

*Arapahoe County  
2035  
Transportation Plan*

*November 2010*



*Adopted December 7, 2010  
Resolution Number 100990*



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# *Arapahoe County 2035 Transportation Plan*

**November 2010**

**Adopted December 7, 2010**

**Resolution Number 100990**

Submitted to



Arapahoe County  
10730 East Briarwood Avenue, Suite 100  
Centennial, CO 80120

Submitted by



David Evans and Associates, Inc.  
1331 17<sup>th</sup> Street, Suite 900  
Denver, CO 80202

In Conjunction with



Felsburg Holt & Ullevig  
6300 S. Syracuse Way, Ste. 600  
Centennial, CO 80111



BBC Research & Consulting  
3773 Cherry Creek N. Drive, Ste. 850  
Denver, CO 80209

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### ***Board of County Commissioners***

Susan Beckman, District 1  
Jim Dyer, District 2  
Rod Bockenfeld, District 3  
Pat Noonan, District 4  
Frank Weddig, District 5

### ***Planning Commission***

Mark Brummel  
Arnold Hayutin  
Kim Herzfeldt  
Brett Larson  
Leah Martin  
Paul Rosenberg  
Brian Weiss

### ***County Staff Technical Advisory Committee***

Bryan Weimer, Transportation Division Manager  
Chuck Haskins, PE, Engineering Services Division Manager  
Irene Valenzuela, PE, Engineer III  
Brian Love, PE, CIP Manager  
Jerry Maschka, Traffic Operation Manager  
Jim Katzer, PE, Road and Bridge Division Manager  
Todd Weaver, Budget Manager  
Jan Yeckes, Planning Division Manager  
Julio Iturreria, Long Range Planning Program Manager  
Chuck Reno, Open Space, Parks and Trails Coordinator  
Ethan Watel, Open Space Planning Assistant  
Andrea Rasizer, Communications Services Director  
Dave Schmit, PE, Public Works and Development Director

### ***Consultant Team***

#### **David Evans and Associates, Inc.**

Stacy Tschuor, PE, PTOE  
Joseph Hart, PE  
Scott Burger, PE, PTOE  
Ian Chase  
Heather Gade, EI  
Leah Langerman

#### **BBC Research and Consulting**

Adam Orens

#### **Felsburg Holt & Ullevig**

Elliot Sulsky, PE, AICP  
Steven Marfitano, EI



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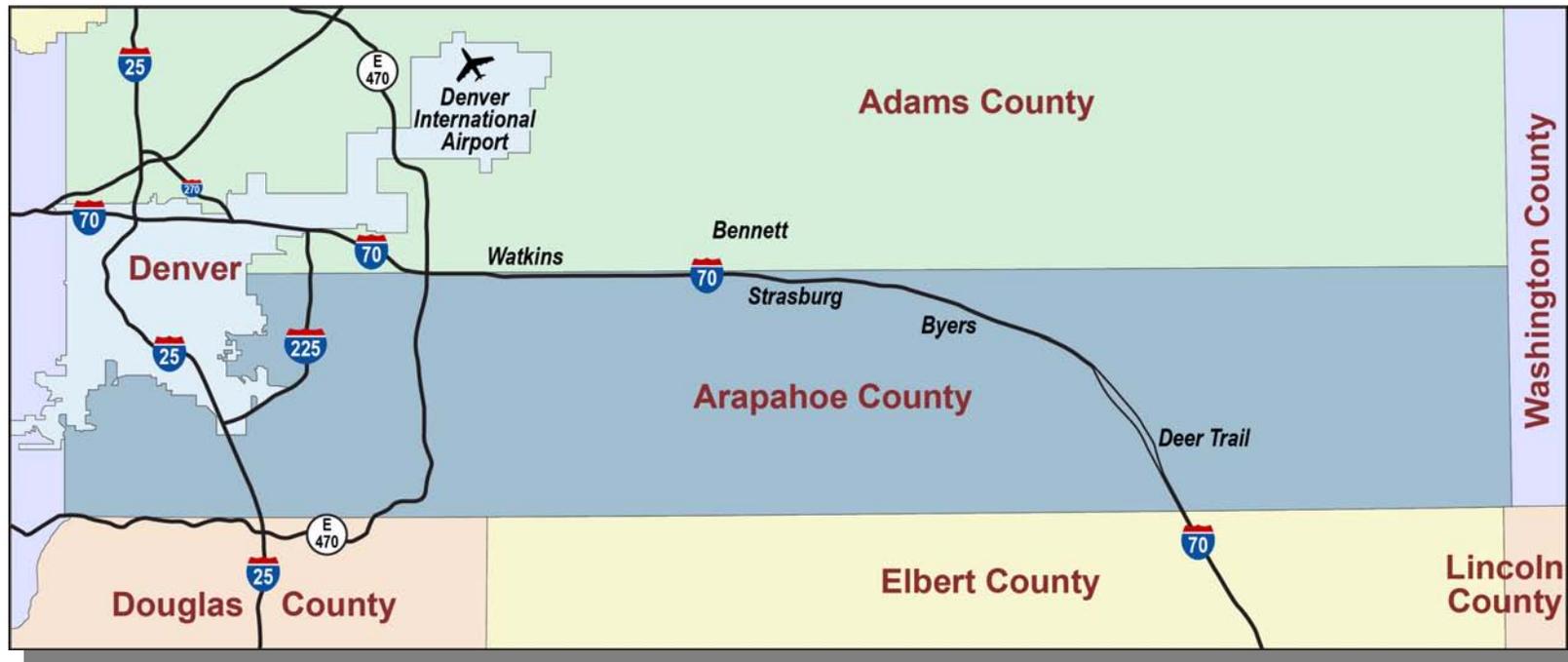


## 1. Introduction

### 1.1. Background

Rapid and continuing growth in Colorado's Front Range has resulted in the need for well-planned and coordinated growth management that addresses both land use and transportation. Arapahoe County has experienced a substantial increase in roadway congestion, primarily within the urban and suburbanizing areas. The western end of the County has experienced major urbanization with residential and commercial development. Since that trend is likely to continue and spread east, it is essential to evaluate the current transportation system's capability to accommodate future growth and to proactively develop plans to respond to forecasted needs.

The unique concerns identified by the rural communities found in the eastern end of the County and the transitional area between the urban and rural regions must also be addressed. These unique areas of the County have very different transportation needs and their residents have varying desires that deserve consideration as part of the comprehensive transportation planning process.



The Arapahoe County 2035 Transportation Plan used the previous 2020 Transportation Plan as a basis for updates to create an updated vision for a multimodal transportation system that addresses the County's growth through 2035.

### **1.2. Purpose**

The primary purpose of 2035 Transportation Plan is to develop a unified multimodal updated transportation plan for Arapahoe County, which considers the previous Arapahoe County 2020 Transportation Plan (adopted March 2002), the most recent regional studies for areas within the County, and the most recent DRCOG plan (2035). While this Transportation Plan considers the transportation plans of the incorporated municipalities within the County to ensure a comprehensive transportation system is provided, the primary focus is on Unincorporated Arapahoe County. The 2035 Transportation Plan also considers the necessary connections to adjacent jurisdictions in Adams, Denver, Elbert, Jefferson and Douglas Counties.

This plan will be used to provide input into the regional planning process and project selection for local/regional/federal funding processes. The plan will specifically be used to develop a 10-year infrastructure capital improvement plan for Arapahoe County. Transportation improvement and mobility needs are evident throughout all of Arapahoe County, but are currently most pressing in key growth areas in the vicinity east of Parker Road to roughly Watkins Road and between Aurora and Douglas County, the I-25 business corridor, the I-70 corridor from E-470 to Byers, the Centennial Airport area, and the Four Square Mile Area in general. As a consequence, the 2035 Transportation Plan addresses general countywide transportation issues and more specific needs in focus areas.

The intent of this planning process has multiple purposes. The plan will:

- ✦ Become part of the County's Comprehensive Master Plan through the year 2035.
- ✦ Serve as a strategic plan to provide guidance to decision-makers in developing the transportation system.
- ✦ Identify alternatives/options and provide input to decision-makers regarding local and regional implications of each alternative so that they can fully understand the ramifications and benefits of identified transportation improvements.
- ✦ Help in developing short and long term strategies for implementation, consistent with area land use plans developed by the County.



### 1.3. Planning Process

The Arapahoe County 2035 Transportation Plan was conducted under the direct supervision of the Arapahoe County Transportation Division within the Public Works Department. The planning process for the development of the plan included the establishment of a Technical Advisory Committee (TAC) to review technical analysis, provide input on the plan development, and review recommendations for the transportation plan. The TAC was made up of professional staff representatives from the following County Divisions and/or Departments:

- ◆ Communication Services
- ◆ Engineering Services
- ◆ Finance
- ◆ Open Space
- ◆ Planning
- ◆ Road and Bridge
- ◆ Transportation

Input from County transportation stakeholders, including cities within Arapahoe County, neighboring counties, major development representatives, property owners, and CDOT, was gathered via interviews and presentations with staff from the following:

- ◆ Adams County
- ◆ City of Aurora
- ◆ Town of Bennett
- ◆ City of Centennial
- ◆ CDOT Region 1
- ◆ CDOT Region 6
- ◆ City of Greenwood Village
- ◆ Elbert County
- ◆ Major Development Representatives
  - ✦ Furniture Row
  - ✦ Prairie Falcon Parkway Express
  - ✦ TransPort Development
  - ✦ State Land Board



November 2010

Community review was provided through three public meetings held specific to the Transportation Plan update and website postings of the public meeting information. Public hearings were also held at the end of the Plan development effort. A summary of the dates and key questions addressed at each of the public meetings is listed in **Table 1**.



**Table 1. Transportation Plan Public Meetings**

Planning Phase/Date	Key Questions
Issues Identification and Existing Conditions October 22, 2009	<ul style="list-style-type: none"> <li>✦ What do you think are transportation issues within the County?</li> <li>✦ Please provide comments and suggestions for the Plan Goals, Policies and Strategies.</li> <li>✦ What do you like about the existing transportation system?</li> <li>✦ What do you see as the largest transportation needs within the County, within the next ten years and beyond 2020?</li> <li>✦ What transportation aspects do you feel are most important to Unincorporated Arapahoe County?</li> </ul>
Alternatives Development April 8, 2010	<ul style="list-style-type: none"> <li>✦ What defines a successful Transportation Plan for you?</li> <li>✦ Please provide comments on the preliminary improvements presented.</li> <li>✦ Do you see the need for additional transportation improvements not shown? If so, please briefly describe.</li> <li>✦ Which improvements should be made the highest priorities in the next ten years and beyond 2020?</li> </ul>
Draft Transportation Plan Recommendations August 26, 2010	<ul style="list-style-type: none"> <li>✦ Are there County transportation issues you feel the Draft Transportation Plan has not addressed? If so, please briefly describe.</li> <li>✦ Please provide comments on the preliminary Transportation Plan elements.</li> <li>✦ Are you satisfied with the level of transportation infrastructure maintenance the County provides? Please provide comments.</li> <li>✦ Which improvements should be made the highest priorities in the short-, mid-, and long-term?</li> </ul>
Board of County Commissioners Adoption December 7, 2010	<ul style="list-style-type: none"> <li>✦ Are there any objections to the Board of County Commissioners adopting the Final 2035 Transportation Plan?</li> </ul>
Planning Commission Adoption December 7, 2010	<ul style="list-style-type: none"> <li>✦ Are there any objections to the Planning Commission adopting the Final 2035 Transportation Plan as part of the County’s Comprehensive Plan?</li> </ul>

#### **1.4. Transportation Plan Goals, Policies, and Implementation Strategies**

The goals and objectives for the County transportation system were identified to provide the basis for assessment of alternatives. Working with the Technical Advisory Committee (TAC), the following goals, strategies, and policies were established to help guide the Transportation Plan process.

##### **GOAL – PROMOTE AN EFFICIENT AND BALANCED TRANSPORTATION SYSTEM**

Arapahoe County will have an efficient, safe transportation system that addresses current and future mobility needs and reduces dependency on the automobile.

##### ***Policy – Develop Implementation Program for Future Transportation System***

Arapahoe County will maintain level of service standards and set relative priorities for road maintenance and improvements on an annual basis.

##### ***Strategy – Implement Transportation Level of Service Standards***

The County will define an acceptable level of service for various regions and roads within the County (Rural and Urban) to apply with roadway standards and the development review process.

##### ***Strategy – Set Priorities for Transportation Improvements***

Based on current and projected transportation needs, system performance monitoring results, and available funding, the County will set priorities for transportation improvements.

##### ***Strategy – Consider Regional Storm Water and Water Quality Requirements***

The County will consider regional storm water and water quality requirements during the planning of transportation improvements and account for storm water and water quality regionally, when possible.

##### ***Strategy – Adopt a Transportation Capital Improvement Program that is Updated Annually***

The County will continue to update its Capital Improvement Plan (CIP) for County transportation projects on an annual basis.

##### ***Strategy – Establish Funding Program for Major Investments and Partnering***

The County will establish funding for transportation improvements and programs including rural town traffic operations and safety improvements, pedestrian and bicycle facilities, rural road paving, intelligent transportation strategies and alternative travel mode programs and facilities.

**Strategy – Implement Alternative Improvement Strategies**

The County will develop potential alternative standards and implement strategies, such as rural road standards, low water stream crossing criteria, and recycled pavement programs, to provide improvements that otherwise may be limited due to fiscal impacts.

**Strategy – Define Land Use Character Boundaries for Application of Standards**

The County will define the boundaries of the “urban”, “semi-urban”, and “rural” land use character for the application of design and level of service standards.

**Strategy – Develop Requirements and Reimbursement for Transportation Improvements**

The County will require development to be responsible for adjacent roadway improvements. In addition, the County will require reimbursement from development, at the stated level, for adjacent roadway improvements constructed before development occurs.

**Policy – Promote Connectivity and Continuity in Local and Regional Roads**

Arapahoe County will promote connectivity and continuity in local roads between adjacent neighborhoods and in regional roads between neighborhoods and commercial and employment areas to minimize unnecessary driving.

**Strategy – Coordinate Planning for Roadway Facilities with Cities and Adjacent Jurisdictions**

The County will coordinate proposed transportation improvements with transportation plans of cities within the County and adjacent jurisdictions to implement complimentary transportation facility improvements.

**Policy – Improve North-South and East-West Connectivity in the Rural Area**

Arapahoe County will consider the need to improve north-south and east-west roadway connectivity in the Rural Area by exploring opportunities to extend arterial roadways.

**Strategy – Set Priorities for Rural Roads in the Transportation Plan**

The County Transportation Plan will set priorities for future north-south and east-west road connections in the eastern part of the County.

**Strategy – Reserve Right-of-Way in the Rural Area**

The County will reserve right-of-way in the eastern part of the County as or before development occurs, to ensure that future roadway needs can be met. This includes requiring the dedication of 30 feet of right-of-way along section lines.

**Strategy – Plan for Supplemental Collector Roadways**

The County will ensure that new developments plan for appropriate collector roadways to serve development areas, especially in clustered developments to maintain hierarchy of roadway infrastructure.

**GOAL – PROMOTE ALTERNATIVE TRANSPORTATION SOLUTIONS**

Arapahoe County will promote alternative transportation solutions to provide travel options to residents.

**Policy – Promote a Multimodal Transportation System**

Arapahoe County will promote a balanced transportation system that provides options to residents in public transit, walking, bicycling and automobile travel.

**Strategy – Establish Multimodal Corridors**

The County will define a system of multimodal corridors that are designed to accommodate a complete range of modes of travel.

**Strategy – Promote Travel Demand Management (TDM) Strategies and Technologies to Reduce Travel Demand**

The County will encourage appropriate TDM Strategies in coordination with transportation management associations operating within Arapahoe County. The County will promote emerging technologies to minimize vehicular travel and vehicle miles traveled in the rural areas.

**Policy – Promote Use of Intelligent Transportation Systems (ITS) Technology**

Arapahoe County will promote and implement ITS technology that leads to reduced traffic congestion, safer roads, smarter transit vehicles and service, less wasted fuel, better air quality, and increased capacity and functioning of the transportation system.

**Strategy – Monitor New Technological Advances**

The County will track and report on new technology advances in ITS that may be utilized to improve the County's overall transportation system.

**Strategy – Coordinate with Area ITS Stakeholders**

The County will coordinate with other ITS stakeholders to share information on current projects and future ITS applications that will serve both rural and urban Arapahoe County transportation users.

**Strategy – Set Priorities for ITS Improvements**

Based on transportation needs and available funding, the County will establish an ITS improvement program to address the overall transportation system.

**Strategy – Establish Funding Program for Major ITS Improvement Projects**

The County will establish funding for the ITS improvement program/projects that is designed to improve the overall efficiency and operation of the County’s transportation system.

**Policy – Support Transportation Enhancement Projects**

Arapahoe County will support enhancement projects that would qualify for programs such as Transportation Enhancements.

**Strategy – Promote Other “Outside the Box” Transportation Projects**

The County will consider transportation related enhancement projects such as scenic beautification, wayfinding signage, welcome centers, streetscapes, and other projects that would qualify for alternative funding programs.

**Policy – Support Public Transit**

Arapahoe County will support the enhancement of mass transit to serve major employment along key transportation corridors in the County and promote efficient connections with such a system.

**Strategy – Coordinate with Public Transit Providers on Expansion of Service Area, Services and Transit Related Amenities**

The County will coordinate with public transit providers to ensure that urban development areas have access to public transportation. The County will promote the annexation of new developing areas into the RTD District. The County will also promote transit priority improvements to support transit corridors. The County will work to preserve existing corridors and right-of-ways for future implementation of long range transit improvements. The County will also promote expansion of amenities such as sidewalks, benches and lighting at transit stops or stations where easements are feasible and potential for use is high.

**Strategy – Coordinate with Others to Provide Efficient and Convenient Connections to Transit**

The County will work with public transit providers, other agencies, and Transportation Management Associations (TMAs) to provide solutions for efficient and convenient connections between public transit stops/stations and places of employment or residential areas.

**Strategy – Coordinate with Regional and Local Agencies**

The County will work with transit providers to develop marketing and education strategies to increase awareness of existing and future transit services (particularly in the rural areas of the County), continue to

coordinate with regional planning commissions, and assist municipalities to develop local public and privately funded transit improvements.

***Policy – Consider Pedestrian Needs***

Arapahoe County will plan a transportation system to accommodate pedestrians with safe, convenient walking via a system of connected sidewalks, walkways, crosswalks and paths which meet minimum pedestrian facility design standards, including Americans with Disabilities Act requirements.

***Strategy – Establish Standards for Streets and Sidewalks***

Require streets and sidewalks and/or walkways to form an interconnected network within neighborhoods and commercial areas and between neighborhoods and commercial areas. Street and sidewalk systems should connect developments with each other and to other parts of the region.

***Strategy – Set Priorities to Address Sidewalk and Trail Missing Links***

The County will identify location priorities for missing sidewalk links in developed areas and pedestrian trail gaps throughout the County to provide efficient and convenient connections.

***Policy – Establish a Bicycling Network***

Arapahoe County will work to provide bicyclists with safe, convenient bicycling facilities including shared use paths, bike lanes, designated bike routes, bike parking, and signage.

***Strategy – Designate Bicycling Routes and Paths***

The County will identify opportunities for bicycle routes and connections in conjunction with the roadway improvements identified in the Transportation Plan and prioritize locations of missing links for bicycle connections in developed areas.

***Strategy – Require Bicycle Network Connectivity***

The County will require developments to plan and build a bicycling network that connects neighborhoods to commercial and office uses, connects outside bicycle networks to the developing area, and links transit with the bicycle network.

***Strategy – Promote the Bicycling Network***

The County will develop a system to provide signs for bicycle facilities and provide countywide bicycle maps for bicyclists.

**GOAL – COORDINATE LAND USE AND TRANSPORTATION**

Arapahoe County will have adequate streets and an efficient transportation system to coincide with new development in growth areas.

***Policy – Promote an Efficient Transportation System through Appropriate Land Use***

Arapahoe County will plan a transportation system that supports the desired land use pattern of compact development and a mix of uses described in the Comprehensive Plan.

***Strategy – Develop Requirements for Transportation Accommodations with Development***

The County will require appropriate accommodations for all modes of travel; pedestrians, bicycles, public transit, and autos. In addition, the County will require new non-residential development to locate in employment and commercial centers to accommodate multimodal forms of transportation, not solely automobiles.

***Policy – Ensure Adequate Transportation Facilities for New Development***

Arapahoe County will ensure that new developments have adequate existing transportation facilities or facilities that are planned to coincide with the phasing of development.

***Strategy – Require Adequate Roads to be Provided Contemporaneously with New Development***

The County will require roads (internal and external) to be in place or planned prior to development. The County will require conformance to specified standards as a condition of approval.

**GOAL – DEVELOP A STRATEGIC MANAGEMENT AND TRACKING APPROACH TO THE COUNTY’S TRANSPORTATION SYSTEM**

Arapahoe County will develop a strategic planning and measurement approach to the transportation system services it provides to meet Countywide Strategic Priorities.

***Policy – Monitor Maintenance and Operational Needs of Transportation Infrastructure***

Arapahoe County will develop an approach for monitoring the condition of the existing transportation infrastructure that will help balance and prioritize the maintenance needs with County’s costs and revenues.

***Strategy – Monitor and Manage Transportation Infrastructure***

The County will develop health indices for monitoring the condition of County transportation infrastructure, including paved roads, gravel roads, bridges, and traffic signals. The County will prioritize and provide maintenance of its transportation infrastructure to maintain a safe and efficient transportation system.

***Policy – Maintain Rural Roadways to an Established Standard***

Arapahoe County will only pave gravel roads that meet County paving criteria which include maintenance, health, and safety. This will help maintain the rural character and balance the County’s costs and revenues. The County will address the need to provide sufficient regional and local connections.

***Strategy – Establish a Road Paving and Maintenance Standard***

The County will develop and adopt a traffic volume threshold for paving of existing gravel roadways and a policy for new development roads, and adopt design and maintenance standards for these roadways.

***Policy - Promote Improved Maintenance and Enhancement of the Traffic Signal System***

Arapahoe County will promote improved traffic signal and signal system maintenance, coordination and technology upgrades. Signal systems can provide among the highest returns on investment of any capital infrastructure projects.

***Strategy - Monitor and Manage Traffic Signal Maintenance Program***

The County will provide proper maintenance and operation of its traffic signals and signal system to improve traffic flow, reduce congestion and promote efficient operational characteristics of the existing transportation system.

***Policy – Develop Performance Management Systems***

The County will apply performance measures and targets to track performance of the transportation system.

***Strategy – Establish Goals and Targets for System Performance***

The County will develop goals and benchmarking strategies to define that the transportation system meets the countywide Strategic Priorities.

***Strategy – Communicate the Performance of the Transportation System***

The County will establish communication protocols to effectively convey the system performance for future prioritization and decision making.

***Strategy – Monitor Transportation System Performance***

The County will monitor readily available data to track system performance and communicate whether the system meets the established goals and targets.

***Strategy – Use Performance Monitoring for Informed Decision Making***

The County will use the information from performance monitoring to make decisions related to project prioritization and implementation.

### **1.5. Issues Identification**

The issues identified in the previous Arapahoe County 2020 Transportation Plan were reviewed in relation to the current state of the County transportation system and planning efforts. New issues were gathered from the project Technical Advisory Committee (TAC) and all key issues presented in this report were reviewed by the TAC, Board of County Commissioners, and the general public. These issues will be considered in the development of the framework of the Arapahoe County 2035 Transportation Plan.

#### **Balanced Transportation System Coordinated with the Policies and Plans of the County and Adjacent Jurisdictions**

- ✦ The magnitude of traffic generated by developments in Douglas, Elbert, Adams, Denver and Jefferson Counties impacts Arapahoe County roadways.
- ✦ The municipal separate storm sewer system (MS4) permit requirements need to be considered during the planning of transportation improvements and accounted for regionally rather than with each linear improvement project. The new MS4 construction standards need to be considered for future projects.
- ✦ There is no countywide plan for pedestrian and bicycle facilities between local jurisdictions.
- ✦ There are discrepancies in the application of Level of Service (LOS) guidelines for development review and roadway standards.

#### **Alternative Transportation Solutions**

- ✦ Air quality should be enhanced with recommended transportation improvements to reduce travel demand.
- ✦ There is a lack of coordinated transportation demand management incentives to provide alternative transportation opportunities for all county residents.
- ✦ Existing transit corridors need to be enhanced and right-of-way in future corridors needs to be preserved to encourage travelers to use transit as an alternative to the automobile.

#### **Transportation System Coordination with Development and Land Use**

- ✦ Roadway discontinuities result from a lack of coordinated land use and transportation planning, political, and physical constraints that require costly road improvements.
- ✦ In the eastern portion of the County, as rural development occurs, the roads and roadway system must be maintained and enhanced in an efficient, economical and beneficial manner.
- ✦ Roadway design and level of service standards should consider not only the functional classification, but the surrounding land use and the desired priority of travel modes.

- ✦ The Plan should establish where the rural roadway cross section will start (where the east/west boundary should be applied).
- ✦ The Plan should consider DRCOG's "semi-urban" classification, in addition to urban and rural.
- ✦ Transportation and land use planning efforts should be coordinated for emerging areas such as along Watkins Road, the State Land Board Lowry Range area, Transport, and the Ports to Plains corridor.

### **Strategic Management Approach**

- ✦ There should be balance and equity between the funding and prioritization of the maintenance of the existing transportation system and the construction of new improvements.
- ✦ Performance measures and standards should be defined to facilitate adaptive management, so changes in the system are recognized and considered.

### **1.6. Strategic Management**

There are four strategies for the Countywide Strategic Map identified in the "Align Arapahoe" initiative that forms the basis for a strategic planning and measurement approach: Customer/Stakeholder, Financial Stewardship, Process, and Organizational Capacity. The objectives identified within these strategies are intended to guide the County's transportation and infrastructure investment. The 2008 National Citizen Survey summary for Arapahoe County identified two of the four community evaluation characteristics receiving the least positive ratings as "ease of bus travel" and "traffic flow on major streets". Improvement alternatives identified in this Transportation Plan will be evaluated as appropriate to address the following County Public Works and Development Strategic Objectives.

#### **County Public Works and Development Strategies**

- ✦ Customer/Stakeholder:
  - Improve Customer Service
  - Enhance Quality of life
- ✦ Financial Stewardship:
  - Optimize Use of Resources
- ✦ Process:
  - Improve & Align Processes
  - Improve Services

- Improve Internal and External Communication
- ✦ Organizational Capacity:
  - Enhance Quality of Workforce
  - Improve Organizational Leadership
  - Increase Accountability & Engagement

The potential performance measures and measurement tools shown in **Table 2** have been identified to provide the County the ability to track and communicate the performance of the transportation system to meet the Public Works' Strategic Objectives. The County will use the information from the performance monitoring to make decisions related to project prioritization and implementation.

Travel time along major corridors and roadway congestion are performance measures that are easily gauged and often noted by the general public. Travel time and congestion will continue to increase as traffic volumes increase corresponding to development trends and economic vitality. Comparison to established congestion measurement thresholds will identify the need for roadway and intersection improvements to maintain quality of life standards.

By prioritizing improvement projects considering the availability of funding and potential for economic development, the County will be responsible financial stewards for County funds. Maintaining good facility conditions and traffic operations will also benefit the economic development potential of undeveloped lands.

Improving processes, communication, and services will increase the efficiency of the County system for maintaining the infrastructure and safety of the transportation system. Signal system upgrades and ITS traveler information are relatively low cost means to improve travel efficiency and effectiveness of the transportation network. Regular monitoring of traffic safety conditions will help identify proactive safety related improvement needs that will also enhance the quality of life for County residents and travelers. The health indices for roadway, bridge and traffic signal condition are established measurement tools that are already helping the County improve services by identifying those facilities most in need of improvement.

**Table 2. Potential Transportation Performance Measures**

Priority and Performance Measure	Measurement Tool	County Public Works Strategy
<b>Customer/Stakeholder</b>		
Travel Time	✦ Travel time on primary corridors or between major origins/destinations	Enhance Quality of Life
Roadway Congestion	✦ Traffic volume/threshold comparison	Enhance Quality of Life
Infrastructure Condition (Roads, Bridges, Traffic Signals)	✦ Health index for conditions of paved roads, gravel roads, bridges, and traffic signals	Enhance Quality of Life
<b>Financial Stewardship</b>		
Projects Readiness	✦ Funding agreements in place at sufficient levels for full project or project phasing	Optimize Use of Resources
Economic Development Potential	✦ Acres of undeveloped lands that would benefit from project	Optimize Use of Resources
Project Delivery	✦ Schedule for project completion and project completed on time	Optimize Use of Resources
<b>Process</b>		
Intelligent Transportation Systems (ITS) (Signal Systems)	✦ Percentage of signals on County system	Improve & Align Processes
Intelligent Transportation Systems (ITS) (Traveler Information)	✦ Frequency of real-time congestion and incident information messages	Improve & Align Processes
Key Intersections	✦ Top 10 intersections (west) (Accidents per year, severity, rate)	Improve & Align Processes
Primary Corridors	✦ Top 10 corridors (east) (Accidents per year, severity, rate)	Improve & Align Processes
Travel Demand Strategies	✦ Program awareness	Improve Internal and External Communication

Subsequent to the adoption of the Transportation Plan, targets will be evaluated with the data requirements and implementation efforts necessary to effectively track and gauge system performance.

## **2. Existing Conditions**

The existing condition of the Arapahoe County transportation system is defined by the following data collected for the transportation facilities and services in the County. Geographic Information Systems (GIS) was used to collect, store, manipulate, and present the facilities and the associated operational and descriptive attributes. The following sections describe the existing community characteristics, roadway system, transit services, and bicycle and pedestrian facilities within Unincorporated Arapahoe County. Transportation projects included in the current County Capital Improvement Program are presented to represent the committed roadway network. Current transportation funding is also described. The data and information presented in this section is current as of the development of the transportation plan (November 2009 – November 2010).

### **2.1. Community Profile**

Arapahoe County spans 806 square miles and is a land of contrast. The western part of the County is mostly urban with residential, retail, office and industrial areas, while the eastern portion is relatively rural. There are a total of 13 incorporated communities of Arapahoe County. 639 square miles of the County are unincorporated and only 3% of the County was categorized as “urbanized” in 2006 by Denver Regional Council of Governments (DRCOG).

The western one-third of the County is a mixture of urban and suburban uses including residential, retail, office, industrial/warehousing, and schools. The western area is mostly within incorporated municipal jurisdictions, including:

- ✦ Aurora
- ✦ Bow Mar
- ✦ Centennial
- ✦ Cherry Hills Village
- ✦ Columbine Valley
- ✦ Englewood
- ✦ Foxfield
- ✦ Glendale
- ✦ Greenwood Village
- ✦ Littleton
- ✦ Sheridan

The eastern portion of the County is predominantly rural, sparsely populated, and mostly agricultural in use with large-lot subdivisions, small settlements, incorporated, and unincorporated towns. Bennett and Deer Trail are incorporated towns while Byers, Strasburg, and Watkins are currently unincorporated.

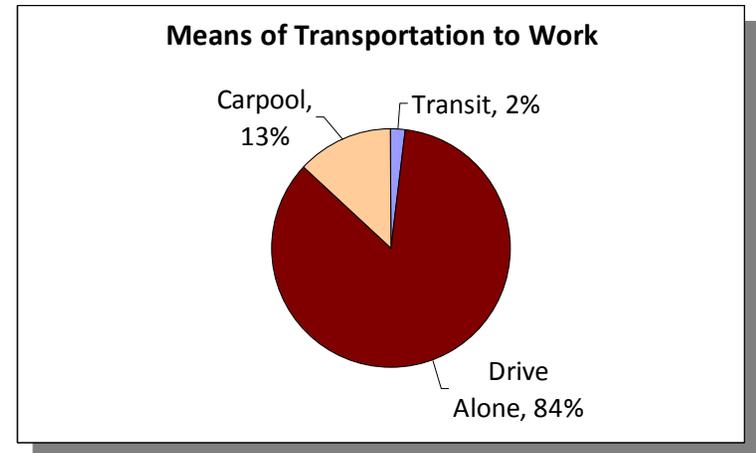
The Arapahoe County population is approximately 560,000 people with almost 75,000 people within the unincorporated areas of the County (2008 DRCOG estimate). According to DRCOG 2005 data, there are over 1.7 million vehicle miles traveled (VMT) per day. Evaluating 2000 Census data shows that approximately 4% of households in Unincorporated Arapahoe County have no access to a

vehicle and 63% of households have two or more vehicles available. Only 2% of work trips are made by transit, which is lower than the rest of the DRCOG region. 84% of work trips within the unincorporated County are made with a single occupancy vehicle. However, DRCOG estimates that 35% of the population within Unincorporated Arapahoe County has good access to jobs via transit, which is similar to the DRCOG region and substantially higher than the surrounding unincorporated areas of Adams County and Jefferson County. The median age of residents of Unincorporated Arapahoe County is 36 and 5% of the residents are over age 65.

**Table 3. Top 10 Commuting Destinations of Workers Who Live in Unincorporated Arapahoe County**

Destination	Percent of Workers
Denver	37%
Aurora	13%
Unincorporated Arapahoe County	11%
Greenwood Village	10%
Centennial	7%
Unincorporated Douglas County	3%
Englewood	2%
Littleton	2%
Lakewood	2%
Out of Region	2%

Source: DRCOG Unincorporated Arapahoe County Community Profile – Snapshot from the 2000 Census



Source: DRCOG Unincorporated Arapahoe County Community Profile – Snapshot from the 2000 Census

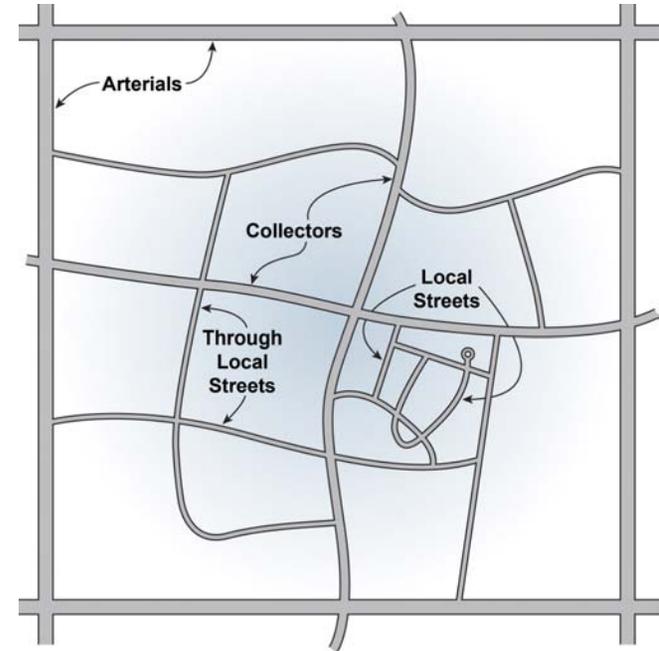
The top destinations for commuters living in Unincorporated Arapahoe County, based on the 2000 Census, are shown in **Table 3**. The highest percentage of workers living in Unincorporated Arapahoe County commute to work locations within the City and County of Denver. Many workers also commute to destinations within Aurora, Greenwood Village, and Centennial. Approximately 11% of the County commuters remain within Unincorporated Arapahoe County.

## 2.2. Roadway System

### Roadway Classification

The roadway network within Arapahoe County is based on facility types with varying characteristics, ranging from freeways to local streets. Two important variables that define roadway function are mobility and access. Interstates have full access control that allows drivers to enter and exit only at interchanges to serve high-speed, longer-distance trips. Local streets contain frequent driveways and roadway connections to provide local access to businesses and residences while serving shorter trips at lower speeds. Arterials and collectors provide for mobility and access between these two high and low end facilities.

Local streets within neighborhoods should be designed to minimize the amount of traffic traveling through the area between arterial or collector roadways. If local streets within urban areas are provided as a connection for through traffic, than there should not be direct residential driveway access and consideration should be given to the safety and quality of life for residents with street frontage. The concept of functional distinctions among roadways is fundamental to maintaining an appropriate level of service and to providing a balance between the needs for mobility and accessibility. The following are descriptions of each roadway classification.



**Freeways/Interstates** –Interstates provide for the high-speed movement of large volumes of traffic with full access control via grade-separated interchanges. Because they are constructed for high speeds, the geometric features of interstates are characterized by many safety features such as comfortable alignment, easy grades, and acceleration/deceleration lanes.

**Arterials** – Major arterials provide a high level of mobility at higher speeds for relatively long distances. Access is generally limited with an infrequent number of intersections and little or no direct property access, depending on the surrounding land use. Land uses adjacent to major arterials should generally be served by other network roadways and inter-parcel connections. Minor arterials are roads that serve moderate speed and traffic volumes over moderate distances. Access is restricted with spacing standards between intersections and limited direct property access. Minor arterials serve major traffic generators or large land areas and link collector streets with the major arterial roadways. Two-lane state highways generally fit into this category, particularly within rural areas.

**Collectors** – The collector system serves intermediate and short-distance travel. Collectors provide a lower level of mobility than arterials at lower speeds. These roads connect local roads to arterials and may have direct access depending on the surrounding land use (no residential driveway access in urban and suburban areas).

**Locals** – This is the lowest classification of roads and includes local streets in urban areas, as well as secondary rural roads. Local roads provide access to abutting land as needed, with limited provision for long-distance mobility within urban areas. Local roads function primarily to serve local traffic circulation and land access. These roads are characterized by shorter trips, direct residential driveway access, lower traffic volumes, and lower speeds than collectors and arterials, although travel speeds on secondary rural roads are typically higher than local streets in urban areas.



**Figures 1 and 2** present the existing County roadway network for the west end and east end of Arapahoe County, respectively. The map for the western end shows the major roadways and their respective classification, for roads classified as collectors and above, serving Unincorporated Arapahoe County. This transportation plan focuses on the major travel corridors within Unincorporated Arapahoe County that provide needed capacity for both local and regional trips, considering roads classified as arterials and above, while including some major collector roadways that provide key connections. In addition to the classification information, the map also illustrates the number of through lanes (not including turn lanes), traffic signal locations (maintained by the County), and freeway interchange locations.

All of the roadways shown in the map for the western end of the County are paved with the exception of Yale Avenue west of Watkins Road. In general, the number of unpaved roadways increases east of E-470. The eastern end map indicates whether the major facilities are paved. Other than I-70, all of the roadways within the eastern end of the County are two lanes.

Within the western end of the County, there are several large physical features that impede roadway continuity. These include the Cherry Creek State Park, the Centennial Airport, the Denver Arapahoe Disposal Site landfill, and the State Land Board Lowry Range property. These barriers have impacted, and will continue to impact, the nature of transportation corridors within the County.

There is a general lack of east-west roadway continuity in the eastern end of the County. I-70 provides one east-west corridor, but the facility does not conveniently serve all areas. With its central location, Quincy Avenue is well positioned to serve east-west demands within the County, and it currently extends as far east as Strasburg Road as a primary road. However, Quincy Avenue is unpaved east of Strasburg Road and it eventually terminates at Bradbury Road.

Figure 1. Existing Roadway Information (2010) – West End

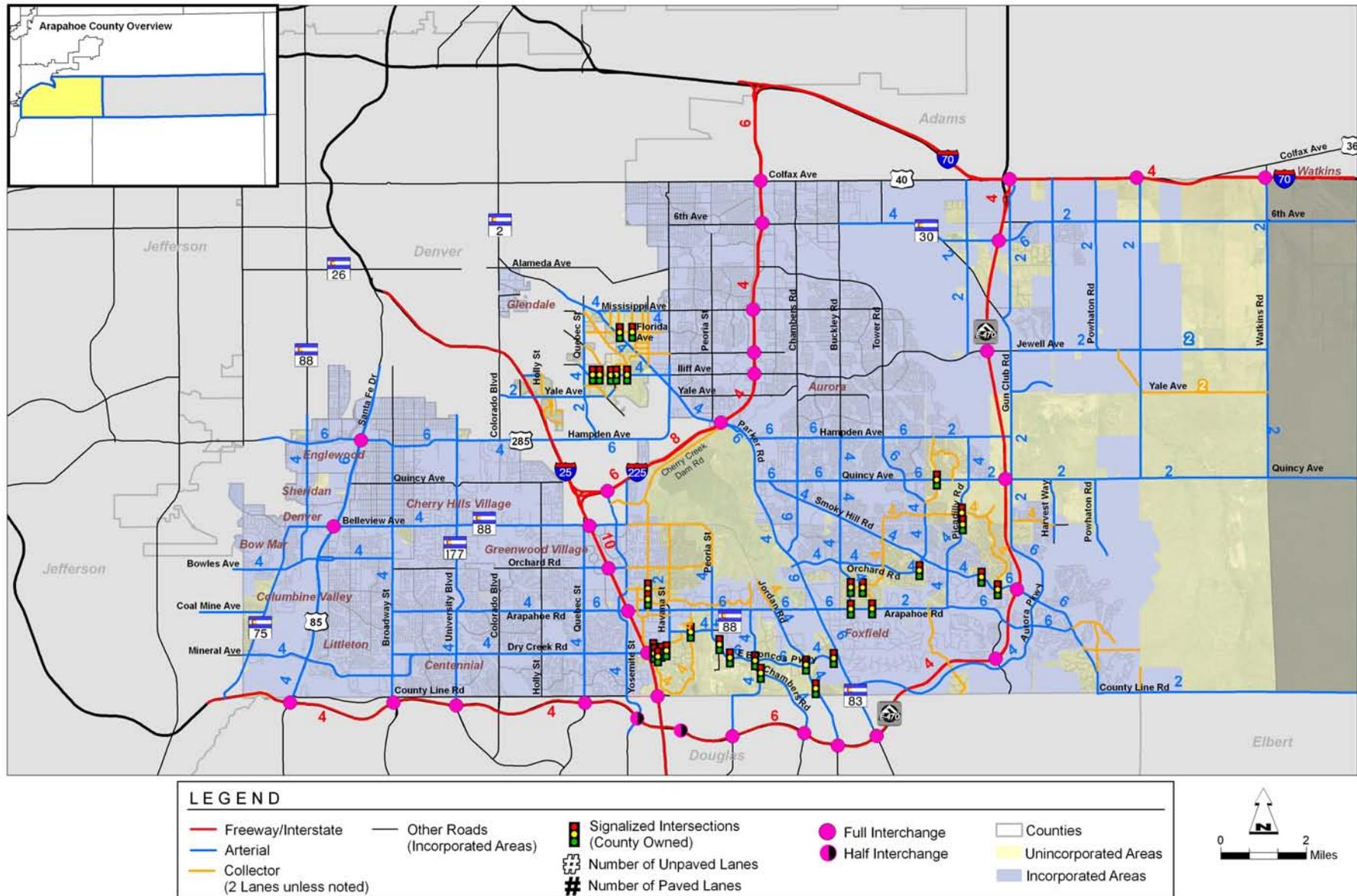
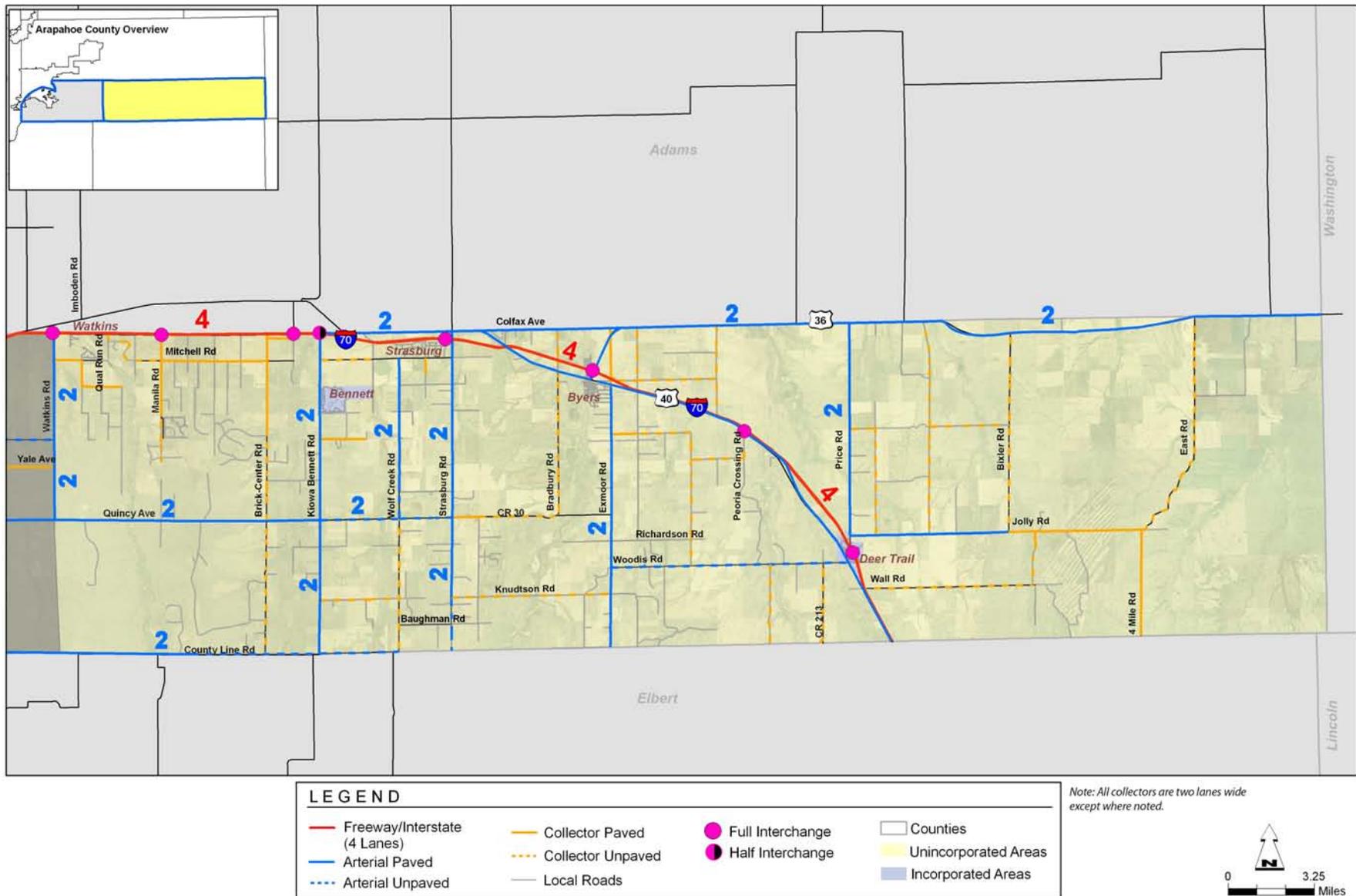


Figure 2. Existing Roadway Information (2010) – East End



**Roadway Conditions**

The current conditions of Arapahoe County roadways are shown in **Figures 3 and 4** for the western and eastern ends, respectively. Roadway pavement conditions and bridge conditions (for spans greater than 20 feet in length) in the current County database are shown. These conditions data are current as of the development of the transportation plan (November 2009 – November 2010).

The pavement data are presented via a measure referred to as Pavement Condition Index (PCI) which is a rating that ranges from 0 to 100, with 100 representing excellent pavement. The large majority of County roadways are rated above 56. County roadway segments (collector classification or higher) that are rated with the poorest pavement condition in the County database include:

- ✦ Broncos Parkway, Peoria Street to Potomac Street (currently being reconstructed with widening project)
- ✦ Orchard Road, Tower Road to Smoky Hill Road
- ✦ Inverness Drive West, Dry Creek Road to County Line Road
- ✦ Exmoor Road (CR 181), Knutson Road (CR 42) to County Line Road

Bridge conditions are often represented through a Sufficiency Rating Index. This measure accounts for numerous considerations with respect to the structural integrity and the functionality of a bridge, and all of the bridges (20 feet or longer) currently have a sufficiency rating that is acceptable (above 70 on a scale of 0 to 100). Specific to the structural aspects of the bridges, the County utilizes the structural integrity-related measures from this index to develop a unique index referenced as a Structure Health Index. The maps illustrate the Health Index information for County bridges relative to an overall percentile range. The lowest-rated quartile bridges do not necessarily translate into an immediate need for repair. Rather, the lower-quartile bridges may be considered as priorities for countywide bridge repairs.

Figure 3. Existing Roadway Conditions (2010) – West End

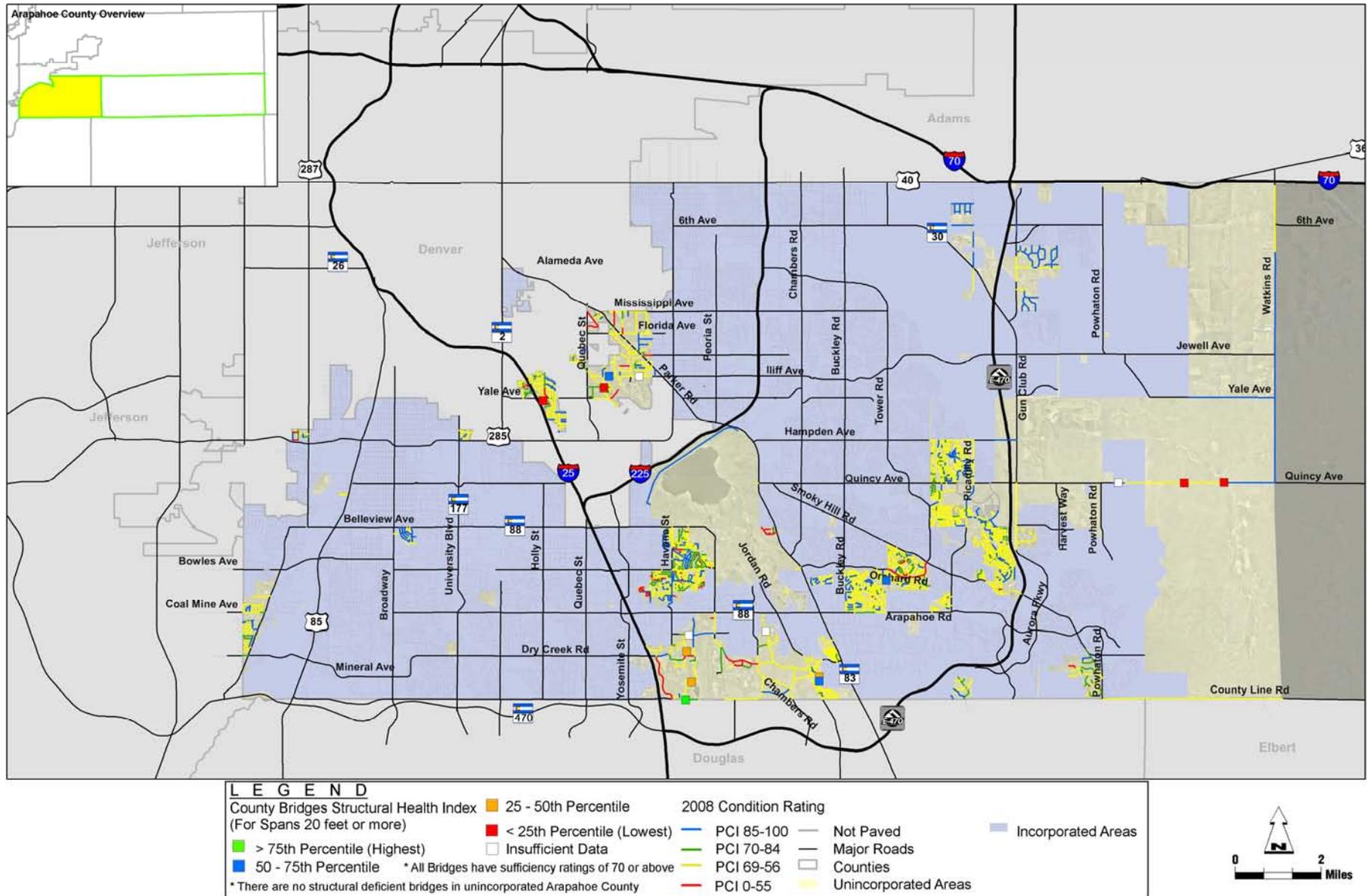
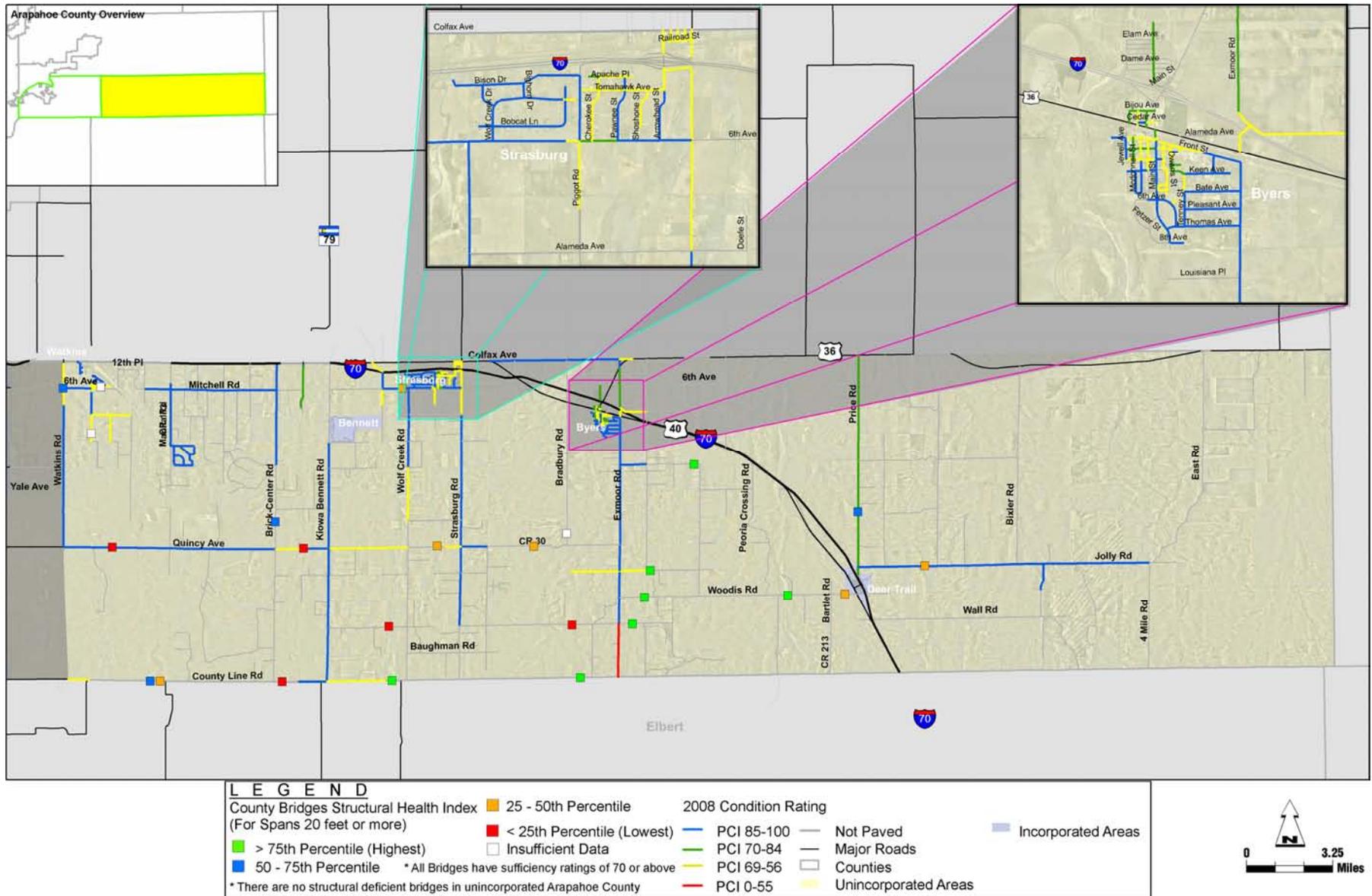


Figure 4. Existing Roadway Conditions (2010) – East End



### **2.3. Traffic Volumes**

**Figures 5 and 6** show the average daily traffic volumes along Arapahoe County roadways (collected 2007-2010). Sources of these data included Arapahoe County, CDOT, DRCOG, and various recent traffic impact studies.

In the west end of the County, the freeway facilities of I-25 and I-225 are the heaviest traveled facilities, serving approximately 220,000 and 130,000 vehicles per day (vpd), respectively. Busy arterial roadways include Arapahoe Road (east of I-25) and Parker Road (south of I-225), which each serve between 70,000 and 80,000 vehicles per day.

In the east end of the County, roadways serve relatively low volumes. I-70 is the busiest facility within Eastern Arapahoe County, carrying 19,500 vpd west of Bennett. Among the busiest roads in the east are the state highways, Quincy Avenue, Watkins Road, Kiowa-Bennett Road, and Strasburg Road. Daily traffic volumes along these facilities range from as high as 1,700 vpd on Quincy Avenue east of Watkins Road to as low as 190 vpd on Quincy Avenue east of Strasburg Road.

Figure 5. Existing Daily Traffic Volumes (2007-2010) – West End

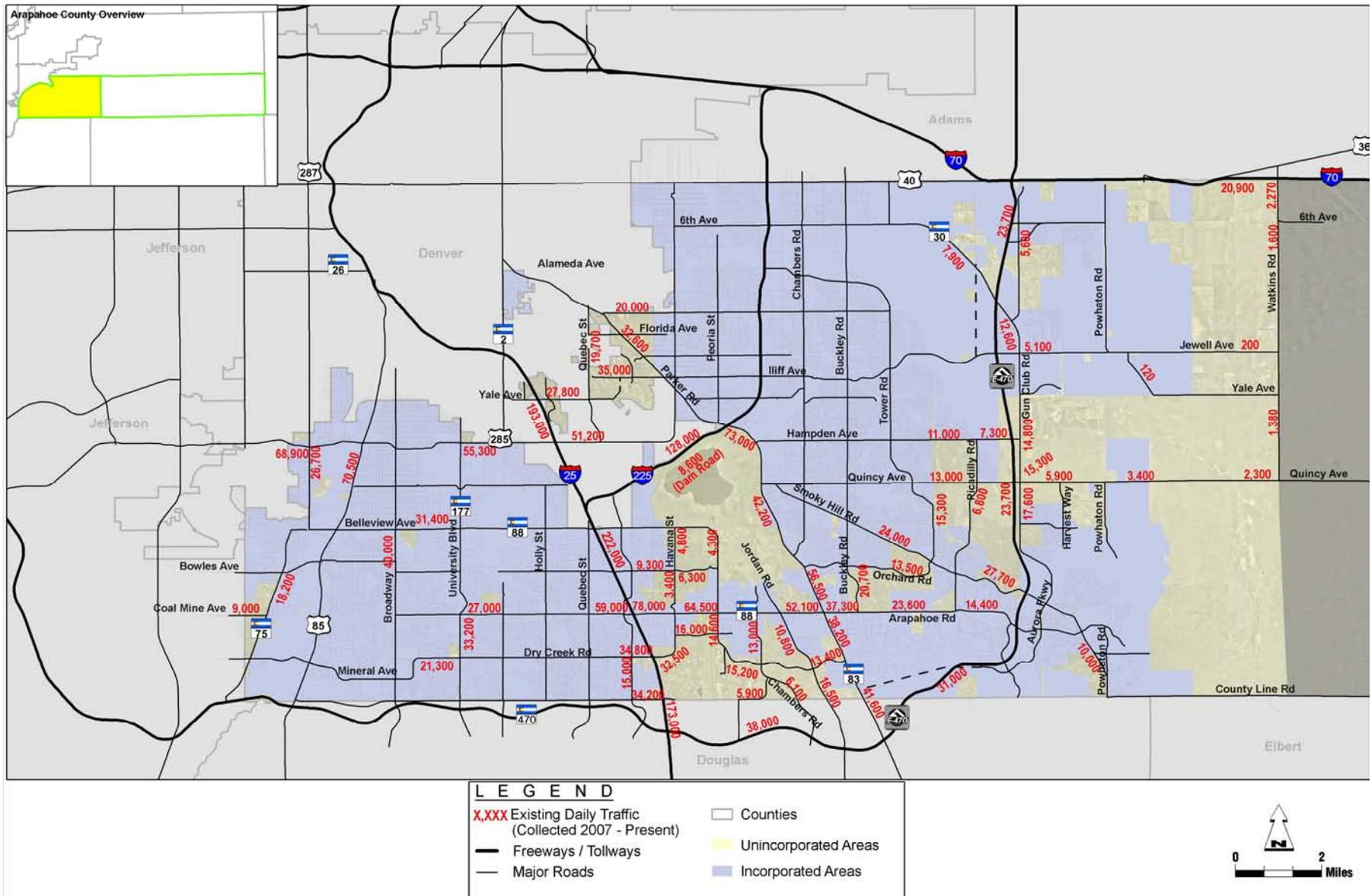
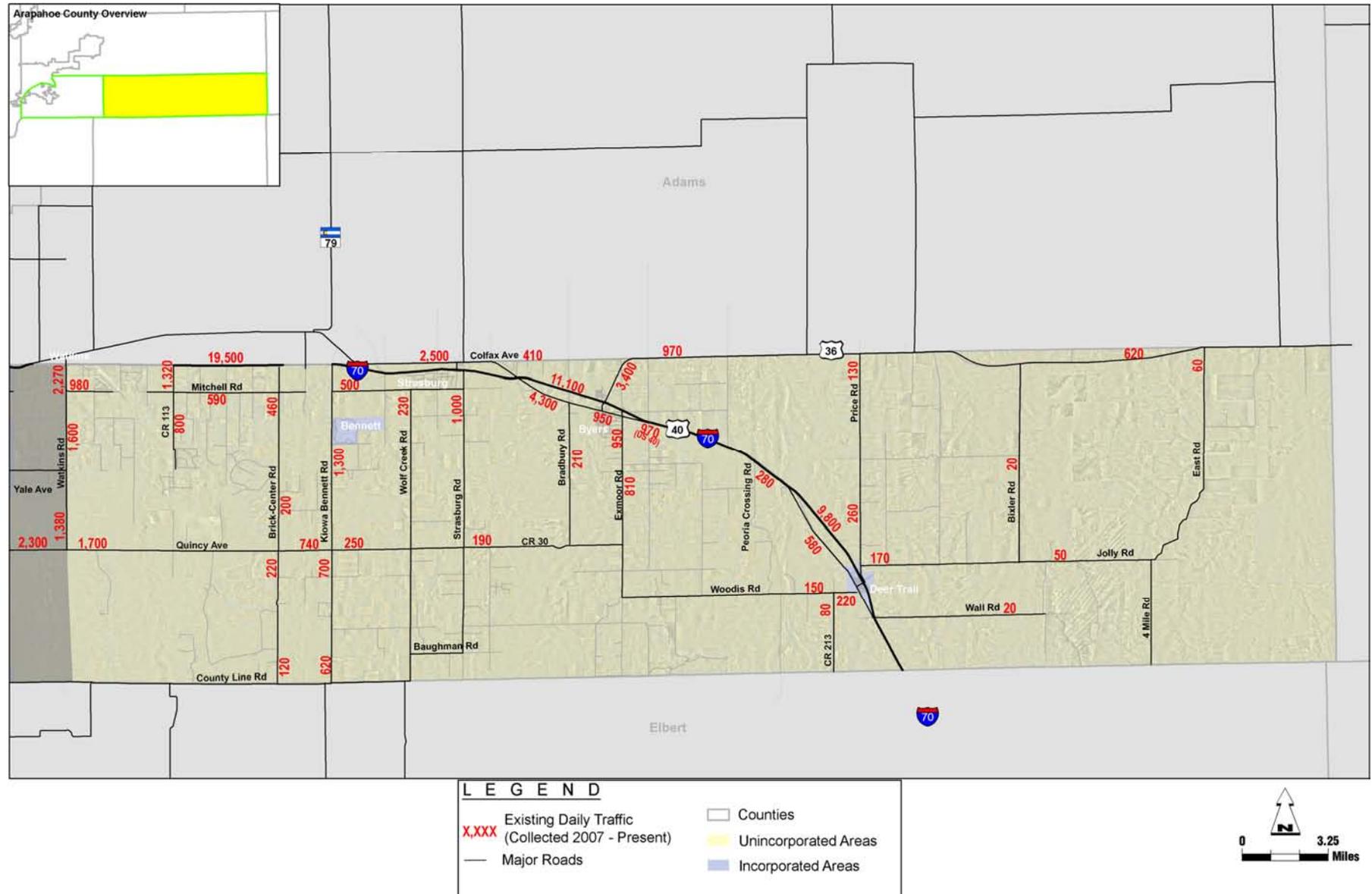


Figure 6. Existing Daily Traffic Volumes (2007-2010) – East End



**2.4. Safety**

Figures 7 and 8 show 2002-2004 traffic accidents reported within the unincorporated areas of Arapahoe County. This data is from the Denver Regional Council of Governments (DRCOG) database of accidents for the Denver metropolitan area for as recently as 2004. Because there are incorporated “flag pole” areas, the figures also include accidents within 100 feet of unincorporated boundaries to provide a full assessment of certain intersections (Gun Club Road and Quincy Avenue is one example).

