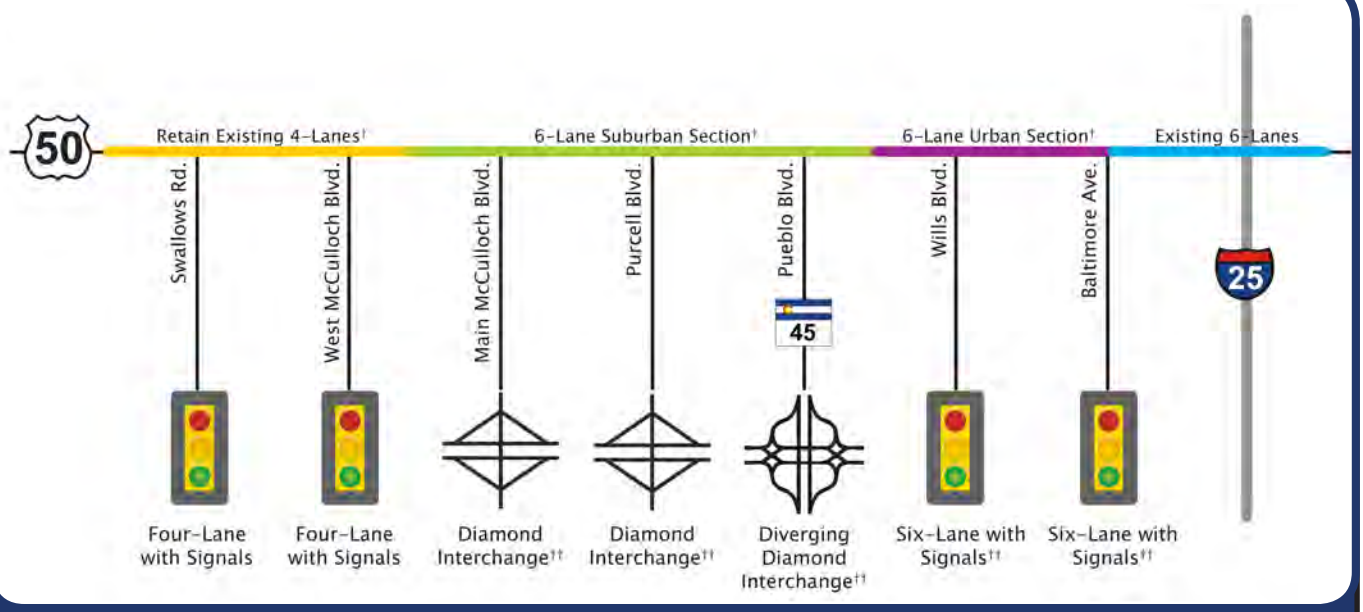
US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

US 50 West PEL Study

Colorado Department
of Transportation



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List of Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
APE	Area of Potential Effect
AST	aboveground storage tank
Ave.	Avenue
Blvd.	Boulevard
BMPs	Best Management Practices
BNSF	Burlington Northern Santa Fe (Railway)
CBEF	Center for Business and Economic Forecasting
CCR	Code of Colorado Regulations
CDOT	Colorado Department of Transportation
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFI	Continuous Flow Intersection
CFR	Code of Federal Regulations
CNG	Colorado Natural Gas
CPW	Colorado Division of Parks and Wildlife
CRS	Colorado Revised Statutes
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
dBA	decibel scale, A-weighting
DDI	diverging diamond interchange
DOLA	Colorado Department of Local Affairs
Dr.	Drive
E. coli	Escherichia coli
EB	eastbound
EIS	Environmental Impact Statement
ERNS	Emergency Response Notification System
FASTER	Funding Advancement for Surface Transportation and Economic Recovery
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
ft.	feet/foot
GIS	geographic information system
GPS	global positioning system
HazMat	hazardous materials
HOV	high-occupancy vehicle
I-25	Interstate 25

JFSA	J.F. Sato and Associates
LOMR	Letter of Map Revision
LOS	Level of Service
LOSS	Level of Service of Safety
LPG	Liquid propane gas
LRTP	Long Range Transportation Plan
LUST	leaking underground storage tank
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MS4	Municipal Separate Storm Sewer System
MUE	multi-use easement
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria (Criterion)
NB	northbound
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OAHP	Colorado Office of Archaeology and Historic Preservation
PACOG	Pueblo Area Council of Governments
PAT	Policy Advisory Team
PEL	Planning and Environmental Linkages
Phase I ESA	Phase I Environmental Site Assessment
PI	Public Involvement
PUD	Planned Unit Development
PWMD	Pueblo West Metropolitan District
RCRA	Resource Conservation and Recovery Act
RCRA GEN	Resource Conservation and Recovery Act Generators
Rd.	Road
ROW	right-of-way
SB	southbound
SECOM	Southeast Communications (broadband internet and telecommunications division of Southeast Colorado Power Association)
SECPA	Southeast Colorado Power Association
SH	State Highway (numbered highway route)
SPF	Safety Performance Function
SPUI	Single-Point Urban Interchange
SQG	Small Quantity Generator
St.	Street
SWMP	Stormwater Management Plan
TAT	Technical Advisory Team

TES	Threatened, Endangered and Special Status Species
TNM	Traffic Noise Model
TRB	Transportation Research Board
TUDI	Tight Urban Diamond Interchange
UGF	Underground Fiber (optic cable)
US	United States (also numbered highway route)
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
UST	underground storage tank
WB	westbound
WCRM	Western Cultural Resource Management, Inc.

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Executive Summary

1. What is a Planning and Environmental Linkages (PEL) study?

A Planning and Environmental Linkages (PEL) Study provides an opportunity to consider environmental and community issues early in the planning process before formal environmental clearance begins. Data collected and analyzed for the PEL Study can be used in future environmental studies as funding for specific improvements becomes available. Projects will be chosen that have independent utility, have logical termini, and do not restrict consideration of alternatives for other reasonably foreseeable transportation improvements. The **Implementation Plan** is included as an addendum to this PEL Study and provides a recommended sequence of improvements based on current traffic forecasts. Compliance with the National Environmental Policy Act will be required if there is a federal nexus on any of the projects, including federal funding or federal permitting approval. **Appendix A** contains responses to the questionnaire that the Federal Highway Administration (FHWA) developed for PEL studies. **Appendix L** includes the partnering agreement among FHWA, the Colorado Department of Transportation (CDOT), federal and state resource agencies, metropolitan planning organizations including the Pueblo Area Council of Governments (PACOG), and other entities to proactively work together when conducting PEL studies.

2. Why is CDOT preparing this PEL Study for US 50 in Pueblo?

CDOT Region 2 is conducting this PEL Study because the section of US 50 from Swallows Rd. to Baltimore Ave. currently experiences peak-hour congestion and above average crash rates, particularly in the eastern end of the Corridor. Both conditions are expected to worsen in the future.

3. What are the study limits and existing transportation facilities within the US 50 Corridor?

The PEL Study Report uses different terms to distinguish between areas that US 50 influences. When talking about US 50 itself, this report uses terms such as "roadway," "segment," or "section." The "US 50 Corridor" refers to US 50 between Swallows Rd. and Baltimore Ave., plus those intersecting and nearby streets that contribute to US 50 traffic. The "Corridor" also includes the land parcels that produce trips that use US 50. The term "study area" refers to an even broader area that may vary with the environmental or community resource being considered. For example, in making travel demand forecasts, the study area is all of Pueblo County.

The section of US 50 being studied extends about 11.8 miles from Swallows Rd. west of the Pueblo West Metropolitan District (at milepost 301.72) to Baltimore Ave. within the city of Pueblo (at milepost 313.52). **Figure ES-1** presents a map highlighting the study corridor and showing surrounding roads.

US 50 west of Pueblo between the intersections of Swallows Rd. and Baltimore Ave. is a four-lane divided east-west highway (two 12-foot lanes in each direction) with signalized intersections at Main McCulloch Blvd., Purcell Blvd., Pueblo Blvd. (State Highway 45), Wills Blvd., and Baltimore Ave. The intersections with Swallows Rd. and West McCulloch Blvd. are unsignalized. There are also right-in/right-out accesses at Westroads Ave. (between Wills Blvd. and Baltimore Ave.) on the

westbound north side of US 50. Another right-in/right-out access is planned from US 50 eastbound to an extension of Tuxedo Blvd. There are several driveways on the eastbound side of US 50.

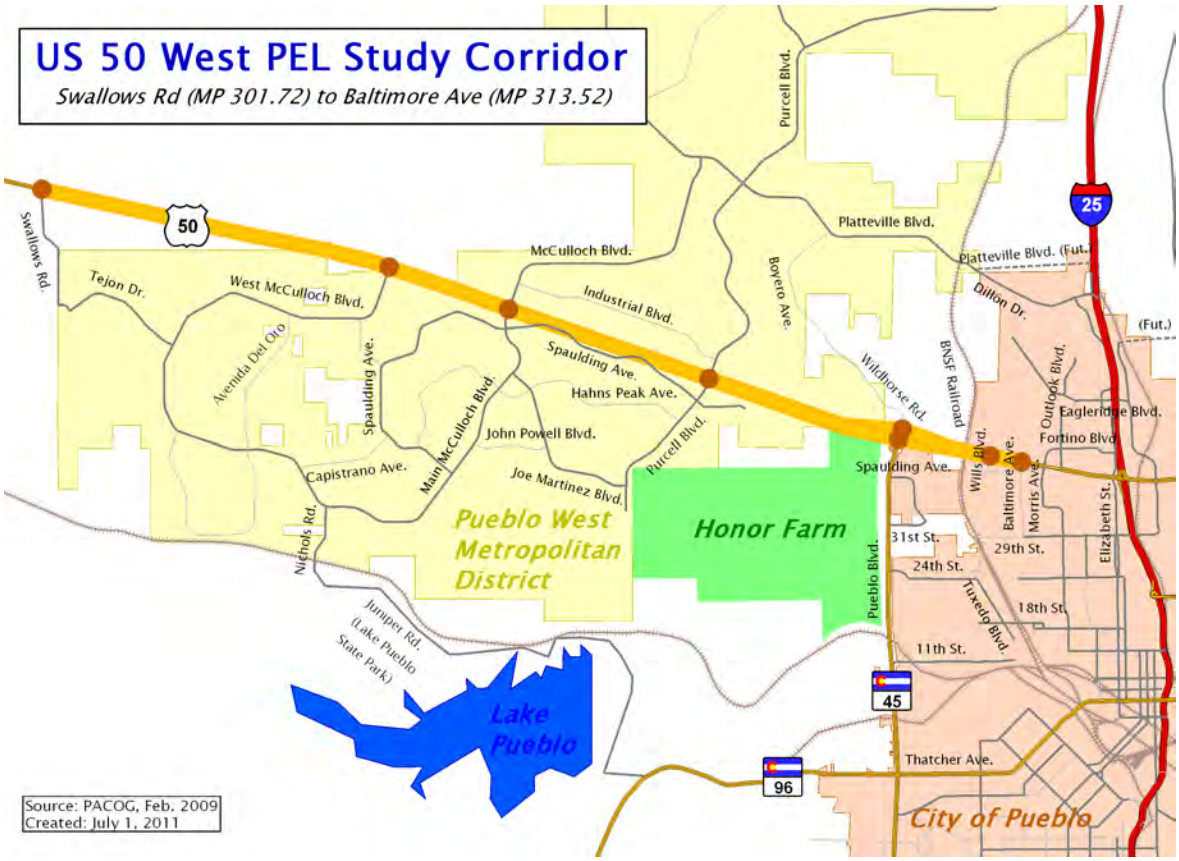


Figure ES-1. Study Corridor and Vicinity

The PACOG 2035 *Long Range Transportation Plan* also calls for a new westbound right-in/right-out north of US 50 between Wills Blvd. and Pueblo Blvd. to provide local access.

This portion of US 50 is divided by a depressed median from Swallows Rd. to the Burlington Northern Santa Fe railroad crossing, and by a raised median between the railroad crossing and Baltimore Ave. Acceleration and deceleration lanes are provided at the major intersections, as are left-turn lanes. US 50 travels through residential and agricultural areas from Swallows Rd. to Main McCulloch Blvd., then through parks and commercial areas between Main McCulloch Blvd. and Pueblo Blvd., and an urban area adjacent to the eastern study limits.

Chapter 1, Section 1.4, of this PEL Study provides more details about the US 50 Corridor.

4. What were the key steps and major planning activities completed in this PEL Study?

The following key steps and major planning activities have been completed for this study:

- A traffic safety assessment within the project area
- Travel demand modeling based on the PACOG socioeconomic forecasts to estimate 2035 traffic volumes

- PEL-level environmental data collection (such as historic properties, utilities, hazardous materials, streams, wetlands, habitat, visual, and noise)
- A scoping process to determine the Purpose and Need of this project
- Alternatives development
- Alternatives screening and comparison
- Agency and public involvement
- The project team's recommendation of the Preferred Alternative
- Development of an **Implementation Plan** (attached as an addendum to this PEL Study)

5. Who participated in those key steps in the PEL process?

Participants and their involvement in the PEL process include the following:

- CDOT and J.F. Sato and Associates invited representatives of the City of Pueblo, Pueblo County, the Pueblo West Metropolitan District, and PACOG to form the Technical Advisory Team (TAT) on April 1, 2010. The TAT met approximately monthly throughout the duration of the study.
- CDOT formed the Policy Advisory Team (PAT) by inviting a representative of the Pueblo West Metropolitan District to ongoing bimonthly coordination meetings with Pueblo County and the City of Pueblo.
- CDOT hosted community work sessions (public meetings) at the Pueblo West Public Library on April 5, 2011, and at Centennial High School in Pueblo on April 7, 2011.
- CDOT met periodically with FHWA's Colorado Division about the progress of the PEL process.

6. What were the federal, state, and local agency coordination processes?

Federal, state, and local agency coordination processes included the following:

- The TAT met periodically to discuss the development, screening, and comparison of alternatives.
- The PAT met periodically to provide guidelines for the PEL process.
- The study team coordinated with the US Fish and Wildlife Service to identify species of concern in the study area. While species with habitat in Pueblo County were identified, none of these species have habitat near the US 50 Corridor.
- The study team also contacted the Colorado Division of Wildlife about species of state concern.

Chapter 4 of this PEL Study describes agency coordination in more detail.

7. What is the purpose and need statement of this PEL Study?

The US 50 Corridor is congested during the peak hours and this congestion is expected to grow. By 2035, traffic volumes are expected to be double their current levels, and it could take as much as a half hour to travel this 12-mile Corridor during peak hours. (Speed limits on US 50 range from 45 miles per hour [mph] to 65 mph, and it takes about 15 minutes to travel the Corridor in light traffic.) The Corridor also has above-average crash rates concentrated around intersections that are related to differences in speed between vehicles. To address these needs, the following elements make up the Purpose and Need statement:

- Improve the safety of the Corridor
- Increase the mobility and relieve traffic congestion on US 50
- Minimize detrimental Level of Service (LOS) impacts on the surrounding network when improving US 50
- Accommodate multimodal connectivity (including local bicycle and pedestrian facilities)
- Maintain reasonable access to future growth

Chapter 1, Section 1.5, of this PEL Study provides a more complete Purpose and Need statement.

8. How were alternatives developed and what alternatives were evaluated?

The study team initially developed alternatives based on similar components (such as intersection types) that might address the congestion and safety issues on US 50. During the evaluation process, the focus shifted to individual intersection options because of concerns about footprint-related impacts. Later in the evaluation process, the remaining intersection options were packaged with two mainline treatments to create the final alternatives for Level 4 analysis. **Chapter 2** of this PEL Study provides more detail about the alternative development and evaluation process.

The following intersection options were examined, among others:

- Unsignalized intersections
- Signalized intersections
- Diamond interchanges
- Single-point urban interchanges
- Partial cloverleaf interchanges
- Continuous flow intersections
- Diverging diamond interchanges

Chapter 2, Section 2.6, of this PEL Study presents the complete list of intersection options that were considered, along with their descriptions.

The study team used two mainline treatments: four-lane and six-lane cross sections with a bicycle and pedestrian path to the south of US 50. **Figure ES-2** shows a comparison of the alternative cross sections with the existing US 50 cross section in Pueblo West. **Chapter 2, Section 2.3** of this PEL Study provides more information about the mainline options.

The study team also examined several local improvements to determine if they could reduce congestion on US 50 without having to make improvements to US 50 itself. Improvements included:

- Extending Pueblo Blvd. north of US 50

- Constructing a new section (Joe Martinez Blvd. Extension) and improving other sections of the West Pueblo Connector
- Extending Eagleridge Blvd. west to the Pueblo Blvd. Extension
- Extending Industrial Blvd. east to Wildhorse Rd.
- Extending Spaulding Ave. through Honor Farm and south to 11th St.
- Extending Tuxedo Blvd. north to US 50

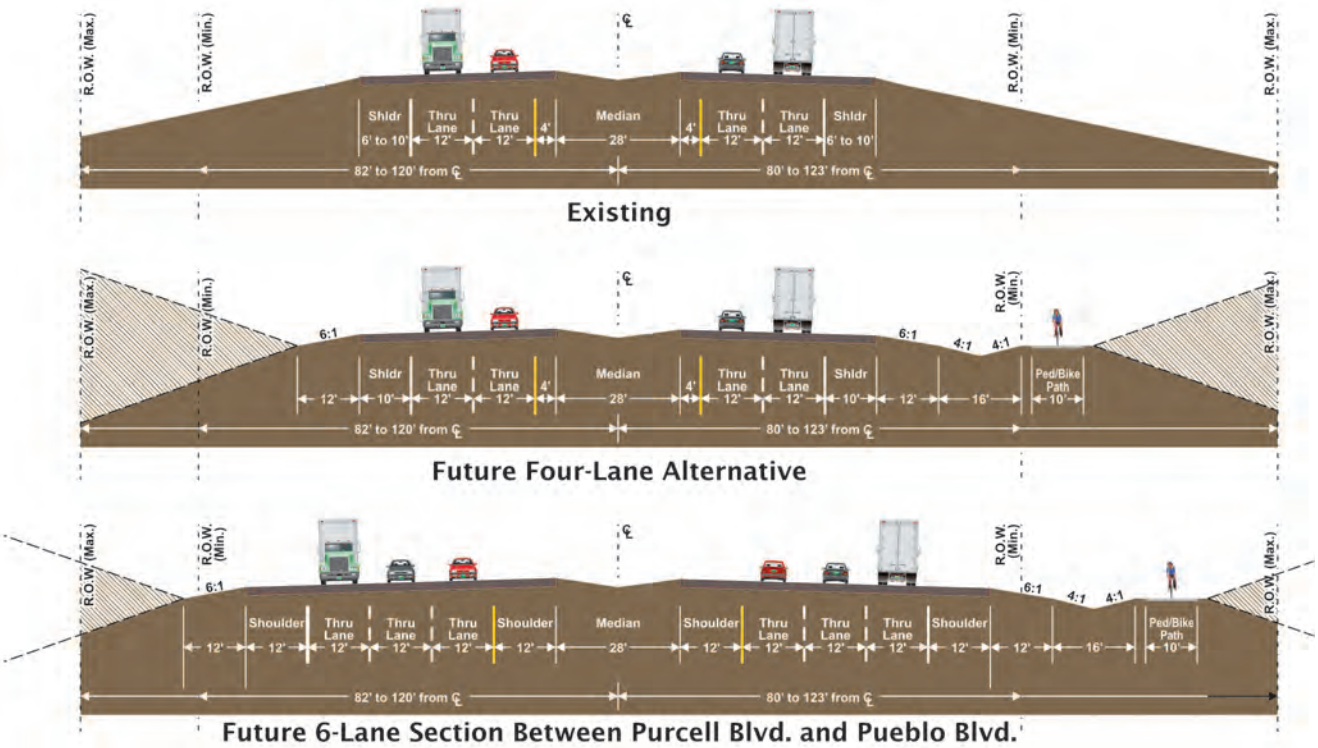


Figure ES-2. Existing and Proposed US 50 Cross Sections

Chapter 1, Section 1.7, of this PEL Study describes these local improvements in more detail. The study team found that these local improvements have benefits in diverting traffic away from US 50, but not enough to eliminate the need to make improvements on US 50 itself. **Chapter 1, Section 1.8,** of this PEL Study discusses the specific benefits of each local improvement project.

9. What criteria were used to evaluate alternatives?

The study team and TAT completed four levels of evaluation to identify the Preferred Alternative. Each level of evaluation considered different issues:

- Level 1 screening examined environmental fatal flaws involving environmental justice, historic properties, recreational properties, and wildlife refuges.
- Level 2 screening considered traffic operations at the seven intersections, which are the bottlenecks along US 50. To pass Level 2 screening, intersection options had to operate at LOS D or better in 2035; namely, they had to handle fewer vehicles than their capacity.

- Level 3 comparative analysis considered footprint-related impacts—such as acquiring additional right-of-way or evaluating disruptions to the environment—along with traffic operations, safety, cost, and implementation of intersection options.
- Level 4 comparative analysis examined five action alternatives and the No Action Alternative using more detailed analysis of the considerations developed during the Level 3 evaluation process. Level 4 evaluation also considered mitigation measures.

Figure ES-3 illustrates the process used to evaluate alternatives for the US 50 PEL. **Chapter 2** of this PEL Study provides a detailed overview of each level of evaluation, while **Appendix B** contains the detailed evaluation tables.

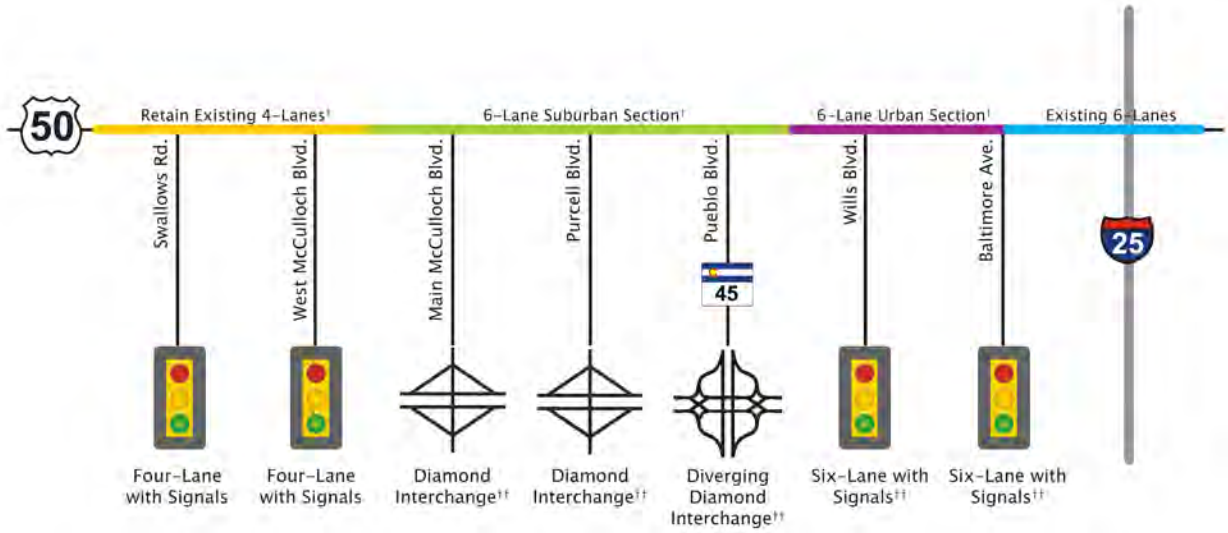
Figure ES-3. Alternative Screening and Comparative Analysis Process

	Facility Types Level 1 None were eliminated	Facility Types and Intersection Options Level 2 Reduced the number of intersection options from 77 to 58	Intersection Options Level 3 Reduced the number of intersection options through TAT process from 58 to 10	Alternatives Level 4 Compared No Action and 5 alternatives	Preferred Alternative
Traffic Operations Topics					
LOS/Travel Time/Average Delay Analyses		LOS – Interchanges	Same as Level 2	LOS, Travel Time, Average Delay/ Interchanges and Segments	Documentation and Implementation
Safety Analysis			Conflict Points	Same as Level 3	
Cost			Quantitative Range	Refined from Level 3	
Environmental Resource Topics					
Land Use			City of Pueblo PACOG Quantitative	Same as Level 3	
Access			Site/Engineering Interpretation	Same as Level 3	
Air Quality (PEL documentation)					PEL Report
Socioeconomics			Site/Planning Interpretation		FHWA Questionnaire
Environmental Justice	Census Data Qualitative				Implementation Plan
Noise			Interchange Interpretation Qualitative	Noise Modeling Quantitative	
Visual			Site/Planning Interpretation		
Utilities			Multiple Sources Qualitative	Same as Level 3	
Hazardous Materials			Multiple Sources Qualitative	Same as Level 3	
Water Quality (PEL documentation)					
Surface Water & Floodplain			FEMA/City of Pueblo Quantitative	Same as Level 3	
TES Species Habitat			USFWS List Habitat Analysis	Research Quantitative	
Wetlands			Field Mapping Quantitative (acres)	Field Delineation Quantitative	
Historic Properties, Recreational Properties, & Wildlife Refuges	Colorado Office of Archaeology and Historic Preservation PACOG		Same as Level 1		

10. Which alternative is the Preferred Alternative and why?

The Preferred Alternative is Alternative E, consisting of six lanes on US 50 east of Main McCulloch Blvd., diamond interchanges at Main McCulloch Blvd. and Purcell Blvd., and a diverging diamond interchange at Pueblo Blvd. The Preferred Alternative would retain the existing traffic signals at Wills Blvd. and Baltimore Ave., as well as add two new signals at Swallows Rd. and West McCulloch Blvd. The Preferred Alternative would also include a 3,970-foot noise wall along the south side of US 50 between West McCulloch Blvd. and Main McCulloch Blvd.

Figure ES-4 illustrates the Preferred Alternative. **Chapter 2, Section 2.16,** of this PEL Study describes the components of the Preferred Alternative in more detail.



Note: The question of whether US 50 will pass over or under Pueblo Blvd. will be decided as part of future design and NEPA clearance processes.

Figure ES-4. Schematic Illustration of Preferred Alternative

Alternative E offers the greatest phasing flexibility and responsiveness to growing traffic volumes. Phasing flexibility is important because the funds to improve US 50 will not be available all at once, and improvements will need to be built in smaller pieces. The Preferred Alternative would balance good traffic operations with minimal environmental impacts. In particular, the diverging diamond interchange at Pueblo Blvd. would minimize impacts on utilities, streams, wetlands, and floodplains. **Chapter 2, Section 2.15,** of this PEL Study presents the complete rationale for identifying Alternative E as the Preferred Alternative.

11. How will the Preferred Alternative be implemented?

Appendix M includes a Memorandum of Agreement (MOA) among CDOT, the City of Pueblo, Pueblo County, the Pueblo West Metropolitan District, and PACOG to establish mutual agreement regarding the selection and implementation of the Preferred Alternative for the US 50 West PEL Study. The same team members who contributed to this study also developed an outline of how each entity will work toward its implementation. The Preferred Alternative will also need to be adopted as part of PACOG's current *Long Range Transportation Plan*.

CDOT has developed an implementation plan for this US 50 PEL study area. The **Implementation Plan**, which is included as an addendum to this PEL Study, identifies individual improvement projects that can be built for US 50 as funds become available. CDOT and the TAT will prioritize those projects based on need, future traffic levels, their relationship to other improvement projects, as well as other factors. **Chapter 5** of this PEL Study contains the details of the implementation process.

12. Whom can I contact for more information about the US 50 West PEL Study?

If you would like more information about this project, contact Tom Wrona, the Regional Transportation Director for CDOT Region 2. His contact information is as follows:

Mailing Address: 905 Erie Ave., PO Box 536, Pueblo, CO 81002

Telephone Number: (719) 546-5451

Fax Number: (719) 546-5414

Email Address: Thomas.Wrona@dot.state.co.us

You may also contact Karen Rowe, South Program Engineer for CDOT Region 2. Her contact information is as follows:

Mailing Address: 902 Erie Ave., Pueblo, CO 81002

Telephone Number: (719) 546-5430

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Email Address: Karen.Rowe@dot.state.co.us

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Chapter 1. Introduction and Purpose and Need

1.1 What is a Planning and Environmental Linkages (PEL) Study?

A Planning and Environmental Linkages (PEL) Study considers environmental and community issues early in the planning process before formal environmental clearance begins. Formal environmental clearance is regulated under the National Environmental Policy Act (NEPA) of 1970. Future environmental studies can use the data collected and analyzed for the PEL Study as funding for specific improvements that become available. Projects will be chosen that have independent utility, logical termini, and do not restrict consideration of alternatives for other reasonably foreseeable transportation improvements. Compliance with NEPA will be required if there is a federal nexus on any of the projects, including federal funding or federal permitting approval.

What's in Chapter 1?

Chapter 1 provides the background of the US 50 West PEL Study. It describes:

- Where the Corridor is
- What the Corridor is like
- The Purpose and Need for improvements to US 50
  - High levels of future vehicular demand
  - Congested intersections
  - High accident rates concentrated around intersections
  - The presence of a number of informal park-and-ride locations in the study area
  - A lack of pedestrian, bicycle, and transit connectivity
- Traffic patterns in the Corridor
- Multimodal travel in the Corridor
- Safety issues in the Corridor
- What the study team wants to accomplish for the Corridor
- What would happen in the Corridor if nothing is done

Chapter 1 also looks at how some local improvement projects might divert traffic demand from US 50.

1.2 What is the study location?

The section of US 50 being studied extends about 11.8 miles from Swallows Rd. west of the Pueblo West Metropolitan District (at milepost 301.72) to Baltimore Ave. within the city of Pueblo (at milepost 313.52). **Figure 1-1** presents a map highlighting the study corridor and showing the surrounding roads.

1.3 Who uses the Corridor?

The following types of travelers are the primary users of the US 50 Corridor:

- Commuters from Pueblo West and the city of Pueblo
- Long-distance through travelers using US 50 as a transcontinental east-west route
- Shoppers traveling to and from the strip commercial areas along US 50 in the city of Pueblo
- Business travelers visiting the Corridor and other US 50 destinations
- Recreational travelers visiting the Pueblo Reservoir (accessible from Main McCulloch Blvd. or Pueblo Blvd.) or the YMCA on Spaulding Ave. east of Pueblo Blvd.
- Freight haulers serving Pueblo West and the commercial areas along US 50
- School buses
- People traveling for special events such as the Colorado State Fair

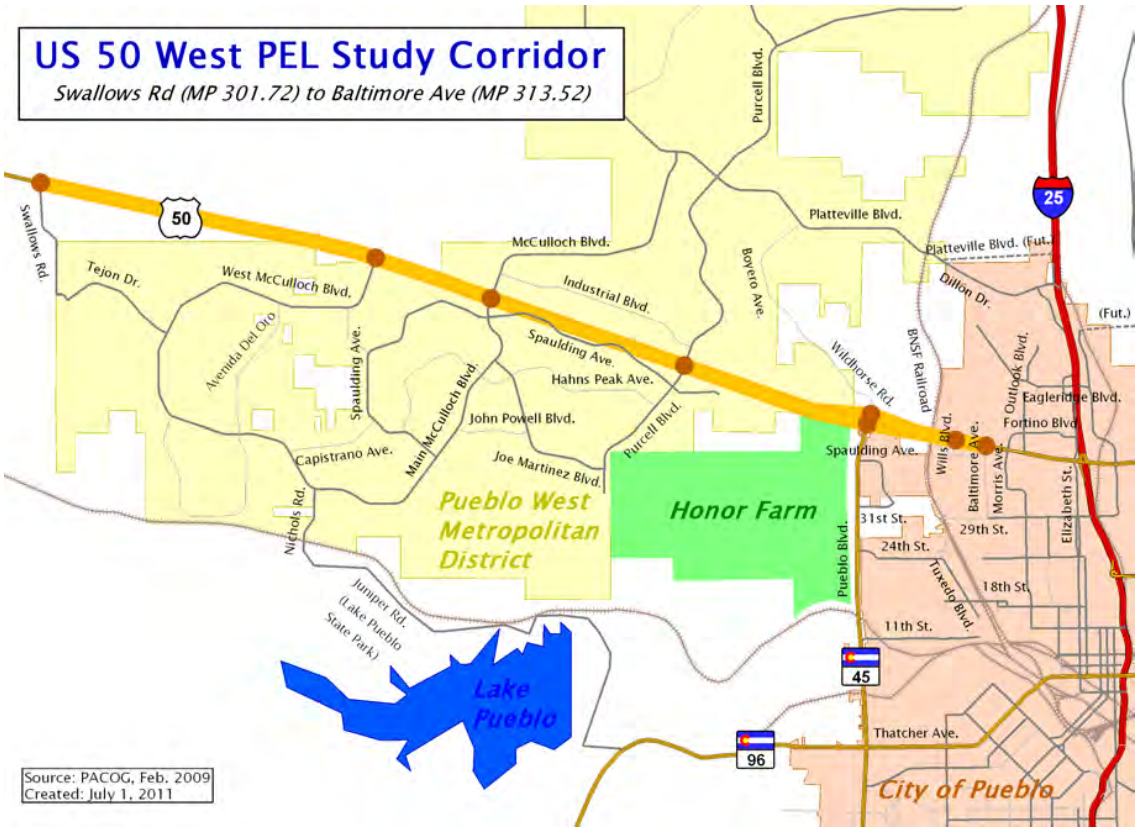


Figure 1–1. Study Corridor and Vicinity

1.4 What are the current conditions in the Corridor?

1.4.1 Speed limits

In the suburban and rural sections of US 50 between Swallows Rd. and Pueblo Blvd. (SH 45), the speed limit is 65 miles per hour (mph). The 65-mph speed limit is typical for divided highways with at-grade intersections in Colorado. Between Pueblo Blvd. and the Burlington Northern Santa Fe (BNSF) railroad crossing, the speed limit transitions to 55 mph. In the urban section east of the BNSF railroad crossing, the speed limit is 45 mph because it is farther east of the Corridor in the direction of I-25.

1.4.2 Cross sections

From Swallows Rd. (milepost 302) to approximately Wild Horse Creek (milepost 312), US 50 is a four-lane divided highway with a 28-foot median, 4-foot inside shoulders, and 6- to 10-foot outside shoulders. **Figure 1-2** shows the cross section between Swallows Rd. and Wild Horse Creek.

At the approaches to Pueblo Blvd., the eastbound and westbound travel lanes separate to a maximum distance of 600 feet. East of Wild Horse Creek, the median changes to a narrower raised brick median for this urban section of US 50. At this location the outside shoulder has curb and gutter. Auxiliary lanes also exist at the approaches to all intersections. **Figure 1-3** shows a typical cross section along the urban segment of US 50 between the BNSF railroad crossing and Baltimore Ave.

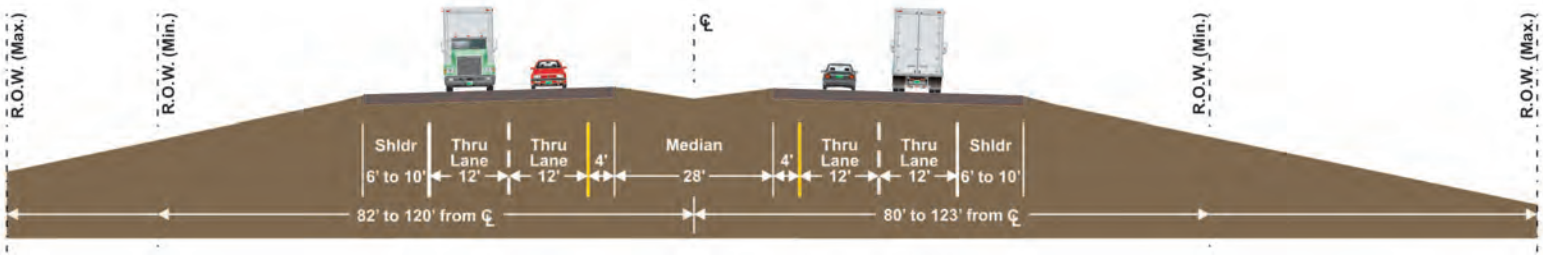


Figure 1-2. Existing Cross Section Between Swallows Rd. and Wild Horse Creek

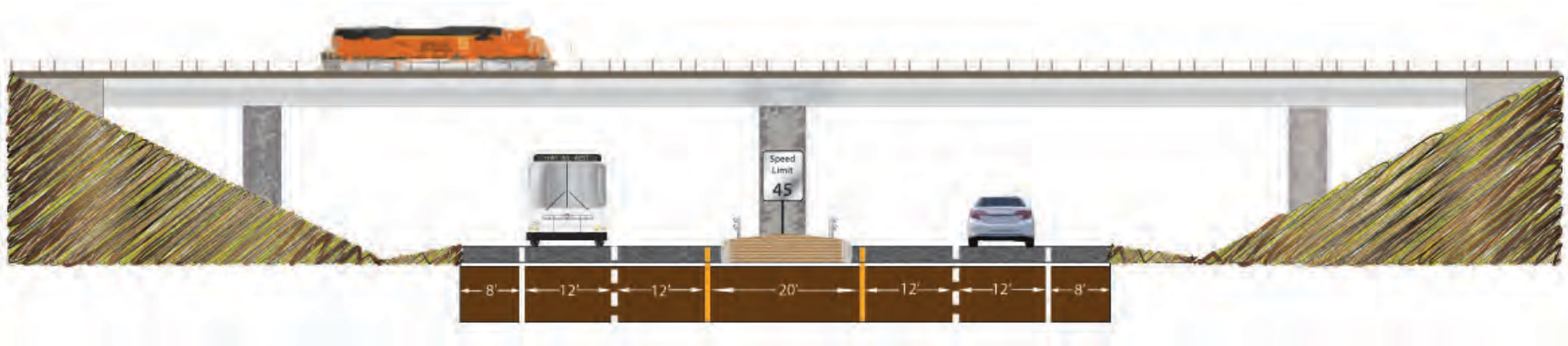


Figure 1-3. Existing Cross Section at BNSF Railroad Crossing

1.4.3 Intersection configurations, traffic patterns, and levels of service

This section describes the configurations, the levels of service (LOS), and the current predominant traffic patterns of the seven major intersections along US 50.

Intersection configurations include the number of lanes, what turns are permitted, and whether a crosswalk is present. Colorado Department of Transportation (CDOT) commissioned traffic counts at the various Corridor intersections during August 2009. LOS measures congestion, which is described below. After the discussion of LOS, each intersection is described, from west to east.

What is LOS?

As defined in the *Highway Capacity Manual*, 2010 (Transportation Research Board, 2010), LOS is a letter grade corresponding to the amount of congestion a road has when completed to a standard. LOS A is the best or the least congested grade. LOS F indicates failure because the demand for a road is more than its capacity. LOS is measured differently for different road parts, such as unsignalized intersections, signalized intersections, highway lanes between intersections, freeways, and freeway ramps.

How is LOS determined for signalized and unsignalized intersections?

LOS for signalized and unsignalized intersections is determined based on the amount of delay cars experience going through the intersection. Delay is usually calculated separately for each turning movement or for each lane when that lane is shared by through and turning traffic. For signalized intersections, the average delay of all vehicles entering the intersection can also be calculated to give an overall LOS grade for the intersection.

The thresholds for finding LOS from delay are different between unsignalized and signalized intersections. Unsignalized intersections generally have lower traffic volumes, and drivers stopped at unsignalized intersections may get more anxious waiting for a break in traffic. **Figure 1-4** shows typical congestion levels associated with the delay of each LOS letter grade.

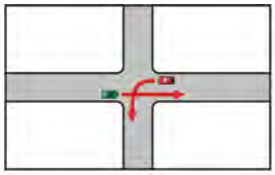
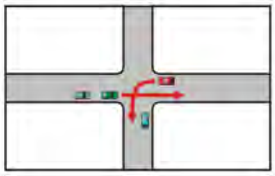
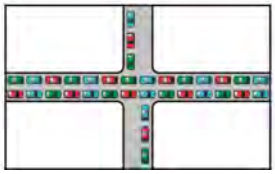
Intersection Based on Vehicle Seconds of Delay				
Delay Description		Level of Service	Signalized Intersection Seconds of Delay	Unsignalized Intersection Seconds of Delay
Minimal or no vehicle delay		A	≤ 10	≤ 10
Slight delay to vehicles		B	> 10 - 20	> 10 - 15
Moderate vehicle delays, traffic flow remains stable		C	> 20 - 35	> 15 - 25
More extensive delays at intersections		D	> 35 - 55	> 25 - 35
Long queues create lengthy delays		E	> 55 - 80	> 35 - 50
Severe delays and congestion		F	> 80	> 50

Figure 1–4. Characteristics of Intersection Level of Service

Figure 1-4 also identifies the thresholds for determining LOS from delay. LOS at a signalized intersection can be calculated for a single turning movement, an approach, or the intersection as a whole.

This PEL Study generally presents signalized intersection LOS based on the average delay of all vehicles using the intersection. Unsignalized intersection LOS is calculated only for movements that must stop or yield and is shown with a lower case letter.

Swallows Rd.

Existing traffic patterns and levels of service

Figure 1-5 shows that US 50 has turn bays and acceleration lanes at Swallows Rd. Because Swallows Rd. has two lanes, left- and right-turning traffic share the northbound lane, which has a stop sign at US 50.

The through movements on US 50 are the main movements at the intersection with Swallows Rd. Although volumes in each direction are nearly equal, there is slightly more eastbound traffic during the morning peak hour and slightly more westbound traffic during the evening peak hour. Traffic volumes on Swallows Rd. are low because the road is at the edge of a less densely settled portion of Pueblo West. The turns from US 50 operate at LOS "a" during both peak hours, while Swallows Rd. operates at LOS "c" during the morning and LOS "b" during the evening.

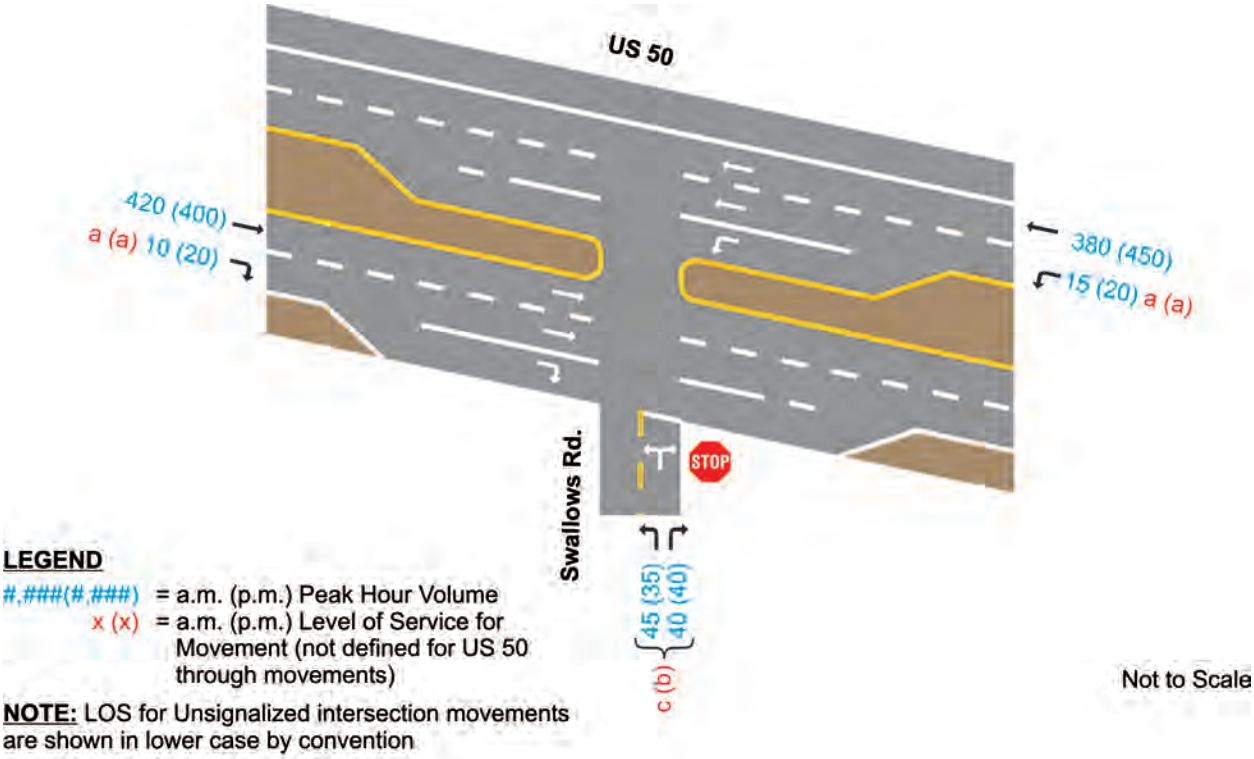


Figure 1-5. Schematic of US 50 and Swallows Rd. with 2011 Traffic Patterns

2035 traffic patterns and levels of service

Figure 1-6 shows that by 2035, the through movements on US 50 at Swallows Rd. would have almost doubled from their current levels. Many other turning movements would grow even more dramatically as the nearby portion of Pueblo West is built out further and as commuters avoid more congested intersections to the east. For example, evening commuters turning left from westbound US 50 to Swallows Rd. would grow from 20 cars now to 260 in 2035. In the morning, the number of cars turning left from Swallows Rd. would increase from 45 to 100, while the number turning right would increase more than four times, from 40 to 170.

