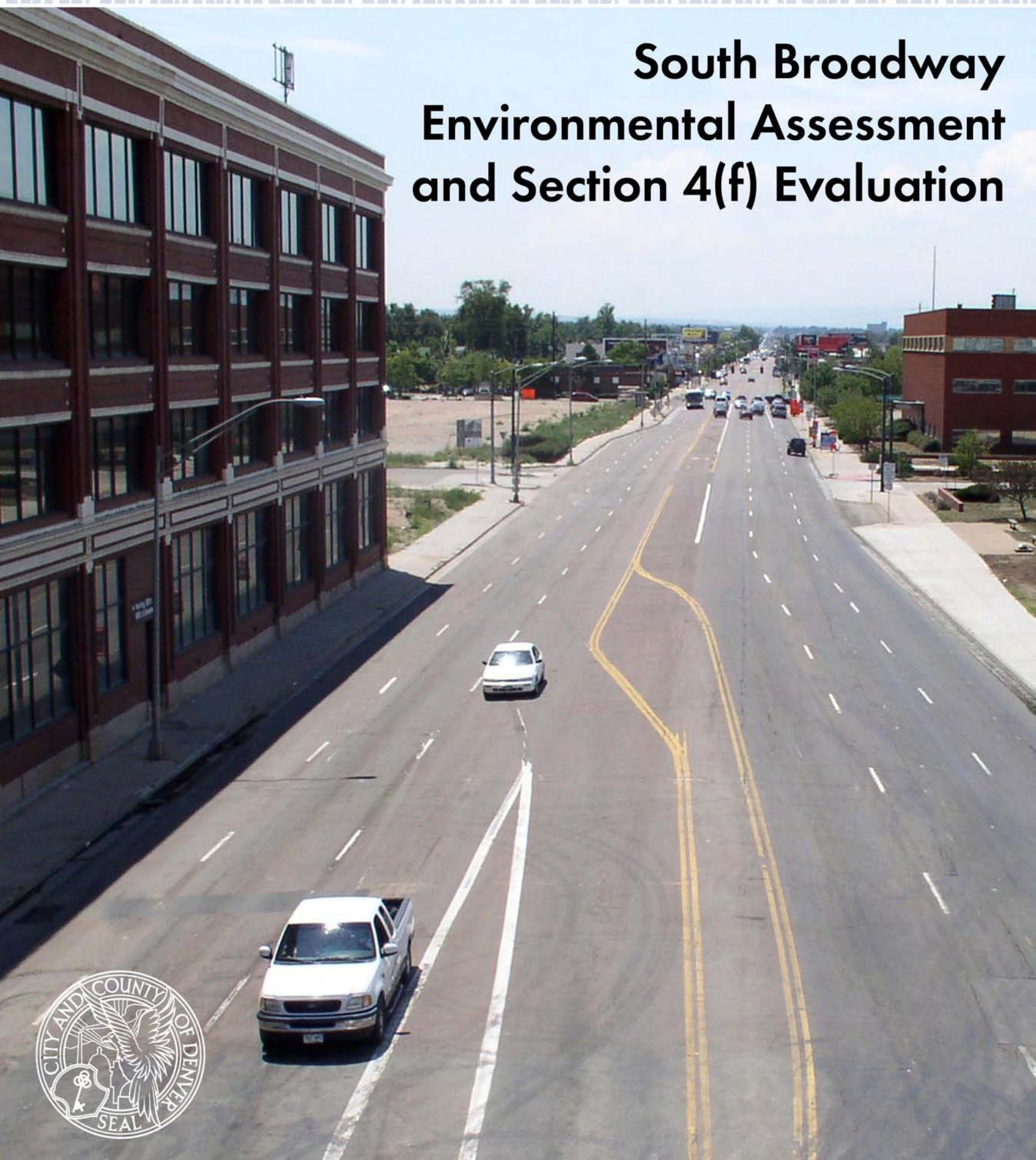




# South Broadway Environmental Assessment and Section 4(f) Evaluation







## ENVIRONMENTAL ASSESSMENT and Section 4(f) Evaluation

Submitted Pursuant to:  
42 USC 4332(2)(c) and 49 USC 303

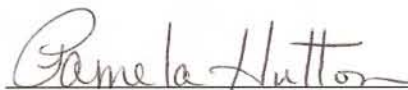
by the  
U.S. Department of Transportation, Federal Highway Administration  
and  
Colorado Department of Transportation

**Submitted by:**

  
\_\_\_\_\_  
Randy Jensen  
Regional Transportation Director  
Colorado Department of Transportation, Region 6


3/20/2008  
\_\_\_\_\_  
Date

**Concurred by:**

  
\_\_\_\_\_  
Pamela A. Hutton, P.E.  
Chief Engineer  
Colorado Department of Transportation

3-25-08  
\_\_\_\_\_  
Date

**Approved by:**

  
\_\_\_\_\_  
Douglas Bennett, P.E.  
Acting Division Administrator, Colorado Division  
Federal Highway Administration

3-26-2008  
\_\_\_\_\_  
Date

for





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## **ENVIRONMENTAL ASSESSMENT and Section 4(f) Evaluation**

Prepared for:  
U.S. Department of Transportation, Federal Highway Administration  
and  
Colorado Department of Transportation

Prepared by:  
  
Carter Burgess

March 2008





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## ACRONYMS AND ABBREVIATIONS

|       |  |
|-------|--|
| ADT   | Average Daily Traffic                                |
| AM    | <i>Ante Meridiem</i> (before Noon)                   |
| AMI   | Average median income                                |
| APCD  | Air Pollution Control Division                       |
| APE   | Area of Potential Effect                             |
| AQ    | Air Quality  |
| AQCC  | Air Quality Control Commission                       |
| BARD  | Broadway Area Revitalization District                |
| BMPs  | Best Management Practices                            |
| BNSF  | Burlington Northern Santa Fe                         |
| BRT   | Bus Rapid Transit                                    |
| C/D   | Collector/Distributor                                |
| CAA   | Clean Air Act  |
| CBD   | Central Business District                            |
| CCD   | City and County of Denver                            |
| CDBG  | Community Development Block Grant                    |
| CDOT  | Colorado Department of Transportation                |
| CDOW  | Colorado Division of Wildlife                        |
| CDPHE | Colorado Department of Public Health and Environment |
| CE    | Categorical Exclusion                                |
| CEQ   | Council on Environmental Quality                     |
| CFI   | Continuous Flow Intersection                         |
| CML   | Consolidated Main Line                               |
| CMAQ  | Congestion Mitigation and Air Quality                |
| CNHP  | Colorado Natural Heritage Program                    |
| CO    | Carbon Monoxide                                      |
| dB(A) | A-weighted decibel level                             |
| DE    | Diesel exhaust                                       |
| DEIS  | Draft Environmental Impact Statement                 |
| DOT   | Department of Transportation                         |
| DRCOG | Denver Regional Council of Governments               |
| DUS   | Denver Union Station                                 |
| EA    | Environmental Assessment                             |
| EDR   | Environmental Data Resources                         |
| EIS   | Environmental Impact Statement                       |
| EJ    | Environmental Justice                                |
| EO    | Executive Order                                      |
| EPA   | Environmental Protection Agency                      |
| ESA   | Endangered Species Act                               |
| FEIS  | Final Environmental Impact Statement                 |
| FEMA  | Federal Emergency Management Agency                  |
| FHWA  | Federal Highway Administration                       |
| FTA   | Federal Transit Administration                       |
| FPPA  | Farmland Protection Policy Act                       |

## ACRONYMS AND ABBREVIATIONS

|                   |  |
|-------------------|--|
| GDP               | General Development Plan                           |
| HOV               | High Occupancy Vehicle                             |
| HUD               | U.S. Department of Housing and Urban Development   |
| I-25              | Interstate 25                                      |
| IRIS              | Integrated Risk Information System                 |
| LOS               | Level-of-Service                                   |
| LRT               | Light Rail Transit                                 |
| MBTA              | Migratory Bird Treaty Act                          |
| MBO               | Minority Business Office                           |
| MESA              | Modified Phase I Environmental Site Assessment     |
| MOA               | Memorandum of Agreement                            |
| MOE               | Measure of Effectiveness                           |
| MS4               | Municipal Separate Storm Sewer System              |
| MSA               | Metropolitan Statistical Area                      |
| MSAT              | Mobile Source Air Toxics                           |
| NAAQS             | National Ambient Air Quality Standards             |
| NAC               | Noise Abatement Criteria                           |
| NATA              | National Air Toxics Assessment                     |
| NCHRP             | National Cooperative Highway Research Program      |
| NEPA              | National Environmental Policy Act                  |
| NHPA              | National Historic Preservation Act                 |
| NLEV              | National low-emission vehicle                      |
| NO <sub>2</sub>   | Nitrogen Dioxide                                   |
| NO <sub>x</sub>   | Nitrogen   |
| NPDES             | National Pollutant Discharge Elimination System    |
| NRCS              | Natural Resources Conservation Service             |
| NRHP              | National Register of Historic Places               |
| O <sub>3</sub>    | Ozone  |
| OD                | Origin Destination                                 |
| Pb                | Lead   |
| PM                | <i>Post Meridiem</i> (after Noon)                  |
| PM <sub>2.5</sub> | Particulate Matter 2.5-Microns or less in Diameter |
| PM <sub>10</sub>  | Particulate Matter 10-Microns or less in Diameter  |
| Ppm               | Parts per million                                  |
| PRT               | Personal Rapid Transit                             |
| RAQC              | Regional Air Quality Council                       |
| RCRA              | Resource Conservation and Recovery Act             |
| RNO               | Registered Neighborhood Organization               |
| ROD               | Record of Decision                                 |
| RTD               | Regional Transportation District                   |
| RTP               | Regional Transportation Plan                       |
| SHPO              | State Historic Preservation Officer                |
| SMP               | Stormwater Management Program                      |
| SO <sub>2</sub>   | Sulfur Dioxide                                     |
| SRHP              | State Register of Historic Places                  |

## ACRONYMS AND ABBREVIATIONS

|         |   |
|---------|---|
| STIP    | Statewide Transportation Improvement Program  |
| T-MU-30 | Transit-Mixed-Use-30                          |
| T-REX   | Transportation Expansion Project (I-25)       |
| TAZ     | Traffic Analysis Zone                         |
| TCE     | Trichloroethylene                             |
| TDM     | Transportation Demand Management              |
| TIP     | Transportation Improvement Program            |
| TMDL    | Total Maximum Daily Load                      |
| TOD     | Transit Oriented Development                  |
| TSM     | Transportation System Management              |
| UPRR    | Union Pacific Railroad                        |
| USACE   | U.S. Army Corps of Engineers                  |
| USDOT   | U.S. Department of Transportation             |
| USFWS   | U.S. Fish and Wildlife Service                |
| VHEIS   | Valley Highway Environmental Impact Statement |
| VHT     | Vehicle Hours of Travel                       |
| VMT     | Vehicles Miles of Travel                      |
| VOT     | Volatile organic compounds                    |
| WWPNA   | West Washington Park Neighborhood Association |





## EXECUTIVE SUMMARY

### INTRODUCTION

The City and County of Denver (CCD) is proactively planning for the infrastructure needs in the South Broadway study area. The CCD initiated the National Environmental Policy Act (NEPA) process for this project following the rezoning of a number of large industrial brownfield properties adjacent to South Broadway, referred to as the Gates property. As part of the rezoning to a Transit Oriented Development (TOD) land use density, the CCD was committed to developing a transportation solution that addressed the transportation needs to this complex corridor.

The South Broadway project process is a collaboration of numerous stakeholder groups and agencies, such as: Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Colorado Department of Transportation (CDOT), CCD, Regional Transportation District (RTD), Consensus Committee and local neighborhood organizations.

The CCD proposes to implement north/south transportation improvements along South Broadway between Exposition Avenue and Arizona Avenue in south-central Denver. A set of transportation improvements including features that accommodate transit, bicyclists, and pedestrians is needed to accommodate the travel demand through the South Broadway study area that considers travel patterns, existing and proposed land use, businesses, and neighborhoods.

Today the South Broadway corridor experiences congestion during peak periods, especially at two key locations: South Broadway and the southbound I-25 ramps and the intersection of South Broadway and Mississippi Avenue. The south Denver street network utilizes South Broadway as a major north/south spine. Projected increases in traffic volumes from the Central Business District (CBD) to the north, and the suburbs to the south, including Englewood, Littleton, and Highlands Ranch, when combined with the projected traffic from the redevelopment of the Gates property, will stress this street network.

This document is an Environmental Assessment (EA) that evaluates the impacts of the proposed transportation improvements along South Broadway between Exposition Avenue and Arizona Avenue in south-central Denver. The purpose of the proposed project is to create a South Broadway corridor that provides safe and efficient mobility for all modes (pedestrian, bicycle, transit, and automobile) which accommodates the transportation needs of area neighborhoods, existing businesses, planned development, and the I-25 and Broadway Station area; and also promotes the development and use of transit-oriented, civic, and neighborhood places.

Major needs to be addressed by this project that have been identified through traffic and engineering analysis, public involvement and agency scoping include:

- ▶ South Broadway is currently experiencing peak hour congestion that is expected to worsen.



- ▶ Projected local and regional growth will result in increased traffic congestion and increase the likelihood of traffic cutting through adjacent neighborhoods.
- ▶ Currently there is a lack of connectivity and inadequate width of bicycle and pedestrian facilities in the study area.

Other transportation projects in the area have also recently been completed or are currently being planned in order to address transportation issues on a regional scale. These include:

- ▶ Broadway Viaduct
- ▶ Valley Highway Environmental Impact Statement (VHEIS)
- ▶ South Broadway Reconstruction Arizona to Iowa Avenues
- ▶ T-REX (Transportation Expansion Project on I-25 south east of the study area)

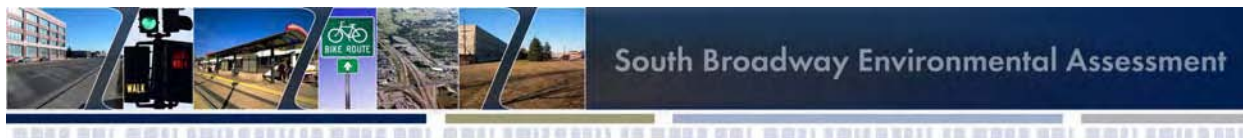
Because the *Valley Highway EIS* (VHEIS) included the Broadway and I-25 interchange, this EA needed to consider the VHEIS Purpose and Need as well as measures of effectiveness in the process of choosing a Preferred Alternative for the interchange. The selection criteria and alternatives selection process was closely coordinated with CDOT staff and the VHEIS Project Team to arrive at an interchange solution that works at least as well for I-25 as the Valley Highway Preferred Alternative.

## ALTERNATIVES

The alternatives development and evaluation process was designed to systematically arrive at the reasonable alternatives that would accomplish the purpose for the project using information gathered through an assessment of existing traffic and environmental conditions and needs, and input from the public and agencies.

The No-Action Alternative includes the VHEIS Preferred Alternative (including Phase VI I-25/South Broadway Interchange Improvements), RTD-planned improvements to light rail service at the I-25 and Broadway Station, and the redevelopment plans for the rezoned former Gates property.

The Preferred Alternative involves the following components of improvements: South Broadway road widening, I-25/South Broadway interchange ramp improvements, signalization and traffic control, intersection improvements, bicycle and pedestrian improvements, transit system improvements and water quality inlet improvements. South Broadway is proposed to be widened to 140 feet between Arizona Avenue and I-25 to accommodate a generous pedestrian zone, double left turn lanes where needed, and up to eight through lanes; however, the outer two through lanes will be utilized as on-street parallel parking in the interim until a determination is made that the lanes are needed to maintain a desirable level-of-service. Interchange improvements would address existing deficiencies and accommodate high demand traffic movements including a modified ramp providing grade separation for southbound South Broadway to southbound I-25, improvements to I-25 northbound on/off-ramps, and improved design speed for the northbound I-25 on-ramp. Pedestrian improvements would include 13.5-foot sidewalks along South Broadway and Mississippi Avenue, improved pedestrian connections to the I-25 and Broadway Station, new and improved signalized intersections, and



median refuges. Signalization and traffic control would be improved or newly built at 10 intersection locations. **Figure ES-1** shows the Preferred Alternative.

## AFFECTED ENVIRONMENT, IMPACTS, AND MITIGATION

Environmental impacts and mitigation measures associated with the Preferred Alternative are discussed in Chapter 3 along with existing conditions and the impacts of the No-Action Alternative. The impacts of the Preferred Alternative are summarized as follows:

- ▶ **Land Use and Zoning**—Approximately 9.74 acres of residential, commercial, and industrial land uses would be converted to a transportation use with some parcels being acquired and potential relocation of some businesses and residential properties. Improved access and multimodal connectivity would optimize land use opportunities for TOD. Improvements would not induce substantial additional growth since substantial growth is already expected.
- ▶ **Social**— Safety and mobility improvements would improve emergency vehicle response times along the corridor over the No-Action Alternative. Improvements would result in improved travel times, reduced cut through traffic in neighborhoods, and a reduction in total corridor delay compared to the No-Action Alternative. The addition of pedestrian and bicycle facilities and improved bus circulation will expand travel choices. Seven residences will require relocation as a result of the Preferred Alternative. The Preferred Alternative would require the acquisition of approximately 9.74 acres of new right-of-way from 20 ownerships in the study area. Existing noise conditions at the only community facility in the study area, the Martin School of Early Education, already exceed NAC thresholds and would experience a negligible increase as a result of the Preferred Alternative.
- ▶ **Environmental Justice (EJ)**—Two Census blocks within the study area have a greater percent minority population than that of the CCD, however, field surveys have determined one of these Census blocks is now abandoned. These populations would not be disproportionately impacted because construction impacts would affect all segments of the population within the study area, and impacts would not be distributed disproportionately to minority residents. There are no known minority-owned businesses in the study area. One Census block group within the study area was identified as having a greater percent of low-income households than the CCD, however, there are no residences located within the portion of this block group that falls within the study area. As a result, there are no disproportionately high and adverse impacts to low-income households within the study area.
- ▶ **Economic**—Improved pedestrian and bicycle amenities, improved access to transit, and improved mobility could enhance the economic condition of the study area and support the planned transit oriented developments. Construction could temporarily boost the economy of the study area by providing employment for construction workers and revenue generated by the purchase of construction material from local sources, partially offsetting any lost revenue from temporary increases in congestion and access restrictions during construction. Two businesses planned for relocation under the No-Action Alternative would also be relocated under the Preferred Alternative. Additionally, two businesses in the study area would be impacted through the loss of the approximately fourteen percent of their existing parking.

Figure ES-1. Preferred Alternative



- ▶ **Right-of-Way**—Right-of-way acquisitions of approximately 9.74 acres from 20 parcels in the study area would be required for roadway widening, a new connector street, pedestrian and bicycle improvements, and various easements including utilities. Seven residential households would be relocated. Some of these acquisitions occur in the No-Action Alternative as well; however, there is no identified funding or approval for the VHEIS to proceed prior to the Preferred Alternative. Two businesses at the Denver Design Center complex would be impacted through the loss of approximately 115 surface parking spaces representing fourteen percent of their total parking spaces. Replacement parking north of the I-25 and Broadway Station is a mitigation commitment between the CCD and RTD.
  
- ▶ **Noise**—Predicted 2030 traffic noise levels would range from 58.3 to 72.6 A-weighted decibel level (dB(A)) with a slight increase in the Lincoln Street area attributed to the new northbound I-25 loop ramp and an increase along South Broadway due to the wider roadway footprint bringing traffic closer to receivers. The removal of buildings along the east side of South Broadway in this area would result in higher noise levels for residential receivers currently located behind the buildings. Noise levels would decrease 3 dB(A) along Mississippi Avenue likely due to the shielding effect of I-25 traffic noise by the elevated southbound I-25 wedge ramp near Kentucky Avenue.
  
- ▶ **Air Quality**—Project level carbon monoxide (CO) analyses resulted in no exceedance of the National Ambient Air Quality Standards (NAAQS) at any of the identified interchanges and intersections representing the highest volume and worst operations within the study area. The Preferred Alternative would not likely cause or contribute to any new localized PM<sub>10</sub> violations or increase the frequency or severity of any existing violations. There would be no appreciable difference in overall Mobile Source Air Toxics (MSAT) emissions among the various alternatives. Emissions will likely be lower than present levels in the design year as a result of the Environmental Protection Agency's (EPA) national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. The Preferred Alternative is not in the fiscally constrained 2035 Regional Transportation Plan (RTP), which was adopted by the Denver Regional Council of Governments (DRCOG) in December 2007. The Preferred Alternative from this EA will be submitted as an amendment by the CCD in February 2008 when DRCOG begins accepting applications for projects to be included in the first amendment to the RTP.
  
- ▶ **Water Resources and Water Quality**—Potential impacts to water resources include stormwater runoff during construction carrying sediments from exposed soils. Construction of the Preferred Alternative would increase impervious surfaces by 3.64 acres. Water demand would be minimal and only needed for watering of bare soils to reduce dust and for landscaping. Elements in the design of the Preferred Alternative including installation of inlet filter treatment devices at the existing Mississippi Avenue outfall would also improve water quality over the No-Action Alternative.
  
- ▶ **Vegetation and Noxious Weeds**—Because no native vegetation exists in the study area, impacts to vegetation would be minimal. Loss of mature landscaped trees such as silver maple and crabapple within the right-of-way could occur. Weedy and noxious species are present in isolation throughout much of the study area. The potential for weeds to spread is limited.

- ▶ **Visual Quality**—Improvements are planned to enhance the visual character of the South Broadway corridor. The Interim Phase on South Broadway would improve the study area's visual character and would attract more pedestrian activity with six travel lanes and outside parking lanes in front of the stores. There would be a slight reduction in visual quality when the two interim parking lanes are converted to travel lanes. The new I-25 on-ramp overpass built immediately south of the existing I-25 structure would not be taller than the existing structure, and paint and texture will be selected to match the existing structures. There would be no impacts to the Washington Park viewshed.
- ▶ **Historic and Archaeological Resources**—The project would require the removal of the Denver Tramway Trolley Lines which would be an *adverse effect*. A Memorandum of Agreement (MOA) has been signed by FHWA, State Historic Preservation Officer (SHPO), and CDOT in order to allow road improvement projects affecting the trolley lines on South Broadway. Mitigation includes an interpretive display of the significance of the trolley lines and archival resource recordation.

The Broadway Brick Sewer (5DV9953.1) and the Mississippi Clay Sewer (5DV9954.1) segments will both be impacted as a result of inlet relocations and connecting drain pipes to improve drainage in this section of South Broadway. With the reconstruction of South Broadway and Mississippi Avenue, stormwater inlet structures and piping would have to be relocated. The impacts will be limited to small sections of the sewers where inlets are constructed or where new piping may need to be constructed to intersect the existing sewer alignment. The SHPO and consulting parties were consulted on the effects to the two sewer resources and the minor nature of the work supports the determination of *no adverse effect* to these resources. A *de minimis* determination for Section 4(f) has been made by FHWA.

- ▶ **Hazardous and Solid Waste**—The southbound South Broadway to southbound I-25 structure would require foundations to be installed in the South Broadway/Kentucky Avenue trichloroethylene (TCE) soil contamination and groundwater plume area and would also encroach on a surface area southwest of the intersection where a portion of a soil and groundwater TCE remediation system is currently located. The acquisition and grading of areas previously used for industrial purposes will be required and because of the wide use of asbestos containing materials in older industrial facilities, these areas may contain asbestos fibers in the surface soil.
- ▶ **Construction**—The operation of various types of machinery would create an undesirable noise and vibration condition during the construction period. Exhaust emissions and fugitive dust would increase as a result of the operation of heavy equipment, lower traffic speed (start/stop driving), and earth excavation activities associated with construction. Spills of fuel, oil, grease, or other chemicals could occur during construction activities and pollute soils. Construction contractors will implement best management practices to reduce the likelihood of chemical spills. Cleanup of spills will be conducted in compliance with Colorado hazardous waste regulations in 6 CCR 1007-3. Stockpiles of earth materials, construction materials, and parked equipment may cause a temporary visual impact to the residents near the locations of construction activities. Local access to intersecting roads and to residences will be maintained during construction. However, limited access and minor detours may be necessary at certain locations during this period.



- **Traffic and Transportation**—The Preferred Alternative would operate at acceptable levels of service during the 2030 peak hours. Improvements at access ramps and intersections throughout the study area would be expected to improve safety over existing conditions. The I-25 and Broadway Station, already one of the busiest transit centers in the Denver metro area, is expected to see major increases in ridership with the Gates redevelopment property. The Preferred Alternative will improve transit operations with a bypass for north/south buses on South Broadway. The Preferred Alternative also makes a number of recommendations to improve bicycle and pedestrian connections throughout the study area.

## OUTSTANDING ISSUES

Stormwater detention pond volumes and locations are being coordinated with CDOT and are to be located within acquired right-of-way areas. With the redevelopment plans around and under the I-25 structure (the Gates Redevelopment, preliminary plans to redesign the I-25 and Broadway Station, and redevelopment plans for the property north of the station between South Broadway and the CML) the opportunity exists to collocate runoff treatment and detention volumes. The CCD will coordinate with these entities to collect and treat, as appropriate, any additional runoff generated by the Preferred Alternative.

## COMMENTS AND COORDINATION

An open, integrated program of public and agency coordination and involvement was undertaken for the South Broadway EA. Agency coordination included scoping meetings with resource and transportation agencies. In addition, monthly coordination meetings were held throughout the process with the local transportation agencies in order to continue to keep them updated on progress. Public involvement activities included a project mailing list, project Web site and issues tracking database. In addition, public outreach efforts included interviews with key neighborhood representatives and visits from project managers to registered neighborhood organization meetings. To help reach decisions on major issues of the improvement plan, a Consensus Committee, made up of key representatives of the community, was formed that met 18 times over the course of the two year planning process. Three public meetings and two public workshops also took place during the planning process. Community outreach programs were specifically tailored to encourage participation by low-income and minority residents that may be impacted by the project. These outreach programs included the availability of Spanish translators at public meetings as well as information on the project being posted in Spanish and at community centers that offer services to low-income and minority populations.

This EA is available to the public for a 30-day review and comment period. Written comments can be submitted by standard mail or E-mail to:

Michael Gill Jr., P.E.  
Department of Public Works  
Capital Projects Management  
201 West Colfax Avenue, Department 506  
Denver, Colorado 80202  
E-mail address: Michael.Gill@denvergov.org



During the 30-day review period the South Broadway EA is available for public review at the following locations:

- ▶ Denver Public Library Central Branch, 10 West Fourteenth Avenue Parkway, Denver, CO 80204
- ▶ Denver Public Library Decker Branch, 1501 South Logan Street, Denver, CO 80210
- ▶ City and County of Denver, Wellington E. Webb Building, Municipal Office Building, Public Works Department, 201 West Colfax Avenue, Denver, CO 80202
- ▶ CDOT Region 6, Planning and Environmental Section, 2000 South Holly Street, Denver, CO 80222
- ▶ FHWA Colorado Division, 12300 West Dakota Avenue, Suite 180, Lakewood, CO 80228

In addition, the EA will also be available online at: [www.denvergov.org/broadwaynepa](http://www.denvergov.org/broadwaynepa).

## CHAPTER 1. PURPOSE AND NEED

### 1.1 STUDY AREA DESCRIPTION

The study area centers on South Broadway and extends from Exposition Avenue on the north to Arizona Avenue on the south, a distance of approximately 0.75 mile, and the Consolidated Main Line (CML) on the west and Logan Street on the east (see **Figure 1-1**). The CML is a set of railroad tracks that is jointly used by Burlington Northern Santa Fe (BNSF) and Union Pacific Railroads (UPRR). For analysis purposes, the study area is a geographic area within which transportation improvements for South Broadway are being considered. Within the study area there is a mixture of single-family residential, commercial, industrial, and vacant lands. The vacant lands are part of approximately 100 acres of the former Gates property that is being redeveloped as a mixed-use Transit Oriented Development. The study area also includes several historic structures and a historic district (Gates Historic District).

### 1.2 PROJECT PURPOSE

The purpose of this project is to create a South Broadway corridor that provides safe and efficient mobility for all modes (pedestrian, bicycle, transit, and automobile), which:

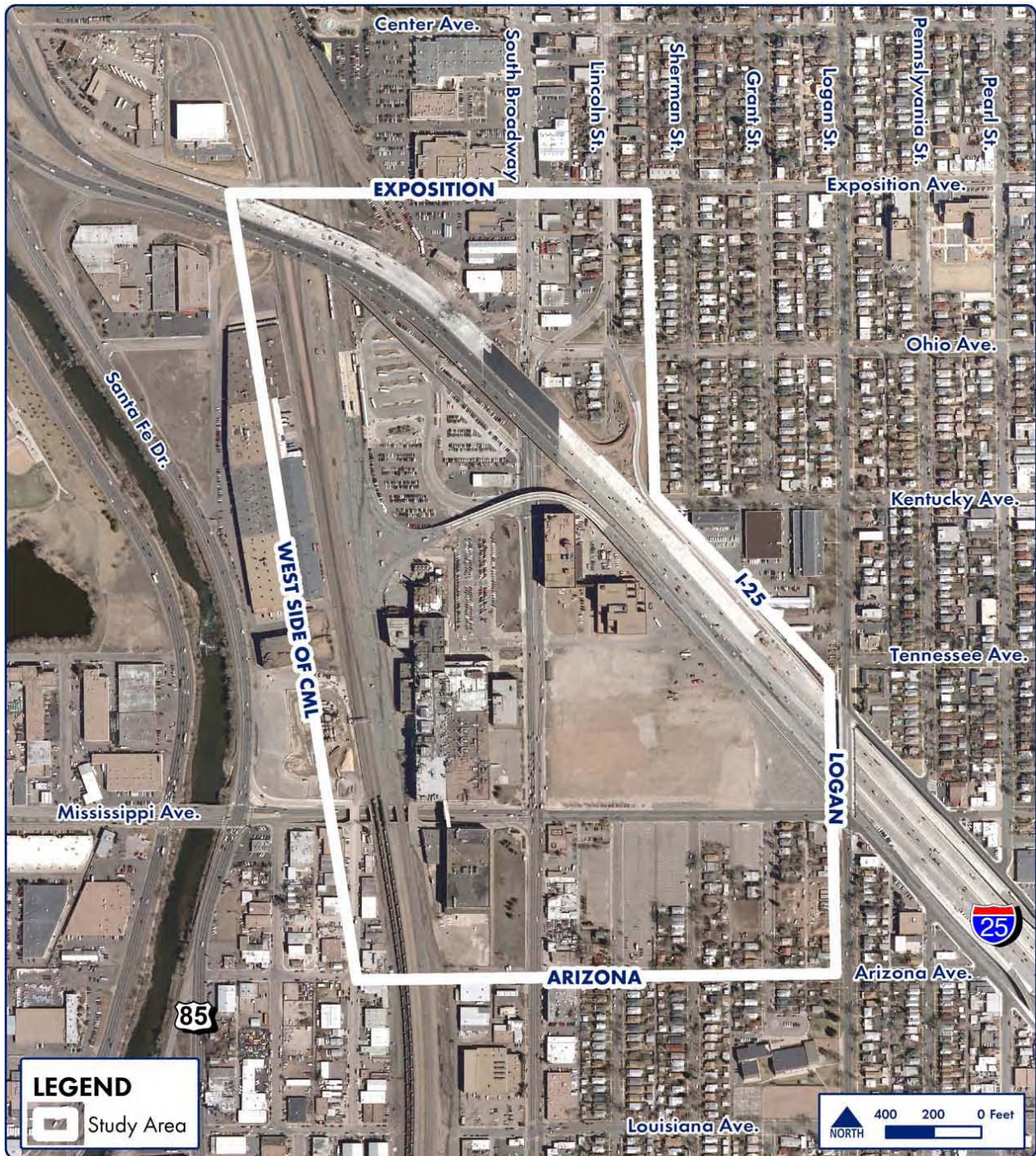
- ▶ Accommodates the transportation needs of area neighborhoods, existing businesses, planned developments, and the I-25 and Broadway Station area.
- ▶ Promotes the development and use of transit-oriented, civic, and neighborhood places.

### 1.3 PROJECT NEEDS

As a result of extensive project coordination with the project stakeholders, traffic and engineering analyses, Consensus Committee input, public involvement activities, and agency scoping, the following major needs have been identified for the project:

- ▶ South Broadway is currently experiencing peak hour congestion that is expected to worsen.
- ▶ Projected regional growth, as well as local growth in traffic due to redevelopment of the rezoned Gates property, will result in increased congestion and increase the likelihood of traffic cutting through adjacent neighborhoods.
- ▶ There is a current lack of connectivity and inadequate width of bicycle and pedestrian facilities that are focused on the South Broadway corridor, bus stops, and I-25 and Broadway Station.

