



Colorado Aerotropolis Visioning Study

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Infrastructure Development for the Colorado Aerotropolis Study Area

Prepared by



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Infrastructure Development for the Colorado Aerotropolis Study Area

Introduction and Overview

An Aerotropolis is an urban plan in which the layout, infrastructure, and economy are centered on an airport.

The Colorado Department of Transportation (CDOT) conducted a study regarding the infrastructure requirements that could enhance economic development surrounding Denver International Airport (DIA). The Colorado Aerotropolis Visioning Study, funded by a Federal Highway Administration grant, along with additional funds from DIA, collaboratively engaged local jurisdictions to examine the benefits and impacts of a proactively planned Aerotropolis infrastructure surrounding DIA. An infrastructure framework for transportation, water, wastewater, power, communications, and drainage is critical to fostering and supporting economic development surrounding the airport.

CDOT engaged Adams County, City of Aurora, City of Brighton, City of Commerce City, City and County of Denver, as well as DIA, in the Visioning Study.

Study Vision

At the onset, study participants jointly developed a vision for a Colorado Aerotropolis:

A sustainable, efficient, well-connected, and globally recognized Colorado Aerotropolis that capitalizes on the economic opportunity surrounding the Denver International Airport through collaborative planning, development, and marketing.

Study Objectives

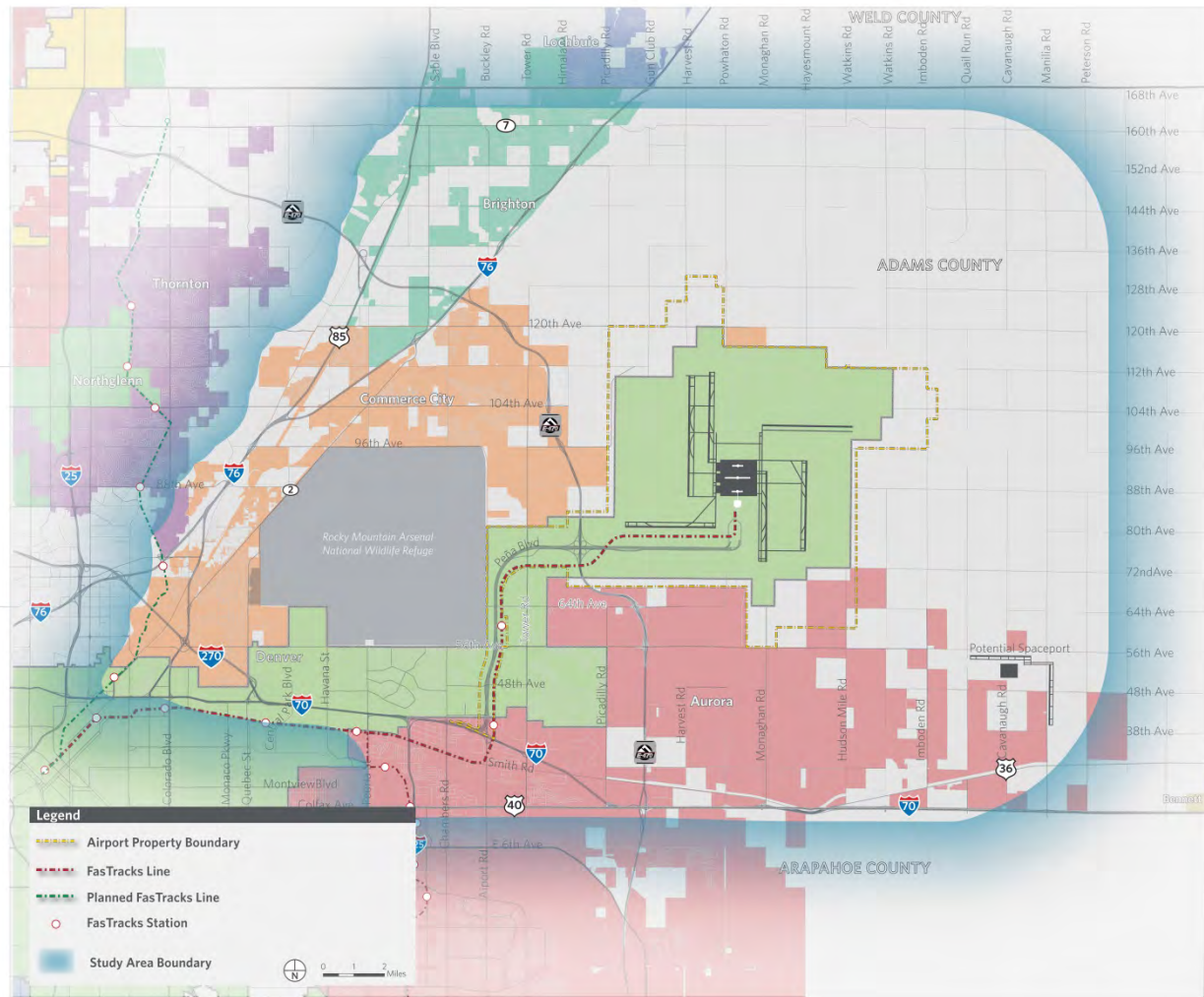
CDOT had the following objectives for the study:

- Agree on a collaborative vision for a Colorado Aerotropolis.
- Learn about the aerotropolis concept.
- Identify commonalities among the local plans.
- Quantify the potential for economic growth—with or without a Colorado Aerotropolis.
- Identify a framework of possibilities for collaboration on infrastructure investments.
- Outline regional governance options to implement investments in transportation, water, wastewater, drainage, power, and communications systems.

Study Area

Figure 1 displays the study area of the Colorado Aerotropolis Visioning Study. The study area boundaries defined an area of influence that impacts or would be impacted by the current and future economic conditions both on and off airport.

Figure 1 Study Area for the Colorado Aerotropolis Visioning Study



Source: Aerotropolis Study Team.

Working Paper Organization

This working paper describes the existing and planned infrastructure systems, identifies opportunities for long-term infrastructure investments, and presents a concept of a phased collaborative infrastructure scenario for fostering the development of an Aerotropolis. The elements of infrastructure included in this paper are Transportation, Water, Wastewater, Power, Drainage, and Communication Systems.

The paper is organized into the following sections:

- Infrastructure Needs Assessment
 - Purpose for Aerotropolis Infrastructure
 - Support for Infrastructure Development
 - Utilities
 - Transportation Networks
- Scenario Comparison
 - Business as Usual Scenario
 - Aerotropolis Scenario

Infrastructure Needs Assessment

Purpose for Infrastructure Development

The construction of efficient infrastructure has long been a catalyst for fostering and supporting economic development. Developers, businesses, and residents are attracted by ample “on the ground” infrastructure. This means sufficient water, power, transportation, communications resources, and other supporting civil infrastructure.

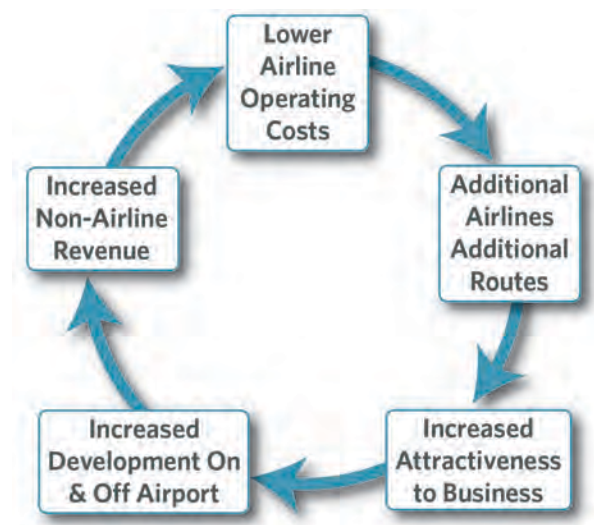
A significant finding of this study is the importance of on-airport commercial development to DIA’s ability to compete globally. A self-sustaining Cycle of Development is feasible, in which catalytic actions can spur greater economic development and growth, as depicted in Figure 2. Maintaining and stimulating this Cycle of Development is extremely important.

When commercial developers invest in on-airport and off-airport property, the airport collects non-airline revenue. This allows airports to lower operating costs for airlines, which in turn attracts additional airlines and additional airline routes. This increases the attractiveness of the airport for further commercial development, which adds to non-airline revenue for the airport and continues the cycle. Increased development also means further investments in infrastructure on and near the airport. Investment in infrastructure is, therefore, one of the catalysts that can be driven by the local municipalities surrounding an airport.

Investment in infrastructure is, therefore, one of the catalysts that can be driven by the local municipalities surrounding an airport.

This Cycle of Development illustrates how an airport can grow to compete globally and contribute to the regional economy once initial investments in infrastructure are made.

Figure 2 Cycle of Development



Source: Aerotropolis Study Team.

Support for Infrastructure Development

Consistent with the Cycle of Development, the Study Review Committee for the Colorado Aerotropolis Visioning Study identified that rapid, collaborative infrastructure development is a key need. In an informal survey of the members regarding the most important near-term collaborative effort, infrastructure development was identified in at least 9 of 21 responses, as shown to the right.

When asked to expand on specific opportunities and constraints, participants zeroed in on the following:

- Opportunities:
 - RTD University of Colorado A Line connectivity.
 - Connection points from the south—Jackson Gap and Piccadilly.
- Constraints:
 - How are we working together and what can we do to make sure that some of the transportation corridor and projects are really linking and provide benefits?
 - Lack of dedicated funding; comes down to politics.
 - Major physical barriers (Rocky Mountain Arsenal National Wildlife Refuge and DIA) form a Pinch Point for north/south travel, where capacity may be constrained.
 - FAA restrictions regarding the amount of non-airport traffic that can be allowed to use Peña Boulevard.

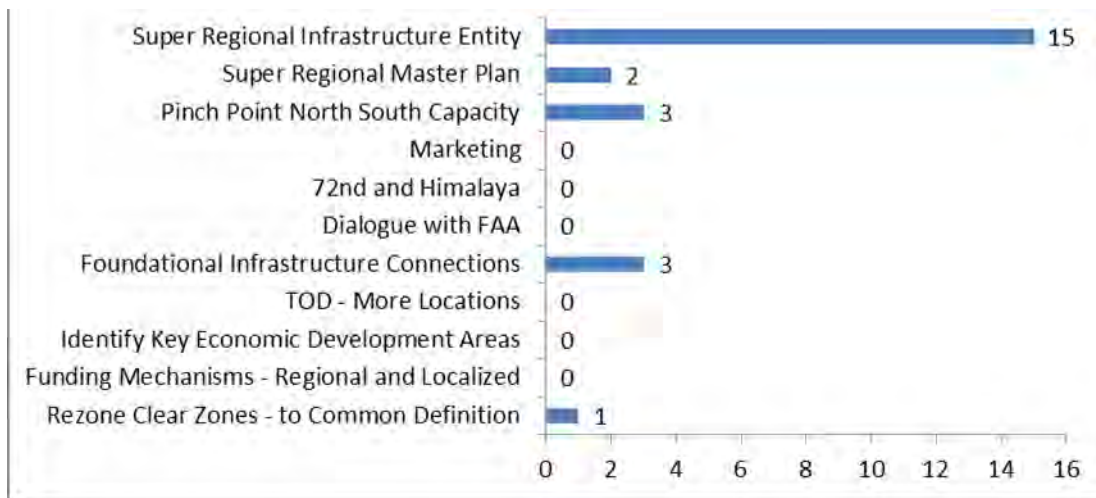
Informal Poll

What is the most important collaborative action in the near term?

- Multi-governmental regional committee structure beyond this plan
- Infrastructure
- Infrastructure
- Infrastructure
- Cross Jurisdictional Planning
- Governance/financing structure
- Funding
- Pass IGA Amendment this Fall
- Cost sharing
- Marketing and infrastructure
- Establish some form of governance/oversight
- Link west side of DIA via Piccadilly
- Cargo
- Peña Corridor solution
- Priority development areas
- Collaborative funding structure
- Roads
- Identify long-term funding stream
- Pass IGA Amendment vote
- Extend water supply to strategic areas outside DIA
- Understand specific regional water and wastewater needs, sources, timing, constraints, and funding operations

In further discussion of action priorities, the members overwhelmingly indicated that the top priority is to establish a regional entity responsible for guiding, planning, and *potentially* funding infrastructure investment. The results of the poll are shown in Figure 3. This visionary collective perspective recognizes that infrastructure investments for Aerotropolis development would support the Denver metropolitan area economy and provide world-class multimodal access and mobility around the airport.

Figure 3 Highest Priority Actions Based on Poll



Source: Study Review Committee poll.

Aerotropolis Scenario Infrastructure Needs

This study presents needs and opportunities for catalytic infrastructure investment, including utilities - water, wastewater, power, communications, and drainage - and transportation.

Utilities

The joint use of the transportation rights-of-way with utilities would require that utilities be implemented at the time transportation improvements are made. While a transportation facility can be built in phases over time, wet and dry utilities are usually implemented to meet their ultimate requirements so that future disruption of the roadway is unnecessary to increase the size of the utility corridor.

Programs and plans for water utility networks were collected from the water supply and wastewater treatment systems service providers to the study area. A key finding is that certain "regional" elements would be required in the study area while the majority of the systems would take the form of typical installations within the transportation rights-of-way.

Water Supply

The major water providers in the study area are Aurora Water, Denver Water, and the South Adams County Water and Sanitation District. These providers have different primary sources of water supply as summarized below.

Aurora Water

Aurora Water has a combination of surface water and a reuse system (Prairie Waters) that is sufficient to provide water to the area north of I-70.

- The system will be incrementally implemented using an "integrated water master plan" that considers all sources, uses, reuse, wastewater, and stormwater flows.
- Water to the area is delivered from treatment facilities south of I-70. Service pressures will be adequate for delivery to all parts of Aurora within the study area.

Trunk and smaller pipelines will need to be incorporated into roadway development projects and paid for primarily on a “pay-as-you-go” basis by adjacent development.

Denver Water

Denver Water has long-term water supplies from surface water storage and trans-mountain diversion based on more than 100 years of programs and agreements.