The intersections that experienced the greatest number of collisions within the study period are in the west end of the County. The top 10 intersections with the highest number of accidents for the 2002-2004 time period are as shown in Table 4.

The Quebec Street and Iliff Avenue/Evans Avenue intersection and the Dry Creek Road and Inverness Drive West intersection are the top two intersections within Unincorporated Arapahoe County with respect to accident occurrence within the study period. Subsequent to 2004, intersection improvements have been implemented at the Quebec Street and Iliff Avenue/Evans Avenue intersection, and County staff have indicated that the improvements have significantly improved safety at the intersection.

The intersections at Arapahoe Road and Parker Road and the I-25 and Arapahoe Road interchange are not located within Unincorporated Arapahoe County and therefore are not identified in this safety assessment for Unincorporated Arapahoe County. However, due to the regional importance of these facilities for County residents, Arapahoe County has led efforts to study these areas for potential solutions to address safety issues related to recurring congestion. An Environmental Assessment (EA) for the I-25 and Arapahoe Road interchange is currently in process and an interchange at the Arapahoe Road and Parker Road intersection is currently under construction.

**Table 4. Most Frequent Accident Locations (2002-2004)**

Location	Number of Traffic Accidents (2002 – 2004)
Quebec Street & Iliff Avenue/Evans Avenue	132
Dry Creek Road & Inverness Drive West	90
Iliff Avenue & Yosemite Street	53
County Line Road & Chester Street	50
Dry Creek Road & Yosemite Street	41
Smoky Hill Road & Orchard Road/Himalaya Street	41
Parker Road & Iliff Avenue	40
Iliff Avenue & Wabash Street	39
County Line Road & Inverness Drive South	39
Tower Road & Smoky Hill Road	37
Iliff Avenue & Dayton Way	37

Figure 7. Existing Accident Density – West End (2002-2004 Data)

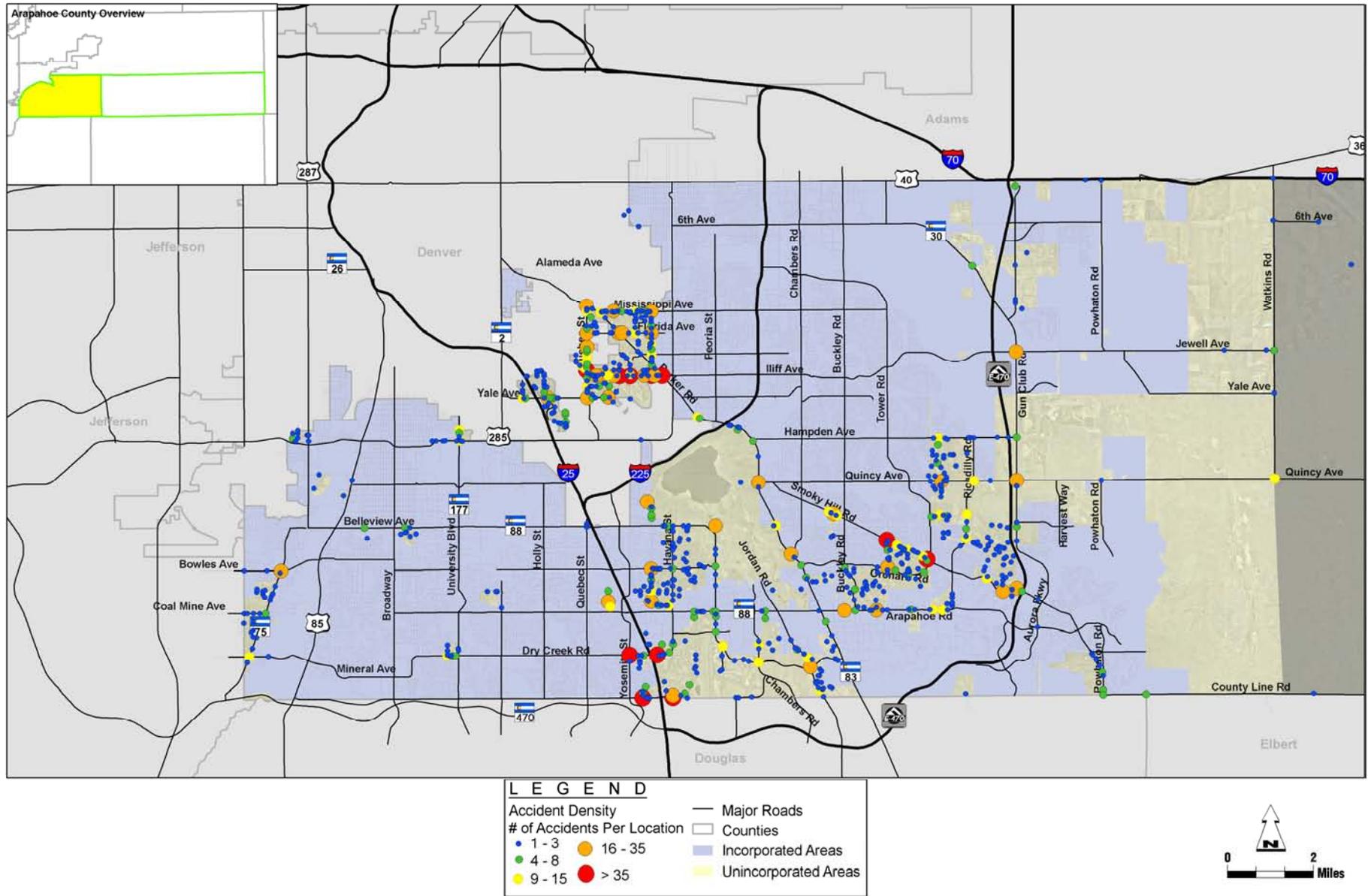
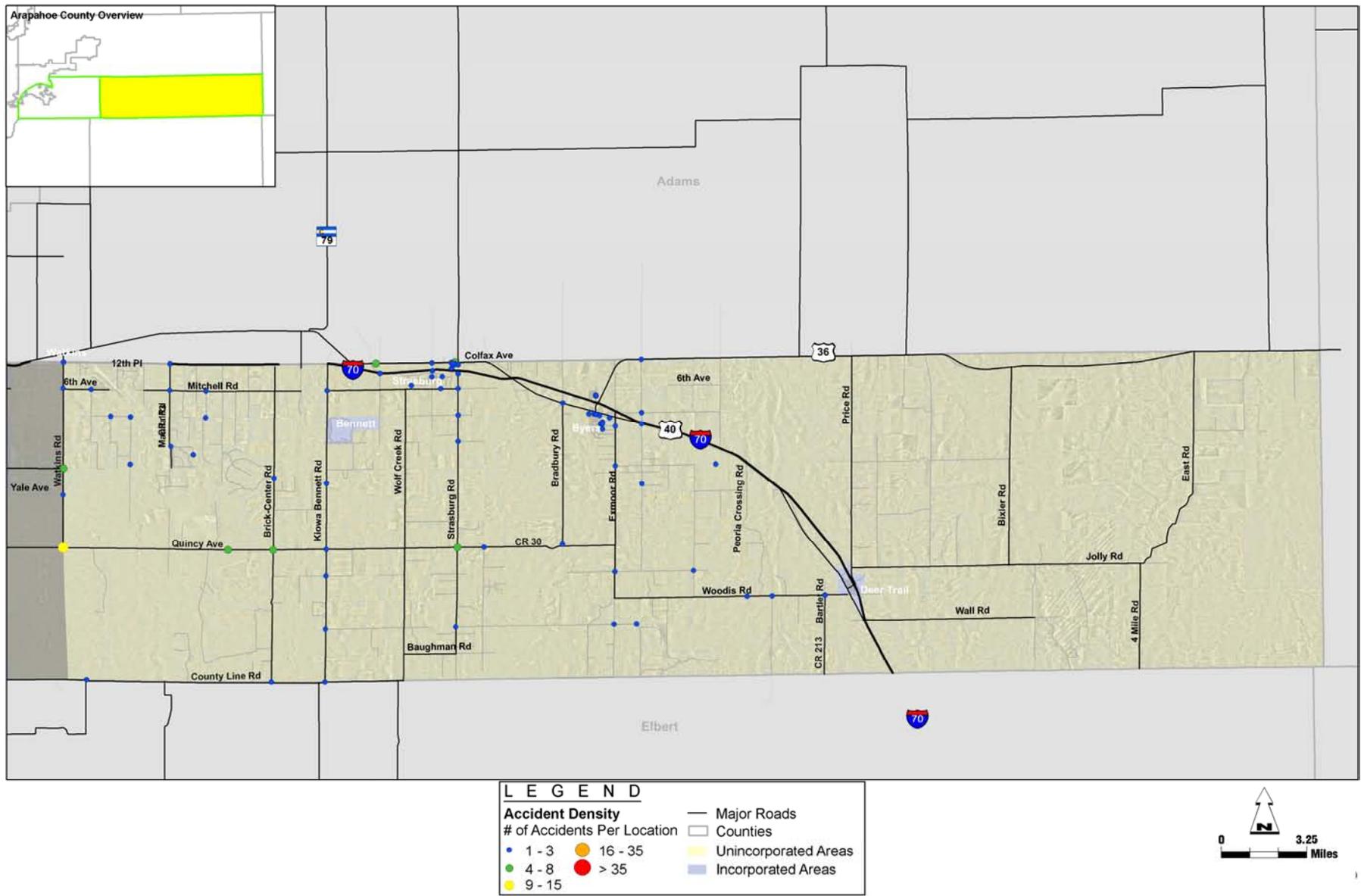


Figure 8. Existing Accident Density – East End (2002-2004 Data)



## 2.5. Transit Services

The following describes the primary options available for people within Arapahoe County who do not have access to a private automobile for transportation. These conditions are current as of the development of the transportation plan (November 2009 – November 2010).

### Regional Transportation District

**Figure 9** shows the current transit service provided by the Regional Transportation District (RTD) within the western end of Arapahoe County. All RTD bus routes are depicted including the current light rail lines, call-n-Ride areas within the unincorporated County areas, and the RTD park-n-ride facilities. Bus routes are shown well beyond the unincorporated limits to show the nature of route connectivity for the unincorporated enclave areas. RTD services include local and regional fixed route service and connections to light rail stations and services to the Denver metropolitan area. Fixed route services are every 15 to 60 minutes in the peak periods and 30 to 120 minutes in the off-peak periods. Service hours are from 5:00 AM to 11:30 PM. The majority of the routes are for weekday service only, although some routes provide service on weekends and holidays.

RTD service is primarily funded through a 1% sales tax on businesses within the RTD boundaries. RTD also accesses Federal Transit Administration (FTA) funds. South of Quincy Avenue, the existing RTD boundary for service extends approximately as far east as Monaghan Road. North of Quincy Avenue, the boundary is roughly E-470 within Arapahoe County, although there are numerous enclave exceptions.

Currently, RTD has two light rail lines within Arapahoe County, the southwest corridor and the southeast corridor. Where data are available, the park-n-Ride parking supply and average utilization is shown in the figure. From Yale Avenue south, the LRT service park-n-Rides contain a total of 6,441 spaces along the I-25 and I-225 line. The average peak utilization of these spaces is approximately 62%, although this varies by facility. Along the southwest light rail corridor, a total of 2,498 spaces exist south of the Englewood station with an average utilization of approximately 94%.

RTD also currently provides call-n-Ride demand responsive services in Arapahoe County in the Denver Tech Center and Inverness areas, using the same fares as RTD's fixed route service. RTD has a park-n-Ride lot in Watkins just north of the County line in Adams County. This park-n-Ride serves the surrounding area within Adams County and Arapahoe County. No dedicated bus routes serve this facility, but rather it is served via a call-n-ride service. According to RTD, this service has not been utilized in the last five years.

### **CARE-ful Wheels Transportation**

CARE-ful Wheels is a Christian-based company serving the Denver metropolitan and front range areas, offering personalized door-to-door transportation for wheelchair-bound individuals, with costs on a per mile basis.

### **Developmental Pathways**

Developmental Pathways is a private, non-profit organization that provides direct, door-to-door transportation services for developmentally disabled persons to Developmental Pathways programs. The service area includes Arapahoe and Douglas counties and service is provided on weekdays from 6 a.m. to 5 p.m. There are 13 vehicles in the Developmental Pathways fleet, eight of which are wheelchair lift-equipped.

### **First Ride**

Arapahoe County and First Transit have teamed up to provide First Ride senior transportation services. The program provides seniors transportation to appointments, dining centers, grocery shopping and food banks in small, wheelchair-accessible buses. All buses are visually identifiable with the logo First Ride making it easier for seniors to recognize that their vehicle has arrived. The service is provided free of charge with contributions suggested.

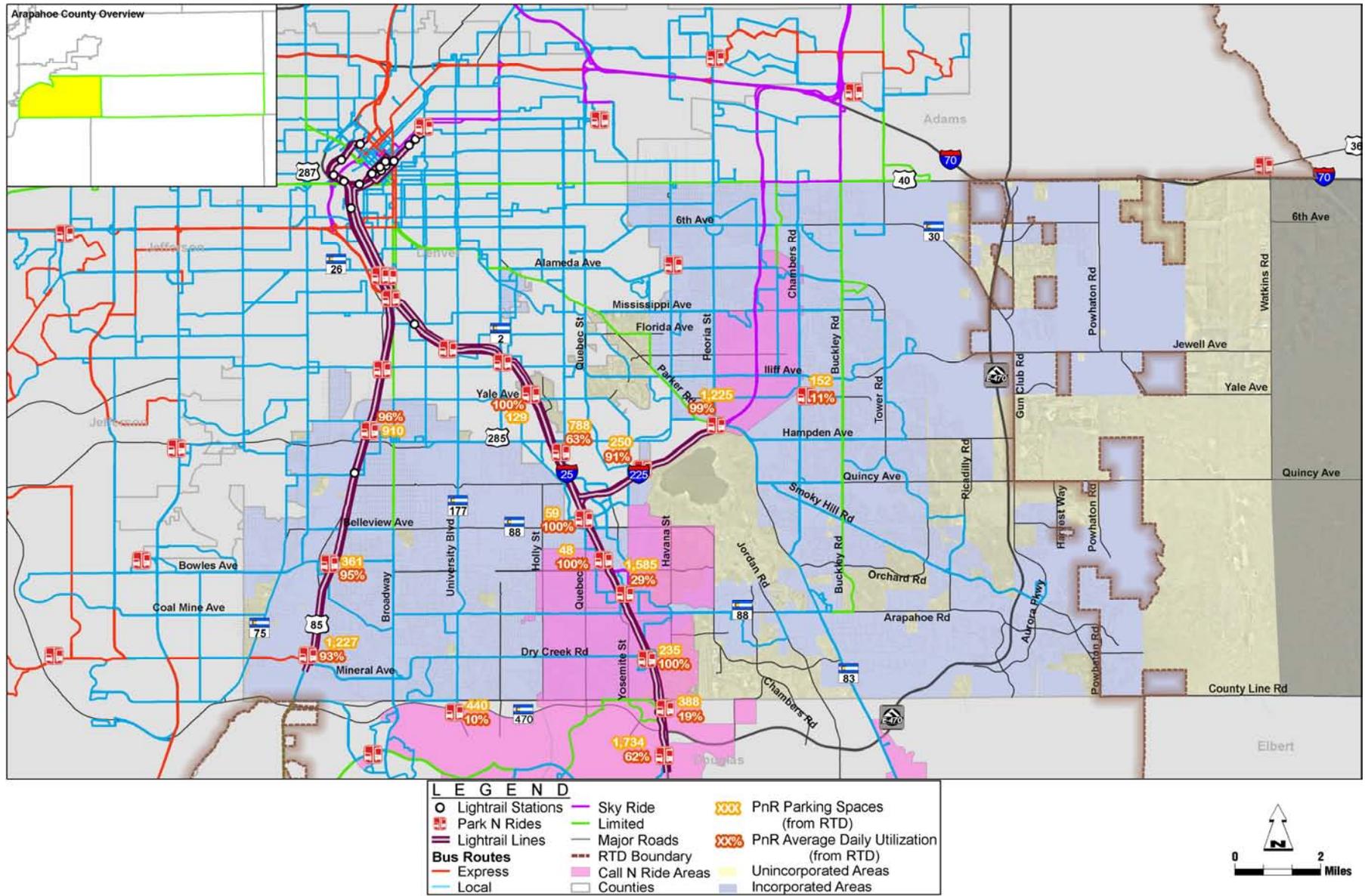
### **Midtown Express**

Midtown Express, a private, for-profit organization, provides demand-responsive transportation to primarily elderly and disabled customers in Denver, Arapahoe, Adams, Douglas and Jefferson counties. Service is available from 5 a.m. to 5 p.m., Monday through Saturday. Midtown Express maintains a fleet of six vehicles, two of which are wheelchair-accessible. 30,000 trips were provided in 2003, with costs on a per mile basis.

### **Special Transit**

Special Transit operates demand-responsive service in the Tri-Valley area of Adams and Arapahoe counties and in Brighton. These services are available to the general public and are heavily used by elderly and disabled riders. Service in the Tri-Valley area is offered on Tuesdays and Fridays and provided around 900 trips in 2006. In larger communities, service is provided Monday through Friday from 7:30 a.m. to 5:00 p.m. Days and times vary in smaller communities and for regional service. Fares are comparable to RTD's.

Figure 9. Existing RTD Transit Service (2010) – West End



## 2.6. Bicycle and Pedestrian Facilities

### Missing Sidewalks

Figures 10 and 11 depict the key missing sidewalk links within unincorporated areas of Arapahoe County. These sidewalk deficiencies were identified from County Public Works staff based on their knowledge and past public inquiries regarding sidewalk issues. In addition, missing sidewalk links in areas surrounding schools or providing access to transit stops within Unincorporated Arapahoe County were compiled via aerial mapping. These conditions are current as of the development of the transportation plan (November 2009 – November 2010).

The missing sidewalk links shown in the following figures are also listed in Tables 5 and 6. Most of the missing key sidewalk links identified are within the west end of the County, which is not surprising given its more urban and suburban nature. Of these missing links within the western end of the County, about one-half are located within the Four Square Mile area and the area surrounding the I-25 and Yale Avenue interchange. The one key missing sidewalk identified in the eastern end is in Byers near the school along Front Street.

Table 5. Key Missing Sidewalk Links

Location	Sides of Roadway	Limits
Arapahoe Road	South	Lewiston Way to Buckley Road
Broncos Parkway	North	Potomac Street to Blackhawk Street
Dahlia Street	Both	Vassar Avenue to Iliff Avenue
Florida Avenue	North	Parker Road to S. Uinta Court
S. Havana Street	East	South of E. Geddes Avenue
Holly Street	West	North and south of Yale Avenue
E. Iliff Avenue	South	At Cherry Creek Country Club
E. Iliff Avenue	South	At roughly S. Valentia Street
Jewell Avenue	Both	Parker Road to Dayton Street
S. Peoria Street	West	South of E. Arapahoe Road
Yosemite Street	Both	Warren Avenue to Evans Avenue
Yosemite Street	West	Iliff Avenue to Warren Avenue
Missing Sidewalk Links near Schools		
Front Street (in Byers)	South	West of the schools
S. Himalya Street	East	Quincy Avenue to Sky Vista Middle School
Quincy Avenue	South	Himalaya Street to Picadilly Street
S. Picadilly Road	East	Chenango/Copperleaf Boulevard to Eaglecrest access

**Table 6. Missing Sidewalk Links Near Transit Locations**

Location	Sides of Roadway	Limits
Picadilly Road	East	Riviera Way to Chenango Avenue (from High School access to Chenango – no bus stops this segment)
Arapahoe Road	South	Lewiston Way to Buckley Road
Parker Road	West	County Line to Nichols Place
	West	Dry Creek Road to Fremont Avenue
	West	Orchard Road to Chambers Road
Dayton Street	West	Parker Road to Colorado Avenue
	West	150’ south of Iowa Avenue to 320’ north of Florida Avenue
	West	50 feet south of Idaho Place to 580’ south of Mississippi Avenue
	East	190’ south of Mississippi Avenue to Mississippi Avenue
Florida Avenue	South	60’ west of Dayton Street to 240’ west of Dayton Street
Iliff Avenue	North	Emporia Street to Dayton Way
	South	200’ west of Wabash Street to 200’ east of Cherry Creek Drive
	South	Trenton Way to 230’ east of Syracuse Way
Yosemite Street/Quebec Way	West	Iliff Avenue to Warren Avenue
	East	300’ south of Evans Avenue to Jewell Avenue

Figure 10. Key Missing Sidewalk Links (2010) – West End

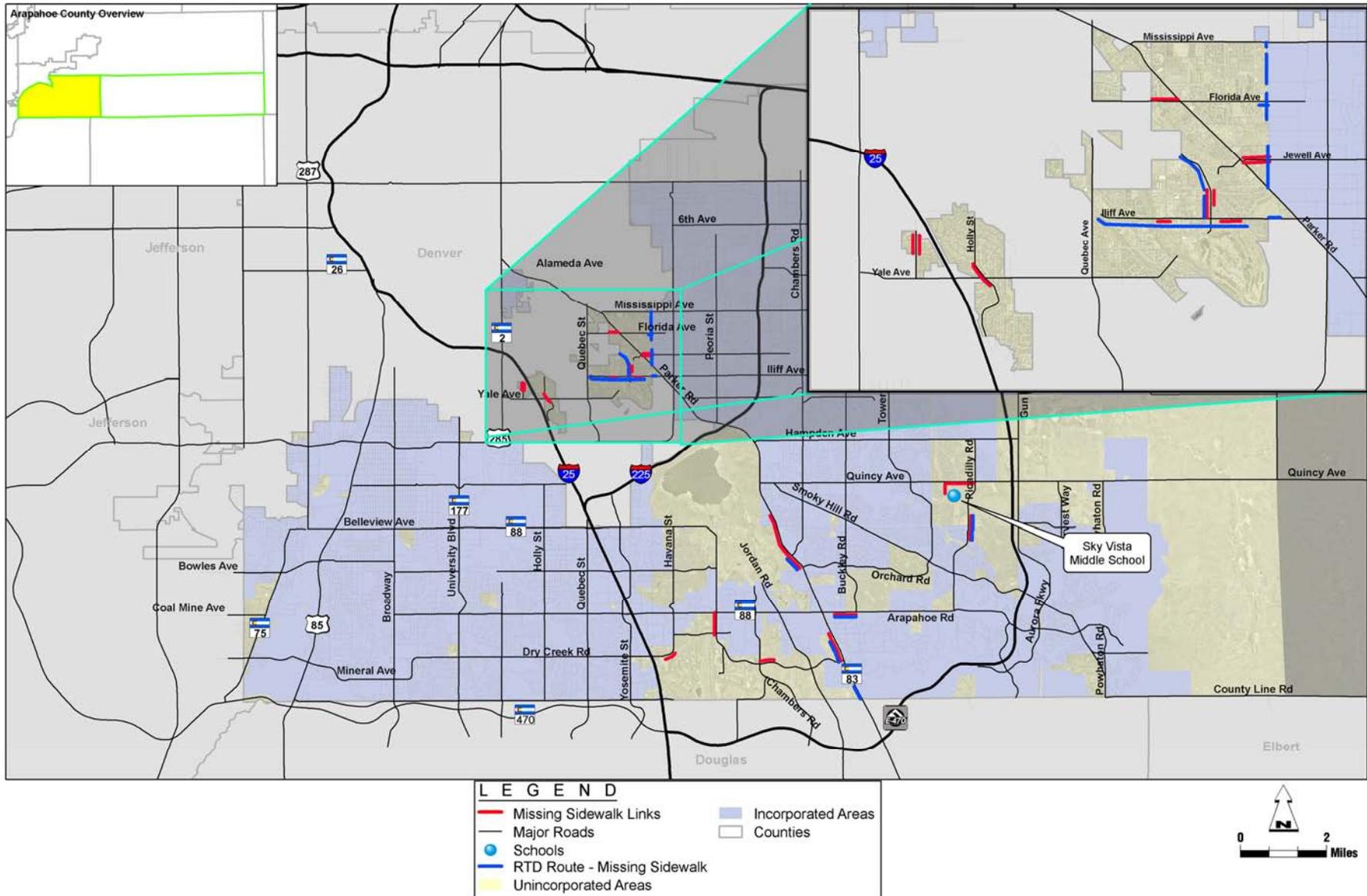
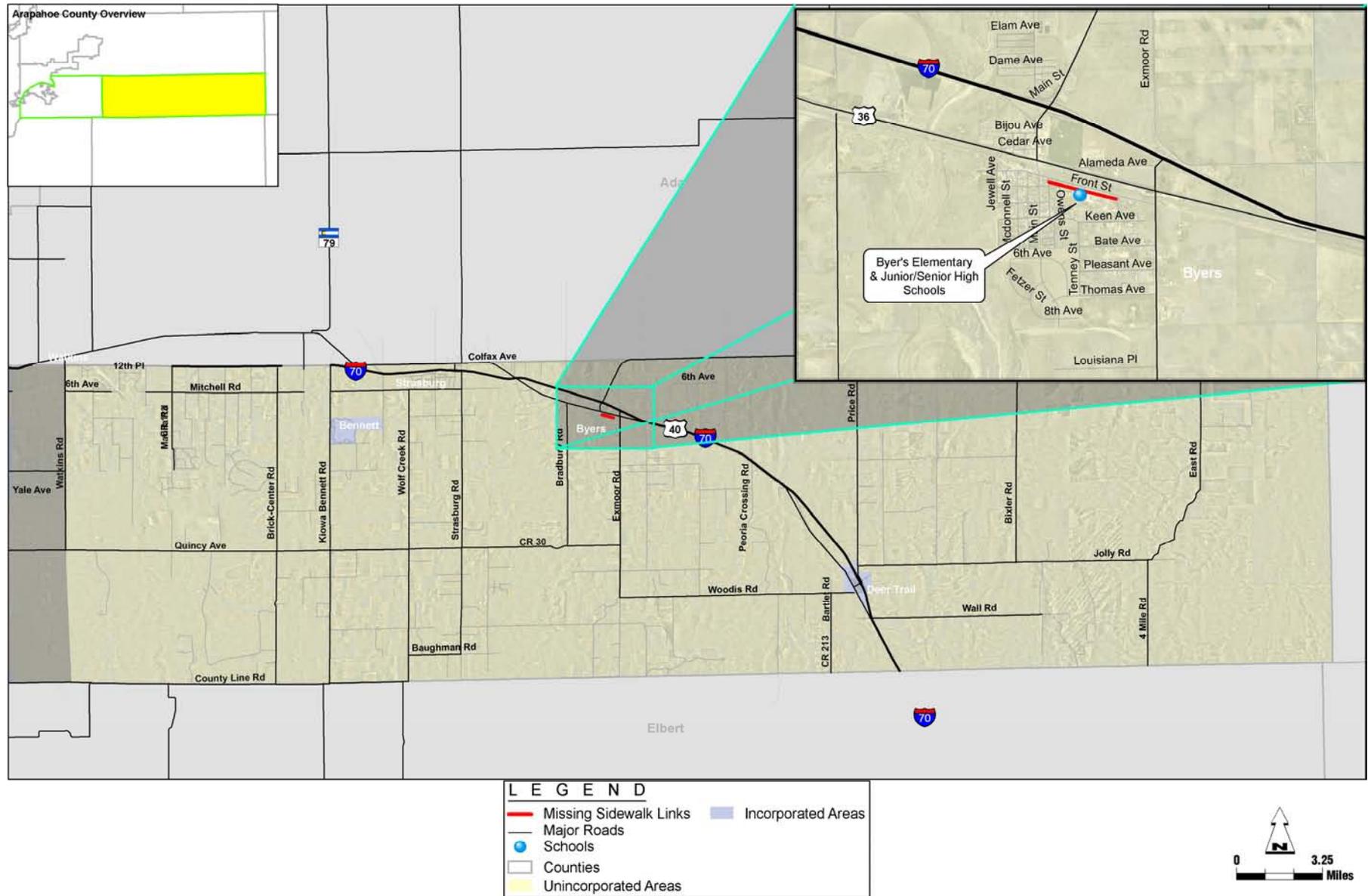


Figure 11. Key Missing Sidewalk Links (2010) – East End



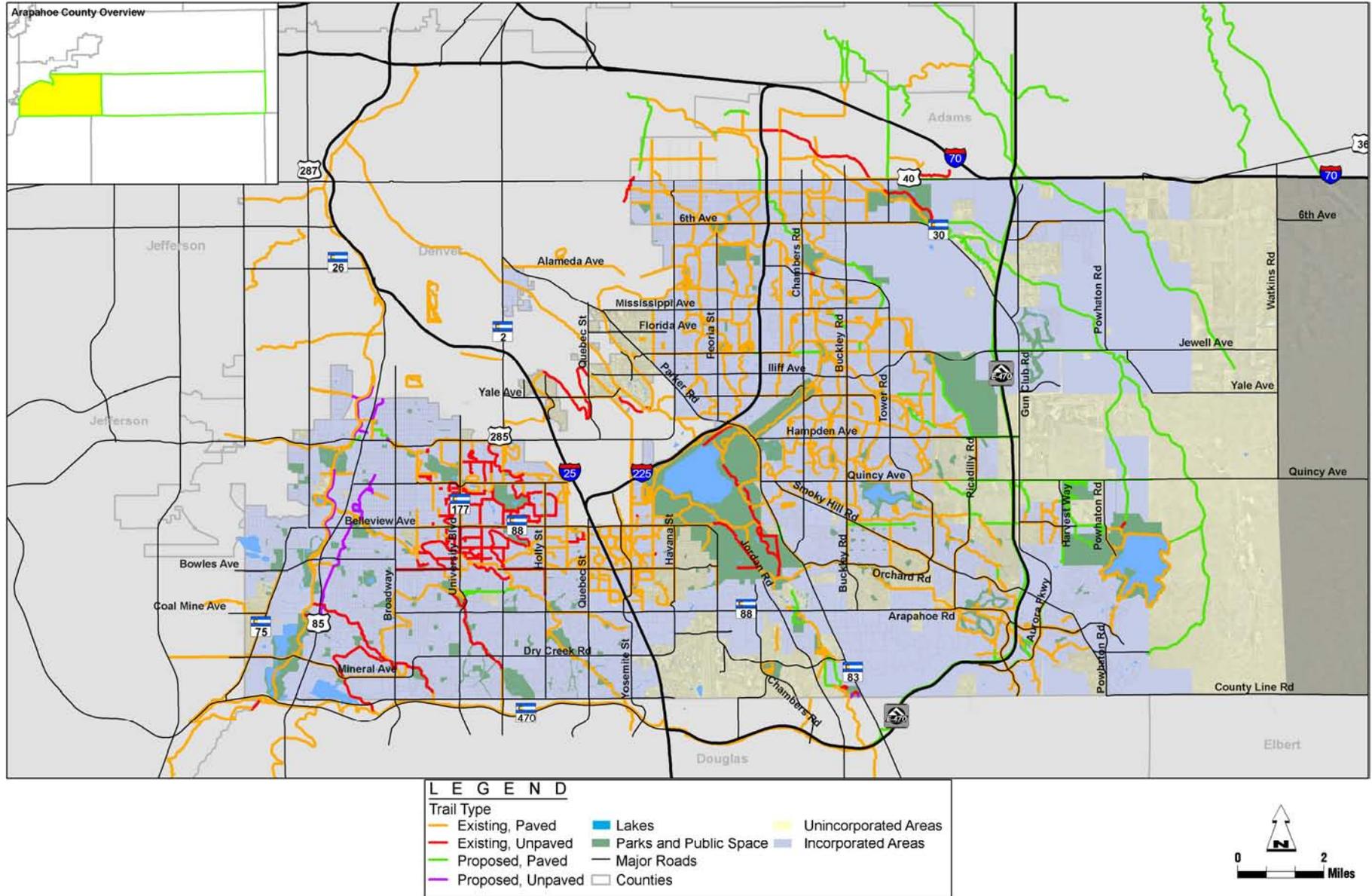
**Bicycle Network**

The existing bicycle network in Arapahoe County consists of off-street paved and unpaved trails. These trails are primarily located in the urbanized areas of the County and are generally used for recreational trips. **Figure 12** shows the trails system within the County based on the County GIS database. These trail data are current as of the development of the transportation plan (November 2009 – November 2010). Trails are shown well beyond the limits of the unincorporated areas to illustrate the nature of the connectivity between incorporated and unincorporated areas. Some of the trails depicted occur in the form of wide detached sidewalks or paths along roadways.

As shown, there are many uncompleted breaks in the trail network outside of the urban areas which limits their use as a more regional form of transportation for residents within Unincorporated Arapahoe County.

With its central location, lower traffic volumes, and connection between the urban and rural areas of the County, the Quincy Avenue corridor east of Gun Club Road experiences relatively high demand for on-road bicycle use. The lack of shoulders and/or a detached path creates some conflicts between vehicles and bicyclists. Currently, the section of Quincy Avenue between Gun Club Road and Watkins Road is also regularly used for major bike racing events, which closes the road to vehicular traffic during the event.

Figure 12. Existing Bicycle Network (2010) – West End



### 2.7. Level of Service Thresholds

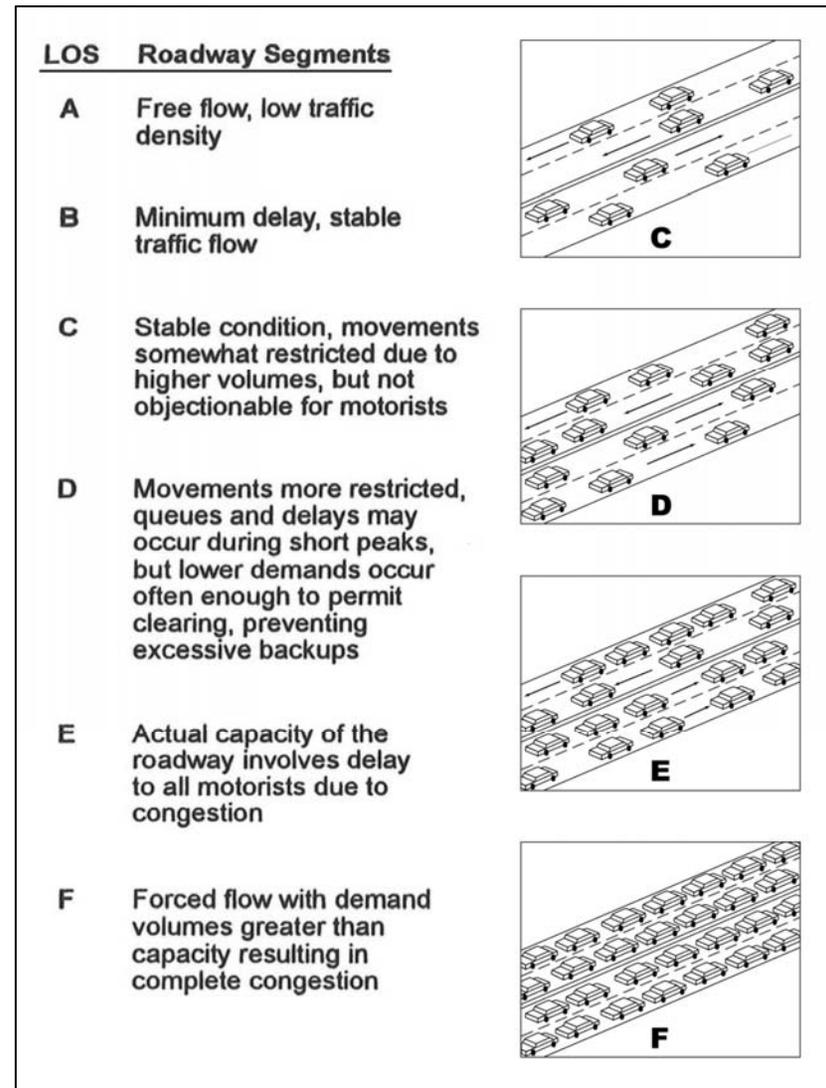
Level of Service (LOS) is a qualitative measure describing traffic operations within a transportation facility that is generally defined in terms of factors such as speed, travel time, and freedom to maneuver. Level of Service for intersections is defined in terms of overall delay, which is a measure of driver frustration, fuel consumption, and lost travel time. Similar to grades in school, LOS is scored using letters from A to F, where A represents the best conditions and F represents failure of the system with excessive delay. General Levels of Service descriptions are illustrated in **Figure 13**.

Roadway corridors that operate at LOS C or better are categorized as uncongested and generally operate in free-flow conditions where drivers can operate at their desired speed without undue delay. During the peak hour, there might be some delay experienced at a traffic signal controlled intersection, but generally drivers can proceed through the intersection within one cycle of the traffic signal.

Corridors operating at LOS D are roadways where drivers can generally travel in free-flow conditions during the off-peak hours, but might experience having to wait more than one signal cycle at a signalized intersection during the peak hours, or may experience difficulty changing lanes while traveling between intersections. Because these corridors are approaching capacity, there can be substantial variations in congestion from day to day, fluctuating between acceptable and congested.

Congested corridors are those roadways where traffic volumes have either reached or exceeded the facility's capacity and the

Figure 13. Roadway Level of Service Descriptions



roadway operates at LOS E or F. These facilities experience daily congestion delays where it is not uncommon that a driver might have to wait two or more signal cycles to proceed through an intersection during peak periods, and with peak periods which last longer through the day.

Levels of service thresholds were developed for the 2035 Transportation Plan. This level of service definition is intended to provide a measure of the quality of mobility in Arapahoe County now and into the future in a manner that is easily quantifiable and understandable by the general public. Based on information gathered from other jurisdictions in Colorado, as well as other counties similar to Arapahoe County in the US, level of service performance measures were established to be generally consistent with neighboring jurisdictions while meeting the goals and objectives of the Transportation Plan. These minimum levels of service thresholds are shown in **Table 7**.

**Table 7. Level of Service (LOS) Thresholds**

Roadway Classification / Location	Level of Service Thresholds					
	Road Segments		Intersections			
	Peak	Non-Peak	Peak		Non-Peak	
			LOS	Overall Delay	LOS	Overall Delay
Arterials						
Urban Areas	D	D	D <sup>(1)</sup>	≤ 55 sec	D <sup>(1)</sup>	≤ 55 sec
Semi-Urban Areas	D	D	D <sup>(1)</sup>	≤ 55 sec	D	≤ 55 sec
Rural Areas <sup>(2)</sup>	C	C	C	≤ 35 sec	C	≤ 35 sec
Collectors – all areas	C	C	C	≤ 35 sec	C	≤ 35 sec

<sup>(1)</sup> Overall intersection LOS D with some turning movements at LOS E or F

<sup>(2)</sup> Includes Semi-Rural Areas as defined by DRCOG

## **2.8. Area Classification**

Area classifications were developed for Unincorporated Arapahoe County to define areas and the differences in the transportation system needs, particularly in relation to roadway cross-section and capacities. These areas were developed rather than defining a strict boundary line for the application of rural versus urban standards. These area classification definitions are based on Denver Regional Council of Government's (DRCOG's) development classification system with modifications to reflect the County Comprehensive Plan Sub-Area Plans for Byers, Strasburg, Four-Square Mile, and Lowry Range and known development plans within the County.

The following definitions provide a consistent classification system to support the County transportation planning activities.

### **Urban**

- ✦ Residential subdivisions or groupings of 10 or more residential parcels with an average residential lot size of less than one acre.
- ✦ Commercial and industrial subdivisions.
- ✦ Commercial activity on isolated parcels.
- ✦ Includes enclaves of semi-urban and other development that are surrounded by urban development.

### **Semi-Urban**

- ✦ Residential subdivisions or groupings of 10 or more residential parcels with an average residential lot size greater than or equal to 1 acre and less than 10 acres.

### **Semi-Rural/Rural**

- ✦ Parcels that are not part of an urban or semi-urban subdivision and that are 10 acres or larger.
- ✦ Any undevelopable parcel 160 acres or larger.

### **Open Space**

- ✦ Protected open space

The area classifications for Unincorporated Arapahoe County are shown in **Figures 14 and 15**. These area classifications are based on currently available information on existing and planned land uses. The classification of any area is dynamic and classifications may be updated as land use changes occur, which could impact the transportation needs of the area. The area around the Watkins Road corridor is particularly expected to change as development occurs.

Figure 14. Unincorporated County Area Classification – West End

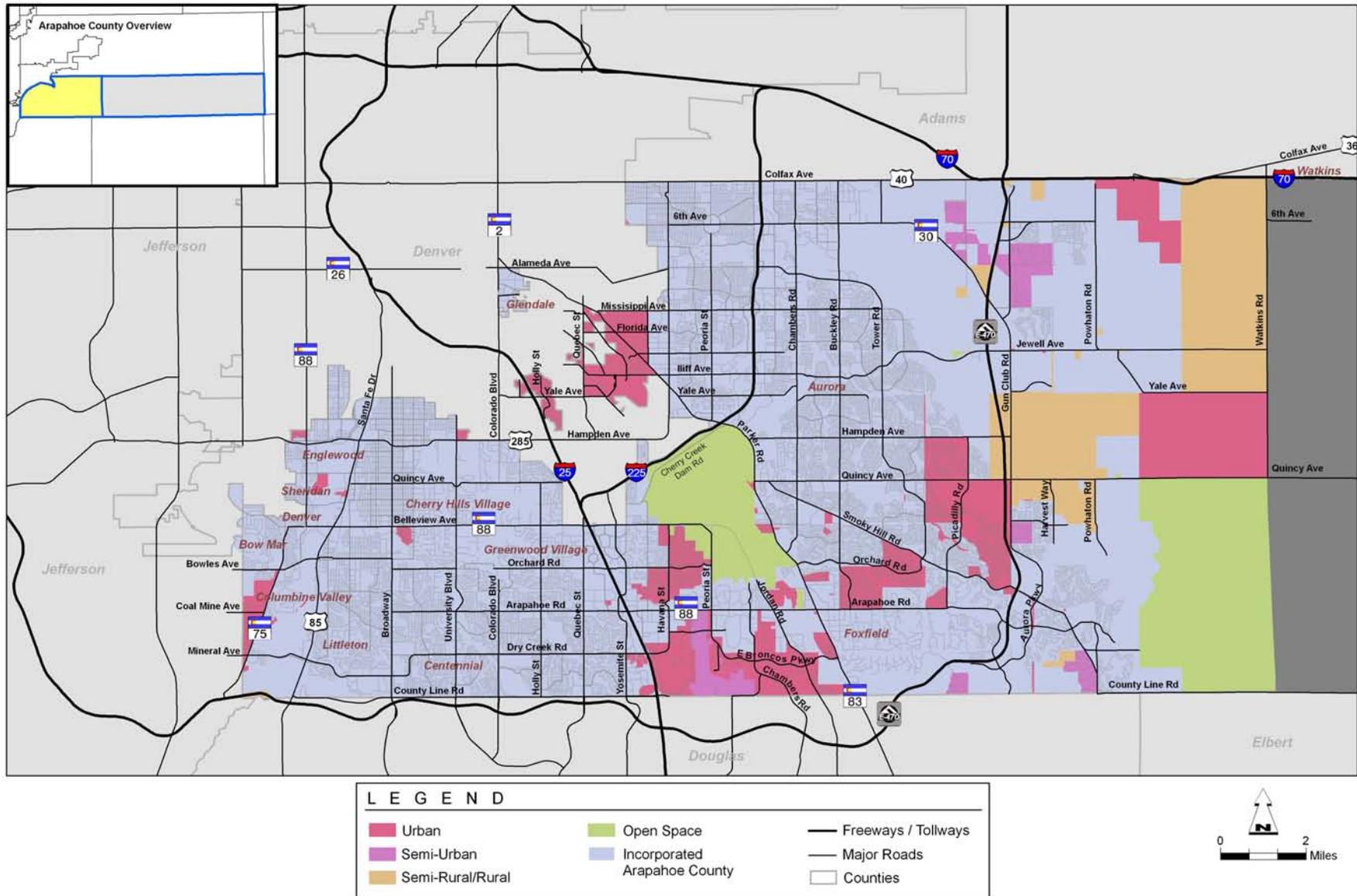
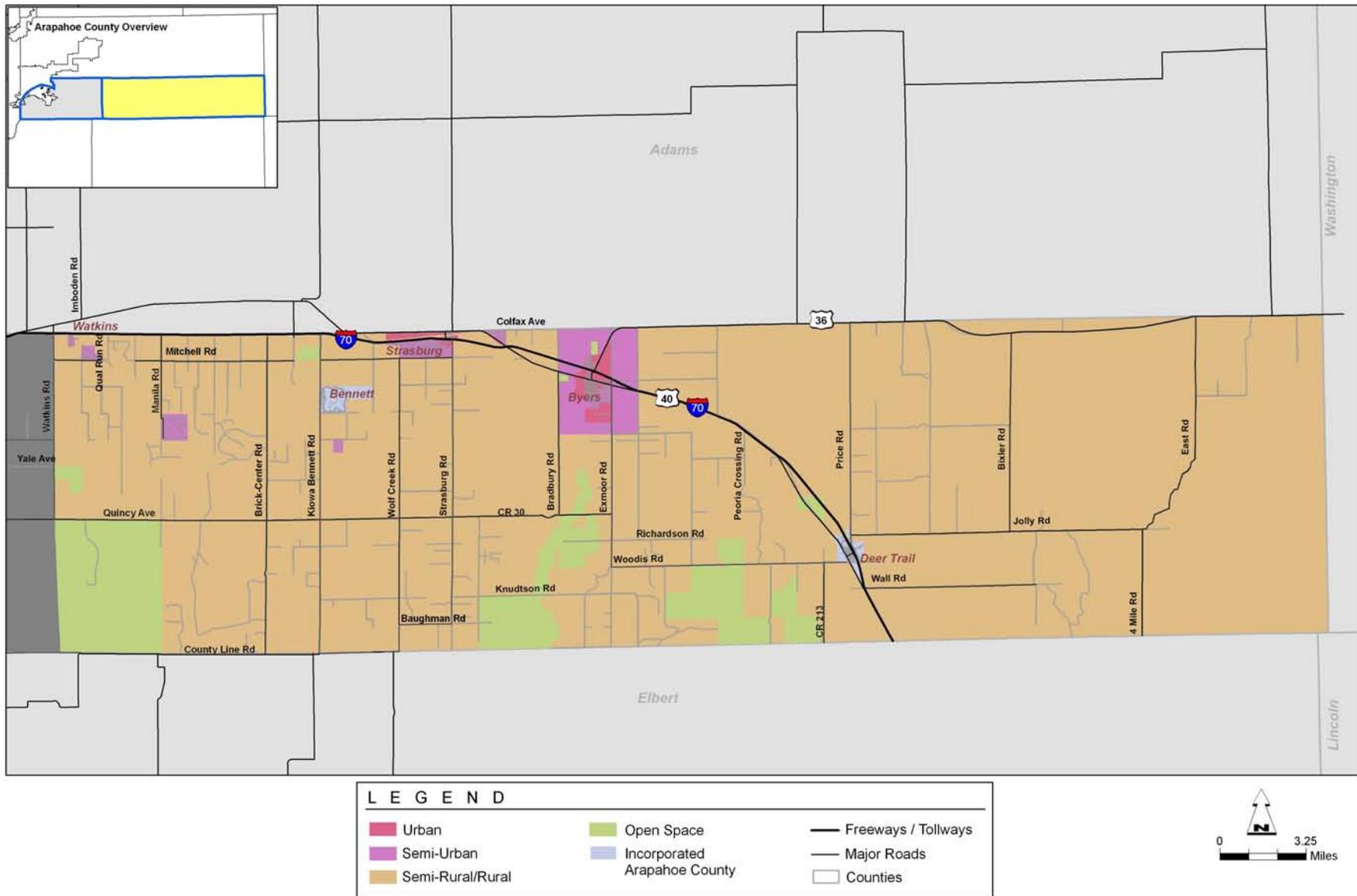


Figure 15. Unincorporated County Area Classification – East End



**2.9. Roadway Capacities**

Roadway capacity can be defined as the maximum traffic volume that a roadway can carry at a desired level of service. Roadway capacity varies for different roadway types based on multiple geometric and operational factors, including roadway surface, number of lanes, lane width, shoulder width, area type (rural, urban), and terrain type (level, rolling, mountainous).

**Unpaved Roads**

Two-thirds of the County land area is served by gravel roads. The gravel roads in eastern Arapahoe County are used as school bus routes, postal/mail routes, as well as for resident access for commuting and services. For unpaved roadways, the Colorado Department of Public Health and Environment requires that a roadway which has vehicular traffic exceeding 200 vehicles per day in PM<sub>10</sub> attainment areas (averaged over any consecutive 3-day period) be paved or treated for dust abatement. PM<sub>10</sub> (Particulate Matter) is a criteria air pollutant consisting of small particles with a diameter of less than 10 microns. The Denver metropolitan area PM<sub>10</sub> attainment/maintenance boundaries, where this applies, includes the automobile inspection and readjustment program portion of Arapahoe County, which is generally west of Kiowa-Bennett Road.

For the previous Transportation Plan, research was conducted on the requirements for paving gravel roads used by other counties within Colorado. It was found that gravel paving criteria were generally based on the daily traffic volume the road served, with thresholds ranging from 300 to 1,000 vehicles per day. Based on that research, the County established a daily threshold of 700 vehicles per day. This updated plan maintains that threshold.

**Table 8. Capacity Assumptions for Paved Two-Lane Roads**

Factor	Arterials			Collectors
	Urban	Semi-Urban	Rural	All
Level of Service	LOS D	LOS D	LOS C	LOS C
Terrain	Level	Level	Rolling	Level
Directional Split	60%/40%	60%/40%	60%/40%	70%/30%
Heavy Trucks	2%	2%	3%	1%
Recreational Vehicles	1%	1%	1%	1%
No Passing Zones	60%	60%	30%	75%
Peak Hour Factor	0.90	0.90	0.90	0.90
Daily Traffic in Peak Hour	9%	10%	10%	9%
Segment Length	1 mile	1 mile	1 mile	1 mile
Base Free Flow Speed <sup>(1)</sup>	55 mph	55 mph	60 mph	55 mph

<sup>(1)</sup> Base Free Flow Speed – General speed of traffic (not speed limit) reflecting the road design and traffic characteristics.

**Paved Two-Lane Roads**

Arapahoe County has established LOS thresholds of LOS D for arterial roadways in urban and semi-urban areas and LOS C for arterial roadways in rural areas and collector roadways in all area types.

The Highway Capacity Manual (Transportation Research Board, 2000) is the nationally-accepted source for roadway capacity evaluations. The Highway Capacity Manual was used to approximate the maximum daily traffic volumes for two-lane roadways to achieve the LOS criteria established by Arapahoe County for County roads.

The capacity calculations were calibrated to more specifically reflect the conditions within Arapahoe County. Manual balancing was completed for classifications with similar geometries and to reflect reasonably lower capacities for narrower shoulders in rural areas. **Table 8** outlines the assumptions used to calculate the two-lane daily roadway capacities, presented in **Table 9**.

**Table 9. Daily Capacities of Paved Two-Lane Roads (at County Level of Service Thresholds)**

	Area Type	Useable Shoulder Width (feet) <sup>(1)</sup>	12-Foot Lanes	11-Foot Lanes	10-Foot Lanes	9-Foot Lanes
Arterials <sup>(2)</sup>	Urban (LOS D)	6	14,600	14,000		
		4	12,500	11,800		
		2	10,200	9,500	8,300	
		0	7,300	6,300	5,100	3,600
	Semi-Urban (LOS D)	6	13,600	13,200		
		4	12,000	11,400		
		2	10,000	9,300	8,200	
		0	7,000	6,000	4,800	3,500
	Rural (LOS C)	6	8,000	7,800		
		4	7,100	6,700		
		2	5,900	5,500	4,900	
		0	4,200	3,600	2,900	2,100
Collectors	All (LOS C)	6	6,300	5,500		
		4	4,000	3,800		
		2	3,000	2,700	2,200	
		0	1,900	1,600	1,300	1,000

Source: Highway Capacity Manual, 2000 with manual balancing

<sup>(1)</sup> Curb-and-gutter meeting design standards is equivalent to a 6-foot shoulder.

<sup>(2)</sup> Arterial roads assumed to have left and right turn lanes at accesses and intersections when warranted by turn volumes.

**Multi-Lane Roads**

Capacities of roads with more than two lanes were estimated based on typical traffic flow characteristics and capacities per hour per lane that have been developed as part of various regional studies within Arapahoe County.

A three-lane roadway is a road where the third lane serves as a continuous left-turn lane for access and intersections. This type of configuration improves traffic flow over a typical two-lane roadway by allowing turning vehicles to wait in dedicated turn lanes out of the way of through traffic. It is assumed four-lane roadways are separated with a median and left and right turn lanes are generally provided at accesses as needed so turning vehicles are outside the through lanes. **Table 10** presents the daily capacities of multi-lane roadways based on the number of lanes.

**Table 10. Daily Capacities of Multi-Lane Roads (at County Level of Service Thresholds)**

Number of Lanes	Arterials			Collectors
	Urban (LOS D)	Semi-Urban (LOS D)	Rural (LOS C)	All (LOS C)
3 <sup>(1)</sup>	23,000	20,000	15,000	10,000
4 <sup>(2)</sup>	30,000	27,000	20,000	15,000
6 <sup>(2)</sup>	45,000	42,000	35,000	n/a

Source: Arapahoe County Roadway Design & Technical Criteria, Highway Capacity Manual, 2000 with manual balancing

- (1) The third lane serves as a continuous left-turn lane for accesses and intersections.
- (2) Four-lane and six-lane roads assumed to be separated with a median with left and right turn lanes provided at accesses and intersections when warranted by turn volumes.

The capacity of each roadway segment was defined for the major roadway system. These daily capacity thresholds were the basis for the volume to capacity (v/c) ratios that indicate congestion on roadway segments. This is the daily traffic volume on a given roadway divided by the daily capacity of that roadway. The resulting v/c ratios were used to determine the needed roadway improvements. Road segments with v/c ratios greater than one were slated for improvements.

**2.10. County Capital Improvement Program**

**Table 11** shows currently proposed higher priority transportation projects identified on the Arapahoe County Capital Improvement Program through 2015. Potential projects in the west end of the County generally include roadway widening or operational improvements. In the east end of the County, there are projects for paving along Quincy Avenue and Brick-Center Road.

**Table 11. Arapahoe County Capital Improvement Program – Projects through 2015**

Project Type	Description
<b>West End</b>	
Construction	Arapahoe Road Widening from Waco Street to Himalaya Way
	C-470/Santa Fe Drive interchange improvements
	Dahlia Street Sidewalk from LaSalle to north of Dahlia Lane
	Dayton/Peakview Intersection Improvements
	Dry Creek/Havana Corridor ITS Improvements
	Gun Club/Quincy Intersection Improvements
	Gun Club Road Widening from Quincy Avenue to Aurora Parkway
	Hampden Avenue Median from Himalaya Street to Picadilly Road
	Hampden Avenue/Picadilly Road Traffic Signal
	Havana Street Sidewalk from Geddes to Inverness Drive East
	Iliff Avenue Pedestrian Crossing for Highline Canal (design in process)
	Iliff Avenue Improvements (from study recommendations)
	Inverness Drive West/County Line Road Operational Improvements
	Inverness Drive West/Dry Creek Operational Improvements
	Jewell Avenue Reconstruction from Parker Road to Dayton
	Parker and Arapahoe Roads Interchange (under construction)
	Quincy Avenue Widening Picadilly to Gun Club Road
	Yale Avenue/Wabash Street Bridge (under construction)
Yale Avenue/Syracuse Way Intersection Improvements	
Yosemite Avenue Reconstruction north of Iliff Avenue	

**Table 11 (cont'd). Arapahoe County Capital Improvement Program – Projects through 2015**

<b>Project Type</b>	<b>Description</b>
Study and/or Design	County Line Road Corridor ITS and Operations Study
	Dry Creek/Havana Corridor ITS and Operations Study
	I-25/Arapahoe Road Interchange Environmental Assessment and Conceptual Design
	Illiff Avenue Corridor Study from Quebec Street to Parker Road
<b>East End</b>	
Construction	Brick Center Road Paving from Quincy Avenue to County Line Road
	Quincy Avenue Extension from Exmoor Road to Bradbury Road (including bridge over Bijou Creek)
	Quincy Avenue Paving from Kiowa Bennett Road to Strasburg Road
Study and/or Design	Kiowa-Bennett Road Study from I-70 to Highway 79
<b>Countywide</b>	
Study and/or Design	Bike Plan for Unincorporated Arapahoe County
	Countywide Intelligent Transportation System (ITS) Study
	Countywide Intelligent Transportation System (ITS) Improvements

**2.11. Current Transportation Funding**

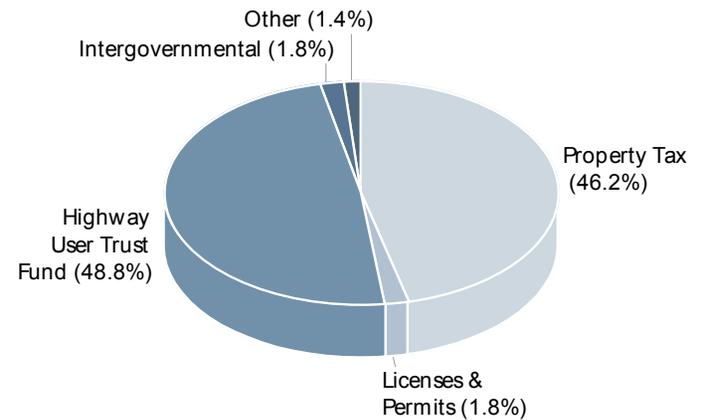
Arapahoe County currently funds operations and maintenance and capital investment of its transportation system through a mix of property tax, Highway User’s Tax Fund (HUTF) revenue, general fund revenue, licenses and permits, impact fee revenue and private developer agreements.

**Transportation Operations and Maintenance**

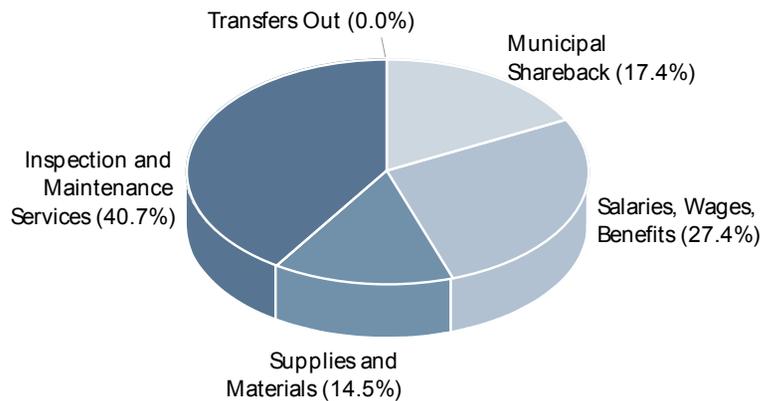
Annual transportation operations and maintenance is currently funded out of the County Road and Bridge fund, which is funded primarily through HUTF funds (state gasoline tax), motor vehicle registration fees, other transfer payments from state and federal governments and a dedicated mill levy.

In 2009, the County Road and Bridge fund had about \$14 million in revenue. About 95% of 2009 road and bridge fund revenue came from HUTF and the dedicated mill levy. The reliance on property tax and HUTF revenue is typical among all Colorado counties.

**Arapahoe County Road and Bridge Fund Revenue (2009)**



**Arapahoe County Road and Bridge Fund Expenditure (2009)**



On the expenditure side, the County budgeted about \$15 million for transportation operations and maintenance in its Road and Bridge fund. Substantial County transportation operations and maintenance expenditure include about 55% on supplies, materials and road maintenance services (including vehicle and equipment costs); and about 27% on personnel. Arapahoe County shares about 17% of its revenue back to incorporated municipalities, including 50% of the dedicated Road and Bridge mill levy. These transfer payments are mandated by state statute as the portion of road and bridge property tax collected within each municipality.

Arapahoe County has run deficits in the Road and Bridge fund for the last three years and is budgeted to have a deficit in 2010. The graph below presents the declining Arapahoe County Road and Bridge fund balance from 2006 to 2010 (budgeted).

As of the beginning of 2010, Arapahoe County’s Road and Bridge fund balance is half of what it was in 2007. The declining fund balance is indicative of the inadequacy of Road and Bridge fund revenues to cover its ongoing expenditure.