Figure 1-1. Study Area Map



## 1.4 PROJECT GOALS

The project purpose statement and goals were developed through extensive coordination with the project stakeholders including the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Colorado Department of Transportation (CDOT), Regional Transportation District (RTD), and the City and County of Denver (CCD), as well as the Consensus Committee and through other public involvement activities.

Goals were developed to guide the alternative development and evaluation process and indicate desired outcomes secondary to meeting the purpose and need of the project. Goals were used during the evaluation of alternatives to distinguish among alternatives. Some goals may relate directly to the project Purpose and Need and some may identify other desirable results from the project.

The following project goals have been identified for the South Broadway Environmental Assessment (EA):

- ▶ Minimize cut through traffic in local neighborhoods.
- ▶ Provide fully integrated and useful bicycle and pedestrian facilities in the corridor.
- ▶ Minimize negative impacts to natural, historic, and social environments.
- ▶ Enhance parking availability in the study area.
- ▶ Enhance the economic viability of residential neighborhoods in the South Broadway corridor by preserving their character.
- ▶ Maintain access to and from area neighborhoods, existing businesses, bus stops, the new developments, and the I-25 and Broadway Station.
- ▶ Enhance the economic viability of the South Broadway corridor.
- ▶ Enhance redevelopment opportunities in conjunction with transportation improvements.
- ▶ Provide multi-modal travel options that may not be accommodated with existing infrastructure to address demand as a result of projected regional and local growth.
- ▶ Develop a solution that can be constructed, funded and is politically acceptable.
- ▶ Develop a proposed action that can be implemented according to funding availability, phasing of development, and expected growth in travel demand.
- ▶ Develop a proposed action that is consistent with the recommendations from the approved plans of *Blueprint Denver, Comprehensive Plan 2000* and relevant supplements, FasTracks, CDOT, and Denver Regional Council of Government's (DRCOG) Metro Vision 2030.

## 1.5 TRAFFIC VOLUMES

According to the DRCOG regional travel demand model, South Broadway is classified as an urban arterial. There are two lanes in each direction from Arizona Avenue to north of Mississippi Avenue where it transitions to three lanes in each direction. At Ohio Avenue, north of I-25, the one-way South Broadway/Lincoln Street couplet begins with Lincoln Street providing three northbound travel lanes and South Broadway providing three southbound travel lanes. The couplet also provides a bus only lane during peak hours which is used for parking during non-peak hours.

Based upon traffic analyses and public and agency scoping, existing traffic along South Broadway during peak travel periods is congested.

### 1.5.1 Existing Traffic Volumes and Patterns

To understand existing traffic demand, 24-hour traffic counts were collected along the corridor in January 2006. During this time, the southbound on-ramp for I-25 was under construction. This construction required the closure of the on-ramp and one travel lane along South Broadway. This likely diverted normal corridor travelers to alternate routes. Though there were atypical travel patterns due to construction, the 2006 24-hour traffic counts provide a baseline comparative reference. Counts collected in January 2006 are shown in **Table 1-1**.

**Table 1-1. Existing Traffic Volumes for Key Roadway Segments**

| Roadway Segment Location                             | Existing Traffic Volumes |
|--|--------------------------|
| South Broadway/Lincoln Street Couplet: North of I-25 | 50,900 vehicles/day      |
| South Broadway: South of I-25                        | 38,700 vehicles/day      |
| South Broadway: South of Mississippi Avenue          | 34,500 vehicles/day      |

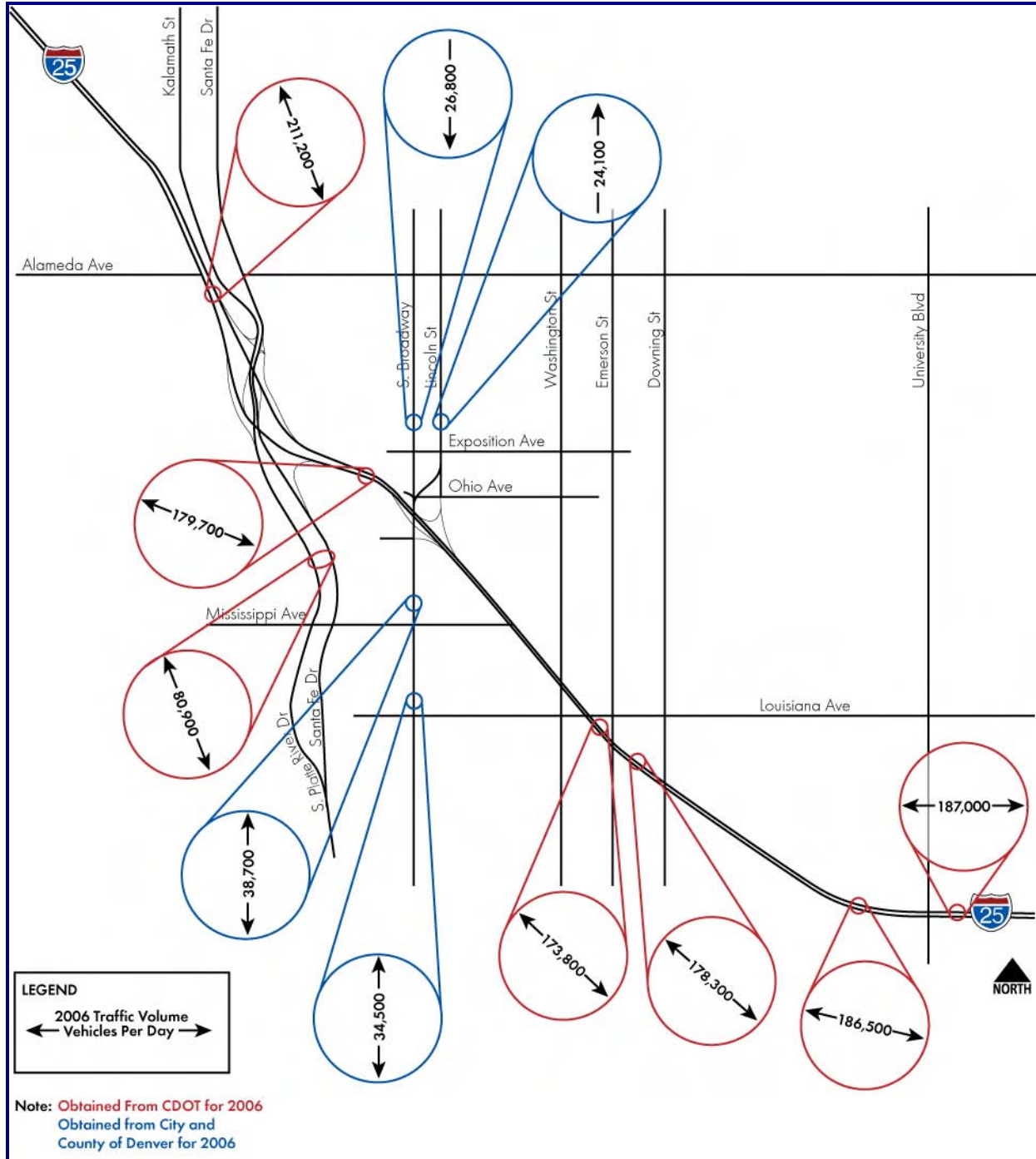
Updated counts were taken on South Broadway in the vicinity of the I-25 interchange in May 2007. The overall volumes were similar to the volumes collected in January 2006. **Figure 1-2** shows existing Average Daily Traffic (ADT) on the roadway network.

### 1.5.2 2030 Traffic Volumes and Patterns

Adjacent to South Broadway and within the study area, significant land use redevelopment is planned. The area land use has been rezoned by the CCD from industrial uses and vacant lands to high density mixed-use and transit oriented uses. This increase in land use density is expected to result in an increase in vehicle, transit, bicycle, and pedestrian activity. Redevelopment plans in the area as well as projected regional growth are expected to increase traffic demand in the corridor resulting in further deteriorated travel conditions.

The DRCOG regional travel demand model (referred to as the travel model) was used to generate forecasted 2030 traffic volumes. The travel model uses land use and socioeconomic inputs and a simulated roadway network to estimate future traffic volumes and travel patterns on individual roadways. The planned redevelopments adjacent to South Broadway were incorporated into the model to more accurately reflect new zoning and future traffic conditions. **Appendix A** contains a detailed description of the travel model application.

Figure 1-2. Existing Average Daily Traffic (ADT) Volumes



The results of the modeling process indicated that in 2030, South Broadway is projected to have as high as a 30 percent increase in daily traffic based on the existing roadway network (see **Table 1-2** for details). Traffic congestion during peak and off-peak travel periods is expected to increase if no transportation infrastructure improvements are made along South Broadway. This congestion will result in greatly increased delay/travel time, increased air pollution, and diversion of traffic to alternate routes that may cut through neighborhoods, as well as change travel behavior.

**Table 1-2. Existing and Forecast Traffic Volumes for Key Roadway Segments**

| Roadway Location  | Existing Traffic Volumes<br>2006-2007 | Forecast Traffic Volumes<br>2030* (No-Action) |
|---|---------------------------------------|---|
| South Broadway/Lincoln Street Couplet:<br>North of I-25 | 50,900 vehicles/day                   | 57,700 vehicles/day                           |
| South Broadway: South of I-25                           | 38,700 vehicles/day                   | 44,900 vehicles/day                           |
| South Broadway: South of Mississippi<br>Avenue          | 34,500 vehicles/day                   | 45,000 vehicles/day                           |

\*Represents traffic forecasts which include new zoning and land use densities

## 1.6 TRAFFIC OPERATIONS

Traffic operations are generally a way of describing travel mobility. Many factors contribute to congested conditions including demand that exceeds capacity, closely spaced intersections, vehicle queuing, poor signal timing, lack of turn-lanes, and other geometric constraints. Traffic operations on South Broadway vary throughout the day with the most congestion usually occurring during the AM and PM peak periods of the day. This is typically described as the hours of 7:00 to 9:00 AM and 4:00 to 6:00 PM and primarily related to poorly operating intersections.

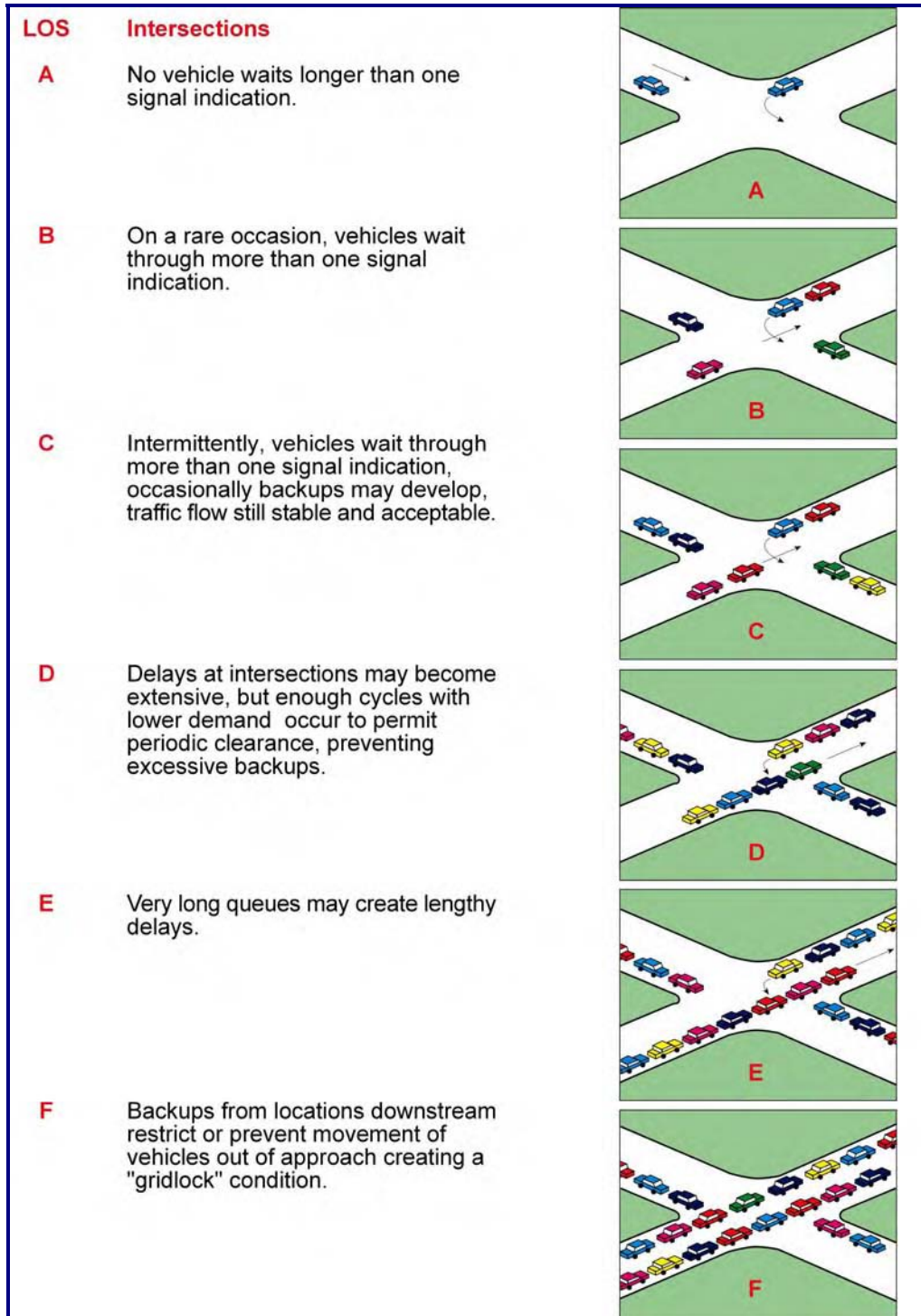
### 1.6.1 Existing Intersection Level-of-Service

Intersection level-of-service (LOS) is a way to describe the operating performance of an intersection. LOS is measured quantitatively and reported on a scale from A to F, with A representing the best performance and F the worst (see **Figure 1-3**).

Individual movements at the Mississippi Avenue and South Broadway intersection and at the South Broadway and I-25 interchange are observed to be failing during peak periods. The southbound on-ramp to I-25 currently has vehicle queuing during the peak periods. At times, queuing extends to the adjacent intersection of Exposition Avenue and South Broadway. Additionally, the intersection of Mississippi Avenue and South Broadway currently has left-turning vehicles that queue far from the intersection, blocking through movements traveling in the adjacent lane. Chapter 4 provides a detailed summary of the existing LOS.



Figure 1-3. Intersection Level-of-Service



## 1.6.2 2030 Intersection Level-of-Service

Traffic modeling forecasts indicate that future automobile and transit demand will exceed existing roadway capacity by approximately 25 percent for the study area. Many of the intersections within the study area will not be able to accommodate the travel demand resulting in failing levels-of-service (LOS F) (see **Table 1-3** for details). The failing intersections will greatly increase delay and travel time through the corridor. Chapter 4 provides detailed discussion on traffic volumes and level-of-service results.

**Table 1-3. Existing and Forecast Intersection Level-of-Service**

| Intersection Location                    | Existing Intersection LOS AM/PM | 2030 No-Action Intersection LOS AM/PM* |
|--|---------------------------------|--|
| South Broadway/Southbound I-25 off-ramps | B/E                             | F/F                                    |
| South Broadway/Mississippi Avenue        | C/C                             | F/F                                    |

\*Represents traffic forecasts which include new zoning and land use densities

## 1.7 LOCAL AND REGIONAL GROWTH

The study area is identified in *Blueprint Denver* and *Denver's Comprehensive Plan* as an “area of change”. The primary properties adjacent to the South Broadway corridor are referred to as the former Gates property, referring to its former owner and land use. These properties have been rezoned by the CCD from industrial to transit mixed-use (TMU-30), which allows for higher densities near transit stations. The current landowners of the Gates property have submitted General Development Plans (GDPs) to the CCD. Both GDPs have been approved. With the addition of millions of square feet of residential, office and retail development, existing transportation infrastructure is inadequate to accommodate this local growth combined with projected regional traffic growth.

## 1.8 OTHER AREA TRANSPORTATION PROJECTS

**Transportation Expansion Project (T-REX)**—I-25 was recently improved as part of the T-REX project. T-REX provided light rail, a collector distributor system, improvements to the cross-section, and improvements to existing interchanges south of the I-25/South Broadway interchange. The proposed improvements that are part of this project are compatible with improvements made as part of T-REX. Changes to the merge/diverge distances will not worsen conditions.

**Broadway Viaduct**—This project is substantially complete and involved reconstruction of the I-25 viaduct structures over South Broadway and the CML railroad tracks. This project was done as an emergency safety repair.

**Valley Highway EIS (VHEIS)**—This project identified improvements to portions of I-25 and US 6 (6th Avenue) from approximately 6th Avenue on the north to Logan Street on the south. A Draft Environmental Impact Statement (DEIS) was signed in April of 2005. The Final Environmental Impact Statement (FEIS) was signed in November 2006 and the phased Record



of Decision (ROD) for Phase 1 (which does not include South Broadway and I-25) was signed July 5, 2007. The South Broadway and I-25 interchange is included as part of the VHEIS. The improvements identified in the VHEIS are incorporated in the No-Action Alternative for this EA.

Because the VHEIS included the South Broadway and I-25 interchange, this Environmental Assessment needed to consider the VHEIS Purpose and Need as well as measures of effectiveness in the process of choosing a Preferred Alternative for the interchange. The selection criteria as well as alternatives selection were closely coordinated with CDOT staff and the VHEIS Project Team to arrive at an interchange solution that works at least as well for the interstate as the Valley Highway Preferred Alternative.

**South Broadway Reconstruction Arizona to Iowa Avenues**—This project consists of reconstructing the entire street section in concrete pavement. Minor widening (5 to 7 feet) is required on either side of the existing curb lines to construct a 10-foot raised median in the center. The project involves major drainage improvements, including construction of a new large storm sewer (48 to 72 inches) that will tie into a major drainage outfall in Florida Avenue.

## **1.9 NEED FOR IMPROVED MULTI-MODAL ACCOMMODATIONS**

### **1.9.1 Transit**

The RTD provides transit service in the study area and throughout the Denver metro region. Service includes bus and light rail service. Within the study area is RTD's I-25 and Broadway Station. This transit station is a heavily used intermodal transportation center connecting local, regional and express buses with light rail routes serving the Central, Southwest, and Southeast Corridors with Denver destinations to the north. The station also is a major park-n-Ride facility.

As part of the redevelopment of the former Gates property, it is intended that the I-25 and Broadway Station area will be developed as a major transit oriented development providing access to local and regional transit for the redevelopments and existing adjacent neighborhoods.

Existing transit ridership at the I-25 and Broadway Station is approximately 10,000 passengers per day. This does not include passengers with origins or destinations outside the study area who are traveling through. The planned land use developments in the area are expected to increase both the number of origins and destinations near the I-25 and Broadway Station.

### **1.9.2 Pedestrian Facilities**

In general, pedestrian facilities are available within the study area to meet the current need. Sidewalks are provided in the existing South Broadway corridor; however, their widths are inconsistent and, in some locations, in disrepair. Recognizing the long range planning vision for the South Broadway corridor to create a pedestrian friendly corridor to meet multi-modal connectivity needs, as well as economic vitality, the project need is to enhance and maintain the pedestrian facilities in accordance with these goals.

### 1.9.3 Bicycle Facilities

Though there is excellent connectivity between bicycle routes throughout the CCD, there are barriers to connectivity within the study area, as indicated below:

- ▶ Intersections of Ohio Avenue at Lincoln Street and South Broadway present a barrier for many bicyclists due to the 5-legged intersection geometry, and the lack of control for the off-ramp traffic (off-ramp traffic does not stop in its current configuration).
- ▶ Limited pedestrian and bicycle connections currently exist between the areas north and south of I-25 and South Broadway, particularly to the I-25 and Broadway Station.

## CHAPTER 2. ALTERNATIVES

### 2.1 INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) requires that all reasonable alternatives, including a No-Action Alternative, be considered and objectively evaluated at comparable levels of analysis. The CEQ has defined reasonable alternatives as those that are practical and feasible from a technical and economic standpoint and which achieve the Purpose and Need for the project.

This chapter describes the process used to identify and evaluate reasonable alternatives for transportation improvements to South Broadway in Denver, Colorado. The information provided herein has been summarized from the *Broadway Alternatives Development Technical Report* (May 2007). This report provides complete documentation of the process and associated technical analysis of alternatives considered for this project.

### 2.2 RELATIONSHIP TO THE VHEIS

The *Valley Highway Environmental Impact Statement* (VHEIS) included the South Broadway and I-25 interchange in its study area because of substandard ramp configurations and its proximity to the I-25 and Santa Fe Drive interchange.

The I-25 and South Broadway interchange needed to be included in the South Broadway EA because of the turning movements and local travel patterns that utilize both I-25 and South Broadway. The purpose and need of the South Broadway EA considers the efficient traffic movements of South Broadway, while the Purpose and Need of the VHEIS was primarily associated with improving operations on I-25.

Since both of these NEPA processes had separate Purpose and Need statements, separate alternative development processes, and different but overlapping screening criteria; the selection process for the interchange Preferred Alternative required a blended screening process. The process by which the main elements of the South Broadway corridor were selected is described in this chapter. Once a South Broadway alternative was selected, the I-25/South Broadway interchange area went through its own screening process which incorporated the screening criteria of both NEPA projects. Section 2.6 describes this sequential interchange screening process.

### 2.3 LOGICAL TERMINI

The Purpose and Need of this project defined north/south movement as the primary need. The study area included sufficient distance west of the Mississippi Avenue and South Broadway intersection to accommodate physical intersection improvements. To the east, the South Broadway corridor is influenced by east-west traffic to Logan Street. Beyond Logan Street, the influence of changes to the transportation network diminishes substantially. To the west, the Consolidated Main Line (CML) acts as a traffic barrier from the South Broadway corridor. This would make transportation improvements to the west of the CML unable to meet the Purpose and Need of the project.



The Project Team applied the following criteria to determine the geographic limits of the study, per requirements in Federal Highway Administration (FHWA) regulations at 23 CFR 771.111(f) in order to ensure meaningful evaluation of alternatives and to avoid commitments to a South Broadway transportation improvement before it is fully evaluated.

1. Logical termini shall be of sufficient length to address environmental matters on a broad scope.
2. Have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made.
3. Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

The northern project terminus is located at Exposition Avenue and on the south at Arizona Avenue. The east and west termini are located on Logan Street to the east and the CML railroad on the west.

The South Broadway/Lincoln Street one-way couplet north of Ohio Avenue operates with different operational characteristics and capacity than the two-way section of South Broadway south of Ohio Avenue; therefore, the northern terminus was established at Exposition Avenue. The South Broadway and I-25 interchange is a capacity constraint to northbound and southbound traffic on the South Broadway corridor and is included in the study area.

To the south, the intersection of Mississippi Avenue and South Broadway operates as a major constraint to northbound and southbound movements and there is a considerable drop in daily traffic on South Broadway south of Mississippi Avenue. To address capacity constraints at this intersection, the block south of Mississippi Avenue was included in the study area setting the southern logical terminus at Arizona Avenue.

## **2.4 COORDINATION AND INVOLVEMENT PROCESS**

Agency coordination and public involvement activities were specifically planned to be open, inclusive, and ongoing throughout the South Broadway NEPA process. This process was designed to respond to the high level of interest within the community concerning improvements for South Broadway and the planned major mixed-use redevelopments in the area.

The alternatives development and evaluation process used a project team coordination structure that included several groups. The primary functions of these groups throughout the alternatives development and evaluation process are summarized in **Table 2-1**.



**Table 2-1. Major Roles and Responsibilities of the Project Team Groups**

| <b>Project Team Group</b>   | <b>Major Roles and Responsibilities</b>   |
|---|---|
| Public  | Provide input and issues.   |
| Environmental Resource Specialists  | Provide necessary environmental input.  |
| Consensus Committee: Project stakeholders, agencies, and Registered Neighborhood Organization (RNO) representatives                           | Provide input, raise issues, and review core Project Team recommendations.                      |
| Project Agencies: City and County of Denver(CCD), CDOT, FHWA, Regional Transportation District (RTD) and Federal Transit Administration (FTA) | Agency coordination input on process, concurrence and approval of Project Team recommendations. |
| City Management Group   | Provide input and issues.   |
| Project Team  | Conduct analysis, evaluation, and documentation.  |

\*RNOs-Registered with the City and County of Denver according to City requirements.

## 2.5 ALTERNATIVES DEVELOPMENT AND EVALUATION PROCESS

The range of alternative suggestions developed through the scoping process is shown in Appendix C of the *South Broadway Alternatives Development Technical Report* (May 2007). In total, over 140 individual suggestions were developed, subsequently evaluated, and either eliminated or incorporated into the Preferred Alternative. Alternative suggestions were generally categorized by the need they were anticipated to address.

The alternatives development and evaluation process was designed to systematically arrive at the reasonable alternatives. However, the process was open to allow for alternatives to be developed and modified throughout the process. The initial list of suggestions was evaluated using Level 1 screening criteria. The advanced suggestions were then evaluated using Level 2 criteria and suggestions advanced from that screening were assessed using Level 3 criteria. The screening process continued until each suggestion was either eliminated or incorporated into the Preferred Alternative. The alternatives development and screening process consisted of the following steps:

1. Development of issues and concerns matrix.
2. Development of Purpose and Need statement.
3. Development of project evaluation criteria and measures of effectiveness based on the Purpose and Need for the project and project goals.
4. Identification of a range of alternatives or 'suggestions' based on an assessment of existing conditions in the study area, project Purpose and Need, and input from the public and agencies.
5. Identification of the reasonable alternatives.

### Screening Process Summary

The screening process utilized evaluation criteria and associated measures of effectiveness (MOE) to assess the utility of the various transportation improvement options. The evaluation criteria were developed based on the project Purpose and Need and the project goals. The goals help define “how” the proposed action would ideally respond to the problems stated in the project’s Purpose and Need.

### **2.5.1 Level 1 Screening**

Level 1 Screening of the initial list of suggestions was performed to eliminate those alternatives that did not meet any element of the Purpose and Need, project goals, or those that had fatal flaws. At each level of screening, evaluation criteria were developed that were appropriate to the level of information available and the level of detail to which the various components or alternatives had been developed. Level 1 evaluation criteria included the following:

1. Is the suggestion in the study area?
2. Does the suggestion meet any element of Purpose and Need?
3. Are potential environmental impacts resulting from the suggestion resolvable?
4. Is the suggestion a proven technology?
5. Would the suggestion be feasible to construct?

The screening criteria were structured to produce “yes” or “no” answers, and if a “no” was generated from any one of them, the suggestion was eliminated from further consideration due to a fatal flaw. Over 140 suggestions were evaluated in the screening process. The suggestions not advanced from the Level 1 screening are summarized in **Table 2-2**.

**Table 2-2. Level 1 Screening: Suggestions Not Advanced**

| <b>Suggestion</b>  | <b>Reason Not Advanced</b>  |
|--|---|
| Northbound Lincoln Street connecting to southbound I-25 via hook ramp from the South Broadway/Lincoln Street couplet | Not constructible due to presence of light rail transit (LRT) structure and tracks connections.   |
| Personal Rapid Transit (PRT) or People mover system  | Not practical because it is not a proven technology.  |
| Bury CML Tracks  | Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.   |
| Cherokee Street extension  | This suggestion is outside the study area; however, the Preferred Alternative has not precluded this improvement.   |
| Eliminate all at-grade intersections (full access control)   | Closing all at-grade intersections limits viability of existing business and Transit Oriented Development (TOD); restricted access causes increased circulation on local streets. |
| Toll all intersections   | Not permitted under existing laws.  |

## 2.5.2 Level 2 Screening

Level 2 Screening was performed on the advanced suggestions to eliminate those that could not meet elements of the Purpose and Need and project goals. Additionally, suggestions that could not be constructed without creating another project were screened out at this time. In the Level 2 screening, the results used a qualitative and comparative evaluation rating system of Very Good, Good, Fair, Poor, Very Poor, or N/A. However, suggestions that received “poor” and “very poor” were not always eliminated (see **Table 2-3**).

Level 2 evaluation criteria included the following:

1. How well does the suggestion address South Broadway peak period congestion?
2. How well does the suggestion restrict regional traffic from cutting through neighborhoods?
3. How well does the suggestion promote/increase transit access and ridership?
4. How well does the suggestion provide access to and from area neighborhoods, existing businesses, bus stops, the redevelopment sites, and the I-25 and Broadway Station?

**Table 2-3. Level 2 Screening: Suggestions Not Advanced**

| Suggestion  | Reason Not Advanced   |
|---|---|
| Build new Bannock Street from north of I-25 to Arizona Avenue on the west side of the Consolidated Main Line Railroad | Does not meet Purpose and Need because it does not address South Broadway peak period congestion within the project termini, as well as other remaining suggestions.  |
| South Broadway corridor expressway from Arizona Avenue to 5th Avenue  | Requires extensive right-of-way and impacts historic buildings. Providing grade separation with I-25 restricts access to South Broadway through the study area.   |
| Lincoln tunnel from north of I-25 to Mississippi Avenue   | Created more environmental impacts from exposure to hazardous and solid wastes (see December 20, 2005, CDOT letter in <b>Appendix D</b> ).  |
| New access to southbound I-25 from northbound Lincoln Street at Tennessee Avenue                                      | Does not meet Purpose and Need because it does not address South Broadway peak period congestion within the project termini, as well as other remaining suggestions.  |
| I-25 Collector-Distributor roads; South Broadway to Santa Fe Drive  | Does not meet Purpose and Need because it does not address South Broadway peak period congestion within the project termini, as well as other remaining suggestions.  |
| Improve Santa Fe Drive/Mississippi Avenue interchange   | Does not meet Purpose and Need because it does not address South Broadway peak period congestion within the project termini, as well as other remaining suggestions.  |
| South Broadway/Acoma Street couplet south of Louisiana Avenue to Evans Avenue   | South of Louisiana Avenue the volume of projected traffic is low enough that the existing cross section is less likely to need additional capacity. Further, the one-way couplet extension causes circulating traffic to utilize local streets. This increase in local street traffic is contrary to the goal of reducing “cut through” traffic. This also would include improvements outside of the project termini. |

**Table 2-3. Level 2 Screening: Suggestions Not Advanced**

| Suggestion   | Reason Not Advanced   |
|--|---|
| Santa Fe Drive reconfiguration (as a local two-way street)                                 | Does not meet Purpose and Need because it does not restrict regional traffic from cutting through neighborhoods within the project termini, as well as other remaining suggestions. |
| South Broadway corridor tunnel/expressway (Exposition Avenue to Arizona Avenue)            | Known and potentially hazardous materials impacts make tunneling infeasible (see December 20, 2005, CDOT letter in <b>Appendix D</b> ).   |
| Utilize Consolidated Main Line railroad corridor for other modes (elevated roadway in CML) | Does not meet Purpose and Need because it cannot function on its own without further construction of a separate project.  |
| Split diamond interchanges on South Broadway and Santa Fe Drive                            | Does not meet Purpose and Need because it does not address South Broadway peak period congestion within the project termini, as well as other remaining suggestions.                |

## 2.5.3 Level 3 Screening

### 2.5.3.1 Level 3 Themed Packages

Following the Level 2 evaluation, a workshop was held to combine the remaining suggestions into packages of alternatives. This workshop was attended by the Project Team, members of the Consensus Committee, and interested public. The 3A Screening advanced packages according to distinct themes to determine how the suggestions would operate in combination with one another within the study area. This resulted in seven packages; however, some of the individual suggestions were included in multiple packages. The suggestions that were not used or eliminated were maintained until more information was available. The seven build packages carried forward into the Level 3A screening were:

- ▶ **Maximizing Transit**—This alternative included enhancements that improved transit service and accessibility. Major elements include: dedicated bus access at Kentucky Avenue, improved light rail service, fixed bus route enhancement, and additional right-of-way for light rail (see **Figure 2-1** for a conceptual drawing).
- ▶ **Multi-Way Boulevard**—This alternative provides rapid traffic flow for northbound and southbound traffic traveling on South Broadway. Private property access is accommodated using a frontage road system that runs parallel to South Broadway between Kentucky and Mississippi Avenues. The objective of this alternative is to separate traffic traveling through the study area to distant destinations from local traffic within the study area (see **Figure 2-2** for a conceptual drawing).
- ▶ **No South Broadway Widening with Flyover**—This alternative does not provide capacity improvements for South Broadway northbound and southbound traffic. The major traffic flow accessing southbound I-25 from southbound South Broadway is improved with a grade-separated ramp that provides additional capacity (see **Figure 2-3** for a conceptual drawing).

