



I-25/Arapahoe Interchange

Environmental Assessment



I-25/Arapahoe Interchange Environmental Assessment

August 2012



Prepared for



In Partnership with Joint Lead Agencies



And Cooperating Agencies



**I-25/Arapahoe Road Interchange NEPA Study
Environmental Assessment**

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By the
U.S. Department of Transportation
Federal Highway Administration
and the
Colorado Department of Transportation

Project Sponsor
Arapahoe County

Cooperating Agencies
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Environmental Assessment Availability

Copies of the Environmental Assessment are available in hard copy format for public review at the following locations and/or by request from CDOT Region 6. The document is also available on the project website at www.i25arapahoeroadea.com.

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Appendix A. Technical Memoranda and Reports (contained on CD)

Environmental Resource Tech Memos

Draft Traffic Noise & Vibration Impact Assessment Tech Report April 2012

TNM Files

Air Quality Evaluation March 2012

Biological Resources Tech Memo July 2012

Hazardous Materials Assessment May 2012

Hazardous Materials Assessment May 2012 Appendix B Radius Map Report

Historic Resource Evaluation Memo December 2011

Visual Resources Tech Memo April 2012

Public Meeting #1 April 15 2010 Summary Document

Public Meeting #2 September 8 2011 Summary Document

CDOT Mitigation Tracking Spreadsheet July 2012

Conceptual Design Plan Set June 2012

Final Interchange & Supplemental I-25 Crossing Alternatives Tech Report August 2011

Final Safety Assessment Summary August 2011

Final Travel Forecasting Summary May 2012

Revised Final Coordination Plan August 2011

Technical Design Documentation July 2012

Walnut Hills Neighborhood Traffic Study July 2011

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Acronyms and Abbreviations

ADT	Average daily traffic
APCD	Air Pollution Control Division
AM	ante meridiem
BMP	Best Management Practice
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Health and Environment
CDPS	Colorado Discharge Permit System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon monoxide
CPW	Colorado Parks and Wildlife
CSS	Context Sensitive Solutions
DRCOG	Denver Regional Council of Governments
dBA	A-weighted decibel
DTC	Denver Technological Center
EA	Environmental Assessment
EC	Executive Committee
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FTA	Federal Transit Administration
GHG	Greenhouse gas
GIS	Geographic Information Systems
I-25	Interstate 25
KOP	Key Observation Point
LOS	Level of service
LRT	Light rail transit
LUST	Leaking underground storage tank
LWCF	Land and Water Conservation Fund
MBTA	Migratory Bird Treaty Act
MMT	Million metric tons
MOA	Memorandum of Agreement
mph	Miles per hour

MS4	Municipal Separate Storm Sewer System
MSAT	Mobil Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
NPS	National Park Service
NRHP	National Register of Historic Places
PEL	Planning and Environmental Linkages
PM	post meridiem
PM ₁₀	Suspended particulate matter less than 10 microns in diameter
ppm	Parts per million
PRT	Personal Rapid Transit
RAQC	Regional Air Quality Council
ROD	Record of Decision
ROW	Right-of-way
RTD	Regional Transportation District
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SH 88	State Highway 88
SIP	State Implementation Plan
SMFRA	South Metro Fire Rescue Authority
SPF	Safety Performance Function
TC	Technical Committee
TCI	Tele-Communications, Inc.
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMDL	Total Maximum Daily Load
TOD	Transit-oriented Development
TRB	Transportation Research Board
TREX	Transportation Expansion project
TSM	Transportation Systems Management
ULSD	Ultra-low surface diesel
USCOE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VMT	Vehicle-miles of travel
VOC	Volatile organic compound
WQCC	Water Quality Control Commission



Glossary

Abutment: An abutment is the part of a bridge at the ends of a bridge that supports the superstructure, contains the earth in the approach fills, and directly receives the impact loads produced by traffic passing from the roadway onto the bridge. An abutment is a wall supporting the end of a bridge or span and sustaining the pressure of the abutting earth.

Acceleration lane: Acceleration lane is a speed-change lane, including tapered areas, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can more safely merge with through traffic.

Access connection: Access connection is a facility for entry and/or exit such as a driveway, street, road, or highway that connects to the highways under the jurisdiction of the department or municipality.

Access control: Access control is the enforcement of specified authorization rules based on positive identification of user and the systems or data they are permitted to access.

Access roadway: An access roadway is a connection to a highway or freeway.

Acquisition: Acquisition is the process of obtaining right-of-way by negotiation and/or eminent domain proceedings. Negotiation would involve getting the owner to convey, dedicate, or possibly option the property to the public agency. Just compensation must be paid in all acquisitions or takings.

Alignments: Alignments refer to the geometric design elements that define the horizontal and vertical configuration of the roadways.

Average daily traffic (ADT): Average 24-hour traffic volume of a given location on a typical weekday.

Arterial highway: An arterial highway is a general term denoting a highway primarily for through traffic, usually on a continuous route.

At-grade: At-grade means a combination of horizontal alignments and vertical grade lines which intersect.

Auxiliary lane: Auxiliary lane is a lane striped for use as an acceleration lane, or deceleration lane, right-turn lane, or left-turn lane, but not for through traffic use.

Best Management Practices (BMPs): The best management practices are schedules of activities, practices, and procedures to prevent or reduce pollution of waters of the United States. Such practices include planning strategies, operating procedures, and physical practices to control site runoff.

Bicycle lane: A bicycle lane is a portion of a roadway that has been designated by striping, signing, or pavement markings for the preferential or exclusive use of bicyclists.

Bicycle path: A bicycle path is a bikeway separated from motorized vehicular traffic by an open space or barrier, either within the highway right-of-way or within an independent right-of-way that may also be used by pedestrians, skaters, joggers, wheelchairs, and other non-motorized users.

Bicycle route: A bicycle route is a continuous pathway usually on a city street designated for bicycles.

Capacity: Capacity is the number of vehicles that can traverse a point or section of a lane or roadway during a set time period under prevailing roadway, traffic, and control conditions.

CDOT: The Colorado Department of Transportation, which manages the network of highways within the state.

Census block groups: The smallest geographic area for which the Bureau of the Census collects decennial census data.

Census tract: Small, relatively permanent statistical subdivisions of a county.

Centerline: The centerline is a line dividing the roadway from opposite moving traffic. It is a survey line with continuous stationing for the length of the project. Construction plans and right-of-way maps refer to this line. Horizontal alignment is the center of the roadbed.

Context Sensitive Solutions (CSS): A collaborative interdisciplinary approach that involves all stakeholders in providing a transportation facility that fits its setting. It is an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions.

Controlled access highway: A controlled access highway, in accordance with applicable state law, is a state highway on which owners or occupants of abutting lands and other persons are denied access to or from the highway except at such points only and in such manner as may be determined by the department.

Corridor: A corridor is a broad geographical band with no predefined size or scale that follows a general directional flow connecting major sources of trips. It involves a nominally linear transportation service area that may contain a number of streets, highways, and transit route alignments.

Corridor study: In planning, a corridor is a broad geographical band that follows a general directional flow or connects major sources of trips. It may contain a number of streets, highways, and transit lines and routes.

Cross section: A cross section is the view of the vertical plane cutting through the roadway, laterally perpendicular to the center line, showing the relationship of the various components of the roadway.

Cul-de-sac street: A cul-de-sac street is a local street only open at one end with a special provision for turning around. A dead end street with a turn-around.

Culvert: A culvert is a structure under a roadway, usually for drainage. It is a bridge-class culvert if it has a clear opening of 20 feet or more measured along the centerline of the roadway between extreme ends of the openings for multiple boxes or multiple pipes that are 60 inches or more in diameter.

Curb: A curb is a vertical or sloping member along the edge of a pavement or shoulder forming part of a gutter, strengthening or protecting the edge and clearly defining the edge to vehicle drivers. The surface of the curb facing the general direction of the pavement is called the “face.”

Deceleration lane: Deceleration lane is a speed-change lane, including tapered areas, for the purpose of enabling a vehicle that is exiting a roadway to leave the travel lanes and slow to a safe exit.

Decibel: A decibel is a basic unit of sound pressure level. Decibels are logarithmic expressions of sound pressure levels.

Delay: The additional travel time experienced by a driver, passenger, or pedestrian due to circumstances that impede the desirable movement of traffic. It is measured as the time difference between actual travel time and free-flow travel time.

Design capacity: Design capacity refers to an estimated capacity, usually based on vehicles per day or design hourly volume, that is used to determine the design of a highway, i.e. number of lanes and other considerations.

Design speed: Design speed is a selected speed used to determine the various design features of a roadway.

Design standard: Design standard is the policies, guidelines, and criteria which guide and/or control detailed design for normal conditions.

Design year: Projects are planned and designed to meet the future, anticipated needs and characteristics of a certain year. This is referred to as the design year. Typically, the design year for roadways is 20 years after the construction year. For bridges, the design year is typically greater.

Diamond Interchange: The most common interchange design, usually consisting of four ramps (two entrance ramps and two exit ramps). Diamond interchanges have a diamond shape when viewed from the air.

Directional Interchange: The directional interchange is an interchange, generally having more than one highway grade separation, with direct connections for the major turning movements.

Divided highway: A divided highway is a highway with a median designed to separate traffic moving in opposite directions.

Drainage channels and side slopes: Side slopes provide a transition from the roadway shoulder to the original ground surface and transmit runoff from the road to a drainage channel.

Easement: Easement refers to the right to use or control an area of the property of another for designated purposes.

Egress: Egress is the right to go out or a place for going out, such as an exit. The right to leave a tract of land. Often used interchangeably with access.

Embankment: An embankment is a raised structure of soil, soil aggregate, rock, or combination of the three. Materials used for fill section.

Endangered species: An endangered species is any species that is in danger of extinction throughout all or a significant portion of its range.

Entrance ramp: Also called an on-ramp, this is a road segment of one or two lanes used by traffic to move from the surface streets to connect to the freeway.

Environmental Assessment (EA): A public document produced as part of the federal National Environmental Policy Act (NEPA) process that evaluates potential impacts of transportation projects in order to determine whether an Environmental Impact Statement (EIS) is necessary.

Erosion control: Erosion control includes protection of soil from dislocation by water, wind, or other agents.

Exit ramp: Also called an off-ramp, this is a road segment of one or two lanes used by traffic to move off of the freeway to connect to the surface streets.

Feasibility study: A study about a project's feasibility which is summarized in a document. The study addresses issues including the project's benefits, costs, effectiveness, alternatives considered, analysis of alternative selection, environmental effects, public opinions, and other factors.

Federal Highway Administration (FHWA): The branch of the federal Department of Transportation that oversees the national highway system. The FHWA works with CDOT on projects affecting national highways in Colorado.

Floodplain: A floodplain is the lowland and relatively flat areas adjoining inland and coastal water including flood prone areas of offshore island, including at a minimum, the area subject to a 1 percent or greater chance of flooding in any given year.

Finding of No Significant Impact (FONSI): A Finding of No Significant Impact, or FONSI, is a public decision document by a federal agency under NEPA that briefly presents the reasons why an action will not have a significant effect on the human or natural environment and for which an EIS, therefore, will not be prepared.

Freeway: A divided highway facility having two or more travel lanes in each direction for the exclusive use of through traffic and full access control.

Frontage road: A frontage road is a roadway that could parallel the bypass in some areas for the purpose of safely and efficiently collecting and distributing traffic between the higher speed regional bypass and the lower speed local street system.

Functional class: Functional class is a description of a highway segment's design purpose (interstate, freeway, expressway, arterial, collector, or local) and location (urban or rural). Among other things, functional class defines a highway segment's eligibility for federal funding.

Geometric design: A geometric design refers to the dimensions and elements of a highway or road.

Grade: A grade is the slope of a roadway, channel, or natural ground.

Grade separation: A grade separation is the crossing of two highways or a highway and a railroad at different levels.

Hazardous materials: Materials that pose a risk to human health or the environment.

Highway structure: Highway structure is a general term to refer to various highway design features which are of particular concern to utility installations, i.e., bridges.

Historic properties: Buildings, structures, objects, sites, or districts with historical or archeological significance that are listed in, or eligible for listing in, the National Register of Historic Places.

Impermeability: Impermeability refers to the resistance an asphalt pavement has to the passage of air and water into or through the pavement.

Ingress: Ingress is the right to enter a highway facility at given points.

Interchange: Interchange is a system of interconnecting roadways in conjunction with one or more grade separations that provides for the movement of traffic between two or more roadways or highways on different levels. A proposed interchange will be

designated as an interchange when the construction contract has been awarded, regardless of whether it is open to the public.

Intersection: An intersection is any at-grade connection with a roadway, including two roads or a driveway and a road.

Leq: Leq is the energy-averaged sound pressure level in decibels. Leq is usually reported on an hourly basis and written as Leq(h).

Level of service: Level of service is a measure of traffic flow and congestion. As defined in the Highway Capacity Manual - A qualitative measure describing operational conditions within a traffic stream; generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Local access road: A local access road is a local public street or road that is generally parallel to a highway. Access for businesses or properties located between the highway and the local access road is provided to the local access road rather than the highway.

Loop ramp: A one-way entrance or exit ramp that loops 270 degrees to the right and merges onto the intersecting road or freeway.

Mainline: The primary through road or freeway, as distinct from ramps, auxiliary lanes, and collector-distributor roads.

Median: The median is the physical separation provided between opposing lanes of traffic.

Merge: A traffic movement in which two separate lanes of traffic combine to form a single lane.

Mitigation: Mitigation is a technique or means of reducing impacts to resources or to the natural environment. Mitigation includes avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

MS4: The abbreviation for Municipal Separate Storm Sewer System, a system used for collecting or conveying stormwater that is not a combined sewer or part of a publicly owned treatment works.

National Ambient Air Quality Standards (NAAQS): The nationwide health-based air quality standards that have been established by the U.S. Environmental Protection Agency.

NEPA: The National Environmental Policy Act, established by Congress in 1969, requires a federal agency to document the environmental impact of its actions, including an evaluation of alternatives.

Noise abatement criteria (NAC): Noise abatement criteria are absolute sound levels, provided by FHWA, used to determine when a noise impact occurs.

Noise barrier: A noise barrier is a solid wall or earth berm located between the roadway and receiver location, which breaks the line-of-sight between the receiver and the roadway noise sources.

Partial property acquisition: A property acquisition that occurs when only a portion of a property would be affected by proposed construction but the remaining portion of the parcel would still be functional.

Partial Cloverleaf Interchange: An interchange design that uses loop ramps for two of the left-turn movements onto or off of the freeway, and straight ramps to handle the other two left-turn movements onto or off of the freeway.

Planning and Environmental Linkages (PEL): An approach to transportation decision-making that considers environmental, community, and economic goals early in the planning stage and carries them through project development, design, and construction.

Public involvement: Public involvement is an ongoing phase of the project planning process that encourages and solicits public input and provides the public the opportunity to become fully informed regarding project development.

Queuing: The formation of lines of automobiles waiting at a red light.

Ramp meter: A traffic signal located on an entrance ramp that controls the flow rate of vehicles onto a freeway. Ramp meters control the frequency and spacing of merging vehicles, which helps to improve the traffic flow on the mainline.

Retaining walls: Retaining walls are vertical walls used to retain earth. A wall for sustaining the pressure of earth or filling deposited behind it.

Right-of-Way (ROW): Right-of-way is a general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes. Right-of-way is the entire width of land between the public boundaries or property lines of a highway. This may include purchase for drainage.

Signal timing: The coordinated timing of a sequence of traffic signals that allows vehicles to progress along an arterial or cross an arterial. The goal of signal timing is to minimize delay (the time a vehicle must wait at a signal) at intersections.

Single Point Urban Interchange: An interchange design similar to the diamond interchange, but with all ramps controlled by a single set of traffic signals.

Scoping: Scoping is the process that occurs prior to the preparation of an EIS. Scoping may include a meeting or series of meetings, an environmental analysis, and interagency coordination. Any information that is gathered will be used and provides the basis for the preparation of the EIS.

Section 4(f) property: A significant publicly owned park, recreation area, wildlife and waterfowl refuge, or historic property (including archeological sites) protected by Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303).

Shoulder: The shoulder is the paved portion of the highway outside of the travel lane.

Sight distance: Sight distance is the distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway from a designated location and to a specified height above the roadway when the view is unobstructed by traffic.

Span: A span is the horizontal distance between supports, or maximum inside distance between the sidewalls of culverts.

Stopping sight distance: Stopping sight distance is the distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance traveled during driver perception-reaction time and the vehicle braking distance.

Storage lane length: Storage lane length is the portion of an auxiliary lane required to store the number of vehicles expected to accumulate in the lane during an average peak period.

Taking: Taking is the process of obtaining right-of-way by negotiation or eminent domain proceedings. Also that portion of real property taken for transportation purposes.

Temporary easement: A non-possessory temporary interest to use property in possession of another person for a stated purpose. Temporary easements are required for CDOT to access properties during construction.

Tight Diamond Interchange: An interchange design that shifts the entrance and exit ramps closer to the freeway than in a traditional diamond interchange. This interchange type requires less land than a traditional diamond interchange.

Total property acquisition: A property acquisition that occurs when the proposed construction limits would directly impact the principal building on the property, such as a home or business, and the property would no longer be economically viable after the building is removed.

Traffic control device: A traffic control device is any sign, signal, marking, or installation placed or erected under public authority, for the purpose of regulating, warning, or guiding traffic.

Travel lane: The travel lanes are the portion of the roadway provided for the through movement of vehicles.

Trip generation: Trip generation is the procedure by which estimates of the number of trips produced and attracted by the zone within an urban area are developed.

Turning movement: Turning movement is the traffic making a designated turn at an intersection.

Typical section(s): Typical section(s) show usual roadway (or bridge) cross sectional features including lane and shoulder widths; limits of surfacing; pavement structure data including subgrade treatment type and depth, base course(s) thickness(es), and type of surfacing material; travel lane and shoulder cross slopes; side slope rates for cut and fill sections; ditch or storm sewer location and depth; typical right-of-way limits; profile grade line location; typical traffic barrier location median width and slopes; and curb location and geometry.

Vehicle miles-of travel (VMT): Vehicle-miles of travel is a unit to measure vehicle travel made by a private vehicle, such as an automobile, van, pickup truck, or motorcycle. Each mile traveled is counted as one vehicle mile regardless of the number of persons in the vehicle.

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Summary

Where Is this Project Located?

The Action Alternative evaluated in this document identifies roadway, bridge, and intersection improvements, beyond normal maintenance, to the Interstate 25 (I-25)/Arapahoe Road (State Highway [SH] 88) interchange complex (see **Figure S2**). The interchange complex refers to the intersecting highway facilities, as well as the ramps and roadway approaches serving and interacting with the interchange between Yosemite Street and Boston/Clinton Street. As shown in **Figure S1**, the project area extends along Arapahoe Road from Greenwood Plaza Boulevard on the west to Clinton Court on the east, and includes these and intermediate roadways and intersections that are being proposed for physical modification. The study area extends beyond the project area from approximately Quebec Street on the west to Havana Street on the east, and from Orchard Road on the north to Dry Creek Road on the south.

Why Was this EA Prepared?

This Environmental Assessment (EA) is being prepared under requirements of the National Environmental Policy Act (NEPA) to determine if the Action Alternative could have significant impacts on the human environment. The purpose of the project is to reduce congestion and improve traffic operations and safety for the traveling public within the I-25 and Arapahoe Road interchange complex.

Why Do We Need this Project?

Arapahoe Road is the critical east-west roadway link for the cities of Centennial and Greenwood Village, and an important transportation corridor supporting economic activity in Arapahoe County, including the cities of Centennial and Greenwood Village. Traffic volumes have increased substantially over the past 30 years due to a nearby business park and residential and retail development. The existing design and capacity of the interchange no longer accommodates traffic demands. The I-25 and Arapahoe Road interchange complex area experiences heavy traffic throughout the day, with high traffic volumes in all three peak periods (AM [ante meridiem], noon, and PM [post meridiem]), and volumes are projected to increase by over 30 percent through 2035 (DEA 2011a). Improvements are needed to:

- ◆ Improve traffic operations of the interchange complex and meet future traffic demands (2035).
- ◆ Improve safety for motorists, pedestrians, and bicyclists.
- ◆ Accommodate multimodal connections.

How Were these Improvements Planned?

The scoping period for this EA began in 2008 with the preparation of the *System Level Feasibility Study* (DEA 2008), following completion of the *Arapahoe Road Corridor Study I-25 to Parker Road* (DEA 2007). During the scoping period, stakeholders, including regulatory agencies, an executive committee established for this project, and

the general public, were asked to provide input on the proposed project. That input was used to develop the purpose and need for this project and a series of design objectives. Preparation of this EA has been a cooperative effort by the Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT) as joint lead agencies; Arapahoe County as project sponsor; and City of Centennial and City of Greenwood Village as cooperating agencies. Arapahoe County provided overall project management.

Figure S1. Study Area and Interchange Complex



What is Being Proposed?

A No Action Alternative and one Action Alternative are evaluated in this EA.

No Action Alternative

The No Action Alternative does not meet the purpose and need, but is carried forward as a baseline against which the Action Alternative is compared. Like the Action Alternative, the No Action Alternative is evaluated under 2035 traffic conditions.

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange beyond normal maintenance. The local jurisdictions may make subsequent modifications to nearby intersecting streets and intersections using local funds, but no improvements would be made to the I-25 bridge, ramps, or to Arapahoe Road within the interchange complex, defined as the intersecting highway facilities, as well as the ramps and roadway approaches serving the interchange between Yosemite Street and Boston/Clinton Street.

Action Alternative

An improved partial cloverleaf interchange is the Action Alternative for this EA. The improvements are illustrated in **Figure S2** and summarized below. For greater detail on the improvements please see Section 2.2, Description of the Alternatives.

Physical Improvements

I-25 Mainline: With the exception of on- and off-ramps, I-25 would be generally unchanged under the Action Alternative. However, in order to accommodate the additional through lanes proposed at Arapahoe Road beneath I-25, the existing bridge would be replaced with a longer, wider and taller structure. The additional height would require reconstruction of I-25 to both the north and south to meet with the existing I-25 mainline lanes.

I-25 Ramps: The interchange ramps would generally remain unchanged from existing conditions at the points of entry and exit from I-25. However, both the northbound and southbound off-ramps would be restriped to provide triple left turns onto Arapahoe Road.

Arapahoe Road: The Action Alternative would include the addition of one eastbound and one westbound through lane between the Yosemite Street and Boston/Clinton Street intersections. The Action Alternative would include the following auxiliary lane improvements along Arapahoe Road:

- ◆ Modification and extension of the westbound auxiliary lane (turn lane and acceleration/deceleration lane) along Arapahoe Road extending from South Clinton Court to the northbound I-25 on-ramp.
- ◆ Addition of a westbound auxiliary lane on Arapahoe Road extending from Yosemite Street to Greenwood Plaza Boulevard.
- ◆ Conversion of the eastbound right turn lane on Arapahoe Road at Yosemite Street to a shared through/right lane and extension of the lane to the west about 300 feet.
- ◆ Addition of an eastbound acceleration lane extending from the northbound off-ramp to connect with the existing deceleration lane approaching Clinton Street.

Yosemite Street: The Action Alternative would include the following auxiliary lane improvements along Yosemite Street:

- ◆ A second northbound left turn lane on Yosemite Street at Arapahoe Road with associated widening of the north leg of Yosemite Street for lane alignment.
- ◆ Raised median with curb and gutter on Yosemite Street north and south of Arapahoe Road.
- ◆ A northbound right turn lane on Yosemite Street at the Yosemite Circle signalized intersection.

Frontage Road: The existing frontage road along the east side of I-25 north of Arapahoe Road would be relocated to help facilitate bridge construction phasing and northbound on-ramp modifications. Rather than reconstructing the frontage road adjacent to I-25, which provides poor access to businesses in the northeast quadrant, a new road extending straight north of the northbound off-ramp intersection with Arapahoe Road would be constructed. This new roadway (shown in **Figure S2**) would intersect with Southtech Drive on the north. Southtech Drive would terminate just east of I-25.

Business Access: In addition to the frontage road modifications in the northeast quadrant, the right turn only driveway to the gas station just east of the frontage road and the motel access drive to Boston Street just north of Arapahoe Road would be impacted by the widening of Arapahoe Road. A combined right turn only replacement drive would be constructed approximately east of the frontage road to provide combined access to the gas station, motel, and restaurant northwest of the Arapahoe Road/Boston Street intersection.

Business access in the southwest quadrant of the interchange would remain generally unchanged, with right turn only driveway access to a tire store west of South Xanthia Street and at the South Xanthia Street public street intersection. Access to the northwest quadrant would be improved with a new right turn lane added on northbound Yosemite Street at the Yosemite Court signalized intersection.

Sidewalks: Existing sidewalks would be reconstructed along both the north and south sides of Arapahoe Road from west of Yosemite Street, through the interchange, to east of Boston/Clinton Street. Sidewalk widths would vary from 8 to 10 feet in the project area. All attempts will be made to construct detached sidewalks where reasonable within available right-of-way (ROW). However, 5-foot sidewalk segments may be utilized along Arapahoe Road west of Yosemite Street and along Yosemite Street south of Arapahoe Road where commitment was made to avoid residential property acquisition. Accordingly, no ROW acquisitions are planned or required from residential properties.

Noise Barriers: Noise mitigation barriers are recommended to be constructed in the following general locations, which will be defined during final design:

- ◆ Along the south side of Arapahoe Road adjacent to residences in the Walnut Hills neighborhood. A noise barrier approximately 8 feet high would extend from Uinta Street east to the west property line of the commercial business on the southwest corner of Arapahoe Road and Yosemite Street.
- ◆ Along the west side of Yosemite Street south of Arapahoe Road. A noise barrier approximately 8 to 11 feet high would extend approximately 500 feet south from the southern property line of the business on the southwest corner.

Phasing of Construction: Based on a constructability analysis, it has been determined that elements of the overall project would be constructed in useful phases. Phased construction may be necessary if construction funding is not all available at one time. Projects considered for phased implementation will be analyzed based on amount of

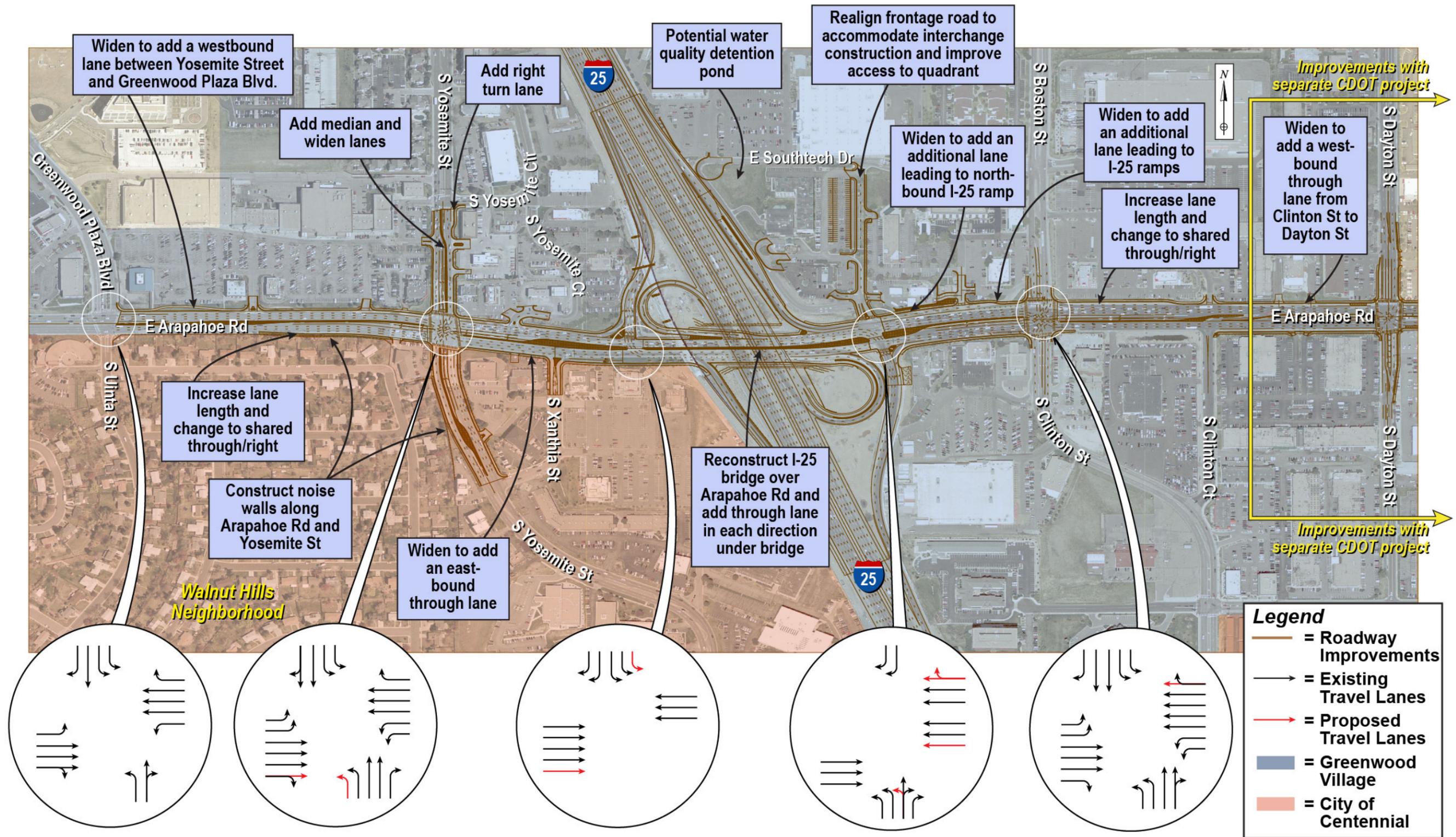
available funding, independent utility, and usefulness of the improvement to address operational needs within the interchange complex.

Operational Improvements

Signal Coordination and Timing: Traffic signal coordination is the timing of traffic signals so that traffic can travel along a street without stopping at every light. Signal system upgrades would be implemented for the signalized intersections along Arapahoe Road from Quebec Street to Havana Street to reduce air pollution emissions, reduce delay for drivers, improve roadway efficiency through reduced congestion, and decrease fuel consumption. The improvements would build upon the signal timing updates being implemented by DRCOG.

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Figure S2. Action Alternative



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How Much Property Would Be Acquired?

The Action Alternative would not require partial acquisition or full acquisition of any residential properties. No residences would be displaced.

The Action Alternative would require full acquisition of one commercial business, resulting in the displacement of one business located northeast of the interchange. Although only a portion of the parcel would be required for ROW (0.65 acre of the 3.5 acre parcel), it would be considered a full acquisition due to the business displacement. Partial acquisition of three neighboring commercial properties (0.13 acre of a 1.40 acre parcel, 0.18 acre of a 0.80 acre property, and 0.68 acre of a 4.73 acre parcel) located in the same shopping center would also be necessary.

Linear portions of commercial parcels would be partially acquired along the northern perimeter of Arapahoe Road between Greenwood Plaza Boulevard and South Yosemite Street and between Clinton Street and Clinton Court, amounting to a total of approximately 0.35 acre. Partial acquisitions would also be required along the eastern edge of South Yosemite Street south of Arapahoe Road, amounting to a total of 0.16 acre. A portion of a commercial property could be acquired for a water quality pond, although selection of this site would not be determined until final design.

To provide uniform and equitable treatment for those whose property is acquired and for persons displaced by such acquisitions, Congress passed the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, and amended it in 1987. This law, called the Uniform Act, is the foundation for the acquisition process that would be followed by CDOT. CDOT would notify property owners that the formal acquisition process is beginning no later than during the appraisal of the property.

What are the Social and Environmental Consequences of the Action Alternative?

Federal NEPA regulations direct agencies to concentrate NEPA documents on issues that are truly relevant to the action in question, and to narrow the scope of the NEPA process to study only those environmental issues. **Table S1** summarizes the impacts that are expected to the resources that meet this requirement. Resources that were determined to be outside the study area or not subject to significant impacts were eliminated from detailed analysis.