- Part of the current agreement with multiple entities regarding trans-mountain diversion restricts the water use to the City and County of Denver only. A small portion (around 4,000 acre-feet) can be shared with adjacent communities. One current partner is SACWSD, which receives a portion of that allocation.
- Denver has sufficient water to serve expected development throughout the study area within Denver. Service levels will include development on airport as well as in the areas of Denver off airport.
- Water supply lines have been laid out in the Master Plan for the area. These include some locations where pumping to maintain service pressures will be required. These lines will be incorporated into roadway development and paid for primarily on a “pay-as-you-go” basis by adjacent development.

South Adams County Water and Sanitation District (SACWSD)

SACWSD primarily serves the areas of Commerce City and Brighton west and north of DIA. SACWSD uses ground water for the bulk of the water distribution in the cities.

- A key issue for service to the east and south of E-470 within Commerce City is the elevation difference to some future development parcels. Pumping of potable water will be required if a different source cannot be found.
- Water supply lines have been laid out in the Master Plan for the area. These include some locations where pumping to maintain service pressures will be required. These lines will be incorporated into roadway development and paid for primarily on a “pay-as-you-go” basis by adjacent development.

Observations

Although the water supply plans have been developed and would provide adequate water for the study area to support future development, there are several areas where more efficient development of the overall network could be achieved with a comprehensive partnership among the primary stakeholders. Substantial savings could be realized by the jurisdictions as well as by the adjacent development projects.

The areas of efficiency could include:

- Balancing of supply to limit or eliminate pumping to any portion of the study area.
- Sharing of trunk and sub-trunk facilities to limit or eliminate duplicative installations.
- Development of a comprehensive reuse plan to tie the area together. The water reuse could be grey water for irrigation purposes; or if tertiary treatment facilities are developed, the water could be mixed to add to the water supply.

To achieve these efficiencies, a comprehensive master plan with an integrated approach similar to Aurora's would be needed.

To provide the water supply infrastructure during initial construction of the Aerotropolis roadway system, the following assumptions were made regarding the size of the pipelines that would be required to serve the area:

- Minor Arterial - 16 inches
- Major Arterial - 24 inches
- Major Arterial with Trunk Water - 30 inches

Wastewater

The Denver metropolitan area is served by the Metro Wastewater Reclamation District (Metro). Metro is comprised of 52 entities, which include the Cities of Aurora, Brighton, Commerce City, and Denver. Unincorporated Adams County is not a part of the district; therefore, any areas that want to link to the Metro system must be approved by the Metro members and provide a buy-in payment.

Since the 1970s, metropolitan wastewater has been collected and directed by gravity flow to the Hite Facility located at 64th Avenue and York Street. This major facility is capable of treating over 150 million gallons per day (MGD), which is currently sufficient for the members for the next several years. To prepare for the future, Metro has built and commissioned the Northern Treatment Plant, located on the Platte River just north of the downtown Brighton area.

In general, gravity flows from the Aerotropolis study area are possible, but each jurisdiction uses their own collection system to carry wastewater flows for treatment. As the collection pipes converge, larger interceptor pipelines controlled by Metro take flows to the Hite treatment plant. For portions of Aurora in the study area, wastewater needs to be pumped from the south, and then west to the Hite facility.

Metro is currently engaged in a comprehensive study of the northeast area of its district to determine the most efficient and effective approach to wastewater collection and treatment for future development, given the locations and capacities of the Hite Plant and the Northern Treatment Plant. The district is working with its member jurisdictions to define alternatives and evaluate options. Once the preferred solution is determined in mid-2016, funding and financing requirements and allocations will be proposed.

Observations

To provide the wastewater collection infrastructure during initial construction of an Aerotropolis roadway system, the following assumptions were made regarding the size of the pipelines that would be required to serve the area:

- Minor Arterial - 24 inches
- Major Arterial - 36 inches
- Major Arterial with Trunk Wastewater - 48 inches

One of the major facilities under consideration in Metro's study is a possible large interceptor to run from the southeast to the northwest portion of the Aerotropolis study area. This interceptor would be large enough to collect flows from each of the jurisdictions and deliver the flows by gravity to the new Northern Treatment Plant. Locations and linkage points for the interceptor will be defined as part of the Metro study. A likely candidate for the alignment is along the Second Creek drainage right-of-way. The length of the interceptor would be about 15 miles and may cost in the range of about \$10 million per mile based on previous costs experience for similar interceptor projects.

One of the key outcomes from the Metro study will be a staging/phasing program based on an agreed-upon development pattern for the area. The Aerotropolis planning process can be used as one mechanism to start the discussions necessary to reach agreement on the pattern and pace of development, which will then support Metro and its Board in developing a master plan for service to the Aerotropolis study area.

Power Utilities

Power utilities consist of electricity and natural gas. Electrical service providers in the Aerotropolis study area are Xcel Energy and United Power. Xcel Energy provides service to Denver, Aurora, parts of Commerce City, and parts of unincorporated Adams County in the southern portion of the study area. United Power serves northern Commerce City, Brighton, and the northern areas of unincorporated Adams County in the study area.

Power-line corridors power substations are located throughout the study area. Xcel Energy recently installed a new substation just south of DIA that has stabilized much of the power network for the study area and for users east of DIA.

Natural gas lines for service leads are typically incorporated within the public right-of-way, while mainlines occasionally have their own right-of-way. When the lines are within the roadway right-of-way, specific locations are provided for gas lines and associated transmission stations.

Power utilities are privately owned, and costs for installation are paid for by the utility owners. Coordination between the jurisdiction and the utilities at the time of roadway design and construction is required to integrate the required lines.

Observations

It is anticipated that there would be sufficient electrical and natural gas power available for build-out of the Aerotropolis study area.

Communications Systems

Technology is constantly evolving, and an effective communications network is needed to serve development investments. Fast, reliable broadband, as well as traditional connectivity in the form of telephone, cable, and fiber optics is needed. How this network is built out, and the roles the latest wireless technologies play, would be decided based on the newest technology at that point in time. However, a collaborative regional effort would benefit each jurisdiction and the Aerotropolis study area as a whole. Some jurisdictions are planning substantial upgrades to various parts of their communications networks, but a coordinated plan is not yet in development.

Observations

While developers in the area would ultimately be responsible for the final connections to homes and businesses, the jurisdictions should consider laying the trunk groundwork to support an integrated communications system.

Drainage Systems

The predominant ground elevation pattern in the study area is downward sloping to the Platte River from southeast to northwest. There are substantial barriers to that pattern, including the DIA property and the Rocky Mountain Arsenal National Wildlife Refuge. However, there are several natural watercourses that carry runoff to the Platte River.

A series of creek-sized drainageways form a pattern across the study area to carry water from southeast to northwest. These are Sand Creek, Irondale Gulch, First Creek, Second Creek, Third Creek, and Box Elder Creek. Third Creek travels through the DIA property from south to north before exiting at the northwest corner of the property. North of the airport, Barr Lake has several smaller drainageways that are tributary to the lake. On the east side of the airport, Box Elder Creek runs almost due north to Boot Lake Reservoir.

There are some unique circumstances concerning drainage within the study area. One is that the Rocky Mountain Arsenal National Wildlife Refuge is in the center of the study area. The agency has stipulations on the amount of drainage water that can flow through its property. This necessitates the need for detention ponds upstream of the property. However, the FAA has restrictions on detention ponds near airports because of concerns about migratory waterfowl. The FAA allows detention ponds but they must be discharged within 48 hours after a flood event. There is also a concern about drainage of the airport property regarding deicing fluids. During normal weather conditions, the deicing fluid run-off is captured and contained. During flood events the flows may exceed capacity of these systems and deicing fluid may enter the drainage basins, which is a water quality concern.

The Urban Drainage and Flood Control District (UDFCD) is a regional agency with a mission to protect people and property. It coordinates improvements to the regional drainageways and assists jurisdictions to implement the improvements. It has an established Northeast Quadrant subgroup that addresses drainage issues in the Aerotropolis study area. Each of the watersheds has been studied at various stages of detail, depending on the stage of development within the watershed. IGAs between jurisdictions are typically in place to establish flow levels across jurisdictional boundaries. Each of the cities and Adams County have adopted drainage requirements for new development and for publicly owned right-of-way along transportation corridors.

Observations

For the cited reasons, the drainage infrastructure may be more complex than other areas of the metropolitan region. The watersheds traverse multiple jurisdictions through the study area. The development of land needs to accommodate detention ponds, and agreements need to be in place to manage the drainage systems. There is an opportunity for long term efficiency, resiliency, and quality of life to be gained by regional collaboration regarding drainage needs.

Proactive planning to preserve the floodplain, wetland, and riparian areas of drainageways would help sustain ecological resources. In contrast to channelization, floodplains store and convey floodwaters, thereby reducing flood damages and erosion. Floodplains enhance biodiversity, providing breeding and feeding grounds for fish and a wide variety of wildlife.

Regional detention facilities typically require proportionally less total land area and are more cost-effective to construct and maintain compared to on-site facilities. Well-designed regional facilities may also provide more favorable riparian habitat and offer greater opportunities for achieving multi-use objectives. Because of the complexities associated with how they function within an entire watershed, regional detention facilities must be developed in the context of a formal master planning process.

The quality of life can be enhanced when drainageways are developed as multiuse recreational corridors. These features add substantially to the overall attractiveness of the Aerotropolis area for future development. Adams County, Aurora, Brighton, Commerce City, and Denver prepared *The Emerald Strands, A Cooperative Park, Open Space, and Trail Plan for the Area Surrounding the new Denver International Airport* for the area around DIA (Adams County et. al. 1990). Figure 4 illustrates the conceptual open space, parks, pedestrian/bicycle trails, and major drainageways in the study area.

A regional and collaborative perspective on multipurpose drainageways produces positive outcomes:

- Lower capital and maintenance costs.
- Multiuse opportunities, including parks and recreation.
- Increased marketing potential.
- Community character and identification.
- Achievement of sustainability principles.

Transportation

Transportation needs have been thoroughly identified and catalogued by the cities and counties in their various transportation plans.

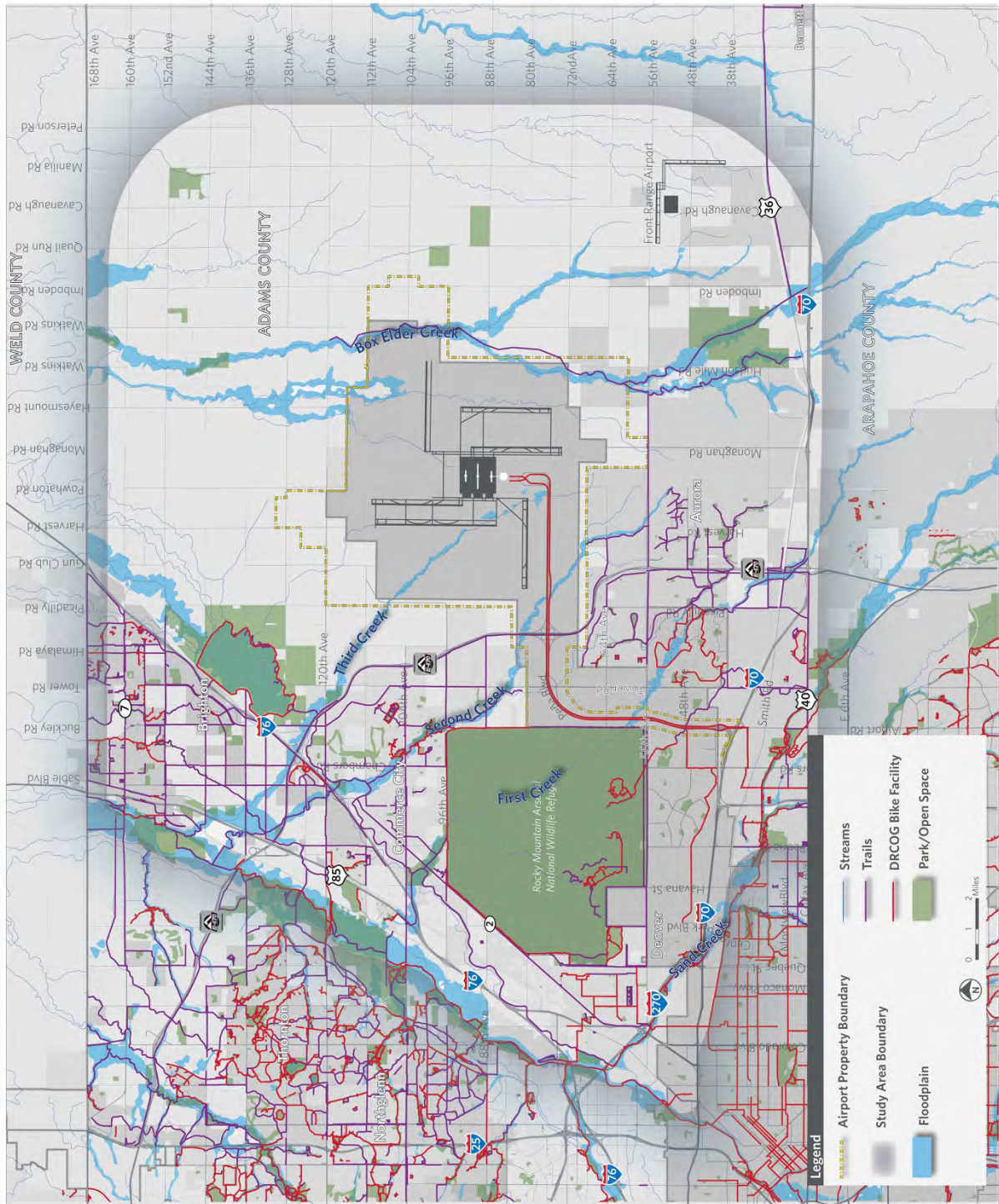
Local and Regional Transportation Plans

Local and regional transportation plans provide the context for future infrastructure development around DIA.

Transportation plans or comprehensive plans have been developed by Adams County, Aurora, Brighton, Commerce City, and Denver and form the basis for the transportation infrastructure prioritization process. Transportation plans relevant to the study area are:

- Adams County *Imagine Adams County Comprehensive Plan, Transportation Plan Update*, 2012
- City of Aurora *Street Construction Priority Program for the Area South of DIA*, 2014

Figure 4 Open Space, Parks, and Major Drainageways in the Study Area



Source: Aerotropolis Study Team from Available Plans.