Figure 2-1. Maximizing Transit

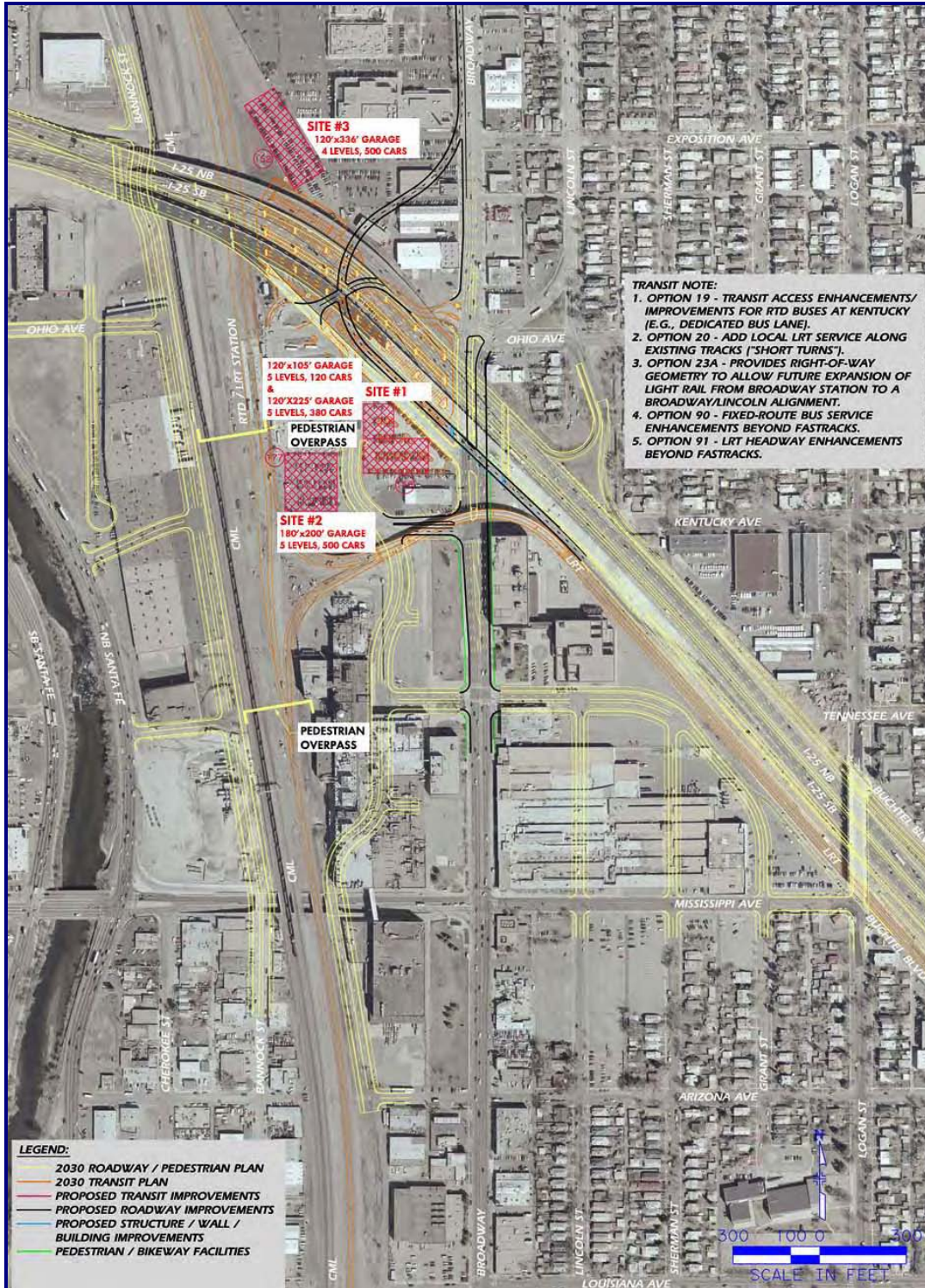


Figure 2-2. Multi-Way Boulevard

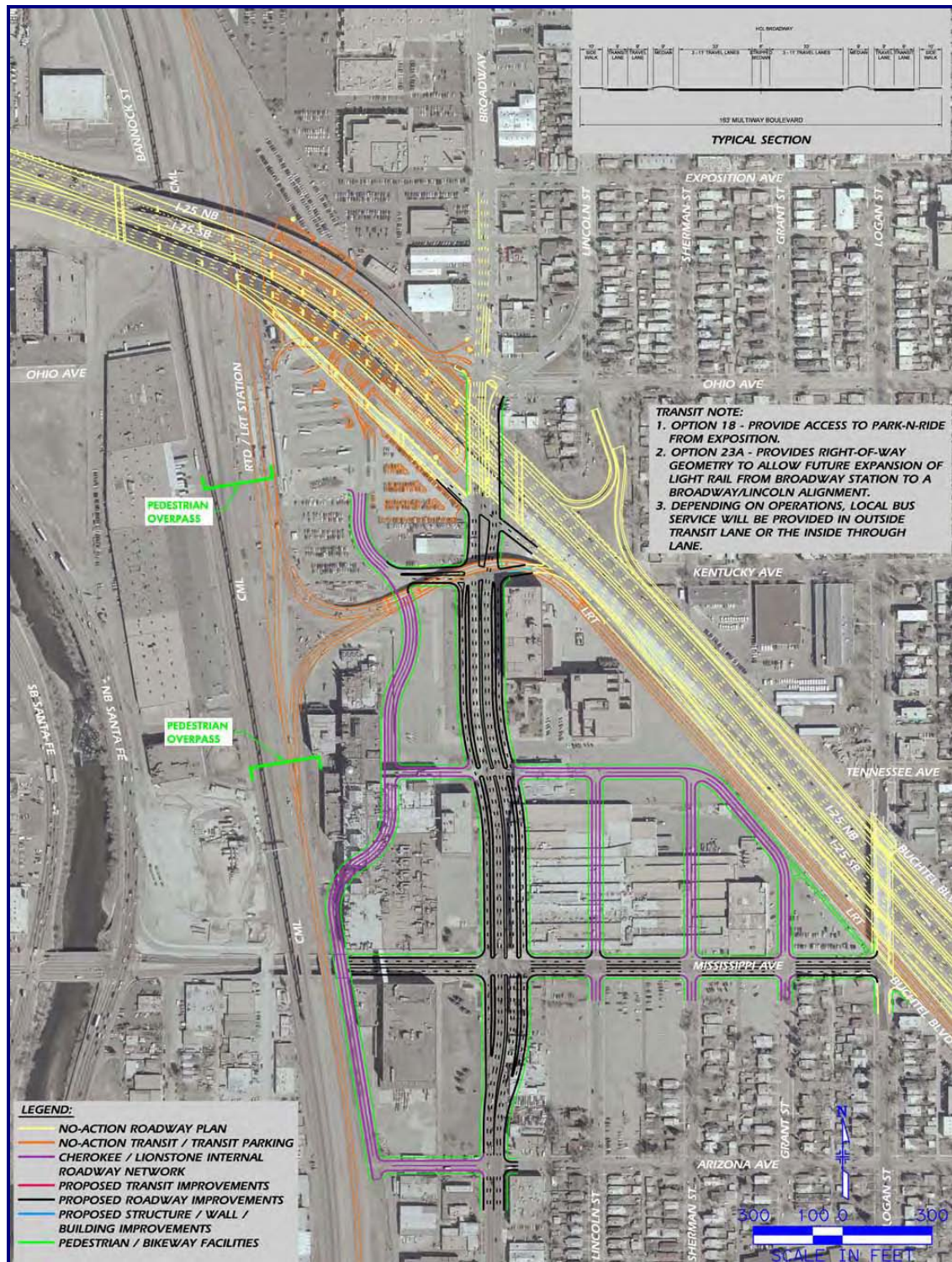
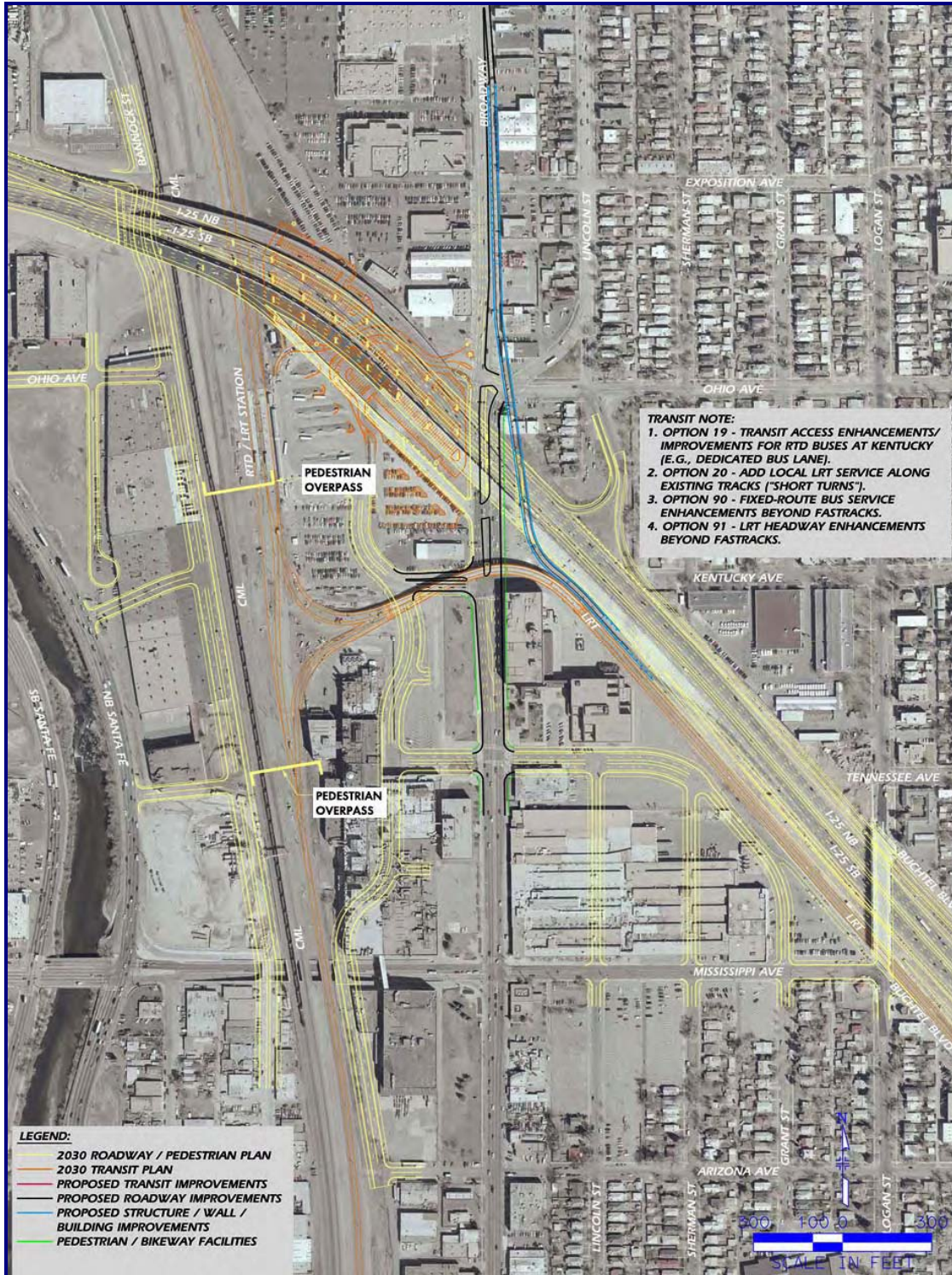


Figure 2-3. No South Broadway Widening with Flyover



- ▶ **Minimal South Broadway Widening**—This alternative included additional through travel lanes on South Broadway between Kentucky and Mississippi Avenues. The southbound South Broadway to southbound I-25 movement was improved with a ‘contra-flow’ ramp access that provided access to I-25 from the Ohio Avenue/South Broadway intersection (see **Figure 2-4** for a conceptual drawing).
- ▶ **Wedge Ramp**—The grade separation of southbound South Broadway to southbound I-25 traffic became known as the wedge ramp because it is wedged in between the existing RTD light rail structure and the I-25 structure. All references to a wedge ramp refer to this grade separation. This alternative proposed a grade-separated ramp that accessed southbound I-25 from southbound South Broadway by a ramp with high overhead clearance of I-25. Part of this alternative was grade separation of the South Broadway/Mississippi Avenue intersection (see **Figure 2-5** for a conceptual drawing).
- ▶ **South Broadway/Acoma Street Couplet**—This alternative continues the South Broadway/Lincoln Street one-way couplet south of Kentucky Avenue along South Broadway to Arizona Avenue. Northbound traffic uses the existing South Broadway right-of-way where southbound traffic parallels the RTD light rail line on the former Gates property (see **Figure 2-6** for a conceptual drawing).
- ▶ **South Broadway/Lincoln Street Couplet**—This alternative continues the South Broadway/Lincoln Street one-way couplet south of the southbound I-25 ramps at South Broadway. Southbound traffic uses the existing South Broadway right-of-way where northbound traffic transverses the former Gates property east of South Broadway (see **Figure 2-7** for a conceptual drawing).

### 2.5.3.2 Level 3 Screening Criteria

In Level 3 Screening, measures of effectiveness (MOE) were developed as the screening criteria to evaluate the potential effectiveness of the individual suggestions, as well as the overall Package. As shown in **Table 2-4** specific speeds, travel times, and congestion ratings were generated for each of the suggestions so that the results could be quantitatively compared among alternatives.

The themed packaged alternatives were subjected to a Level 3A Screening that evaluated comparative differences between the alternatives related to the project Purpose and Need and goals, using the measures of effectiveness identified in **Table 2-4**. Strengths and weaknesses of each of the alternative packages and the individual suggestions were identified.

### 2.5.3.3 Level 3A Screening Results

The results of the Level 3A Screening for the themed packages are shown in **Figure 2-8**. The results of the Level 3A Screening indicate that the Wedge Ramp configuration out performed all other I-25/South Broadway interchange options and therefore was maintained as a common element for the three alternatives carried forward into Level 3B Screening.



# South Broadway Environmental Assessment

Figure 2-4. Minimal South Broadway Widening



Figure 2-5. Wedge Ramp



Figure 2-6. South Broadway/Acoma Street Couplet

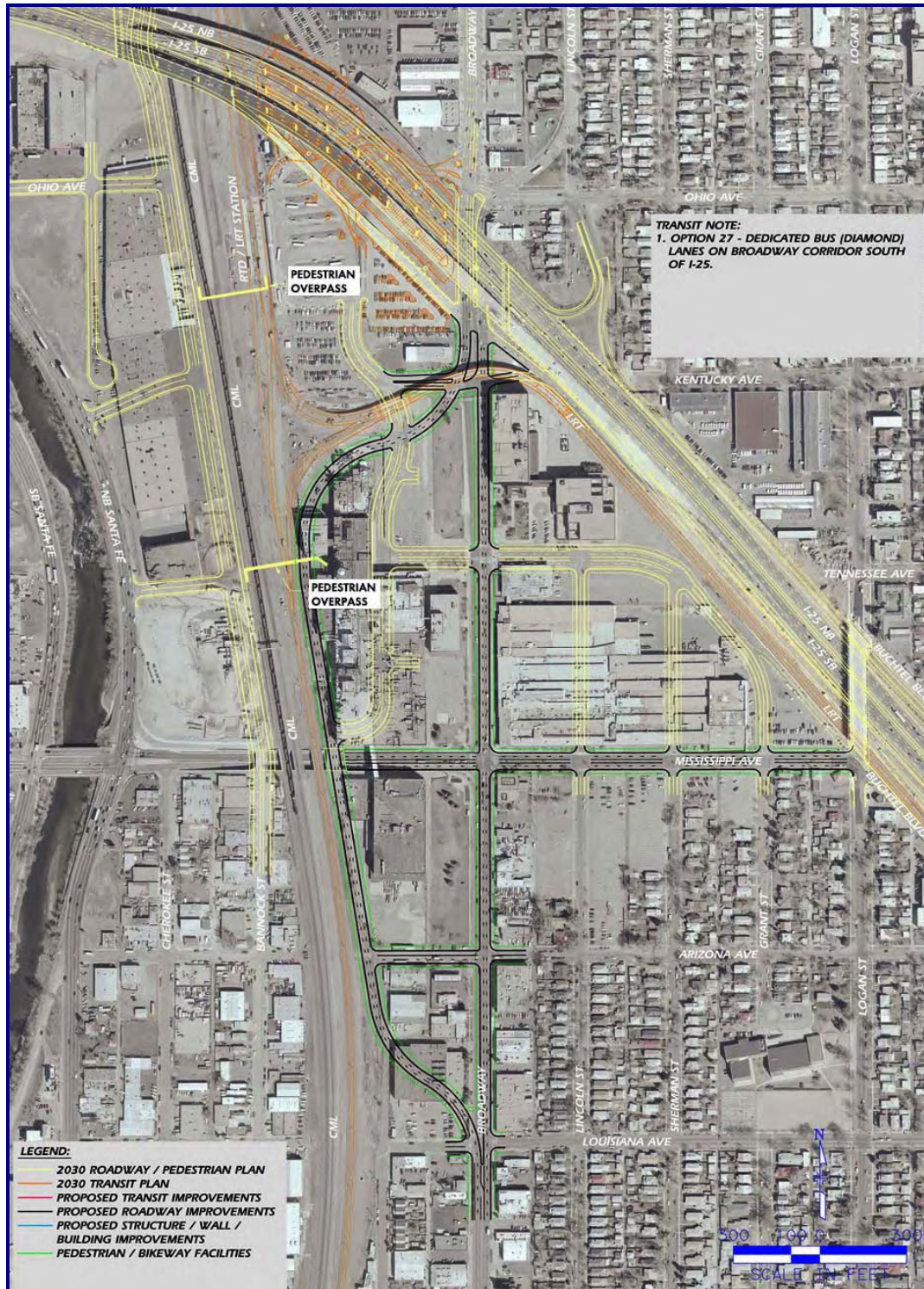


Figure 2-7. South Broadway/Lincoln Street Couplet



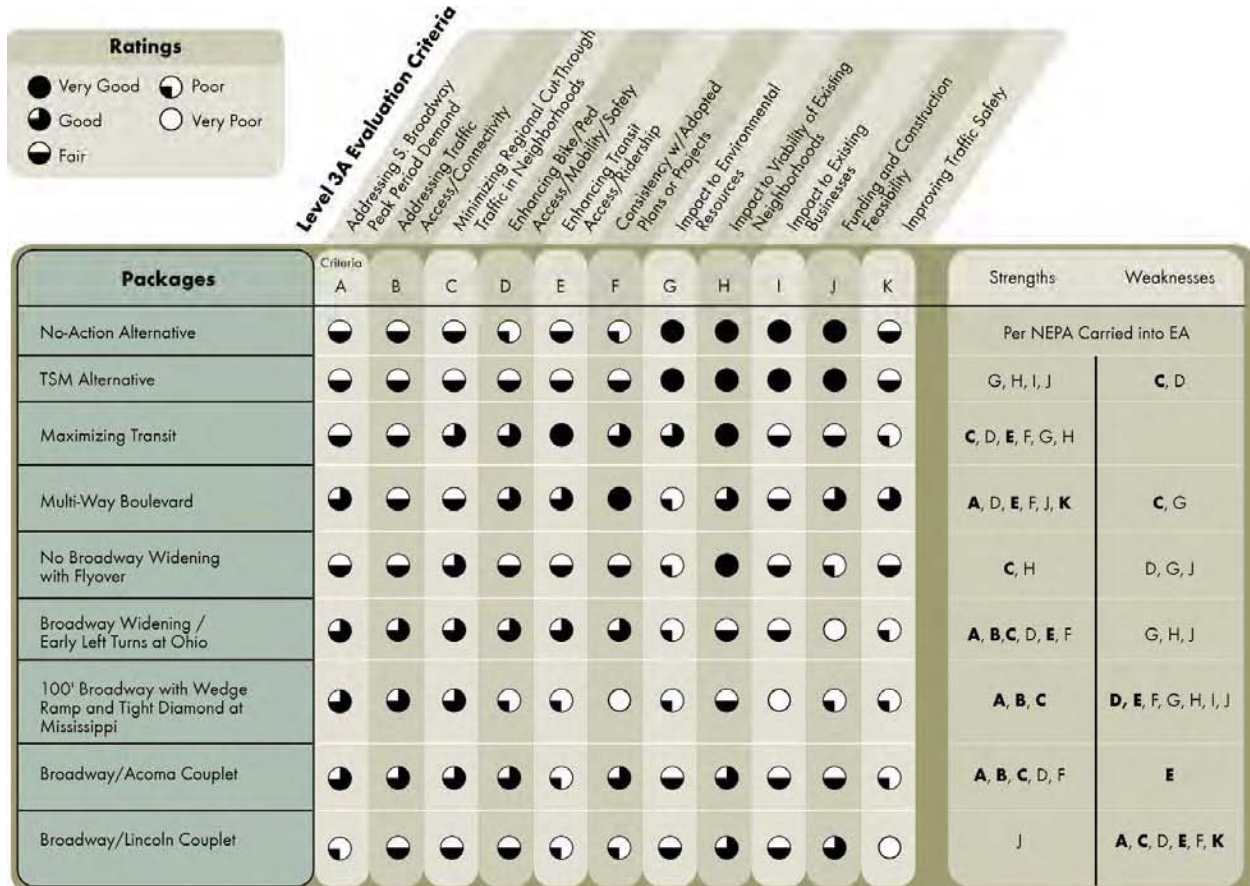
**Table 2-4. Level 3 Evaluation Criteria and Measures of Effectiveness**

| Evaluation Criteria  | Measures of Effectiveness (MOE)  |
|--|--|
| Criteria A:<br>Addressing South Broadway Peak Period Demand              | <ul style="list-style-type: none"> <li>▪ Percent of traffic demand served (South Broadway/Lincoln Street corridor).</li> <li>▪ Intersection approach delays (north/south movements).</li> <li>▪ Maximum South Broadway queue lengths (study intersections).</li> <li>▪ Average travel speed on South Broadway.</li> <li>▪ Average travel time on South Broadway.</li> <li>▪ Vehicle miles traveled (selected origin destination (OD) pairs).</li> <li>▪ Vehicle hours traveled (selected OD pairs).</li> <li>▪ Significance of out-of-direction vehicle movements.</li> </ul>  |
| Criteria B:<br>Addressing Traffic Access/Connectivity                    | <ul style="list-style-type: none"> <li>▪ East-west street intersection LOS and maximum queue length (Center; Exposition; Ohio; Kentucky; Tennessee; Mississippi; Arizona; and Louisiana Avenues).</li> <li>▪ Average travel speed and travel time (selected east-west and north/south OD pairs).</li> </ul>  |
| Criteria C:<br>Minimizing Regional Traffic Cutting Through Neighborhoods | <ul style="list-style-type: none"> <li>▪ Traffic diverted from three local collector roadways: Logan Street, Louisiana Avenue, and Ohio Avenue. Rating based on reduction in volume on these collectors and increase in traffic on South Broadway.</li> </ul>  |
| Criteria D:<br>Enhancing Bicycle/Pedestrian Access/Mobility/Safety       | <ul style="list-style-type: none"> <li>▪ Rating based on number and type of routes, vehicle conflicts, significant new infrastructure, etc.</li> </ul>   |
| Criteria E:<br>Enhancing Transit Access and Ridership                    | <ul style="list-style-type: none"> <li>▪ Rating based on how much out-of-direction movement.</li> <li>▪ Rating based on level and potential effectiveness of transit accommodations and not precluding potential alignments needed for future improvements.</li> <li>▪ Rating based on transit ridership potential; proximity and access to bus/transit stops.</li> <li>▪ Quantify change in number of parking stalls.</li> </ul>  |
| Criteria F:<br>Consistency with Adopted Plans or Projects                | <ul style="list-style-type: none"> <li>▪ Rating based on significance of features that are either positive or negative with respect to agency plans including: <i>Blueprint Denver</i>, <i>Comprehensive Plan 2000</i> and relevant supplements (including South Broadway Area Revitalization District's (BARD) South Broadway streetscape plans), FasTracks, and DRCOG's 2030 Metro Vision.</li> <li>▪ Rating based on significance of features that are either positive or negative with respect to existing development plans.</li> <li>▪ Rating based on significance of features that are either positive or negative with respect to the VHEIS.</li> </ul> |
| Criteria G:<br>Impact to Environmental Resources                         | <ul style="list-style-type: none"> <li>▪ Rating based on level of impacts and how well impacts can be minimized.</li> <li>▪ Rating to quantify estimated right-of-way impacts.</li> <li>▪ Rating based on qualitative estimate of noise impacts.</li> </ul>  |

**Table 2-4. Level 3 Evaluation Criteria and Measures of Effectiveness**

| Evaluation Criteria  | Measures of Effectiveness (MOE)  |
|--|--|
| Criteria H:<br>Impact to the Viability of Existing Neighborhoods | <ul style="list-style-type: none"> <li>Rating based on number of parking spaces lost.</li> <li>Rating based on volumes, speeds, and access.</li> </ul> |
| Criteria I:<br>Impact to Existing Businesses                     | <ul style="list-style-type: none"> <li>Rating based on access requirements/changes.</li> <li>Rating based on number of parking spaces lost.</li> </ul> |
| Criteria J:<br>Funding and Construction Feasibility              | <ul style="list-style-type: none"> <li>Rating considered the cost and feasibility.</li> </ul>  |
| Criteria K:<br>Improving Traffic Safety                          | <ul style="list-style-type: none"> <li>Rating based on how well the alternative meets minimum and desirable design standards.</li> </ul>               |

**Figure 2-8. Level 3A Screening Summary**



**Bold Letter Indicates Evaluation Criteria Defined from Project Purpose and Need (A, B, C, E, K).**

The three best performing alternatives from Level 3A Screening were refined to focus on the through capacity on South Broadway. They were subjected to a Level 3B evaluation in which more quantitative information was developed to provide more detailed evaluation. The goal of the screening process was to identify the alternatives that best met the Purpose and Need and the goals and provided a balance between optimizing transportation operations and minimizing environmental impacts. Alternatives were eliminated if other alternatives better met the Purpose and Need and the goals.

#### 2.5.3.4 Level 3B Screening

The three most promising alternative packages from the Level 3A Screening and the No-Action Alternative were then modeled to provide a more detailed analysis of the traffic operations provided by the various options. The three build packages evaluated in the Level 3B Screening were:

- ▶ **Multi-way Boulevard**—This alternative from Level 3A screening was modified to include the wedge ramp, the Exposition Avenue extension and a combined Kentucky Avenue/southbound I-25 off-ramp intersection (see **Figure 2-9** for a conceptual drawing).
- ▶ **South Broadway Widening**—This alternative from the Level 3A screening also included the wedge ramp, Exposition Avenue, and modified Kentucky Avenue/southbound I-25 off-ramp intersection (see **Figure 2-10** for a conceptual drawing).
- ▶ **South Broadway/Acoma Street One-Way Couplet**—The South Broadway/Acoma Street one-way couplet from Level 3A screening included the same features from Kentucky Avenue north as the other two Level 3B alternatives (see **Figure 2-11** for a conceptual drawing).

#### 2.5.3.5 Level 3B Screening Results

**Table 2-5** through **Table 3-13** describe the individual screening results for each component that was included in the modified themed packages. The results of the VISSIM analysis showed that the one-way couplet outperformed the other options to varying degrees in terms of percent vehicle demand served and intersection delay. However, it did not rate as well in terms of impacts to transit operations, out of direction travel and consistency with adopted plans. When considering all of the performance measures, the Widening option was advanced as best meeting the Purpose and Need of the project. See **Figure 2-12** for a Level 3B Screening Summary.

At the end of Level 3B Screening, the components of the packages that performed the best were included in the Preferred Alternative. Components with less favorable results were eliminated from further consideration.

Figure 2-9. Modified Multi-way Boulevard

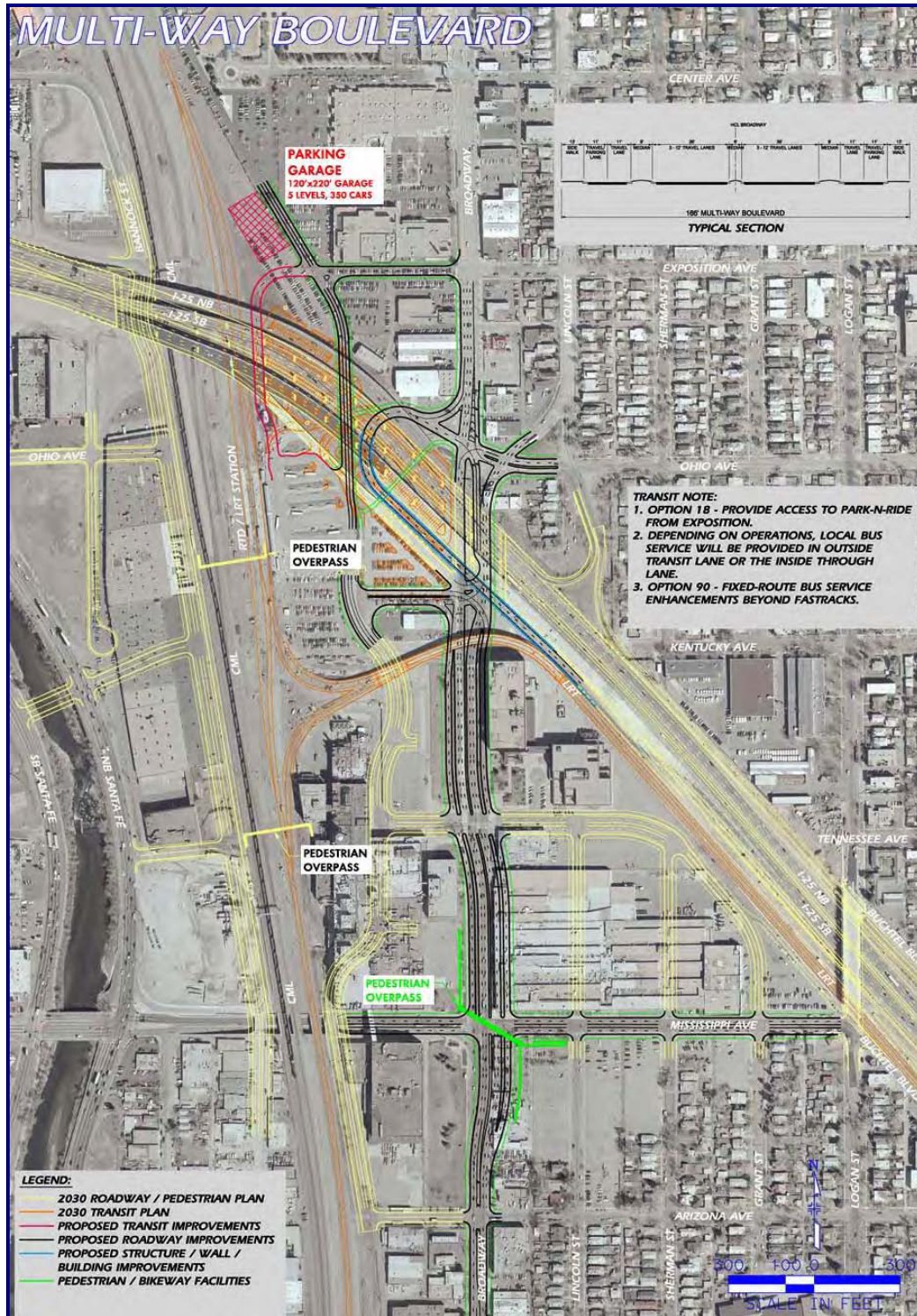


Figure 2-10. Modified South Broadway Widening

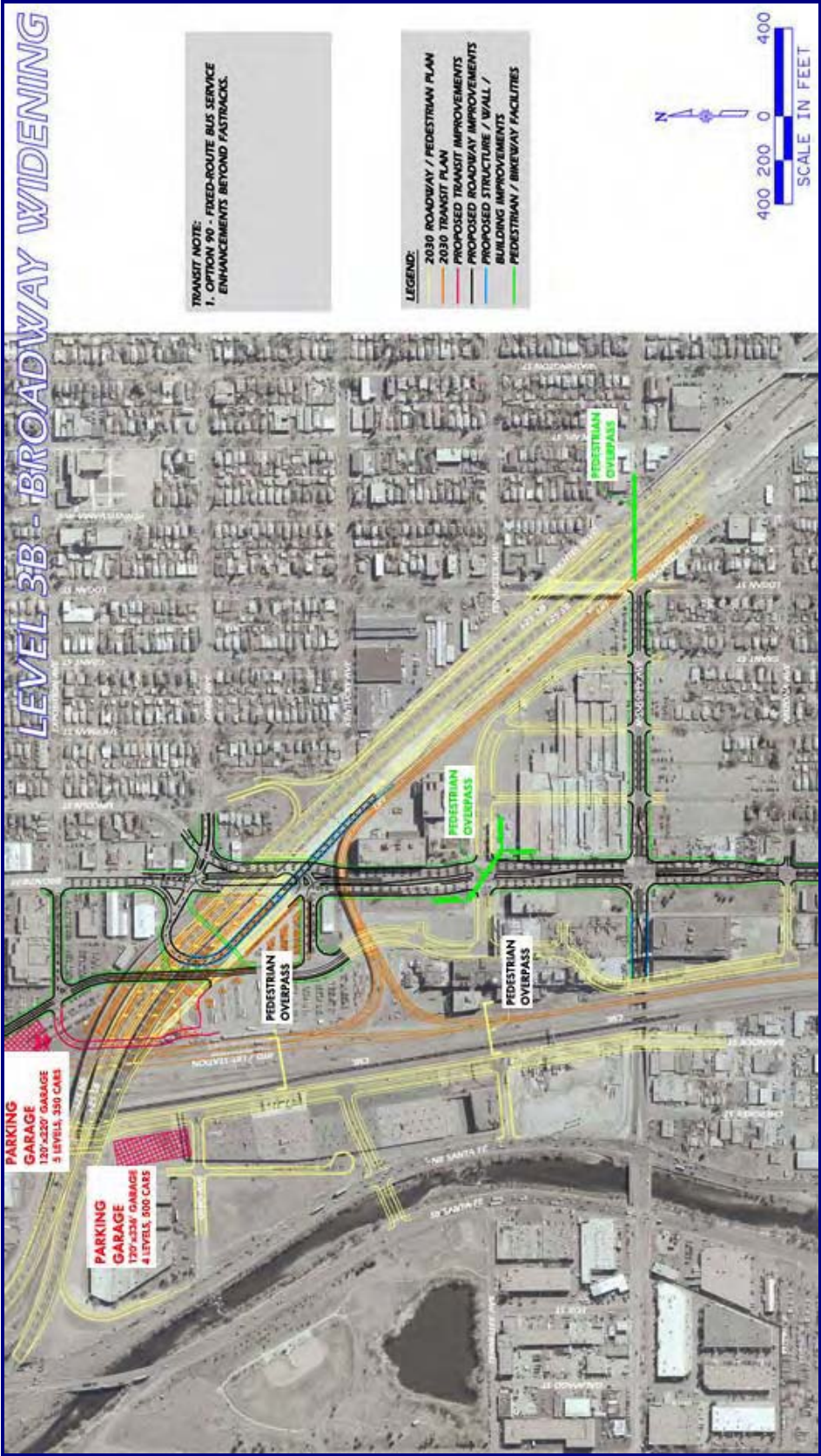


Figure 2-11. Modified South Broadway/Acoma Street Couplet





### New Arterials

Several suggestions centered around a new location for a roadway parallel to South Broadway to spread the travel demand among two or more smaller arterials rather than forcing South Broadway to carry all of the projected volume (see **Table 2-5**).