The increased traffic at US 50 and Swallows Rd. would have a noticeable effect on LOS. The Swallows Rd. approach would operate at LOS "f" during both peak hours because there would be fewer gaps in US 50 through traffic. The westbound left movement would grow so dramatically that it would operate at LOS "b" in the evening. Only the eastbound right turn, which is relatively unimpeded, would continue to operate at LOS "a."

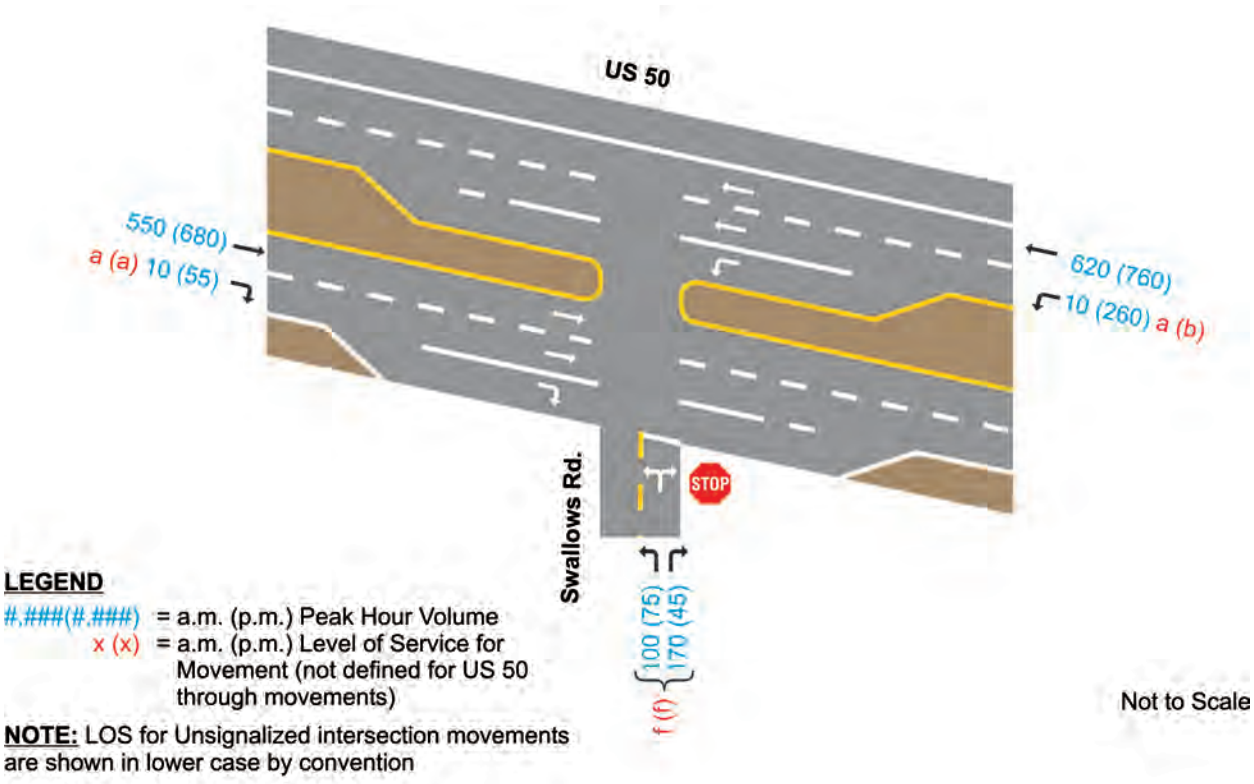


Figure 1-6. 2035 Traffic Patterns at US 50 and Swallows Rd.

West McCulloch Blvd.

Existing traffic patterns and levels of service

Figure 1-7 shows the configuration of West McCulloch Blvd. after improvements made to a short section of the cross street in 2010 widened it to four lanes. With the widening, there is a separate lane for left turns and right turns. Cars on West McCulloch Blvd. must stop before entering US 50.

During the morning peak hour, the 550 cars turning right from West McCulloch Blvd. to eastbound US 50 are about 50 percent greater than the eastbound cars already on US 50. In the evening, there are slightly more westbound cars turning left onto West McCulloch Blvd. than are continuing west on US 50. These patterns show how Pueblo West is an important residential area for people who work in the city of Pueblo and other locations to the east. A few Pueblo West residents—about 55—turn left from West McCulloch Blvd. to US 50 to work in Cañon City and Florence.

The right turn from eastbound US 50 operates at LOS "a" during both peak hours. The westbound left turn operates at LOS "a" in the morning and at LOS "b" in the evening when there is more turning traffic. Both turns from West McCulloch Blvd. operate at LOS "c" during the morning peak hour—when more people are using it. In the evening, the right turn operates at LOS "b" while the few left-turning vehicles experience LOS "f" delays.

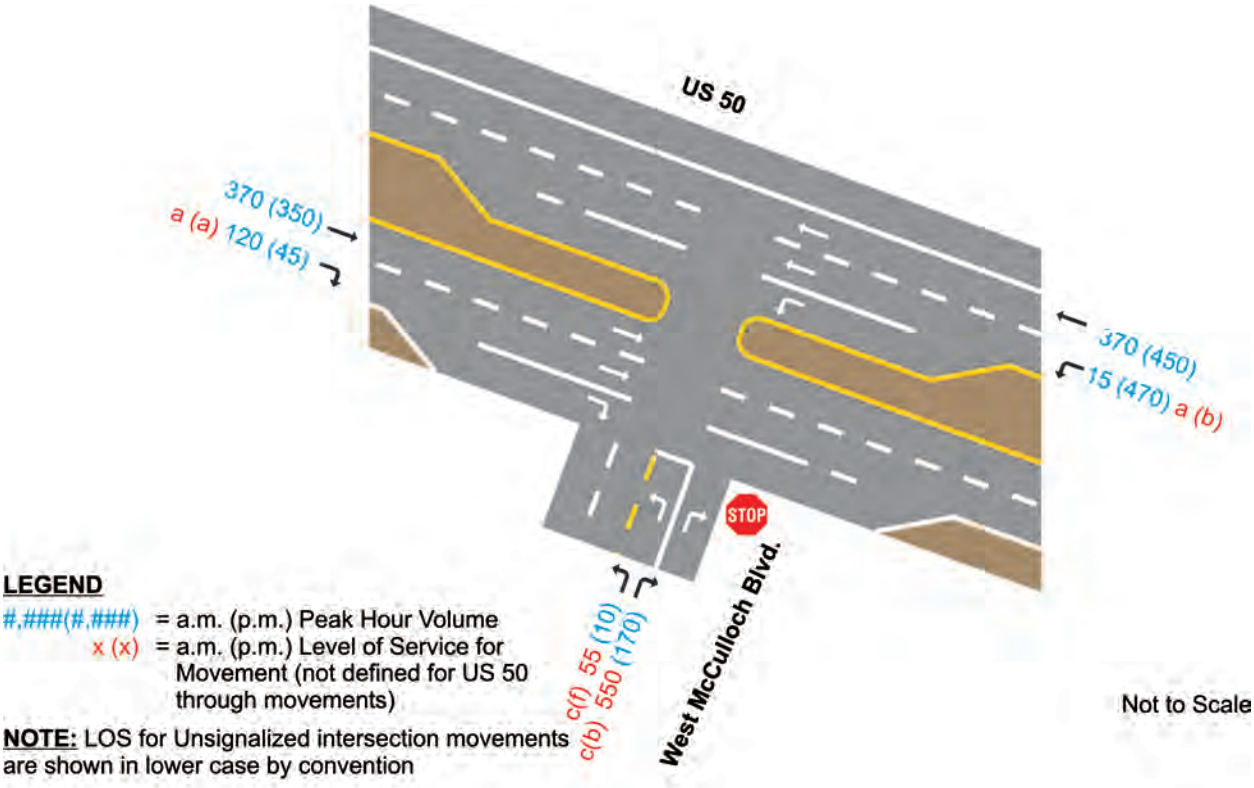


Figure 1-7. Schematic of US 50 and West McCulloch Blvd. with 2011 Traffic Patterns

2035 traffic patterns and levels of service

When comparing **Figure 1-7** to **Figure 1-8**, the eastbound through traffic, the westbound through and the left-turning traffic, as well as the northbound right-turning traffic at US 50 and West McCulloch Blvd. would all have at least doubled during their respective peak hours by 2035. Even with the additional lane on West McCulloch Blvd., the northbound movements would both operate at LOS "f" during the morning peak hour, as would the northbound left turn to westbound US 50 during the evening. The left turn from westbound US 50 to West McCulloch Blvd. would also operate at LOS "f" during the evening peak hour. Similar to Swallows Rd., the eastbound right turn from US 50 would continue to operate at LOS "a" during both peak hours.

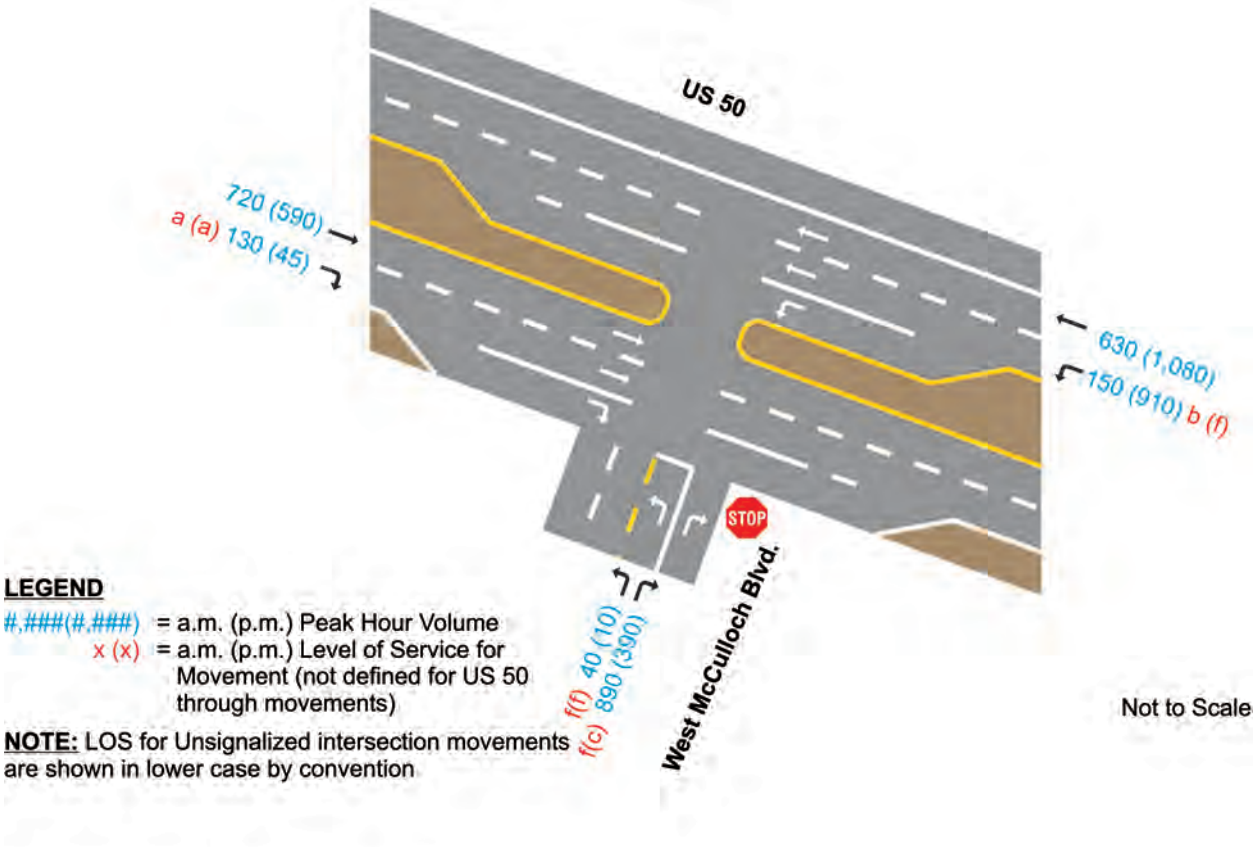


Figure 1-8. 2035 Traffic Patterns at US 50 and West McCulloch Blvd.

Main McCulloch Blvd.

Existing traffic patterns and levels of service

Main McCulloch Blvd. is the first signalized intersection one encounters when travelling east in the Corridor. At this location, US 50 has two left turn lanes in each direction and separate right turn lanes. Each direction of Main McCulloch Blvd. has two through lanes and separate right turn lanes. There are two southbound left turn lanes. The single northbound left turn lane is separated from the through lanes by a 12-foot paint buffer, which could be converted to a second left turn lane if needed in the future. All left turns must be made while a green left arrow is present. **Figure 1-9** shows the configuration of the Main McCulloch Blvd. intersection.

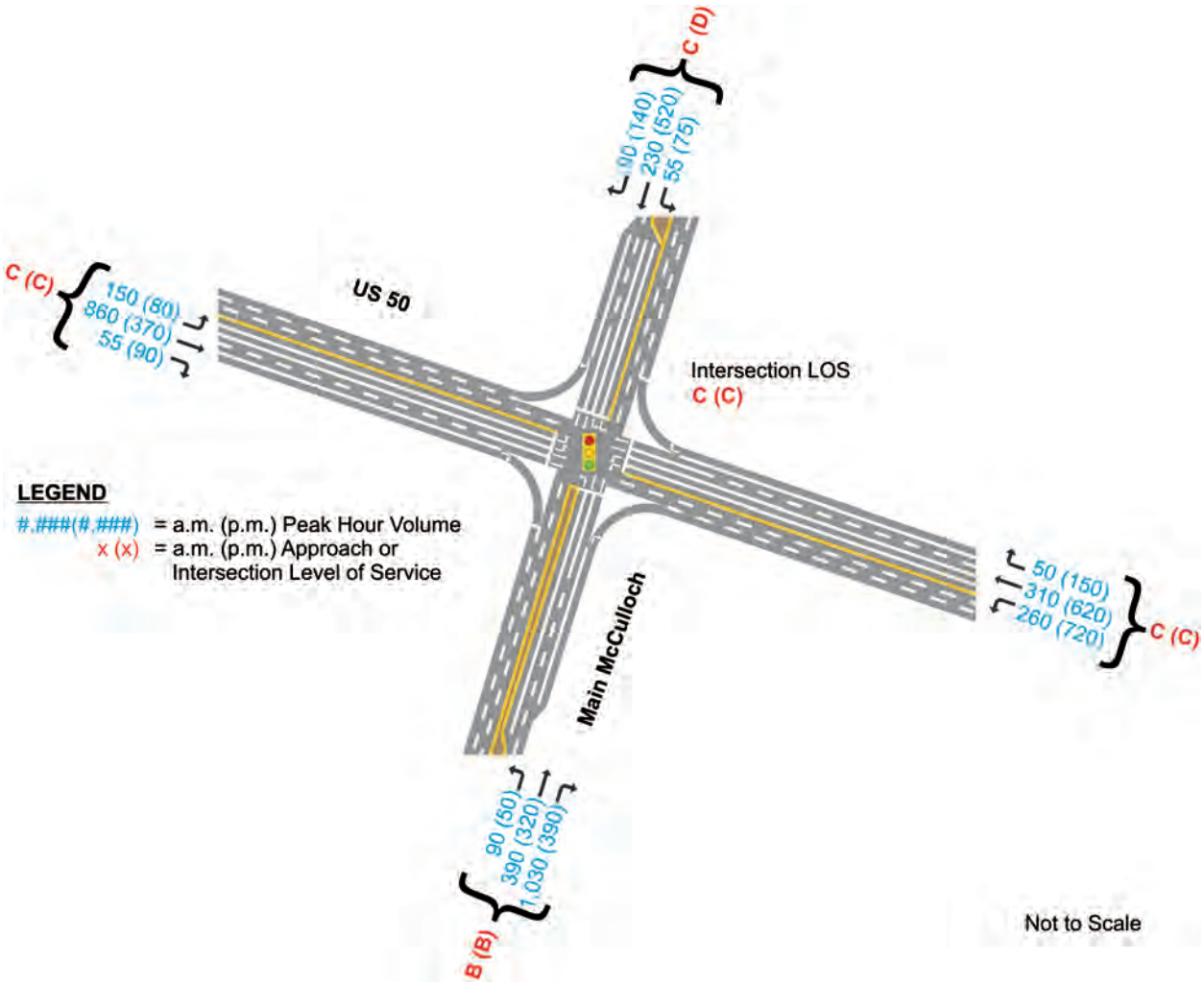


Figure 1-9. Schematic of US 50 and Main McCulloch Blvd. with 2011 Traffic Patterns

During the morning peak hour, the heaviest turning movement is the northbound right turn from Main McCulloch Blvd. to eastbound US 50 (1,030 vehicles), followed by eastbound US 50 through traffic (860 vehicles). More northbound through traffic occurs on Main McCulloch Blvd. (390 vehicles) than takes place when westbound vehicles continue through on US 50 (310 vehicles) or turn left to Main McCulloch Blvd. southbound (260 vehicles). The northbound through vehicles

are likely commuters from parts of Pueblo West south of US 50 going to jobs in the commercial and industrial area north of US 50 or work in Colorado Springs after using Purcell Blvd. to reach I-25.

The evening peak hour travel patterns mirror those of the morning. The heaviest turning movement is the left turn from westbound US 50 to southbound Main McCulloch Blvd. (720 vehicles), followed by 620 westbound US 50 through vehicles. The 520 southbound Main McCulloch Blvd. through vehicles outnumber the 370 eastbound US 50 through vehicles.

The intersection of US 50 and Main McCulloch Blvd. operates at LOS C during both peak hours. Cars on the northbound approach fare better than average because they experience LOS B delays during either peak hour. However, in the evening, southbound vehicles experience LOS D.

2035 traffic patterns and levels of service

By 2035, further development in the western sections of Pueblo West would mean that the eastbound US 50 through movement would displace the northbound right turn as the heaviest movement at Main McCulloch Blvd. during the morning peak hour. **Figure 1-10** shows that about 1,400 vehicles are expected to continue east on US 50, compared to 1,260 turning right from northbound Main McCulloch Blvd. At 1,270 vehicles, the northbound through movement would become the second heaviest movement during the morning.

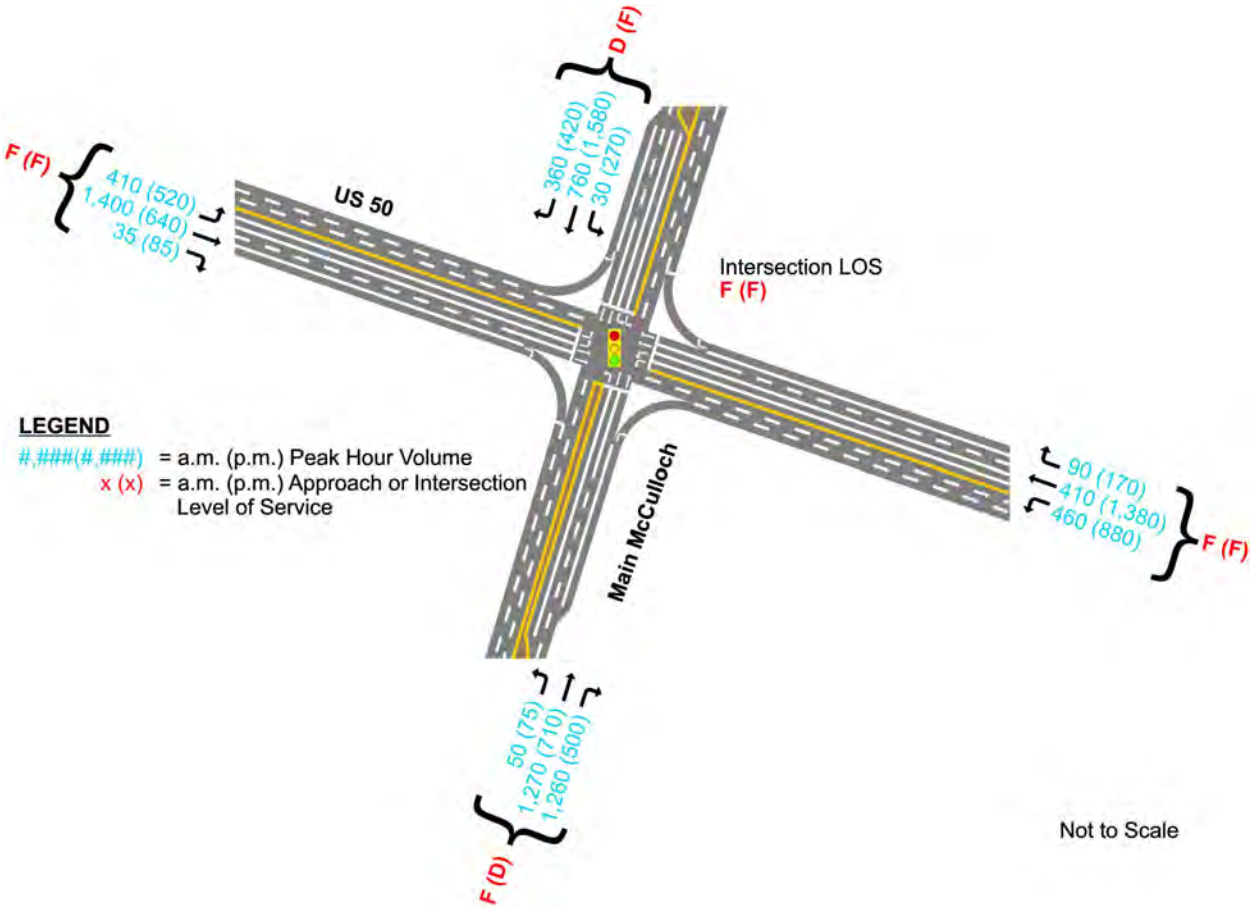


Figure 1-10. 2035 Traffic Patterns at US 50 and Main McCulloch Blvd.

During an evening peak hour in 2035, more traffic is expected to continue south on Main McCulloch Blvd. (1,580 vehicles) than the 1,380 cars that continue westbound on US 50. Westbound traffic turning left to southbound Main McCulloch Blvd. would continue to be a heavy movement.

This intersection would operate at LOS F during both peak hours if no improvements are made.

Purcell Blvd.

Existing traffic patterns and levels of service

Similar to the intersection at Main McCulloch Blvd., each direction of US 50 at Purcell Blvd. has two through lanes, two left turn lanes, and a separate right turn lane (see **Figure 1-11)**. Purcell Blvd. also has two through lanes in each direction with separate right turn lanes. There are two southbound left turn lanes and only one northbound left turn lane because the city of Pueblo is a more popular destination than points west. All left turns here must be made during the green left arrow signal.

By the time they reach Purcell Blvd. during the morning peak hour, Pueblo West residents continuing eastbound on US 50 outnumber those entering US 50 from northbound Purcell Blvd., 1,850 vehicles to 1,040 vehicles. Other heavy morning movements include:

- Westbound US 50 through travel
- Northbound Purcell Blvd. through travel
- Westbound right turns
- Southbound left turns
- Westbound left turns

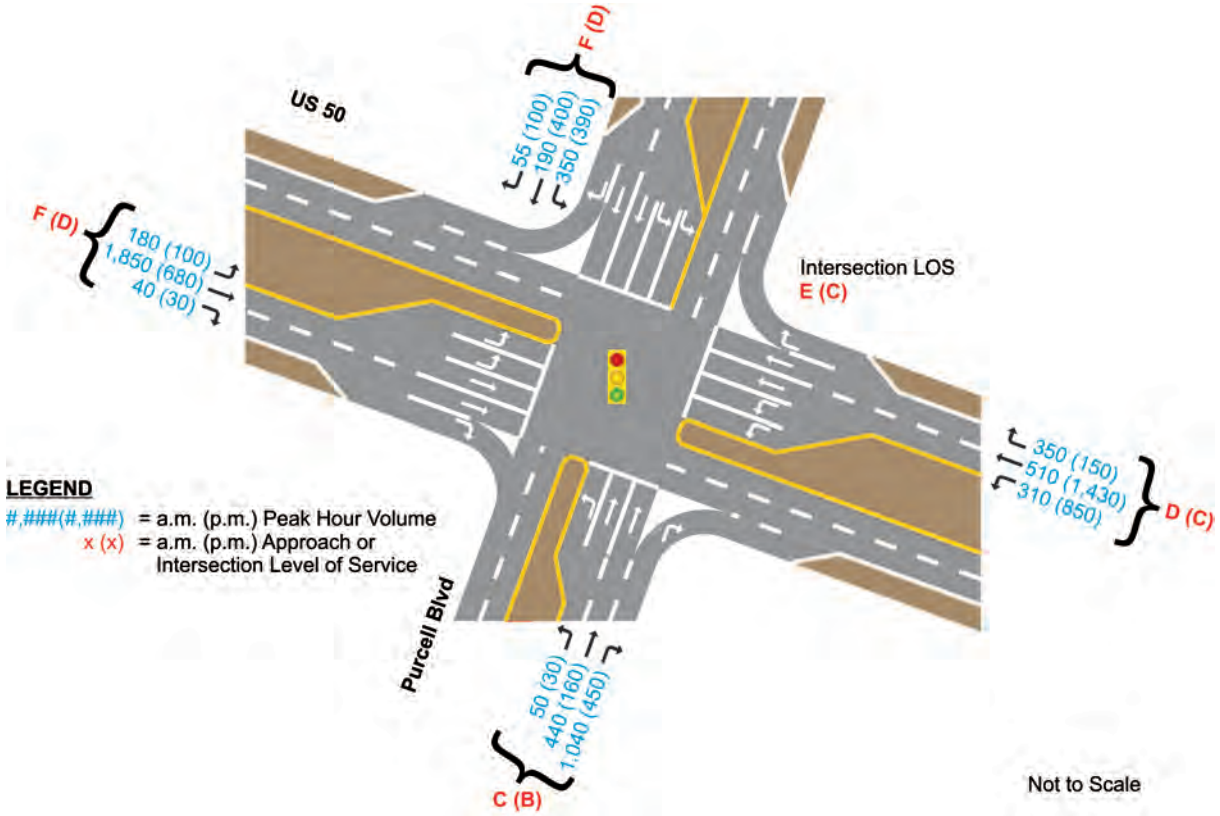


Figure 1-11. Schematic of US 50 and Purcell Blvd. with 2011 Traffic Patterns

The intersection operates at LOS E during the morning peak hour. The eastbound and southbound approaches experience the most congestion and function at LOS F.

During the evening peak hour, westbound traffic continuing on US 50 (1,430 vehicles) are the heaviest movement. More vehicles are turning left from westbound US 50 to southbound Purcell Blvd. (850 vehicles) than continuing eastbound on US 50 (680 vehicles). There are 450 cars turning right from northbound Purcell Blvd. to eastbound US 50, and about 400 vehicles each making the left turn and continuing through from southbound Purcell Blvd. In the evening, the LOS is C.

2035 traffic patterns and levels of service

Figure 1-12 shows that the morning peak hour traffic continuing east on US 50 would continue to be the heaviest movement of the day, growing from 1,850 vehicles today to 2,410 vehicles in 2035. Other heavy morning movements would include the 1,310 cars turning right from northbound Purcell Blvd. to US 50, the 1,170 cars on westbound US 50 turning right to northbound Purcell Blvd., and the 770 cars making the left turn from southbound Purcell Blvd. to eastbound US 50. This intersection would operate at LOS F during the morning peak hour.

The evening peak hour at US 50 and Purcell Blvd. would also operate at LOS F, indicating that over-capacity conditions exist. The heaviest movement, cars continuing westbound on US 50, is expected to grow from 1,430 vehicles per hour today to 2,140 vehicles per hour in 2035. However, by 2035, the southbound left turn to eastbound US 50 (1,540 vehicles) would pass the westbound left turn to southbound Purcell Blvd. (1,240 vehicles) as the second heaviest movement.

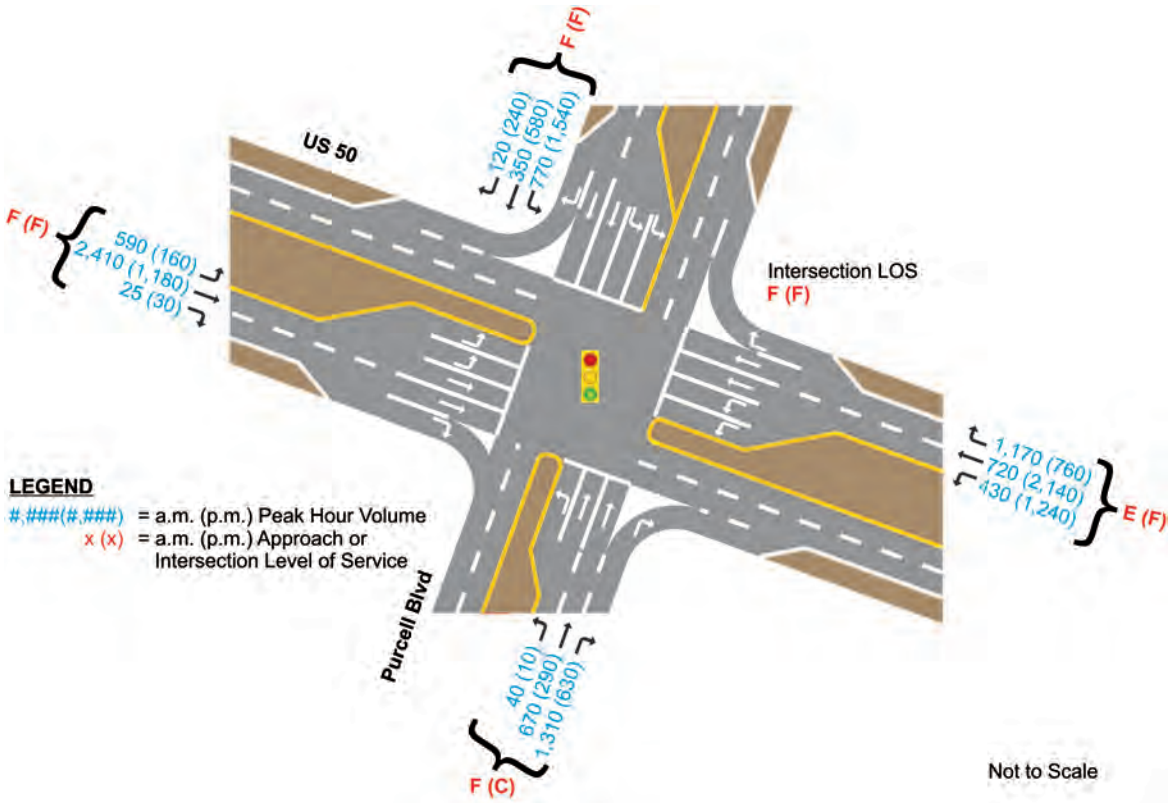


Figure 1-12. 2035 Traffic Patterns at US 50 and Purcell Blvd.

Pueblo Blvd. (SH 45)

Existing traffic patterns and levels of service

Because the eastbound and westbound lanes of US 50 are about 600 feet apart at Pueblo Blvd., the two intersections work more or less independently. (In fact, the signals here are programmed so that drivers on US 50 get consecutive green lights, rather than the drivers on Pueblo Blvd.) These two halves of US 50 were originally designed as the ramps of a diamond interchange. In the original plans, a bridge would have been built over Pueblo Blvd. to carry US 50 through traffic.

Figure 1-13 shows the intersection of eastbound US 50 and Pueblo Blvd. Large, gently-curved roads allow traffic to make the right turns from US 50 to southbound Pueblo Blvd. and from northbound Pueblo Blvd. to eastbound US 50 at relatively high speeds. Eastbound US 50 has two through lanes and a separate left turn lane. Pueblo Blvd. has two through lanes in each direction and a separate left turn lane for southbound Pueblo Blvd. drivers going to US 50. These left-turning vehicles may proceed when a green left arrow is shown or when the flashing yellow left arrow signal is shown and northbound Pueblo Blvd. traffic is clear.

During the morning peak hour, eastbound through traffic on US 50 (1,960 vehicles) and eastbound traffic turning right to southbound Pueblo Blvd. (1,120 vehicles) are clearly the dominant movements.

During the evening peak hour, the eastbound through traffic (900 vehicles) is tied with northbound Pueblo Blvd. through traffic. Most of this northbound traffic will turn left to westbound US 50. The LOS is C during both peak hours.

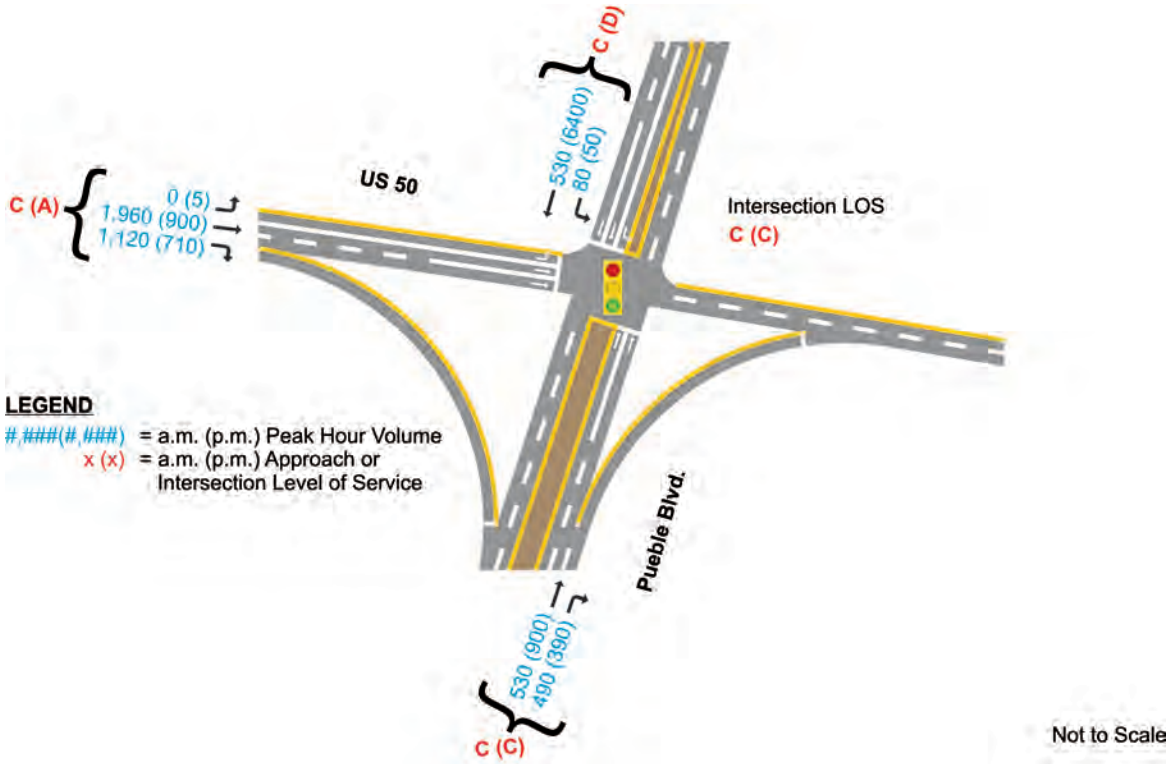


Figure 1-13. Schematic of Eastbound US 50 and Pueblo Blvd. with 2011 Travel Patterns

At the intersection of westbound US 50 and Pueblo Blvd., US 50 has two through lanes, a separate left turn lane, and a separate right turn lane (see **Figure 1-14**). There are two northbound lanes on Pueblo Blvd.; the left lane must turn left on to US 50, while drivers in the right lane may turn left or continue north to Wildhorse Rd. In fact, most of the traffic in this right lane does turn left. North of US 50, Wildhorse Rd. has one southbound lane, which splits into two at the intersection with westbound US 50. Traffic in the left lane must continue south, while traffic in the right lane may turn right on to westbound US 50 or continue south on Pueblo Blvd. The signal here is timed so that all westbound traffic goes at once, followed by all southbound traffic, and then finally all northbound traffic. This signal pattern is used because of the shared northbound through and left turn lane.

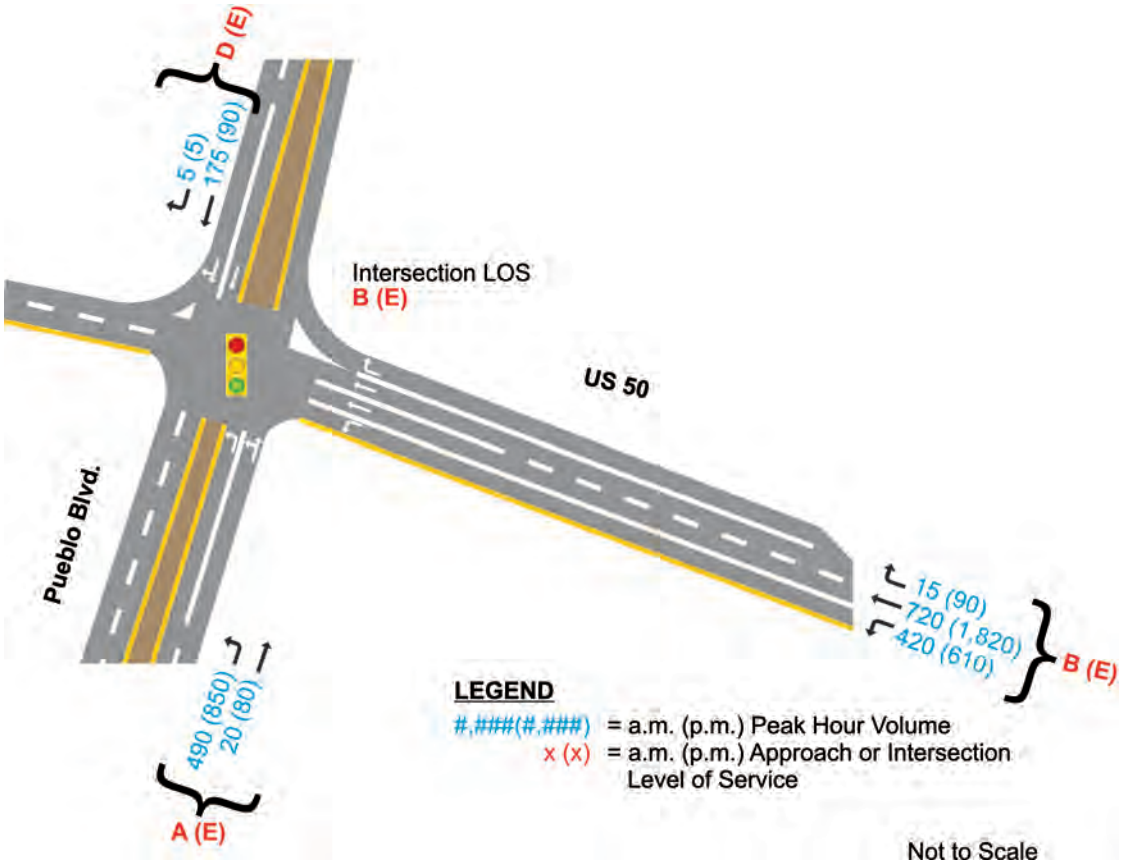


Figure 1-14. Schematic of Westbound US 50 and Pueblo Blvd. with 2011 Travel Patterns

Westbound US 50 through traffic is the heaviest movement during both peak hours at this intersection, totaling 720 vehicles during the morning peak hour and 1,820 vehicles during the evening peak hour. Northbound left turns are the second heaviest movement during both peaks, with 490 vehicles in the morning and 850 vehicles in the evening making this turn. Interestingly, the westbound left turn is the third heaviest movement for both the morning and evening peak hours. In the morning, 420 westbound vehicles turn left to southbound Pueblo Blvd., while 610 vehicles make this movement during the evening peak hour.

The overall LOS of this intersection is B during the morning peak hour. However, the northbound Pueblo Blvd. approach operates at LOS A and the southbound Wildhorse Rd. approach operates at LOS D. The LOS is E in the evening.

2035 traffic patterns and levels of service

Through traffic on US 50 at Pueblo Blvd. would continue to grow here, as would commuting patterns between Pueblo West and areas south on Pueblo Blvd. The peak hour, peak direction US 50 through movements would include 3,030 vehicles eastbound in the morning (see **Figure 1-15**) and 3,060 vehicles westbound in the evening (see **Figure 1-16**). Another 1,440 cars would turn right from eastbound US 50 to southbound Pueblo Blvd. in the morning, only to be surpassed by 1,580 cars making the same movement during the evening peak hour. The corresponding return movement, turning left from northbound Pueblo Blvd. to westbound US 50, would be made by 960 cars in the morning and 1,240 in the evening.

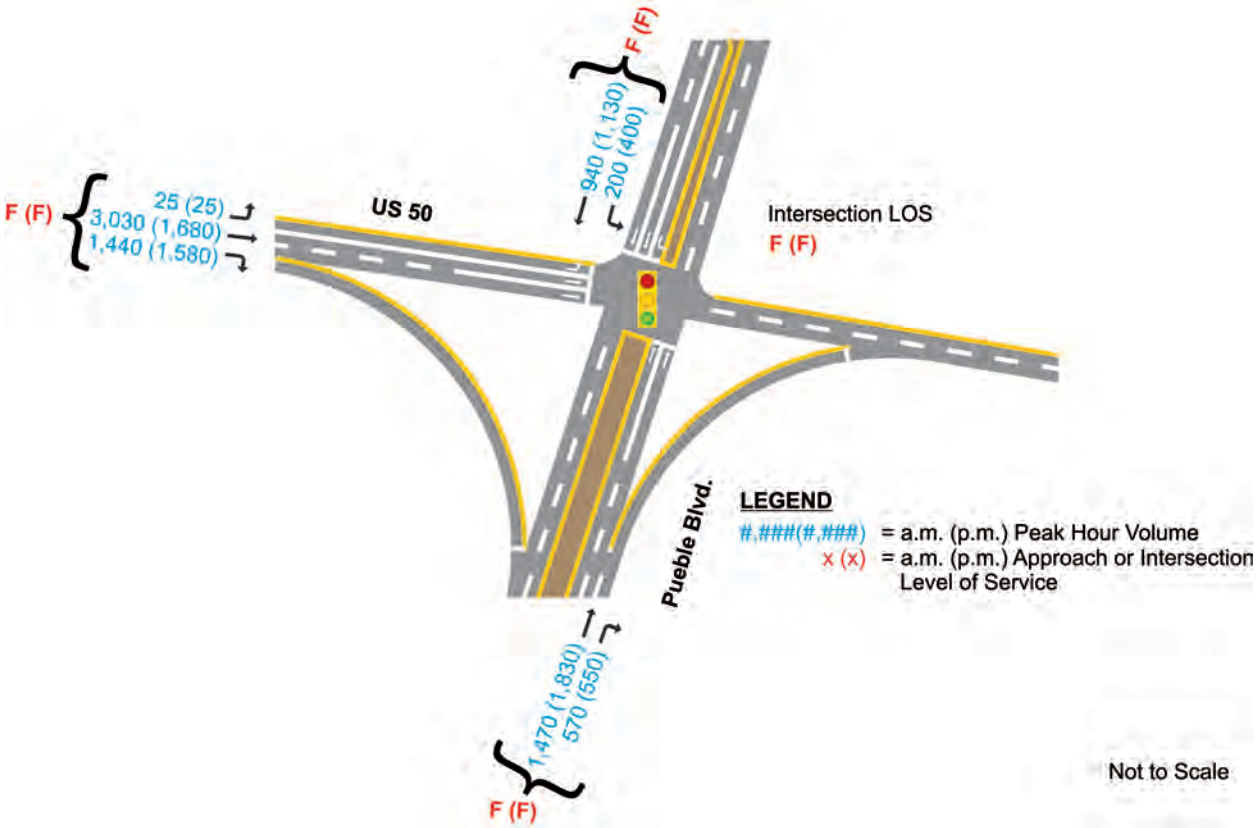


Figure 1-15. 2035 Traffic Patterns at Eastbound US 50 and Pueblo Blvd.