- City of Aurora *Northeast Area Transportation Study*, 2009
- City of Brighton *2020 Comprehensive Plan*, Amended 2009
- City of Commerce City *C3 Vision Transportation Plan*, 2010
- City and County of Denver *Strategic Transportation Plan*, 2008
- Denver Regional Council of Governments (DRCOG) *2040 Fiscally Constrained Regional Transportation Plan (DRCOG 2040 RTP)*, 2014

All of these plans identify priorities for infrastructure investment in the Aerotropolis study area and recognize the massive potential for growth in the area.

The Adams County *Transportation Plan Update* identifies significant capacity improvement for all modes in the area as strategic corridors (Figure 5).

Summary of Adams County *Transportation Plan Update*

Roadway	High-Order and Regional Facilities – I-70 – I-76 – E-470 – US 85 – Peña Boulevard – 56th Avenue – Imboden Road – 120th Avenue	Other Strategic Corridors – Tower Road – Picadilly Road – 64 th Avenue – 48 th Avenue – Harvest Mile – 104 th Avenue – SH 2 – 88 th Avenue
Transit	– FasTracks University of Colorado A Line – FasTracks Northeast Area Transit Corridor (FasTracks Right-of-Way Preservation) – High Speed Rail Corridor(s) To Be Determined	
Pedestrian/Bicycle	– Colorado Front Range Trail	

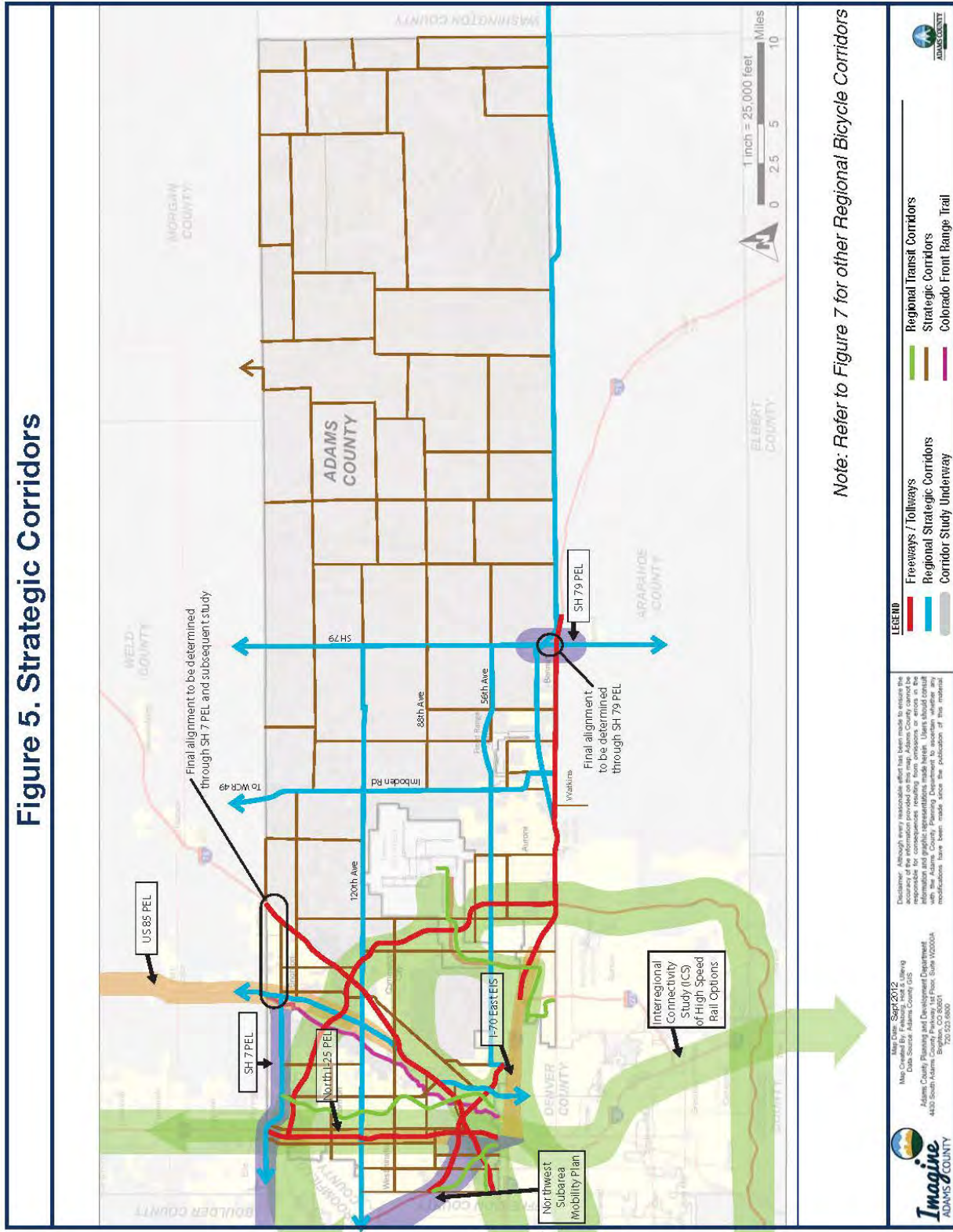
The City of Aurora *Northeast Area Transportation Study* and *Street Construction Priority Program for the Area South of DIA* also identified priorities for infrastructure investments in the study area. These are listed below and shown in Figure 6 and Figure 7.

Summary of City of Aurora *Northeast Area Transportation Study* and *Street Construction Priority Program for the Area South of DIA*

Roadway	Interchanges (Bold = High Priority) – E-470/48th Avenue – E-470/64 th Avenue – I-70/Harvest Road – I-70/Manilla Road – I-70/Picadilly Road – I-70/Quail Run Road – I-70/Watkins Road	Corridors (Bold = High Priority) – 26 th Avenue – 48th Avenue – 56 th Avenue – 64th Avenue – Harvest Road – Picadilly Road
Transit	– E-470 corridor for future transit – UPRR/I-70 – Jewell Avenue	
Pedestrian/Bicycle	– Several regional trail corridors (see Figure 7)	

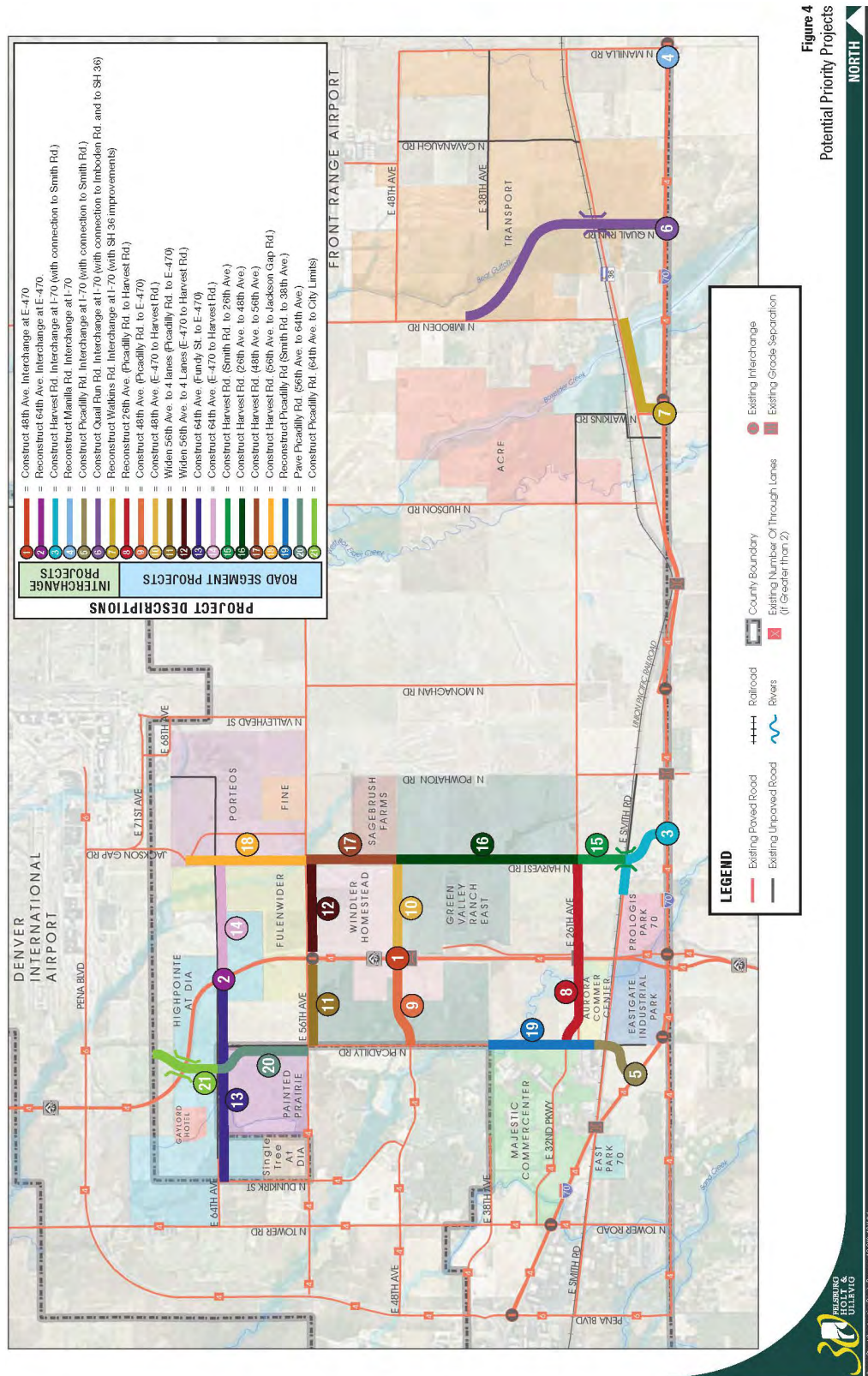
Figure 5 Adams County *Transportation Plan Update* Strategic Corridors

Figure 5. Strategic Corridors



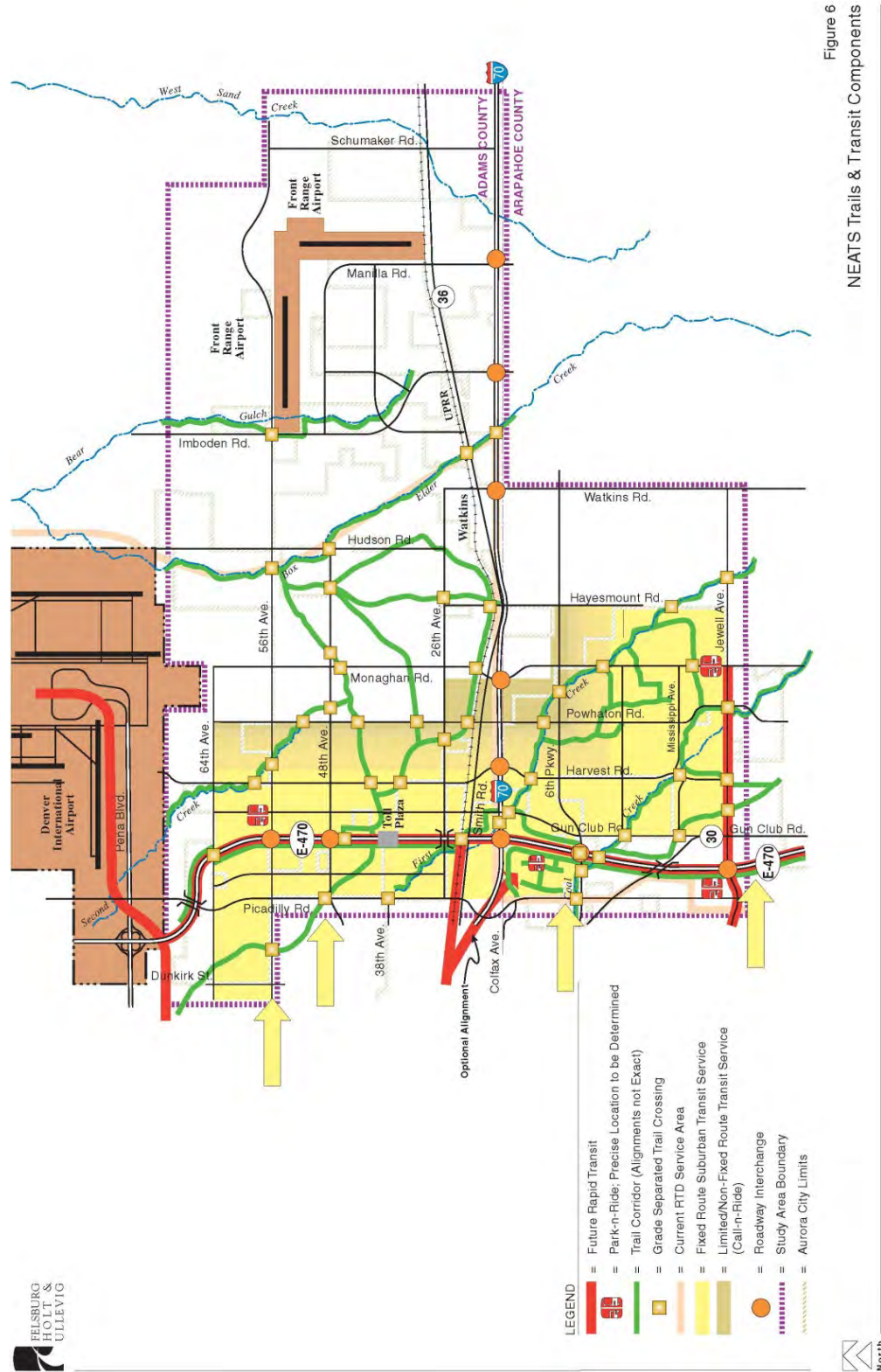
Source: Adams County Transportation Plan Update

Figure 6 City of Aurora Streets Plan from the *Northeast Area Transportation Study*



Source: City of Aurora Northeast Area Transportation Study

Figure 7 City of Aurora Bicycle & Pedestrian Plan from the *Northeast Area Transportation Study*



Source: City of Aurora *Northeast Area Transportation Study*

The City of Brighton is working on updates to its Transportation Master Plan and Comprehensive Plan. Prior plans identified 120th Avenue and SH 2 as major arterials in the Aerotropolis study area. Brighton is also focused on bringing better transit service to town as part of the FasTracks Northeast Area Transit Evaluation studies, which focus on right-of-way preservation for bus rapid transit (BRT) and/or rail to Brighton.