**Table 2-5. New Arterials Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>   |
|---|---|
| Build new Acoma Street arterial street from north of I-25 to Arizona Avenue   | Eliminated—Does not meet Purpose and Need. Acoma Street has limited connectivity to the existing regional network. Would provide limited utility as an arterial.            |
| New east-west connection north of study area  | Eliminated—Does not meet Purpose and Need because does not address South Broadway peak period congestion within the project termini as well as other remaining suggestions. |
| Special roadway paralleling CML within study area (with grade-separated crossings)                                    | Eliminated—Not constructible since no connection points are available at north and south ends. Additionally, constructing within the railroad right-of-way is prohibited.   |
| Complete east-west grid for all streets, at CML tracks, river, and developments from South Broadway to Santa Fe Drive | Eliminated—Does not meet Purpose and Need because does not address peak period north/south travel demand.   |

### One-way Couplets

In addition to the new arterial suggestions above, other ideas centered on trying to improve north/south capacity by extending the existing one-way couplet system north of Ohio Avenue, south through the study area (see **Table 2-6**).

**Table 2-6. One-way Couplets Screening Results**

| <b>Suggestion Received</b>   | <b>NEPA Screening Summary</b>  |
|--|--|
| Northbound Santa Fe Drive and southbound South Broadway one-way couplet  | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.   |
| Extend South Broadway/ Lincoln Street one-way couplet south of I-25 at grade under I-25 viaduct                              | Eliminated—While best of the final options at meeting vehicle demand, on balance did not meet Purpose, need, and goals as well as the Preferred Alternative.   |
| Extend South Broadway/ Lincoln Street one-way couplet south of I-25 including a one-way northbound tunnel segment under I-25 | Eliminated—Created more environmental impacts to hazardous materials (see CDOT Letter #2 in <b>Appendix D</b> ) and historic properties (Gates Historic District).   |
| Change South Broadway/ Lincoln Street back to two-way streets north of I-25  | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of an adjoining segment.   |
| One-way pairs to manage east-west cut-through traffic in neighborhoods   | Eliminated—Does not meet Purpose and Need because does not meet the need for north/south capacity and encourages rather than discourages regional traffic from cutting through neighborhoods within the project termini. |
| Lincoln Street/Acoma Street couplet south of I-25  | Eliminated—Does not meet Purpose and Need because other alternatives have higher capacity and fewer right-of-way impacts.  |



### **Interchange Reconfiguration**

The South Broadway and I-25 interchange was identified by many on the Consensus Committee as failing under existing conditions. As such, several ideas were put forward to improve the operation of the interchange (see **Table 2-7**).

**Table 2-7. Interchange Reconfiguration Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>   |
|---|---|
| Relocate I-25 to north at South Broadway to allow for wedge ramp and northbound South Broadway to southbound I-25                                   | Eliminated—Although it is feasible, it is not practical as northbound to southbound movement is the lightest of the on-ramp movements at the interchange and the movement can be accommodated adequately for much less effort.  |
| Southbound South Broadway tunnel to southbound I-25 highway on-ramp (off east side of South Broadway)   | Eliminated—Created more environmental impacts to hazardous materials (see CDOT Letter #1 in <b>Appendix D</b> ).  |
| Move southbound South Broadway to southbound I-25 on-ramp closer to I-25  | Part of No-Action Alternative.  |
| Southbound South Broadway loop ramp to southbound I-25  | Eliminated—Not feasible to construct due to skewed intersection of I-25 and South Broadway and proximity of South Broadway to the CML.  |
| Close access from northbound South Broadway to northbound I-25  | Eliminated—Does not meet Purpose and Need because does not restrict regional traffic from cutting through neighborhoods within the project termini as well as other remaining suggestions.  |
| Close South Broadway/I-25 interchange   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.  |
| Continuous Flow Intersections (CFI) at Mississippi Avenue and South Broadway at I-25  | Eliminated—Creates more environmental impacts: Right-of-way and possible impact to historic property.   |
| Direct I-25 access to I-25/ South Broadway park-n-Ride  | Eliminated—Not feasible to construct due to elevation difference between I-25 and the station combined with the limited area between I-25, the CML, the Light Rail structure, and South Broadway.   |
| One-lane wedge ramp to allow northbound South Broadway to southbound I-25 ramp merge (parallel the wedge ramp until grades match)                   | Eliminated—Cannot be built: Traffic operations require a 2 lane ramp for southbound South Broadway to southbound I-25 traffic. Minimum cross section for 1 lane ramp is approximately 28 feet. 2 ramps side by side would require approx. 54 feet; however only 33 feet is available. |
| Southbound South Broadway to southbound I-25 left turn at Ohio Avenue, then accesses on-ramp via easternmost lanes underneath South Broadway bridge | Eliminated –Creates confusing vehicle maneuvers. Did not improve operations as much as Preferred Alternative.   |
| Southbound South Broadway flyover to southbound I-25  | Eliminated—Provides same operational improvement as ramp design in the Preferred Alternative. Impacts to right-of-way, visual resources and through construction much greater than Preferred Alternative.   |



**Table 2-7. Interchange Reconfiguration Screening Results**

| Suggestion Received   | NEPA Screening Summary  |
|---|---|
| Wedge Ramp to southbound I-25 (intersect South Broadway south of Exposition Avenue) | Advanced—Utilized in wedge ramp design. Addresses Purpose and Need by addressing high traffic demand for this movement. |

### New or Revised Access

This group of suggestions focused specifically on providing access to important locations or restricting access to improve efficiency of South Broadway (see **Table 2-8**).

**Table 2-8. New or Revised Access Screening Results**

| Suggestion Received  | NEPA Screening Summary  |
|--|---|
| Right-in/right-out only on existing South Broadway between Exposition Avenue and Louisiana Avenue  | Eliminated—Does not meet Purpose and Need because other alternatives reduce congestion without limiting access. Severely limiting access to South Broadway will cause significant out of direction travel and increased traffic on local streets (cut-through traffic). |
| South Broadway tunnel from north of I-25 to Mississippi Avenue (2-lane tunnel or contra flow lanes)  | Eliminated—Created more environmental impacts to hazardous materials (see CDOT Letter #1 in <b>Appendix D</b> ).  |
| Grade separate South Broadway (elevated) over Mississippi Avenue   | Eliminated—Created more environmental impacts to historic property and to right-of-way.   |
| Connect Mississippi Avenue to southbound I-25 Collector/ Distributor (C/D) system  | Eliminated—Not constructible due to LRT and vertical geometry of I-25 and adjacent streets.   |
| Provide right-of-way geometry that does not preclude future expansion of LRT from I-25 and Broadway Station to South Broadway/Lincoln Street alignment | Eliminated—Does not meet Purpose and Need because does not independently address the project need. Used as criteria in comparative screening.   |
| Maintain left-turn options at park-n-Ride (Kentucky Avenue)  | Not needed as an improvement as it is included as part of No-Action Alternative.  |
| Southbound South Broadway to southbound I-25 tunnel that peels off of the west side of South Broadway  | Eliminated—Known and potentially hazardous materials impacts make tunneling infeasible (see letter in <b>Appendix D</b> ).  |
| Two-lane on-ramp to southbound I-25 at Kentucky Avenue   | Not needed as an improvement as it is included as part of No-Action Alternative.  |
| Right-in/right-out (only) at South Broadway and Kentucky Avenue  | Eliminated—Does not meet Purpose and Need because other suggestions better remove traffic from intersection.  |
| Grade separate South Broadway under Mississippi Avenue   | Eliminated—Infeasible because of excessive construction costs of sub-surface I-25 drainage, and potential impact to historic property.  |

**Table 2-8. New or Revised Access Screening Results**

| Suggestion Received   | NEPA Screening Summary   |
|---|--|
| Direct access ramp from park-n-Ride (grade-separated)   | Eliminated—Not feasible to construct due to elevation difference between I-25 and the station combined with the limited area between I-25, the CML, the Light Rail structure, and South Broadway.                              |
| Roundabout at South Broadway/ Mississippi Avenue (3 Lanes)  | Eliminated—Does not meet Purpose and Need because other improvements provide higher capacity and have less right-of-way impacts. This intersection would require a 3-lane roundabout, which is an unproven design in Colorado. |
| Provide better street connections at the new T-REX bridges over I-25                                | Eliminated—Does not meet Purpose and Need of meeting capacity requirements on South Broadway.  |
| Improve east-west routes to and from Washington Park along Ohio Avenue                              | Advanced as Modified—Specific improvements to Ohio Avenue and Transit Station connections incorporated as part of No-Action and Preferred Alternatives.  |
| Grade separate all South Broadway intersections (Elevated)  | Eliminated—Not feasible to construct, cannot create ramp connections to cross streets within a city block and maintain acceptable grades.  |
| Build bridge across I-25 at Cherokee Street   | Eliminated—Does not meet Purpose and Need because Cherokee Street has limited connectivity to the existing regional network. Would provide limited improvement in north/south capacity in the study area.                      |
| Restrict turning on Mississippi Avenue to prevent traffic from cutting through the residential area | Eliminated—Does not meet Purpose and Need because other suggestions better meet regional traffic demand and pull traffic away from neighborhoods.  |
| Multi-modal bridge across I-25 at Tennessee Avenue  | Eliminated –Does not have logical connection on eastside of I-25. Pedestrian connections have been provided at Ohio and Mississippi Avenues to improve east-west pedestrian mobility.  |

### **Modified Arterial Configurations**

This group of suggestions center around the idea of improving the capacity of South Broadway by revising the existing use of the street, moving its location or creating a new roadway parallel to South Broadway (see **Table 2-9**).

**Table 2-9. Modified Arterial Configurations Screening Results**

| Suggestion Received   | NEPA Screening Summary   |
|---|--|
| Convert South Broadway to two-way between Ohio and Exposition Avenues for left-turn (northbound South Broadway) to wedge ramp | Eliminated—Does not meet Purpose and Need because does not address South Broadway peak period congestion within the project termini.   |
| Add reversible lane on South Broadway to accommodate peak traffic flows   | Eliminated—Does not meet Purpose and Need of improved north/south capacity. For a reversible lane to provide improved capacity, the directional split in peak hour traffic typically needs to be at least 60 percent to 40 percent in favor of the peak direction. |



**Table 2-9. Modified Arterial Configurations Screening Results**

| <b>Suggestion Received</b>   | <b>NEPA Screening Summary</b>   |
|--|---|
| Add High Occupancy Vehicle (HOV) lanes on South Broadway   | Eliminated—There are not HOV lanes north and south of study area. This decreases the effectiveness of such an improvement.  |
| Extend Ohio Avenue west to Santa Fe Drive  | Eliminated—Not feasible to construct (Intersection on I-25 ramp not allowed).   |
| Connect Ohio Avenue west across South Broadway and end before CML with access to Cherokee Street and LRT Station   | Not needed as an improvement as it is included as part of No-Action Alternative.  |
| Bridge across I-25 at Mississippi Avenue   | Eliminated—Does not meet the Purpose and Need because this would encourage cut-through traffic to neighborhoods. This has little benefit in addressing South Broadway traffic demand.   |
| Additional east-west vehicle connection over CML north of Mississippi Avenue   | Eliminated—To provide adequate clearance over the CML in the distance between South Broadway and the CML would require steep grades far in excess of acceptable maximums. Not feasible to construct due to vertical geometry. |
| Tunnel Acoma Street (South Broadway/Acoma Street Couplet) under Cherokee development and connect in "T" intersect at Mississippi Avenue under or east of the CML (southbound only) | Eliminated—Does not meet Purpose and Need because does not address South Broadway peak period congestion within the project termini as well as other remaining suggestions.   |
| Contra flow northbound South Broadway to southbound I-25 via wedge ramp  | Eliminated—Does not meet Purpose and Need because requires additional signal on South Broadway, which adversely effects traffic operations. Impact to historic property north of Ohio Avenue intersection.                    |
| Extend Exposition Avenue west of South Broadway to provide access to businesses and the wedge ramp   | Advanced as Modified –This suggestion has been altered to provide access to RTD transit station and businesses.   |
| Extend Exposition Avenue west of South Broadway over CML tying into the frontage road system and making connection to Santa Fe Drive   | Eliminated—Does not meet Purpose and Need of addressing peak hour demand on South Broadway.   |
| South Broadway converted to pedestrian and transit mall in center lanes with frontage roads on the outside   | Eliminated—Does not meet Purpose and Need because does not promote/increase transit access and ridership within the project termini as well as other suggestions.   |
| Ramp southbound Acoma Street down to intersect with existing Mississippi Avenue at-grade below railroad bridges (couplet)  | Eliminated—Cannot be constructed without impacts to contaminated soils in the area.   |
| Texas U-turn for southbound Acoma Street access to northbound South Broadway (via Arizona Avenue) (couplet)  | Eliminated—Project cannot be constructed without the construction of another project.   |



**Table 2-9. Modified Arterial Configurations Screening Results**

| <b>Suggestion Received</b>   | <b>NEPA Screening Summary</b>   |
|--|---|
| Relocate Kentucky Avenue access to I-25 and Broadway Station north of LRT structure                        | Advanced—Relocation of Kentucky Avenue is part of the Preferred Alternative; however, suggestion has been adjusted to better meet Purpose and Need of accommodating peak hour traffic demand. |
| Two-way bypass along the west side of Cherokee property with "Main Street" South Broadway for local access | Eliminated—Project cannot be constructed without the construction of another project.   |
| Elevated South Broadway with local access at-grade   | Eliminated—The cost to construct this alternative would be substantial.   |
| Widen South Broadway to 8 through lanes  | Advanced  |

### **Bicycle Enhancements**

This group of suggestions addresses the goal of maintaining or improving bicycle access in and through the study area by providing bicycle facilities that are fully integrated with the larger bicycle network of the city. Providing enhanced alternative mode facilities will help to reduce the vehicular demand in the study area (see **Table 2-10**).

**Table 2-10. Bicycle Enhancements Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>  |
|---|--|
| More bicycle capacity on South Platte River Trail   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of an adjoining segment. |
| Provide bicycle lanes in study area   | Advanced   |
| Bicycle/pedestrian improvements on Louisiana Avenue and Pearl Street  | Eliminated—Outside of the study area.  |
| Bicycle/pedestrian access paralleling South Broadway  | Advanced   |
| Improve bicycle and pedestrian access to Val Verde and Ruby Hill Parks  | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of an adjoining segment. |
| Improve crossing for bicycles and pedestrians at I-25 and Bayaud Ave  | Eliminated—Outside of the study area.  |
| Provide bicycle parking at new Louisiana light rail station and ensure good bus access                                | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.   |
| Create bicycle and pedestrian improvements to Iowa Avenue from east of South Broadway to the South Platte River Trail | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.   |
| Create off road trail along Santa Fe Drive on the Overland Golf Course  | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.   |



**Table 2-10. Bicycle Enhancements Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>   |
|---|---|
| Build commuter bicycle trails throughout the study area to provide continuous flow and higher speeds for bicyclists   | Eliminated—Infeasible because cannot connect with other regional bicycle/pedestrian routes from study area. Dedicated commuter route would also require extensive right-of-way acquisition. |
| Create bicycle improvements through the entire study area, extending a 3 mile radius from the I-25 and Broadway Station. Improvements should focus on the needs to feel safe using pedestrian and bicycle modes and intersection crossing signals should be timed to allow several bicycles through | Advanced as Modified—Improvements to bicycle connections incorporated where practical and feasible in the Preferred Alternative.  |

### **Pedestrian Enhancements**

This group of suggestions addresses the goal of maintaining or improving the pedestrian environment and facilitating the viability of existing redeveloped businesses (see **Table 2-11**).

**Table 2-11. Pedestrian Enhancements Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>  |
|---|--|
| Pedestrian crossing area at the CML   | Not needed as an improvement as it is included as part of No-Action Alternative.   |
| Pedestrian signals at Ohio Avenue and the northbound I-25 ramp to facilitate a pedestrian connection from the neighborhood to the I-25 and Broadway Station   | Advanced   |
| Construct a multimodal bridge over South Broadway at either Tennessee Avenue or Mississippi Avenue that provides a safe pedestrian/bicycle crossing and increase signage                              | Eliminated—Does not meet Purpose and Need of encouraging a pedestrian environment along the corridor.  |
| Coordinate this study with the Baker Neighborhood Plan; improve bicycle and pedestrian crossing at Alameda and Cherokee Street intersection and connect neighborhood to the I-25 and Broadway Station | Advanced as Modified—By itself this suggestion does not meet Purpose and Need without further construction of a separate project. Acoma Street extended as pedestrian route as part of Preferred Alternative.                                |
| East-west pedestrian plaza under South Broadway at developments (traffic remains at-grade)  | Eliminated—Known environmental issues due to contaminated soils in the area.   |
| Overhead pedestrian crossing at Kentucky, Arizona, and Tennessee Avenues  | Eliminated—Does not meet Purpose and Need by promoting a strong pedestrian environment. Pedestrian activities will be maintained at the ground level when possible. Pedestrian safety improvements are planned at each of the intersections. |



**Table 2-11. Pedestrian Enhancements Screening Results**

| Suggestion Received  | NEPA Screening Summary  |
|--|---|
| Extend bicycle/pedestrian only connection from Buchtel Boulevard to Tennessee Avenue across South Broadway to link with the Light Rail Station | Eliminated—Does not meet Purpose and Need because of difficulties created with signalization at Logan Street, Mississippi Avenue, and Buchtel intersection. The bicycle path would create a new movement at the intersection reducing the efficiency of the signal and causing drivers to weave through local streets to avoid the intersection in peak hours (encourages cut-through traffic). |
| Retime pedestrian crossing signal at the Logan Street and Iowa intersection to allow more time to cross Logan Street.                          | Eliminated—Outside of the study area.   |
| Second story-level sidewalks along South Broadway with grade-separated crossing  | Eliminated—Does not meet Purpose and Need because other grade-separated crossings of South Broadway are comparatively better and cost less.   |
| Pedestrian infrastructure improvements   | Advanced  |
| Minimum 13-foot sidewalks  | Advanced  |

### **Transit Enhancements**

As many were supportive of the CCD's plans for a TOD in the area and support maximizing the use of the I-25 and Broadway Station, several ideas to improve South Broadway operations by improving transit access and service were put forward for consideration (see **Table 2-12**).

**Table 2-12. Transit Enhancements Screening Results**

| Suggestion Received   | NEPA Screening Summary   |
|---|--|
| Add local LRT service along existing tracks   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of an adjoining segment.                   |
| Central Connector/Bus Rapid Transit (BRT)/LRT, at-grade/subway to civic Center via South Broadway/Lincoln Street) | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of an adjoining segment.                   |
| Dedicated bus (diamond) lanes on South Broadway corridor south of I-25  | Eliminated—Not feasible because there are no bus diamond lanes north and south of study area. This decreases the effectiveness of such improvements. |
| FasTracks enhancements to fixed-route bus service   | Not needed as an improvement as it is included as part of No-Action Alternative.   |
| FasTracks-enhanced LRT headways   | Not needed as an improvement as it is included as part of No-Action Alternative.   |
| Increase LRT to 4 cars  | Not needed as an improvement as it is included as part of No-Action Alternative.   |
| Four-car LRT trains during peak hours to Denver Union Station (DUS)   | Eliminated—Cannot function on its own without further construction of an adjoining segment.  |
| Four-car LRT trains during peak hours on the D, F, and H lines to downtown  | Eliminated—Cannot function on its own without further construction of an adjoining segment. Requires improvements outside the study area.            |



**Table 2-12. Transit Enhancements Screening Results**

| <b>Suggestion Received</b>   | <b>NEPA Screening Summary</b>  |
|--|--|
| FasTracks-enhanced Central Corridor LRT capacity                   | Not needed as an improvement as it is included as part of No-Action Alternative.   |
| Central Corridor LRT capacity enhancements beyond FasTracks        | Eliminated—Infeasible because cannot function on its own without further construction of an adjoining segment.                   |
| LRT headway enhancements beyond FasTracks                          | Eliminated—Infeasible because it cannot function on its own without further construction of an adjoining segment.                |
| South Broadway streetcar running from CBD south to Highlands Ranch | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project. |
| South Broadway LRT Line  | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project. |

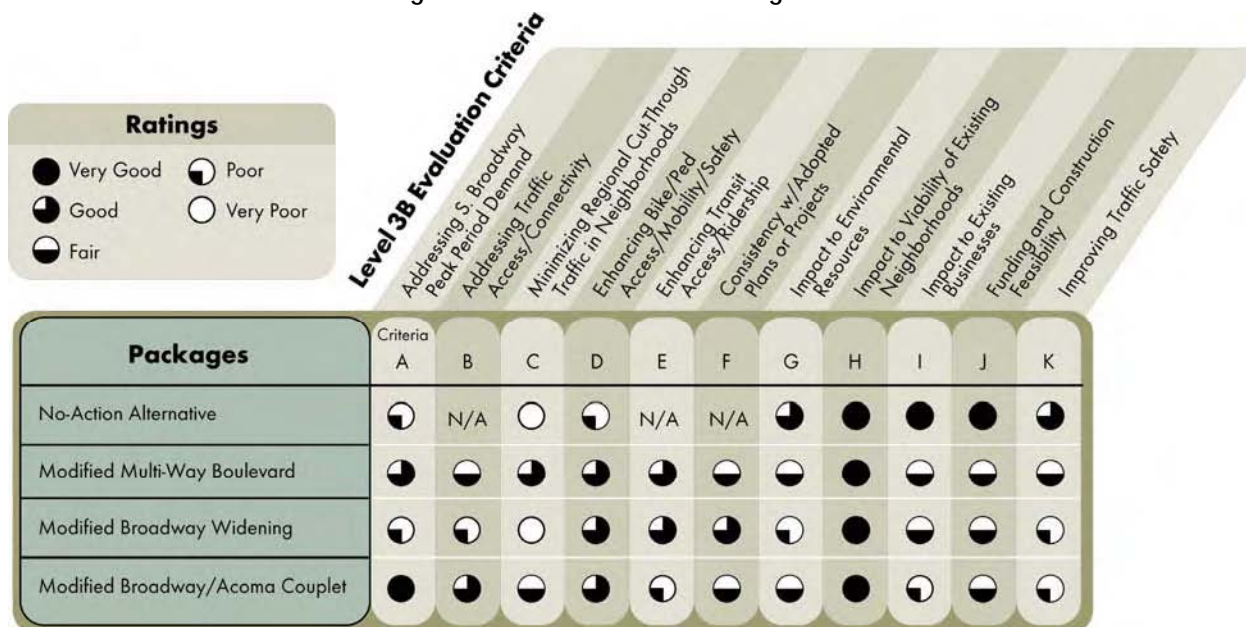
### **Other Improvements**

See **Table 2-13** for a list of other improvements screening results.

**Table 2-13. Other Improvements Screening Results**

| <b>Suggestion Received</b>  | <b>NEPA Screening Summary</b>   |
|---|---|
| Implement congestion management Transportation System Management (TSM)/Transportation Demand Management (TDM) programs and policies                 | Advanced—TSM and TDM plans are part of the General Development Plans for the Gates property redevelopment. Since no construction is needed, these plans will be incorporated as the developments progress.  |
| Improve parking at Evans park-n-Ride. Connect surface lot to structure/deck   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project. This would also require improvements outside the study area.   |
| Parking management adjacent to or at three LRT stations   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project.  |
| Major parking facility north of I-25 with shuttle bus to redevelopment areas (dedicated right-of-way could be shared with bicycles and pedestrians) | Eliminated—Does not meet Purpose and Need because does not provide access to and from area neighborhoods, existing businesses, bus stops, the redevelopment sites, and the I-25 and Broadway Station within the project termini as well as other remaining suggestions. |
| No on-street parking allowed on South Broadway during AM and PM peak periods  | Part of No-Action and Preferred Alternative.  |
| Add additional parking at Alameda Station with structured parking   | Eliminated—Does not meet Purpose and Need because cannot function on its own without further construction of a separate project. This would also require improvements outside the study area.   |

Figure 2-12. Level 3B Screening Results



## 2.5.4 Components Advanced to Preferred Alternative

The suggestions carried forward to the Preferred Alternative from the Level 3 Screening are listed below. These elements of the Preferred Alternative are explained in more detail in Section 2.7.

To accommodate the transportation needs of area neighborhoods, existing businesses, and planned developments, the Preferred Alternative includes:

- ▶ Widening South Broadway to an eight-lane cross-section.
- ▶ Wedge ramp to southbound I-25 (intersect South Broadway south of Exposition Avenue).
- ▶ Extend Exposition Avenue west of South Broadway to provide access to businesses and the wedge ramp.
- ▶ Relocate Kentucky Avenue access to I-25 and Broadway Station north of LRT structure.

To promote the development and use of transit-oriented, civic, and neighborhood places, the Preferred Alternative includes the following improvements:

- ▶ Provide bicycle lanes in study area.
- ▶ Implement bicycle/pedestrian access paralleling South Broadway.
- ▶ Create bicycle improvements through the entire study area, (as determined practical and feasible) extending a three-mile radius from the I-25 and Broadway Station.
- ▶ Add pedestrian signals at Ohio Avenue to connect with I-25 and Broadway Station.

- ▶ Add pedestrian infrastructure improvements.
- ▶ Add minimum 13-foot sidewalks.
- ▶ Extend Acoma Street to Exposition Avenue as pedestrian route.
- ▶ Implement congestion management Transportation System Management (TSM)/ Transportation Demand Management (TDM) programs and policies. Since no construction is needed, these plans will be incorporated as the developments progress.

## 2.6 I-25/SOUTH BROADWAY INTERCHANGE ALTERNATIVES ADVANCED

Since the VHEIS was underway and near completion during the South Broadway alternatives development process, identification of an interchange configuration had to be deferred until the VHEIS process identified a Preferred Alternative for the South Broadway and I-25 interchange. This alternative became the No-Action Alternative for the South Broadway EA.

The selection of an interchange Preferred Alternative required screening for effectiveness at addressing the Purpose and Need of both the South Broadway EA and the VHEIS. This evaluation considered criteria developed by the South Broadway EA and VHEIS. These criteria are:

### Traffic Safety

- ▶ Is there a relative traffic congestion improvement?
- ▶ Does this alternative maintain local access?
- ▶ How consistent is this with current design guidelines?

### Construction/Community

- ▶ How easy is it to construct?
- ▶ What is the relative capital cost of this alternative?
- ▶ Can this be built within existing right-of-way?
- ▶ How consistent is this with local agency plans?
- ▶ Does this provide opportunity to improve pedestrian/bicycle access to trail systems and other activity centers?

### Environmental

- ▶ Does this alternative share benefits with and avoid adverse impacts to minority or low-income population?
- ▶ Does this alternative avoid impacts to public parks and historic sites?

Review of the VHEIS Preferred Alternative indicated that it met the Purpose and Need for the VHEIS but did not address all of the elements of the South Broadway EA. To be certain that an interchange alternative addressed the Purpose and Need of both NEPA processes, ten build configurations were developed and evaluated for effectiveness for all screening criteria in both processes. **Figure 2-13** provides a detailed comparison of VHEIS and South Broadway interchange improvements and screening criteria from both projects.

Figure 2-13. I-25/South Broadway Interchange Screening

| Alternatives  | Level 3 Evaluation Criteria |   |   |   |     |     |   |   |   |   |   | Broadway Summary |   |   |   | VHEIS Summary       |                                  |   |
|---|-----------------------------|---|---|---|-----|-----|---|---|---|---|---|------------------|---|---|---|---------------------|----------------------------------|---|
|   | A                           | B | C | D | E   | F   | G | H | I | J | K |                  |   |   |   | VHEIS Environmental | VHEIS Constructability/Community | VHEIS Traffic Congestion/Traffic Safety |
| No Action - Tight Diamond   | ○                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | No-A             | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 1 - Original Option with Wedge Ramp                                | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 1                | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 2 - Access to Houses Inside Loop from Broadway                     | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 2                | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 3A - NB I-25 Loop On-ramp Accessed Directly from Broadway          | ●                           | ● | ● | ● | N/A | N/A | ○ | ● | ● | ● | ● | 3A               | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 3B - NB I-25 Loop Ramp Accessed from Ohio and Lincoln Intersection | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 3B               | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 4A - NB I-25 Accessed by means of Wedge Ramp                       | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 4A               | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 4B - NB I-25 Accessed by Wedge Ramp and Existing Loop Ramp         | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 4B               | ● | ● | ● | ●                   | ●                                | ○                                       |
| Option 5 - Option 4a with "C/D" Road on Interstate                        | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ● | ● | 5                | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 6 - Braided Ramps  | ●                           | ● | ● | ● | N/A | N/A | ● | ● | ● | ○ | ● | 6                | ● | ○ | ● | ●                   | ●                                | ●                                       |
| Option 7 - Option 3B with C/D Road on Interstate                          | ●                           | ● | ● | ● | N/A | N/A | ○ | ● | ● | ● | ● | 7                | ● | ● | ● | ●                   | ●                                | ●                                       |
| Option 8 - Diverging Diamond  | ●                           | ● | ○ | ○ | N/A | N/A | ● | ● | ● | ● | ○ | 8                | ● | ● | ● | ●                   | ●                                | ●                                       |

## 2.6.1 Interchange Screening Process

To select an interchange alternative that met the combined needs of both the VHEIS and the South Broadway EA, a screening process specific to the interchange was developed using the measures of effectiveness developed in both processes.

Eleven interchange alternatives were developed by the project team and the public, which includes the No-Action Alternative. These were:

- ▶ No Action (the VHEIS preferred alternative): A tight diamond interchange configuration.
- ▶ Option 1: This was the alternative included with the South Broadway preferred alternative to that point (October 19 Option). It included the wedge ramp for the southbound I-25 on movements but no changes to the northbound access from South Broadway over existing conditions.
- ▶ Option 2: Wedge ramp improvements as well as modifications to the northbound I-25 hook ramp to improve design speed. Access to properties inside the loop ramp was maintained.