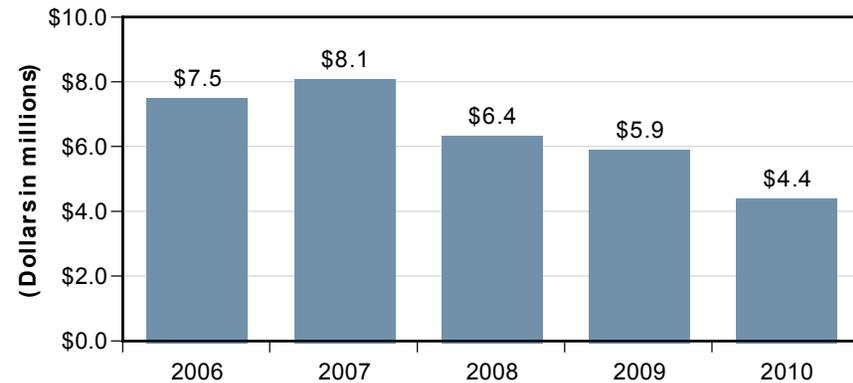
One potential cause of the declining fund balance is the general rise in costs for raw materials, such as aggregate and asphalt. Expenditures on additional transportation maintenance and improvements also results in less fund balance, since there is less money rolled into the next year.

Another potential cause is the general decline in County HUTF revenue, which is largely the result of high gasoline prices and the associated consumer response. The Arapahoe County share of HUTF was down in 2007 and 2008, although it has risen again in 2009 as a result of the passage of the “FASTER” bill. The FASTER bill was signed into law in early 2009 and Arapahoe County began accruing additional HUTF funds as a result in July 2009. The FASTER bill raises additional revenue for the HUTF through a rental car fee and an additional annual motor vehicle registration fee. The additional monies augment the revenue already distributed to the counties from the state through the HUTF. Arapahoe County FASTER funding was spent on the annual roadway rehabilitation program and the bridge maintenance program. The FASTER funding allowed the expenditures on the annual infrastructure maintenance programs to nearly double.

**Transportation Capital Funding**

In general, Arapahoe County transportation capital projects are funded through the County infrastructure fund, which has historically received about \$4 million per year as a transfer from the County capital fund. The County capital fund primarily generates revenue through a dedicated mill levy. In other instances, a capital project may be funded through a one-time transfer from the County general fund. This generally occurs when the project is time-sensitive, for instance if the County must match grant funds from the state or federal government. Other historical transportation capital financing sources include IGAs, private developer exactions and the regional transportation improvement fee (RTIF). RTIF is an impact fee that has been in place since 1994, although

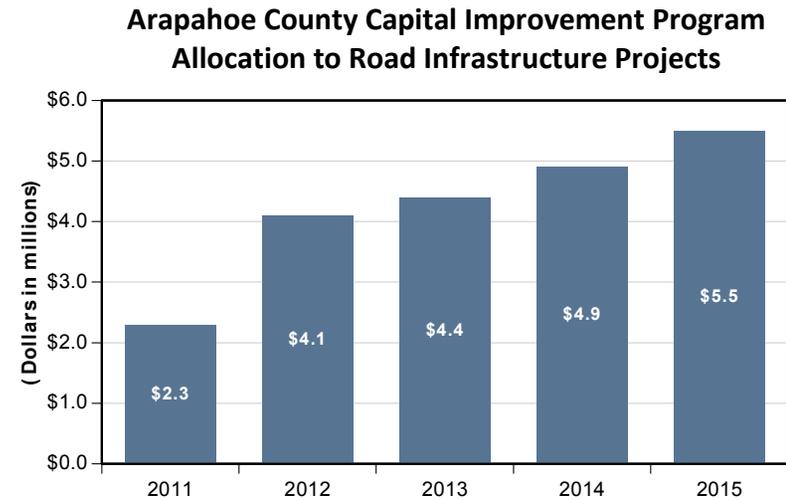
**Arapahoe County Road and Bridge Fund  
Beginning of Year Balance, 2006 to 2010**



it was temporarily suspended in 2009 for single family residential development and remains inactive. The following exhibit shows the projected CIP allocations for Transportation infrastructure projects from 2011 to 2015.

As shown, Arapahoe County reduced the capital improvement program for transportation capital projects for 2011 from historic funding levels. The reduction in transportation capital funding in 2011 is due to a funding advance of \$4.2 million the County provided in 2009 for the construction of portions of the Arapahoe Road and Parker Road interchange. Planned transportation capital funding is expected to return to customary levels in 2012.

In general, it appears that the County is able to sustain the annual transportation capital funding allocation at about \$4 million, which has been the level the County has provided since the early 1990's. If future transportation-related capital needs are regularly higher than \$4 million, the County will need to address a future funding gap.



### 3. Travel Demand

#### 3.1. Methodology Overview

A travel demand model for Arapahoe County was developed in conjunction with the Transportation Plan update. A travel model is a planning tool for assessing alternative improvements to a transportation system, given projected future demand. It provides output in the form of estimated traffic volumes on the roadway system. The Arapahoe County travel demand model will be used for County roadway planning and improvement project prioritization for capital programming.

Travel demand models were developed for the 2020 and 2035 planning horizons based on DRCOG land use forecasts and with a High Growth land use scenario to test if the transportation plan recommendations will provide adequate levels of service if development occurs more rapidly than expected.

The most current version of the Denver Regional Council of Governments' (DRCOG's) regional travel demand forecasting model, Compass 3.0, was used as a basis for developing traffic forecasts for the 2020, 2035, and High Growth scenarios for the Arapahoe County 2035 Transportation Plan. The base DRCOG 2020 and base DRCOG 2035 regional travel demand forecasting models were used as the basis for each of the three planning scenarios. The DRCOG Traffic Analysis Zone (TAZ) system was refined to provide more focused analysis during the previous Parker Road and Arapahoe Road Corridor Studies. TAZ splits made during those previous studies were carried forward into this transportation plan modeling effort. Specific TAZ splits carried forward from the Parker Road Corridor Study (which incorporated TAZ splits from the Arapahoe County Corridor Study) are shown in **Appendix A**.

The first step in developing the model specifically for the Arapahoe County 2035 Transportation Plan was to review and verify the land use data contained within the base models. This process involved considering the base land use data as well as additional development plans known within the immediate study area. The general process involved reviewing the 2035 scenario and adjusting the total household and employment numbers to reflect the expectations of Arapahoe County staff. Following this process, the 2020 scenario was refined by considering the anticipated growth given the previously determined 2035 land use. Finally, special development areas were identified within the planning areas, which have the potential to develop faster than anticipated with the 2035 scenario. These land use adjustments were added to the 2035 land use to create the High Growth scenario and provide additional information about transportation infrastructure which may be needed if growth occurs rapidly.

Next, the TAZs within Unincorporated Arapahoe County were considered. Since the eastern portion of Arapahoe County is on the periphery of the DRCOG modeling area, the regional model has been developed at a relatively coarse level, with some very large

TAZs. To focus the regional model to provide more reliable forecasts for Arapahoe County, further TAZ disaggregation was performed in the eastern end of the County. Before disaggregation, two very large zones represented the majority of land in the east end. Disaggregation was done to separate the zones into 18 unique TAZs. In addition, TAZ disaggregation that was performed for previous Arapahoe County planning studies was replicated in other parts of the County, again to improve the focus on County roadways.

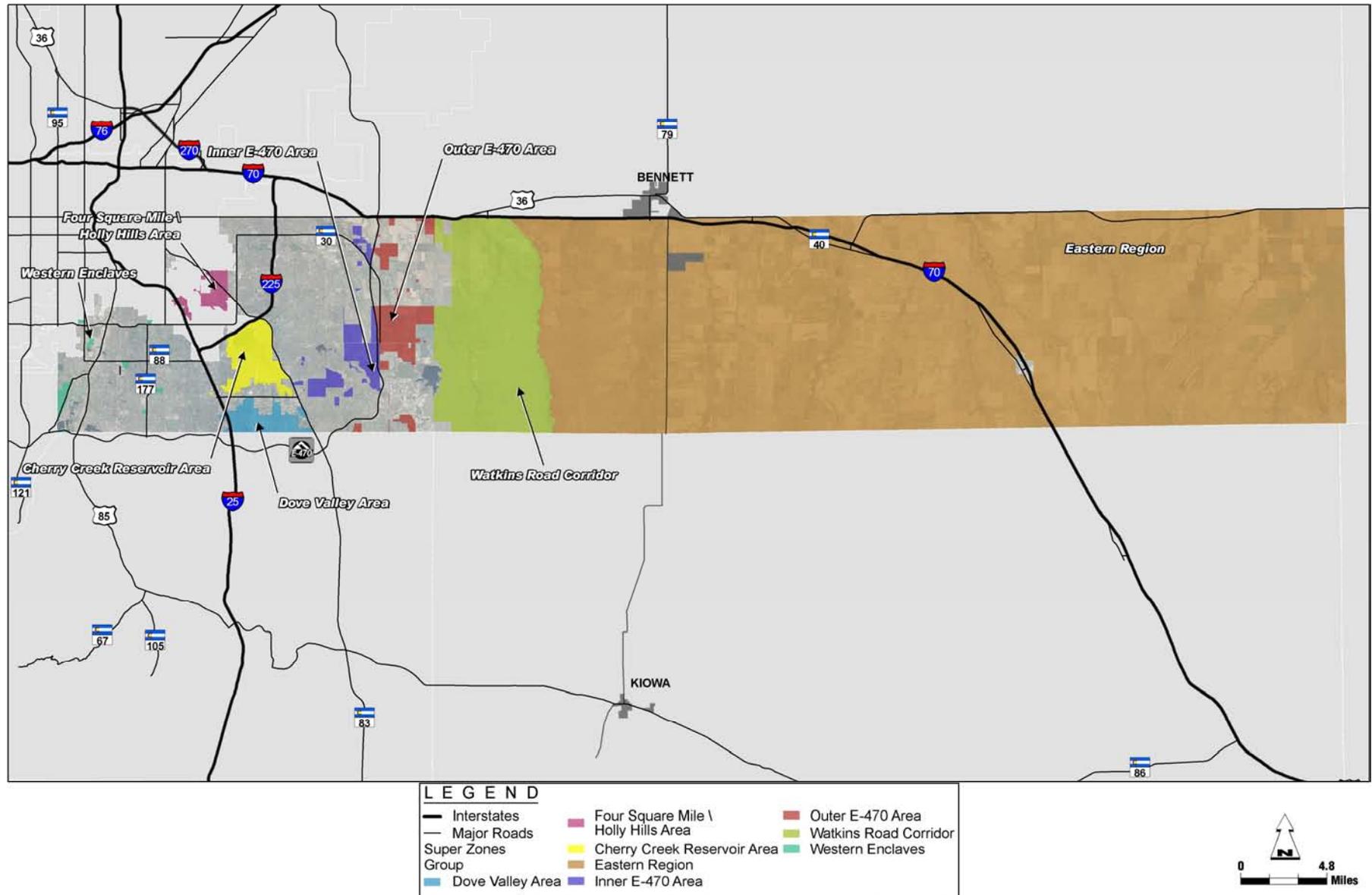
After performing land use changes and TAZ disaggregation for each model scenario: 2020, 2035, and High Growth, the models were run and the results calibrated. Due to the complexity of real-world driver behavior and individual roadway characteristics, travel demand forecasting models cannot be expected to result in precise representations of traffic volumes on each roadway. A common technique used to improve the reliability of travel demand forecasts is referred to as post-processing adjustment. This technique uses comparisons of the base year (2005) model's predicted traffic volumes versus actual traffic counts. These comparisons provide estimations of the error associated with the model's representation of travel conditions. The model-produced forecasts can then be adjusted to account for the errors found in the model to provide more reliable forecasts. This post-processing adjustment process, as prescribed in the Transportation Research Board's publication *NCHRP 255*, was applied to Arapahoe County 2035 Transportation Plan forecasts.

### **3.2. Land Use**

The base DRCOG 2020 and DRCOG 2035 regional travel demand forecasting models were used as the basis for each of the three planning scenarios. The primary goal for this study is to develop recommendations for Unincorporated Arapahoe County. Keeping this goal in mind, the unincorporated portions of Arapahoe County were identified and broken into more manageable study segments. These regional study areas have been termed Super Zones, meant to allude to the fact that each Super Zone is composed of many smaller TAZs. It should be recognized that TAZs do not necessarily coincide directly with unincorporated versus incorporated areas, and as such, the total land use values presented do not precisely represent Unincorporated Arapahoe County but serve as a reasonable approximation for the purposes of this land use exercise.

**Figure 16** illustrates the Super Zones identified for this study.

Figure 16. Unincorporated Arapahoe County Super Zone ID Map

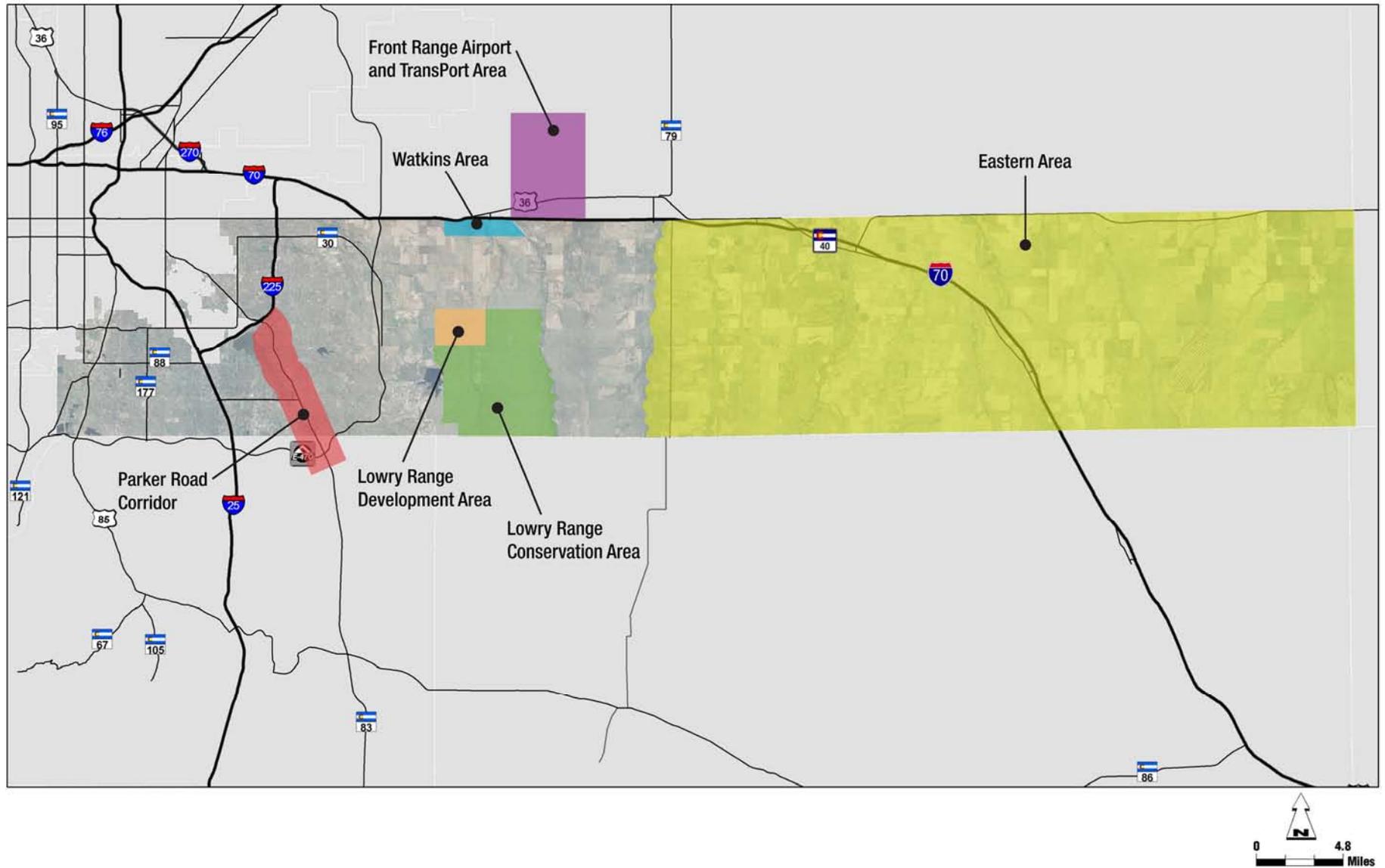


After developing the Super Zones, the land use assumptions for each Super Zone, particularly number of households and employment, were examined to determine the validity of DRCOG assumptions in the base models. As a result of discussions with the County, several areas, primarily located east of E-470, were identified for changes in land use from the DRCOG data. The land use assumptions within the DRCOG dataset for the Strasburg, Byers, and Deer Trail areas were deemed acceptable by County staff. Areas outside of those communities generally represent the more rural portions of the County and therefore represent areas with larger land areas with the possibility for significant development. These significant land use changes from the DRCOG assumptions were the focus of this land use exercise since large changes to the land use forecasts are more likely to substantially change travel demand. The *I-70 Corridor Economic Assessment* is a study currently being conducted to summarize the current economic conditions, growth trends, future economic growth projections, and economic drivers in the I-70 corridor from E-470 to Deer Trail. When that study is completed, the travel demand growth projections in the transportation plan may be confirmed.

The only land use forecast adjustments made west of E-470 are along the Parker Road corridor. The higher corridor growth forecasts that were developed for sensitivity analysis performed as part of the Parker Road Corridor Study were incorporated in the High Growth scenario. The Arapahoe Road Corridor Study, completed prior to the Parker Road study, used a 2030 planning horizon. It was determined that land use forecast adjustments to the DRCOG 2030 forecasts that were developed for the Arapahoe Road study were generally reflected in DRCOG's subsequent 2035 regional forecasts that are being used for the County 2035 Transportation Plan, so no additional land use changes were made based on Arapahoe Corridor Study forecasting.

As a result of these discussions, the areas of TAZs with modified land use are identified in **Figure 17** with the associated land use modifications from the DRCOG land use data provided in **Table 12** for 2020 and **Table 13** for 2035 and the High Growth scenario. Areas not noted within the figure and tables may still be expected to experience large amounts of land use growth, however, the assumptions contained within the DRCOG land use model were deemed acceptable.

Figure 17. TAZ Areas with Modified DRCOG Land Use



**Table 12. TAZ Areas with Modified DRCOG 2020 Land Use Forecasts**

Modified Land Use Area (shown in Figure 19)	Description & Source of Modifications	DRCOG 2020		Modified Baseline 2020	
		Households	Employment	Households	Employment
TransPort Area (Adams County)	Modifications based on TransPort preliminary build-out program, developed in 2006. Assumed Phase I in 2020.	153	2,416	0	4,480
Lowry Range Development Area	Modifications based on County’s May 2007 Urban Growth Boundary expansion request to DRCOG.  For 2020, use 1/3 of Baseline 2035	5,000	1,808	4,317	2,233
Lowry Range Conservation Area	Remove household and employment from DRCOG projections for TAZs to be retained as Conservation Areas	139	84	0	0
Watkins Area	Mirror the DRCOG forecasts to the north for the Watkins area TAZs to the south	46	19	400	110
Total Resulting Change Versus DRCOG Forecasts				-621	+2,496

Table 13. TAZ Areas with Modified DRCOG 2035 and High Growth Land Use Forecasts

Modified Land Use Area (shown in Figure 19)	Description & Source of Modifications	DRCOG 2035		Modified Baseline 2035		Modified High Growth Forecasts	
		Households	Employment	Households	Employment	Households	Employment
Parker Road Corridor	Sensitivity Analysis Scenario from Corridor Study, with higher forecasts in 10 TAZ's in Arapahoe County, Centennial, and Parker.	2,820	7,967	NC	NC	4,688	13,106
TransPort Area (Adams County)	Modifications based on TransPort preliminary build-out program, developed in 2006. Assumed 1/3 of Build-out for 2035 Baseline, 2/3 of Build-out for High Growth.	202	4,154	0	20,800	0	41,600
Lowry Range Development Area	Modifications based on County's May 2007 UGB expansion request to DRCOG.  For Baseline 2035 use 32,380 population projection (assuming 2.5 pop/household) and low end of employment range. For High Growth use 5/3 of 32,380 population projection based on 5 du/acre density rather than 3 du/acre base assumption and high end of employment range.	11,836	3,138	12,952	6,700	21,587	15,900
Lowry Range Conservation Area	Remove household and employment from DRCOG projections for TAZs to be retained as Conservation Areas.	1,526	729	0	0	0	0
Watkins Area	Mirror the DRCOG forecasts to the north for the Watkins area TAZs to the south.	82	21	1,198	329	1,198	329
Eastern Area	Double the DRCOG 2005 total households for the 2035 High Growth scenario.	1,053	508	NC	NC	1,710	NC
Total Resulting Change Versus DRCOG Forecasts				+504	+19,787	+11,664	+54,926
<p><i>NC indicates No Change proposed to DRCOG forecasts.</i></p>							

A summary of the final land use for the 2020, 2035, and High Growth scenarios can be seen on **Table 14** and **Table 15**. These land use tables represent the sum of all the Super Zones, more specific data regarding the land use used for each TAZ within each Super Zone can be found in **Appendix A**.

**Table 14. Unincorporated Arapahoe County Household Land Use Summary**

Super Zone (shown in Figure18)	2005	2020		2035		2035 High Growth	
	Households	Households	% Growth from 2005	Households	% Growth from 2005	Households	% Growth from 2005
Cherry Creek Reservoir Area	4,809	5,850	22%	7,249	51%	7,249	51%
Dove Valley Area	1,434	2,445	71%	3,809	166%	5,613	291%
Eastern Region	2,378	6,262	163%	11,649	390%	12,306	417%
Four-Square Mile Area	8,822	9,737	10%	11,009	25%	11,009	25%
Inner E-470 Area	8,795	12,049	37%	16,572	88%	16,572	88%
Outer E-470 Area	1,366	4,814	252%	9,600	603%	9,600	603%
Watkins Road Corridor	180	5,482	2945%	15,762	8657%	24,397	13454%
Western Enclaves	3,020	3,191	6%	3,426	13%	3,426	13%
Super Zone Total	30,804	49,830	62%	79,076	157%	90,172	193%
Arapahoe County Total	209,275	276,408	32%	363,990	74%		
DRCOG Model Area Total	1,046,657	1,384,942	32%	1,822,829	74%		

**Table 15. Unincorporated Arapahoe County Employment Land Use Summary**

Super Zone (shown in Figure18)	2005	2020		2035		2035 High Growth	
	Employment	Employment	% Growth from 2005	Employment	% Growth from 2005	Employment	% Growth from 2005
Cherry Creek Reservoir Area	5,558	7,201	30%	8,569	54%	8,569	54%
Dove Valley Area	26,261	35,863	37%	42,707	63%	45,393	63%
Eastern Region	831	1,310	58%	1,793	116%	1,793	116%
Four-Square Mile Area	6,413	7,448	16%	8,132	27%	8,132	27%
Inner E-470 Area	3,823	3,993	4%	4,288	12%	4,288	12%
Outer E-470 Area	499	2,808	463%	4,602	822%	4,602	822%
Watkins Road Corridor	52	2,398	4512%	7,104	13562%	16,304	31254%
Western Enclaves	1,916	2,105	10%	2,217	16%	2,217	16%
Super Zone Total	45,353	63,126	39%	79,412	75%	91,298	101%
Arapahoe County Total	265,370	357,810	35%	400,315	51%		
DRCOG Model Area Total	1,313,488	1,860,460	42%	2,261,375	72%		

A pictorial representation of the resulting household and employment land use data can be seen on the following population and employment density maps. On these maps, each blue dot represents 100 jobs and each red dot represents 100 households (see **Figure 18**, and **Figure 19**). These figures show the progressive development anticipated from 2020 to 2035. These figures are helpful in showing where future growth is projected to occur, what density is expected, and what the proportional balance between housing and employment will look like in Unincorporated Arapahoe County.

Figure 18. Unincorporated Arapahoe County 2020 Population and Employment Density

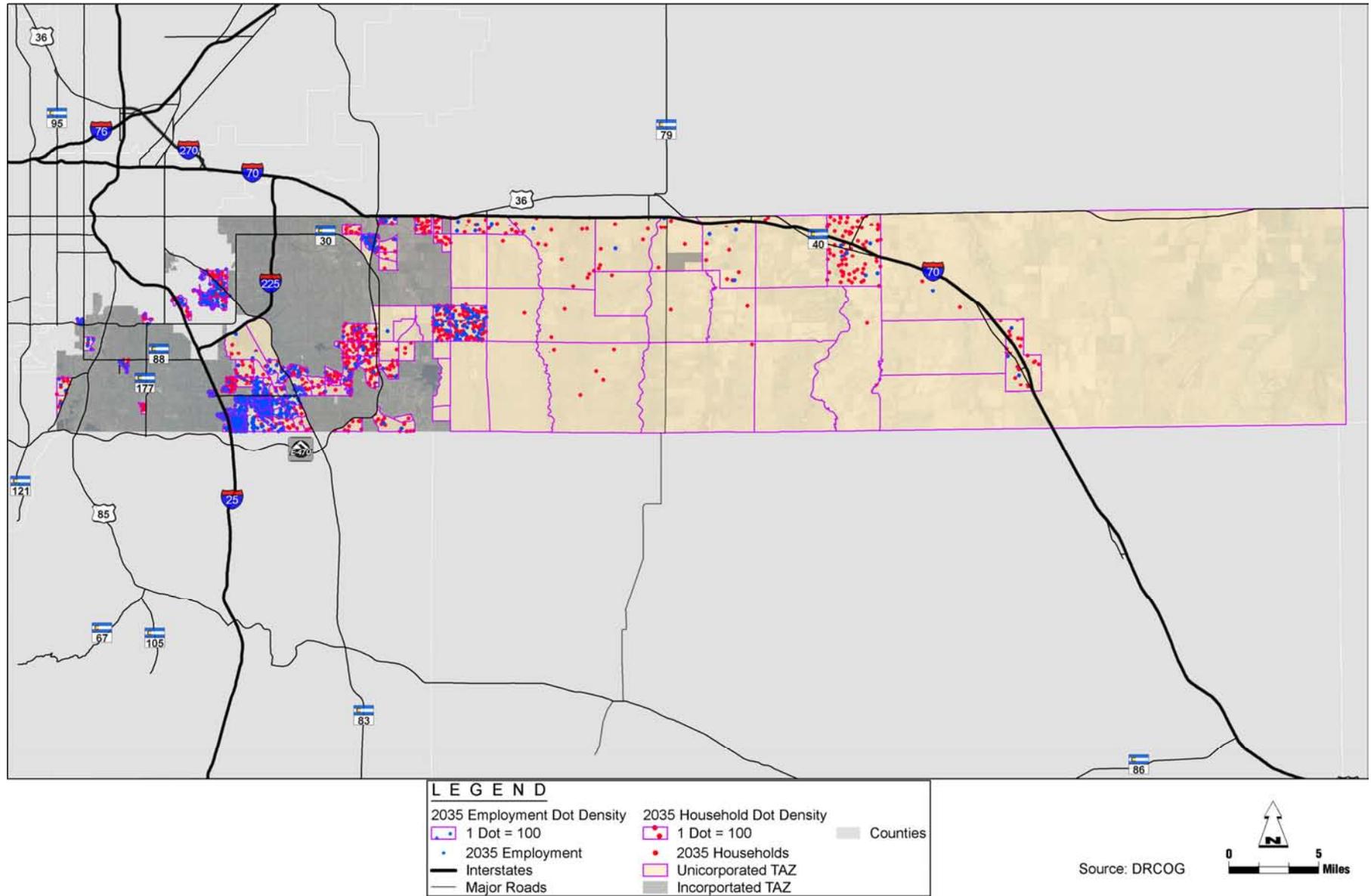
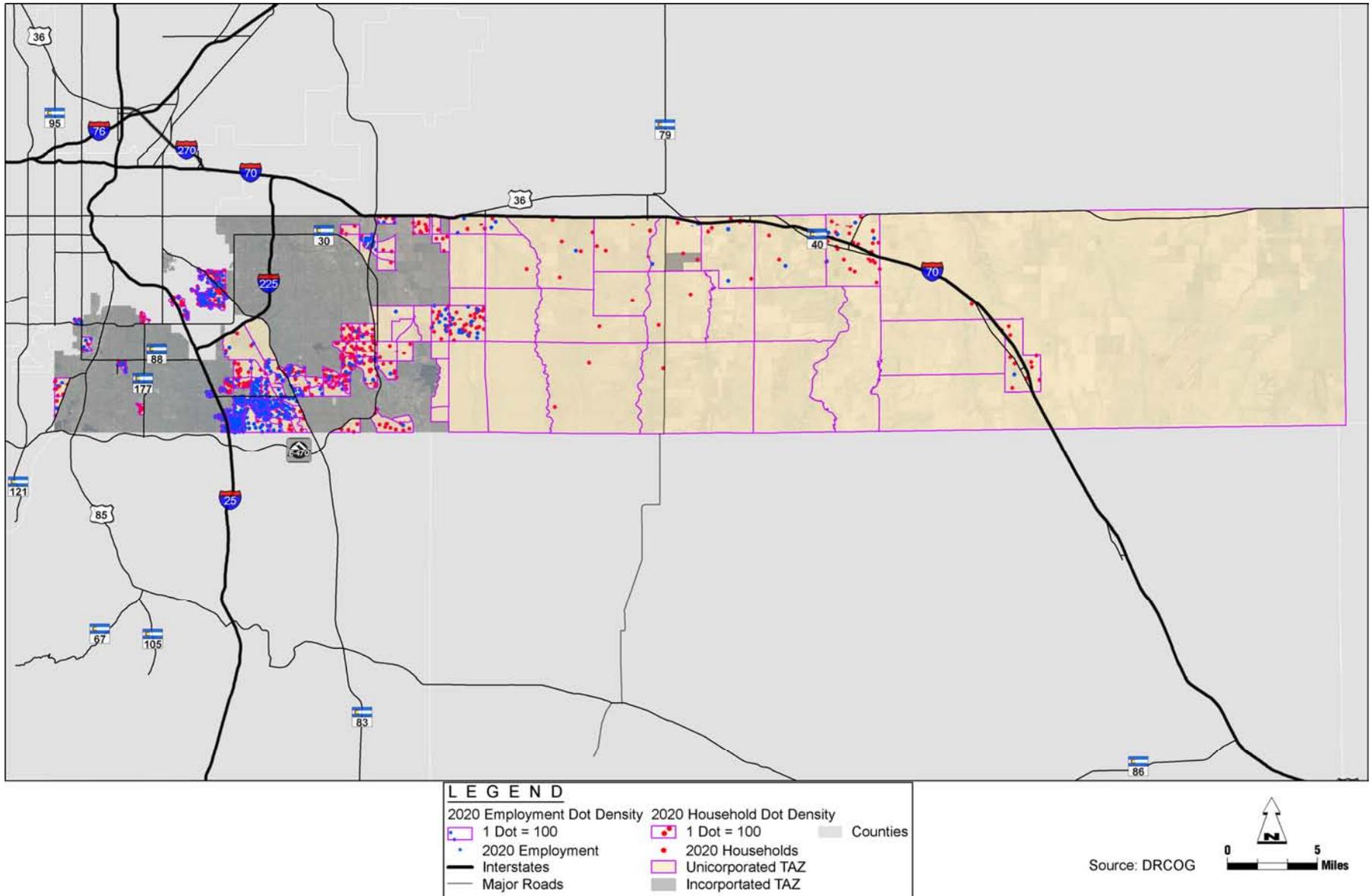


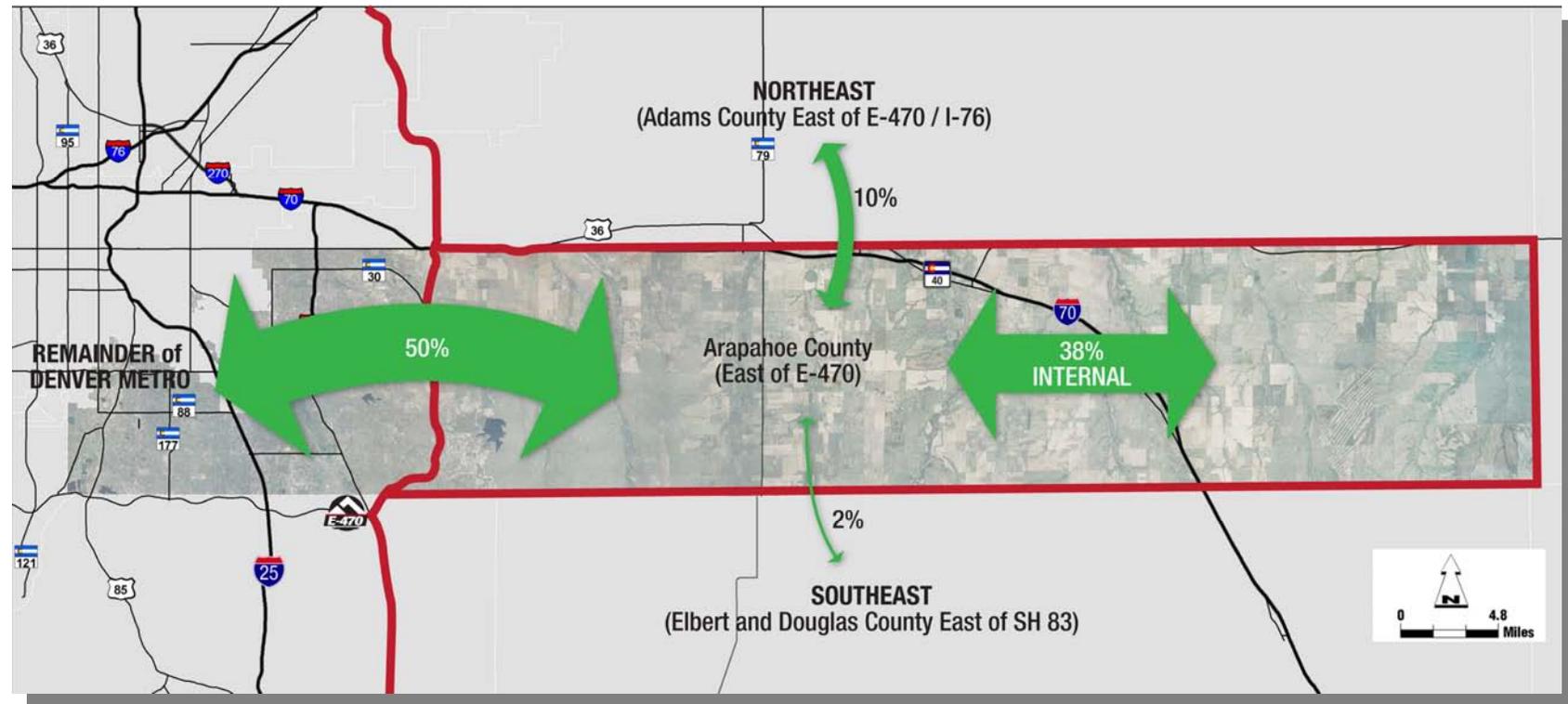
Figure 19. Unincorporated Arapahoe County 2035 Population and Employment Density



**3.3. 2020 and 2035 Travel Demand**

Figure 20 depicts overall traffic patterns for the central and eastern parts of Arapahoe County, based on the 2035 traffic model’s forecasted 360,000 daily vehicle trips generated by this portion of Arapahoe County. An estimated 38% of trips are internal to the area, meaning they both start and end within the County east of E-470. The figure shows that approximately half of all the vehicle trips generated in this part of the County come from or go to other parts of the Denver metropolitan area to the west. Approximately 10% of trips are to or from Adams County to the north. Only 2% of trips are oriented to the south to Elbert County or eastern Douglas County. The results of this travel pattern analysis show that more than 80% of the external travel to and from the eastern part of the County is oriented toward the major part of the Denver metropolitan area to the west (50% to the west divided by the 62% of trips that are external). It should be noted that these origins and destinations to the west include parts of both incorporated and Unincorporated Arapahoe County west of E-470.

**Figure 20. 2035 Eastern Arapahoe County Origin-Destination Distribution**

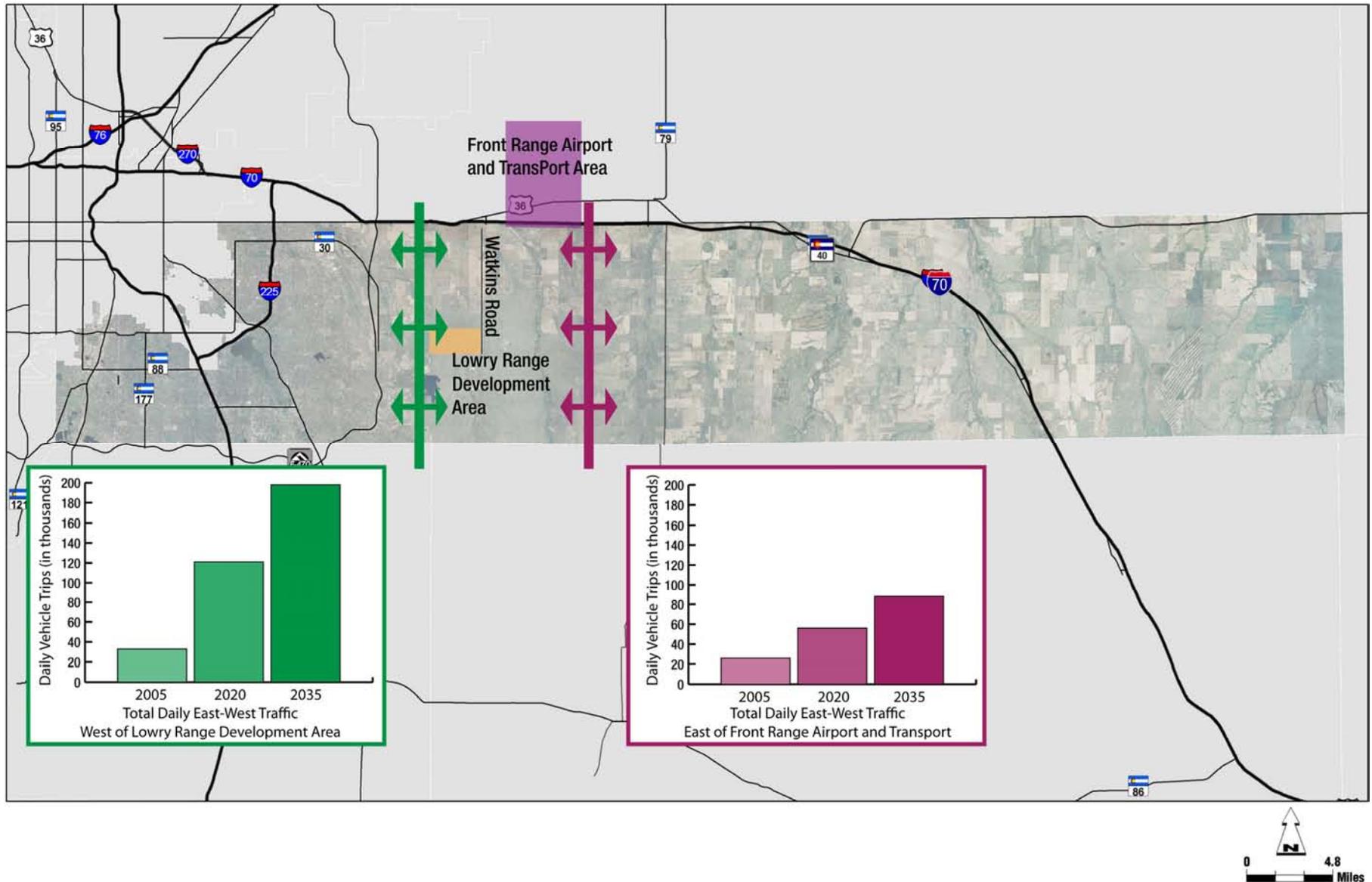


East-west travel demand in the eastern part of the County represents an important issue for Arapahoe County's transportation plan development. **Figure 21** depicts this growth by displaying east-west traffic growth across two "screenlines". Screenlines are imaginary lines drawn across an area to look at the aggregate travel demand on a group of roadways. Screenlines were drawn across the entire County to measure east-west travel at two locations:

- ✦ First, east-west travel was measured west of Watkins Road and the Lowry Range development area. This green graph shows that nearly 200,000 vehicles per day are projected at this location, including traffic that would use I-70, Jewell Avenue, Yale Avenue, Quincy Avenue, and County Line Road. This compares to less than 40,000 vehicles per day currently. Much of this growth in travel demand is associated with two major development areas just east of this screenline: the Lowry Range and TransPort development.
- ✦ The second screenline was drawn just east of the TransPort development area, which is also east of the Lowry Range development. While sharp growth is projected over current traffic levels, traffic at this screenline is forecast to be less than half of the total to the west.

Examining and comparing these two screenlines provides insight into the future travel demand in the eastern portion of Arapahoe County. As can be seen, the volumes passing through each screenline in 2005 are relatively small and nearly equal. As development occurs in the far eastern part of the County, east-west travel demand, as indicated across the eastern screenline, would increase from approximately 20,000 vehicles per day to more than 80,000. But due to the intensive development projected in the Lowry Range and Front Range Airport/TransPort development areas, approximately double the traffic is forecast to cross the western screenline as compared to the eastern screenline. This difference is caused by the more than 100,000 trips generated by the two large development areas with associated travel oriented toward the west.

Figure 21. Arapahoe County East-West Travel Patterns



Following are some general observations about forecasted traffic growth on different parts of the County's road system.

- ✦ Many of the roads in the largely developed parts of the County west I-25 and I-225 are projected to have relatively modest growth in traffic levels. Examples of roadways forecast to see growth of approximately 30 percent or less between now and 2035 include segments of Platte Canyon Road (SH 75), Broadway, US 285, University Boulevard, Arapahoe Road, Quebec Street, Iliff Avenue, and Leetsdale Drive/Parker Road. This includes roadways within the Four Square Mile area.
- ✦ Sharper traffic growth is projected on most of the roadways between I-25/I-225 and E-470. Roads with projected growth generally in the range of 50% to 100% in this area include I-25, I-225, Arapahoe Road (with sharper growth projected east of Parker Road), Parker Road, Smoky Hill Road, Quincy Avenue, Dry Creek Road and Broncos Parkway.
- ✦ The most pronounced growth is projected for E-470 and roadways east of E-470. More than a doubling of traffic levels is forecasted on E-470 and I-70. The most dramatic traffic growth is anticipated on some eastern arterial roadways that currently carry small traffic volumes, including Quincy Avenue and Watkins Road around the Lowry Range development area.
- ✦ Traffic volumes on Quincy Avenue between E-470 and Watkins Road are forecast to increase substantially by 2035, and Watkins Road north of Quincy Avenue is forecasted to have even more dramatic growth. These forecasts are driven by the development of the Lowry Range development area and TransPort in Adams County. These developments have a significant impact on roadways connecting the developments to the greater Denver area, specifically I-70 for TransPort and Quincy Avenue for the Lowry Range development area. In addition, the two development areas would have a significant interaction with each other due to their large size and complementary land uses (with industrial and office employment in TransPort and a large number of housing units in the Lowry Range). It should be noted that the volumes shown in this analysis are predicated on the intensive development scenarios described previously for both the Lowry Range development area and TransPort. Reduced development levels in either area would lead to corresponding reductions in future traffic levels on Quincy Avenue, I-70, and particularly on Watkins Road connecting the two.

## **4. Evaluation of Alternatives**

The study goals and objectives formed the fundamental framework for the development of the Arapahoe County 2035 Transportation Plan to address transportation needs within specific areas of the County. In order to provide a comprehensive transportation system, the recommended plan considers and incorporates local and neighboring transportation plans to satisfy future needs. Continuity with existing and planned roadways in these adjacent communities was addressed and functional relationships between various classes of roadways were considered.

The provision of adequate facilities to satisfy the projected travel demand for year 2020 and 2035 was an important consideration in the development of the recommended transportation improvements, along with providing reasonable accessibility to all areas of the County, consistent with the anticipated level of development and demand for multimodal transportation services.

As a result of the balanced approach for the development of the 2035 Transportation Plan, the transportation network improvement analyses focused on the following major components.

- ✦ Key transportation corridor improvements of regional importance and elimination of discontinuities in the roadway system
- ✦ Confirmation of short-term improvements outlined in the current Arapahoe County Capital Improvement Program (CIP)
- ✦ Maintaining a hierarchy of roadway facilities
- ✦ Coordination with other regional and local plans
- ✦ Multimodal facilities to enhance mobility
- ✦ Congestion management programs, strategies, and services

### **4.1. Roadway Connections**

New roadway segments were evaluated to address roadway system discontinuities that create substantial out-of-direction travel, particularly in the east end of the County. Travel forecasts, conceptual design, and costs were developed for the potential extension of following arterial roadway corridors between E-470 at the eastern edge of the Denver metropolitan area and Deer Trail:

- ✦ 6th Avenue
- ✦ Watkins Road
- ✦ Jewell Avenue
- ✦ Kiowa-Bennett Road
- ✦ Quincy Avenue
- ✦ Manila Road
- ✦ Yale Avenue

The roadway connections considered were based on input from the Technical Advisory Committee (TAC) and other agencies within the County and the general public comments from the first public meeting. **Table 16** summarizes the benefits, impacts, and costs related to each of the new roadway connection alternatives considered.

**Table 16. Evaluation of Roadway Connection Alternatives**

Name / Description	Benefit	Constraint/Impact
<p><b>Watkins Road</b> – Extended south of Quincy Avenue as a two-lane arterial and widen existing segment north of Quincy Avenue to I-70 to six lanes to provide a continuous arterial roadway from <b>I-70 to County Line Road</b></p>	<ul style="list-style-type: none"> <li>◆ Continuous arterial provides a supplemental north-south route and improved connectivity east of E-470.                             <ul style="list-style-type: none"> <li>- New connection is located along Watkins Rd development corridor north of Quincy (expected development from Lowry Range and TransPort).</li> </ul> </li> <li>◆ Alignment provides opportunity for trail access.</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- Approximately 14,000 vehicles/day along new alignment between Quincy and County Line Rd</li> </ul> </li> <li>◆ New roadway connection pulls traffic volumes from E-470 between Belleview and Quincy (-5%) and Gun Club (-15%).                             <ul style="list-style-type: none"> <li>- Reduces out-of-direction travel</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ There are four water crossings.</li> <li>◆ Environmental impacts to the Lowry Range conservation area (piedmont grasslands, wildlife corridors, Coal Creek, Box Elder Creek) and proposed water storage sites would need to be mitigated.</li> <li>◆ Alignment is not consistent with the Stewardship Trust designation on this portion of the Lowry Range.</li> <li>◆ Alignment follows the contours to attempt to minimize cut/fill for the roadway.</li> <li>◆ New connection adds traffic to Watkins Rd north of Quincy to I-70 (+20%), which is expected to experience congestion with surrounding development with base forecasts.</li> <li>◆ New alignment would connect to Elbert County Road 17 to provide maximum connectivity, which may have impacts on residents along that roadway.</li> <li>◆ Conceptual cost estimate = \$15-20 Million</li> </ul>
<p><b>Manila Road</b> – Extend to Quincy Avenue as a three-lane arterial and improve existing segments to I-70 to provide a continuous arterial roadway from <b>I-70 to Quincy Avenue</b></p>	<ul style="list-style-type: none"> <li>◆ Continuous arterial provides a supplemental north-south route and improved connectivity north of Quincy Ave</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- Approximately 10,000 vehicles/day along new alignment between I-70 and Quincy Ave</li> </ul> </li> <li>◆ New roadway connection pulls traffic volumes from E-470 between Belleview and Quincy (-5%), Watkins Rd (-5%), and Kiowa-Bennett Rd (-60%).                             <ul style="list-style-type: none"> <li>- Provides effective supplemental route</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ There are two water crossings.</li> <li>◆ Existing roadway south of 6th Ave/Mitchell Rd will need to be improved/paved, which may negatively impact residents along existing alignment.</li> <li>◆ Conceptual cost estimate = \$7-10 Million</li> </ul>

Table 16 (cont'd). Evaluation of Roadway Connection Alternatives

Name / Description	Benefit	Constraint/Impact
<p><b>Manila Road</b> – Improve between I-70 and Quincy Avenue as a three-lane arterial and extend to County Line Road as a two-lane arterial to provide a continuous arterial roadway from <b>I-70 to County Line Road</b></p>	<ul style="list-style-type: none"> <li>◆ Continuous arterial provides a supplemental north-south route and improved connectivity east of E-470.</li> <li>◆ Alignment provides opportunity for trail access.</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- Approx. 21,000 vehicles/day along segment between I-70 and Quincy Ave</li> <li>- Approx. 14,000 vehicles/day along new alignment between Quincy Ave and County Line Rd</li> </ul> </li> <li>◆ New connection pulls traffic volumes from E-470 (-5%), Gun Club (-15%), Watkins Rd (-5%), and Kiowa-Bennett Rd (-60%).                             <ul style="list-style-type: none"> <li>- Provides effective supplemental route and reduces out-of-direction travel</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ There are six water crossings.</li> <li>◆ Existing roadway south of 6th Ave/Mitchell Rd will need to be improved/paved, which may negatively impact residents along existing alignment.</li> <li>◆ Environmental impacts to the area (riparian area along Box Elder Creek) and impacts to potential oil and gas development along eastern boundary of the Lowry Range.</li> <li>◆ Alignment is not consistent with the Stewardship Trust designation on this portion of the Lowry Range.</li> <li>◆ New alignment would connect to Elbert County Road 29 to provide maximum connectivity, which may have impacts on residents along that roadway.</li> <li>◆ Conceptual cost estimate = \$20-25 Million</li> </ul>
<p><b>6th Avenue</b> – Extend and improve existing segments to provide a continuous four-lane arterial roadway from <b>E-470 to Strasburg Road</b></p>	<ul style="list-style-type: none"> <li>◆ Continuous arterial provides a supplemental east-west route and improved connectivity close to the I-70 corridor.</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- 13,000 vehicles/day east of Watkins Rd</li> <li>- 2,000 vehicles/day east of Kiowa-Bennett Rd</li> </ul> </li> <li>◆ Alternate route relieves traffic congestion expected at Watkins/I-70 interchange. Traffic forecasts on Watkins Rd at I-70 reduced (-20%).</li> <li>◆ New roadway pulls traffic volumes from Quincy Ave (-50%), Strasburg/I-70 interchange (-10%), Colfax Ave in Bennett (-20%), and I-70 east of Watkins Rd (-5%).                             <ul style="list-style-type: none"> <li>- Reduces out-of-direction travel</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ There are five water crossings.</li> <li>◆ Existing roadway segments will need to be improved/paved.</li> <li>◆ Between SH 79 and Kiowa Bennett Rd, the roadway alignment avoids the existing lake.</li> <li>◆ Alignment west of Kiowa-Bennett Rd may impact Kiowa Creek North Open Space.</li> <li>◆ New roadway adds traffic to Kiowa-Bennett Rd (+20%).</li> <li>◆ Conceptual cost estimate = \$35-40 Million</li> </ul>

Table 16 (cont'd). Evaluation of Roadway Connection Alternatives

Name / Description	Benefit	Constraint/Impact
<p><b>6th Avenue</b> – Extend and improve existing segments to provide a continuous four-lane arterial roadway from <b>E-470 to US 36</b></p>	<ul style="list-style-type: none"> <li>✦ Continuous arterial provides a supplemental east-west route and improved connectivity close to the I-70 corridor.</li> <li>✦ Connection to US 36 provides additional ease of access for travelers to/from Byers.</li> <li>✦ 2035 traffic forecasts and area changes are similar with the alignment ending at Strasburg Rd                             <ul style="list-style-type: none"> <li>- 500 vehicles/day forecasted between Strasburg Rd and US 36.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✦ There are seven water crossings.</li> <li>✦ Existing roadway segments will need to be improved/paved.</li> <li>✦ Between SH 79 and Kiowa Bennett Rd, the roadway alignment avoids the existing lake.</li> <li>✦ Alignment west of Kiowa-Bennett Rd may impact Kiowa Creek North Open Space.</li> <li>✦ A costly railroad grade separation will be required for the extension east of Strasburg Rd.</li> <li>✦ Conceptual cost estimate = \$60-70 Million</li> </ul>
<p><b>Jewell Avenue</b> – Extend east of Watkins Road as a two-lane collector to Kiowa-Bennett Road with an extension of Schumaker Road to provide a new east-west route from <b>E-470 to Kiowa-Bennett Road</b> with an I-70 connection</p>	<ul style="list-style-type: none"> <li>✦ Collector extension provides a supplemental east-west route north of Quincy Ave                             <ul style="list-style-type: none"> <li>- New connection would provide additional east-west connection for Lowry Range area</li> </ul> </li> <li>✦ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- 2,000 vehicles/day between Watkins Rd and Kiowa-Bennett Rd</li> </ul> </li> <li>✦ New connection pulls minimal traffic from Watkins Rd and Quincy (1,000-2,000 vehicles/day).</li> </ul>	<ul style="list-style-type: none"> <li>✦ There are twelve water crossings.</li> <li>✦ The extension may require additional cut/fill for roadway due to long, steep areas.</li> <li>✦ Roadway between Schumaker Rd and Brick-Center Rd curved to avoid steep grades</li> <li>✦ New roadway may impact established neighborhoods east of Manila Rd and west of Brick-Center Rd.</li> <li>✦ Conceptual cost estimate = \$50-60 Million</li> </ul>
<p><b>Yale Avenue</b> – Extend east of Watkins Road as a two-lane collector to Kiowa-Bennett Road with an extension of Manila Road to provide a new east-west route from <b>Watkins to Kiowa-Bennett Road</b> with an I-70 connection</p>	<ul style="list-style-type: none"> <li>✦ Collector extension provides a supplemental east-west route north of Quincy Ave                             <ul style="list-style-type: none"> <li>- New connection location would provide additional east-west connection for Lowry Range area.</li> </ul> </li> <li>✦ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- 2,000 – 3,000 vehicles/day between Watkins Rd and Kiowa-Bennett Rd</li> </ul> </li> <li>✦ New connection pulls minimal traffic from Watkins Rd and Quincy (1,000-2,000 vehicles/day).</li> </ul>	<ul style="list-style-type: none"> <li>✦ There are seven water crossings.</li> <li>✦ Roadway between Watkins Rd and Manila Rd may require extensive cut/fills due to steep grades.</li> <li>✦ Potential environmental impacts include wildlife corridor.</li> <li>✦ Existing roadway south of 6th Ave/Mitchell Rd will need to be improved/paved, which may negatively impact residents along existing alignment.</li> <li>✦ New roadway may impact established neighborhoods east of Manila Rd and west of Brick-Center Rd.</li> <li>✦ Conceptual cost estimate = \$45-55 Million</li> </ul>

Table 16 (cont'd). Evaluation of Roadway Connection Alternatives

Name / Description	Benefit	Constraint/Impact
<p><b>Quincy Avenue –</b> Extend from Exmoor Road to Woodis Road and improve existing segments of Quincy and Woodis to provide a continuous two-lane arterial roadway from <b>Watkins Road to Deer Trail</b></p>	<ul style="list-style-type: none"> <li>◆ Continuous arterial provides a supplemental east-west route and improved connectivity in middle of the County.</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- 6,000 - 7,000 vehicles/day between Watkins Rd and Deer Trail (increased from 1,000 – 2,000 vehicles/day base forecasts without extension)</li> </ul> </li> <li>◆ New roadway connection pulls traffic volumes from I-70 interchanges at Byers (-10%) and Bennett (-5%) and Kiowa-Bennett Rd north of Quincy (-30%)                             <ul style="list-style-type: none"> <li>- Reduces out-of-direction travel</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ There are three water crossings.</li> <li>◆ New connection adds traffic to Quincy Ave west of Watkins Rd (+5%).</li> <li>◆ Right-of-way currently being acquired for Bijou Creek bridge for connection to Exmoor Rd due east (without a curve). Alternate alignment may require more right-of-way.</li> <li>◆ Environmental impacts to West Bijou Creek Conservation Easement (west of Exmoor) and Middle Bijou Creek Conservation Easement (along Woodis Road) would need to be mitigated.</li> <li>◆ Conceptual cost estimate = \$10-15 Million</li> </ul>
<p><b>Kiowa-Bennett Road –</b> Realign north of <b>6th Avenue to connect with SH 79</b></p>	<ul style="list-style-type: none"> <li>◆ Arterial realignment provides an easier, more direct connection to I-70 and SH 79 for north-south travel.</li> <li>◆ 2035 Traffic Forecasts:                             <ul style="list-style-type: none"> <li>- Approximately 9,000 vehicles/day along realignment south of I-70.</li> <li>- Realignment increases traffic volumes at SH 79 consistent with Town of Bennett planning.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>◆ One major water crossing requiring a bridge.</li> <li>◆ Steep grades may require extensive cut/fill.</li> <li>◆ Alignment may impact Kiowa Creek North Open Space.</li> <li>◆ Conceptual cost estimate = \$5-6 Million</li> </ul>

**North-South Connection**

With the potential development of the State Land Board property at Lowry Range, the TransPort development north of I-70 in Adams County, and the continued residential development in the Elizabeth area of Elbert County, there is a recognized need for additional north-south routes to serve travel to, from, and through Arapahoe County between E-470 and Kiowa-Bennett Road. Extending Watkins Road south of Quincy Avenue to County Line Road and extending Manila Road from Arizona Avenue to County Line Road were recommendations in the Arapahoe County 2020 Transportation Plan. The following alternatives for a north-south connection were evaluated:

- ✦ Watkins Road Extension between Quincy Avenue and County Line Road, including widening Watkins Road north of Quincy Avenue to I-70
- ✦ Manila Road Upgrade between I-70 and Quincy Avenue
- ✦ Manila Road Extension between I-70 and County Line Road

The Watkins Road extension south of Quincy Avenue may have extensive environmental impacts to the Lowry Range conservation area, which is a large concern for the County and the State Land Board. The travel forecasts evaluation indicates that the Manila Road extension between I-70 and County Line Road would provide the most effective supplemental north-south route by reducing out-of-direction travel without adding volumes to the congestion expected along the Watkins Road corridor with area development. The Manila Road connection also provides opportunities to connect to Elbert County Road 29 to the south and the new I-70/Quail Run interchange planned with the TransPort development. These connections would make Manila Road a regional corridor beyond Arapahoe County with continuity through Adams County to the north and Elbert County to the south.

**East-West Connection**

Quincy Avenue serves as the only continuous east-west arterial route south of I-70 between the Denver metropolitan area and Strasburg. This causes a moderate amount of out-of-direction travel and vehicle traffic on local roadways within the rural eastern area of the County. In order to build regional connectivity of the rural roadway network, the following alternatives for an east-west connection were evaluated:

- ✦ 6th Avenue Completion/Extension between E-470 and Strasburg Road
- ✦ 6th Avenue Completion/Extension between E-470 and US 36
- ✦ Jewell Avenue Extension between Watkins Road and Kiowa-Bennett Road
- ✦ Yale Avenue Extension between Watkins Road and Kiowa-Bennett Road

The upgrade and extension of 6th Avenue east of E-470 would provide the most beneficial east-west route and would be close to the I-70 corridor, where most population expansion and development is expected to occur. The extension of 6th Avenue beyond Strasburg Road to connect to US 36 would require a costly grade separation with the railroad and the travel forecasts indicate only minimal traffic volumes on that segment. The Jewell Avenue and Yale Avenue extensions would provide minimal travel benefits with a high cost due to steep grades.

### **Quincy Avenue**

Quincy Avenue currently ends at Bradbury Road and an extension across Bijou Creek to Exmoor Road is on the current Arapahoe County Capital Improvements Program (CIP) as a short-term project. Even with that extension, travel to/from the I-70 at Deer Trail area would be discontinuous between Woodis Road and Exmoor Road. An extension of Quincy Avenue east of Exmoor Road to connect to Woodis Road was evaluated. This connection would provide a continuous arterial alignment between I-70 and the Denver metropolitan area. Travel forecasts indicate that the connection would reduce out-of-direction travel within the east end of the County. A study is recommended to identify the best roadway alignment for the new connection to minimize cost and impacts to properties and the natural environment.

### **Kiowa-Bennett Road**

Kiowa-Bennett Road serves as a regional north-south connection with discontinuities at Bennett and Kiowa (within Elbert County). The I-70/Kiowa-Bennett Road interchange is a partial interchange and only the Eastbound I-70 exit ramp movement is provided at Kiowa-Bennett Road with the Westbound I-70 entrance and exit ramp movements provided at Colfax Avenue (US 36), which makes it difficult for travelers unfamiliar with the area to access I-70. Traffic traveling between Kiowa-Bennett Road and SH 79 must travel along Colfax Avenue (US 36) and through the Town of Bennett.

A direct connection of Kiowa-Bennett Road with SH 79 and a full I-70 interchange would improve regional connectivity and reduce out-of-direction travel. Impacts to private property within the area, Kiowa Creek, and the Kiowa Creek North Open Space area south of I-70 would need to be mitigated. A study is recommended to identify the best connection alignment to minimize cost and impacts to properties and the natural environment.

## **4.2. Area Transportation Planning Studies**

The Arapahoe County 2035 Transportation Plan will build upon the extensive background of transportation planning efforts conducted within and adjacent to the County over the last five years. The following contains a brief summary of applicable transportation plans. In addition, the comprehensive plans and/or transportation plans prepared by Denver Regional Council of

Governments (DRCOG), Colorado Department of Transportation (CDOT), and the local agencies within the County were reviewed so the appropriate transportation elements identified in those plans for Unincorporated Arapahoe County were integrated into the development of this transportation plan.

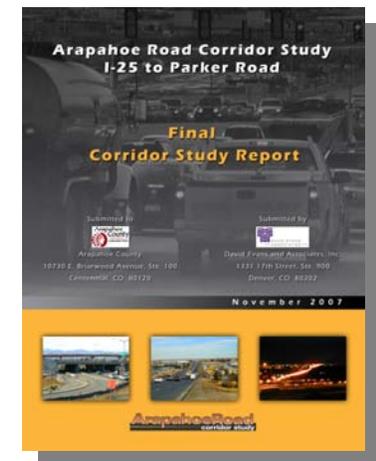
**SH 83-86 Corridor Optimization Plan (2004)**

Thirteen agencies were involved in the development of the *SH 83–86 Corridor Optimization Plan*, including Colorado Department of Transportation (CDOT), Denver Regional Council of Governments (DRCOG), Town of Bennett, Arapahoe County, Eastern Colorado Council of Local Governments, City of Aurora, as well as the Town of Kiowa, Elbert County, Town of Parker, El Paso County, Douglas County, Town of Castle Rock, and Town of Elizabeth. The study evaluated the interactions between the strategic elements of land use characteristics, transportation system attributes, and funding limitations to identify and address regional problems along the SH 83 and SH 86 transportation corridors. A key recommendation of the study was the paving, upgrading, and improving of the Kiowa-Bennett Road to provide a continuous, all-weather facility with new alignments near Kiowa and Bennett to SH 79 to fill in a large north-south gap in the regional transportation system.