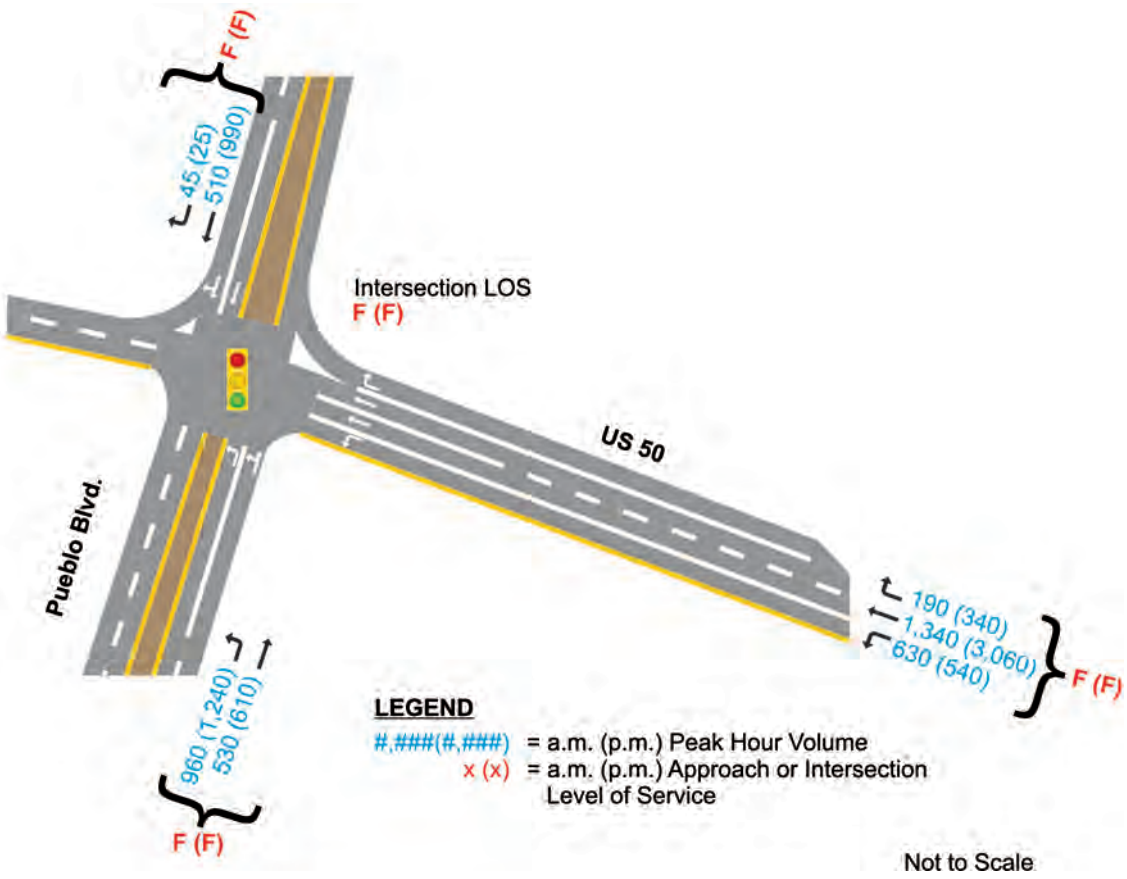


Figure 1-16. 2035 Traffic Patterns at Westbound US 50 and Pueblo Blvd.

In addition to these existing travel markets growing rapidly, traffic volumes at US 50 and Pueblo Blvd. would also increase as a result of development in Pueblo West north of US 50 and possibly due to long-distance travelers seeking to avoid congestion on I-25. These new travel markets are shown by the growth in traffic on Wildhorse Rd. Today, about 180 vehicles enter the southbound approach from Wildhorse Rd. in the morning and 100 vehicles enter in the evening. By 2035, these volumes would grow to about 550 in the morning and to more than 1,000 in the evening. Northbound through traffic would also grow from 20 trips to 530 trips in the morning, and from 80 to 610 vehicles in the evening.

With all this traffic growth, it is not surprising that both sets of signals at Pueblo Blvd. would operate at LOS F during both peak hours.

Wills Blvd.

Existing traffic patterns and levels of service

At Wills Blvd., each direction of US 50 has a left-turn lane and a dedicated right-turn lane, as shown in **Figure 1-17**. Before August 2011, there were two westbound through lanes and two eastbound through lanes at Wills Blvd. Recent construction added a third eastbound through lane. The approaches for Wills Blvd. have separate lanes for left turns, through traffic, and right turns.

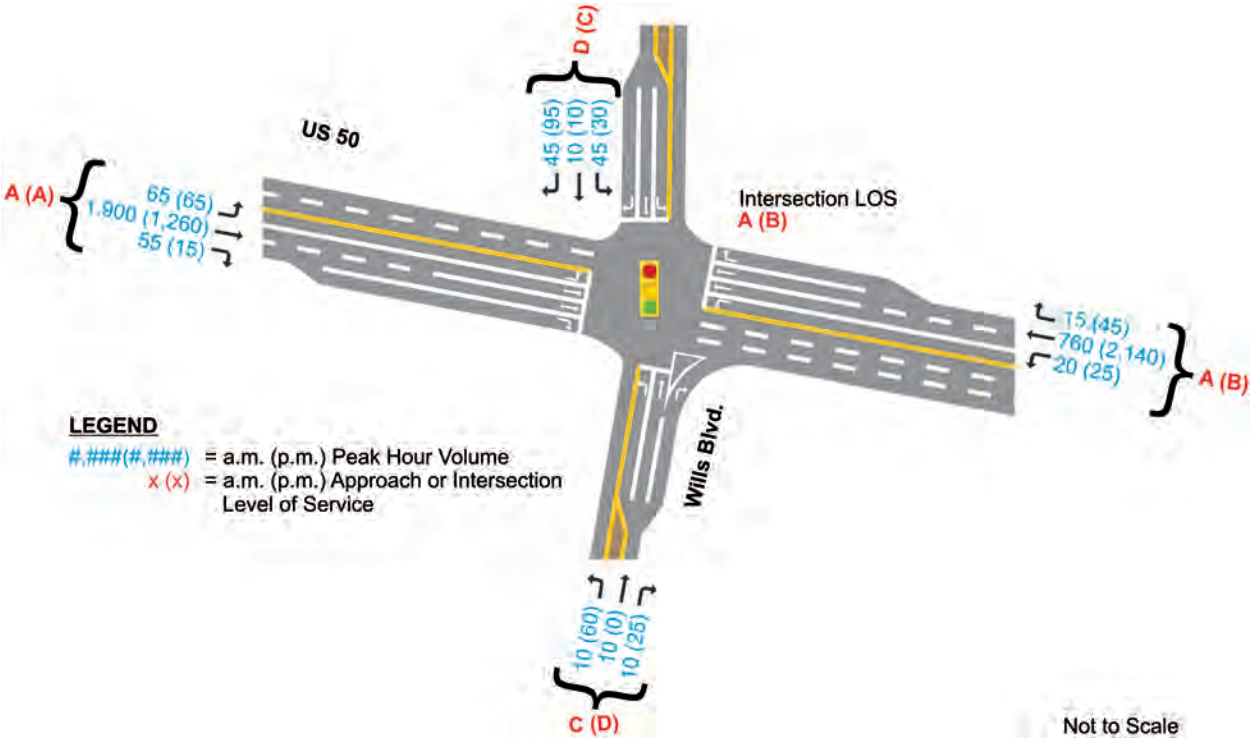


Figure 1-17. Schematic of US 50 and Wills Blvd. with 2011 Travel Patterns

Left-turning traffic from US 50 may proceed when the green left arrow is shown, or when the flashing yellow left arrow is shown and oncoming traffic is clear. Because the signals for Wills Blvd. show only the circular green indicators, left-turning vehicles must yield to oncoming traffic.

The through movements on US 50 are considerably larger than any other movements here. During the morning peak hour, 1,900 cars continue eastbound on US 50 and 760 continue westbound. The evening peak hour volumes are even higher, with 2,140 westbound vehicles and 1,260 eastbound vehicles. At this location LOS is A during the morning peak hour and B during the evening peak hour, due in part, because the other movements have such low volumes. However, the approaches from Wills Blvd. experience LOS C and D conditions.

2035 traffic patterns and levels of service

Figure 1-18 shows that future eastbound and westbound US 50 through movements would continue to be important at Wills Blvd. Eastbound through traffic on US 50 is expected to be 2,690 vehicles during the morning peak hour and 2,350 vehicles during the evening peak hour. Westbound evening peak hour volumes would be even higher, with 3,320 cars continuing westbound on US 50.

While none of the other movements at Wills Blvd. exceed 100 vehicles per hour today, by 2035 there would be two such movements:

- Left off eastbound US 50 to northbound Wills Blvd.
- The reverse southbound right turn

In the morning, 170 cars are expected to turn left from eastbound US 50 and 140 cars would turn right to westbound US 50. In the evening, another 180 vehicles would turn left to northbound Wills Blvd., while 190 southbound vehicles would turn right on to US 50.

Despite all the traffic growth, the LOS at US 50 and Wills Blvd. is expected to be B during the morning peak hour. However, the intersection would operate at LOS F during the evening.

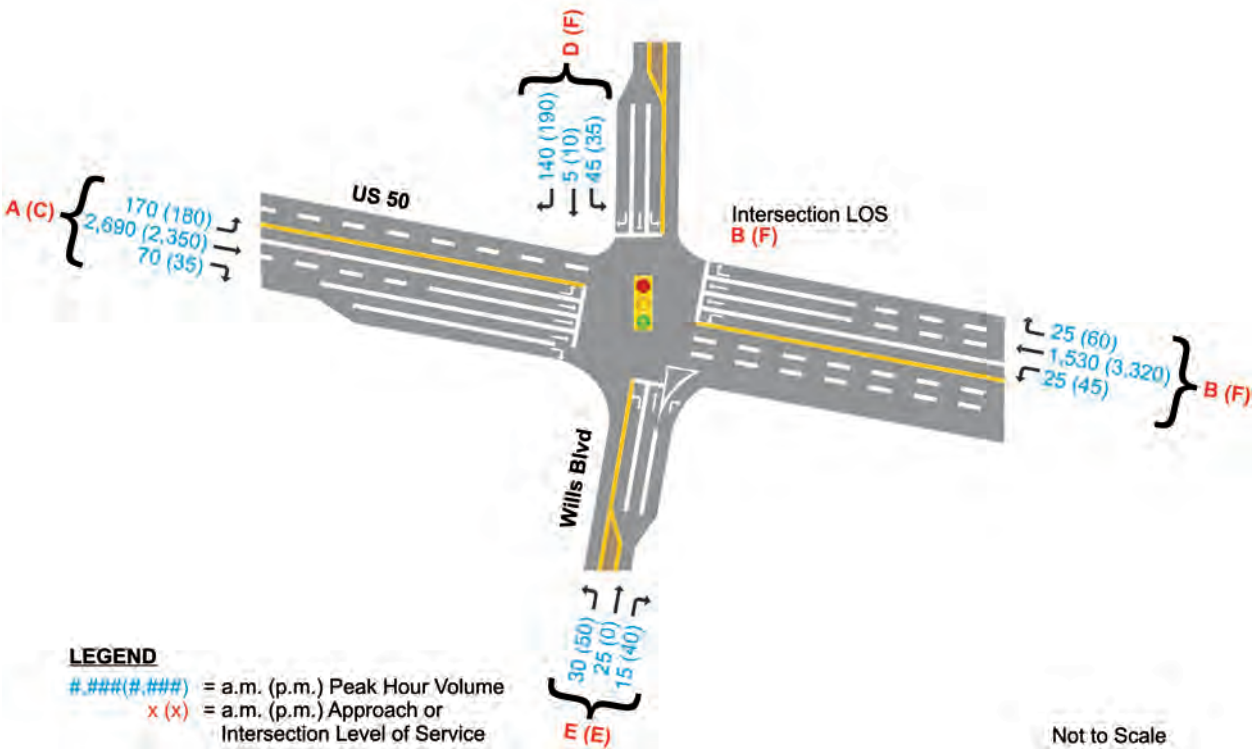


Figure 1-18. 2035 Traffic Patterns at US 50 and Wills Blvd.

Baltimore Ave.

Existing traffic patterns and levels of service

Figure 1-19 shows that eastbound US 50 approaching Baltimore Ave. has three through lanes, a left-turn lane, and a right-turn lane at the intersection. Three through lanes continue westbound at this intersection, although the rightmost lane must turn right later at Westroads Ave. The westbound approach also has a right-turn lane and a left-turn lane. Both approaches of Baltimore Ave. have two lanes for left turns. The northbound approach has separate lanes for through traffic and right turns. Through and right-turning traffic currently share a lane on the southbound approach.

Similar to Wills Blvd., left-turning traffic from US 50 may proceed during the green left arrow or during the flashing yellow left arrow when there is no oncoming traffic. Left-turning traffic from Baltimore Ave. may proceed only on the green left arrow.

During the morning peak hour, eastbound US 50 through traffic is the predominant movement, totaling 2,130 vehicles, followed by 970 westbound through vehicles. Some important minor movements are the 260 cars turning right on to southbound Baltimore Ave. from eastbound US 50 and the 210 cars turning left from westbound US 50. These drivers are likely going to Centennial High School, although there are other destinations to the south.

The largest movement of the day occurs during the evening peak hour, with 2,290 cars continuing westbound on US 50. There are also 1,310 vehicles continuing eastbound. The 170 vehicles turning left from westbound US 50 are an important minor movement, as are the 140 vehicles turning right from northbound Baltimore Ave. to eastbound US 50.

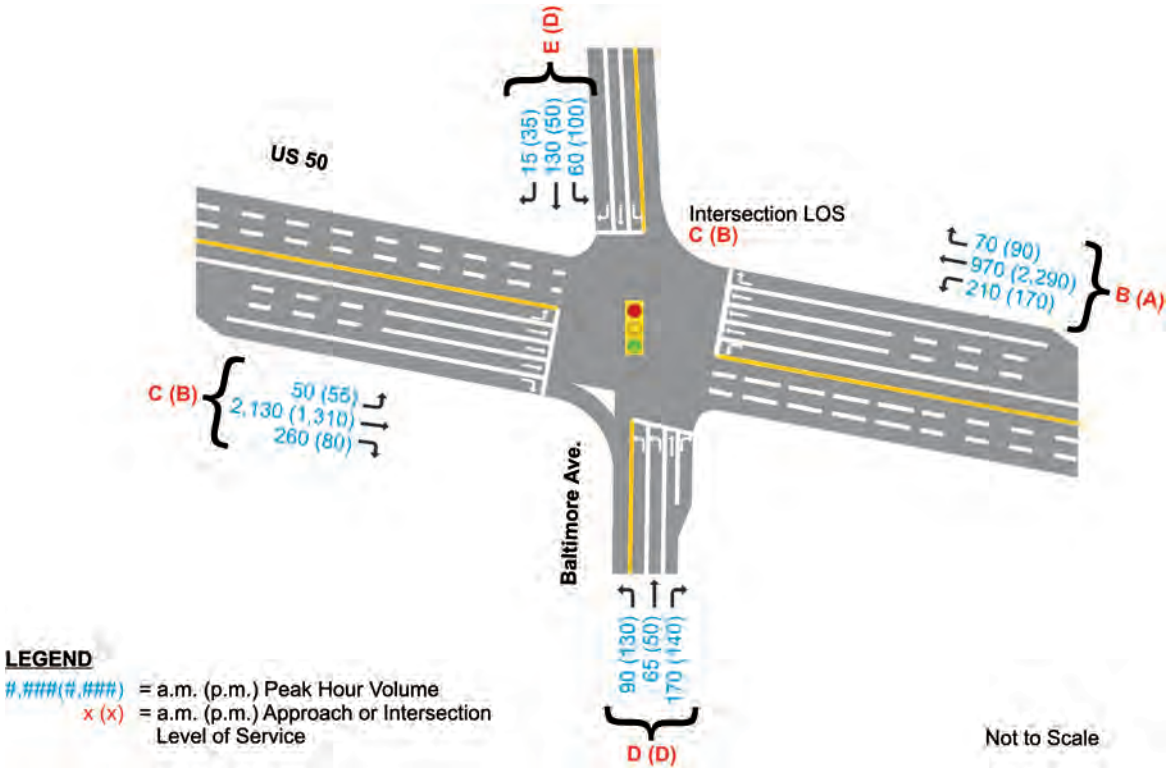


Figure 1-19. Schematic of US 50 and Baltimore Ave. with 2011 Travel Patterns

The intersection operates at LOS C during the morning peak hour and LOS B during the evening peak hour. The LOS of individual approaches ranges from A for westbound vehicles during the evening to E for southbound vehicles in the morning.

2035 traffic patterns and levels of service

Figure 1-20 shows that some of the heaviest hourly volumes in the PEL Study Corridor are expected to occur at Baltimore Ave. The peak hour, peak direction through traffic on US 50 would be 3,020 vehicles eastbound in the morning and 3,440 vehicles westbound in the evening. Even the reverse-peak volumes would be significant, with 1,760 vehicles continuing westbound on US 50 in the morning and 2,440 eastbound through trips in the evening.

Side street traffic at the Baltimore Ave. intersection would be more oriented to the south, unlike the Wills Blvd. intersection, where side street traffic would be more oriented to the north. In the morning, a combined 690 cars would use the northbound approach from Baltimore Ave., and 550 in the evening. Across US 50, these numbers would be lower, with a combined 290 vehicles entering the southbound approach in the morning and about 480 in the evening.

Turning traffic from US 50 would also more likely head south at Baltimore Ave. The westbound left turn movement would be heavier, with 270 vehicles in the morning and 350 in the evening. Also, 280 cars would make the eastbound right turn on to Baltimore Ave. in the morning and another 170 would do so in the evening.

With these high traffic volumes, it is not surprising that US 50 and Baltimore Ave. would operate at LOS F during the morning peak hour and at LOS E during the evening.

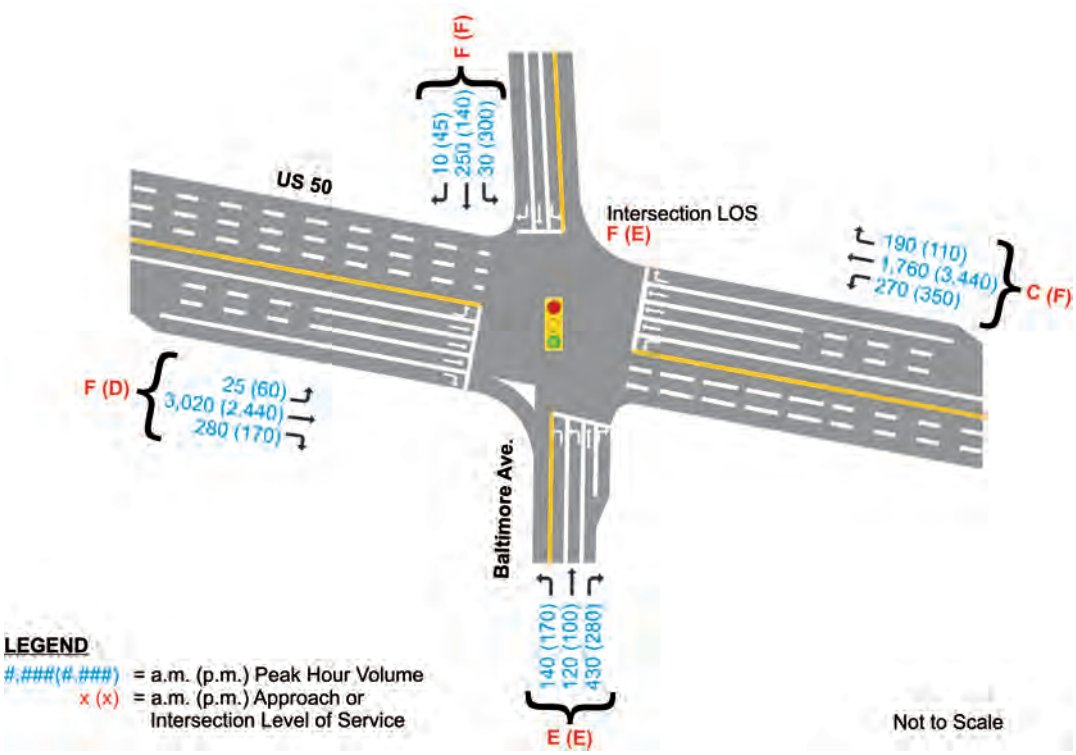


Figure 1-20. 2035 Traffic Patterns at US 50 and Baltimore Ave.

1.4.4 Current crash rates and safety concerns

Crash analysis

The safety analysis for the US 50 Corridor used the latest available five years of crash data that was obtained from CDOT for calendar years 2004 through 2008. The crash data set was divided into intersections and through highway segments, with each being analyzed separately.

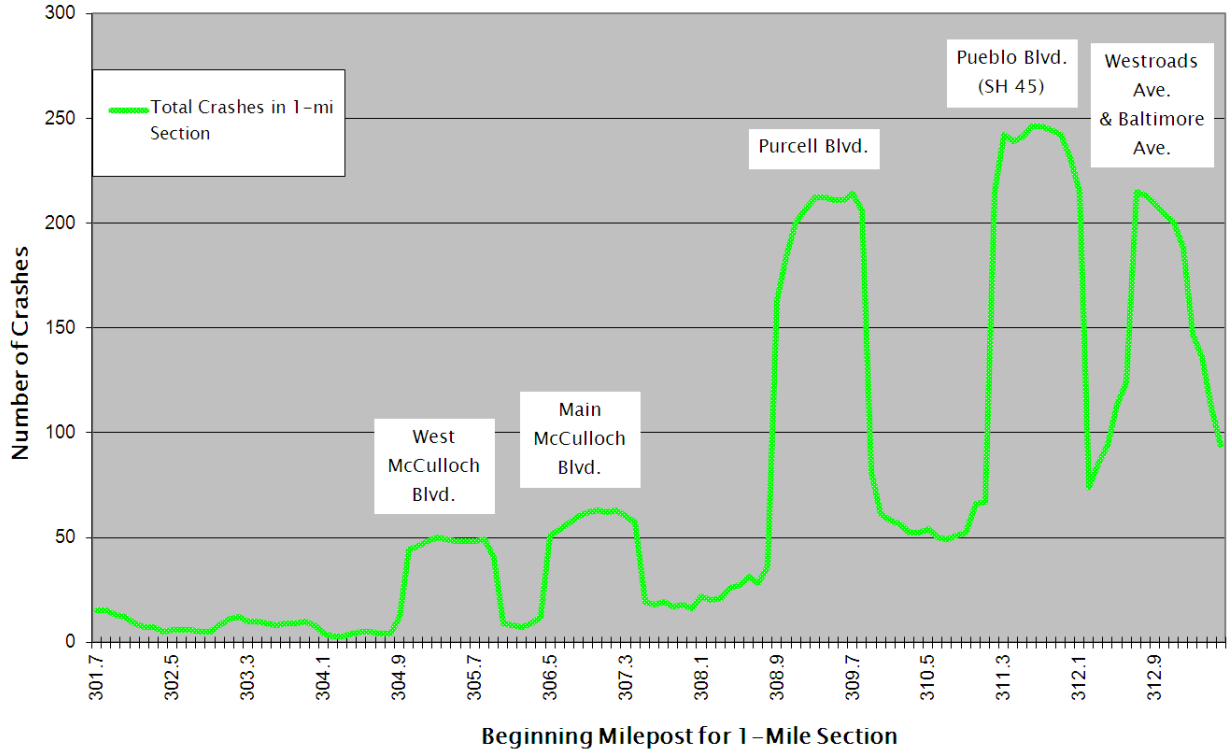
Once study limits are determined, a typical crash analysis follows these steps:

1. Perform an overall crash-location analysis to obtain an overview of crash clusters by developing crash concentration graphs.
2. Analyze Level of Service of Safety (LOSS) using Safety Performance Function (SPF) analysis for highway segments (portions of the highway excluding intersections, and usually at least 2 miles in rural areas and 0.9 mile in urban areas).
3. Perform a Direct Diagnostic review to detect over-represented crash types on the highway segments (based on terrain, width, and other characteristics).
4. Conduct a Continuous Pattern Recognition analysis to help detect subsegments with issues that may not have been identified by the SPF or Direct Diagnostic method for the entire segment.
5. Analyze intersection crashes separately, first using the SPF method, if both major and minor street annual average daily traffic are available.
6. Use the Direct Diagnostic method to analyze intersections and identify over-represented crashes in the crash data set.

SPF analysis is only possible where the intersections are 2 miles or more apart. For the US 50 Corridor, segment SPF analysis was not always possible because most intersections, except at the west end, are within 2 miles of each other. East of Wills Blvd., the intersections are less than 0.9 mile apart; therefore, the safety study primarily focused on the intersections.

Overall crash patterns

Figure 1-21 shows a distribution of crashes for every 1 mile section, in increments of 0.10 mile. This distribution helps identify segments that have a high number of crashes. The distribution shows that the crashes peak at intersections, with a relatively low number of crashes associated with through segments.



Note: Median crossover at Westroads Ave. was closed in conjunction with improvements made in 2009.

Figure 1-21. Distribution of Crashes along US 50 during Calendar Years 2004 to 2008

More detailed analysis of the crashes along the US 50 Corridor during 2004 through 2008 showed that they have the following broad characteristics:

- The spikes in the crash distribution graph (**Figure 1-21**) correspond to major intersection locations. The five main spikes are at West McCulloch Blvd., Main McCulloch Blvd., Purcell Blvd., Pueblo Blvd., and Baltimore Ave.
- As shown in **Figure 1-22**, the most common crash occurrences are At Intersection or Intersection-Related locations, with Pueblo Blvd. (SH 45) and Purcell Blvd. recording the highest number of crashes in the Corridor.

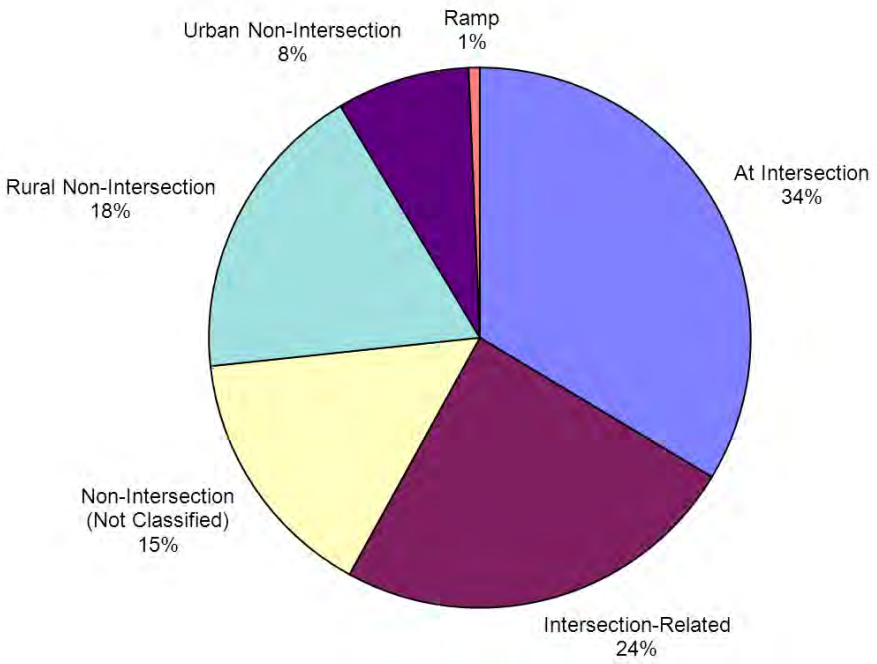


Figure 1-22. Distribution of Crashes by Location Type

- A disproportionate number of Rear-End crashes occur in the Corridor, as shown in **Figure 1-23**. Even though the most common crash locations are intersections, Broadside and Approach Turn crash frequencies are relatively low.

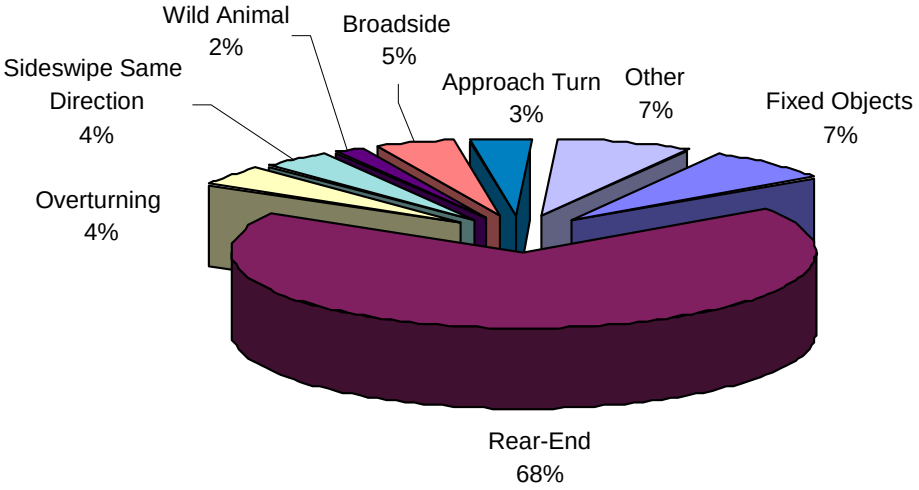


Figure 1-23. Distribution of Crashes by Type

- The severity of crashes does not seem to be an issue because most crashes result in property damage only, as shown in **Figure 1-24**.

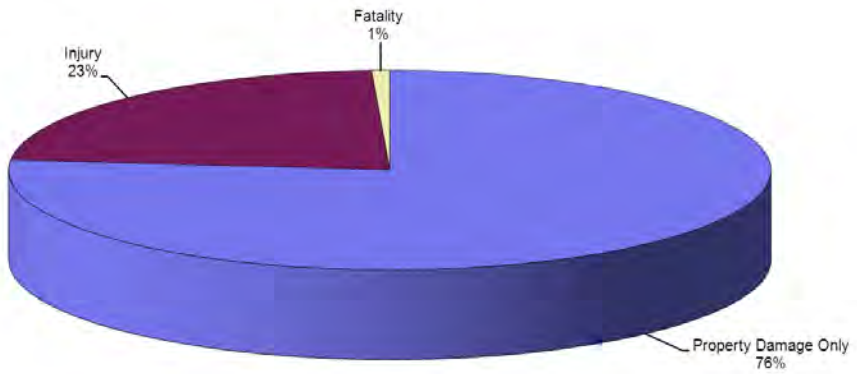


Figure 1-24. Distribution of Crashes by Severity

- **Figure 1-25** shows that a high frequency of crashes occur during hours of the day that correspond to the peak periods of traffic volume, which implies that a high percentage of the crashes observed are related to congestion.

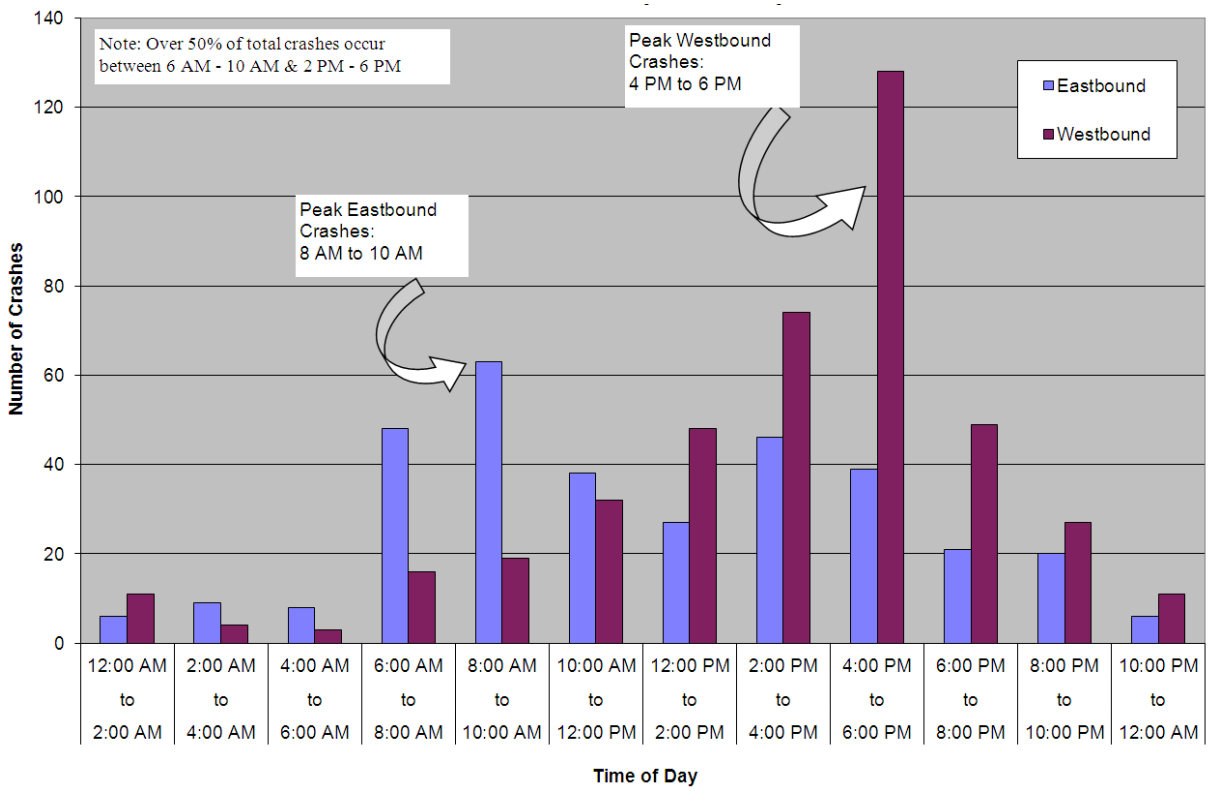


Figure 1-25. US 50 (MP 301.7 to 313.6) Distribution of Crashes by Direction and Time of Day

- The distribution of crashes is skewed in the westbound direction for most of the Corridor resulting in nearly 47 percent of the crashes (eastbound accounts for nearly 37 percent). The east end of the Corridor suggests the eastbound direction is more problematic. The Pueblo Blvd. intersection has 54 percent of the mainline (US 50) crashes in the westbound direction (eastbound accounts for slightly less than 40 percent). However, the highest number of crashes at this intersection is in the northbound direction on Pueblo Blvd. followed by westbound on US 50.

Segment LOSS and pattern recognition analysis

The study team completed an LOSS analysis for through segments with a length greater than 2 miles. Given the high volumes and the formal designation of US 50 as a freeway (despite its signalized intersections), the study team used the *Rural Flat and Rolling 4-Lane Interstate* SPF for this analysis. The segments from West McCulloch Blvd. to Main McCulloch Blvd.; Pueblo Blvd. to Wills Blvd.; and Wills Blvd. to Baltimore Ave. were less than 2 miles and, therefore, could not be analyzed with the available SPF. The results were:

- Swallows Rd. to West McCulloch Blvd.: LOSS I
- Main McCulloch Blvd. to Purcell Blvd.: LOSS I
- Purcell Blvd. to Pueblo Blvd.: LOSS II

LOSS I indicates crash rates well below the statewide average and that additional safety measures would be unlikely to further reduce crash rates. LOSS II indicates crash rates below the statewide average; therefore, additional safety measures may or may not be cost-effective.

The pattern recognition analysis was applied to all segments longer than 1 mile using the Direct Diagnostic method. The patterns determined through this method revealed the following:

- Rear-End crashes are an issue throughout the Corridor, with a systematic increase from west to east. This is logical given the increased traffic volumes in that direction.
- Sideswipe (same direction) crashes are an issue east of Purcell Blvd. This is also a result of increased traffic volumes.
- Fixed Object crashes are an issue between West McCulloch Blvd. and Main McCulloch Blvd. (These are guardrail-, fence-, and delineator-related crashes.)

Intersection crash analysis

In the five-year period studied (January 1, 2004 – December 31, 2008), more than 58 percent of the crashes involved intersections. The study team analyzed eight intersections (including Westroads Ave.) in nearly 12 miles of US 50, with the last three being within a 0.5-mile section at the east end of the Corridor.

The study team used the Direct Diagnostic method to determine statistically whether the intersections in the study area had unusually high frequencies of any crash type. **Table 1-1** shows that the intersections of concern are West McCulloch Blvd., Purcell Blvd., Pueblo Blvd., Wills Blvd., and Baltimore Ave.

Table 1-1 also shows that the main crash type of concern is the Rear-End crash. The other concern is the unusually high number of Injury crashes at intersections. Even though Overturning crashes are over-represented at Pueblo Blvd., as are Fixed Object crashes at Swallows Rd., only a small number of crashes are involved in either case.

The primary direction of concern is westbound for the more suburban part of US 50 and eastbound for the intersections in the urban part. Heavy congestion during the peak periods could be a major factor in the unusually high number of crashes observed at these intersections. Aside from congestion, a closer look at the study area (especially in the east end) suggests the need for access management. Median work done in 2009 between Wills Blvd. and Baltimore Ave., which also converted Westroads Ave. to right-in/right-out only access, addressed this issue to an extent.

Table 1-1. Significantly Frequent Crash Types by Intersection

Cross Street	Observed Number of Crashes per Year	Expected Crashes per Year (Based on Intersection SPF)	Major Crash Direction and Percent	Crash Type with Significantly High Frequency (Direct Diagnostic)
Swallows Rd.*	0.6	1.21	WB (100%)	Fixed Object (66.7%), though only 2 of the 3 crashes here involved Fixed Objects
West McCulloch Blvd.*	**8.2**	**2.75**	WB (39%)	Rear-End (65.9%)
Main McCulloch Blvd.	8.0	13.70	WB (53%)	Rear-End (70.0%)
Purcell Blvd.	**30**	**20.40**	WB (51%)	Rear-End (73.3%)
Pueblo Blvd. (SH 45)	43.6	**	NB (36%) WB (32%)	Rear-End (53.8%) and Overturning (4.6%), though there are only 10 crashes involved Overturning
Wills Blvd.	**9.2**	**4.95**	EB (54%)	Rear-End (67.4%)
Baltimore Ave.	**21.0**	**15.46**	EB (59%)	Rear-End (76.2%)

Sources: CDOT, 2009; Highway Safety Manual (AASHTO, 2010)

*Notes: * The intersections of US 50 with Swallows Rd. and West McCulloch Blvd. are unsignalized, three-leg intersections. For these two intersections, methods from the Highway Safety Manual were used to calculate the expected number of crashes per year based on nationwide data. All the other intersections in the table are signalized; their expected number of crashes per year was calculated using Colorado-specific SPFs.*

*** SPF not available. Even though no SPF is available for the Pueblo Blvd. configuration, this is the location with the highest number of crashes per year.*

*Entries shown in **bold** indicate intersections where the observed number of crashes per year exceeds the expected number of crashes per year, based on available intersection SPF.*

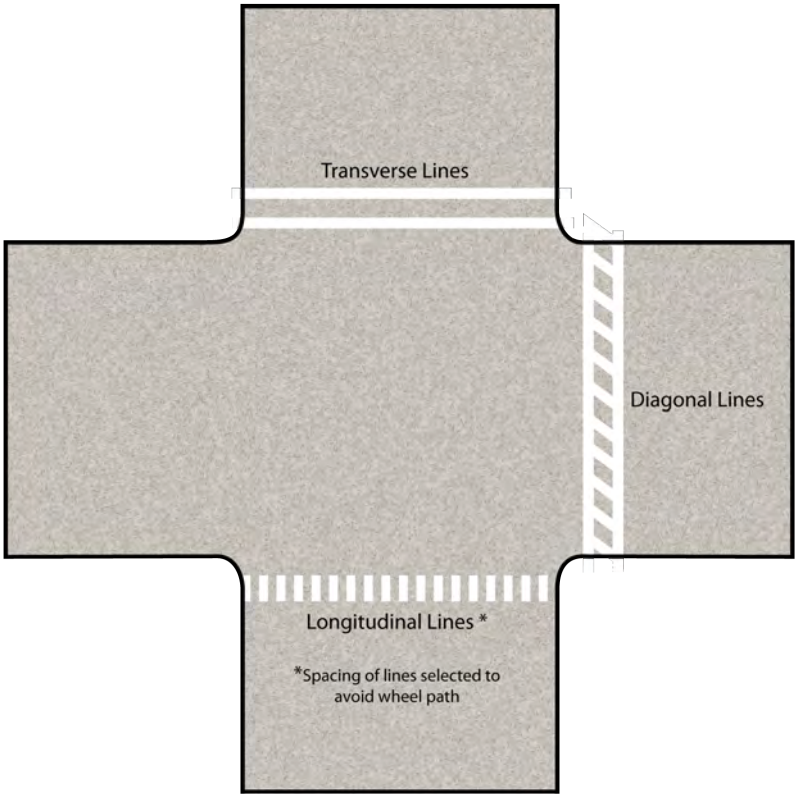
Construction during 2009 upgraded the median in a section including Wills Blvd. and Baltimore Ave. This median work would have the greatest effect on crashes at Westroads Ave. (not shown), which was converted to right-in, right-out only access.

Abbreviations: EB = Eastbound NB = Northbound SPF = Safety Performance Function WB = Westbound

1.4.5 Bicycle and pedestrian facilities

Currently along US 50, there are no separate bicycle or pedestrian facilities west of Wills Blvd to Swallows Rd. Between Wills Blvd. and Baltimore Ave., there is a section of sidewalk on the south side of US 50, but a small gap exists.

For the cross streets, only Wills Blvd. and Baltimore Ave. have sidewalks and crosswalks in place at the intersection with US 50. Main McCulloch Blvd. has painted crosswalks across all four approaches, but no sidewalk leading to the intersection. The east leg of the US 50 and Purcell Blvd. intersection also has painted longitudinal lines for a crosswalk. (**Figure 1-26** provides examples of crosswalk striping patterns.) All five signalized intersections in the Corridor have pedestrian signal heads across at least some of the intersection legs.