- ▶ Option 3A: Wedge ramp improvements for southbound I-25 access. Northbound I-25 accessed directly from South Broadway. Eliminated local use of eastbound Ohio Avenue and access to properties inside the loop ramp.
- ▶ Option 3B: The current preferred alternative interchange configuration.
- ▶ Option 4A: Existing hook ramp eliminated. All access to I-25 achieved on the West side of South Broadway.
- ▶ Option 4B: Included access options for Option 4A but did not eliminate the existing hook ramp. Northbound I-25 traffic could access I-25 on either side of South Broadway.
- ▶ Option 5: Access to I-25 from South Broadway the same as in Option 4A. The interstate merge for northbound I-25 traffic achieved via a Collector/Distributor road (C/D road). Northbound traffic from South Broadway would merge with the I-25 mainline north of Santa Fe Drive.
- ▶ Option 6: Access to I-25 from South Broadway the same as in Option 4A. Included separate braided ramps for Santa Fe Drive off-ramp traffic and northbound I-25 traffic from South Broadway.
- ▶ Option 7: Same access from South Broadway as in Option 3B. The merge with I-25 for northbound traffic would occur via a C/D road. Northbound traffic from South Broadway would merge with the I-25 mainline north of Santa Fe Drive.
- ▶ Option 8: Revised the interchange to an at-grade “Diverging Diamond” configuration.

Based on the screening, the tight diamond (No-Action) configuration advanced as the Preferred Alternative in the VHEIS met the VHEIS criteria better than all other options. However, when combined with the criteria contained in the South Broadway EA process, the tight diamond did not perform as well as other options. The combined summary ratings were used to select a configuration that was at least adequate at meeting the criteria of both processes. As shown in **Figure 2-13** Option “3B” adequately met the VHEIS criteria and met the criteria of the South Broadway EA better than all other options.

## 2.7 ALTERNATIVES ADVANCED FOR SOUTH BROADWAY EA

Following completion of the alternatives evaluation process, one build alternative was identified as the Preferred Alternative to be analyzed in this EA along with the No-Action Alternative. These were determined to be the reasonable alternatives.

### 2.7.1 No-Action Alternative

The No-Action Alternative includes projects that already have committed funds for improvements and also includes the Preferred Alternative for the VHEIS. These improvements would be made whether or not any other improvements are made in conjunction with the South Broadway EA. Committed projects that are included in the No-Action Alternative are listed below. The projects include improvements to the I-25 mainline, the South Broadway and I-25 interchange, and the light rail transit and bus systems. No improvements are planned for South Broadway, or the cross-streets, within the study area. The No-Action Alternative is shown in **Figure 2-14**.

Figure 2-14. No-Action Alternative



- ▶ VHEIS Preferred Alternative. The VHEIS Preferred Alternative work begins at the southern end of the existing I-25 viaduct over South Broadway and extends north past the South Broadway study area boundary. The improvements include a tight diamond interchange design at South Broadway and I-25 and an additional through lane on northbound I-25.
- ▶ RTD FasTracks improvements in the South Broadway study area include no physical improvements, only changes to train headways and operations. These changes have been incorporated in the volume projections for the study area.

RTD-planned improvements to the I-25 and Broadway Station include establishing paved parking under the I-25 viaduct between South Broadway and the CML.

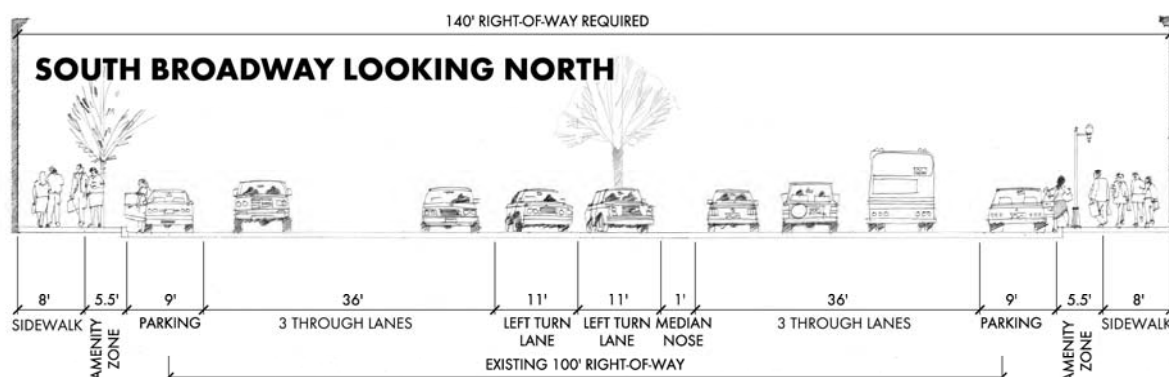
In addition to the above transportation projects, the redevelopment of the former Gates property will occur regardless of whether or not any improvements are made to South Broadway in the study area. CCD has approved the general development plans (GDPs) for the redevelopment sites. These plans include the local street connections as part of the redevelopment projects. While the connections to South Broadway and Mississippi Avenue are fixed in the GDP, the internal street networks on the redeveloped properties are still under development.

TSM/TDM programs and policies will be implemented as part of the GDP for the former Gates property. Since no construction is needed, these plans will be incorporated as the developments progress. The CCD and the Broadway Station Metro District will be responsible for implementing the TSM/TDM strategies.

## 2.7.2 Preferred Alternative

South Broadway would be widened to an eight-lane cross-section from Arizona Avenue to the South Broadway/Lincoln Street one-way couplet. This improvement provides increased capacity to better accommodate forecasted traffic volumes. South Broadway would be built to provide the full eight-lane cross-section with medians and turn lanes. The center median would be landscaped in a manner that is consistent with CCD standards and will be maintained by the Broadway Station Metro District. This width is included in 140 feet of right-of-way along South Broadway. The outside lanes would be 12 feet wide, with three interior travel lanes 11 feet wide. To match capacity for the short-term demand, the pavement for the two outside lanes would initially be utilized as on street parking. On-street parking will improve the pedestrian environment by providing a shorter crossing distance across South Broadway. See **Figure 2-15** for a cross section depiction of this scenario, with three 12-foot inside lanes.

Figure 2-15. South Broadway Widening Interim Lane Configuration



At some point in the future and before the planning horizon of 2030, traffic demand is forecasted to exceed the capacity of a six-lane cross-section. To address this and to provide a mechanism that is fluid and responsive to conditions, "trigger language" was developed to fairly and



equitably convert the outside parking lanes into travel lanes. Essentially the trigger language defines a public process for determining when the outside lanes are necessary. The full text of the trigger language is provided in **Figure 2-16**. The CCD would be responsible for managing this transition process. **Figure 2-17** shows the ultimate Preferred Alternative with an eight-lane cross-section.

Figure 2-16. Trigger Language

**South Broadway NEPA Trigger Language  
(as endorsed by the Consensus Committee 4-19-2007)**

The intent of this trigger language is to preserve more pedestrian-oriented cross sections for S. Broadway and Mississippi Avenue for as long as possible while establishing a public process to address concerns if there are negative impacts from increasing vehicle traffic. For purposes of this “trigger language”, a major change shall be defined as a change that requires re-designation of any parking, travel or turn lanes, or removal of any medians or pedestrian bulb-outs. Minor changes are any other operational modification including changes to stop signs, traffic signals, etc.

Prior to making a major change to the South Broadway NEPA preferred alternative initial cross sections of South Broadway or Mississippi Avenue, the CCD shall provide reasonable notice, ideally 3 months, to the impacted parties (including at least nearby RNOs, Home Owners Associations, business districts, and adjacent property owners and residents). In that three-month period, the CCD will provide an opportunity for the public to comment on the proposed changes and will work with the local Councilperson to hold a public hearing to discuss the identified problems, potential changes, and public concerns. Where possible, the decision should consider the original purpose and need and screening criteria used to development the preferred alternative when deciding which, if any, adjustments should be made.

The changes considered shall include at least: conversion of parking lanes to travel lanes; construction/adjustment of medians; and, operational modifications (e.g. changes to stop signs, traffic signals, or directional signage).

Situations that will trigger a public process will include whenever a major change is deemed necessary due to:

- ▶ Queuing from a signalized intersection consistently, negatively impacting the operation of an adjacent signal.

OR

- ▶ A traffic study indicating that the streets listed below are regularly enduring regional cut-through traffic greater than the number of trips expected on those streets at that point in time.
- ▶ Louisiana Avenue between South Broadway and Logan Street.
- ▶ Lincoln Street, Sherman Street, Grant Street and Arizona Avenue between Mississippi Avenue and Louisiana Avenue.

OR

- ▶ An impacted party's report of a traffic or safety concern that the CCD Traffic Engineer investigates and subsequently determines is only addressable by a major change.

Denver will monitor traffic volumes, as needed, by placing traffic counters in the streets, typically every two years or when necessary to assess impacts of increased traffic. This data is available to the public at [www.denvergov.org/trafficcount](http://www.denvergov.org/trafficcount).

Nothing in this trigger language shall limit the CCD Traffic Engineer or Manager of Public Works responsibility to make critical adjustments within the right-of-way as they deem necessary. If there is a need to make an immediate major change, the CCD will act immediately and provide information to the public about that change as soon as is reasonable. Information about minor changes will be available upon request by contacting Denver Public Works.

Figure 2-17. Preferred Alternative



As part of the Preferred Alternative, Kentucky Avenue would be realigned to the north to combine with the I-25/South Broadway interchange movements, eliminating one signalized intersection and improving overall operations of South Broadway.

### **I-25/South Broadway Interchange Improvements**

Improvements are planned for the South Broadway and I-25 interchange to better accommodate high demand traffic movements. Critical elements of the interchange improvements include:

- ▶ A new ramp, referred to as the wedge ramp that provides grade separation for heavy southbound South Broadway to southbound I-25 demand. Southbound South Broadway access to the ramp would be controlled as part of the signal at South Broadway and Ohio Avenue.
- ▶ Improvements to the intersection of Ohio Avenue and the northbound I-25 ramps. These include:
  - The segments of Lincoln Street, which access the houses inside the ramp, will be closed. The existing five-legged intersection is a more standard 4-legged intersection in the build scenario.
  - Signal added to control the intersection and to prioritize the higher demand movements.
  - Channelized right turn lane added to provide positive guidance to on-ramp traffic eastbound on Ohio Avenue. All ramp traffic should be in this lane. Overhead signage will reinforce lane assignments and further inform drivers not to turn the wrong way on the off-ramp.
  - Channelized westbound Ohio Avenue prevents access from the neighborhood street. Access to the interstate is from the arterials only. The island barrier provides opportunity for ground level signs reinforcing the turn restriction.
  - Improved design speed for northbound I-25 hook ramp: While not part of the No-Action Alternative, the existing northbound I-25 on-ramp includes a ramp with substandard design speed. The Preferred Alternative incorporates a new ramp in roughly the same location as the existing ramp but with significantly improved design speed (24 mph).

### **Signalization and Traffic Control**

As part of the Preferred Alternative, ten signalized intersections are planned to have improvements or be newly constructed. Signalization improvements are planned for the following intersections:

- ▶ Exposition Avenue/Lincoln Street ..... new signal
- ▶ Exposition Avenue/South Broadway ..... new signal
- ▶ Lincoln Street/Walsh Place ..... reconstructed existing signal
- ▶ Ohio Avenue/South Broadway ..... reconstructed existing signal
- ▶ Kentucky Avenue/I-25 southbound off-ramp  
South Broadway ..... modified signal
- ▶ Ohio Avenue/I-25 northbound off/on-ramp ..... new signal
- ▶ Tennessee Avenue/South Broadway ..... new signal



- ▶ Mississippi Avenue/South Broadway ..... reconstructed existing signal
- ▶ Arizona Avenue/South Broadway ..... new signal
- ▶ Logan Street/Mississippi Avenue ..... reconstructed existing signal

### **Pedestrian and Bicycle Improvements**

Pedestrian and bicycle enhancements are critical elements of the Preferred Alternative. Pedestrian improvements include 13.5-foot sidewalks (including an amenity zone) in both directions along South Broadway and Mississippi Avenue, between Logan Street and Santa Fe Drive. Improved pedestrian connections are planned to connect with the I-25 and Broadway Station. Additional pedestrian enhancements planned as part of the Preferred Alternative include:

- ▶ Minimum 13.5 foot sidewalks (including an amenity zone) along all roadways constructed as part of the Preferred Alternative.
- ▶ Median refuge on Mississippi Avenue to facilitate safer crossing at Lincoln Street.
- ▶ Signal provided at the Ohio Avenue/northbound I-25 ramps to provide pedestrian crossing time.

Bicycle enhancements planned as part of the Preferred Alternative include:

- ▶ Improved connectivity of bicycle routes to the I-25 and Broadway Station. A multi-use trail of a minimum 15 feet is provided:
  - From the intersection of Ohio Avenue and the northbound I-25 off-ramp on the south side of Ohio Avenue, continuing on the east side of South Broadway to the South Broadway/Kentucky Avenue/I-25 southbound off-ramps intersection.
  - On the west side of South Broadway from the intersection with the new southbound I-25 on-ramp to the South Broadway/Kentucky Avenue/I-25 southbound off-ramps intersection continuing to the transit station on the north side of Kentucky Avenue.
  - A direct connection between the transit station and the intersection of South Broadway and the southbound I-25 on-ramp.
  - On the east side of the new Acoma Street alignment from the transit station to the intersection of Acoma Street and Exposition Avenue.

### **Transit Enhancements**

The Preferred Alternative adjusts the alignment of the Exposition Avenue extension west of South Broadway to minimize impacts to parking and operations of the surrounding properties while preserving the functional improvement associated with this alternate I-25 and Broadway Station access. In addition to the Exposition Avenue extension, a bus only roadway west of the extended Acoma Street alignment improves bus operations into and out of the station area.

### **Other Elements**

**Water Quality and Drainage**—The intersection of Tennessee Avenue and South Broadway is the local high point. Areas south of this intersection drain to the existing Mississippi Avenue outfall that was reconstructed with the T-REX project. This outfall has no water quality treatment facilities, so inlet filter treatment devices will be installed as part of this project under Denver's MS4 permit to address water quality with locations to be identified in final design. These will be maintained by Denver.

The areas north of the Tennessee Avenue and South Broadway intersection drain to the existing water quality pond north of I-25 and just east of the CML. This pond is being expanded to accept drainage from the VHEIS improvements. As part of the South Broadway EA improvements, inlet treatment will be provided for this drainage. Additional detention pond storage required if any, can be incorporated in the properties being acquired for the EA north of I-25 and west of South Broadway.

Parking impacts resulting from the Preferred Alternative will be replaced in coordination with the affected property owners. Depending on on-going negotiations with the affected property owners, the remediation could range from payment for loss of parking to construction of a 3-story parking structure within the footprint of right-of-way acquisitions required by the Preferred Alternative. This EA assumes the parking structure will be built just north of I-25, west of South Broadway and east of Acoma Street as a worst -case scenario.

## **2.8 PRELIMINARY ASSUMPTIONS OF COSTS**

The following preliminary assumptions of costs were developed for the Preferred Alternative based on the conceptual designs prepared for this Environmental Assessment (see **Table 2-14**).

**Table 2-14. Preliminary Assumptions of Costs in 2007 Dollars**

| <b>Item</b>                                     | <b>Preferred Alternative</b> |
|---|------------------------------|
| Pavement/Median/Curb/Gutter/Sidewalk            | \$4,427,000                  |
| Traffic Signal Updates                          | \$2,750,000                  |
| Utilities + Drainage+ Landscape + Misc.         | \$4,400,000                  |
| Bridges/Structures                              | \$3,148,000                  |
| Retaining Walls                                 | \$1,667,000                  |
| Parking Mitigation                              | \$1,500,000                  |
| Contingencies/Unlisted Items                    | \$2,800,000                  |
| Preliminary Engineering                         | \$1,900,000                  |
| Construction Engineering                        | \$2,800,000                  |
| Mobilization                                    | \$1,077,000                  |
| Right-of-way/Easements                          | \$7,738,000                  |
| Environmental Mitigation of Hazardous Materials | \$400,000                    |
| <b>Total Rounded Cost</b>                       | <b>\$34,607,000</b>          |



## **2.9 PROJECT RELATIONSHIP TO REGIONAL PLANNING**

The current 2035 Regional Transportation Plan (RTP) was adopted by the DRCOG board in December of 2007. In February 2008, DRCOG will accept applications for projects to be included in its first amendment to the 2035 RTP. The Preferred Alternative from this EA will be submitted as an amendment by the CCD at that time. DRCOG plans to model the revised fiscally constrained 2035 RTP in April 2008 with adoption of the fiscally constrained 2035 plan in July 2008.



## CHAPTER 3. AFFECTED ENVIRONMENT, IMPACTS, AND MITIGATION

### 3.1 INTRODUCTION

This chapter describes the existing social, economic and environmental setting for the study area (see **Figure 1-1**). This chapter also describes the environmental impacts that could occur as a result of implementation of either the No-Action Alternative or the Preferred Alternative (see Chapter 2 for detailed description of the alternatives). Mitigation measures are identified for impacts associated with the Preferred Alternative.

All resources were reviewed for presence in the study area and for impacts. Based on the project description, agency scoping, field investigation, and evaluation, the following resources were not present in the study area or had no impacts: farmlands, floodplains, wetlands, wildlife and fisheries, threatened and endangered species, paleontological resources, and parks and recreational facilities. Information regarding these resources is summarized in Section 3.2 based on Technical Memoranda provided in **Appendix B**. All other resources are fully assessed for impacts and described in Section 3.3.

The approach to the No-Action Alternative evaluation of impacts includes projects that have committed funds as well as impacts expected to occur as a result of Phase VI improvements of the Preferred Alternative for the *Valley Highway EIS* (VHEIS). The VHEIS is a phased Record of Decision (ROD) in which Phase VI includes interchange improvements at the South Broadway/I-25 interchange. Phase VI of the ROD has not been signed, nor are there plans to dedicate funds to this phase until at least 2030. Impacts under the No-Action Alternative were quantified using the VHEIS Phase VI design. Impacts associated with Phase VI of the VHEIS include socio-economic, environmental justice populations, right-of-way and relocations, visual conditions, and construction.

### 3.2 ENVIRONMENTAL RESOURCES NOT AFFECTED

#### 3.2.1 Farmlands

The Natural Resources Conservation Service (NRCS) field office in Lakewood, CO was contacted in May 2006 for information on available soil survey maps and soil descriptions for the study area. Based on conversation with staff at the NRCS Lakewood office, no soil surveys were ever conducted within the City and County of Denver (CCD). Furthermore, the study area falls within the Census urbanized area with no irrigated croplands present. See the Farmlands Technical Memorandum in **Appendix B**.

#### 3.2.2 Floodplains

A review of Federal Emergency Management Agency (FEMA) National Flood Insurance Rate maps showed the study area is not in any delineated flood zone (FEMA, 2006 A). The project would not be affected by flood flows, or directly or indirectly affect the 100 year floodplain. See the Floodplains Technical Memorandum in **Appendix B**.



### 3.2.3 Wetlands

Based on the field survey it was concluded that the study area does not contain any wetlands, nor could it maintain a hydrologic cycle that would be conducive to forming hydric soils. None of the plant species observed are indicative of wetlands and no conditions exist that would produce wetlands. See the Wetlands Technical Memorandum in **Appendix B**.

### 3.2.4 Wildlife and Fisheries

The study area is completely urbanized and highly disturbed. It consists primarily of commercial, industrial and residential uses as well as major transportation facilities. The study area does not contain any areas that would be suitable for supporting wildlife or fish species. The South Platte River is located adjacent to, but outside of the study area. The project would not result in impacts to the river or to any wildlife or fish species that may be associated with the river.

The Migratory Bird Treaty Act (MBTA) states that most migratory birds and their parts, including nests, eggs, feathers, and parts thereof are fully protected under federal law. Additionally, the act requires federal agencies to avoid or minimize any negative impacts associated with their actions on migratory birds and to take active steps in protecting birds and their habitat.

The study area is highly urbanized with large volumes of vehicular and pedestrian traffic. Landscaped trees and shrubs are located sporadically in front of the former Gates Rubber Company along the pedestrian sidewalk, however, due to their location, suitable nesting habitat for birds protected under the MBTA is unlikely and impacts to bird species are not anticipated. Prior to the start of any construction, a nest survey is recommended during the breeding season to ensure no bird species are utilizing trees/shrubs in the area for nesting. Trees will be replaced at a 1:1 ratio. See the Wildlife and Fisheries Technical Memorandum in **Appendix B**.

### 3.2.5 Threatened and Endangered Species

A field survey of the study area was conducted to determine the presence of threatened and endangered species or their habitat. No federally or state listed species, habitat or potential areas of associated habitat for those species listed with the potential to occur within the CCD were observed. Water utilized for construction will be derived through CCD municipal sources and therefore will not affect downstream habitat of threatened and endangered species. See the Threatened and Endangered Species Technical Memorandum in **Appendix B**.

### 3.2.6 Paleontological Resources

A paleontological resources survey was conducted for this project by Rocky Mountain Paleontology (2007) in order to evaluate potential impacts on scientifically significant non-renewable paleontological resources, which could result from ground disturbance within the study area. Based on the project description, it is anticipated that most excavations for the Preferred Alternative would be shallow (at or close to existing grade), resulting in minimal subsurface disturbance of fossiliferous bedrock. However, excavations deeper than four feet have the potential to adversely impact scientifically significant fossils in unweathered bedrock. These may include excavations for caissons, inlet relocations, and reconstruction of a retaining wall along the north side of Mississippi Avenue west of South Broadway. When the project



design plans are finalized, the CDOT Staff Paleontologist will examine them and determine the extent of impact to Denver Formation bedrock, and the scope of paleontological monitoring, if any is required. No preconstruction mitigation measures are necessary. The potential need for performing mitigation measures during construction will be addressed during the final design phase of this project. If any sub-surface bones or other potential fossils are found anywhere within the study area during ground disturbance, the CDOT Staff Paleontologist will be notified immediately to assess their significance and make further recommendations. See Paleontological Resources Memorandum in **Appendix B**.

### **3.2.7 Parks and Recreational Facilities**

Based on CCD planning documents, no existing or planned parks or recreational facilities were identified in the study area. See the Parks and Recreational Facilities Technical Memorandum in **Appendix B**.

## **3.3 LAND USE AND ZONING**

### **3.3.1 Existing Land Use and Zoning Conditions**

The South Broadway project is located entirely within the CCD. Portions of the following four neighborhoods are found within the study area: Baker, Overland, Platt Park and Washington Park West. There are several city plans and neighborhood plans that guide land use within the study area. These plans include:

- ▶ *Transit-Oriented Development Strategic Plan, 2006*
- ▶ *Denver Comprehensive Plan 2000*
- ▶ *Blueprint Denver, 2002*
- ▶ *Baker Neighborhood Plan, 2000*
- ▶ *Platt Park Neighborhood Assessment, 2003*
- ▶ *Overland Neighborhood Assessment, 2005*
- ▶ *West Washington Park Neighborhood Plan, 1991*

The neighborhood plans have been adopted as supplements to the *Denver Comprehensive Plan* and provide more specific guidance related to land use, transportation and urban design to fit the unique character and visions of the individual neighborhoods. The neighborhood assessments are not adopted plans, rather they provide a foundation for planning in a specific geographical location based on the current conditions and the needs of that area.

The South Broadway study area contains a variety of land uses. Along South Broadway, existing uses are primarily commercial and industrial, including the former Gates Rubber Company. For over 80 years this area was predominately industrial in nature with the Gates Rubber Company and the Ford Motor Plant. In the mid-1990s the Gates factory ceased operations. Approximately 100 acres of the former Gates property is to be redeveloped both to the east and west of South Broadway between I-25 and Arizona Avenue. Land use one block east of South Broadway is characterized by established residential neighborhoods consisting primarily of single-family units with a few newer multi-family units such as those being developed along Grant Street and Logan Street south of Mississippi Avenue. West of South

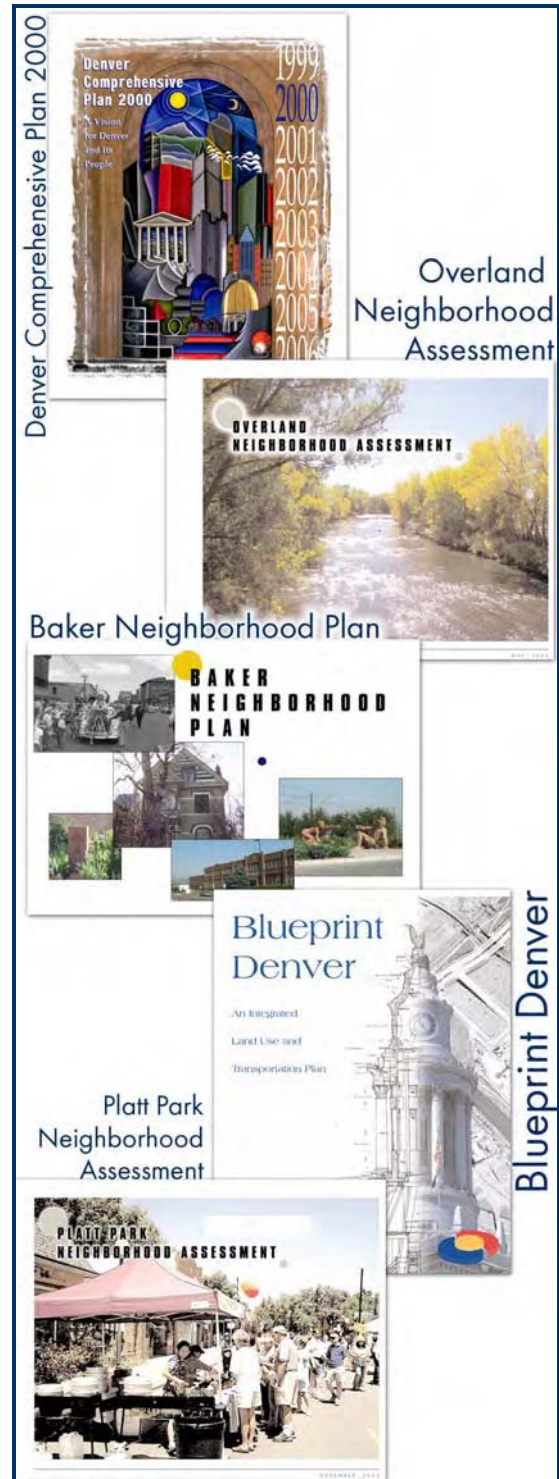
Broadway, along the South Platte River and rail corridor, land uses tend to be more industrial in nature.

Several zoning districts are in place within the study area. These include industrial, business, residential, residential mixed-use, parking and transit mixed-use, a new district. The former Gates property has been rezoned from industrial to transit mixed-use (T-MU-30) by the CCD to reflect the redevelopment of the Gates property and adjacency to the I-25 and Broadway Station. The T-MU-30 district allows for a mix of uses in close proximity to a transit facility that support transit ridership, Transit Oriented Development (TOD) and encourage walking and bicycling. TOD is centered on a transit facility and is a higher density and a mix of land uses, generally residential, office, commercial, retail and open space within a ¼-mile radius.

### 3.3.2 Future Land Use

The majority of the study area along South Broadway falls into an Area of Change as identified in *Blueprint Denver*. Areas of Change are “parts of the city where new growth or redevelopment can best be accommodated because of transportation choices and opportunities for mixed-use development.” Additionally, *Blueprint Denver* identifies this for Transit-Oriented Development, linking land use and transportation through street typologies. This is important when evaluating not only development, but all multi-modal improvements. South Broadway is a “Mixed-Use Arterial” which emphasizes the movement of people through a variety of travel choices coupled with a high-intensity land use mixture. *Blueprint Denver* further sets forth necessary design elements such as wide sidewalks, bicycle facilities, medians, and on-street parking.

The *Baker Neighborhood Plan* also covers a majority of the study area and similarly identifies it as an area for TOD south of I-25, and as retail centers and commercial corridors north of I-25. As mentioned previously, the former Gates property is to be redeveloped as a mixed-use



development centered on the existing I-25 and Broadway Station. The former Gates property is being redeveloped under two projects: Cherokee and Gates East. The Cherokee project is on the west side of South Broadway and the Gates East project is on the east.

In December 2001, 50-acres of the former Gates property located west of South Broadway were rezoned for transit mixed-use. A General Development Plan (GDP) for the former Gates property west of South Broadway and both north and south of Mississippi Avenue was approved by the CCD in 2005. As currently planned, the former Gates property would be redeveloped with approximately 2,000 to 4,000 dwelling units and 2 to 4 million square feet of commercial space integrated with an existing light rail station. Building heights would vary from 3 to 11 floors (up to 130 feet). There is a 10 percent open space requirement and a 25 percent transit mode split requirement. Build out of the redevelopment project is estimated for 10 to 15 years (2015 to 2020). **Figure 3-1** depicts the GDP redevelopment plan for the area west of South Broadway.

Figure 3-1.      Redevelopment Plan for the Former Gates Property West of South Broadway



Source: Cherokee Denver, 2002, Valley Highway EIS.



East of South Broadway, the 33-acre Gates East site, which includes 300,000 square feet of existing buildings, is zoned for high-intensity transit mixed-use, residential mixed-use and commercial development. A GDP was approved for the Gates East site by the CCD in 2006. Initial plans indicate that the area would be redeveloped with 2.7 million square feet of residential (single-family, duplexes and triplexes allowed), retail, office, and transit and residential mixed-uses.

These two redevelopments will bring about a significant change to this area of Denver. It will be one of the first TODs of this size for the CCD. The developers are currently working on cleaning up environmental contamination from over 80 years of industrial uses and replacing the dilapidated factory buildings with a variety of uses and public spaces. The proximity to transit encourages higher density development with a mix of residential, office, retail and entertainment and provides easy access to transit while enhancing pedestrian and bicycle facilities. The two developments will draw approximately 48,000 daily vehicle trips to the South Broadway area.

### **3.3.3 Land Use and Zoning Impacts**

#### **3.3.3.1 No-Action Alternative**

The No-Action Alternative includes area redevelopment plans. Both sides of South Broadway, south of I-25 would be developed with approximately 7 million square feet of mixed-use TOD. Congestion would continue to increase making it difficult for all modes to travel through the study area. Opportunities for transit oriented land uses at the former Gates and adjacent properties would be hindered without optimal connections to the regional transportation system. Furthermore, the No-Action Alternative would not be fully supportive of future land use and transportation recommendations identified by the CCD in *Blueprint Denver*, the *Transit-Oriented Development Strategic Plan*, and other area neighborhood plans.

#### **3.3.3.2 Preferred Alternative**

The Preferred Alternative is compatible with existing and future land use, land use plans, and zoning. Construction of the Preferred Alternative would result in a direct conversion of approximately 9.74 acres of residential, commercial, and industrial land uses to a transportation use. Some parcels would be acquired with potential relocation of seven residential properties along South Lincoln Street, south of Ohio Avenue (see Social, Economic and Right-of-Way sections). The redevelopment of the Gates property would be complimented by the Preferred Alternative. Improved access and multimodal connectivity provided by the Preferred Alternative would optimize land use opportunities for TOD. Furthermore, improvements to South Broadway would not induce additional growth since growth is already expected with the redevelopment of Gates by 2015 to 2020. Rather, transportation improvements are necessary to accommodate for the expected traffic volumes with or without the planned development.

### **3.3.4 Land Use and Zoning Mitigation**

Because the Preferred Alternative is compatible with existing land use and zoning and consistent with planning efforts conducted by the CCD in the *Comprehensive Plan 2000* and *Blueprint Denver*, as well as adjacent neighborhood plans, there is no mitigation required. The CCD is already conducting the necessary steps to ensure that land use policies, implementation strategies, and zoning are supportive of the proposed improvements. Mitigation for right-of-way is discussed in Section 3.6.3.

## 3.4 SOCIAL CONDITIONS

### 3.4.1 Existing Social Conditions

This section discusses the social characteristics of the region and the study area. It describes the area's demographic composition including population, housing characteristics, the location of neighborhoods and important community facilities, and a description of public safety providers. Information in this section was derived from the *Denver Comprehensive Plan 2000; Blueprint Denver, 2002; South Broadway Transportation and Urban Design Study, 2001; Overland Neighborhood Assessment 2005; Platt Park Neighborhood Plan 2003; Metro Vision 2030; and the Baker Neighborhood Plan 2003.*

#### 3.4.1.1 Population

In 1990 the CCD had a population of 467,610 (Census 2000). By the year 2000 the population had increased by 87,026 (approximately 20 percent) for a total population of 554,636. According to *Blueprint Denver*, the CCD is growing at a rate unmatched since 1940, and the city's population growth is expected to continue and reach 716,791 persons by 2030 (Colorado Division of Local Government). The DRCOG Metro Vision 2030, cites 2.6 million people currently (2005) living in the nine county metro Denver planning region (Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin and Jefferson Counties) and has forecasted growth to increase to 3.9 million people (or 50 percent) by the year 2030. **Table 3-1** presents population statistics for the CCD, the region, and Colorado.