**Arapahoe Road Corridor Study and I-25/Arapahoe Interchange Feasibility Study (2007)**

This study determined needed multimodal transportation improvements on Arapahoe Road (SH 88) from Yosemite Street to Parker Road. The final study recommendations include:

- ✦ I-25/Arapahoe Road Interchange improvements (currently being evaluated with the I-25/Arapahoe Environmental Assessment project).
- ✦ Arapahoe/Parker interchange (currently under construction)
- ✦ A six-lane Arapahoe Road corridor with combination of at-grade and grade-separated intersections with grade separations at Havana Street, Revere Parkway, and Jordan Road
- ✦ Peakview and Briarwood corridor improvements
- ✦ Briarwood extension across the golf course west of Peoria Street
- ✦ Six-lane Easter Avenue/Broncos Parkway corridor, including bike lanes and intersection realignments
- ✦ Transit service improvements, including new call-n-Rides, Limited Route 66 overlay on Arapahoe Road, and fixed route local service off Arapahoe Road



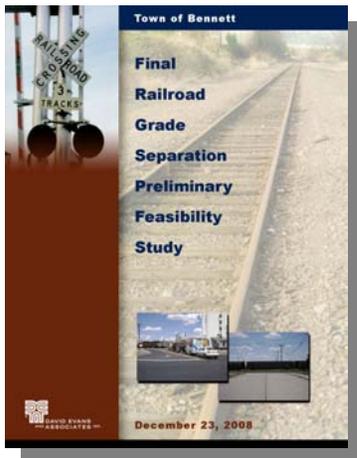
- ✦ Pedestrian/bicycle improvements, including sidewalk improvements, two grade-separated crossings of Arapahoe Road (east of I-25 and at Cherry Creek), and bike route signing/stripping
- ✦ Intelligent Transportation System (ITS) improvements, including signal coordination and communications infrastructure

**Bennett Railroad Grade Separation Preliminary Feasibility Study (2008)**

The Town of Bennett completed a study to evaluate the benefits, impacts, and general feasibility of alternative connections for a railroad grade separated crossing of the Union Pacific Railroad (UPRR) in the vicinity of Bennett. The study considered conceptual design, traffic, and environmental evaluation criteria to identify alignment fatal flaws and reasonable alternatives to recommend for future study.

Constructing a highway-railroad grade separation in Bennett would provide substantial time savings and safety benefit for local and regional traffic on SH 79. As residential and commercial growth continues through the Front Range, Kiowa-Bennett Road will increasingly become a popular north-south alternative to I-25 and SH 83. Area transportation projects that would increase the traffic volume traveling SH 79 to Bennett or regionally would only strengthen the need for a highway-railroad grade separation.

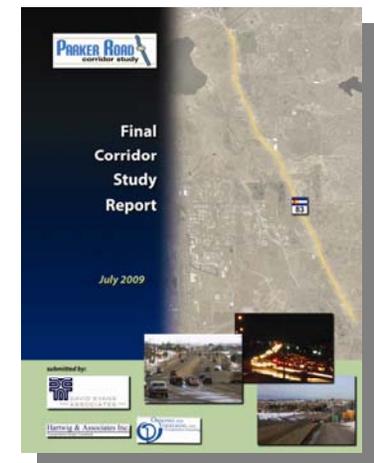
All three alignments recommended for more detailed analysis would connect to SH 79 north of the I-70 interchange. An alignment that provided a direct connection from Kiowa-Bennett Road at US 36 to SH 79 northeast of Bennett was dismissed due to major environmental challenges and design, construction, and maintenance issues related to the proximity of Kiowa Creek and required grade differences.



**Parker Road Corridor Study (2009)**

This study documented the development and analysis of alternatives for improvement of the Parker Road (SH 83) corridor from Hampden Avenue to E-470. The final study recommendations include:

- ✦ Widening Parker Road with an additional lane in each direction between Quincy Avenue and Arapahoe Road
- ✦ Combination of improved at-grade and grade-separated intersections with grade separations at Quincy Avenue, Orchard Road, and Aurora Parkway

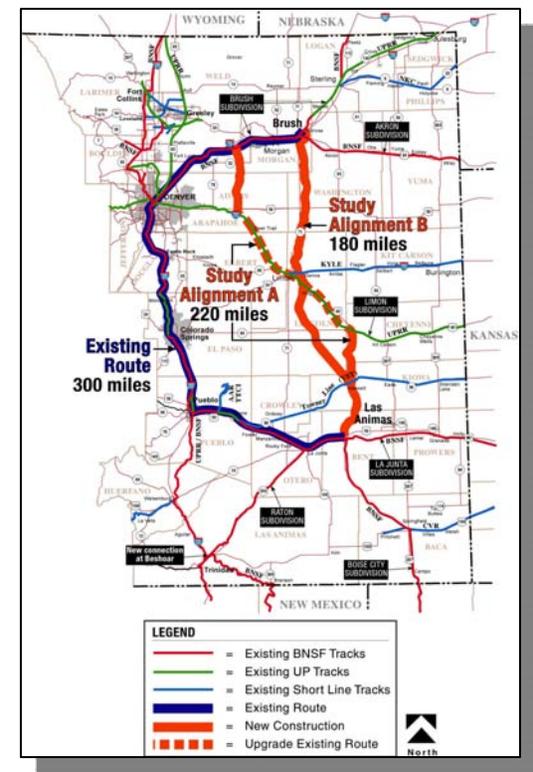


- ✦ Improvements to existing transit stops and pedestrian enhancements
- ✦ Corridor transit preferential treatments, including queue jump lanes and/or bus pull-out lanes
- ✦ New park-n-Ride near Arapahoe Road and Parker Road interchange
- ✦ Limited bus service on Parker Road
- ✦ Transportation Demand Management programs, including developing transit education/marketing, ECO passes, and transit development mobility guidelines
- ✦ Sidewalk improvements
- ✦ Bike route signing/stripping
- ✦ Completion of Cherry Creek Trail
- ✦ Jordan Road bicycle connection to Cherry Creek Trail
- ✦ Parallel adjacent multi-use path along Parker Road
- ✦ Intelligent Transportation System (ITS) improvements, including signal coordination, communications infrastructure, enhanced signal detection, video monitoring, variable message signs, and ramp metering

**Rail Relocation Implementation Study (CDOT)**

The *Colorado Rail Relocation Implementation Study (R2C2)* was completed in 2009 as the next phase of work to investigate the potential for public-private partnerships for the relocation of a significant portion of through freight rail traffic away from the congested Front Range onto a bypass route in the Eastern Plains of Colorado. Several previous studies and reviews were completed by CDOT and the two Class I Railroads operating in Colorado, BNSF Railway (BNSF) and the Union Pacific Railroad (UP). The purpose of the study was to:

- ✦ Determine what steps will have to be carried out to form a public-private partnership;
- ✦ Better define and finalize the scope and costs of any potential project;
- ✦ Determine how costs should be shared based on both public and private benefits and related factors;



- ✦ Investigate what sources of funding are available
- ✦ Determine how to finance a project
- ✦ Develop strategies for carrying out the necessary environmental requirements; and
- ✦ Make recommendations for next steps.

The project studied two alternative alignments. Study Alignment A traverses from Brush along BNSF's Brush Subdivision to Omar, then along a new route south to the existing UP Limon Subdivision between Byers and Peoria. From this point the route uses the existing UP Limon Subdivision through Arapahoe County. Study Alignment B is all new construction and does not traverse through Arapahoe County. The evaluation found that either of the alignments could result in diversion of a majority of the freight traffic that currently uses the Joint Line. The Joint Line would still be required to serve rail freight customers in Front Range communities.

The study concluded with a strong recommendation for further study of the project to achieve the potential for diverting the majority of heavy freight traffic from the Front Range communities and thereby possibly opening up the Joint Line for intercity passenger rail service. More detailed engineering of alignments and environmental analyses are needed to define and minimize potential community impacts.

### **Prairie Falcon Parkway Express**

The Front Range Toll Road Company was formed in 1985 with interest in constructing a toll road from south of Pueblo to north of Fort Collins. In 2006, following public backlash, the Colorado Legislature passed laws that:

- ✦ Require any private toll road that is to be built in the state to be limited to within a three-mile wide corridor;
- ✦ Require any private toll road to be included in the statewide and regional transportation plans;
- ✦ Require any private toll road to get approval from the regional planning organizations where it is located;
- ✦ Require the toll road company to prepare an environmental study subject to CDOT guidelines;
- ✦ Require the toll road company to submit its studies and plans for review to CDOT, the state health department, other state agencies and regional planning organizations; and
- ✦ Require the toll road company to get approval from the state transportation commission.

In addition, the power of eminent domain was stripped from private toll road companies.

Prairie Falcon Parkway Express would be in a 210-mile corridor parallel to but approximately 25 miles east of I-25. The corridor within Arapahoe County would cross I-70 west of Bennett and swing east of Kiowa in Elbert County. It would be a four-lane divided freeway with rail lines in the median. The CDOT Rail Relocation Study recommendations are not consistent with the Prairie Falcon Parkway Express alignment.

At this time, it is highly unlikely that the project would move forward within this planning horizon. This corridor is not a recommendation for the Arapahoe County 2035 Transportation Plan.

## 5. Recommended Transportation Plan

The Arapahoe County Transportation Plan recommendations are consistent with the transportation goals, policies, and strategies for implementation outlined in Section 1. The recommended plan, shown in **Figure 22** and **Figure 23**, includes recommendations for the roadway network, multimodal corridors and connections, and transportation congestion management programs and services. The plan has been developed to be responsive to anticipated land development trends. The plan is consistent with the Arapahoe County Comprehensive Plan and attempts to balance the interrelated elements of land use, traffic operations, and transportation improvements. These projects can help to shape future land use and provide guidance for the appropriate magnitude of future development. Recommendations for transportation network improvements were balanced with concerns over the negative impacts of roadway widening, required right-of-way, and aesthetic/environmental impacts. Lists of the recommended improvements with descriptions and expected time periods are provided in **Appendix B**.

### 5.1. Roadway Network

The roadway network forms the backbone of the County transportation system. In addition to automobiles, roads accommodate transit, commercial vehicles, and frequently pedestrian and bicycle facilities.

The roadway network is based on the roadway hierarchy of streets. These roadways include Freeways, Arterials, Collectors, and Locals. As shown in the graphic to the right, the higher the level of roadway, the higher volumes of regional traffic and the less emphasis on access. Capacity reductions for arterials caused by turning traffic should be kept to a minimum through diligent access control. The lower roadway classifications, including Collectors and Locals, should limit through traffic and should be designed for slower speeds and more direct access. Secondary Rural Roads fit within the Locals classification with more direct access, but with typically higher speeds and longer trips than Local Streets in urban areas. Design elements used in differentiating roadway types include: width of roadway, medians and lanes, continuity of alignment, spacing and control of intersections, and vertical and horizontal alignments. Characteristics of each roadway, including the service performed, access, and intersection spacing, is presented in **Table 17**.

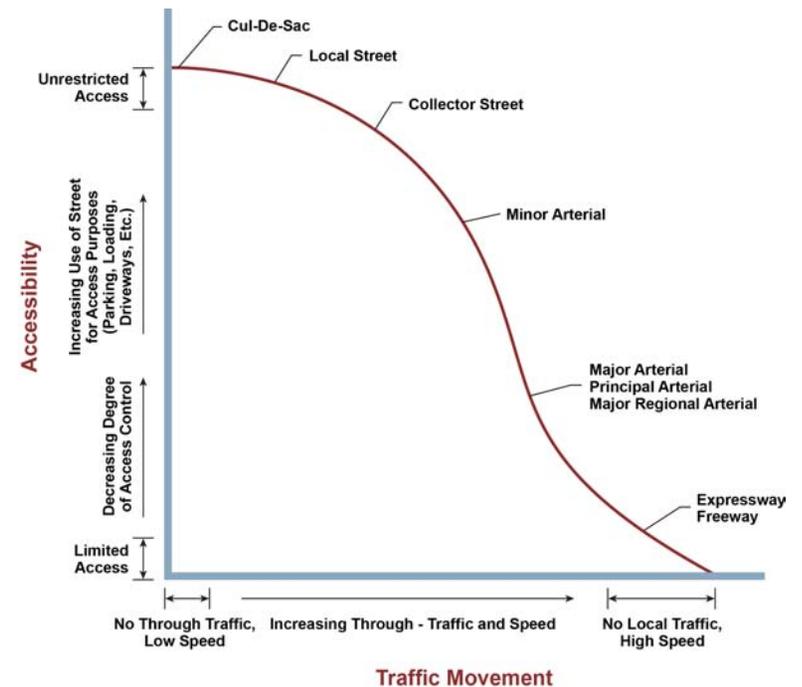


Figure 22. Arapahoe County 2035 Transportation Plan – West End

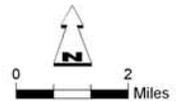
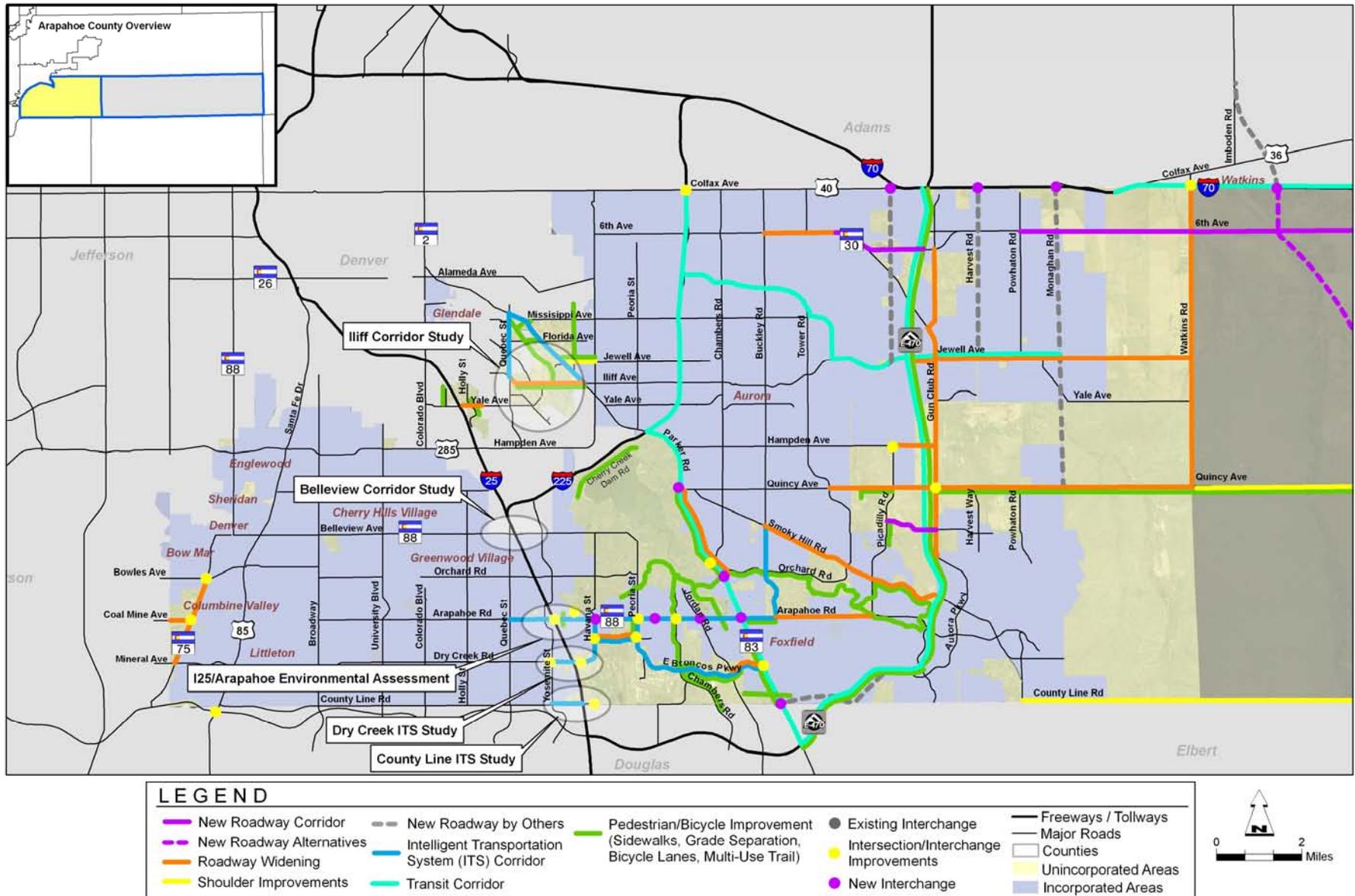


Figure 23. Arapahoe County 2035 Transportation Plan – East End

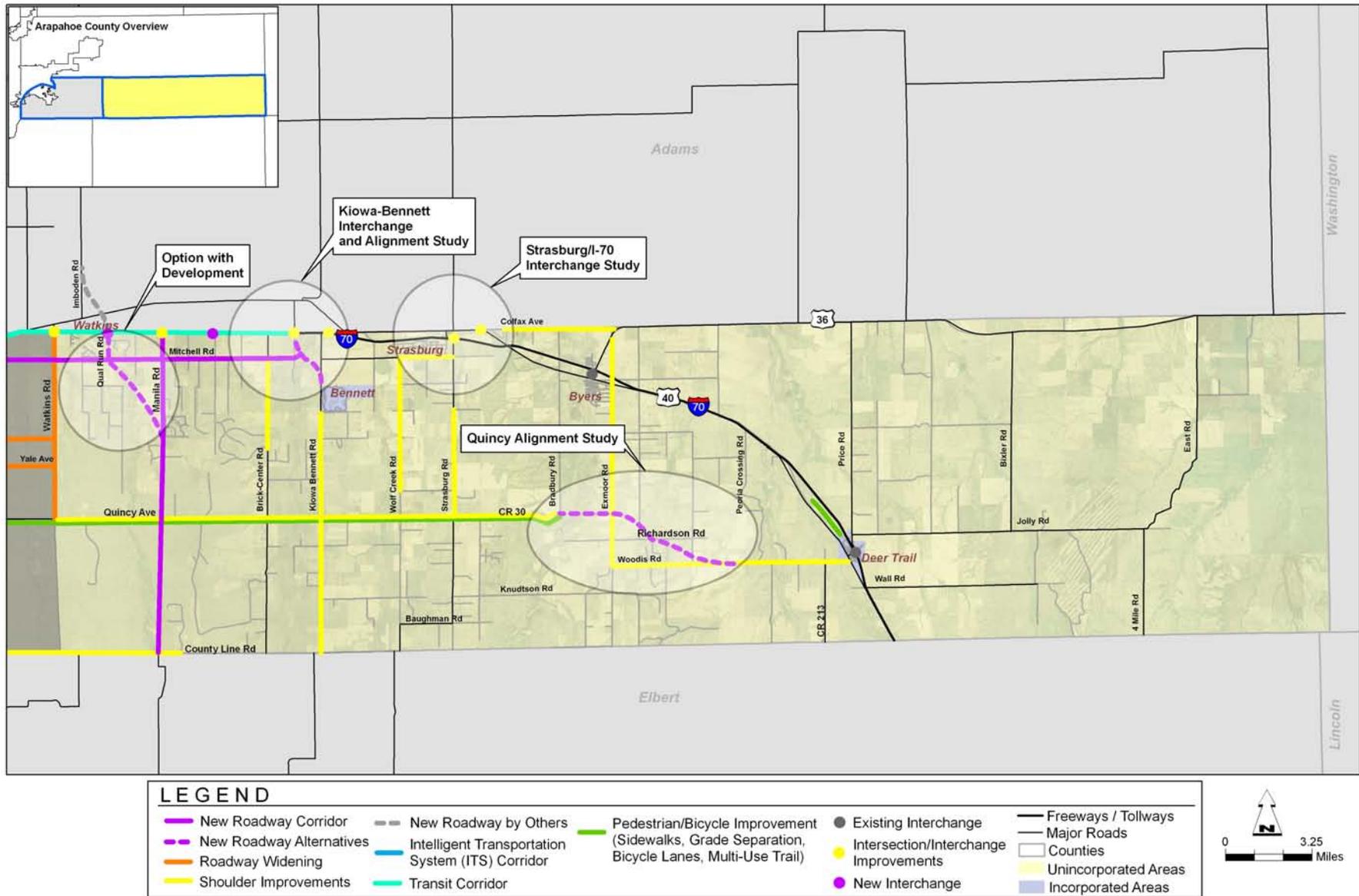


Table 17. Functional Classification Criteria Characteristics

Functional Classification	Freeways / Interstates	Urban Arterials	Semi-Urban Arterials	Rural Arterials	Collectors	Local Streets
Function	Mobility Only	Mobility Primary Accessibility Secondary	Mobility Primary Accessibility Secondary	Mobility Primary Accessibility Secondary	Accessibility and Mobility Equal	Accessibility Only
Service Performed	Traffic movement, highest speed, no direct land access	Traffic movement, high speed, limited land access	Traffic movement, high speed, minimal land access	Traffic movement, high speed, infrequent land access	Frequent land access, relatively low speeds	Direct land access, low speeds
Typical Trip Lengths	Interstate and between major regions of metro area	Between major regions of metro area	Between and within communities	Between regions of County	Within communities, Connects to arterial system	Within neighborhoods and business centers
Average Daily Traffic (ADT)	45,000 +	15,000 – 45,000	14,000 – 42,000	8,000 – 35,000	6,300 – 15,000	0 – 2,500
Intersection Spacing	Interchanges at 1 mile spacing	Signalized intersections at ½ mile	Signalized and roundabout intersections at 1,200 feet	Signalized and roundabout intersections at 1,600 feet	Signalized and roundabout intersections at 600 feet	600 feet
<b>Direct Driveway Access</b>						
◆ Business	Prohibited	Controlled & Limited with Enhanced Design	Controlled & Limited with Enhanced Design	Allowed	One per minimum 250 ft frontage	Unrestricted
◆ Residential – Multi-family	Prohibited	Controlled & Limited	Controlled & Limited	Allowed	One per minimum 250 ft frontage	Unrestricted
◆ Residential – Single-family	Prohibited	No	No	Allowed	No	Unrestricted
Shoulder/Bike Lane	No	Yes (at key locations)	Yes (at key locations)	Yes	Yes	No

Roadway network recommendations were focused on the major travel corridors within Unincorporated Arapahoe County that provide needed capacity for both local and regional trips. The roadway improvements include road widening for additional travel and auxiliary lanes, new roadway segments, intersection improvements, interchanges and grade separations, and corridor studies.

**Roadway Improvements**

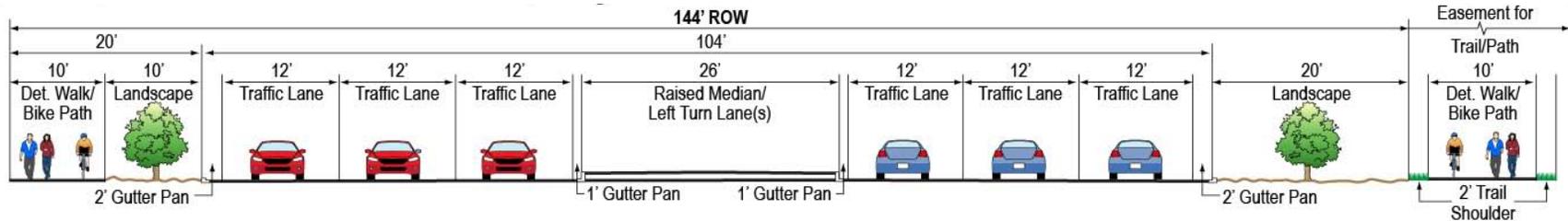
Additional through lanes are recommended on several key corridors. The widening of Watkins Road is directly tied to the anticipated development of the Lowry Range area and TransPort development in Adams County. In addition to right-of-way for specific roadway improvements, the County will reserve right-of-way as or before development occurs, to meet future roadway needs. This includes requiring the dedication of 30 feet of right-of-way along section lines in the eastern part of the County.

The Quincy Avenue corridor vision includes the construction of additional lanes west of Watkins Road and new connections and shoulder improvements east of Watkins Road leading to the community of Deer Trail. The roadway widening with a raised median west of Watkins Road could accommodate major bike racing events with lane closures. In addition to the right-of-way necessary for this road construction, additional right-of-way could be acquired to accommodate roadside trail development. This vision for a multimodal corridor providing access to the open space, parks, and trails in eastern Arapahoe County is consistent with the Arapahoe County Open Space Master Plan completed in May 2010.

**Quincy Avenue Corridor – West of Watkins Road (six lanes)**

North Side of Quincy Avenue  
(Lowry Range development area)

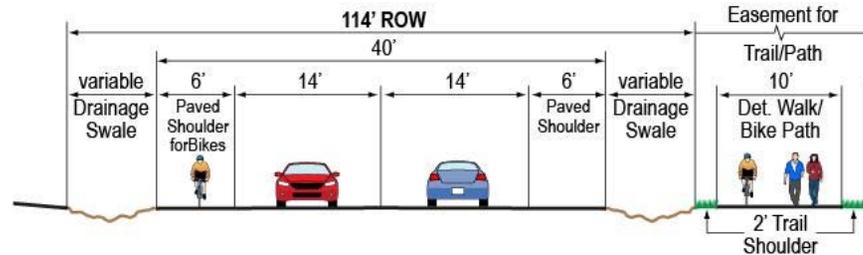
South Side of Quincy Avenue  
(Lowry Range conservation area)



**Quincy Avenue Corridor – East of Watkins Road (two lanes)**

North Side of Quincy Avenue

South Side of Quincy Avenue



Recommendations for new roadway segments are also identified, primarily focused in the east end of the County. Some of these new roadways are recommended for construction in conjunction with new development, such as the Manila Road alternative connection to I-70. The Quincy Avenue connection between Bradbury Road and Exmoor Road will provide a new crossing of Bijou Creek to provide a valuable alternative route and reduce out-of-direction travel in the rural area of the County.

The recommendations include corridor and alignment studies for key regional arterial corridors. Corridor studies will provide a comprehensive analysis of how best to meet travel demands considering modal mix, capacity, access, land use, cost, and funding. Alignment studies will be completed prior to the final design of the new roadway connections. These studies will consider the balance of design standards, property impacts, cost, and environmental impacts to identify the best roadway alignment to minimize cost and negative impacts. Alignment studies are recommended for the new roadway segments of Kiowa-Bennett Road, Quincy Road, and Manila Road.

### **Intersections and Interchanges**

Safety and mobility along roadway corridors can be improved through various intersection treatments. Treatments to intersections may include building auxiliary lanes, installing traffic signals or installing alternative intersection control measures such as modern roundabouts. Appropriate intersection control and intersection improvements are typically determined through a detailed engineering study on a case by case basis.

Several intersections along major regional arterials within the County are recommended to be reconstructed as interchanges and most of these locations are recommendations from the Arapahoe Road and Parker Road corridor studies. The existing intersection laneage at those locations have been maximized and additional future capacity is needed. By eliminating the traffic signals at these locations, the capacity of the roadway corridors approaching and departing these locations can be increased. Any new or modified interchanges on state highways (such as Arapahoe Road and Parker Road) or interstates (such as I-70) will require study documentation and approval consistent with CDOT's 1601 Procedural Directive, Interchange Approval Process.

### **Shoulder Improvements**

Shoulder improvements were identified for rural roads that are currently paved, but lack standard shoulder widths. These roadways are not anticipated to have capacity issues that would require widening. The shoulder improvements are recommended as relatively low cost options to improve the rural road network by improving traveler safety with the increase in recovery area and area for passing farm equipment and postal vehicles, and by accommodating space along the paved shoulder for bicyclists.

## 5.2. Paving Plan

In addition to the traffic volume threshold of 700 vehicles per day the County has previously established, additional considerations were given to prioritize the paving of gravel roads. These considerations include regional connectivity, main school bus routes, and safety issues. **Figure 24** illustrates the roads that are planned for paving by 2035. Gravel roads that are anticipated to remain gravel are also shown. Additional paving may occur for safety improvements within the eastern communities along I-70. Other roadway paving may also be necessary as development occurs in rural areas.

## 5.3. Transit

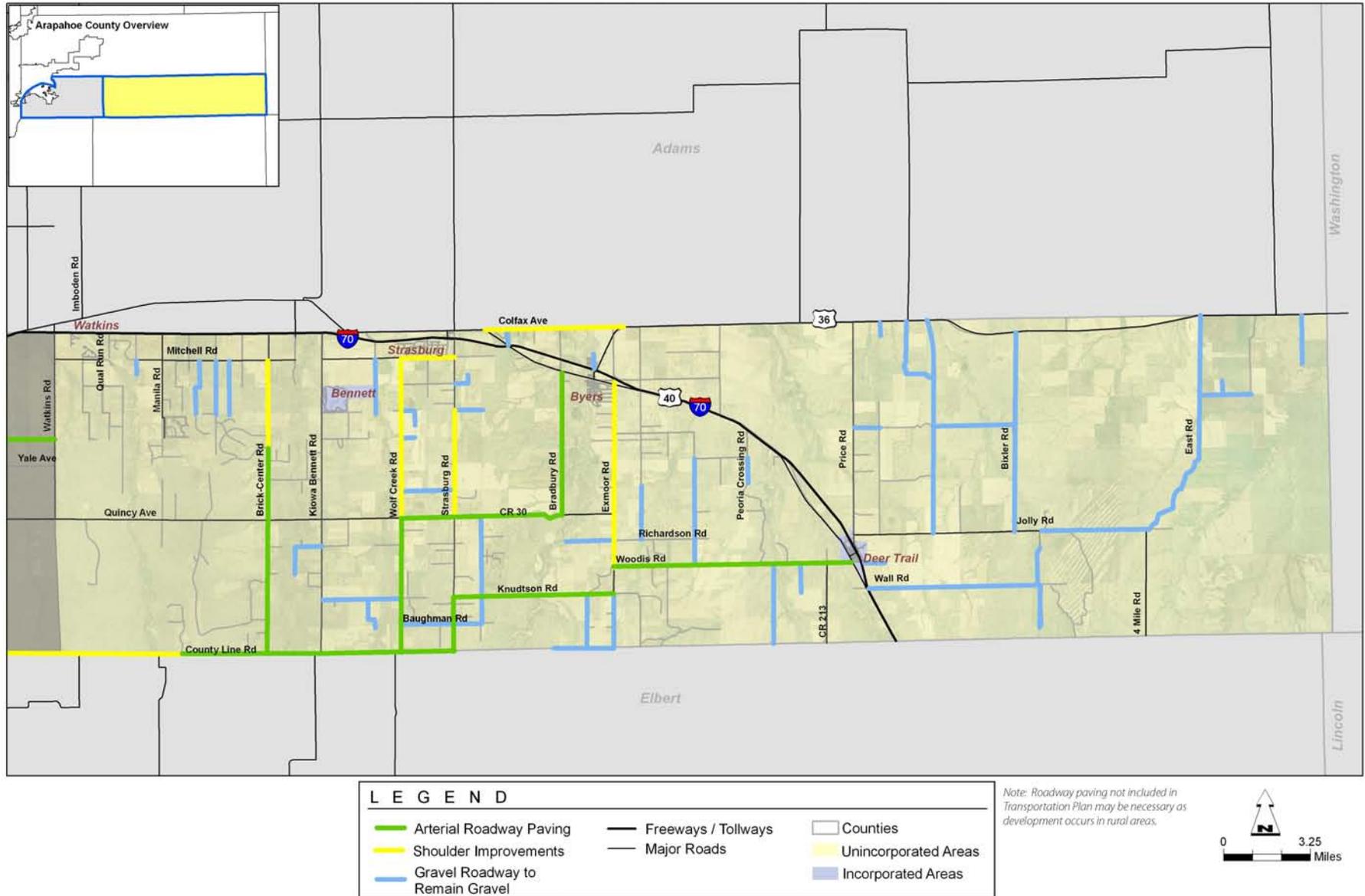
The stated policy of the Arapahoe County Transportation Plan related to transit service is that “Arapahoe County will support the enhancement of mass transit to serve major employment along key transportation corridors in the County and promote efficient connections with such a system.” This policy can be achieved with a variety of strategies and projects, including the preservation of existing corridors as “transit corridors” for the expansion of transit-related amenities. These amenities can be in the form of identifying and helping purchase land for future park-n-Rides, providing benches, shelters, and lighting at transit stops, and improving the accommodation of alternative modes when constructing or repairing roadways. Coordination with regional and local governments is also recognized as a key to developing public and/or privately funded transit improvements.

There are many benefits to supporting a well-developed transit system. The availability of transit services provides travelers an alternative to the automobile. The amount of congestion on the roadways in Unincorporated Arapahoe County leading to the Denver metropolitan area is expected to rise dramatically in the future and connections to transit gives travelers an option to reduce the length of their trip. The reduction of automobile use also helps reduce congestion and improves air quality.

Providing or promoting transit services to rural areas is challenging due to the low population density and sparse distribution of housing and employment. A review of service types and opportunities for the east end of Arapahoe County are included in a white paper in **Appendix D**.

Actions by Arapahoe County to promote transit use include: sidewalk improvements leading to transit stops within Unincorporated Arapahoe County (listed under pedestrian/bicycle improvements); recognizing Parker Road (SH 83), E-470, and the Jewell Avenue corridors as priorities for stop enhancement, route improvements, and transit signal priority; and coordinating plans for future park-n-Rides at several key locations within the County.

Figure 24. Arapahoe County 2035 Paving Plan – East End



#### **5.4. Bicycle and Pedestrian**

The development of a bicycle and pedestrian network is an important component of a balanced transportation system. Bicycling can be a healthy alternative to the automobile for some trips and can help reduce traffic congestion, improve air quality, and enhance the quality of life in the County. The bicycle and pedestrian element of the Transportation Plan outlines strategies to improve conditions and opportunities for bicycle and pedestrian travel with the County, specifically related to facilities adjacent to roadway corridors. The *Arapahoe County Open Space Master Plan* identified additional bicycle and pedestrian strategies to develop facilities outside of roadway corridors. The recommendations included in the Transportation Plan were developed in coordination with the Open Space Master Plan recently completed by the County. A countywide Trails Master Plan is recommended as a short term study.

##### **Bicycle Facilities**

The key to the bicycle improvement recommendations is to create a well-connected system of bikeways within Unincorporated Arapahoe County. Several rural arterial corridors were identified for separated bicycle paths or improved shoulders to serve as bike lanes. Quincy Avenue east of E-470 is recommended as a multimodal corridor with a separated bike path between E-470 and Watkins Road. East of Watkins Road, shoulders that would accommodate on-street bike lanes are recommended, ultimately leading to Deer Trail with the proposed Quincy Avenue extension. These bicycle facilities along Quincy Avenue will provide direct access to open space facilities planned within eastern Arapahoe County. The recommended studies for additional roadway connections across I-70 in Byers and Strasburg would also consider integrated bicycle and pedestrian facilities.

Key bicycle connections are also recommended for Arapahoe Community Park, located at Chambers Road and Potomac Street, the Cherry Creek Trail south of Cherry Creek State Park, and the Cherry Creek Trail and High Line Canal within the Four Square Mile area.

##### **Pedestrian Facilities**

Recommendations for improvements to pedestrian facilities focused on key missing sidewalk links near transit stops and schools and grade separations to provide safer connections across arterial roadways. Many of the proposed sidewalk connections are within the Four Square Mile and Holly Hills areas within the Denver metropolitan area. In Byers, sidewalk construction and improvements are recommended along Front Street to improve pedestrian safety and access to the Byers Schools.

Grade separations are recommended across Arapahoe Road east of I-25 at the Boston/Clinton intersection, at the Cherry Creek Trail crossing Arapahoe Road, at the High Line Canal crossing Iliff Avenue, across Gun Club Road south of Quincy Avenue, across Quincy Avenue west of E-470, and across Parker Road at the Temple Avenue intersection. The recommended studies for additional roadway connections across I-70 in Byers and Strasburg would also consider integrated bicycle and pedestrian facilities.

### **5.5. System Management Strategies**

System management strategies are programs or projects that examine ways to manage transportation demand, especially in areas where the opportunities for substantial gains in system performance through expansion or operational improvements is limited. For example, Intelligent Transportation System (ITS) technologies include cost-effective improvements that can be implemented with relatively low cost and limited physical impacts.

In its broadest sense, travel demand management (TDM) is any action or set of actions intended to influence the intensity, timing, and spatial distribution of transportation demand for the purpose of reducing the impact of traffic or enhancing mobility options. Such actions can include offering commuters one or more alternative transportation modes and/or services, providing incentives to travel on these modes or at noncongested hours, providing opportunities to better link or “chain” trips together, and/or incorporating growth management or traffic impact policies into local development decisions. A review of TDM strategies and the potential application to Arapahoe County is provided in **Appendix D**. Arapahoe County should consider implementing a variety of complementary techniques and strategies for travel demand management, since TDM strategies are most effective when used in combination. A countywide Transportation Demand Management Strategic Plan is recommended as a short term study to provide the County with a toolbox of implementable strategies tailored to the County’s varying land use, demographics, and travel patterns.

Managing traffic flow along Arapahoe County’s roadway network requires ongoing upgrades into ITS applications. ITS improvements include signal upgrades, signal system interconnect and upgrades, and improved signal detection and monitoring. Also, traveler information strategies include monitoring traffic flow, incidents, or congestion and getting that information to drivers either pre-trip or during-trip will allow more efficient use of roadways by assisting drivers in choosing alternate routes.

The development of an ITS Strategic Plan is recommended as a short term study to identify the ITS strategies and technology investments for Arapahoe County, coordinated with DRCOG’s planning efforts for a regional ITS architecture. Several roadway corridors within the Dove Valley area are recommended for communication upgrades, taking advantage of coordination with the work the City of Centennial is currently undertaking with ITS applications within the area.

### **5.6. Focus Areas**

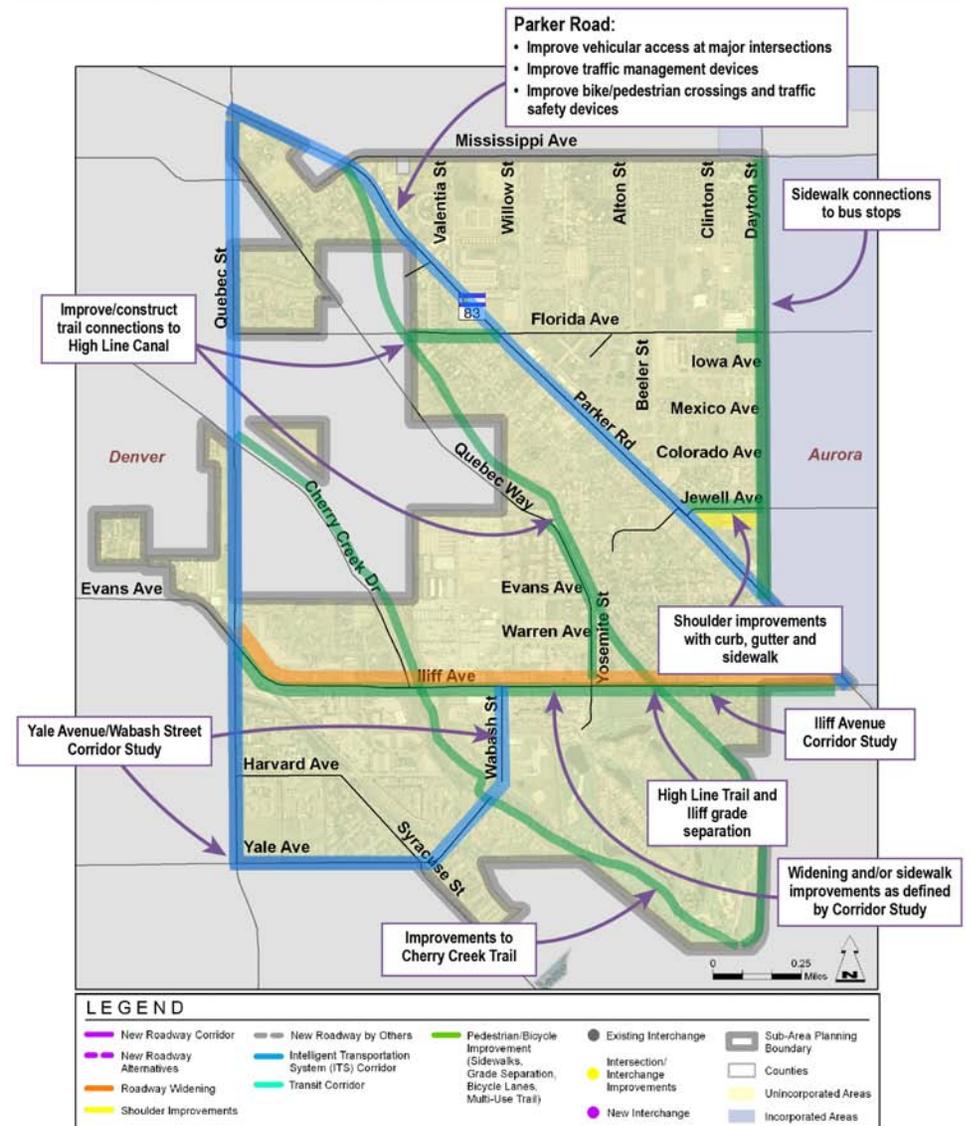
To build upon the goals and strategies for the four adopted SubArea Plans of the Arapahoe County Comprehensive Plan, the transportation improvements recommended for the Transportation Plan are discussed in more detail within the following Focus Areas.

**Four Square Mile**

The Four Square Mile Area is an enclave surrounded on all sides by Aurora and Denver. It is generally bounded by Mississippi Avenue on the north, Dayton Street on the east, Yale Avenue on the south, and Quebec Street on the west. While the area population has grown, the area remains distinctive with rural character on properties immediately adjacent to multi-family residential units. The Four Square Mile Sub-Area Plan was adopted in February 2005. The transportation goals established by that plan include:

- ✦ Addressing the inadequate transportation corridors to improve traffic circulation in and through the area.
- ✦ Working with the City and County of Denver and community groups to complete the Wabash/Yale bridge over Cherry Creek, including improvements at the Yale Avenue/Syracuse Street intersection for safer and efficient traffic flow.
- ✦ Improving the traffic flow and traffic management devices along the Parker Road corridor.
- ✦ Addressing the funding of construction and maintenance of transportation facilities within the area.
- ✦ Increasing the usability and access to the area multi-use trails from the surrounding neighborhoods.

The Transportation Plan includes recommendations for multimodal access throughout the area and the traffic flow along the major arterial corridors of Parker Road, Iliff Avenue, Quebec Street, and Yale Avenue. Specific improvements along Iliff Avenue will be determined through a multimodal corridor study, which may or may not include the widening to six lanes included in the current transportation plan. However, right-of-way along the corridor should be preserved for six lanes until the corridor study results are determined.



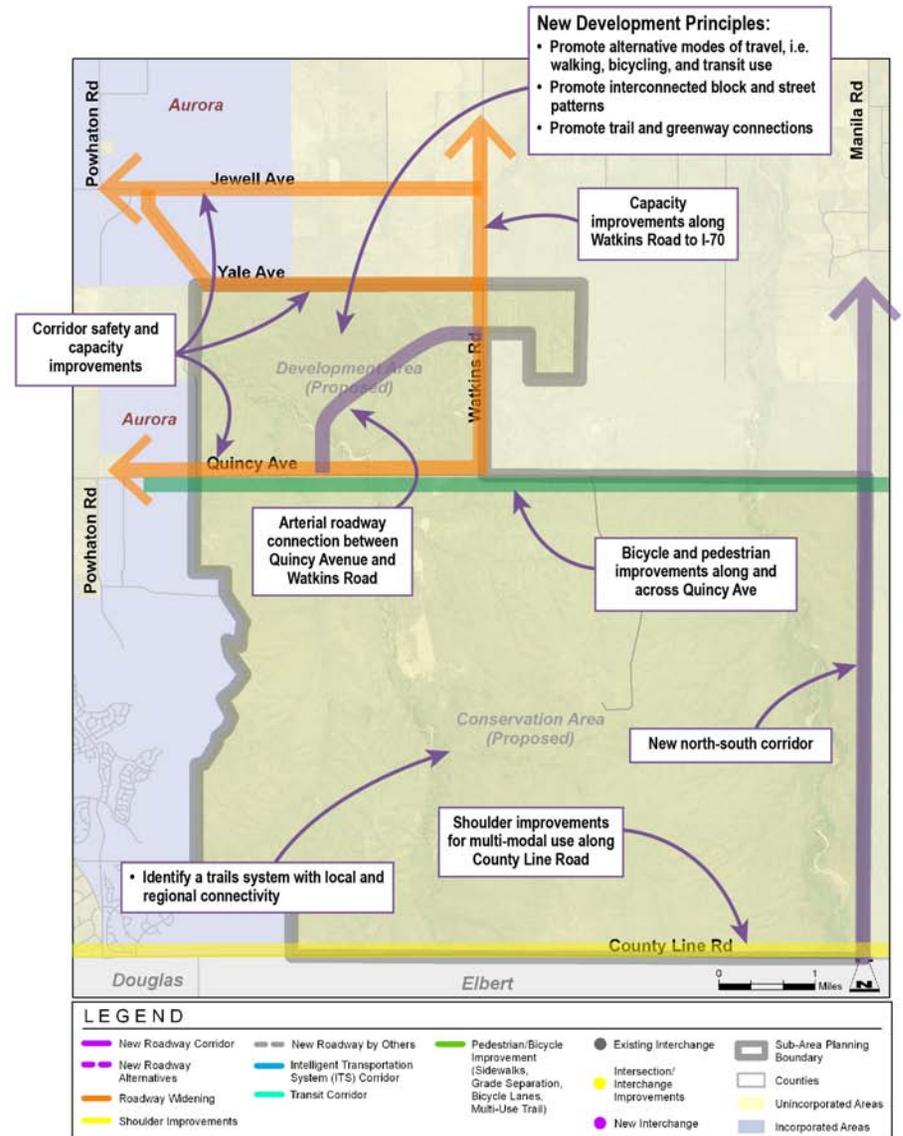
**Lowry Range**

The Lowry Range Sub-Area Plan was completed in January 2007 to update the Comprehensive Plan and frame key issues that should be addressed when development occurs. The potential for future development of the State Land Board’s Lowry Range will continue to be a factor for long-term road improvement needs. Physical constraints presented by the topography of the area and the limited existing transportation infrastructure are among the key transportation related issues.

- ✦ Few roadway connections to the Denver metropolitan area exist due to physical constraints, which results in overloading of Quincy Avenue and Watkins Road.
- ✦ Crossing the floodplain for Coal Creek would require expensive bridge structures so the number of future roadway crossings would likely be limited.
- ✦ The site is beyond RTD boundaries and the low density of the surrounding area could result in limited multimodal options.
- ✦ Continuing development in Elbert County and eastern Arapahoe County will result in additional traffic demand to cut through the general area.

Recommendations within the Transportation Plan to respond to the potential Lowry Range development include the following:

- ✦ Reinforcing north/south transportation connections via Watkins Road and Manila Road improvements to respond to growing employment opportunities in the I-70 corridor and the TransPort development to the north.
- ✦ Location of future transportation corridors complimentary of the natural environment and trail/conservancy areas that encourage non-motorized travel for recreation and secondary travel.



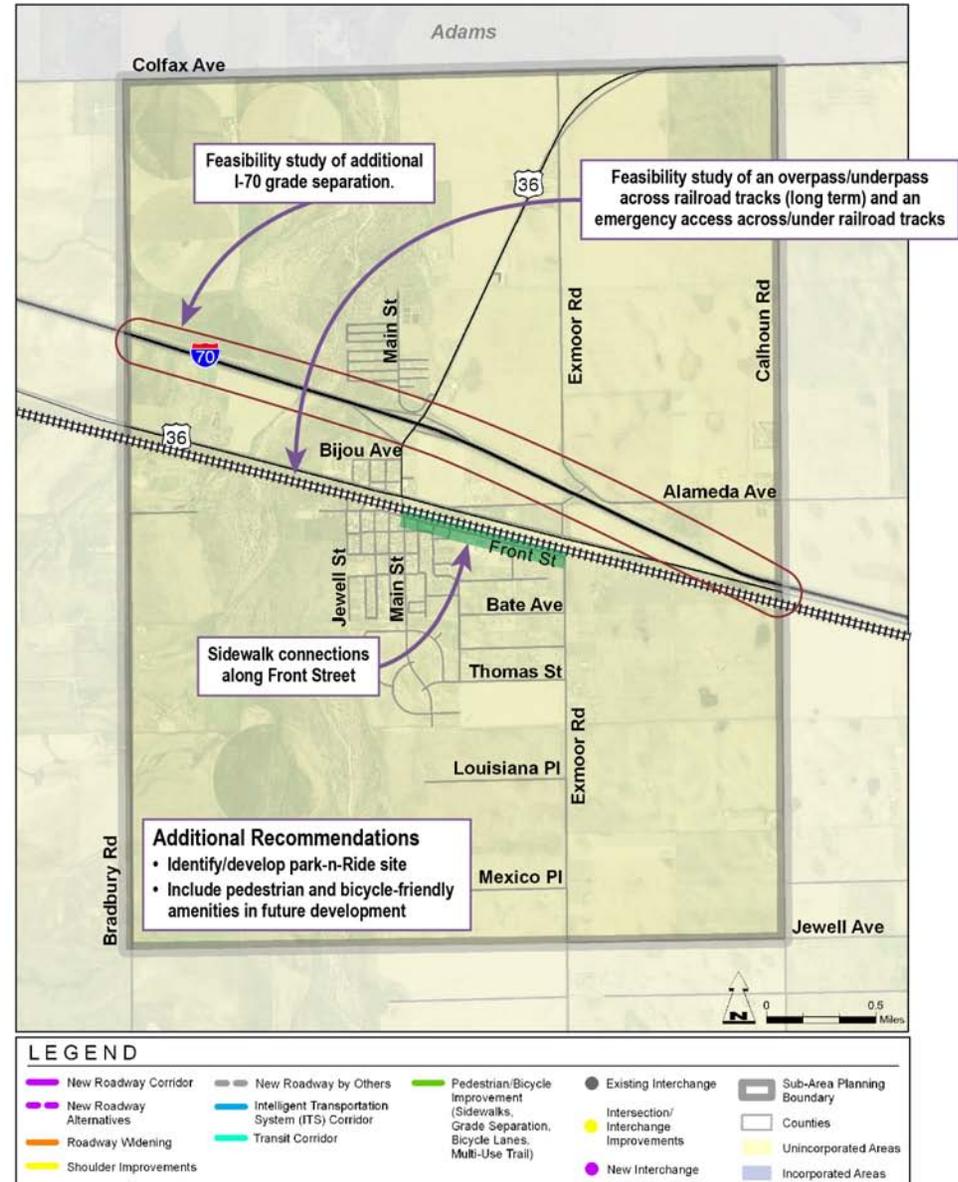
**Byers**

The Byers Sub-Area Plan was adopted in June 2003 as an amendment to the Arapahoe County Comprehensive Plan. The Sub-Area Plan identifies a transportation vision that will centralize higher traffic business uses around the I-70 and US 36 interchange and establish traffic patterns that minimize impacts to residential areas. The transportation goals established by that plan include:

- ✦ Creating a park-n-Ride facility for carpooling.
- ✦ Developing short-term and long-term access improvements across the railroad tracks.
- ✦ Developing a second freeway grade separation.

The Transportation Plan includes feasibility studies to evaluate the location, benefits, cost, and impacts of access improvements across the railroad tracks and an additional I-70 grade separation, which would include integrated bicycle and pedestrian facilities. These studies will involve multi-agency coordination efforts with CDOT, Arapahoe County, and the railroads to gain support and identify funding opportunities. The Plan also includes the identification of a site and development of a park-n-Ride lot to provide and promote opportunities for carpooling and ride-sharing utilizing the I-70 corridor.

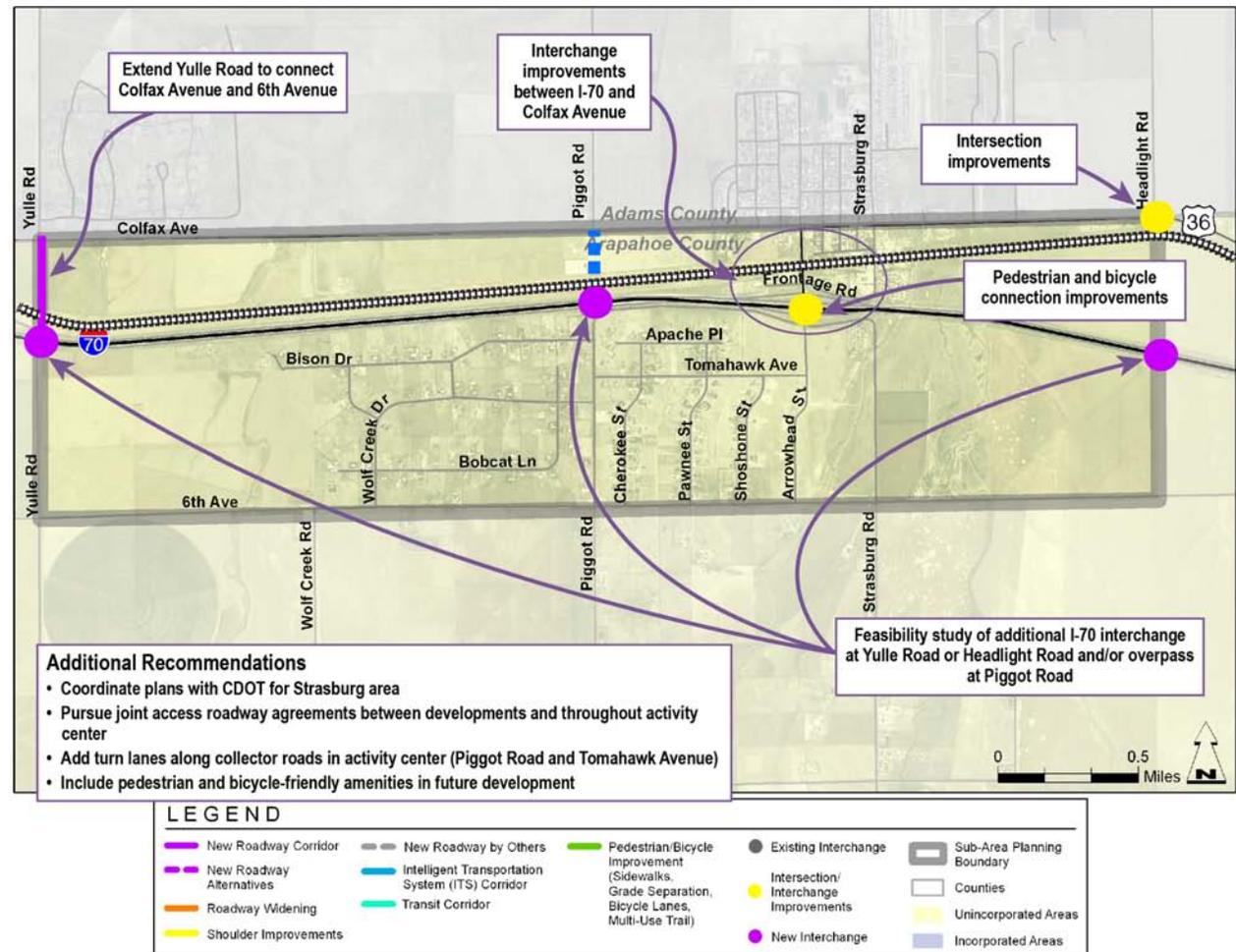
Pedestrian improvements identified in the Plan include enhanced sidewalk connections along Front Street to improve pedestrian access and safety for the Byers School. Pedestrian and bicycle-friendly amenities should also be encouraged and/or required by the County for future development within the Byers area.



**Strasburg**

The Strasburg Plan was completed in May 2002 as an amendment to the Adams County and Arapahoe County Comprehensive Plans. The plan notes the importance of achieving a balance between maintaining the small town character of the town and the ability to provide adequate circulation for new commercial and residential development. The transportation goals established by that plan are based on building a transportation system that supports planned land uses and provides options for all travel modes. Outlined improvement strategies include:

- ✦ Extension of Yulle Mile Road north to address the lack of north-south connectivity
- ✦ I-70 interchange improvements
- ✦ Feasibility study of an additional I-70 interchange complex
- ✦ Collector roadways within activity centers constructed with adequate auxiliary lanes for circulation and capacity



The Transportation Plan includes recommendations for these improvements, as well as safety and capacity improvements at the Colfax Avenue (US 36) and County Road 2 and Headlight Road intersection and other improvements related to the Comanche Creek development on the south side of town. Improved bicycle and pedestrian facilities and connections across I-70 and the railroad will also be studied with the interchange improvements between I-70 and Colfax Avenue.

### **5.7. Roadway Design Considerations**

Typical sections for each of the designated roadway classifications are illustrated in **Figure 25**. These typical sections have been developed based on the current County typical sections to provide a consistent, appropriate level of design for the varying land use and developing areas of Arapahoe County. The constraints and opportunities related to the operations, right-of-way, and physical features must be considered when developing the specific roadway section to be provided with a project, which may be a mixture of the typical sections with narrower widths than shown here. The County will make every effort to provide reasonable accommodations in accordance with American with Disabilities Act (ADA) standards for new construction.

A width of 12 feet is generally provided for all through traffic lanes. Through travel and auxiliary lanes may utilize reduced lane width of 11 feet in urban or sub-urban areas if right-of-way is limited or physically restricted. 14-foot through travel lanes are provided in the Secondary Rural Road and Two-Lane Rural Arterial typical sections to enhance the safety of the rural corridors with higher speeds, more direct access, and the relatively frequent need to pass slow-moving farming equipment or postal vehicles.

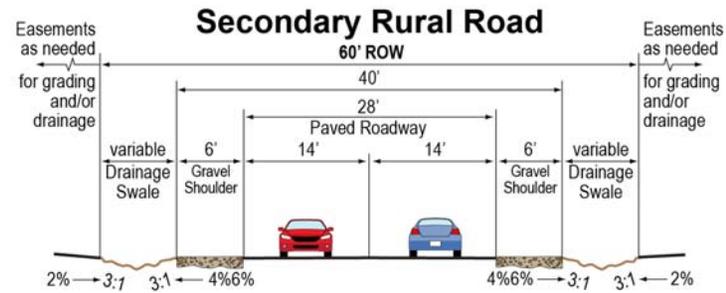
Medians are established to provide width for a center turning lane, when appropriate, and to provide lateral clearance between opposing vehicle movements. A wider painted median is provided within the Four-Lane Rural Arterial section to provide greater inside clear zone due to the higher speeds and rolling vertical alignment typically experienced within rural areas. A landscaped median requires a long-term maintenance commitment. Raised landscaped medians are most appropriate along four-, six-, and eight-lane arterials where the width of median is sufficient to maintain a reasonable level of landscaping. A raised separation on wide streets is also useful in better defining the wide roadway expanse for driver comprehension, safety, and access control.

Designated bike lanes should be included only if they are part of an overall, consistent plan for bicycle facilities. Bike lanes are not recommended on streets with limited continuity. Local, low-speed, low-volume streets are able to accommodate bicyclists on-street without formal bike lanes. Designated on-street bike lanes are also typically not recommended for six-lane roadways, due to high speeds and high traffic volumes. To provide safer bicycle and vehicle operations, a separate multi-use path is recommended behind the curb along six-lane arterials. If considerable pedestrian traffic is anticipated, a 12-foot multi-use path or a separate, signed sidewalk for pedestrians could be constructed in addition to the bike path. As an alternative facility, parallel roads to six-lane arterials may be more appropriate for bike facilities. Bike lanes on four-lane roadways with numerous commercial driveways can also present a safety problem with numerous conflict points. Generally, the County will not widen a roadway to provide bike lanes without additional operational, safety, or vehicular capacity benefits.

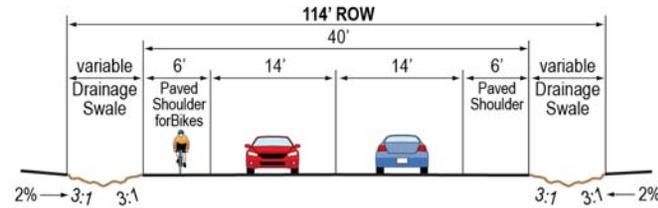
**Right-of-Way**

Right-of-way requirements are planned to reserve the minimum width of public land for the roadway, sidewalk, and drainage areas of roads. **If the roadway has the potential to need widened or will be constructed in phases, the maximum amount of right-of-way should be acquired in the initial phases.** The roadway typical sections indicate the minimum right-of-way required along the roadway corridor. Additional width may be required through major intersections for auxiliary lanes. A table in **Appendix C** tabulates the identified roadway laneage in the Transportation Plan and required right-of-way, based on the typical sections developed for the roadway classification. Local municipality right-of-way requirements may vary and **additional right-of-way may be required due to drainage and grading requirements** along specific corridors.