The City of Commerce City *C3 Vision Transportation Plan* identified the following priority corridors and projects. Figure 8 shows all strategic corridors identified by Commerce City.

Summary of City of Commerce City *C3 Vision Transportation Plan*

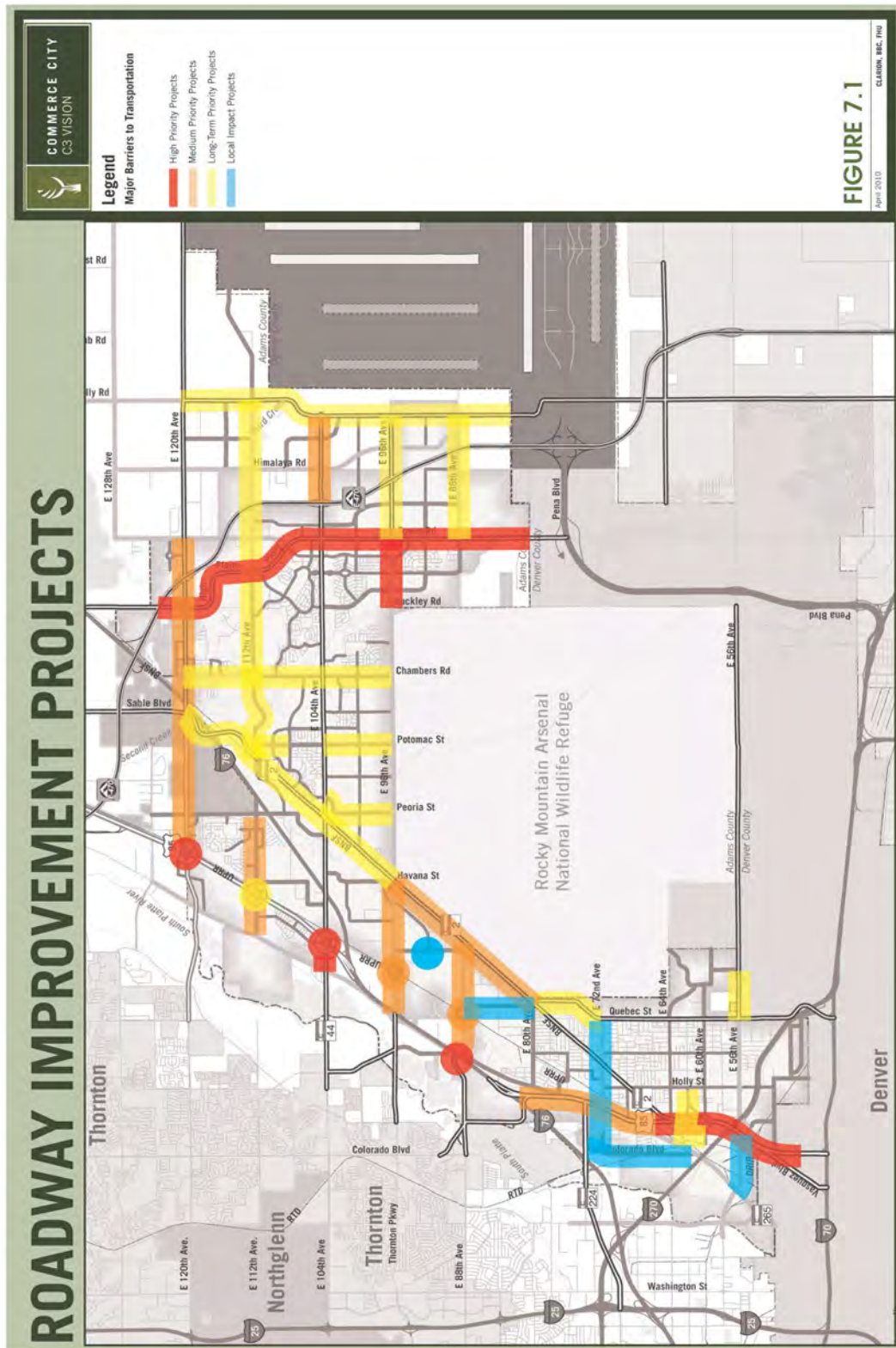
Roadway	High Priority <ul style="list-style-type: none"> - Tower Road - US 85 - 96th Avenue - 104th Avenue - 120th Avenue - High Plains Parkway - I-76/88th Avenue Interchange - US 85/120th Avenue - US 85/104th Avenue
Transit	<ul style="list-style-type: none"> - FasTracks North Metro Commuter Rail - FasTracks University of Colorado A-Line - FasTracks Northeast Area Transit Corridor (FasTracks Right-of-Way Preservation) - E-470 corridor for future transit
Pedestrian/Bicycle	<ul style="list-style-type: none"> - Several regional trail corridors (see Figure 9)

The City and County of Denver *Strategic Transportation Plan* developed recommendations for corridors and projects within the “Gateway” travel shed. These projects are shown below and displayed in Figure 10.

Summary of City and County of Denver *Strategic Transportation Plan*

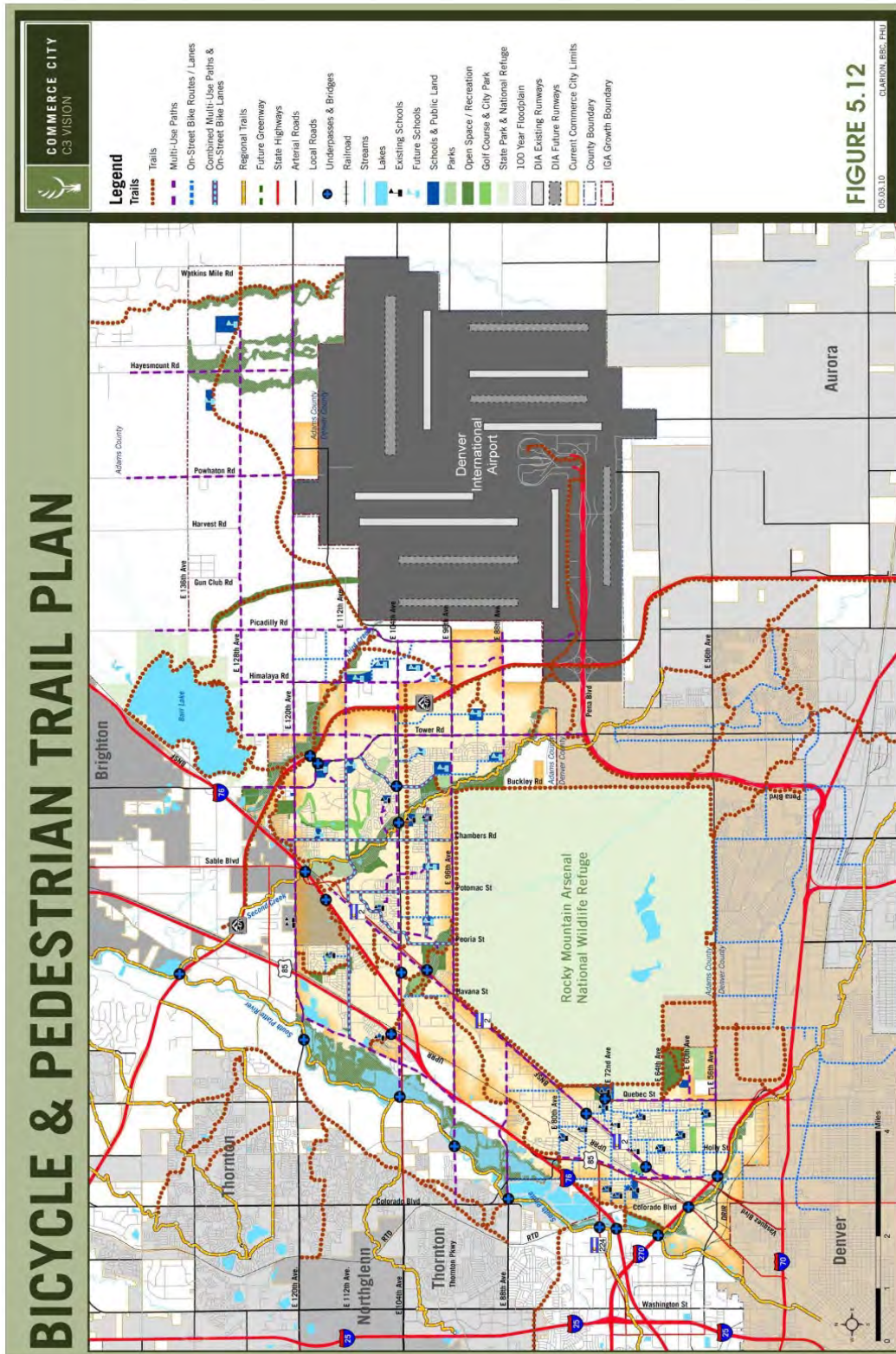
Roadway	High Priority <ul style="list-style-type: none"> - 38th Avenue - 48th Avenue - 56th Avenue - Tower Road - Telluride Street - Dunkirk Street - Picadilly Road - 64th Avenue - 71st Avenue
Transit	<ul style="list-style-type: none"> - FastConnects hubs to connect to University of Colorado A Line - Enhanced amenities at bus stops
Pedestrian/Bicycle	<ul style="list-style-type: none"> - Connections to University of Colorado A Line Stations - Regional trail system

Figure 8 City of Commerce City Strategic Corridors from the *C3 Vision Transportation Plan*



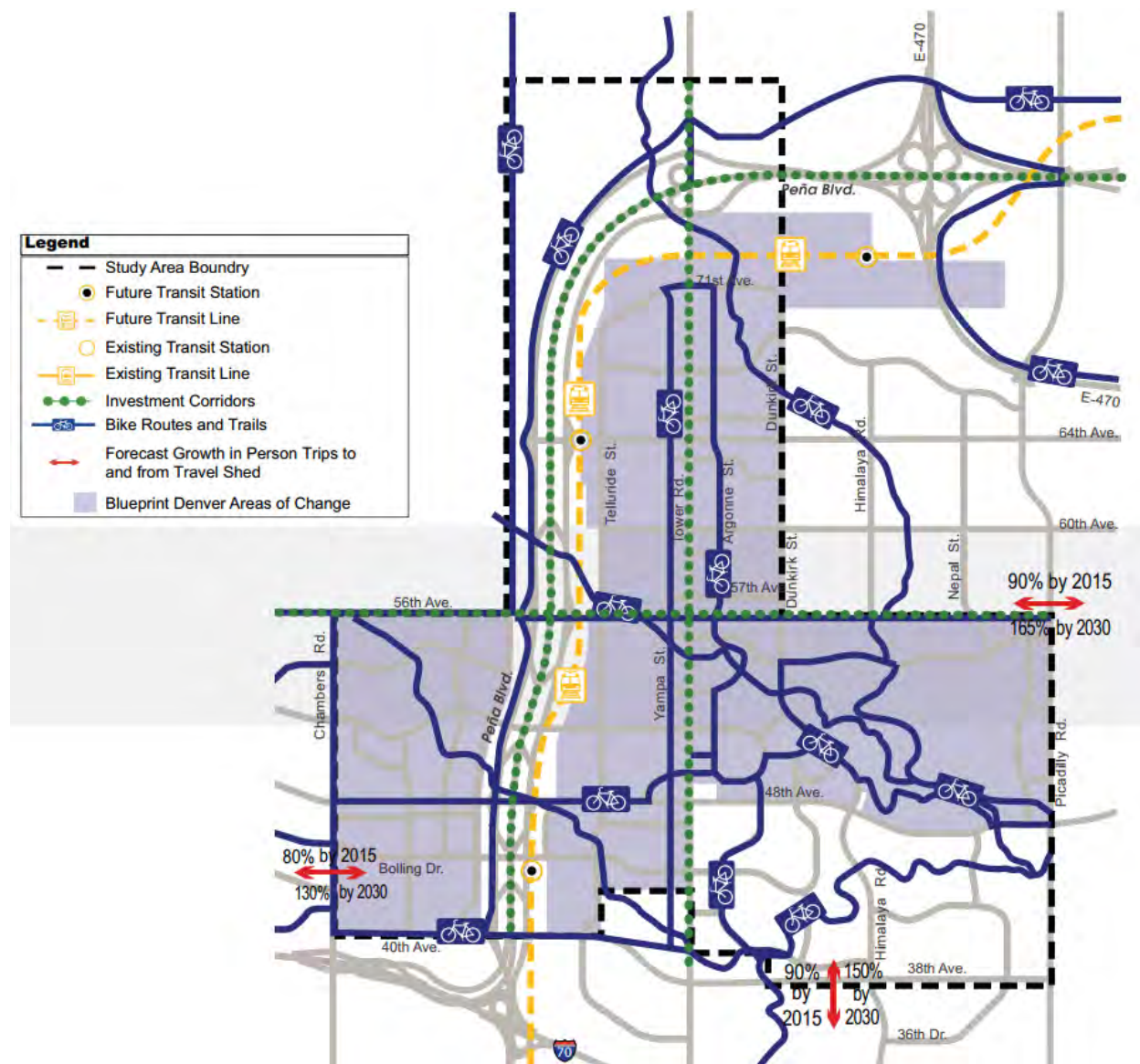
Source: City of Commerce City *C3 Vision Transportation Plan*

Figure 9 City of Commerce City Bicycle and Pedestrian Plan from the *C3 Vision Transportation Plan*



Source: City of Commerce City *C3 Vision Transportation Plan*

Figure 10 City and County of Denver Projects within the “Gateway” Travel Shed



Source: City and County of Denver

On the whole, the various local and regional plans indicate that the Aerotropolis study area warrants substantial investments in transportation infrastructure.

Common themes in the transportation plans include:

Roadway

- Increase north-south capacity through the area between DIA and the Rocky Mountain Arsenal National Wildlife Refuge corridors, including:
 - Peña Boulevard
 - E-470
 - Imboden Road
 - Tower Road

- Picadilly Road
- Plus at least one more arterial for additional capacity
- Provide additional connections into the airport properties. These would consist of connections for access through Jackson Gap, and connections of future on-airport land uses to adjacent sites in adjoining cities.
- East-West capacity improvements to:
 - 48th Avenue
 - 56th Avenue
 - 64th Avenue
 - 72nd Avenue
 - 88th Avenue
 - 96th Avenue
 - 104th Avenue
 - 120th Avenue
- Connection to the metropolitan region controlled-access highway system with interchange construction and improvements along both E-470 and I-70.