Table S1. Summary of Impacts and Mitigations

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Transportation Traffic Capacity and Operations	Negative direct impacts would occur to traffic operations within the study area as congestion increases. Negative indirect impacts would occur along roadways outside the study area from diverted traffic avoiding the I-25/Arapahoe Road interchange area.	Positive direct impacts would occur as traffic operations improve and traffic congestion decreases surrounding the I-25/Arapahoe Road interchange complex and throughout the project area. The Action Alternative would have a negative direct impact to traffic operations during construction through the I-25/Arapahoe Road interchange complex and throughout the study area. Both regional and local traffic traveling through the interchange and along mainline I-25 would experience some delays during construction.	Mitigation measures have been designed into the Action Alternative. Attention was given to shifting lane alignments to avoid residential property acquisition, realigning the frontage road to minimize business impacts, and construction phases to maintain business access during construction A minimum of two through lanes will be maintained in each direction along Arapahoe Road during construction, with the addition of turn lanes at various locations. Temporary business access wayfinding signage will be utilized to help mitigate impacts during times of construction when business access would be limited or closed.
Safety	Negative direct impacts would occur as congestion increases, resulting in increased crash frequency. Slight negative indirect impacts would occur to safety outside the study area from diverted traffic avoiding the I-25/Arapahoe Road interchange area.	Positive direct impacts would occur as crashes are anticipated to decrease along Arapahoe Road and at intersections within the vicinity of the interchange.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Transit Operations	Negative direct impacts would potentially occur as bus travel times would increase along Arapahoe Road to the west and east of the interchange due to congestion. Slightly negative indirect impacts to bus operations outside the study area from diverted traffic and increased congestion would occur. Light rail operations would not be impacted. Positive indirect impacts would potentially occur from individuals using alternative transportation as a result of increased congestion.	Positive direct impacts would occur as bus operations along Arapahoe Road to the west and east of the interchange would benefit from improved traffic flow through the corridor. Light rail operations would not be impacted. Improved timeliness of bus service would facilitate timely transfers between buses and light rail transit (LRT).	Mitigation measures have been designed into the Action Alternative. This includes traffic signal timing optimization at the Arapahoe/Yosemite and Arapahoe/Boston/Clinton intersections that serve buses traveling to and from timed transfers with the Southeast Corridor LRT at the Arapahoe at Village Center LRT station.
Pedestrian and Bicycle Facilities	Negative direct impacts would occur to pedestrian and bicycle operations and safety due to increased congestion. Slight negative indirect impacts would occur outside the study area from diverted traffic avoiding the I-25 / Arapahoe Road interchange area. Positive indirect impacts would potentially occur from individuals using pedestrian and bicycle facilities to avoid the traffic congestion.	Slight positive direct impacts would occur from widened sidewalks and improved traffic operations.	During final design, consideration will be given to sidewalks widened to 10 feet and detached, where practical.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Land Use	Existing land uses would remain the same, with no direct or indirect impacts.	There would be improved accessibility to the commercial land uses in the northeast quadrant due to the realigned frontage road. Slight impacts may be associated with the acquisition of ROW for the improvements; however, the area is highly developed and these would not measurably affect land use.	The Action Alternative is consistent with the local plans described under Local Plans; no mitigation is required. Mitigation for ROW acquisitions and displacements are addressed in the Right-of-Way Section.
Socioeconomic Conditions			
Demographic and Neighborhood Characteristics	No direct or indirect impacts.	The study area may become more easily accessible, but no measurable change expected.	No mitigation required.
Economic Development	Negligible direct and indirect impacts would occur as mobility between employment centers continues to degrade.	Slight beneficial impacts would occur due to improved mobility to reach area businesses. Temporary beneficial impacts would occur as construction workers patronize study area establishments. However, construction activities may temporarily impede access to local establishments.	Project construction would be implemented in phases or other methods would be employed to minimize impeded access to businesses, such as timing construction activities to avoid peak periods, and providing temporary business access wayfinding signing during phases of construction.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Community Resources	Negative impacts would occur as congestion increases, diminishing access to community resources. Congestion would continue to increase emergency service response. Slight beneficial impacts could occur if more individuals use alternative transportation as a result of increased congestion.	Beneficial impacts from improved access to and within communities would occur. Emergency vehicle response would improve, lessening the amount of time required to reach emergency sites.	No mitigation needed.
Community Cohesion and Connections	Slight negative impacts from increased congestion due to impeded travel across the interstate would reduce community cohesion.	Slight beneficial impacts from improved access to community facilities for motorists would occur. Direct benefits would occur in some areas to benefit emergency response time.	No mitigation needed.
Environmental Justice	No disproportionate and adverse impacts to minority or low-income populations would occur.	Overall impacts of the Action Alternative are expected to be beneficial. Negative impacts would be negligible and would affect all populations approximately equally. Therefore, no disproportionate and adverse impacts are expected to minority and low-income populations.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Right-of-Way	<p>No direct or indirect impacts anticipated.</p>	<p>One business would be impacted, resulting in a full acquisition of one commercial business northeast of the interchange. Partial acquisition of three other commercial properties in the same shopping center would be required.</p> <p>Other impacts would include the partial acquisition of commercial parcels located northeast of the interchange, along the northern perimeter of Arapahoe Road between Greenwood Plaza Boulevard and South Yosemite Street and between Clinton Street and Clinton Court, and along the western edge of South Yosemite south of Arapahoe Road.</p> <p>A portion of a commercial property could be acquired for a water quality pond, although selection of this site would not be determined until final design.</p> <p>No residences would be displaced. There would be no partial or full acquisition of any residential property.</p> <p>Temporary construction impacts would occur to adjoining commercial and residential property from road construction activities.</p>	<p>Acquisition:</p> <p>For any person(s) whose real property interests may be impacted by this project, the acquisition of those property interests will comply fully with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, (Uniform Act). The Uniform Act is a federally mandated program that applies to all acquisitions of real property or displacements of persons resulting from federal or federally assisted programs or projects. It was created to provide for and insure the fair and equitable treatment of all such persons. To further ensure that the provisions contained within this act are applied “uniformly,” CDOT requires Uniform Act compliance on any project for which it has oversight responsibility regardless of the funding source. Additionally, the Fifth Amendment of the United States Constitution provides that private property may not be taken for a public use without payment of “just compensation.” All impacted owners will be provided notification of the acquiring agency’s intent to acquire an interest in their property including a written offer letter of just compensation specifically describing those property interests. A Right of Way Specialist will be assigned to each property owner to assist them with this process.</p>

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
			<p>Relocations:</p> <p>In certain situations, it may also be necessary to acquire improvements that are located within a proposed acquisition parcel. In those instances where the improvements are occupied, it becomes necessary to “relocate” those individuals from the subject property (residential or business) to a replacement site. The Uniform Act provides for numerous benefits to these individuals to assist them both financially and with advisory services related to relocating their residence or business operation. Although the benefits available under the Uniform Act are far too numerous and complex to discuss in detail in this document, they are available to both owner occupants and tenants of either residential or business properties. In some situations, only personal property must be moved from the real property and this is also covered under the relocation program. As soon as feasible, any person scheduled to be displaced shall be furnished with a general written description of the displacing agency’s relocation program which provides at a minimum, detailed information related to eligibility requirements, advisory services and assistance, payments, and the appeal process. It shall also provide notification that the displaced person(s) will not be required to move without at least 90 days advance written notice. For residential relocatees, this notice cannot</p>

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
			<p>be provided until a written offer to acquire the subject property has been presented, and at least one comparable replacement dwelling has been made available. Relocation benefits will be provided to all eligible persons regardless of race, color, religion, sex, or national origin. Benefits under the Act, to which each eligible owner or tenant may be entitled, will be determined on an individual basis and explained to them in detail by an assigned Right of Way Specialist.</p>
Utilities	No direct or indirect impacts anticipated.	Several utilities, including above ground electric lines, cable television lines, natural gas valves, manholes and sewer lines, fire hydrants and water lines, and fiber optic lines would need to be relocated.	During final design, utilities would be avoided through design modifications or, where conflicts cannot be avoided, utilities will be relocated. Utility relocations will be coordinated with the local jurisdictions/CDOT and private utility providers prior to construction.
Visual	No direct or indirect impacts anticipated.	No measurable direct or indirect impacts anticipated.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Noise	Direct impacts to 16 residential properties and 2 commercial properties would occur from traffic noise. No noise abatement measures would be implemented.	Direct impacts to 16 residential properties and 2 commercial properties would occur from traffic noise (same as the No Action Alternative). Implementation of noise abatement would provide a noise-reduction benefit to all 16 impacted homes and 2 commercial properties and reduce estimated noise levels below the CDOT Noise Abatement Criteria (NAC) for 14 of the homes. Temporary impacts would occur to adjoining properties from road construction activities.	A barrier along Arapahoe Road approximately 8 feet high by 1,060 feet long and a barrier along Yosemite Street approximately 8-11 feet high by 500 feet long are being recommended preliminarily for the Action Alternative. A pre-construction survey of the impacted residents will be conducted to garner input on abatement actions. The final decision on the noise barriers will be made during final design through the public involvement process. Mitigation for noise from temporary construction impacts includes: use of barriers, limiting work to certain hours of the day, re-routing traffic away from residential areas and using well-maintained equipment.
Energy	Direct negative impacts would occur as congestion increases, which reduces fuel economy. Indirect benefits to air quality may occur if more people start using transit as a result of increased congestion.	Benefits would occur as congestion decreases and fuel economy is improved. Indirect impacts could occur if mass transit riders switch back to driving cars. This could be offset by more transit riders due to enhanced accessibility to transit. Energy use would increase temporarily during construction.	For impacts associated with construction: The contractor will conduct activities when feasible during periods of reduced traffic volumes to reduce idling vehicles. The contractor will keep equipment well-maintained and will use cleaner fuels, when possible and encourage carpooling to and from the site. Staging areas will be located as close to the project area as possible.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Air Quality	None. Future emissions from vehicles would be minimized through federal regulations (e.g., emission standards) and regional controls (e.g., street sanding regulations).	None. Future emissions from vehicles would be minimized through federal regulations (e.g., emission standards) and regional controls (e.g., street sanding regulations). Overall air pollution would be lower than the No Action Alternative due to lower overall congestion. Indirect impacts from construction activities may be sources of temporary air quality impacts from fugitive dust or equipment emissions.	The construction contractor will prepare and implement a fugitive dust control plan. The contractor will plan to minimize idling and maintain equipment. Particular attention will be given to minimizing total emissions near sensitive areas. The contractor will keep its maintenance equipment well-maintained and will use cleaner fuels when possible. Staging areas will be located as close to the project area as possible.
Hazardous Materials	No direct or indirect impacts anticipated.	Nine sites with potential or recognized environmental conditions may be affected directly through property acquisition or indirectly by construction activities.	Protective measures (including development of a Materials Management Plan or Safety Plan, if required) will be taken before, during, and after construction to minimize the risk of encountering hazardous materials, see Appendix A.
Water Resources and Water Quality	No direct or indirect impacts anticipated.	Direct, temporary, and construction impacts would occur from ground disturbance and an increase in impervious surfaces. Benefits would occur due to required water quality improvements. The minor drainage basin would have a slightly higher percent of imperviousness, and peak flows would increase. Added paved surfaces would not measurably alter the water table or groundwater quality.	Mitigation will include Best Management Practices (BMPs) during construction. A detailed erosion control plan will be developed. Mitigation for the drainage infrastructure may be required. Municipal Separate Storm Sewer System (MS4) permits require that permanent water quality facilities, including ponds, be installed to treat the runoff. A detailed analysis of the existing drainage system will be performed. Dewatering permits will be obtained if necessary.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Cultural, Historic, and Archaeological	No direct or indirect impacts anticipated.	No direct or indirect impacts are anticipated.	No mitigation necessary. At the time of final design/construction, any resources that have recently become 50 years or older will need Section 106 consultations if there will be any permanent or temporary easements or full or partial property acquisitions.
Biological Resources	No direct or indirect impacts anticipated.	No known direct or indirect impacts are anticipated. Soils would be disturbed during construction but detailed geotechnical analysis of the surrounding subsurface will be required during the preliminary/final design.	If construction is to occur during the breeding season, an additional nest survey will be conducted. Existing nests will be removed prior to the nesting season. No construction work can occur that would impact the nests, if occupied nests are observed during construction.
Paleontological Resources	No direct or indirect impacts are anticipated.	No direct or indirect impacts are anticipated.	To ensure that important paleontological remains are not destroyed during construction, a qualified, state-permitted paleontologist will examine the final design plans. If any subsurface bones or other potential fossils are found anywhere within the study area during construction, a qualified, state-permitted paleontologist will assess their significance and make further recommendation.
Soils and Geology	No direct or indirect impacts are anticipated.	No direct or indirect impacts are anticipated.	Techniques would be applied to improve soil or ground suitability for roadway construction during project design. Analysis will be used to establish the design of the roadway and structures and to establish erosion control procedures.

What Happens if No Action is Taken?

This EA provides analysis of the impacts of doing nothing (the No Action Alternative). Without a substantial investment in roadway improvements, the existing transportation problems in the study area would worsen. Traffic would become increasingly congested, particularly during peak travel hours. The potential for crashes would increase, and emergency response time would continue to be negatively affected by congestion and interchange design. Traffic noise would continue to affect residences in the project area, and no noise abatement measures would be implemented.

The No Action Alternative would not require a large capital expenditure or require any property acquisition.

What Happens Next?

Remaining steps to complete the NEPA process for the I-25/Arapahoe Interchange EA after this document is issued include:

- ◆ Hold a 30-day public review of the EA and public hearing.
- ◆ Prepare and publish a Finding of No Significant Impact (FONSI), the final decision document that concludes the NEPA process, if found to be appropriate following agency and public review of the EA.
- ◆ If significant impacts are identified through the course of the process, mitigation measures would be identified to reduce the impacts below the level of significance, if possible, or an Environmental Impact Statement (EIS) would be prepared in accordance with NEPA.

Following conclusion of the NEPA process, final design of the interchange improvements can be initiated. Subsequent ROW acquisitions and construction will be dependent on the availability of funding.



Chapter 1: Purpose and Need

This chapter describes why this project is proposed. The Purpose of the Action Alternative section explains the intended outcomes of this project. The Need for the Action Alternative explains why this project is necessary.

1.1 Introduction

This Environmental Assessment (EA) is being prepared under requirements of the National Environmental Policy Act (NEPA) to determine if the Action Alternative could have significant impacts on the human environment. The Act defines the “human environment” to include the natural and physical environment, and the relationship of people with that environment. Preparation of this EA has been a cooperative effort by the Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT) as joint lead agencies; Arapahoe County as project sponsor; and City of Centennial and City of Greenwood Village as cooperating agencies. Arapahoe County provided overall project management.

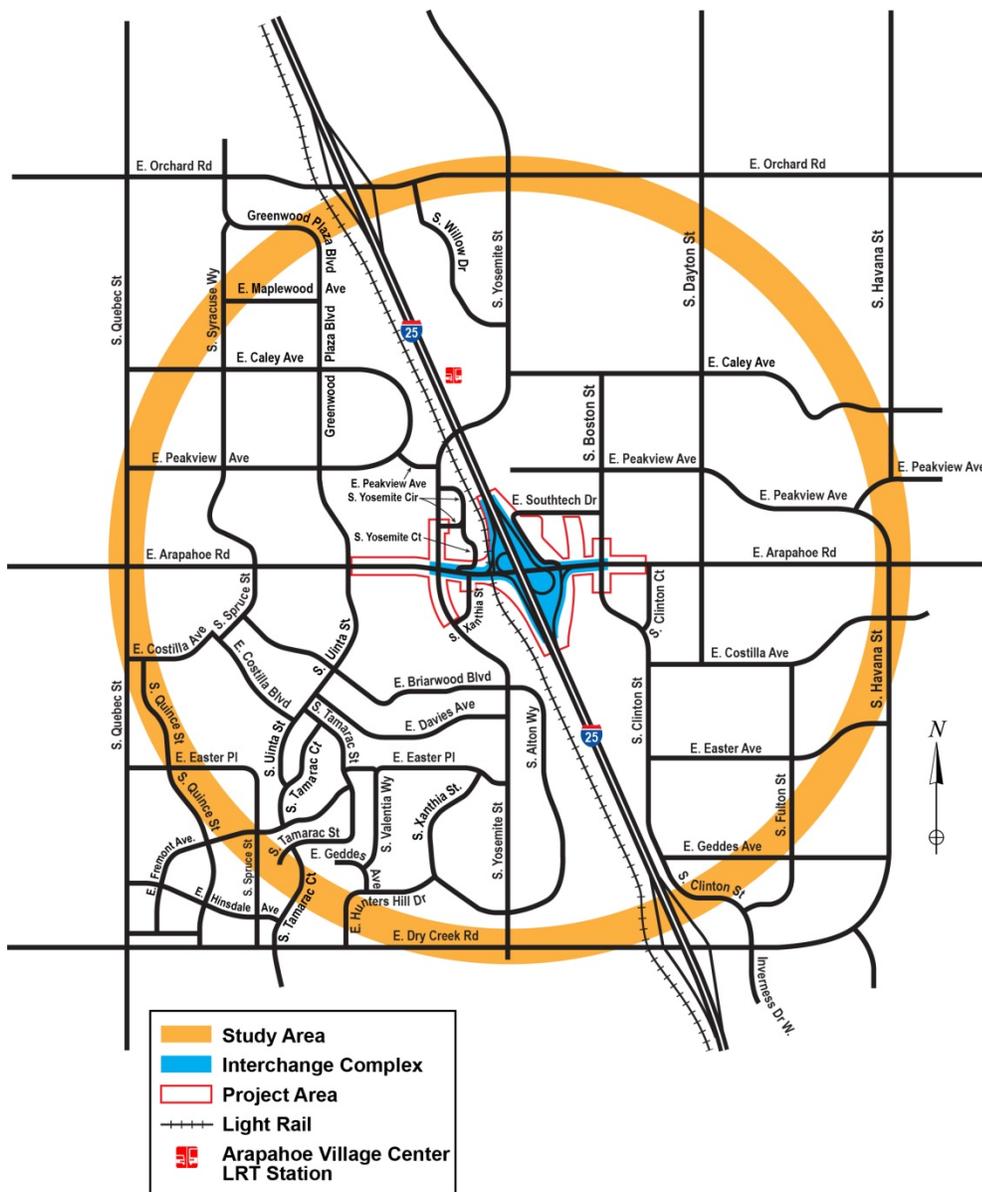
The Action Alternative evaluated in this document identifies roadway, bridge, and intersection improvements beyond normal maintenance to the Interstate 25 (I-25)/Arapahoe Road (State Highway [SH] 88) interchange complex discussed in Section 2.2.2 Action Alternative. The interchange complex refers to the intersecting highway facilities, as well as the ramps and roadway approaches serving and interacting with the interchange between Yosemite Street and Boston/Clinton Street. As shown in **Figure 1**, the project area includes the specific roadways and intersections that are being proposed for physical modification. The study area extends beyond the project area from approximately Quebec Street on the west to Havana Street on the east, and from Orchard Road on the north to Dry Creek Road on the south.

During the project development process, stakeholders, including regulatory agencies, an executive committee established for this project, and the general public, were asked to provide input on the proposed project. That input was used to develop the purpose and need for this project and a series of design objectives, which are described in this chapter. The design objectives served as guidelines in the development of a range of project alternatives. The purpose and need statement defines the problems the project addresses and helps to establish the criteria against which the project is evaluated.

1.2 Purpose of the Action Alternative

The purpose of the project is to reduce congestion and improve traffic operations and safety for the traveling public within the I-25 and Arapahoe Road interchange complex.

Figure 1. Study Area and Interchange Complex



1.3 Need for the Action Alternative

Arapahoe Road is the critical east-west roadway link for the cities of Centennial and Greenwood Village and an important transportation corridor supporting economic activity in Arapahoe County, including the City of Centennial and Greenwood Village. Traffic volumes have increased substantially over the past 30 years due to a nearby business park, and residential, service industry, and retail development. The existing design and capacity of the interchange no longer accommodates traffic demands. The I-25 and Arapahoe Road interchange complex area experiences heavy traffic throughout the day, with high traffic volumes in all three peak periods (AM [ante meridiem], noon, and PM [post meridiem]), and volumes are projected to increase by over 30 percent through 2035 (DEA 2011a). Improvements are needed to:

- ◆ Improve traffic operations of the interchange complex and meet future traffic demands (2035).
- ◆ Improve safety for motorists, pedestrians, and bicyclists.
- ◆ Accommodate multimodal connections.

Figure 2 shows locations where these improvements are needed. Operational inefficiencies indicate areas with insufficient acceleration or deceleration lengths, intersections too closely spaced, conflicts between travel lanes and shoulders or median types, and/or inadequate vertical and horizontal clearance. Areas indicated as capacity issues are locations where existing and/or future travel demand exceeds the physical limitations of the existing system. Areas indicated as safety issues represent documented or high potential crash locations. Multimodal accommodation issues identify locations where pedestrian and bicycle facilities are narrow and/or attached to high volume roadway sections, and/or where barriers to pedestrian and bicycle travel exist. These issues are described in more detail below.

1.3.1 Operations and Capacity

The I-25 and Arapahoe Road interchange was constructed in the late 1950s. In 2010, traffic counts measured approximately 100,000 vehicles per day entering the interchange complex from either Arapahoe Road or the I-25 ramps. By 2035, traffic entering the interchange is projected to exceed 130,000 vehicles per day. Existing average daily traffic (ADT) on Arapahoe Road east of I-25 is approximately 66,000 vehicles, while west of I-25 the ADT is about 50,000 vehicles. By 2035, Arapahoe Road traffic is forecasted to exceed 80,000 vehicles per day east of I-25 and over 70,000 vehicles per day west of I-25. Traffic volumes within the interchange along Arapahoe Road are forecasted to grow from over 55,000 vehicles per day to over 75,000 vehicles per day in 2035. About one-third of the traffic is through traffic traveling along Arapahoe Road through the interchange complex. Both existing and forecasted traffic volumes on Arapahoe Road at I-25 are nearly double the existing and forecasted traffic volumes on Orchard and Dry Creek Roads at I-25, located north and south of Arapahoe Road, respectively (DEA 2011a).

Following improvements in the mid 1980s, travel lanes on Arapahoe Road under I-25 were split by bridge piers as traffic bound for the I-25 on-ramps was placed outside the piers with through traffic lanes between the bridge piers. Interim improvements completed in the summer of 2010 have resulted in two through travel lanes in each direction between the bridge piers, and one through travel lane in each direction on the outside of the bridge piers in addition to a lane leading to the I-25 cloverleaf on-ramps (see **Figure 3**). The bridge is classified as “functionally obsolete” due to substandard vertical clearance according to a 2008 CDOT inspection report. Although the interim lane improvements have substantially improved traffic movements through the interchange for the near term, they did not address future anticipated operational issues and will not accommodate long-term future traffic volumes (DEA 2011b).

Lane widths within the interchange complex vary. I-25 freeway and ramp lane widths are generally 12 feet, with the exception of the westbound Arapahoe Road to southbound I-25 on-ramp and the eastbound Arapahoe Road to southbound I-25 on-ramp, with 14- and 10-foot lane widths, respectively. Along Arapahoe Road, lane widths west of the interchange are generally 11 feet, while lane widths east of the interchange are generally 12 feet. Lane widths on Yosemite Street north of Arapahoe Road are as narrow as 10.5 feet.

1.3.1.1 *Summary of Existing Operational and Capacity Issues*

Existing traffic volumes at the interchange create operating conditions characterized by restricted movements and backups.

Figure 2. Locations Needing Improvements



Figure 3. Existing I-25 Bridge Piers Separate Lanes on Arapahoe Road



Figure 4. Southbound Off-ramp Traffic Queue Adjacent to I-25 Through-travel Lanes



- ◆ **Queuing on the southbound I-25 off-ramp** – Due to the geometric design constraints of the two eastbound “inside” through lanes on Arapahoe Road, vehicular traffic (especially large trucks) slowly negotiate the southbound I-25 to eastbound Arapahoe Road double left turn. In addition, high traffic volumes along Arapahoe Road do not allow sufficient green signal time to clear the ramp traffic. The result is a long line of vehicles waiting to exit I-25 on the southbound off-ramp, which backs up onto I-25 during peak periods (see **Figure 4**).
- ◆ **Queuing along Arapahoe Road** – The close spacing and high turning traffic volumes at the Yosemite Street and Boston/Clinton Street intersections on Arapahoe Road add to traffic congestion and delays within the interchange area, and up to one-half mile of eastbound and westbound traffic queuing on Arapahoe Road approaching the interchange. These conditions cause drivers to slow their speeds through the interchange area, which further limits the capacity of the interchange and adversely affects through traffic on Arapahoe Road.

A qualitative assessment of traffic operations within the study area was performed based on existing conditions. The relationship between the volume and capacity of a facility is reported through level of service (LOS) ratings. The highest level (LOS A) describes free-flow conditions in which vehicles experience minimal delay. The lowest level (LOS F) describes stop-and-go conditions in which long delays are experienced by most vehicles in the traffic stream. LOS E and F are considered unacceptable (TRB 2000).

Table 1 shows the existing operational performance of intersections within the project area. During the AM peak period (generally between 7:00 AM and 8:30 AM), all intersections perform at acceptable LOS, LOS A to D. During the PM peak hour (generally between 4:30 PM and 6:00 PM), the Yosemite Street/Arapahoe Road intersection performs at LOS E.

Though overall performance at the ramp intersections with Arapahoe Road is acceptable, some individual turn movements approach or exceed acceptable LOS. The southbound left turn from the I-25 off-ramp to eastbound Arapahoe Road operates at LOS D in the AM peak hour and LOS E in the PM peak hour. Additionally, the northbound left turn from the I-25 off-ramp to westbound Arapahoe Road operates at LOS F in the AM peak hour and LOS D in the PM peak hour.

Table 1. Existing Year 2010 and Year 2035 No Action Intersection Performance

Intersection	Existing Year 2010 LOS (AM / PM)	Year 2035 No Action LOS (AM/PM)
Greenwood Plaza Boulevard at Arapahoe Road	B / B	D / F
Yosemite Street at Arapahoe Road	C / E	F / F
I-25 Southbound Ramps at Arapahoe Road <i>Southbound Off-Ramp Left Turn Movement</i>	C / C D / E	E / C F / F
I-25 Northbound Off-Ramp at Arapahoe Road <i>Northbound Off-Ramp Left Turn Movement</i>	C / B F / D	F / D F / F
Boston Street/Clinton Street at Arapahoe Road	B / C	C / E

At a stakeholder meeting conducted for this project (May 24, 2010), emergency service providers identified Arapahoe Road as a primary east-west route for emergency responders. Although fire stations exist on all sides of the interchange area, South Metro Fire Rescue Authority (SMFRA) dispatches units based on their proximity to an emergency location. Therefore, the closest unit can be on the opposite side of the interchange. SMFRA representatives noted that Arapahoe Road is frequently unusable as an emergency service route due to severe congestion at the interchange through the narrow, barrier-separated segment of Arapahoe Road between the I-25 off-ramp intersections.

1.3.1.2 *Anticipated Future Operational and Capacity Issues*

Traffic operations in the study area were evaluated to determine the anticipated level of congestion during the morning and evening hours of peak traffic use. Without improvements to the interchange, operational forecasts for 2035 based on regional growth show that traffic conditions will degrade to a higher level of congestion, as shown in **Table 1**. Anticipated impacts to intersection performance within the project area include the following:

- ◆ The Greenwood Plaza Boulevard intersection with Arapahoe Road is projected to operate at LOS F during the PM peak hour, with an average delay of over 100 seconds per vehicle.
- ◆ The Yosemite Street intersection with Arapahoe Road is projected to operate at LOS F, with an average delay of nearly 100 seconds per vehicle during the AM peak hour and over 180 seconds per vehicle during the PM peak hour.
- ◆ The southbound I-25 off-ramp terminal intersection is projected to operate at LOS E during the AM peak hour, with an average delay of over 60 seconds per vehicle.
- ◆ The northbound I-25 off-ramp terminal intersection is projected to operate at LOS F during the AM peak hour, with an average delay of over 130 seconds per vehicle.
- ◆ The southbound left turn at the southbound off-ramp intersection with Arapahoe Road and the northbound left turn at the northbound off-ramp intersection with Arapahoe Road are both projected to operate at LOS F during the AM and PM peak hours.

Without implementation of the Action Alternative, drivers will experience substantially more congestion surrounding the I-25/Arapahoe interchange complex in the year 2035.

1.3.2 Safety

Between 2006 and 2008, the total crash rate of 1.29 crashes per million vehicle-miles of travel (VMT) on I-25 at the Arapahoe Road interchange was higher than the rate on I-25 at the Orchard Road interchange (0.92) to the north and the Dry Creek interchange (0.86) to the south. The higher crash rate at the Arapahoe Road interchange may be due to greater ramp volumes and multiple entry ramps.

1.3.2.1 *Issues Related to Congestion*

Congestion at the interchange contributes to traffic crashes as drivers attempt to navigate the high traffic volume conditions. Although the crash rate on Arapahoe Road within the interchange complex is equal to the statewide average (3.5 crashes per million VMT), a number of intersections have high and moderately high crash occurrences (DEA and FHU 2011).

Locations with high crash rates from 2006-2008 along the Arapahoe Road corridor include the I-25 northbound off-ramp and Yosemite Street intersections. Locations with moderately high crash rates include the Boston/Clinton Street intersection, the I-25 southbound off-ramp, and the Greenwood Plaza Boulevard/Uinta intersection. Prevalent crash types at intersections in the project area (rear ends, side swipes, and broadsides) are primarily related to congestion (DEA and FHU 2011).

Safety concerns related to congestion also exist at the southbound I-25 off-ramp. Queuing on the southbound off-ramp frequently exceeds the capacity of the ramp and results in traffic backing up onto southbound I-25. Slowed and stopped vehicles on southbound I-25 adjacent to free-flowing high-speed through travel lanes poses a safety issue. The severity and frequency of this issue is anticipated to increase over time with traffic volumes projected to increase 30 percent through 2035, based on Safety Performance Function (SPF) procedures developed by CDOT.

1.3.2.2 *Issues Related to Geometrics under the I-25 Bridge*

The segment of Arapahoe Road under the I-25 bridge has multiple barriers between travel lanes. Following roadway improvements in the mid-1980s, travel lanes on Arapahoe Road under I-25 were split by bridge piers, with traffic bound for the I-25 on-ramps placed outside the piers and through traffic lanes placed between the bridge piers. Travel lanes under the bridge are also divided by a concrete median barrier. Several crashes along Arapahoe Road have occurred in this segment involving collisions with the median barrier (DEA and FHU 2011).

1.3.3 Multimodal Accommodation

Though no transit routes currently extend through the I-25/Arapahoe interchange, bus routes do operate along Arapahoe Road east and west of the interchange and along Yosemite Street and Boston Street. Bus operations along these roadways are negatively impacted by traffic congestion and increased travel times through the project area. As a result, timeliness of bus service is degrading at stops along the corridor and at the Arapahoe Village Center Light Rail Transit (LRT) station.

Within the project area, Arapahoe Road is not a designated bike route and does not serve pedestrian-oriented land uses. However, the comprehensive plans for Arapahoe County, Greenwood Village, and City of Centennial, and the City of Centennial Arapahoe Urban Center Sub Area Plan, all document objectives to encourage non-motorized travel

(Arapahoe County 2011, Greenwood Village 2011a, City of Centennial 2011a, City of Centennial 2007a).

Sidewalks in the project area are narrow in places and located immediately adjacent to the high volume arterial roadways. This situation exists not only along Arapahoe Road, but also along Yosemite Street and Boston/Clinton Streets leading to the interchange. Although no pedestrian accidents were recorded at the interchange ramps (DEA and FHU 2011), pedestrian crossing of the high volume cloverleaf on-ramps is difficult because traffic is not controlled and does not stop on these free-flowing highway ramps.

There are no designated bike lanes or shoulder areas through the interchange on Arapahoe Road or on the intersecting streets. At a bicycle and pedestrian focus group meeting conducted for this project (held June 7, 2010), attendees noted that bicyclists use Yosemite Street and the Yosemite Street overpass of I-25 and other routes to avoid travel on the narrow lanes along Arapahoe Road through the congested interchange.

1.4 Design Objectives

The purpose and needs described above define the problems the project is trying to solve and establish the criteria from which the project alternatives are evaluated. The following design objectives were developed to serve as guidelines in the development of the range of alternatives considered for this project:

- ◆ Address identified 2035 capacity and operational issues.
- ◆ Be sensitive to and preserve the residential and business community character of the area through Context Sensitive Solutions (CSS).
- ◆ Minimize and/or avoid impacts to environmental resources.
- ◆ Consider the economic importance of the interchange at the local and regional levels.
- ◆ Create the best value, considering benefits, anticipated construction costs, and potential for funding.



Chapter 2: Alternatives Analysis

This chapter describes the project background and alternatives explored.

2.1 Introduction

This chapter summarizes the alternatives screening process, describes the alternatives fully evaluated in this EA, and identifies the alternatives that were eliminated during the screening process. Additional information regarding the alternatives development and screening process is available in the *Interchange and Supplemental I-25 Crossing Alternatives Technical Report* (DEA 2011b) included in Appendix A.

2.1.1 Background

Improvement to the I-25/Arapahoe Road interchange has been the subject of studies previous to this EA. The Transportation Expansion (TREX) project added lanes to I-25 and improved ramp acceleration and deceleration lanes but, due to financial constraints, did not rebuild the I-25 bridge to allow improvement to Arapahoe Road approaching and traveling through the interchange. Interim improvements completed in 2010 provided some improvement in traffic operations, but lanes on Arapahoe Road are still split by the bridge piers, and vertical clearance at the I-25 bridge is substandard.

In 2005, Arapahoe County, CDOT, and the cities of Greenwood Village and Centennial sponsored the *Arapahoe Road Corridor Study I-25 to Parker Road* (DEA 2007). This study was conducted following guidelines for Planning and Environmental Linkages (PEL), and included the evaluation of initial configuration options for the I-25/Arapahoe interchange. The PEL study identified improvements to the I-25/Arapahoe interchange as a top priority for the Arapahoe Road Corridor. Interchange alternatives were further examined in the *System Level Feasibility Study* (DEA 2008) and approved by the Colorado Transportation Commission in December 2008.

These activities led to the initiation of this EA of interchange improvements.

2.2 Description of Alternatives

The No Action Alternative and the Action Alternative evaluated in this EA are described in sections 2.2.1 and 2.2.2 below. The alternatives considered but eliminated during the screening process are summarized in Section 2.3.1.

2.2.1 No Action Alternative

The No Action Alternative does not meet the purpose and need, but is carried forward as a baseline against which the Action Alternative is compared. Like the Action Alternative, the No Action Alternative is evaluated under 2035 traffic conditions.

Under the No Action Alternative, no further improvements, aside from ongoing operations and maintenance, would be made to the I-25/Arapahoe Road interchange. The local jurisdictions may make subsequent modifications to nearby intersecting streets and intersections using local funds, but no improvements would be made to the I-25 bridge, ramps, or to Arapahoe Road within the interchange complex.

2.2.2 Action Alternative

The improved partial cloverleaf interchange is the recommended Action Alternative for this EA. Components of the conceptual design for this alternative, including local access, major intersection design along Arapahoe Road, and movements to/from I-25, are discussed below and shown in Appendix A. Physical improvements would occur within the defined project area shown in **Figure 1** in Chapter 1. Operational improvements include no physical changes but are designed to improve traffic flow through signal timing. The Action Alternative is shown in **Figure 5**.

2.2.2.1 Physical Improvements

I-25 Mainline: I-25 would be generally unchanged under the Action Alternative. However, in order to accommodate the additional through lanes proposed at Arapahoe Road beneath I-25, described below and illustrated in **Figure 6**, the existing bridge would be replaced with a longer structure, which would be approximately 7 feet higher than the existing one. The additional height would require reconstruction of approximately 2,000 feet of I-25 to meet with the existing I-25 mainline lanes. In addition, the I-25 bridge would be wider than the existing structure in order to provide adequate room for temporary lane-alignment shifts during construction. The location of the merge/diverge points along I-25, where on-ramp lanes meet with off-ramp lanes, would remain unchanged.

I-25 Ramps: The interchange ramps would remain unchanged from existing conditions at the points of entry and exit from I-25. The ramps would be shifted slightly to accommodate the wider I-25 bridge. Because Arapahoe Road would be raised approximately 1 foot, the ramps' height would also be raised approximately 1 foot at Arapahoe Road. From that point, the ramps would gradually increase in elevation to meet with mainline I-25 at the existing merge/diverge points. Both the northbound and southbound off-ramps would be restriped to provide triple left turns onto Arapahoe Road to address capacity issues of the exit ramps.

Arapahoe Road: Improvements to Arapahoe Road would be designed to meet CDOT and local agency design standards. The Action Alternative would include the addition of one eastbound and one westbound through lane between the Yosemite Street and Boston/Clinton Street intersections. Arapahoe Road would also be raised approximately 1 foot within the interchange complex. The Action Alternative would include the following auxiliary lane improvements along Arapahoe Road:

- ◆ Modification and extension of the auxiliary lane (turn lane and acceleration/deceleration lane) along Arapahoe Road extending from South Clinton Court to the northbound I-25 on-ramp in order to separate right turning traffic bound for the northbound on-ramp from the lanes leading to the southbound on-ramp loop.
- ◆ Addition of a westbound auxiliary lane on Arapahoe Road extending from Yosemite Street to Greenwood Plaza Boulevard.
- ◆ Conversion of the eastbound right turn lane on Arapahoe Road at Yosemite Street to a shared through/right turn lane and extension of the lane to the west about 300 feet.
- ◆ Addition of an eastbound auxiliary acceleration/deceleration lane extending from the northbound off-ramp to Clinton Street.

Yosemite Street: Improvements to Yosemite Street would be designed to meet the requirements of local agency design standards. The Action Alternative would include the following auxiliary lane improvements along Yosemite Street:

- ◆ A second northbound left turn lane on Yosemite Street at Arapahoe Road with associated widening of the north leg of Yosemite Street for lane alignment.
- ◆ Raised median with curb and gutter on Yosemite Street for approximately 500 feet north and south of Arapahoe Road.
- ◆ A northbound right turn lane on Yosemite Street at the Yosemite Circle signalized intersection to better accommodate truck access into the northwest quadrant of the interchange.

Frontage Road: The existing frontage road along the east side of I-25 north of Arapahoe Road would be relocated to help facilitate bridge construction phasing and northbound on-ramp modifications. Rather than reconstructing the frontage road adjacent to I-25, which provides poor access to businesses in the northeast quadrant, a new road extending straight north of the northbound off-ramp intersection with Arapahoe Road would be constructed. This new roadway (shown in **Figure 5**) would pass through a parking lot between two hotels and would terminate with Southtech Drive on the north. Southtech Drive terminates just east of I-25. At the frontage road intersection with Arapahoe Road, access would remain limited to right turn in and out plus the northbound through movement from the northbound I-25 off-ramp. The southbound right turn out movement would be limited to the maximum 6 seconds of green time per the 1997 Eagle Hardware/Gart Highway Access Appeal legal agreement addressing this access (included in Appendix A). This revised access configuration is consistent with City of Greenwood Village plans and was recommended as part of the *Arapahoe Road Corridor Study I-25 to Parker Road* (DEA 2007). Any future redevelopment of the northeast quadrant land uses should encourage improved development circulation and connections to Southtech Drive and Boston Street to minimize traffic loading onto the frontage road, and ideally closure of the access to Arapahoe Road. Redevelopment would also require a new access permit for the frontage road public street connection with Arapahoe Road (SH 88), and for the driveway described below.

Business Access: In addition to the frontage road modifications in the northeast quadrant, the right turn only driveway to the gas station just east of the frontage road and the motel access drive to Boston Street just north of Arapahoe Road would be impacted by the widening of Arapahoe Road. A combined right turn only replacement drive would be constructed approximately 350 feet east of the frontage road to provide combined access to the gas station, motel, and restaurant northwest of the Arapahoe Road/Boston Street intersection. A permanent easement to provide for cross-access between properties would be provided.

Business access in the southwest quadrant of the interchange would remain generally unchanged, with right turn only driveway access to a tire store west of South Xanthia Street and at the South Xanthia Street public street intersection. Access to the northwest quadrant would be improved with a new right turn lane added on northbound Yosemite Street at the Yosemite Court signalized intersection to facilitate large truck turns that are prohibited from turning right from westbound Arapahoe Road to South Yosemite Court.

Sidewalks: Existing sidewalks would be reconstructed along both the north and south sides of Arapahoe Road from west of Yosemite Street, through the interchange, to east of Boston/Clinton Street. Sidewalk widths would vary from 8 to 10 feet in the project area. All attempts will be made to construct detached sidewalks where reasonable within available right-of-way (ROW). However, 5-foot sidewalk segments may be utilized along Arapahoe Road west of Yosemite Street and along Yosemite Street south of Arapahoe Road where

commitment was made to avoid residential property acquisition. Accordingly, no ROW acquisitions are planned or required from residential properties.

Noise Barriers: Noise mitigation barriers are recommended to be constructed in the following general locations, which will be defined during final design:

- ◆ Along the south side of Arapahoe Road adjacent to residences in the Walnut Hills neighborhood. The noise barrier would extend from Uinta Street east to the west property line of the commercial business on the southwest corner of Arapahoe Road and Yosemite Street. The noise barrier would be approximately 8 feet high and would mitigate noise impacts for residential lots (specific lengths and heights of noise barriers would be determined during final design based on results of the noise analysis).
- ◆ Along the west side of Yosemite Street south of Arapahoe Road. The noise barrier would extend approximately 500 feet south from the southern property line of the business on the southwest corner. The noise barrier would be approximately 8 to 11 feet high, to be confirmed during final design. Although there is greater traffic volume along Arapahoe Road than Yosemite Street, a shorter wall could be built because Arapahoe Road is lower than the adjacent residences, which provides additional effective height.

Phasing of Construction: Based on a constructability analysis, it has been determined that elements of the overall project would be constructed in useful phases. Phased construction may be necessary if construction funding is not all available at one time. Projects considered for phased implementation will be analyzed based on amount of available funding, independent utility, and usefulness of the improvement to address operational needs within the interchange complex.