Source: Manual on Uniform Traffic Control Devices *(FHWA, 2009,) with modifications adapted by JFSA*

Figure 1-26. Examples of Techniques for Marking Crosswalks

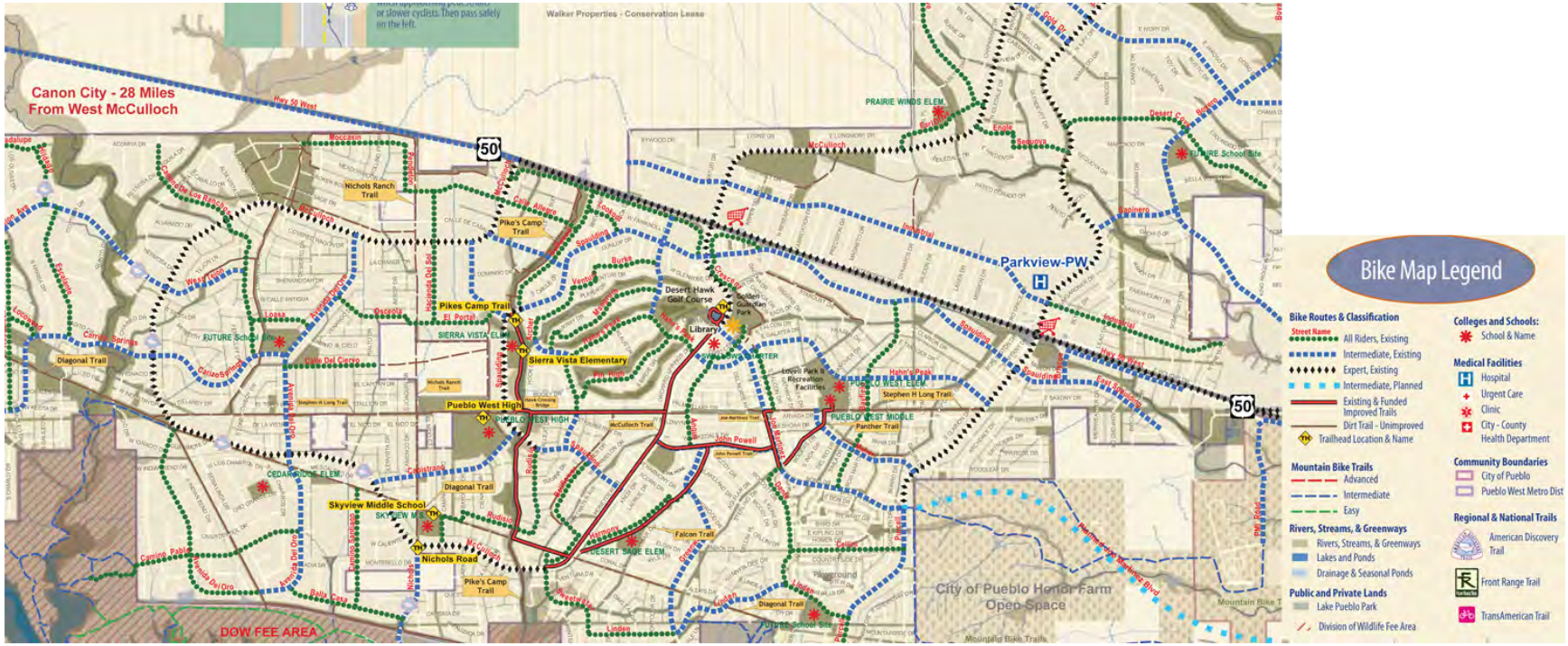
The US 50 West Trail, part of the city of Pueblo's off-street trail system, begins approximately 0.5 mile east of the BNSF railroad crossing, travels parallel to US 50, and proceeds to the junction of the Fountain Creek River Trail on the east side of I-25.

According to the *Pueblo West Bike and Trails Map* and the *Pueblo Bicycle and Trails Map* produced by the Pueblo Area Council of Government (PACOG) (2010a, 2010b), US 50 is a designated bike route. Portions of these maps have been reproduced and are shown as **Figure 1-27** through Pueblo West and **Figure 1-28** east of Pueblo Blvd. The *Pueblo West Bike and Trails Map* suggests that US 50 west of Main McCulloch Blvd. would be appropriate for riders with intermediate skills, while the highway east of Main McCulloch Blvd. is only recommended for expert riders.

There are no clearly marked bike lanes on either direction of US 50. Bikers typically ride on the roadway shoulders or in the general traffic lanes when the shoulders are littered with debris. All streets crossing US 50 within the study limits are also currently designated as bike routes.

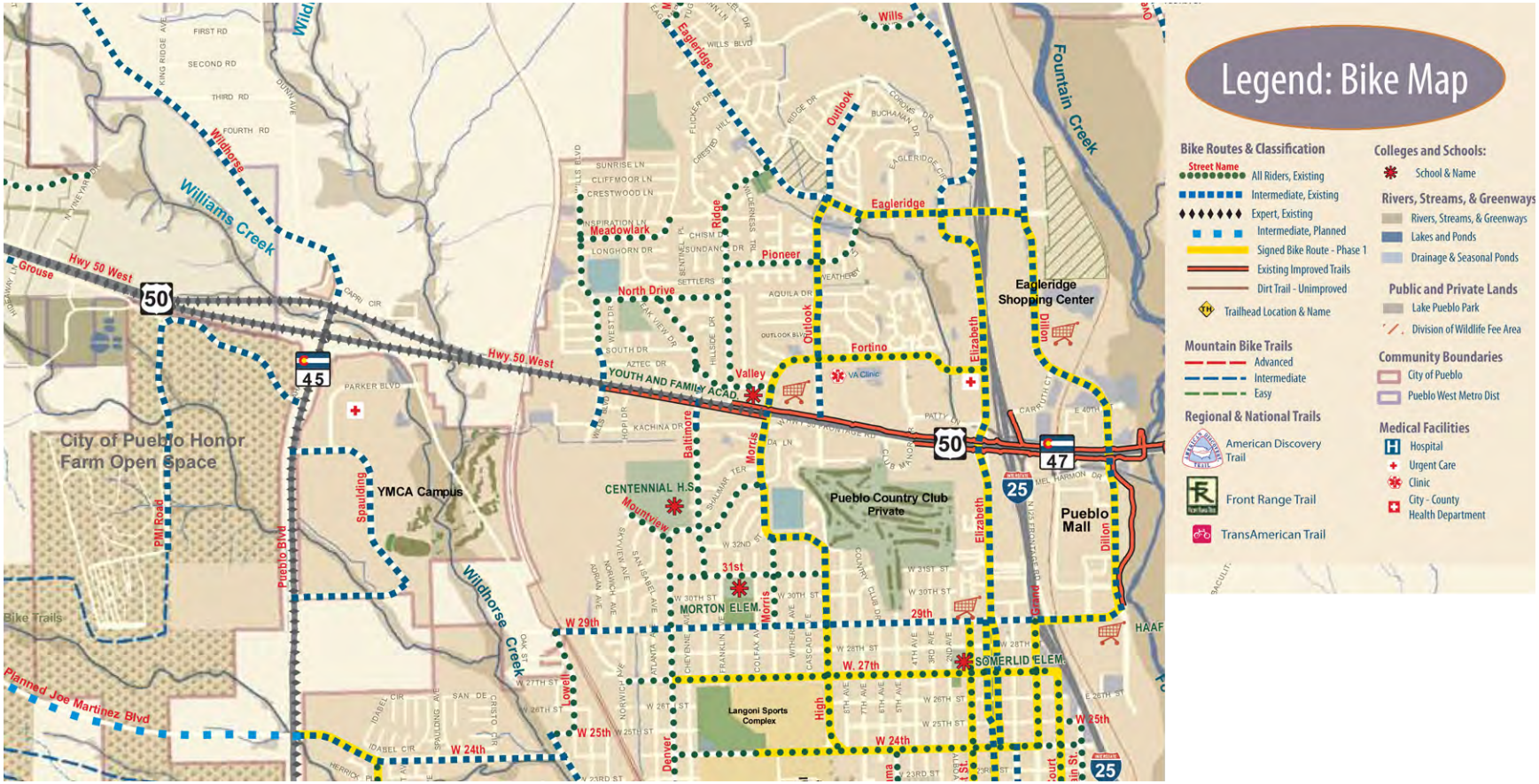
Parallel bike routes are designated on Industrial Blvd. north of US 50, and Spaulding Ave. and Grouse Drive south of US 50.

The PACOG *2035 Long Range Transportation Plan* has identified US 50 within the project limits as a part of the urban regional multi-use trail system. A multi-use trail is a concrete or an asphalt path physically separated from motor vehicle traffic (except at road crossings) to accommodate a variety of users, including commuting and recreational bicyclists, as well as pedestrians.



Source: PACOG, Pueblo West Bike and Trails Map, 2010a.

Figure 1-27. Bicycle Paths and Trails near US 50 through Pueblo West



Source: PACOG, Pueblo Bicycle and Trails Map, 2010b.

Figure 1-28. Bicycle Paths and Trails near US 50 east of Pueblo Blvd.

1.4.6 Transit and park-and-ride lots

Pueblo Transit runs bus routes inside the city of Pueblo (or outside the city limits with special funding arrangements), as shown on **Figure 1-29**. The easternmost portion of the PEL Study Corridor is served by Route 8, Highway 50 West, with stops at the YMCA on Spaulding Ave., Park West Medical Center, and Baltimore Ave. at Kachina Dr.

Figure 1-29 also shows two formal and four informal park-and-ride lots in the study area. In 2010, CDOT relocated its park-and-ride lot from the northwest quadrant of US 50 and Wildhorse Rd. to the northeast quadrant to build a maintenance facility. Later that year, the park-and-ride lot at I-25 and Purcell Blvd. was selected to receive state Funding Advancement for Surface Transportation and Economic Recovery (FASTER) funds for improvements.

Pueblo West residents also use informal parking lots in the southwest quadrant of US 50 and West McCulloch Blvd., and in the northwest quadrant of Spaulding Ave. and Calle de Camelia, near Main McCulloch Blvd. Local staff reported that residents also informally use the parking lots of Walmart (in the northeast quadrant of US 50 and Main McCulloch Blvd.) and Safeway (in the northeast quadrant of US 50 and Purcell Blvd.). Because of their location and ownership, Pueblo Transit riders do not use these park-and-ride lots. Instead, these facilities are used to meet other carpool members before commuting to jobs in Colorado Springs, Florence, or Cañon City.

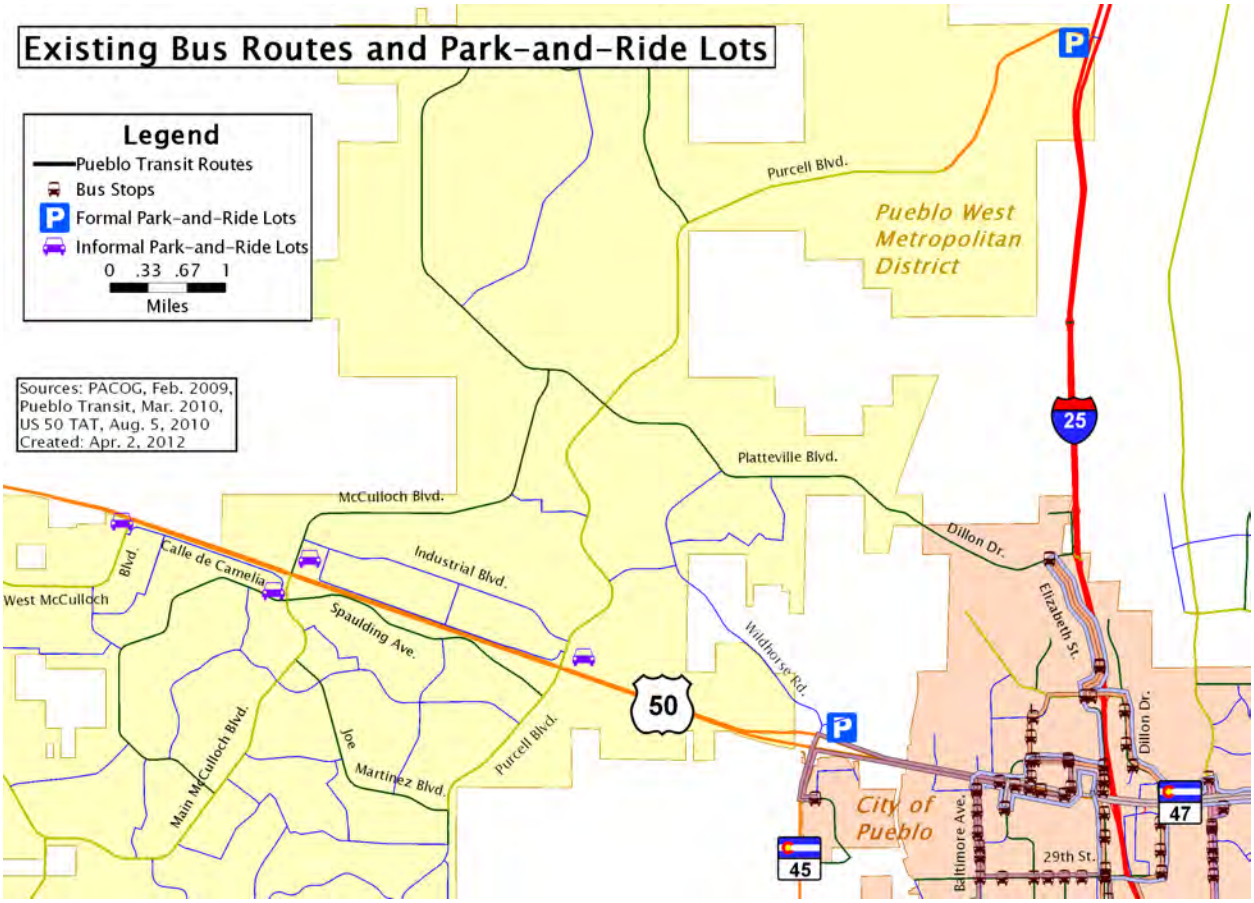


Figure 1-29. Pueblo Transit Bus Routes and Various Park-and-Ride Lots

1.5 What is the study Purpose and Need?

1.5.1 Corridor needs

The Need for improvements to the US 50 Corridor is demonstrated by:

- High levels of future vehicular demand
- Congested intersections
- High accident rates concentrated around intersections
- The presence of a number of informal park-and-ride locations in the study area
- A lack of pedestrian, bicycle, and transit connectivity

Traffic counts conducted in September 2009 showed that average weekday volumes on US 50 range from just over 10,000 vehicles west of Swallows Rd. to just over 44,000 vehicles between Purcell Blvd. and Pueblo Blvd. (SH 45). Daily volumes between Pueblo Blvd. (SH 45) and Baltimore Ave. are slightly lower, at just over 42,000. In 2035, these volumes are forecast to range from almost 20,000 west of Swallows Rd. to more than 86,000 between Purcell Blvd. and Pueblo Blvd. (SH 45). That is, 2035 traffic volumes are anticipated to be roughly double their current volumes.

Increased traffic volumes result in poor intersection operating conditions. In 2035, all of the signalized intersections examined from Main McCulloch Blvd. to Baltimore Ave. are expected to operate at LOS F in both the morning and evening peak hours. Furthermore, the northbound leg of the unsignalized intersection of US 50 and Swallows Rd. is anticipated to operate at LOS "f" in both the morning and evening peak hours. At the unsignalized intersection of US 50 and West McCulloch Blvd., the northbound left and right movements are expected to operate at LOS "f" during the morning peak. During the evening peak, both the northbound and westbound left turn movements will experience LOS "f" conditions.

In the five-year period spanning 2004 to 2008, a total of 910 accidents were recorded on mainline US 50 between milepost 301.70 (1.4 miles west of Swallows Rd.) and milepost 313.60 (0.1 mile east of Baltimore Ave.), while another 125 accidents were recorded on Pueblo Blvd. (SH 45) at its intersection with US 50. Although few intersections were involved, a majority (58 percent) of the accidents that were recorded were coded as At Intersection or Intersection-Related. Also, 68 percent of the reported accidents involved Rear-End collisions that were associated with speed differentials between moving traffic and traffic stopped at the signalized intersections along US 50.

Pueblo West residents have created informal park-and-ride lots within the Corridor (see **Section 1.4.6** and **Figure 1-29**.) A small formal park-and-ride exists on Wildhorse Rd. north of the US 50 and Pueblo Blvd. (SH 45) intersections. These park-and-ride lots are used for carpool formation, because Pueblo Transit service is limited to within the city limits, plus a branch to the Salt Creek area southeast of the city. 2035 travel demand forecasts suggest that there may be sufficient demand to support peak-hour transit service between Pueblo West and Pueblo, provided that proper connections can be made to the Pueblo Transit system. Potential locations for future formal park-and-ride lots should be identified so that private property owners are not burdened with informal park-and-ride use.

Pedestrian and bicycle facilities have been planned in the study area as part of a regional network. Currently, the City is developing a bicycle master plan that will meet non-motorized east-west

connectivity. Improvement projects in the Corridor might incorporate one of three levels of treatment for pedestrian and bicycle facilities:

1. Ensuring that the ability of other entities to construct such facilities is not precluded
2. Reserving right-of-way for these facilities
3. Constructing the facilities

Connectivity to other multimodal facilities in the regional network and connectivity through intersections will be of particular importance for implementation.

1.5.2 Study purposes

The Purposes of the US 50 West PEL Study are to:

1. Improve the safety of the Corridor by addressing safety concerns identified in the safety assessment of the Corridor.
2. Increase the mobility and relieve traffic congestion on US 50 from Swallows Rd. to Baltimore Ave. Because this section of US 50 is functionally classified as an urban freeway, LOS E (at capacity, which would fail with any interruption) and LOS F (failing) for the planning year of 2035 are not consistent with transportation planning practice.
3. Minimize detrimental LOS impacts on the surrounding network when improving US 50.
4. Accommodate multimodal connectivity that includes auto, pedestrian, bicycle, and public transit modes within the project area, in response to projected 2035 demand.
5. Maintain reasonable access for future growth.

In addition to the Purpose and Need statement, Corridor stakeholders expressed a vision that improvements to US 50 would preserve and enhance the environmental qualities of the Corridor. This community vision is also consistent with the *CDOT Environmental Stewardship Guide*. Alternatives must meet the transportation purpose and needs, be developed in a manner that provides for and accommodates the preservation and enhancement of the environmental qualities and community values of the Corridor, and avoids and minimizes environmental impacts.

Improvements to US 50 are needed because even if all the local improvement projects are constructed by 2035, they would not remove enough traffic from US 50 to keep the US 50 intersections operating at acceptable levels of service.

Chapter 2 of this PEL Study discusses potential improvements to US 50 and describes the performance of these improvements, as well as their potential environmental impacts.

1.6 What is the potential for carpool and bus travel in the future?

The study team used the PACOG travel demand model to determine potential carpool use and bus ridership on US 50 in 2035. While there may be more than 2,700 carpool trips to and from Pueblo West each peak hour, their diverse origins and destinations away from Pueblo West make them difficult to serve with High-Occupancy Vehicle (HOV) lanes. For example, the study team calculated that just over 100 carpool trips would be made each peak hour between Pueblo West and downtown Pueblo.

The study team estimated that in 2035, there might be as many as 70 transit trips between Pueblo West and the Pueblo Transit service area during the morning peak hour, and 130 trips during the evening peak hour. With 40-passenger buses, these ridership levels could justify service every 20 to 30 minutes. In Pueblo West, such a route might serve the park-and-ride lots discussed in **Section 1.4.6**. However, the bus service would need to be designed to serve the most popular destinations and to allow for convenient transfers to Pueblo Transit routes to achieve these ridership levels.

Ridership estimates drop to about 15 trips each peak hour when using a more realistic transit market limited to Pueblo West residents who are going to downtown Pueblo (and reverse commuters). This level of ridership would be more appropriate to serve with a cut-away shuttle van.

1.7 What local improvements were analyzed?

All local improvement projects identified in the PACOG *2035 Long Range Transportation Plan* for the Northwest Quadrant Projects were analyzed for their potential to reduce the congestion on the US 50 Corridor. The following local improvements were considered:

- The **Pueblo Blvd. Extension**, as developed in the 1999 *Eden Interchange/Pueblo Blvd. Feasibility Study*, is a four-lane expressway north of US 50 to a new interchange at I-25. This facility uses part of the existing Purcell Blvd. right-of-way for its northern section. Signalized intersections are provided at Wildhorse Rd. (relocated), Eagleridge Blvd. Extension, Platteville Blvd., and Purcell Blvd.
- Improvements to **Platteville Blvd.,** including
  - Upgrading the cross section to that of a Principal Arterial between Purcell Blvd. and I-25
  - Widening to four lanes between Purcell Blvd. and Dillon Dr.
  - Providing a grade separation at the BNSF railroad crossing
  - Widening to six lanes between Dillon Dr. and I-25
- A four-lane **Eagleridge Blvd. Extension** west to the Pueblo Blvd. Extension
- A two-lane **Industrial Blvd. Extension** east to Wildhorse Rd.
- A four-lane **Spaulding Ave. Extension** constructed in two pieces: (1) Through the Honor Farm east to Pueblo Blvd. (SH 45); and (2) Between 11th St. and 31st St.
- A two-lane **Tuxedo Blvd. Extension** from 29th St. to a right-in/right-out intersection at US 50
- Reduced delays at the **29th St.** at-grade BNSF railroad crossing as a result of the improvements described in the *Colorado Rail Relocation Implementation Study* (2009)
- The **West Pueblo Connector**, including:
  - The Joe Martinez Blvd. Extension as a four-lane parkway through the Honor Farm (between Purcell Blvd. and Pueblo Blvd.), including the installation of new traffic signals and turn bays at Purcell Blvd. and Joe Martinez Blvd.
  - Widening existing two-lane portions of 24th Street between Pueblo Blvd. and Tuxedo Blvd. to four lanes
  - Installing traffic signals at 18th St. and Tuxedo Blvd.

- Constructing a new roadway from about 18th St. and Tuxedo Blvd. to an existing section of D St. west of Lamkin Ave. This section would be four lanes from 18th St. to a spur connecting to 1st St. The West Pueblo Connector would be two lanes south of the 1st St. spur.
- Rehabilitating the existing sections of D St.
- Constructing a new two-lane, grade-separated railroad crossing connecting D St. at Oneida St. to D St. at Plum St., providing connectivity to Santa Fe Ave.

Figure 1-30 shows these local improvements.

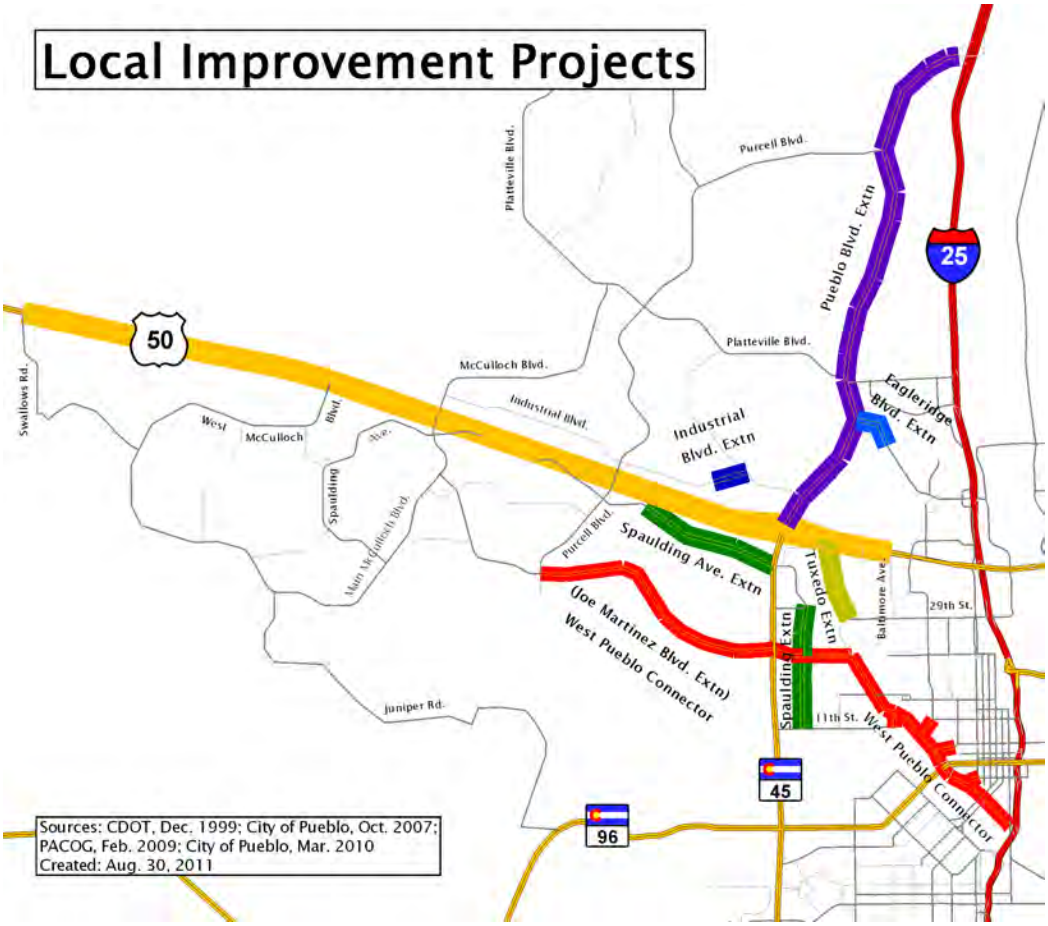


Figure 1-30. Location of Local Improvement Projects

1.8 What effect do the local improvements have on US 50?

In **Table 1-2**, the 2035 daily traffic forecasts show that (taken as a whole) local improvement projects have the potential to remove about 25 to 30 percent of the volume from US 50, depending on location. However, the effectiveness of the local improvements varies depending on location and design standards, including lane widths and speed limits.

Table 1-2. 2035 Two-Way Daily US 50 Volumes with and without Local Improvements

Location	Without Local Improvements	With Local Improvements	Traffic Diverted to Local Improvements	Percentage Diversion
Purcell Blvd. to Pueblo Blvd.	86,000	65,000	21,000	24%
Pueblo Blvd. to Wills Blvd.	80,000	55,000	25,000	31%

Source: JFSA, 2010.

The most effective local improvement is the Pueblo Blvd. Extension, which by itself, is expected to draw about 22,000 trips from US 50 east of Pueblo Blvd. and about 4,000 trips from US 50 between Purcell Blvd. and Pueblo Blvd. (This diversion is calculated by comparing **Table B-8** and **Table B-11** of **Appendix B**.) The least effective improvement is the two-lane Tuxedo Blvd. Extension, which serves only a few hundred vehicles to and from eastbound US 50 each peak hour.

The Joe Martinez Blvd. Extension, part of the West Pueblo Connector, is forecast to carry about 10,300 daily trips in either direction. (See **Table B-7** of **Appendix B** for more details.) However, about 7,000 of these trips would come from Juniper Rd. through Lake Pueblo State Park, so the Joe Martinez Blvd. Extension would remove only about 3,000 trips from US 50 between Purcell Blvd. and Pueblo Blvd. East of Pueblo Blvd., 24th St. carries 20,000 daily vehicles, or about 6,000 more than it would without the new sections of the West Pueblo Connector.

The Pueblo Blvd. Extension is expected to handle about 68,000 daily vehicles in either direction just north of US 50, and 55,000 daily vehicles between the Eagleridge Blvd. Extension and Platteville Blvd. The improvements to Platteville Blvd. would more than double the volume it currently carries between Purcell Blvd. and the BNSF railroad (near the Pueblo Blvd. Extension alignment)—from 12,000 to 26,000 vehicles per day. The Eagleridge Blvd. Extension is expected to carry 17,000 vehicles per day. The Industrial Blvd. Extension is forecast to handle 7,000 daily trips, while the Spaulding Ave. Extension—which passes through a residential area east of Purcell Blvd.—is expected to draw only about 5,000 vehicles per day.

1.9 Are any local improvements part of any alternative of the PEL Study?

No. Local improvements were not included as part of any study alternative because on their own, the local improvements are not sufficient to remove enough traffic from US 50 to meet the study Purpose and Need.

Because the local improvements are not part of any alternative, the study team did not examine their potential environmental impacts on various resources. However, traffic patterns were examined to determine the effect of the Pueblo Blvd. Extension to Platteville Blvd. and the West Pueblo Connector on LOS at Wills Blvd. and Baltimore Ave. This approach is consistent with these two roadways being included in the PACOG *2035 Long Range Transportation Plan*. Without these local improvements, the the Wills Blvd. and Baltimore Ave. intersections with US 50 cannot meet the Purpose and Need criteria. Because of this, CDOT will re-examine the Preferred Alternative if these improvements are not built.

Chapter 2. Alternatives Considered and Evaluated

2.1 How were alternatives developed and evaluated?

Chapter 2 describes how the study team identified existing and future problems in the US 50 Corridor to develop a wide range of alternatives for transportation improvements, how those alternatives were evaluated, and how that evaluation led to a Preferred Alternative. **Chapter 2** also describes and analyzes alternatives to address the Corridor transportation problems using an interdisciplinary approach with public and stakeholder involvement. **Chapter 1** of this PEL Study considers alternatives to address the project Purpose and Need, which includes long-range Corridor mobility, accessibility, and safety needs.

The alternatives focus on the US 50 Corridor. The local improvement projects identified in the PACOG *2035 Long Range Transportation Plan* (*LRTP*) were not included as part of any study alternative because, on their own, the local improvements are not sufficient to remove enough traffic from US 50 to meet the project Purpose and Need.

Consistent with the National Environmental Policy Act (NEPA), **Section 2.2** describes the No Action Alternative, which provides the basis for comparing environmental impacts among all alternatives.

The study team used four levels of evaluation to identify the Preferred Alternative, including:

- Level 1 – Environmental Fatal Flaw Screening
- Level 2 – Purpose and Need Screening
- Level 3 – Environmental Comparative Analysis of Intersection Options
- Level 4 – Environmental Comparative Analysis of Alternatives

What's in Chapter 2?

Chapter 2 describes all the alternatives that were considered to solve the congestion and safety issues on US 50 while preserving the environment and quality of life.

- The No Action Alternative represents conditions if no capacity improvements are made to US 50.
- Action alternatives consist of mainline treatments and intersection options.

The study team examined four lanes and six lanes for US 50 and considered 14 intersection options, ranging from unsignalized intersections to large, high-speed, fully controlled freeway-style interchanges.

Chapter 2 also discusses the process used to narrow down the large number of facility types and intersection options to a Preferred Alternative. The process used four levels of analysis and evaluation. Each level of evaluation used different considerations or criteria to reduce the number of options to address the Purpose and Need in the study area.

Finally, **Chapter 2** describes the Preferred Alternative.

For Levels 1 and 2, the term *screening* indicates a pass or fail test for each facility type or intersection option. At Levels 3 and 4, the study team compared intersection options or alternatives and selected those that best achieved the Purpose and Need with the least impacts. The study team carefully considered possible solutions for the US 50 Corridor at each level of evaluation. Some levels of evaluation took a corridor-wide approach, while others considered individual components. **Figure 2-1** shows the alternatives development and evaluation process used in the PEL Study.

The study team used different terms to describe alternatives as they were developed and evaluated, and those terms are retained in this PEL Study. The term *alternative* is used consistently with NEPA guidance to describe mutually exclusive options for the entire US 50 Corridor. Alternatives consist of *components*, which are individual pieces associated with a particular location or segment within the Corridor. *Intersection options* and *mainline options* are two types of components that were considered in

the alternatives development and evaluation process. Intersection options refer to the configuration where US 50 meets a cross street, and to which movements are signalized, grade separated, or accommodated with ramps. Mainline options (also called *facility types*) include the number of lanes and the type of facility provided—a freeway or an expressway, which is determined by whether grade-separated intersection options are used. Other improvement components that were considered include bicycle and pedestrian paths, as well as bus services.

Level 1 Environmental Fatal Flaw Screening considered general facility types, including four- and six-lane freeways and expressways, as well as local improvement projects that may attract traffic off US 50. **Figure 2-1** lists these facility types in the upper left corner. **Section 2.3** describes the four- and six-lane options for US 50. A freeway is a highway with only grade-separated interchanges at crossing roads. An expressway may have all intersections at grade or a mix of at-grade and grade-separated intersections. **Chapter 1, Section 1.7,** of this PEL Study describes the local improvement projects. **Section 2.4** discusses the considerations for Level 1 screening, while **Section 2.5** summarizes the Level 1 screening results.

For Level 2 Purpose and Need Screening, the study team identified all reasonable options at each intersection that could potentially address the capacity and safety needs. **Section 2.6** describes the intersection options that were considered. **Figure 2-1** lists the intersection options in the upper right corner. Intersections are the main sources of traffic congestion and safety needs. Levels of Service (LOS) describe how the traffic demand at an intersection compares to the intersection's capacity. The study team examined sets of demands corresponding to the facility types that were considered in Level 1 screening. **Section 2.9** describes how the study team used LOS in Level 2 screening to screen intersection options. **Section 2.10** discusses the Level 2 screening results.

Level 3 evaluation involved a comparative analysis of the transportation and environmental impacts of different intersection treatments at the seven major intersections in the Corridor. Because the environmental impacts associated with an intersection option are often related to its footprint, the Level 3 evaluation could consider each of the seven intersections in the Corridor independently. **Section 2.12** describes the considerations that distinguished the intersection options at each location, and **Section 2.13** describes those options selected for further evaluation.

For Level 4 evaluation, the study team matched four or six lanes of mainline segments with the remaining intersection options to form the alternatives that encompass the entire study Corridor. **Figure 2-1** illustrates how the evaluation process is interwoven with arrows in the middle section. Intersection options from the upper right column are placed at the seven locations along the Corridor, depicted with the light grey arrowheads. Facility types from the upper left column form alternative components between intersections, depicted with the dark grey arrowheads, with the alternatives represented symbolically in the lower section. **Section 2.14** describes how the alternatives compare. **Section 2.15** tells which alternative is preferred and identifies the reasons why. **Section 2.16** describes the Preferred Alternative in detail. **Figure 2-1** shows that the Level 4 evaluation arrives at the Preferred Alternative (Alternative E), shown symbolically at the bottom section.

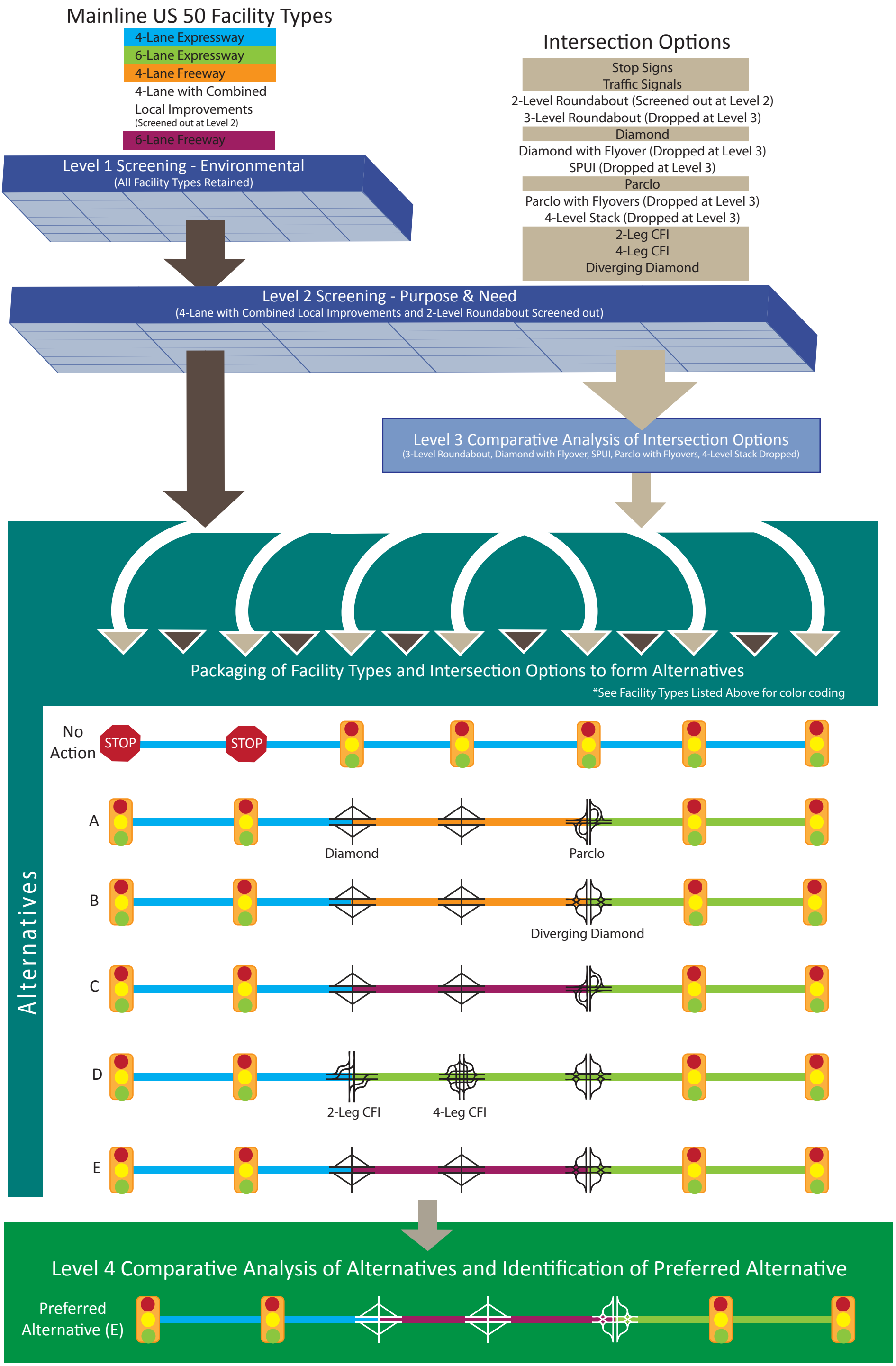


Figure 2-1. Alternatives Development and Evaluation Process

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The following also played a major role in developing and formulating the reasonable alternatives:

- Results from field investigations
- Input from Technical Advisory Team (TAT) members, agencies, and the public
- Consideration of the Pueblo Area Council of Governments (PACOG) planned transportation improvements

As discussed in **Chapter 1, Section 1.6**, of this PEL Study, the low levels of carpool and transit demand led the study team to conclude that carpool lanes or new bus service would not meet the mobility criterion of the study Purpose and Need on their own. However, improvements such as park-and-ride lots that support carpool and bus travel could be included with each alternative to address the multimodal element of the Purpose and Need. Similarly, a pedestrian and bicycle path could also be included with all alternatives.

2.2 What is the No Action Alternative?

The No Action Alternative assumes no major capacity improvements would be made to the transportation network, other than committed projects outside the US 50 Corridor, such as the new split diamond interchange at the I-25 Dillon/Eden Exit. However, the No Action Alternative would include routine maintenance to keep the existing transportation network in good operating condition as it does today.

Although the No Action Alternative does not meet the project Purpose and Need (as described in **Chapter 1, Section 1.5** of this PEL Study), NEPA requires that it be carried forward until a Preferred Alternative is selected. Although this PEL Study comes before any NEPA evaluation, the study team decided to follow NEPA guidance regarding the No Action Alternative so that any future NEPA study would be able to make the most use of this PEL Study. A future NEPA study would be required, for example, if federal money is used to build the Preferred Alternative or if Colorado Department of Transportation (CDOT) would need a permit to disturb a stream.

2.3 What options were considered for the US 50 mainline?

The study considered both four-lane and six-lane options for US 50. Although US 50 currently has four standard 12-foot lanes, **Figure 2-2** shows that its shoulders are substandard in some locations. The current standards for shoulders on a four-lane highway are 4-feet-wide for inside shoulders and 10-feet-wide for outside shoulders.

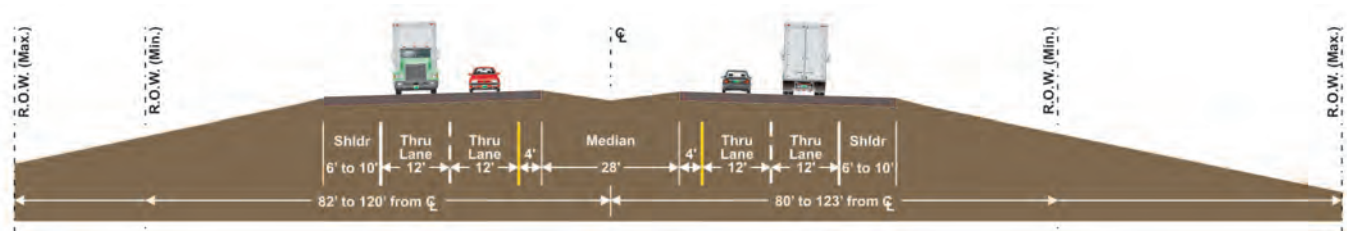


Figure 2-2. Existing Cross Section of US 50 Between Swallows Rd. and the Burlington Northern Santa Fe Railroad Crossing

Table 2-1 presents the current design standards and criteria used for highways such as US 50 and for possible grade-separated interchanges. Standards and criteria come from several sources. Federal Highway Administration (FHWA) and American Association of State Highway and Transportation Officials (AASHTO) make design policies at the national level. However, sometimes these national entities leave certain design decisions to the individual states. CDOT's *Design Guide* (2005) lists such criteria for Colorado. **Table 2-1** combines and summarizes all criteria used to design every component of every action alternative considered for this PEL Study.

Table 2–1. Mainline and Intersection Design Criteria Summary

Design Element	US 50 Mainline	Interchange Ramps*	Cross Roads
Number of through lanes	4 or 6	1 or 2	4 or 6
Lane widths (ft)	12	1-lane: 15 2-lane: 12	12
Shoulder width (ft)	4-lane inside: 4 4-lane outside: 10 6-lane (both sides): 12	Inside: 4 Outside: 6	10
Design speed (mph)	65	Entrance or exit curves: 45 Ramp curves: 35	Pueblo Blvd. Extension: 50 All others: 35
Horizontal curve radius (ft)	2,500 (75 mph) desirable 1,500 (60 mph) minimum	Loop: 220 (30 mph) Directional and Flyover: 590 (45 mph) desirable 450 (40 mph) minimum	N/A
Superelevation	4%	6% desirable 8% maximum	4%
Entrance type	N/A	1-lane: taper 2-lane: parallel	N/A
Exit type	N/A	1-lane: taper 2-lane: parallel	N/A
Tapers (ft)	Add lane: 600 Drop lane: 300	300	300
Acceleration lane lengths (ft)	25 to 65 mph: 1220 35 to 65 mph: 1000 45 to 65 mph: 600	N/A	N/A
Deceleration lane lengths (ft)	65 to 30 mph: 470 65 to 40 mph: 390 65 to 45 mph: 340	N/A	N/A

Sources: CDOT, 2005; AASHTO, 2004; FHWA, 2010

*Notes: * All interchange alternatives were laid out to meet desirable criteria. Only in cases of severe right-of-way (ROW) constraints were minimum criteria used. Interchanges were located to keep as much of the disturbance footprint within existing ROW or to minimize impacts on developed land parcels. Design criteria will be reviewed during future project-specific design phases to conform to current design standards.*

Abbreviations: ft = feet mph = miles per hour N/A = not applicable ROW = right-of-way

Table 2-1 also shows that different criteria apply for different parts of the roadway being designed. The second column of the table shows criteria for the US 50 mainline. The last column of the table shows criteria for the mainline of crossing roadways, such as Purcell Blvd. or Pueblo Blvd. The third column of the table presents criteria for the ramps that connect US 50 to crossing roadways. For example, US 50 through traffic was designed to be able to go at the highest speed—65 miles per hour (mph). The speed limit on cross streets might be anywhere between 35 mph and 50 mph. Tight loop ramps were designed to be signed with an advisory speed of 30 mph.

The four-lane option brings US 50's shoulders to modern standards and preserves right-of-way (ROW) for a pedestrian and bicycle path along the south side of US 50. **Figure 2-3** shows the cross section of the four-lane option. Note that in some places, narrow strips of additional ROW would be required.

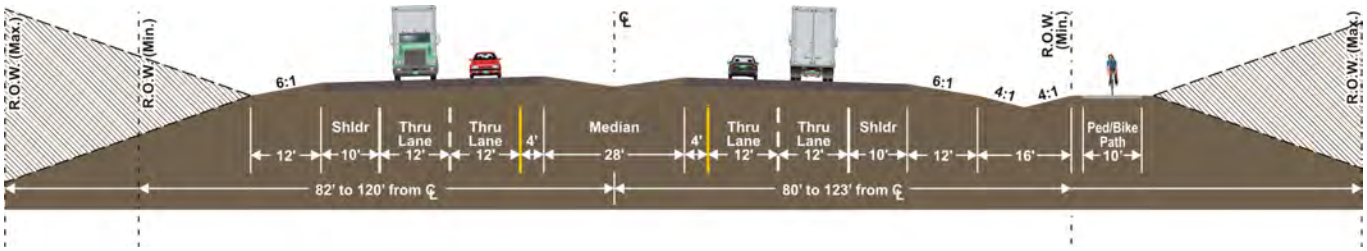


Figure 2-3. Cross Section of the Four-Lane US 50 Option

The standard for shoulders on a six-lane highway is 12-feet-wide for both inside and outside shoulders. The six-lane option would also preserve ROW for a pedestrian and bicycle path along the south side of US 50. **Figure 2-4** shows the six-lane option.