Transit

- Capitalize on the RTD commuter rail University of Colorado A Line.
- Consider additional transit capacity in the following forms:
 - BRT or other regional bus service on major corridors.
 - Right-of-Way Preservation and eventual construction on the Northeast Area Transit Corridor.
 - Right-of-Way Preservation and eventual construction on the E-470 corridor for future transit - potential for high-speed rail.

Pedestrian and Bicycle

- Build out a regional trail system.
- Build multimodal streets complete with high-quality sidewalks, bike lanes, cycle tracks and other treatments, as appropriate.
- Focus on providing high-quality access to transit.

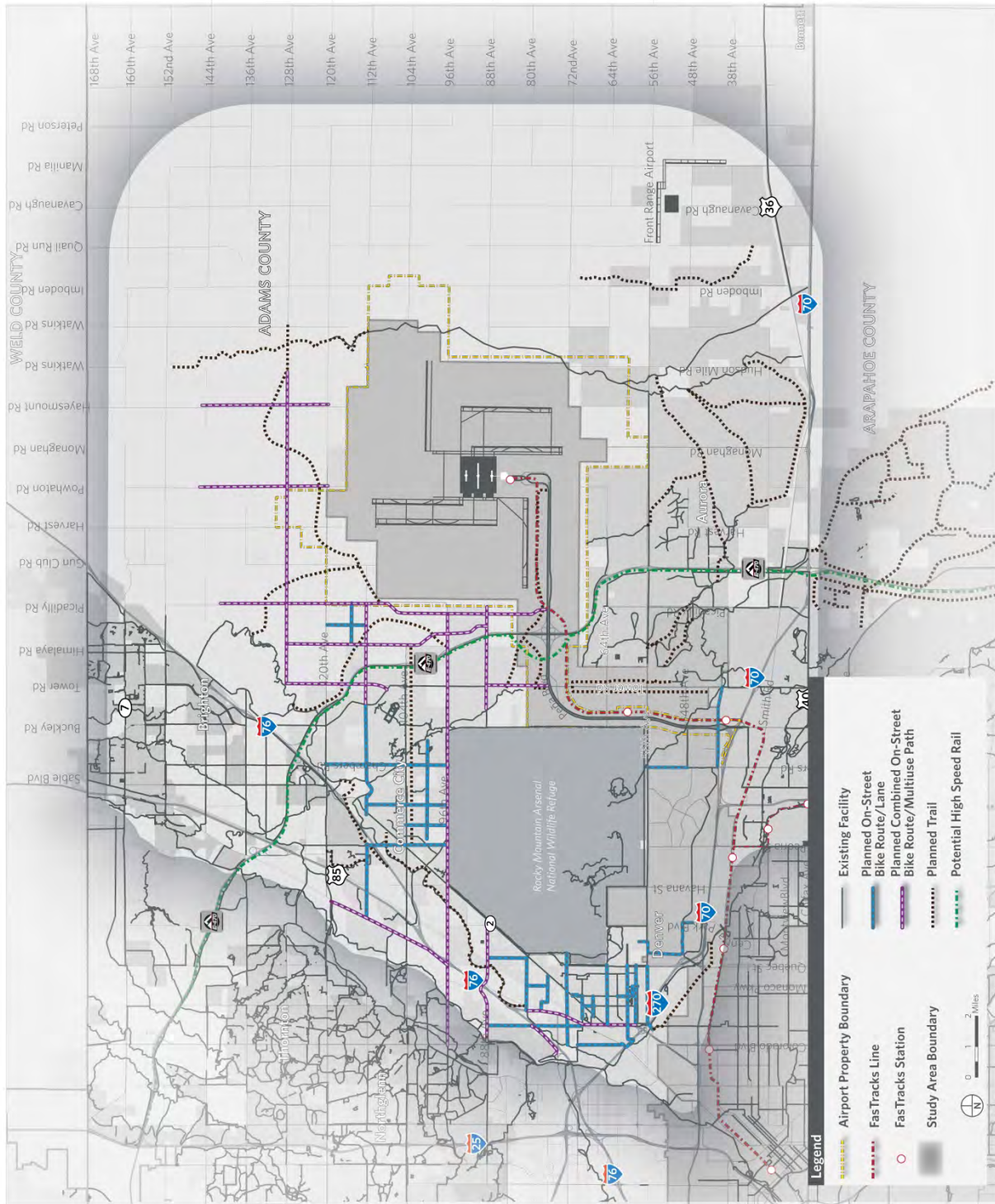
Figure 11 illustrates a compilation of the roadway plans from the jurisdictions. Figure 12 illustrates a compilation of the pedestrian, bike, and transit plans from the primary stakeholders.

Figure 11 Compilation of Transportation Plans



Source: Aerotropolis Study Team from Available Plans.

Figure 12 Compilation of Transit, Pedestrian, and Bicycle Plans



Source: Aerotropolis Study Team from Available Plans.

Recent and Ongoing Studies

In addition to the local plans and updates outlined above, other recently completed or ongoing studies are addressing transportation needs in the Aerotropolis study area. These are described below and shown on Figure 13:

- Peña Boulevard Corridor Transportation Study

A study of Peña Boulevard is underway to identify new funding options for Peña Boulevard maintenance and expansion. Peña Boulevard was built with Federal Aviation Administration funds. A key condition of federal law is that all revenue generated by DIA is used only for airport purposes. This rule applies to the maintenance and operation of Peña Boulevard.

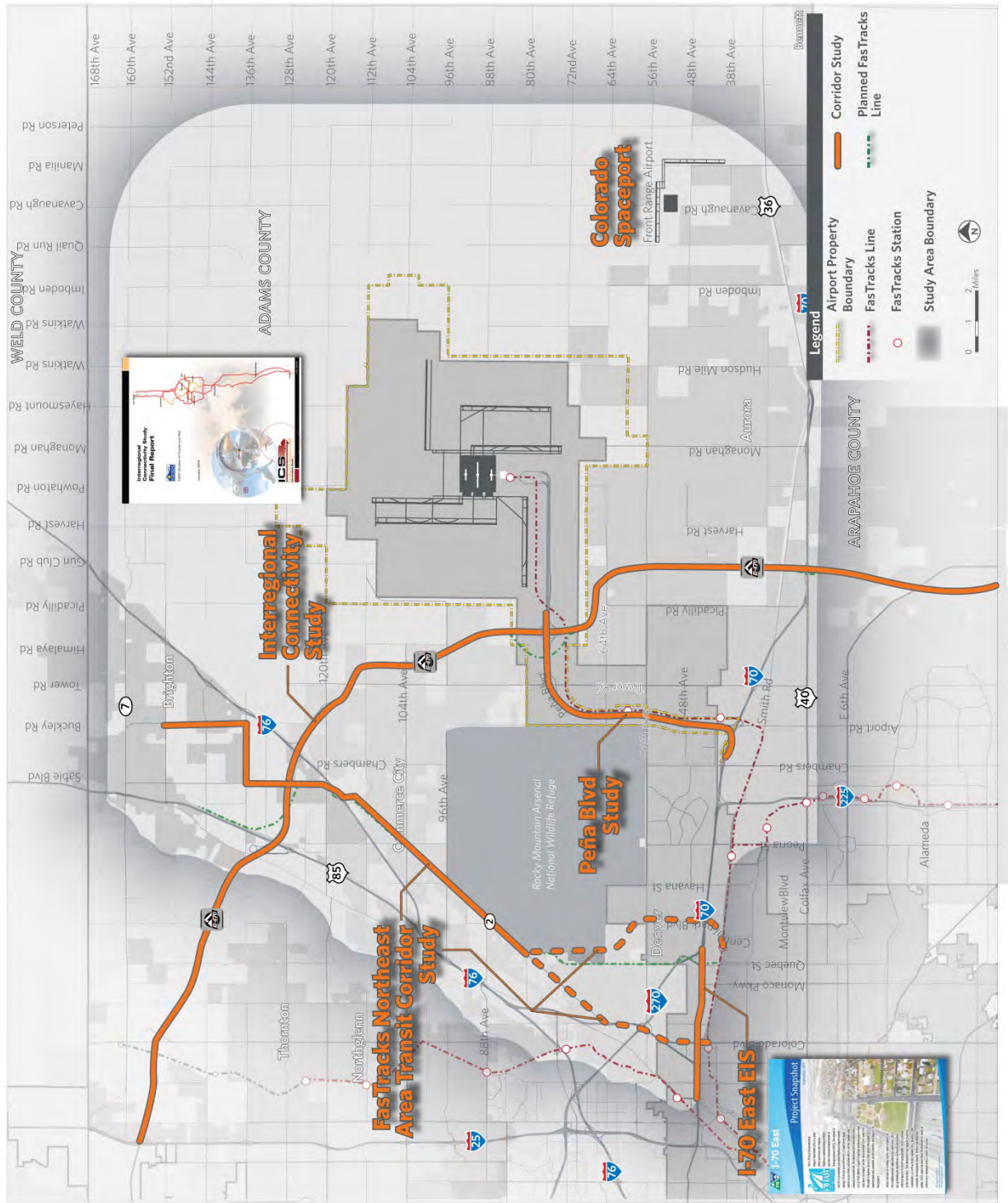
Since the opening of DIA, commercial and residential development near the airport has resulted in an increasing number of motorists using Peña Boulevard for reasons other than to reach the airport. While traffic on Peña Boulevard between E-470 and the Terminal is 100 percent airport-related, a travel survey indicates 40 percent of the traffic on Peña Boulevard on the southern segment between I-70 and 40th is not airport-related. This non-airport related traffic currently results in DIA spending about \$1 million a year in additional maintenance funds on Peña Boulevard.

This issue, as well as future regional opportunities for the use of Peña Boulevard, must be addressed to remain in compliance with the covenants DIA has executed with the FAA.

Therefore, the purpose of the Peña Boulevard Study is to:

- Identify short- and long-term transportation needs of the Peña Boulevard corridor.
 - Identify and analyze alternatives for improving and funding Peña Boulevard.
 - Work with neighboring jurisdictions and local, state, and federal partners to find solutions.
- FasTracks Northeast Area Transit Evaluation (NATE) II Study
- RTD is conducting the FasTracks NATE II Study to evaluate transit options in the northeastern metropolitan area between downtown Denver and Brighton. This involves updating environmental, transportation, land use and municipal plan information from the NATE I study; performing high-level fatal flaw analysis of commuter rail and light rail alternatives; and developing BRT alternatives and evaluations.
- Spaceport Colorado
- The Spaceport Colorado team is in the process of preparing a License Application and Environmental Assessment that would allow spacecraft horizontal launch operations at Front Range Airport. Spaceport Colorado's vision is to increase the value and revenue-generating potential of the Front Range Airport; engage the suborbital commercial space market for scientific research, education, and space tourism; establish Colorado as the North American commercial space node, growing into an international system of spaceports;

Figure 13 Recent and Ongoing Studies



Source: Aerotropolis Study Team from Available Studies.

and sustain and accelerate Colorado's aerospace industry by attracting high-value aerospace technology clusters that support advanced manufacturing, technology, educational, and research and development aerospace industries.

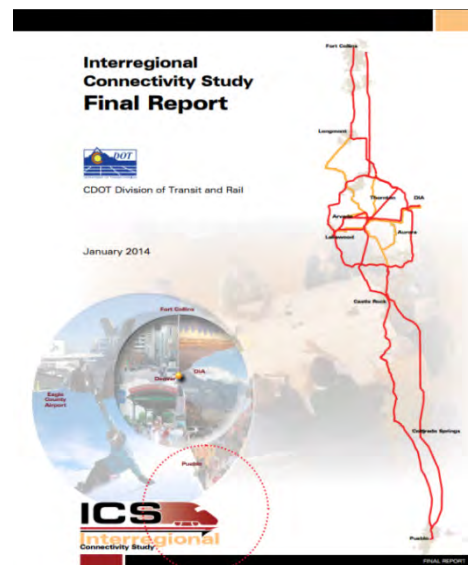
- Interregional Connectivity Study

CDOT's Interregional Connectivity Study, completed in 2014, evaluates the feasibility of high-speed transit (HST) options in Colorado.

The objectives of the study were to:

- Serve as a planning document and provide preliminary recommendations for HST segments, technologies, and station locations in the Denver metropolitan area that would maximize ridership for the existing and proposed RTD FasTracks transit system and future HST service.
 - Identify potential future HST connections with the RTD FasTracks system.
 - Determine optimal locations for a north-south (Front Range) corridor HST segment from Fort Collins to Pueblo and an east-west HST segment from the airport to the C-470/I-70 interchange in Jefferson County. The recommended alignment to serve DIA is along the median of E-470 to the north and to the south.
- I-70 East Environmental Impact Statement (EIS)

The I-70 East EIS is a joint effort between the Federal Highway Administration (FHWA), and CDOT. The intent of the EIS is to identify potential highway improvements along I-70 between I-25 and Tower Road and to assess their potential effects on the human and natural environment. After a decade of working closely with residents of the neighborhoods adjacent to the interstate, CDOT has preliminarily identified a preferred alternative, which proposes to lower and



partially cover a portion of the interstate. This alternative has support from the community, as well as from regional civic, business, and economic development leaders.

Typical Roadway Cross-Sections

The Aerotropolis area could benefit from a common set of typical roadway cross-sections, which would create a sense of place that provides cohesion across jurisdictional boundaries.

The study team reviewed existing design standards from the municipalities within the study area, as well as best practices for creating safe and efficient roadways. Many commonalities were identified through this review.