**Table 3-1. Population Statistics**

| Location | 1990      | 2000      | % Change 1990-2000 | 2005      | 2030      | % Change 2005-2030 |
|----------|-----------|-----------|--------------------|-----------|-----------|--------------------|
| Colorado | 3,294,394 | 4,301,261 | 30.6%              | 4,665,177 | 7,337,330 | 57.3%              |
| Region   | 1,859,008 | 2,419,079 | 29.9%              | 2,664,894 | 3,875,200 | 45.4%              |
| CCD      | 467,610   | 554,636   | 18.6%              | 557,917   | 716,791   | 28.5%              |

Source: Census 2000 Data, DRCOG Data

#### 3.4.1.2 Housing

According to 2004 Census Data, there were 2,010,806 housing units in Colorado, of which 265,101 are situated in the CCD. The CCD has an 89 percent occupied housing rate. The average household size for Denver in 1990 was 2.17 people and in 2004 was 2.3 people, which represents an increase of 6 percent. The Metro Denver Economic Development Corporation reported that year-to-date residential construction activity in May 2006 was up 9.4 percent from 2005, however within the study area the neighborhoods are stable and well established. On the eastern side of South Broadway, the Gates East GDP identifies construction of 1,000 to 1,200 residential units and 50,000 to 100,000 square feet of retail. The Cherokee Redevelopment Plan calls for 2,000 to 4,000 new residential units to be built over the next 10-15 years at the former Gates site on the west side of South Broadway. Current housing characteristics are depicted in **Table 3-2.**

**Table 3-2. Housing Characteristics**

| Location        | Denver  |         |                | Colorado  |           |                |
|-----------------|---------|---------|----------------|-----------|-----------|----------------|
|                 | 1990    | 2004    | Percent Change | 1990      | 2004      | Percent Change |
| Housing Units   | 239,636 | 265,101 | 10.6%          | 1,447,349 | 2,010,806 | 38.9%          |
| Occupied        | 210,952 | 236,345 | 12.0%          | 1,282,489 | 1,850,238 | 43.3%          |
| Owner-Occupied  | 103,765 | 140,823 | 35.7%          | 798,277   | 1,268,619 | 58.9%          |
| Renter-Occupied | 107,187 | 95,522  | -10.9%         | 484,212   | 581,619   | 20.1%          |
| Vacant          | 28,684  | 28,756  | 0.0%           | 194,860   | 160,568   | -17.6%         |
| Household Size  | 2.17    | 2.3     | 6.0%           | 2.51      | 2.43      | -3.2%          |
| Occupancy Rate  | 88%     | 89.2%   | 1.2%           | 89%       | 92%       | 4%             |

Source: Census 2000

An average price for a single-family home in the CCD in 1980, 1990, and 2000 was \$63,400, \$83,507, and \$217,016, respectively. This represents a 242 percent change in housing sales prices between 1980 and 2000.

According to a 2004 report by the Colorado Housing and Finance Authority, the number of households outnumbered the number of available housing units creating a supply problem and pushing housing prices higher. Also, income growth did not keep pace with the higher cost of housing contributing to a need for affordable housing.

### 3.4.1.3 Community Facilities

Following is a brief description of important community facilities found in and around the study area that have the potential to either be influenced by or influence activity within the study area.

**Education**—The study area is served by Denver Public Schools. Students in the study area attend the following schools: South High School, West High School, Grant Middle School, Rishel Middle School, Fairmount Elementary, Lincoln Elementary, McKinley-Thatcher Elementary, Larks Preschool, and the Martin School of Early Education. The only community facility located inside the study area is the Martin School of Early Education at 776 South Lincoln Street. Two schools located very near, but just outside the study area are Lincoln Elementary (710 South Pennsylvania Street) and McKinley-Thatcher Elementary (1230 South Grant Street).

**Public Health and Safety**—The CCD is primarily served by Denver Health Medical Center, located north of the study area. Twenty-five percent of all Denver residents, or 160,000 individuals, receive their health care at Denver Health.

The Denver Fire Department serves the study area with most emergency services provided by the station located just north of the study area at 40 West Second Avenue and a second station east of the study area at 1500 E. Virginia Avenue. Emergencies occurring south of Mississippi Avenue would be responded to by the station located south of the study area at 1601 South Ogden Street. The study area is also served by the Denver Police Department, District Three, located south of the study area at 1625 South University Boulevard.



Other Community resources near the study area include: Vanderbilt Park (located at South Platte River Drive and West Tennessee Avenue), the Denver Public Library Decker branch (located just south of the study area at 1501 South Logan Street), Platte Park Senior Center (located at 1500 South Grant Street), and Fleming Mansion, an alternative home (located in Platte Park adjacent to the Senior Center).

### **3.4.2 Social Impacts**

#### **3.4.2.1 No-Action Alternative**

Projected growth in the study area would closely reflect the projected growth from the redevelopment of the former Gates property; these two projects would bring about drastic change to this area of Denver. Replacing the former Gates property with higher density development and a mix of residential, office, retail, and entertainment uses will result in acute growth. Because mobility would not be improved within the study area, greater congestion would continue to make it difficult for all modes of transportation to access businesses, residences, and community facilities within the study area. A further concern related to the expected increase in traffic congestion is that it would cause a corresponding increase in cut-through traffic in adjacent neighborhoods.

McKinley-Thatcher Elementary lies just southeast on Louisiana Avenue and Grant Street. Based on the traffic model, the level-of-service (LOS) on Louisiana Avenue would not improve with the No-Action Alternative. In turn, increased congestion on South Broadway may result in Louisiana Avenue being used more often as a cut-through route near the school.

The VHEIS project would result in two residential relocations, as well as construction impacts that would temporarily alter travel patterns.

#### **3.4.2.2 Preferred Alternative**

Construction of the Preferred Alternative would have no effect on population growth within or adjacent to the study area.

Improvements associated with the Preferred Alternative would prevent congestion from reaching unacceptable levels as traffic continues to increase in the area. Further, the addition of pedestrian and bicycle facilities would improve the situation for multimodal travel options that are not currently accommodated with existing infrastructure. The addition of the bus only roadway connection would improve bus mobility and travel time. This is consistent with the goals of *Blueprint Denver, 2002* which encourage an improved environment for pedestrians, bicyclists, and transit users, and less reliance on single-occupant vehicles.

According to conversations with the CCD Fire Department, South Broadway is a major thoroughfare that is commonly used as an emergency service route. Therefore, safety and mobility improvements to South Broadway would allow emergency vehicles to continue to operate effectively.

There is only one community facility existing within the study area: the Martin School of Early Education, along Lincoln Street. Near the Martin School of Early Education, noise levels are predicted to increase less than 1 dB(A) over existing noise levels on Lincoln Street (see Section



3.7.2, Noise Conditions). However, existing noise levels at this location are above the 66 dB(A) threshold today. In addition, a sensitive Mobile Source Air Toxics (MSAT) receiver near the school would be affected. See Section 3.8.2.3, Project Level MSAT Analysis for discussion on MSAT emissions.

Related to the concern regarding the existing and future traffic conditions is the cut-through traffic in adjacent neighborhoods that results from congestion on South Broadway. The Preferred Alternative is designed to prevent congestion on South Broadway from worsening from current conditions thereby reducing the likelihood of cut-through traffic in those adjacent neighborhoods. Decreased congestion on South Broadway would allow for less traffic congestion on Louisiana Avenue, which would improve conditions adjacent to McKinley-Thatcher Elementary School.

On the northeast side of I-25 between Ohio Avenue and Kentucky Avenue, seven residential properties would be directly impacted. These properties lie inside of the estimated right-of-way to be acquired for the project, and therefore residents would be displaced. See Section 3.6. Right-of-Way for further discussion on relocations.

During construction temporary detours and related out-of-direction travel would impact residents and businesses throughout the study area.

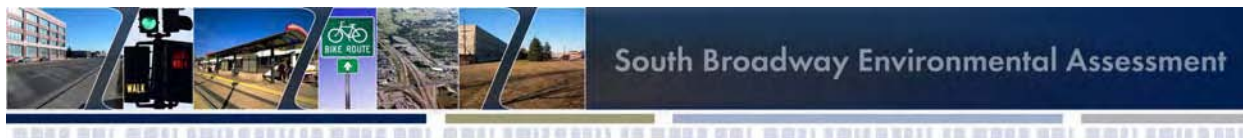
### **3.4.3 Social Mitigation**

Good communication with emergency service providers, residents, and local businesses with regards to delays, access changes, detours, and special construction activities will be maintained throughout the construction of the project. Effective communication will be accomplished through radio and public announcements, newspaper notices, and on-site signage. Acquisition of property will comply with the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended.

### **3.4.4 Environmental Justice (EJ)**

Presidential Executive Order 12898 (EO 12898), February 11, 1994, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations in the United States. EO 12898 requires Federal agencies to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects on minority or low-income populations. For those projects that do, EO 12898 requires actions to avoid, minimize, or mitigate such effects.

Executive Order 12898 reinforces Title VI of the Civil Rights Act of 1964 which states "No person in the United States shall, on the grounds of race, color or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." Subsequent Orders at the federal level, including Department of Transportation (DOT) Order 5610.2 Order To Address Environmental Justice in Minority Populations and Low-Income Populations (USDOT, 1997) and FHWA Order 6640.23 Actions to Address Environmental Justice in Minority Populations and



Low-Income Populations (FHWA, 1998), have further defined the obligations outlined in EO 12898.

On May 27, 2005, the Colorado Department of Transportation issued CDOT's Title VI and Environmental Justice Guidelines for NEPA Projects—Rev.3 to assist in interpreting environmental justice mandates. The guidance outlines the process for environmental justice analysis, including data collection, public involvement, impact analysis, and mitigation requirements. The analysis that follows has been prepared in accordance with this and all other applicable guidance for addressing environmental justice.

#### **3.4.4.1 Minority Populations and Minority Owned Businesses**

The discussion of minority populations is based upon information from *Census 2000* data at the block level. Minority populations are composed of ethnic and/or racial minorities. As defined in FHWA Order 6640.23, a minority is a person who is Black, Hispanic, Asian American, or American Indian or Alaskan Native. It is important to note that Hispanic or Latino heritage is not listed as a race category in the Census data: a person of Hispanic or Latino origin can identify with any racial group. To avoid double counting, the total White, Non-Hispanic population of a geographic area is subtracted from the total population to generate the total minority population. The percentage of minorities is then compared to city or county averages. Any blocks with a higher percentage of minorities than the CCD are evaluated for disproportionately high and adverse effects and are targeted for outreach.

According to *Census 2000* data for the CCD, there are approximately 6,200 persons living in the 10 census blocks that encompass the study area. The CCD has a minority population of 48 percent. The analysis revealed that of the 10 blocks within the study area, two contain minority populations above the CCD average of 48 percent. One of these blocks (Block 1003; Group 1; Tract 3001) is located at the southeast corner of South Broadway and Mississippi Avenue, while the other (Block 3005; Group 3; Tract 2901) is at the northeast corner of South Broadway and Ohio Avenue (see **Figure 3-2**). According to the *Census 2000*, the block located on Mississippi Avenue has a total population of 13 people, nine (69 percent) of whom are minorities. However, field survey shows that all houses within this block are abandoned. The block located on Ohio Avenue has a total population of 28 people, 18 (64 percent) of whom are minorities. Information regarding minority business enterprises within the study area was derived from the Colorado Minority Business Office (MBO). According to the MBO at the time of this writing, there are no known minority business enterprises in the study area. However, the MBO only identifies businesses that register with the office. To ensure that minority-owned businesses were adequately identified, potentially affected businesses were individually contacted and surveyed by the Project Team. Some business owners did not provide information about themselves or their employees. Of the approximately 1,790 persons employed by these businesses, eight were identified as minority. None of the businesses were identified as being minority-owned.

#### **3.4.4.2 Low-Income Populations**

CDOT's recommended approach for identifying low-income populations is to identify the number and percentage of low-income populations within the study area, using Census data at the block group level, and to compare this figure to low-income thresholds set annually for counties (or in some cases, Metropolitan Statistical Areas) by the U.S. Department of Housing and Urban

Development (HUD) for the distribution and allocations of Community Development Block Grant (CDBG) funds.

Figure 3-2. Minority and Low-Income Populations in the Study Area





The median family income in the Denver-Aurora Metropolitan Statistical Area (MSA) is \$71,300 (2006 HUD Section 8 Housing Income Limits). The average household size in the CCD is 2.3 persons. The income limits for a household of this size at 30 percent of average median income (AMI) is \$17,845. Since census income statistics are divided into increments of \$5,000, the income threshold of \$20,000 is used. Any households in the CCD with average household incomes below \$20,000 are considered low-income.

In the CCD, 23 percent of households fall below the \$20,000 threshold. Four block groups encompass the study area, which include over 1,700 households. In only one of these (block group 3 of tract 2100) does the census data indicate that more than 23 percent of households fall below the \$20,000 threshold (see **Figure 3-2**). This block group extends more than 1.5 miles north of the study area. Analysis of aerial photography and field inspection indicate that there are no households in the portion of this block group that is located within the study area. Therefore, there are no low-income populations in the study area.

#### **3.4.4.3 Specialized Outreach**

Specialized outreach to minority populations was conducted as part of the public involvement process to gather comments and identify concerns regarding the project. Specialized outreach activities included project mailings (in English and Spanish), which announced upcoming meetings and described the project process, and news releases (including a display advertisement in *La Voz Nueva* a Spanish language newspaper).

Flyers about the project and upcoming public involvement activities were also delivered to locations throughout the study area where minority populations might have access to them, including:

- ▶ The Platt Park Senior Center
- ▶ Grant Avenue Community Center
- ▶ Denver Public Library Decker Branch
- ▶ La Familia Recreation Center
- ▶ Denver Public Library Ross-Broadway Branch

Points that were raised by residents during specialized outreach that were considered throughout the development of the Preferred Alternative include such concerns as:

- ▶ Business and residential property impacts.
- ▶ Safety and user friendliness for pedestrians and bicyclists crossing South Broadway to access the transit station and other neighborhood destinations.
- ▶ Increased travel speeds on South Broadway with widening.
- ▶ Minimizing the extent of widening of South Broadway to develop a feeling of “Main Street Broadway” as an important place for shoppers, pedestrians, and community gatherings and meetings.
- ▶ Ensuring that South Broadway contributes to tying together the redevelopment of the former Gates property and increasing its integration into the adjacent neighborhoods.

### 3.4.5 Environmental Justice Impacts

The environmental justice analysis evaluates each alternative to determine whether there is a potential for disproportionately high and adverse impacts to minority or low-income populations when compared to populations that are not minority or not low-income in the study area. A disproportionate impact is defined by FHWA as one that is:

- ▶ Predominantly borne by a minority and/or low-income population, or
- ▶ Suffered by the minority 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/non-low-income population

As discussed in Section 3.4.4.2 Low-Income Populations, although a portion of a block group identified as low-income falls within the study area, low-income populations were not identified within the study area because no residences exist within this block group in the study area. The analysis that follows addresses the potential for disproportionately high and adverse impacts to minority populations, identified at the northeast corner of South Broadway and Ohio Avenue (see **Figure 3-2**). Census identified minority populations located near Mississippi Avenue and South Broadway are no longer present.

#### 3.4.5.1 No-Action Alternative

Traffic congestion would worsen in the study area, hindering access to housing and businesses. This impact would be experienced by the minority population at Ohio Avenue and South Broadway, as well as by the overall community.

The VHEIS would require the acquisition and relocation of two businesses on the southeast and northwest corners of South Broadway and Ohio Avenue. The VHEIS states that relocation of these businesses would affect minority/non-minority and low-income/non-low-income owners and employees in a similar manner.

The No-Action Alternative therefore, would not result in disproportionately high and adverse impacts to minority or low-income populations. Impacts would affect all populations to the same degree regardless of minority or low-income status.

#### 3.4.5.2 Preferred Alternative

There are no low-income populations identified within the study area and, therefore, would be no disproportionately high and adverse impacts to low-income populations as a result of the Preferred Alternative.

Existing noise levels in the identified Census block (between Ohio Avenue and Kentucky Avenues on the east side of I-25) currently exceed the Noise Abatement Criteria (NAC) levels and, with the Preferred Alternative, would increase by approximately 0.5 dBA. This noise increase is not perceptible. However, this minority population along with the general population would experience increases in noise. Construction related impacts would be temporary in duration and would affect the minority population at Ohio Avenue and South Broadway as well as the overall community.



Benefits that would occur include improvements in mobility, pedestrian and bicycle connections, and access to housing and businesses in the study area. Residents and travelers in the area would also benefit from the safety and pedestrian enhancements associated with the Preferred Alternative, including a landscaped center median and new off-street multi-use trails.

Construction of the Preferred Alternative would result in the acquisition of seven residences on the east side of I-25 between Ohio Avenue and Kentucky Avenues. None of the affected properties, which appear to be mostly tenant-occupied single-family housing units, are located in the census block that contains minority populations.

The realignment of South Broadway near Mississippi Avenue would result in acquisition of some right-of-way currently in commercial use; however, developers working on the Gates East redevelopment will have previously relocated these businesses and right-of-way would be acquired from those developers. According to the Minority Business Office, there are no minority-owned businesses in the study area.

Because impacts would be distributed across the community, they would not be predominantly borne by minorities. Nor would they be appreciably more severe or greater in magnitude than the impacts suffered by the non-minority population. Therefore, the Preferred Alternative would not result in disproportionately high and adverse impacts to minority populations.

### **3.4.6 Environmental Justice Mitigation**

Since there are no disproportionately high and adverse human health or environmental effects on minority or low-income populations as a result of this project, no mitigation measures are necessary. Good communication will be maintained with residents and businesses within the area regarding traffic delays, access changes, and construction activities. In regards to the directly impacted residential properties, the Uniform Relocation Assistance and Real Property Acquisition Policies Act as well as housing availability is thoroughly discussed in Section 3.6 Right-of-Way.

## **3.5 ECONOMIC CONDITIONS**

### **3.5.1 Existing Economic Conditions**

The types of businesses on and in the vicinity of South Broadway are generally smaller, well-established and non-chain. Many of the businesses draw customers from around the region. Retail space in the study area totals approximately 313,000 square feet, of which 3,400 square feet is vacant. Approximately 10,000 square feet has been developed since 1985.

To the west of South Broadway are industrial uses, located in close proximity to the railroad tracks where several large businesses established operations, defining it as one of the city's original industrial concentrations. According to the commercial real estate company, CoStar, industrial space in the study area totals more than 2.0 million square feet in 36 buildings. An additional 36,000 square feet of flex space, defined as space that can be apportioned in various amounts to office or industrial uses among others, and 160,000 square feet of office space being used (excluding space under renovation) are also located in association with the industrial space. Vacant industrial space within the study area in 2006 totaled approximately 24,000

square feet, while vacant flex space during this same timeframe totaled 8,000 square feet. Vacant office space was approximately 317,000 square feet. The square footage in this section is all existing buildings, some of which are vacant and some of which may be demolished for the development projects. No industrial, flex or office space has been constructed in the study area since 1985. The future land use designation for the study area is transit mixed use (T-MU-30).

The two mixed-use developments occurring on the former Gates property are considered positive contributors to economic stabilization of the area. This area has been ripe for redevelopment since the introduction of light rail in the early 1990s. With the I-25 and Broadway Station as the area's anchor, transit oriented redevelopment has been encouraged by the CCD and surrounding neighborhoods as a way to revitalize the South Broadway corridor. This area was designated an "Area of Change" in the CCD's land use and transportation plan, *Blueprint Denver* and has been rezoned from industrial to transit mixed-use.

The entire study area is located within an Enterprise Zone. Colorado's Enterprise Zone program was set up in 1986 and provides tax incentives to encourage businesses to locate and expand in economically distressed areas. Businesses located within a Denver Enterprise Zone are eligible to receive tax credits on their state taxes. Those that move to, or expand in an Enterprise Zone, may also qualify for tax credits.

Many corridor businesses located along South Broadway south of I-25 participate in the Broadway Partnership and Broadway Area Revitalization District (BARD). Other special districts include an urban renewal district put in place in 2005 to assist with redevelopment of the former Gates property.

The 2001 study, *Broadway Corridor: Transportation and Urban Design Study*, provided an assessment of South Broadway from I-25 south to Yale Avenue along with recommendations for revitalizing the corridor and its environs. Key observations from this study include the lack of pedestrian and bicycle friendly amenities, few neighborhood destinations, lack of diversity among business types, and underutilization of many properties.

### 3.5.1.1 General Economic Trends

Between 1990 and 2000 the CCD experienced growth in several key economic indicators (see **Table 3-3**). These growth trends are expected to continue into the future. According to the 2030 Metro Vision *Regional Transportation Plan* (RTP), the number of jobs in the Denver metro region is forecasted to increase over 51 percent from 1.56 million (2005) to approximately 2.36 million in 2030. Population in the CCD is expected to increase 29 percent by 2030 compared to the current population (Colorado Department of Local Affairs). According to *Blueprint Denver*, much of this growth would be accommodated by infill development and redevelopment both throughout the CCD and within the study area.

Per capita and median household income estimates in neighborhoods in and around the study area are

**Table 3-3. CCD Economic and Demographic Trends**

| Measure                 | 1990     | 2000     | Percent Change |
|-------------------------|----------|----------|----------------|
| Population              | 467,610  | 554,636  | +19%           |
| Median Household Income | \$25,106 | \$39,500 | +57%           |
| Per Capita Income       | \$15,590 | \$24,101 | +55%           |
| Employment              | 233,602  | 284,340  | +22%           |
| Unemployment            | 17,141   | 17,094   | -0.27%         |

Sources: ESRI-BIS, DRCOG, Census 2000, and Leland Consulting Group



higher than the city as a whole. According to DRCOG in 2000, the top three employment sectors in Denver were services, retail trade, and transportation and communication, respectively. Approximately 38 percent of those persons employed were in management occupations and 26 percent were employed in sales and related occupations. In 2003, the total number of business establishments (employers) in Denver was 21,267 ([www.dataplace.org](http://www.dataplace.org)).

## **3.5.2 Economic Impacts**

### **3.5.2.1 No-Action Alternative**

High-density, mixed-use development is planned to occur on both the east and west side of South Broadway with the No-Action Alternative. This development would cause a shift in growth and commercial development patterns within the study area. Direct economic impacts would be caused by the increased density of housing and commercial establishments. There will be more people living in the area and a significant increase in commercial activity.

Under the No-Action Alternative, the LOS during AM and PM peak periods would be LOS F by 2030 along this section of South Broadway. As traffic volumes grow, it would become increasingly difficult for commuter, truck, transit, local, and delivery traffic to use and traverse South Broadway. With the anticipated growth, and no improvement to South Broadway, this would become a more critical issue and will likely affect economic vitality, because customers would choose to shop elsewhere.

As a result of improvements associated with the VHEIS, as part of the No-Action Alternative, two businesses would be relocated. These are Hurricane Drain and Renal Care Group of the Rockies. This is described in more detail in the Right-of-Way Section of this document. The VHEIS will not do anything to relieve traffic on South Broadway. The same negative effect to economic vitality would occur with or without the VHEIS.

### **3.5.2.2 Preferred Alternative**

The Preferred Alternative would be consistent with economic growth plans for the area. It would improve access and mobility along this section of South Broadway. The access improvements include enhancement of transit, pedestrian and bicycle facilities in the study area. Mobility improvements include improved travel times and reduced delays in the corridor compared to the No-Action Alternative. The expansion of travel choice and the improved mobility and circulation in the corridor would enhance the economic condition of the study area due to increased visits to businesses by potential customers compared to the No-Action Alternative.

Initially, the existing on-street parking along South Broadway south of Mississippi Avenue will be replaced by parking accommodated in the outside lanes of the Interim Preferred Alternative. As traffic volumes increase, the interim parking lanes will be converted into a fourth travel lane in each direction. When this happens, on-street parking within the study area would be converted to travel lanes. The businesses currently located on South Broadway within the study area have alternate parking available in private lots and on side streets. Proposed developments that are planned to occur east and west of South Broadway would bring expanded customer base to these businesses and would provide more parking opportunities in the area. Furthermore, the continued expansion of the light-rail system and bicycle and pedestrian connections offer an expanded range of options to people accessing these



businesses. These factors taken together would have the potential to offset the loss of on-street parking on South Broadway.

The Preferred Alternative could temporarily boost the economy of the study area during the construction period by providing employment of construction workers and revenue generated by the purchase of construction material from local sources. Additional employment could provide a temporary economic boost to the region, through increased wages and retail sales to firms in the project vicinity, partially offsetting any lost revenue from temporary increases in congestion and access restrictions during construction.

The same two businesses in the study area relocated as a result of the No-Action Alternative would also be relocated due to construction of the Preferred Alternative. Additionally, two businesses north of I-25 in the Denver Design Center complex would be partially impacted under the Preferred Alternative. Although the buildings would not be impacted, 115 surface parking spaces would be impacted behind the buildings for right-of-way required for the extension of Exposition Avenue to Acoma Street. This represents approximately 14 percent of the total parking spaces available around the Denver Design Center complex. Furthermore, a parcel of land owned by RTD currently being used for approximately 100 surface parking spaces for the I-25 and Broadway Station would be acquired for right-of-way purposes. These spaces represent approximately 10 percent of the parking at this station, however new parking lots at this station are currently under construction and alternate parking has been made available by RTD in adjacent lots.

### **3.5.3 Economic Mitigation**

Good communication with the community, business owners, and residents with regard to road delays, detours, access, and special construction activities is recommended during the construction phase. This will be accomplished through radio and public announcements, newspaper notices, on-site signage, and through the CCD's and CDOT's Web sites. Construction activities will be staged and work hours varied to minimize the disruption to traffic and local businesses.

Mitigation for property acquisition and relocation impacts is addressed in the Right-of-Way section of this document. The CCD will mitigate the parking impacts to both the Design Center and the I-25 and Broadway Station. The CCD, the Design Center, and RTD are currently in negotiations as to how best to mitigate the parking impacts, up to and including constructing a 3-level parking structure. If the parking structure is not constructed, parking impacts will be mitigated through increasing surface parking by optimizing existing land available in the vicinity, however, this EA assumes the parking structure will be built as mitigation.

## **3.6 RIGHT-OF-WAY**

This section discusses right-of-way requirements and relocations of businesses and residences that would occur under the No-Action and Preferred Alternatives. Acquisitions and relocations are considered preliminary and are subject to revision during final design and right-of-way acquisition.

### 3.6.1 Existing Right-of-Way Conditions

Parcel mapping information needed for the analysis of the existing publicly owned right-of-way in the study area was obtained from CDOT and the CCD assessor's records. Right-of-way width varies greatly within the study area depending on roadway size and functionality. Approximate widths for principal roads within the study area are shown in **Table 3-4**.

### 3.6.2 Right-of-Way Impacts

#### 3.6.2.1 No-Action Alternative

The No-Action Alternative includes improvements to the South Broadway and I-25 interchange as described in the VHEIS. The VHEIS identified right-of-way impacts in the vicinity of the South Broadway and I-25 interchange. Specifically, as shown in **Figure 3-3**, the need is to fully acquire and relocate two residential properties on the west side of South Lincoln Street, south of Ohio Avenue, and four partial residential acquisitions in the same location. The VHEIS would also require the acquisition and relocation of two businesses on the southeast and northwest corners of South Broadway and Ohio Avenue (Hurricane Drain and Renal Care Group of the Rockies). These same properties would be impacted under the Preferred Alternative for this EA.

#### 3.6.2.2 Preferred Alternative

Construction of the Preferred Alternative would require additional right-of-way and acquisitions. Acquisitions would be required for widening South Broadway from 100 feet to 140 feet, extension of Exposition Avenue and Acoma Street, pedestrian and bicycle improvements, and various easements including utilities. **Figure 3-3** depicts the ownerships that are anticipated to be impacted by the Preferred Alternative. The VHEIS would also require the acquisition and relocation of two businesses on the southeast and northwest corners of South Broadway and Ohio Avenue (Hurricane Drain and Renal Care Group of the Rockies). These same properties would be impacted under the Preferred Alternative for this EA, but would not be considered as new impacts since they would already be impacted under the No-Action Alternative. The Preferred Alternative would require the acquisition of approximately 9.74 acres of new right-of-way from 20 ownerships in the study area (see **Table 3-5**).

Right-of-way north of I-25 is needed for access ramps to I-25, connections to Ohio Avenue, and for the extension of Exposition Avenue and Acoma Street on the west side of South Broadway. Acquisition of right-of-way for this area would displace the occupants of seven residential properties along South Lincoln Street, south of Ohio Avenue. These properties would not be impacted directly by widening, but would be relocated because of loss of access when South Lincoln Street is closed south of Ohio Avenue for the new northbound I-25 access ramp.

The impacted residential properties are single-family housing units located in the West Washington Park Neighborhood. According to the U.S. Census, the seven residential properties are not located in low-income or minority population areas (see Environmental

**Table 3-4. Existing Right-of-Way**

| Road/Street       | Average Right-of-Way Width |
|-------------------|----------------------------|
| Interstate        |                            |
| ▪ I-25            | 300 feet                   |
| North/South Grid: |                            |
| ▪ South Broadway  | 100 feet                   |
| ▪ Surface Roads   | 60 feet                    |
| ▪ Alleys          | 14 feet                    |
| East-west Grid:   |                            |
| ▪ Surface Roads   | 70 feet                    |

Justice, Section 3.4.4). For privacy reasons family characteristics have not been included. There are no other affected neighborhoods, public facilities, non-profit organizations, or other factors that would require special relocation considerations and measures.

Two businesses north of I-25 in the Denver Design Center complex would be partially impacted under the Preferred Alternative (755 South Broadway LLC and Denver Collection LLC). Although the buildings would not be impacted, the two businesses would have approximately 115 surface parking spaces impacted behind the buildings for right-of-way required for the extension of Exposition Avenue and Acoma Street.

Figure 3-3. Right-of-Way Parcel Impacts





**Table 3-5. Estimate of Right-of-Way Requirements for Preferred Alternative**

| Location   | Address   | Primary Use             | Approximate Acres to be Acquired | Relocation Required? |
|--|---|-------------------------|----------------------------------|----------------------|
| 1  | 1100, 1102, 1134, 1136, 1140, 1148, 1156, 1170, South Broadway* | Commercial              | 0.29                             | No                   |
| 2  | 1000, 1050, South Broadway and 1099 South Logan Street*         | Commercial              | 1.18                             | No                   |
| 3  | 901, 941, 961, 999 South Broadway*                              | Commercial              | 0.75                             | No                   |
| 4  | 887 South Broadway  | Commercial              | 0.10                             | No                   |
| 5  | 831 & 833 South Lincoln Street                                  | Res. Duplex             | 0.11                             | Yes                  |
| 6  | 827 South Lincoln Street  | Residential             | 0.12                             | Yes                  |
| 7  | 823 South Lincoln Street  | Residential             | 0.06                             | Yes                  |
| 8  | 819 South Lincoln Street  | Residential             | 0.05                             | Yes                  |
| 9  | 807 South Lincoln Street  | Residential             | 0.10                             | Yes                  |
| 10   | 805 South Lincoln Street  | Residential             | 0.07                             | Yes                  |
| 11/12  | 801 and 803 South Lincoln Street*                               | Residential             | 0.13                             | Yes                  |
| 13   | 800 South Broadway  | Commercial              | 0.29                             | Yes                  |
| 14   | 788 South Broadway  | Commercial              | 0.01                             | No                   |
| 15   | 765 South Broadway  | Commercial              | 0.85                             | Yes                  |
| 16   | 761 South Broadway  | Commercial              | 0.45                             | No                   |
| 17   | 801 South Broadway (RTD)  | Commercial              | 3.26                             | No                   |
| 18   | 701 South Broadway  | Commercial              | 0.76                             | No                   |
| 20   | 1125, 1195 South Broadway*                                      | Commercial              | 0.01                             | No                   |
| 21   | 765 South Broadway (parking no structures)                      | Commercial              | 0.30                             | Yes                  |
| 22   | 801 South Broadway  | Commercial/<br>Railroad | 0.85                             | No                   |
| <b>Total Right-of-Way Required for Preferred Alternative</b> |   |                         | <b>9.74</b>                      |                      |

Note: Table does not include right-of-way required for No-Action Alternative.

\* Multiple addresses at this location signify common ownership.

Acquisition of right-of-way for the area south of I-25, including properties between Mississippi Avenue and Arizona Avenue would involve no residential or business relocations. Rather, the parcels south of I-25 are owned by two developers involved in the redevelopment of the former Gates property. In this area, approximately 2.3 acres of land immediately adjacent to South Broadway and Mississippi Avenue would be acquired for the Preferred Alternative. The existing commercial buildings in this area either will soon or already have undergone demolition and redevelopment. Right-of-way required for this area has been planned in direct coordination with the developers to minimize or eliminate potential impacts to new development. Any potential business relocations associated with properties south of I-25 are part of the redevelopment process, and not considered an impact under the Preferred Alternative.