Figure 5. Action Alternative

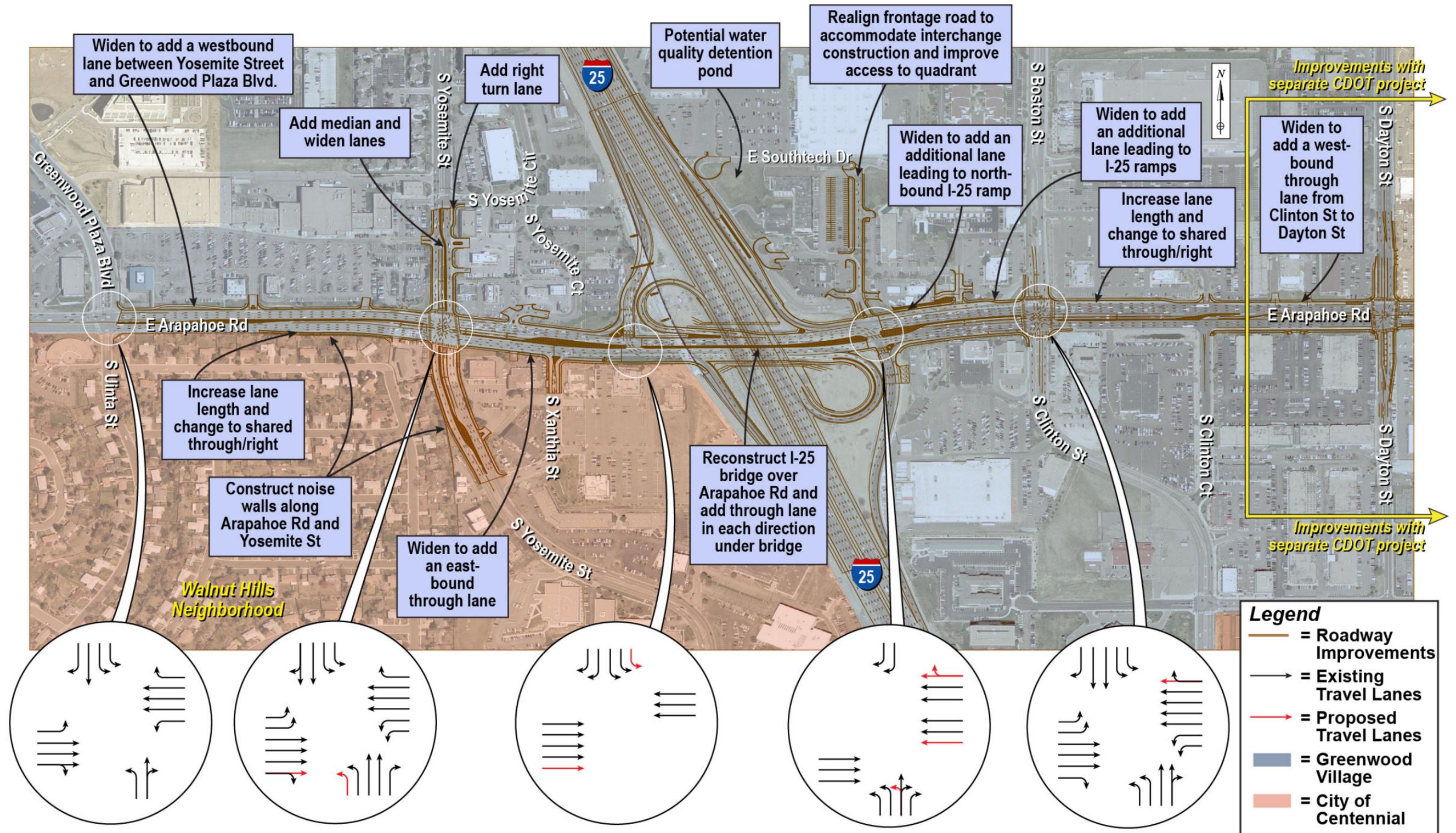
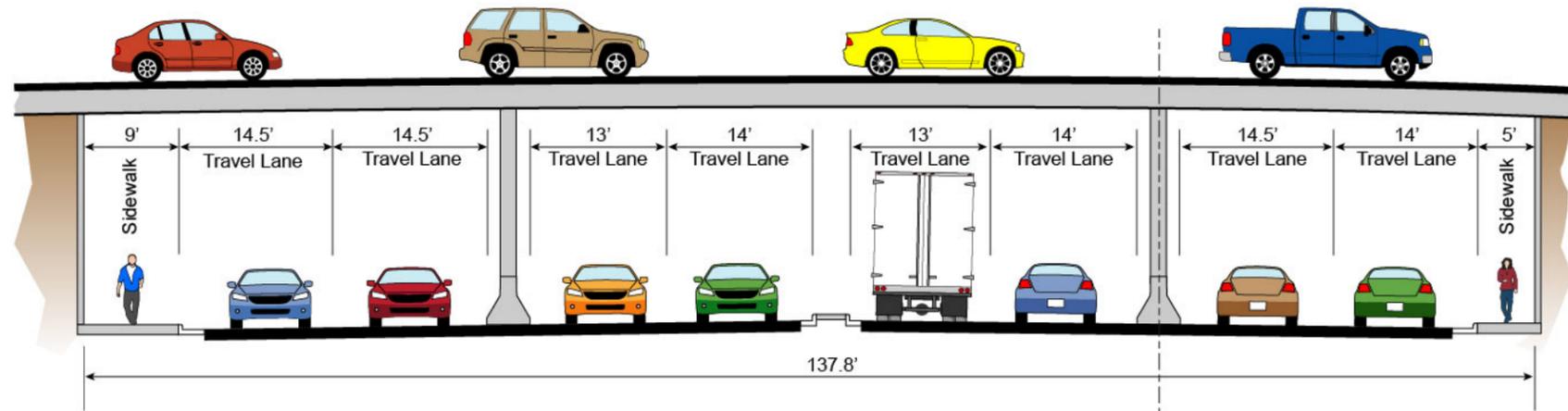
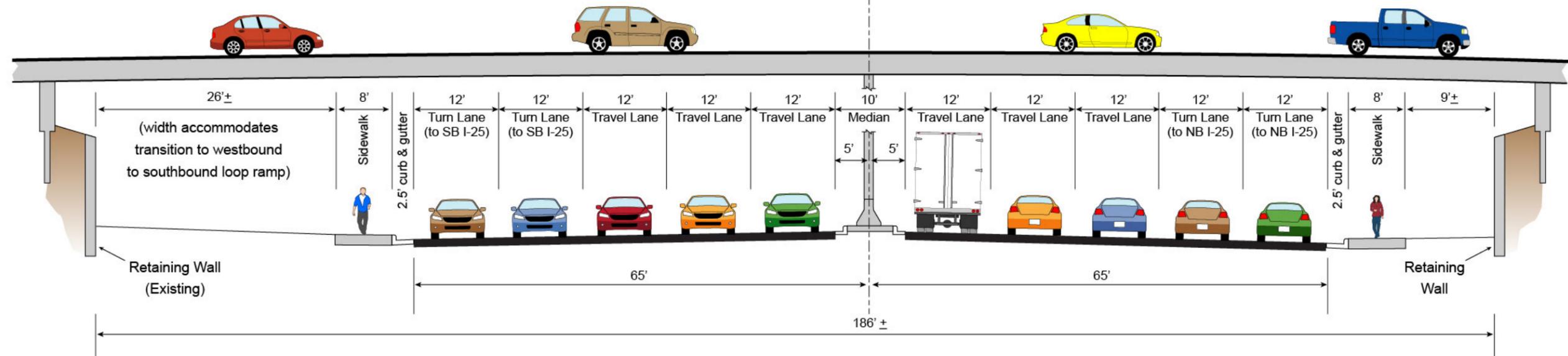


Figure 6. Existing and Action Alternative Cross Section – Looking East

Existing Cross Section



Action Alternative Cross Section



Note: Appendix A, Conceptual Design Plan Set (June 2012) includes cross sections for Arapahoe Road east and west of I-25.

2.3 Process for Developing and Evaluating Alternatives

2.3.1 Screening Process Alternatives Eliminated

More than 30 alternatives were considered through the course of the alternatives development and screening process. Project evaluation screening criteria were developed based on the Purpose and Need, design guidelines, and project goals. This section identifies the alternatives that were considered but eliminated. Prior to the screening analysis conducted as part of this EA, recommendations for improving the interchange were analyzed and evaluated in both the *Arapahoe Road Corridor Study* (conducted consistent with PEL guidelines) and the *System Level Feasibility Study (2008)*. A full range of potential alternatives was screened against project goals. Analysis and screening results are fully documented in these studies. These studies recommended an improved partial cloverleaf including a connection of Costilla Avenue between Yosemite Street and Clinton Street. During public and agency scoping conducted for this EA, there was a recommendation to re-evaluate a full range of potential alternatives, including those previously considered. Alternatives analysis was conducted for three levels:

- ◆ Preliminary Screening
- ◆ Level 1 Screening
- ◆ Level 2 Screening

2.3.1.1 Preliminary Screening Alternatives

Eight alternatives were evaluated during the Preliminary Screening process, of which seven were eliminated. Based on the previous studies and stakeholder scoping, preliminary analysis was conducted to determine those basic interchange ramp configuration alternatives that were most practical or feasible based on traffic operations and safety performance, design and construction, environmental, ROW, and cost considerations. This preliminary screening analysis was conducted prior to reconsideration of the interchange improvements linked with the supplemental crossing of I-25 that was recommended in the previous studies. These became the “preliminary alternatives.” These preliminary alternatives included seven basic interchange alternatives and one stand-alone I-25 crossing alternative.

Following are the seven interchange alternatives:

- ◆ Alt A - Improved partial cloverleaf
- ◆ Alt B - Single point urban interchange
- ◆ Alt C - Tight urban diamond interchange
- ◆ Alt D - Directional ramps interchange
- ◆ Alt E - Arapahoe Road tunnel interchange
- ◆ Alt F - Diverging diamond interchange
- ◆ Alt G - Three-level diamond interchange

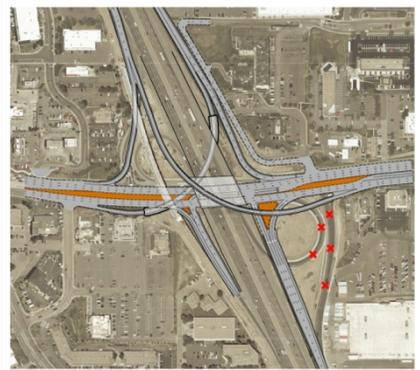
The following stand-alone alternative was also evaluated:

- ◆ Alt H - Supplemental I-25 crossing at Costilla Avenue as a stand-alone improvement

Table 2 provides a description of the preliminary alternatives, noting which alternatives moved forward for consideration in Level 1 analysis and which were eliminated from further consideration. The primary reason(s) for elimination are noted in the table. Alternative A, the improved partial cloverleaf, was forwarded for detailed evaluation in Level 1. The results supported the general conclusions of the *Arapahoe Road Corridor Study* and the subsequent *System Level Feasibility Study* that an improved partial cloverleaf interchange best met the evaluation criteria specific to interchange ramp configuration.

Table 2. Preliminary Screening Alternatives

Alternative	Forwarded to Level 1?	Characteristics	Primary Reason for Elimination
<p>Alt A – Improved Partial Cloverleaf</p>  <p>Alt. A - Improved Partial Cloverleaf</p>	<p>Yes</p>	<p>Four intersections on Arapahoe Rd. No left turns at on-ramp terminals Direct connection for eastbound to northbound and westbound to southbound left turn lanes</p>	<p>Forwarded to Level 1 as best meeting the evaluation criteria</p>
<p>Alt B – Single Point Urban</p>  <p>Alt. B - Single Point Urban Interchange</p>	<p>No</p>	<p>Replaces existing interchange and signalized ramp intersections with a single three-phase signalized intersection on Arapahoe Rd. Requires a long, deep clear span structure over Arapahoe Rd. Requires relatively long clearance intervals at the ramps' signalized intersection</p>	<p>Insufficient capacity on the single lane northbound on-ramp with decreased storage lengths for queuing at ramp meters Complex construction phasing for single span bridge structure Steep southbound on-ramp would not meet design criteria and would impact LRT walls</p>

Alternative	Forwarded to Level 1?	Characteristics	Primary Reason for Elimination
Alt C – Tight Urban Diamond	No	<p>Includes two closely-spaced signalized intersections to serve the I-25 ramps</p> <p>Intersection signals would operate as one signal with four-phase overlap phasing</p> <p>Left turn storage outside the intersections would be necessary as there would be limited storage between the intersections</p>	<p>Insufficient capacity for future volumes at the ramp intersections and on the single lane on-ramps</p> <p>Insufficient capacity and storage length of double left-turn lanes between ramp intersections</p> <p>Poor signal progression along Arapahoe Rd. resulting in vehicle queuing through adjacent intersections</p>
 <p data-bbox="347 655 553 672">Alt. C - Tight Urban Diamond Interchange</p>			
Alt D – Directional Ramps	No	<p>Includes directional ramps to/from north I-25 with diamond configuration</p> <p>ramps to/from south I-25</p> <p>Requires significant shift to I-25 lane alignments and I-25 widening to the east</p> <p>Requires a short weave area for southbound I-25 to eastbound Arapahoe Rd. prior to the Boston/Clinton intersection</p>	<p>Safety and operational issues due to insufficient weaving distance from ramps to adjacent intersections</p> <p>Insufficient westbound to southbound double left turn lane capacity and storage</p> <p>Decreased storage for southbound on-ramp</p>
 <p data-bbox="324 1169 579 1186">Alt. D - Directional Ramps Interchange</p>			
Alt E – Arapahoe Rd Tunnel	No	<p>Includes tunnels to accommodate the eastbound to northbound and westbound to southbound ramp movements</p> <p>Traffic to I-25 would be separated along Arapahoe Rd. west of Yosemite St. and east of Boston/Clinton St.</p> <p>Local southwest and northeast quadrant traffic would cross over the on-ramps</p> <p>Requires shift to I-25 lane alignments and I-25 widening to the east</p>	<p>Safety and operational issues due to insufficient weaving distance from ramps to adjacent intersections</p> <p>Complex construction of the ramp tunnels</p> <p>High number of ROW acquisitions in the southwest and northeast quadrants resulting in high costs</p>
 <p data-bbox="358 1715 542 1732">Alt. E - Tunnel Interchange</p>			

Alternative	Forwarded to Level 1?	Characteristics	Primary Reason for Elimination
<p>Alt F – Diverging Diamond</p>  <p>Alt. F - Diverging Diamond Interchange</p>	<p>No</p>	<p>Eastbound and westbound Arapahoe Rd. alignments would cross to opposite sides at the diamond interchange</p> <p>Simple two-phase signal control of intersections</p> <p>Ramp traffic would merge onto and from Arapahoe Rd.</p> <p>Requires reduced speed limits along Arapahoe Rd. through the interchange</p>	<p>Insufficient capacity for future volumes at the ramp intersections and on the single lane on-ramps</p> <p>Proximity to Boston/Clinton St. and Yosemite St. intersections limits improvements to traffic operations</p>
<p>Alt G – Three-Level Diamond</p>  <p>Alt. G - Three Level Diamond Interchange</p>	<p>No</p>	<p>Includes two lanes for east and westbound Arapahoe Rd. through traffic under the existing level of Arapahoe Rd.</p> <p>Ramp intersections would occur on the existing level of Arapahoe Rd.</p> <p>I-25 would remain the top level</p> <p>Turn limitations for Yosemite St. and Boston/Clinton St. would be necessary to eliminate unsafe weaving</p>	<p>Safety and operational issues due to insufficient weaving distance from ramps to adjacent intersections</p> <p>High costs for drainage infrastructure and ROW acquisitions required along Arapahoe Rd.</p> <p>Excessive impacts to traffic flow during construction</p>
<p>Alt H – Supplemental I-25 Crossing (stand-alone improvement)</p>  <p>Alt. H - Costilla Connection</p>	<p>No</p>	<p>Includes a new underpass of I-25 to connect Yosemite St. and Costilla Ave.</p> <p>Existing Arapahoe Rd. interchange configuration and number of lanes would remain unchanged</p> <p>Includes improvements to Costilla Ave. east of Clinton St.</p>	<p>Diverts an insufficient volume of traffic from Arapahoe Rd.</p> <p>Does not eliminate the need for additional capacity improvements within the Arapahoe Rd./I-25 interchange</p>

2.3.1.2 Level 1 Screening Alternatives

In addition to the improved partial cloverleaf, other alternatives were brought back from Preliminary Screening with modifications during the Level 1 Screening in response to agency and stakeholder suggestions. The alternatives with similar characteristics were categorized and compared relative to each other and the No Action Alternative and included:

- ◆ Supplemental crossing
- ◆ Single point urban interchanges with supplemental improvements
- ◆ Three-level interchanges
- ◆ Other alternatives

Improved Partial Cloverleaf

As described in the Preliminary Screening Alternatives section, the improved partial cloverleaf alternative was advanced to Level 1 Screening. The alternative was advanced to Level 2 Screening due to its good operational performance and minimal physical impacts.

Supplemental Crossings

Although the supplemental stand-alone I-25 crossing alternative was eliminated during the Preliminary Screening, a supplemental crossing of I-25 was evaluated as an additional component to the interchange improvements that could provide additional access opportunities across I-25 and potentially reduce traffic volumes through the interchange. An I-25 crossing analysis was performed during Level 1 Screening to identify the best location for a crossing as a supplement in addition to feasible improvements to the interchange. Evaluation criteria included capacity/operations/safety, local/community impacts, design, environmental impacts, economic impacts, and cost. **Table 3** identifies the twelve alternative crossing locations evaluated in Level 1 Screening. Eleven of these were eliminated. The supplemental I-25 crossing alternatives are illustrated in **Figure 7**.

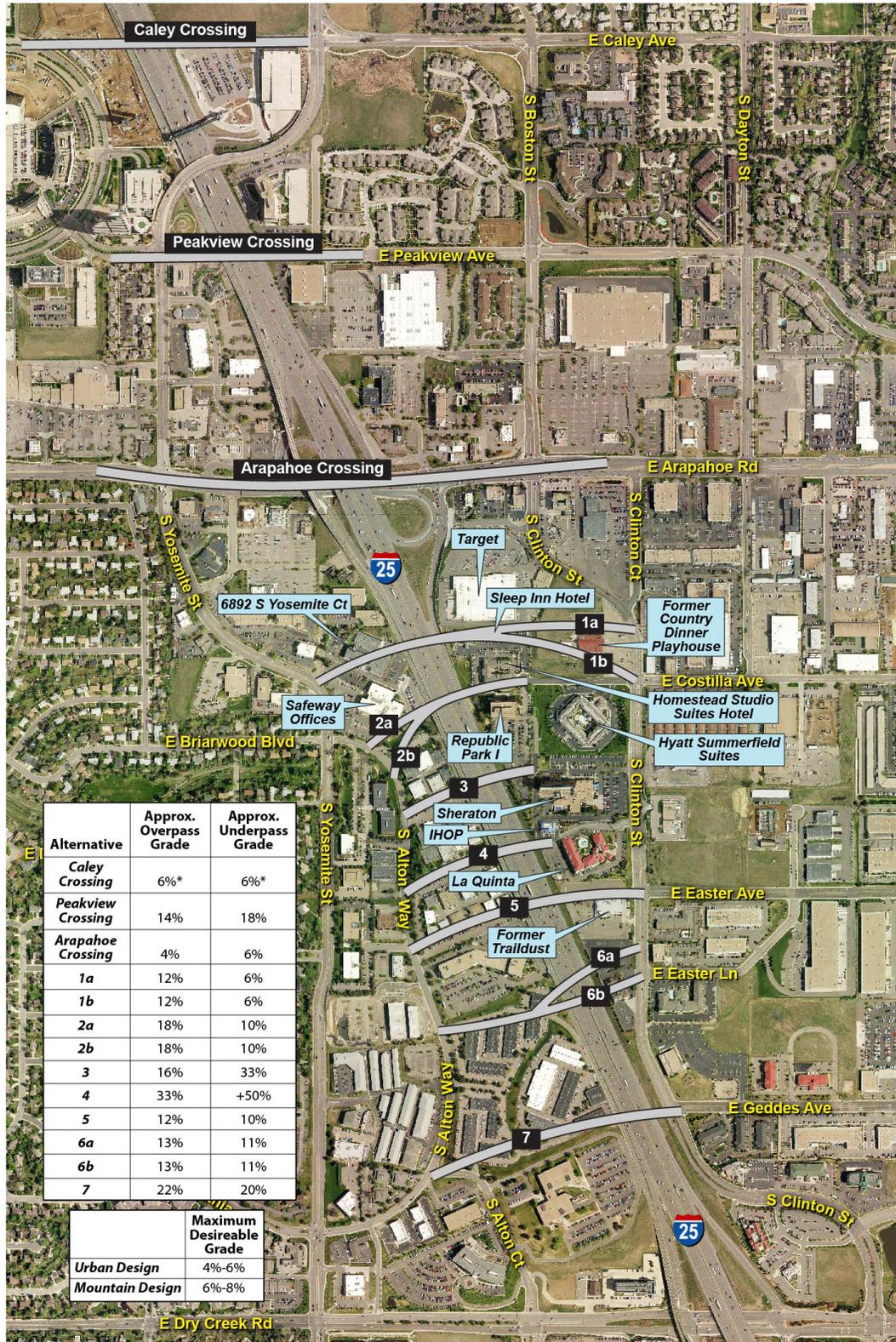
Based on the results of the I-25 crossing analysis, the Costilla Avenue crossing location was advanced during Level 1 Screening for further consideration as a supplement to the interchange improvement alternative. This supplemental crossing alternative was combined with interchange improvements resulting in the Improved Partial Cloverleaf Alternative and the Costilla Avenue Connection (Alignment 1b) for consideration in Level 2.

Table 3. Level 1 Screening – Supplemental Crossing Alternatives

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
Caley Crossing	No	Overpass/underpass connecting South Fiddler's Way to East Caley Ave.	Redundant with Yosemite St. overpass Minimal benefits, high ROW impacts and property acquisitions
Peakview Crossing	No	Overpass/underpass connecting East Peakview Ave. on both sides of I-25	Redundant with Yosemite St. overpass High impacts to roadway network and residential/business development

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
Connection to Clinton Ct. (1a) (north of Costilla Ave.)	No	Overpass/underpass connecting Yosemite St. to Clinton Ct.	Not as desirable for local/regional accessibility as Costilla Ave. connection (1b)
Costilla Ave. Crossing Connection (1b)	Yes	Overpass/underpass connecting Yosemite St. to Costilla Ave. Provides increased mobility in area south of Arapahoe Rd.	Forwarded to Level 2 as best meeting the evaluation criteria detailed in <i>Interchange and Supplemental I-25 Crossing Alternatives Technical Report</i>
Costilla to Briarwood Blvd. (2a)	No	Overpass/underpass connecting Briarwood Blvd. to Costilla Ave.	Physical limitation/does not meet design standards (exceeds maximum grades) Inconsistent with community character
Costilla Ave. to Alton Way (2b)	No	Overpass/underpass connecting Alton Way to Costilla Ave.	Physical limitation/does not meet design standards (exceeds maximum grades) Minimal benefits, high ROW impacts and property acquisitions
South of Costilla to Alton (3)	No	Overpass/underpass connections generally between Alton Way to the west and Clinton St. to the east Crossing locations are between Costilla Ave. on the north and Geddes Ave. on the south	Connections do not meet design criteria (exceeds maximum grades) Minimal benefits, high ROW impacts and property acquisitions
North of Easter Ave to Alton (4)			
Easter Ave. to Alton (5)			
North of Easter Ln. to Alton (6a)			
Easter Ln. to Alton (6b)			
Geddes Ave. to Alton (7)			

Figure 7. Other Suggested Alternative Locations for Supplemental Crossings of I-25



*assuming reconstruction to modify intersecting street elevations

Single Point Urban Interchanges with Supplemental Improvements

Two single-point urban interchange alternatives with supplemental improvements were analyzed during Level 1 Screening to measure safety and traffic operations relative to the improved partial cloverleaf. The first alternative included the single point interchange with a northbound collector/distributor road to the east of I-25. The second alternative included the single point urban interchange with a northbound loop on-ramp. As documented in **Table 4**, both alternatives were eliminated during the Level 1 Screening.

Table 4. Level 1 Screening – Single Point Urban Interchange Alternatives

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
Single-Point Urban Interchange with Northbound Collector / Distributor Road	No	Includes a northbound collector/distributor road from Arapahoe Rd. to north of Orchard Ave. On-ramps to I-25 would merge to single lane before merging with I-25	Insufficient capacity of on-ramp merges Significant cost of ROW impacts, impacts to roadways and grade-separated structures along I-25, and additional drainage infrastructure
Single-Point Urban Interchange with Northbound Loop On-Ramp	No	Replaces existing signalized ramp intersections with a single signalized intersection Eastbound to northbound loop on-ramp eliminates need for eastbound to northbound left-turn movement at single-point intersection	Exceeds maximum ramp grade requirements which does not meet design criteria Substandard design speeds of on-ramps Insufficient capacity of single lane southbound on-ramp

Three-Level Alternatives

Analysis of the Arapahoe Road/I-25 interchange as a three-level interchange was performed during Level 1 Screening. Four three-level interchange alternatives were included in the analysis. All three-level Arapahoe Road interchange alternatives were based on the concept that I-25 would remain the top level, local traffic and ramp intersections and turn movements would remain on the existing level (the middle level), and Arapahoe Road through movement traffic would be diverted to the lower level below the existing grade. Additionally, turn limitations for Yosemite Street and Boston/Clinton Street would be necessary to eliminate unsafe weaving. Analysis of the Arapahoe Road/I-25 interchange as a three-level interchange was performed during Level 1 Screening. One three-level interchange was forwarded to Level 2 Screening as shown in **Table 5**.

Table 5. Level 1 Screening – Three-level Interchange Alternatives

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
Three-Level Interchange with Existing I-25 Bridge	No	Includes two lanes for east and westbound Arapahoe Rd. through traffic beneath the existing interchange and I-25 bridge	Inefficient and highly uneconomical to construct Difficult and costly to maintain High costs

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
Three-level Interchange – Arapahoe Rd. Through Traffic in Covered Lower Level	No	Includes two lanes for east and westbound Arapahoe Rd. through traffic in a tunnel beneath a reconstructed interchange and I-25 bridge	Safety and operational issues along Arapahoe Rd. at Greenwood Plaza Blvd. and Dayton St. Difficult and costly to maintain High costs
Three-Level Interchange – Arapahoe Rd. Through Traffic in Open, Trenched Lower Level on Inside of Middle Level Lanes	Yes	Two lanes for east and westbound through traffic on middle level in an open, trenched lower level beneath a reconstructed interchange and new I-25 bridge	Forwarded to Level 2 for more detailed evaluation
Three-Level Interchange – Arapahoe Rd. Separated, Trenched Through Lanes on Outside of Middle Level Lanes	No	Two lanes for east and westbound through traffic on middle level in an open, trenched lower level beneath a reconstructed interchange and new I-25 bridge	Safety and operational issues along Arapahoe Rd. at Greenwood Plaza Blvd. and Dayton St. Difficult and costly to maintain High costs

Other Alternatives

Other alternatives considered during the course of the alternatives development and screening process are listed below.

- ◆ Transportation Systems Management (TSM) Alternative: The TSM Alternative identifies activities that would maximize the efficiency of the existing transportation system without major investments in new infrastructure.
- ◆ Improved Partial Cloverleaf Interchange Sub-Alternatives: Two improved partial cloverleaf interchange sub-alternatives were analyzed during Level 1 Screening. Both alternatives included southbound off-ramp left-turn grade separations.
- ◆ Alternate Route Improvement Alternatives: The three alternatives analyzed during Level 1 Screening included providing alignment, lane, operational and/or signage improvements on other alternatives to divert traffic from the Arapahoe Road/I-25 interchange. Elimination of these alternatives from consideration as part of this project would not preclude local agencies from pursuing these improvements separately.
- ◆ Personal Rapid Transit (PRT) Alternative: A PRT alternative connecting the Arapahoe at Village Center LRT station with a new proposed 800-space park-n-Ride was suggested as a means to relieve interchange traffic congestion. A PRT system is a system of driverless taxicabs that transport passengers to destinations along a dedicated guideway.
- ◆ Grade-Separated Pedestrian Crossings of Arapahoe Road: Grade-separated pedestrian crossings were analyzed as a means of reducing delay at intersections in the project area (DEA 2012a).

Table 6. Level 1 Screening – Other Alternatives

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
TSM	No	Includes signal timing optimization and auxiliary turn lanes	These improvements alone would be insufficient to address interchange traffic demand
Improved Partial Cloverleaf with Southbound Off-Ramp Left Turn Grade Separation	No	Includes an overpass of the southbound to eastbound off-ramp movement over the westbound Arapahoe Rd. lanes Grade-separated structure would connect with eastbound Arapahoe Rd. to the west of the I-25 bridge structure	Physically infeasible due to LRT bridge abutment proximity and LRT bridge vertical clearance Safety and operational issues due to restricted merging/weaving approaching Yosemite St. with depressed westbound traffic lanes
Improved Partial Cloverleaf with Southbound Off-Ramp Through Movement Grade Separation	No	Includes an overpass of the southbound off-ramp movement over east and westbound Arapahoe Rd. Provides access to southwest quadrant of interchange, reducing westbound left turn volume at Yosemite St.	Exceeds maximum ramp grade requirements which would not meet design criteria
Alternate Route Improvements: Caley Ave. and Boston St.	No	Realignment of Caley Ave. and Boston St. to create a sweeping curve Improved access to Arapahoe at Village Center LRT station Consistent with previous plans by Greenwood Village	These improvements alone would be insufficient to address interchange traffic demand
Alternate Route Improvements: Caley Ave./Boston St./Peakview Ave./Havana St.	No	Additional auxiliary lanes and operational improvements along Caley Ave., Boston St., Peakview Ave., and Havana St. to Arapahoe Rd. Greenwood Village already working to implement these improvements	These improvements alone would be insufficient to address interchange traffic demand
Alternate Route Improvements: Yosemite St./Xanthia St.	No	Directional signage for use of Xanthia St. by northbound Yosemite St. to I-25 traffic was also considered	These improvements alone would be insufficient to address interchange traffic demand

Alternative	Forwarded to Level 2?	Characteristics	Primary Reason for Elimination
PRT Complex 	No	System of driverless taxicabs along a dedicated guideway without intermediate stops 2.5-mile one-way loop with 8 stations Connects Arapahoe at Village Center LRT Station to a new supplemental park-n-Ride at Clinton St. and Easter Ave.	High cost with only marginal benefits to local traffic demand and interchange operations at Arapahoe Rd./I-25 Supplemental park-n-Ride capacity unwarranted since Arapahoe Station park-n-Ride is underutilized
Grade-Separated Pedestrian Crossing of Arapahoe Rd.	Yes	Overpasses of Arapahoe Rd. at Yosemite St. and at Boston/Clinton St. Reduces north-south pedestrian phase actuations potentially benefiting traffic flow	Forwarded to Level 2 for more detailed evaluation

Level 1 Screening provided a qualitative assessment of each alternative's ability to meet the project purpose and need in six general categories: 1) capacity, operations, and safety, 2) local and community impacts, 3) design, 4) environmental impacts, 5) economic impacts, and 6) cost. The No Action Alternative, improved partial cloverleaf with and without the Costilla Crossing, pedestrian grade separation of Arapahoe Road and a three level interchange were advanced to Level 2 Screening. The pedestrian grade separation and three level interchange alternatives were considered for screening based on continued input from local agencies and public stakeholders.

2.3.1.3 Level 2 Screening

The Level 2 Screening assessed the alternatives in the same six categories from the Level 1 Screening but quantitatively and at a greater level of detail. The recommendation based on the results of this screening was to advance the No Action Alternative and the Improved Partial Cloverleaf Alternative as described below. A No Action and an Action Alternative were advanced for full evaluation in the EA. The following three alternatives were eliminated in the Level 2 Screening:

- ◆ The improved partial cloverleaf with Costilla Avenue crossing connection. Analysis of the improved partial cloverleaf with Costilla crossing indicated insufficient improvement to traffic operations within the interchange complex to justify the additional impacts to area businesses and residences resulting from the Costilla Avenue connection. Although the improved partial cloverleaf with Costilla crossing would increase mobility in the area south of I-25, only a small volume of traffic is forecasted to be diverted from Arapahoe Road through the interchange. In addition, the cost of constructing this alternative is substantially beyond the available foreseeable funding identified for the interchange in the 2035 Regional Transportation Plan (RTP).

- ◆ The grade-separated pedestrian crossing of Arapahoe Road was eliminated at Level 2. Given the low expected usage from current land uses, limited reduction in vehicular delay, ROW acquisition requirements, and substantial funding investment, a pedestrian/bicycle grade separation was not recommended. The technical and executive committees established for this project recommended that a pedestrian grade separation should be re-evaluated as part of future redevelopment of the Arapahoe Road corridor area. Redevelopment of the southwest quadrant of the interchange was addressed in the City of Centennial’s Arapahoe Urban Center Sub-Area Plan (City of Centennial 2007a), indicating the potential for future substantial increase in development density, which could increase pedestrian demand. The Arapahoe at Village Center LRT station is less than 0.5 mile north of Arapahoe Road, which could also contribute to increased future pedestrian demand. Once specific redevelopment plans are confirmed, future pedestrian and bicyclist demand could be estimated from the changes in adjacent land use, along with potential city plans for pedestrian/bicycle routes through the area. In lieu of an overpass, a pedestrian/bicycle underpass could be considered in the future if redevelopment allowed for recontouring adjacent properties to enhance visibility and usage of the grade-separated crossing.
- ◆ The three-level interchange – Arapahoe Road through traffic in open trenched lower level on inside of middle level lanes. Analysis of the three-level interchange indicated insufficient improvement to traffic operations within the interchange complex to justify the additional impacts to area businesses and residences resulting from extensive multi-level construction. Although through traffic would be removed from the Yosemite and Boston/Clinton intersections, a substantial amount of traffic would still travel through the intersections, traveling to/from Yosemite Street, the I-25 ramps, and Boston/Clinton Streets. Further, the cost of constructing this alternative is substantially beyond the available foreseeable funding identified for the interchange in the 2035 RTP.

Table 7. Level 2 Screening

Alternative	Forwarded to Level 3?	Characteristics	Primary Reason for Elimination
Improved Partial Cloverleaf	Yes	Four intersections on Arapahoe Rd. No left turns at on-ramp terminals Direct connection for eastbound to northbound and westbound to southbound left turn lanes	Forwarded to Level 3
Improved Partial Cloverleaf with Costilla Ave. Crossing Connection (1b)	No	Includes improvements to partial cloverleaf interchange and supplemental I-25 crossing from Yosemite St. to Costilla Ave. Provides increased mobility in area south of Arapahoe Rd.	Insufficient improvement to traffic operations to outweigh impacts to businesses and residences Minimal traffic diverted from Arapahoe Rd. to supplemental crossing High costs

Alternative	Forwarded to Level 3?	Characteristics	Primary Reason for Elimination
Grade-Separated Pedestrian Crossing of Arapahoe Rd.	No	Overpasses of Arapahoe Rd. at Yosemite St. and at Boston/Clinton St. Reduces north-south pedestrian phase actuations potentially benefiting traffic flow	Low expected usage from current land uses Limited reduction in vehicular delay ROW acquisition requirements Substantial funding investment
Three-Level Interchange – Arapahoe Rd. Through Traffic in Open, Trenched Lower Level on Inside of Middle Level Lanes	No	Two lanes for east and westbound through traffic on middle level in an open, trenched lower level beneath a reconstructed interchange and new I-25 bridge	Insufficient improvement to traffic operations to outweigh impacts to businesses and residences Minimal traffic diverted from Arapahoe Rd. High costs

2.4 Conclusion

The improved partial cloverleaf interchange was identified as the Action Alternative since it best meets the project purpose and need and design objectives. The Action Alternative improvements would improve traffic operations and safety for the traveling public within the interchange complex. Substantial time savings for travel through the interchange complex would result from the Action Alternative improvements. By minimization and avoidance of impacts to environmental resources, residences and businesses, the Action Alternative is sensitive to and preserves the residential and business community character of the area. The Action Alternative provides the best value of all the improvement options, considering benefits, anticipated construction cost, and potential for project funding.

2.5 Cost

The probable construction cost of the Action Alternative is approximately \$65 to \$70 million (in 2010 dollars). This approximated cost includes construction materials, labor, ROW acquisitions, and engineering. Construction cost would likely increase with inflation by the time of construction. General maintenance costs would increase slightly due to increased pavement widths.

Costs associated with the No Action Alternative would be limited to general maintenance of the interchange complex transportation infrastructure. Maintenance of the I-25 bridge over Arapahoe Road would become more frequent and costly as the bridge structure ages.

2.6 Funding

The interchange improvements at I-25 and Arapahoe Road are included in the *Denver Regional Council of Governments' (DRCOG) Fiscally Constrained 2035 RTP* with a budget of \$83 million in the 2015-2024 time frame (DRCOG 2011b). The project is listed as “Regionally Funded.” The 2012-2017 DRCOG Transportation Improvement Program

(TIP) identifies \$4.2 million (plus local matching funds) for a total of \$6.0 million for final design of the environmentally cleared interchange improvements (DRCOG 2011a).

Non-federal funding participation has yet to be formalized with CDOT and the I-25 and Arapahoe Road Interchange Coalition. The Coalition is comprised of the City of Greenwood Village, City of Centennial, and Arapahoe County, Colorado. The Coalition agencies are committed to work together with CDOT to ensure that the recommended interchange improvements can be implemented in a timely manner. In addition, the interchange is located within the Southeast Public Improvement Metropolitan District, a Transportation Management Area (TMA) that is supported partially via a mill-levy from adjacent metropolitan districts that have earmarked funding for I-25 corridor improvements. The I-25/Arapahoe interchange improvements are eligible for this funding. The TMA has already committed to fund half of the local match towards this EA and has additional funding which could be used for design and construction.



Chapter 3: Affected Environment and Environmental Consequences

This chapter summarizes how the proposed project is likely to affect the social, economic, and natural environment within the study area.