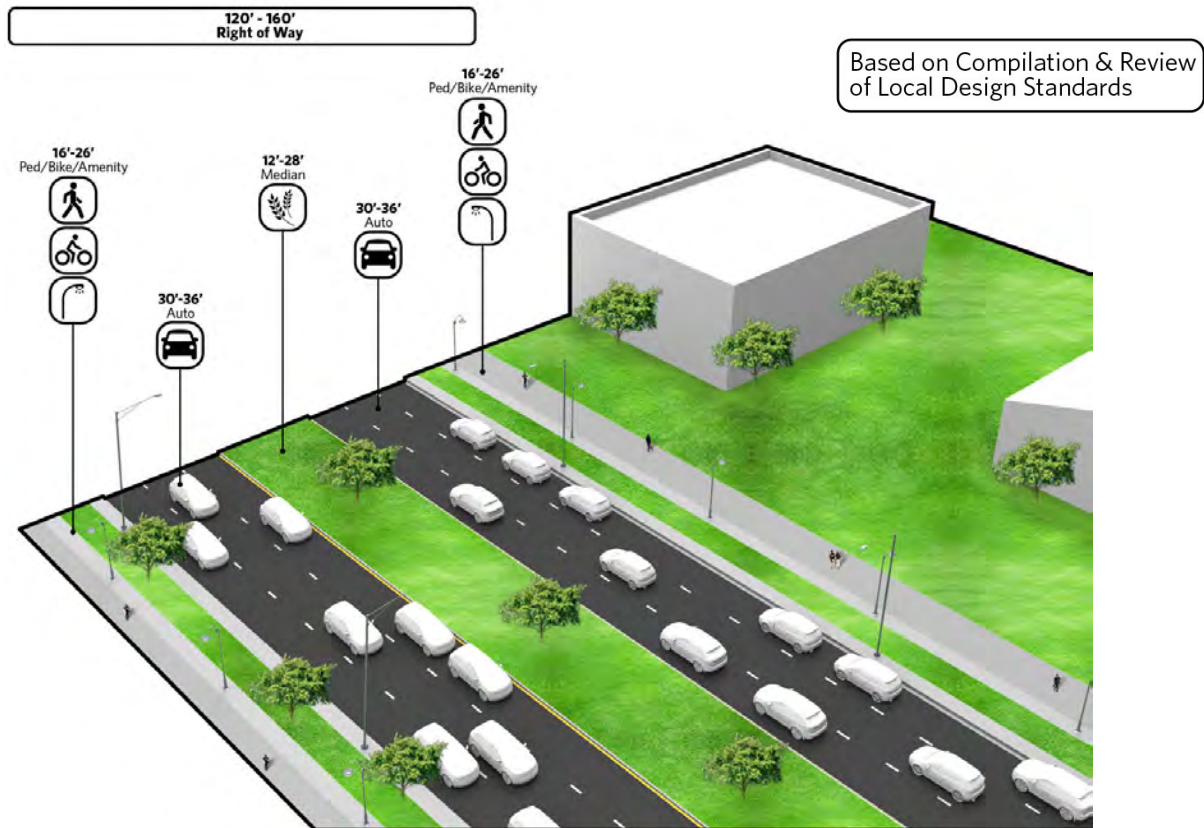
Representative conceptual cross-sections illustrating the types of roads that could comprise the roadway network are presented in this section (Figure 14, Figure 15, and Figure 16). These do not represent a full set of cross-sections needed to guide the Aerotropolis roadway network; it simply illustrates that the various municipalities already have commonalities regarding design standards, and collaboration on developing a common set of cross-sections is achievable.

Figure 14 Major Arterial Cross-Section

Major Arterial: The major arterial cross-sections are aimed primarily at moving a high volume of people. The facility would serve both general purpose and transit trips, and space in the cross-section could be allocated accordingly. Separated facilities are provided for pedestrians and bicyclists.

**Recommended
Right-of-Way:**
120' -160'

Cross-section Elements (Each Side):
16' -26' Pedestrian, Bike, and Amenity Zone
10' -12' Travel Lanes (3)
12' -28' Median



Note that the urban form/land use depiction is not intended to convey specific buildings or land use types.

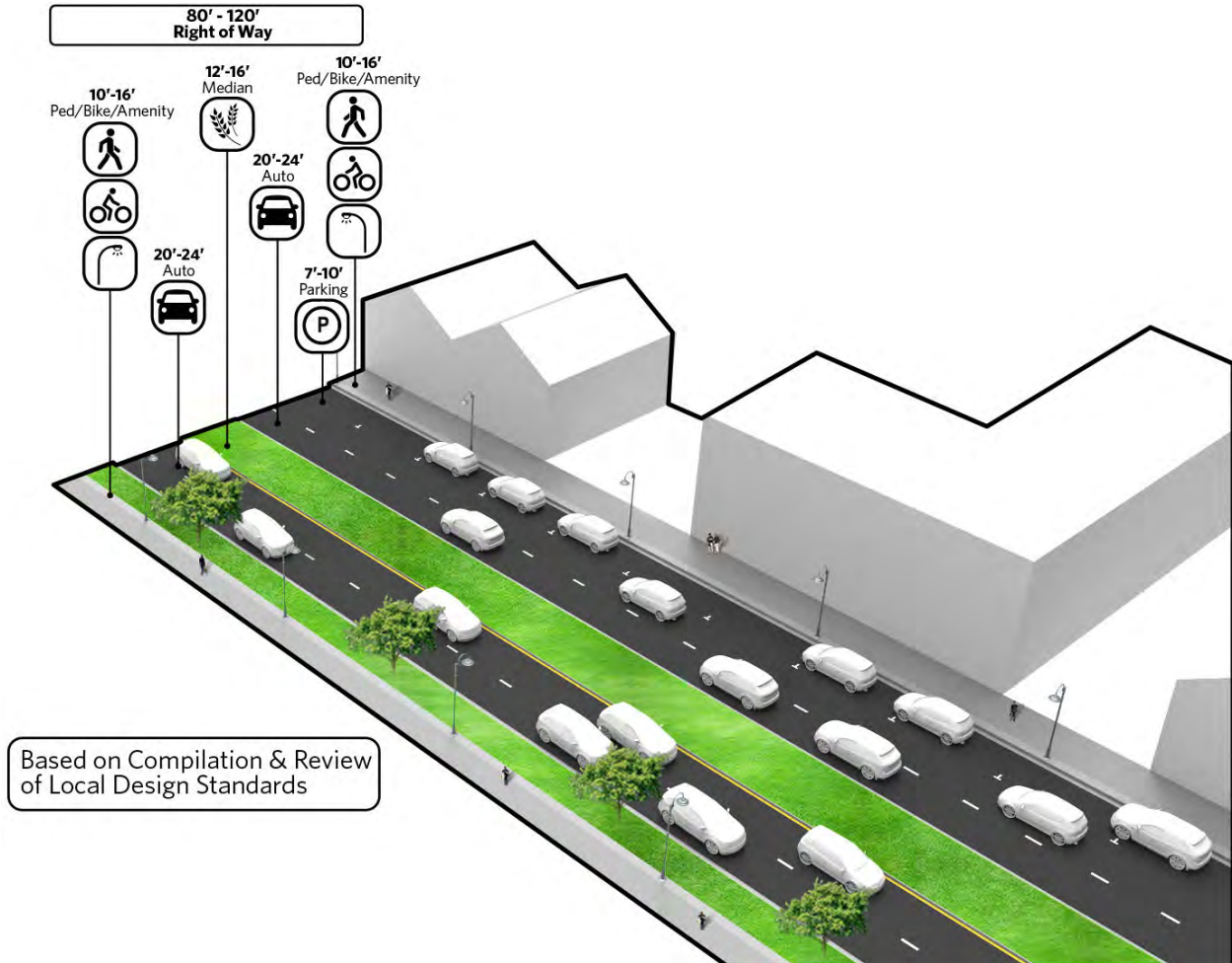
Source: Aerotropolis Study Team.

Figure 15 Minor Arterial Cross-Section

Minor Arterial: The character of minor arterials within the Aerotropolis area should reflect an ability to move about safely on foot while still prioritizing efficient mobility. The facility would serve both general purpose and transit trips, and space in the cross-section could be allocated accordingly.

**Recommended
Right-of-Way:**
80'-120'

Cross-section Elements (Each Side):
10'-16' Pedestrian, Bike, and Amenity Zone
8' Parking Lane
10'-12' Travel Lanes (2)
16' Median



Note that the urban form/land use depiction is not intended to convey specific buildings or land use types.

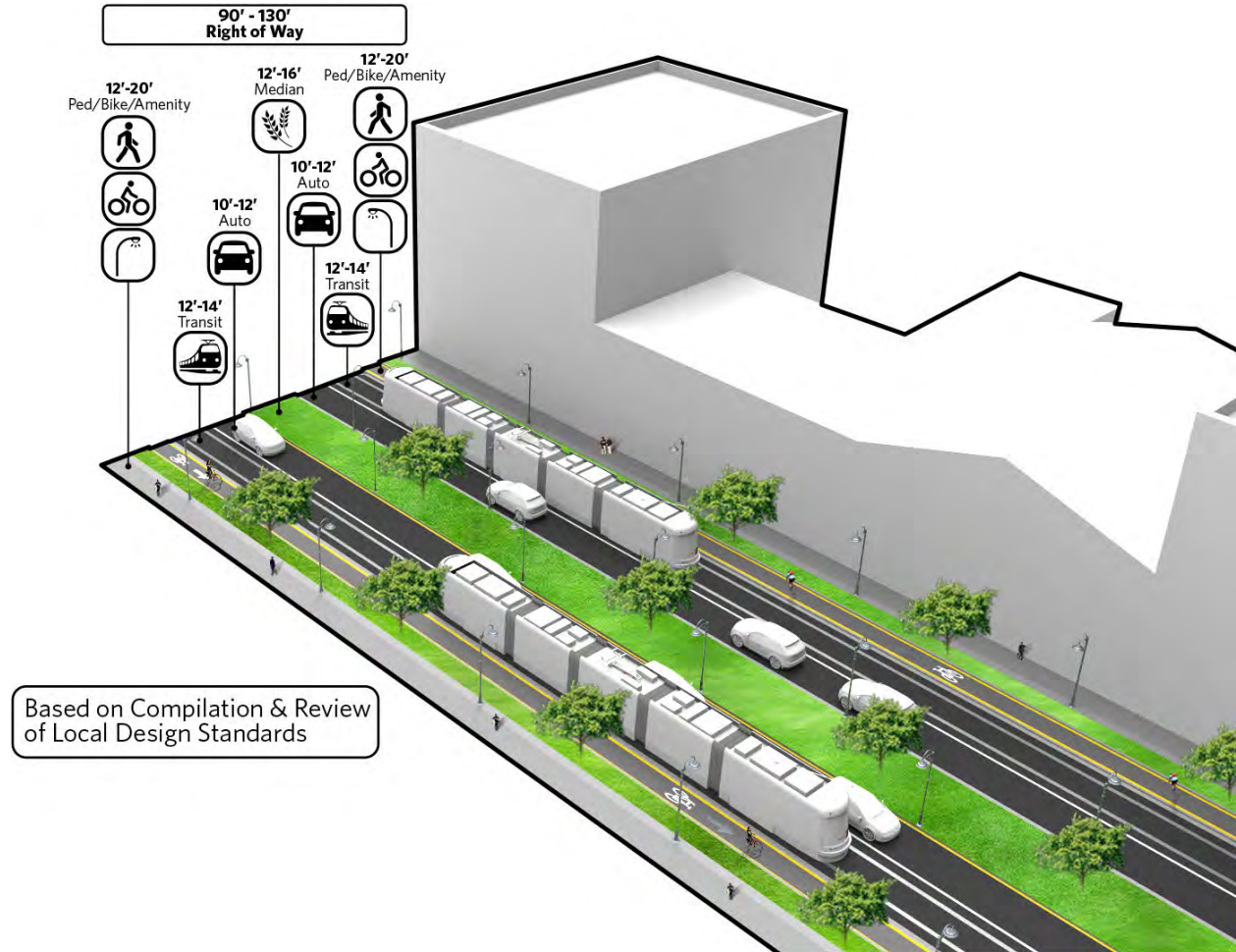
Source: Aerotropolis Study Team.

Figure 16 Multimodal Boulevard Cross-Section

Multimodal Boulevard: The multimodal boulevard cross-section proposed for the Aerotropolis study area minimizes vehicular traffic while providing robust facilities for people walking, biking, and using transit.

Recommended Right-of-Way:
 90' -130'

Cross-section Elements (Each Side):
 12' -20' Pedestrian, Bike, and Amenity Zone
 12' Streetcar/LRT/BRT
 10' Travel Lane
 14' Median



Note that the urban form/land use depiction is not intended to convey specific buildings or land use types.

Source: Aerotropolis Study Team.

Scenarios Comparison

To demonstrate the benefits and challenges associated with the development of a Colorado Aerotropolis, the study team compared two scenarios:

- **Business as Usual Scenario.** This scenario represents a continuation of past trends reflecting development patterns near the airport. It is a hypothetical case to contrast with an IGA-enabled Aerotropolis Scenario.
- **Aerotropolis Scenario.** This scenario represents a higher level of regional coordination and marketing relative to infrastructure and development surrounding DIA leading to a collaborative Aerotropolis plan and more rapid, cohesive development in the study area.

Business as Usual Scenario

The Business as Usual Scenario assumes that only those transportation projects identified as federally or state-funded in the *DRCOG 2040 RTP* would be constructed. Municipalities also will build projects with their own funds, such as a dedicated sales tax. In general, any local funding of transportation projects in the *DRCOG 2040 RTP* is partially dependent on build-out of the area and associated revenue streams from developers.

The Business as Usual Scenario transportation network is shown in Figure 17. The infrastructure cost of this scenario would be approximately \$366 million (excluding the \$1.2 billion Central 70 project). Table 1 shows the regionally funded projects and their conceptual cost estimates.