Figure 25. Roadway Typical Sections



**Two-Lane Rural Arterial with or without Bike Accommodations**



**Two-Lane Urban or Semi-Urban Collector**

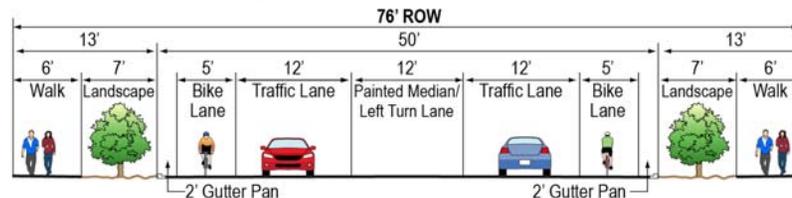


Figure 25 (cont'd). Roadway Typical Sections

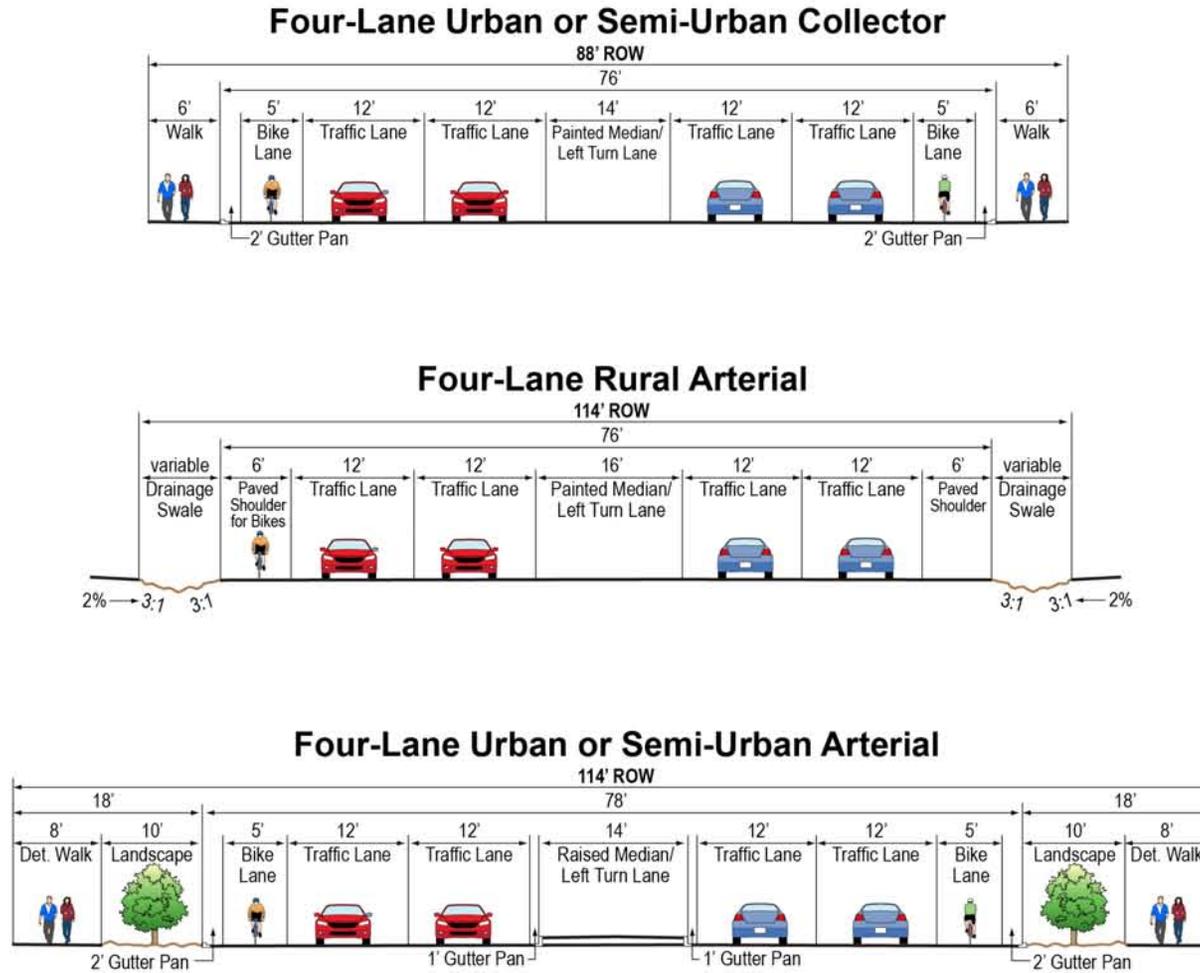
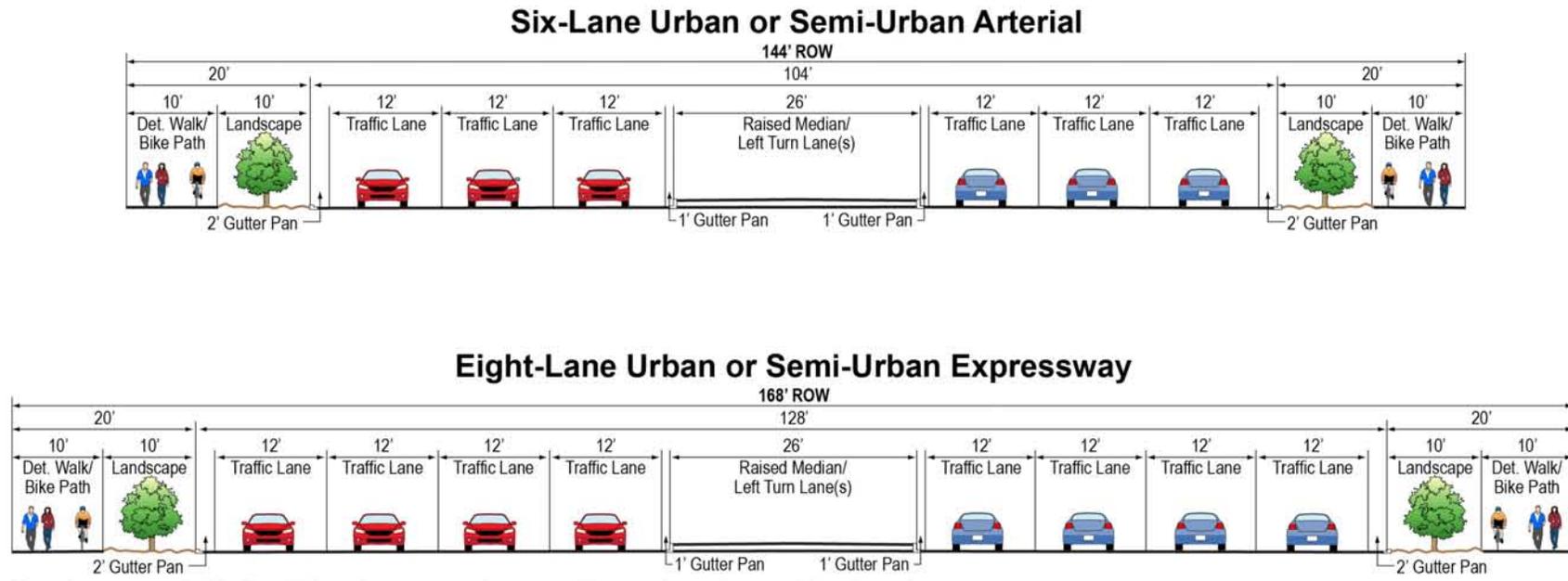


Figure 25 (cont'd). Roadway Typical Sections



**Note:** Access controlled facility with interchanges or grade separated intersections at key arterial road crossings.

**Low Water Stream Crossings**

It is typical practice to design stream or river crossing structures to accommodate a 50- to 100-year flood without overtopping. This helps ensure that the road will remain in service, except in extreme flood events. However, these bridge structures have a high capital cost and in areas like the east end of Arapahoe County, with many long drainageways crisscrossing rural areas, these capital costs can be prohibitive to upgrading gravel roads or the construction of new roadway connections. Low water stream crossings (LWSC) can provide an acceptable, low cost alternative to bridges and culverts on low volume rural roads.



Individual governmental entities set the design flood frequency that they will accept. The most common practice is to use a 50- or 100-year frequency for structure sizing, with a 500-year scour check. The bridge is designed to remain intact after the 500-year event.

Current Arapahoe County standards allow overtopping with identified maximum depths for Local streets and Collector roadways and minor drainageways, but do not allow overtopping for a major storm runoff event for Arterial roadways. No overtopping is allowed for any street classification at major drainageway crossings. Where it is determined that overtopping is allowed for major storm events at minor drainageways, the Arapahoe County Stormwater Management Manual allows for sizing to a 10-year storm runoff event.

A LWSC is a structure that provides reasonable access as a stream crossing, but may be flooded periodically and therefore closed to traffic. These structures are relatively inexpensive and particularly suitable for low volume roads, across streams with periodically dry beds, or streams where the normal depth of flow is relatively low. A LWSC can be constructed as an interim crossing structure to allow a new roadway connection to be constructed within an agency’s limited budget with the long-term bridge structure accommodating the longer flood frequency constructed as warranted with increases in traffic volumes. A white paper in **Appendix D** outlines the characteristics, potential benefits, and opportunities for LWSCs in Arapahoe County.

### **Wildlife Crossings**

Animal-vehicle collisions have a profound impact on driver safety and wildlife viability, particularly in rural areas like eastern Arapahoe County. For species that commonly attempt to cross roads, the number of animals killed can greatly decrease the local population. Roads act as barriers for other species, isolating populations and increasing the chance of local extinction. Wildlife crossings, passages beneath or above a roadway, are a form of mitigation designed to facilitate safe wildlife movement across a transportation corridor.

Properly sized and located structures receive heavy use by wildlife, thereby reducing animal-vehicle collisions. Many biologists believe that the placement and frequency of these structures can be more important than the actual physical features. The use of many inexpensive underpasses along a stretch of road may be more effective than just one or two overpasses. Studies have shown that if only a minimal number of deer-vehicle collisions are prevented by an effective underpass, the savings in property damage alone can outweigh the construction costs of the structure. Arapahoe County should consider wildlife crossing construction with new road construction and maintenance projects where appropriate.

Riparian corridors are key elements of wildlife habitats. Designing structures for the dual purpose of drainage and wildlife passage can be a functional and cost-effective way to satisfy both needs. Underpasses and overpasses will not be as effective unless they are accompanied by fencing on both sides of the road. Most studies indicate that fencing should be about eight feet tall. Fencing should be built around the crossing structure to guide (funnel) animals to the passageway, thus preventing them from circumventing the system.

The largest type of wildlife common to the eastern plains of Colorado is the deer, followed by the pronghorn. To accommodate deer and pronghorns, bridges or box culverts should have an opening at least 10 feet high by 20 feet wide. Structures that are designed to accommodate deer passage have been found to also serve a variety of other smaller wildlife species, including foxes, rabbits, coyotes, kangaroo rats, snakes, turtles, horny toads, and groundhogs. Species specific design features to consider include:

- ✦ Raised ledges within the structure to offer dry passageways above the ordinary high water line on each side of the creek or river
- ✦ Additional lighting inside an underpass can be provided by grating or a similar opening in a culvert ceiling
- ✦ Planting vegetation up to structure entrances
- ✦ Adding dirt, grass, or other ground cover to culvert floors



#### **Municipal Separate Storm Sewer System (MS-4) Permit Requirements**

With linear transportation facilities, it is typically difficult to obtain adjacent right-of-way for water quality needs specific to the roadway widening or new alignment. With new roadway facilities in undeveloped areas, there may be opportunities to acquire property adjacent to the corridor that can address water quality for the new construction as well as acting as a regional facility for future expansion. However, in developed areas where a roadway is being widened, there are minimal opportunities to address water quality within existing right-of-way, and it is generally unrealistic to look at a property take or condemning property for a water quality facility.

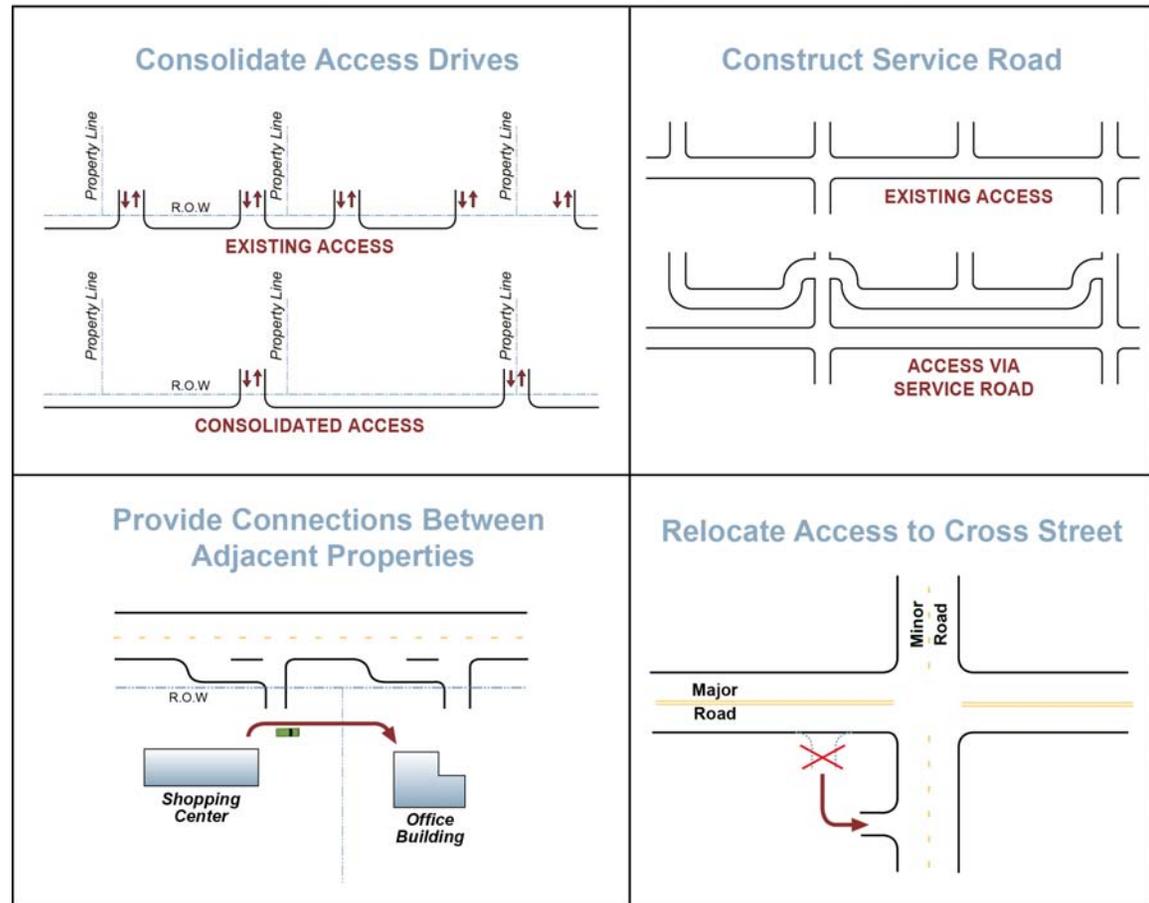
Within the jurisdiction of Southeast Metro Stormwater Authority (SEMSWA), the timing and funding of regional improvements does not necessarily correlate well with the timing of roadway improvements. This disconnect can stall the transportation improvement construction and create unanticipated costs to the project. In order to avoid these unnecessary delays and costs, water quality needs for the transportation improvements identified in the Transportation Plan will be accounted for in master planning and regional water quality improvements completed by SEMSWA. The coordination of the water quality and transportation master plans will determine the timing of when regional water quality improvements would need to be constructed in relation to the recommended roadway improvements.

**Access Management**

Access management is the systematic control of the location, spacing, design, and operation of driveways, median openings, and street connections to a roadway. The purpose of access management is to provide land development access in a manner that preserves the safety and efficiency of the transportation system. Uncontrolled access can reduce the capacity of a roadway by as much as 30%.

Access management plans are recommended for developing corridors so that land developers understand where access may or may not be permitted. The access management plan should be comprehensive with a consistent approach applied throughout the corridor. Access management strategies include:

- ✦ Driveway consolidation and minimum driveway spacing
- ✦ Driveway access relocation to cross street
- ✦ Construction of parallel access roads to provide access off the primary roadway
- ✦ Internal connections between adjacent properties
- ✦ Raised median design to control full driveway access



The access control characteristics of each roadway classification are presented in Section 5. Roadway and driveway design shall follow the *Arapahoe County Infrastructure Design and Construction Standards*.

### **Complete Streets**

Many states and local jurisdictions have adopted “Complete Streets” policies within their transportation design standards. The Complete Streets philosophy is based on providing corridors that are safe and convenient for travel by automobile, foot, bicycle and transit regardless of age or ability. As new roadway alignments or roadway widening needs are identified for Unincorporated Arapahoe County, the Complete Streets concept should be considered as a strategy to address safe mobility needs across all modes. In some cases, a hierarchy of road classifications may be required to focus transit, pedestrian and bicycle uses on facilities where they are most appropriate. In more rural areas, it will be important to consider strategic connections to the recommended park-n-Rides, which will provide for subsequent connections to regional services, such as I-70 or Quincy Avenue for longer distance travel. The degree of this multi-modal consideration will need to be varied on a case-by-case basis within the County.

### **5.8. Costs of Recommended Plan**

Capital costs for the elements of the Arapahoe County 2035 Transportation Plan were developed consistent with the recommended roadway typical sections and unit costs from the Colorado Department of Transportation (CDOT). Costs were estimated for planning purposes only and a more detailed cost estimation process would be completed in conjunction with final design of any improvements. Elements used for the infrastructure cost estimates included pavement, curb and gutter, major intersections, excavation, embankment, structures, landscaping, drainage, right-of-way, and engineering.

Total costs for the recommended improvements in the Transportation Plan were estimated to be between \$700 and \$900 million. Cost estimates for each recommended project are provided in **Appendix B**.

## 6. Funding Analysis

This section presents funding mechanisms and administrative options commonly used to finance transportation system expansion, repair and maintenance. A mix of federal, state and local funding mechanisms and administrative options were evaluated considering the following criteria:

- ✦ Revenue productivity
- ✦ Revenue reliability
- ✦ Public support
- ✦ Ease of administration/implementation
- ✦ Equity/Fairness

### 6.1. Federal Funding Mechanisms

The Federal government finances transportation through congressional legislation and transportation programs under the United States Department of Transportation (USDOT) and Federal Highway Administration (FHWA). Funding, typically in the form of block grants or loans, is directed to state governments through funding formulas or to statewide transportation agencies for allocation.

Federal funding programs that may be utilized by Arapahoe County are listed below. More detailed descriptions of each funding mechanism are provided in **Appendix E**.

- ✦ Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)
- ✦ Surface Transportation Program (STP).
- ✦ Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- ✦ Highway Safety Improvement Program (HSIP)
- ✦ Recreational Trails Program (RTP)
- ✦ Safe Routes to Schools (SRTS)
- ✦ Transportation Infrastructure Finance and Innovation Act (TIFIA)

## **6.2. State Funding Mechanisms**

State funding mechanisms consist of legislative actions, taxes, and fees that raise revenue for construction and maintenance of transportation infrastructure. In 2009, the Colorado State Legislature passed a number of transportation-related laws aimed at bolstering transportation revenues; most notable is the FASTER bill. All legislative actions discussed in this section were passed during the 2009 legislative session. No transportation funding related bills were passed in the 2010 legislative session. FASTER and three additional transportation bills passed during the 2009 legislative session are listed below along with other state funding methods.

State funding programs that may be utilized by Arapahoe County are listed below. More detailed descriptions of each funding mechanism are provided in **Appendix E**.

- ✦ Funding Advancements for Surface Transportation and Economic Recovery (FASTER, HB 108)
- ✦ Regional Transportation Authority Property Taxes (HB 1034)
- ✦ Motor Vehicle Emissions Programs (SB 003)
- ✦ Devolve State Highways to Local Government (SB 078)
- ✦ Statewide Transportation Improvement Plan (STIP)
- ✦ Highway Users Tax Fund (HUTF)
- ✦ State Infrastructure Bank (SIB) Loan Program

## **6.3. State Administrative Agencies**

The State has the option to establish administrative agencies that target the transportation system within a specific geographic area. The primary agency managing statewide transportation funding is CDOT. To a lesser extent, the Department of Local Affairs (DOLA), MPOs and the Denver RTD also help to administer state transportation funds. CDOT and the other agencies distribute Federal funds, maintain transportation infrastructure and coordinate transit.

The State administrative agencies that may work with Arapahoe County to fund transportation related infrastructure are listed below. Many of these state agencies allocate federal funds. More detailed descriptions of each funding mechanism are provided in **Appendix E**.

- ✦ Colorado Department of Transportation (CDOT)

- ✦ Regional Transportation District (RTD)
- ✦ High Performance Transportation Enterprise (HPTE)
- ✦ Statewide Bridge Enterprise

#### **6.4. Local Funding Mechanisms**

Counties adopt transportation funding mechanisms either through administrative action or popular vote. Generally, fees (i.e. impact fees or utility fees) are imposed by government action, such as county commissioners’ resolution. New taxes usually require a majority vote from citizens for approval.

**Table 18** presents a list of the local funding mechanisms and administrative options available to Arapahoe County and associated strengths, weaknesses and administrative characteristics. More detailed descriptions of each funding mechanism are provided in **Appendix E**.

**Table 18. Local Funding Mechanism and Administrative Entity Funding Table**

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Additional Property Tax	<ul style="list-style-type: none"> <li>◆ Increase of road &amp; bridge fund or capital improvement fund property tax.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Proven and productive revenue stream.</li> <li>◆ Captures the property value increase created by transportation improvement.</li> <li>◆ Potential use with improvement districts for funding of targeted capital improvements.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Commercial property owners pay roughly 3.5 times more than residential property owners per dollar of property value.</li> <li>◆ TABOR limitations may apply in some applications.</li> <li>◆ Requires public acceptance of tax increase.</li> </ul>	<ul style="list-style-type: none"> <li>◆ County Government</li> <li>◆ Improvement Districts</li> <li>◆ Metro District</li> </ul>	<ul style="list-style-type: none"> <li>◆ Systemwide transportation funding</li> <li>◆ Specific intersections or roadways.</li> <li>◆ Capital improvements</li> <li>◆ Operations and maintenance</li> </ul>
Bonds	<ul style="list-style-type: none"> <li>◆ Debt instrument used to finance a capital purchase over a set time period.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Useful in purchasing an expensive capital improvement without having all necessary funds up front.</li> <li>◆ Can be guaranteed with a future revenue stream, i.e., sales tax, special assessment, etc.</li> <li>◆ Relatively low interest debt securities available to public sector entities.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Must be guaranteed with another source of future revenue.</li> <li>◆ Enters the county into a long-range financial obligation.</li> <li>◆ Requires a public vote.</li> </ul>	<ul style="list-style-type: none"> <li>◆ County Government</li> <li>◆ Improvement Districts</li> <li>◆ Metro District</li> </ul>	<ul style="list-style-type: none"> <li>◆ Systemwide transportation funding</li> <li>◆ Specific intersections or roadways.</li> <li>◆ Capital improvements</li> </ul>

Table 18 (cont'd). Local Funding Mechanism and Administrative Entity Funding Table

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Dedicated Sales Tax	<ul style="list-style-type: none"> <li>◆ Tax on retail goods sold on Arapahoe County dedicated to transportation</li> </ul>	<ul style="list-style-type: none"> <li>◆ Has ability to raise large amounts of revenue if a good mix of retail uses exist.</li> <li>◆ Major regional retailers are located in Arapahoe County.</li> <li>◆ Diffuses funding burden over many people and businesses, including out-of-region visitors.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Considered a regressive tax – burden is exaggerated on low-income households.</li> <li>◆ Vulnerable to business cycles and may stagnate or decline during economic downturn.</li> <li>◆ Requires public vote.</li> <li>◆ Likely opposed by cities in Arapahoe County as they see this revenue stream as theirs.</li> </ul>	<ul style="list-style-type: none"> <li>◆ County Government</li> <li>◆ Regional Transportation Authority</li> </ul>	<ul style="list-style-type: none"> <li>◆ Systemwide transportation funding</li> <li>◆ Capital improvements</li> <li>◆ Operations and maintenance</li> </ul>
Public Improvement Fee (PIF)	<ul style="list-style-type: none"> <li>◆ Voluntary fee applied to goods sold in a specific commercial development. PIFs usually provide funds for a specific time period and have a sunset clause.</li> </ul>	<ul style="list-style-type: none"> <li>◆ See strengths from Sales Tax</li> <li>◆ Directly aligns funding with primary beneficiaries of transportation improvements.</li> <li>◆ Can generate substantial revenue for specific improvements within a specified time period.</li> <li>◆ Does not require public vote.</li> </ul>	<ul style="list-style-type: none"> <li>◆ See weaknesses from Sales Tax.</li> <li>◆ Higher cost of goods at specific commercial establishments.</li> <li>◆ Dependent on negotiation with private commercial developer.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Agreement between commercial establishment and County.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Specific intersections or roadways.</li> <li>◆ Capital improvements</li> </ul>

Table 18 (cont'd). Local Funding Mechanism and Administrative Entity Funding Table

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Public-Private Partnership	<ul style="list-style-type: none"> <li>An agreement between the public sector and a private party that allows the private party to provide a public good or service, such as operating a toll highway or public transit line.</li> </ul>	<ul style="list-style-type: none"> <li>Allows the public sector to capitalize on the efficiencies of private enterprise.</li> <li>Shifts financial risk to the private sector.</li> <li>Often places the burden of up front capital investment on the private sector.</li> </ul>	<ul style="list-style-type: none"> <li>Dependent on negotiation with private entity.</li> <li>Generally requires forfeiture of a future revenue stream.</li> <li>Lack of county control over service levels.</li> </ul>	<ul style="list-style-type: none"> <li>Agreement between private entity and County Government</li> </ul>	<ul style="list-style-type: none"> <li>Specific roadways or transit lines.</li> <li>Capital improvements</li> <li>Operations and maintenance</li> </ul>
Special Assessments	<ul style="list-style-type: none"> <li>A special assessment is a fee collected for improvements or services that have a “unique” benefit to property within the jurisdiction.</li> </ul>	<ul style="list-style-type: none"> <li>Directly aligns funding with primary beneficiaries of transportation improvements.</li> <li>Assessment amount generally follows the degree of benefit of the improvement.</li> <li>Requires residents within an assessment district to take ownership of localized transportation issues.</li> </ul>	<ul style="list-style-type: none"> <li>Assessment district must be large enough to diffuse the funding burden to avoid high individual assessments.</li> <li>Requires vote of landowners in district.</li> </ul>	<ul style="list-style-type: none"> <li>County Government</li> <li>Improvement Districts</li> </ul>	<ul style="list-style-type: none"> <li>Specific intersections or roadways.</li> <li>Capital improvements</li> </ul>
Specific Ownership Tax	<ul style="list-style-type: none"> <li>A specific ownership tax is levied by a county government on the value of motor vehicles based on a tax formula specified in the State Constitution.</li> </ul>	<ul style="list-style-type: none"> <li>Aligns funding with primary beneficiaries of transportation improvements—vehicle owners.</li> </ul>	<ul style="list-style-type: none"> <li>Motor vehicle registration fees, which are collected alongside specific ownership tax, recently increased under FASTER bill.</li> <li>Requires an Amendment of the Constitution, which would require a statewide Referendum.</li> </ul>	<ul style="list-style-type: none"> <li>County Government</li> </ul>	<ul style="list-style-type: none"> <li>Systemwide transportation funding</li> <li>Capital improvements</li> <li>Operations and maintenance</li> </ul>

**Table 18 (cont'd). Local Funding Mechanism and Administrative Entity Funding Table**

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Developer Agreements	<ul style="list-style-type: none"> <li>◆ Agreements with land developers to jointly fund mutually beneficial transportation improvements. Developers also fund improvements entirely under some agreements.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Aligns funding burden with a financial beneficiary of capital improvement (developer).</li> <li>◆ Depending on the improvement, the county may have no capital contribution requirement.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Dependent on negotiation with private developer.</li> <li>◆ County may assume risk if developer defaults.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Agreement between private developer and County Government</li> </ul>	<ul style="list-style-type: none"> <li>◆ Specific intersections or roadways.</li> <li>◆ Capital improvements</li> </ul>
Impact Fee	<ul style="list-style-type: none"> <li>◆ A fee imposed only on new development to recover the cost of growth related capital improvement.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Aligns funding with beneficiary of transportation improvements.</li> <li>◆ Common, accepted method for recovering growth related capital investment.</li> <li>◆ Fair—Burdens growth and existing development proportionate to transportation demand.</li> <li>◆ Does not require public vote.</li> <li>◆ Existing Arapahoe County precedent (RTIF).</li> </ul>	<ul style="list-style-type: none"> <li>◆ Funding stream dependent on pace of future growth.</li> <li>◆ Can only partially fund capital improvements in certain situations.</li> <li>◆ In practice, impact fees are often adopted at lower than recommended amounts due to economic development considerations.</li> </ul>	<ul style="list-style-type: none"> <li>◆ County Government</li> </ul>	<ul style="list-style-type: none"> <li>◆ Systemwide transportation funding—or within specific benefit districts</li> <li>◆ Capital improvements</li> </ul>

Table 18 (cont'd). Local Funding Mechanism and Administrative Entity Funding Table

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Utility Fee	<ul style="list-style-type: none"> <li>An annual or monthly fee imposed on County households and businesses scaled by usage of transportation system.</li> </ul>	<ul style="list-style-type: none"> <li>Precedent has been established locally and nationally for treating Transportation as a utility.</li> <li>Spreads costs to all users based on their use of the transportation network.</li> <li>Does not require public vote.</li> </ul>	<ul style="list-style-type: none"> <li>Generally more cost per household than sales tax, when compared to revenue generated.</li> <li>Only few local applications (Loveland and Ft. Collins), although used in other states for transportation and transit.</li> </ul>	<ul style="list-style-type: none"> <li>County Government</li> <li>Metro District</li> </ul>	<ul style="list-style-type: none"> <li>Systemwide transportation funding</li> <li>Operations and maintenance</li> </ul>
Public or Local Improvement District	<ul style="list-style-type: none"> <li>A funding district that usually employs a special assessment or property tax to recover costs of specific capital improvements.</li> </ul>	<ul style="list-style-type: none"> <li>Directly aligns funding with primary beneficiaries of transportation improvements.</li> <li>Targets specific area for capital improvement.</li> <li>Specific time frame established for payback of capital costs.</li> </ul>	<ul style="list-style-type: none"> <li>Capital improvements only.</li> <li>Requires vote of landowners in district.</li> </ul>	<ul style="list-style-type: none"> <li>County Government</li> <li>Improvement District Board</li> </ul>	<ul style="list-style-type: none"> <li>Specific intersections or roadways.</li> <li>Capital improvements</li> </ul>
Title 32 Metropolitan District	<ul style="list-style-type: none"> <li>Governmental district with authority to provide many public services, including transportation.</li> <li>“Metro” Districts can impose property tax as well as fees, tolls and charges.</li> </ul>	<ul style="list-style-type: none"> <li>Has broad flexibility in transportation funding capabilities.</li> <li>Requires residents within the district to take ownership of localized transportation issues.</li> </ul>	<ul style="list-style-type: none"> <li>Need substantial buy-in from businesses within the district.</li> <li>Poor business climate may affect revenue raising ability.</li> </ul>	<ul style="list-style-type: none"> <li>Metro District Self-appointed Board</li> </ul>	<ul style="list-style-type: none"> <li>Specific intersections or roadways.</li> <li>Capital improvements</li> <li>Operations and maintenance</li> </ul>

**Table 18 (cont'd). Local Funding Mechanism and Administrative Entity Funding Table**

Funding Mechanism or Entity	Description	Strengths	Weaknesses	Governance Options	Application
Regional Transportation Authority (RTA)	<ul style="list-style-type: none"> <li>◆ An administrative authority enabled by state statute to impose a sales tax, lodging tax and motor vehicle registration fee to support transportation infrastructure and operations funding.</li> </ul>	<ul style="list-style-type: none"> <li>◆ See strengths from Sales Tax.</li> <li>◆ Lodging tax provides funding for transportation by visitors to Arapahoe County.</li> <li>◆ Governed by appointed board of directors (could also be viewed as weakness).</li> </ul>	<ul style="list-style-type: none"> <li>◆ See weaknesses from Sales Tax.</li> <li>◆ Motor vehicle registration recently increased under FASTER bill.</li> <li>◆ Requires public vote.</li> </ul>	<ul style="list-style-type: none"> <li>◆ RTA</li> </ul>	<ul style="list-style-type: none"> <li>◆ Systemwide transportation funding</li> <li>◆ Capital improvements</li> <li>◆ Operations and maintenance</li> </ul>
Transportation Management District	<ul style="list-style-type: none"> <li>◆ A TMA is a non-governmental organization that provides transportation services in a commercial district, mall, medical center or industrial park.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Business owners within a TMA fund improvements through membership fees.</li> <li>◆ No county or taxpayer funding obligation.</li> <li>◆ Aligns transportation improvement benefits with funding burden.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Requires vote of landowners in district.</li> <li>◆ County does not appoint any board members.</li> </ul>	<ul style="list-style-type: none"> <li>◆ TMA member board—may contain public and private sector</li> </ul>	<ul style="list-style-type: none"> <li>◆ Specific intersections or roadways.</li> <li>◆ Capital improvements</li> <li>◆ Operations and maintenance</li> </ul>

Source: BBC Research & Consulting.

## 7. Recommended Transportation Network

The 2035 recommended transportation network for Unincorporated Arapahoe County is illustrated in **Figures 26 and 27**. These figures show the roadway classification and laneage and interchanges with the implementation of the Arapahoe County Transportation Plan recommendations.

Subsequent to the Transportation Plan adoption, a Capital Improvement Program (CIP) will be developed to identify prioritized recommendations for County funding for the next ten years. Prioritization of improvements may be based on several criteria, including:

- ✦ Traffic operations – Improvements that would address current critical traffic congestion would rank high in project prioritization.
- ✦ Traffic safety – Improvements that would address a documented safety issue would rank high in project prioritization.
- ✦ Anticipated growth – Near term development generated growth, or increases anticipated due to new roadway connections or improvements of adjacent or regional jurisdictions, would result in high project prioritization.
- ✦ Cost/Benefit and Available funding – Project with low to moderate cost that could be initiated with known County, local, and/or regional agency funding could rank higher in project prioritization than high cost projects requiring new and/or multiple funding sources.
- ✦ Partnership opportunity – Multi-jurisdictional and agency support would be an important criteria, especially for complex, high cost projects.
- ✦ Approval requirements – Timely approval through local, regional, state and federal approval and permit requirements would allow projects to be implemented when needed without costly delays.
- ✦ Connectivity – Improvements that connect with other regional and local facilities.

The current County CIP (shown in Section 2.10) is the basis for short-term improvements planned for completion in the next five years. Several other short-term improvements have been identified that could be implemented in the next ten years given available funding. Mid-term projects include those anticipated for construction by agencies and developers in response to development trends. Long-term improvements include those projects that would require large federal funding not yet identified in the Denver Regional Council of Governments (DRCOG) program, or that would require new or unique funding sources in order to implement. The table in **Appendix B** identifies the planned period for the recommended improvements.

Figure 26. 2035 County Transportation System – West End

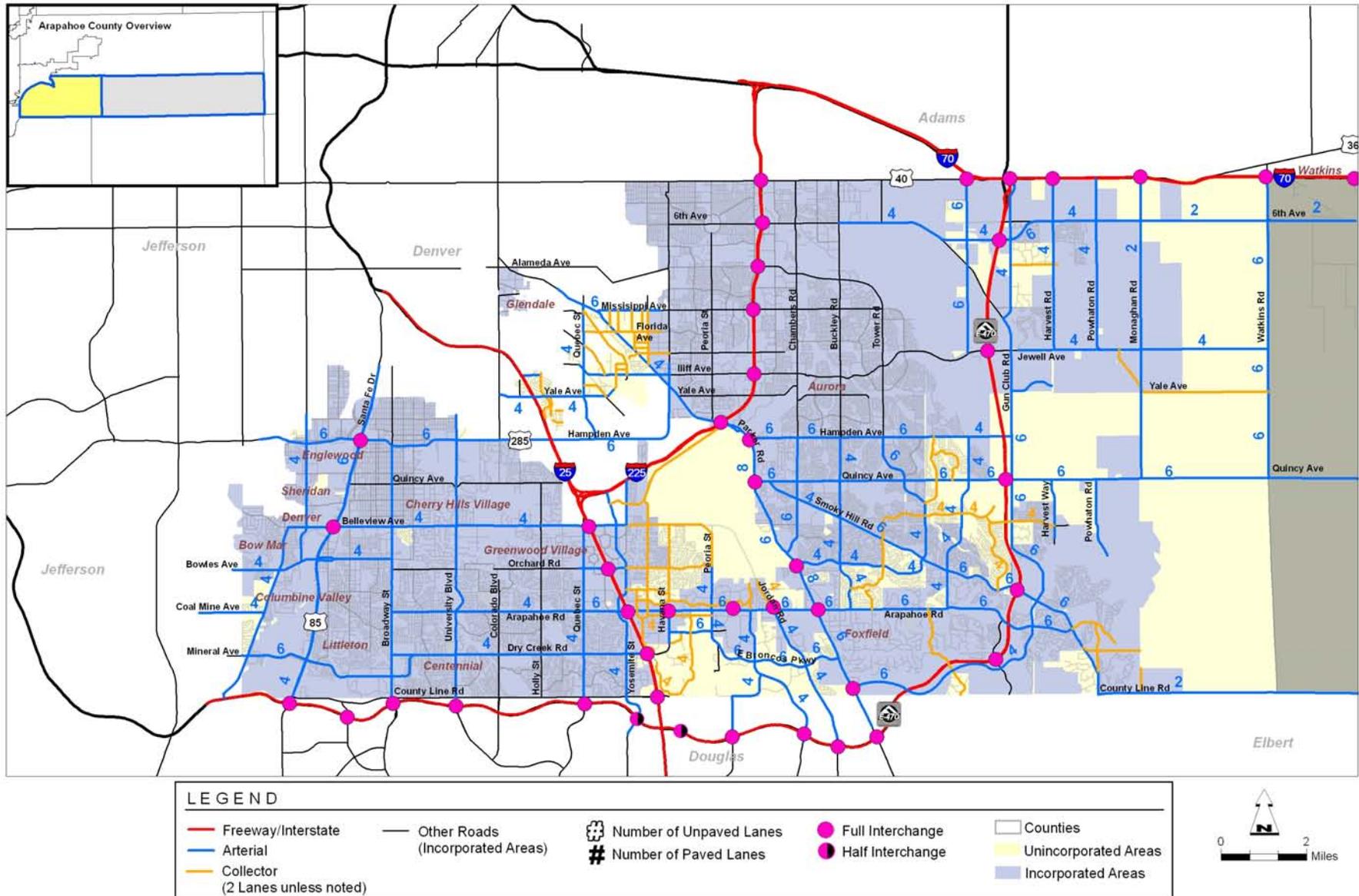
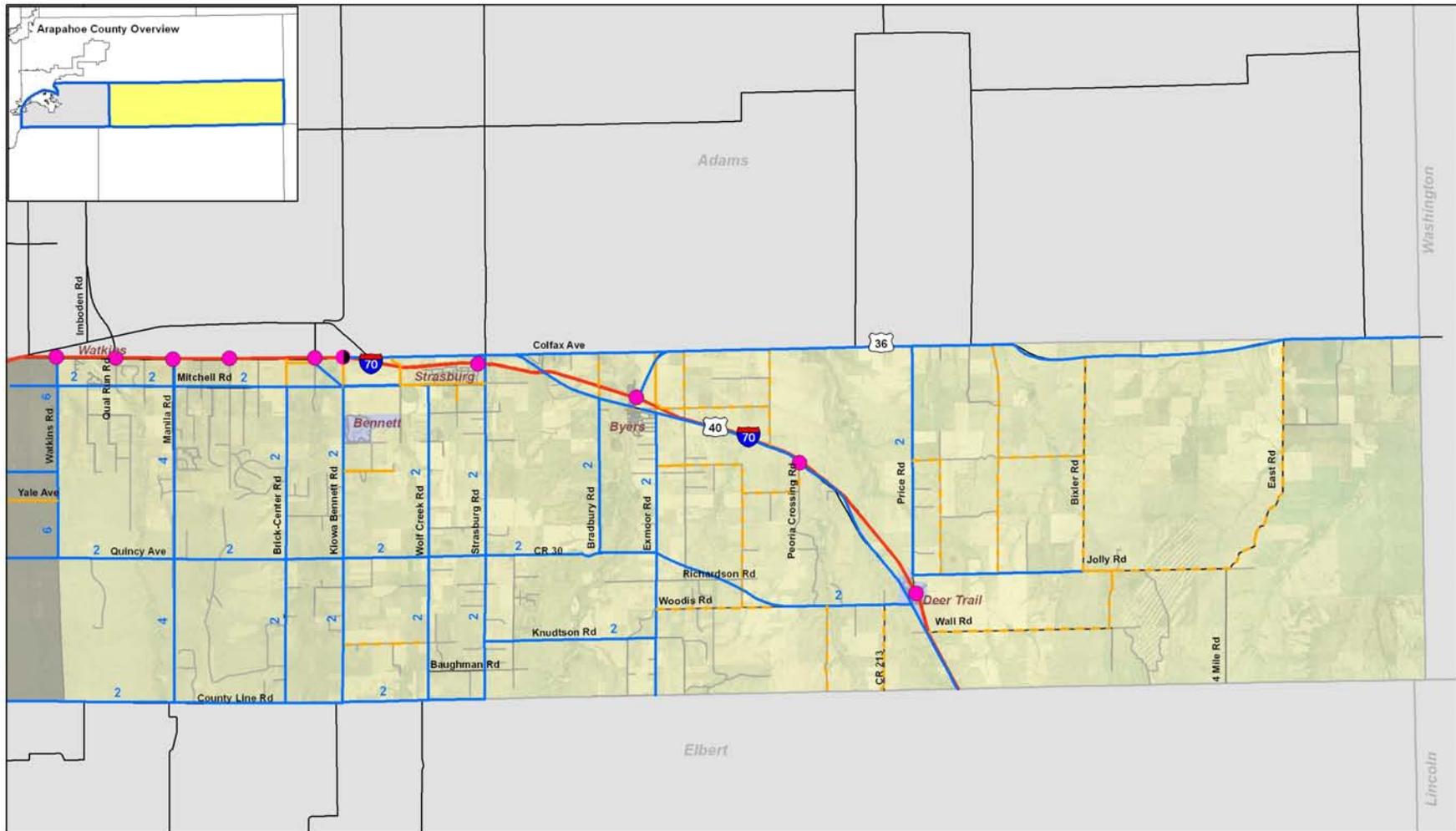


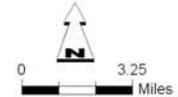
Figure 27. 2035 County Transportation System – East End



**LEGEND**

Freeway/Interstate (4 Lanes)	Collector	Number of Unpaved Lanes	Full Interchange	Counties
Arterial Paved	Rural Secondary	Number of Paved Lanes	Half Interchange	Unincorporated Areas
Local Roads				Incorporated Areas

Note: All collectors are two lanes wide except where noted.



**7.1. System Operations with Transportation Plan Improvements**

The transportation improvements recommended in the Transportation Plan focus on regional corridors, as appropriate with the forecasted demand. These regional corridor improvements are expected to increase overall mobility and reduce congestion on Arapahoe County roadways. The travel demand model developed for the Transportation Plan was used to predict the effect of the recommended improvements on system-wide measures for the County. **Table 19** provides a comparison of four measures, comparing forecasted year 2035 daily conditions on the major roadway system in Arapahoe County. The measures shown are for the entire County, including both unincorporated parts of the County and municipalities within the County, and also including a combination of major roads owned and maintained by the State, the County, municipalities, and the E-470 Public Highway Authority.

The comparisons show that implementation of the recommended improvements would cause small increases (less than one percent) in total travel in Arapahoe County, as measured in Vehicle Miles of Travel (VMT) and Vehicle Hours of Travel (VHT). However, the additional capacity provided by the recommended plan would enhance overall traffic flow on the County’s roadway system. This enhancement is shown by the one percent increase in projected average speeds and the three percent decrease in Vehicle Miles of Travel that would occur in congested conditions.

**Table 19. 2035 Forecasted Effects of Transportation Plan Improvements**

Measure	County System with Existing & Committed Road Improvements Only (no Transportation Plan Recommendations)	County System with Recommended Transportation Plan Improvements	Change Due to Transportation Plan Improvements
Vehicle Miles of Travel (VMT)	18,626,000	18,877,000	+ 1%
Vehicle Hours of Travel (VHT)	658,500	660,800	0%
Average Speed	28.3 mph	28.6 mph	+ 1%
Congested VMT	5,838,000	5,681,000	- 3%

Many of the major roadway infrastructure improvements will be dependent on state/federal funding, funding partnerships with local jurisdictions, or developer funding. Given that public transportation funding is severely limited and development construction is historically low, many of the major roadway projects within the Transportation Plan may not be completed and actual congestion on County roadways would subsequently be more prevalent. Arapahoe County collaboration with local partners, CDOT, and private developers will be critical for implementing future improvements, especially in the urban area between I-25, I-225, and E-470 in the Denver metropolitan area and the development areas between E-470 and Kiowa-Bennett Road.

**Projected 2020 Operations**

The Transportation Plan identifies transportation improvements targeted for implementation between 2010 and 2020. These are labeled “short term” in the list of improvements in **Appendix B**. The only new roadway connection within the east end of Arapahoe County slated for construction by 2020 is the Quincy Avenue extension from Bradbury Road to Exmoor Road, which is also on the current Arapahoe County Capital Improvements Program (CIP). Major capacity improvements in the west end of the County include widening Arapahoe Road, Easter Avenue, Gun Club Road, Hampden Avenue, Quincy Avenue, Jewell Avenue, and Iliff Avenue.

Projected traffic volumes with the recommended transportation improvements for year 2020 are presented in **Figures 28 and 29**. The roadways which are expected to be congested in 2020, even with the recommended improvements, are arterials within the Denver metropolitan area, such as Hampden Avenue west of I-25, Bowles Avenue west of Santa Fe Avenue (US 85), Smoky Hill Road, Arapahoe Road west of Quebec Street and east of I-25, and Parker Road (US 83). Reviewing the roadways owned and maintained by Arapahoe County, forecasted traffic will generally be uncongested. If development of the Lowry Range area and/or the TransPort development occurs within this timeframe, widening Watkins Road to four lanes (with anticipation of the ultimate six-lane cross-section) would accommodate the anticipated 2020 traffic volumes.

**Projected 2035 Operations**

The Transportation Plan identifies the improvements expected to be implemented between 2020 and 2035. These are labeled “mid term” (2020-2030) and “long term” (2030-2035) in the list of improvements in **Appendix B**. All of the major new roadway connections in the east end of the County are expected to occur in these later years, provided that development along the Watkins Road corridor and within the area around the Town of Bennett has occurred.

Projected traffic volumes with the recommended improvements for year 2035 are presented in **Figures 30 and 31**. The major roadways which are forecasted to be congested in 2035, even with the recommended improvements completed, are the same arterials within the Denver metropolitan area anticipated for congestion in 2020. Reviewing the roadways owned and maintained by Arapahoe County, forecasted traffic is generally expected to travel without congestion. Arapahoe Road east of Waco Street and Watkins Road between Quincy Avenue and I-70 are projected to operate above capacity with congestion during peak periods.

Figure 28. Projected 2020 Travel Forecasts with Transportation Plan Improvements – West End

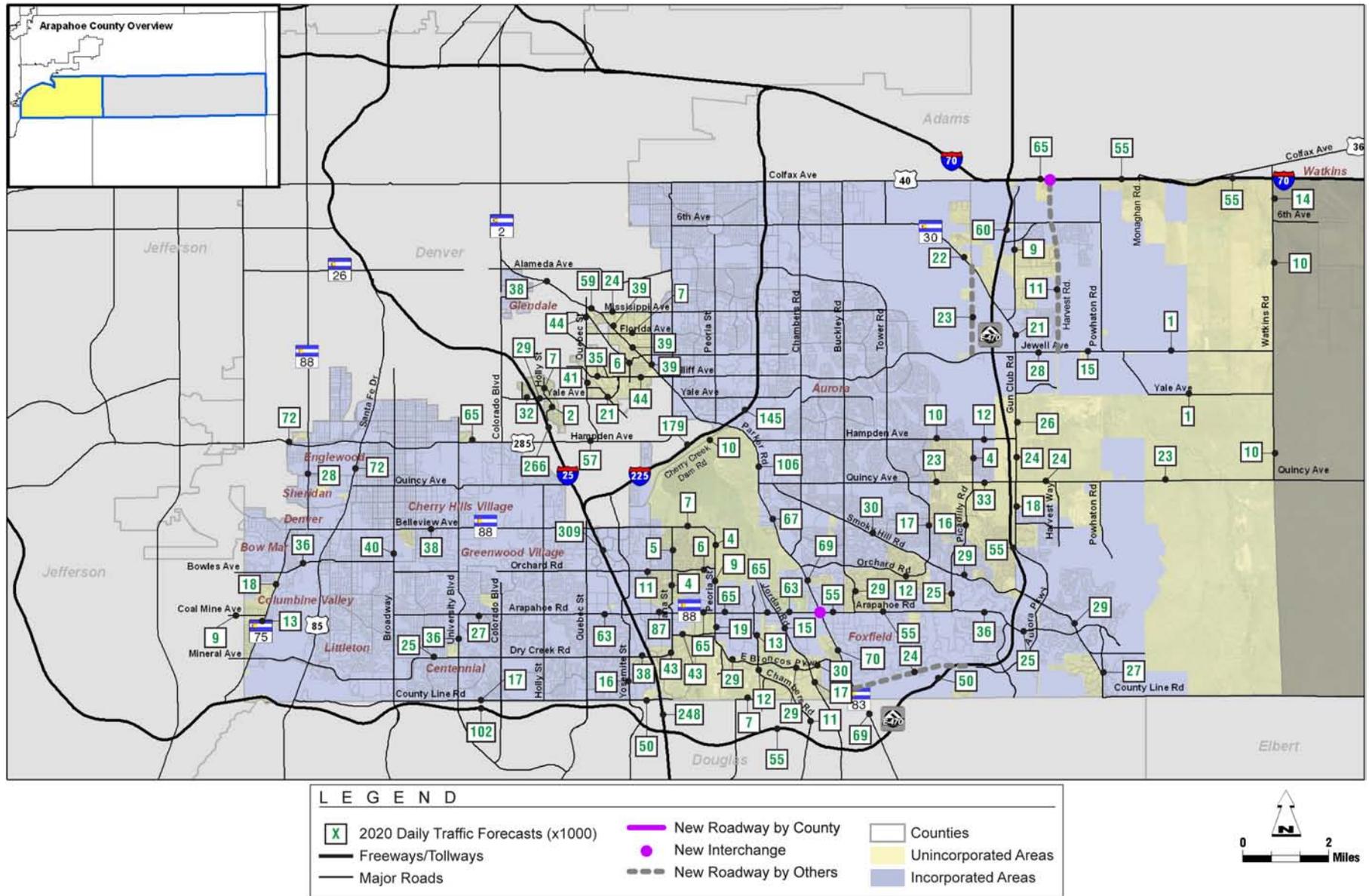


Figure 29. Projected 2020 Travel Forecasts with Transportation Plan Improvements – East End

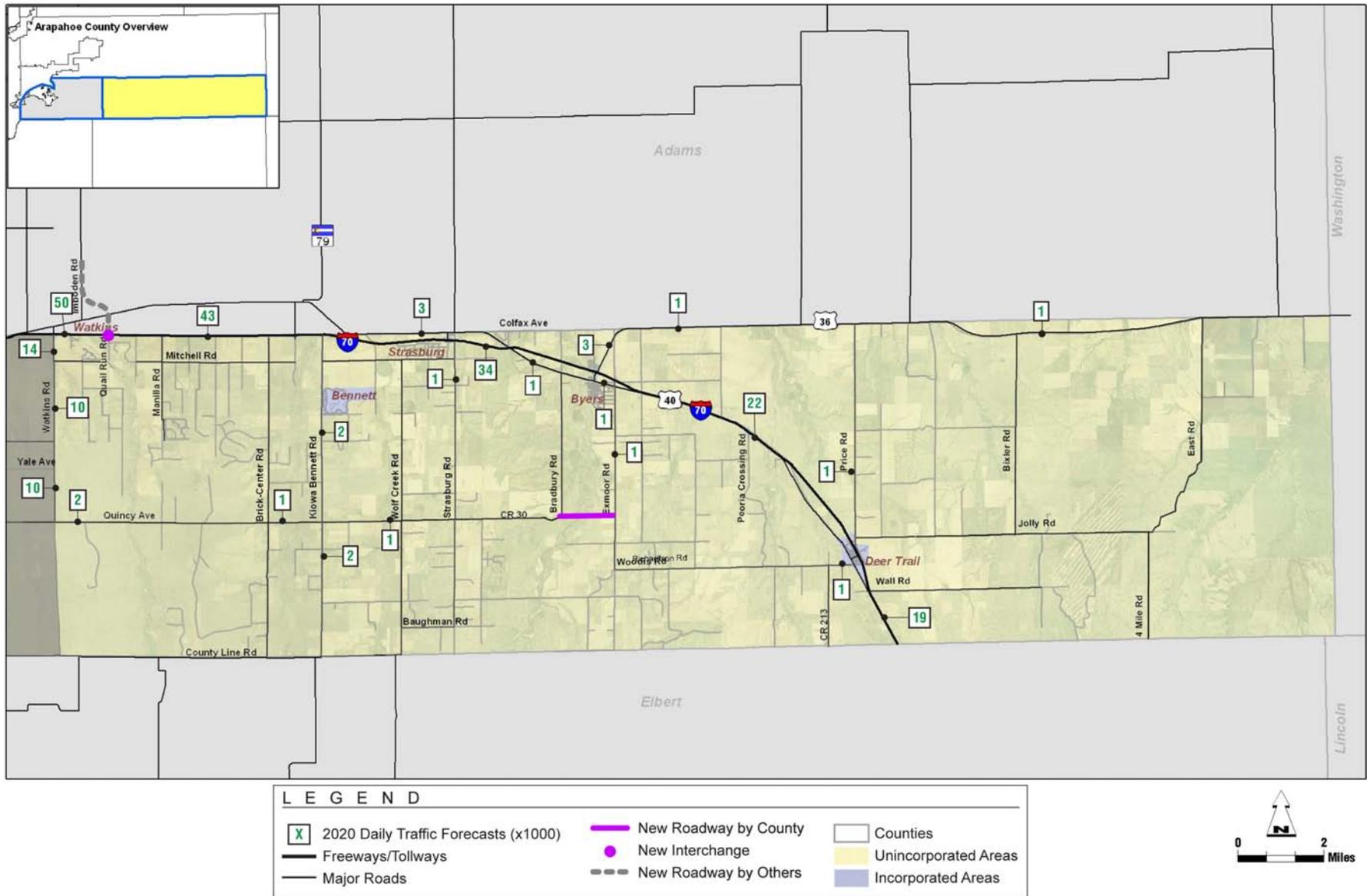


Figure 30. Projected 2035 Travel Forecasts with Transportation Plan Improvements – West End

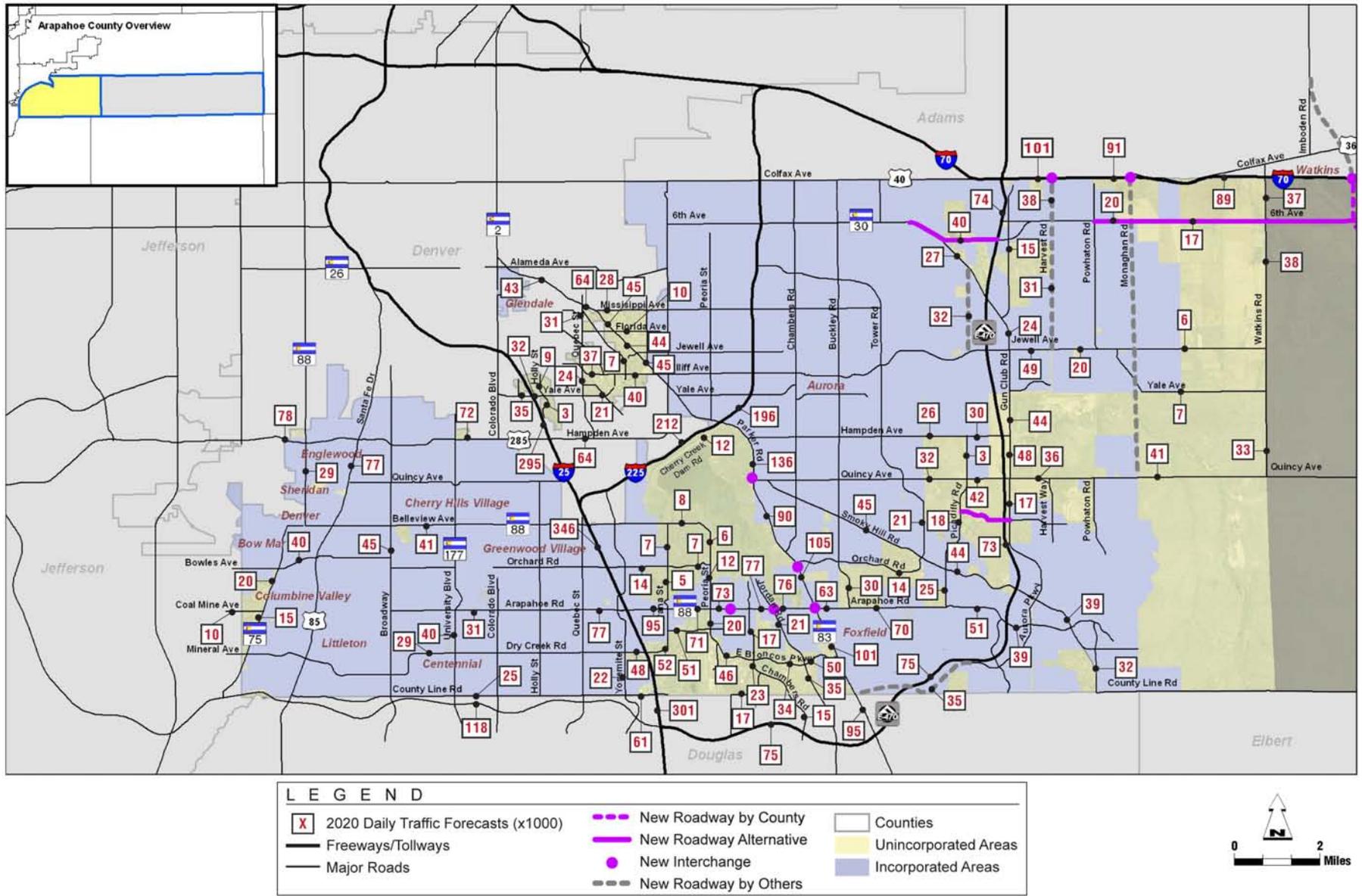
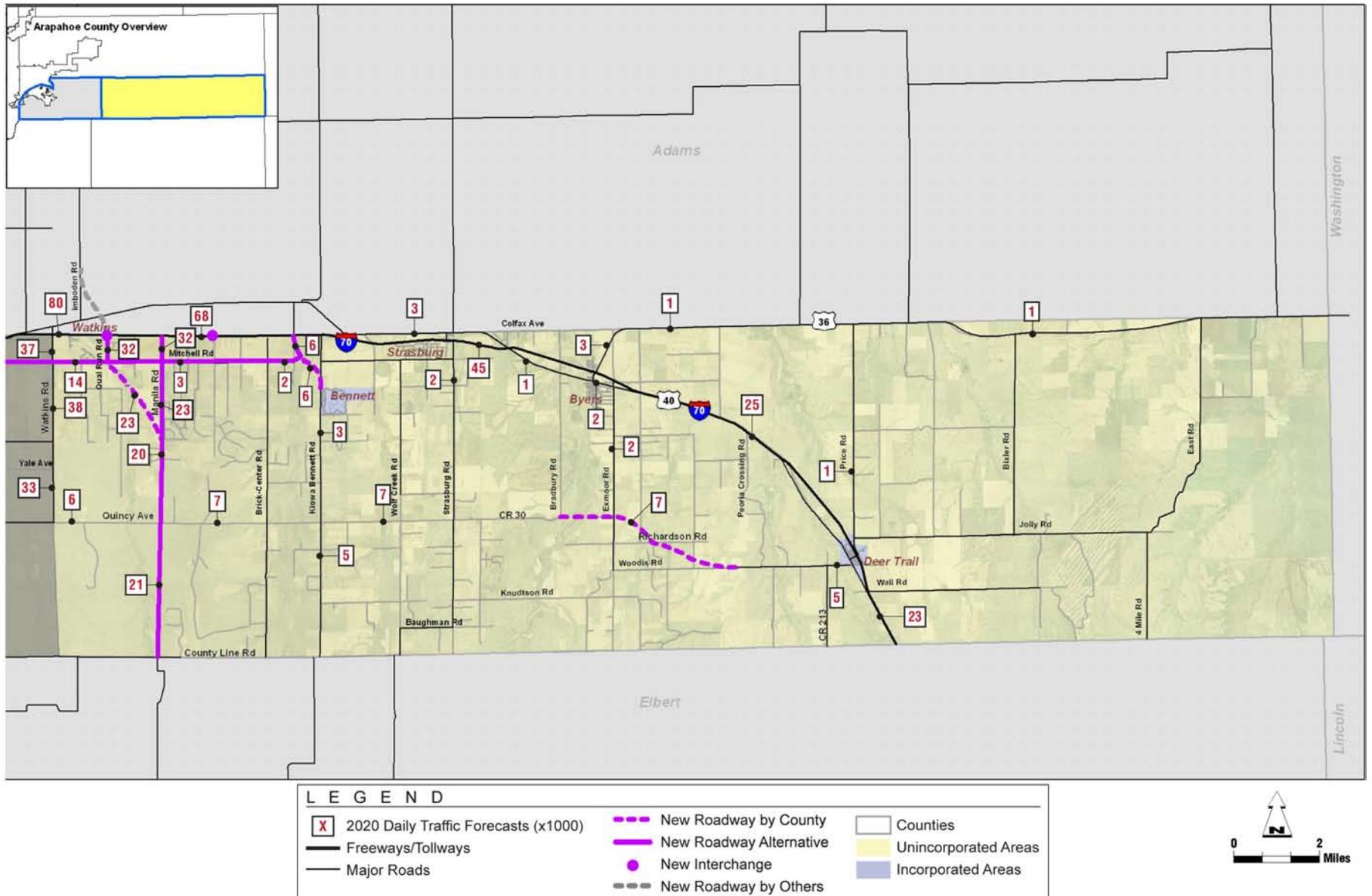


Figure 31. Projected 2035 Travel Forecasts with Transportation Plan Improvements – East End



## **7.2. High Growth Sensitivity Review**

As seen in Chapter 3, a High Growth land use scenario and travel forecast scenario was developed to test if the Transportation Plan recommendations will provide adequate levels of service if development occurs more rapidly than expected. Projected traffic volumes with the recommended improvements for the High Growth scenario are presented in **Figures 32 and 33**. These figures provide the travel forecasts for roadways which are projected to increase by at least 2,000 vehicles per day (vpd), compared with baseline 2035 forecasts, as a result of the High Growth scenario.

As shown, substantial increases in the travel forecasts are projected with the High Growth land use scenario adjacent to the TransPort development, the Lowry Range development area, and the Parker Road Corridor. With this level of growth, these corridors will experience congestion, even with the improvements identified in the Transportation Plan.

System management and operational improvements, such as TDM and ITS strategies, transit strategies, and access management, would help mitigate some of this congestion. The future policies and right-of-way that may be necessary to implement these types of system and operational management strategies should be considered during the initial planning and design for each corridor.