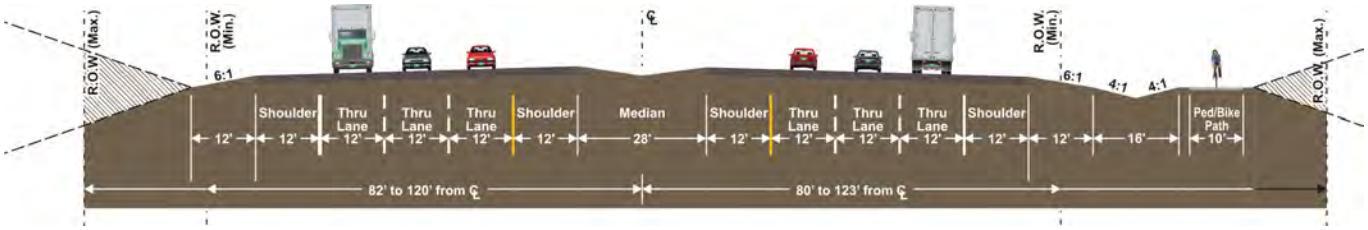


Figure 2-4. Cross Section of the Six-Lane US 50 Option

In evaluating facility types for Level 1 screening, the study team considered both the number of lanes and how extensively grade-separated interchanges would be used. Facility types included:

1. Four-lane expressway
2. Six-lane expressway
3. Four-lane freeway (with all intersections grade-separated)
4. Combined local improvement projects
5. Six-lane freeway (with all intersections grade-separated)

2.4 What were the considerations for Level 1 screening?

Level 1 screening involved an environmental fatal flaw analysis of facility types and their components. Environmental factors included:

- Environmental justice issues
  - Minority populations
  - Low-income populations
- Issues related to Section 4(f) and 6(f) analysis in a NEPA study
  - Historic properties
  - Recreational properties
  - Wildlife refuges
  - Improvements made with Land and Water Conservation Funds

2.4.1 Where are the minority and low-income neighborhoods?

Environmental justice requirements stem from the Civil Rights Act of 1964; Executive Order 12898—*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*—issued in 1994; and U.S. Department of Transportation and Federal Highway Administration (FHWA) procedures for compliance with Executive Order 12898.

Environmental justice promotes the fair treatment and meaningful involvement of all people in the decision-making process for transportation projects. Environmental justice seeks to avoid disproportionately high and adverse impacts on low-income and minority populations.

The first step in analyzing environmental justice was to define what was meant by minority and low-income neighborhoods. Minorities are persons who are not white, including Black, Hispanic or Latino, Asian American, American Indian and Alaskan Native, and Native Hawaiian or Pacific Islander (CDOT, 2008). The study team used the federal poverty line to define low-income because this information is readily available from the Census. In preparing NEPA documents, CDOT typically uses the state- or county-specific poverty thresholds to identify low-income populations. The same procedures would be used when future US 50 projects move through NEPA clearance.

The team was interested in areas where the percentages of minorities or low-income families were greater than the average for Pueblo County as a whole. Pueblo County is distinctive in that 38 percent of its residents are Hispanic and 42 percent are any minority.

Figure 2-5 highlights Census block groups where the percentage of minorities is greater than the 42 percent for Pueblo County as a whole. Care is needed in interpreting the figure because some of the block groups are large and not uniformly settled. For example, along US 50 east of Pueblo Blvd., businesses abut the highway. These businesses act as a buffer between US 50 traffic and the residences to the north and south. Another example is the block group north of US 50 and west of I-25. Though the Pueblo Blvd. Extension passes through this block group, the area immediately next to the extension is undeveloped; therefore, minority families would not be affected by its construction. The neighborhoods east of Pueblo Blvd. (SH 45) and south of 24th St. are more densely settled.

In Pueblo County, just over 11 percent of all families earn less than the federal poverty level. **Figure 2-6** shows those block groups where the fraction of these low-income families is greater than the County average. **Figure 2-5** identifies many block groups as having a greater than average fraction of minority residents, which correlates to a greater-than-average fraction of low-income families. The areas of greatest concern are along the Spaulding Ave. Extension between 11th St. and 24th St. and the West Pueblo Connector (WPC) east of Pueblo Blvd.

Figure 2-5. Map of Minority Block Groups in the US 50 Study Area

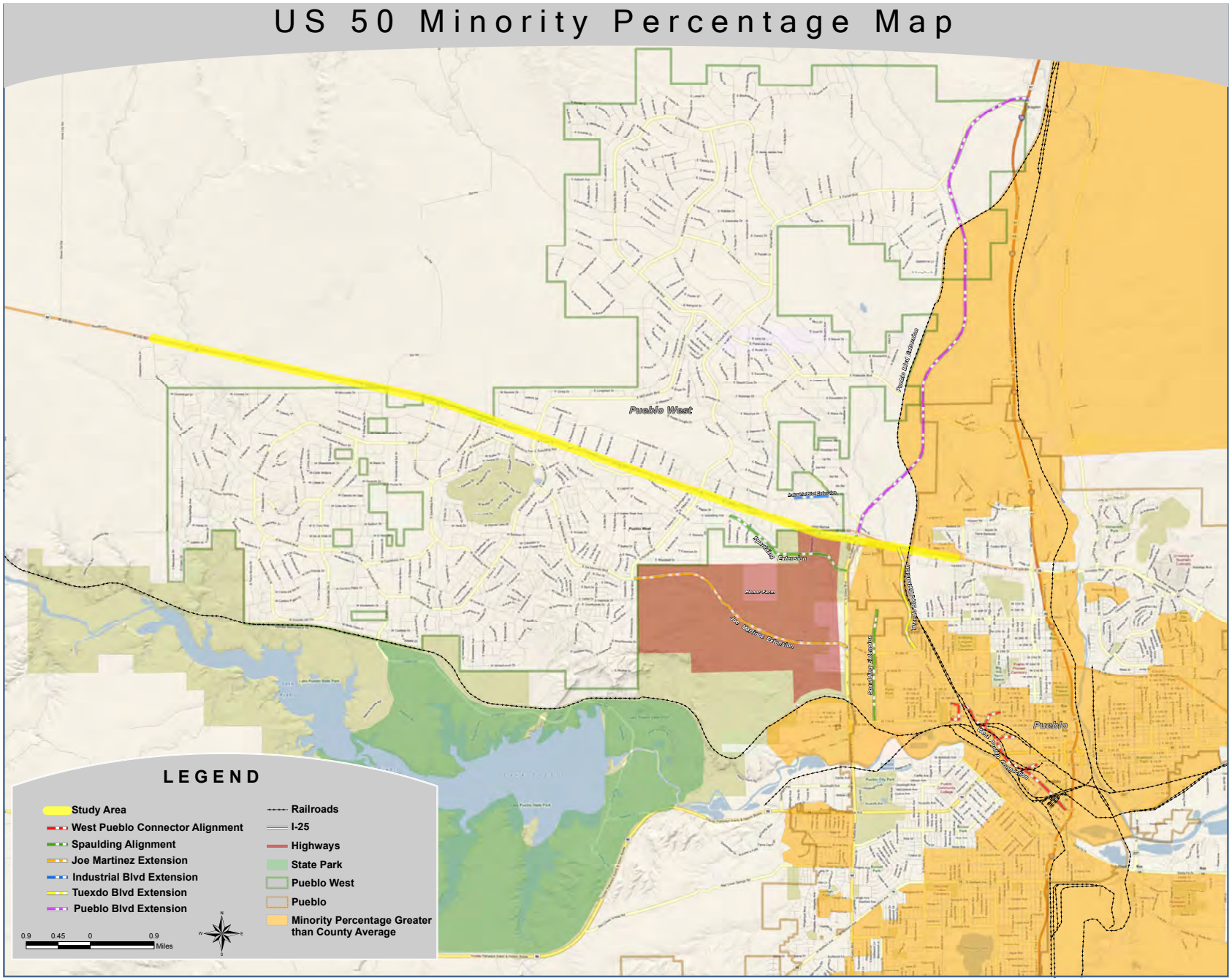
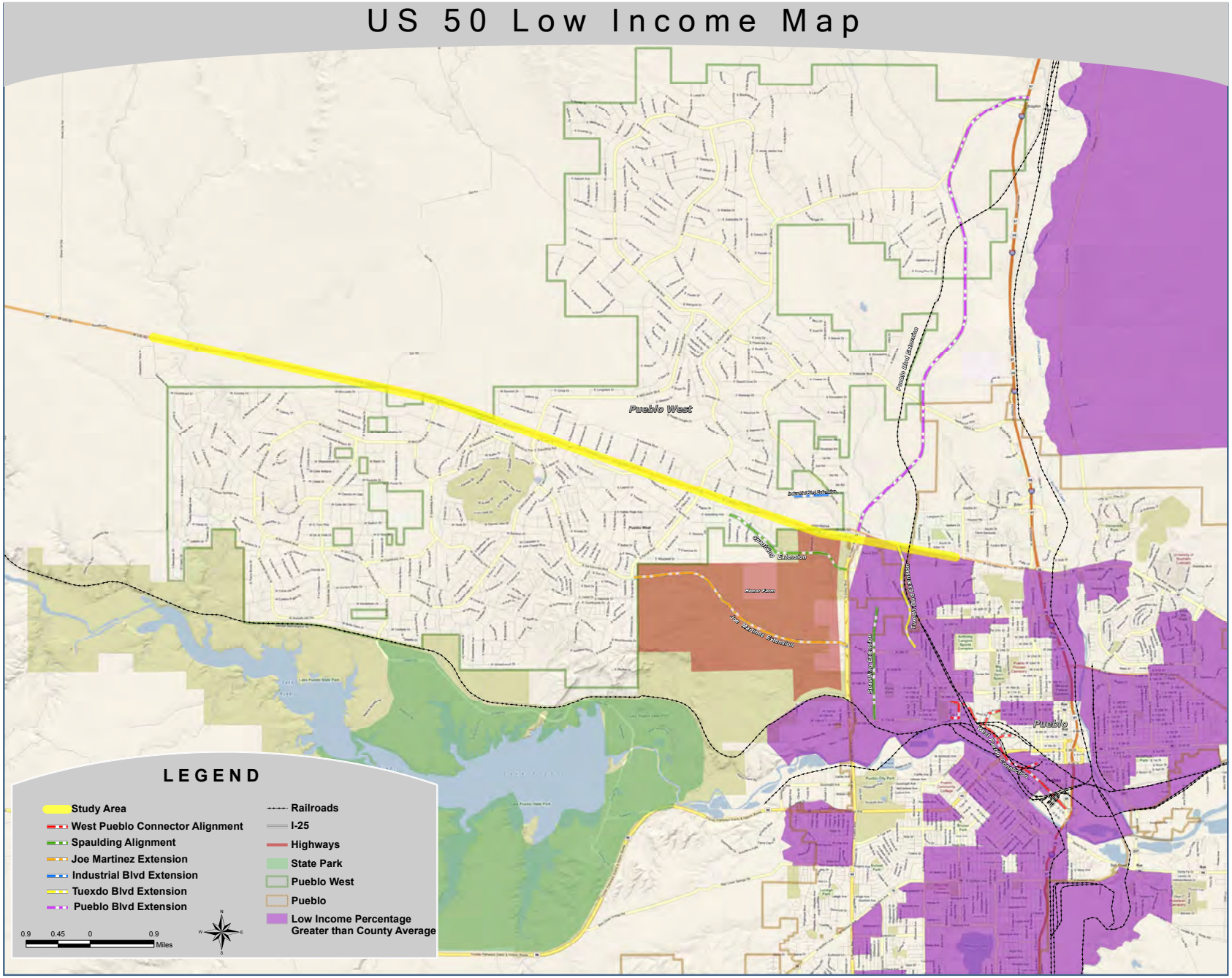


Figure 2-6. Map of Low-Income Block Groups in the US 50 Study Area



2.4.2 Where are there historic properties, recreational properties, or wildlife refuges?

To identify historic properties, the study team searched a database maintained by the Colorado Office of Archaeology and Historic Preservation (OAHP), the official repository of cultural resources records for the state. (See **Chapter 3, Section 3.11** of this PEL Study for a detailed discussion of the historic property search.) For a property to be included in the database, a historic survey must be taken. **Figure 2-7** shows the locations in the study area where previous historic surveys have been conducted. Note that a considerable effort was made to complete surveys as part of the I-25 New Pueblo Freeway EIS. Other survey efforts focused on Pueblo Blvd. and 24th St.

The study identified no known recorded historic properties near US 50 between Swallows Rd. and Baltimore Ave. No known recorded historic properties were found near the alignments of the Pueblo Blvd. Extension, the Industrial Blvd. Extension, either section of the Spaulding Ave. Extension, or the Joe Martinez Blvd. Extension section of the WPC through the Honor Farm Park and Open Space.

The study team found that most historic properties are located near downtown Pueblo and the historic Union Street District. **Figure 2-8** highlights these previously recorded sites in yellow. The WPC has the potential to affect these properties. However, since a final alignment of the WPC has not been established, no determination can be made as to whether constructing this local improvement would constitute a use of these properties under federal regulations.

Some other historic properties were found near 24th St. near Tuxedo Blvd., and near Tuxedo Blvd. between 18th St. and 24th St. While ROW would likely not be required from these properties, additional analysis is necessary to determine if other impacts, such as noise, would constitute a use of these properties.

What is a Section 4(f) protected property?

Section 4(f) of the U.S. Department of Transportation Act of 1966, as amended, and codified in 49 United States Code §303, declares that "[i]t is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites."

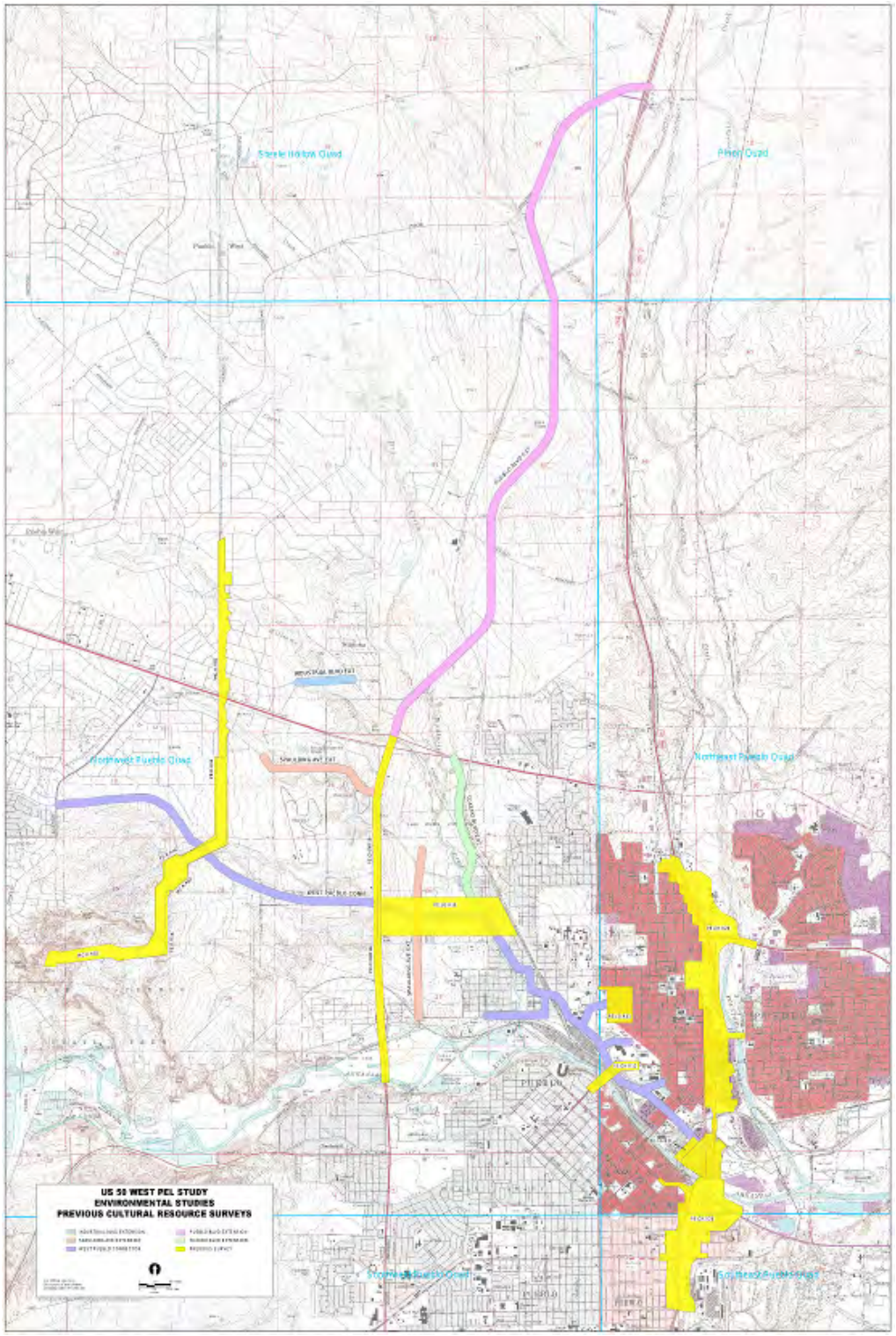
Section 4(f) specifies that:

> *"The Administration may not approve the use of a Section 4(f) property unless it makes a determination that:*
>
> *1) there is no feasible and prudent avoidance alternative to the use of land from the property; and*
>
> *2) the action includes all possible planning to minimize harm to the property resulting from such use."*

The joint Federal Highway Administration (FHWA)/Federal Transit Administration (FTA) regulations for Section 4(f) compliance are found at 23 Code of Federal Regulations (CFR) §774, and following. Additional guidance is available from the FHWA Technical Advisory T 6640.8A (1987) and the revised FHWA Section 4(f) Policy Paper (2005).

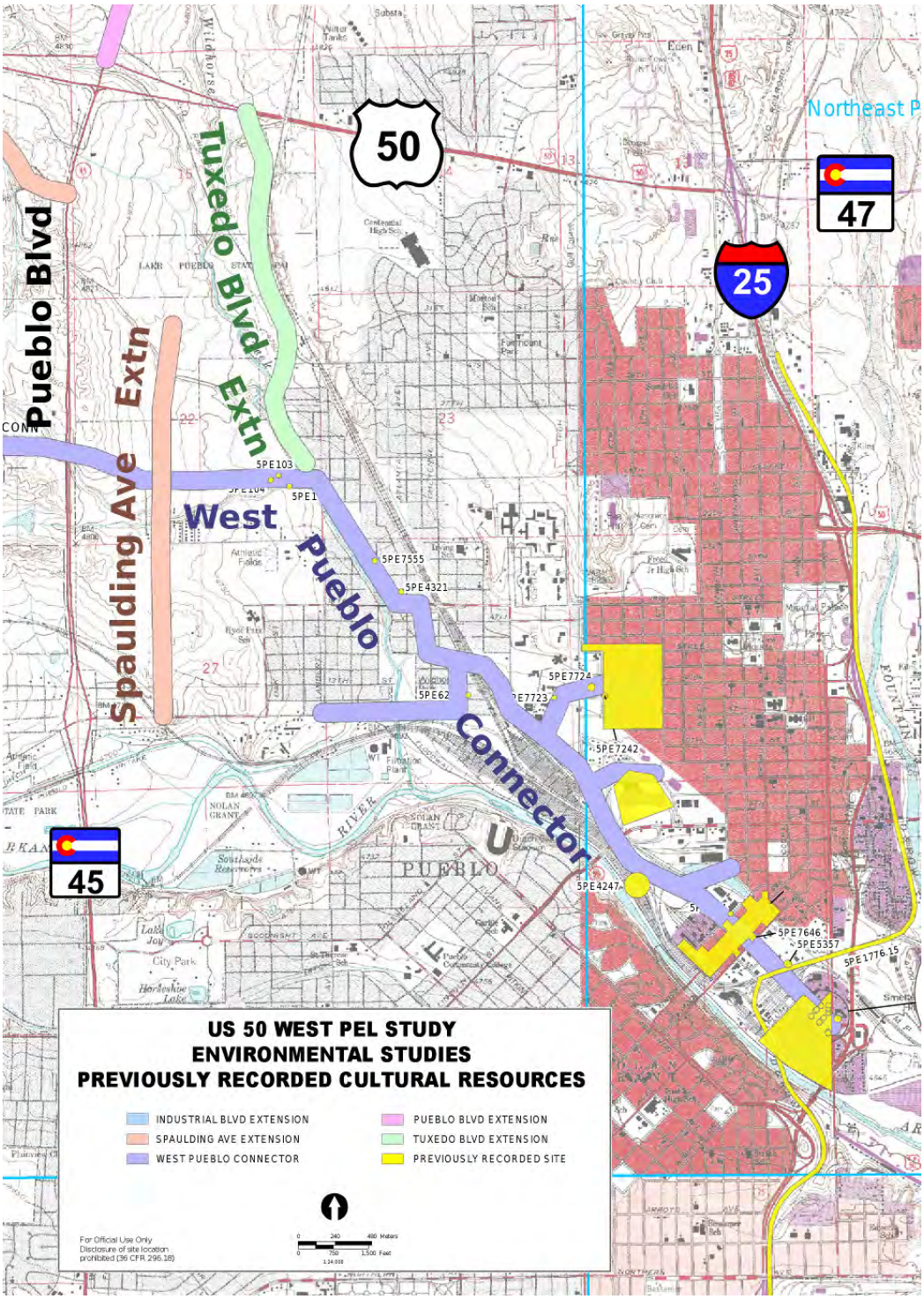
As defined in 23 CFR part §774.17, the "use" of a protected Section 4(f) property occurs in any of the following cases:

1. Land is permanently incorporated into a transportation facility. (This is called a direct use.)
2. There is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose. (This is called a temporary direct use.)
3. There is no permanent incorporation of land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify the property for protection are substantially impaired. (This is called a constructive use.)



Source: WCRM, 2011.

Figure 2-7. Study Area for Historical Resources



Source: WCRM, 2011.

Figure 2-8. Historical Resources in Downtown and Northwest Pueblo

While the database search found only the previously listed properties, other historic properties could exist elsewhere. Fieldwork to identify historic properties would need to be undertaken in any corridor where federal funds are used to build improvements, such as along US 50.

The most prominent recreational property in the study area is the Honor Farm Park, which is south of US 50 between Purcell Blvd. and Pueblo Blvd. The City of Pueblo purchased the property from the State of Colorado and developed a master plan for recreational uses, including:

- On- and off-road vehicle use
- A radio-controlled aircraft area
- Playgrounds
- Picnic areas
- Trails
- Natural conservation areas

Figure 2-9 shows a map of the recreational use areas from the *Honor Farm Park and Open Space Master Plan* (2007). Note that the area closest to US 50 is dedicated to private development uses. Similarly, the Spaulding Ave. Extension that passes through this land is planned for private development. Because the master plan reserves ROW for the Joe Martinez Blvd. Extension (part of the WPC), it is not subject to Section 4(f), which governs the use of parks and recreational properties for transportation projects.

Figure 2-10 shows the properties in the study area that have received Land and Water Conservation Funds and would be protected under Section 6(f). They include:

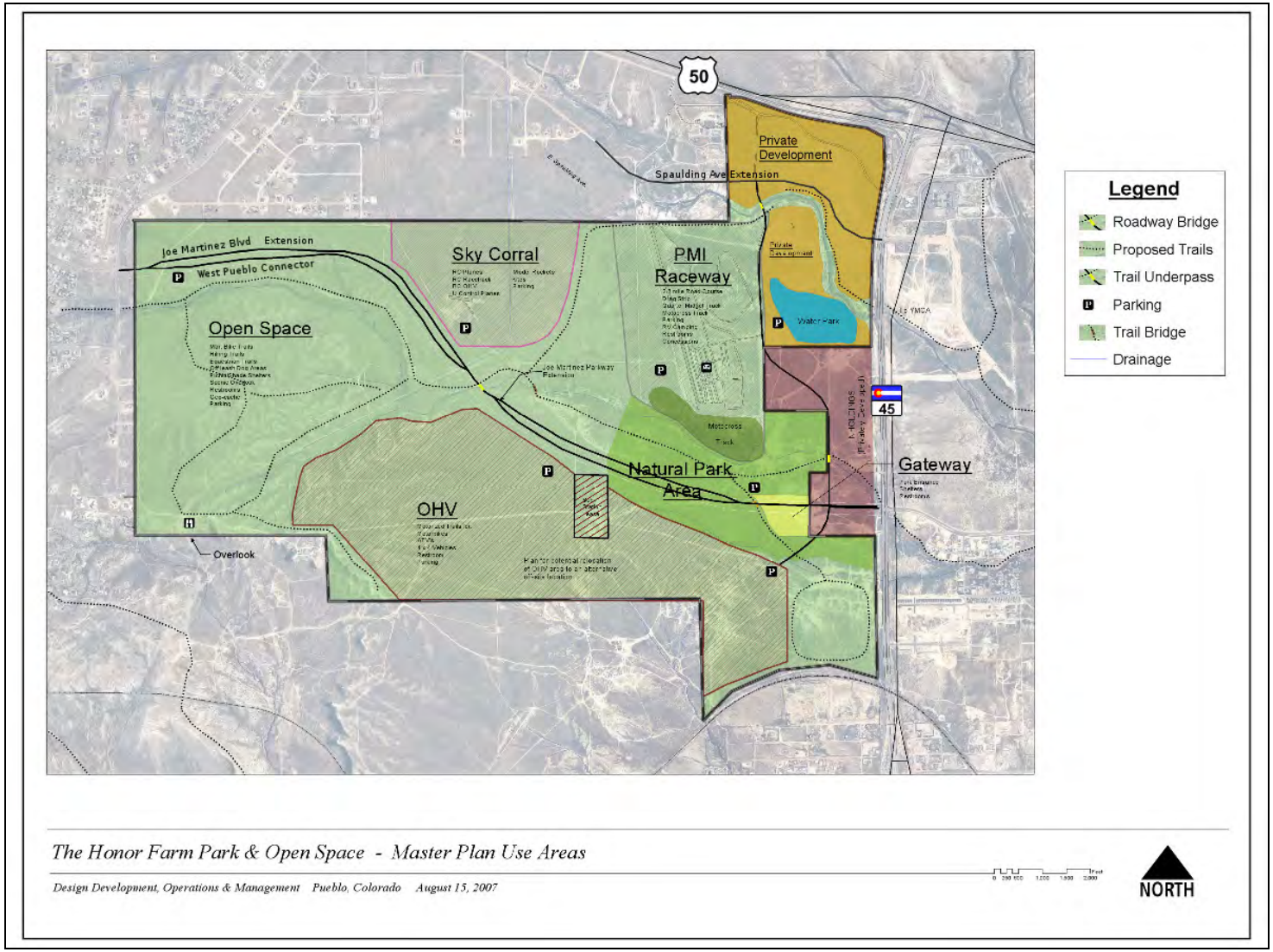
- Hyde Park, near the Dolores Huerta Preparatory High School and Cesar Chavez Academy, south of 18th St., between Spaulding Ave. and Oak St.
- Northridge School Park, at North Drive and Peakview Drive, about three-eighths of a mile north of US 50 between Wills Blvd. and Baltimore Ave.
- Lovell Park in Pueblo West, on Hahns Peak Ave. between Joe Martinez Blvd. and Purcell Blvd.
- Liberty Point in Pueblo West, at the south end of Purcell Blvd., overlooking Lake Pueblo
- Lake Pueblo State Park, where Land and Water Conservation Funds were used to purchase several buoys

What is a Section 6(f) protected property?

In addition to the National Environmental Policy Act (NEPA), other laws and regulations that apply to recreation resources include Section 6(f) of the Land and Water Conservation Fund Act (36 Code of Federal Regulations 59). Section 6(f) protects recreational lands planned, acquired, or developed with Land and Water Conservation Funds.

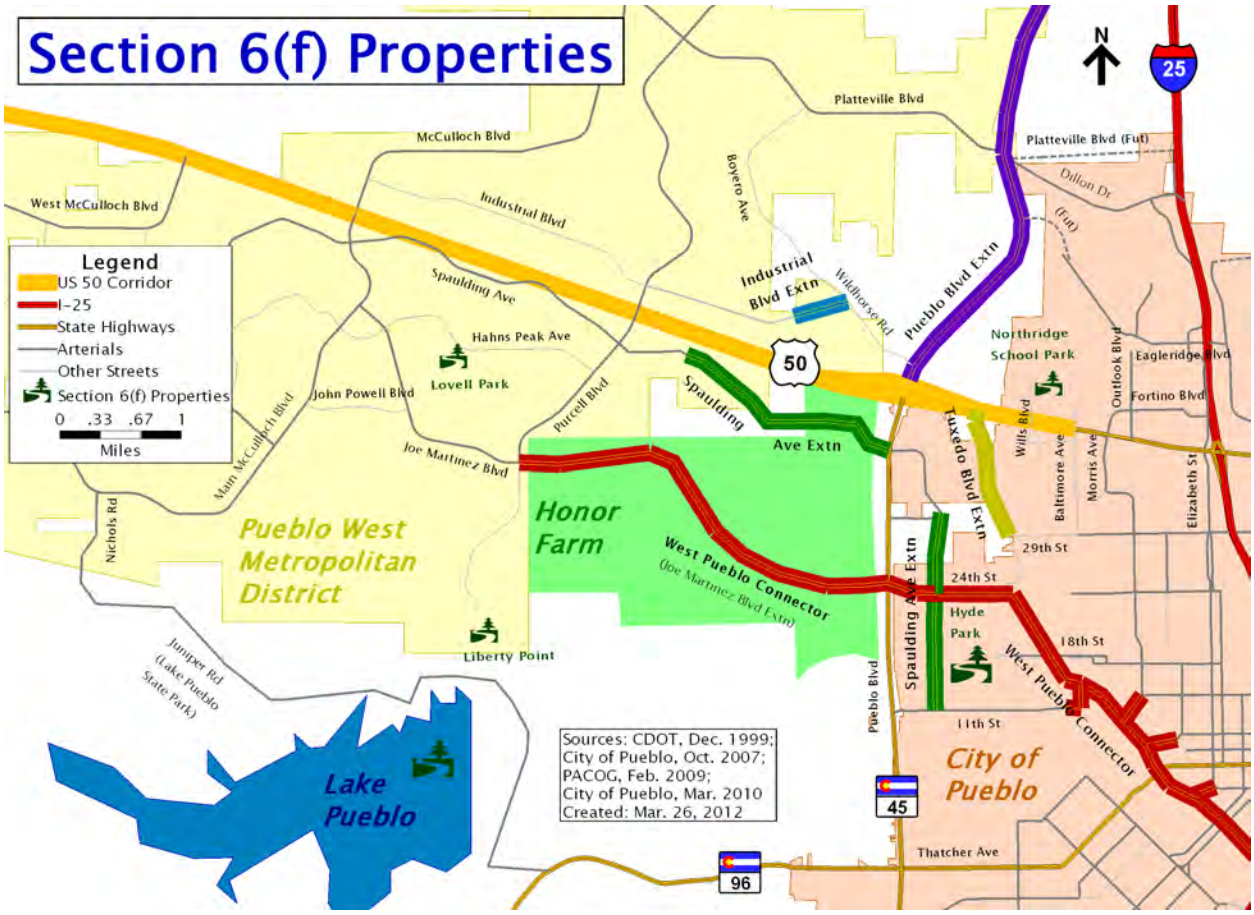
The Spaulding Ave. Extension could potentially have impacts on Hyde Park, although it is unlikely that additional ROW is required here since this section of Spaulding Ave. has already been constructed.

There are no wildlife refuges in the US 50 study area.



Source: City of Pueblo, 2007

Figure 2-9. Future Recreational Use Areas in Honor Farm Park



Sources: CDOT, 2012; CPW, 2012

Figure 2-10. Section 6(f) Properties in the Study Area

2.5 What facility types passed Level 1 screening?

Table 2-2 shows all of the facility types that passed Level 1 screening.

As mentioned previously, the minority and low-income families who live near US 50 live behind businesses that are adjacent to the highway. No Section 4(f) or 6(f) protected properties were found along US 50. Because facility types 1, 2, 3, and 5 have improvements only on US 50, these were not considered fatally flawed.

The study team decided that the local improvements that form parts of facility type 4 fell into one of the following three categories regarding environmental justice:

- There are no impacts because the local improvement is built in an undeveloped area.
- Any impacts from the local improvements can be mitigated.
- The improved access the roads offer offsets the impacts from the local improvements.

While it is possible that the local improvement projects could be designed to avoid, minimize, or mitigate disproportionately high and adverse impacts on environmental justice communities, additional analysis and data collection would be required to make such a determination.

Table 2-2. Level 1 Screening Summary

Facility Type	Any Fatal Flaws Related to		Result
	Environmental Justice?	Section 4(f) or 6(f) Resources?	
No Action Alternative	No	No	Retain
1 – Four-Lane Expressway	No	No	Retain
2 – Six-Lane Expressway	No	No	Retain
3 – Four-Lane Freeway	No	No	Retain
4 – Combined Local Improvements	Unknown*	Unknown*	Retain*
5 – Six-Lane Freeway	No	No	Retain

*Note: * While environmental justice communities and Section 4(f) or 6(f) protected properties are present near some local improvement projects, the preliminary nature of some alignments and incomplete resource data collection makes it impossible to determine if potential impacts would constitute a fatal flaw. Also, Section 4(f) and 6(f) protections do not apply to projects built without federal funds. The study team chose to advance facility type 4 to traffic analysis in Level 2 evaluation on the assumption that these impacts could be avoided, minimized, or mitigated.*

As discussed previously, there is the potential that the WPC would have an impact on some historic properties. However, the extent of these impacts cannot be calculated at this time. There is a possibility that the WPC would be built solely with local funds, in which case Section 4(f) and 6(f) protections would not apply.

Although the study team could not determine if the local improvement projects were fatally flawed, the study team chose to advance facility type 4 to Level 2 screening.

2.6 What intersection options were considered?

The study team considered a number of intersection options with a wide range of capacities and operating characteristics.

Each option is described in its own section in this Chapter. Aerial photography or design plans illustrate some of the less familiar types. **Table 2-3** found later in this Chapter presents the advantages and disadvantages of each configuration.

In this discussion, a distinction is made between the terms *intersection* and *interchange*. Intersection is used generically for where any two roads meet. An intersection may be at grade or grade-separated. If an intersection is grade-separated, it can also be said to be an interchange. Interchanges usually involve more complicated configurations because ramps have to connect the two grade-separated main roads. **Table 2-1** lists the design criteria for interchanges.

Intersection Options Considered

- Unsignalized intersection
- Signalized intersection
- Signalized intersection with flyover ramp
- Diamond interchange
- Diamond interchange with flyover ramp
- Single-point urban interchange (SPUI)
- Partial cloverleaf interchange
- Partial cloverleaf interchange with flyover ramps
- Four-level stack interchange
- Two-level roundabout interchange
- Three-level roundabout interchange
- Two-leg continuous flow intersection (CFI)
- Four-leg CFI
- Diverging diamond interchange

2.6.1 Unsignalized intersection

An unsignalized intersection is controlled by stop or yield signs on some or all of the approaches. State law includes the "rules of the road," which say when drivers on the signed approaches may proceed. Unsignalized intersections are the most familiar because so many intersections involve low-volume local roads.

2.6.2 Signalized intersection

Signalized intersections are controlled by the familiar red, yellow, and green traffic signals facing each approaching direction. A signal head with three or more lights is typically provided for each travel lane. Some signalized intersections use arrow signals to regulate turning traffic separately from through traffic. Signals are typically used between two roads with moderate volumes.

2.6.3 Signalized intersection with flyover ramp

A flyover ramp for a heavy left turn movement adds more capacity to a signalized intersection. The capacity of a signalized intersection is influenced by how long each approach or turning movement gets a green signal. By taking some left-turning traffic over or under the interchange rather than through the signal, the time that would have been given for that left turn movement can now be allocated to the remaining movements at the intersection. **Figure 2-11** shows a signalized intersection with a flyover ramp.

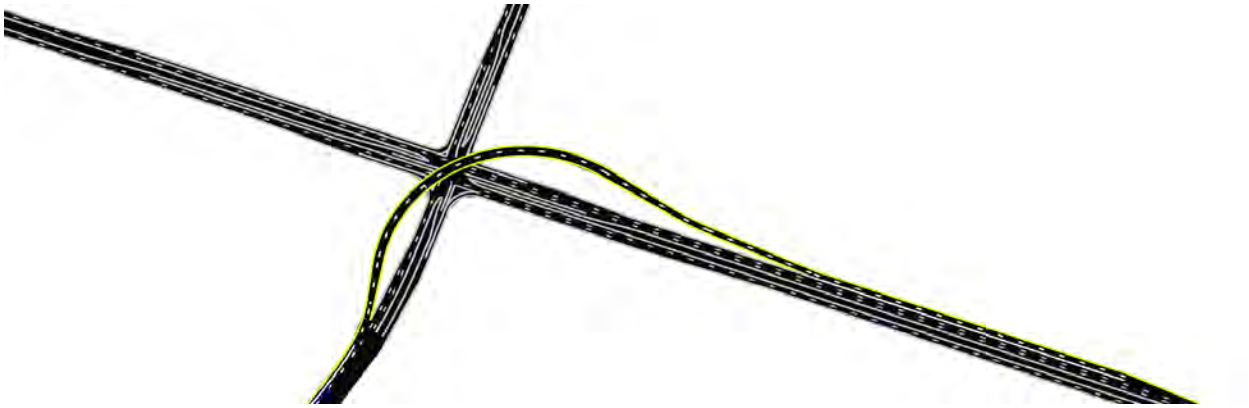


Figure 2-11. Plan Drawing of a Signalized Intersection with Flyover Ramp

2.6.4 Diamond interchange

A diamond interchange, named for the shape made by its ramps, is perhaps the simplest grade-separated interchange. The main road is divided and passes over or under a crossing road without having to stop. Off-ramps split from the main road and intersect the crossing road at signalized or unsignalized intersections. On-ramps from the same intersection allow traffic from the crossing road to enter the main road. Ramps may be aligned close to the main roadway to minimize ROW requirements. This type of diamond interchange is referred to as a tight urban diamond interchange (TUDI).

Figure 2-12. Aerial Photo of the Diamond Interchange at I-25 and 13th St. in Pueblo

There are several diamond interchanges (or modified diamond interchanges) in Pueblo on I-25. **Figure 2-12** shows the diamond interchange at I-25 and 13th St. near downtown Pueblo. Note that this particular diamond interchange has only three legs because 13th St. does not cross Fountain Creek.

2.6.5 Diamond interchange with flyover ramp

The diamond interchange with flyover ramp configuration is the same as the diamond interchange described in **Section 2.6.4**, with the addition of a flyover ramp to carry the heaviest turning movement over or under the interchange. By taking some left-turning traffic over or under the interchange rather than through the ramp intersections, the time that would have been given for that left turn movement can now be used by the remaining movements at the cross road intersections.

Figure 2-13 shows an example of a diamond interchange with flyover ramp. The roadways involved are I-225, which is traveling in a northeast and southwest direction, and SH 83 (Parker Rd.). Although SH 83 is signed as a northbound and southbound route, at this location, it travels more east and west. The flyover ramp carries the heavy volume from northbound SH 83 (traffic traveling west) to southbound I-225 (heading southwest).

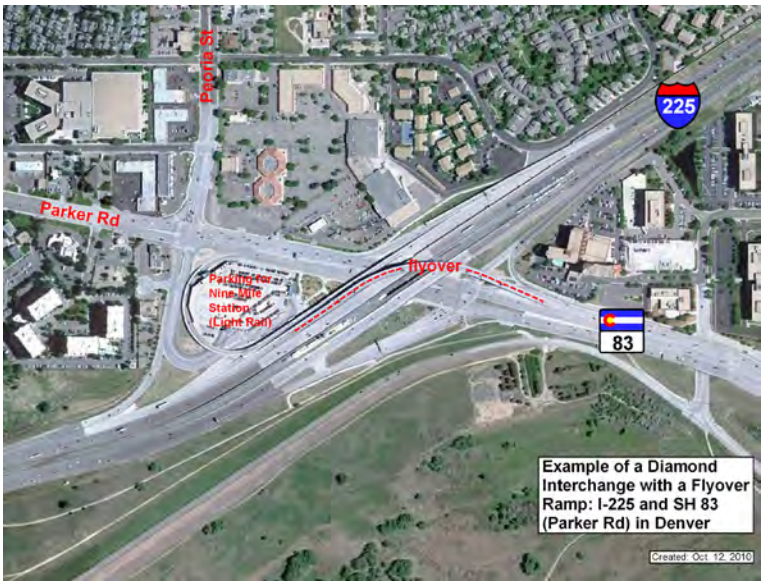


Figure 2-13. Aerial Photo of a Diamond Interchange with Flyover Ramp at I-225 and SH 83 in Denver

In this example, the on-ramp to southbound I-225 from southbound SH 83 (Parker Rd. heading east) is at Peoria St., offset from the southbound I-225 off-ramp.

A special case happens when a diamond interchange with flyover ramp is used at a three-leg intersection. **Figure 2-14** shows such a case where SH 58 meets I-70 in Wheat Ridge. SH 58 is an east-west highway, and while I-70 is signed east-west, here it goes to the south and northeast.

Suppose the heaviest left turn movement here is from eastbound SH 58 to eastbound I-70. (This is actually the ramp built first.) Because SH 58 does not continue east of I-70, there is no need for a diamond ramp in the northeast quadrant. That is, because there is no westbound approach, there is no need for a ramp to accommodate a westbound right turn heading northeast onto eastbound I-70.

Figure 2-14. Three-Leg Version of Diamond Interchange with Flyover Ramp

If a traditional diamond-shaped ramp were to be provided in the southeast quadrant, it would connect with only westbound SH 58. Because there would be no conflicting traffic movements, the eastbound I-70 off-ramp traffic would flow more smoothly if that ramp curved into westbound SH 58, essentially creating a second flyover ramp.

This three-leg diamond interchange with flyover ramp configuration shown in **Figure 2-14** is sometimes called a *fully directional Y* or *fully directional T* interchange because of the shape made by the ramps. Note that there is no need for traffic signals anywhere in such a configuration.

2.6.6 Single-point urban interchange

The single-point urban interchange (SPUI) configuration is a modification of the diamond interchange. The four ramp terminals of the diamond are brought together to meet at a single point on the cross road, either above or below the main road. This allows all turning and through movements to be controlled by one signal, not two, as on a conventional diamond. **Figure 2-15** shows a SPUI interchange. An example of a SPUI is US 50 at I-25.

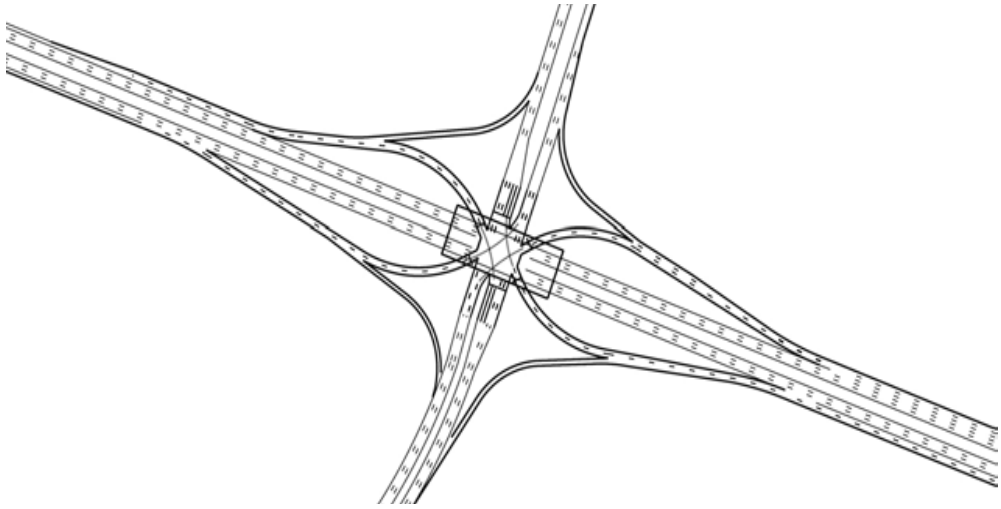


Figure 2-15. Single-Point Urban Interchange

2.6.7 Partial cloverleaf interchange

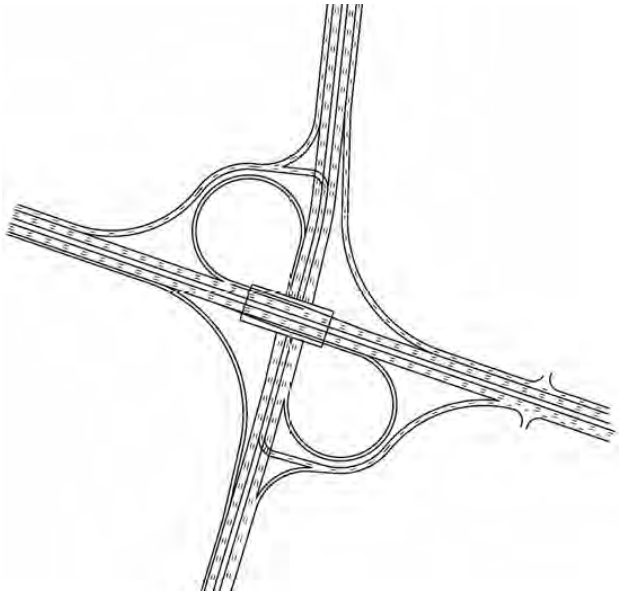


Figure 2-16. Partial Cloverleaf Interchange

A partial cloverleaf interchange is a variation of the full cloverleaf interchange. A full cloverleaf interchange has a loop ramp and a directional ramp in each of the four quadrants formed by the intersecting roadways. The full cloverleaf eliminates the need for all traffic signals on the cross road. However, the four loop ramps create short weaving sections where traffic entering the roadway will change lanes with traffic wanting to exit on a loop ramp. Because of these weaving areas, the full cloverleaf is not suitable to areas with heavy traffic volumes. The full cloverleaf configuration was not considered for the US 50 West PEL for this reason.