### 3.6.3 Right-of-Way Mitigation

**Acquisition**—For any person(s) whose real property interests will 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 also will 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 relocates, 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.

## 3.7 NOISE

**Study Area Description**—Land uses in the study area are classified within Noise Categories B and C (see **Table 3-6**). Category C land uses are primarily transportation, commercial and light industrial uses. The core of the study area surrounding South Broadway is occupied by the former Gates property. South Broadway frontage is occupied by small businesses, light industrial/warehouse buildings and parking. Category B land uses include numerous single-family residential units and are concentrated in the neighborhoods along Lincoln Street north of I-25 and southeast of South Broadway and Mississippi Avenue within the study area. Much of the abandoned Gates property is expected to be redeveloped as retail-residential in the future; however, these parcels are not yet platted and permitted. **Figure 3-4** shows the locations of noise sensitive areas.

**Noise Abatement Criteria**—The adopted noise abatement criteria by which to determine noise impacts from traffic sources on certain land uses are shown in **Table 3-6**. These criteria are typically applied to outdoor areas of use, which for residences is usually described as a first-floor outdoor patio/deck area. If a project results in noise levels above these thresholds, noise mitigation will need to be considered as a part of the project. In addition, a noise level is considered to be an impact and substantial if the project will result in a noise increase of 10 dB(A) or greater over existing noise levels. Mitigation will then need to be considered.

**Table 3-6. Noise Abatement Criteria (NAC)**

| Category | Leq(h)* dB(A) | Description of Activity Category  |
|----------|---------------|---|
| A        | 56 Exterior   | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B        | 66 Exterior   | Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.  |
| C        | 71 Exterior   | Developed lands, properties or activities not included in Categories A or B above.  |
| D        | --            | Undeveloped lands.  |
| E        | 51 Interior   | Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.   |

\*Leq(h) describes the hourly value of Leq. Leq is the mean noise level during the peak traffic period.

Figure 3-4. Noise Sensitive Areas, Monitoring Sites and Representative Noise Receptors



### 3.7.1 Existing Noise Conditions

Existing noise measurements were taken during the evening peak hours at the four locations designated as M1 through M4 in **Table 3-7** and shown in **Figure 3-4**. Noise levels ranged from 56.8 to 72.5 decibels, or A-weighted decibel level (dBA). Noise levels are measured in decibels (dB) and are adjusted to better match the response of the human ear by a method called A-weighting (A). The resultant noise measurement is recorded as dBA. Noise level measurements are also averaged to replicate an hour-long period to better represent the multiple noise events occurring in an area rather than measuring a single noise event. This measurement is referred to as the Leq (h), simplified here as Leq. The measured noise levels were then used to validate a TNM v2.5 computer model of the site. Noise levels from computer modeling incorporate free flowing peak hourly traffic volumes, traffic speeds, local topography, roadway configurations, vehicle mix, and the location of noise sensitive receivers relative to the roadway.

**Table 3-7. Comparison of Measured and Predicted Noise Levels (Leq)**

| Receptor Site # | Measured (2006) Peak Level (dBA) | Predicted (2006) Level (dBA) | Variation between Measured and Predicted Levels (dBA) |
|-----------------|----------------------------------|------------------------------|---|
| M1              | 72.5                             | 70.6                         | 1.9   |
| M2              | 64.9                             | 70.6                         | -5.7  |
| M3              | 67.3                             | 68.5                         | -1.2  |
| M4              | 56.8                             | 58.1                         | -1.3  |

Validation results for the South Broadway study area noise model were within typical limits of plus or minus 3 dBA, except for site M2. Actual traffic counted at this site during the measurements was much lower than those used for peak hour traffic input for the existing condition, resulting in much higher modeled noise values.

The loudest areas occurred at residential land uses adjacent to Lincoln Street. These levels were higher than the NAC for Category B land uses of 66 dBA (see **Table 3-7**).

Noise levels were then predicted for similar peak hour existing (2006) conditions at each of the representative receptor locations shown in **Figure 3-4**. Existing noise levels exceed Category B NAC of 66 dBA at residential areas represented by receptors R1 through R3 and R5 through R7 located adjacent to Lincoln Street. Receptor R18 located south of Mississippi Avenue near Logan Street is also impacted under existing noise conditions. Businesses along South Broadway experience noise levels in excess of the Category C, 71 dBA (see **Table 3-8**).

**Table 3-8. Existing and Predicted Noise Levels (dBA)**

| Site ID | # Receivers | Noise Levels (dBA) |           |                       | NAC (dBA) | Impact |
|---------|-------------|--------------------|-----------|-----------------------|-----------|--------|
|         |             | Existing           | No-Action | Preferred Alternative |           |        |
| R1      | 3           | 70.6               | 70.6      | 70.7                  | 66        | Yes    |
| R2      | 5           | 70.1               | 70.1      | 70.2                  | 66        | Yes    |
| R3      | 3           | 68.8               | 68.9      | 69.1                  | 66        | Yes    |
| R4      | 3           | 62.5               | 62.6      | 61.8                  | 66        |        |

**Table 3-8. Existing and Predicted Noise Levels (dBA)**

| Site ID | # Receivers | Noise Levels (dBA) |           |                       | NAC (dBA) | Impact |
|---------|-------------|--------------------|-----------|-----------------------|-----------|--------|
|         |             | Existing           | No-Action | Preferred Alternative |           |        |
| R5      | 6           | 69.1               | 69.1      | 69.5                  | 66        | Yes    |
| R6      | 2           | 67.9               | 67.9      | 68.5                  | 66        | Yes    |
| R7      | 5           | 65.8               | 65.8      | 67.1                  | 66        | Yes    |
| C8      | 4           | 67.1               | 67.1      | 69.3                  | 71        |        |
| C9      | 3           | 70.5               | 70.5      | 72.6                  | 71        |        |
| C10     | 1           | 70.8               | 71.4      | 70.2                  | 71        |        |
| C11     | 2           | 68.2               | 70.6      | 71.8                  | 71        |        |
| R12     | 2           | 60                 | 60.6      | 58.3                  | 66        |        |
| R13     | 1           | 63.5               | 64        | 63                    | 66        |        |
| M4      | 1           | 62.3               | 62.5      | 58.9                  | 66        |        |
| R15     | 1           | 64.4               | 64.7      | 60.5                  | 66        |        |
| R16     | 1           | 66                 | 66.5      | 62.3                  | 66        |        |
| R17     | 1           | 67.2               | 67.6      | 62.4                  | 66        |        |
| R18     | 1           | 68.4               | 68.8      | 64.1                  | 66        |        |
| R19     | 1           | 67.5               | 67.8      | 62.5                  | 66        |        |
| R20     | *           | 70.5               | 71.7      | 71.5                  | 66        | Yes    |
| M3      | *           | 68.5               | 70.3      | 69.3                  | 66        | Yes    |
| R22     | *           | 67.5               | 68.8      | 68.8                  | 66        | Yes    |
| R23     | *           | 69.7               | 70        | 65.5                  | 66        |        |

\*These locations represent future retail-residential development. Design details identifying residential units have not yet been disclosed.

## 3.7.2 Noise Impacts

### 3.7.2.1 No-Action Alternative

The 2030 No-Action levels predicted by the traffic noise model for the 23 modeled locations (which represent 36 individual residences and 10 businesses) range from 60.6 to 71.7 dB(A). No-Action Alternative noise levels increased less than 1 dB(A) over existing noise levels along Lincoln Street. No-Action Alternative noise levels along South Broadway between Kentucky Avenue and Mississippi Avenue increased an average of 2 dB(A) entirely due to increase traffic volume. Noise levels calculated along Mississippi Avenue were generally the same. Of the 9 impacted modeled locations representing 24 individual homes, all are at or above the 66 dB(A) threshold today. All affected residences are located along Lincoln Street or South Broadway. Receivers M3, R20, R22 and R23 are currently commercial receivers associated with the former Gates property along South Broadway between Kentucky and Mississippi Avenues. These buildings will be demolished and replaced by residential-retail development. Therefore, the receiver designations reflect the future change in NAC category. Noise levels for affected sensitive receptors are listed in **Table 3-8**.

### 3.7.2.2 Preferred Alternative

The predicted 2030 ultimate 8-lane Preferred Alternative traffic noise levels for 23 representative locations within the study area range from 58.3 to 72.6 dB(A). Because traffic volumes would not significantly change in 2030 between the No-Action Alternative and the



Preferred Alternative, noise levels along Lincoln Street associated with the Preferred Alternative would be the same as those for the No-Action Alternative in that area. The Martin School of Early Education is located in this area of Lincoln Street. A slight increase in the Lincoln Street area over the No-Action condition is attributed to the new northbound I-25 loop ramp. There would be an increase in noise levels at the School of less than 1 dBA and existing noise levels already exceed the NAC. Because of the existing condition there would be no impact to the Martin School of Early Education as a result of the Preferred Alternative.

Five homes represented as receiver M2 would be acquired due to the reconfiguration of the northbound I-25 loop ramp at Ohio Avenue. Relocated receivers are not considered in the final noise analysis. Redevelopment plans for the former Gates property located along both sides of South Broadway between Kentucky Avenue and Tennessee Avenue are not yet permitted, however; noise receptors R20, R22, R23 and M3 have been located to simulate future mixed use and residential receivers for that area. Properties in the area of the realignment of South Broadway near Mississippi Avenue represented by receptor C11 would experience increased noise levels due to the wider Preferred Alternative roadway footprint which brings traffic closer to receivers. The removal of buildings along the east side of South Broadway in this area should result in higher noise levels for residential receivers currently located east of the buildings. The unusual results for noise levels associated with the Preferred Alternative is a 3 dB(A) decrease in noise along Mississippi Avenue. This is likely due to the shielding effect of I-25 traffic noise by the elevated southbound I-25 wedge ramp near Kentucky Avenue. Noise levels for impacted receptors are listed in **Table 3-8**.

### **3.7.3 Noise Mitigation**

Noise mitigation was investigated for affected residences along Lincoln Street and Mississippi Avenue. Results from this analysis indicate that it would not be feasible to construct noise mitigation for these homes located very close to the roadway. Pedestrian and occasional alley/driveway access required to and from Lincoln Street from the multiple closely spaced residences would not allow construction of a continuous noise barrier. The gaps created by access points will allow noise generated by the street traffic to leak through the noise barrier, reducing the amount of noise abatement for each residence. According to the CDOT Noise Analysis and Abatement Guidelines, 2002, a noise barrier that cannot reduce and maintain a noise reduction of at least 5 dBA for the impacted residential receivers is not feasible. The *South Broadway Noise Analysis Technical Report, 2007* details the results of this analysis.

## **3.8 AIR QUALITY**

As the primary north/south arterial, South Broadway has a free flowing northbound access with I-25 via Lincoln Street and a signalized intersection southbound I-25 ramp access at South Broadway and Kentucky Avenue. South Broadway transitions from a one-way street couplet with Lincoln Street to a two-way thoroughfare south of I-25. Recently I-25 was expanded to include light rail and added capacity to ten lanes. The local road network is generally a grid. I-25, the Southwest, Southeast, and Central light rail lines, and the CML terminate east-west avenue continuity across the study area. Traffic is characterized by directional morning and evening peak commuter traffic and consistent commercial and delivery truck traffic.

### National Ambient Air Quality Standards (NAAQS)

EPA uses six "criteria pollutants" as indicators of air quality, and has established for each of them a maximum concentration above which adverse effects on human health may occur. These six pollutants are: carbon monoxide (CO), ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter less than 10 microns in diameter and less than 2.5 microns in diameter (PM<sub>10</sub> and PM<sub>2.5</sub>), and lead (Pb). These threshold concentrations are called NAAQS. The State of Colorado has adopted the NAAQS for these criteria pollutants. Concentrations of these pollutants in the ambient air are monitored by the Air Pollution Control Division (APCD). The NAAQS are shown in **Table 3-9**.

**Table 3-9. National Ambient Air Quality Standards**

| Pollutant/Averaging Time   | Primary Standard*                  | Secondary Standard*               |
|--|------------------------------------|-----------------------------------|
| <b>Carbon monoxide (CO)</b>  |                                    |                                   |
| 8-hour <sup>1</sup>  | 10,000 µg/m <sup>3</sup> (9.0 ppm) | --                                |
| 1-hour <sup>1</sup>  | 40,000 µg/m <sup>3</sup> (35 ppm)  | --                                |
| <b>Lead (Pb)</b>   |                                    |                                   |
| Calendar quarter   | 1.5 µg/m <sup>3</sup>              | --                                |
| <b>Nitrogen dioxide (NO<sub>2</sub>)</b>                           |                                    |                                   |
| Annual Arithmetic Mean   | 100 µg/m <sup>3</sup> (0.053 ppm)  | 100 µg/m <sup>3</sup> (0.053 ppm) |
| <b>Ozone (O<sub>3</sub>)</b>                                       |                                    |                                   |
| 1-hour <sup>2</sup>  | 235 µg/m <sup>3</sup> (0.12 ppm)   | 235 µg/m <sup>3</sup> (0.12 ppm)  |
| 8-hour <sup>3</sup>  | 157 µg/m <sup>3</sup> (0.08 ppm)   | 157 µg/m <sup>3</sup> (0.08 ppm)  |
| <b>Particulate matter less than -10 microns (PM<sub>10</sub>)</b>  |                                    |                                   |
| Annual <sup>4</sup>  | 50 µg/m <sup>3</sup>               | 50 µg/m <sup>3</sup>              |
| 24-hour <sup>5</sup>   | 150 µg/m <sup>3</sup>              | 150 µg/m <sup>3</sup>             |
| <b>Particulate matter less than 2.5 microns (PM<sub>2.5</sub>)</b> |                                    |                                   |
| Annual <sup>6</sup>  | 15 µg/m <sup>3</sup>               | 15 µg/m <sup>3</sup>              |
| 24-hour <sup>7</sup>   | 35 µg/m <sup>3</sup>               | 35 µg/m <sup>3</sup>              |
| <b>Sulfur dioxide (SO<sub>2</sub>)</b>                             |                                    |                                   |
| Annual Arithmetic Mean   | 80 µg/m <sup>3</sup> (0.03 ppm)    | --                                |
| 24-hour <sup>1</sup>   | 365 µg/m <sup>3</sup> (0.14 ppm)   | --                                |
| 3-hour <sup>1</sup>  | --                                 | 1300 µg/m <sup>3</sup> (0.5 ppm)  |

\*Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

<sup>(1)</sup>Not to be exceeded more than once per year.

<sup>(2)</sup> (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

(b) As of June 15, 2005, EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone non-attainment Early Action Compact (EAC) Areas.

<sup>(3)</sup> To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

<sup>(4)</sup>Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the EPA revoked the annual PM<sub>10</sub> standard in 2006, effective December 17, 2006.

<sup>(5)</sup>Not to be exceeded more than once per year on average over 3 years.

<sup>(6)</sup> To attain this standard, the 3-year average of the weighted annual mean PM<sub>2.5</sub> concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m<sup>3</sup>.

<sup>(7)</sup> To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m<sup>3</sup>, effective December 17, 2006.



When an area does not meet the air quality standard for one of the criteria pollutants, it may be subject to the formal rule-making process that designates it as non-attainment. The Clean Air Act further classifies ozone, carbon monoxide, and some particulate matter non-attainment areas based on the magnitude of an area's problem. Non-attainment classifications may be used to specify what air pollution reduction measures an area must adopt, and when the area must reach attainment. The technical details underlying these classifications are discussed in the Title 40 Code of Federal Regulations, Part 81 (40 CFR 81).

### **Transportation Conformity**

The transportation conformity regulations of July 2004 require that regionally significant, and/or federally funded transportation projects demonstrate conformity to State Implementation and Maintenance Plans. The transportation conformity regulations require that:

1. The project is included in a fiscally constrained conforming RTP.
2. The project is included in a fiscally constrained conforming Transportation Improvement Program (TIP).
3. The project does not cause or contribute to any new or existing violations of NAAQS.

The South Broadway project is not in conformity because it is not yet on the 2035 RTP, nor is it on the latest 2007-2012 TIP. The project will need to be included in the current fiscally constrained RTP and TIP as an amendment, or included in a future TIP before a decision document can be signed.

The current RTP was adopted by the DRCOG board in December 2007. In February 2008 DRCOG will accept applications for projects to be included in its first amendment to the RTP. The Preferred Alternative from this EA will be submitted as an amendment by the CCD at that time. DRCOG plans to model the revised fiscally constrained RTP in April 2008 with adoption of the fiscally constrained RTP in July of 2008.

### **3.8.1 Existing Air Quality Conditions**

The geographical and meteorological characteristics of the Denver metropolitan area are a major cause of the air quality (AQ) conditions that exist within the study area. It is located within the valley of the South Platte River, making the region susceptible to temperature inversions during the winter months.

In 1997 EPA established a new, more stringent 8-hour standard for ozone. Ozone is formed as a by-product of combining the precursor pollutants of oxides of nitrogen (NOx) and volatile organic compounds (VOCs) with sunlight. The DRCOG oversees conformity emissions modeling for the Denver area incorporating mobile source and non-road, industrial, and agricultural source ozone precursor emissions of NOx and VOCs, to establish area-wide emissions limits or budgets to assure emissions generated from future projects does not cause further exceedances or violations of the ozone NAAQS. Because of the very recent identification of the Denver Metro Area as an ozone non-attainment area under the 8-hour standard, new measures are currently being devised and adopted by EPA, Regional Air Quality Council (RAQC), and Colorado Department of Public Health and Environment (CDPHE) to reduce future ozone precursor emissions and provide new regulatory guidance for emissions compliance in the metropolitan area.

### AQ Monitoring

There are ten locations within the metropolitan Denver area that are monitoring critical pollutants (see **Table 3-10**). Three locations are within or very close to the study area: 1050 South Broadway, 305 East Mississippi Avenue, and 678 South Jason Street. There have been no exceedances or violations of air quality standards for CO since 1996 and no exceedance of particulate matter since 1995 at any Denver monitoring site. In July 2007, ozone concentrations in Jefferson County put the nine-county Denver region in violation of the federal health based eight-hour standard.

**Table 3-10. Critical Pollutant Monitoring Stations in the Denver Metropolitan Area**

| Monitoring Station | Address                       | Monitored Pollutant |                 |                 |                |                  |                  |
|--------------------|-------------------------------|---------------------|-----------------|-----------------|----------------|------------------|------------------|
|                    |                               | CO                  | SO <sub>2</sub> | NO <sub>x</sub> | O <sub>3</sub> | PM <sub>10</sub> | PM <sub>25</sub> |
| 080310002          | 2105 South Broadway           | X                   | X               | X               | X              | X                | X                |
| 080310013          | 14th and Albion Street        | X                   |                 |                 |                |                  | X                |
| 080310014          | 23rd Avenue and Julian Street | X                   |                 |                 | X              |                  |                  |
| 080310015          | 1050 South Broadway           |                     |                 |                 |                | X                |                  |
| 080310017          | 225 West Colfax               |                     |                 |                 |                | X                | X                |
| 080310019          | 1300 Blake Street             | X                   |                 |                 |                |                  |                  |
| 080310022          | 8100 Lowry Boulevard          |                     |                 |                 |                | X                |                  |
| 080310023          | 4650 Columbine Street         |                     |                 |                 |                |                  | X                |
| 080310024          | 305 East Mississippi Avenue   |                     |                 |                 |                | X                |                  |
| 080310025          | 678 Jason Street              |                     |                 |                 |                | X                |                  |

### Mobile Source Air Toxics

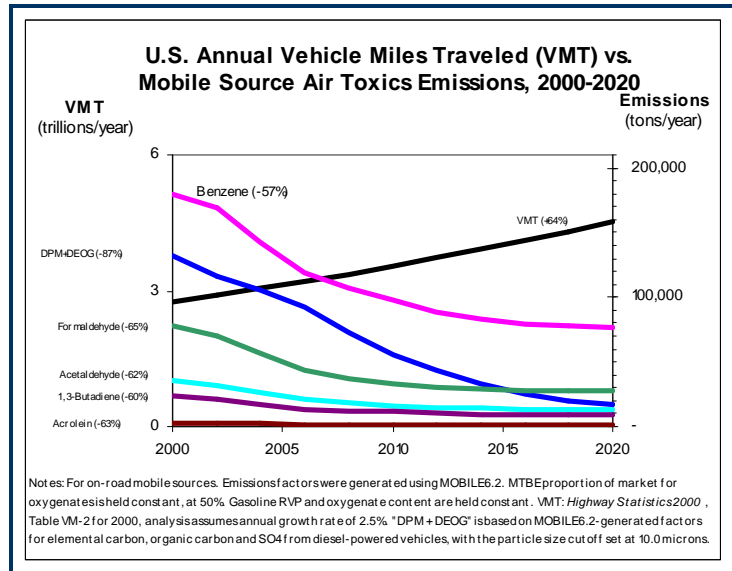
Mobile Source Air Toxics (MSAT) are a subset of the 188 air toxics defined by the Clean Air Act. The MSAT are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSAT emissions. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources {66 FR 17229} (March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in Vehicles Miles of Travel (VMT), these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel particulate matter emissions by 87 percent, as shown in the following graph:

As a result, EPA has so far concluded that no further motor vehicle emissions standards or fuel standards are necessary to further control MSATs. The agency is preparing another rule under authority of the Clean Air Act (CAA) Section 202(l) that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

### Unavailable Information for Project Specific MSAT Impact Analysis

This study includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the alternatives in this EA. Due to these limitations, the following discussion is included in accordance with Council of Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.



**Information that is Unavailable or Incomplete.** Evaluating the environmental and health impacts from MSAT on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- 1. Emissions**—The tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Lastly, in discussions of particulate matter under the conformity rule, EPA has identified problems with MOBILE 6.2 that are an obstacle to quantitative analysis.

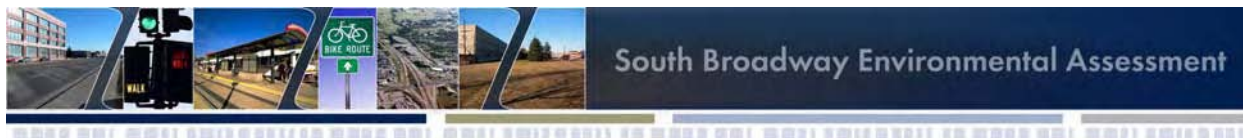
These deficiencies compromise the capability of MOBILE 6.2 to estimate MSAT emissions.

MOBILE 6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

2. **Dispersion**—The tools to predict how MSAT disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the National Ambient Air Quality Standards (NAAQS). The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The National Cooperative Highway Research Center (NCHRP) is conducting research on best practices in applying models and other technical methods in the analysis of MSAT. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.
3. **Exposure Levels and Health Effects**—Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude FHWA from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSAT near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

**Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSAT.** Research into the health impacts of MSAT is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of



or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at <http://www.epa.gov/iris>. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- ▶ Benzene is characterized as a known human carcinogen.
- ▶ The potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- ▶ Formaldehyde is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- ▶ 1,3-butadiene is characterized as carcinogenic to humans by inhalation.
- ▶ Acetaldehyde is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- ▶ Diesel exhaust (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. DE as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- ▶ DE also represents chronic respiratory effects, possibly the primary non-cancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes particularly respiratory problems. Much of this research is not specific to MSAT, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

**Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of Impacts Based Upon Theoretical Approaches or Research Methods Generally Accepted in the Scientific Community.** Because of the uncertainties outlined above FHWA has decided that a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

In this document, FHWA has provided a qualitative analysis of MSAT emissions relative to the No-Action and Preferred Alternatives, and has acknowledged that the Preferred Alternative may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

### **3.8.2 Air Quality Impacts**

Regional air quality analyses included in the VHEIS and T-REX (Transportation Expansion Project) under the Southeast I-25 Corridor EIS overlap the South Broadway EA study area. No predicted exceedances of NAAQS have been identified in these studies. Because of the limited size of the study area and the overlapping analyses from the cited recent air quality studies, the APCD has concurred that no additional regional air quality analyses is required for the South Broadway EA.

#### **3.8.2.1 Project Level CO Analysis**

CO emissions rates have been steadily declining over the past 10 years due to improvements in vehicle engine emission controls, motor efficiency, and fuel composition. However, traffic volumes due to increasing population and travel trips are continuing to rise over time. Ambient monitoring levels for CO concentrations within the study area have remained below 5 ppm since 2000. The highest 2005 readings for 8-hour CO in the study area was 2.9 ppm for Denver CAMP.

Pollutant levels from CO emissions were estimated using CAL3QHC air quality dispersion modeling. This model is used to estimate CO concentrations at poorly operating signalized intersections to simulate worse case localized air pollutant emissions at points where vehicles congregate, incorporating idling emissions and start- stop traffic conditions. High volume signalized intersections and interchanges within the study area affected by the Preferred Alternative traffic conditions, and operating with unacceptable levels of congestion (Level-of-service D or worse) were selected through consultation with CDPHE—APCD and FHWA for project level "hot spot" analysis. Level-of-service for intersections within the study area are shown in **Table 3-11**.

**Table 3-11. Study Area Intersection Traffic Volumes and Levels of Service**

| Intersection  | 2006 Peak PM Hourly Volume | 2006 Peak AM/PM LOS | 2030 No-Action Peak PM Hourly Volume | 2030 No-Action AM/PM LOS | 2030 Preferred Alternative Peak PM Hourly Volume | 2030 Preferred Alternative AM/PM LOS |
|---|----------------------------|---------------------|--------------------------------------|--------------------------|--|--------------------------------------|
| Exposition Avenue/South Broadway                                | 2855                       | B/A                 | 4937                                 | B/F                      | 5038   | A/E                                  |
| Lincoln Street/Ohio Avenue/ northbound I-25 off-ramp            | 1292                       | C/B                 | 2161                                 | D/C                      | 2180   | A/A                                  |
| Ohio Avenue/Walsh Place/South Broadway/ southbound I-25 on-ramp | NA                         | NA                  | NA                                   | NA                       | 6558   | C/D                                  |
| South Broadway/ southbound I-25 off-Ramp and on-ramp            | 3960                       | B/E                 | 5837                                 | D/C                      | NA   | NA                                   |
| Kentucky Avenue/South Broadway                                  | 3177                       | A/A                 | 5555                                 | D/F                      | NA   | NA                                   |
| Kentucky Avenue/South Broadway/ southbound I-25 off-ramp        | NA                         | NA                  | NA                                   | NA                       | 5617   | C/D                                  |
| Mississippi Avenue/South Broadway                               | 4219                       | C/C                 | 6704                                 | F/F                      | 6704   | D/D                                  |

The following locations have been identified for CO hot spot analysis:

- ▶ I-25 interchange and Kentucky Avenue at South Broadway
- ▶ Mississippi Avenue at South Broadway
- ▶ Exposition Avenue at South Broadway

Traffic volumes at these intersections are some of the highest along the South Broadway corridor. These intersections and interchange experience current congestion at peak hours and would continue to experience congestion in the future with the No-Action and Preferred Alternatives. Each location was modeled for interim 2015 and 2030 traffic volumes, number of through lanes, turning lanes, and signalization.

Motor vehicle emissions rates for 2007 were combined with projected 2030 peak hour traffic volumes at each intersection to utilize the highest emissions rate coupled with the highest traffic volumes, to represent the worst-case modeling conditions for future years. Modeled receptors are located approximately 10 feet from the edge of roadways.

The project level CO analyses resulted in no exceedances of the NAAQS at any of the identified interchanges and intersections representing the highest volume and worst operations within the

study area. The highest modeled 8-hour average concentration was 5.8 ppm associated with the Preferred Alternative at Mississippi Avenue and South Broadway in the year 2030. This value is less than the 8-hour NAAQS of 9 ppm. Carbon monoxide concentrations within 100 feet of the intersection would be 4.3 ppm. Lower concentrations would be expected at greater distance from the roadway due to dispersion of the pollutions by wind and air turbulence (see **Table 3-12**).

**Table 3-12. Results of Hot Spot Analyses for Carbon Monoxide**

|                               | Location   | NAAQS<br>1-hour<br>CO | Back-<br>ground<br>1-hour<br>CO | Max.<br>1-hour<br>CO | NAAQS<br>8-hour<br>CO | Back-<br>ground<br>8-hour<br>CO | Max.<br>8-hour<br>CO |
|-------------------------------|--|-----------------------|---------------------------------|----------------------|-----------------------|---------------------------------|----------------------|
| 2015 Interim<br>Condition     | Exposition Avenue—South Broadway                   | 35 ppm                | 7.5                             | 11.7                 | 9 ppm                 | 3.8                             | 5.7                  |
|                               | I-25 Interchange—Kentucky Avenue at South Broadway | 35 ppm                | 7.5                             | 10.7                 | 9 ppm                 | 3.8                             | 5.1                  |
|                               | Mississippi Avenue at South Broadway               | 35 ppm                | 7.5                             | 11.6                 | 9 ppm                 | 3.8                             | 5.6                  |
| 2030 No-Action                | Exposition Avenue—South Broadway                   | 35 ppm                | 6.8                             | 9.7                  | 9 ppm                 | 3.0                             | 4.7                  |
|                               | I-25 Interchange—Kentucky Avenue at South Broadway | 35 ppm                | 6.8                             | 10.0                 | 9 ppm                 | 3.0                             | 4.8                  |
|                               | Mississippi Avenue at South Broadway               | 35 ppm                | 6.8                             | 10.5                 | 9 ppm                 | 3.0                             | 5.1                  |
| 2030 Preferred<br>Alternative | Exposition Avenue—South Broadway                   | 35 ppm                | 6.8                             | 11.2                 | 9 ppm                 | 3.0                             | 5.5                  |
|                               | I-25 Interchange—Kentucky Avenue at South Broadway | 35 ppm                | 6.8                             | 9.9                  | 9 ppm                 | 3.0                             | 4.7                  |
|                               | Mississippi Avenue at South Broadway               | 35 ppm                | 6.8                             | 11.7                 | 9 ppm                 | 3.0                             | 5.8                  |

NAAQS—National Ambient Air Quality Standards.

### 3.8.2.2 Project Level PM<sub>10</sub> Analysis

PM<sub>10</sub> is one of the air quality criteria pollutants outlined in the Clean Air Act that are generated, in part, by motor vehicles. PM<sub>10</sub> is a pollutant of concern in the Denver attainment/maintenance area. Although this analysis addresses emissions generated by mobile sources, area and point source PM<sub>10</sub> emissions in the Denver area include the Denver International Airport, Buckley Air Force Base, a large oil refinery complex, 4 power generation plants, and other industrial sources.

Some PM<sub>10</sub> particles are formed by eroded natural surface rock and soil material and enter the air through a variety of actions including "entrainment" into the atmosphere by wind blown dust. This is particularly important to the Denver metropolitan area because it is situated within a low

lying basin where atmospheric temperature inversions trap entrained dust and other pollutants underneath a ceiling of overriding cold air. This frequent winter condition creates stagnant air within the metro area and acts to concentrate pollutants. Counteracting this condition, Denver also experiences very strong westerly winds that effectively disperse pollutants. These same winds act to accelerate entrainment of exposed dust and sand.

Particles from winter road sanding, brake and tire wear, from pavement wear, and from other vehicle degenerative processes contribute to PM<sub>10</sub>. Road dust generated from vehicle entrainment of excess roadside sand is also a source of PM<sub>10</sub> in the study area. The primary vehicular emissions source of PM<sub>10</sub> comes from diesel engines that are critical to both the transit and transportation freight industries.

A survey of PM<sub>10</sub> levels recorded from monitoring stations within the study area for the years 2001 to 2007 shows that there have not been any exceedances of the annual mean or 24-hour NAAQS Maximum PM<sub>10</sub> levels from monitoring stations within the Denver area for either 24-hour or annual mean. Although the annual average PM<sub>10</sub> standard was revoked by the EPA in December 2006, maximum concentrations recorded at area monitoring stations during 2006 and 2007 have been listed in **Table 3-13** for comparison purposes.

**Table 3-13. Maximum 2006-2007 Annual Mean and 24-Hour PM<sub>10</sub> Concentrations**

| Monitoring Station       | Average Annual <sup>1</sup> |      | 24-Hour |     |
|--------------------------|-----------------------------|------|---------|-----|
|                          | Std                         | Mean | Std     | Max |
| 2105 South Broadway—CAMP | 50                          | 24   | 150     | 75  |
| 225 West Colfax          | 50                          | 27   | 150     | 88  |
| 8100 Lowry Boulevard     | 50                          | 20   | 150     | 55  |
| 678 Jason Street         | 50                          | 27   | 150     | 102 |

<sup>1</sup> The annual standard for PM<sub>10</sub> was revoked in 2006.