3.1 Introduction

This chapter summarizes how the proposed project is likely to affect the social, economic, and natural environment through comparison of potential impacts and effects of the No Action Alternative and Action Alternative. The analyses summarized in this chapter were conducted in accordance with guidance provided by NEPA (NEPA, 42 USC 4332 (2)(c)) and FHWA Environmental Impact and Related Procedures (23 Code of Federal Regulations (CFR) § 771.105).

This document focuses on the resource issues that differentiate the alternatives being described. The Council for Environmental Quality regulations on implementing NEPA provides direction to focus the assessment criteria for the impact discussions. It is the policy of NEPA (40 CFR 1500.2(b)) “...to emphasize real environmental issues and alternatives.” NEPA requires the analysis of direct, indirect, and cumulative impacts. This analysis also considers temporary impacts.

Direct impacts are defined as impacts that:

- ◆ Are caused by the action; and
- ◆ Occur at the same time and same place.

Indirect impacts are defined as impacts that:

- ◆ Are caused by the action;
- ◆ Are later in time or farther removed in distance;
- ◆ Are reasonably foreseeable; and
- ◆ May include growth inducing effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems including ecosystems.

Cumulative impacts, as defined in 40 CFR 1508.7 are those that:

- ◆ Result from the incremental impact of the action when added to the past, present, and reasonably foreseeable future actions.
- ◆ Can result regardless of what agency (federal or non-federal) or person undertakes such other actions.
- ◆ Can result from individually minor but collectively significant actions taking place over period of time.

There are a number of committed projects in the study area, discussed in more detail in Section 3.15, Cumulative Impacts. The committed projects are “reasonably foreseeable” projects to be implemented over a longer time period, and are included in the Cumulative Impacts analysis.

Temporary impacts are defined as impacts that:

- ◆ Are caused by the action;
- ◆ Are short term; and
- ◆ Are related to construction activities.

This impacts analysis provides an appropriate level of detail commensurate with the early stages of design to compare the No Action and the Action Alternatives and relative project impacts using consistent assumptions. This level of detail is sufficient to show relative comparison of impacts among the alternatives. During final design additional site-specific details may be developed in order to further avoid, minimize, and mitigate impacts to resources whenever possible.

3.1.1 Resources Evaluated in Detail

Based on the characteristics of the study area and input from CDOT, resource agencies, stakeholders, and the public, impacts to the following key resources present in the study area are evaluated in detail in this EA.

- ◆ Transportation
- ◆ Land Use
- ◆ Socioeconomic Conditions
- ◆ Environmental Justice
- ◆ Right-of-Way
- ◆ Utilities
- ◆ Visual Resources
- ◆ Noise
- ◆ Energy
- ◆ Air Quality
- ◆ Hazardous Materials
- ◆ Water Resources and Water Quality

3.1.2 Resources Dismissed from Detailed Evaluation

Resources not present in the study area and/or expected to experience minimal impacts were evaluated early in the process and dismissed from detailed analysis as detailed below.

Farmlands

No farmlands have been identified in the study area. Therefore, there would be no impacts to farmlands under the No Action Alternative or the Action Alternative.

Floodplains

A review of Federal Emergency Management Agency (FEMA) National Flood Insurance Plan maps showed that no delineated flood zones exist within the project area (FEMA, 2012, Map Reference #07080579V080011). Two delineated flood zones designated as 100-year floodplains exist within the study area. The Goldsmith Gulch floodplain extends south from Orchard Road and terminates north of East Peakview Avenue between South Yosemite Street and South Boston Street. The Little Dry Creek floodplain extends

northwest of Arapahoe Road at South Krameria Way. The project would have no impacts on either of these 100-year floodplains under the No Action Alternative or the Action Alternative.

Parks and Recreation

Five parks and one trail exist within the study area. The Action Alternative would result in slight improvements over existing conditions regarding improved mobility, enabling easier access to parks and recreation resources. However, most people likely use recreational facilities on weekends or evenings when peak hour for congestion has passed. Beneficial impacts to parks and recreation resources would be slight. No measurable indirect impacts are expected. Therefore, no impacts to parks and recreation are expected.

Section 4(f)

Section 4(f) of the Department of Transportation Act of 1966 was set forth in Title 49 United States Code (U.S.C.), Section 303 and stipulates that FHWA and other state transportation agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless there is no feasible and prudent alternative to the use of land, and the action includes all possible planning to minimize harm to the property resulting from use (FHWA n.d.a.). No properties within the project area meet the Section 4(f) definition, and no impacts to parks and recreation are expected, as mentioned above. Therefore, the project would have no impacts to Section 4(f) properties under the No Action Alternative or the Action Alternative (Felsburg, Holt & Ullevig 2011).

Section 6(f)

The Land and Water Conservation Fund (LWCF) Act of 1965 established a federal funding program to assist states in developing outdoor recreation sites. Section 6(f) of the act prohibits the conversion of property acquired or developed with these funds to a non-recreational purpose without the approval of the National Park Service (NPS 2008). No properties within the project area meet the Section 6(f) definition. Therefore, the project would have no impacts to Section 6(f) properties under the No Action Alternative or the Action Alternative.

Biological Resources

Biological resources were reviewed based upon literature assessment, field reconnaissance, map and photo interpretation, and desktop analysis.

Vegetation: Current land use in the project area is urban and fully developed. Vegetation primarily consists of landscaped lawns and well-maintained ornamental plantings. No infestations of noxious weeds were identified within the project area. All of the transportation ROW contained well-maintained and mowed vegetation. For these reasons, no impacts to vegetation are expected under the No Action or the Action Alternatives.

Wetlands: No wetlands or riparian areas were identified within the project area. Therefore, no impacts to wetlands are expected under the proposed alternatives.

Wildlife and Special Status Species: The U.S. Fish and Wildlife Service (USFWS) has identified nine threatened, endangered, candidate, and proposed species in Arapahoe County. None are known or expected to occur within the project area due to a lack of

suitable native habitat, and none are anticipated to be affected by the No Action or Action Alternatives. Similarly, no state protected species are anticipated to be affected.

Disturbance of any migratory bird nests, if active, are prohibited under the Migratory Bird Treaty Act (MBTA). Removal of active bird nests requires a MBTA permit from the USFWS. Typically, unless a nest is endangering human life or could cause injury, the permit to take an active nest is denied. More often, seasonal restrictions are used to ensure that active nests are not harmed during the breeding season. A number of migratory bird species that are adapted to urban landscapes are likely to use the landscaped vegetation as habitat within the project study area. If construction occurs during the breeding season, an additional nest survey will be conducted no more than 7 days prior to construction. To avoid impacts to nesting birds, any existing nests will be removed prior to the nesting season (April 1st). Construction cannot begin until unoccupied nests have been removed. In addition, any new nesting material encountered will be removed during construction. If occupied nests are observed during construction, no construction work will occur that would impact the nests. No other wildlife or special status species were identified that would be impacted by the No Action or Action Alternative.

For these reasons, the project would have no impacts on biological resources under the No Action Alternative or the Action Alternative.

Cultural Resources

Cultural resources are tangible remains of past human activity, and include archaeological materials, features, sites, as well as historical buildings, structures, and districts at least 50 years old. Significant cultural resources are those which meet the criteria established for the National Register of Historic Places (NRHP).

The study area is a highly developed, urbanized area. The Colorado Office of Archaeology and Historic Preservation's Compass database was searched for evaluated sites and the building records for Arapahoe County were reviewed to assess the age of buildings in the project area. No NRHP-eligible sites in the project area were listed in the Compass database. Arapahoe County's records indicated that the earliest buildings on properties that abut the roads affected by the project date from 1964 (Walnut Hills neighborhood). Commercial buildings in the area are slightly newer (e.g., the Conoco gas station northeast of the interchange was built in 1967).

Consequently, there are no documented historic resources in the project area or any known potential historic resources that require further investigation or evaluation under Section 106 at this time (Felsburg, Holt & Ullevig 2011). It should be noted that based on these data, some of the homes in Walnut Hills will begin turning 50 years old in 2014. At that time, it may become necessary to begin Section 106 consultations or surveying these buildings for potential eligibility as historic resources for any future decisions or actions.

No archaeological resources have been recorded in the study area. All of the ground in the I-25/Arapahoe Road interchange area has been disturbed by previous construction. Construction of the project would follow applicable federal, state, and local requirements and practices.

Paleontological Resources

Paleontological resources are the fossilized remains of prehistoric plant and animal organisms, as well as the mineralized impressions (trace fossils) left as indirect evidence

of the form and activity of such organisms. These non-renewable resources are protected by the Colorado Historical, Prehistorical, and Archaeological Resources Act of 1973.

The geologic formations that comprise the surface of the study area have the potential to contain scientifically significant fossils. Subsurface excavation from construction activities associated with the Action Alternative may potentially cause direct impacts (damage or destruction) to scientifically important paleontological resources.

To ensure that important paleontological remains are not destroyed during construction, a qualified, state-permitted paleontologist will examine the final design plans to estimate the scope of construction monitoring work, if any, that is required. If any subsurface bones or other potential fossils are found anywhere within the study area during construction, a qualified, state-permitted paleontologist will assess their significance and make further recommendation.

For these reasons, the project would have no adverse impacts on paleontological resources under the No Action Alternative or the Action Alternative.

Soils and Geology

Although soils would be disturbed during construction of the Action Alternative, disturbance would be minimal and best management practices would be employed to minimize erosion. A review of U.S. Geological Survey and Natural Resources Conservation Service soil data indicates that no major geologic hazards or significant and geologically-active faults occur in the study area. Swelling soils exist in the study area; if necessary, techniques would be applied to improve soil or ground suitability for roadway construction during project design. The project is not likely to be affected by or negatively affect soils and geologic conditions in the study area.

A detailed geotechnical analysis of the surrounding subsurface will be required during the preliminary/final design process to determine the structural stability and load-bearing capacity of the soils where project structures will be built. The results of the geotechnical analysis will be used to establish the design of the roadway and structures and to establish erosion control procedures.

For these reasons, the project would have no direct, indirect, temporary or cumulative impacts on soils and geology under the No Action Alternative or the Action Alternative.

3.2 Transportation

Arapahoe Road is a critical east-west arterial extending approximately 13 miles from Broadway on the west and past E-470 on the east. It is an important transportation corridor in Arapahoe County and within the study area it serves the cities of Centennial and Greenwood Village. The arterial corridor has six through travel lanes and additional turn lanes and acceleration/deceleration lanes at intersecting streets. Due to a strict access management policy applied in 1982, Arapahoe Road has very few private accesses (Colorado Department of Highways 1982).

The Arapahoe Road interchange at I-25 provides critical access to activity in the region. Arapahoe Road includes two through travel lanes in each direction between the bridge piers, and one through travel lane in each direction on the outside of the bridge piers with an acceleration/deceleration lane leading to the I-25 cloverleaf on-ramps. The westbound to northbound I-25 on-ramp is two lanes merging to a single lane following ramp metering. Ramp metering is the signalization of freeway on-ramps to manage the rate of

vehicles entering the freeway and to eliminate vehicle platoons. The eastbound to southbound I-25 on-ramp is one lane with ramp metering. Both I-25 off-ramps have two lanes and are signal-controlled at Arapahoe Road.

As described in Chapter 1, traffic volumes through the interchange complex have increased substantially over the past 30 years and the existing design and capacity of the interchange no longer accommodates traffic demands. Traffic counts measuring approximately 100,000 vehicles per day entering the interchange complex far exceed the design of the interchange. The interchange complex experiences heavy traffic throughout the day, with high traffic volumes in all three peak periods (AM, noon, and PM). Traffic volumes are projected to exceed 130,000 vehicles per day by 2035.

Although the 2010 interim improvements, as described in Chapter 1, Section 1.3.1, resulted in improved traffic movements through the interchange and reduced traffic queues, operational and capacity issues persist. Existing traffic volumes at the interchange create operating conditions with restricted movements and backups.

3.2.1 Environmental Consequences of the No Action Alternative

The No Action Alternative does not meet the purpose and need, but is carried forward as a baseline against which the Action Alternative is compared. Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. The local jurisdictions may make subsequent modifications to nearby intersecting streets and intersections using local funds, but no improvements would be made to the I-25 bridge, ramps or to Arapahoe Road within the interchange complex.

Impacts of the No Action Alternative on traffic capacity and operations, safety, and transit operations are discussed in the sections below.

3.2.1.1 *Traffic Capacity and Operations*

The existing I-25/Arapahoe Road interchange configuration cannot accommodate future traffic volumes. Traffic operations would continue to deteriorate as traffic volumes entering the interchange complex are forecast to increase 30 percent by year 2035.

As described in Chapter 1, unacceptable LOS, LOS E and F, are projected to occur at intersections along Arapahoe Road within the project area, including the I-25 ramp intersections, the Yosemite Street intersection, and the Boston/Clinton Street intersection. **Table 8** illustrates the projected intersection LOS.

Additionally, though the overall performance at the ramp intersections with Arapahoe Road may be acceptable during the PM peak hour, unacceptable LOS is projected for individual movements. The southbound left turn movement at the southbound off-ramp intersection with Arapahoe Road and the northbound left turn movement at the northbound off-ramp intersection with Arapahoe Road both perform at unacceptable LOS during the AM and PM peak hours.

Table 8. Year 2035 Intersection Performance – No Action Alternative

Intersection	No Action LOS (AM/PM)
Greenwood Plaza Boulevard at Arapahoe Road	D / F
Yosemite Street at Arapahoe Road	F / F
I-25 Southbound Ramps at Arapahoe Road <i>Southbound Off-Ramp Left Turn Movement</i>	E / C F / F
I-25 Northbound Off-Ramp at Arapahoe Road <i>Northbound Off-Ramp Left Turn Movement</i>	F / D F / F
Boston Street/Clinton Street at Arapahoe Road	C / E

Source: DEA Team, 2011.

Travel times under the No Action Alternative would deteriorate over time within the study area. Travel times along Arapahoe Road between Greenwood Plaza Boulevard and Dayton Street, a section of roadway less than 1 mile long, would range from nearly 5 minutes to over 10 minutes, as shown in **Table 9**.

Table 9. Year 2035 Arapahoe Road Travel Times – No Action Alternative

Travel Time Segment	Direction	Travel Time in Minutes (AM/PM)
Greenwood Plaza Boulevard through Dayton Street	Eastbound	4.8 / 7.4
	Westbound	5.3 / 10.1

The No Action Alternative would have negative direct impacts to traffic operations within the study area. Without roadway improvements, in the year 2035 drivers would experience substantially more congestion surrounding the I-25/Arapahoe Road interchange complex. Additionally, negative indirect impacts would occur along roadways outside the study area from diverted traffic attempting to avoid the I-25/Arapahoe Road interchange area, particularly potential increase in cut-through traffic on streets in the Walnut Hills neighborhood.

3.2.1.2 Safety

Under the No Action Alternative, mainline I-25 should continue to exhibit average safety performance when compared to similar facilities. However, as congestion increases along Arapahoe Road, vehicle queues at the I-25/Arapahoe Road off-ramps extending back onto I-25, especially in the southbound direction, would become more common. This would likely result in increased crashes at the off-ramp divergence points.

As described in Chapter 1, a number of intersections along Arapahoe Road exhibit moderately high crash occurrences. As congestion on Arapahoe Road increases in the future, drivers may take greater risks entering gaps in traffic or making turns across travel lanes. This is likely to result in increased crash frequency, a negative direct impact of the No Action Alternative. Additionally, negative indirect impacts to safety would potentially occur as diverted traffic avoiding the I-25/Arapahoe Road interchange would cause increased congestion and traffic accidents along roadways outside the study area.

3.2.1.3 Transit Operations

The general area surrounding the I-25/Arapahoe Road interchange is relatively well served by the existing fixed route transit system operated by the Regional Transportation District (RTD). As noted in Chapter 1, there are no transit routes using the interchange. Instead, buses travel along Yosemite Street, the Yosemite Street overpass, Caley Avenue, and Boston Street to access the Arapahoe at Village Center LRT station. Bus operations along Arapahoe Road to the west and east of the interchange would be affected by the growing traffic congestion and increased travel times through the interchange complex, a negative direct impact of the No Action Alternative. Additionally, negative indirect impacts to bus operations would occur outside the study area from diverted traffic and the resulting increased congestion. Light rail operations would not be impacted.

All though bus operations would be negatively impacted, transit ridership would potentially increase as a result of travelers choosing alternative modes to avoid traffic congestion, a positive indirect impact.

3.2.1.4 Pedestrian and Bicycle Operations

The sidewalks in the project area are narrow and generally located immediately adjacent to the relatively high volume travel lanes along Arapahoe Road and immediate intersecting streets. There are no designated bike lanes or shoulder areas, and no designated bike routes through the interchange complex. According to CDOT's bicycle policy directive and Roadway Design Guide, bicycles are permitted on Arapahoe Road and the surrounding street network, with the exception of I-25. The policy's directive to provide transportation infrastructure that accommodates bicycle and pedestrian use of the highways in a manner that is safe and reliable for all highway users. The needs of bicyclists and pedestrians shall be included in the planning, design, and operation of transportation facilities, as a matter of routine. Pedestrian and bicycle operations and safety would be affected by increasing congestion as traffic volumes increase along the existing streets, a negative direct impact of the No Action Alternative. Additionally, negative indirect impacts to pedestrian and bicycle operations and safety would occur outside the study area from diverted traffic and the resulting increased congestion. Conversely, pedestrian and bicycle use would potentially increase as a result of travelers choosing alternative modes to avoid traffic congestion, a positive indirect impact.

3.2.2 Environmental Consequences of the Action Alternative

Impacts of the Action Alternative on traffic capacity and operations, safety, transit operations, and pedestrian and bicycle operations are discussed below. Construction impacts are also discussed.

3.2.2.1 Traffic Capacity and Operations

By year 2035, traffic volumes entering the interchange complex are forecast to increase 30 percent. The Action Alternative addresses the increased traffic volumes by improving traffic operations at the I-25/Arapahoe Road interchange and the adjacent intersections along Arapahoe Road. Components of the Action Alternative conceptual design include:

- ◆ Improvements to the I-25/Arapahoe Road interchange
- ◆ Intersection improvements along Arapahoe Road
- ◆ Additional/improved auxiliary lanes along Arapahoe Road
- ◆ Improvements to local access off Arapahoe Road

- ◆ Realignment of the frontage road in the northeast quadrant of the interchange

Under the Action Alternative, improvements along Arapahoe Road extend from the Greenwood Plaza Boulevard intersection to west of the Dayton Street intersection.

The Action Alternative would result in improved traffic operations and decreased congestion along Arapahoe Road throughout the project area. Overall intersection performance would improve to acceptable conditions at the I-25 off-ramp terminal intersections and the Boston Street/Clinton Street intersection compared to the No Action Alternative, as shown in **Table 10**.

Table 10. Year 2035 Intersection Performance – No Action Alternative Versus Action Alternative

Intersection	LOS	
	No Action (AM/PM)	Action (AM/PM)
Greenwood Plaza Boulevard at Arapahoe Road	D / F	D / F
Yosemite Street at Arapahoe Road	F / F	E / F
I-25 Southbound Ramps at Arapahoe Road <i>Southbound Off-Ramp Left Turn Movement</i>	E / C F / F	C / B D / D
I-25 Northbound Off-Ramp at Arapahoe Road <i>Northbound Off-Ramp Left Turn Movement</i>	F / D F / F	C / B D / D
Boston Street/Clinton Street at Arapahoe Road	C / E	B / C

Source: DEA Team, 2011.

The following are the key traffic operations characteristics within the project area as a result of the Action Alternative:

- ◆ Overall intersection performance improves to acceptable LOS at the I-25 off-ramp terminal intersections.
- ◆ Overall intersection performance improves to acceptable LOS at the Boston Street/Clinton Street intersection with Arapahoe Road in the AM and PM peak hours.
- ◆ Decreased vehicle delay at the Yosemite Street/Arapahoe Road intersection by more than 30 seconds during the AM and PM peak hours.
- ◆ Improved overall intersection delay at the Greenwood Plaza Boulevard and Dayton Street intersections with Arapahoe Road during both the AM and PM peak hours.

Additionally, travel times along Arapahoe Road through the project area would improve. Travel times from Greenwood Plaza Boulevard through Dayton Street would decrease between about 1 minute and nearly 4 minutes, as show in **Table 11**.

Table 11. Year 2035 Arapahoe Road Travel Times – Action Alternative

Travel Time Segment	Direction	Travel Time in Minutes (AM/PM)	Travel Time Change from No Action in Minutes (AM/PM)
Greenwood Plaza Boulevard through Dayton Street	Eastbound	3.8 / 3.6	-1.0 / -3.8
	Westbound	3.7 / 7.4	-1.6 / -2.7

The decrease in delay through the interchange and adjacent intersections would likely reduce the desire of drivers to find alternate routes around the congestion. This could result in a reduction in cut-through traffic through adjacent neighborhoods such as the Walnut Hills neighborhood.

Traffic operations in the northeast quadrant would also benefit from the realigned frontage road and combined driveway access. These improvements would improve access to businesses and reduce cut-through and out-of-direction traffic movements. These improvements recognize the balance between local access to businesses and minimizing queuing for traffic to and from the interchange ramps, and the limited green signal time for the southbound frontage road at the Arapahoe Road/northbound off-ramp signalized intersection per the 1997 legal agreement addressing this access.

The Action Alternative would have positive direct impacts to traffic operations and would decrease congestion surrounding the I-25/Arapahoe Road interchange complex and throughout the study area.

3.2.2.2 Safety

Under the Action Alternative, the I-25 mainline freeway configuration, traffic volumes, and crash frequency would not change. However, improvements to the interchange would result in decreased queue lengths at the off-ramps. Accordingly, there would be a decrease in crashes at the off-ramp divergence points caused by off-ramp vehicle queues backing up onto mainline I-25, a positive direct impact.

Crashes along Arapahoe Road and at intersections within the vicinity of the interchange are expected to decrease, a positive direct impact of the Action Alternative. Congestion-related crash types, including rear ends, sideswipes, and broadsides, are expected to decrease as congestion decreases. In addition, median barrier related crashes at the interchange would decline with the removal of the existing concrete barriers on Arapahoe Road under I-25 that separate through lanes of the same direction, as illustrated in **Figure 6**. The new bridge piers would align with the light rail bridge piers, separating eastbound and westbound through lanes on Arapahoe Road.

3.2.2.3 Transit Operations

As previously noted, transit routes do not extend through the interchange but rather travel along adjacent streets and through nearby intersections. Bus operations along Arapahoe Road to the west and east of the interchange would benefit from improved traffic flow through the corridor, a positive direct impact of the Action Alternative. Improved travel times through the corridor would result in improved timeliness of bus service at stops along the corridor and at the Arapahoe at Village Center LRT station, facilitating timely transfers between buses and LRT and allowing for the option of future bus routes through the interchange.

3.2.2.4 Pedestrian and Bicycle Operations

Under the Action Alternative, pedestrian operations within the interchange complex would benefit from widened sidewalks. Bicycle operations would benefit from the additional travel lanes with improved vehicular traffic operations. Pedestrians crossing Arapahoe Road and Yosemite Street may be affected by the increased crossing width due to the additional vehicular traffic lanes. Signal timing would be adjusted to accommodate pedestrians crossing the widened intersection. The Action Alternative does not preclude future pedestrian and bicycle improvements, including grade separations if warranted, as

a separate action or project. Overall, the widened sidewalks and improved traffic operations would benefit pedestrians and bicyclists, a positive direct impact of the Action Alternative.

3.2.2.5 Construction Impacts

The Action Alternative would have a negative direct impact to traffic operations during construction through the I-25/Arapahoe Road interchange complex and throughout the study area. Both regional and local traffic traveling through the interchange and along mainline I-25 would experience some delays during construction. Constructing the project in phases would help minimize impacts due to lane closures, detours, and increased congestion. However, residents and businesses in the area would be inconvenienced as some delays would occur throughout the study area during construction along with temporary closures of business access to/from Arapahoe Road. Increased congestion could also cause delays to transit operations east and west of the interchange and affect timely bus and light rail transfers at the Arapahoe at Village Center LRT station.

3.2.3 Mitigation

Mitigation measures for transportation have been designed into the Action Alternative. Wherever possible, avoidance and minimization of impacts were included in the concept design of the Action Alternative. Some examples of mitigation measures included in the design include:

- ◆ Avoided freeway modifications that would change the ramp junctions with mainline I-25.
- ◆ Included additional lanes at ramp intersections to reduce vehicle queuing on off-ramps.
- ◆ Added additional lanes on Arapahoe Road and removed barriers, which will benefit emergency response time through the interchange complex.
- ◆ Avoided residential property acquisition by shifting lane alignments.
- ◆ Realigned frontage road to maintain business access during freeway reconstruction.

The reconstruction of the I-25/Arapahoe interchange will follow the CDOT Region 6 *Lane Closure Strategy* (CDOT 2010). This strategy only allows for closures on I-25 during non-peak periods, generally between 8:00 PM and 5:30 AM. Therefore all lanes of traffic on I-25 and Arapahoe Road will be maintained during the peak periods.

In order to comply with the *Lane Closure Strategy*, construction phasing for replacing the I-25 bridge will occur in a minimum of three phases, with the initial phase starting on the east side of I-25. In order to accommodate the phases of bridge construction, the reconstructed I-25 bridge width will be increased. The phasing is described below:

- ◆ *Phase 1* – Northbound I-25 traffic will be shifted to the west (towards the median barrier) using reduced lane widths and shoulders.
- ◆ *Phase 2* – Northbound I-25 traffic will be shifted onto a portion of the new northbound bridge (constructed in Phase 1). Southbound I-25 traffic will be shifted to the west and reduced lane and shoulder widths will be used.
- ◆ *Phase 3* – Northbound I-25 traffic will remain in the same location as in Phase 2, and southbound traffic will be shifted east (onto the northbound I-25 structure constructed Phase 2).

The typical detour section is assumed to include 11-foot travel lanes, 2-foot shoulders, and, where possible, a 5-foot buffer between any barrier and the construction zone edge.

Along Arapahoe Road, it was determined to be impractical to maintain all lanes during construction. The physical constraints combined with the large number of existing lanes along Arapahoe Road make it necessary to reduce the number of lanes to complete construction in a reasonable manner. A minimum of two through lanes will be maintained in each direction along Arapahoe Road during construction, with the addition of turn lanes at various locations. Temporary business access wayfinding signage will be utilized to help mitigate impacts during times of construction when business access would be limited or closed.

3.3 Land Use

Transportation projects influence the way surrounding land is used and managed. It is important to consider the compatibility of a proposed project with surrounding land uses and management policies and identify how the project could affect future land use patterns and policies. This section discusses the local plans that provide land use guidance and describes the zoning and land use characteristics and patterns of the study area. The study area is roughly bounded by Orchard Road, Dry Creek Road, South Quebec Street, and South Havana Street, and encompasses portions of the City of Centennial and Greenwood Village. Arapahoe County, Greenwood Village, and Centennial hold jurisdiction over some or all of the study area. Existing and future land use patterns were identified through a survey of recent aerial photos, community development plans, and zoning ordinances from each jurisdiction in the study area.

3.3.1 Local Plans

Several local land use plans provide guidance on land use and zoning within the study area. These documents include the following:

Arapahoe Road Corridor Study I-25 to Parker Road: Land Use and Socio Economic Data Summary Report (Arapahoe County 2006a)

This document describes the regional and local land use along Arapahoe Road between Quebec Street, Belleview Avenue, Himalaya Street, and E-470. The report summarizes the process and results of the existing land use review, and presents a socioeconomic dataset that was the basis of the travel demand forecast for the Corridor Study. The report also identifies projected future land uses.

Arapahoe County Comprehensive Plan (Arapahoe County 2001)

This plan guides the land use, growth, and development decisions in Arapahoe County. The plan was developed through coordination with public officials, county staff, consultants, citizen volunteers, advisory committee members, and the public. The plan discusses the existing conditions and identifies the goals, policies, and strategies for future conditions. This plan was adopted by Arapahoe County in 2001.

Greenwood Village Comprehensive Plan (Greenwood Village 2011a)

This plan identifies the existing conditions, as well as community and environmental objectives of Greenwood Village. The plan was adopted by the Greenwood Village City Council in 2011.

City of Centennial Comprehensive Plan (City of Centennial 2004)

This is a guidance document designed to “guide public policy and implement the vision for the City of Centennial.” The plan discusses community appearance, economic development, housing, land use, recreation facilities, regional cooperation and land use management, transportation, and utilities and services within the City of Centennial. The plan provides a base from which progress can be measured and “implementation strategies can be crafted, adopted, and pursued over time.”

Arapahoe Urban Center Sub-Area Plan (City of Centennial 2007a)

This plan guides the vision to development of a major urban center for the Arapahoe Road Urban Center Sub-Area. The Sub-Area falls within the boundaries of Quebec Street and I-25, north and south of Arapahoe Road. The plan was developed through coordination with decision-makers, landowners, and other stakeholders and includes “an evaluation of existing conditions, summary of the public outreach process undertaken in developing the plan, statements of visions and goals, future land uses, framework and typology recommendations, and major steps needed to implement the plan.”

2035 Metro Vision RTP Appendix 1: Denver Region Multimodal Corridor Visions (DRCOG 2011b)

The *2035 Metro Vision RTP* identifies the transportation facilities, improvements, and services planned for the DRCOG planning region for the horizon year of 2035. The plan was developed in cooperation with local governments, CDOT, RTD, the Regional Air Quality Council, the Air Pollution Control Division of the Colorado Department of Public Health and Environment, and public input. Appendix 1 provides detailed maps and corridor vision plan sheets describing the growth, development, and transportation visions for key multimodal corridors in the Denver region, one of which is Arapahoe Road.

3.3.2 Existing Land Use Patterns

Land in the study area is developed and consists primarily of service-type retail, residential, and office uses. Single-family homes make up the majority of residential land use, which is located in the southwest and northeast quadrants of the study area. Multi-family residences are present near the intersection of Dry Creek Road and South Yosemite Street, south of Orchard Road near South Yosemite Street, and along the north side of East Peakview Avenue. Retail/commercial uses are concentrated along the Arapahoe Road corridor and southeast along the I-25 corridor south of the I-25/Arapahoe Road interchange. The northwest and southeast quadrants are comprised mainly of office employment centers, with some retail/commercial uses (Arapahoe County 2006a). Several vacant parcels are scattered throughout the study area. **Figure 8** depicts existing land uses within the study area.

3.3.3 Future Land Use Patterns

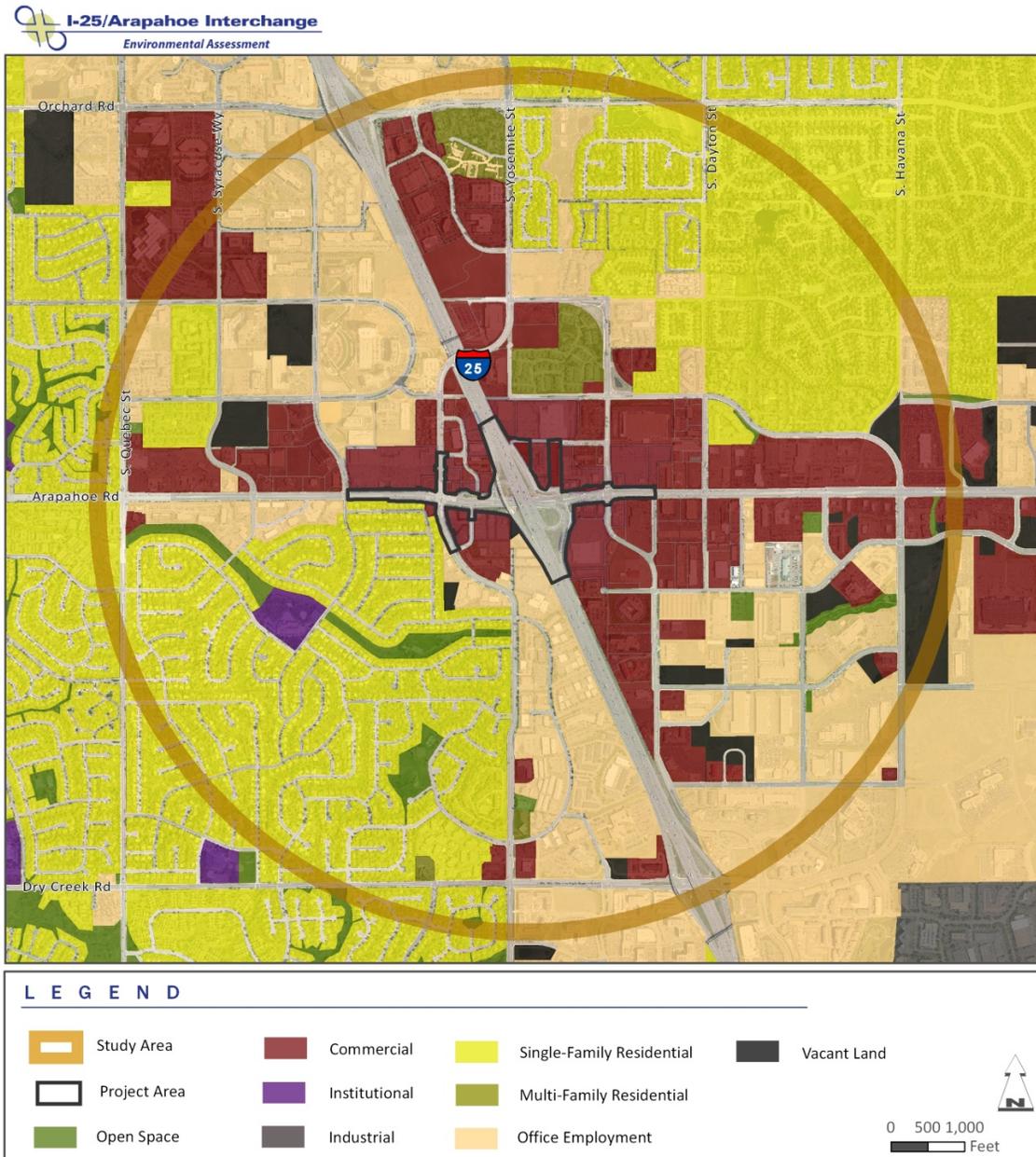
Land use within the study area is anticipated to stay fairly stable, with the exception of commercial development, which is anticipated to increase along Arapahoe Road and adjacent thoroughfares. The *Arapahoe Road Corridor Study I-25 to Parker Road: Land Use and Socio Economic Data Summary Report* (2006) identifies a minor increase in mixed-use development along I-25 near East Caley Avenue and south of East Peakview Avenue utilizing parcels that are currently vacant. Along Arapahoe Road, the area east of Quebec Street is anticipated to undergo zoning changes in order to allow an increase in mixed uses (Centennial 2007a). The I-25 and Arapahoe Road interchange is identified as

a Gateway to the City of Centennial in the *Arapahoe Urban Center Plan* (2007). This plan recommends future redevelopment southwest of the interchange ranging from multi-storey, signature office buildings along I-25 and east of Yosemite Street, to lower mixed-use buildings with predominately residential uses west of Yosemite Street.

3.3.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. Existing land uses would remain the same until they are altered or replaced as part of community development efforts. Therefore, there are no direct, indirect, temporary, or cumulative impacts associated with the No Action Alternative.

Figure 8. Existing Land Uses



3.3.5 Mitigation

No mitigation would be required for the No Action Alternative.

3.3.6 Environmental Consequences of the Action Alternative

Overall, existing land uses are not expected to change as a result of the Action Alternative; however, the addition of travel lanes would require the acquisition of new ROW from adjacent commercial parcels. There would be improved accessibility to the commercial land uses in the northeast quadrant due to the realigned frontage road. As discussed in Section 3.6, Right-of-Way, the total square feet impacted outside of the existing ROW limits would be minimal. As a result, the proposed improvements to the interchange would not measurably alter land use patterns in the study area.

3.3.7 Mitigation

The Action Alternative is consistent with the local plans described under Section 3.3.1, Local Plans, and no mitigation is required.

3.4 Socioeconomic Conditions

Socioeconomic resources were evaluated to determine the effects of the alternatives on local communities and their quality of life. This section describes the social and economic characteristics of the study area, including economic development, community resources, and community cohesion and connections.

3.4.1 Demographic and Neighborhood Characteristics

The study area is located within Arapahoe County, Colorado, and includes the City of Centennial and Greenwood Village, shown in **Figure 9**. Demographic characteristics of these entities as a whole are shown in **Table 12** below.

Table 12. Demographic Characteristics for Jurisdictions within the Study Area

	Arapahoe County	City of Centennial	Greenwood Village
Population, 2000	487,967	NA	11,035
Population, 2010	572,003	100,377	13,925
Population, percent change, 2000 to 2010	17.2%	NA	26.2%
Mean travel time to work (minutes), 2006-2010	26.6	24.3	20.7
Housing units, 2010	238,301	38,779	6,301
Homeownership rate, 2006-2010	65.9%	85.4%	71.0%
Median value of owner-occupied housing units, 2006-2010	\$232,300	\$289,300	\$757,600
Households, 2006-2010	218,909	37,506	5,385

	Arapahoe County	City of Centennial	Greenwood Village
Median household income, 2009	\$58,719	\$87,007	\$112,009
Persons below poverty level, percent, 2006-2010	11.6%	4.1%	3.8%

NA: Centennial was established in 2001; therefore, no Census data exists for 2000.

Source: U.S. Census Bureau n.d.