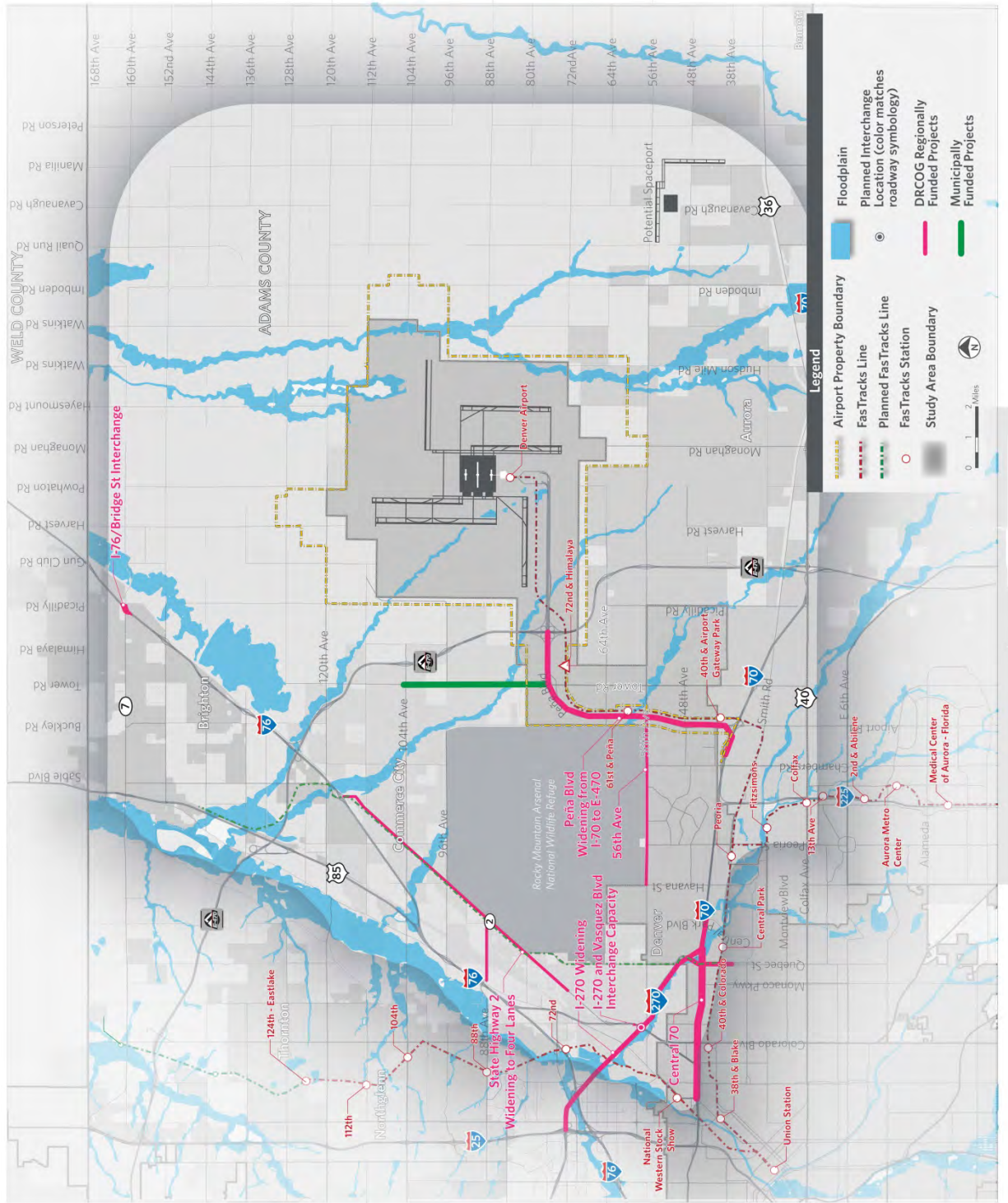
Table 1 DRCOG Projects in Study Area to be Funded with Regional Sources

Roadway	Project Location	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (\$M) 2015\$	County
56th Ave.	Havana St. to Peña Blvd.	Widen from 2 to 6 Lanes	4.3	2015-2024	45.0	Denver
88th Ave.	I-76 NB Ramps to SH-2	Widen from 2 to 4 Lanes	1.7	2015-2024	21.5	Adams
Peña Blvd.	I-70 to E-470	Widen from 4 to 8 Lanes	6.4	2015-2024	55.0	Denver
Quebec St.	35th Ave. to Sand Creek Dr. S	Widen from 4 to 6 Lanes	1.2	2015-2024	11.0	Denver
I-70	Brighton Blvd. to I-270	Add 4 Managed Lanes	3.8	2015-2024	1175.7	Denver
I-270	I-25 to I-70	Widen from 4 to 6 Lanes	6.3	2035-2040	160.0	Adams
I-270	Vasquez Blvd.	Interchange Capacity	n/a	2015-2024	60.0	Adams
SH-2	72nd Ave. to I-76	Widen from 2 to 4 Lanes	7.5	2015-2024	13.6	Adams

Note: 2015 dollars.

Source: DRCOG 2040 RTP.

Figure 17 DRCOG 2040 RTP Regionally Funded Projects (Business as Usual Network)



Source: DRCOG 2040 RTP.

Aerotropolis Scenario

An Aerotropolis Scenario assumes that greater collaboration, increased economic activity, and greater efficiencies can result in an earlier build-out of employment and residential land uses, which would mean earlier implementation of already-planned infrastructure.

Conceptual Transportation Networks

Based on the local and regional plans, and projections for a transportation network to support an Aerotropolis development, conceptual transportation networks were developed for two planning horizons:

- A long-term vision illustrates the potential build-out condition of the Aerotropolis, which would be realized several decades into the future.
- A near-term vision uses 2040 as the planning horizon for regional planning.

Aerotropolis Long-term Vision Transportation Network (2075 or Beyond)

The long-term vision for a fully developed Aerotropolis may have a horizon timespan of several decades, perhaps to 2075 or beyond. The long-term future transportation network serving a fully developed Aerotropolis would be a full hierarchical grid system of facilities surrounding the DIA property. This would include high-order facilities designed for safe, fast, and efficient *movement* of people, goods, and information through and around the Aerotropolis area and local access facilities designed for efficient *delivery* of people, goods, and information within the Aerotropolis area. The future transportation grid would likely include Vehicle to Infrastructure (V2I) communication-enabled technology.

The core of this network exists today. High-order facilities include I-70, I-76, Peña Boulevard, E-470, and RTD's commuter rail University of Colorado A Line. Major arterials in the area include 56th Avenue, Tower Road, 104th Avenue, and 120th Avenue. There are local access roads within the master-planned developments in the study area. As development occurs over the next 50 years or more, this core network would serve as the foundation upon which economic activity is built. Preserving right-of-way for efficient, fast movement is of paramount importance. Dr. John Kasarda, who coined the term *Aerotropolis* and is largely credited for the increased focus on the concept, has said, "it's not the big eat the small. It's the fast eat the slow." In other words, Kasarda contends that ground transportation near an airport must be fast and efficient, and that the places with the fastest access to jobs and industry near airports would win a greater share of global economic activity driven by air travel.

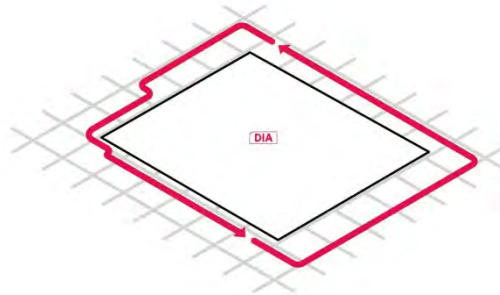
*It's not the big eat the small.
It's the fast eat the slow.
—John Kasarda*

Because of the expanse of the potential Aerotropolis build-out area and the need for fast and efficient access around the development, one of the higher-order facilities might be a controlled-access multimodal loop that encircles the Aerotropolis area. This loop would be a high-speed facility serving travel modes of technologies potentially unknown today. It would potentially be placed off of the section lines to allow efficient access to development along the arterials. The need for this type of facility and its characteristics will need further definition and study.

It is also recognized that several nodes of intense development would be geographically dispersed within the study area, and that these activity centers would each have their own distinct character. For the region to succeed, and to become a globally recognized hub for aviation and drive economic activity, such nodes must be well-connected to both the airport and the surrounding transportation network.

Figure 18 shows a concept of a Long-term Vision Transportation Network from a regional perspective, which could include a higher-order multimodal loop; it does not show the significant infrastructure investments that would be necessary at the local level to develop each node or corridor activity center. Future studies could determine the need for a multimodal loop and potentially identify a long-range phasing schedule for the post-2040 timeframe.

Figure 18 Aerotropolis Long-term Vision Transportation Concept (2075 or Beyond)



Source: Aerotropolis Study Team.

Aerotropolis Near-term 2040 Transportation Network

A conceptual near-term (2040) transportation network for the Aerotropolis was developed based on guiding principles and priority issues for each jurisdiction. The network is made up of near-term projects that would be the foundation for the Long-term Vision Transportation Network.

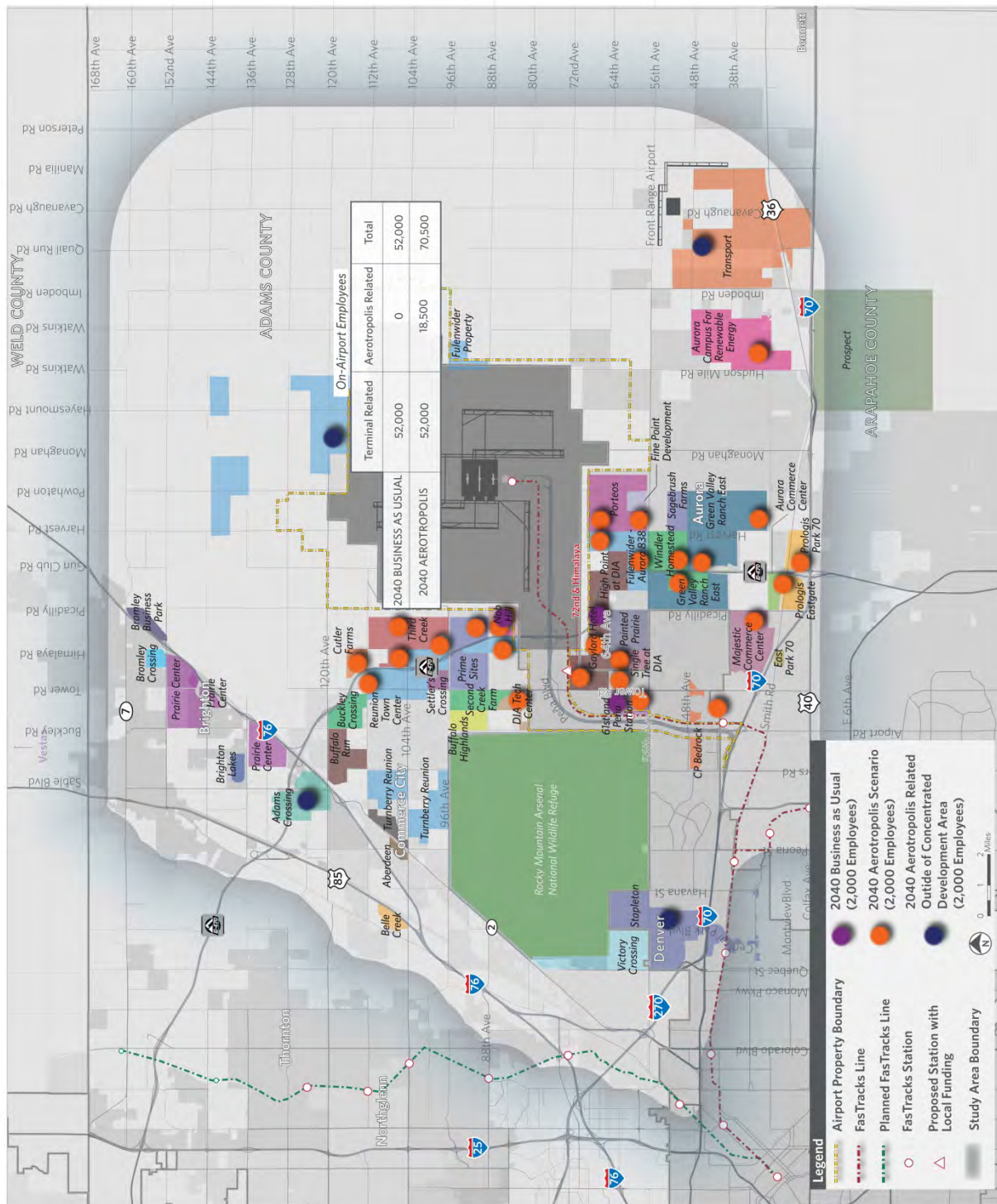
Guiding Principles

Based on input from study participants, principles were established to identify priorities for near-term projects to build the Near-term 2040 Transportation Network. The principles are listed without order of importance and are described in more detail below:

- Contiguous to Active Developments
- Reflect Current Local Plans
- Incremental to Previous Investments
- Achieve Early Attainable Projects
- Prioritization Through Regional Collaboration
- Support the Long-term Vision

Contiguous to Active Developments. Information from planning staff from the local jurisdictions helped to identify the active developments shown in Figure 19. The purple dots represent project growth areas under a Business as Usual Scenario. The orange dots represent growth projections under the Aerotropolis Scenario. These growth projections are described in detail in the *Assessment of Growth Projections for the Colorado Aerotropolis Study Area* working paper (Aerotropolis Study Team 2016).

Figure 19 Business as Usual Scenario and Aerotropolis Scenario Growth Areas



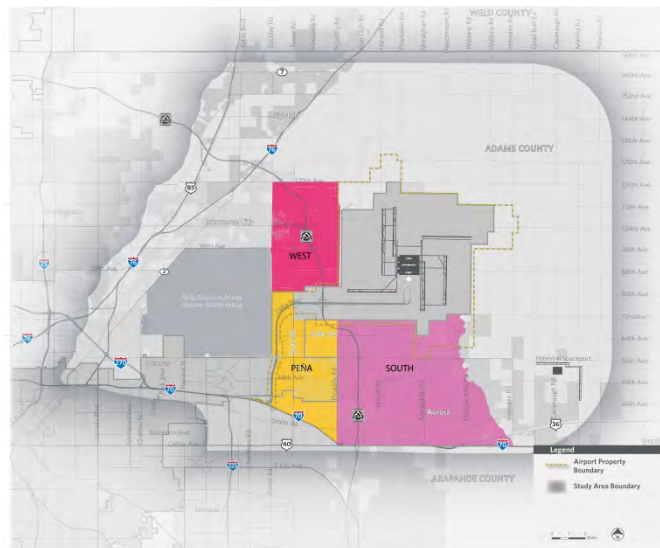
Source: Aerotropolis Study Team with input from Study Review Committee.