Figure 32. Projected High Growth County Transportation System – West End

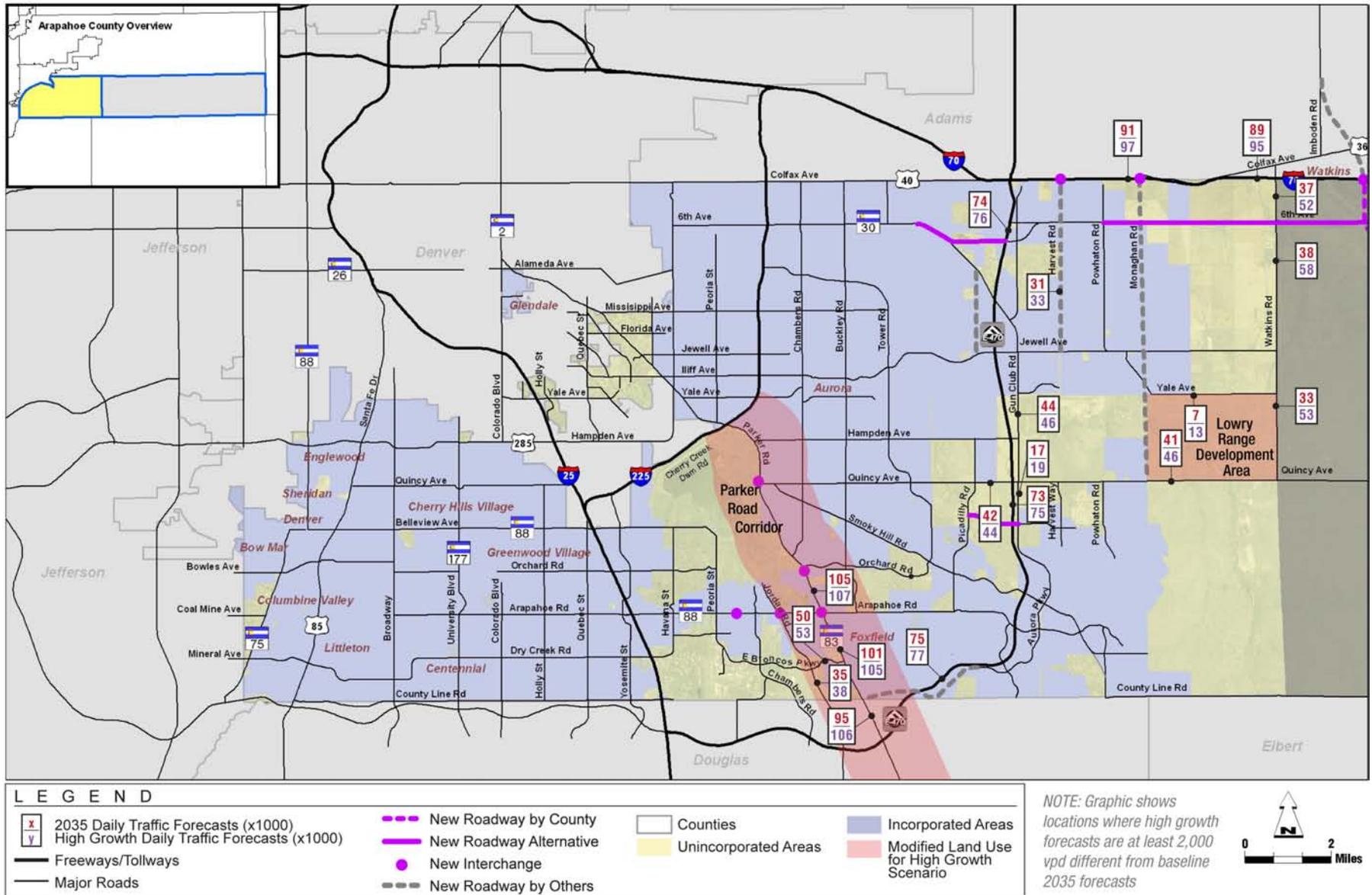
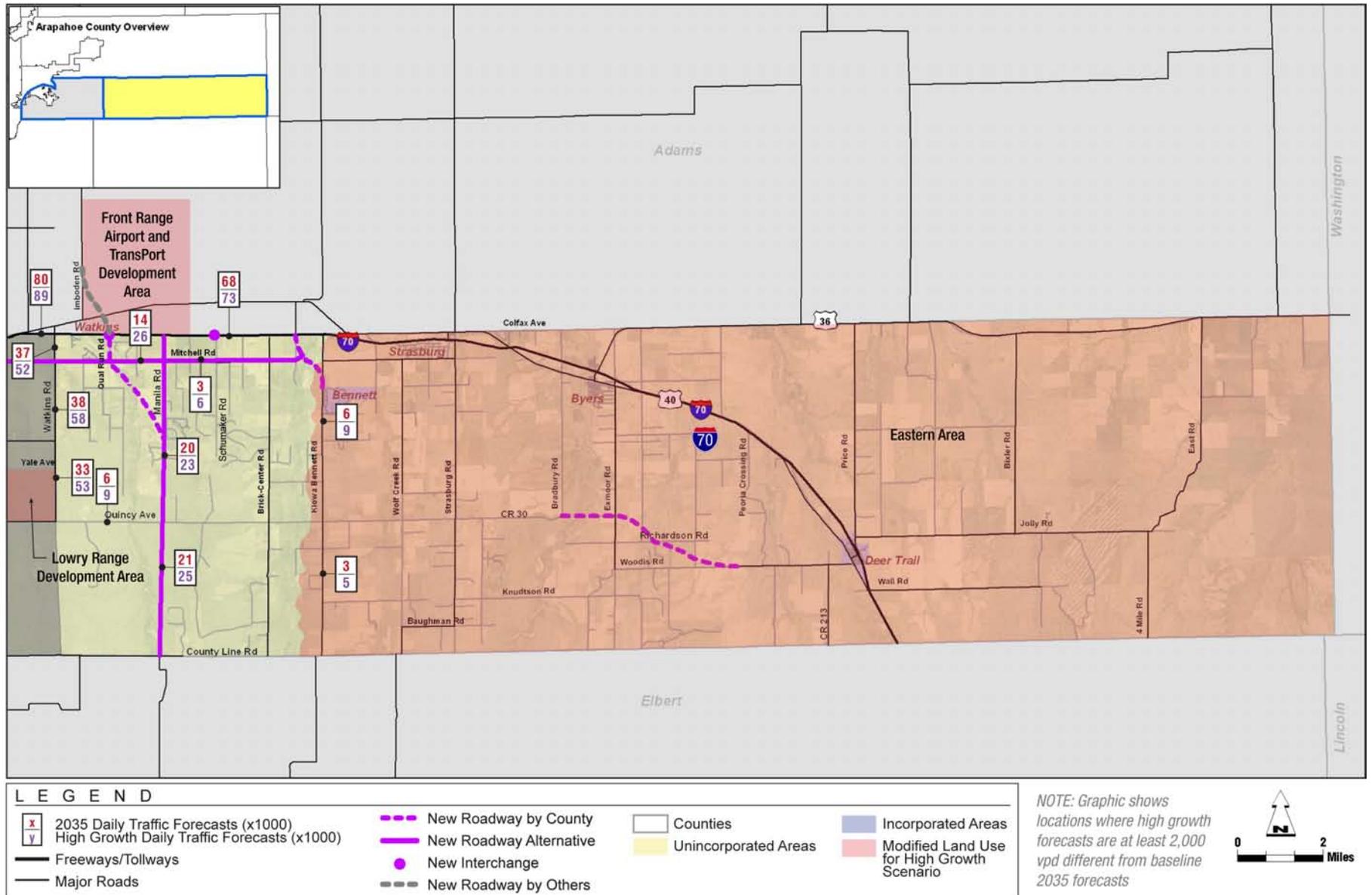


Figure 33. Projected High Growth County Transportation System – East End



*Arapahoe County  
2035  
Transportation Plan*

**Technical Appendix**

**November 2010**



**Appendix A**

**Traffic Analysis Zones and Land Use Information**



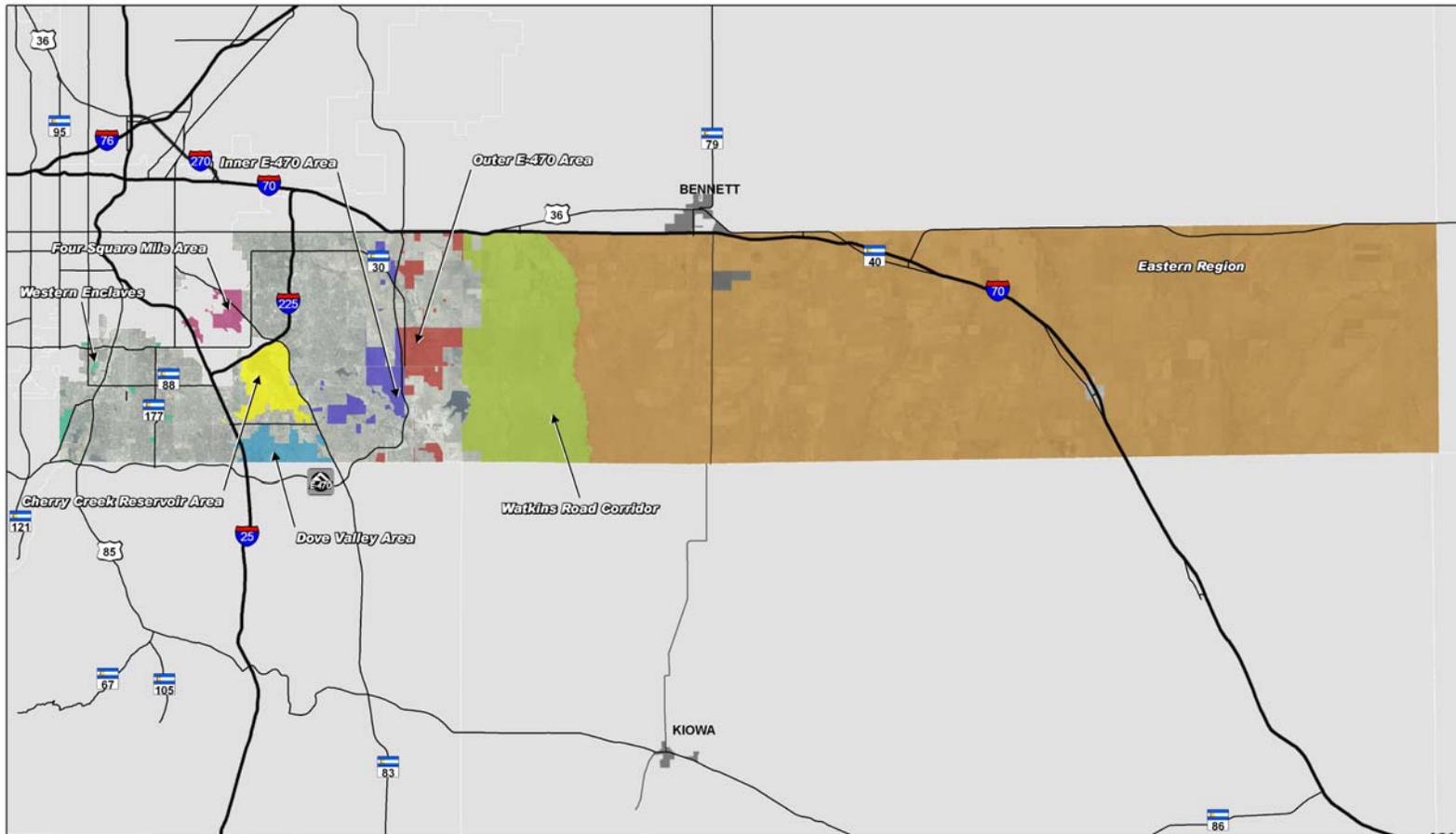
## Land Use by Super Zone



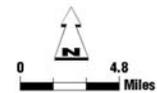
**Unincorporated Arapahoe County  
Land Use Data by Super Zone**

Super Zone	2005	2020		2035		2035 High Growth	
	Households	Households	Percent Growth	Households	Percent Growth	Households	Percent Growth
Cherry Creek Reservoir Area	4,809	5,850	22%	7,249	51%	7,249	51%
Dove Valley Area	1,434	2,445	71%	3,809	166%	5,613	291%
Eastern Region	2,378	6,262	163%	11,649	390%	12,306	417%
Four-Square Mile Area	8,822	9,737	10%	11,009	25%	11,009	25%
Inner E-470 Area	8,795	12,049	37%	16,572	88%	16,572	88%
Outer E-470 Area	1,366	4,814	252%	9,600	603%	9,600	603%
Watkins Road Corridor	180	5,482	2945%	15,762	8657%	24,397	13454%
Western Enclaves	3,020	3,191	6%	3,426	13%	3,426	13%
Super Zone Total	30,804	49,830	62%	79,076	157%	90,172	193%
Arapahoe County Total	209,275	276,408	32%	363,990	74%		

Super Zone	2005	2020		2035		2035 High Growth	
	Employment	Employment	Percent Growth	Employment	Percent Growth	Employment	Percent Growth
Cherry Creek Reservoir Area	5,558	7,201	30%	8,569	54%	8,569	54%
Dove Valley Area	26,261	35,863	37%	42,707	63%	45,393	63%
Eastern Region	831	1,310	58%	1,793	116%	1,793	116%
Four-Square Mile Area	6,413	7,448	16%	8,132	27%	8,132	27%
Inner E-470 Area	3,823	3,993	4%	4,288	12%	4,288	12%
Outer E-470 Area	499	2,808	463%	4,602	822%	4,602	822%
Watkins Road Corridor	52	2,398	4512%	7,104	13562%	16,304	31254%
Western Enclaves	1,916	2,105	10%	2,217	16%	2,217	16%
Super Zone Total	45,353	63,126	39%	79,412	75%	91,298	101%
Arapahoe County Total	265,370	357,810	35%	400,315	51%		



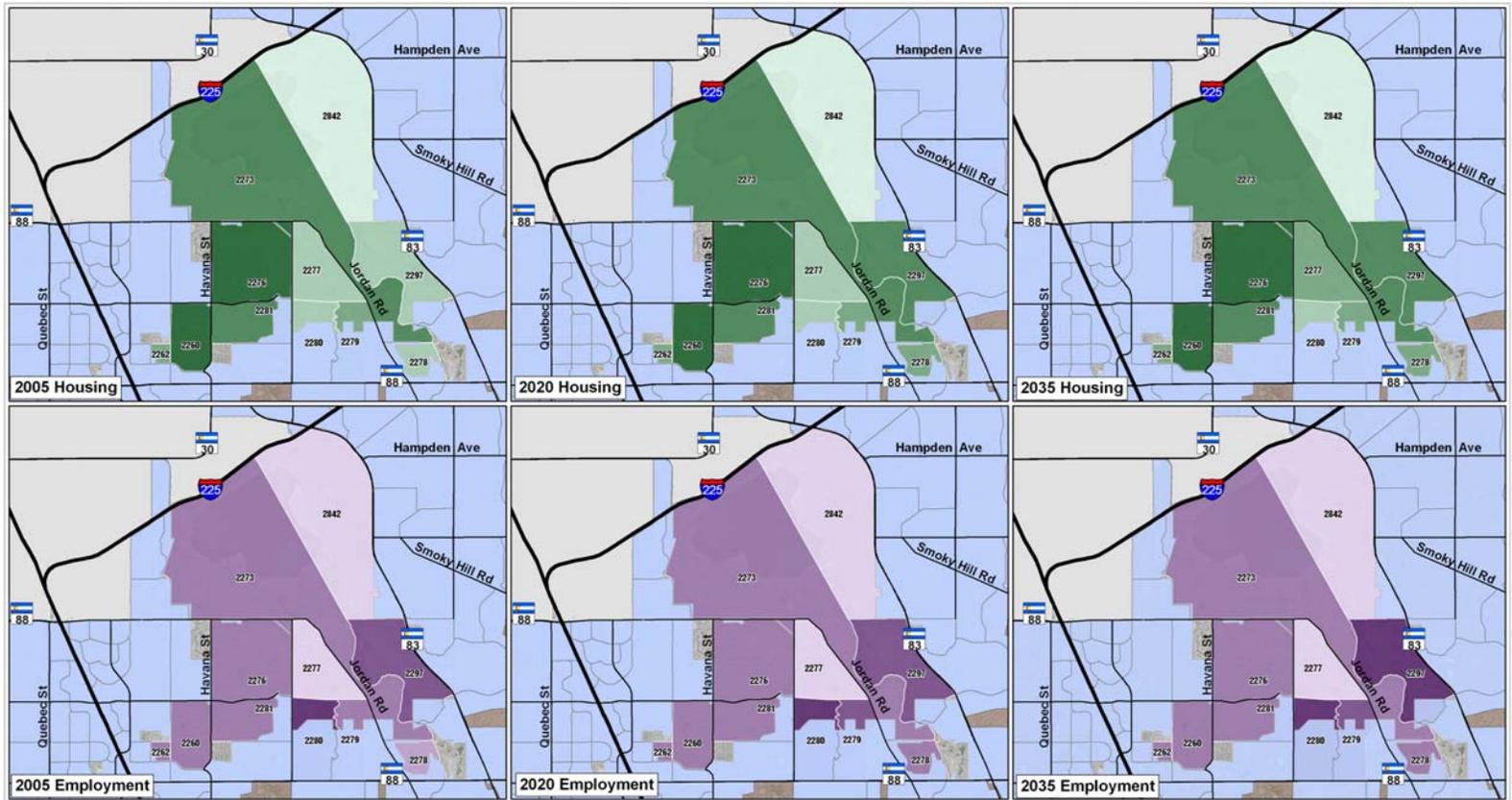
LEGEND		
	Interstates	Super Zones Group
	Major Roads	Eastern Region
	Four Square Mile Area	Inner E-470 Area
	Cherry Creek Reservoir Area	Outer E-470 Area
	Dove Valley Area	Watkins Road Corridor
	Western Enclaves	



TAZ	2005	2020	2035
	Households	Households	Households
2223	1	395	941
2260	1312	1556	1895
2262	225	278	353
2273	506	506	506
2276	1089	1089	1089
2277	69	88	114
2278	62	190	368
2279	143	228	312
2280	58	58	58
2281	782	868	987
2297	513	517	520
2839	49	77	106
2842	0	0	0
Cherry Creek Reservoir Area	4809	5850	7249
Percent Growth		22%	51%

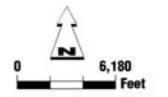
TAZ	2005	2020	2035
	Employment	Employment	Employment
2223	1013	1953	2671
2260	299	301	328
2262	323	318	323
2273	266	264	266
2276	167	176	184
2277	2	8	13
2278	53	187	290
2279	455	598	740
2280	2239	2275	2239
2281	158	151	158
2297	583	970	1357
2839	0	0	0
2842	0	0	0
Cherry Creek Reservoir Area	5558	7201	8569
Percent Growth		30%	54%

Cherry Creek Reservoir Area



**LEGEND**

<b>Cherry Creek Reservoir Area</b>		— Interstates
<b>Housing</b>	<b>Employment</b>	— Major Roads
0 - 50	0 - 50	Other Super Zones
51 - 100	51 - 100	Incorporated Arapahoe Co.
101 - 500	101 - 500	Other Counties
501 - 1000	501 - 1000	
> 1000	> 1000	



TAZ	2005	2020	2035
	Households	Households	Households
2238	0	0	0
2239	1	12	28
2243	0	0	0
2270	7	7	7
2283	0	0	0
2284	15	17	20
2286	0	0	0
2287	175	288	445
2288	175	175	175
2289	51	251	528
2290	132	322	585
2291	33	33	33
2292	14	14	14
2293	17	17	17
2294	62	62	62
2295	151	484	946
2296	134	143	156
2310	0	0	0
2325	86	139	213
2835	73	73	73
2838	94	94	94
2840	214	314	413
Dove Valley Area	1434	2445	3809
Percent Growth		71%	166%

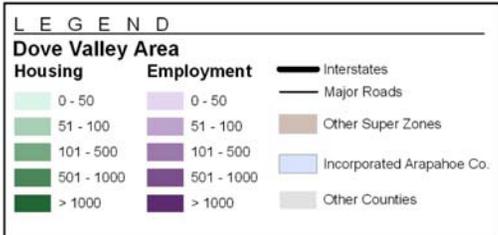
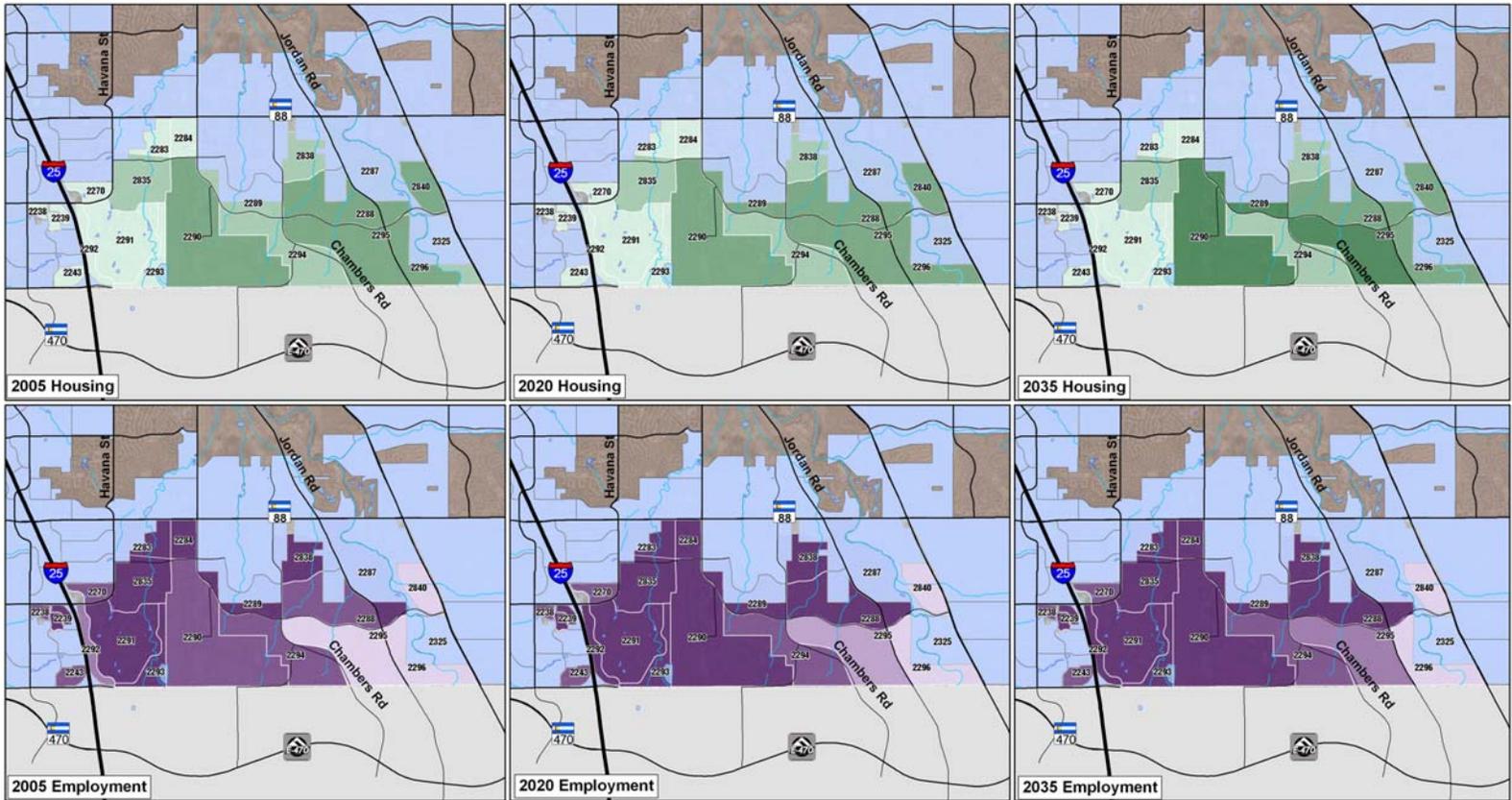
2035 High Growth Households
0
28
0
7
0
20
0
651
750
528
585
33
14
17
0
0
1000
1400
73
94
413
5613
291%

TAZ	2005	2020	2035
	Employment	Employment	Employment
2238	899	929	899
2239	1017	2084	2817
2243	678	691	678
2270	569	705	789
2283	3343	3402	3462
2284	1078	1051	1078
2286	217	233	250
2287	1645	1643	1645
2288	931	1148	1316
2289	3211	3451	3493
2290	969	1605	2095
2291	5936	9132	11340
2292	480	2107	3304
2293	1692	3505	4798
2294	907	917	935
2295	0	59	104
2296	14	21	24
2310	29	396	762
2325	0	14	25
2835	1365	1390	1414
2838	1281	1380	1479
2840	0	0	0
Dove Valley Area	26261	35863	42707
Percent Growth		37%	63%

2035 High Growth Employment
899
2817
678
789
3462
1078
250
1645
1326
3493
2095
11340
3304
4798
936
900
25
762
1903
1414
1479
0
45393
73%

# Arapahoe County 2035 Transportation Plan

## Dove Valley Area



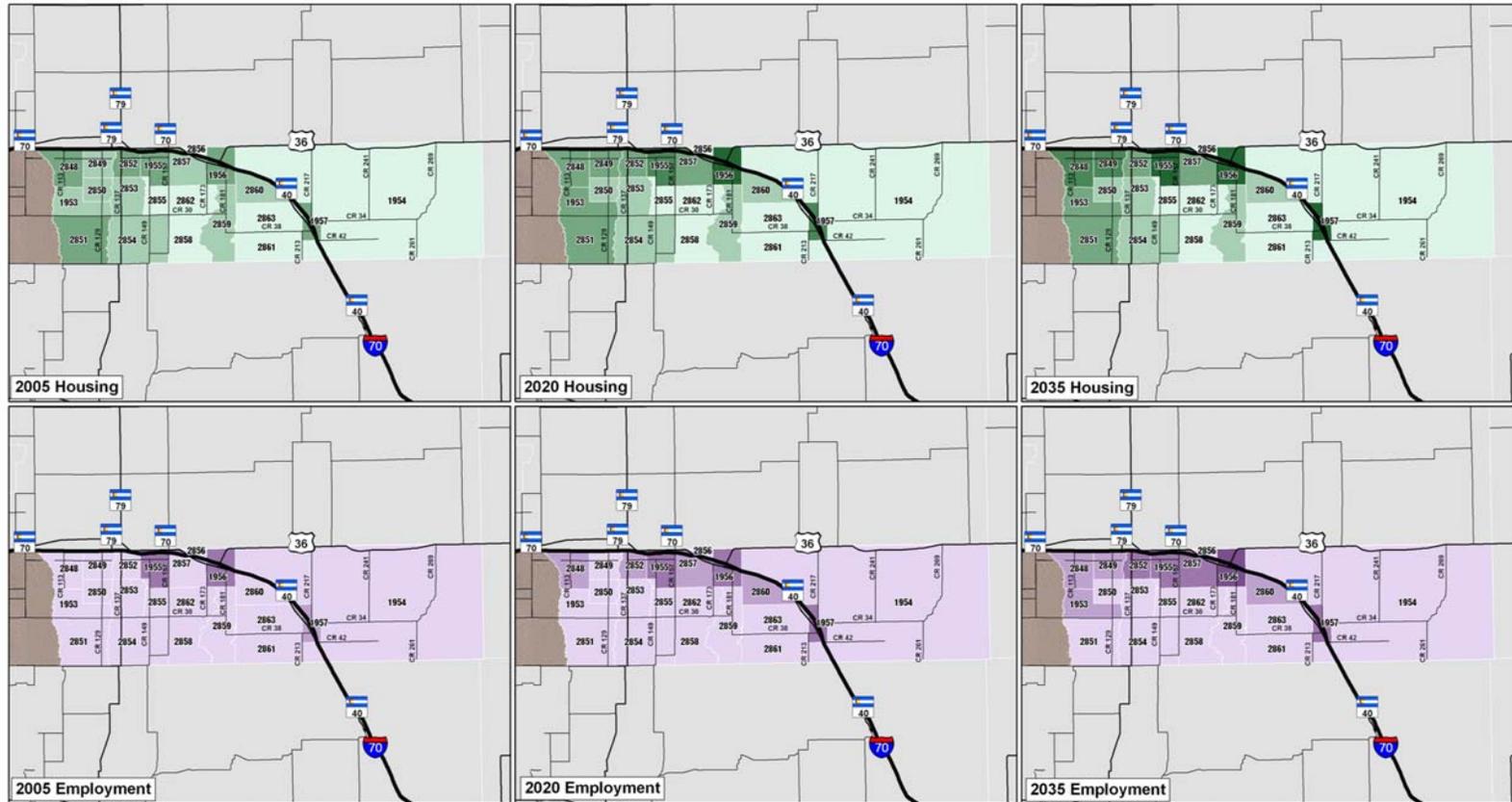
TAZ	2005	2020	2035
	Households	Households	Households
1953	56	160	289
1954	45	45	45
1955 (Strasburg)	230	620	1161
1956 (Byers)	471	2443	5181
1957 (Deer Trail)	262	924	1844
2848	224	481	940
2849	84	401	723
2850	95	95	96
2851	101	200	362
2852	185	215	260
2853	90	90	90
2854	80	80	80
2855	25	35	50
2856	20	25	40
2857	95	118	143
2858	45	45	45
2859	85	85	85
2860	70	85	100
2861	45	45	45
2862	30	30	30
2863	40	40	40
Eastern Region	2378	6262	11649
Percent Growth		163%	390%

2035 High Growth Households
289
145
1161
5181
1844
940
723
96
362
410
150
110
65
50
235
65
115
210
55
45
55
12306
417%

TAZ	2005	2020	2035
	Employment	Employment	Employment
1953	12	40	56
1954	12	12	12
1955 (Strasburg)	137	196	260
1956 (Byers)	289	401	569
1957 (Deer Trail)	65	118	174
2848	46	70	99
2849	17	40	56
2850	20	20	28
2851	21	30	42
2852	48	95	128
2853	24	24	24
2854	21	21	21
2855	7	17	28
2856	5	10	15
2857	25	87	127
2858	12	12	12
2859	22	22	22
2860	18	65	90
2861	12	12	12
2862	8	8	8
2863	10	10	10
Eastern Region	831	1310	1793
Percent Growth		58%	116%

# Arapahoe County 2035 Transportation Plan

## Eastern Region



2005 Housing

2020 Housing

2035 Housing

2005 Employment

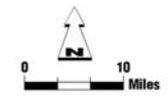
2020 Employment

2035 Employment

**LEGEND**

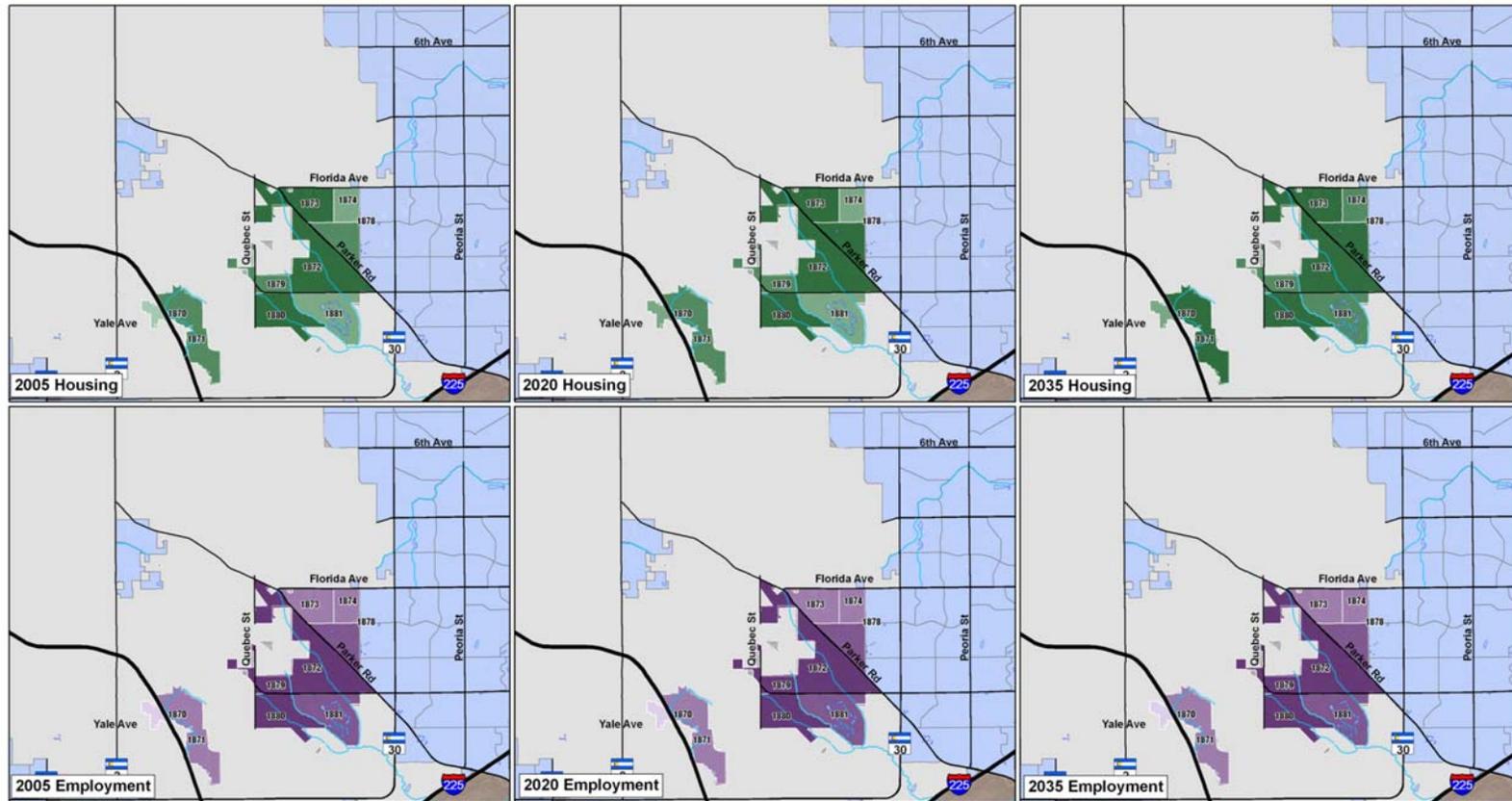
**Eastern Region**

<b>Housing</b>	<b>Employment</b>	Interstates
0 - 50	0 - 50	Major Roads
51 - 100	51 - 100	Other Super Zones
101 - 500	101 - 500	Incorporated Arapahoe Co.
501 - 1000	501 - 1000	Other Counties
> 1000	> 1000	



TAZ	2005	2020	2035
	Households	Households	Households
1870	97	113	135
1871	909	962	1036
1872	1865	2126	2487
1873	1346	1517	1755
1874	301	392	519
1878	965	1095	1275
1879	839	880	937
1880	2087	2187	2327
1881	413	465	538
Four-Square Mile Area	8822	9737	11009
Percent Growth		10%	25%

TAZ	2005	2020	2035
	Employment	Employment	Employment
1870	9	28	40
1871	249	375	454
1872	2030	2368	2611
1873	187	202	223
1874	160	153	160
1878	539	532	539
1879	1071	1155	1195
1880	1648	2080	2338
1881	520	555	572
Four-Square Mile Area	6413	7448	8132
Percent Growth		16%	27%



**LEGEND**

<b>Four Square Mile Area</b>		— Interstates
<b>Housing</b>	<b>Employment</b>	— Major Roads
0 - 50	0 - 50	Other Super Zones
51 - 100	51 - 100	Incorporated Arapahoe Co.
101 - 500	101 - 500	Other Counties
501 - 1000	501 - 1000	
> 1000	> 1000	

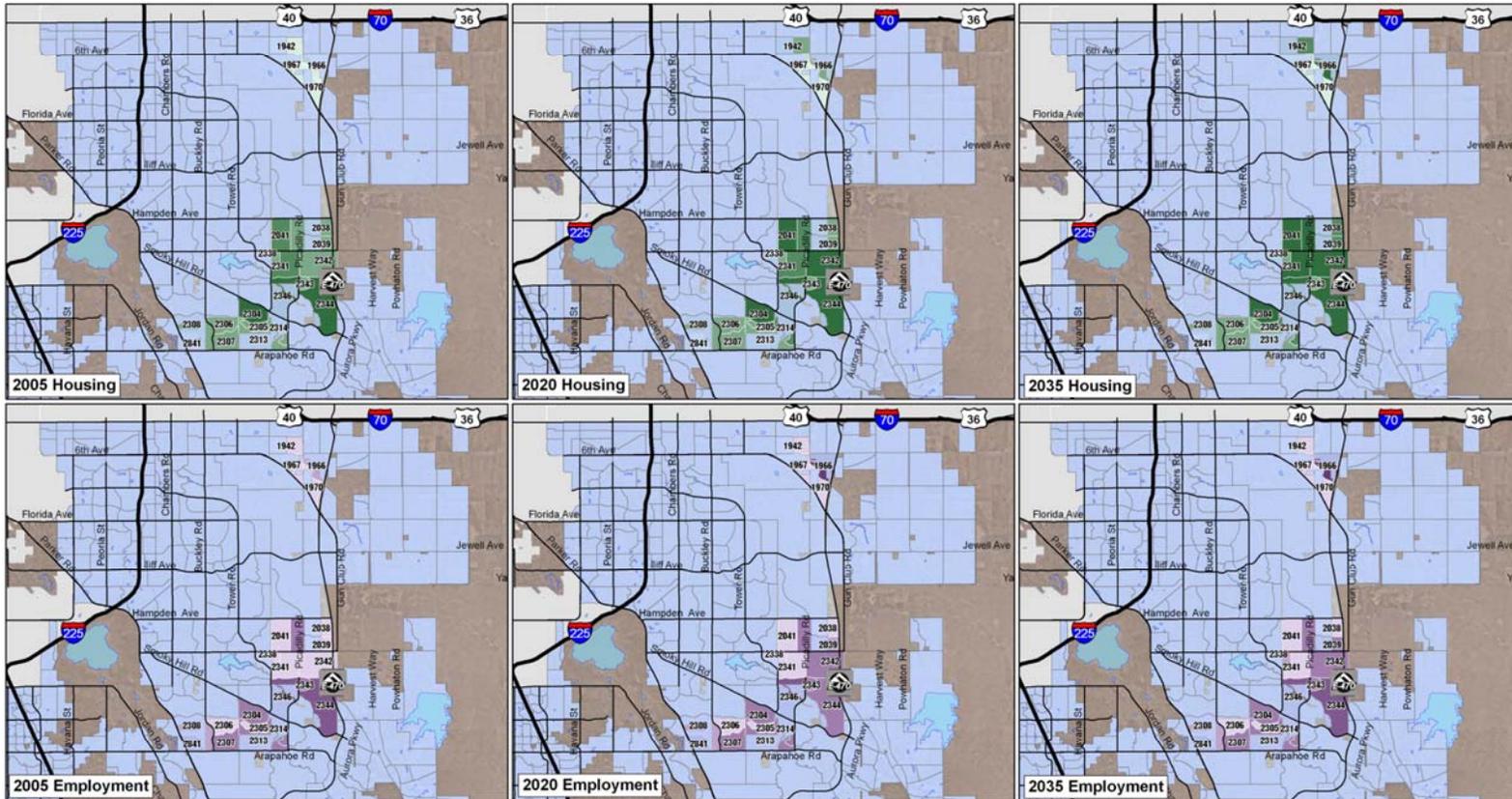


TAZ	2005	2020	2035
	Households	Households	Households
2038	124	294	531
2039	246	477	798
2040	175	811	1694
2041	914	1072	1291
2304	1125	1198	1299
2305	176	251	355
2306	199	199	199
2307	278	321	380
2308	444	454	463
2313	358	373	394
2314	468	685	987
2338	360	360	360
2341	603	897	1306
2342	340	1170	2323
2343	102	102	102
2344	1296	1580	1974
2346	1587	1805	2116
2841	0	0	0
Inner E-470 Area	8795	12049	16572
Percent Growth		37%	88%

TAZ	2005	2020	2035
	Employment	Employment	Employment
2038	3	2	3
2039	34	93	136
2040	116	129	174
2041	50	45	50
2304	224	217	224
2305	27	25	27
2306	28	28	28
2307	170	165	170
2308	55	55	55
2313	115	113	115
2314	206	191	206
2338	3	38	51
2341	24	27	36
2342	0	140	245
2343	315	314	315
2344	518	494	518
2346	550	532	550
2841	1385	1385	1385
Inner E-470 Area	3823	3993	4288
Percent Growth		4%	12%

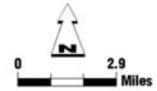
# Arapahoe County 2035 Transportation Plan

## Inner E-470 Area



**LEGEND**  
Inner E-470 Area

<b>Housing</b>	<b>Employment</b>	<b>Interstates</b>
0 - 50	0 - 50	Major Roads
51 - 100	51 - 100	Other Super Zones
101 - 500	101 - 500	Incorporated Arapahoe Co.
501 - 1000	501 - 1000	Other Counties
> 1000	> 1000	

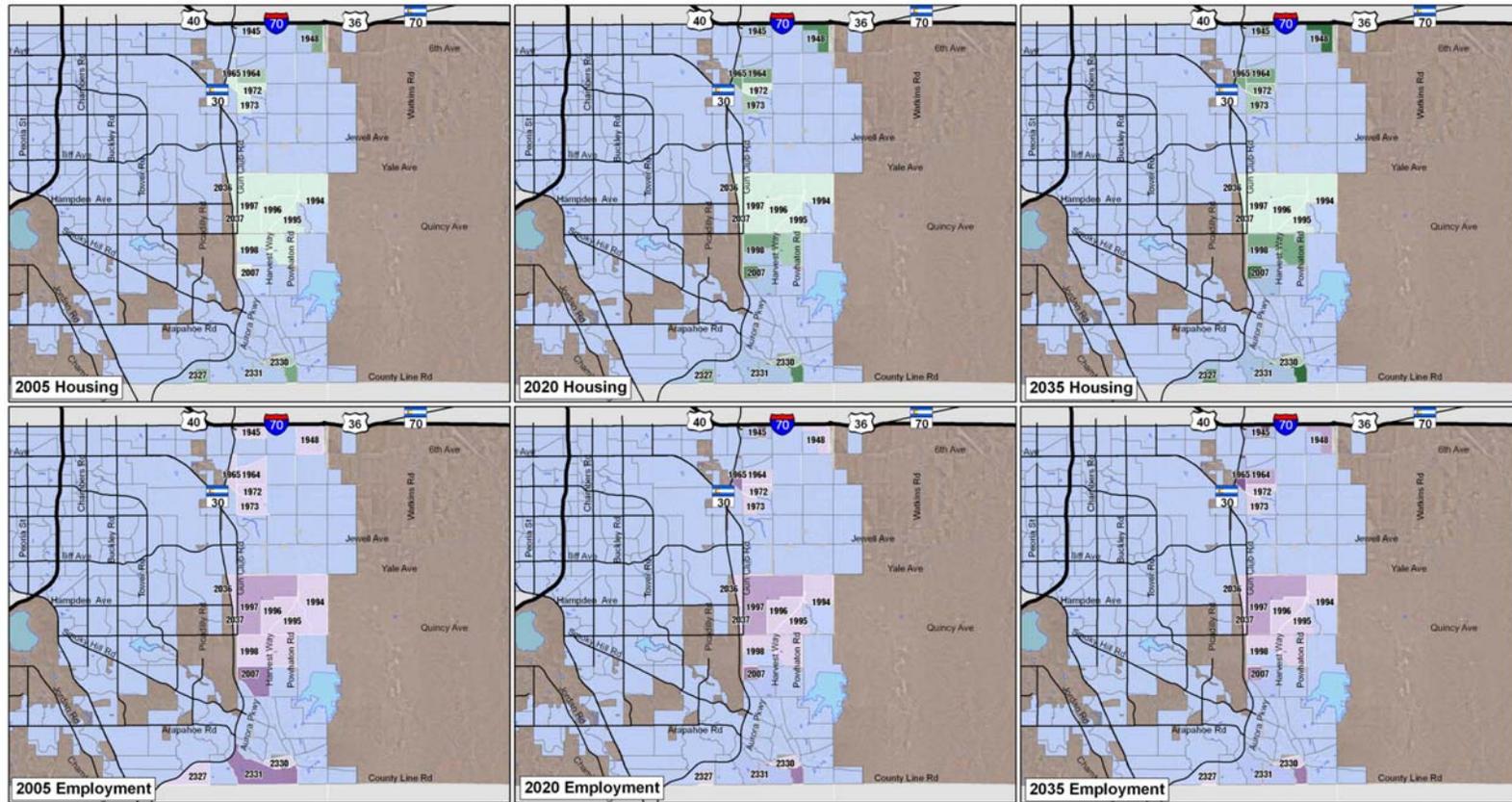


TAZ	2005	2020	2035
	Households	Households	Households
1942	38	395	890
1945	2	338	805
1948	459	973	1687
1964	68	190	360
1965	4	177	416
1966	7	492	1164
1967	12	19	30
1970	5	8	12
1972	31	41	54
1973	47	57	71
1994	4	4	4
1995	4	4	4
1996	1	1	1
1997	3	3	3
1998	27	153	329
1999	4	94	218
2007	29	536	1241
2036	15	15	15
2037	13	13	13
2327	118	442	892
2330	84	90	98
2331	391	769	1293
Outer E-470 Area	1366	4814	9600
Percent Growth		252%	603%

TAZ	2005	2020	2035
	Employment	Employment	Employment
1942	5	5	8
1945	0	432	739
1948	0	29	51
1964	7	41	64
1965	31	365	616
1966	53	1504	2598
1967	4	3	4
1970	4	4	4
1972	7	9	10
1973	4	4	4
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	64	65	64
1998	0	5	9
1999	0	4	7
2007	149	180	238
2036	0	0	0
2037	0	0	0
2327	0	9	15
2330	2	2	2
2331	169	147	169
Outer E-470 Area	499	2808	4602
Percent Growth		463%	822%

# Arapahoe County 2035 Transportation Plan

## Outer E-470 Area



2005 Housing

2020 Housing

2035 Housing

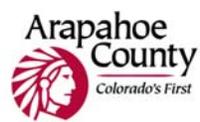
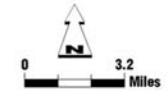
2005 Employment

2020 Employment

2035 Employment

**LEGEND**

<b>Outer E-470 Area</b>		<ul style="list-style-type: none"> <li> Interstates</li> <li> Major Roads</li> <li> Other Super Zones</li> <li> Incorporated Arapahoe Co.</li> <li> Other Counties</li> </ul>
<b>Housing</b>	<b>Employment</b>	
0 - 50	0 - 50	
51 - 100	51 - 100	
101 - 500	101 - 500	
501 - 1000	501 - 1000	
> 1000	> 1000	

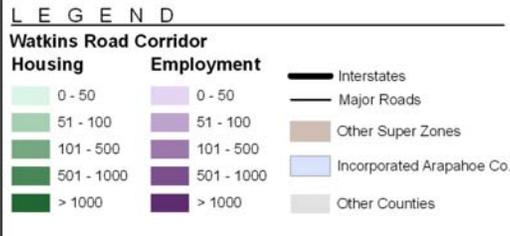
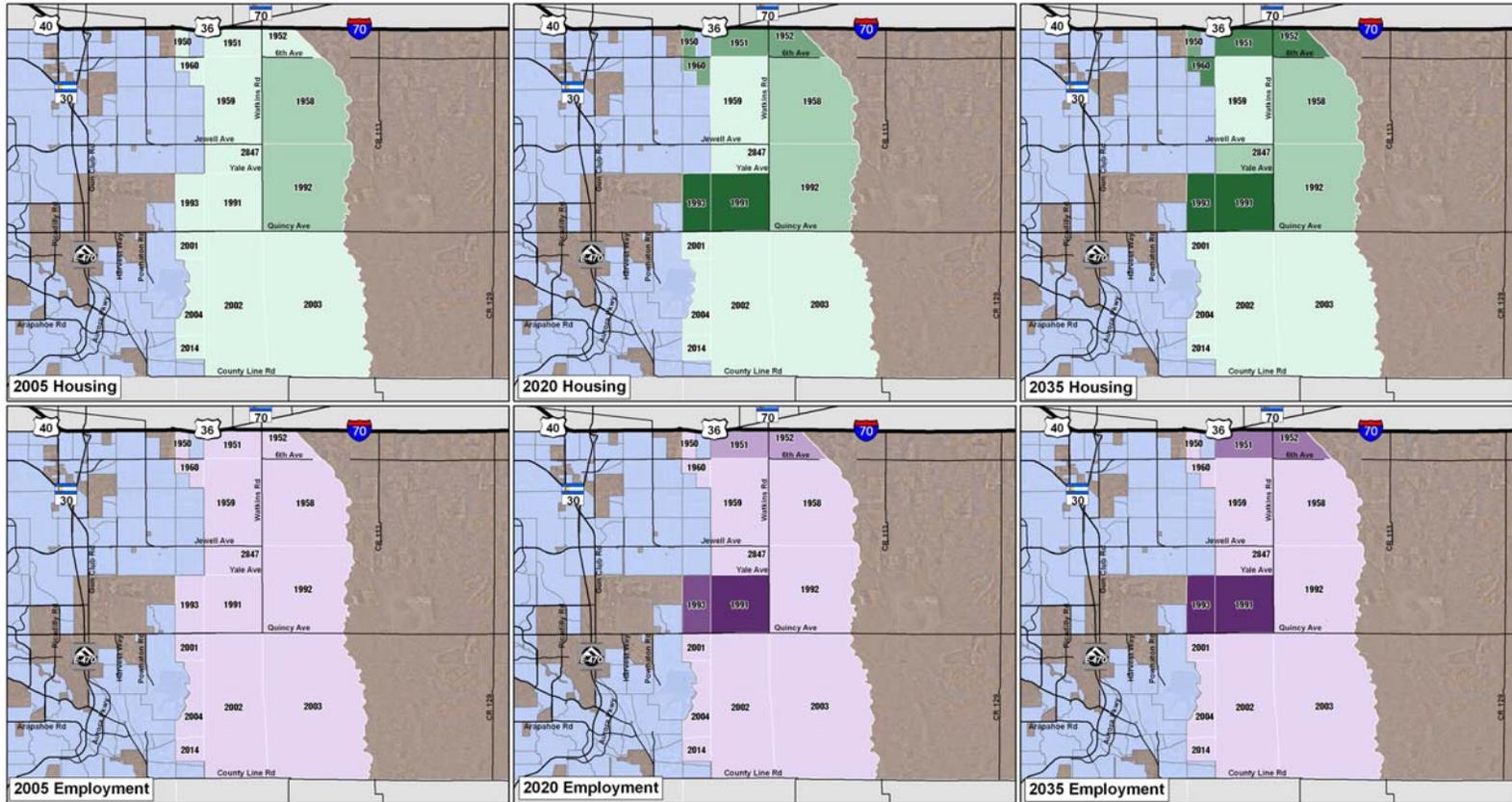


TAZ	2005	2020	2035	2035 High Growth
	Households	Households	Households	Households
1950	3	209	494	494
1951	10	200	599	599
1952	9	200	599	599
1958	73	73	73	73
1959	25	25	25	25
1960	2	368	876	876
1991 (Lowry Range Potential Development)	6	2878	8635	14391
1992 (Lowry Range Conservation Area)	51	51	51	51
1993 (Lowry Range Potential Development)	1	1439	4317	7196
2001 (Lowry Range Conservation Area)	0	0	0	0
2002 (Lowry Range Conservation Area)	0	0	0	0
2003 (Lowry Range Conservation Area)	0	0	0	0
2004 (Lowry Range Conservation Area)	0	0	0	0
2014 (Lowry Range Conservation Area)	0	0	0	0
2847	0	39	93	93
Watkins Road Corridor	180	5482	15762	24397
Percent Growth		2945%	8657%	13454%

TAZ	2005	2020	2035	2035 High Growth
	Employment	Employment	Employment	Employment
1950	0	0	0	0
1951	0	55	165	165
1952	20	55	165	165
1958	27	29	31	31
1959	4	4	4	4
1960	0	8	15	15
1991 (Lowry Range Potential Development)	1	1489	4467	10600
1992 (Lowry Range Conservation Area)	0	0	0	0
1993 (Lowry Range Potential Development)	0	744	2233	5300
2001 (Lowry Range Conservation Area)	0	0	0	0
2002 (Lowry Range Conservation Area)	0	0	0	0
2003 (Lowry Range Conservation Area)	0	0	0	0
2004 (Lowry Range Conservation Area)	0	0	0	0
2014 (Lowry Range Conservation Area)	0	0	0	0
2847	0	14	25	25
Watkins Road Corridor	52	2398	7104	16304
Percent Growth		4512%	13562%	31254%

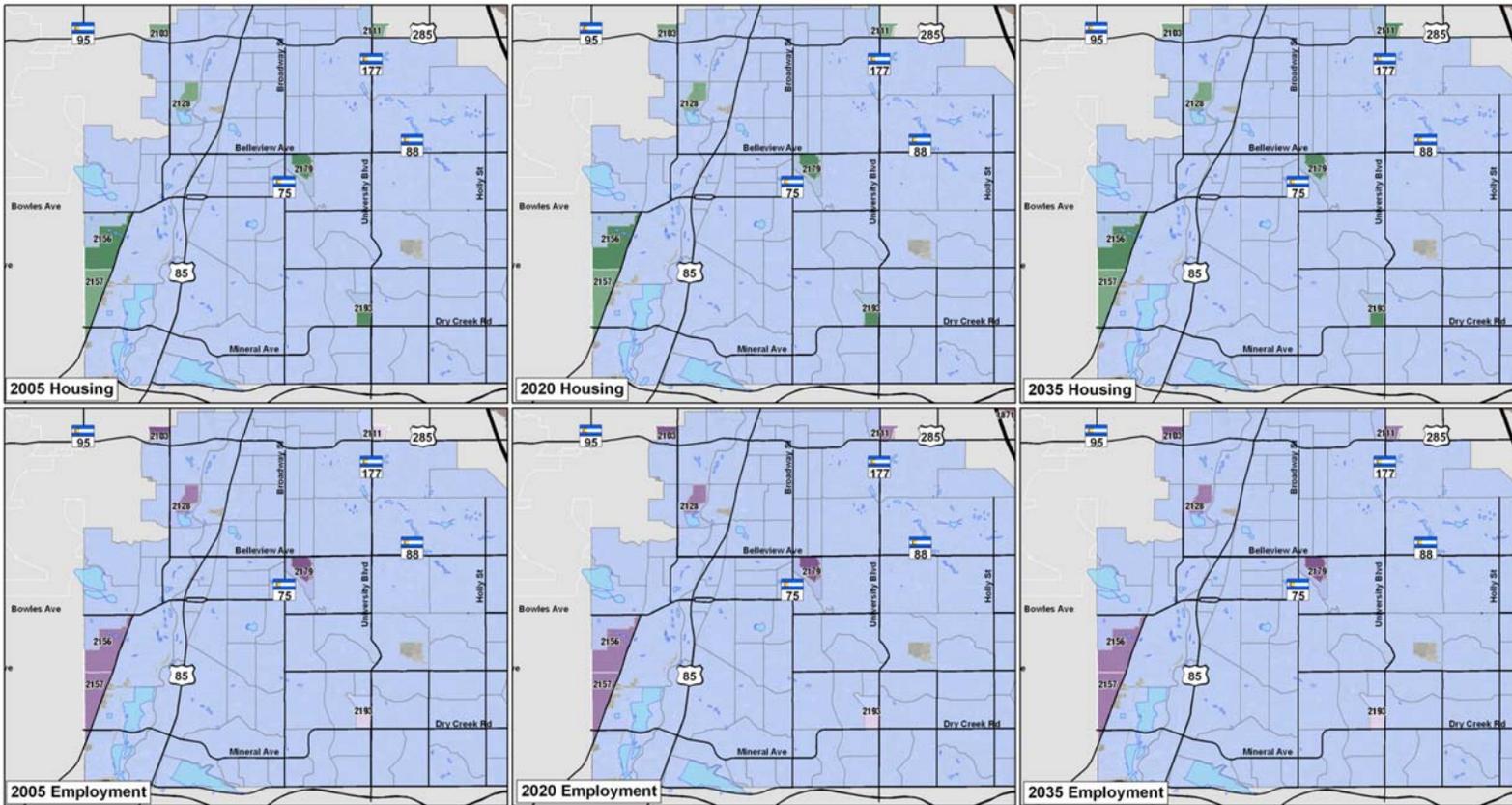
# Arapahoe County 2035 Transportation Plan

## Watkins Road Corridor



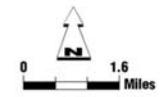
TAZ	2005	2020	2035
	Households	Households	Households
2103	268	282	300
2111	321	465	664
2128	192	197	204
2156	812	812	812
2157	242	242	242
2179	612	620	631
2193	573	573	573
Western Enclaves	3020	3191	3426
Percent Growth		6%	13%

TAZ	2005	2020	2035
	Employment	Employment	Employment
2103	509	531	547
2111	26	109	164
2128	444	444	444
2156	182	181	182
2157	148	146	148
2179	595	658	688
2193	12	36	44
Western Enclaves	1916	2105	2217
Percent Growth		10%	16%



**LEGEND**  
Western Enclaves

<b>Housing</b>	<b>Employment</b>	<b>Interstates</b>
0 - 50	0 - 50	Major Roads
51 - 100	51 - 100	Other Super Zones
101 - 500	101 - 500	Incorporated Arapahoe Co.
501 - 1000	501 - 1000	Other Counties
> 1000	> 1000	



**TAZ Splits**



**TAZ 1953 Land Use Splits**

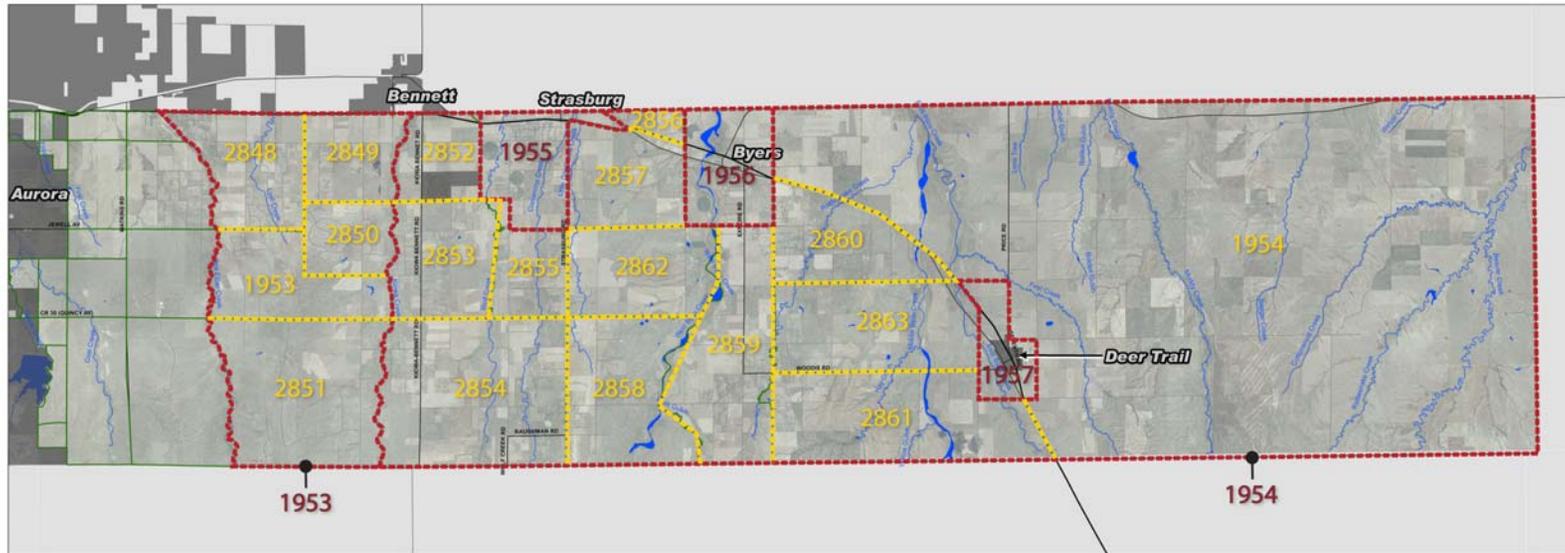
TAZ	2005 Households	2020 Households	2035 Households
1953	56	160	289
2848	224	481	940
2849	84	401	723
2850	95	95	96
2851	101	200	362
Original TAZ 1953 LU	560	1337	2410

TAZ	2005 Employment	2020 Employment	2035 Employment
1953	12	40	56
2848	46	70	99
2849	17	40	56
2850	20	20	28
2851	21	30	42
Original TAZ 1953 LU	116	200	281

**TAZ 1954 Land Use Splits**

TAZ	2005 Households	2020 Households	2035 Households
1954	45	45	45
2852	185	215	260
2853	90	90	90
2854	80	80	80
2855	25	35	50
2856	20	25	40
2857	95	118	143
2858	45	45	45
2859	85	85	85
2860	70	85	100
2861	45	45	45
2862	30	30	30
2863	40	40	40
Original TAZ 1954 LU	855	938	1053

TAZ	2005 Employment	2020 Employment	2035 Employment
1954	12	12	12
2852	48	95	128
2853	24	24	24
2854	21	21	21
2855	7	17	28
2856	5	10	15
2857	25	87	127
2858	12	12	12
2859	22	22	22
2860	18	65	90
2861	12	12	12
2862	8	8	8
2863	10	10	10
Original TAZ 1954 LU	224	395	509

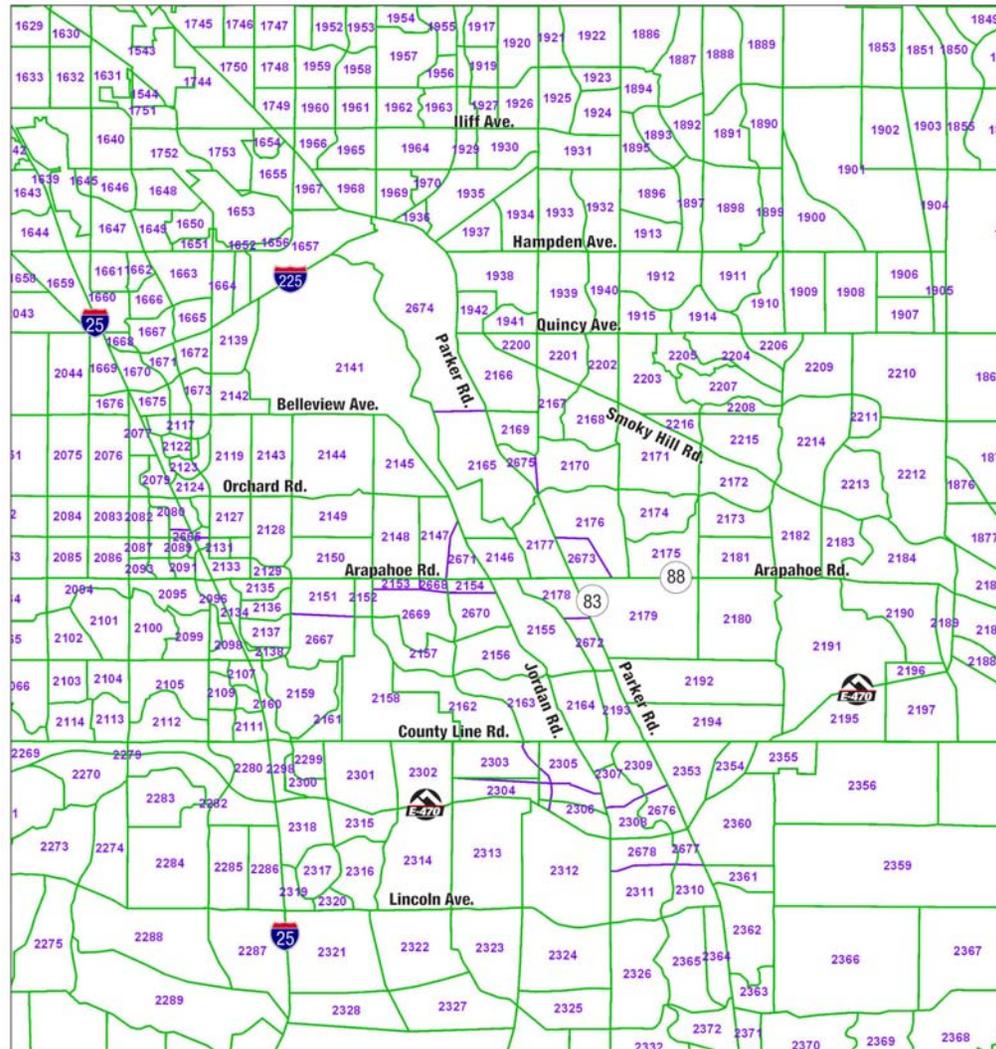


**LEGEND**

- XXXX Old TAZ Boundaries and Numbers
- XXXX New TAZ Boundaries and Numbers



Figure B-1 from Parker Road Corridor Study showing TAZ splits from Arapahoe Road and Parker Road Corridor Studies



