” will be maintained in its current location.
- Additional parallel taxiways on opposite sides of each runway are protected for.
A future parallel runway (Runway 11L/29R), as shown on historical plans for the Airport, is protected for at a standard runway/runway separation (4,300 feet) to allow for the potential of simultaneous IFR approaches.

A north side airport access road, connecting the future 29 Road interchange with I-70 and both I Road and 27 ¼ Road, is planned to provide vehicular access to potential north side aviation-related development, including the potential relocated ATCT.

Positive Qualities of Alternative Three

- The existing Runway 11/29 will remain operational during construction of the new Runway 11/29, and, the operational capability of the Airport to fully serve the air carriers and cargo carriers will not be diminished.
- Allows for construction of the new Runway 11/29 without FAR Part 77 transitional surface penetrations by construction equipment.
- Increases safety by correcting the RVZ without having to relocate the landside facilities that penetrate the RVZ. Correction of the RVZ will also increase the utility of the Airport by allowing Runway 4/22 to remain open during evening hours when the ATCT is closed.
- Increases safety by correcting the non-standard longitudinal and transverse gradients associated with Runway 11/29.
- Allows for the correction of the non-standard longitudinal gradients on the connector taxiways between Runway 11/29 and the relocated Taxiway “A”.
- Increases safety by correcting the non-centered runway “crown”.
- Increases the hourly capacity of the runway system by allowing for the construction of high speed exit taxiways with reverse double-back curves.
- Does not require any BLM land for the RPZ to the approach end of the relocated Runway 11.

Negative Qualities of Alternative Three

- Alternative Three has the highest construction costs of the three alternatives, primarily due to the amount of excavation required to construct the new runway 938 feet from the existing runway.
- The siting of the new Runway 11/29 in Alternative Three would likely restrict any future extension of the approach end of Runway 22.
• Requires the relocation of 27 ¼ Road around the shifted RPZ to the approach end of Runway 11.
• Requires the relocation of the existing aircraft maintenance run-up area northeast of Taxiway “A7”.
• Would significantly increase the runway/taxiway separation of the primary runway system. Aircraft would be required to taxi greater distances to access landside facilities, resulting in an increase in ground taxi fuel burns and aircraft emissions.

Conclusions and Recommended Alternative
Several conclusions can be reached with regard to the future airfield components that should be recommended as part of this Airport Master Plan Update. The conclusions that appear to be appropriate at this preliminary stage include:

• The Airport’s main runway (Runway 11/29) should be relocated at the minimum allowable separation (Airside Alternative Two) for construction phasing in order to correct all non-standard conditions associated with this runway and its connector taxiways. Additional benefits of this new runway include the correction of the non-standard RVZ, the correction of the non-centered runway “crown”, and the elimination of the need to upgrade the crosswind runway (Runway 4/22).

• A two-phase land acquisition of BLM land can be programmed with the first phase required for the relocated Runway 11/29, the future ATCT, and the future north side access road. The second phase BLM land transfer could include the land required for the ultimate parallel runway (Runway 11L/29R).

• Aircraft engine run-up areas/holding bays should be provided at each runway end possibly combined with a maintenance related engine run-up area.

• A potential extension of the approach end of Runway 22 should be protected for in the siting of the new Runway 11/29.

• Future instrument approach minimums lower than ¾-mile for Runway 11/29 and as low as ¾-mile for Runway 4/22 should be protected for to the greatest extent practicable.
Figure D3  
**Airside Alternative Three**  
*New Runway 11/29*  
(Maximum Separation with no Part 77 Transitional Surface Penetrations by 20' Construction Equipment)
Landside Development Concepts

Introduction
With the basic framework of the Airport’s ultimate airside development identified, the placement of landside facilities can now be analyzed. In general, landside facilities consist of terminal area development, aircraft parking aprons, support facility development, hangar development areas, and airport access. The overall objective of landside development planning at the Airport is the provision of facilities that are conveniently located and accessible to the community, and that accommodate the specific requirements of airport users.

The current landside development area at Grand Junction Regional Airport is located south of Runway 11/29 and west of Runway 4/22. This area is very close to full build out, with only three locations left for development including the area adjacent to connector Taxiways A1 and A2, the “infill” area between connector Taxiways A3 and A4, and the area south of Navigators Way. The preferred airside alternative (Alternative Two) shifts Runway 11/29 approximately 650 feet to the north and east, which will create additional landside developable area for both aircraft parking apron and aviation facilities expansion. This is a significant benefit to the Airport because, once the previously mentioned landside areas are developed, the Airport will likely need to look at concepts for landside development north and east of Runway 11/29. The area north and east of Runway 11/29 currently has almost no landside access or infrastructure necessary for development and the extensions to properly serve the area will be very costly.

Illustrations of the landside area created by Airside Alternative Two have been prepared to graphically depict the potential acreage available for both aviation-related development and apron/tie down expansion. Also, in consideration of the forecasts of enplanements and air carrier operations, as well as the evolving security requirements and airline business practices, passenger terminal facilities at the Airport will require significant modification, renovation, and expansion. An envelope for potential passenger terminal redevelopment has also been identified.