The following key demographic characteristics can be derived from the table above:

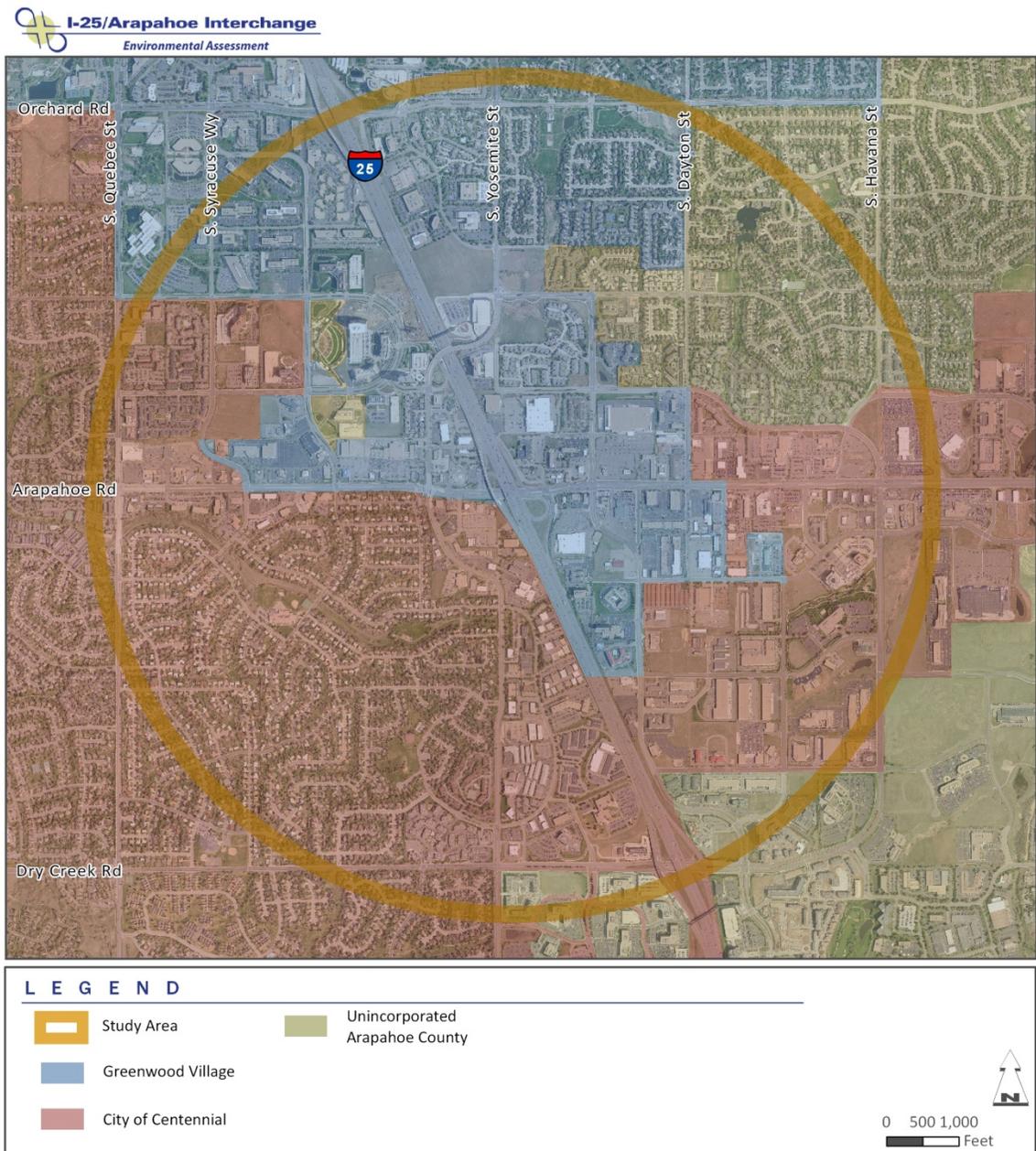
- ◆ Greenwood Village comprises a small portion – 2.4 percent – of Arapahoe County’s 2010 population, and Centennial comprises 17.5 percent.
- ◆ Housing values are considerably higher in Greenwood Village compared to both the county and Centennial, which are similar in home values.
- ◆ Greenwood Village has the highest household income in the study area, more than double the county’s median household income. However, Greenwood Village’s household income is not substantially higher than Centennial’s.

3.4.1.1 *City of Centennial*

Within the study area, Centennial is located primarily southwest of I-25 and Arapahoe Road. Centennial is a Home Rule City and was legally established as a Colorado city in 2001, with an estimated population of 103,000 (City of Centennial n.d.a.). The city had a total population of 100,377 in the 2010 census, a slight decrease since its inception. Centennial has collected demographic data specifically for the vicinity of I-25 and Arapahoe Road (March 2011), which includes population statistics within a 1-, 3-, 5-, and 10-mile radius from the interchange. Relevant characteristics within this area are described below (City of Centennial 2011b):

- ◆ The greatest population increases have occurred within a 5-mile radius of the interchange from 1990 to 2010, with a historic annual growth of 5.7 percent in that time frame. This number is projected to increase another 2.1 percent by 2015. Similar growth is expected for the 3- and 5-mile radii, with 1.5 percent growth expected within the 1-mile radius from 2010 to 2015.
- ◆ The highest population density occurs within 1 mile of the interchange, at 3,397 people per square mile (2010).
- ◆ The largest growth in households occurred within the 1-mile radius from 1990-2010, at 3.4 percent. This growth is expected to change to 0.8 percent by 2015, with similar trends for the other radii.
- ◆ The lowest household income growth (2.4 percent) occurred within the 1-mile radius from 1990-2010, and the highest income growth (4.6 percent) within the 10-mile radius.

Figure 9: Local Jurisdictions



3.4.1.2 Greenwood Village

A small section of the southernmost area of Greenwood Village encompasses approximately three-quarters of the interchange. Greenwood Village experienced a substantial increase in households, population, and employment from 1990 to 2010. The number of homes increased from 2,599 in 1990 to 3,997 in 2000. By 2010, that number had increased to 6,301. The most predominant housing type is single family. The number of residents increased 45 percent between 1990 and 2000, from 7,589 to 11,035, representing a 3.8 percent annual growth rate. The population continued to increase, reaching 13,925 in 2010 (Greenwood Village 2011a).

Greenwood Village’s 2011 *Comprehensive Plan* identifies two specific planning areas within the study area.

- ◆ The Corridor Planning Area is north of (but not adjacent to) Arapahoe Road both east and west of I-25. This area is characterized by highly developed urban office parks, an amphitheater, commercial activity, and “higher density” residential neighborhoods.
- ◆ The Arapahoe Road Commercial District is adjacent to the north side of Arapahoe Road both east and west of I-25, and south of Arapahoe Road east of I-25. This district is a developed commercial area consisting primarily of office, restaurants, retail (including big box retail such as Home Depot, Lowes, and Target), light industrial, and hotel uses.

3.4.1.3 *Environmental Consequences of the No Action Alternative*

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. No direct or indirect impacts are expected.

3.4.1.4 *Environmental Consequences of the Action Alternative*

The Action Alternative would reduce congestion and improve mobility in the study area. The study area may become more easily accessible, but no measurable change is expected to demographics and neighborhood characteristics.

3.4.2 Economic Development

Table 13 below shows 2010 employment and unemployment statistics for the jurisdictions within the study area in their entirety based on U.S. Census data. Arapahoe County experienced a substantial increase in unemployment by 2010, with similar levels for Centennial. However, unemployment in Greenwood Village increased only marginally.

Table 13. Employment and Unemployment Percentages for Jurisdictions within the Study Area

	Employment		Unemployment	
	2000	2010	2000	2010
Arapahoe County	70.4%	65.2%	2.4%	6.7%
Centennial	N/A	65.9%	N/A	7.1%
Greenwood Village	64.7%	64.2%	1.7%	2.7%

NA: Centennial was established in 2001; therefore, no Census data exists for 2000.

Source: U.S. Census Bureau n.d.

Note: The data refers to the civilian population and does not include individuals not in the labor force. No data is available for Centennial for 2000 because the city was incorporated in 2001.

Employment for Arapahoe County, City of Centennial, and Greenwood Village are shown by industry in the table below. Service industries employ the majority of people in the study area, for a total of 65 percent for Arapahoe County and Centennial, and 83 percent for Greenwood Village.

Table 14. Employment by Industry

Industry	Arapahoe County	City of Centennial	Greenwood Village
Business Services	22%	25%	38%
Personal Services	28%	22%	20%
Professional Services	15%	18%	25%
Retail Trade	11%	10%	5%
Wholesale Trade	6%	8%	4%
Utilities and Construction	7%	10%	3%
Public Administration	5%	3%	2%
Manufacturing	3%	3%	0%
Extractive Activities ^a	0%	0%	1%
Other	3%	3%	2%

Source: DRCOG 2011

^a Although not defined by the reference source, extractive activities typically includes the mining of metals and rocks, as well as the extraction of fossil fuels such as oil, natural gas, and coal from the earth.

The Southeast Corridor (I-25 and I-225) connects the two largest employment centers in the region, downtown Denver and the Southeast Business District, which includes the Denver Technological Center (DTC) and the Inverness, Meridian, and Greenwood Plaza business parks (FHWA n.d.b., Greenwood Village 2011a). The DTC and the Greenwood Plaza developments, along with the rest of the Southeast Corridor, have continued to develop since their inception into a major economic and employment center. New and expanding businesses, located primarily in the large office parks along the I-25 corridor, added nearly 27,000 jobs to Greenwood Village in the 1990s. Greenwood Village's Corridor Planning Area is currently the primary employment district within the Greenwood Village, providing a diverse and stable economic base (Greenwood Village 2011a).

Large shopping centers and retail stores provide goods and services, as well as employment opportunities for the area. Big box retail uses such as Target, Home Depot, and Lowes are located in Greenwood Village and occupy the majority of land near the I-25 and Arapahoe Road interchange (Arapahoe County 2006a). Major shopping centers within the study area include the following (Arapahoe County 2006b):

- ◆ The Arapahoe East Shopping Center and the Arapahoe Marketplace (150,001-250,000 square feet each) are located on Arapahoe Road on the west side of the interstate and serve both Greenwood Village and the City of Centennial.
- ◆ Arapahoe Station (250,001-350,000 square feet) exists on Arapahoe Road on the east side of I-25 in Greenwood Village.
- ◆ Northridge Shopping Center (150,000 square feet) is located on the west side of I-25 near Dry Creek Road in the City of Centennial.

In addition to these major shopping centers, IKEA, a large home furnishings retailer, opened a new store in Centennial in late 2011. The 415,000-square-foot store employs approximately 400 workers (City of Centennial n.d.b.).

Centennial Airport, open in 1967, is a general aviation airport that has grown steadily over the years and provides economic benefits within the study area. The airport is the

country's third busiest general aviation airport and has an \$815 million impact on local and state economies, and is second behind Denver International Airport in the creation of airport jobs in the state. The airport is owned and operated by the Arapahoe County Public Airport Authority, a subdivision of Arapahoe County (Greenwood Village 2011a). The airport is located at 7800 South Peoria Street, east of I-25 and south of Arapahoe Road, approximately 3.0 miles from the interchange.

Along with Centennial Airport, Comfort Dental Amphitheater, Arapahoe County Justice Center, Arapahoe at Village Center LRT Station, RTD Regional Bus Transfer Center, and approximately 1,350 hotel rooms comprise major regional destinations in or near the study area.

3.4.2.1 *Environmental Consequences of the No Action Alternative*

The No Action Alternative would continue to limit mobility between the large economic and employment centers served by the Southeast Corridor. As described in Chapter 1, motorists in the study area are expected to experience substantially more congestion by 2035. Serious congestion results in hours of lost employee productivity and delay in the movement of goods. Congestion within the interchange complex may have contributed to some commercial businesses closing or relocating. As congestion and other traffic-related issues increase, people may avoid shopping in the area, which could negatively affect local businesses — an indirect impact. Existing businesses may eventually relocate, which would affect local employment and tax revenue generation. Business owners may also avoid establishing new offices, retail shops, restaurants, and other types of enterprises in the study area, with similar results. This alternative would not address the economic importance of the interchange, as defined under Design Objectives in Chapter 1. However, long-term office and retail vacancies are not expected as a result of the No Action Alternative given the proximity of the interchange to consumers and potential employees. Although mobility between employment centers would be degraded, direct and indirect impacts to economic development would be negligible.

3.4.2.2 *Environmental Consequences of the Action Alternative*

This alternative would promote the economic importance of the interchange, as defined under Design Objectives in Chapter 1. The Action Alternative would improve access to major regional employment centers served by the Southeast Corridor by reducing congestion and improving mobility. Access to Centennial Airport from the west side of the interstate would also be improved. Improved turning movements at key intersections would improve access to local businesses such as Target, Home Depot, and Lowes, as well as other businesses and shopping centers along and near Arapahoe Road west of the interchange in Greenwood Village and Centennial. Slight indirect economic benefits could result in the form of increased retail sales and tax revenues. Improved accessibility may enhance redevelopment opportunities and attract more business development, with similar results. Increased business may indirectly result in the need to hire more employees, with potential indirect benefits to regional residents.

Slight beneficial impacts would occur in the short term from construction activities. Some local residents may be hired on a short-term basis, and construction workers may patronize dining establishments and convenience stores. Indirect impacts to area businesses and local economy would also occur in the short term as construction activities may temporarily impede local access.

3.4.2.3 *Mitigation*

In order to comply with Lane Closure Strategy, construction phasing for replacing the I-25 bridge will occur in a minimum of three phases to minimize impeded access. The reconstructed I-25 bridge width will be increased during construction to allow continual movement. Temporary business access wayfinding signage will be utilized to help mitigate impacts during times of construction when business access would be limited or closed. The construction contractor will notify emergency service providers of the timing of impending construction-related closures.

3.4.3 Community Resources

The following community resources exist within or near the study area (see **Figure 10**).

3.4.3.1 *Transportation Services*

Centennial Airport provides important benefits to local communities, such as air ambulance, check transport, and air cargo flights (Greenwood Village 2011a). The airport also offers support for a number of flight schools, flying clubs, air charter services, aircraft sales services, and aircraft maintenance services (Centennial Airport n.d.).

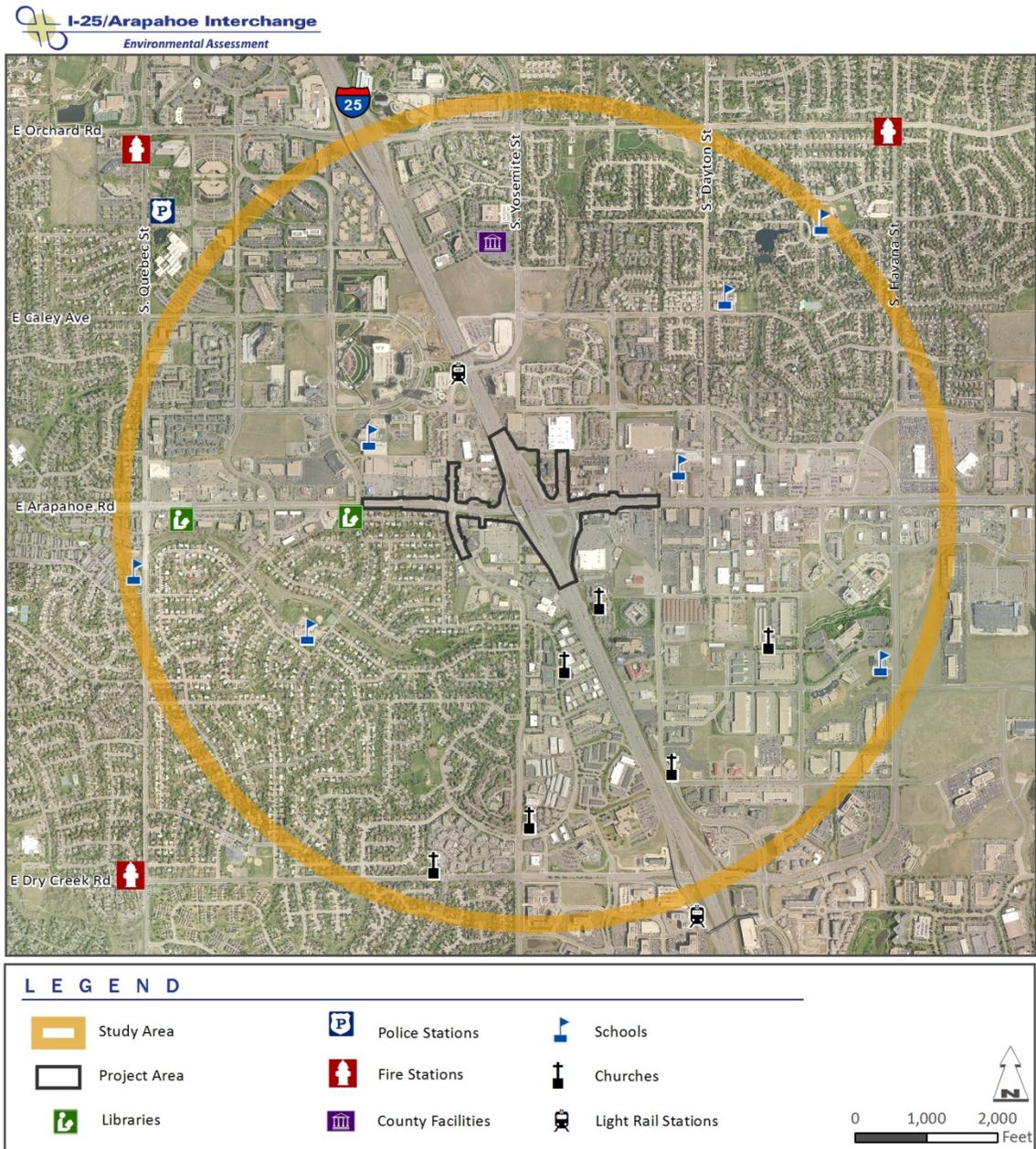
RTD Light Rail E and F lines are served by the “Arapahoe at Village Center Station” at Caley Avenue and Yosemite Street, with a park-n-Ride offering 1,115 parking spaces. The park-n-Ride also serves bus routes 66, 65, AT, ATX, and T.

- ◆ Bus Route 66, Arapahoe Crosstown, travels roughly east to west on Arapahoe Road from South Parker Road to Broadway, ultimately arriving at downtown Littleton.
- ◆ Bus Route 65 travels north from the station, providing service primarily along Monaco Parkway.
- ◆ Bus Route AT and ATX provide service from the station to Denver International Airport.
- ◆ Bus Route T provides service from the station through Greenwood Plaza to the city of Boulder.

Within the study area, RTD provides call-n-Ride service, which is a personalized curb-to-curb bus service that travels within a designated service area based on an individual’s schedule. Three call-n-Ride service areas operate within the study area (RTD 2012).

- ◆ Arapahoe call-n-Ride service area: East of I-25; bounded by Union Avenue on the north, Peoria Street on the east, Arapahoe Road on the south, and Yosemite Street on the west. Includes Arapahoe Village LRT station. Within the study area, primarily serves Greenwood Village and Arapahoe County residents.
- ◆ Orchard call-n-Ride service area: West of I-25; bounded by East Progress Place on the north, I-25 on the east, Arapahoe Road on the south, and Holly Street on the west. Includes Orchard LRT station. Within the study area, primarily serves Greenwood Village residents.
- ◆ Dry Creek call-in-Ride service area: West of I-25 and bounded by Arapahoe Road on the north, I-25 on the east, County Line Road on the south, and South Holly Street on the west. Includes Dry Creek LRT station. Within study area, primarily serves Centennial residents.

Figure 10. Community Resources



3.4.3.2 Emergency Response (Firefighters/Emergency Medical Technicians), Police, Hospitals

SMFRA serves Centennial, Greenwood Village, and unincorporated portions of Arapahoe County within the study area. SMFRA provides emergency response with firefighter/emergency medical technicians. As mentioned in Chapter 1, SMFRA dispatches emergency service providers based on their proximity to the emergency location, which can be on either side of the interchange. If needed, neighboring fire districts and/or private ambulance companies provide backup patient transport. No SMFRA stations are located within the study area; the nearest are (SMFRA 2012):

- ◆ Station 31: 5901 South Havana Street near Havana Street and Belleview Avenue, east of I-25
- ◆ Station 32: 5945 South Quebec Street near Orchard Lane, west of I-25
- ◆ Station 33: 7281 East Dry Creek Road near Quebec Street, west of I-25
- ◆ Station 35: 12080 East Briarwood Avenue, south of Arapahoe Road near Peoria Street, east of I-25 (outside the aerial photograph shown in **Figure 10** above)

In addition, Centennial Airport is used regularly by Flight for Life, various medical flights, and law enforcement (Centennial Airport n.d.).

The Arapahoe County Sheriff's office provides law enforcement services to residents of unincorporated Arapahoe County and the City of Centennial. The administrative office is located in Centennial at 13101 East Broncos Parkway just east of Centennial Airport, and the Columbine Valley Police Department is located northeast of the administrative office, at 7305 South Potomac Street (both are outside the aerial photograph shown in **Figure 10**). The Village Police Department provides police services for Greenwood Village. The department is located in Greenwood Village at 6060 South Quebec Street between Orchard and Arapahoe Roads, outside the study area. No police stations have been identified within the study area.

Aerial maps show that no hospitals occur within the study area, although Parker Hospital is located north of the study area on Greenwood Plaza Boulevard, just south of Orchard Boulevard. A Doctor's Express and a dental emergency office are located on Arapahoe Road between Quebec and Yosemite Streets, and an injury care clinic is located on Yosemite Street south of Arapahoe Road. American Medical Response (ambulance service) is located on South Syracuse Way between Orchard and Arapahoe Roads.

3.4.3.3 *Libraries*

The Arapahoe Library District serves the cities of Centennial and Greenwood Village, and the unincorporated areas of Arapahoe County. Within the Arapahoe Library District, the Castlewood Library is located at the southwest corner of Arapahoe Road and South Uinta Street, west of I-25 in Centennial (Arapahoe Library District 2011). The Colorado Library Consortium is located on Arapahoe Road just east of Quebec Street.

3.4.3.4 *Schools*

The following schools are located within the study area (City of Centennial 2011c):

- ◆ Walnut Hills Elementary School: just south of Arapahoe Road and west of Yosemite Street at 8195 East Costilla Boulevard
- ◆ High Plains Elementary: north of Arapahoe Road and west of Havana Street at 6100 South Fulton Street
- ◆ Cherry Creek Charter Academy: north of Caley Avenue and east of Dayton Street
- ◆ Private school: Quebec Street just south of Arapahoe Road

The following early childhood learning centers are located within the study area (identified as schools on **Figure 10**):

- ◆ 6560 South Greenwood Plaza Boulevard, north of Arapahoe Road and west of I-25
- ◆ 6625 South Dayton Street, east of I-25 at the northwest corner of Arapahoe Road and South Dayton Street

- ◆ 10472 East Easter Avenue, east of I-25 and south of Arapahoe Road near Havana Street

3.4.3.5 Places of Worship

Aerial maps show several churches within the study area. The following are located west of I-25:

- ◆ Colorado Baptist General Convention: 7393 South Alton Way, near Yosemite Street and Dry Creek Road
- ◆ Good Shepherd Episcopal Church: 8545 East Dry Creek Road, just west of Yosemite Street
- ◆ Southside Bible Church: 7076 South Alton Way, between Arapahoe and Dry Creek Roads

The following churches are located east of I-25:

- ◆ Grace Community Church: 7200 South Clinton Street near East Geddes Avenue
- ◆ Global Connection International: 9250 East Costilla Avenue, south of Arapahoe Road
- ◆ Oasis Center: 9940 E Costilla Ave, south of Arapahoe Road

3.4.3.6 Environmental Consequences of the No Action Alternative

As congestion continues to degrade mobility within the study area, access to community resources such as schools, libraries, etc., would be negatively affected. In particular, congestion would continue to impede emergency vehicle access through the study area, resulting in delayed response time. Although Arapahoe Road provides one of the few east-west routes in the area, emergency service providers, which are located on both sides of the interstate, avoid the road to reach emergency sites. As mentioned in Chapter 1, Arapahoe Road is frequently unusable as an emergency service route due to severe congestion at the interchange. These conditions would continue to increase the amount of time required to reach emergency locations, potentially jeopardizing human life and property.

Neighborhood traffic impacts due to traffic cutting through the Walnut Hills neighborhood may increase as congestion increases in future years under the No Action Alternative. This would be an indirect negative impact to area residents.

As congestion increases, more individuals may take advantage of bus, LRT, and call-n-Ride services in the area, which would be a beneficial indirect impact by reducing the number of motor vehicles driving the roads. However, such a change is not expected to have a measurable impact.

3.4.3.7 Environmental Consequences of the Action Alternative

The Action Alternative would improve access to and within the affected communities, as well as to community resources. People may be more inclined to visit libraries and other services if they are not hindered by congestion and access issues. Emergency vehicle response would improve, lessening the amount of time required to reach emergency sites. In particular, adding a through lane under the I-25 bridge may help address issues raised by emergency service providers regarding this area, where several crashes have occurred (see Chapter 1). Reduced congestion on Arapahoe Road and Yosemite Street may result in less traffic cutting through the Walnut Hills neighborhood. Improved mobility would

also make it easier to reach medical services, such as those provided on or near Arapahoe Road, and Parker Hospital. Overall, beneficial impacts would result, primarily regarding emergency response neighborhood traffic. No measurable indirect impacts are expected.

3.4.4 Community Cohesion and Connections

The 2011 *Greenwood Village Comprehensive Plan* notes that the Southeast Corridor is both a unifying element and the feature that physically divides the community. Although the plan specifically addresses Greenwood Village, this is likely true for Centennial as well, given that both towns are split by the corridor and likely face similar cohesion issues. Because the corridor has federal and state significance, it can become a focal point that generates concern and involvement beyond local jurisdictions. Therefore, the local community exercises limited control over the corridor (Greenwood Village 2011a).

Aerial and land use maps show that residential uses in Centennial exist primarily west of I-25 within the study area, and commercial uses exist east of the highway. For Greenwood Village and Arapahoe County, residential and commercial areas are primarily east of the interstate. Within the study area, Arapahoe Road and Yosemite Street to the north provide the only connections between land uses that are divided by the highway. A lack of east-west roadways limits cross-travel between these residential and commercial areas.

3.4.4.1 *Environmental Consequences of the No Action Alternative*

As congestion continues to increase and mobility decreases in the study area, travel across the interstate, which divides the cities in the study area, would become more difficult. Residents would find it harder to make east-west connections to desired destinations. The result would be reduced community cohesion. However, the No Action Alternative would have little influence on the magnitude of the interstate as a dividing element. Direct and indirect impacts to community cohesion and connections would be slight.

3.4.4.2 *Environmental Consequences of the Action Alternative*

Improved access and mobility under the Action Alternative would result in slight beneficial impacts to community cohesion and connections. Improved east-west connections would increase access to desired destinations on either side of the highway. However, the Action Alternative would have little influence on the magnitude of the interstate as a dividing element. As mentioned in Section 3.2.2.1, there would be a reduction in cut-through traffic through adjacent neighborhoods as drivers try to find alternative routes around the congestion. Beneficial direct and indirect impacts to community cohesion and connections would be slight.

3.5 Environmental Justice

Environmental Justice (EJ) is the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws and policies, as defined by *Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. The intent of these policies is to:

- ◆ Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- ◆ Ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- ◆ Prevent the denial of, relocation in or significant delay in the receipt of benefits by minority and low-income populations.

The definition of minority populations is Black, Hispanic or Latino, Asian American, American Indian and Alaskan Native, and Native Hawaiian or Pacific Islander (FHWA 1998a).

Low-income is defined as a household income at or below the Department of Health and Human Services' poverty guidelines (FHWA 1998a), which are based on the Bureau of Census poverty thresholds. In accordance with Council on Environmental Quality (CEQ) guidance, annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty, were used to determine low-income thresholds (CEQ 1997a).

This analysis determines whether there is a potential for disproportionately high or adverse impacts from the project on low-income or minority populations compared to populations that are not minority or low-income in the project area. Disproportionately high and adverse effect on minority and low-income populations means an adverse effect that (1) is predominately borne by a minority population and/or a low-income population; or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the nonminority population and/or non low-income population. This analysis also evaluates whether full and fair participation is provided to all potentially affected communities in the decision-making process.

Minority and low-income populations that could be affected by the Action Alternative are those that exist within 500 feet of the project area boundary, which is where physical changes to roadway facilities would occur. A 500-foot area was used to account for potential physical impacts to property, as well as noise impacts, and defines the impact area to analyze EJ effects (see **Figure 11**).

Potential adverse impacts to minority and low-income populations could result from:

- ◆ Property loss due to ROW acquisition
- ◆ A change in air quality and noise impacts
- ◆ Destruction or diminution of aesthetic values
- ◆ Destruction or disruption of community cohesion or a community's economic vitality
- ◆ Destruction or disruption of the availability of public and private facilities

CEQ provides guidance for identifying minority and low-income populations for a NEPA Analysis (CEQ 1997a):

- ◆ "Minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis."

- ◆ “Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty.”

CEQ notes that census tracts are an appropriate unit of geographical analysis (CEQ 1997a).

Based on this guidance, the impact area for EJ includes Census Tracts 006712, 006858, 006815, and 006707. Census tracts are small, relatively permanent statistical subdivisions of a county. Within the Census Tracts are Census Block Groups, which are the smallest geographic area for which the Bureau of the Census collects decennial census data.

Figure 11 shows data census tracts and block groups within the impact area. **Table 15** shows the percentage of minority and low-income populations in the impact area and for the general population (i.e., Arapahoe County, Greenwood Village, and City of Centennial).

Table 15. Percentage of Minority Populations and Populations in Poverty

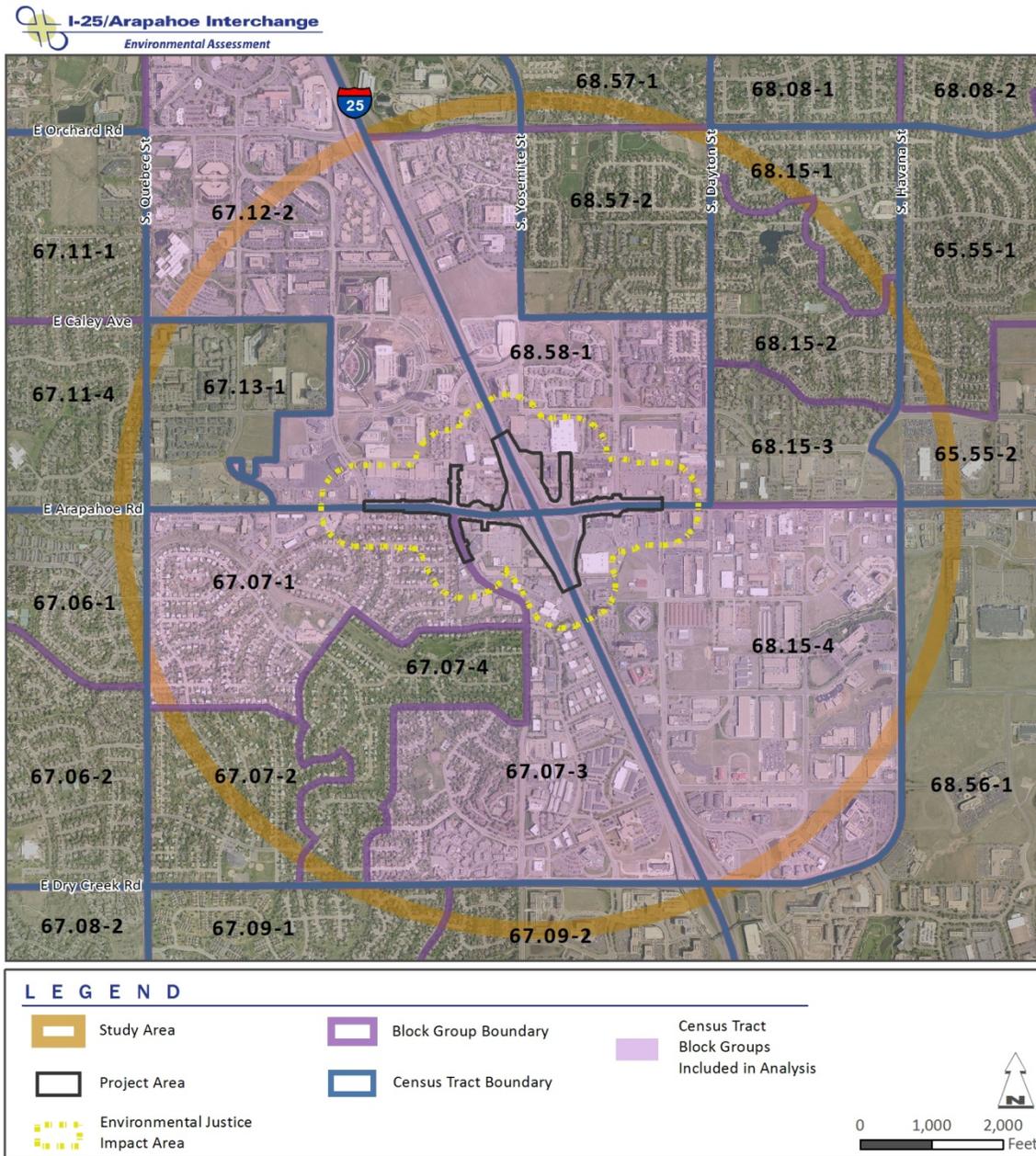
Census Tract Block Group	Percent Minority	Percent Poverty
Block Group 1, Census Tract 67.07	10.77%	3.0%
Block Group 3, Census Tract 67.07	5.39%	3.0%
Block Group 4, Census Tract 68.15	25.25%	9.7%
Block Group 2, Census Tract 67.12	9.13%	2.0%
Block Group 1, Census Tract 68.58	22.90%	12.0%
Greenwood Village	15.29%	3.8%
City of Centennial	17.65%	4.1%
Arapahoe County	36.76%	11.6%

Source: U.S. Census Bureau 2010.

As shown in **Table 15**, the minority population of the block groups within the impact area does not exceed 50 percent. The minority population percentage of two block groups (Block Group 4, Census Tract 68.15 and Block Group 1, Census Tract 68.58) is greater than that of the cities but less than Arapahoe County. Therefore, minority populations are identified within Block Group 4, Census Tract 68.15 and Block Group 1, Census Tract 68.58 based on CEQ guidance. None of the census tracts have a minority population percentage that would trigger analysis under the CEQ guidance.

CDOT EJ guidelines recommend comparing low-income block group percentages to the county percentage to identify low-income populations in the impact area. If the percentage of low-income households is higher than the county percentage, then the block group should be targeted for EJ analysis. Block Group 1, Census Tract 68.58, slightly exceeds the poverty thresholds for Arapahoe County and is therefore identified for analysis. That block group, along with Block Group 4, Census Tract 68.15, also exceeds low-income percentages for Greenwood Village and Centennial.

Figure 11. Minority and Low-Income Populations



3.5.1 Environmental Consequences of the No Action Alternative

As defined in FHWA Order 6640.23, a disproportionately high and adverse effect on minority and low-income populations means an adverse effect that: (1) is predominantly borne by a minority population and/or a low-income population; or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non minority population and/or non low-income population.

The No Action Alternative would result in continued and increased congestion at the interchange, the related traffic, access, and safety concerns would continue for residents and businesses in the study area. Indirect impacts could occur if the negative effects of taking no action result in a decrease in property values. Impacts experienced by minority and low-income populations would be the same as those experienced by the general population of the study area. There would be no displacement of minority or low-income businesses and employees.

Although impacts would increase under the No Action Alternative, they would not disproportionately and adversely affect minority or low-income populations.

3.5.2 Environmental Consequences of the Action Alternative

As discussed in Section 3.6, Right-of-Way, the Action Alternative would require a partial acquisition of one business property and a full acquisition of another located northeast of the interchange along Arapahoe Road. According to Colorado state government's Office of Economic Development and International Trade, neither is listed as minority owned (State of CO 2012). No residential property would be partially or fully acquired, no residences would be displaced, and the only potential impacts would arise from temporary construction easements, and these impacts would not be permanent.

The majority of impacted parcels exist in Block Group 1, Census Tract 68.58, which has the highest percentage of minority and low-income populations in the impact area. These parcels would be used to accommodate the proposed new frontage road. The largest affected parcels in that block group include a vacant area just east of the frontage road and south of Southtech Drive, and a parking lot east of the hotel served by the existing frontage road. According to Colorado state government's Office of Economic Development and International Trade, the hotel served by the existing frontage road is not minority owned (State of CO 2012). The new frontage road would improve access to businesses in this area. The remaining property that would be acquired for new ROW would consist of linear parcels along the edge of existing roadways, and would not affect overall use of the parcels. These parcels occur in all block groups throughout the impact area. One minority-owned business exists in a shopping center where linear parcels along the roadway would be acquired, but the business would not be affected.

As described in Section 3.9, Noise, there would be no measurable difference between the No Action and Action Alternatives regarding noise. The same 16 residents and 2 commercial properties would experience noise levels that exceed noise abatement criteria (NAC) in 2035. Indirect impacts experienced by minority and low-income persons would be the same as those experienced by the general population and would include temporary construction related impacts such, as access changes, dust, noise, and construction related traffic and delays, as well as longer term impacts including increased traffic, noise, and added pavement to the viewshed. Roadway improvements would also address traffic safety and access concerns, provide enhanced access to transit, and increase mobility in the study area. These impacts would benefit minorities and low-income populations in the study area. Therefore, impacts to low-income and/or minority populations are not considered to be disproportionately high and adverse.

The Action Alternative would relieve congestion in the study area, thereby improving accessibility to community resources, businesses, and residences for residents, employees, and customers in the study area.

Chapter 4 describes the public involvement efforts undertaken for this EA. Extensive public coordination and outreach activities were conducted to help ensure the full and fair

participation by all potentially affected communities in the decision-making process. These activities include public meetings, advertisements, news releases, and a web site. Key issues raised by the public were identified and addressed to the extent possible.