**LEGEND**

- = DRCOG TAZ system
- = Parker Road Corridor Study TAZ splits





**Appendix B**

**2035 County Plan Improvements**



**Roadway Improvements**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
6th Avenue	Roadway	Buckley Road to west of Picadilly Road	Widen from 2 to 4 lanes	Aurora	Arapahoe County	Long Term	\$3,030,000
	Roadway	Himalaya Street to E-470	Construct new 4-lane facility	Aurora	Arapahoe County	Long Term	\$15,900,000
	Roadway	Powhaton Road to Watkins Road	Construct new 2-lane facility	Arapahoe County	Aurora	Long Term	\$17,500,000
	Roadway	Watkins Road to Manila Road	Construct new 2-lane facility	Arapahoe County	-	Mid Term <sup>(2)</sup>	\$24,000,000
	Roadway	Manila Road to Kiowa-Bennett Road	Reconstruct for new 2-lane facility	Arapahoe County	Bennett	Mid Term <sup>(2)</sup>	\$1,500,000
Arapahoe Road (SH88)	Roadway	Waco Street to Liverpool Street	Widen from 2/4 lanes to 6 lanes	Centennial	Arapahoe County	Short Term	\$17,000,000
Bellevue Avenue	Study	Monaco to DTC Boulevard	Corridor Study	Greenwood Village / Denver	Arapahoe County / CDOT	Short Term	\$250,000
Bellevue/E-470	Grade Separation	Chenango Avenue to Bellevue	New grade separation over E-470	Aurora	Arapahoe County	Short Term	\$12,000,000
Broncos Parkway	Roadway	Jordan Road to Parker Road	Widen from 4 to 6 lanes	Centennial / Arapahoe County	-	Mid Term	\$6,000,000
Coal Mine Road	Roadway	Sheridan Boulevard to Platte Canyon Road	Widen from 2 to 4 lanes	Arapahoe County	Jefferson County	Long Term	\$1,010,000
Easter Avenue	Roadway	Havana Street to Peoria Street	Widen from 4 to 6 lanes	Centennial / Arapahoe County	-	Mid Term	\$2,020,000
Gun Club Road (SH 30)	Roadway	6th Avenue to Jewell Avenue	Widen from 2 to 4 lanes	Aurora / Arapahoe County	CDOT	Mid Term	\$6,060,000
	Roadway	Jewell Avenue to Quincy Avenue	Widen from 2 to 6 lanes	CDOT	Aurora/Arapahoe County	Mid Term	\$26,610,000
	Roadway	Quincy Avenue to Aurora Parkway	Widen from 2 to 6 lanes	Aurora / Arapahoe County	-	Short Term	\$20,000,000
Hampden Avenue	Roadway	Picadilly Road to Gun Club Road	Widen from 2 to 4 lanes	Aurora	Arapahoe County	Short Term	\$700,000
Iliiff Avenue	Study	Quebec Street to Parker Road	Corridor Study	Arapahoe County	-	Short Term	\$500,000
	Roadway	Quebec Street to Parker Road	Corridor Improvements	Arapahoe County	-	Short Term	\$3,000,000
Jewell Avenue	Roadway	E-470 to Powhaton Road	Widen from 2 to 4 lanes	Aurora	Arapahoe County	Short Term	\$5,000,000
	Roadway	Powhaton Road to Watkins Road	Construct/widen to 4 lanes	Aurora	Arapahoe County	Mid Term <sup>(2)</sup>	\$8,100,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

(2) Project timing dependent on area development

**Roadway Improvements (continued)**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Kiowa-Bennett Road	Study	6th Avenue to SH 79 (including I-70 interchange)	Alignment Study	Arapahoe County	Bennett / Adams County / CDOT	Short Term	\$400,000
	Roadway	6th Avenue to I-70	Construct new 2-lane facility	Arapahoe County	Bennett / Adams County	Mid Term	\$3,700,000
Manila Road	Study	I-70 to County Line Road	Alignment Study	Arapahoe County	Adams County	Mid Term	\$200,000
	Roadway	I-70 to Quincy Avenue	Construct/widen to 4-lane facility	Arapahoe County	-	Long Term	\$18,000,000
	Roadway	Quincy Avenue to County Line Road	Construct 4-lane facility	Arapahoe County	-	Long Term	\$29,100,000
Parker Road (SH 83)	Roadway	Quincy Avenue to Orchard Road	Widen from 4 to 6 lanes	CDOT	Arapahoe County / Aurora / Centennial	Mid Term	\$4,940,000
Platte Canyon Road (SH 75)	Roadway	Ken Caryl Avenue to Coal Mine Avenue	Widen from 2 to 4 lanes	CDOT / Arapahoe County	Littleton	Long Term	\$2,620,000
	Roadway	Coal Mine Avenue to Bowles Avenue	Widen from 2 to 4 lanes	CDOT / Arapahoe County	Littleton	Long Term	\$2,620,000
Quincy Avenue	Roadway	Picadilly Road to E-470	Widen from 2 to 6 lanes	Aurora	Arapahoe County	Short Term <sup>(2)</sup>	\$10,140,000
	Roadway	E-470 to Powhatan Road	Widen from 2 to 6 lanes	Aurora	Arapahoe County	Mid Term <sup>(2)</sup>	\$13,520,000
	Roadway	Powhatan Road to Watkins Road	Widen from 2 to 6 lanes	Arapahoe County	Aurora	Mid Term <sup>(2)</sup>	\$27,040,000
	Study	Bradbury Road to Woodis Road	Alignment Study	Arapahoe County	-	Short Term	\$100,000
	Roadway	Bradbury Road to Exmoor Road	Construct 2-lane facility	Arapahoe County	-	Short Term	\$6,300,000
	Roadway	Exmoor Avenue to Woodis Road	Construct 2-lane facility	Arapahoe County	-	Long Term	\$6,800,000
Smoky Hill Road	Roadway	Buckley Road to Liverpool Street	Widen from 4 to 6 lanes	Centennial	Arapahoe County / Aurora	Long Term	\$6,060,000
	Roadway	Liverpool Street to E-470	Widen from 4 to 6 lanes	Centennial	Arapahoe County / Aurora	Long Term	\$4,000,000
Watkins Road	Roadway	I-70 to Quincy Avenue	Widen from 2 to 6 lanes	Arapahoe County	-	Mid Term <sup>(2)</sup>	\$47,320,000
Yale Avenue	Roadway	I-25 to Monaco Parkway	Widen from 2 to 4 lanes	Arapahoe County	Denver	Mid Term	\$1,000,000
Yosemite Street	Roadway	Iliff Avenue to Evans Avenue	Reconstruction/Improvement with Sidewalks	Arapahoe County	-	Short Term	\$400,000
Yulle Road	Roadway	I-70 to Colfax Avenue	Realign/construct 2-lane facility	Arapahoe County / Adams County	CDOT	Long Term	\$850,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

(2) Project timing dependent on area development

**Intersections and Interchanges**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Arapahoe Road (SH 88)/Havana	Interchange	Interchange and approaches	New Interchange	CDOT	Arapahoe County / GWV / Centennial	Mid Term	\$20,000,000
Arapahoe Road (SH 88)/Jordan	Study	Intersection and approaches	Interchange Feasibility Study	CDOT	Arapahoe County / Aurora / Centennial	Short Term	\$300,000
Arapahoe Road (SH 88)/Jordan	Interchange	Intersection and approaches	New Interchange	CDOT	Arapahoe County/Aurora/Centennial	Mid Term	\$20,000,000
Arapahoe (SH 88)/ Parker (SH 83)	Interchange	Interchange and approaches	New Interchange	CDOT	Arapahoe County/Aurora/Centennial / Foxfield	-	-
Arapahoe Road (SH 88)/Peoria	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Arapahoe County/Aurora/Centennial	Long Term	\$2,000,000
Arapahoe Road (SH 88)/Potomac	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Centennial / Arapahoe County	Long Term	\$2,000,000
Arapahoe Road (SH 88)/Revere	Interchange	Intersection and approaches	New Interchange	CDOT	Arapahoe County / Centennial	Long Term	\$10,000,000
Dayton/Peakview	Intersection	Intersection and approaches	Safety and capacity improvements and new signal	Arapahoe County / GWV / Centennial	-	Short Term	\$350,000
Dry Creek Road/Yosemite Street	Intersection	Intersection and approaches	Safety and capacity improvements	Centennial	Arapahoe County	Short Term	\$350,000
Easter Avenue/Havana and Peoria	Intersection	Intersections and approaches	Intersection Realignments	Arapahoe County / Centennial	-	Short Term	\$11,300,000
Gun Club/Quincy	Intersection	Intersection and approaches	Safety and capacity improvements	Aurora / Arapahoe County	CDOT	Short Term	\$10,000,000
Hampden Avenue/Picadilly Road	Intersection	Intersection and approaches	Safety and capacity improvements	Aurora/Arapahoe County	-	Short Term	\$350,000
Headlight Rd/US 36/County Rd 2	Intersection	Intersection and approaches	Safety and capacity improvements	Adams County / Arapahoe County	-	Short Term	\$250,000
I-25/Arapahoe Road (SH 88)	Interchange	Yosemite Street to Boston Street	Interchange Improvements	CDOT	Arapahoe County / GWV / Centennial	Long Term	\$120,000,000
I-70 at Byers	Study	I-70 Corridor through Byers	Grade separation feasibility study	Arapahoe County	CDOT	Mid Term	\$100,000
I-70 at Strasburg	Study	I-70 Corridor through Strasburg	Interchange Feasibility Study	CDOT	Arapahoe County / Adams County	Short Term	\$150,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

(2) Project timing dependent on area development

**Intersections and Interchanges (continued)**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
I-70/Converse Road (SH 79)	Interchange	Interchange and approaches	Interchange Improvements	CDOT	Bennett / Adams County / Arapahoe County	Mid Term	\$2,000,000
I-70/Manila Road	Interchange	Interchange and approaches	Interchange Improvements	Adams County / Aurora	Arapahoe County	Long Term	\$2,000,000
I-70/Monaghan Road	Interchange	Interchange and approaches	New Interchange	Arapahoe County	Aurora / Adams County	Mid Term <sup>(2)</sup>	\$20,000,000
I-70/Quail Run	Interchange	Interchange and approaches	New Interchange	Adams County / Aurora	Arapahoe County	Mid Term <sup>(2)</sup>	\$20,000,000
I-70/Strasburg Road	Interchange	Interchange and approaches	Interchange Improvements	CDOT	Arapahoe County / Adams County	Short Term	\$2,000,000
I-70/Watkins Road	Interchange	Interchange and approaches	Interchange Improvements	Adams County / Aurora	Arapahoe County	Mid Term <sup>(2)</sup>	\$2,000,000
Inverness Dr West/County Line Rd	Intersection	Intersection and approaches	Operational improvements	Arapahoe County / Douglas County	TMA	Short Term	\$500,000
Inverness Dr West/Dry Creek Rd	Intersection	Intersection and approaches	Operational improvements	Arapahoe County	TMA	Short Term	\$1,000,000
Parker Road (SH 83)/ Aurora Parkway	Interchange	Intersection and approaches	Interim At-Grade Intersection with Ultimate New Interchange	CDOT	Centennial/Aurora /Arapahoe County	Long Term	\$20,000,000
Parker Road (SH 83)/ Broncos Parkway	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Centennial / Arapahoe County	Long Term	\$12,000,000
Parker Road (SH 83)/ Chambers Road	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Centennial / Arapahoe County	Long Term	\$6,000,000
Parker Road (SH 83)/ Orchard Road	Interchange	Interchange and approaches	New Interchange	CDOT	Arapahoe County/Aurora/Centennial	Long Term	\$32,000,000
Parker Road (SH 83)/ Quincy Avenue	Study	Interchange and approaches	Interchange Feasibility Study	CDOT	Aurora / Arapahoe County	Short Term	\$300,000
Parker Road (SH 83)/ Quincy Avenue	Interchange	Interchange and approaches	New Interchange	CDOT	Aurora / Arapahoe County	Mid Term	\$27,000,000
Platte Canyon Road (SH 75)/ Bowles Ave	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Arapahoe County / Littleton	Mid Term	\$350,000
Platte Canyon Road (SH 75)/Coal Mine Ave	Intersection	Intersection and approaches	Safety and capacity improvements	CDOT	Arapahoe County / Littleton	Mid Term	\$350,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

(2) Project timing dependent on area development

**Roadway Paving**

Corridor	Type of Improvement	Length	Ultimate Pavement Treatment	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Bradbury Road	Pavement	US 36 to Quincy Avenue	Asphalt Pavement	Arapahoe County	-	Short Term	\$1,930,000
Brick Center Road	Pavement	Iliff Trail to Quincy Avenue	Asphalt Pavement	Arapahoe County	-	Short Term	\$1,050,000
	Pavement	Quincy Avenue to County Line Road	Asphalt Pavement	Arapahoe County	-	Mid Term	\$600,000
County Line Road	Pavement	Patrick Trail to Kiowa-Bennett Road	Asphalt Pavement	Arapahoe County	-	Long Term	\$1,400,000
	Pavement	Kiowa-Bennett Rd to Wolf Creek Rd	Recycled Asphalt	Arapahoe County	-	Long Term	\$300,000
	Pavement	Wolf Creek Road to Strasburg Road	Recycled Asphalt	Arapahoe County	-	Long Term	\$200,000
Knudtson Road	Pavement	Strasburg Road to Exmoor Road	Recycled Asphalt	Arapahoe County	-	Mid Term	\$2,100,000
Quincy Avenue	Pavement	Kiowa-Bennett Rd to Strasburg Rd	Asphalt Pavement	Arapahoe County	-	Short Term	\$600,000
	Pavement	Wolf Creek Road to Bradbury Road	Asphalt Pavement	Arapahoe County	-	Short Term	\$2,100,000
Strasburg Road	Pavement	Knudtson Road to County Line Road	Asphalt Pavement	Arapahoe County	-	Long Term	\$700,000
Wolf Creek Road	Pavement	Quincy Avenue to County Line Road	Asphalt Pavement	Arapahoe County	-	Mid Term	\$1,750,000
Woodis Road	Pavement	Exmoor Road to Gravel Pit Road	Asphalt Pavement	Arapahoe County	-	Mid Term	\$2,800,000

**Shoulder Improvements**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
6 <sup>th</sup> Avenue	Roadway	Wolf Creek Road to Strasburg Road	Shoulder/Safety Improvements	Arapahoe County	-	Long Term	\$900,000
Asbury Avenue	Roadway	Oneida Avenue area	Curb and Gutter Improvements	Arapahoe County	Denver	Short Term	\$300,000
Brick Center Road	Roadway	6 <sup>th</sup> Avenue to Iliff Trail	Shoulder/Safety Improvements	Arapahoe County	-	Mid Term	\$1,050,000
Colfax Avenue	Roadway	US 36 west to US 36 east of Byers	Shoulder/Safety Improvements	Arapahoe County	-	Mid Term	\$1,650,000
County Line Road	Roadway	Smoky Hill Road to Patrick Trail	Shoulder/Safety Improvements	Arapahoe County	-	Mid Term	\$1,200,000
Exmoor Road	Roadway	Woodis Road to US 36 Byers	Shoulder/Safety Improvements	Arapahoe County	-	Long Term	\$2,100,000
Jewell Avenue	Roadway	Parker Road to Dayton Street	Shoulder/Safety Improvements	Arapahoe County	-	Short Term	\$200,000
Kiowa-Bennett Road	Roadway	Bennett to County Line Road	Shoulder/Safety Improvements	Arapahoe County	-	Mid Term	\$2,400,000
Pontiac Avenue	Roadway	Oneida Avenue area	Curb and Gutter Improvements	Arapahoe County	Denver	Short Term	\$300,000
Quincy Avenue	Roadway	Watkins Road to Bradbury Road	Shoulder/Safety Improvements	Arapahoe County	-	Long Term	\$3,900,000
Strasburg Road	Roadway	Mississippi Ave to Quincy Ave	Shoulder/Safety Improvements	Arapahoe County	-	Long Term	\$1,200,000
Wolf Creek Road	Roadway	Lloyd Road to 6 <sup>th</sup> Avenue	Shoulder/Safety Improvements	Arapahoe County	-	Mid Term	\$1,500,000
Woodis Road	Roadway	Quincy Avenue to Deer Trail	Shoulder/Safety Improvements	Arapahoe County	-	Long Term	\$2,400,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

**System Management Strategies**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Travel Demand Management Study	Study	Countywide	TDM Strategic Plan	Arapahoe County	-	Short Term	\$75,000
Rural Transportation Fee Study	Study	Eastern County – Rural Area	Options for Transportation Funding in Rural Area	Arapahoe County	-	Short Term	\$100,000
Rural Transit Study/Survey	Study	Eastern County – Rural Area	Study and Survey for Rural Transit Strategies	Arapahoe County	-	Short Term	\$100,000
ITS Strategic Plan	Study	Countywide and interjurisdictional	ITS Strategic Plan	Arapahoe County	-	Short Term	\$100,000
Countywide ITS	ITS	Countywide	ITS implementation	Arapahoe County	-	Short Term	\$300,000
Arapahoe Road (SH88)	ITS	Quebec Street to Buckley Road	Participate in communications and monitoring upgrades	CDOT / Centennial	Arapahoe County	Short Term	\$100,000
Broncos Parkway	ITS	Peoria Street to Parker Road	Participate in communications and monitoring upgrades	Centennial / Arapahoe County	-	Short Term	\$100,000
Buckley Road	ITS	Smoky Hill Road to Arapahoe Road	Participate in communications and monitoring upgrades	Centennial	Arapahoe County	Short Term	\$100,000
County Line Road	Study	Yosemite Street to I-25	ITS / Operations Corridor Study	Arapahoe County / Douglas County	TMA	Short Term	\$100,000
Dry Creek Road	Study	Yosemite Street to Arapahoe Road (via Havana Street)	ITS / Operations Corridor Study	Centennial / Arapahoe County	TMA	Short Term	\$100,000
Dry Creek Road	ITS	Yosemite Street to Arapahoe Road (via Havana Street)	Participate in communications and monitoring upgrades	Centennial / Arapahoe County	TMA	Short Term	\$600,000
Easter Avenue	ITS	Havana Street to Peoria Street	Participate in communications and monitoring upgrades	Centennial / Arapahoe County	-	Short Term	\$100,000
Parker Road (SH 83)	ITS	Illiff Avenue to Leetsdale	Participate in communications and monitoring upgrades	CDOT / Denver	Arapahoe County	Long Term	\$100,000
Quebec Street	ITS	Leetsdale Drive to Yale Avenue	Participate in communications and monitoring upgrades	Denver	Arapahoe County	Long Term	\$100,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

**Transit**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Alameda/Jewell Avenue	Transit	I-225 to Monaghan Road	Route Improvements, Stop Enhancements	RTD	Aurora/Arapahoe County	Long Term	\$100,000
Arapahoe Road	park-n-Ride	park-n-Ride site	New park-n-Ride	RTD	Arapahoe County/ Centennial/ Aurora	Short Term	\$200,000
Bennett at I-70	park-n-Ride	park-n-Ride site	New park-n-Ride	Arapahoe County	RTD	Short Term	\$200,000
Byers at I-70	park-n-Ride	park-n-Ride site	New park-n-Ride	Arapahoe County	RTD	Mid Term	\$200,000
Parker Road (SH 83)	Transit	I-225 to E-470	Transit Priority, Route Improvements, Stop Enhancements	RTD	Arapahoe County/Aurora/ Centennial/ Douglas County/Parker	Mid Term	\$100,000
Quincy Avenue/ E-470	park-n-Ride	park-n-Ride site	New park-n-Ride	RTD	Arapahoe County/Aurora	Mid Term	\$200,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

**Pedestrian / Bicycle Improvements**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Countywide Trails Master Plan	Bike/Ped	Countywide	Planning study	Arapahoe County	-	Short Term	\$100,000
Arapahoe County Community Park	Bike/Ped	ACCP to Cherry Creek State Park	Construct trail connection along S. Potomac Street	Arapahoe County	Centennial	Mid Term	\$200,000
	Bike/Ped	ACCP to County Line	Construct trail connection along S. Chambers	Arapahoe County	Parker	Mid Term	\$100,000
	Bike/Ped	Chambers Road to Jordan Road	Construct connection between ACCP and Happy Canyon Trail	Arapahoe County	-	Mid Term	\$200,000
	Bike/Ped	ACCP to Cherry Creek Trail	Construct trail connection	Arapahoe County	Parker	Mid Term	\$200,000
Arapahoe Road	Bike/Ped	East of I-25 at Boston/Clinton intersection	Pedestrian grade separation	CDOT / Arapahoe County / GWV	Centennial	Mid Term	\$3,000,000
	Bike/Ped	Lewiston Way to Buckley Road	Construct sidewalk on south side of Arapahoe Road	Aurora / Foxfield	Arapahoe County	Short Term	\$100,000
Broncos Parkway	Bike/Ped	Potomac Street to Blackhawk Street	Construct sidewalk on north side of Broncos Parkway	Arapahoe County	-	Short Term	\$100,000
Cherry Creek Dam Trail	Bike/Ped	Along Cherry Creek dam	Construct trail connection	State Parks	Arapahoe County/ GWV/ Aurora	Mid Term	\$500,000
Cherry Creek Trail	Bike/Ped	Under Arapahoe Road	Trail connection and improvements under Arapahoe Road	CDOT	Centennial / Aurora / Arapahoe County	Short Term	\$5,000,000
	Bike/Ped	Quebec Street to Iliff Avenue	Trail improvements	Arapahoe County	Denver	Short Term	\$200,000
	Bike/Ped	17-Mile House/Parker Road	Construct trail connection with future connection across Parker Road	Arapahoe County	CDOT/ Centennial/ Aurora	Long Term	\$2,000,000
	Bike/Ped	Arapahoe Road to CC State Park	Construct trail connection	Arapahoe County	CDOT/Aurora	Long Term	\$100,000
Dahlia Street	Bike/Ped	Vassar Avenue to Iliff Avenue	Construct/improve sidewalk on both sides of Dahlia Street	Arapahoe County	Denver	Short Term	\$50,000
Dayton Street	Bike/Ped	Parker Road to Mississippi Avenue	Construct/improve sidewalk connections to bus stops	RTD / Arapahoe County	Denver	Short Term	\$190,000
E-470	Bike/Ped	Parker Road to I-70	Construct multi-use path	E-470 / Aurora / Centennial	Arapahoe County	Long Term	\$3,500,000
Florida Avenue	Bike/Ped	High Line Trail to Parker Road	Construct sidewalk on south side of Florida Avenue	Arapahoe County	Denver	Short Term	\$100,000
	Bike/Ped	West of Dayton Street	Construct sidewalk leading to bus stop at Florida/Dayton	RTD/Arapahoe County	Denver	Short Term	\$50,000
Front Street	Bike/Ped	Main Street to Exmoor Road	Construct/improve sidewalk connections to Byers School	Arapahoe County	-	Short Term	\$190,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

**Pedestrian / Bicycle Improvements (continued)**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources		Time Period <sup>(1)</sup>	Cost Estimate
				Primary	Secondary		
Gun Club Road	Bike/Ped	South of Quincy Avenue intersection	Pedestrian grade separation	Arapahoe County	Aurora	Mid Term	\$1,500,000
Havana Street	Bike/Ped	Geddes to Inverness Drive East	Construct sidewalk on east side of Havana Street	Arapahoe County	TMA	Short Term	\$300,000
High Line Canal	Bike/Ped	Quebec Street to Parker Road	Construct/Improve trail connections	Arapahoe County	Denver	Short Term	\$205,000
Holly Street	Bike/Ped	Holly Place to south of Yale Avenue	Construct sidewalk on west side of Holly Street	Arapahoe County	-	Short Term	\$50,000
Iliff Avenue	Bike/Ped	Quebec Street to Parker Road	Construct/improve sidewalk on both sides of Iliff Avenue	Arapahoe County	RTD/Denver	Mid Term	\$380,000
	Bike/Ped	at High Line Canal	Grade separation for High Line Trail	Arapahoe County	-	Short Term	\$1,500,000
Jewell Avenue	Bike/Ped	Parker Road to Dayton Street	Construct sidewalk on both sides of Jewell Avenue	Arapahoe County	-	Short Term	\$50,000
Parker Road (SH 83)	Bike/Ped	Orchard Road to Quincy Avenue	Construct detached multi-use path on west side of Parker Road	CDOT	Arapahoe County/Aurora/Centennial	Long Term	\$500,000
	Bike/Ped	Nichols Place to Fremont Avenue	Construct detached multi-use path on west side of Parker Road	CDOT	Arapahoe County/Aurora/Centennial	Long Term	\$190,000
	Bike/Ped	South of Temple Avenue intersection	Pedestrian grade separation	CDOT	Arapahoe County/Aurora/Centennial	Long Term	\$2,000,000
Peoria Street	Bike/Ped	Easter Avenue to Arapahoe Road	Construct sidewalk on the west side of Peoria Street	Arapahoe County	Centennial	Mid Term	\$100,000
Picadilly Road	Bike/Ped	Chenango Avenue to Eaglecrest High School	Construct sidewalk on east side of Picadilly Road	Arapahoe County	Aurora	Short Term	\$105,000
Piney Creek	Bike/Ped	Entire length	Construct/improve trail connections	Arapahoe County	Centennial/Aurora	Mid Term	\$3,100,000
Quincy Avenue	Bike/Ped	West of E-470	Pedestrian grade separation	Arapahoe County	Aurora	Mid Term	\$2,000,000
Quincy Avenue/Himalaya Street	Bike/Ped	Himalaya Street to Picadilly Street	Construct sidewalk on south side of Quincy Avenue	Arapahoe County	Aurora	Short Term	\$190,000
Quincy Avenue	Bike/Ped	E-470 to Bradbury Road	Construct detached multi-use path and incorporate bicycle lanes	Arapahoe County	-	Long Term	\$4,300,000
State Highway 40	Bike/Ped	Deer Trail to Richmil Ranch Open Space	Construct detached multi-use path	Arapahoe County	CDOT/Deer Trail	Long Term	\$610,000

(1) Short Term = 2010-2020, Mid Term = 2020-2030, Long Term = 2030-2035

**Other Projects for County Endorsement**

Corridor	Type of Improvement	Length	Specific Improvement	Jurisdiction and Potential Funding Sources	
				Primary	Secondary
Aurora Parkway	Roadway	Parker Road to Gartrell	Construct 6-lane facility	Aurora	Douglas County
E-470	Transit	I-25 to I-70	Future transit corridor	Fed/CDOT	Aurora
Harvest Road	Roadway	I-70 to Jewell Avenue	Construct/widen to 4-lane facility	Aurora	-
I-225	Transit	Parker Road to Colfax Avenue	Construct LRT	RTD	Aurora/Arapahoe County
I-225/Colfax Avenue	Interchange	New access to University Health Center	Split diamond with 17th Ave east	Aurora	CDOT
I-70/Harvest Road	Interchange	Interchange and approaches	New Interchange	Aurora	-
I-70/Picadilly	Interchange	Interchange and approaches	New interchange	CDOT	Aurora/Arapahoe County
I-70/Schumaker Road	Interchange	Interchange and approaches	New Interchange	CDOT	Aurora/Arapahoe County
Monaghan Road	Roadway	I-70 to Quincy Avenue	Construct new 2-lane facility	Aurora	-
Picadilly Street	Roadway	Colfax Avenue to 6th Avenue	Widen from 2 to 6-lanes	Aurora	Arapahoe County
	Roadway	6th Avenue to Jewell Avenue	Construct/widen to 6-lane facility	Aurora	Arapahoe County
Santa Fe (US 85)/C-470	Interchange	Interchange and approaches	Safety and capacity improvements	Fed/CDOT	Douglas County/Arapahoe County

**Appendix C**

**County Roadway Laneage and Right-of-Way**



Roadway	Classification	From	To	Proposed Lanes	ROW
6th Ave.	Urban Arterial	Buckley Rd.	E-470	4	114
6th Ave.	Urban Arterial	E-470	Harvest Rd.	6	144
6th Ave.	Semi-Urban Arterial	Harvest Rd.	Powhaton Rd.	4	114
6th Ave.	Rural Arterial	Powhaton Rd.	Watkins Rd.	2	114
6th Ave.	Rural Arterial	Watkins Rd.	Kiowa-Bennett Rd.	2	114
6th Ave.	Rural Arterial	Kiowa-Bennett Rd.	Yulle Rd.	2	114
6th Ave.	Semi-Urban Collector	Yulle Rd.	Strasburg Rd.	2	76
Alameda Ave.	Semi-Urban Collector	Gun Club Rd.	Harvest Mile Rd.	2	76
Arapahoe Rd.	Urban Arterial	I-25	Parker Rd.	6	144
Arapahoe Rd.	Urban Arterial	Parker Rd.	Liverpool St.	6	144
Arapahoe Rd.	Urban Arterial	Liverpool St.	Smoky Hill Rd.	6	144
Bellevue Ave.	Urban Arterial	Broadway	University	4	114
Bellevue Ave.	Urban Arterial	I-25	DTC Blvd.	6	144
Bellevue Ave.	Urban Arterial	Picadilly St.	Gun Club Rd.	4	114
Bowles Ave.	Urban Arterial	Platte Canyon Rd.	Santa Fe Dr.	4	114
Bradbury Rd.	Rural Arterial	US 36	Quincy Ave.	2	114
Brick Center Rd.	Rural Arterial	6th Ave.	County Line Rd.	2	114
Broncos Pkwy.	Urban Arterial	Peoria St.	Parker Rd.	6	144
Buckley Rd.	Urban Arterial	Orchard Rd.	Arapahoe Rd.	4	114
Chenago Ave.	Urban Collector	Himalaya Rd.	Picadilly St.	4	114
Clinton St.	Urban Collector	Geddes Ave.	Dry Creek Rd.	4	114
Coal Mine Rd.	Urban Arterial	County line	Platte Canyon Rd.	4	114
Colfax Ave.	Rural Arterial	US 40	US 36	2	114
County Line Rd.	Rural Arterial	County line	Strasburg Rd.	2	114
County Line Rd.	Urban Arterial	Yosemite St.	I-25	8	168
Dry Creek Rd.	Urban Arterial	Yosemite St.	Havana St.	6	144
Easter Ave.	Urban Arterial	Havana St.	Peoria St.	6	144
Exmoor Rd.	Rural Secondary	US 36	US 40	2	60
Exmoor Rd.	Rural Arterial	US 40	County line	2	114
Florida Ave.	Urban Collector	County line	Dayton St.	2	76
Front St.	Urban Arterial	Main St.	Exmoor Rd.	2	114
Gun Club Rd.	Semi-Urban Arterial	6th Ave.	Jewell Ave.	4	114
Gun Club Rd.	Urban/Semi-Urban Arterial	Jewell Ave.	Aurora Pkwy.	6	144
Hampden Ave.	Urban Expressway	Lowell Blvd.	Santa Fe Dr.	6	144
Hampden Ave.	Urban Arterial	University	Colorado Blvd.	6	144
Hampden Ave.	Semi-Urban Arterial	Himalaya Way	Gun Club Rd.	4	114
Harvest Rd.	Semi-Urban Arterial	I-70	Jewell Ave.	4	114

Roadway	Classification	From	To	Proposed Lanes	ROW
Havana St.	Urban Collector	Arapahoe Rd.	Bellevue Ave.	2	76
Havana St.	Urban Arterial	Dry Creek Rd.	Arapahoe Rd.	6	144
Himalaya St.	Urban Collector	Quincy Ave.	Chenanqo Ave.	4	114
Iliff Ave.	Urban Arterial	Quebec St.	Parker Rd.	4 / 6 <sup>(1)</sup>	144
Inverness Dr. E.	Urban Collector	County Line Rd.	Lima St.	4	114
Inverness Dr. W.	Urban Collector	Dry Creek Rd.	County Line Rd.	4	114
Jewell Ave.	Rural Arterial	E-470	Powhaton Rd.	4	114
Jewell Ave.	Rural Arterial	Powhaton Rd.	Watkins Rd.	4	114
Jordan Rd.	Urban Arterial	Arapahoe Rd.	County line	4	114
Kiowa-Bennett Rd.	Rural Arterial	I-70	County Line Rd.	2	114
Knudtson Rd.	Rural Arterial	Strasburg Rd.	Exmoor Rd.	2	114
Lima St.	Urban Collector	Inverness Dr. E.	Arapahoe Rd.	4	114
Liverpool St.	Urban Collector	Smoky Hill Rd.	Arapahoe Rd.	4	114
Manila Rd.	Rural Arterial	I-70	County Line Rd.	4	114
Mineral Ave.	Urban Arterial	Platte Canyon Rd.	Polo Ridge Dr.	6	144
Mississippi Ave.	Urban Arterial	Parker Rd.	Alton St.	6	144
Mississippi Ave.	Urban Arterial	Alton St.	Havana St.	6	144
Mississippi Ave.	Semi-Urban Arterial	Gun Club Rd.	Harvest Rd.	4	114
Monaqhan Rd.	Rural Arterial	I-70	Jewell Ave.	2	114
Orchard Rd.	Urban Arterial	Buckley Rd.	Himalaya St.	4	114
Oxford Ave.	Urban Collector	Federal Blvd.	Santa Fe Dr.	4	114
Parker Rd.	Urban Arterial	Mississippi Ave.	Havana St.	4	114
Parker Rd.	Urban Expressway	I-225	Quincy Ave.	8	168
Parker Rd.	Urban Expressway	Quincy Ave.	Orchard Rd.	6	144
Parker Rd.	Urban Expressway	Orchard Rd.	Arapahoe Rd.	8	168
Parker Rd.	Urban Expressway	Arapahoe Rd.	County line	6	144
Peoria St.	Urban Arterial	Broncos Pkwy.	Arapahoe Rd.	4	114
Picadilly Rd.	Semi-Urban Arterial	Colfax Ave.	6th Ave.	6	144
Picadilly Rd.	Semi-Urban Arterial	6th Ave.	Jewell Ave.	6	144
Picadilly Rd.	Urban Arterial	Hampden Ave.	Chenanqo Ave.	4	114
Picadilly Rd.	Urban Arterial	Chenanqo Ave.	Smoky Hill Rd.	4	114
Platte Canyon Rd.	Urban Arterial	Ken Caryl Rd.	Coal Mine Ave.	4	114
Platte Canyon Rd.	Urban Arterial	Coal Mine Ave.	Bowles Ave.	4	114

<sup>(1)</sup> Laneage to be determined from Corridor Study recommendations

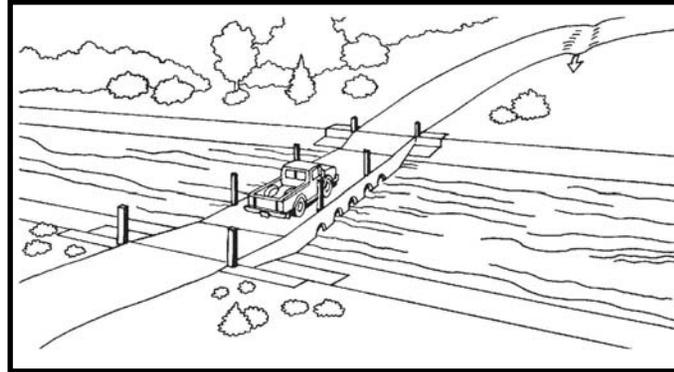
Roadway	Classification	From	To	Proposed Lanes	ROW
Potomac St.	Urban Arterial	Broncos Pkwy.	County line	4	114
Quebec St.	Urban Arterial	Cherry Creek Dr.	Iliff Ave.	4	114
Quincy Ave.	Urban Arterial	Picadilly Rd.	E-470	6	144
Quincy Ave.	Urban Arterial	E-470	Powhaton Rd.	6	144
Quincy Ave.	Urban Arterial	Powhaton Rd.	Watkins Rd.	6	144
Quincy Ave.	Rural Arterial	Watkins Rd.	Exmoor Rd.	2	114
SH 30	Semi-Urban Collector	6th Ave.	Gun Club Rd.	2	76
Smoky Hill Rd.	Urban Arterial	Tower Rd.	Himilaya Rd.	6	144
Smoky Hill Rd.	Urban Arterial	Picadilly Rd.	E-470	6	144
Strasburg Rd.	Rural Arterial	I-70	County Line Rd.	2	114
Tower Rd.	Urban Collector	Waco St.	Smoky Hill Rd.	2	76
Waco St.	Urban Collector	Buckley Rd.	Arapahoe Rd.	2	76
Wabash St.	Urban Arterial	Syracuse Way	Iliff Ave.	2	114
Watkins Rd.	Urban Arterial	I-70	Quincy Ave.	6	144
Wolf Creek Rd.	Rural Arterial	6th Ave.	County line	2	114
Woodis Rd.	Rural Arterial	Quincy Ave. Extension	Deer Trail	2	114
Yale Ave.	Urban Arterial	I-25	Monaco Pkwy.	4	114
Yale Ave.	Urban Arterial	Quebec St.	Syracuse Way	2	114
Yale Ave.	Urban Collector	Monaghan	Watkins Rd.	2	76
Yosemite St.	Urban Collector	County line	Iliff Ave.	2	76
Yosemite St.	Urban Arterial	County Line Rd.	Dry Creek Rd.	4	114
Yulle Rd.	Semi-Urban Collector	Colfax Ave.	6th Ave.	2	76



**Appendix D**  
**White Papers**



# *Arapahoe County 2035 Transportation Plan*



## LOW WATER STREAM CROSSINGS WHITE PAPER

November 2010

Submitted to



Arapahoe County  
10730 East Briarwood Avenue, Suite 100  
Centennial, CO 80120

Submitted by



David Evans and Associates, Inc.  
1331 17<sup>th</sup> Street, Suite 900  
Denver, CO 80202



## Low Water Stream Crossings

It is typical practice in the United States to design stream or river crossing structures to accommodate a 50- to 100-year flood without overtopping. This helps ensure that the road will remain in service, except in extreme flood events. However, bridge structures have a high capital cost and in areas like the east end of Arapahoe County, with many long drainageways crisscrossing rural areas, these capital costs can be prohibitive to upgrading gravel roads or the construction of new roadway connections.

There are several known existing water crossings on County roads, listed below.

### Existing Water Crossings

Road	Location	Width of Crossing (feet)
County Line Road (CR 50)	7,000 ft east of Delbert Road (Douglas CR 01)	420
County Line Road (CR 50)	7,000 ft west of Elbert CR 17	400
County Line Road (CR 50)	2,800 ft east of Elbert CR 17	250
Watkins Road (CR 97)	835 feet south of 6 <sup>th</sup> Avenue (CH 6)	175
Baughman Road (CR 46)	2,100 feet east of South Lenz Street	200
Lloyd Road (CR 26)	1 mile east of Wolf Creek Road (CR 149)	400
Mississippi Avenue (CR 14)	1,130 feet east of Strasburg Road (CR 157)	80
Alameda Avenue (CR 10)	750 feet east of Piggot Road (CR 153)	350
Alameda Avenue (CR 10)	395 feet east of Strasburg Road (CR 157)	140
6 <sup>th</sup> Avenue (CR 6)	415 feet east of Arrowhead Street	150
Strasburg Road (CR 157)	2,575 feet north of 6 <sup>th</sup> Avenue (CR 6)	270
Woodis Road (CR 38)	1 mile west of Koepke Road (CR 205)	150
Deter-Winters Road (CR 229)	½ mile south of 15 <sup>th</sup> Avenue (US 36/CR 2)	450
Serena/Kalcevic Road (CR 18)	7/10 mile west of Bixler Road (CR 241)	250

Low water stream crossings (LWSC) can provide an acceptable, low cost alternative to bridges and culverts on low volume roads. A LWSC is a structure that provides reasonable access as a stream crossing but may be flooded periodically and therefore closed to traffic. The LWSC is typically designed to remain intact after a 100-year flood event. These structures are relatively inexpensive and particularly suitable for low volume roads, across streams with periodically dry beds, or streams where the normal depth of flow is relatively low. There are two basic categories of road projects where consideration of LWSCs may be appropriate: new road construction and bridge replacement.

### ***New Road Construction***

Selection of design flood frequency for local road projects is at the discretion of the local agency, as long as the project funding does not come from state or federal funding sources. If state or federal funding is used, there are associated compliance guidelines. There is some precedence for the use of a two-year, five-year, ten-year or 25-year design flood frequency in some rural jurisdictions, based on drainage basin size and road volume.

### ***Bridge Replacement***

There is an increasing need for replacement of old, unsafe bridges on low volume roads. Many counties across the United States have bridges that are no longer adequate, and are faced with large capital expenditure for replacement structures. In situations where a county does not have sufficient funds to replace a dilapidated old bridge with a new one, LWSCs may be a good alternative to closing the road when the existing bridge becomes unsafe for use. The feasibility of using an LWSC in these situations will depend on the site specific characteristics. Lack of available funding was cited as the rationale for the installation of some LWSCs by County engineers in both Keokuk County and Hamilton County, Iowa.

## Common Types of LWSCs

### ***Unvented Ford***

An unvented ford (no pipes) is a structure that crosses streams that are dry most of the year or where normal stream flow is less than six inches in depth. Unvented fords can be placed to conform with the streambed or the crossing elevation can be raised (in some locations up to four feet) above the streambed. The crossing may be constructed of crushed stone, riprap, precast concrete slabs, or other suitable material. These are most commonly used on public land access roads.



### ***Vented Ford (with pipes)***

Vented fords have a driving surface elevated some distance above the streambed with culverts (vents) that enable low flows to pass beneath the roadbed. The vents can be one or more pipes, box culverts, or open-bottom arches. High water will periodically flow over the crossing. The pipe(s) or culverts may be embedded in earth fill, aggregate, riprap, or portland cement concrete. This is the most commonly used LWSC on low-volume local roads.



### ***Low-Water Bridge***

Low-water bridges are open-bottom structures with elevated decks. They may be designed with one or multiple piers depending on the stream bed size. Low-water bridges generally have greater capacity and are able to pass higher flows underneath the driving surface than most vented and unvented fords. As with fords, however, low-water bridges are designed and installed with the expectation they will be under water at higher flows. The smooth, unobstructed cross section is designed to allow high water to flow over the bridge surface without damaging the structure. These structures are ideal for fish passages, due to their minimal disruption to the stream at typical low flow levels.



The choice to use a LWSC and the type selection depends on stream geometry, discharge, road classification, and budget availability. Experience suggests that a low water bridge for a small stream may cost about \$45,000 to \$60,000, whereas a vented ford may be constructed for \$20,000 to \$25,000. For all three types of LWSCs, roadway approaches are designed to provide acceptable grades of less than 10% by shaping the roadway or adjusting the elevation of the crossing.

### **Current Practices in Other Jurisdictions**

- ✦ Iowa: Usage of LWSC structures appears to be more prevalent here than in any other state. The Iowa DOT and Iowa State University have produced several reports covering this subject. They are typically paved, vented fords on low-volume county roads.
  - ✦ Keokuk County: The County has a standard LWSC design, with a 60-foot paved section and culverts varying from two 12-inch to six 18-inch pipes. If this type of structure is inadequate for a location, then the County provides a bridge designed for a 50- or 100-year flood.
  - ✦ Hamilton County: The County designs LWSCs for a two- to ten-year flood. If designed for lesser flows, the LWSCs have been found to require a lot of maintenance. The County only uses LWSCs on smaller streams, but there is one location with approximately 15 24-inch pipes.
- ✦ Mendocino County, California: The County replaced an unimproved ford with a single-cell arched concrete culvert that would be overtopped by one foot in a 100-year flood. It was installed on a low volume backcountry road in response to a regulatory mandate to improve fish habitat.
- ✦ San Diego County, California: The County has a number of low water crossings currently, but they are not building any new ones. If any of the existing LWSC locations need improved in the future, they will be replaced with structures that would accommodate a 100-year flood. Due to the high capital cost, the County is not replacing any LWSCs.

### **Frequency of Design Flood**

Individual governmental entities set the design flood frequency that they will accept. The most common practice is to use a 50- or 100-year frequency for structure sizing, with a 500-year scour check. The bridge is designed to remain intact after the 500-year event. Current Arapahoe County standards allow overtopping with identified maximum depths for Local streets and Collector roadways and minor drainageways, but do not allow overtopping for a major storm runoff event for Arterial roadways. No overtopping is allowed for any street classification at major drainageway crossings. Where it is determined that overtopping is

allowed for major storm events at minor drainageways, the Arapahoe County Stormwater Management Manual allows for sizing to a 10-year storm runoff event.

The Arapahoe County Stormwater Management Manual also states:

*“The County may consider lesser criteria for rural areas or low volume roadways on a case-by-case basis, if there is adequate justification. Any variance from the [allowable bridge and culvert overtopping] will have to be approved by the County.”*

The CDOT Drainage Design Manual allows for a 25-year frequency on two-lane rural roads if the 50-year flow is less than 4,000 cubic feet per second (cfs). Design flood frequency criteria from other example agencies are noted below:

- ✦ Iowa: The Iowa DOT has recently issued a memo to county engineers that calls for a two-year to 50-year frequency for rural county roads, depending on the road traffic volume and stream size.
- ✦ Mendocino County, California: The County has alternate design standards that allow for a 25-year interval on secondary waterways (one to four square mile drainage area) and a ten-year interval on minor waterways (less than one square mile drainage area).
- ✦ Malibu, California: The City replaced an unimproved ford with a four-span concrete slab bridge. Insufficient right-of-way precluded construction of suitable approaches to place the bridge above the 100-year flow. The “submersible” bridge was ultimately designed to be overtopped by the five-year peak flow of 2,500 cfs and to withstand a 100-year peak flow, which would submerge the bridge by more than nine feet.

### **Example Site Selection Criteria**

The Iowa DOT and Iowa State University have produced several reports and some guidelines on the use of LWCSs. The following is a list of data that may be used in determining potential sites as well as geometric design and material selection for low water stream crossings:

- ✦ Type of stream:
  - ✦ Perennial: water flows in the stream at least 90% of the time in a well-defined channel
  - ✦ Intermittent: flow generally occurs only during the wet season (50% of the time or less)
  - ✦ Ephemeral: flow generally occurs for a short time after extreme storms. The channel is usually not well defined.

- ✦ Type of road: paved, gravel, or dirt
- ✦ Use of road: dwellings, emergency response, recreation, farm access, schools, mail routes, alternate available access, etc.
- ✦ Channel geometry: width, depth, side slope, and longitudinal slope
- ✦ Manning's roughness coefficient ( $n$ )
- ✦ Roadway geometry: width, approach grades, and height of roadway above streambed
- ✦ Drainage area: drainage area can be determined by measuring watershed area on USGS topographic maps or through other County information
- ✦ Historical daily discharges at the site for the development of a flow-duration curve
- ✦ Level of access desired or tolerable time out of service
- ✦ Design flow for the acceptable closing duration per year is determined from a flow duration curve

A flow-duration curve indicates the percent of time, within a certain period, in which given rates of flow were equaled or exceeded. The curve is prepared by arranging past daily discharge data. The road and LWSC is closed when a design discharge,  $Q_e$ , is equaled or exceeded and results in LWSC overtopping. The acceptable closing percent of time per year ( $e$ ) can be called as the design exceedence probability. For example, a 2% exceedence probability means the crossing will be closed, on the average, for 2% time of a year, i.e. 7 days in the year, because the design discharge,  $Q_{2\%}$ , is equaled or exceeded and the crossing structure is overtopped during that time period.

The following criteria may be considered when selecting a site for a LWSC:

- ✦ A LWSC is recommended only for unpaved or primitive roads, field access roads, roads with no inhabited dwellings, low traffic volume roads, and roads with alternate routes available during flooding.
- ✦ The stream channel should be stable. If evidence of aggradation, degradation, or lateral migration is present at the proposed location, then the site may not be desirable. These issues should be considered in the LWSC design.
- ✦ Approach grades to the LWSC structure should be less than 10%.
- ✦ The height between the road approach and the LWSC surface should be less than 12 feet.
- ✦ Cost comparison analysis with bridges or culverts should indicate considerable savings.

The following table describes the relevant site selection criteria to consider. These criteria may be used to determine if a site is appropriate for a LWSC structure, versus a bridge or culvert.

**Potential LWSC Site Selection Criteria**

Criteria	Most Favorable for LWSC	Unfavorable for LWSC
Average Daily Traffic (ADT)	5 vehicles	More than 700 vehicles
Average annual flooding (Acceptable closing duration) - How many times/year would the location flood/overtop the LWSC	Less than 2 times per year	More than 10 times per year
Average duration of traffic interruption per occurrence	Less than 24 hours	More than 3 days
Extra travel time for alternate route	Less than 1 hour	More than 2 hours
Bridge length versus design flood frequency - Does the lower design significantly shorten the bridge length?	Lower design flood frequency allows significant savings versus standard bridge or culvert	Lower design flood frequency does not show much savings versus standard bridge or culvert
Frequency of using LWSC as an emergency route	None	More than once per month

If a site is selected as a potential location for a LWSC, then the design of the LWSC may be able to mitigate some issues. The County would need to develop design standards to include in the *Arapahoe County Infrastructure Design and Construction Standards*.

**Liability / Safety Issues**

***When Bridge Is Not Overtopped***

The vast majority of the time, the road surface will be above water. The following are some of the issues to consider during these periods:

- ✦ Most LWSCs do not have bridge rail or approach guardrail. Some have barrier curbs with gaps or large slots to allow for drainage. The lack of a bridge rail is a potential safety hazard and land access issue. An example bridge in Malibu, California has bridge rails that are designed to collapse when the structure is overtopped.
- ✦ Maintenance forces will need to check the LWSC locations periodically to ensure that they were not damaged during periods when they were overtopped.

- ✦ Debris that has collected at the crossing may need to be removed. The riding surface may need to be swept after overtopping to remove the thin film of dirt or sand that may remain and become slippery.

### ***When Bridge Is Overtopped***

Vehicles entering the crossing when it is overtopped can be a serious safety issue, with the potential for vehicles to be swept off the road in as little as six inches of water. Drivers may also drive into damaged sections of the road that are not visible under the water. Signing and notification standards should be established with the County design standards for LWSCs. The following measures can help reduce the safety risks.

- ✦ Standard Static Signs: The Iowa DOT and U. S. Forest Service (USFS) recommend the following sequence of signs on each approach to a LWSC:
  - ✦ “FLOOD AREA AHEAD”, with a supplemental plaque below that says either “X FEET AHEAD” or “X MPH”.
  - ✦ “IMPASSABLE DURING HIGH WATER”
  - ✦ “DO NOT ENTER WHEN FLOODED”
- ✦ Other Static Signs: Johnson County, Kansas has recently added signs at LWSCs that state “TURN AROUND – DON’T DROWN”.
- ✦ On-Site Warning Systems: San Diego County, California has the following warning devices at LWSCs:
  - ✦ Warning Flasher: Warning light activates when water is over the road.
  - ✦ ALERT Flasher: Flashes yellow when the road is overtopped by up to six inches. Flashes red when it is overtopped by more than six inches.
  - ✦ ALERT Flasher/Barrier: Crossing gates, like at railroad crossings, are added to the LWSC approaches.
- ✦ Road Barricades / Closure Signs: Maintenance forces can physically barricade the road closed when it is unsafe to cross.
- ✦ Public Notification Measures:
  - ✦ Hays County, Texas has an on-line flood warning system that indicates when LWSCs are flooded, in warning or in service. This system covers about 35 crossings in a ten-county area around Austin and San Antonio, including 16 crossings in Hays County.
  - ✦ Agencies may issue LWSC warning alerts along with notifications regarding flooding, weather conditions and traffic incidents.

## Potential Candidates for LWSCs in Arapahoe County

### ***New Road Construction***

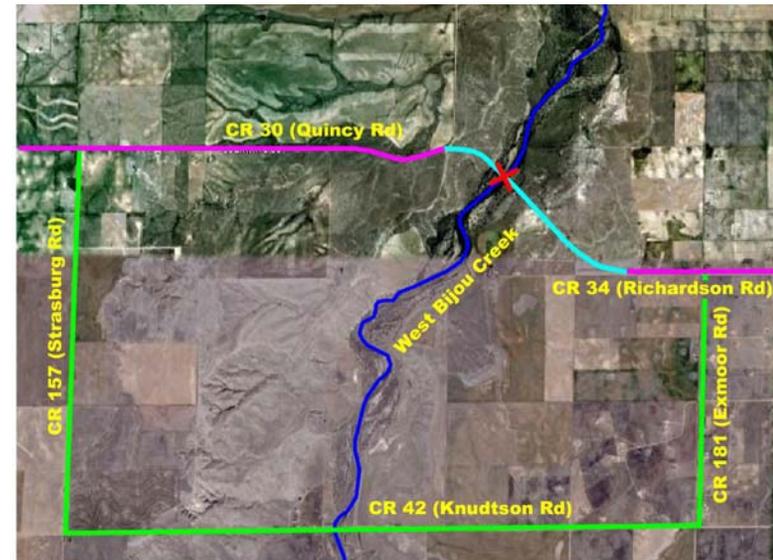
The new road alignments that are recommended in the Arapahoe County 2035 Transportation Plan have an average daily traffic volume (ADT) of 300 vehicles per day (vpd) in 2020 and 1,000 vpd in 2035. The Iowa memo suggests that if the ADT is 400 or more, then a 50-year frequency should be used. A 100-year frequency design, which would produce a somewhat larger bridge, is the standard procedure for Arapahoe County. However, Arapahoe County can establish a higher design frequency for a crossing, taking into account the balance between capital cost, maintenance and operation costs and roadway functionality.

The extension of Quincy Avenue across West Bijou Creek east of Bradbury Road is expected to carry 300 vpd in 2020 and 1,000 vpd in 2035. This location would be a good candidate for a low water bridge, which is the type of LWSC that has the highest flow capacity and the best resistance to damage during high water events.

The potential new route option that would connect Quincy Avenue to Richardson Road at Exmoor Road was chosen for this LWSC discussion.

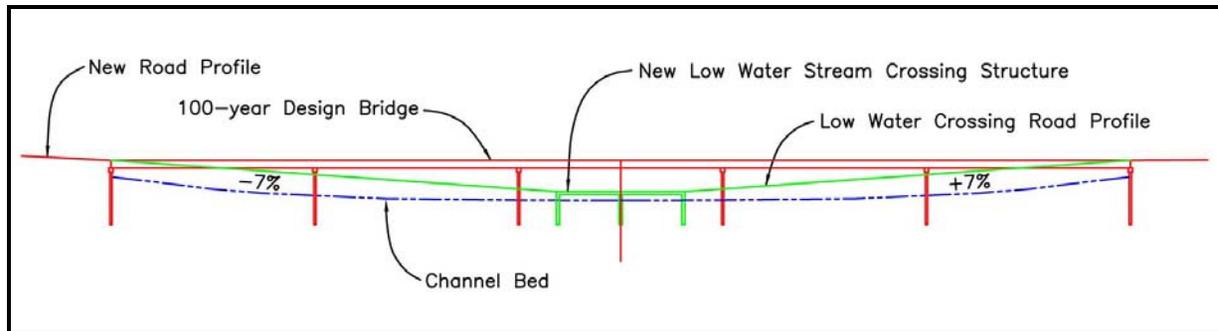
### **Quincy Avenue (CR 30) over West Bijou Creek**

- ✦ Average daily traffic (ADT): Current = Not Applicable, 2020 = 300 vpd, 2035 = 1,000 vpd
- ✦ Unskewed crossing in a relatively straight portion of the creek.
- ✦ Large ephemeral channel with small perennial low flow channel.
- ✦ The 100-year design bridge would be approximately 475 feet long.
- ✦ The LWSC would be approximately 60 feet long and designed to handle a one-or two-year flood event without overtopping.
- ✦ Alternate route: Up to 14.5 extra miles (about 25 extra minutes) via Knudtson Road (load restricted road)



#### Map Legend

- Red X = Low water bridge location that would carry Quincy Avenue (CR 30) over West Bijou Creek
- Turquoise Line = New roadway section
- Green Line = Detour route when LWSC is closed
- Magenta Line = Primary travel route



The LWSC in this example is a low water bridge, which would have a reinforced concrete slab superstructure and a substructure composed of concrete walls with footings, pilings or caissons that extend to bedrock or scour resistant material. This drawing illustrates the reduced capital cost of the LWSC, as compared to a 100-year design bridge. Depending on how the LWSC performs in this location (frequency and duration of closures, safety issues, maintenance needs after high flow events), eventually replacing this LWSC with a 100-year design bridge should be considered as traffic volumes increase. Given the traffic forecasts within the Transportation Plan, this LWSC would be adequate for at least ten years.

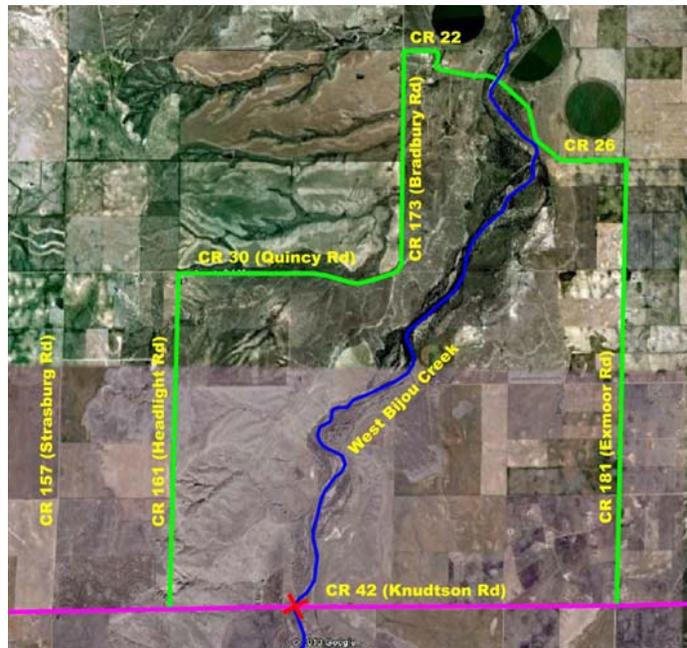
### Bridge Replacement

The 43 Arapahoe County bridges were reviewed to identify a potential candidate for future replacement with an LWSC. A candidate is a bridge at CR 42 (Knutson Road) over West Bijou Creek.

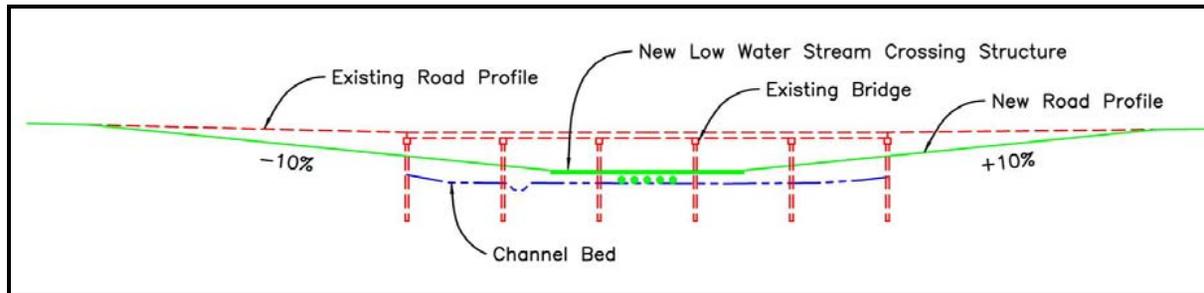
#### Knudtson Road (CR 42) over West Bijou Creek

- ◆ Average daily traffic (ADT): Current = about 75 vpd, Future = about 125 vpd
- ◆ Deck, Superstructure and Substructure condition ratings = 5 (lowest County bridge values)
- ◆ Bridge Weight Limit = 25 tons (load restricted)
- ◆ Unskewed crossing, but in a mild creek bend.
- ◆ Large ephemeral channel with small perennial low flow channel.
- ◆ Alternate route: Up to 17 extra miles (about 30 extra minutes) via Quincy Avenue and local roads





**Map Legend**  
 Red X = Low water crossing location that would carry Knudtson Road (CR 42) over West Bijou Creek  
 Green Line = Detour route when LWSC is closed  
 Magenta Line = Primary travel route



The LWSC in this example is a vented ford (with pipes). This drawing illustrates the reduced capital cost of the LWSC, as compared to a replacement bridge. For the LWSC option to function acceptably, it is critical that the approach roadway sections and the vented ford survive high flow events with minimal damage. To help achieve this, the embankment sections that protrude into the channel would need to be well-armored.

## Recommendations

Low water stream crossings (LWSCs) are recommended for consideration by Arapahoe County as an economical design option for old rural roadway bridges in need of replacement and for the potential phased construction of new rural roadways crossing streams. If utilized for phased construction, the LWSC should be upgraded to bridge or culvert standards when the traffic volume limit (700 vpd) is exceeded. LWSCs should not be allowed for new and/or phased road construction that is being required as part of a new development. If a LWSC is located on a roadway that will provide access to new development, the upgrade of the LWSC to bridge or culvert standards should be considered as a potential impact to be mitigated by the developer.

Based on a review of criteria from other jurisdictions dealing with rural road stream crossings and consideration of the substantially less precipitation in eastern Colorado than in the example locations, the following criteria are recommended for Arapahoe County.

### Potential LWSC Site Selection Criteria – Arapahoe County

Criteria	Application	
	Existing Bridge Replacement	New Crossing or Phased Construction <sup>(1)</sup>
Average daily traffic (ADT)	Up to 400 vpd	400 – 700 vpd
Average annual flooding (Acceptable closing duration) - How many times/year would the location flood/overtop the LWSC	10 times per year	5 times per year
Average duration of traffic interruption per occurrence	Less than 4 days	Less than 3 days
Bridge length versus design flood frequency - Does the lower design significantly shorten the bridge length?	Lower design flood frequency allows significant savings versus standard bridge or culvert	Lower design flood frequency does not show much savings versus standard bridge or culvert

<sup>(1)</sup> LWSC not recommended for new and/or phased rural road construction required as part of new development

The County will need to adopt a policy for the site selection and application of LWSCs and develop design standards to include in the *Arapahoe County Infrastructure Design and Construction Standards*. The design standards should include the requirements for the design storm frequency, allowable overtopping flow depth, structural design details, approach grades, guardrails, height of crossing above streambed, erosion protection, and construction procedures. It is recommended that the design standards include signing, warning device, and public notification standards. The public notification standards should include the protocol for considering and providing road closure information to the general public, area residents, school districts, fire districts, and emergency responders.