The partial cloverleaf configuration occurs when only two loop ramps are constructed diagonally across from each other. Left turning vehicles from one roadway use the loop ramps to merge onto the other roadway without stopping at a signal. For left turning movements where a loop ramp is not present, traffic signals are needed on the cross road.

Figure 2-16 shows a partial cloverleaf interchange. The nearest examples to Pueblo are I-25 and Academy Blvd. and US 24 (Platte Ave.) and SH 21 (Powers Blvd.) in Colorado Springs.

2.6.8 Partial cloverleaf with flyover ramps

A partial cloverleaf with flyover ramps configuration is the same as a partial cloverleaf, except with two flyover ramps added to eliminate the need for traffic signals on the cross road. **Figure 2-17** shows a design of such an interchange. This type of interchange is used in Denver where I-25 and US 6 meet.

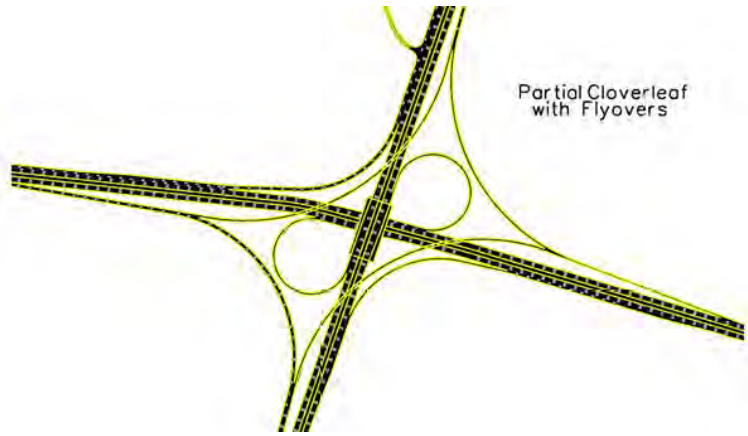


Figure 2-17. Plan View of a Partial Cloverleaf Interchange with Flyover Ramps

2.6.9 Four-level stack interchange

A four-level stack interchange is typically used at the crossing of two high-speed, high-volume roadways. The four-level stack interchange configuration offers the highest capacity and highest speed for turning vehicles. Off-ramps from the main road split into a flyover for left turns and a directional ramp for right turns. For on-ramps, the flyover and the directional ramp merge before joining the main road. **Figure 2-18** shows an example of a four-level stack interchange north of Denver where I-25 crosses E-470 and the Northwest Parkway.

Figure 2-18. Profile View of the Four-Level Stack Interchange at I-25, E-470, and the Northwest Parkway

2.6.10 Two-level roundabout interchange

There are two ways to picture a two-level roundabout interchange. One way is to imagine a diamond interchange where the ramp intersections are replaced with one or two roundabouts. The second way is to imagine an at-grade (one-level) roundabout where a heavy through movement is later grade separated. The net result is that through traffic on the major road can flow unimpeded while through traffic on the minor road and all turning traffic use a roundabout. The roundabout can have a traditional circular shape or can be compressed to a figure-8 shape to minimize the required bridges. The figure-8 roundabout can be further modified into two smaller roundabouts so that U-turning traffic does not need to cross the major road twice.

Figure 2-19 and **Figure 2-20** illustrate the two types of two-level roundabout interchanges.

Figure 2-19 shows a two-level roundabout interchange with a circular (or oval) roundabout near Woburn, Massachusetts. The major roadway, I-95, crosses east to west above Massachusetts SH 38, which travels north and south. Note that because this roundabout is a large oval, I-95 must cross above it on two sets of bridges—one above southbound traffic and one above northbound traffic.

Figure 2-20 shows a two-level roundabout interchange in Avon, Colorado, with a figure-8 roundabout. Here, I-70 is the major road, traveling generally east and west. Avon Rd. travels north and south through the interchange and then becomes Nottingham Rd. north of I-70. Using a figure-8 means there is only one set of bridges on I-70. However, traffic in the Avon roundabouts must travel more slowly than traffic in the roundabout shown in **Figure 2-19**.

Figure 2-19. Aerial Photo of a Two-Level Roundabout Interchange with a Circular Roundabout in Massachusetts

Figure 2-20. Aerial Photo of a Two-Level Roundabout Interchange with a Figure-8 Roundabout in Avon, Colorado

2.6.11 Three-level roundabout interchange

The three-level roundabout interchange uses a roundabout for making all turning movements between the cross roads. The through traffic on each cross road is separated from the turning movements by bridges over or under the roundabout.

Figure 2-21 shows an example of a three-level roundabout interchange.

Figure 2-21. Aerial View of a Three-Level Roundabout Interchange in Louisiana

2.6.12 Two-leg continuous flow intersection

The continuous flow intersection (CFI) is a variation of the standard, at-grade signalized intersection and is sometimes called a displaced left-turn intersection for reasons that will be seen. **Figure 2-22** provides an example of a two-leg CFI.

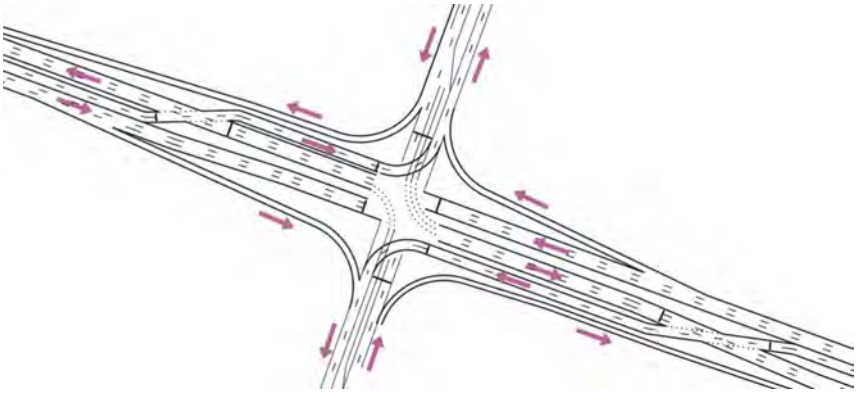


Figure 2-22. Two-leg Continuous Flow Intersection

At conventional intersections, left-turn movements are frequently made from separate left-turn lanes directly onto the cross road. Drivers turning left must cross the path of the oncoming through traffic. At a CFI, left turn traffic is laterally displaced before reaching the main crossroad. In other words, left turning traffic crosses over the opposing through movement at a location several hundred feet upstream of the major intersection. This upstream crossover location is typically signal controlled. The left turning traffic then travels on a separated road, which is on the outside of the opposing though lanes, toward the major intersection. When these left-turning motorists reach the major intersection, they can proceed without conflict at the same time as the opposing through traffic.

A two-leg CFI implies that only one of the cross streets uses the displaced left turn; the other cross street has the standard left-turn lane location between the two opposing directions.

The advantage of a two-leg CFI is that it reduces the number of signal phases required at the main intersection. At a standard signalized intersection, eight signal phases are required, which are displayed in a sequence of four pairs, for example:

1. Eastbound and westbound left turns
2. Eastbound and westbound through traffic
3. Northbound and southbound left turns
4. Northbound and southbound through traffic

In the example shown in **Figure 2-22**, the eastbound and westbound left turn and through traffic phases are combined, resulting in a total of three pairs of signal phases for the main intersection. During each signal phase, time is lost when drivers react to the light turning green, then again at the end of the yellow signal, and when the signals show red in every direction so that cars can clear the intersection. Therefore, a signal with fewer phases, such as with a two-leg CFI, operates more efficiently.

A two-leg CFI was recently built in Loveland, at US 34 (Eisenhower Blvd.) and Madison Ave.

2.6.13 Four-leg continuous flow intersection

A four-leg CFI, shown in **Figure 2-23**, uses the same concept as the two-leg CFI, except with displaced left turn lanes on both cross streets. Just as a two-leg CFI has one fewer signal phase than a traditional signalized intersection, a four-leg CFI has two fewer signal phases than a two-leg CFI. That is, a four-leg CFI requires only two pairs of signal phases, one for the eastbound and westbound approaches and the other for the northbound and southbound approaches.

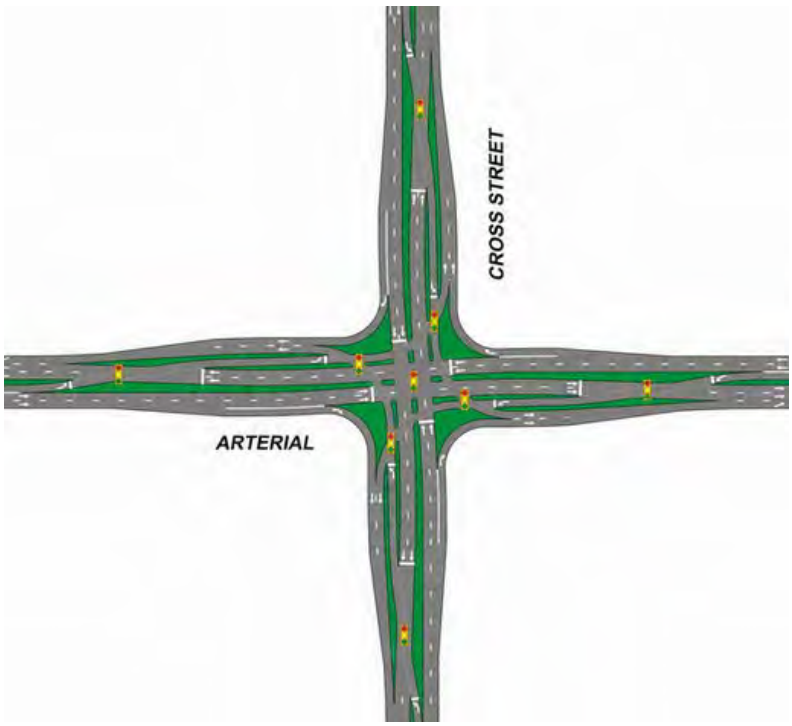


Figure 2-23. Four-leg Continuous Flow Intersection

2.6.14 Diverging diamond interchange

Similar to the design of a conventional diamond interchange, the diverging diamond interchange (DDI) differs in the way that the left and through movements navigate between the ramp terminals. The purpose of this interchange design is to accommodate left-turning movements onto arterials and limited-access highways, while eliminating the need for a left-turn bay and signal phase at signalized ramp intersections.

Figure 2-24. Aerial View of a Diverging Diamond Interchange in Springfield, Missouri

Figure 2-24 shows that the first DDI located in the United States was built in Springfield, Missouri. Some DDIs have also been built in Utah.

The highway is connected to the arterial cross street by two on-ramps and two off-ramps in a manner similar to a conventional diamond interchange. However, on the cross street, the traffic moves to the left side of the roadway between the ramps. This allows the vehicles on the cross street that need to turn left onto the ramps to continue to the on-ramps without conflicting with the opposing through traffic.

2.7 What general features distinguish the intersection options?

Each intersection option is ideal for certain types of traffic patterns and not well suited for others. Other factors, such as the construction and installation cost as well as the amount of land it requires, may also help determine what intersection option would be appropriate. **Table 2-3** lists benefits of each intersection option and identifies issues that may lead to the consideration of other options.

Table 2-3. Benefits and Issues Concerning Intersection Options

Intersection Options	Benefits	Issues
Unsignalized intersection	• Inexpensive – No electrical or mechanical equipment • Most familiar	• Can only accommodate very low volumes
Signalized intersection	• Use of signals to control the duration of each phase	• Limit to traffic volumes accommodated
Signalized intersection with flyover ramp	• By grade separating a high-volume turning movement, more signal green light time for other movements • Potentially lower cost than grade separating through movements	• Limit to traffic volumes accommodated • Long ramp lengths required to get vertical clearance over roadways
Diamond interchange	• No delay to through movements on major roadway • Familiar to drivers • Intersection of ramps and cross street may be signalized or unsignalized • May align ramps close to the main road to minimize ROW requirements (TUDI) • May be built in phases	• Small to medium footprint • Difficult to coordinate both signals at ramp intersections to provide favorable progression (signals timed to turn green as vehicles arrive) to all movements

Intersection Options	Benefits	Issues
Diamond interchange with flyover ramp	• No delay to high-volume turning movement using flyover • May add flyover to diamond interchange when needed	• Small to medium footprint • Flyover structure adds to interchange cost
Single-point urban interchange	• Single traffic signal for intersection of ramps and cross street • Familiar to driver – Existing interchange at I-25 and US 50	• Pedestrians and cyclists on cross street must cross three sets of ramps • Increased cost due to longer or greater number of structures than diamond interchange • Small to medium footprint
Partial cloverleaf interchange	• High-volume left turn movements accommodated with loop ramps rather than at signalized intersection • Structure requirements comparable to diamond interchange • May be built in phases	• Large footprint • Low-speed loop ramps
Partial cloverleaf interchange with flyover ramps	• Fully grade separated - No signals • Flyover ramps allow high-speed (45 mph) travel for high-volume left turn movements	• Tall structures • Large footprint • Independent pedestrian/bicycle facility needed
Four-level stack interchange	• Fully grade separated - No signals • All ramps allow high-speed (45 mph) travel for all turn movements • May be built in phases	• Tall structure – 70 to 80 ft. • Greatest cost of all intersection options • Large footprint • Independent pedestrian/bicycle facility needed
Two-level roundabout interchange	• Grade separated with no signals • Through movements of the major roadway bypass the roundabout(s)	• Tradeoff among structure requirements, roundabout size, and travel speed within roundabout(s) • Through movements of crossing roadway pass through one or two roundabouts
Three-level roundabout interchange	• Fully grade separated - No signals • Through movements bypass roundabout	• Tall structures • Tradeoff between footprint size and travel speed within roundabout • Difficult to build in phases • Independent pedestrian/bicycle facility needed
Two-leg continuous flow intersection	• Main road left turns share green phase with through movement • Lower cost because no structures are required • May be built in phases	• May be disorienting for left turning vehicles driving to left of oncoming traffic • Unfamiliar to drivers - Only one in Colorado • Longer travel distance for pedestrians and bicycles to cross main road or use grade-separated crossing • Small to medium footprint

Intersection Options	Benefits	Issues
Four-leg continuous flow intersection	• Left turns share green phase with corresponding through movement • Lower cost because no structures are required • May be built in phases	• May be disorienting for left turning vehicles driving to left of oncoming traffic • Unfamiliar to drivers - None in Colorado • Longer travel distances for pedestrians and bicycles to cross main road or use grade-separated crossing • Small to medium footprint
Diverging diamond interchange	• Left turns are free or yield-controlled movements to and from ramps • Accommodates large left turning volumes • May be built in phases from a conventional diamond interchange	• May be disorienting for through vehicles driving to left of oncoming traffic • Unfamiliar to drivers - None in Colorado • May be difficult to accommodate pedestrians and bicycles crossing at ramps • Medium footprint

Notes: ft = feet ROW = right-of-way TUDI = tight urban diamond interchange

2.8 Why were so many intersection options considered?

Through a comprehensive analysis, the study team considered many intersection options to identify which ones were best suited for the intersections along US 50. Because the study team examined so many intersection options at the PEL level, they should not have to be re-examined later during the site-specific environmental clearance process.

2.9 What were the considerations for Level 2 screening?

Level 2 screening considered the Purpose and Need elements, including safety, mobility, and access to development. The most pressing safety issues in the Corridor are related to congestion around intersections (see **Chapter 1, Section 1.4.4,** of this PEL Study for more details). Improvements that reduce congestion and improve the LOS at intersections would also be expected to improve safety. Building improvements to US 50 according to current design standards would also address other existing safety concerns.

All of the facility types examined during Level 1 screening for US 50 (that is, facility types 1, 2, 3, and 5) involve the same access points. While the combined local improvements (facility type 4) could create access to new, currently undeveloped parcels, these improvements do not meet the mobility criterion of the Purpose and Need. Therefore, at Level 2, the remaining facility types were equal in terms of the access they provide. Level 3 evaluation examined the access implications of specific intersection options, as described in **Section 2.12**.

As a result, Level 2 screening focused on the ability of the intersection options to address the Purpose and Need of reducing congestion and improving mobility. The PACOG travel demand model uses 2035 as its future forecast year, and the team adopted this year to test the intersection options.

Traffic operations are described by LOS, which is a letter grade that represents congestion. LOS A is the most free-flowing, while LOS F is "failing" because demand is greater than the available

capacity. Because the current bottlenecks on US 50 involve the intersections, the Level 2 analysis focused on these locations. At intersections, LOS is based on the average delay to vehicles.

2.9.1 Why was LOS D chosen as the threshold for meeting the Purpose and Need?

The PACOG travel demand model predicts traffic volumes for a typical weekday when school is in session. The study team wanted 2035 traffic to flow smoothly for this condition so that unusually high volumes (such as those related to special events) and future traffic growth could potentially be accommodated. The study team decided that roads operating near or over capacity—corresponding to LOS E and F—did not accommodate these 2035 traffic levels and, therefore, did not meet the Purpose and Need. AASHTO (2004) recommends LOS C as the appropriate design LOS for an urban or suburban arterial such as US 50, although LOS D can be tolerated for highly developed areas. Considering the intensity of development in certain sections along the Corridor, the likely availability of future funding, and the likely competition for funding with other corridors, such as the I-25 New Pueblo Freeway, the study team decided that LOS D was an appropriate threshold for the study Purpose and Need. However, the team also recognized that there might be cost-effective improvements at certain locations that might bring the LOS to C or better and included this consideration in the Purpose and Need.

2.9.2 How does the LOS at intersections compare for the options considered?

Table 2-4 summarizes the 2035 LOS for the 13 intersection options tested at the 7 crossings along US 50. Not surprisingly, unsignalized intersections had the worst LOS of any of the options and did not meet the Purpose and Need anywhere in 2035. Signalized intersections (with or without flyover ramps) had the next worst LOS. However, signalized intersections met the Purpose and Need at Swallows Rd. and West McCulloch Blvd. They also met the Purpose and Need at Wills Blvd. and Baltimore Ave. if the Pueblo Blvd. Extension and WPC are also built.

Diamond interchanges (with or without flyover ramp) and SPUIs met the Purpose and Need everywhere except Pueblo Blvd. Likewise, neither version of the CFI could handle all of the traffic at Pueblo Blvd.

A partial cloverleaf interchange or a DDI met the Purpose and Need at each of the seven locations. In fact, partial cloverleaf interchanges had among the best LOS of intersection options that use traffic signals.

A two-leg CFI met the Purpose and Need at the five intersections other than Purcell Blvd. and Pueblo Blvd. A four-leg CFI met the Purpose and Need everywhere except Pueblo Blvd.

Although LOS was not calculated, a capacity analysis described in **Appendix B** showed that a two-level roundabout interchange would be inadequate at Main McCulloch Blvd., Purcell Blvd., and Pueblo Blvd. The study team decided to treat the two-level roundabout interchange as a design option of a diamond interchange for the four remaining intersections in the Corridor.

Table 2-4. 2035 Intersection Levels of Service for Options and Facility Types Examined

Intersection Option	Swallows Rd.	West McCulloch Blvd.	Main McCulloch Blvd.	Purcell Blvd.
Unsignalized Intersection	"f"/ "f" [a]	"f" / "f" [a]	"f" / "f" [a, b]	"f" / "f" [a, b]
Signalized Intersection	B / B	B / C	E / E	F / F [a]
Signalized Intersection with Flyover Ramp	B / B	A / B	D / E [c]	F / F [c]
Diamond Interchange – EB Ramps	N/A	N/A	B / C	D / C
Diamond Interchange – WB Ramps	A / C [e]	A / A [e]	C / C	D / C
Diamond Interchange with Flyover Ramp – EB Ramps	N/A	N/A	B / C	D / B
Diamond Interchange with Flyover Ramp – WB Ramps	N/A	N/A	A / B	D / B
Single-Point Urban Interchange	A / C [e]	A / A [e]	D / D	D / C
Partial Cloverleaf Interchange – EB (or NB) Ramps	N/A	N/A	A / A	A / A
Partial Cloverleaf Interchange – WB (or SB) Ramps	N/A	N/A	A / A	A / A
Two-Leg Continuous Flow Intersection	N/A	N/A	D / D [e]	E / E [e]
Four-Leg Continuous Flow Intersection	N/A	N/A	D+ / D+ [b, e]	C / D [e]
Diverging Diamond Interchange	N/A	N/A	B+ / C+ [b, d]	C+ / B+ [b, d]

	Pueblo Blvd. (SH 45)			
Intersection Option	At US 50 EB	At US 50 WB	Wills Blvd.	Baltimore Ave.
Unsignalized Intersection	"f"/ "f" [a, b]	"f" / "f" [a, b]	"f"/ "f" [a, b]	"f" / "f" [a, b]
Signalized Intersection	F / F [a]	F / F [a]	A / B	D / D
Signalized Intersection with Flyover Ramp	F / F [c]	F / F [c]	A / B	D+ / D+ [b]
Diamond Interchange – EB Ramps	B / B [d]	N/A	B / B [f]	A / A [f]
Diamond Interchange – WB Ramps	N/A	C / F [d]	A / A [f]	B / B [f]
Diamond Interchange with Flyover Ramp – EB Ramps	B / B [d]	N/A	C / B	A / A
Diamond Interchange with Flyover Ramp – WB Ramps	N/A	C / F [d]	A / A	A / A
Single-Point Urban Interchange	F / F [e] (ramps exit Pueblo Blvd.)		A / B	B / B
Partial Cloverleaf Interchange – EB (or NB) Ramps	A / A		A / A	A / A
Partial Cloverleaf Interchange – WB (or SB) Ramps	B / A		A / A	A / A

Intersection Option	Pueblo Blvd. (SH 45) At US 50 EB	Pueblo Blvd. (SH 45) At US 50 WB	Wills Blvd.	Baltimore Ave.
Two-Leg Continuous Flow Intersection	F / F [e]		D+ / D+ [b, e]	D / D [e]
Four-Leg Continuous Flow Intersection	E / E [e]		D+ / D+ [b, e]	D+ / D+ [b, e]
Diverging Diamond Interchange	C / D [e]		C+ / C+ [b, d]	C+ / C+ [b, d]

Legend: *AM peak hour LOS / PM peak hour LOS*

Notes: *For unsignalized intersections, LOS is shown with a lowercase letter in quotation marks indicating the LOS for the most-delayed movement of that intersection. LOS assumes Scenario 7 – Six-Lane Expressway with the Pueblo Blvd. Extension and WPC, unless otherwise specified.*

(See Appendix B for a full description of the travel demands associated with the various facility types and scenarios.)

A "+" suffix after an LOS indicates that level or better. For example, C+ indicates LOS A, B, or C.

N/A = Not applicable. In some instances this indicates a configuration with no crossing traffic streams and no vehicle delays.

"No Conflict" indicates there are no at-grade crossing movements. This is also the case for any partial cloverleaf interchange with flyover ramps, four-level stack interchange, or three-level roundabout interchange options; therefore, these options are not shown in the table.

Red highlighting indicates that an intersection does not meet the Purpose and Need criterion (LOS D or better) during the AM or PM peak hour.

[a] *Based on No Action.*

[b] *Inferred from similar intersection options or similar locations.*

[c] *Based on Facility Type 1, Four-Lane Expressway to specifically test signalized intersections with flyover ramps.*

[d] *Based on Facility Type 3, Four-Lane Freeway (without local improvements).*

[e] *Based on Scenario 6, Six-Lane Expressway with the Pueblo Blvd. Extension. This scenario does not include the WPC.*

[f] *Based on Facility Type 5, Six-Lane Freeway (without local improvements).*

Abbreviations: *EB = eastbound* *LOS = Level of Service* *NB = northbound* *SB = southbound* *SH = State Highway* *WB = westbound*

2.10 What facility types passed Level 2 screening?

Table 2-5 shows that facility types 1, 2, 3, and 5 passed Level 2 evaluation in whole or part. Under the No Action Alternative, all seven Corridor intersections are forecast to operate at LOS F during both peak hours in 2035. Although it did not meet the project Purpose and Need, the No Action Alternative was retained so that environmental analysis conducted at later stages of the evaluation process could follow NEPA regulations.

Table 2-5. Level 2 Facility Type Screening Results

Facility Type	2035 Mobility Evaluation	Screening Result
No Action Alternative	• Does not meet Purpose and Need	• Retain per NEPA guidelines
1 – Four-Lane Expressway	• Meets Purpose and Need west of Pueblo Blvd. with certain intersection options • Does not meet Purpose and Need east of Pueblo Blvd.	• Retain west of Pueblo Blvd. • Discontinue east of Pueblo Blvd.
2 – Six-Lane Expressway	• Meets Purpose and Need with certain intersection options	• Retain
3 – Four-Lane Freeway	• Meets Purpose and Need	• Retain

Facility Type	2035 Mobility Evaluation	Screening Result
4 – Combined Local Improvements	• Does not meet Purpose and Need for US 50	• Discontinue as a stand-alone alternative • Some improvements may be considered in travel demand sensitivity analyses because they are included in the PACOG *2035 LRTP*
5 – Six-Lane Freeway	• Meets Purpose and Need	• Retain

A multilane highway capacity analysis showed that as a four-lane expressway, US 50 did not operate at LOS D or better east of Pueblo Blvd. during one or both peak hours. Therefore, consideration of facility type 1 was discontinued east of Pueblo Blvd. but retained for west of Pueblo Blvd.

Mainline capacity analysis showed that as a six-lane expressway, US 50 would operate at LOS D or better during both peak hours. For US 50 to meet the Purpose and Need as an expressway, grade-separated interchanges must be provided at certain intersections—specifically Purcell Blvd. and Pueblo Blvd.—regardless of the lane width. Six through lanes on US 50 and additional turn bays are required for US 50 to function as a signalized intersection at Main McCulloch Blvd. in 2035.

Freeway capacity analysis showed that as a four-lane freeway, US 50 would operate at LOS D or better during either peak hour in 2035 Therefore, facility type 3 was retained.

Even with the combined local improvement projects included in facility type 4, intersection capacity analysis showed that US 50's intersections with Swallows Rd., West McCulloch Blvd., Purcell Blvd., and Baltimore Ave. would operate at LOS F during both peak hours in 2035. Additionally, the Main McCulloch Blvd. intersection is forecasted to operate at LOS E during the morning peak hour.

If not improved, the Pueblo Blvd. intersections in each direction of US 50 will operate at LOS F during both peak hours of 2035 under facility type 4. Because facility type 4 includes the Pueblo Blvd. Extension north from US 50, the study team also examined various intersection options for US 50 and Pueblo Blvd. Only certain high-capacity grade-separated interchanges, such as the partial cloverleaf interchange and the DDI, were capable of handling the anticipated demand at LOS D or better.

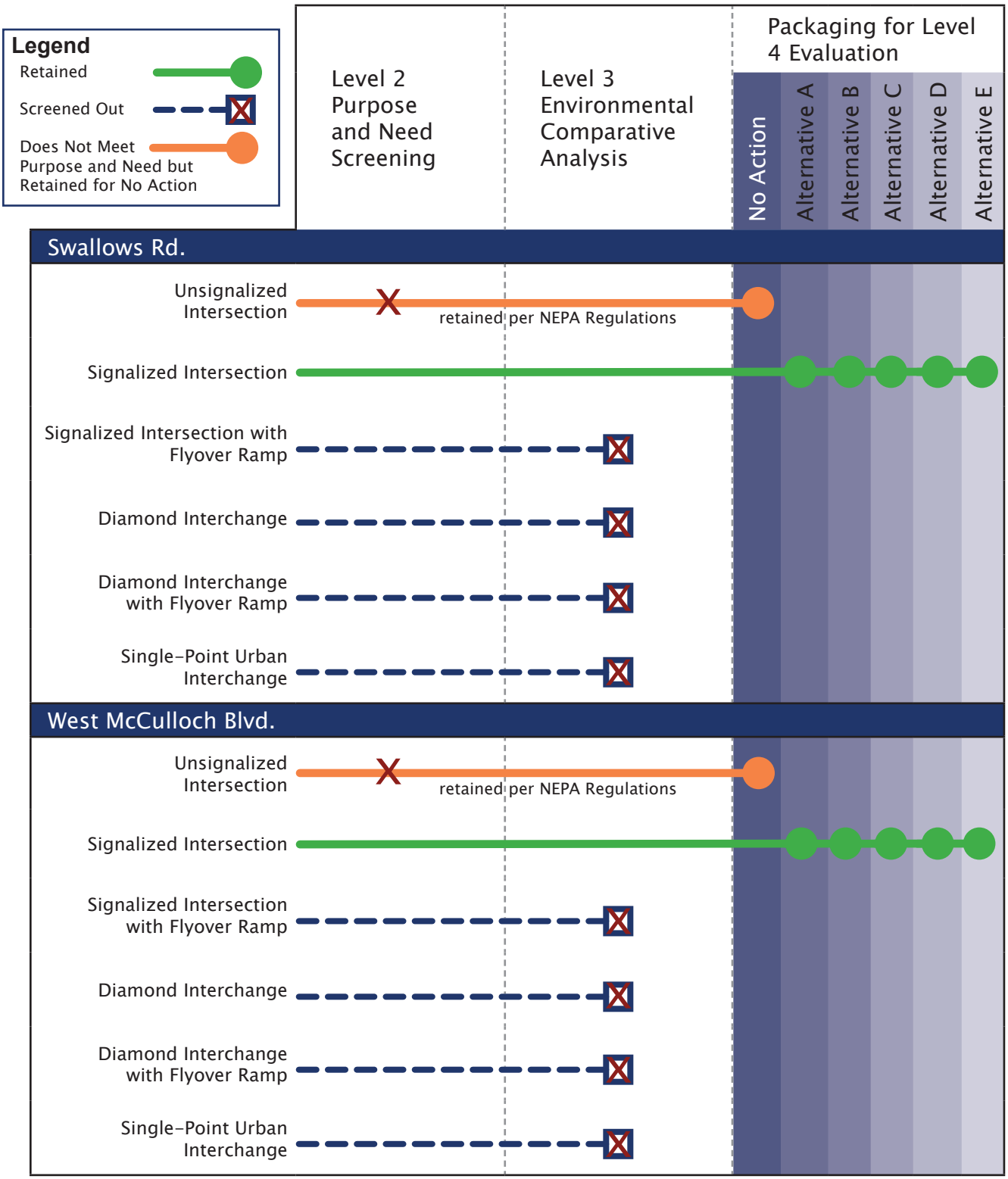
Facility type 5, US 50 as a six-lane freeway, would operate much the same as facility type 3 at the interchanges and with the same or improved LOS along the mainline segments. As a result, it was retained for further analysis.

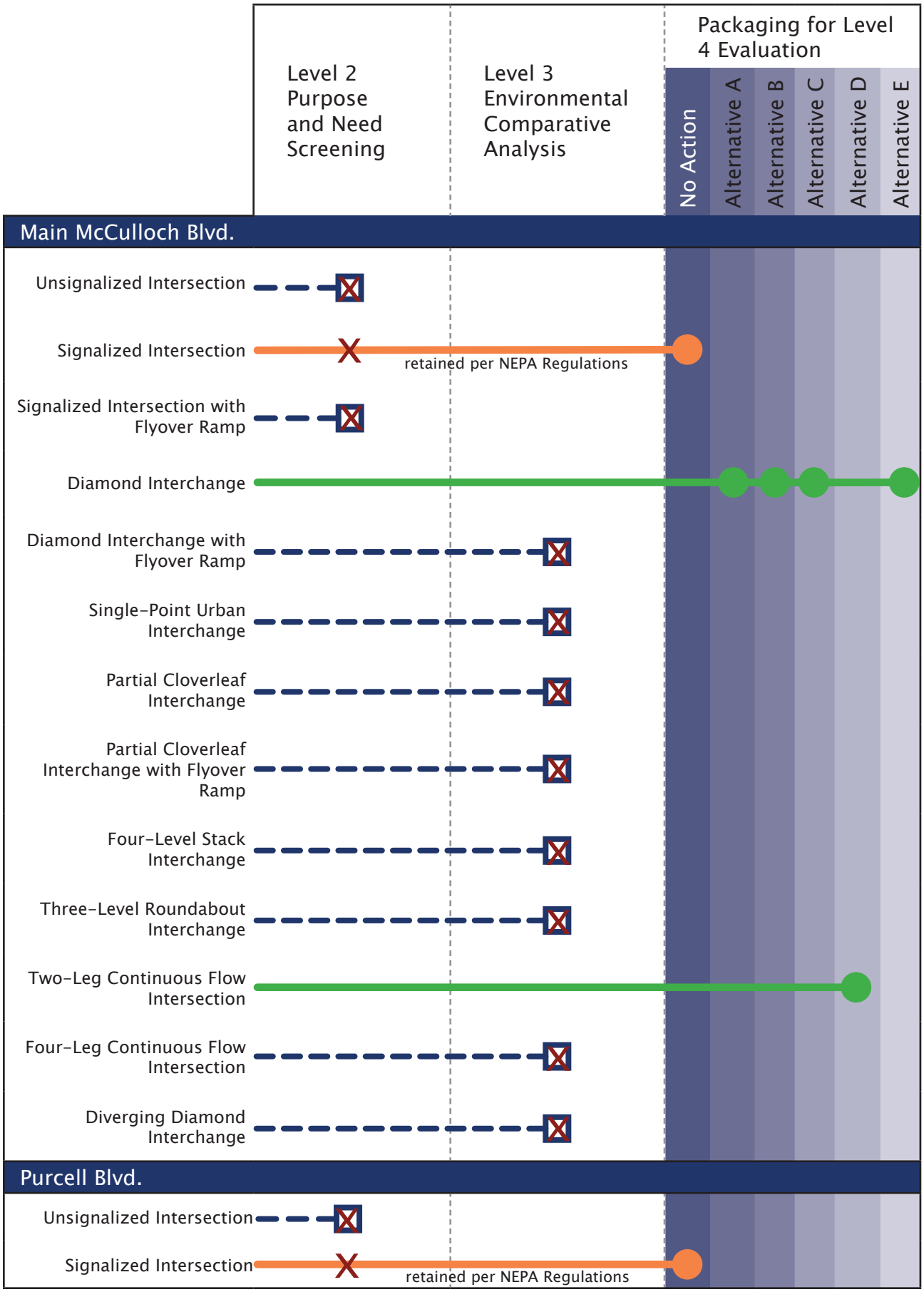
In addition to these facility types, the study team evaluated multimodal improvements such as carpool lanes and new bus service. Because of the low demand for these modes, they had negligible impact on LOS compared to the No Action Alternative and were dropped from further consideration. However, other improvements, such as park-and-ride lots and a shared pedestrian and bicycle path, were included in all action alternatives.

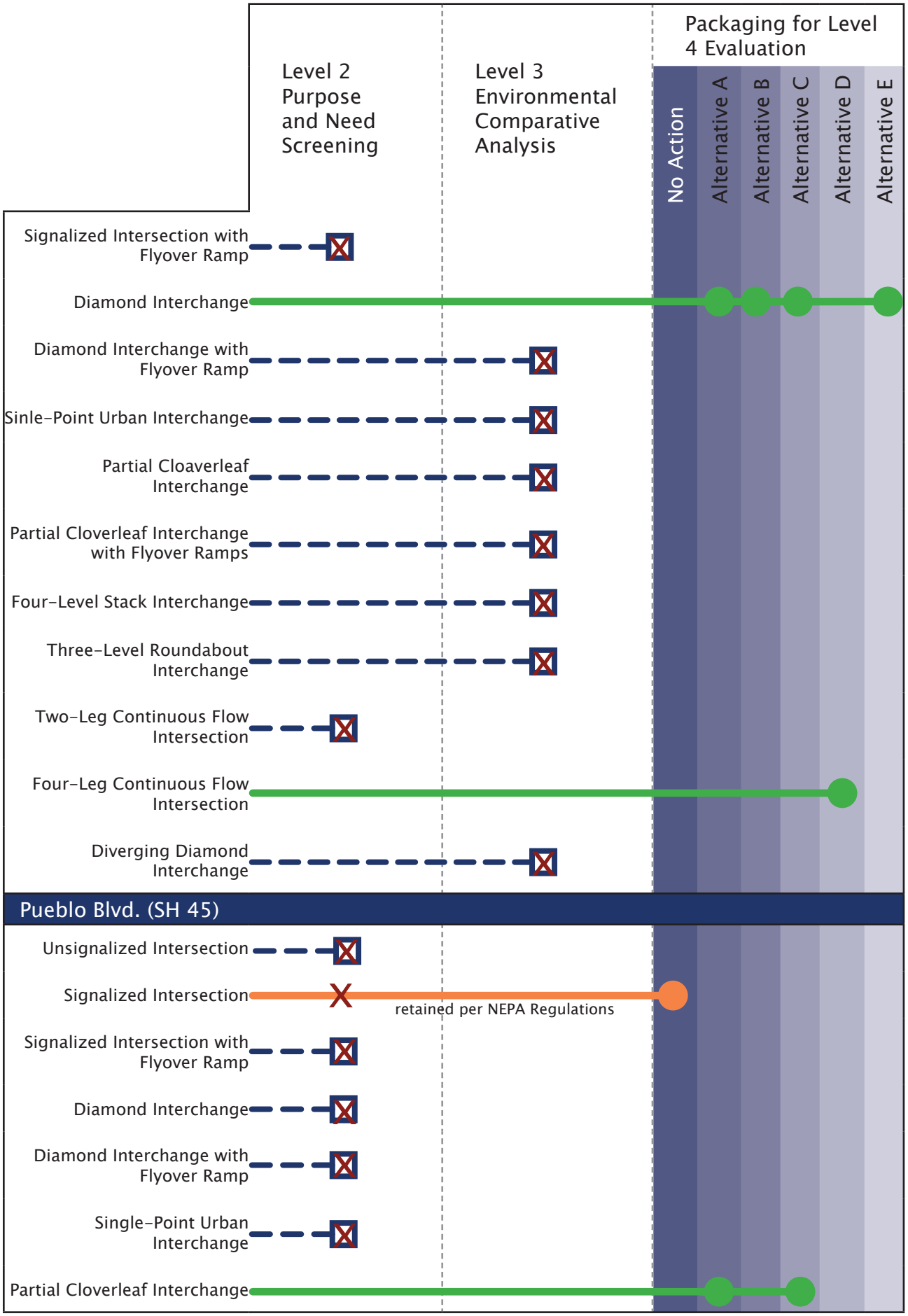
2.11 What intersection options passed Level 2 screening?

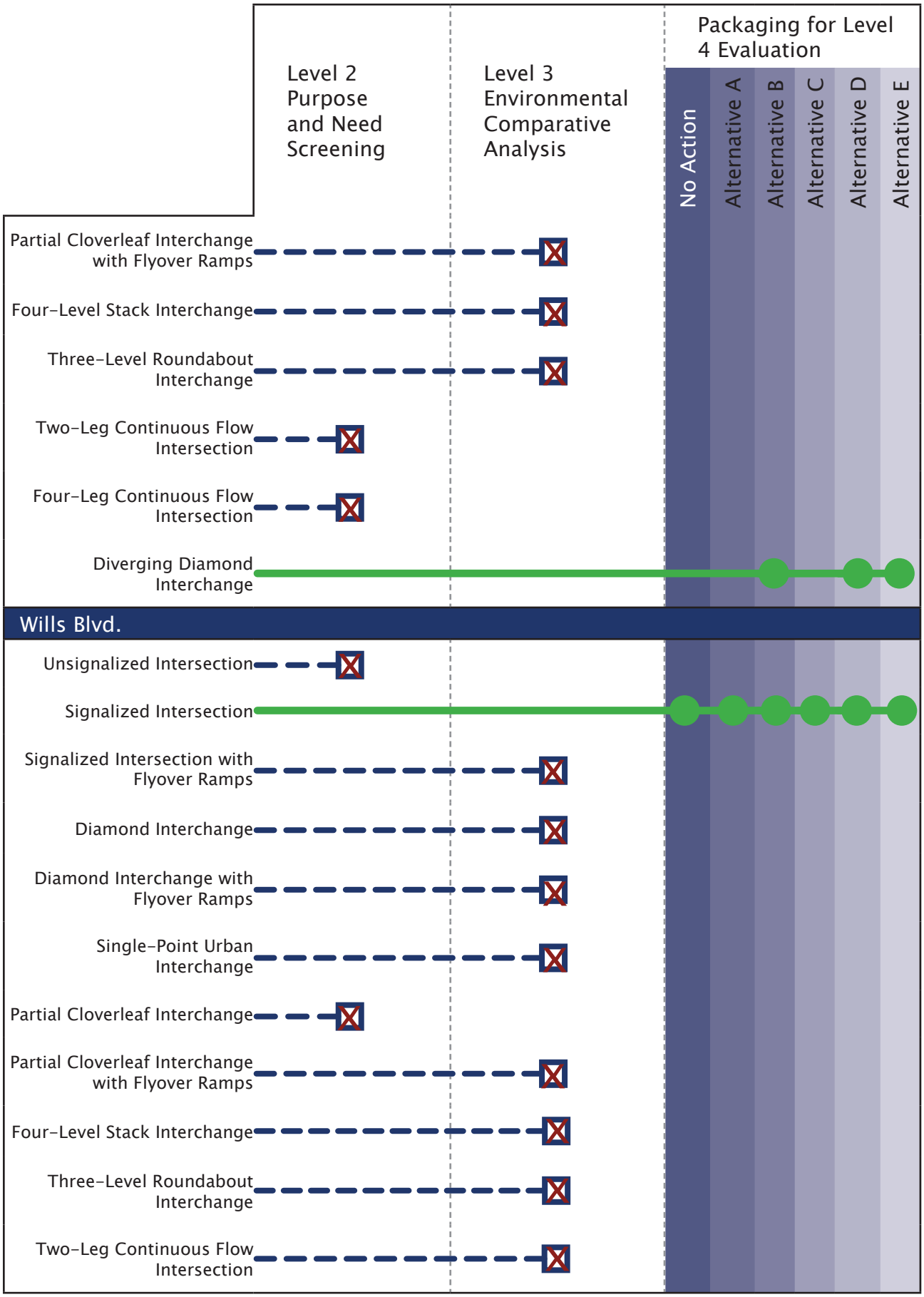
Because the intersection options that passed Level 2 screening depended on the location being considered, the intersections are discussed sequentially in the following sections. **Figure 2-25** shows schematically those intersections that passed Level 2 screening for each of the seven major Corridor intersections. **Figure 2-25** illustrates Level 3 and Level 4 evaluations, discussed later in this Chapter.