CDPHE enforces several regulations through the Air Quality Control Commission (AQCC) to reduce particulate emissions from mobile sources as control strategies and contingency measures for non-attainment areas, including gas and diesel motor vehicle inspections and maintenance programs (AQCC Regulations 11 and 12) and street sanding and sweeping standards to clean up winter sanding operations and excess roadside sand accumulations (AQCC Regulation 16).

There is currently no FHWA approved quantitative dispersion modeling methodology for assessing PM<sub>10</sub>, therefore a qualitative analysis was performed following the guidelines presented in the Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in PM<sub>2.5</sub> and PM<sub>10</sub> Non-attainment and Maintenance Areas (2006).

Consultation with the CDPHE-APCD and FHWA determined that project level (hot spot) analysis need not be conducted for the South Broadway study area. PM<sub>10</sub> hotspot analysis from the VHEIS overlaps the portions of the study area and reported that the project would not be likely to cause or contribute to any new localized PM<sub>10</sub> violations or increase the frequency or severity of any existing violations (40CFR93.116).



### **3.8.2.3 Project Level MSAT Analysis**

The amount of MSAT emitted by the Preferred Alternative would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. In this small scale of project, VMT was not modeled and average peak hour traffic volumes are substituted as a proportional measure of MSAT emissions. Because the estimated peak hour traffic volume under both the No-Action and Preferred Alternatives are nearly the same, varying by less than 5 percent, it is expected there would be no appreciable difference in overall MSAT emissions between the two alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

Sensitive receivers that would be affected by MSAT generated from traffic associated with the study are generally located within 500 feet of the study area. This includes the residential neighborhoods along Lincoln Street north of I-25 and neighborhoods south of Mississippi Avenue between Logan Street and South Broadway, and three schools: Martin School of Early Education on Lincoln Street, Larks Pre-school on South Logan Street, and McKinley-Thatcher Elementary School on South Grant Street. Most of the South Broadway corridor is commercial. However, the redevelopment area between Kentucky and Mississippi Avenues will include a segment containing higher density residential dwelling units.

### **3.8.3 Air Quality Mitigation**

There are no air quality impacts expected from the Preferred Alternative that require mitigation. However, regional and local agency strategies that could be used to reduce criteria pollutant and mobile source air toxics emissions, especially diesel particulate matter from existing diesel engines include tailpipe retrofits, closed crankcase filtration systems, clean fuels, engine rebuild and replacement requirements, contract requirements, anti-idling ordinances and legislation, truck stop electrification programs, aggressive fleet turnover policies, and more. Construction mitigation techniques are described in Section 3.14.2.

## **3.9 WATER RESOURCES AND QUALITY**

### **3.9.1 Existing Water Resources and Quality Conditions**

There are no bodies of water within the boundaries of the study area. Regionally, the study area is in the 200 square mile Upper South Platte watershed, which is within the larger Denver Basin. Locally, the study area is located close to the South Platte River and three small, confined man-made water bodies. Ranging between 400 and 1,500 feet to the west is the South Platte River. Sanderson Gulch, and a small lake located at the northeast corner of West Tennessee Avenue and South Huron Street are approximately 1,000 feet west. Other surface water features within 1.5 miles of the study area include Huston Lake to the west, Smith Lake and Lake Grasmere within Washington Park to the east, and a small pond adjacent to Florida Avenue to the south. These water bodies, to varying degrees, support floodplains, drinking water supplies, recreation, wildlife, aquatic life and habitat, and water quality within the Denver



basin. In general, these types of resources can be impacted by various human activities. No water bodies are located in proximity to the study area to the north.

### **3.9.1.1 Groundwater**

The Denver Basin is an important nonrenewable source of groundwater for municipal, industrial, agricultural and domestic uses. It is a geologic feature that extends south from Greeley, east from Golden, west from Limon, and north from Fountain (Colorado Geologic Survey, 2006). Four hydrologic units or aquifers are located within the Denver Basin and include (from nearest the surface to the deepest) Dawson aquifer, Denver aquifer, Arapahoe aquifer, and Laramie - Fox Hills aquifers. Water within the upper portion of the Denver Basin aquifers is located within an unconfined layer of sedimentary deposits. At lower depths water is located between bands of hard rock in confined aquifer layers. Water drawn from these aquifers is typically obtained from the unconfined water table. As depth increases, the aquifers become confined in various layers of very dense sedimentary rock (Colorado Geologic Survey, 2006).

The main source of groundwater recharge is from precipitation in the Rocky Mountains to the west, from snowmelt in the winter months and rainfall between the months of April and July (Stanford University, 2006). Groundwater is typically recharged via rain infiltrating the upper layers of soil then making its way deeper to the water table aquifer, and sometimes to the confined aquifer layers. Groundwater recharge is inhibited when the surface layers of soil are compacted or covered by impermeable surfaces such as asphalt, concrete, and other hardscape (Colorado Geologic Survey, 2006).

### **3.9.1.2 Water Quality**

The Clean Water Act requires states to adopt water quality standards to protect the nation's waters. These standards define how much of a pollutant can be in a surface and/or groundwater while still allowing it to meet its designated uses, such as for drinking water, fishing, protection of aquatic life, swimming, irrigation, or industrial uses.

Section 303(d) of the Clean Water Act requires states to submit to the EPA a list of those waters that are not meeting their designated uses because of excess pollutants. These include water bodies where it is known that water quality does not meet applicable water quality standards, and/or it is not expected to meet applicable water quality standards and for which technology-based effluent limitations (and other required controls) are not stringent enough to implement water quality standards.

As described in WQCC Reg. 38, segment 14 of the South Platte River is the "Mainstream of the South Platte River from Bowles Avenue in Littleton, Colorado, to the Burlington Ditch diversion in Denver, Colorado." Segment 14 currently is only identified as impaired for its designated uses by E. coli. The primary contributor of nutrients (including nitrate) to segment 14 of the South Platte River is the Littleton/Englewood Wastewater Treatment Plant which discharges to the river downstream of Dartmouth Avenue. The Centennial Wastewater Treatment Plant discharges to Marcy Gulch, which is a tributary to segment 6c of the South Platte River and is approximately 4 miles upstream of segment 14 and 15 miles upstream of the Burlington Ditch Headgate. CCD storm sewers are believed to be one of the primary contributors of E. coli in the South Platte River.

### **3.9.1.3 Local Providers**

Denver Water is the main supplier of potable water to consumers within the greater metropolitan Denver area. Denver Water obtains its water from the South Platte collection system and the Moffat collection system on the east slope of the Rocky Mountains (Denver Water 2006). The CCD draws most of its water from the smaller Middle South Platte—Cherry Creek watershed (Stanford University, 2006). Seventy percent of Denver's water supply flows into these smaller watersheds from the South Platte River drainage located to the southwest (Colorado State, 2000). Currently, the quality of water provided by Denver Water meets all standards set by EPA (Denver Water, 2006).

Groundwater and surface water quality is determined by the presence and quantity of contaminants in the water (Stanford, 2006). Prior to reaching consumers, the contaminants must be removed from the water distribution system. Although water from these sources is generally of a very high quality, due to their chemical characteristics and mineral concentration, treatment is still required.

The City of Thornton owns a junior water right on the South Platte River and diverts water from the Burlington Headgate diversion at the northern terminus of stream segment 14. This water is stored in municipal reservoirs for drinking water supply.

## **3.9.2 Water Resources and Quality Impacts**

The South Platte River is the only water resource potentially affected as a result of project implementation because of its location adjacent to the western project boundary. All other water resources are located outside the study area boundary and do not have the potential to be affected by the construction or operation of the South Broadway project.

### **3.9.2.1 No-Action Alternative**

The No-Action Alternative would result in impacts identified in the VHEIS associated with the increase in impervious surface area. Redevelopment of the former Gates property may also have impacts to water resources or water quality as a result of increases or decreases in the amount of impervious surface however these are not yet quantified as a result of the lack of final development plans for these areas. The impacts of growth and development continuing throughout the study area will occur over the next 20 years and beyond. Runoff associated with the No-Action Alternative would be retained and treated in the existing and future water quality basins. As such, both direct and indirect impacts to South Platte water quality would be minimal as a result of the No-Action Alternative.

### **3.9.2.2 Preferred Alternative**

The Preferred Alternative involves improvements along South Broadway and its intersections south from Exposition Avenue to Arizona Avenue. Other work includes improvements to roads between South Broadway and the South Platte River that would improve access to RTD facilities and enhance pedestrian and transit linkages. No improvements as part of the project would occur immediately adjacent to, or over, the South Platte River or other water body. Therefore, the project does not have the potential to directly impact any water body.



Potential indirect impacts to water resources would occur due to runoff during storm events both during and after construction. Stormwater from rain and snow events during construction would carry sediments from bare soils exposed during construction. The primary pollutant of soil erosion is sediment. Sediment discharged into receiving waters increases turbidity, heightens costs for water treatment, and affects aquatic plant and wildlife species. In addition, stormwater runoff carrying pollutants from impervious surfaces, such as paved streets, parking lots, driveways, and impacts from roadway operations also have the potential to affect water quality.

The amount of stormwater runoff carrying sediment and other non-point source pollutants increases proportionately with the amount of impervious surface area. Construction of the Preferred Alternative would increase the existing impervious surface within the study area from 14.30 acres to 17.94 acres, a gain of 3.64 acres. The project would be constructed to capture the runoff from not only the new impervious surface but also the existing impervious surface of the existing roadway system. Elements in the design of the Preferred Alternative would also improve water quality over the No-Action Alternative. This includes installation of inlet filter treatment devices at the existing Mississippi Avenue outfall, which was reconstructed with the T-REX project. Bio-retention basins are not precluded and would be considered in the final design phase of the project.

With the incorporation of Best Management Practices (BMPs) as discussed under mitigation, no construction or operational impacts to water quality would occur.

The project does not include any components other than infrastructure improvements. Water demand would be minimal and only needed for watering of bare soils to reduce dust and watering for landscaping. No water would be drawn from the South Platte River for these purposes because all water will be derived through municipal sources. Therefore, the project would not result in any impacts associated with drawing down the South Platte River.

The southbound South Broadway to southbound I-25 structure that is a part of the Preferred Alternative would require that foundations be installed in the South Broadway/Kentucky Avenue Trichloroethylene (TCE) soil contamination and groundwater plume area located northeast of South Broadway and Kentucky Avenue. Additionally, this alternative would also encroach on a surface area southwest of the intersection of South Broadway and Kentucky Avenue where a portion of a soil and groundwater TCE remediation system is currently located. As noted previously, no improvements as part of the project would occur immediately adjacent to or over the South Platte River or other water body. Therefore, the project does not have the potential to directly impact any water body.

### **3.9.3 Water Resources and Quality Mitigation**

The project will incorporate BMPs to control run-off during and after construction activities. BMPs will be designed to ensure a no net increase in peak flow and to control overall runoff volume. Additionally, BMPs will remove pollutants and sediments from runoff prior to being released to the stormwater system. Incorporation of BMPs will prevent pollutants from entering the South Platte River.

As discussed above, without proper planning, adverse water quality impacts could occur during construction. The use of standard erosion and sediment control BMPs in accordance with the



*Erosion Control and Storm Water Quality Guide*, CDOT, 2002 will be included in the final design plans. All work on the project will be in conformity with Section 107.25 (Water Quality Control) and Section 208 (Erosion Control) of the CDOT *Standard Specifications for Road and Bridge Construction*.

Water quality mitigation will adhere to the MS4 (Municipal Separate Storm Sewer System) Regulations. This MS4 permit identifies specific requirements intended to decrease the adverse impacts of stormwater discharged from stormwater system. Specifically, the MS4 Permit, “clearly identifies binding provisions and essentially states that Denver must aggressively address the problems caused by urban stormwater discharges” (City of Denver, 2006).

To conform to the above requirement, a Stormwater Management Program (SMP) designed to reduce the discharge of pollutants will be developed, implemented, and enforced. As part of the SMP, BMPs both structural (detention basins, silt fencing, etc.) and non-structural (public education and outreach, etc.) will be established. Construction-related mitigation measures are identified in Section 3.14.2.

Conformance to the MS4 permits, as well as implementing BMPs listed above that are not included in the City of Denver Water Quality Management Plan would ensure water quality is not affected by the project. This measure will ensure the most stringent adherence to mitigation practices.

### **3.10 VEGETATION AND NOXIOUS WEEDS**

In May 2007, a field survey was conducted that included a vegetation and noxious weed survey of the study area. This section summarizes the findings of the survey.

#### **3.10.1 Existing Vegetation Conditions**

The study area is controlled by human activities and most of the area contains hardscape including roads, sidewalks, and parking lots, with land uses that consist of commercial, industrial, and residential. The entire study area has been disturbed by past and present land use practices. Accordingly, vegetation patterns in the study area have been completely changed and historic vegetation communities are no longer present. These disturbances have facilitated the introduction of some weedy species to the area. These include kochia (*Bassia sieveriana*), curly dock (*Rumex crispus*), dandelion (*Taraxacum officinale*), prickly lettuce (*Lactuca serriola*), flixweed (*Descurainia sophia*), and western salsify (*Tragopogon dubius*). These are not listed noxious species for the state, county, or under CDOT designation. A number of ornamental trees and shrubs are located throughout the study area. These are concentrated within residential tracts, areas adjacent to businesses and landscaped islands and medians.

#### **3.10.2 Vegetation Impacts**

Because no native vegetation exists in the study area, impacts to vegetation would be minimal in both the No-Action Alternative as well as in the Preferred Alternative. Loss of mature landscaped trees such as silver maple and crabapple within the right-of-way may occur as a result of the Preferred Alternative.

### 3.10.3 Vegetation Mitigation

There are no vegetation impacts expected from the Preferred Alternative, therefore, no mitigation is required.

### 3.10.4 Existing Noxious Weeds Conditions

Noxious weeds are invasive, non-native plants introduced to Colorado by accident or which spread after being planted for another purpose and which result in lands with decreased economic and environmental value. The Colorado Noxious Weed Act of 2003 (35-5.5-101 through 119, C.R.S) recognizes that, “certain undesirable plants constitute a present threat to the continued economic and environmental values of the lands of the state and if present in any area of the state must be managed.” The legislation places all public and private lands in Colorado under the jurisdiction of local governments to manage noxious weeds. According to the Act, a noxious weed meets one or more of the following criteria:

- ▶ Aggressively invades or is detrimental to economic crops of native plant communities.
- ▶ Is poisonous to livestock.
- ▶ Is a carrier of detrimental insects, disease or parasites.
- ▶ Results in direct or indirect impacts that are detrimental to the environmentally sound management of natural or agricultural ecosystems (Colorado Department of Agriculture, 2006 A).

The State Department of Agriculture has implemented a Noxious Weed Management Program. The program is aimed at preventing the introduction of new invasive plant species, eradication of species with isolated or limited populations, and containing and managing invasive species already well established and widespread in Colorado. The Department of Agriculture provides lists of noxious weed species by county. Additionally, the CDOT Noxious Weed Management Plan requires surveys for some of the states high-priority weed species. **Table 3-14** identifies the noxious weeds (Colorado Department of Agriculture, 2006B) present in the study area at the time of the survey (May 2007).

**Table 3-14. Listed Weed Species Observed in the Study Area**

| Common Name     | Species                     | Denver County Weed List | State Noxious Weed List | CDOT Noxious Weed List |
|-----------------|-----------------------------|-------------------------|-------------------------|------------------------|
| Canada Thistle  | <i>Cirsium arvense</i>      | Yes                     | B*                      | Yes                    |
| Redstem filaree | <i>Erodium cicutarium</i>   | No                      | B*                      | No                     |
| Field bindweed  | <i>Convolvulus arvensis</i> | No                      | C+                      | Yes                    |
| Cheatgrass      | <i>Bromus tectorum</i>      | No                      | C+                      | No                     |

\*B list noxious weeds are species that the commissioner, state noxious weed advisory committee, local governments, and interested parties are to develop and implement a state noxious weed management plan designed to stop the spread of the species.

+C list noxious weeds for which resources will be provided to jurisdictions that choose to require management thereof.

Weedy and noxious species are present in isolation throughout much of the study area; however, there are identified areas where the concentration of weeds is greater. These are shown in **Figure 3-5**.

**Figure 3-5. Noxious Weed Areas**



**Area 1**—Along the roadside on Ohio Avenue between Lincoln Street and South Broadway. Approximately 300 square feet between the roadway and the northern sidewalk are infested with cheatgrass, which accounts for 50 percent ground cover density.

**Area 2**—Along the roadside on Ohio Avenue between Lincoln Street and the I-25 on-ramp. Approximately 645 square feet between the roadway and the sidewalk are infested with redstem filaree, cheatgrass, and field bindweed. Redstem filaree accounts for approximately 30 percent



ground cover, whereas cheatgrass and field bindweed account for approximately 15 percent and 5 percent ground cover, respectively.

**Area 3**—Along the eastern side of the on-ramp from Ohio Avenue to I-25. An area approximately 18,240 square feet in size is infested with redstem filaree and field bindweed. Redstem filaree accounts for approximately 15 percent ground cover, whereas field bindweed accounts for approximately 5 percent ground cover.

**Area 4**—Along the eastern right-of-way of South Broadway between Tennessee Avenue and Mississippi Avenue. Weeds in this area are located along the right-of-way boundaries in an area that has been identified for mixed-use development. An area approximately 33,953 square feet in size is infested with Canada thistle, field bindweed, cheatgrass, and redstem filaree. Canada thistle and field bindweed each account for less than 5 percent ground cover. Cheatgrass and redstem filaree account for 30 percent and 10 percent ground cover, respectively.

### **3.10.5 Noxious Weed Impacts**

#### **3.10.5.1 No-Action Alternative**

The No-Action Alternative would contribute to the spread of noxious weeds, since it involves soil disturbance. Future development is planned for the area, much of it centered around the former Gates property, that would further disturb the soil and increase the potential for the invasion and/or spread of noxious weeds. The developers involved would implement their own Weed Management Plans to deal with weeds within construction zones, but as this area would change rapidly as development projects are completed, the locations, density, and patch size of weed infestations also would change.

#### **3.10.5.2 Preferred Alternative**

The Preferred Alternative is located mainly within existing right-of-way or paved areas. Weedy and noxious species are present in isolation throughout much of the study area; however, there are identified areas where the concentration of weeds is greater. As most areas are paved, the potential for further invasion and spread of noxious weeds would be minimal.

Proposed construction activities in all of the listed areas would occur along development areas with little vegetation aside from the present weeds. The potential to spread any of the weeds in this area is limited to newly constructed fill slopes and a small portion of the adjacent railroad tracks.

### **3.10.6 Noxious Weed Mitigation**

To ensure that weeds do not spread, the following measures will be incorporated in to the construction plans.

Since soil disturbance with accompanying invasion by noxious weed species can be associated with highway construction, a management plan for noxious weeds will be incorporated into the project design and implemented during construction. Specific BMPs will be required during construction to reduce the potential for introduction and spread of noxious weed species and includes:

- ▶ During the design phase, detailed weed mapping of the study area will be conducted by a weed specialist. Mapping will be included in the construction documents along with appropriate control methods for noxious weeds.
- ▶ Identification of all existing noxious weed infestations within the roadway right-of-way will occur during the design phase. Roadway right-of-way areas will periodically be inspected by the CCD or its consultants during construction and during post-construction weed monitoring for invasion of noxious weeds.
- ▶ Preparation of Integrated Noxious Weed Management Plan prior to construction, if required.
- ▶ Use of herbicides will include selection of appropriate herbicides and timing of herbicide spraying, and use of a backpack sprayer.
- ▶ Certified weed-free hay and/or mulch will be used in all revegetated areas.
- ▶ No fertilizers will be allowed on the project site.
- ▶ Topsoil Management: Topsoil shall never be salvaged if contaminated by noxious weeds or seeds. Importing topsoil onto the project site shall not be allowed unless it is weed-free.
- ▶ Minimize soil disturbance: The areas most vulnerable to invasive infestations are areas that have been recently cleared of vegetation.
- ▶ Equipment Management: Equipment will stay out of weed-infested areas until they are treated. All equipment shall be cleaned of soil and vegetative plant parts prior to arriving on the project site, to avoid introducing additional invasive species.
- ▶ Native plants: Native species of vegetation will be used for revegetation purposes.
- ▶ Stakeholder Coordination: Weed management efforts will be coordinated with local jurisdictional agencies and adjacent landowners to the extent possible.
- ▶ Supplemental noxious weed control measures will be added during the design and construction planning.

### **3.11 VISUAL RESOURCES**

#### **Visual Resource Assessment Intent and Objectives**

Visual resources and aesthetics are important considerations when planning transportation improvements. Visual resources help define the character of a community or transportation corridor and can enhance the quality of life for study area users and residents.

The South Broadway visual assessment process includes an inventory of existing visual resources, evaluation of visual quality, analysis of the visual impacts of each alternative, and development of mitigation to avoid impacts or enhance visual resources through design aesthetics or urban design amenities. Viewer types, community landmarks, typical views, and land use character are key elements of a visual resource assessment.

### Land Uses

Land uses within the study area are primarily urban. There are no natural areas or parks within the study area boundaries. South Broadway is fronted by retail, residential and light industrial uses, but dominated by major transportation features such as I-25, the I-25 and Broadway Station, and South Broadway itself: a major north/south arterial and regional bus route linking downtown Denver and areas to the south. The I-25 and Broadway Station and park-n-Ride fronts the west side of South Broadway between Ohio Avenue and Kentucky Avenues. Light industrial land uses, such as auto service businesses, are few and clustered near the former Gates redevelopment property (see **Photo A**). Land uses adjacent to South Broadway corridor include residential neighborhoods to the east, and the Consolidated Main Line (CML) and light industrial businesses to the west. Platt Park, Overland, Baker and West Washington Park neighborhoods have boundaries within the study area. These neighborhoods are characteristic of Denver's older residential neighborhoods. The residential streets are lined with mature street trees and detached sidewalks. Front porches of these older homes face the street and alleys provide access to the back of each lot (see **Photo B**).



Photo A. Former Gates Property



Photo B. Typical Platt Park House

### Community Policies for Visual Resources

*Broadway Corridor Transportation and Urban Design Study June 1999- July 2001.* The purpose of this study was to “define the present South Broadway corridor situation and create a vision for what the corridor could become in the future.” The study recognized characteristics that degraded the visual quality of the corridor. It noted that sidewalks are inconsistent in quality and pedestrian amenities are at isolated locations that relate to adjacent businesses rather than the corridor. The view from the road is cluttered with public and private signs that lack visual continuity.

### CCD View Plane Ordinance

The CCD has established a land use ordinance “for the preservation of a certain panoramic view” to preserve views toward the Rocky Mountains. Denver Building Code, RMC Section 10-61.5 establishes a view plane from a reference point within Washington Park that limits buildings heights to allow clear views from the neighborhood to the mountains in the west. Although this view plane does not originate in the South Broadway study area, it does limit new structure heights. Since the South Broadway study area is within 9,000 feet horizontally of the



reference point, new structures shall not exceed “an elevation of five thousand three hundred twenty-three and nine-tenths (5,323.9) feet above mean sea level plus one foot for each hundred (horizontal) feet” from the reference point. **Figure 3-6** displays the Washington Park View Plane map shown in Section 10-61.5 of the Denver Municipal Code.

### **3.11.1 Existing Visual Resources**

#### **Viewer Types**

The majority of viewer types in the South Broadway study area are traveling through the area, en route to downtown Denver or to south Denver and Englewood. Motorists and transit riders are interested in views from the South Broadway roadway, or the light rail line. Their view experiences are a sequence of images seen while their vehicle is moving. Generally, their views are quick, change often, and focus on middle and background views.

A smaller number of viewers include people who work, shop or live in the study area. Most of their views are toward South Broadway from their homes or workplaces. Their everyday views are often stationary and focus on the details of view foreground and middle ground. Distant views of regional landmarks may be of high value to residents and employees.

A third group of viewers include bicyclists and pedestrians who may live in the study area or come to visit. This group experiences views both from South Broadway sidewalks and toward South Broadway from adjacent local streets. Pedestrians and bicyclists appreciate the details of foreground and distant views, since their travel time is slow.

#### **Visual Resource Inventory**

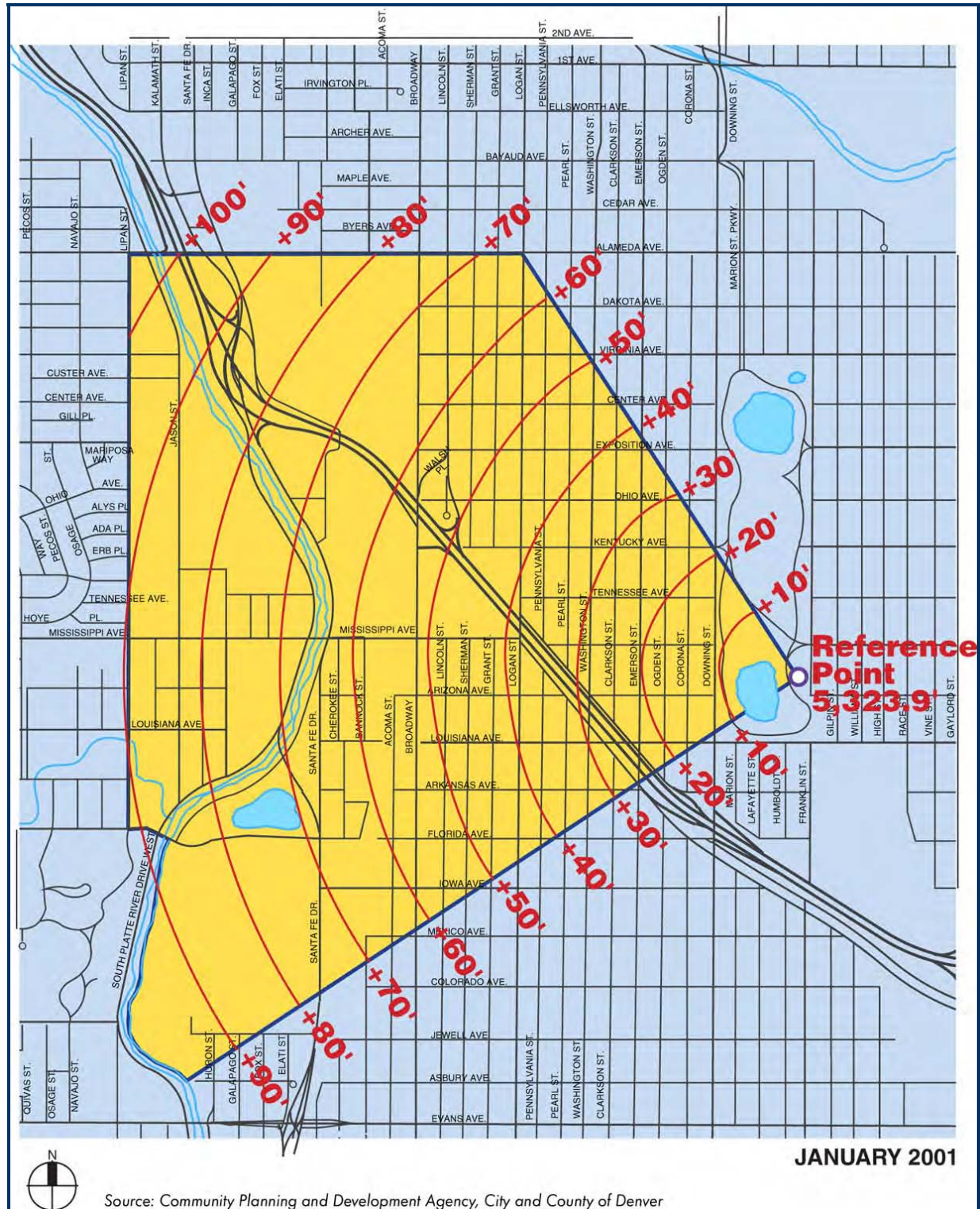
Since many of the project improvements are proposed for South Broadway and at the South Broadway and I-25 interchange, this visual resource inventory describes foreground, middle ground and background views from the South Broadway viewer perspective.

Foreground views along South Broadway, from Exposition Avenue to Arizona Avenue include the street pavement, sidewalk and street elements such as utility poles and overhead lines, traffic signals, billboards/signs, light fixtures, bus shelters and landscaping.

Middle ground views are toward adjacent single-story or multi-level buildings, with the occasional views of CML tracks running west and parallel to South Broadway.

Background views include the regionally important landmarks of the Denver skyline to the north and the Front Range of the Rocky Mountains to the west. The view from northbound South Broadway includes the Denver skyline in the background with I-25 overpass in the foreground.

Figure 3-6. Washington Park View Plane



The majority of streets running east to west across South Broadway have background views of the mountains across a foreground and middle ground of South Broadway (see **Photo C**). Mississippi Avenue is the exception to this since Mississippi Avenue crosses under the CML. Views east of South Broadway are toward the Platt Park neighborhood (see **Photo D**).



Photo C. View west on Arizona Avenue



Photo D. View east on South Broadway at Ohio Avenue

### **Visual Quality**

South Broadway's visual resources are of low to moderate quality. Views from and to South Broadway have low vividness and are not of memorable quality. The street corridor is not recognized by a consistent and distinctive building frontage or street tree pattern. Building form is of mixed architectural style, age, and condition.

South Broadway's street image has low to moderate intactness. The pattern of street elements is inconsistent and street sidewalks do not have consistent width. I-25 interrupts the regional view of the downtown Denver skyline for northbound travelers on South Broadway.

The unity of South Broadway's street elements is low. Street tree layout is not regular. Pedestrian zones are not identifiable or predictable. Bus stops are not recognizable because each stop does not have bus shelters or a unified sign design and location.

## **3.11.2 Visual Resources Impacts**

### **3.11.2.1 No-Action Alternative**

Many elements of the No-Action Alternative are common to both the No- Action and Preferred Alternatives as a result of the inclusion of other projects already planned in the area that would improve the visual quality of the study area. These include the preservation of the historic Ford Building, urban design amenities constructed as part of the redevelopment of the former Gates property, wider sidewalks, street trees, and other pedestrian amenities along South Broadway between I-25 and Mississippi Avenue. The redevelopment projects would also replace current views toward existing vacant lots with new multi-story buildings, new streets, landscaped parking lots and pedestrian plazas. This would substantially alter the visual character of areas east of South Broadway.



Impacts also expected under the No-Action Alternative would be related to implementation of the Preferred Alternative of the VHEIS Phase VI improvements. Many of these are similar to those expected in the Preferred Alternative for South Broadway because they relate to changes in alignments for I-25 and its ramps, South Broadway, Ohio Avenue and Kentucky Avenue, and the replacement of aging infrastructure with new, more visually appealing structures.

### **3.11.2.2 Preferred Alternative**

The Preferred Alternative would include improvements to street and traffic circulation that would change the street image of South Broadway and the South Broadway and I-25 interchange. These improvements would enhance the existing visual character of the South Broadway corridor, in addition to the planned aesthetic improvements by the redevelopment projects described in the No-Action Alternative.

The Interim Phase on South Broadway would improve the study area's visual character and would attract more pedestrian activity with six travel lanes and outside parking lanes in front of stores. Fewer travel lanes with parking would help calm traffic speeds and provide a shorter crossing distance for pedestrians.

While the Ultimate Phase on South Broadway would benefit from visual improvements made in the Interim Phase, there would be a slight reduction of visual quality when the two outside interim parking lanes are converted to travel lanes. The businesses on each side of the roadway would appear as separate commercial areas. The Preferred Alternative would add a landscaped center median in accordance with the *Broadway Corridor Transportation and Urban Design Study*.

A new I-25 on-ramp overpass would be built immediately south of the existing I-25 structure. This overpass would not be taller than the existing I-25 structure. Paint and texture will be selected to match the existing I-25 interchange structures. Since the overpass height is below 117 feet high, the Washington Park view plane would be preserved. In addition, a 3-story parking structure is being negotiated between the City and County of Denver and RTD to off-set parking impacts. The CCD and RTD are currently negotiating the details regarding the construction of the parking structure. It would be designed to preserve the Washington Park view plane.

### **3.11.3 Visual Resources Mitigation**

The Preferred Alternative includes a landscaped center median, widened sidewalks and new pedestrian and bicycle facilities. The redevelopment projects will fund landscaping and other urban design elements to the unified sidewalk and street improvements of the Preferred Alternative. These street improvements will help unify South Broadway's image, add continuity to many blocks of the South Broadway corridor, and enhance foreground and middle ground views to and from South Broadway. No further mitigation is required.

In addition to the visual enhancement of this project the 'kit of parts' recommended in the *South Broadway Corridor Transportation and Urban Design Study*, would likely be added by private landowners as existing land uses are redeveloped. These urban design features would continue to improve upon the visual character of the study area.