# *Arapahoe County 2035 Transportation Plan*



## RURAL TRANSIT WHITE PAPER

November 2010

Submitted to



Arapahoe County  
10730 East Briarwood Avenue, Suite 100  
Centennial, CO 80120

Submitted by



David Evans and Associates, Inc.  
1331 17<sup>th</sup> Street, Suite 900  
Denver, CO 80202



## Rural Transit in America

Providing transit services to rural areas is challenging due to the low population density and sparse distribution of housing and employment. Rural residents tend to be automobile dependent. Compared to urban areas, transit vehicles within rural areas carry fewer passengers and drive a greater distance to pick up each passenger. Therefore, the cost per passenger-mile is much higher in rural areas than in urban areas.

Rural transit is an important part of a “life-sustaining” network of services for residents of rural areas. Most often, rural transit services are focused on the needs of the elderly and the disabled, taking riders to medical appointments, senior activity and meal centers, bringing people to grocery stores and shopping centers, and helping people tend to personal business.

### *Types of Service*

The Federal Transit Administration (FTA) divides rural transit services into the following categories:

- ✦ **Demand Response:** Passenger cars, vans or small buses operating in response to calls from passengers. These vehicles are typically wheelchair-accessible and the passengers are typically senior citizens or developmentally disabled. Some systems accept low-income passengers or those who are too young to drive. According to FTA, this accounts for 66% of rural transit in the United States.
- ✦ **Bus** (including four types of service for rural areas):
  - ✦ Fixed Route: Fixed routes and fixed schedule (10% of rural transit)
  - ✦ Deviated Fixed Route: Along fixed routes at generally fixed times, but deviate up to a set distance to collect or drop off passengers (13% of rural transit)
  - ✦ Fixed and Deviated: A combination of the services described above (7% of rural transit)
  - ✦ Private Intercity Bus: Connects a rural area to an urban area (3% of rural transit)
- ✦ **Vanpool:** Vans, small buses and other vehicles operating as a ridesharing arrangement, typically transporting a group of individuals from their homes to a regular destination (1% of rural transit)

### **Funding Sources**

Rural transit operators derive a high percentage of their operating funding from federal and state grants, with the remainder of funds coming from local government and contracts (usually with human service agencies), and a small portion from fares and donations. Since transit services are not a required function of local governments, as are police and fire protection, rural transit operators must compete for general fund dollars along with other government services. Operating funding sources include:

- ✦ Federal funds (administered by the FTA provide about 25% of operational funding through the Section 5311 – Non-Urbanized Area Program; Section 5310 – Special Needs of Elderly Individuals and Individuals with Disabilities Program; Section 5316 – Job Access and Reverse Commute Program; and Section 5317 – New Freedom Program.
- ✦ State assistance provides about 20% of operational funding.
- ✦ Local assistance (counties, cities and other local jurisdictions) provides about 25% of operational funding.
- ✦ Fare revenues and donations provide only about 10% of operational funding. Many providers do not charge fares for their services due to restrictions that come with federal grants, but can accept donations.
- ✦ Contract revenues provide about 20% of funding, primarily through contracts with human service agencies, schools, and other entities to provide passenger services.

Capital funding for items such as transport vehicles, maintenance facilities and on-route improvements relies on Federal assistance, which accounts for nearly two-thirds of the funding totals. A brief description of capital funding sources is as follows:

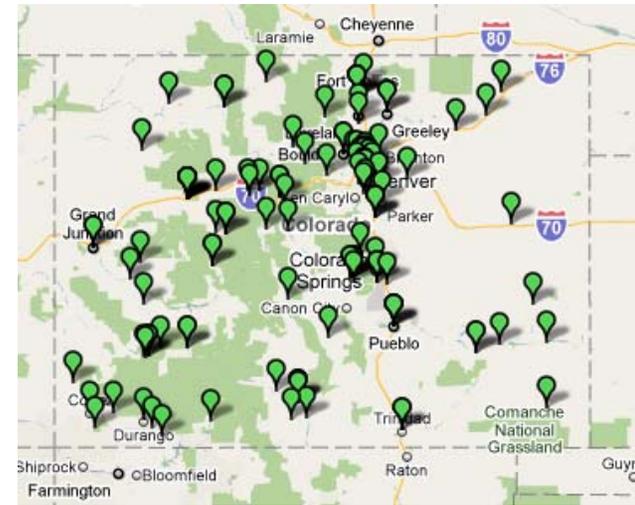
- ✦ Federal funds (administered by the FTA provide about 67% of capital funding through the Section 5311 – Non-Urbanized Area Program, Section 5309 – Capital Program, and the Section 5310 – Special Needs of Elderly Individuals and Individuals with Disabilities Program.
- ✦ State assistance provides about 15% of capital funding.
- ✦ Local assistance (counties, cities and other local jurisdictions) provides about 18% of capital funding.

### **Transit Systems around Colorado**

There are a wide variety of transit systems that currently operate in Colorado. They vary from large urban systems that provide millions of annual passenger trips to small rural systems with one van that provides less than ten thousand trips per year. There are 64 counties in Colorado. All but two of them (San Juan County and Hinsdale County) have a transit system that serves some portion

of their populace. The best characteristic that can be used to categorize the type of system that operates in each county is population density, which indicates the number of residents per square mile.

There is a broad distribution of transit systems located around the State of Colorado, as indicated on this map provided by the Colorado Association of Transit Agencies (CASTA).



**Fixed Route**

There are 28 counties in Colorado where fixed route transit systems operate. Demand responsive transit services are also provided in each of these counties, although these services are typically provided by a different organization than the primary fixed route operator. The following table and list categorize the function of the transit systems into several primary categories.

**Fixed Route Systems**

Category	Number of Counties	Total Population in Counties	Population Density (people per square mile)
Front Range	11	4,100,000	270
Resort / Tourist	9	220,000	16
Commute to Resort	3	80,000	10
Other	5	225,000	25

- ◆ **Front Range:** These counties have over 80 percent of Colorado’s total population of about five million people. Transit systems include the six-county Regional Transportation District (RTD) and smaller systems such as Greeley Transit and Pueblo Transit. The primary transit systems in these counties provide service to the urbanized areas, which comprise about one-fifth of the total area of these counties.
- ◆ **Resort / Tourist:** These operations include the Summit Stage in Summit County, ECO Transit in Eagle County and Steamboat Springs Transit in Routt County. Attractions in these counties draw visitors during peak seasons that far exceed their resident

populations. The amount collected from fares is low because many of these operators do not charge fares. This is the result of competition with resorts in other states and concerns that large volumes of skiers would be delayed greatly by fumbling around for change or bus passes.

- ✦ **Commute to Resort:** These systems provide bus routes that transport low-income workers to ski resort areas from outlying counties where housing is more affordable. Services include extensions of ECO Transit into Leadville, in Lake County.
- ✦ **Other:** The only major urbanized area in this category is Grand Junction. The other four counties provide interesting examples of fixed-route service in rural portions of the state.
  - ✦ The Northeast Colorado Association of Local Governments (NECALG) operates the County Express system that provides demand responsive transit service to a six-county area. In recent years, they have added fixed route service from Fort Morgan to Brush, in Morgan County, and within Sterling, in Logan County.
  - ✦ Archuleta County provides a route that covers Pagosa Springs and stops along US 160, extending about 15 miles to the west of the city.
  - ✦ In Otero County, the Arkansas Valley Community Center operates, in conjunction with the City of La Junta, a 30-mile long fixed route service open to the general public. This service travels from Fowler to Rocky Ford and La Junta.

### ***Demand Response and Deviated Fixed Route Service***

There are 35 counties in Colorado where no fixed route service is provided. These systems provide door-to-door demand response service. Most commonly, these services are provided for the elderly and developmentally-disabled segments of the populace. In some counties, these services are expanded to cover low-income residents and others who do not have adequate access to personal transportation. Service areas vary, with nominal coverage provided to the entire county in some locations and where pick-up areas are limited to the more populous areas in other counties.

In a limited number of Colorado counties, deviated fixed route service is provided. This type of service operates on established days and picks up passengers who are within a certain distance from the route who have called ahead of time for a reservation. There are four types of operational structures that are used around the state to provide these services, as described in the following table and list.

**Demand Response and Deviated Fixed Route Systems**

Operated By	Number of Counties	Total Population in Counties	Population Density (people per square mile)
Private Non-Profit	16	250,000	12
County	7	60,000	5
Multi-County	10	80,000	4
City	2	15,000	3

- ✦ **Private Non-Profit:** This is the most common type of demand responsive provider throughout the state. In rural Colorado, these agencies provide services in the relatively more populous rural counties.
- ✦ **County:** There are seven counties where the demand responsive service is run by the county (Baca, Bent, Dolores, Kiowa, Montezuma, Ouray, and Prowers)
- ✦ **Multi-County:** There are three systems that are run by cooperatively organized agencies, including:
  - ✦ The Northeast Colorado Association of Local Governments (NECALG) operates the County Express system in northeastern Colorado (Logan, Morgan, Phillips, Sedgwick, Washington, and Yuma counties).
  - ✦ The East Central Council of Governments operates the Outback Express service in a four-county area (Cheyenne, Elbert, Kit Carson, and Lincoln counties).
  - ✦ The South Central Council of Governments operates the Outback Express service in a two-county area (Huerfano and Las Animas counties).
- ✦ **City:** The cities of Meeker, in northwest Colorado, and La Junta, in southeast Colorado, run demand responsive transit systems that serve their communities.

“Without County Express, the quality of life of these residents would be adversely affected and these residents would face difficult personal choices, including relocation from their hometown.”  
 - Larry Worth,  
 Executive Director, NECALG

These services are of vital importance to the customers of these systems.

## Existing Transit Services in Rural Arapahoe County

The east end of Arapahoe County has about 70% of the County's land area and about 1% of the County's population. The population density is 13 people per square mile. About half of the counties in Colorado have greater population densities and about half have less. There are about 4,000 Arapahoe County residents in the communities along I-70 and about 3,000 in the rest of this area. Transit services in this portion of the County are as follows:

### ***Private / Non-Profit Organizations***

- ◆ Demand Response Service: Special Transit operates demand response service from the communities along I-70 (Deer Trail, Byers, Strasburg, Bennett and Watkins) to the Aurora Metro area on Tuesdays and Fridays. Special Transit is a private / non-profit organization based in the City of Boulder. Trips head west to Aurora in the morning and return in the afternoon. These services are available to the general public, but are primarily used by elderly and disabled riders. There were a total of about 1,000 trips to / from these communities in 2009, collectively referred as the Tri-Valley area. This service is partially funded by Arapahoe County.
- ◆ Vanpool Service: This program is run by the Tri-Valley Senior Citizens Association, with partial funding from Arapahoe County. Rather than sharing driving among the users, as is common with vanpools, the vans are driven by paid drivers.

The type of transit services currently available in the eastern end of Arapahoe County are comparable with those provided in other counties that are of a similar nature.

## Alternative Transit Delivery Concepts for Rural Arapahoe County

Provision of rural transit services by private/non-profit agencies is a successful solution that works well in many counties. These agencies receive funding from a variety of different sources, which helps to offset the costs of running the service. This delivery model does not, however, provide counties with much control over how the program is administered. Other concepts that can be considered by Arapahoe County are described below.

### ***County-operated***

If Arapahoe County were to operate its own transit system for the eastern end, it would have more control over where and when the services are provided. Service could be provided for more days than are currently provided by Special Transit. Areas further away from I-70 could be covered. This would, however, entail the County taking on significant new responsibilities. County personnel

would need to obtain transit vehicles and hire paid drivers or recruit volunteer drivers. This could be as simple as obtaining one dedicated van, but the level of service may suffer if the demand for services exceeds the available resources.

Example systems operated by other rural Colorado counties include:

- ✦ Prowers County, with a population of about 13,000 people, runs a demand response service with five vehicles. It serves about 26,000 passenger trips per year.
- ✦ Baca County, with a population of approximately 4,000 people, runs a demand response service with one vehicle. It serves about 20,000 passenger trips per year.

These total trips served are significantly greater than the approximately 1,000 annual trips that are provided by Special Transit in Arapahoe County. A careful assessment of currently unmet demand, as well as costs and potential revenue sources would need to be undertaken before committing to this type of new County-operated service. There are other rural counties around Colorado that would provide good information regarding the operation of this type of system.

### ***Multi-County***

Arapahoe County could partner with surrounding rural counties to provide a multi-county rural transit system. This model has been successfully applied to other areas within the eastern plains of Colorado, including the Outback Express service and County Express system.

### ***Public/Private Partnerships***

Exclusive relationships typically exist between users and private providers of transportation. For example:

- ✦ School boards typically contract school bus operators to provide transportation
- ✦ Social service agencies use volunteers and / or agency vans
- ✦ Health facilities primarily use ambulances

Improved coordination of transportation services between public agencies and private companies can result in less duplication, increased efficiency and fewer gaps in service. It also breaks down barriers between client groups, thus providing a wider range of vehicles to meet users' needs in a more flexible and cost-effective manner.

Providing transit services to government social service agencies and private companies can increase the potential revenue pool for transit systems and increase utilization of their vehicle fleet. The following quote comes from Larry Worth, the executive director for NECALG, “Last year, we signed a contract with Banner Health, Colorado to provide non-emergency transportation to its clients between Sterling, Brush and Greeley. This public-private partnership eliminates duplication of trips and provides better service to the client. In addition to financial support, it would take new partnerships with local counties, municipalities, nursing homes, senior centers, and assisted living facilities to meet the estimated demand for transit.”

### ***New Services Connecting to West End Transit Services***

New fixed route or demand response call-n-Ride services could be added to connect semi-urban and rural citizens into the transit systems that are available in the west end of Arapahoe County. This service would be expensive and the ridership potential may be fairly minimal. Travel to the Denver Metro area involving this new east end service and transfers to one or more RTD bus or rail lines could result in long travel times. These travel times would be uncompetitive with automobile travel time on relatively uncongested rural roads, which would limit usage.

### ***New Service for Future Lowry Range Development***

Transportation service and connectivity will need to be addressed for the future Lowry Range development. Development density more typical of urban and semi-urban development than that of rural eastern Arapahoe County is proposed. Limited area roadway infrastructure and the opportunity to model the development layout and design to support public transit usage make consideration of future transit service viable.

### ***Public Transportation Service Outside the RTD District***

RTD cannot legally provide service outside the district directly or by directly contracting with a private provider per state statutes defined in Title 32, Article 9, and beginning with section 32-9-106.6. RTD does provide subsidies to DRCOG for vanpool services, and to Castle Rock, for service part in and part out of the district based on proportion of miles served. RTD has not been responsible for arranging the service, just subsidizing that portion that is in the district. Consistent with that approach, if the Lowry Range development was to provide some service and portions ran within the RTD district, RTD could subsidize that portion. When RTD contracts with private providers under 32-9-119.5, they act under RTD’s governmental authority, not PUC authority, and are not required to obtain PUC authority for RTD contracted service under the privatization statute. RTD also has no legal authority to operate outside the district except for charter service, which comes under a host of Federal Transit Administration proscriptions.

**RTD Boundary Expansion**

The RTD boundary can be expanded in several different ways. Prior to 1994, the only way was for a bill to be passed by the legislature officially changing the boundary description and that is still an option. However, HB1344, effective May 25, 1994, made a number of changes:

1. Any property annexed by a municipality after that effective date, if that municipality was wholly or partially within RTD, automatically became part of the RTD (and the stadium and scientific and cultural districts). This would be applicable if the Lowry Range was annexed into Aurora.
2. A property owner or group of property owners – if 100% of the property owners – could petition the RTD Board to annex any unincorporated property of 35 acres or larger to become part of RTD, if the land was contiguous to any part of the existing RTD boundary. The Lowry Range is not contiguous to the existing RTD boundary.
3. A group of property owners could request an annexation election for an unincorporated area that wanted to become part of RTD. A petition signed by at least eight percent of the eligible electors residing within the land to be annexed needs to be submitted to the Board for approval. This would also work for any land within a municipality. The election would only be for those persons residing within the area to be annexed. The applicability of this option for the Lowry Range is uncertain.
4. If an area is entirely surrounded by land within RTD, the Board can pass a resolution to annex that land. The only restriction is that a public right of way cannot make up any part of the boundary of the enclave to be annexed. The Lowry Range is not surrounded by land within the District.

**Recommendations**

Based on the review of transit-related service options for rural Arapahoe County, the following opportunities and strategies are recommended for consideration:

- ✦ A transit study, including a citizen survey, should be completed for the eastern rural area to determine the transit demand levels and characteristics that will shape future transit program initiatives. As part of that study, transit programs in Unincorporated Arapahoe County should be investigated so that the County may integrate transit programs with other service providers.
- ✦ Park-n-Ride lots are recommended along the I-70 Corridor at Bennett, Byers and Strasburg. These lots would facilitate formation of carpools and vanpools for ride sharing.

- ◆ A ride share matching/awareness program should be initiated to assist ride sharing by rural residents.
- ◆ Proposed development of the Lowry Range should focus development intensity within proximity of potential transit terminals. Pedestrian and bicycle friendly street design should be incorporated with direct continuous sidewalks or equivalent provisions for walking to maximize walking trips to and from future transit stops in the area.
- ◆ Multi-jurisdictional coordination, planning and support for “transit corridors” should be continued to provide connections to the more rural areas of the County. This includes Parker Road, I-225, E-470, and Jewell and Quincy Avenues that lead to the proposed Lowry Range development area.

# *Arapahoe County 2035 Transportation Plan*



## TRAVEL DEMAND MANAGEMENT WHITE PAPER

November 2010

Submitted to



Arapahoe County  
10730 East Briarwood Avenue, Suite 100  
Centennial, CO 80120

Submitted by



David Evans and Associates, Inc.  
1331 17<sup>th</sup> Street, Suite 900  
Denver, CO 80202



## What is Travel Demand Management?

In recent decades, travel demand has increased significantly due to population growth, social trends, the rising numbers of vehicles on the road, and changing land use characteristics. Adding roadway capacity with new roads or roadway widening has traditionally been the standby solution to combating this problem, however many areas continue to struggle with outpaced roadway capacities. Additionally, limited funding for capital improvements and environmental concerns associated with roadway expansion make it necessary to find other solutions to maintaining an efficient roadway system. Travel Demand Management (TDM) refers to the concept of increasing and influencing travel choices in order to manage travel demand.

## TDM Strategies

TDM strategies provide alternatives to single-occupancy vehicle (SOV) and peak period travel and help to make more efficient use of existing and future roadway infrastructure. Fundamental TDM strategies include:

- ◆ Transit
- ◆ Vanpools
- ◆ Carpools
- ◆ Bicycling/walking
- ◆ Telecommuting
- ◆ Variable work hours
- ◆ Land use/development models to support alternative transportation modes

Within the Denver Metro area, the Denver Regional Council of Governments (DRCOG) RideArrangers helps business and individuals avoid traffic congestion and reduce pollution by promoting and providing transportation options, including registration and matching for vanpooling and carpooling and assistance with setting up telecommuting programs.

While the fundamental strategies provide a basis for TDM, the implementation of a single strategy rarely provides the relief needed for significant travel demand reduction on a regional transportation system. TDM strategies work best when used in combination. Additionally, several support strategies are essential to the success of the core strategies. These secondary strategies include:

- ◆ Parking management
- ◆ Incentives
- ◆ Intelligent Transportation Systems (ITS)
- ◆ Marketing and education
- ◆ Smart growth practices

### **Transit**

Transit provides an alternative mode to automobile travel and also provides transportation for those who cannot drive or do not have an automobile available to them. Fixed-use bus service and call-n-ride services are currently provided to western Arapahoe County (generally west of Picadilly Road) through the Regional Transportation District (RTD), and to the eastern communities along the I-70 Corridor through Special Transit.

### **Vanpools**

A vanpool is an organized group of 5-15 people that commute together on a regular basis in a van. The vans are driven by one or more members of the vanpool who typically receive free fare in exchange for service. Riders pay a relatively low monthly fee.

Vanpools typically fall into one of three categories:

- ◆ Third-party vanpools: Vans are owned and operated by a for-profit vendor that leases the vehicle to the vanpool. Maintenance, insurance, and administration is provided by the vendor while the vanpool members are responsible for promoting the service and collecting fees. The Denver region vanpool program is a partnership between DRCOG and RTD.
- ◆ Employer-sponsored vanpools: Employers purchase or lease vans to employees and cover the maintenance, insurance, and administration of the program.
- ◆ Owner-operated vanpools: Vans are owned by one or more of the group's members, who may receive subsidies through employers or organizations. The owner(s) arrange for maintenance, insurance, and fare collection.

Benefits to riders include cost savings, reduced wear and tear on personal vehicles, reduced stress associated with commuting, and the convenience of door-to-door service. Employers benefit from reduced parking needs, increased employee productivity and morale, and reduced tardiness and absenteeism.

Vanpools work best for commuters that live and work reasonably close together and travel over 15 miles to their destination.

### **Carpools**

Carpooling is when two or more people commute to work or other destinations together. Participants make their own arrangements as to who drives, how often, schedules, and payment for gas/parking and vehicle maintenance. DRCOG assists interested drivers with matching other interested people who live and work closely.

Benefits to participants are similar to vanpooling and include cost savings, reduced wear and tear on personal vehicles, reduced stress associated with commuting, and the convenience of door-to-door service. Carpooling has an additional advantage of being more flexible to individual schedules and rules.

### **Bicycling/Walking**

Additional transportation modal choices help reduce congestion by reducing vehicle trips and miles traveled. Modal shifts from driving to bicycling or walking also increases community livability and generally improves public health. Bicycling and walking are important ways to supplement other TDM strategies such as transit, vanpooling, and carpooling.

Examples of bicycling and pedestrian-friendly land use design considerations include:

- ✦ Complete Streets design concepts that provide facilities for all users, including pedestrians and bicyclists
- ✦ Continuous and uninterrupted systems of bike paths, trails, and sidewalks
- ✦ Safe, convenient, and frequent street crossings
- ✦ Building entrances close to bike paths, trails, and sidewalks
- ✦ Adequate signing of bike paths and trails
- ✦ Bicycle parking in commercial and recreational areas and bicycle storage at transit centers, transit stops, and park-and-ride lots
- ✦ Pedestrian and bicycle facilities constructed as land is developed based on standards for the street classification
- ✦ Buffer zones between traffic and pedestrian areas using trees, landscaping, or on-street parking areas

Rural areas tend to have roadways with higher travel speeds and physical conditions not supportive to walking and bicycling. Speed reduction techniques using signage and 'gateway' designs in transition areas may provide safer conditions for pedestrians and bicyclists in semi-urban or semi-rural areas. Gateway designs, which include treatments like curb extensions, medians/islands, and raised crosswalks, notify drivers of a change in roadway character, encourage slower speeds, and increase awareness of the

possibility of surrounding pedestrians and bicyclists. Roadways in rural areas should include paved shoulders, which may be striped and signed as a bicycle lane. Rural areas can also benefit from right-of-way acquisition along roadways to add future bike paths or sidewalks in areas with future development expected.

### ***Telecommuting***

Allowing and promoting employees to telecommute from home or other remote locations one or more days a week provides an effective, low-cost method of reducing commuter travel. Benefits to employers include increased productivity, higher retention rates, and cost savings. Employee benefits include better work/life balance, less commuting stress, and cost and time savings.

### ***Variable Work Hours***

Changing commute time periods can reduce the traffic volumes experienced during peak morning and evening congestion periods, particularly on primary commute corridors within large urban areas. Strategies to implement variable work hours include:

- ✦ Flex-Time: Employees are allowed some flexibility in their work schedules that allow them to commute during off-peak periods, but employees often require employee presence during predetermined core business hours.
- ✦ Compressed Work Week: Employees work fewer but longer days, such as four 10-hour days each week (4/40), or 9-hour days with one day off every two weeks (9/80).
- ✦ Staggered Shifts: Employee shifts are staggered to reduce the number of arriving and leaving a worksite at one time.

Variable work hours benefit employees and employers by increasing overall job satisfaction and productivity and helping to accommodate transit and ridesharing use.

### **Rural TDM**

TDM techniques can be applied in rural areas, but need to be tailored to the context of these environments.

### ***Land Use/Development Models***

Low density residential areas cannot sustain traditional transit services. Transit options suitable to rural areas include call-n-ride services and flexible routing services. An additional opportunity for increased transit usage in rural areas involves the development

over time of residential and commercial areas that are transit-supportive. Land use and transportation planning must be integrated. Basic development models used as a framework for this approach include:

**Mixed Use Development** - Mixed-use development that balances jobs and housing or housing and other services can reduce longer commuting and service-related trips on regional roadways.

**Concentrated Employment Areas** - Concentrated Employment Areas (exceeding 50 employees per acre) can generate relatively high ridership on public transportation.

**Dense Residential Development Areas** - Ridership on public transit increases as residential density increases. At a minimum, residential densities should be at least 4,000 people per square mile to support public transit. Rural Arapahoe County, with single family homes on 5 to 35 acre lots, currently has residential densities of about 50 to 350 people per acre.

### ***Intelligent Transportation System (ITS) Strategies***

ITS strategies can also improve transportation system efficiency and safety in a cost-effective manner with reduced large-scale infrastructure construction. Rural areas benefit from ITS methods that promote driver information, emergency or hazard notification, and mobility services. Examples of these methods include:

#### **Dynamic Message Signs**

Dynamic or variable message signs can be used in rural areas to alert drivers of changing weather and traffic conditions. They may warn drivers of congestion, construction, or various roadway or weather related hazards like snow and flooding. They can also assist with traffic management for special-use areas or during special events.

#### **Integrated Traveler Information Systems**

Integrated Traveler Information Systems provide pre-trip planning and real-time information to drivers using a variety of media such as dynamic message signs, telephone, internet, and television. Integrated Traveler Information Systems are commonly used for event management, road closures and detours, and inclement weather conditions. They assist drivers by giving directions and routing information. Traveler Information Systems can also manage travel demand on congested roadways by warning drivers and directing them to alternate routes with more capacity.

**Speed Warning Systems**

Speed warning systems can be used in rural areas to inform drivers of their speeds or to inform drivers of recommended speeds due to congestion or weather changes. Variable speed zones are implemented by monitoring and detecting changes in roadway surface conditions that affect drivability. These systems alert drivers of driving conditions using dynamic message signs and electronically reduce posted speed limits to a speed consistent with the current roadway conditions.

**Current Practices: Example TDM in Colorado Counties*****Boulder County***

Boulder County's Transit Awareness Program implements a variety of strategies for TDM. Current strategies consist of transit marketing, education, and incentives. As part of this program, Boulder County offers an Eco Pass subsidy to all Boulder County companies and neighborhoods. This introductory subsidy takes up to 60 percent off the first year and 30 percent off the second year of new Eco Pass contracts. Boulder County also has a Countywide Transit Coordinator responsible for ensuring successful implementation of TDM strategies.

***Douglas County***

The Douglas County 2030 Transportation Plan, adopted in 2009, outlines potential TDM activities, including pedestrian/bicycle facility planning and design, transit corridor preservation and ridesharing incentives. The Plan notes that to maximize the effectiveness of transit services, Douglas County will work closely with transit service providers to enhance transit corridor facilities. The Plan also highlights supportive activities related to carpools, vanpools and variable work hours. These activities range from general promotion to zoning incentives and development credits for projects that provide significant rideshare commitments.

***Gunnison County***

The Upper Gunnison Valley Transportation Plan, updated in October 2008, addresses alternative modes/transit, pedestrian/bicycle systems, maximum carrying capacity of roadways and travel demand management. The TDM strategies supported in the Plan include bus passes, flex-time, telecommuting, and park-n-ride lots to serve carpools.

***Jefferson County***

Jefferson County's Major Thoroughfare Plan (2004) and Countywide Transportation Plan (2002 addendum) supports several TDM-related policies and implementation actions. These include:

- ✦ Street and road design to encourage walkable neighborhoods and activity centers, applying a “complete streets” philosophy and design guidelines
- ✦ Transit Oriented Development integrated with surrounding development
- ✦ Support of multimodal and transit corridors through jurisdictional coordination, planning and design
- ✦ Encouraging transportation alternatives in new development, such as providing carpool parking spaces, bus stop shelters and bicycle racks
- ✦ Promotion of TDM incentives to encourage telecommuting, car/vanpooling and transit ridership

### **Opportunities: TDM and Arapahoe County**

Arapahoe County should consider implementing a variety of complementary techniques and strategies for travel demand management, since TDM strategies are most effective when used in combination. Considering the existing and future land use and transportation system within unincorporated Arapahoe County, potential strategies for County support and implementation are listed below.

#### ***Urban and Semi-Urban Applications***

- ✦ Web-based services that facilitate commuters to find carpools, learn of transit options, or get a route map of the safest bike routes, with links to other agency web applications (i.e., RTD, DRCOG), as appropriate.
- ✦ Direct-marketing campaigns to County residents that improves awareness about travel options and provides incentives to try alternative modes of travel.
- ✦ Coordination with RTD transit that reaches semi-urban and rural residents and provides greater accessibility for all users.
- ✦ Improved pedestrian and bicycle routes for school children that reduces the number of school buses and provides students easier and safer access to schools.
- ✦ Mixed-use development models centered on transit centers or commercial developments that incorporate multi-modal transportation options in the plans.
- ✦ Transit-friendly planning and design at new developments, including increased intensity near potential future transit terminals, pedestrian and bicycle facilities.

- ✦ Integration of TDM strategies in zoning regulations.

### **Rural Application**

- ✦ Implementation of ITS strategies such as Integrated Traveler Information Systems on rural roadways.
- ✦ Carpool and vanpool matching, awareness, promotion and incentives.
- ✦ Park-n-Ride lots for ride sharing along the I-70 Corridor at Bennett, Byers and Strasburg.
- ✦ Coordination, planning and support of “transit corridors” that provide connections from the Denver Metro area to the eastern rural portion of the County.

### **Implementation Considerations**

Arapahoe County must consider several factors in implementation of TDM strategies. These include the cost for staff commitment, facility planning, design, construction and maintenance, and policy issues, including funding. Opportunities for the County to work with and promote the DRCOG RideArrangers program should be explored. Links to and coordination with the TDM strategies of other agencies, such as RTD, and jurisdictions within the County should be explored as much as possible to maximize program effectiveness while minimizing County spending.

### **Further Study**

The TDM strategies outlined and discussed should be more fully developed and defined as part of a countywide TDM Strategic Plan. This TDM Plan would identify the specific TDM strategies for the County, considering specific areas, applications, and funding to create a “toolbox” of strategies for prioritized implementation.

**Appendix E**  
**Funding Mechanisms**



## **1. Funding Mechanisms**

### **1.1. Federal Funding Mechanisms**

The Federal government finances transportation through congressional legislation and transportation programs under the United States Department of Transportation (USDOT) and Federal Highway Administration (FHWA). Funding, typically in the form of block grants or loans, is directed to state governments through funding formulas or to statewide transportation agencies for allocation.

#### **Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)**

In 2005, the SAFETEA-LU<sup>1</sup> bill was passed and signed into law. The legislation is the largest surface transportation investment in the Nation's history and aims to improve safety, reduce traffic congestion, improve efficiency in freight movement, increase intermodal connectivity and protect the environment. Most items funded by the SAFETEA-LU bill are targeted at federal highways, interstate transit or commerce and not directed at local communities. State departments of transportation generally administer programs directed at local communities. It is important to note that the programs initiated by SAFETEA-LU are funded through the end of 2010. As of this writing, Congress has yet to renew funding for the legislation.

#### **Surface Transportation Program (STP).**

The STP provides grants that may be used by states and local governments for projects on any federal-aid highway<sup>2</sup>, including the National Highway System, bridge projects on any public road, transit capital projects, and intra-city and intercity bus terminals and facilities. The SAFETEA-LU legislation made additional projects eligible for funding, including intersections with disproportionately high accident rates or high congestion as well as environmental restoration and pollution abatement projects. About 10 percent of all STP funds are set aside for transportation enhancement projects such as pedestrian or bicycle facilities, landscaping or other scenic beautification projects, historic preservation and mitigation of water pollution due to highway runoff. The Denver Regional Council of Governments (DRCOG) administers STP funding as well as the enhancement funds, which in 2009 totaled \$60.6 million.

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<sup>1</sup> Information regarding the SAFETEA-LU legislation was gathered from The U.S. Department of Transportation, Federal Highway Administration.

<sup>2</sup> A federal aid highway is any street or highway that is open to public travel, except one classified as a local street and/or minor collector. Roads classified as local streets or minor collectors are not part of the Federal-aid Highway System and are not normally eligible for STP funds.

**Congestion Mitigation and Air Quality Improvement Program (CMAQ)**

This federal program was re-authorized in 2005 when the SAFETEA-LU legislation was signed into law. CMAQ provides grants to state and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. The Federal share of project funds is generally 80 percent for intrastate projects and 90 percent for interstate projects. Other eligible improvements include carpool/vanpool projects; priority control systems for emergency vehicles and transit vehicles; and traffic control signalization. In Colorado, CMAQ funds are used to implement projects in three urban areas through Metropolitan Planning Organizations (MPOs).

**Highway Safety Improvement Program (HSIP)**

The HSIP is designed to reduce traffic fatalities and serious injuries on all public roads through the implementation of infrastructure-related highway safety improvement. To receive HSIP grant funding, the state must investigate highway crash data and define countermeasure strategies, write a Statewide Transportation Improvement Plan (STIP) and report the top five percent of high crash locations on the public roadway network within the state. States that have met all of their infrastructure safety goals are eligible to spend up to 10 percent of their HSIP funds for non-infrastructure projects (flex funds) including public awareness campaigns, education programs, and enforcement activities. Colorado is eligible to spend 10 percent on non-infrastructure projects. The Colorado Department of Transportation (CDOT) administers HSIP funding as well as the 10 percent flex fund.

**Recreational Trails Program (RTP)**

The RTP provides grant funds to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. The Federal Highway Trust Fund finances the RTP, which comes from a portion of the motor fuel excise tax collected from non-highway recreational fuel use. County governments are eligible to apply for these funds through the Colorado State Trails Grant program (responsible for the review process of all grant applications). In 2010, Colorado received approximately \$1.1 million in RTP funding.

**Safe Routes to Schools (SRTS)<sup>3</sup>**

Federally funded and administered by CDOT, the SRTS program allows any political subdivision of the state to apply for funds to construct or modify transportation infrastructure aimed at making routes to local schools safer. Projects may include but are not

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<sup>3</sup> The SRTS program was initiated by the SAFETEA-LU legislation.

limited to: installing bicycle parking facilities, facilities to slow traffic, striping, installing or improving sidewalks and developing off-street bicycle and pedestrian facilities. Projects must range in cost from \$50,000 to \$250,000.

### **Transportation Infrastructure Finance and Innovation Act (TIFIA)**

TIFIA provides Federal credit assistance in the form of direct loans, loan guarantees, and lines of credit to finance surface transportation projects. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms and potentially more favorable interest rates than can be found in private capital markets. Many surface transportation projects (highway, transit, railroad and intermodal freight) are eligible for assistance. TIFIA funded projects are significant. Anticipated projects must total at least \$50 million, or one-third or more of the state's Federal-aid highway apportionments for the most recently completed fiscal year, whichever is less. Projects where the primary purpose is to install an intelligent transportation system<sup>4</sup>, have a lower minimum cost—about \$15 million. Private and public entities can apply for financing, including county governments.

## **1.2. State Funding Mechanisms**

State funding mechanisms consist of legislative actions, taxes, and fees that raise revenue for construction and maintenance of transportation infrastructure. In 2009, the Colorado State Legislature passed a number of transportation-related laws aimed at bolstering transportation revenues; most notable is the FASTER bill. All legislative actions discussed in this section were passed during the 2009 legislative session. No transportation funding related bills were passed in the 2010 legislative session. FASTER and three additional transportation bills passed during the 2009 legislative session are described below along with other state funding methods.<sup>5</sup>

### **Funding Advancements for Surface Transportation and Economic Recovery (FASTER, HB 108)**

FASTER increases state transportation revenue collection and is projected to generate approximately \$250 million annually for structurally deficient bridges and statewide road safety projects. Sixty percent of the annual funding is devoted to statewide transportation projects, 22 percent to counties and the remaining 18 percent to municipalities. The bill increases motor vehicle registration fees, imposes a Road Safety Surcharge, rental car surcharges and higher late vehicle registration fees. The bill also allows

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<sup>4</sup> Examples of intelligent transportation systems: traffic signal control systems; variable message signs; automatic number plate recognition, speed cameras, etc.

<sup>5</sup> Information on the 2009 Colorado State Legislative Session bills is from Tomlinson & Associates' 2009 Colorado General Assembly Legislative Session Review and <http://www.colorado.gov/>

the Denver RTD to create ballot initiatives for tax increases without legislative approval as well as increase local and regional participation in the High Performance Transportation Enterprise (HPTE) and the Statewide Bridge Enterprise for completing surface transportation infrastructure projects.

**Regional Transportation Authority Property Taxes (HB 1034)**

Authorizes, with voter approval, a regional transportation authority to impose a uniform mill levy of up to 5 mills on all taxable real and personal property within its territory.

**Motor Vehicle Emissions Programs (SB 003)**

Expands the motor vehicle emissions program to now include Weld and Larimer counties. The bill also expands the program to include all previously excluded portions of Adams and Arapahoe counties.

**Devolve State Highways to Local Government (SB 078)**

Allows the state transportation commission to change the composition of the state highway system. This legislation allows existing state highways to be deemed city or county roads. In effect, this bill may shift a larger share of transportation maintenance responsibility from the state to local governments.

**Statewide Transportation Improvement Plan (STIP)**

STIP is a federally mandated plan<sup>6</sup> that addresses, by region, all transportation projects in Colorado. Counties may indicate capital improvement needs through their regional transportation district representatives (Arapahoe County is part of District 1 and District 6) to obtain funding. The state, in conjunction with CDOT, conducts the “Project Priority Planning Process” (4P) annually, from May through September. The 4P prioritizes capital improvement projects across the state to allocate funding. Arapahoe County can expect this program to contribute necessary transportation funding for major corridors and state highways.

**Highway Users Tax Fund (HUTF)**

HUTF primarily collects transportation-related revenue from motor fuel excise taxes, annual vehicle license and registration fees. Court fines from traffic infractions and specialty license plate fees are also attributed to the fund. The largest source of revenue for the fund is the motor fuel tax (22 cents per gallon). Combined with vehicle license and registration fees, these sources of revenue

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<sup>6</sup> The SAFETEA-LU legislation requires every state to develop a STIP with at least 4 years worth of projects. Colorado’s STIP contains 6 years of projects.

generate more than 90 percent of annual funds. The office of the State Treasurer manages HUTF. Arapahoe County receives HUTF funds through a statewide allocation process based on lane mileage and population. Revenue increases and new fees mandated by the FASTER bill are dedicated to the HUTF. Estimates conducted by the Governor's Office of State Planning and Budgeting indicate that due to the additional revenue streams included in the FASTER bill, Arapahoe County's annual HUTF allotment will increase by 17 percent over their 10-year historical annual average of about \$7.1 million.

### **State Infrastructure Bank (SIB) Loan Program**

Enacted by the Colorado State Legislature in 1998, the SIB funds transportation facilities with a low-interest revolving loan program. Funding is eligible for transportation projects; including feasibility studies, engineering, construction, reconstruction, resurfacing, restoring and rehabilitation; right-of-way acquisitions; maintenance projects; aviation projects; and safety projects. There is no minimum or maximum loan amount as this is a revolving loan fund and the amount of funds on hand for loans may fluctuate from year to year. The SIB loan program targets a specific project area that may serve the entire system (i.e., all traffic signals and street signs) or an individual element of the transportation system (i.e. traffic corridor, intersection, or airport runway).

### **1.3. State Administrative Agencies**

The State has the option to establish administrative agencies that target the transportation system within a specific geographic area. The primary agency managing statewide transportation funding is CDOT. To a lesser extent, the Department of Local Affairs (DOLA), MPOs and the Denver RTD also help to administer state transportation funds. CDOT and the other agencies distribute Federal funds, maintain transportation infrastructure and coordinate transit. This section discusses the State administrative agencies that may work with Arapahoe County to fund transportation related infrastructure. Many of these state agencies allocate federal funds.

#### **Colorado Department of Transportation (CDOT)**

CDOT has been in existence since 1903 and is responsible for approximately 9,000 miles of Colorado highways and nearly 3,500 bridges. CDOT has a relationship with Colorado counties mainly through the administration of several federal funding sources. CDOT helps to allocate funds created by recent federal legislative bills (i.e., SRTS and STP programs). The SRTS and STP programs are focused on transportation infrastructure maintenance and improvements. CDOT also allocates several funding sources that aid transit agencies and public transit.

#### **Regional Transportation District (RTD)**

RTDs are usually created by state legislature, but can also be created by local governments. Currently, the Denver RTD covers the majority of the seven counties comprising the Denver Metro Area, including portions of Arapahoe County. Generally, RTDs are not

involved in capital improvements or repairing infrastructure but help alleviate traffic congestion through public transportation (such as rail and bus). The citizens of the western portion of Arapahoe County currently fund the Denver RTD through a sales tax.

**High Performance Transportation Enterprise (HPTE)**

HPTE was established by the 2009 FASTER bill. The organization takes the place of the Colorado Tolling Enterprise. HPTE pursues important surface transportation infrastructure projects that improve the safety, capacity, and accessibility of the surface transportation system. HPTE aims to find federal and state funding opportunities that will improve the transportation system. The program vision is to partner with local government entities to identify the greatest transportation needs in order to allocate funding efficiently. Projects utilizing user fee-based or other non-traditional forms of project funding are favored by HPTE funding programs.

**Statewide Bridge Enterprise**

Established by the 2009 FASTER bill, the Statewide Bridge Enterprise finances, repairs, reconstructs and replaces bridges across the state. The Statewide Bridge Enterprise has the ability to impose a bridge safety surcharge, issue revenue bonds or contract with other governmental or nongovernmental entities for loans or grants. This program, along with the HPTE, is in the process of implementation. Transportation projects have yet to be funded under these programs.

**1.4. Local Funding Mechanisms**

Counties adopt transportation funding mechanisms either through administrative action or popular vote. Generally, fees (i.e. impact fees or utility fees) are imposed by government action, such as county commissioners’ resolution. New taxes usually require a majority vote from citizens for approval.

**Additional Property Tax**

Property taxes are levied on the assessed value of real property (housing units, land, and commercial buildings) and personal property (commercial equipment) within a taxing entity’s boundaries. Property taxes may be increased for all residents or a targeted area (through a special district) and dedicated to transportation funding. Property taxes are a consistent source of revenue, although there is some mild fluctuation with property values. Arapahoe County currently imposes a 0.740 mill levy to fund transportation operations and maintenance, which is dedicated to the county’s road and bridge fund. The county can increase this mill levy, although a portion of any increase will be rebated to municipalities. The county currently allocates about \$4 million in annual revenue to transportation capital improvements, which is indirectly funded through the property tax-supported capital improvement fund (0.581 mills).

**Bonds**

Various types of bonds are used to raise low interest capital for transportation infrastructure improvement and maintenance: general obligation (GO) bonds, revenue bonds and private activity bonds (PAB). GO bonds are backed by the “taxing power” of a jurisdiction and are issued by a county government, a Public Improvement District (PID) or a Local Improvement District (LID). Revenue bonds are backed by revenues collected by a specific revenue-generating method such as a sales tax, public improvement fee or property tax. Generally, revenue bonds have higher interest rates than GO bonds. PABs are issued by or on behalf of a state or local government for the purpose of financing a private project deemed to have public benefit.

**Dedicated Sales Tax**

Sales taxes are a tax on retail merchandise that is levied and collected at the point of sale by the retailer. Local governments may dedicate a new sales tax to transportation system capital or operations. Sales taxes have the potential to raise large amounts of revenue but can be somewhat vulnerable to prevailing economic conditions. Dedicated sales taxes are generally used to fund systemwide capital improvements. Arapahoe County currently has voter-approved ¼-cent sales tax dedicated to fund open space, parks and trails. The open space sales tax is budgeted to generate \$17.2 million in revenue in 2010.

**Public Improvement Fee (PIF)**

A PIF is a voluntary fee that retail establishments collect on their customers’ sales transactions. A PIF is imposed at the point of sale and is usually a percentage of the sales price of purchased goods. PIFs are usually levied within a specific area or established district to improve surrounding public infrastructure. A PIF is generally used for targeted transportation capital improvements near retailing centers.

**Public-Private Initiative/Partnership (PPP)**

A PPP is an agreement between a public-sector entity and a private party. The agreement allows the private party to provide a public good or service, such as operating a toll highway or public transit line. The private party assumes the majority of the financial and operational risk in the project in exchange for a future revenue stream. Common public-private partnership applications in transportation include long-term lease agreements for toll highways and design-bid-build-operate arrangements in transit systems. The Northwest Parkway in Northwest Metro Denver is operated by a private company under a long term lease. The Eagle P3 is an example of a design-bid-build-operate arrangement associated with FasTracks light rail service in Denver, Arapahoe and Adams County.

### **Special Assessments**

A special assessment is a fee collected by a governing authority (special district or county government) for improvements or services that have a “unique” benefit to property within the jurisdiction. Special assessments are usually imposed on a proportional basis (e.g., linear feet of street frontage or lot acreage). In general, the benefit must be at least equal to the assessment imposed. Special assessments are generally used to finance transportation infrastructure improvements.

### **Specific Ownership Tax**

A specific ownership tax is levied by a county government on the ownership of specific items or goods. Arapahoe County currently collects a specific ownership tax from owners of motor vehicles, trailers, semi-trailers, and trailer coaches in lieu of any ad valorem taxes. This tax is collected in excess of the state-assessed fees and taxes collected for motor vehicle ownership. The revenues from this tax are deposited into several county funds including the road and bridge fund where the revenues are used for systemwide transportation operations and maintenance. Specific ownership tax rates are based on a formula specified in the state constitution. The tax rate could only be altered by an amendment to the state constitution through a statewide voter referendum.

### **Developer Agreement**

Arapahoe County currently enters into agreements with land developers to jointly fund mutually beneficial transportation improvements. Developers also may fund entire transportation infrastructure expansion projects in some instances. These negotiated agreements are designed on an ad hoc basis and generally are used to fund specific road widening and intersection improvements near new residential or commercial development.

### **Impact Fee**

Impact fees are generally defined as one-time assessments used to recover the capital costs imposed on local governments by new growth. They are governed by principles established in both state and federal law, most recently Colorado’s Senate Bill 15, which was passed in 2001 and specifically gives cities, towns and counties the authority to levy impact fees. While the state legislation does not define impact fees, it does define land development charges, as “any fee charge, or assessment relating to a capital expenditure which is imposed on land development as a condition of approval...”<sup>7</sup>

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<sup>7</sup> Colorado Municipal League, *Paying for Growth, Impact Fees Under Senate Bill 15*, April 2002, p. 3.

### What can impact fees be used for?

Colorado’s Senate Bill 15 is generally consistent with federal law in the restrictions it places on the use of impact fees. As discussed by the Colorado Municipal League in their handbook, *Paying for Growth, Impact Fees Under Senate Bill 15*, governments “contemplating impact fees should first consider the following limitations:

- ✦ Impact fees can only be used to finance capital infrastructure—they cannot be used to cover ongoing operations and maintenance costs.
- ✦ Impact fees cannot be deposited in the general fund—they must be earmarked for capital expenses and deposited into separate accounts.
- ✦ Impact fees should be expended within a short time frame (typically the horizon for the Capital Improvement Plan, or approximately five years).
- ✦ Impact fees cannot be imposed to address existing service deficiencies.<sup>8</sup>

In addition, impact fees must be “intended to defray projected impacts on capital facilities caused by proposed development.”<sup>9</sup> In federal law, there are two guidelines that govern this last principle. First, impact fee revenues must be dedicated exclusively to infrastructure expansion required by new development. That is, there must be a “rational nexus” (as described in federal case law) between the charge levied and the infrastructure needs imposed. Additionally, impact fees must be calculated in “rough proportion” to new development’s appropriate share of infrastructure cost. The impact fees described in this report meet all of the standards outlined above.

### How should impact fees be calculated?

The approach to calculating arterial road fees allocates residential and nonresidential infrastructure costs by analyzing trip generation data for specific land-use types from the Institute of Transportation Engineers’ *Trip Generation Manual (ITE Manual)*.

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<sup>8</sup> Ibid. p. 23.

<sup>9</sup> Ibid. p. 13.

If the county decides to adopt impact fees, capital costs for impact fee calculation are provided in the county’s capital improvement plan (CIP). The types of costs eligible for inclusion in this calculation include any right-of-way purchases; construction of new roads; and expansion of existing roads to serve growth at existing service levels.

In Arapahoe County, as in any local government, not all capital costs are associated with growth. Some capital costs are for repair and replacement of facilities e.g., standard periodic investment in existing facilities such as paving and chip sealing. These costs are not impact fee eligible. Some capital costs are for betterment of facilities, or implementation of new services (e.g., development of dedicated bicycle lanes for the first time). These costs are generally not entirely impact fee eligible. Some costs are for expansion of facilities to accommodate new development at the current level of service (e.g., construction of new streets and bridges in growing areas). These costs are impact fee eligible. An analysis of the county transportation CIP is necessary to determine which projects, or portions of projects are impact fee eligible.

### **Utility Fee**

A transportation utility fee (or transportation maintenance fee) is similar to a water or sewer rate. It is a fee collected on residences and businesses—essentially, a user fee tied to the use of the transportation system. The city of Fort Collins was the first government in the nation to impose a transportation utility fee. The fee was challenged by citizens, but upheld by the Colorado Supreme Court.<sup>10</sup>

In upholding the transportation utility fee, the court defined the following requirements for fees levied by local governments:

- ✦ The fee must be used solely for the purpose of defraying the cost of a particular governmental service;
- ✦ The amount of the fee must be reasonably related to the overall cost of the service; and
- ✦ Mathematical exactitude is not required, as long as the above conditions are met.

The court went on to affirm that, “An ordinance creating a special service fee...will generally be upheld as long as the ordinance is reasonably designed to defray the cost of the particular service rendered by the [jurisdiction].”<sup>11</sup>

Currently, the City of Loveland is the only Colorado government that imposes a transportation utility fee. The city of Fort Collins, although legally empowered to impose a transportation utility fee, decided to fund transportation utility through other means and

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<sup>10</sup> Bloom v. City of Fort Collins. 1990. 784 P. 2d 304 (Colo. 1990).

<sup>11</sup> Ibid, pg. 7.

eventually abandoned the maintenance fee. Transportation utility fees are widely used in Oregon, where 19 jurisdictions impose a transportation utility fee. In Colorado, any government with power to impose fees, rates or charges can legally impose a utility fee.

**What can transportation utility fees be used for?**

Transportation utility fees can be used only for transportation maintenance, repair and operation purposes. The roads are considered a utility much like water and sewer services; utility fees must only be used for system operations and maintenance, much like the use of water and sewer rates. The jurisdiction has flexibility to adjust fees as the costs of labor and materials fluctuate. Furthermore, the jurisdiction can set a revenue target for the fee, to recover all, or any portion of, transportation operations and maintenance costs.

**How should transportation utility fees be calculated?**

The reasoning behind transportation utility fees holds that the road system functions as a public utility comparable to water and sewer systems. Water and sewer utilities are funded by charging users based on how much they use the system, and road operations and maintenance funding can be approached in a similar way. Properties that cause more traffic by the nature of their use are responsible for a greater portion of the wear and tear on street infrastructure, and are reasonably expected to make a larger contribution toward operations and maintenance expenses.

The most common basis for a transportation utility fee is an estimated number of trip ends attributable to each land use type using trip generation rates found in the *Trip Generation Manual* published by the Institute of Transportation Engineers (ITE). The ITE Trip Generation Manual provides estimates of average daily trips generated by residential unit and by commercial and industrial square foot.

**1.5. Local Administrative Options**

County governments have the option to establish administrative entities to target a specific geographic area or type of transportation infrastructure (i.e., roads, bridges, intersections and safety measures).

**Local improvement district (LID)**

A LID is an administrative subdivision of a county. The primary purpose of a LID is to allocate the costs of public infrastructure to those who are specially “benefited” by the improvements. LIDs raise revenue for infrastructure through special assessments and can issue special assessment bonds. In addition to special assessments, LIDs in counties with large populations (over 100,000) can

impose a sales tax of up to 0.5 percent if approved by district landowner vote. If 50 percent or more of the property owners within the proposed district protest the creation of a LID, the county cannot proceed with formation. A LID is generally used for targeted capital improvements within the district.

### **Public Improvement District (PID)**

PIDs are also a subdivision of a county government that finances, constructs and maintains capital improvements. A PID has the authority to issue GO or revenue bonds and to impose a mill levy against real and personal property within the district and to charge, rates, tolls or fees. According to Colorado Statutes<sup>12</sup>, a petition must be signed by 30 percent or two hundred electors of the district, whichever is less, to create a PID. Transportation projects are selected depending on needs within the district. A PID can be used to fund transportation capital, operations and maintenance expenditure.

### **Title 32 Metropolitan District**

Title 32 of the Colorado Revised Statutes authorizes the creation of Metropolitan Districts. These “quasi-municipal corporations” are created by a resolution, a petition signed by at least 20 percent or 200 taxpaying electors, a public hearing and approval by district electors. Metro districts are not limited to providing transportation and may provide funding for other public services such as fire protection, parks and recreation as well as water and wastewater treatment. Metro districts have the power to impose fees and charges, to issue general obligation bonds (with an election) and revenue bonds as well as levy and collect ad valorem taxes. Metro Districts are authorized to invest in capital improvements and provide services within their boundaries. Metro Districts can construct and operate a transportation system with its boundaries.

### **Regional Transportation Authority (RTA)**

RTAs are special districts established by a county government or a coalition of local governments. Citizens vote to create a RTA and through additional voter approval, RTAs can levy sales taxes, lodging taxes, ad valorem taxes and motor vehicle registration fees to pay for transportation projects within the district. RTAs generally provide regional transportation infrastructure improvements; roadway construction and maintenance; and traffic congestion-easing measures (buses, bike lanes, or pedestrian walkways). RTAs generally fund capital, operations and maintenance expenditures.

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<sup>12</sup> Colorado State Statues 30-20 Part 5 and Part 6.

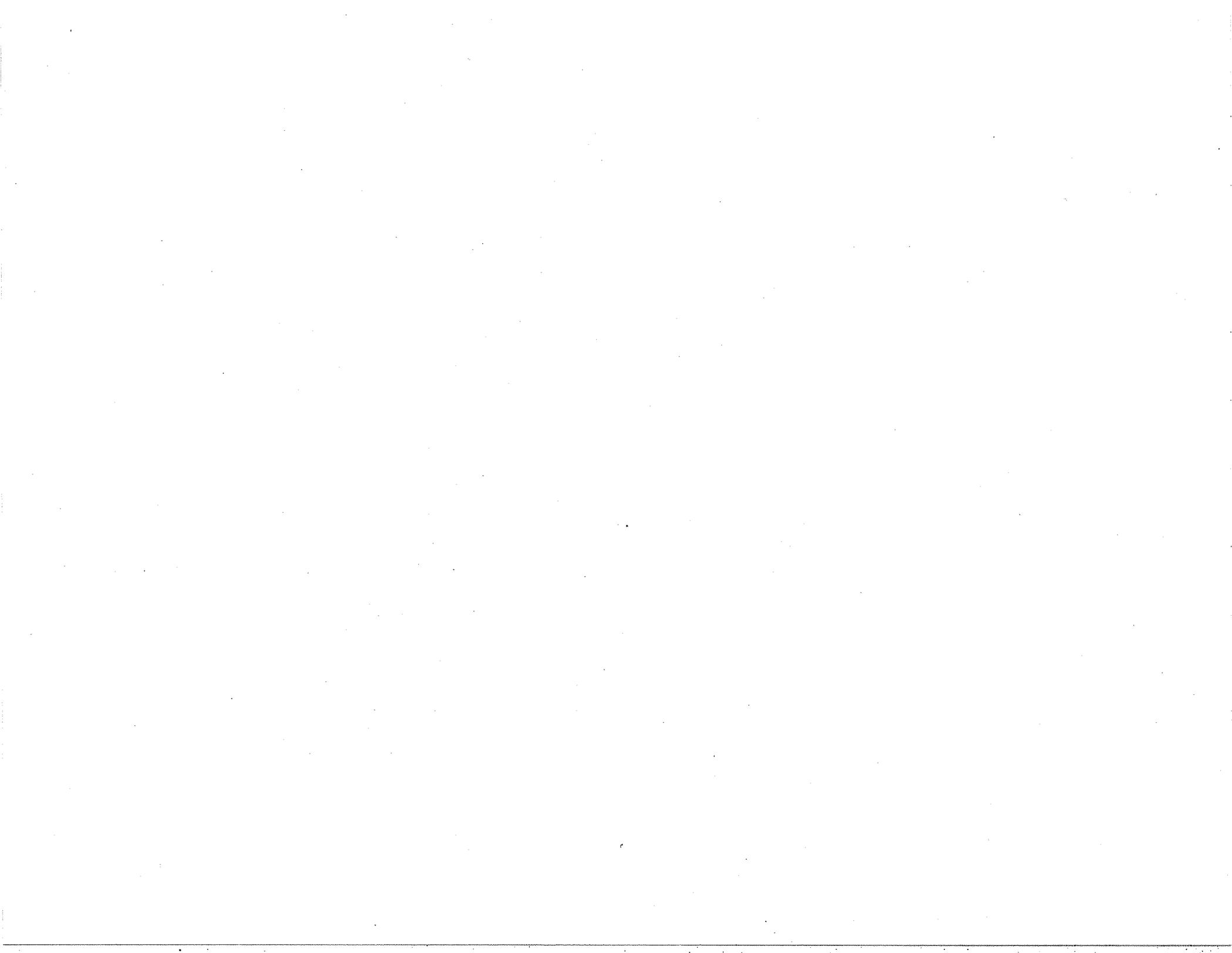
**Transportation Management Authority or Association (TMA)**

A TMA is a non-governmental organization that provides transportation services in a particular area such as a commercial district, mall, medical center or industrial park. Transportation services are targeted at alleviating congestion, which may include providing bus routes, shared parking lots or improvements to non-vehicle transportation routes (e.g. bike lanes and pedestrian) within the TMA area. TMAs do not have authority to levy taxes but collect membership fees from business within their area of service. Local governments, business associations and chambers of commerce can help create a TMA by providing preliminary funding. Capital improvements made by TMAs are generally targeted to traffic congestion within a specific area. Arapahoe County currently participates in the South I-25 Urban Corridor TMA.



**Appendix F**

**Glossary**



## Glossary

**Accessibility** – The degree to which the traveler is able to directly access private property from the public transportation system.

**ADT (Average Daily Traffic)** – The number of vehicles passing a fixed point in a day, averaged over a number of days. The number of count days included in the average varies with the intended use of the data.

**Capacity** – The maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per hour or persons per hour.

**CDOT** – Colorado Department of Transportation

**CIP (Capital Improvement Program)** – A schedule of planned, public capital expenditures during a specified period of time.

**Connectivity** – A roadway facility that connects to other roads creating an entire network and network redundancy.

**Continuity** – A roadway facility that is continuous through a region and accommodates long trips.

**Delay** – A measure of the quality of service provided to the road user. Typically measured in seconds.

**Denver Regional Council of Governments (DRCOG)** – A voluntary association of county and municipal governments in the greater Denver area which work together to address issues of regional concern, including growth management, transportation, and regional water quality.

**Functional Classification** – Identifies the type of transportation service provided by a facility. Facilities providing a high level of mobility have a high functional classification such as a freeway or expressway. Facilities providing a high level of accessibility have a low functional classification such as a local street with driveway access.

**HCM (Highway Capacity Manual)** – The recognized manual describing accepted methodology for computing the capacity and level-of-service for various types of roads.

**Impact Fees** – Changes that are assessed on new development to help pay for the capital facilities need by new development. Impact fees are based upon a standard formula and predetermined fee schedule.

**Intergovernmental Agreement (IGA)** – A written agreement between two or more governmental jurisdictions.

**ITS (Intelligent Transportation Systems)** – A group of technological improvements designed to improve the operational efficiency of the transportation system – improving safety, reducing congestion, improving mobility and enhancing environmental quality.

**Level of Service (LOS)** – A measure of the congestion on a roadway on a scale of A to F, with “A” representing little or no traffic delay and “F” representing long delays and a high level of congestion.

**Measures of Effectiveness** – Parameters describing the quality of service provided by a traffic facility to drivers, passengers, or pedestrians; examples include speed, density, delay, and similar measures.

**Mitigation** – The amelioration, alleviation, or avoidance of potentially adverse effects associated with implementation or development of a project.

**Mixed-Use Development** – Development projects which combine retail and commercial services, offices, entertainment and residential uses within easy walking distance. The mix of uses may occur vertically within one building or horizontally among several buildings linked by strong pedestrian connections.

**Mobility** – The degree to which the traveler is able to achieve uninterrupted motion in completing a trip.

**Nonattainment Area** – Any geographic region of the United States that the Environmental Protection Agency (EPA) has designated as a nonattainment area for a transportation related pollutant(s) for which a National Ambient Air Quality Standard (NAAQS) exists.

**Out-of-Direction Travel** – The additional distance added to a trip when the shortest or more reasonable path is not available to the traveler.

**Peak-Hour(s)** – The hours of the day usually called “rush hour”, when the largest number of people travel to and from work (generally 6-9am and 4-7pm), sometimes creating high levels of congestion.

**Screenline** – A “pseudo” line laid across a roadway network along which roadway traffic volumes (existing and projected) are evaluated as part of the transportation modeling process.

**Subarea Plan** – A plan for a defined community or area within the county, typically developed with the involvement of residents of the area for which the plan has been prepared, that is adopted as an element of the County’s Comprehensive Plan.

**Transit-Oriented Development (TOD)** – Urban development designed to accommodate pedestrians and non-vehicular forms of transportation on site and that has densities high enough to sustain transit use (i.e., typically at least seven dwelling units per acre).

**Transportation Analysis Zones (TAZs)** – An area that is defined, for the purpose of travel demand forecasting, to have a certain road network, number of households and number of employees.

**Transit Corridor Preservation** – Obtaining control of right of way, through regulation or ownership, to ensure that development does not preclude future transit options.

**Travel Demand Forecasting** – Modeling of transportation demand in a region or subarea that accounts for changes in household, employment and roadway network characteristics.

**Transportation Demand Management Program** – Programs that reduce and manage the number of private auto trips made by a single occupant in order to improve the efficiency of the overall transportation network.

**Urban Growth Boundary (DRCOG)** – The line of the map that is used to mark the separation between lands where urban growth should be encouraged and contained and outside of which urban development should not occur.

**V/C Ratio (Volume over capacity ratio)** – Indicates the portion of roadway capacity being utilized. Volume over capacity ratios greater than 1.0 indicate that the roadway facility is over capacity.

**VMT** – Vehicle Miles Traveled (including all types of vehicles).