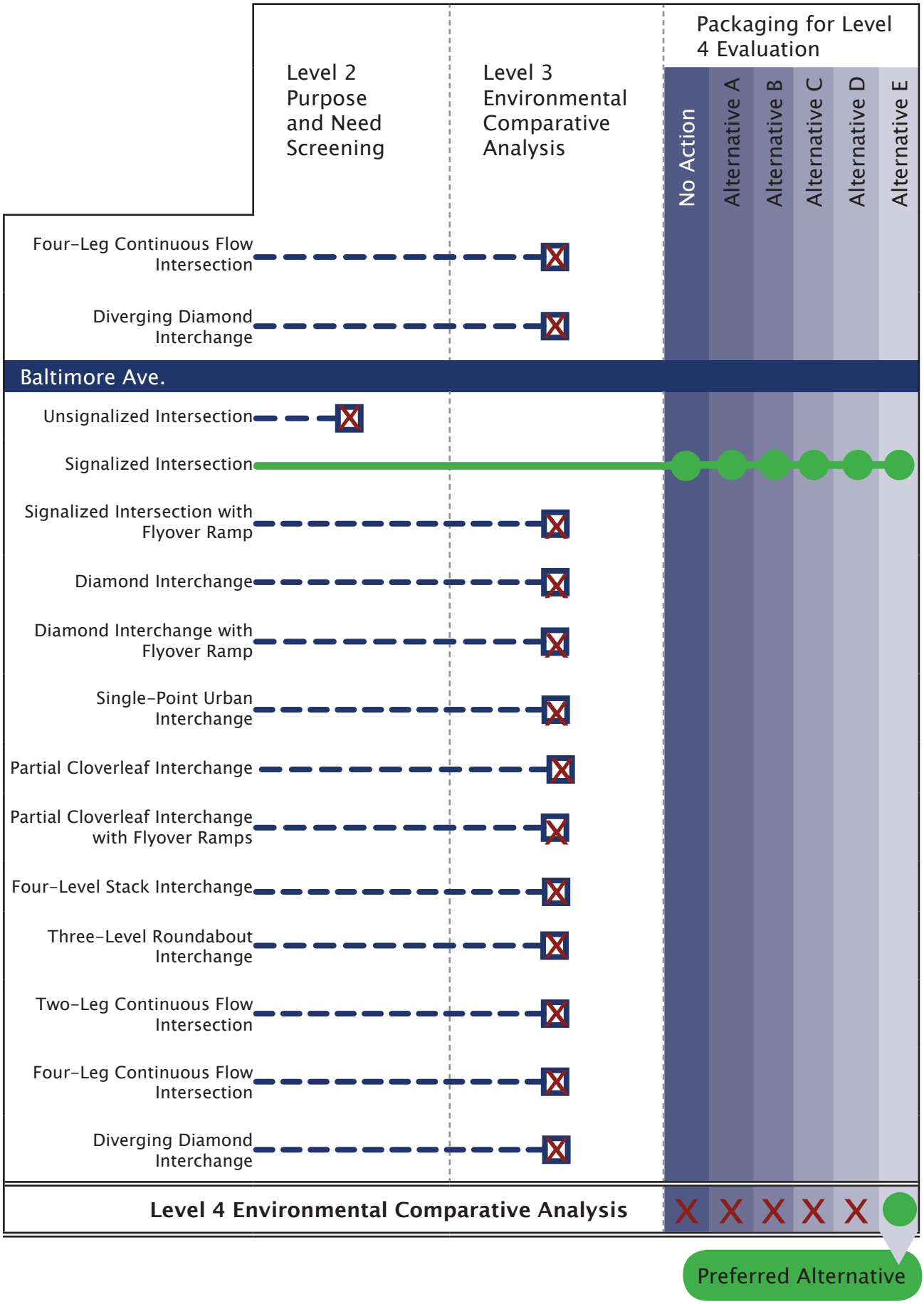
Figure 2-25. Level 2 and 3 Evaluation of Intersection Options with Level 4 Evaluation of Alternatives




Level 2 Purpose and Need Screening
Level 3 Environmental Comparative Analysis
Packaging for Level 4 Evaluation
No Action
Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Main McCulloch Blvd.
Unsignalized Intersection
Signalized Intersection
retained per NEPA Regulations
Signalized Intersection with Flyover Ramp
Diamond Interchange
Diamond Interchange with Flyover Ramp
Single-Point Urban Interchange
Partial Cloverleaf Interchange
Partial Cloverleaf Interchange with Flyover Ramp
Four-Level Stack Interchange
Three-Level Roundabout Interchange
Two-Leg Continuous Flow Intersection
Four-Leg Continuous Flow Intersection
Diverging Diamond Interchange
Purcell Blvd.
Unsignalized Intersection
Signalized Intersection
retained per NEPA Regulations


Level 2 Purpose and Need Screening
Level 3 Environmental Comparative Analysis
Packaging for Level 4 Evaluation
No Action
Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Signalized Intersection with Flyover Ramp
Diamond Interchange
Diamond Interchange with Flyover Ramp
Sinle-Point Urban Interchange
Partial Cloaverleaf Interchange
Partial Cloverleaf Interchange with Flyover Ramps
Four-Level Stack Interchange
Three-Level Roundabout Interchange
Two-Leg Continuous Flow Intersection
Four-Leg Continuous Flow Intersection
Diverging Diamond Interchange
Pueblo Blvd. (SH 45)
Unsignalized Intersection
Signalized Intersection
retained per NEPA Regulations
Signalized Intersection with Flyover Ramp
Diamond Interchange
Diamond Interchange with Flyover Ramp
Single-Point Urban Interchange
Partial Cloverleaf Interchange


Level 2 Purpose and Need Screening
Level 3 Environmental Comparative Analysis
Packaging for Level 4 Evaluation
No Action
Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Partial Cloverleaf Interchange with Flyover Ramps
Four-Level Stack Interchange
Three-Level Roundabout Interchange
Two-Leg Continuous Flow Intersection
Four-Leg Continuous Flow Intersection
Diverging Diamond Interchange
Wills Blvd.
Unsignalized Intersection
Signalized Intersection
Signalized Intersection with Flyover Ramps
Diamond Interchange
Diamond Interchange with Flyover Ramps
Single-Point Urban Interchange
Partial Cloverleaf Interchange
Partial Cloverleaf Interchange with Flyover Ramps
Four-Level Stack Interchange
Three-Level Roundabout Interchange
Two-Leg Continuous Flow Intersection


Level 2 Purpose and Need Screening
Level 3 Environmental Comparative Analysis
Packaging for Level 4 Evaluation
No Action
Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Four-Leg Continuous Flow Intersection
Diverging Diamond Interchange
Baltimore Ave.
Unsignalized Intersection
Signalized Intersection
Signalized Intersection with Flyover Ramp
Diamond Interchange
Diamond Interchange with Flyover Ramp
Single-Point Urban Interchange
Partial Cloverleaf Interchange
Partial Cloverleaf Interchange with Flyover Ramps
Four-Level Stack Interchange
Three-Level Roundabout Interchange
Two-Leg Continuous Flow Intersection
Four-Leg Continuous Flow Intersection
Diverging Diamond Interchange
Level 4 Environmental Comparative Analysis
X X X X X
Preferred Alternative

2.11.1 Swallows Rd. and West McCulloch Blvd.

Because the intersections of Swallows Rd. and West McCulloch Blvd. with US 50 each have three legs, six different intersection types were relevant. All but unsignalized intersections met the Purpose and Need. With unsignalized intersections, the most delayed movements functioned at LOS "f" during both peak hours at both locations. The following intersection options passed Level 2 screening for these two locations:

- Signalized intersections
- Signalized intersections with flyover ramp
- Diamond interchanges
- Diamond interchanges with flyover ramp
- SPUIs

2.11.2 Main McCulloch Blvd.

The ten intersection options that met the Purpose and Need at US 50 and Main McCulloch Blvd. include:

- Diamond interchange
- Diamond interchange with flyover ramp
- SPUI
- Partial cloverleaf interchange
- Partial cloverleaf interchange with flyover ramps
- Four-level stack interchange
- Three-level roundabout interchange
- Two-leg CFI
- Four-left CFI
- Diverging diamond interchange

The presence of traffic signals here indicates that they are warranted and that an unsignalized intersection would function at an unacceptable level of service. (This inference also applies to the four signalized intersections to the east.) **Table 2-4** shows that a signalized intersection here is anticipated to function at LOS E during both peak hours in 2035. Adding a flyover ramp to the signalized intersection improves the morning peak hour LOS to D but does not change the evening peak hour LOS.

2.11.3 Purcell Blvd.

With the exception of the two-leg CFI, the intersection options that met the Purpose and Need at Main McCulloch Blvd. also met the Purpose and Need at Purcell Blvd. The unsignalized intersection, signalized intersection, and signalized intersection with flyover ramp are expected to operate at LOS F during both peak hours in 2035. The two-leg CFI is expected to operate at LOS E during both peak hours here.

2.11.4 Pueblo Blvd.

The following five intersection options would meet the Purpose and Need at Pueblo Blvd. where traffic volumes are the highest:

- Partial cloverleaf interchange
- Partial cloverleaf interchange with flyover ramps
- Four-level stack interchange
- Three-level roundabout interchange
- Diverging diamond interchange

Note that three of these intersection options for Pueblo Blvd. are fully grade-separated:

- Partial cloverleaf interchange with flyover ramps
- Four-level stack interchange
- Three-level roundabout interchange

The other two options that meet the Purpose and Need here have signals on the minor roadway. Under the most likely demand scenario, which assumes completion of the Pueblo Blvd. Extension and WPC improvements, turning movement volumes are higher during the evening peak hour than the morning peak hour, and through volumes on Pueblo Blvd. are higher than those encountered on US 50 during the evening peak hour. In accordance with this demand scenario, the through movements on Pueblo Blvd. were grade separated, and US 50 is treated as the minor roadway here. Through traffic on US 50 must pass through two traffic lights with the partial cloverleaf interchange and the DDI intersection options. Given that the DDI in this configuration operates at LOS D, it is unlikely to meet the Purpose and Need criterion if the traffic signals are moved to Pueblo Blvd.

Both existing signalized intersections are forecast to operate at LOS F during both peak hours in 2035 (see **Table 2-4**). An unsignalized intersection would result in more delay and worse LOS than a signalized one. Adding a single flyover ramp to the signalized intersections does not address the congestion issues at this location, as there are two heavy left turn movements—from westbound US 50 and from northbound Pueblo Blvd.—that conflict with US 50 through movements.

The signal on the westbound ramps of a diamond interchange at this location is forecast to operate at LOS F during the evening rush hour in 2035. Adding a flyover ramp to the diamond interchange does not improve the LOS.

A SPUI with ramps exiting Pueblo Blvd. would operate at LOS F during both peak hours. Because Pueblo Blvd. through volumes are heavier than US 50 through volumes during the 2035 evening peak hour, a SPUI with ramps exiting US 50 would also function at LOS F.

A two-leg CFI here would operate at LOS F during both peak hours in 2035, and a four-leg CFI would operate at LOS E during both peak hours.

2.11.5 Wills Blvd. and Baltimore Ave.

All intersection options other than unsignalized intersections met the Purpose and Need at both Wills Blvd. and Baltimore Ave. However, at Baltimore Ave., the signalized intersection and signalized intersection with flyover ramp options would depend on congestion reduction from both the Pueblo Blvd. Extension and WPC improvements included in the PACOG *2035 LRTP* network. At Wills Blvd., these two intersection options met the Purpose and Need provided that the traffic relief to US 50 comes only from the Pueblo Blvd. Extension improvement.

2.12 What were the considerations for Level 3 evaluation?

Level 3 evaluation involved a comparative analysis of intersection options that considered transportation and environmental factors. **Chapter 3, Section 3.1** of this PEL Study provides a complete list of the environmental resources that were evaluated. **Appendix B** includes the detailed comparison matrices and maps of intersection footprints. The following subsections identify the

Level 3 evaluation criteria that were applied to screen the intersection options that passed Level 2 screening.

Purpose and Need evaluation criteria

Purpose and Need evaluation criteria included LOS, turning movements, local access, pedestrian and bicycle access, safety, and driver expectation.

Environmental and community evaluation criteria

Environmental and community evaluation criteria included streams, wetlands, floodplains, Threatened, Endangered, and Special Status Species (TES Species), land use compatibility, ROW and parcels, visual, utilities, hazardous materials (HazMat), historic properties, noise, and community/business cohesion.

Financing and implementation evaluation criteria

Financing and implementation evaluation criteria included construction cost and phasing.

The following sections summarize the Level 3 screening process results by intersection, including the key differentiating factors within the evaluation criteria, the preferred option(s), and the rationale for discontinuing other options from further consideration.

2.12.1 Swallows Rd.

Preferred option

The signalized intersection option was retained for the Main McCulloch Blvd. intersection. In summary, Level 3 evaluation for this option identified the following advantages:

- No street or access closures
- Avoids land use or ROW impacts
- Least visual impact
- Least cost – Range of typical costs for this option is $200,000 to $250,000

Primary Factors Influencing Options at Swallows Rd.

- ROW impacts
- Consistency with future land use
- Vehicular access
- Visual impacts
- Cost

All land north of US 50 near the Swallows Blvd. intersection is part of the Gary Walker Conservation Easement (see **Chapter 3, Section 3.13.2, Transitions in land use planning for the Corridor** of this PEL Study). The signalized intersection is the preferred option for two reasons. It would be consistent with the Gary Walker Conservation Easement because it avoids ROW and local access impacts. It would also have minimal visual impacts as compared to grade-separated interchanges that involve one or two levels of overpasses.

The signalized intersection would be the least expensive option for Swallows Rd.; however, it must be built as a single phase.

In **Appendix B,** the **Level 3 Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Swallows Rd.** table in **Section B.3.1** shows evaluations specific to the preferred option.

Options considered and discontinued from further consideration

Signalized intersection with flyover ramp, diamond interchange, diamond interchange with flyover, and single-point urban interchange were discontinued due to local ROW and access impacts, conflicts with the Gary Walker Conservation Easement, as well as increased visual impacts and costs. These options would result in a range of impacts, including:

- Inconsistent with future land use
- ROW and parcel impacts
- Access closures
- Visual impact
- Impact on pedestrian and bicycle access
- Noise impacts
- High costs – Range of typical costs for these grade-separated interchanges is $5 million to $35 million

In **Appendix B,** the **Level 3 Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Swallows Rd.** table in **Section B.3.1** shows the evaluations specific to each discontinued option.

All four grade-separated interchange options would require acquisition of the Gary Walker Conservation Easement and would also affect local access. Some of the land north of US 50 at Swallows Rd. is part of the Gary Walker Conservation Easement. Greenhorn View Dr. provides local access from Swallows Rd. about 500 feet south of US 50. The two options involving flyover ramps called for that ramp to cross above this access, meaning that residents entering from westbound US 50 would have a more circuitous access at another intersection of Greenhorn View Dr. and Swallows Rd. about 2,500 feet to the south. The diamond interchange, diamond interchange with flyover ramp, and SPUI also require closing a minor access route north of US 50 about 1,000 feet west of Swallows Rd.

The diamond interchange with flyover ramp would be the most expensive option considered for Swallows Rd. ranging from $30 million to $35 million. The SPUI would be difficult to build in phases.

2.12.2 West McCulloch Blvd.

Preferred option

The signalized intersection option was retained for the Main McCulloch Blvd. intersection. In summary, Level 3 evaluation of this option identified the following advantages:

- No street or access closures
- Avoidance of land use or ROW impacts
- Least visual impact
- Least cost – Range of typical costs for the signalized intersection option is $200,000 to $250,000

Primary Factors Influencing Options at West McCulloch Blvd.

- ROW impacts
- Consistency with future land use
- Vehicular access
- Visual impacts
- Cost

Similar to the Swallows Rd. intersection, all land north of US 50 near the West McCulloch Blvd. intersection is part of the Gary Walker Conservation Easement (see **Chapter 3, Section 3.13.2, Transitions in land use planning for the Corridor** of this PEL Study). Additionally, a roughly 50-acre parcel south of US 50 west of the West McCulloch Blvd. intersection is also part of the conservation easement.

The signalized intersection would be the preferred option for two reasons. It would be consistent with the Gary Walker Conservation Easement because it would avoid ROW and local access impacts. It would have minimal visual impacts as compared to grade-separated interchanges that involve one or two levels of overpasses.

The signalized intersection would be the least expensive option for West McCulloch Blvd.; however, it must be built as a single phase.

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & West McCulloch Blvd.** table in **Section B.3.2** shows evaluations specific to the preferred option.

Options considered and discontinued from further consideration

Signalized intersection with flyover ramp, diamond interchange, diamond interchange with flyover, and single-point urban interchange options were discontinued due to local ROW and access impacts, conflicts with the Gary Walker Conservation Easement, as well as increased visual impacts and costs. These options would result in a range of impacts including:

- Property takes
- Access closures
- Incompatible with future land use – requires construction on conservation easement
- Stream impacts
- Visual impacts
- Impacts on pedestrian and bicycle access
- Noise impacts
- High costs – Ranging from $5 million to $35 million

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & West McCulloch Blvd** table in **Section B.3.2** shows evaluations specific to each discontinued option.

The diamond interchange with flyover ramp would involve the greatest potential parcel takes, likely acquiring three developed residential properties and four undeveloped agricultural parcels. It would also result in closing Calle de Estavan, Calle de Camelia, and McCulloch Place about 700 feet south of US 50.

The diamond interchange with flyover ramp would be the most expensive of the options considered for West McCulloch Blvd. at $30 million to $35 million. The SPUI would be difficult to build in phases.

2.12.3 Main McCulloch Blvd.

Preferred options

The diamond interchange and two-leg continuous flow intersection (CFI) options were retained for the Main McCulloch Blvd. intersection. In summary, Level 3 evaluation of the diamond interchange identified the following advantages:

- Has no access impacts
- Is compatible with future planning
- Generally avoids land use and parcel impacts
- May be built in phases
- Has medium costs – Range of typical costs for the diamond interchange option is $20 million to $25 million

Primary Factors Influencing Options at Main McCulloch Blvd.

- ROW impacts
- Hazardous materials
- Vehicular access
- Community and business cohesion
- Cost

For the two-leg CFI, the Level 3 evaluation identified the following advantages:

- Has no parcel takes
- Has least visual impacts
- Has least cost – Range of typical costs for the two-leg CFI is $3 million to $5 million
- Is compatible with future planning
- May be built in phases

This intersection is generally developed in three of its four quadrants (all but the northwest). Acquiring developed parcels would disrupt community and business cohesion. Some of the parcels are also HazMat sites. Other important factors that were considered included vehicular access, community and business cohesion, and cost.

The diamond interchange would not disrupt local access. This intersection option is compatible with existing and planned land uses, as well as the local road network because it generally avoids land use and parcel impacts. The diamond interchange would require approximately 0.5 acres of outside CDOT ROW (including lands zoned for business and public use) and would result in minor impacts on three undeveloped parcels outside the CDOT ROW. This option may be built in phases.

The two-leg CFI would not require any additional ROW or parcel impacts, would avoid local access impacts, may be built in phases, and would be the least cost option.

In **Appendix B**, the **Level 3 Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Main McCulloch Blvd.** table in **Section B.3.3** shows evaluations specific to the preferred option.

Options considered and discontinued from further consideration

Other options evaluated for the Main McCulloch Blvd. intersection include the diamond interchange with flyover, SPUI, partial cloverleaf, partial cloverleaf with flyovers, four-level stack interchange, three-level roundabout, four-leg continuous flow intersection, and DDI.

These options would result in a range of impacts, including:

- Major impacts on developed parcels
- Access closures
- Inconsistency with future planning due to access closures
- Loss of land use viability at the entrance of Pueblo West
- Reduction in community/business cohesion due to access closures and impacts on developed parcels
- Potential hazardous material conflict
- Potential conflict with utilities
- Visual impacts
- High costs – Ranging from $5 million to $75 million

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Main McCulloch Blvd** shows in **Section B.3.3** evaluations specific to each discontinued option.

The partial cloverleaf with flyover ramps would require the greatest amount of additional ROW that covers approximately 25 to 30 acres and includes 17 total property acquisitions. Its footprint would contain three known underground storage tanks (USTs), including two USTs with leaks near the intersection of Main McCulloch Blvd. and Spaulding Ave.

This option would also result in the most access closures—10 in total—to streets including Dunlap Dr., Calle de Camelia, and Spaulding Ave. The following four options do not disrupt vehicular access at Main McCulloch Blvd.:

- Diamond interchange
- SPUI
- Two-leg CFI
- Four-leg CFI

The four-level stack interchange would be the most expensive of the options considered for Main McCulloch Blvd. ranging from $65 million to $75 million. Construction cost would be directly correlated with the number of levels an interchange structure has. The SPUI and the three-level roundabout would be difficult to build in phases.

2.12.4 Purcell Blvd.

Preferred Options

Four-leg CFI and diamond interchange options were retained for the Purcell Blvd. intersection. These options vary in their advantages as transportation improvements to the Purcell Blvd. intersection. In summary, Level 3 evaluation of the four-leg CFI identified the following advantages:

- Least visual impact
- Least cost – Range of typical costs for the four-leg CFI is $5 million to $10 million

Primary Factors Influencing Options at Purcell Blvd.

- ROW needs
- Vehicular access
- Hazardous materials
- Visual impacts
- Noise
- Cost

- Among the least impacts to land use
- Minimization of stream impacts
- Consistent with future planning
- Generally compatible with community/business cohesion
- Phasing flexibility – The ROW used for this layout can be used for future diamond interchange if the demand exceeds the capacity of four-leg CFI

For the diamond interchange, the Level 3 evaluation identified the following advantages:

- Minimizes impacts on land uses
- Avoids any developed parcels
- Has no access impacts
- Is compatible with future planning
- Is a familiar interchange type
- Offers phasing flexibility
- May be built in phases
- Has medium costs – Range of typical costs is $20 million to $25 million

The diamond interchange and the four-leg CFI would minimize ROW requirements totaling 0.5 acre to 1 acre. However, the diamond interchange would require buying only two or three undeveloped parcels, while the four-leg CFI would require acquiring two developed parcels. Because the diamond interchange would require only undeveloped parcels, it also would avoid HazMat sites.

As an at-grade intersection, the four-leg CFI would have the least visual impacts before making accommodations for bicycle and pedestrian movements with a bridge. Providing an elevated walkway over the CFI would result in visual impacts similar to two-level interchanges such as the diamond interchange.

The TAT did not reach agreement on whether raising Purcell Blvd. over US 50 for the diamond interchange would have an impact on access to businesses north of US 50 via Hailey Lane and North Market Plaza. However, all other intersection options would have at least one access closure. The four-level stack interchange would have six access closures, the most of any intersection option.

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Purcell Blvd.** table in **Section B.3.4** shows evaluations specific to the preferred option.

Options considered and discontinued from further consideration

Other options evaluated for the Purcell Blvd. intersection include the diamond interchange with flyover, SPUI, partial cloverleaf, partial cloverleaf with flyovers, four-level stack interchange, three-level roundabout, four-leg continuous flow intersection, and DDI. These options would result in a range of impacts, including:

- Inconsistency with future planning due to access closures
- Reduction or elimination of community/business cohesion
- Potential to increase noise
- Visual impacts
- Stream impacts
- High costs – Ranging from $25 million to $75 million

In **Appendix B**, the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Purcell Blvd.** table in **Section B.3.4** provides evaluations specific to each discontinued option.

The partial cloverleaf interchange with flyover ramps would have the greatest potential to disturb HazMat sites in its footprint. This option would affect three known USTs, including one UST with a leak. The footprint would also be in the vicinity of a fourth UST.

The SPUI and the three-level roundabout interchange would have the greatest potential to increase noise levels because both would involve raising US 50 above Purcell Blvd.

The four-leg CFI would be the least expensive option for Purcell Blvd., followed by the diamond interchange and the DDI.

The four-level stack interchange would be the most expensive of the options considered for Purcell Blvd. ranging from $65 million to $75 million. Construction cost is directly correlated with the number of levels an interchange structure has. The SPUI and the three-level roundabout would be difficult to build in phases.

2.12.5 Pueblo Blvd.

Preferred options

The partial cloverleaf and DDI options were retained for the Pueblo Blvd. intersection. Each option provides various advantages as transportation improvements to the Pueblo Blvd. intersection.

Primary Factors Influencing Options at Pueblo Blvd.

- Vehicular access
- Driver expectancy
- Stream-related impacts
- Visual impacts
- Cost

In summary, Level 3 evaluation of the partial cloverleaf interchange identified the following advantages:

- Has the least impacts on floodplains
- Minimizes impacts on parcels
- Avoids impacts on business
- Requires no access closures
- Minimizes visual impacts
- Offers phasing flexibility – May be built in phases
- Has moderate cost – Range of typical costs for the partial cloverleaf is $35 million to $40 million
- Offers a familiar interchange type

For the DDI, the Level 3 evaluation identified the following advantages:

- Minimizes acreage to be purchased for additional ROW
- Has the least overall impacts on streams, wetlands, and floodplains
- Minimizes impacts on parcels
- Requires no access closures
- Minimizes visual impacts

- Has the least cost – Range of typical costs for the diverging diamond is $20 million to $25 million
- Offers phasing flexibility – May be built in phases from a conventional diamond interchange

The partial cloverleaf interchange and DDI would not require access closures, although Wildhorse Rd., Capri Cir., Bahama Dr., and Baker Steamer Rd. may need to be realigned. In contrast, the four-level stack interchange would eliminate access to these four roads. These access closures would result in some property takes outside the footprint of the four-level stack interchange.

In **Appendix B**, the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Pueblo Blvd.** table in **Section B.3.5** shows evaluations specific to each preferred option.

Options considered and discontinued from further consideration

Other options evaluated for the Pueblo Blvd. intersection include the partial cloverleaf with flyovers, four-level stack interchange, and the three-level roundabout. These options would result in a range of impacts including:

- Stream and wetland impacts
- Floodplain impacts
- Impacts on land use and parcels
- Potential to increase noise
- Inconsistency with future planning due to access closures
- Reduction or elimination of community/business cohesion
- Visual impacts
- High costs – Ranging from $35 million to $75 million

In **Appendix B**, the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Pueblo Blvd.** table in **Section B.3.5** shows evaluations specific to each discontinued option.

None of the intersection options that would meet the Purpose and Need at Pueblo Blvd. currently exist elsewhere in Pueblo County. The closest example of one of these five options is the partial cloverleaf interchange, which can be found in two locations in Colorado Springs. The Denver metropolitan area has partial cloverleaf interchanges with flyover ramps and four-level stack interchanges. While there are no DDIs in Colorado, a few have been built in Utah.

Williams Creek crosses the middle of the US 50 and Pueblo Blvd. intersection, and Wild Horse Creek crosses US 50 about 0.5 mile to the east. Impacts on their floodplains and wetlands are a concern. The footprints for the partial cloverleaf interchange and the DDI would overlap with the Federal Emergency Management Agency (FEMA) floodplain maps by about 1 acre—the least of the five options. The three-level roundabout interchange's footprint would have the most overlap with the floodplain at about 2 acres. The DDI also would have the least impacts on wetlands, with only 0.3 acre affected. The four-level stack interchange would have the greatest impacts on wetlands, affecting about 1.3 acres.

With two levels each, the partial cloverleaf interchange and the DDI would have the least visual impact of the intersection options for Pueblo Blvd. The four-level stack interchange would be the most visually imposing.

The four-level stack interchange would be the most expensive of the options considered for Pueblo Blvd. ranging from $65 million to $75 million. Construction cost is directly correlated with the number of levels an interchange structure has. The three-level roundabout would be difficult to build in phases.

2.12.6 Wills Blvd. and Baltimore Ave.

Preferred Options

The signalized intersection option was retained for the Wills Blvd. and Baltimore Ave. intersections. In summary, Level 3 evaluation of this option identified the following advantages:

- No street or access closures
- Avoidance of land use or ROW impacts
- Compatible with existing and future land use
- Least visual impact
- Least cost – Range of typical costs for the signalized intersection is $200,000 to $250,000

Primary Factors Influencing Options at Wills Blvd. and Baltimore Ave.

- ROW impacts
- Vehicular access
- Community and business cohesion

The most important considerations at Wills Blvd. and Baltimore Ave. were ROW and vehicular access impacts. Only the signalized intersection would not require additional ROW or result in access closures.

The signalized intersection would be the least expensive option for Wills Blvd. and Baltimore Ave.; however, it must be built as a single phase.

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Wills Blvd.** table in **Section B.3.6** and the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Baltimore Ave.** table in **Section B.3.7** show evaluations specific to the preferred option.

Options considered and discontinued from further consideration

Other options evaluated for the Wills Blvd. and Baltimore Ave. intersections include the signalized intersection with flyover ramp, TUDI, diamond interchange with flyover, SPUI, partial cloverleaf, partial cloverleaf with flyovers, four-level stack interchange, three-level roundabout, two-leg CFI, four-leg CFI, and the DDI.

These options would result in a range of impacts including:

- Incompatibility with planned Arterial Commercial Mixed Uses and Urban Residential, due to loss of access to businesses in each quadrant, and impacts on residential community north of US 50
- Access impacts on existing dealerships, undeveloped commercial parcels, and residential parcels

- Street closures
- Undevelopable lands adjacent to intersection due to access impacts
- Incompatibility with future arterial commercial planning along US 50
- Access closure to land-locking parcels
- Increased noise levels
- Total takes to existing businesses including street access closure and parcel takes
- Visual impacts
- High costs – Ranging from $3 million to $75 million

In **Appendix B,** the **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Wills Blvd.** table in **Section B.3.6** and **Level 3 Screening Environmental Comparative Analysis Comparison of Intersection Options – US 50 & Baltimore Ave.** table in **Section B.3.7**show the evaluations specific to each discontinued option.

The grade-separated interchange option with the smallest footprint—TUDI—would require an additional 4 to 5 acres at Baltimore Ave. and an additional 9 to 10 acres at Wills Blvd. These ROW requirements at Baltimore Ave. would involve completely buy out three businesses. At Wills Blvd., another two businesses would need to be acquired because they would otherwise lose too much of their parking. Some of the interchanges with the largest footprints could require purchasing as many as 60 to 70 properties. However, the acquisition estimates for these intersection options should be viewed with caution because they were developed in isolation.

Some intersection options are so large that if they were selected for both Wills Blvd. and Baltimore Ave., they would have to be designed as a single complex because their footprints would overlap. Ramps would have to be braided because there would not be enough room for traffic from one on-ramp to merge before the next off-ramp exited. Clearly, these types of interchanges would destroy community and business cohesion.

The four-level stack interchange would be the most expensive option considered for Pueblo Blvd. ranging from $65 million to $75 million. Construction cost is directly correlated with the number of levels an interchange structure has. The SPUI and the three-level roundabout would be difficult to build in phases.

2.13 What intersection options passed Level 3 evaluation and why?

The signalized intersection option was selected for Swallows Rd. because it would require no additional ROW, avoid conflicts with the Gary Walker Conservation Easement, have minimal visual impact, and would be the least expensive. The signalized intersection option was also selected for West McCulloch Blvd. for similar reasons.

At Main McCulloch Blvd., the diamond interchange and two-leg CFI intersection options advanced from the Level 3 evaluation process.

The two-leg CFI would require no additional ROW, would have no impacts on vehicular access or community and business cohesion, and would be the least expensive. Because the CFI would be new to Pueblo drivers, the study team also selected the diamond interchange for consideration at Level 4 evaluation, because it would have minimal ROW requirements, would lack vehicular access or

community cohesion impacts, and would provide a low cost alternative among grade-separated interchange options.

At Purcell Blvd., the diamond interchange and the four-leg CFI advanced to Level 4 evaluation. The diamond interchange would avoid access closures, HazMat sites, and acquisition of developed parcels. The four-leg CFI would have the least construction cost and minimal ROW acquisition impacts. It also would have the advantages of being phased as a two-leg CFI in the beginning and having the least impacts on a local drainage south of US 50.

The partial cloverleaf interchange and DDI were selected for further examination at Pueblo Blvd. Neither would result in access closures and both would have minimal visual impact. The DDI would be the least expensive to build, while the partial cloverleaf intersection might be the most familiar to Pueblo drivers.

The study team selected the continued use of signalized intersections at Wills Blvd. and Baltimore Ave. to avoid ROW impacts. Signals would minimize visual impacts and disturbance of HazMat sites. Signals also would be the least expensive option and result in no access closures. However, the use of signals at Wills Blvd. and Baltimore Ave. would assume that Pueblo Blvd. is extended north to Platteville Blvd. and that the WPC is built by 2035.

Table 2-6 summarizes the intersection options advancing from the Level 3 comparative analysis. Level 3 evaluation results are also shown schematically in the middle column of **Figure 2-25**.

Table 2–6. Summary of Level 3 Evaluation Results

Intersection	Options Advancing to Level 4 Evaluation
Swallows Rd.	• Signalized Intersection
West McCulloch Blvd.	• Signalized Intersection
Main McCulloch Blvd.	• Diamond Interchange • Two-Leg Continuous Flow Intersection
Purcell Blvd.	• Diamond Interchange • Four-Leg Continuous Flow Intersection
Pueblo Blvd. (SH 45)	• Partial Cloverleaf Interchange • Diverging Diamond Interchange
Wills Blvd.	• Signalized Intersection
Baltimore Ave.	• Signalized Intersection

2.14 What were the considerations for Level 4 evaluation?

Level 4 evaluation involved a comparative analysis of corridor-wide alternatives that considered transportation and environmental factors.

2.14.1 How were intersection options that passed Level 3 evaluation packaged into alternatives with other improvements?

To create corridor-wide alternatives for the final level of evaluation, the intersection options that passed Level 3 evaluation had to be packaged with each other and with options for mainline US 50 between intersections.

In packaging these options, the following considerations were made:

- To aid driver expectancy, it is helpful to use the same or similar intersection options in sequence.
- Signalized intersections at Swallows Rd. and West McCulloch Blvd. would meet the Purpose and Need with the existing four through lanes on US 50. There is no additional benefit to widening US 50 to six through lanes in this section.
- The diamond interchanges at Main McCulloch Blvd. and Purcell Blvd. would meet the Purpose and Need with four or six through lanes on US 50.
- The CFIs at Main McCulloch Blvd. and Purcell Blvd. would require six through lanes on US 50 to meet the Purpose and Need.
- The partial cloverleaf interchange and the DDI at Pueblo Blvd. would require six through lanes on US 50.
- The signalized intersections at Wills Blvd. and Baltimore Ave. would require six through lanes on US 50.
- US 50 should change between four through lanes and six through lanes only once.

These considerations limited the number of possible action alternatives to be examined. Furthermore, because CFIs and DDIs are unfamiliar innovative concepts, the study team thought it would be important to have some alternatives that would use them and some that would not. **Table 2-7** summarizes the alternatives that the study team examined. The gray italic text in **Table 2-7** identifies components common to all five action alternatives, as follows:

- Signalized intersections at Swallows Rd., West McCulloch Blvd., Wills Blvd., and Baltimore Ave.
- Four through lanes on US 50 west of West McCulloch Blvd.
- Six through lanes on US 50 east of Pueblo Blvd.

Table 2-7. Components of Alternatives

Location	No Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Swallows Rd.	Unsignalized	*Signal*	*Signal*	*Signal*	*Signal*	*Signal*
Swallows Rd. to West McCulloch Blvd.	4 Lanes	*4 Lanes*	*4 Lanes*	*4 Lanes*	*4 Lanes*	*4 Lanes*
West McCulloch Blvd.	Unsignalized	*Signal*	*Signal*	*Signal*	*Signal*	*Signal*

Location	No Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
West McCulloch Blvd. to Main McCulloch Blvd.	4 Lanes	4 Lanes	4 Lanes	4-6 Lanes	4-6 Lanes	4-6 Lanes
Main McCulloch Blvd.	Signal	Diamond Interchange	Diamond Interchange	Diamond Interchange	Two-Leg CFI	Diamond Interchange
Main McCulloch Blvd. to Purcell Blvd.	4 Lanes	4 Lanes	4 Lanes	6 Lanes	6 Lanes	6 Lanes
Purcell Blvd.	Signal	Diamond Interchange	Diamond Interchange	Diamond Interchange	Four-Leg CFI	Diamond Interchange
Purcell Blvd. to Pueblo Blvd.	4 Lanes	3 Lanes EB 2 Lanes WB	3 Lanes EB 2 Lanes WB	6 Lanes	6 Lanes	6 Lanes
Pueblo Blvd.	Signal	Partial Cloverleaf Interchange	Diverging Diamond Interchange	Partial Cloverleaf Interchange	Diverging Diamond Interchange	Diverging Diamond Interchange
Pueblo Blvd. to Wills Blvd.	4 Lanes	*6 Lanes*	*6 Lanes*	*6 Lanes*	*6 Lanes*	*6 Lanes*
Wills Blvd.	Signal	*Signal*	*Signal*	*Signal*	*Signal*	*Signal*
Wills Blvd. to Baltimore Ave.	4 Lanes	*6 Lanes*	*6 Lanes*	*6 Lanes*	*6 Lanes*	*6 Lanes*
Baltimore Ave.	Signal	*Signal*	*Signal*	*Signal*	*Signal*	*Signal*

Note: Components that are common to all action alternatives are shown in gray italic text.

Abbreviations: CFI = continuous flow intersection EB = eastbound WB = westbound

The five action alternatives can be distinguished based on whether they typically would have four or six through lanes on US 50 between West McCulloch Blvd. and Pueblo Blvd. Alternatives A and B would be four-lane alternatives, while Alternatives C, D, and E would be six-lane.

Alternatives A and B would differ only by the intersection option at Pueblo Blvd. Alternative A would have a partial cloverleaf interchange, while Alternative B would have a DDI.

Alternative C would have the same intersection options as Alternative A but would differ by having six through lanes on US 50 between West McCulloch Blvd. and Pueblo Blvd.

Alternative D would be a combination of unfamiliar, innovative intersection options, with a two-leg CFI at Main McCulloch Blvd., a four-leg CFI at Purcell Blvd. and a DDI at Pueblo Blvd.

Alternative E would have the same intersection options as Alternative B but would differ by having six through lanes on US 50 between West McCulloch Blvd. and Pueblo Blvd.

The green dots in the last group of columns in **Figure 2-25** (found earlier in this chapter) indicate that an intersection option would be part of an alternative.

2.14.2 What are the tradeoffs among alternatives?

Table 2-8 presents a broad view of the relative levels of impacts and measures of effectiveness associated with each alternative. Impacts are classified into three categories for comparison across alternatives:

- Among the least impacts
- Intermediate impacts (or impacts that can be mitigated)
- Among the most impacts

Similar categories are used for measures of effectiveness such as LOS.

Appendix B, Section B.4, provides all of the data and detailed information that was used in the evaluation process. Most of the tradeoffs among alternatives would involve traffic operations. Note that Alternative C would have positive ratings for each criterion related to Purpose and Need. Generally, Alternative C would have the most capacity. It would have six through lanes instead of four. The diamond interchanges would be able to handle more traffic than CFIs, and the partial cloverleaf interchange would have better LOS than the DDI. The No Action Alternative generally would have negative ratings for Purpose and Need criteria because it has no capacity improvements. Among the action alternatives, Alternative D would have the lowest LOS, although the difference between the No Action Alternative and the action alternatives would be far greater than any difference among the action alternatives.

LOS and ROW

One tradeoff would be between LOS and ROW acquisition. Generally, the intersection options that passed Level 3 evaluation at Swallows Rd., West McCulloch Blvd., Main McCulloch Blvd., Purcell Blvd., Wills Blvd., and Baltimore Ave. would fit within the existing ROW or would require minimal acquisitions (less than one acre). Therefore, this tradeoff would primarily be related to the intersection options at Pueblo Blvd. The partial cloverleaf interchange (part of Alternatives A and C) would greatly exceed the Purpose and Need LOS threshold, while the DDI (part of Alternatives B, D, and E) would come closer to matching it. However, the partial cloverleaf interchange would also require a greater acreage of additional ROW. The partial cloverleaf interchange would require purchasing about 3 acres of additional ROW, while the DDI would require obtaining only about one more acre.

LOS and Streams

A second tradeoff involves LOS and stream-related impacts. The stream crossings in the Corridor are Turkey Creek east of Swallows Rd., and both Williams and Wild Horse Creeks near Pueblo Blvd. Since all alternatives retain the existing four lanes between Swallows Rd. and West McCulloch Blvd., Turkey Creek is unaffected. Therefore, this tradeoff also focuses on the Pueblo Blvd. intersection.

To minimize ROW impacts, the partial cloverleaf interchange would require the US 50 mainline to be realigned essentially where Williams Creek is now. The results of this design would include impacts on wetlands and the floodplain. Because the DDI would have a smaller footprint, it would be more flexible to design, with an optimal placement realigning the westbound US 50 lanes with the existing eastbound lanes. With this arrangement, stream crossings would occur at limited distinct places.

Table 2-8. Relative Levels of Alternative Impacts and Measures of Effectiveness

Comparison Criteria	No Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Meeting Purpose and Need						
AM Peak Hour EB Travel Time	–	/	/	+	–	+
AM Peak Hour WB Travel Time	–	/	/	+	–	/
PM Peak Hour EB Travel Time	–	+	/	+	–	/
PM Peak Hour WB Travel Time	–	/	/	+	–	/
AM & PM Peak Hour Average Delay	–	+	/	+	/	+
Local Vehicular Access	–	+	/	+	/	/
Bicycle & Pedestrian Access	/	+	+	+	/	+
Crossing Conflict Points	–	+	+	+	–	+
Environmental Impacts						
ROW Acquisitions	+	–	/	–	+	/
Developed Parcel Acquisitions	+	+	+	+	+	+
Future Land Use Consistency	/	+	+	+	–	+
Community & Business Cohesion	/	+	+	+	–	+
Visual	+	/	/	/	/	/
Noise	+	/	/	/	/	/
Hazardous Materials	+	+	+	+	/	+
Utilities	+	–	+	–	/	+
Streams	+	–	+	–	+	+
Wetlands	+	–	+	–	+	+
Floodplains	+	–	+	–	+	+
Implementation and Phasing						
Construction Cost	+	/	/	–	+	–
Flexibility in Construction Phasing	/	–	–	+	+	+
Flexibility for Future Expansion	–	+	+	+	–	+

Legend:

+	*Option among the least impacts on resource or best measures of effectiveness*
/	*Option with intermediate impact on resource or measure of effectiveness, or potential for mitigation*
–	*Option among the greatest impacts on resource or worst measures of effectiveness; difficult to mitigate*

Note: See Appendix B, Section B.4, for more detail on levels of impacts and measures of effectiveness.

LOS and Construction Cost

Most transportation studies would reveal a tradeoff between construction cost and LOS, and the US 50 Corridor is no different. Generally, additional construction is required to create new capacity, which improves traffic operations. Among the action alternatives, Alternative C would have the most capacity and would be the most expensive for the US 50 Corridor. Alternative D would be the least expensive and also would have the most delay. Of course, No Action would have no capital cost, but its LOS would not meet the Purpose and Need.

Construction Cost and Flexibility

The tradeoff between cost and traffic operations must also consider flexibility for future expansion. Generally, the higher the construction cost, the greater the need for flexibility in phasing because more roadway is being built. Dividing a construction project into multiple phases tends to increase construction costs because workers must be mobilized at the beginning of each phase. Providing opportunities for future expansion also tends to increase construction costs. In the US 50 Corridor, low-cost Alternative D would have the least flexibility for expansion, should travel demand grow much beyond its 2035 forecast. In contrast, Alternatives C and E would have the greatest flexibility for both phasing and future expansion. Alternative C would be the most expensive at $122 million, followed closely by Alternative E at $119 million.

2.14.3 How does corridor-wide travel time compare for the alternatives?

Table 2-9 shows the travel time between Swallows Rd. and Baltimore Ave. for the alternatives during the morning and evening peak hours. Travel time is shown as a range because the traffic simulation calculated it for 15-minute intervals during the peak hour. With any of the action alternatives, it generally would take 12 to 15 minutes to cross the Corridor in either direction during either peak hour.

Table 2-9. Corridor-Wide Travel Time (minutes) Comparison

Peak Hour and Direction	No Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
AM Peak Eastbound	14.4-25.8	12.5-13.2	12.4-13.3	12.5-12.9	13.5-13.8	12.4-13.0
AM Peak Westbound	13.6-18.2	12.5-13.0	13.2-13.9	12.3-12.6	13.9-14.7	13.2-13.8
PM Peak Eastbound	19.2-30.4	12.4-13.0	12.8-13.8	12.5-12.8	14.0-14.5	12.5-13.6
PM Peak Westbound	19.5-30.1	12.6-13.5	12.7-13.7	12.6-13.2	13.8-14.7	12.7-13.5

Source: JFSA, 2011.

Under the No Action Alternative, the forecasted time to travel east from Swallows Rd. to Baltimore Ave. in the morning would be about 15 to 25 minutes, and about 15 to 20 minutes to make the return trip. In the evening, crossing the Corridor in either direction would take about 20 to 30 minutes.