As illustrated, the near-term development is projected to occur primarily to the west and to the south of DIA. This subarea of the Aerotropolis study area is referred to as the Concentrated Development Area depicted in Figure 20.

Reflect Current Local Plans.

Current local transportation and comprehensive plans were reviewed and compiled. Each of the primary stakeholders of Adams County, Aurora, Brighton, Commerce City, and Denver has identified transportation needs and visions in the Aerotropolis area. The early-action needs are summarized below.

Figure 20 Concentrated Development Area



Source: Aerotropolis Study Team.

- Adams County
 - Arterial grid development
 - Access to Front Range Airport from:
 - DIA
 - I-70
- Aurora
 - Second connection to DIA from south
 - I-70 interchanges
 - E-470 interchanges
 - Arterial grid development and links to interchanges
- Brighton
 - Access to DIA north
- Commerce City
 - Resolve pinch-point capacity issues
 - Access to DIA west
 - Access to DIA north
 - E-470 interchanges
 - Arterial grid development and links to interchanges
- Denver
 - E-470 interchanges
 - Peña Boulevard capacity
 - Arterial grid development and links to interchanges

Incremental to Previous Investments. This principle steers project selection to incrementally build upon the current infrastructure. As shown in prior sections, there are several recent and upcoming infrastructure investments in the study area. These include the FasTracks commuter rail University of Colorado A Line, the FasTracks light rail R Line through Aurora, and widening projects on Tower Road, 56th Avenue, SH 2, and potentially I-70 and I-270.

Achieve Early Attainable Projects. This principle was adopted in recognition of the scale of the study area and its needs. The magnitude of some needed infrastructure projects, even within the Concentrated Development Area, present a daunting challenge in terms of funding. This principle guides early project selection towards those improvement projects that are a realistic size, given the current conditions.

Prioritization through Regional Collaboration. Projects that cross jurisdictional lines and requiring regional collaboration would be good starter projects for demonstrating the needs and benefits of a jointly planned Aerotropolis Scenario.

Support the Long-term Vision. As investments are made to develop infrastructure in the Aerotropolis area, it is important that the projects cohesively build towards the longer-term Aerotropolis Scenario as envisioned by the regional partners.

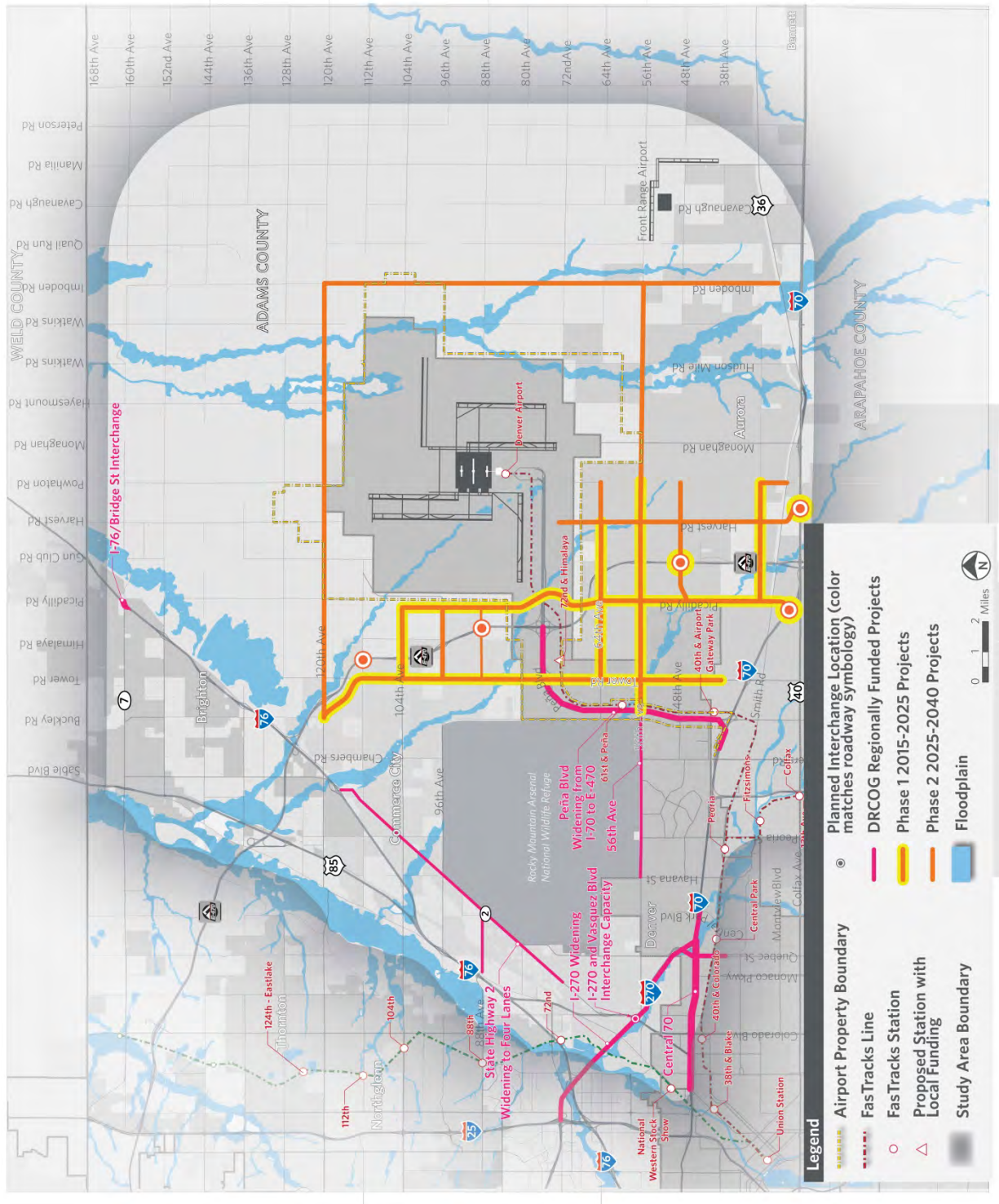
Projects for the Aerotropolis Near-term 2040 Transportation Network

Following these guiding principles, with a focus on the priority issues for each jurisdiction, a conceptual Aerotropolis Near-term 2040 Transportation Network was developed (shown in Figure 21). The projects are largely drawn from the *DRCOG 2040 RTP*, reflecting projects as submitted by the local jurisdictions, and local plans. The projects in the *DRCOG 2040 RTP* and local plans represent a robust set of projects that would provide improved connectivity and mobility. Note that this is in contrast to the *DRCOG 2040 RTP* socioeconomic growth projections in the study area. These projections reflect a low-growth state of affairs, which would be mismatched to the infrastructure investment proposed by local jurisdictions in the *DRCOG 2040 RTP*. Figure 21 also displays the floodplains where drainage and other infrastructure are located.

The improvement projects for the Aerotropolis Near-term 2040 Transportation Network are a combination of new roads and/or widening projects. The projects are shown in two phases—Phase 1 early-action projects (2015 to 2025) and Phase 2 projects (2025 to 2040) that would complete the conceptual Aerotropolis Near-term Transportation 2040 Network.

It is recognized that the conceptual network recommendations may change over time as additional detailed transportation studies are conducted.

Figure 21 Aerotropolis Near-term 2040 Transportation Network



Source: Aerotropolis Study Team.

Aerotropolis Near-term 2040 Transportation Network Costs

The Aerotropolis 2040 Transportation Network represents a significant investment in infrastructure. The planning level cost estimates for the 2040 projects were obtained from the *DRCOG 2040 RTP*. These conceptual planning estimates are all-inclusive costs for implementing each project through completion, including costs of right-of-way, planning, construction, and utilities. For the 25-year period leading to 2040, the total cost of the Aerotropolis Near-term 2040 Transportation Network is on the order of magnitude of \$750 to \$800 million (2015 dollars). The Phase 1 (2015-2030) projects subtotal about \$400 million. Phase 2 (2030-2040) subtotal \$350 to \$400 million. Table 2 shows the cost by project.

Table 2 2040 Transportation Network Improvements

Roadway	Project Location	Improvement Type	Phase 1 and Phase 2 Conceptual Cost (\$M) 2015\$	Phase 1 Conceptual Cost (\$M) 2015\$
26th Ave.	Picadilly Rd. to Powhaton Rd.	Widen to 4 lanes	\$20	\$20
48th Ave.	Picadilly Rd. to Powhaton Rd.	New 6 Lanes	\$41	
56th Ave.	Peña Blvd. to Powhaton	Widen to 6 Lanes	\$74	\$74
56th Ave.	Powhaton to Imboden	Widen to 4 Lanes	\$60	
64th Ave.	Tower Rd. to Powhaton	Construct/Widen to 4/6 Lanes	\$37	\$37
88th Ave.	Tower Rd. to Picadilly Rd.	Widen to 6 Lanes	\$15	
96th Ave.	Tower Rd. to Picadilly Rd.	Widen to 6 Lanes	\$15	
104th Ave.	Tower Rd. to Picadilly Rd.	New 2 Lanes	\$12	\$12
120th Ave.	Tower Rd. to Imboden Rd.	Widen to 4 lanes	\$60	
Harvest Mile Rd.	I-70 to 72nd Ave.	Construct/Widen to 4 Lanes	\$79	
Imboden Rd.	US 36 to 120th Ave.	Widen to 4 lanes	\$72	
Powhaton Rd.	I-70 to 26th Ave.	Widen to 4 lanes	\$10	
Picadilly Rd.	Smith Rd. to 96th Ave.	Construct/Widen to 6 Lanes	\$90	\$90
Tower Rd.	38th/40th Ave. to 120th Ave.	Construct/Widen to 6 Lanes	\$80	\$80
E-470	48th Ave.	Add New Interchange	\$27	\$27
E-470	88th Ave.	Add New Interchange	\$18	
I-70	Harvest Mile Rd.	Add New Interchange	\$40	\$40
I-70	Picadilly Rd.	Add New Interchange	\$28	\$28
		Total	\$748	\$408

Note: 2015 dollars.

Source: DRCOG 2040 RTP.

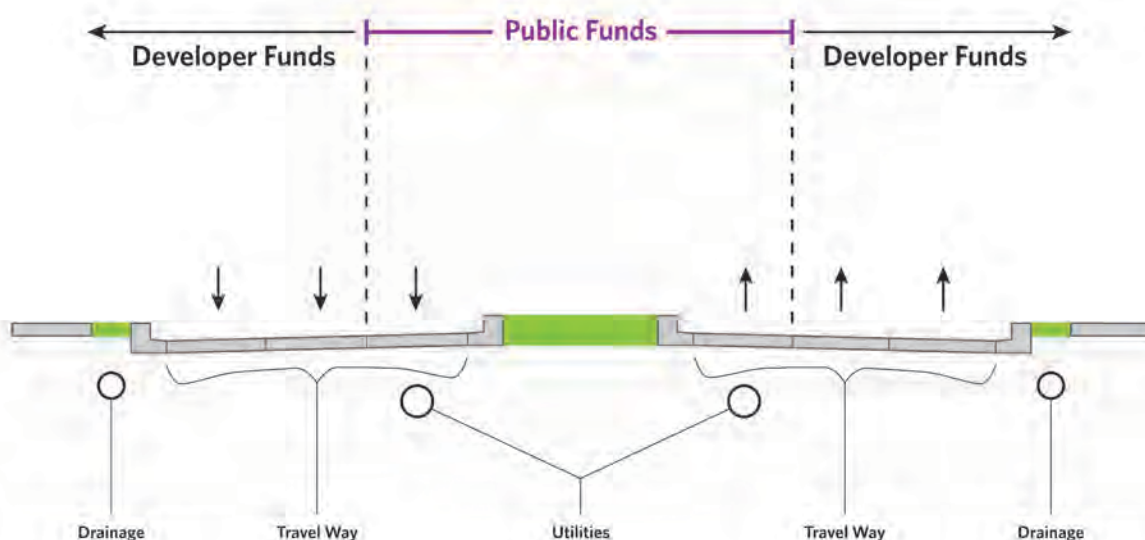
Aerotropolis Near-term 2040 Transportation Network Funding

Revenue to fund these improvements is assumed to be from taxes and fees on the new development attracted to the Colorado Aerotropolis. These would include increased residential and commercial property taxes associated with new Aerotropolis-related real estate development, increased sales taxes associated with additional household and business spending, and additional residential development impact fees. In the aggregate, these local revenues would range between \$705 and \$735 million and are roughly similar to the costs associated with additional infrastructure investment of \$750 to \$800 million (in 2015 dollars), indicating the potential for value capture revenues to provide a significant funding share over the 25-year analysis period. The addition of commercial development impact fees, not assumed in this conceptual analysis, would raise additional revenue. Additional funding from municipal, regional, and federal sources would also contribute to the investments but current plans show very little of those funds available for the area. Full documentation of the methodology for developing revenue estimates is detailed in the *Colorado Aerotropolis Economic and Financial Analysis* working paper (Aerotropolis Study Team 2016).

Pay-as-You Go Roadway Funding

The initial costs of the proposed roadway improvements would be lower than the \$750 to \$800 million estimate because the roadway cross-section would be built in phases over time as demand increases. Figure 22 shows a typical pay-as-you-go method for establishing a roadway cross-section in an undeveloped area. Typically, right-of-way would be identified and reserved for the full cross-section. Depending on funding capabilities, local jurisdictions could initially construct a portion of the road, including the utility infrastructure. Additional lanes would be added as demand increases and development occurs. Private developers would typically contribute to construction costs for these regional arterials, which would provide access to their land.

Figure 22 Pay-As-You-Go Roadway Funding



Source: Aerotropolis Study Team.

References

Adams County, Aurora, Brighton, Commerce City, and Denver. 1990. The Emerald Strands, A Cooperative Park, Open Space, and Trail Plan for the Area Surrounding the new Denver International Airport.

Aerotropolis Study Team. 2016. Assessment of Growth Projections for the Colorado Aerotropolis Study Area Working Paper.

Aerotropolis Study Team. 2016. Colorado Aerotropolis Economic and Financial Analysis Working Paper.

DRCOG. 2015. *2040 Fiscally Constrained RTP*.

<https://drcog.org/sites/drcog/files/resources/2040%20Fiscally%20Constrained%20Regional%20Transportation%20Plan.pdf>.