Overall impacts of the Action Alternative are expected to be beneficial. Negative impacts would be negligible and would affect all populations approximately equally. Therefore, no disproportionate and adverse impacts are expected to minority and low-income populations.

3.6 Right-of-Way

ROW is generally owned by CDOT and local municipalities, and comprises the land used to operate and maintain transportation facilities. This section describes the existing ROW within the project area and discusses the impacts that may occur to property owners and structures, such as businesses or residences, as a result of ROW acquisition. The potential ROW footprint for the Action Alternative project area was estimated to be approximately 5 feet to 20 feet outside of the proposed improvements, depending on the improvements to take place and the character of the surrounding parcels. In some areas the footprint extends farther out, and in others it is more constricted. ROW widths and ownerships were determined using parcel data obtained from Arapahoe County (2012). Impacts were identified through a visual survey of aerial photos and analysis performed in Geographic Information Systems (GIS).

3.6.1 Existing Right-of-Way

Existing ROW widths for segments of roadways within the project area are identified in **Table 16**:

Table 16. Existing ROW Widths within Project Area

Roadway (within project footprint)	Approximate Width	Jurisdiction
Arapahoe Road	115 feet	Greenwood Village
Boston Street	100 feet	Greenwood Village
Clinton Court	115 feet	Greenwood Village
Greenwood Plaza Blvd.	Ranges 45 feet - 90 feet	Greenwood Village
I-25	250 feet	CDOT
South Tech Drive	40 feet	Greenwood Village
Yosemite Street	100 feet	North of Arapahoe Road – Greenwood Village South of Arapahoe Road – City of Centennial
Xanthia Street	60 feet	City of Centennial

3.6.2 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. No additional ROW would be acquired and there would be no direct, indirect, temporary, or cumulative effects to private properties.

3.6.3 Environmental Consequences of the Action Alternative

Under the Action Alternative, the addition of travel lanes would require acquisition of new ROW from adjacent privately-owned commercial properties. Properties are identified as total acquisitions if the proposed ROW limits would require removal of the principal structure on the property, such as a home or business. Properties are also identified as total acquisitions if the existing use or operations would be altered to an extent that the property would no longer be economically viable. Partial acquisitions are identified if only a portion of the property would be affected but the property would remain economically viable.

Two types of ROW impacts were assessed: permanent acquisitions of land and relocation of businesses and homes (although no homes would be impacted). For the purposes of the NEPA evaluation, a conservative estimate of the ROW needs is established for clearance in the environmental document.

Impacted Parcels and Displacements

The project area is approximately 50 acres, most of which is already existing public ROW. Property acquired for new ROW would primarily amount to linear parcels along the edge of the existing roadway, and would not affect overall use of the parcel. The Action Alternative would not require any partial acquisition or full acquisition of any residential property and no residences would be displaced.

Direct impacts of the Action Alternative would include the displacement and acquisition of one business located northeast of the interchange along Arapahoe Road (Pat's Philly Steaks and Subs). The project would acquire approximately 0.65 acre of this 3.5 acre parcel.

Three commercial parcels located in the same shopping center as the displaced business would be partially acquired as described below:

- ◆ Acquisition of approximately 0.13 acre of a 1.40 acre parcel would remove several parking spaces.
- ◆ Acquisition of approximately 0.18 acre of a 0.80 acre parcel would directly impact the first set of gas pumps and on-site vehicular circulation at the Conoco Gas Station.
- ◆ Acquisition of approximately 0.68 acre of a 4.73 acre parcel would be required for construction of a new frontage road.

Other partial acquisitions within the project area would include:

- ◆ Linear portions of commercial parcels along the northern perimeter of Arapahoe Road between Greenwood Plaza Boulevard and South Yosemite Street and between Clinton Street and Clinton Court, amounting to a total of approximately 0.35 acre.
- ◆ Linear portions of commercial parcels along the eastern edge of South Yosemite Street south of Arapahoe Road, amounting to approximately 0.16 acre.

A portion of a commercial parcel located northeast of the interchange has been identified as a potential location for a water quality pond, although selection of this site would not be determined until final design.

In several cases, temporary construction easements would be necessary for roadway construction activities along commercial and residential properties; these would not be permanent impacts to the commercial or residential properties. Temporary easements

would only be needed for construction and would not require the permanent acquisition of property. **Figure 12** depicts the project footprint, impacted parcels and portions of the parcels that would be affected, and the displaced business.

Individual meetings were held with property owners and tenants of the potentially affected properties in late 2011 to inform them of the possibility of property impacts. The same individuals were notified of the refined Action Alternative plans via email in January 2012. Potentially affected business property owners and tenants participated in a northeast quadrant business focus group meeting in April 2012. Additional individual meetings with some of these property owners and tenants occurred in February and May 2012.

3.6.4 Mitigation

Impacts to private properties have been minimized through design modifications to the Action Alternative. Acquisitions will be further minimized and avoided wherever feasible. Property acquisition for ROW will conform to the requirements set forth in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) and the Uniform Relocation Act Amendments of 1987 (as amended). For all real property acquired, the property owner will be paid just compensation.

Acquisition

For any person(s) whose real property interests may be impacted by this project, the acquisition of those property interests will comply fully with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, (Uniform Act). The Uniform Act is a federally mandated program that applies to all acquisitions of real property or displacements of persons resulting from federal or federally assisted programs or projects. It was created to provide for and insure the fair and equitable treatment of all such persons. To further ensure that the provisions contained within this act are applied “uniformly,” CDOT requires Uniform Act compliance on any project for which it has oversight responsibility regardless of the funding source. Additionally, the Fifth Amendment of the United States Constitution provides that private property may not be taken for a public use without payment of “just compensation.” All impacted owners will be provided notification of the acquiring agency's intent to acquire an interest in their property including a written offer letter of just compensation specifically describing those property interests. A Right of Way Specialist will be assigned to each property owner to assist them with this process.

Relocation

In certain situations, it may also be necessary to acquire improvements that are located within a proposed acquisition parcel. In those instances where the improvements are occupied, it becomes necessary to “relocate” those individuals from the subject property (residential or business) to a replacement site. The Uniform Act provides for numerous benefits to these individuals to assist them both financially and with advisory services related to relocating their residence or business operation. Although the benefits available under the Uniform Act are far too numerous and complex to discuss in detail in this document, they are available to both owner occupants and tenants of either residential or business properties. In some situations, only personal property must be moved from the real property and this is also covered under the relocation program. As soon as feasible, any person scheduled to be displaced shall be furnished with a general written description of the displacing Agency's relocation program which provides at a minimum, detailed

information related to eligibility requirements, advisory services and assistance, payments, and the appeal process. It shall also provide notification that the displaced person(s) will not be required to move without at least 90 days advance written notice. For residential relocatees, this notice cannot be provided until a written offer to acquire the subject property has been presented, and at least one comparable replacement dwelling has been made available. Relocation benefits will be provided to all eligible persons regardless of race, color, religion, sex, or national origin. Benefits under the Act, to which each eligible owner or tenant may be entitled, will be determined on an individual basis and explained to them in detail by an assigned Right of Way Specialist.

Figure 12. Impacted Parcels and Structures in Project Area



3.7 Utilities

There are various utilities within the project area which would need to be maintained, protected, or relocated as a result of this project. Impacts to the existing utilities located within the proposed ROW were identified by Hartwig & Associates, Inc. in the *Roadway Design and Utilities Arapahoe Road/I-25 Interchange Technical Memorandum* (2011) and documented using preliminary utility mapping developed from aerial surveys, base maps collected from individual utility companies, and field reconnaissance. Areas of concern include those surrounding the proposed and existing bridge substructures, retaining walls, and proposed storm sewer systems.

3.7.1 Existing Utilities

The utilities within the project area are described below:

Electric and Cable TV - Above- and below-grade electric lines in the corridor are owned by Xcel Energy. Approximately three electric lines run along both sides of I-25. Overhead and below ground cable television lines owned by Tele-Communications, Inc. (TCI) run parallel along the north side of Arapahoe Road.

Natural Gas - Approximately 15 natural gas pipelines, all owned and operated by Xcel Energy, cross and/or run parallel on the north and south sides of Arapahoe Road. These pipelines vary from 2 to 3 inches in diameter.

Sanitary Sewer - Sanitary sewer services are owned by Southgate Water and Sanitation and Castlewood Water District, and run underneath Arapahoe Road. Approximately seven crossings have been identified, with pipelines approximately 8 inches in diameter.

Water Lines - Approximately fifteen water lines cross Arapahoe Road through the project area and are owned by Denver Water, Castlewood Water District, or Southgate Water and Sanitation.

Fiber Optic Lines - Fiber optic lines run throughout the corridor and are owned by Century Link, CDOT, Adesta, MCI Communications, Time Warner Cable, and ICG Communications, Inc. Approximately 15 lines run along the north and south sides of Arapahoe Road.

3.7.2 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. There would be no direct, indirect, temporary, or cumulative effects to utilities as a result of the No Action Alternative.

3.7.3 Environmental Consequences of the Action Alternative

Anticipated direct impacts to utilities as a result of the Action Alternative are described below:

Electric and Cable TV - It is anticipated that the majority of the underground electric lines are deep enough to avoid excavation impacts. Many above-ground electric lines would need to be reset since the existing poles would be impacted by Arapahoe Road improvements. The three electric lines running parallel to I-25 would need to be relocated. The overhead and below ground cable television lines running parallel to Arapahoe Road would need to be relocated.

Natural Gas - It is anticipated that most of these natural gas pipelines are deep enough to avoid impacts, although valves may need to be adjusted in response to the elevation change of the road related to the project.

Sanitary Sewer - It is anticipated that the majority of these sewer pipelines are deep enough to avoid excavation impacts, although manholes may need to be adjusted. There may be isolated realignment of lines required to mitigate impacts from bridge substructure or storm sewer improvements.

Water Lines - The relocation of water lines would be minor, but all fire hydrants and valves within the corridor would need to be reset or adjusted. There may be isolated realignment of lines required to mitigate impacts from bridge substructure or storm sewer improvements.

Fiber Optic Lines - It is anticipated that most of the fiber optic lines running along Arapahoe Road are deep enough to avoid impacts from excavation. One line running along existing I-25 would need to be relocated to the proposed interchange. Manholes and vaults would need to be adjusted to new grades. There may be isolated realignment of lines required to mitigate impacts from bridge substructure, storm sewer improvements, or retaining walls.

Utilities would be avoided. Temporary construction impacts could include temporary disruption of services as utilities are relocated.

3.7.4 Mitigation

During final design, utilities will be avoided through design modifications or, where conflicts cannot be avoided, utilities will be relocated. Utility relocations will be coordinated with the local jurisdictions/CDOT and private utility providers prior to construction.

3.8 Visual Resources

Visual quality analyses for the alternatives were conducted in accordance with the U.S. Department of Transportation, FHWA *Visual Impact Assessment for Highway Projects* (FHWA 1998b). The FHWA methodology uses a qualitative and quantitative approach to analyze existing and proposed views of the project area. Visual quality is assessed under FHWA guidance through three elements: vividness, intactness, and unity, none of which alone is equivalent to total visual quality. All three must be high to indicate high visual quality (FHWA 1998b). A technical memorandum developed for this project describes this approach in more detail (DEA 2012b). The characteristics of these elements ranging from very high to very low are described in **Table 17**.

Table 17. Visual Quality Rating Descriptions

Component	Very High	Average	Very Low
Vividness	<ul style="list-style-type: none"> Highly memorable; contrasting landscape elements combine to form distinctive visual patterns. Strongly defined landscape or landforms, i.e., mountains, large bodies of water. 	<ul style="list-style-type: none"> Moderately memorable, some distinctive patterns. Moderately defined landscape or landforms, i.e., low rolling hills and smaller water bodies. Vegetation patterns, colors, and textures are 	<ul style="list-style-type: none"> Low memorability. Little visual pattern; landscape elements do not form striking and distinctive pattern. Homogeneous landforms or landscapes and small bodies of water.

Component	Very High	Average	Very Low
	<ul style="list-style-type: none"> Distinctive patterns, colors, and textures of vegetation or memorable built structures. 	less visible. Some memorable built structures.	<ul style="list-style-type: none"> Unnoticeable vegetation patterns, colors, textures; built structures are not memorable.
Intactness	<ul style="list-style-type: none"> High visual integrity between natural and built landscape, free from visual encroachment. Natural areas and built landscapes blend into surrounding character and create no visual discontinuity. Natural and built patterns are not disturbed and maintain visual order. 	<ul style="list-style-type: none"> Average visual integrity between natural and built landscape. Some visual encroachment present and lacks visual order. Some disruption of natural and built patterns. 	<ul style="list-style-type: none"> Low visual integrity between natural and built landscape. Visual encroachment very apparent. Disrupted patterns; integrity of natural visual order is lost.
Unity	<ul style="list-style-type: none"> Landscape elements join to form highly coherent, harmonious visual pattern. Built and natural elements blend together. 	<ul style="list-style-type: none"> Landscape elements join to form a moderately coherent, harmonious visual pattern. Built elements blend with natural elements, but visual order is disrupted. 	<ul style="list-style-type: none"> Landscape elements do not join to form a coherent, harmonious visual pattern. Built elements have no visual relationship to natural landforms or patterns; no visual order.

Source: FHWA 1998b.

Evaluations based on the three criteria have proven to be good predictors of the visual quality using the following equation (FHWA 1988):

$$\text{Visual Quality} = \frac{\text{Vividness} + \text{Intactness} + \text{Unity}}{3}$$

The table below provides the numeric ranges for total visual quality ratings based on FHWA guidance (FHWA 1998b).

Table 18. Visual Quality Rating Numeric Range

Vividness, Unity, Intactness	Developed Land Uses	Encroachments, Undesirable Elements
Very High: 5.7-7	None	None
High: 4.7-5.6	Little	Few
Moderately High: 3.7-4.6	Some	Some
Average: 2.7-3.6	Average	Average
Moderately Low: 1.9-2.6	Moderately High	Several
Low: 1.0-1.8	High	Many
Very Low: 0.0-0.9	Very High	Very Many

Source: FHWA 1988.

The existing and post-construction conditions within the study area are described and evaluated below based on the anticipated changes in vividness, intactness, and unity. The following images demonstrate the study area's existing visual quality for viewers looking *from* the road (i.e., drivers) and viewers looking *toward* the road (e.g., pedestrians, shoppers, etc.).



Looking northwest from Arapahoe Road and Yosemite Street toward Red Robin, shopping center, and office buildings.

Looking southeast from the southbound I-25 off-ramp and Arapahoe Road.

The study area is highly developed. I-25 is currently an important transportation arterial that serves local communities, the metropolitan region, and the western U.S. The City of Greenwood Village believes that I-25 is “an important public image and landscape element of the community” and notes that “the I-25 corridor warrants special attention to design and landscaping detail because it is both a major transportation and image element” (Greenwood Village 2011a). As shown in Section 3.3, Land Use and validated with site visits, several commercial enterprises of various size occur along Arapahoe Road, with a large residential area southwest of Yosemite Street. Banks, fast-food establishments, shopping centers, service providers, and gas stations border much of Arapahoe Road within the study area. Large structures that occupy substantial amounts of space, such as motels and big box stores like Lowe's and Target, are also visible. Considerable amounts of land are occupied by sizeable parking lots on both sides of I-25. No parks and few undeveloped areas exist in the study area. The visual quality of this setting is described below.

Vividness: Some memorable built structures exist, particularly the high-rise buildings; however, there are few distinctive or memorable building patterns. The mountains can be seen in the distance from views looking west. Some man-made landscaping exists, primarily where residential areas front the roadways. Recent improvements include landscaping at the interchange and landscaping improvements made as part of the Boston/Clinton intersection project. Vegetation patterns are not particularly noticeable in the majority of the study area. Trees typically exist in isolation. The result is moderate memorability. Therefore, vividness is moderately low, with a rating of 2.7.

Intactness: Developed land use is very high, resulting in a high degree of visual encroachment. The natural landscape consists of some landscaped trees and low vegetation; no naturally occurring vegetation exists. Visual order between the natural and built landscape is mostly lacking. Building heights and store front designs vary considerably, resulting in disrupted visual patterns. Disruption is minimized on the south side of Arapahoe Road between South Uinta and Yosemite Streets, and on the west side

of Yosemite Street where a residential area exists. The level of traffic varies, with high peak rush hour periods, resulting in inconsistent traffic flow and encroachment. For these reasons, intactness is low, with a rating of 1.0.

Unity: The fence and landscape elements that buffer the residential area described above join to form a moderately coherent, harmonious visual pattern. Elsewhere throughout the study area, the varying building heights and store front designs lack visual order and have little to average visual relationship between natural landforms or patterns. The visual elements are moderately coherent, but the visual order is intermittently interrupted. Unity is generally average, with a rating of 2.7.

Using the evaluation formula for vividness, intactness, and unity described above, overall existing visual quality in the study area is 2.13, moderately low.

3.8.1 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, no further improvements would be made to the I-25/Arapahoe Road interchange. Further increases in congestion would result in additional encroachment into the visual setting. However, this change would be minimal in the overall setting. The existing built environment would continue to dominate views. Therefore, direct impacts to viewers from the road and toward the road would be negligible. No measurable indirect impacts are expected.

3.8.2 Environmental Consequences of the Action Alternative

The primary visual changes that would occur under the Action Alternative include:

- ◆ Raising the I-25 bridge an additional 7 to 8 feet.
- ◆ Widening Arapahoe Road primarily by creating additional lanes.
- ◆ Widening northbound Yosemite Street where it approaches Arapahoe Road by creating additional lanes.
- ◆ Modifying the intersections of Arapahoe Road with Yosemite Street and Clinton Street, and the I-25 on-/off-ramps to accommodate additional lanes.
- ◆ Realigning the frontage road in the northeast quadrant of the study area to accommodate construction and improve access.

Although additional improvements are called for under the Action Alternative, they are not expected to measurably affect visual resources.

One Key Observation Point (KOP) was selected to represent the most substantial changes proposed in the study area for views both *from* and *toward* the interchange. The photo for this KOP was taken looking east on Arapahoe Road from Xanthia Street, shown in **Figure 13**. A visual simulation¹, **Figure 14** shows the proposed changes that would occur under the Action Alternative.

Raising the I-25 bridge 7 to 8 feet would not be visually noticeable. Widening Arapahoe Road to provide an additional eastbound through lane would result in removal of some landscaping on the south side of the road and the addition of a short retaining wall. The bridge supports for the new interstate bridge over Arapahoe Road would be moved to the

¹ A visual simulation is a photographic representation of a future situation based on anticipated changes used to estimate its characteristics.

center of Arapahoe Road (which would be widened), and the relocated median may be vegetated and more prominent.

Figure 13. Existing Conditions Looking East on Arapahoe Road from Xanthia Street



Figure 14. Simulated Conditions Looking East on Arapahoe Road from Xanthia Street



The highway signs that overhang Arapahoe Road would be relocated behind the viewer position, and may be sized differently (which would be determined during final design). The simulation shows a sign for the interstate beside the sidewalk in conjunction with interstate emblems potentially painted on the eastbound lanes, which are visually unobtrusive.

The telephone lines may be replaced aboveground (as shown in the simulation) or buried underground (also to be determined during final design). In general, removal of some vertical elements would add a slight degree of unity by decreasing the number of man-made visual elements. The additional lanes and reconfigured pavement markings would help create a visual convergence point from the foreground toward the bridges, creating slightly more visual order and enhancing unity.

Vividness and intactness would not noticeably change. Slight increases in unity would change the unity rating at this KOP from 2.7 to 2.9, as developed land use would remain moderately high and visual encroachments would remain. Overall visual quality would not be anticipated to incur a noticeable change at this location for viewers *from* the interchange and *toward* the interchange — a negligible impact.

Visual quality is not expected to measurably change throughout the study area at other locations. Widening Arapahoe Road and Yosemite Street to provide additional lanes would not create a perceptible visual change in the context of the setting, which is primarily defined by existing built elements.

The existing frontage road in the northeast quadrant of the study area would be closed and a new road constructed to the north of the intersection of the northbound I-25 exit ramp with Arapahoe Road. The new road would pass between the La Quinta Inn and Motel 6, and would terminate at East Southtech Drive behind Lowes. The road would provide access to two large existing parking lots that serve the motels on either side. The area that would be occupied by the new road is already disturbed and paved, although some landscaped vegetation associated with the parking lots would be removed. The City of Greenwood Village may add landscaping along this new city street. The new road would not measurably alter visual quality given the highly developed visual setting. Closing the existing frontage road would slightly improve visual quality for viewers from the road as they enter northbound I-25, but the change would be slight and unnoticeable as drivers would be concentrating on merging with highway traffic.

There would be no perceptible change in the number of parking lots and variety of building heights and store front designs throughout the study area as a result of the Action Alternative. Changes to vegetation would be minimal. Overall visual quality is not expected to fall below 2.1 or exceed 2.6 and would therefore remain moderately low for viewers both *from* the road and *toward* the road. Direct impacts would be negligible, and no measurable indirect impacts are expected.

3.9 Noise

A traffic noise and vibration analysis was conducted for the project in accordance with the current CDOT guidelines (CDOT 2011b). The corresponding technical report is included in Appendix A and the findings are summarized below.

The noise analysis focused on roads and streets that would be substantively modified or newly built by the proposed project or were important local noise sources, including Arapahoe Road, Yosemite Street, and I-25. The proposed road modifications under the Action Alternative have been described elsewhere (Chapter 2). Note that vibration from traffic was found not to be a substantive concern for this project (Appendix A) and is not discussed further.

To summarize the noise analysis process, traffic noise impacts occur when properties near the project roads will have future design year (2035) noise levels at or above the relevant CDOT NAC (**Table 19**) or future noise levels that increase by 10 decibels or more over current conditions. Typically, the most crucial NAC is for homes (Land Use Category B), which is an hourly average noise level of 66 decibels. The locations of greatest concern generally are exterior areas of frequent human use. The future noise levels are evaluated through computer modeling. Properties that are found to be impacted by noise are then considered for noise abatement actions (mitigation). Noise abatement actions that are found to be both feasible and reasonable according to the guidelines are recommended for construction under the proposed improvements.

Traffic noise tends to be loudest when the highest volume of traffic is moving at the highest speeds, which may not be during rush hours when traffic can become congested and slow. There are no noise walls currently in the study area; however, there are wooden

privacy fences along the major streets adjacent to the Walnut Hills neighborhood, which do not currently mitigate noise (**Figure 15**).

Table 19. CDOT Noise Abatement Criteria

Land Use Category	CDOT NAC (L_{eq})	Description of Land Use Category
A	56 dBA (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is to continue to serve its intended purpose
B	66 dBA (Exterior)	Residential
C	66 dBA (Exterior)	Active sport areas, amphitheatres, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, Section 4(f) sites, trails, trail crossings, and television studios
D	51 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools and television studios
E	71 dBA (Exterior)	Hotels, motels, offices, restaurants, bars and other developed lands, properties or activities not included in A-D or F
F	NA	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship yards, utilities (water resources, water treatment, electrical), and warehousing
G	NA	Undeveloped lands that are not permitted for development

Source: CDOT, 2011

3.9.1 Environmental Consequences of the No Action Alternative

The No Action Alternative was calculated to impact 16 residential properties and 2 commercial properties (Category E restaurant patios) due to traffic noise in 2035 (**Figure 15**). These properties (impacted receptors) are primarily located along the Arapahoe Road and Yosemite Street corridors. Front-row homes were calculated to have 2035 noise levels of approximately 71 decibels, while second-row homes would have 2035 noise levels of approximately 63 decibels. Because the No Action Alternative would not involve making any improvements to the study area, these impacts are not evaluated for abatement actions.

Figure 15. Noise Impacts for No Action Alternative (2035)



3.9.2 Environmental Consequences of the Action Alternative

Direct impacts from the Action Alternative were calculated to impact 16 residential properties and 2 commercial properties (Category E restaurant patios) due to traffic noise in 2035 (**Figure 16**), which is the same as No Action. Front-row homes were calculated to have 2035 noise levels of approximately 71 decibels, while second-row homes would have 2035 noise levels of approximately 63 decibels. The same properties (impacted receptors) would be impacted as the No Action Alternative.

Figure 16. Noise Impacts for Action Alternative (2035)



Construction

Adjoining properties in the study area may be exposed to noise from road construction activities when the Action Alternative is constructed. Construction noise differs from traffic noise in several ways:

- ◆ Construction noise is temporary, lasting only for the duration of the construction event, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to adjacent and nearby residents.
- ◆ Construction activities generally are short-term, and depending on the nature of the construction operations, could last from seconds (e.g., a truck passing a receiver) to several months (e.g., constructing a bridge).
- ◆ Construction noise is intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle. Traffic noise, on the other hand, is present in a more continuous fashion after construction activities are completed.
- ◆ Construction noise involves heavy equipment rather than primarily passenger cars.

3.9.3 Mitigation

Because of the impacts described for the Action Alternative (Section 3.9.2), noise mitigation measures were evaluated. Several abatement actions were considered for the impacted receptors—several were found not to be feasible and reasonable (Appendix A).

Statement of Likelihood: Noise barriers for the Walnut Hills neighborhood were found to be feasible and reasonable (Appendix A). A barrier along Arapahoe Road approximately 8 feet high by 1,060 feet long and a barrier along Yosemite Street approximately 8-11 feet high by 500 feet long (**Figure 17**) were found to meet the CDOT abatement criteria (CDOT 2011b). These barriers would provide approximately 7-8 dBA of noise reduction for front-row homes along Arapahoe Road and approximately 6-7 dBA of noise reduction for front-row homes along Yosemite Street. Barriers for the other impacted properties (restaurants) were found not to be feasible and reasonable.

The two barriers are being recommended preliminarily for the Action Alternative, pending the outcome of the opinions of the benefiting parties (which will be gathered during the public comment period and at the public meeting for the EA) and final design review for this project. Specific invitations to participate in the EA public meetings will be provided to owners and residents for the affected properties along Arapahoe Road. Input from the potentially benefiting receptors will be solicited regarding their opinion on the potential abatement actions. A pre-construction survey of the impacted residents will be conducted to garner input on abatement actions. The final decision on the noise barriers will be made during final design through the public involvement process. Implementation of the noise abatement would provide a noise-reduction benefit to all 16 impacted homes and would reduce the estimated traffic noise levels below the CDOT NAC for 14 of the homes (see **Figure 17**).

Mitigation for noise from temporary construction impacts includes: use of temporary noise barriers when feasible, limiting work to certain hours of the day when feasible, limiting nighttime construction near residential areas, re-routing construction-related traffic away from roads adjacent to residential areas and requiring the contractor to use well-maintained equipment, particularly with respect to mufflers. Noise producing activities can be subject of local ordinances, although most ordinances have only “nuisance noise” ordinances in place. The City of Centennial has enacted an ordinance in its municipal code (2007-0-16) that prohibits excessive noise but does not specifically address construction noise.

Figure 17. Recommended Noise Abatement Barrier (Action Alternative)



3.10 Energy

Petroleum is the primary energy source for transportation in the U.S. (96.6 percent). Highway use accounts for approximately three-fourths of total U.S. transportation energy consumption, with about 80 percent from automobiles, light trucks, and motorcycles, and about 20 percent from heavy trucks and buses. Highway projects that add capacity, which increases average vehicle speeds and improves traffic flows, have the greatest effect on fuel economy (TRB 1995).

Fuel consumption is a function of different traffic characteristics. Fuel efficiency under steady state, cruise-type driving conditions peaks at speeds of 35 to 45 miles per hour (mph) and then rapidly declines at higher speeds (the speed limit along Arapahoe Road within the project area is 40 mph). At lower speeds, engine friction, tires, and accessories (e.g., power steering and air conditioning) reduce fuel efficiency (TRB 1995).

Although several factors affect fuel economy, average vehicle speed is the biggest determinant for fuel consumption variability. Fuel efficiency under start-and-stop traffic conditions, such as within the project area, is diminished compared to steady speed driving due to greater amounts of acceleration and stopping. Energy is lost from braking, and repeated braking can account for as much as 15 percent of fuel use in an urban driving trip. Aggressive accelerations result in higher engine speeds and greater fuel consumption than constant “cruise” driving. In a congested urban setting, rapid accelerations result in a 10 percent increase in fuel use. As mentioned in Section 1.3.1.2,

the intersection is projected to operate with an average delay of nearly 100 seconds per vehicle during the AM peak hour and over 180 seconds per vehicle during the PM peak hour. Projects that add highway capacity can smooth traffic flows by reducing the incidence of sharp accelerations and rapid braking, thereby improving fuel economy (TRB 1995).

The characteristics of the highway itself can also affect fuel economy. For example, steep grades and rough roads reduce fuel efficiency, the former from increased fuel use as a function of heavy loads on the engine, and the latter from increased rolling resistance (TRB 1995). To the extent that highway capacity additions improve these conditions, fuel efficiency can be gained.

All else being equal, stop-and-start traffic, low speeds, and highly variable speeds are all associated with poor fuel economy. Expansion of highway capacity typically reduces the probability of stop-and-start traffic, raises average vehicle speeds, and reduces speed variability (i.e., smooth the traffic flow). Expansion of highway capacity also reduces traffic density and improves LOS (TRB 1995).

3.10.1 Environmental Consequences of the No Action Alternative

Congestion (which decreases vehicle speed and results in stop-and-start traffic) is measured by LOS ratings. The highest level (LOS A) describes free-flow conditions in which vehicles experience minimal delay. The lowest level (LOS F) describes stop-and-start conditions in which long delays are experienced by most vehicles. The existing and projected LOS at intersections within the project area (i.e., those that would experience physical improvements) are shown in **Table 1**, Section 1.3.1.1.

Projected LOS and congestion within the study area indicate overall poor fuel economy due to repeated braking and acceleration, particularly during peak hours. As described in Chapter 1, traffic volumes within the study area are projected to increase 30 percent by 2035. As traffic volumes increase, so would congestion and an associated increase in stop-and-start traffic. Fuel economy would further decrease as much as 15 percent per trip as a result of repeated braking, and as much as 10 percent from rapid accelerations. In the long term, fuel efficiency would be particularly diminished at the intersections of Arapahoe Road with Greenwood Plaza Boulevard/South Uinta Street, Yosemite Street, and the I-25 ramps, which are expected to experience the biggest decrease in LOS within the study area by 2035. In addition, three of these intersections would experience decreases in LOS to Level F, which is characterized by gridlock and considered unacceptable. LOS F would result in substantial engine idling, slow speeds, and repeated braking and accelerating, all of which contribute to poor fuel economy and increased energy use.

As congestion increases, more people may use transit options in the study area, such as LRT. Less energy would be consumed as fewer vehicles would be on the road, resulting in an indirect beneficial impact.

Ongoing maintenance would be required on Arapahoe Road, during which traffic delays and stop-and-start traffic conditions conducive to high emission levels would occur. Fuel would also be used by maintenance equipment, as well as by workers traveling to the site. Therefore, energy use would increase in the short term during road maintenance.

3.10.2 Environmental Consequences of the Action Alternative

Projected LOS for the Action Alternative for those intersections within the project area are shown in **Table 10**, Section 3.2.2.1.

Substantial improvements in LOS are expected at the I-25 ramps and the Boston/Clinton Street intersection with Arapahoe Road in the long term. All of these intersections would be improved to LOS C or better. Under LOS C, vehicles wait intermittently through more than one traffic signal; traffic backups occur occasionally but traffic flow remains stable and acceptable (TRB 2000). Therefore, an improvement to LOS C would improve fuel efficiency within the project area by maintaining stable traffic flow. As noted above, fuel efficiency under steady state driving conditions peaks at speeds of 35 to 45 mph.

Increasing the opportunity for vehicles to consistently drive at Arapahoe Road's speed limit (currently 40 mph) would maximize fuel efficiency in the project area. However, because LOS would not measurably improve at the Greenwood Plaza Boulevard and Yosemite Street intersections during peak travel periods, congestion would still occur west of the interstate, minimizing fuel efficiency due to long traffic queues at these intersections.

Improving LOS in the project area may result in a reduction of traffic cutting through adjacent neighborhoods to avoid congestion on Arapahoe Road. Fuel efficiency would improve as fewer drivers navigate stop signs and slower speeds typical of neighborhood streets (fuel efficiency is reduced at speeds lower than 35 to 45 mph, as mentioned above).

Operational improvements that include signal system upgrades would be implemented for the signalized intersections along Arapahoe Road from Quebec Street to Havana Street. Traffic would flow more smoothly with fewer stops from coordinating and timing traffic signals in the project area. These improvements would decrease fuel consumption by reducing frequent stops and idling time while waiting for traffic signals to change.

According to the Transportation Research Board (TRB 1995), highway capacity additions can affect other modes of travel. New capacity that reduces highway congestion and commuting time may encourage mass transit riders to switch back to driving their cars. Bicycle and pedestrian travel may be discouraged if the capacity addition (e.g., intersection widening) improves traffic flow patterns for automobiles and trucks to the detriment of slower-moving modes (TRB 1995). The result would be an indirect impact to energy use.

As mentioned above, rough roads can reduce fuel efficiency. To the extent that highway capacity additions improve these conditions, fuel efficiency can be gained (TRB 1995). Materials used during construction can also affect energy use. Waste materials can replace some of the natural materials used in highway construction projects for paving applications. Such alternative materials conserve natural resources, including energy used for mining and transportation to landfills (McEntire 2004).

The physical improvements proposed under this alternative would improve roadway conditions and therefore, fuel efficiency in the short-term — a beneficial impact. In the long term, ongoing maintenance would be required as described for the No Action Alternative. However, maintenance impacts would be less because more capacity would be available to accommodate traffic during maintenance activities.

Construction would cause traffic delays and create stop-and-start traffic conditions, resulting in increased fuel usage. Fuel would also be used by construction equipment

such as graders, cranes, and trucks, as well as by workers traveling to and from the construction site. Therefore, energy use would increase temporarily during construction.

3.10.3 Mitigation

The construction contractor will conduct activities when feasible during periods of reduced traffic volumes to reduce idling vehicles. The contractor will keep equipment well-maintained and will use cleaner fuels, such as low-sulfur diesel, when possible and encourage carpooling to and from the site. Staging areas will be located as close to the project area as possible.

3.11 Air Quality

The National Ambient Air Quality Standards (NAAQS) are nationwide health-based air quality standards that have been established by the U.S. Environmental Protection Agency. Three NAAQS pollutants are primary concerns for the Denver region: carbon monoxide (CO); suspended particulate matter (PM₁₀) and ground-level ozone. An air quality analysis was performed to assess potential air quality impacts from the proposed transportation improvements (Appendix A). The air quality analysis for the project consisted of several components:

- ◆ A regional conformity evaluation to assess the Action Alternative for conformity with the regional air quality improvement plans, which are called State Implementation Plans (SIPs).
- ◆ A local conformity analysis for CO to assess the Action Alternative for potential locations where NAAQS pollutants could accumulate. Congested intersections where CO could accumulate were identified and analyzed.
- ◆ Qualitative analyses for PM₁₀ and toxic air pollutants.

Ozone is a regional pollutant and analyzed at the regional level; therefore, a project-level analysis for ozone is not appropriate for the EA.

Overall, there has been a trend of decreasing total pollutant emissions nationwide from mobile sources for several decades, even when allowing for the growing number of vehicle miles traveled. These improving results are due to a number of successful emission control regulations. Highway sources account for varying amounts of the overall emissions but tend to be declining even though national miles traveled more than doubled over the past 30 years. Advances in vehicle technology as well as cleaner fuels have been major reasons for the improvements.

Several recent federal regulations on vehicle emissions are expected to continue the trend of improvement and further lower vehicle emissions in the future. A discussion of greenhouse gas emissions and global climate change is provided in Appendix A.

3.11.1 Environmental Consequences of the No Action Alternative

The No Action Alternative would make no changes to the interchange and study area, which means that these road and traffic conditions in the study area in the future would not be consistent with the conditions that have been evaluated by DRCOG for the 2035 Metro Vision RTP. Currently, the No Action Alternative does not conform to the RTP because the RTP includes reconstruction of the interchange.

In general, future emissions from vehicles will be minimized through several federal regulations (such as emission standards) and regional controls (such as street sanding regulations). The Denver area maintenance plans that are already in place for CO and PM₁₀ will serve to avoid and minimize pollutant emissions from vehicles. Due to cleaner vehicles, future daily air pollutant levels for most pollutants are predicted to be lower than current levels, even with more vehicles on the roads.

3.11.2 Environmental Consequences of the Action Alternative

The Action Alternative improvements are included in the RTP and the relevant conformity documents, which demonstrates in the long term that the proposed improvements conform to the SIPs. However, only design activities and preparation of the EA for the interchange are included in the 2012-2017 TIP. Construction of the interchange would need to be added to the TIP and evaluated before actual construction can begin, to fully demonstrate conformity with the SIPs.

The localized air quality analysis for the Action Alternative indicated that there would not be violations of the CO NAAQS. The highest predicted 8-hour CO concentration around a project intersection was 4.1 parts per million (ppm), which is less than the NAAQS of 9 ppm (Appendix A).

The qualitative analysis for PM₁₀ showed that the proposed project would not be likely to cause or contribute to violations of the PM₁₀ NAAQS (Appendix A). Total particulate matter levels may increase in the future because of more vehicles, but the preliminary analysis indicates the concentrations would still meet the NAAQS.