Following input from stakeholders, airport staff, the FAA, and the public on major landside elements, more detailed factors will be addressed. The detailed factors include such items as roadway access, automobile parking, fuel storage facilities, conceptual layout of future hangars, fencing and gates, aircraft parking aprons, utilities, etc. The following illustrations, entitled LANDSIDE FACILITIES CONCEPTUAL LAYOUT WEST and LANDSIDE FACILITIES CONCEPTUAL LAYOUT EAST, provide an idea of the areas that can be reserved for landside facilities in consideration of the preferred airside alternative.
Passenger Terminal Facilities
As identified in the previous chapter, the existing passenger terminal building is approaching capacity in various areas and consideration should be given to the space requirements to accommodate the forecast passenger demand at the Airport. Previous planning documents have introduced the potential alternative of relocating the passenger terminal and related facilities to the northwest side of Runway 11/29. However, as stated previously, this area has almost no landside access or infrastructure necessary for development and the extensions to properly serve the area would be very costly. Furthermore, the preferred alternative (Airside Alternative Two) would create an additional development envelope for terminal expansion that will better utilize the significant investment the Airport has made in both vehicle parking and landside access improvements in recent years. Additional space for both Transportation Security Administration (TSA) and airport administration/operations requirements should be programmed.

A potential passenger terminal redevelopment area and terminal apron expansion area are shown on the previous illustration entitled LANDSIDE FACILITIES CONCEPTUAL LAYOUT EAST. More detailed information related to this terminal redevelopment will be provided in later chapters of this Airport Master Plan Update.

General Aviation Aircraft Storage Facilities
The other significant current landside development issue that has been identified is development area for general aviation storage facilities (hangars) and for commercial aviation activity.

General aviation aircraft storage facilities can range from T-hangars, which house aircraft in individual walled-in units that are contained in a larger structure (in most cases, units are intended to accommodate one aircraft), to small conventional hangars (executive hangars, which can house one or two small- to medium-sized general aviation aircraft), to corporate hangars capable of housing one or more business jet aircraft. There are also large “gang storage” hangars that can house a number of aircraft under one roof without the separating partitions that characterize a T-hanger structure. This Airport Master Plan Update will provide a detailed “concept” layout of facilities to provide space for these various hangar types, but will also strive to provide flexibility so that the type of hangar built can be in response to actual demand. The primary area that has historically been reserved for general aviation facility expansion is located southwest of Navigators Way. The layout of these facilities, shown on the following illustration entitled CONCEPTUAL GENERAL AVIATION FACILITIES LAYOUT, has been revised to accommodate several large “corporate lease” parcels. These parcels could be leased to aviation-related businesses or businesses and institutions with corporate flight departments desiring to construct aircraft storage facilities with convenient access to the runway/taxiway system.
Figure D6 Conceptual General Aviation Facilities Layout
Land Acquisition Considerations
As can be noted on the previous illustrations, the Airport’s facilities are located on a limited amount of property. To help ensure land use compatibility, approach protection, and to provide additional development area for aviation/airport support facilities, several parcels adjacent to airport property are being considered for acquisition. The parcels being considered for acquisition include Federal BLM land and private land. The BLM land north and west of the Airport is the highest priority for acquisition and a portion of this property is needed in order to implement Airside Alternative Two. Several parcels of state-owned land were recently acquired along the eastern airport property line. The purpose of this state land is both for approach protection as well as the potential for an ultimate north side airport access road. Finally, a parcel of private land southeast of Runway 4/22 is being considered for acquisition. Acquisition of this parcel would protect the Airport from potentially incompatible development within the Building Restriction Line (BRL) of Runway 4/22 and this parcel could potentially accommodate future aviation-related development. These parcels are shown in the previous airside alternative illustrations.

Conceptual Airport Development Plan
Following discussions and input from the Study Committee, airport stakeholders, airport staff, the public, and the Federal Aviation Administration, a conceptual development plan for Grand Junction Regional Airport was finalized. The CONCEPTUAL DEVELOPMENT PLAN for the Airport is illustrated in the following figure. Following the acceptance of this Conceptual Development Plan by the Airport Authority Board, the plan was utilized as the basis for the Environmental Review, the development of detailed Airport Plans, and the production of a long-term Capital Improvement Program for the Airport.

Airport Traffic Control Tower Location Analysis
Based on the Conceptual Development Plan, an ATCT location analysis was conducted in accordance with FAA Order 6480.4A, Airport Traffic Control Tower Siting Process. Siting considerations included TERPS criteria, FAR Part 77 criteria, sight distances and shadowing effects, and physical considerations such as infrastructure development, access, topography and general location factors, and facility construction costs. Three primary ATCT relocation sites were considered. The location of these sites, as well as the required cab eye height at each site, is shown on the following illustration entitled CONCEPTUAL DEVELOPMENT PLAN. The recommended preferred site is Site number 3, with a cab eye height of 90 feet above ground level (AGL). Selection of the final relocation site will be at the discretion of the FAA.