Both the No Action and Action Alternatives in 2035 are expected to have reduced air toxics emissions in the immediate area of the project, relative to current conditions, due to several ongoing pollutant reduction programs. Air quality would not get worse than existing conditions under No Action. The Action Alternative is estimated to be slightly better than No Action due to less peak hour congestion for the same traffic volume. Overall air toxic emissions in the study area are expected to be equivalent between the No Action and Action Alternatives. On a regional basis, vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide air toxics levels to be significantly lower than today.

Indirect impacts from construction activities may be sources of temporary air quality impacts from fugitive dust or equipment emissions. Properties adjoining the construction activities in the study area could be exposed to construction-related emissions at the time the proposed project is built. Excavation, grading, and fill activities could increase local fugitive dust emissions during construction. Because of the particle size, this fugitive dust typically settles within 30 feet of the source. Smaller particles could travel as much as several hundred feet depending on wind speed.

A discussion on greenhouse gas emissions and global climate change is provided in Appendix A.

3.11.3 Mitigation

Future emissions from on-road mobile sources will be minimized nationwide through several federal regulations. The Denver area SIPs for CO, ozone, and PM₁₀ will serve to avoid and minimize pollutant emissions from project roads.

The construction contractor will prepare and implement a fugitive dust control plan that includes wetting of disturbed areas. The contractor will plan to minimize idling and maintain equipment. Particular attention will be given to minimizing total emissions near sensitive areas such as homes. The contractor will keep its maintenance equipment well-maintained and will use cleaner fuels, such as low-sulfur diesel, when possible. Staging areas will be located as close to the project area as possible.

3.12 Hazardous Materials

Hazardous materials include materials that are regulated as solid waste, hazardous waste, and other wastes contaminated with hazardous substances, radioactive materials, petroleum fuels, toxic substances, or pollutants. Encountering soil or groundwater contamination during the construction process without prior knowledge of the contamination has the potential to affect the project in terms of mitigation, cost, schedule, and worker health and safety. Therefore, it is important to identify any sites with potential hazardous materials concerns prior to ROW acquisition and construction.

A hazardous materials assessment was completed for the EA (Appendix A) and is summarized below. The intent of the hazardous materials assessment is to identify any nearby sites with recognized or potential environmental conditions. Recognized environmental conditions have known (current or historic) soil or groundwater contamination and sites with potential environmental conditions have evidence of storage, handling, or disposal of hazardous materials that could not be confirmed without additional inspection or investigation.

Potential sites of interest were identified through an environmental database search and field reconnaissance—those within the study area or no more than 1,000 feet from the study area boundary were reviewed for possible environmental conditions. More information on these sites is included in Appendix A. The primary businesses within the study area include gasoline stations, automotive repair and maintenance shops, restaurants and commercial offices. General environmental concerns within the study area include residual contamination from leaking underground storage tanks (LUSTs) and spilled chemicals due to a long history of chemical storage and handling practices. In total, 30 potential sites of interest were identified in the study area and examined in more detail. See Appendix A for the full report.

3.12.1 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no effects on sites with potential or recognized environmental conditions because no physical changes would be made by the project.

3.12.2 Environmental Consequences of the Action Alternative

Of the 30 sites of interest, nine sites with potential or recognized environmental conditions were identified within the study area (**Table 20**) that may be affected by the Action Alternative. The sites could be affected directly through property acquisition or indirectly by construction activities. The environmental conditions consist of known or potential soil and groundwater contamination (**Table 20**; **Figure 18**, Appendix A).

Table 20. Sites with Potential or Recognized Environmental Conditions

Site Address/Name	Impact	Site Description/Concern
6770 S. Yosemite St. (Brakes Plus/Fast Traxx Fast Lube)	Partial ROW acquisition expected. Direct impact.	Potential Environmental Condition. Unknown material handling, storage, and disposal practices. Potential materials include: fuel, motor oils, hydraulic fluids, degreasers, paints and solvents. It is unknown if any contamination has occurred at this property.
8151 E. Arapahoe Rd. (Big O Tires)	Construction could occur near this site. Indirect impact.	Potential Environmental Condition. Currently this site is an automotive repair/maintenance shop. Unknown material handling, storage, and disposal practices. Potential materials include: fuel, motor oils, hydraulic fluids, degreasers, paints, and solvents.
6787 S. Clinton St. (Former Continental Cleaners)	Construction could occur near this site. Indirect impact.	Recognized Environmental Condition. Former dry cleaner facility. Former use, handling, and storage of solvents (e.g., perchloroethylene). Unknown disposal practices.
9555 E. Arapahoe Rd. (Former Dry Cleaners)	Construction could occur near this site. Indirect impact.	Recognized Environmental Condition. Former dry cleaner facility. Former use, handling, and storage of solvents (e.g., perchloroethylene). Unknown disposal practices.
6802 S. Yosemite St. (7- Eleven #39214/Silco Oil Co., Barn Store)	Construction could occur near this site. Indirect impact.	Recognized Environmental Condition. Currently the site is an operating gasoline station.
8660 E. Arapahoe Rd. (Firestone Store No. 2843)	Partial ROW acquisition expected. Direct impact.	Recognized Environmental Condition. Unknown material handling, storage, and disposal practices. Potential materials include: fuel, motor oils, hydraulic fluids, degreasers, paints, and solvents.
8755 E. Arapahoe Rd. (Phillips 66 #23880)	Construction could occur near this site. Indirect impact.	Recognized Environmental Condition. Currently the site is an operating gasoline station. Remediation on-going.
9170/9171 E. Arapahoe Rd. (Amoco Oil #8606, BP Facility #24545, K & G Store #518)	Partial ROW acquisition is expected. Direct impact.	Recognized Environmental Condition. Currently the site is an operating gasoline station. Remediation on-going.
9400 E. Arapahoe Rd. (Arapahoe Mitsubishi, Global Collision Arapahoe, Inc.)	Construction could occur near this site. Indirect impact.	Recognized Environmental Condition. Currently this site is an automotive sales and repair/maintenance facility.

In addition, lead-based paint and asbestos-containing materials are hazardous substances that could exist on highway or other structures (e.g., buildings), particularly if they were constructed prior to 1980. Asbestos and lead-based paint can be a worker health and safety concern due to potential negative health impacts associated with these materials.

3.12.3 Mitigation

Protective measures will be taken before, during, and after construction to minimize the risk of encountering hazardous materials. For properties that are to be acquired by the project, further investigation and/or coordination may be necessary to confirm the presence or absence of contamination and to determine the extent and severity, appropriate methodology and preliminary costs of corrective or preventive action. Recommendations for further assessment (e.g., Initial Site Assessment or Phase I Environmental Site Assessment) of the sites with potential and recognized conditions are included in Appendix A.

The following mitigation measures will be implemented to ensure proper management of contaminated material, if encountered:

- ◆ Either a Materials Management Plan or Health and Safety Plan may be required per Section 250.03 of the *CDOT Standard Specifications for Road and Bridge Construction* (CDOT 2011c), when stated as such in the contract with the Engineer's approval. Section 250 of *CDOT Standard Specifications for Road and Bridge Construction* (CDOT 2011c) will be followed for any work that involves the transportation, handling, monitoring, and disposal of hazardous materials encountered during construction.
- ◆ If structure demolition is expected, asbestos-containing materials, lead-based paint, and miscellaneous hazardous materials surveys will be conducted at each site, where applicable, prior to demolition. If construction debris is encountered during excavation, the material will be inspected, and if found to contain asbestos, the material will be handled and disposed of in accordance with the procedures and policies described in Appendix A.
- ◆ Lead-based paint may need to be removed prior to demolition if the lead is leachable at concentrations greater than regulatory levels. Where lead-based painted surfaces would be removed via torching, additional health and safety monitoring requirements are applicable.

Additional information on the mitigation measures for hazardous materials is included in Appendix A.

3.13 Water Resources and Water Quality

An analysis of potential impacts to water resources, water quality, and drainage issues for the No Action and the Action Alternative was conducted as part of this EA. The information was derived from a literature search and field investigation for each of the basins and their respective drainages.

3.13.1 Surface Water

Transportation projects can impact water quality during both the construction and maintenance/operation phases of a project. Water quality is primarily affected by impervious areas. Impervious areas, such as pavement, increase the volume, velocity, and contaminant concentrations in runoff that reach water bodies such as lakes and streams. The combination of these factors can create erosion, sedimentation, and contamination of water bodies.

The western portions of the study area are located in the upper basin areas of Little Dry Creek (**Figure 19**), which is a tributary to the South Platte River. An existing storm drainage system at Arapahoe Road and I-25 passes these flows to the south and west and eventually into the main channel for Little Dry Creek. Little Dry Creek, classified by the Colorado Department of Public Health and Environment Water Quality Control Commission (WQCC) as segment COSPUS16c, is designated as a Warm Water Aquatic Life Class 2 stream with a Recreational Classification of E (used for primary contact recreation or has been used for such activities since November 28, 1975), with additional beneficial use for agriculture (WQCC 2005). This segment of the South Platte River is on the 303d List Water-Quality-Limited Segments Requiring Total Maximum Daily Loads (TMDLs) for arsenic (high priority). High arsenic levels may be due to herbicides and pesticides that were used prior to 1973, and not as a result of from roadways. The 303d list identifies components that can identify a specific water quality problem.

The eastern portions of the study area are located in the upper basin areas of the West Tributary to Goldsmith Gulch (**Figure 19**), which is a tributary to Cherry Creek. An existing storm drainage system at Arapahoe Road and I-25 passes these flows to the northeast and eventually to this drainageway. The West Tributary to Goldsmith Gulch, classified by the WQCC as segment COSPCH04, is designated as Warm Water Aquatic Life Class 2 stream with a Recreational Classification of E, with additional beneficial use for agriculture (WQCC 2005). This segment of Cherry Creek is on the 303d list for selenium (low priority). Selenium is attributed to native shale within the tributary basin and not a result from roadways.

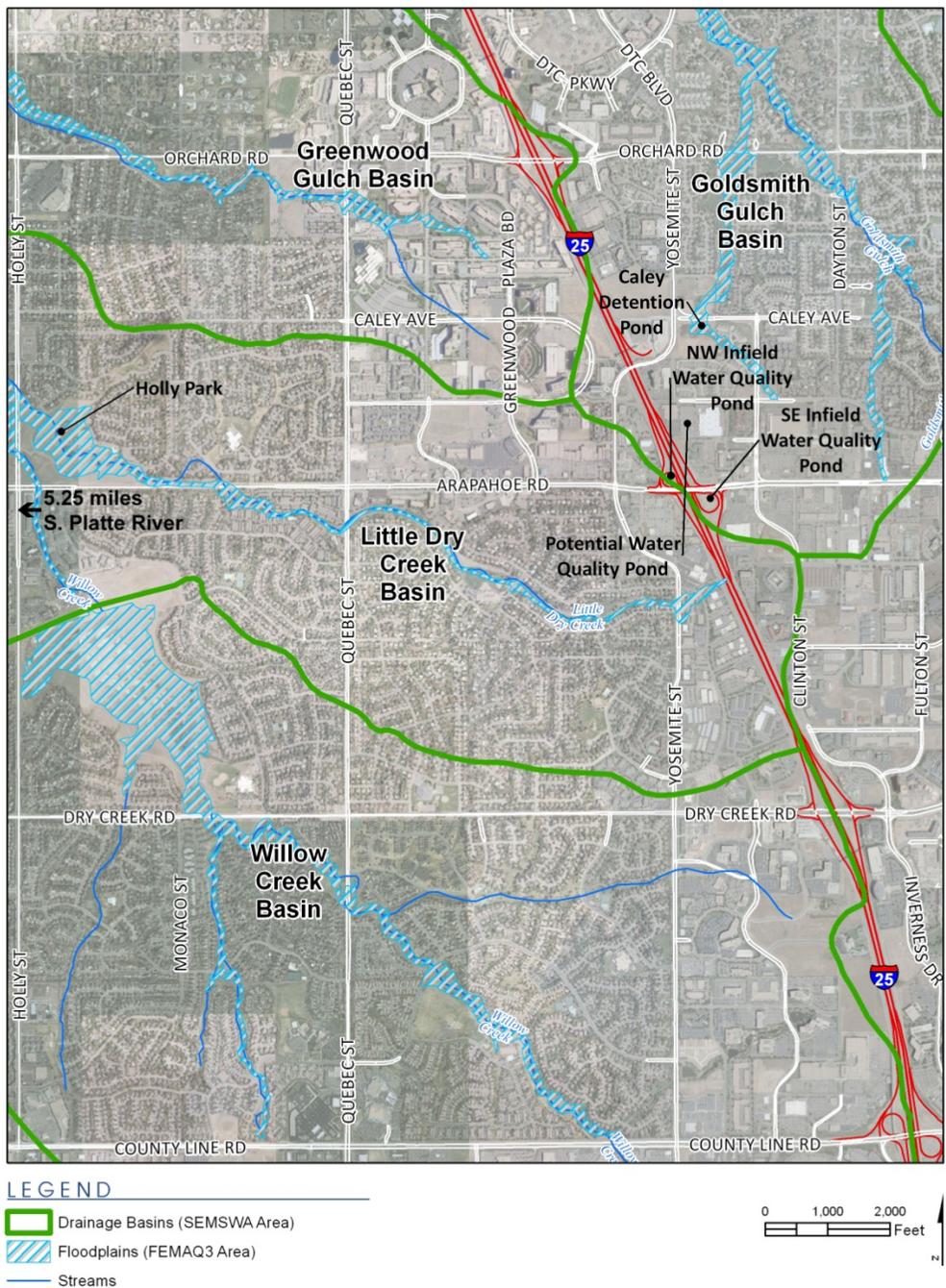
3.13.2 Groundwater

Groundwater information was derived from a review of well data and maps from the Colorado State Engineer's office on October 25, 2011. Wells within the study area include several groundwater monitoring wells for area gas stations (Phillips 66, Conoco Phillips, and BP Products North America). These monitoring wells are away from the ROW and away from any proposed construction. No active wells for potable water use were identified in the study area.

The area around I-25 and to the west is in the Southgate Water and Sanitation District. The area east of I-25 is in the Castlewood Water and Sanitary District. Both of these companies purchase their water from the Denver Water Department and are not supplied

from any groundwater sources. The study area does not include any wells, ditches, reservoirs or other sources of potable water that could be used for human consumption.

Figure 19. Water Resources in the Study Area



3.13.3 Environmental Consequences of the No Action Alternative

3.13.3.1 *Surface Water*

The No Action Alternative would not disturb ground surfaces or add paved surfaces to the study area; likewise, no water quality improvement features would be added. Also, the No Action Alternative would not modify the drainage infrastructure that lies within or beyond the study area. The major and minor drainage basin boundaries would remain unchanged and peak flows would remain the same. There would be no direct, indirect, temporary, or construction impacts from the No Action Alternative, nor would there be benefits provided.

3.13.3.2 *Groundwater*

The No Action Alternative would not impact ground water quality beyond the current levels. There are no direct, indirect, temporary, or construction impacts as a result of the No Action Alternative.

3.13.4 Environmental Consequences of the Action Alternative

3.13.4.1 *Surface Water*

The Action Alternative would disturb ground surfaces and increase the potential for erosion and movement of sediment from the site into surface waters from an increase in impervious surfaces. Due to the size of the project, it is assumed that both erosion control for construction and post-construction permanent features will be necessary to treat water quality. All applicable federal, state, and local requirements will be met at the time of final design and construction. There would be direct, temporary, and construction impacts from the Action Alternative.

Also, the Action Alternative could require modifications of the drainage infrastructure, such as the detention/water quality ponds that lie within or adjacent to the study area. This may include adjusting drainage structure locations to accommodate the proposed widening, and increasing storm drainage facility sizes if the conceptual design warrants improvements. The minor drainage basin would have a slightly higher percent of imperviousness due to the added pavement and peak flows would increase accordingly.

3.13.4.2 *Groundwater*

The Action Alternative would add impervious surfaces within the study area. The added paved surfaces would not significantly alter the water table or groundwater quality and quantity.

3.13.5 Mitigation

Surface Water

Mitigation will include utilizing Best Management Practices (BMPs) during construction and permanent water quality treatment facilities once construction has been completed. During final design of the Action Alternative, a detailed erosion control plan will be required to limit the amount of erosion within the construction limits and control the sediment that could potentially leave the area and enter adjacent waterways. The erosion control plan will identify the placement and types of BMPs, such as silt fence, inlet

protection, gravel bags, stabilized construction entrances, concrete washouts, and other structures. Mitigation for the drainage infrastructure may also be necessary due to the increased flows in the storm drainage system.

CDOT, the City of Centennial, and the City of Greenwood Village each have Municipal Separate Storm Sewer System (MS4) permits through Colorado Department of Health and Environment (CDPHE). The MS4 permits require that evaluations for stormwater be conducted, and that adequate mitigation be implemented if certain thresholds are met. This may require that permanent water quality facilities be installed to treat the runoff. Potential locations of permanent facilities include the following: Holly Dam at Arapahoe Road and Holly Street, existing I-25/Arapahoe Road infields, the southeast corner of East Southtech Drive and the I-25 Frontage Road, the existing detention pond located along the south side of Southtech Drive immediately north of the motel, or other new facility locations near or within the study area.

The final water quality treatment method and location will be selected during the final design. Additionally, a detailed analysis of the existing drainage system will be required during design to identify any needed upgrades to the system. Dewatering permits may be required if necessary.

Groundwater

There would be no impact to groundwater, so mitigation will not be required.

3.14 Permits Required

The permits, approvals, and certifications described below may be required for construction of the Action Alternative. Additional permits may be identified during final design.

Table 21. Permits Required

Permit	Applicability	Permitting Agency
State		
Colorado Discharge Permit System (CDPS) Stormwater Construction Permit	The CDPS program issues, monitors, and enforces permits for direct discharge of pollutants into the nation's waters. Construction storm water discharge permits are required to assure the quality of storm water run-off for projects where more than one acre is disturbed by construction. ²	Colorado Department of Public Health and Environment, Water Quality Control Division

² This definition is based on current regulations. The project will need to follow all applicable federal, state, and local regulations at the time of construction.

Permit	Applicability	Permitting Agency
CDPS Construction Dewatering Industrial Wastewater Discharge Application	Required for dewatering of construction areas if necessary. The contractor shall obtain the appropriate CDPS general permit for management of groundwater.	Colorado Department of Public Health and Environment, Water Quality Control Division
Dewatering Well Permit	Required for installation of any temporary dewatering wells installed for more than 12 months.	Colorado Division of Water Resources
Air Pollution Emission Notice	Required for projects where more than 25 acres of land are impacted and/or the project is more than 6 months in duration.	Colorado Department of Public Health and Environment, Air Quality Control Division
Demolition Permit	Required for asbestos abatement in area of public access. Applies to the removal of all structures, including buildings and bridges.	Colorado Department of Public Health and Environment, Air Quality Control Division
Form 137 Access Permit	Required for construction, relocation, modification or access to a State Highway. Modifications to access points along Arapahoe (SH 88) will require a Form 137 Permit Application.	Colorado Department of Transportation
Local		
1041 Permit	Required to address the City's Home Rule Authority. A variance to the City's 55dBA noise level for residential areas will be required in addition to other unique and specific permit submission requirements related to traffic forecasts and land use.	City of Centennial
Other Local Permits or Approvals	May be required for utility relocations, land survey, local roadway access, temporary construction detours, retaining walls, erosion control, and grading.	City of Centennial, City of Greenwood Village, Arapahoe County

3.15 Cumulative Impacts

The assessment of cumulative impacts in NEPA documents is required by CEQ regulations (CEQ 1997b). Cumulative effects result from the incremental impact of the

Action Alternative when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes them. Cumulative impacts result in the compounding of the effects of all actions over time. According to the U.S. Department of Transportation (USDOT 2005), a cumulative impacts analysis should identify:

1. the area in which the effects of the proposed project will be felt;
2. the impacts that are expected in that area from the proposed project;
3. other actions – past, present, and proposed, and reasonably foreseeable – that have or are expected to have impacts in the same area;
4. the impacts or expected impacts from these other actions; and
5. the overall impact that can be expected if the individual impacts are allowed to accumulate.

Steps 1 and 2 were addressed under the impact topics in this chapter. The other actions listed under step 3 are described below, with the analysis from steps 4 and 5 at the end of the section.

Further, CEQ recommends that the analysis focus on the effects and resources within the context of the Action Alternative and analyze only those issues that have anticipated effects of the Action Alternative or the eventual decision. Therefore, not all resource areas are evaluated in this section. Only the resources that have the potential to be impacted by the accumulation of actions are discussed below. In addition, if a project has no direct or indirect impacts on a particular resource, then it also has no cumulative impacts on that resource.

3.15.1 Time Frame for Analysis

A time frame for analysis was identified to focus the assessment of cumulative impacts. The time frame should be neither too short (such that longer-term trends are not recognized) nor too long (such that the analysis lacks focus). Typical time frames that have been used on transportation projects include 20 to 30 years, start of development, original highway construction, or similar time frames based on the characteristics of the area. The following time frame was established for this cumulative impacts analysis:

- ◆ Past – The analysis begins in the mid 1970s, when development of DTC and its surrounding business parks began.
- ◆ Future – The analysis extends to 2035. This corresponds to the horizon used for regional transportation planning.

Thus, the time frame for cumulative impacts analysis for the Valley Highway Project extends from approximately 1975 to approximately 2035.

3.15.2 Past Actions

This section presents a summary of past development and land use change within the study area, concentrating on the time frame for analysis beginning in the mid 1970s. This section considers development patterns rather than individual projects and actions.

Arapahoe County was Colorado’s first county, established in 1861 when the Colorado Territory was formed. In 1872, the first urban development began along present U.S. Highway 85. In the 1940s and 1950s, the area contained a mixture of farmers, suburbanites, and city dwellers with “country homes.” Greenwood Village was legally

incorporated in 1951 to halt creeping development from Denver. Office park development began in the 1960s, and Greenwood Village began annexing land in DTC and Greenwood Plaza. Annexations in 1970 brought commercial sites on both sides of I-25 into Greenwood Village. In 1987, Greenwood Village annexed Arapahoe Road commercial owners. By the early 1980s, traffic was the number one issue in Greenwood Village, a concern that continued into the 1990s. The number of cars on I-25 had increased substantially, causing major backups, especially during bad weather and accidents. Such situations drove more cars onto crosstown streets. One major effort to address transportation in the area was the Four Corners agreement, which committed four organizations to resolve traffic issues within four major interchanges: I-225 and I-25; Arapahoe Road and I-25; Arapahoe Road and Parker Road; and Parker Road and I225 (City of Greenwood Village n.d.b.).

In 1997, a Mediated Transportation Agreement involving Greenwood Village, the City of Aurora, Arapahoe County, and Joint Southeast Public Improvement Association was signed, which called for \$500 million in transportation improvements. Projects included construction of the Serpentine Road to relieve traffic off of Arapahoe Road by providing direct access into DTC. The agreement called for construction of two parallel roads on the north and south sides of Arapahoe Road west of Parker Road, allowing drivers to take parallel roads at 40 mph. The agreement also called for closing Jordan Road, either upon completion of the flyover at I-225 and Parker Road (under construction in 1999) or within five years, whichever comes first. Much of this area was in the proposed City of Centennial. Other “road-calming” improvements were identified to keep “cut-through traffic” from going through residential areas, such as a slip ramp off I-225 at DTC Boulevard to allow ingress and egress onto arterial streets (City of Greenwood Village n.d.b.).

Regional growth has contributed to increased travel demand and traffic volumes along Arapahoe Road. According to the 2010 census, Arapahoe County experienced a 17 percent increase in population from 2000 to 2010, and Greenwood Village experienced a 26 percent increase in population during the same time frame. No data is available for the City of Centennial due to its recent incorporation (formed in 2000). The suburban development that occurred in Douglas County, the City of Parker, the town of Castle Rock, and the City of Aurora resulted in a substantial increase in commuter trips to the study area, using limited east-west connections like Arapahoe Road (Arapahoe County 2006a). The rapid growth influenced economic expansion in the study area. TREX widened I-25 and I-225 as part of a multi-modal transportation improvement project. Construction began in 2001 and was completed in 2006. Seventeen miles of highway were widened, spanning up to 5 lanes in each direction at its widest point through DTC. The expansion was built to accommodate 300,000 vehicles per day compared to approximately 200,000 before project construction. The project also included development of the Southeast LRT, which links downtown Denver and DTC. It consists of light rail lines that provide service along the west side of I-25 from Lincoln Avenue to the I-25 and Broadway LRT station, and along the center of I-225 from the I-25/I-225 interchange to Parker Road in Aurora. RTD also added new bus routes, revised some existing routes, and introduced six new call-n-Rides (Metro Denver EDC 2012). As part of the Southeast LRT line, the Arapahoe at Village Center Station was developed at the southwest corner of South Yosemite Street and East Caley Street. This station includes a parking structure to accommodate more than 1,500 vehicles. A pedestrian overpass was constructed to access the LRT platform on the west side of I-25 (Greenwood Village 2011a).

Safety and operational improvements to the Arapahoe Road and I-25 interchange were completed between Yosemite Street and Boston/Clinton Street in 2010. In an effort to accommodate the growing traffic volumes and address safety concerns along Arapahoe Road and I-25, the project added east/west through lane capacity in each direction by reconfiguring the existing I-25 on- and off-ramp intersections. This change resulted in the through lanes being separated from the existing through lanes by the bridge pillars. In addition, the project added a dedicated westbound right turn lane on Arapahoe Road to northbound Yosemite Street; modified the center median to improve the left-turn movement from southbound I-25 to eastbound Arapahoe Road; added a right turn acceleration lane from southbound I-25 to westbound Arapahoe Road; and improved sight distance for pedestrians at various locations within the project limits on Arapahoe Road (Greenwood Village 2011a). The improvements to the transportation system over time have generally been outpaced by the growth in transportation demand, resulting in a general increase in congestion.

3.15.3 Present Actions

Like the entire Denver metropolitan area, the study area is currently emerging from a recession (Greenwood Village 2011a). Although still slow, Colorado's economy gained momentum in late 2010. Employment and consumer spending in Colorado are growing at rates faster than in the nation. Colorado's economy was boosted in 2010 by tourism, robust agricultural markets, and a recovery in the energy industry. Despite signs that the state's economy is expanding, ongoing challenges continue to restrict the recovery. Such challenges may affect small and medium-sized businesses present in the study area. Financial and housing markets continue to work through the imbalances that caused the recession (Colorado Legislative Council 2011).

CDOT recently completed the final phase of the Parker Road/Arapahoe Road interchange improvement project. The grade-separated interchange eliminated the traffic signal on Parker Road, allowing for free-flowing traffic through the intersection, which benefited traffic on Arapahoe Road (CDOT 2011a).

3.15.4 Reasonably Foreseeable Future Actions

Growth is expected to increase into the future, with traffic volumes projected to increase by over 30 percent through 2035 as described in Chapter 1 (DEA 2011a).

A steady increase in population is expected for the Denver region and Arapahoe County from 2010 through 2040, with an average annual increase of 1.3 percent for the region and 1.4 percent for the county (Colorado Department of Local Affairs 2012).

Opportunities for mixed-use and transit-oriented development (TOD) located adjacent to LRT stations along the Southeast Corridor LRT are expected to provide redevelopment opportunities (Greenwood Village 2011a). TOD is a mixed-use residential or commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership. This development is expected to contribute to growth in the study area by approximately 5,300 additional households by 2030 (Arapahoe County 2006a).

Greenwood Village is proposing development of a "Village Center" in the area surrounding the Arapahoe at Village Center LRT Station. Greenwood Village's Arapahoe Commercial District (adjacent to the north side of Arapahoe Road both east and west of I-25, and south of Arapahoe Road east of I-25) is envisioned as a commercial

improvement area that will attract and retain high quality commercial uses. The district will remain auto-oriented, but be more accessible for pedestrians and transit. Greenwood Village plans to provide pedestrian connections to surrounding neighborhoods and between uses within the district. Sidewalks and outdoor spaces will be designed to attract pedestrian activity by separating pedestrian and vehicular access to the extent possible (Greenwood Village 2011a).

Centennial has identified a “Primary Major Activity Center” at the intersection of I-25 and Arapahoe Road, and specifically in the southwest quadrant of the interchange. The interchange is also identified as a gateway to the city. An activity center is a mixed-use area designed to attract a higher level of development than its surroundings, and is typically located adjacent to freeways, mass transportation, or major intersections to encourage revitalization of major corridors into commercial areas. (City of Centennial 2004).

Improvements are being planned by CDOT in conjunction with the Cities of Greenwood Village and Centennial at the Arapahoe Road intersections with Dayton, Havana, Peoria, and Revere Streets, consistent with the recommendations of the Arapahoe Road Corridor PEL study. The improvements are being funded by FASTER funds and should be completed by 2014.

Retail expenditures for the area are expected to increase, and numerous new jobs are anticipated through 2030 (Arapahoe County 2006b). As the recession recedes, smaller retail centers and restaurants are anticipated to develop on parcels along Arapahoe Road and adjacent thoroughfares, with the existing Arapahoe Station shopping center meeting increased future shopping demand. Retail expenditures for the area are expected to increase from \$629,545 between 2005 and 2015 to \$1,264,775 between 2015 and 2030 (Arapahoe County 2006b). In the northeast quadrant of the study area, employment is expected to increase by approximately 700 jobs by 2035; an increase of approximately 300 jobs is expected in the southeast quadrant; an increase of approximately 3,500 jobs is expected in the southwest quadrant; and an increase of approximately 400 jobs is expected in the northwest quadrant (DEA 2011a).

Future plans for small parks in the study area and implementation of planning goals for parks and recreation are identified by Greenwood Village and the City of Centennial. Greenwood Village’s Comprehensive Plan (2011) identifies three small future parks/open space areas and pedestrian and bicycle objectives in the Arapahoe Road Commercial District within the study area; none currently exist. The City of Centennial’s Comprehensive Plan (2004) does not identify future development of specific parks, but includes a goal to “obtain and preserve parks, trails, open space, and recreation opportunities” (Centennial 2004).

3.15.5 Environmental Consequences of the Action Alternative

The impacts from the other actions listed above when combined with the actions expected under the Action Alternative are described for each topic area, below.

3.15.5.1 Transportation

3.15.5.1.1 Traffic Capacity and Operations

The TREX project resulted in beneficial impacts to traffic capacity and operations from widened lanes and new transit services. Current projects along Arapahoe Road are expected to beneficially affect traffic capacity and operations. These projects will

continue to improve mobility and relieve congestion. Future plans for TOD in the area are expected to slightly alleviate congestion by concentrating live and work areas, and encourage transit use.

Surrounding regional growth has contributed to increased travel demand and traffic volumes along Arapahoe Road and resulted in a substantial increase in commuter trips to the study area. Growth is projected to continue into the future, with a 30 percent projected increase in traffic volumes. Past and future projected growth has had, and is expected to have, negative impacts on traffic capacity and operations.

These impacts would be combined with the positive impacts of the Action Alternative, under which traffic capacity and traffic operations would improve. Cumulative impacts would be particularly positive regarding the other projects along Arapahoe Road, as the Action Alternative would enhance their overall effectiveness.

3.15.5.1.2 Safety

Recent improvements to the Arapahoe Road and I-25 interchange resulted in positive impacts to safety. Under the Action Alternative, congestion-related crash frequency is expected to decrease. The combined effect of these safety improvements would result in a positive cumulative impact.

3.15.5.1.3 Transit Operations

Improved traffic flow expected under the Action Alternative would improve transit operations. This impact would be added to the negative effects of growth and positive effects of other past and ongoing transportation projects in the area. The resulting cumulative impacts would be primarily positive.

3.15.5.1.4 Pedestrian and Bicycle Operations

Greenwood Village's plans to provide more pedestrian connections and separate pedestrian and vehicular activity would offer a slight beneficial effect in the context of the study area. The Action Alternative would provide benefits, but would also be slight in the context of the study area, where pedestrian and bicycle operations are limited. Cumulative impacts would be positive but negligible.

3.15.5.2 Land Use

Past regional growth has contributed to increased travel demand and traffic volumes along Arapahoe Road, leading to rapid commercial development in the area. More commercial and high-density residential growth is expected in the future. This development is expected to be primarily infill, and would not greatly affect undeveloped land. When these actions are combined with the negligible impacts to land use expected under the Action Alternative, cumulative impacts to land use would also be negligible.

3.15.5.3 Socioeconomics

3.15.5.3.1 Demographic and Neighborhood Characteristics

Surrounding regional growth has contributed to increased travel demand and traffic volumes along Arapahoe Road and resulted in a substantial increase in commuter trips to the study area, using limited east-west connections like Arapahoe Road (Arapahoe County 2006a). The resulting growth likely influenced neighborhood development patterns, demographics, and housing values, with both beneficial and negative effects.

Growth resulting from TOD is expected to occur adjacent to existing high density residential neighborhoods, such as Greenwood Village's Corridor Planning Area. This development may also increase property values, which would benefit neighborhood residents. Anticipated future growth and economic changes could also influence area demographics and neighborhood characteristics. However, because most land within the study area is already developed, such changes would be slight.

Decreased congestion and improved mobility resulting from the Action Alternative would combine with effects of past growth and the benefits of high-density TOD, slightly improving the quality of life in adjacent neighborhoods. Population growth in the regional area will continue, however transportation improvements in the study area will not affect this growth greatly. Improvements may expedite the growth but likely not induce additional population growth. Eased access to the area along with TOD may increase property values in surrounding neighborhoods. Slight beneficial cumulative impacts could result from the proposed improvements.

3.15.5.3.2 Economic Development

Rapid growth has influenced economic expansion in the study area, such as the development of Centennial Airport and location of business ventures providing employment opportunities. Opportunities for mixed-use and TOD are expected to provide future redevelopment opportunities (Greenwood Village 2011a). As the recession recedes, smaller retail centers and restaurants are anticipated to develop on parcels along Arapahoe Road and adjacent thoroughfares, with the existing Arapahoe Station shopping center meeting increased future shopping demand. Retail expenditures for the area are expected to increase overall (Arapahoe County 2006b).

Greenwood Village's plans for a "Village Center" in the area surrounding the Arapahoe LRT Station and Centennial's "Primary Major Activity Center" at the intersection of I-25 and Arapahoe Road will enhance economic development in the study area.

Planned economic development in the area coupled with the improved access and mobility derived from this alternative would result in a beneficial cumulative impact. Improving access to the retail and commercial development would have beneficial impacts. Retail expenditures for the area are expected to increase, and numerous new jobs are anticipated through 2030 (Arapahoe County 2006b). The potential retail sales and employment benefits from the Action Alternative would be combined with these projections, with beneficial cumulative impacts. The Action Alternative would also enhance the ability of Greenwood Village to attract and retain high quality commercial uses to its proposed Village Center and the Arapahoe Commercial District, which will be primarily auto-oriented. Similarly, improving access under the Action Alternative would enhance the location's function as a gateway to Centennial and would support revitalization of commercial areas where the Primary Major Activity Center is located. Therefore, the combination of the Action Alternative with these other actions would result in beneficial cumulative impacts.

3.15.5.3.3 Community Resources

Anticipated growth and increased travel demand may increase demand for emergency response services. However, positive effects of the Action Alternative on emergency response time and eased access for providers would be anticipated. This growth could also place pressure on property values and the need for community services. Combined with past, present, and reasonably foreseeable actions, the proposed improvements would have a negligible cumulative effect on community resources in the study area.

3.15.5.3.4 *Community Cohesion and Connections*

Approximately 5,300 additional households are expected as a result of TOD by 2030. TOD is typically high density and is characterized by a pedestrian-oriented environment that allows people to live, work, shop, and play in places accessible by transit. TOD helps discourage automobile dependency (RTD 2012). High density developments would enhance community cohesion and connections by locating people, goods, services, and possible employment opportunities in close proximity to each other.

Although Greenwood Village anticipates that its Arapahoe Commercial District will generally remain auto-oriented, it will be more accessible for pedestrians and transit. Greenwood Village also plans to provide pedestrian connections, and Centennial encourages TOD and pedestrian and bike facilities at future activity centers, which will also enhance community cohesion and connections.

The Action Alternative would expedite the beneficial effects of future TOD and high density developments, as well as other planned accessibility improvements by improving access to these areas. The resulting cumulative impacts would be beneficial.

3.15.5.4 *Visual*

Rapid high-density development and growth have altered the historic setting of the study area. Expedited TOD and planned development as a result of the Action Alternative may result in more visual cohesiveness — a slight beneficial effect. Alternately, development of small retail centers and restaurants along Arapahoe Road and adjacent thoroughfares would likely further decrease intactness and unity, decreasing overall visual quality for viewers *from* the road and *toward* the road to a slight degree. Local planning and development policies may alter the visual setting more than the planned improvements. The past, present, and reasonably foreseeable actions combined with the incremental effects of the Action Alternative, would not cause cumulative impacts to visual resources in the study area.

3.15.5.5 *Noise*

Traffic noise has increased in the study area as development has progressed through the years. Anticipated growth will continue to create a travel demand and increased levels of noise may occur in the study area due to the projected increase in traffic. Overall, the incremental impacts to noise associated with the Action Alternative are not expected to result in cumulative impacts because of the existing transportation infrastructure in the area and the localized nature of noise impacts.

3.15.5.6 *Energy*

Past actions in the region and study area have had both negative and beneficial effects on energy use. The substantial growth that occurred in the past increased the number of motorists driving on roads and highways, resulting in increased energy consumption. However, this may be offset by increased fuel efficiency being developed in association with newer vehicles. The Southeast Corridor Expansion Project (completed in 2006) eased some of the highway congestion on I-25, and development of the Southeast LRT line reduced congestion and associated petroleum fuel consumption by providing an alternative transportation option. Improvements to Arapahoe Road within the study area and at the Parker Road interchange are also expected to ease congestion by providing more free-flowing traffic conditions. However, projected future growth in the area will

increase congestion, decreasing fuel efficiency and likely negating improvements gained by the recent changes to Arapahoe Road.

TOD is encouraged in the study area, which will help reduce congestion and fuel consumption. Conversely, development of Greenwood Village's "Village Center" and Centennial's "Primary Major Activity Center" will draw more automobile traffic to those locations. If the economic recession recedes, employment and retail spending will increase, also increasing traffic in the study area.

The Action Alternative is designed to address the increased traffic volumes expected by 2035, and would also help alleviate current congestion conditions that have resulted from past growth. When combined with other recent improvements to Arapahoe Road, the Action Alternative would further enhance traffic flow along the corridor, thereby decreasing the amount of start and stop activity that results from congestion and increases energy use. The Action Alternative would also help facilitate increased traffic flow to future destinations envisioned by Greenwood Village and the City of Centennial, as well as to local shopping and employment areas as the economy recovers. For these reasons, cumulative effects to energy would be negligible.

3.15.5.7 Air Quality

Air quality has been an issue of concern in the Denver metropolitan region, including the study area, in the past and presently. Thirty years ago, the Denver metropolitan area was a nonattainment area for three NAAQS. With improvements in vehicle emissions and reductions in other air emissions, air quality has improved over time for the metro area to the point that compliance with all of the NAAQS was attained, even with large increases in vehicle travel. The Denver area has since been redesignated as nonattainment due to a recent ozone NAAQS. Because travel demand has exceeded the capacity of the interchange, the congestion has continued to worsen. Recent transportation improvements will help to lessen congestion and reduce the time vehicles idle in traffic, thereby lessening emissions. However, in the future, while emissions from motor vehicles are expected to decline due to new regulations and technologies, the growth in miles travelled may result in an overall increase in the emissions.

The issue of global climate change is an important national and global concern that is being addressed in several ways by the federal government. The transportation sector is the second largest source of total greenhouse gases (GHGs) in the U.S., and the greatest source of carbon dioxide (CO₂) emissions – the predominant GHG. In 2004, the transportation sector was responsible for 31 percent of all U.S. CO₂ emissions. The principal anthropogenic (human-made) source of carbon emissions is the combustion of fossil fuels, which account for approximately 80 percent of anthropogenic emissions of carbon worldwide. Almost all (98 percent) of transportation-sector emissions result from the consumption of petroleum products such as gasoline, diesel fuel, and aviation fuel.

Recognizing this concern, FHWA is working nationally with other modal administrations through the DOT Center for Climate Change and Environmental Forecasting to develop strategies to reduce transportation's contribution to greenhouse gases - particularly CO₂ emissions – and to assess the risks to transportation systems and services from climate changes.

At the state level, there are also several programs underway in Colorado to address transportation GHGs. The Governor's Climate Action Plan, adopted in November 2007, includes measures to adopt vehicle CO₂ emissions standards and to reduce vehicle travel through transit, flex time, telecommuting, ridesharing, and broadband communications. CDOT issued a policy Directive on Air Quality in May 2009. This Policy Directive was

developed with input from a number of agencies, including the CDPHE, the U.S. Environmental Protection Agency (EPA), FHWA, the Federal Transit Administration (FTA), RTD, the Denver Regional Air Quality Council (RAQC). This Policy Directive addresses unregulated mobile source air toxics (MSAT) and GHG produced from Colorado's state highways, interstates, and construction activities.

As a part of CDOT's commitment to addressing MSATs and GHGs, some of CDOT's program-wide activities include:

1. Continue researching pavement durability opportunities with the goal of reducing the frequency of resurfacing and/or reconstruction projects.
2. Developing air quality educational materials, specific to transportation issues, for citizens, elected officials, and schools.
3. Offering outreach to communities to integrate land use and transportation decisions to reduce growth in VMT, such as smart growth techniques, buffer zones, TOD, walkable communities, access management plans, etc.
4. Promoting effective, sustained idling reduction programs for schools, commercial fleets and communities throughout the state.
5. Expanding Transportation Demand Management (TDM) efforts statewide to better utilize the existing transportation mobility network.
6. Continuing to diversify the CDOT fleet by retrofitting diesel vehicles, specifying the types of vehicles and equipment contractors may use, purchasing low-emission vehicles, such as hybrids, and purchasing cleaner burning fuels through bidding incentives where feasible. Incentivizing is the likely vehicle for this.
7. Funding truck parking electrification (note: mostly via exploring external grant opportunities)
8. Researching additional ways to improve freight movement and efficiency statewide.
9. Developing a low- volatile organic compound (VOC) emitting tree landscaping specification.

Because climate change is a global issue, and the emissions changes due to project alternatives are very small compared to global totals, the GHG emissions associated with the alternatives were not calculated. Because GHGs are directly related to energy use, the changes in GHG emissions would be similar to the changes in energy consumption presented in Section 3.10 of this EA. The relationship of current and projected Colorado highway emissions to total global CO₂ emissions is presented in the table below. Colorado highway emissions are expected to increase by 4.7 percent between now and 2035. The benefits of the fuel economy and renewable fuels programs in the 2007 Energy Bill are offset by growth in VMT; the draft 2035 statewide transportation plan predicts that Colorado VMT will double between 2000 and 2035. This table also illustrates the size of the project corridor relative to total Colorado travel activity.

Table 22. Current and Projected Colorado Highway CO₂ Emissions Compared to Global CO₂ Emissions

Global CO ₂ Emissions, 2005, million metric tons (MMT) ¹	Colorado Highway CO ₂ Emissions, 2005, MMT ²	Projected Colorado 2035 Highway CO ₂ Emissions, MMT ²	Colorado Highway Emissions, % of Global Total (2005) ²	Project Corridor VMT, % of Statewide VMT (2035) ³
27,700	29.9	31.3	0.108%	0.05%

¹ EIA, International Energy Outlook 2007

² Calculated by FHWA Resource Center

³ Statewide VMT was 47.9 billion in 2005, based on the Colorado Department of Transportation's *Fact Book 2006-2007, Transportation Facts (CDOT 2007)*

Cumulative effects to air quality would be negligible as the difference in emissions at a local level generated by the Action Alternative, compared to changes at the regional level due to growth and increased travel demand with or without the project, would be inconsequential.

3.15.6 Mitigation

No measures to minimize cumulative effects beyond those incorporated in the project design are necessary.

3.16 Summary of Impacts and Mitigation

Federal NEPA regulations direct agencies to concentrate NEPA documents on issues that are truly relevant to the action in question, and to narrow the scope of the NEPA process to study only those environmental issues. **Table 23** summarizes the impacts that are expected to the resources that meet this requirement. Resources that were determined to be outside the study area or not subject to significant impacts were eliminated from detailed analysis.

Table 23. Summary of Impacts and Mitigation

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Transportation			
Traffic Capacity and Operations	Negative direct impacts would occur to traffic operations within the study area as congestion increases. Negative indirect impacts would occur along roadways outside the study area from diverted traffic avoiding the I-25/Arapahoe Road interchange area.	Positive direct impacts would occur as traffic operations improve and traffic congestion decreases surrounding the I-25/Arapahoe Road interchange complex and throughout the project area. The Action Alternative would have a negative direct impact to traffic operations during construction through the I-25/Arapahoe Road interchange complex and throughout the study area. Both regional and local traffic traveling through the interchange and along mainline I-25 would experience some delays during construction.	Mitigation measures have been designed into the Action Alternative. Attention was given to shifting lane alignments to avoid residential property acquisition, realigning the frontage road to minimize business impacts, and construction phases to maintain business access during construction A minimum of two through lanes will be maintained in each direction along Arapahoe Road during construction, with the addition of turn lanes at various locations. Temporary business access wayfinding signage will be utilized to help mitigate impacts during times of construction when business access would be limited or closed.
Safety	Negative direct impacts would occur as congestion increases, resulting in increased crash frequency. Slight negative indirect impacts would occur to safety outside the study area from diverted traffic avoiding the I-25/Arapahoe Road interchange area.	Positive direct impacts would occur as crashes are anticipated to decrease along Arapahoe Road and at intersections within the vicinity of the interchange.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Transit Operations	Negative direct impacts would potentially occur as bus travel times would increase along Arapahoe Road to the west and east of the interchange due to congestion. Slightly negative indirect impacts to bus operations outside the study area from diverted traffic and increased congestion would occur. Light rail operations would not be impacted. Positive indirect impacts would potentially occur from individuals using alternative transportation as a result of increased congestion.	Positive direct impacts would occur as bus operations along Arapahoe Road to the west and east of the interchange would benefit from improved traffic flow through the corridor. Light rail operations would not be impacted. Improved timeliness of bus service would facilitate timely transfers between buses and light rail transit (LRT).	Mitigation measures have been designed into the Action Alternative. This includes traffic signal timing optimization at the Arapahoe/Yosemite and Arapahoe/Boston/Clinton intersections that serve buses traveling to and from timed transfers with the Southeast Corridor LRT at the Arapahoe at Village Center LRT station.
Pedestrian and Bicycle Facilities	Negative direct impacts would occur to pedestrian and bicycle operations and safety due to increased congestion. Slight negative indirect impacts would occur outside the study area from diverted traffic avoiding the I-25 / Arapahoe Road interchange area. Positive indirect impacts would potentially occur from individuals using pedestrian and bicycle facilities to avoid the traffic congestion.	Slight positive direct impacts would occur from widened sidewalks and improved traffic operations.	During final design, consideration will be given to sidewalks widened to 10 feet and detached, where practical.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Land Use	Existing land uses would remain the same, with no direct or indirect impacts.	There would be improved accessibility to the commercial land uses in the northeast quadrant due to the realigned frontage road. Slight impacts may be associated with the acquisition of ROW for the improvements; however, the area is highly developed and these would not measurably affect land use.	The Action Alternative is consistent with the local plans described under Local Plans; no mitigation is required. Mitigation for ROW acquisitions and displacements are addressed in the Right-of-Way Section.
Socioeconomic Conditions			
Demographic and Neighborhood Characteristics	No direct or indirect impacts.	The study area may become more easily accessible, but no measurable change expected.	No mitigation required.
Economic Development	Negligible direct and indirect impacts would occur as mobility between employment centers continues to degrade.	Slight beneficial impacts would occur due to improved mobility to reach area businesses. Temporary beneficial impacts would occur as construction workers patronize study area establishments. However, construction activities may temporarily impede access to local establishments.	Project construction would be implemented in phases or other methods would be employed to minimize impeded access to businesses, such as timing construction activities to avoid peak periods, and providing temporary business access wayfinding signing during phases of construction.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Community Resources	Negative impacts would occur as congestion increases, diminishing access to community resources. Congestion would continue to increase emergency service response. Slight beneficial impacts could occur if more individuals use alternative transportation as a result of increased congestion.	Beneficial impacts from improved access to and within communities would occur. Emergency vehicle response would improve, lessening the amount of time required to reach emergency sites.	No mitigation needed.
Community Cohesion and Connections	Slight negative impacts from increased congestion due to impeded travel across the interstate would reduce community cohesion.	Slight beneficial impacts from improved access to community facilities for motorists would occur. Direct benefits would occur in some areas to benefit emergency response time.	No mitigation needed.
Environmental Justice	No disproportionate and adverse impacts to minority or low-income populations would occur.	Overall impacts of the Action Alternative are expected to be beneficial. Negative impacts would be negligible and would affect all populations approximately equally. Therefore, no disproportionate and adverse impacts are expected to minority and low-income populations.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Right-of-Way	No direct or indirect impacts anticipated.	<p>One business would be impacted, resulting in a full acquisition of one commercial business northeast of the interchange. Partial acquisition of three other commercial properties in the same shopping center would be required.</p> <p>Other impacts would include the partial acquisition of commercial parcels located northeast of the interchange, along the northern perimeter of Arapahoe Road between Greenwood Plaza Boulevard and South Yosemite Street and between Clinton Street and Clinton Court, and along the western edge of South Yosemite south of Arapahoe Road.</p> <p>A portion of a commercial property could be acquired for a water quality pond, although selection of this site would not be determined until final design.</p> <p>No residences would be displaced. There would be no partial or full acquisition of any residential property.</p> <p>Temporary construction impacts would occur to adjoining commercial and residential property from road construction activities.</p>	<p>Acquisition:</p> <p>For any person(s) whose real property interests may be impacted by this project, the acquisition of those property interests will comply fully with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, (Uniform Act). The Uniform Act is a federally mandated program that applies to all acquisitions of real property or displacements of persons resulting from federal or federally assisted programs or projects. It was created to provide for and insure the fair and equitable treatment of all such persons. To further ensure that the provisions contained within this act are applied "uniformly," CDOT requires Uniform Act compliance on any project for which it has oversight responsibility regardless of the funding source. Additionally, the Fifth Amendment of the United States Constitution provides that private property may not be taken for a public use without payment of "just compensation." All impacted owners will be provided notification of the acquiring agency's intent to acquire an interest in their property including a written offer letter of just compensation specifically describing those property interests. A Right of Way Specialist will be assigned to each property owner to assist them with this process.</p>

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
			<p>Relocations:</p> <p>In certain situations, it may also be necessary to acquire improvements that are located within a proposed acquisition parcel. In those instances where the improvements are occupied, it becomes necessary to “relocate” those individuals from the subject property (residential or business) to a replacement site. The Uniform Act provides for numerous benefits to these individuals to assist them both financially and with advisory services related to relocating their residence or business operation. Although the benefits available under the Uniform Act are far too numerous and complex to discuss in detail in this document, they are available to both owner occupants and tenants of either residential or business properties. In some situations, only personal property must be moved from the real property and this is also covered under the relocation program. As soon as feasible, any person scheduled to be displaced shall be furnished with a general written description of the displacing agency’s relocation program which provides at a minimum, detailed information related to eligibility requirements, advisory services and assistance, payments, and the appeal process. It shall also provide notification that the displaced person(s) will not be required to move without at least 90 days advance written notice. For residential relocatees, this notice cannot</p>

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			be provided until a written offer to acquire the subject property has been presented, and at least one comparable replacement dwelling has been made available. Relocation benefits will be provided to all eligible persons regardless of race, color, religion, sex, or national origin. Benefits under the Act, to which each eligible owner or tenant may be entitled, will be determined on an individual basis and explained to them in detail by an assigned Right of Way Specialist.
Utilities	No direct or indirect impacts anticipated.	Several utilities, including above ground electric lines, cable television lines, natural gas valves, manholes and sewer lines, fire hydrants and water lines, and fiber optic lines would need to be relocated.	During final design, utilities would be avoided through design modifications or, where conflicts cannot be avoided, utilities will be relocated. Utility relocations will be coordinated with the local jurisdictions/CDOT and private utility providers prior to construction.
Visual	No direct or indirect impacts anticipated.	No measurable direct or indirect impacts anticipated.	No mitigation needed.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Noise	Direct impacts to 16 residential properties and 2 commercial properties would occur from traffic noise. No noise abatement measures would be implemented.	Direct impacts to 16 residential properties and 2 commercial properties would occur from traffic noise (same as the No Action Alternative). Implementation of noise abatement would provide a noise-reduction benefit to all 16 impacted homes and 2 commercial properties and reduce estimated noise levels below the CDOT Noise Abatement Criteria (NAC) for 14 of the homes. Temporary impacts would occur to adjoining properties from road construction activities.	A barrier along Arapahoe Road approximately 8 feet high by 1,060 feet long and a barrier along Yosemite Street approximately 8-11 feet high by 500 feet long are being recommended preliminarily for the Action Alternative. A pre-construction survey of the impacted residents will be conducted to garner input on abatement actions. The final decision on the noise barriers will be made during final design through the public involvement process. Mitigation for noise from temporary construction impacts includes: use of barriers, limiting work to certain hours of the day, re-routing traffic away from residential areas and using well-maintained equipment.
Energy	Direct negative impacts would occur as congestion increases, which reduces fuel economy. Indirect benefits to air quality may occur if more people start using transit as a result of increased congestion.	Benefits would occur as congestion decreases and fuel economy is improved. Indirect impacts could occur if mass transit riders switch back to driving cars. This could be offset by more transit riders due to enhanced accessibility to transit. Energy use would increase temporarily during construction.	For impacts associated with construction: The contractor will conduct activities when feasible during periods of reduced traffic volumes to reduce idling vehicles. The contractor will keep equipment well-maintained and will use cleaner fuels, when possible and encourage carpooling to and from the site. Staging areas will be located as close to the project area as possible.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Air Quality	None. Future emissions from vehicles would be minimized through federal regulations (e.g., emission standards) and regional controls (e.g., street sanding regulations).	None. Future emissions from vehicles would be minimized through federal regulations (e.g., emission standards) and regional controls (e.g., street sanding regulations). Overall air pollution would be lower than the No Action Alternative due to lower overall congestion. Indirect impacts from construction activities may be sources of temporary air quality impacts from fugitive dust or equipment emissions.	The construction contractor will prepare and implement a fugitive dust control plan. The contractor will plan to minimize idling and maintain equipment. Particular attention will be given to minimizing total emissions near sensitive areas. The contractor will keep its maintenance equipment well-maintained and will use cleaner fuels when possible. Staging areas will be located as close to the project area as possible.
Hazardous Materials	No direct or indirect impacts anticipated.	Nine sites with potential or recognized environmental conditions may be affected directly through property acquisition or indirectly by construction activities.	Protective measures (including development of a Materials Management Plan or Safety Plan, if required) will be taken before, during, and after construction to minimize the risk of encountering hazardous materials, see Appendix A.
Water Resources and Water Quality	No direct or indirect impacts anticipated.	Direct, temporary, and construction impacts would occur from ground disturbance and an increase in impervious surfaces. Benefits would occur due to required water quality improvements. The minor drainage basin would have a slightly higher percent of imperviousness, and peak flows would increase. Added paved surfaces would not measurably alter the water table or groundwater quality.	Mitigation will include Best Management Practices (BMPs) during construction. A detailed erosion control plan will be developed. Mitigation for the drainage infrastructure may be required. Municipal Separate Storm Sewer System (MS4) permits require that permanent water quality facilities, including ponds, be installed to treat the runoff. A detailed analysis of the existing drainage system will be performed. Dewatering permits will be obtained if necessary.

	No Action Alternative	Action Alternative	Mitigation Measures for the Action Alternative
Impact Topic			
Cultural, Historic, and Archaeological	No direct or indirect impacts anticipated.	No direct or indirect impacts are anticipated.	No mitigation necessary. At the time of final design/construction, any resources that have recently become 50 years or older will need Section 106 consultations if there will be any permanent or temporary easements or full or partial property acquisitions.
Biological Resources	No direct or indirect impacts anticipated.	No known direct or indirect impacts are anticipated. Soils would be disturbed during construction but detailed geotechnical analysis of the surrounding subsurface will be required during the preliminary/final design.	If construction is to occur during the breeding season, an additional nest survey will be conducted. Existing nests will be removed prior to the nesting season. No construction work can occur that would impact the nests, if occupied nests are observed during construction.
Paleontological Resources	No direct or indirect impacts are anticipated.	No direct or indirect impacts are anticipated.	To ensure that important paleontological remains are not destroyed during construction, a qualified, state-permitted paleontologist will examine the final design plans. If any subsurface bones or other potential fossils are found anywhere within the study area during construction, a qualified, state-permitted paleontologist will assess their significance and make further recommendation.
Soils and Geology	No direct or indirect impacts are anticipated.	No direct or indirect impacts are anticipated.	Techniques would be applied to improve soil or ground suitability for roadway construction during project design. Analysis will be used to establish the design of the roadway and structures and to establish erosion control procedures.

4

Chapter 4: Agency/Public Involvement

This chapter describes the communication and coordination that has occurred with stakeholders during the EA process. Coordination with stakeholders focused on gathering input on interchange area issues and alternatives, as well as proactive, open communication with potentially affected property owners and agency representatives.

4.1 Coordination Plan

A *Coordination Plan* (DEA 2011c) was developed to facilitate and document interaction with the public and with local, regional, state, and federal agencies throughout the EA process, and to inform the public and agencies of how the coordination will be accomplished. A coordination plan is only required for an EIS but can be used for any project. The plan was intended to communicate with the public and agencies, document issues, and identify and incorporate any issues into the planning and decision making process.

4.2 Agency Coordination

Local, regional, state, and federal agencies were engaged early and throughout the study process. Under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), there are several formally designated roles for agencies within the NEPA process, including the lead and joint lead agencies, cooperating agencies and participating agencies. Agencies that acted in the capacity of a particular role are listed in **Table 24** along with their primary responsibilities.

Table 24. Summary of Agency Roles and Responsibilities

Agency Name	Responsibilities
Role: Joint Lead Agency	
Federal Highway Administration Colorado Department of Transportation	Oversight of NEPA process; participation in EA alternatives process; review of EA document and concept design deliverables.
Role: Project Sponsor	
Arapahoe County	Coordinate public and agency process; coordinate with local project funding partners. Manage EA process, including public and agency coordination.
Role: Cooperating Agencies	
City of Centennial	Participation in EA alternative analysis; review of EA document; participate in public and agency coordination.
City of Greenwood Village	Participation in EA alternative analysis; review of EA document; participate in public and agency coordination.

Agency Name	Responsibilities
Other Interested Agencies and Organizations	
DRCOG	Input, review and approval of travel forecasting process and alternative analysis; review air quality conformity findings.
Regional Transportation District	Coordination regarding Southeast LRT Line interface.
Environmental Protection Agency	Review and comment on EA.
Colorado Parks and Wildlife (CPW)	Review and comment on EA for wildlife issues.
CDPHE	Review and comment on EA for hazardous materials, air quality and water resources issues.
U.S. Army Corps of Engineers (USCOE)	Review and comment on EA for waters of the U.S. and wetlands.
Colorado State Historic Preservation Officer	Review and comment on EA for findings relating to historic resources; coordinate with CDOT on Section 106 consultation if required.

4.2.1 Agency Coordination Activities

The first agency scoping meeting was held on January 19, 2010 with FHWA, CDOT, and Arapahoe County to present study methodologies and identify any issues of concern to the agencies. Additional resource agency coordination occurred through individual communications to identify areas of concern. A letter was sent to resource agencies in May 2010 defining the project and inviting them to review the range of alternatives, screening criteria, and the environmental resources located in the project area. Illustrations of the alternatives being considered were included in the transmittal. In some cases, the resource agency representatives did not anticipate issues, so no further coordination was required.

The resource agencies identified issues of concern, which are discussed in Section 4.2.2. Four follow-up meetings were scheduled to discuss specific concerns.

A second agency scoping meeting was held on May 24, 2010 with CDOT regarding proposed traffic noise analysis methods. A third meeting was held on May 25, 2010 with Air Pollution Control Division (APCD), FHWA, CDOT, and DRCOG regarding proposed air quality analysis methods. A fourth meeting was held on June 2, 2010 with Arapahoe County and City of Centennial representatives to discuss Walnut Hills neighborhood traffic concerns. A fifth agency scoping meeting was held on October 14, 2011 with FHWA, CDOT, and Arapahoe County to discuss the environmental resource evaluation and provide project status updates to agency staff.

To foster ongoing communication with agencies, an Executive Committee (EC) and a Technical Committee (TC) were formed. The EC was composed of elected or appointed officials from Arapahoe County, the City of Centennial, the City of Greenwood Village, CDOT, and FHWA. The TC included technical staff from CDOT, FHWA, DRCOG, the City of Greenwood Village, Arapahoe County, and the City of Centennial. The EC and TC members reviewed key findings and provided input on project purpose and need, the range of reasonable alternatives, and evaluation and identification of the Action Alternative. Meetings were held with agency stakeholders throughout the study regarding specific issues and to provide status updates on the project.

Table 25 lists the agency coordination activities that occurred with local, regional, state, and federal agencies.

Table 25. Agency Coordination Activities

Activity	Date
FHWA, CDOT, Arapahoe County agency scoping meeting	1/19/2010
Centennial City Council Study Session presentation (by City staff)	2/8/2010
Joint EC/TC meeting #1	3/25/2010
Project introduction/meeting request letter sent to resource agencies	5/2010
TC meeting #2	5/13/2010
CDOT agency scoping meeting – noise	5/24/2010
APCD, FHWA, CDOT, DRCOG agency scoping meeting – air quality	5/25/2010
Arapahoe County, Centennial agency scoping meeting – Walnut Hills traffic	6/2/2010
EC meeting #2	6/10/2010
Greenwood Village coordination	6/21/2010
Centennial coordination	6/30/2010
RTD, CDOT coordination	7/15/2010
Arapahoe County, Centennial coordination	12/7/2010
CDOT, Arapahoe County, Centennial, Greenwood Village coordination	12/9/2010
CDOT, Arapahoe County, Centennial coordination	1/11/2011
CDOT, Arapahoe County, Centennial, Greenwood Village coordination	3/3/2011
Arapahoe County, Centennial coordination	3/29/2011
FHWA, CDOT, Arapahoe County, Centennial, Greenwood Village coordination	7/6/2011
Centennial coordination	7/13/2011
TC meeting #3	8/4/2011
EC meeting #3	8/18/2011
Arapahoe County, Greenwood Village coordination	8/31/2011
FHWA, CDOT, Arapahoe County agency scoping meeting	10/14/2011
FHWA, CDOT, Arapahoe County, Centennial, Greenwood Village coordination	11/15/2011
CDOT, Greenwood Village coordination	1/10/2012
Greenwood Village City Council Study Session presentation	1/23/2012
TC meeting #4	2/2/2012
EC meeting #4	2/15/2012
Greenwood Village coordination	4/12/2012
TC meeting #5	8/14/2012
EC meeting #5	9/7/2012

4.2.2 Key Issues Raised

This section summarizes the key issues raised during agency scoping and the actions taken to address them.

Issue: The City of Centennial expressed concerns that the initial interchange alternatives did not sufficiently explore all reasonable and feasible options.

Action: Over 30 alternatives were evaluated through a three level evaluation and screening process that was fully documented in the *Final Interchange and Supplemental I-25 Crossing Alternatives Technical Report* (DEA 2011b).

Issue: FHWA stated concerns about lack of programmed funding in the *DRCOG 2035 Fiscally-Constrained RTP* for the improvements, since a decision document can only be issued if the long-range RTP identifies funds to pay for the proposed improvements.

Action: A financial plan identifying substantial or full funding for construction of recommended improvements is being developed as part of this study. The intent is to clear all project recommendations through the EA, but implement improvements in phases as funding becomes available.

Issue: The perception of cut-through traffic in the Walnut Hills neighborhood (both existing and potential resulting from proposed improvements) should be investigated.

Action: The *Walnut Hills Neighborhood Traffic Study* (DEA 2011d) was completed and findings were taken into consideration during interchange alternatives evaluation.

Issue: The City of Centennial will need to issue a 1041 Permit for project components to be constructed within the City. The City of Centennial's 1041 Regulations, authorized by the State of Colorado, are meant to facilitate identification, designation, and administration of matters of state interest consistent with the home rule power. The City of Centennial's 1041 Regulation calls for a 55 dBA average noise level or less for residential areas. This would be substantially lower than what exists today and this low a noise threshold cannot be achieved in this area.

Action: Securing the 1041 permit was listed as a necessary step in this EA document. The City of Centennial plans to note that achieving the 55 dBA noise threshold is technically infeasible, therefore a variance to the 1041 Regulation will need to be granted.

4.3 Public Involvement

Public involvement efforts for this EA built upon the extensive public coordination that occurred during the Arapahoe Road Corridor Study. Public involvement activities during the EA were extensive and informed members of the community about the work previously completed and newly developed alternatives and analysis, as well as gathering public feedback during each step of the study. A proactive approach to information distribution was taken. Specific outreach and involvement efforts are summarized below. Stakeholder considerations identified during this process were used to screen, evaluate, and recommend a solution.

4.3.1 Public Meetings

Two public open house meetings have been conducted to date to obtain input from the community, including one public scoping meeting at the start of the EA process to obtain public input and a second meeting to review the results of the alternatives analysis and screening. An additional public meeting is planned when the EA is released for public review. The public meetings were well attended, with approximately 230 people

attending the first meeting and over 150 people attending the second. Public meeting summary documents were completed following each public meeting.

Individual and small group meetings were also held throughout the project with a wide variety of stakeholders. These are listed in **Table 26**.

Table 26. Public Stakeholder Meetings

Activity	Date
Brown Development stakeholder meeting	1/22/2010
Walnut Hills Civic Association annual meeting	3/25/2010
Public open house meeting #1	4/15/2010
Business stakeholder focus group	4/20/2010
Emergency provider focus group	5/24/2010
Sleep Inn stakeholder meeting	5/26/2010
Metro district/chamber of commerce/business focus group	5/27/2010
Walnut Hills neighborhood traffic concerns stakeholder meeting	6/7/2010
Bicycle/pedestrian focus group	6/7/2010
Walnut Hills resident meeting	6/8/2010
PRT Consulting meeting	11/2/2010
Walnut Hills Civic Association annual meeting	3/10/2011
Hunters Hill neighborhood Board meeting	6/9/2011
Public open house meeting #2	9/8/2011
Pat's Cheesesteak business owner meeting	9/20/2011
Former Bennigan's property owner meeting	9/28/2011
Motel 6 property and business owner meeting	9/29/2011
Conoco property and business owner meeting	10/11/2011
LaQuinta property owner meeting	10/11/2011
McDonald's property and business owner meeting	10/17/2011
Suncor property owner meeting	11/15/2011
Taco Bell property and business owner meeting	11/17/2011
Conoco property and business owner meeting	2/1/2012
FirstBank property and business owner meeting	3/8/2012
Northeast quadrant business focus group	4/17/2012
Pat's Cheesesteak business owner meeting	5/29/2012

4.3.2 Public Outreach Efforts

In addition to meetings, many other methods of outreach were used to disseminate project information. Specific outreach efforts are described below.

Public meetings were advertised in many ways, and these advertisements were also used as opportunities to distribute project information. Over 3,000 hard copies of a postcard advertisement were mailed to property owners and tenants in the interchange area prior to each public meeting. An electronic newsletter was sent via email to over 400 stakeholders on the project mailing list, and hard copies of this newsletter were made available at

Arapahoe County, City of Centennial, and City of Greenwood Village offices, as well as the Castlewood Library. Also, a news release was sent to local media and public information officers at involved agencies and jurisdictions.

Targeted outreach was conducted for business tenants closest to the potential improvements. Approximately 400 businesses were visited and invited to the first public meeting, as well as a separate meeting focused on business concerns.

Project update news releases were sent to the electronic mailing list of interested parties in March, July, August, and September 2011. The Walnut Hills neighborhood adjacent to the interchange complex may incur impacts as a result of the improvements; therefore, special outreach was conducted. Letters were sent to Walnut Hills residents describing potential impacts in August 2011. This was followed by another letter to these stakeholders sent the week before the second public meeting, announcing that no residential property acquisitions are anticipated related to the improved partial cloverleaf alternative. News releases and project updates were frequently included in neighborhood newsletters, and the project was covered by local media outlets.

A project website was established early in the project, and regular updates were posted to the site (www.I-25ArapahoeRoadEA.com). The website contained a record of all public meeting graphics and comments received, and included a comment form that was used often by members of the public.

4.3.3 Key Issues Raised

In general, most stakeholders agreed that improvements to the I-25/Arapahoe Road interchange are necessary to reduce congestion and improve safety. Hundreds of comments were received throughout the project listing various suggestions for these improvements. Major comment themes included:

- ◆ the EA process
- ◆ location and configuration of improvements
- ◆ traffic operations
- ◆ residential and business property acquisition
- ◆ noise
- ◆ safety
- ◆ pedestrian and bicycle access

The project team considered the comments during alternatives analysis and conceptual design refinements. This section summarizes primary issues raised by the public throughout the study and the actions taken to address them.

Issue: Supplemental crossings of I-25 north of Arapahoe Road should be investigated.

Action: I-25 crossings north of Arapahoe Road at Caley Avenue and at Peakview Avenue were considered, but eliminated in the first level of screening.

Issue: Concern that the proposed Costilla crossing of I-25 would have major impacts to the Walnut Hills neighborhood (traffic, noise, safety, property values) and should be eliminated.

Action: Following CDOT's completion of interim improvements at the interchange, more detailed traffic analyses of the Costilla crossing were completed. The analyses

found marginal improvement in congestion levels at the interchange, high cost for anticipated benefit, and many construction impacts. The crossing was eliminated during screening.

Issue: Necessary improvements should be focused only on Arapahoe Road.

Action: The Action Alternative recommendation focuses on improving the existing partial cloverleaf interchange and widening Arapahoe Road through the interchange complex, with complementary improvements recommended at nearby intersections.

Issue: Residential property impacts need to be avoided.

Action: The design concept recommendations for improvements to arterial streets and intersections within the interchange complex were refined, resulting in a concept design with lane improvements along both Arapahoe Road and Yosemite Street that can be made with no permanent property acquisition required from residential properties in Walnut Hills.

Issue: Yosemite Street improvements could impact the Walnut Hills neighborhood.

Action: Future traffic volumes on Yosemite Street following construction of the recommended improvements were modeled. No substantial increase in traffic volumes are anticipated compared to the No Action alternative.

Issue: Business property impacts need to be mitigated.

Action: The study recommended the intersection of Arapahoe Road and Yosemite Court remain in the existing right-in/right-out configuration to maintain this access to many businesses. Access to businesses in the northeast quadrant of the interchange is expected to improve as a result of the proposed realigned frontage road concept, and a new shared right-in/right-out access is proposed along Arapahoe Road to mitigate for the necessary closure of Conoco's existing right-in/right-out access on Arapahoe Road and elimination of the Motel 6 access drive along the north side of Arapahoe Road to Boston Street due to Arapahoe Road widening. The business access improvements recognize the balance needed to provide reasonable local access while not impacting traffic to and from the interchange ramps.

Issue: Noise impacts to the Walnut Hills neighborhood need to be mitigated.

Action: A noise wall is recommended along the south side of Arapahoe Road from Uinta Street to the commercial property at the corner of Arapahoe Road and Yosemite Street, and along south on Yosemite Street from the south side of the commercial property approximately 500 feet.

Issue: Address pedestrian facilities/operations along and crossing Arapahoe Road and Yosemite Street.

Action: Potential locations for grade-separated crossings of Arapahoe Road were investigated in detail. Based on existing land use, relatively low expected usage would be anticipated with high construction cost and property acquisitions necessary. Therefore, a grade-separated crossing is not recommended as part of this project, but could be reevaluated in the future, particularly in conjunction with future redevelopment. The Action Alternative recommendation includes improved sidewalk facilities on Arapahoe Road and intersecting streets.

4.4 Remaining Public and Agency Involvement

Arapahoe County will circulate this EA for agency and public review and comment for 30 days. A third and final public meeting will be scheduled in the City of Centennial during the fall of 2012. A postcard announcing the public meeting and release of the EA will be sent to all individuals on the mailing list. In addition, a more detailed newsletter describing the EA findings will be created and sent to individuals on the electronic mailing list, and copies will be sent to Arapahoe County, CDOT, City of Centennial, City of Greenwood Village, and Castlewood Library for distribution at high traffic areas of their buildings. The public meeting will also be advertised on the project website and links on local agency websites. A news release advertising the meeting and EA review period will be sent to local media contacts. Interested individuals can attend the public meeting to provide comments and learn more about the EA and its recommendations. After the 30-day review period ends, comments will be addressed in the final decision document.

Comments on the EA can be provided in person at the public meeting, on the project website (www.I25ArapahoeRoadEA.com) or via mail, fax or email:

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Chapter 5: Preparers and References

This chapter provides a list of preparers for the I-25/Arapahoe Interchange Environmental Assessment, as well as a list of references used in the preparation.

5.1 Preparers

The table below lists the responsibilities of those who prepared this EA. David Evans and Associates, Inc. is the primary consultant responsible for the preliminary roadway design, environmental studies, and EA preparation, with assistance of subconsultants Felsburg Holt & Ullevig, Hartwig & Associates, and Bunyak Research.

Preparers	
David Evans and Associates, Inc.	
Name and Title	EA Responsibility
Joseph Hart, PE Project Manager	EA Project Management, Public Involvement, Alternatives Development and Evaluation
Wendy Wallach Environmental Project Manager	Project Documentation
Laura Meyer, AICP Environmental Planner	EA Project Management, Alternatives Development and Evaluation
Patricia Steinholtz NEPA Planner	Socioeconomic Conditions, Environmental Justice, Visual Resources, Energy Consumption
Ian Chase, PTP Transportation Planner	Traffic Capacity, Safety, Transit Operations
Stacy Tschuor, PE, PTOE Senior Traffic Engineer	Transportation Analysis
Leah Langerman Community Outreach Coordinator	Agency/Public Involvement, Project Coordination
Kacey Meis Planner, GIS Analyst	Land Use, Right-of-Way, Utilities
Felsburg Holt & Ullevig	
Name and Title	EA Responsibility
Dale Tischmak Senior Environmental Scientist	FHU Task Manager, Traffic Noise Analysis, Air Quality
Ed Lind, PE Associate Engineer	Floodplains, Water Resources and Water Quality
Kate Baird, PE Environmental Engineer	Traffic Noise Analysis, Air Quality
Laura Haas Environmental Scientist	Hazardous Materials

Preparers	
Elliot Sulsky, PE Senior Transportation Planner	Travel Forecasts
Ryan Germeroth, PE	Safety Assessment
Hartwig & Associates	
Name and Title	EA Responsibility
Marvinetta Hartwig, PE Senior Roadway Design Manager	Conceptual Design, Construction Phasing, Cost Estimates
Bunyak Research	
Name and Title	EA Responsibility
Dawn Bunyak Historian	Historic Properties, Paleontological Resources

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