Among the action alternatives, Alternative C would consistently be the fastest, while Alternative D would consistently be the slowest. However, the travel time difference between the two alternatives would only be a minute or two.

Table 2-9 also reveals an interesting aspect of the DDI's operation. For No Action, Alternative A, and Alternative C, the peak direction—eastbound in the morning and westbound in the evening—travel time would generally be greater than the off-peak direction travel time. This relationship would be expected because congestion would result in longer travel times. However, the reverse would be true for the alternatives with a DDI at Pueblo Blvd.—Alternatives B, D, and E.

Recall that for the DDI at Pueblo Blvd., there are two traffic signals where eastbound and westbound US 50 traffic cross sides. The signals would be timed so that for the peak direction, cars that leave the first signal light when it turns green would get to the second signal light just as it turns green. However, this "green wave" would come at a cost. The best signal timing for one direction usually would not be the best for the other direction. Off-peak direction traffic would have to stop at both signals in the DDI, and the time spent waiting for the signal to change would add to the Corridor-wide travel time.

2.14.4 What other considerations distinguish alternatives?

Traffic safety

Because the study team examined traffic safety in terms of crossing conflict points—places where two traffic streams would cross each other—ROW must be established by traffic signals, stop or yield signs, or the "rules of the road." For example, a driver turning left from westbound US 50 to southbound Purcell Blvd. must cross where eastbound US 50 vehicles also travel. Because of the conflicting movements, certain types of crashes would be more likely to occur at crossing conflict points. The number of crossing conflict points could be reduced by changing the intersection geometry or by grade separating crossing movements.

Other Considerations That Distinguish Alternatives

- Traffic safety
- Hazardous materials
- Utilities
- Streams, wetlands, and floodplains

The No Action Alternative would have the greatest number of crossing conflict points because all seven intersections along US 50 are at grade. Each three-leg intersection would have six crossing conflict points, and each four-leg intersection would have 16.

Among the action alternatives, Alternative D would have the most crossing conflict points because CFIs are at grade. A two-leg CFI would have 14 crossing conflict points and a four-leg CFI would have 12. The remaining action alternatives are tied for the lowest number of crossing conflict points. Both a partial cloverleaf interchange and a DDI would have only two crossing conflict points; namely, at the traffic signals.

Hazardous materials

The No Action Alternative obviously would not disturb any HazMat sites. All action alternatives would share some potential HazMat impacts associated with mainline improvements. There are four Resource Conservation and Recovery Act (RCRA) generator sites and four USTs along US 50 between Main McCulloch Blvd. and Purcell Blvd. There are also two UST leaks, a HazMat spill, and a RCRA small quantity generator site along US 50 between the Burlington Northern Santa Fe (BNSF) railroad crossing and Baltimore Ave. Recall that the four-lane action alternatives would widen the shoulders of US 50 to current standards and add a pedestrian and bicycle path. Therefore, the impacts of the four-lane and six-lane alternatives would not be significantly different. However,

Alternative D would have more potential HazMat impacts resulting from the four-leg CFI footprint at Purcell Blvd.

Utilities

Utility impacts at Purcell Blvd. and Pueblo Blvd. also differentiate the alternatives. The four-leg CFI at Purcell Blvd. would affect about 500 more feet of Southeast Communications (SECOM) underground fiber optic cable (UGF) and about 500 more feet of water line than the diamond interchange. At Pueblo Blvd., the partial cloverleaf interchange would affect about 3,400 more feet of UGF than the DDI. CDOT owns 2,400 feet of this additionally affected cable, and SECOM owns the other 1,000 feet. Note that Alternatives A and C would have the same utility impacts, as would Alternatives B and E.

Streams, wetlands, and floodplains

As mentioned previously, the two intersection options that remain in consideration for the Pueblo Blvd. intersection are constrained by their footprints. The partial cloverleaf interchange would have a larger footprint than the DDI.

The partial cloverleaf interchange of Alternatives A and C would need to be designed to balance ROW acquisition with impacts on streams, wetlands, and floodplains. If ROW acquisition is minimized, the optimal position for the interchange would be centered in the existing ROW. This would place the new US 50 mainline between the existing eastbound and westbound lanes—where Williams Creek is. This alignment would have, perhaps, the most impacts on Williams Creek. Avoiding Williams Creek would require moving the interchange to the south—and possibly impacting Parkview Hospital and other development near Spaulding Ave.—or to the north, which would have an impact on the CDOT maintenance facility northwest of the intersection and the park-and-ride lot northeast of the intersection.

Because the DDI of Alternatives B, D, and E would have a smaller footprint, it would have more flexibility in avoiding impacts on streams, wetlands, and floodplains. One attractive possibility is to relocate the westbound US 50 lanes to the immediate north of the existing eastbound lanes. The box culvert at Williams Creek would need to be extended or replaced. The northbound on-ramp and the southbound off-ramp to and from Pueblo Blvd. would also need to cross Williams Creek with bridges or culverts. Because these structures cross Williams Creek at nearly right angles, impacts on streams, wetlands, and floodplains would be reduced.

2.14.5 What considerations don't distinguish alternatives?

Visual and noise impacts are similar among all action alternatives. With the CFIs using elevated bicycle and pedestrian crossings to mitigate access impacts from a wider intersection, all of the remaining intersection options at Main McCulloch Blvd., Purcell Blvd., and Pueblo Blvd. would involve two levels of structures. Because travel demand would not be significantly different between the four-lane alternatives and the six-lane alternatives, the noise levels predicted for each action alternative would be similar. Likewise, all action alternatives would benefit from using a roughly 4,000-foot noise wall south of US 50 and west of Main McCulloch Blvd. as mitigation.

None of the action alternatives would require total acquisition of any parcel.

As mentioned previously, corridor-wide travel time is not as big a differentiating factor among action alternatives as it is between the action alternatives and the No Action Alternative. **Table 2-9**

showed that Corridor travel times would range from 12 to 15 minutes for the action alternatives, but up to half an hour under the No Action Alternative.

Once detailed construction cost estimates were compiled for Level 4 evaluation, the TAT observed that the costs of the action alternatives would fall within a narrow range. Alternative D, with the lowest cost, would require about $100 million to build all at once. Alternative C would represent the high end of the range at about $120 million, only 20 percent more than Alternative D.

2.15 Which alternative is preferred and why?

Alternative E is the Preferred Alternative because it would offer reasonably good traffic operations in 2035 while minimizing HazMat impacts, utility relocation, and stream-related impacts. Alternative E would also be attractive because of its flexibility for construction phasing and for future expansion. Alternative E's improved traffic operations and additional capacity justified its additional cost as compared to other action alternatives. The bottom right corner of the final page of **Figure 2-25** (found earlier in this chapter) schematically shows the selection of the Preferred Alternative at Level 4 evaluation.

Alternative E is the Preferred Alternative

Alternative E was identified as the Preferred Alternative because it does well regarding:

- Traffic operations
- HazMat impacts
- Utility relocation
- Stream impacts
- Wetlands impacts
- Construction phasing
- Flexibility for future expansion
- Cost-effectiveness

Based on the data, stream and wetlands impacts of the partial cloverleaf interchange at Pueblo Blvd. would be too great to justify the improved traffic operations as compared to the DDI. This decision meant that Alternatives A and C would not be the Preferred Alternative. Also of concern was the ability of Alternatives B and D to accommodate travel demand beyond 2035.

Recall that Alternative B was designed as a four-lane alternative between West McCulloch Blvd. and Pueblo Blvd. However, traffic operations eastbound from Purcell Blvd. to Pueblo Blvd. would not meet the Purpose and Need LOS D threshold. (This was also the case for Alternative A.) Level 4 evaluation includes mitigation of adverse impacts and the cost of selected mitigation measures in the total project cost. Consistent with that approach, a third eastbound lane was added as an auxiliary lane between Purcell Blvd. and Pueblo Blvd. to restore traffic operations to LOS D or better. The study team expected morning and evening peak hour volumes on US 50 to be nearly symmetric. Eastbound 2035 volumes are expected to be just above the capacity of a two-lane roadway. Therefore, if westbound volumes in 2035 are expected to be within the two-lane capacity, they must be just barely under capacity. A third westbound lane would need to be added in a few years if traffic volumes continue to grow and pass the current two-lane capacity. This conclusion led to the preference for Alternative E over Alternative B.

The study team was also concerned that the four-leg CFI at Purcell Blvd. would operate at LOS D during 2035 evening peak hours. If travel demands rise beyond the 2035 forecasts, the four-leg CFI cannot easily be converted to another intersection type (as opposed to the way a two-leg CFI can be converted to a four-leg CFI). Replacing the four-leg CFI with a diamond interchange after 2035 would result in greater construction impacts than initially building to a complete diamond interchange configuration. Alternative E would have a diamond interchange at Purcell Blvd., with another diamond interchange at Main McCulloch Blvd. for a consistent driving experience.

2.16 What are the components of the Preferred Alternative?

Figure 2-26 illustrates the Preferred Alternative and its surroundings. Across the top, the figure identifies three typical cross sections that would be used in the Corridor:

1. A four-lane rural section
2. A six-lane suburban section
3. A six-lane urban section that connects to the existing six-lane urban section east of Baltimore Ave.

Figure 2-27 illustrates these three cross-section types.

Section 2.16.1 discusses mainline US 50 improvements and their corresponding cross sections that would be made as part of the Preferred Alternative. **Section 2.16.2** specifies the improvements that would be made at each of the seven major Corridor intersections to construct the Preferred Alternative (see the middle portion of **Figure 2-26** for details). **Section 2.16.3** describes multimodal improvements that may be built in conjunction with the Preferred Alternative, particularly to link sections of the regional bicycle and pedestrian trail network. **Section 2.16.4** describes modifications to structures that would have to be made in the Corridor to build the Preferred Alternative.

2.16.1 Corridor improvements

As part of the Preferred Alternative, US 50 would be improved in the following ways:

- One through lane in each direction would be added between Main McCulloch Blvd. and Baltimore Ave.
- Substandard outside shoulders would be widened to 10 feet for four-lane sections.
- Because six-lane highways have more stringent standards than four-lane highways, the existing outside and median shoulders would not meet the 12 feet now required and would, therefore, also be widened
- US 50 bridges and concrete box culverts would be widened or replaced.
- Side slope and drainage improvements would be made.
- Water quality would be improved to meet Metropolitan Separate Storm Sewer System (MS4) requirements.
- Noise walls would be built where cost-effective.
- Aesthetic treatments would be applied to structures, landscaping, and other elements of the Preferred Alternative.

Figure 2-26. Illustration of Preferred Alternative

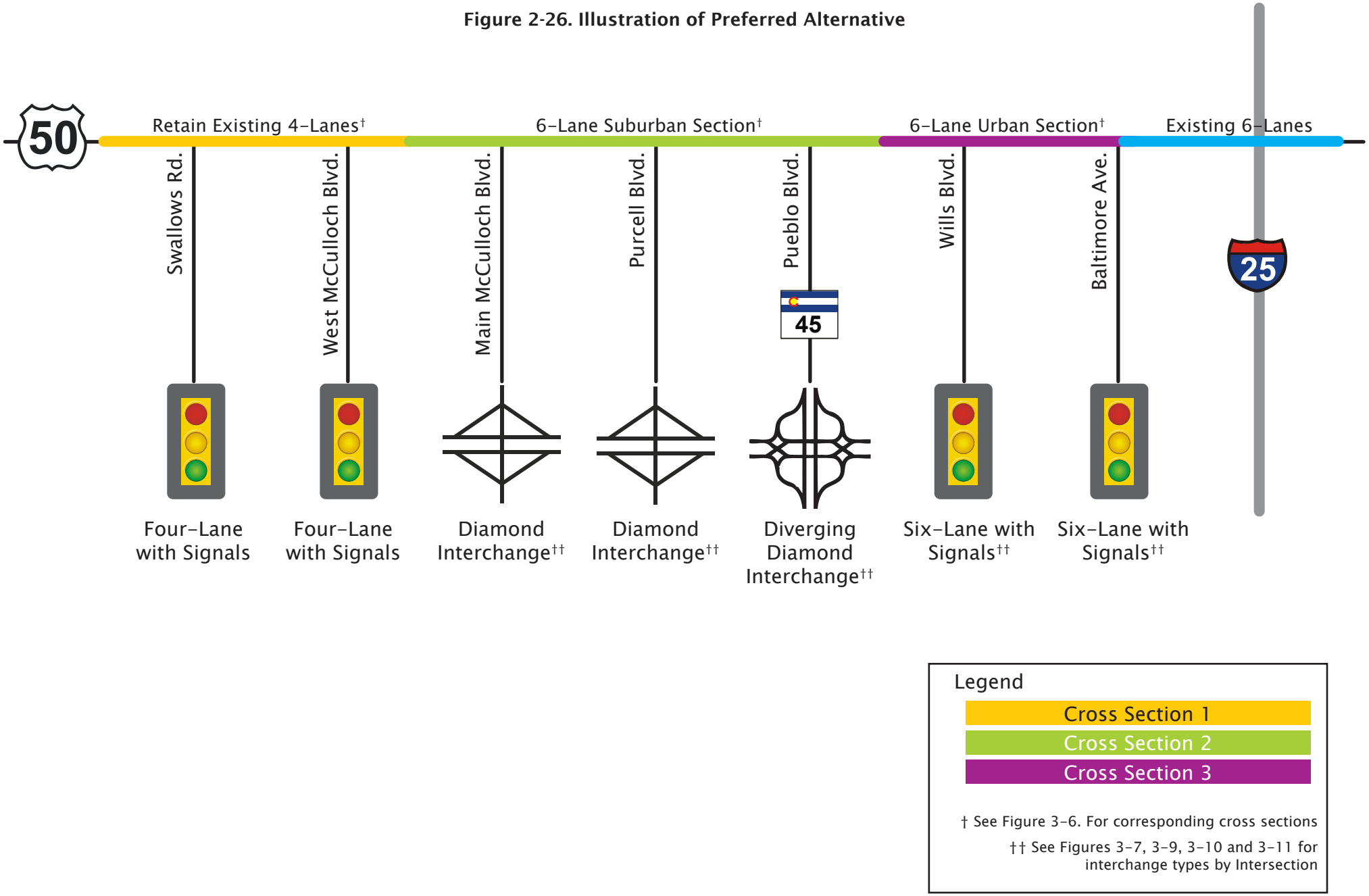
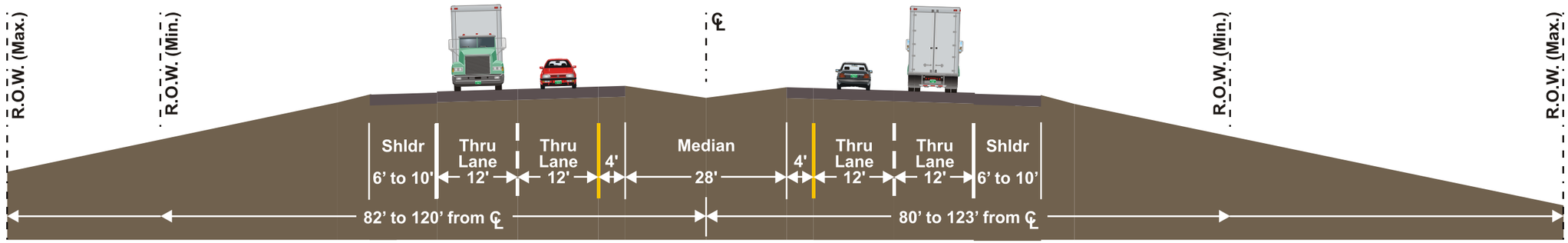
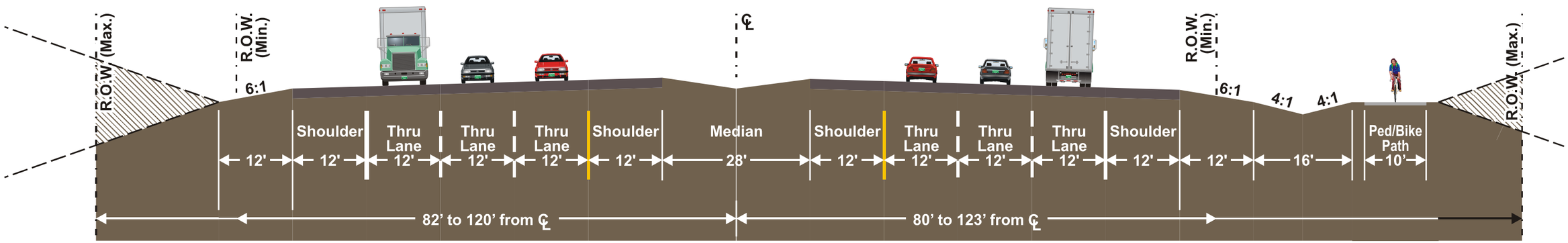


Figure 2-27. Cross Sections Types

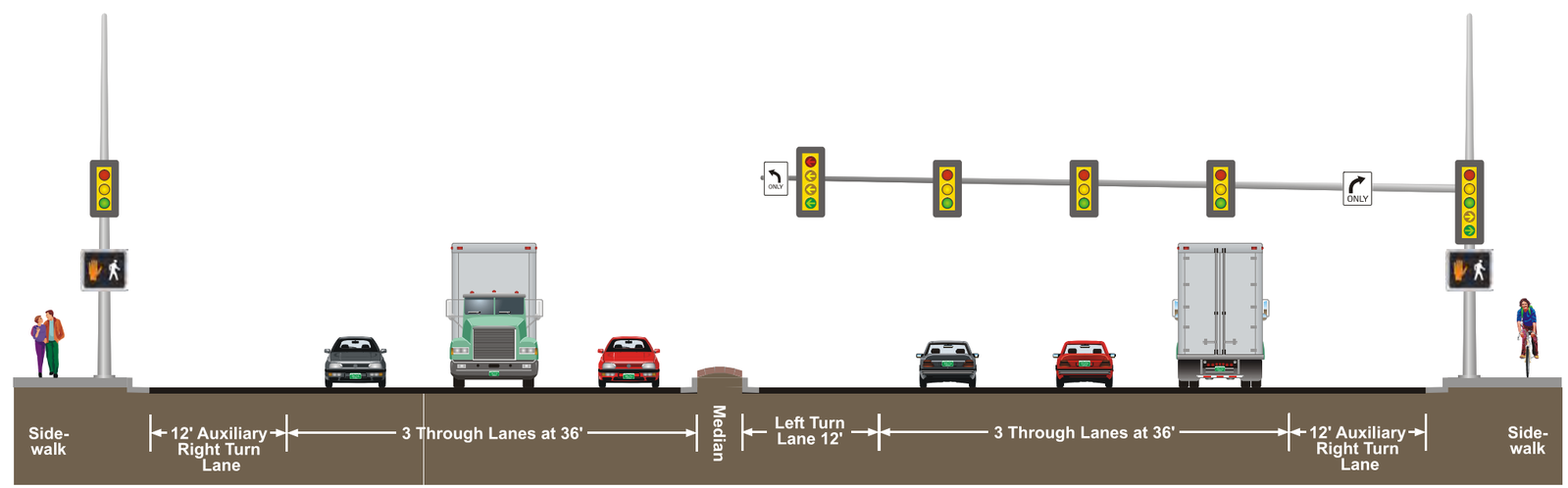
Cross Section 1 – Existing



Cross Section 2 – Future 6-Lane



Cross Section 3 – Future 6-Lane Urban



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2.16.2 Intersection improvements

The intersections at Swallows Rd. and West McCulloch Blvd. would be improved by installing traffic signals based on future traffic congestion. Intersection lighting would be installed with the traffic signals or earlier if safety issues arise.

Diamond interchanges would be constructed at Main McCulloch Blvd. by 2033 and at Purcell Blvd. by 2029. Both cross streets would go over US 50 on a new bridge structure. Additional through lanes or auxiliary lanes would be added on Main McCulloch Blvd. by 2025 and on Purcell Blvd. by 2021. Improved pedestrian facilities along the cross streets through the interchange and new interchange lighting would be included. **Figure 2-28** shows an aerial view of the diamond interchange to be built at Main McCulloch Blvd., while **Figure 2-29** shows the one to be constructed at Purcell Blvd. **Figure 2-30** shows a street-level view of the diamond interchange to be built at Purcell Blvd.

As shown in **Figure 2-31**, a DDI at Pueblo Blvd. would be constructed in conjunction with the Pueblo Blvd. Extension to I-25. The final bridge configuration to decide whether Pueblo Blvd. would go over or under US 50 would be determined during the design phase of the interchange. Improved pedestrian facilities along Pueblo Blvd. and US 50 through the interchange, as well as new interchange lighting, would be included.

Even though Wills Blvd. and Baltimore Ave. would remain signalized, they would be improved by widening US 50 to three through lanes in each direction. At Baltimore Ave., US 50 would also gain a second left turn lane. Baltimore Ave. itself would be widened to have two left-turn lanes, two through lanes, and a dedicated right turn lane. **Figure 2-32** shows an aerial view of improved US 50 near these two intersections.

Figure 2-28. Aerial View of Diamond Interchange at Main McCulloch Blvd.

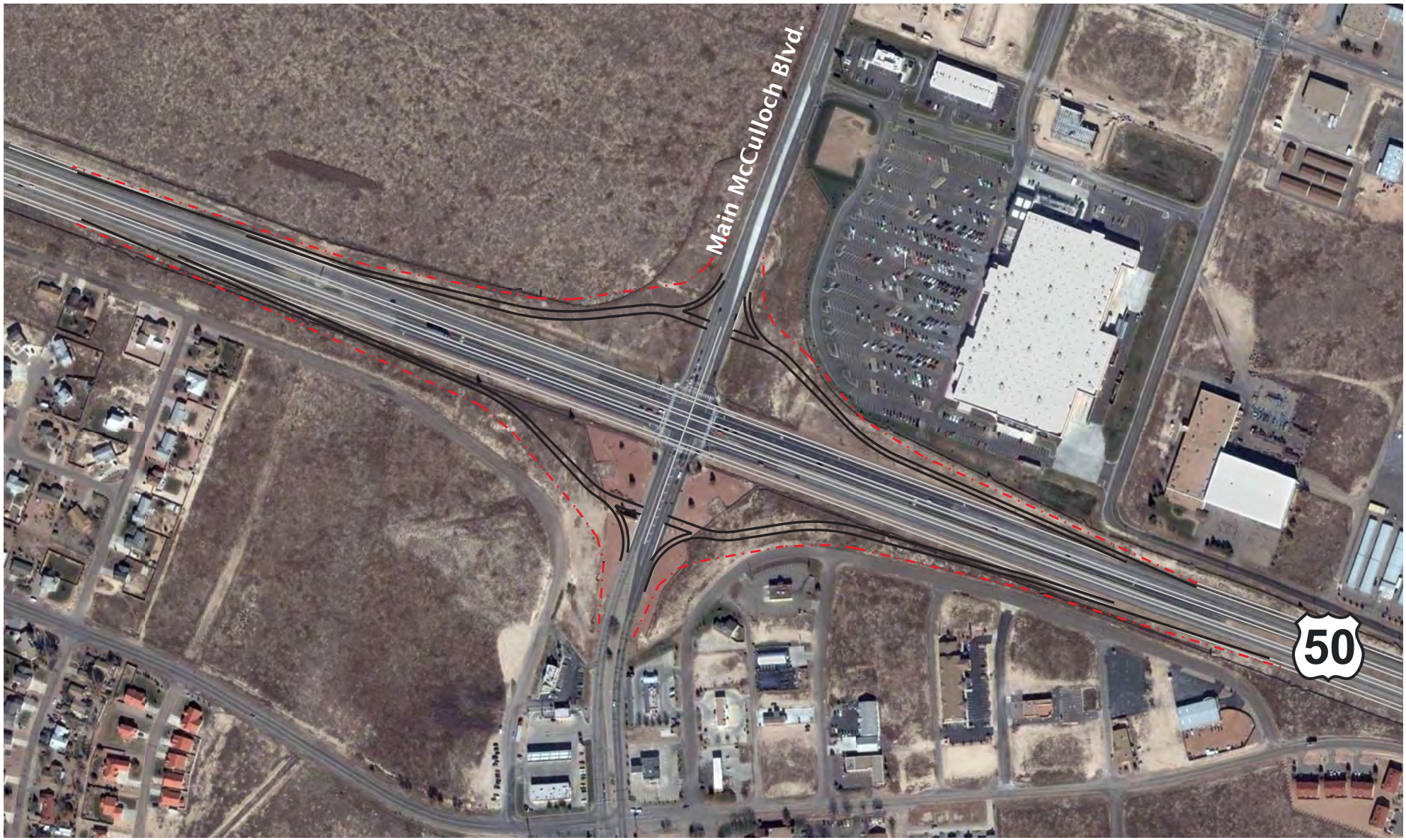


Figure 2-29. Aerial View of Diamond Interchange at Purcell Blvd.

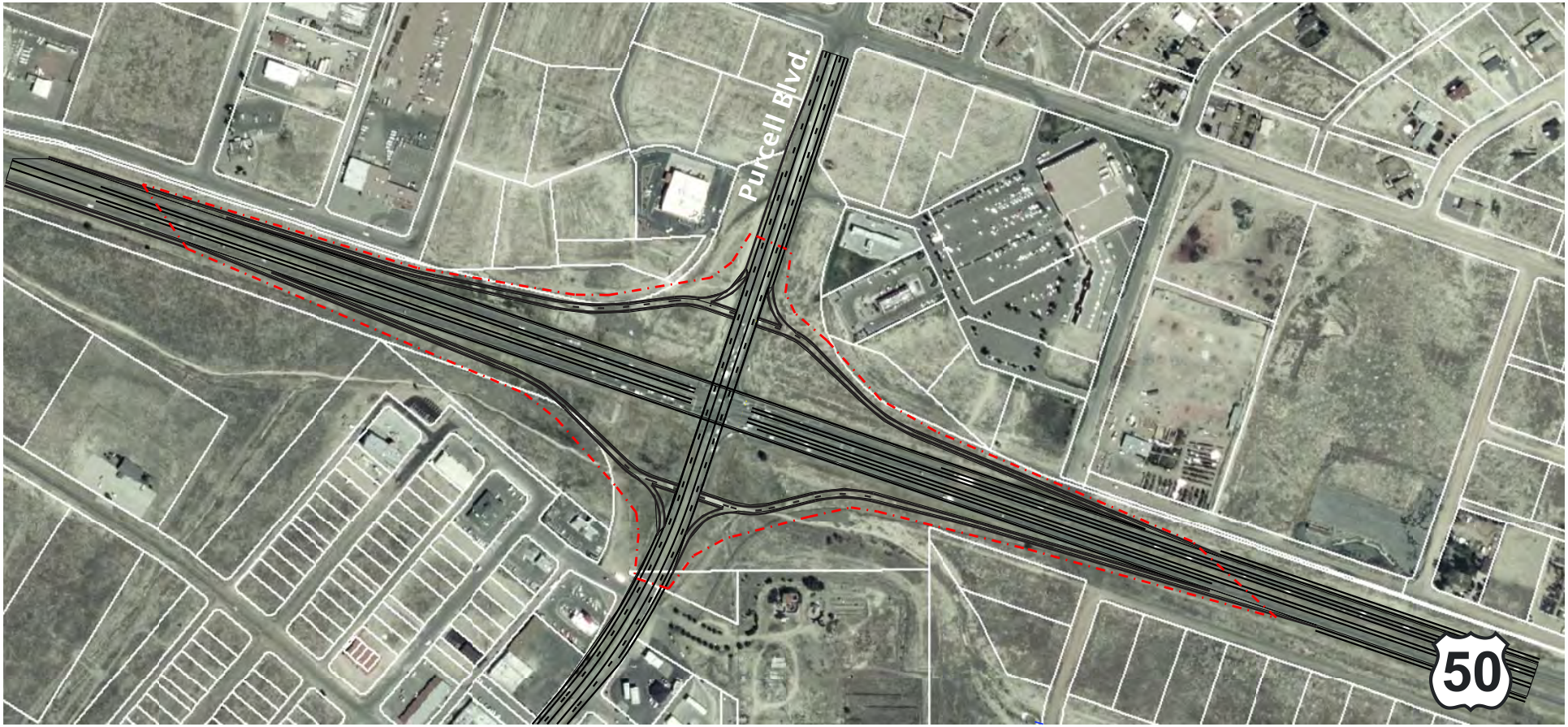


Figure 2-30. Diamond Interchange - Visualization at Purcell

view of proposed diverging diamond at Purcell from a typical driver along US 50.

Figure 2-31. Aerial View of Diverging Diamond Interchange at Pueblo Blvd.

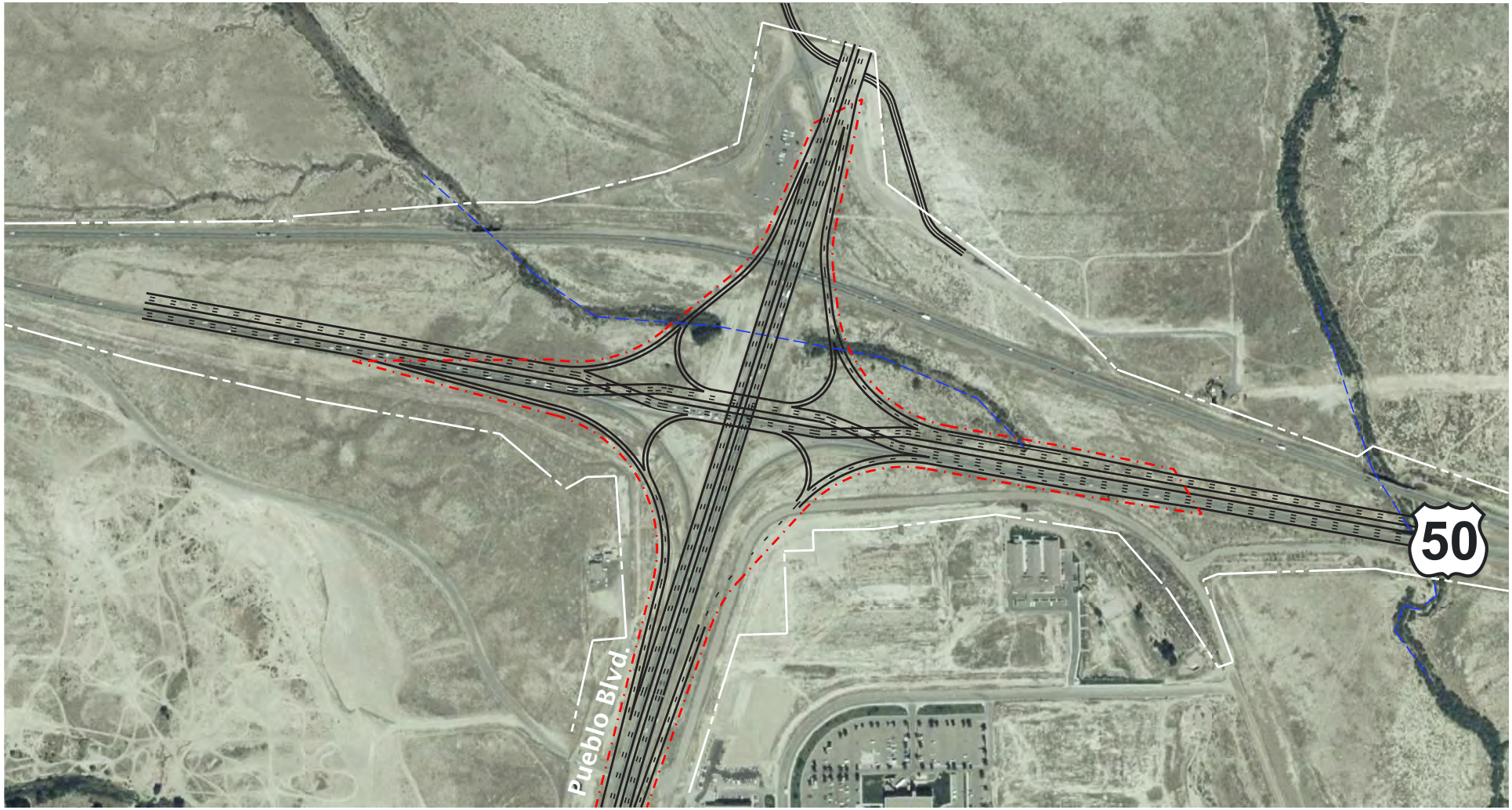


Figure 2-32. Aerial View of Six-Lane US 50 at Wills Blvd. and Baltimore Ave.

2.16.3 Multimodal improvements

Opportunities exist to improve US 50 not only for vehicles, but also for bicyclists and pedestrians. The new traffic signals proposed for Swallows Rd. and West McCulloch Blvd. would be equipped with pedestrian buttons (or possibly video detection) and displays. Crosswalks—like those found at Main McCulloch Blvd. and Purcell Blvd.—could be painted at minimal cost.

The Preferred Alternative would provide for improvements to multimodal facilities in the following ways:

- Interchange and intersection improvements would include sidewalk improvements along the cross streets. Pedestrian mobility would be enhanced with sidewalks and pedestrian ramps designed to the latest Americans with Disabilities Act standards.
- Construction of diamond interchanges at Main McCulloch Blvd. and Purcell Blvd. would result in reducing the total length of crosswalk to be shared with crossing vehicles because through movements on US 50 would be grade separated. Attached sidewalks would be provided along both sides of the Main McCulloch Blvd. and Purcell Blvd. bridges over US 50. The signals at the ramp junctions would have standard pedestrian amenities.
- Roadway improvements along US 50 would accommodate a future 10-foot wide paved multi-use trail along the south side of US 50 from Main McCulloch Blvd. to the existing sidewalk near Wills Blvd. The trail may use existing CDOT ROW or the Pueblo West multi-use easement or both. Connections to the trail can be made at intersections and with proposed trails crossing US 50, such as at Wild Horse Creek.
- West of Main McCulloch Blvd., bicyclists and pedestrians would be able to make connections to the Pueblo West trail network, including sidewalks along Calle de Camelia.
- Future connections to park-and-ride facilities would be accommodated in the Preferred Alternative. These park-and-ride lots may be located to also serve as trailhead parking for the bicycle and pedestrian path along the south side of US 50. The lots may also be served by future bus routes to be developed for the area.

2.16.4 Structure replacement

The following structures on US 50 would be removed, modified, or replaced as part of the Preferred Alternative:

- Extend the concrete box culvert over draw at milepost 303.92, or add guardrail to accommodate 10-foot outside shoulder widths for four-lane section
- Remove the westbound bridge over Williams Creek.
- Extend the Williams Creek concrete box culvert under Pueblo Blvd., or replace the structure to accommodate the DDI and Pueblo Blvd. Extension.
- Extend the Williams Creek concrete box culvert under eastbound US 50 to accommodate the DDI.
- Under the Williams Creek interchange ramps, construct a new concrete box culvert or bridge structure at two locations.
- Remove and replace the eastbound bridges over Wild Horse Creek with two bridges to accommodate six travel lanes and widened shoulders.

- Remove the westbound bridge over Wild Horse Creek.
- Potentially remove the existing railroad bridge over US 50 and replace with a new bridge to accommodate six-travel lanes and widened shoulders. Alternatively, if this crossing is designed to urban standards, rather than those for its current rural designation, the existing structure may be able to accommodate six lanes on US 50 with slight modifications. The next section of this chapter and **Chapter 3, Section 3.16.4, Railroad** of this PEL Study discuss these issues in more detail.

Table 2-10 summarizes the changes that would be made to the bridges and culverts on US 50 to implement the Preferred Alternative. It also provides the sufficiency rating from the last structural inspection. Photographs show the features and condition of each structure.

Note that while the basic design features of the Preferred Alternative—such as number of lanes, lane width, and shoulder width—allow for this assessment of existing structures, other additional details will need to developed in later NEPA clearance and design phases to better assess impacts on streams, wetlands, floodplains, and other affected resources.

Figure 2-33 shows the existing cross section of US 50 at the BNSF railroad crossing, looking east. This part of US 50 is currently classified as rural. If rural design standards were to be used, the exiting BNSF railroad crossing would be too narrow to fit six 12-foot traffic lanes, standard shoulders, and roadside drainage facilities. Relocating this crossing would require a 4,000-foot shoofly parallel to the existing bridge that connects to curves in the track north and south of US 50. The shoofly and new bridge are estimated to cost about $13 million.

However, if this part of US 50 was to be reclassified as urban—like the area to the immediate east—a different set of design standards could be used. One particular difference is that curb and gutter, connecting to an underground storm sewer, could be used for drainage rather than a roadside ditch. **Figure 2-34** illustrates what a six-lane cross section might look like using urban design standards. Clearly, not having to replace the railroad bridge would greatly reduce construction costs. However, there are other factors to consider, such as emergency vehicles not having the option of driving in a wide shoulder. BNSF would need to approve any modifications made to their structure or abutments, such as the construction of a bicycle and pedestrian path or installation of roadside barriers. With travel lanes closer to its structure, BNSF may request improvements to make the bridge more crashworthy. The study team did not contact BNSF as part of this PEL effort.

Table 2-10. Structure Modifications to Implement the Preferred Alternative

US50 Milepost	Structure ID	Number of Spans	Structure Type	Description	Sufficiency Rating* and Date of Inspection	Required Action for Preferred Alternative	Photo
302.20	K-17-AC	3	Concrete on I-beam continuous and composite	EB over Turkey Creek	96.9 Dec. 17, 2010	None	
302.20	K-17-I	3	Concrete on I-beam	WB over Turkey Creek	78.9 Dec. 27, 2010	None	
303.92	K-17-AD	3	Concrete box culvert	Draw	69.9 Dec. 27, 2010	None, add guardrail, or extend	
311.50	K-18-O	2	Concrete slab and girder	WB over Williams Creek	73.0 Dec. 27, 2010	Remove	
N/A	N/A	2	Concrete box culvert (2-14 x 10) 2	Pueblo Blvd. (SH 45) over Williams Creek	N/A	Extend or replace	

US50 Milepost	Structure ID	Number of Spans	Structure Type	Description	Sufficiency Rating* and Date of Inspection	Required Action for Preferred Alternative	Photo
312.50	K-18-CZ	N/A	Concrete box culvert (2-14 x 10) 250'	EB over Williams Creek	83.8 Nov. 11, 2008	Extend	N/A
312.56	K-18-CW	3	Concrete slab and girder continuous	EB over Wild Horse (Dry) Creek	97.8 Nov. 11, 2008	Replace	
312.56	K-18-AC	3	Concrete on I-beam	WB over Wild Horse (Dry) Creek	53.8 Dec. 27, 2010	Remove	
312.86	K-18-BL	4	Welded girder	Railroad over US 50	No rating given on Dec. 27, 2010 inspection report	Replace or modify	

Source: CDOT, 2011. *Note: * Federal funds may be used to replace a structure with a sufficiency rating less than 50 or to repair a structure with a sufficiency rating less than 80.*

Abbreviations: *EB = eastbound* *WB = westbound* *N/A = Not applicable or not available*

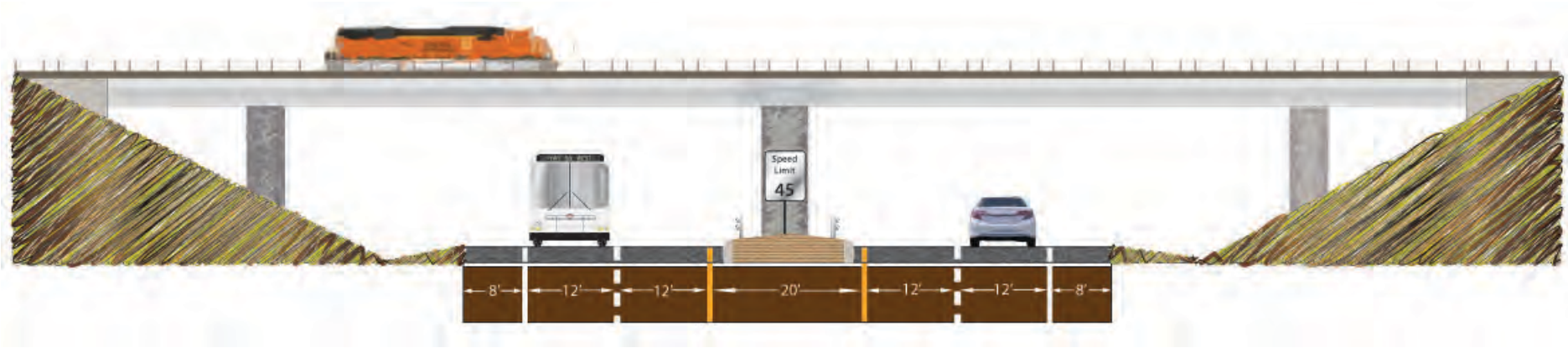


Figure 2-33. Existing Cross Section of US 50 at the BNSF Railroad Crossing

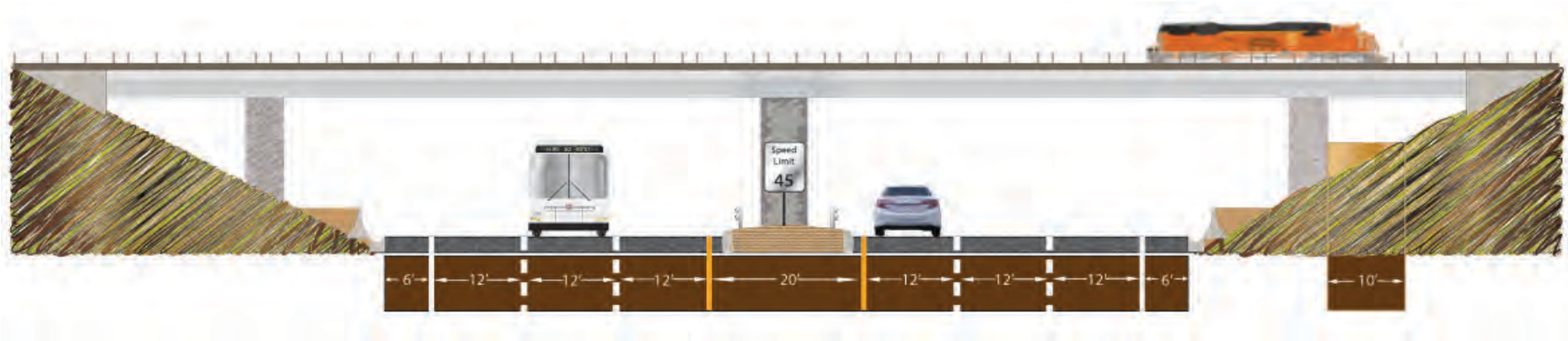


Figure 2-34. Potential Reduced-Width Six-Lane Cross Section at the BNSF Railroad Crossing

2.17 What is the cost of the Preferred Alternative?

The cost to construct the Preferred Alternative is about $120 million, which includes $4.2 million for noise mitigation and $4.6 million for utility relocation. The cost estimate also includes $13 million to construct a new, wider BNSF railroad crossing over US 50. The cost estimate is based on 2011 CDOT cost data, without adjusting for future inflation. It is also based on implementing the Preferred Alternative all at once. If the Preferred Alternative is built in phases, which is likely to occur, some expenses such as labor force, mobilization, and construction traffic control would be incurred more than once.

The construction cost does not include the cost to acquire the necessary additional ROW. Narrow strips of additional ROW would be needed in specific locations between Main McCulloch Blvd. and Baltimore Ave. to widen US 50 to six lanes and to accommodate a bicycle and pedestrian path. Between Main McCulloch Blvd. and Pueblo Blvd., the land adjacent to the existing CDOT ROW is an un-platted portion of the Pueblo West Metropolitan District. CDOT will need to enter into negotiations with PWMD to purchase or obtain an easement for the additional ROW. Between Pueblo Blvd. and the BNSF railroad crossing, a total of about 0.1 acre would need to be acquired from three property owners. Another 0.1 acre would need to be acquired from four property owners near Baltimore Ave. to accommodate for sidewalks.

Because the responsibility for constructing the multi-use path on the south side of US 50 has not been assigned, its cost has not been included in estimates of alternative construction costs. However, the path has been included in all action alternatives.

2.18 What changing factors could cause the Preferred Alternative to need to be reconsidered?

The choice of the Preferred Alternative is based on many assumptions about the most reasonably-foreseeable conditions in 2035. These assumptions include how many people are expected to live and work in Pueblo County, as well as what roads will be built by that time. This PEL Study also assumes that environmental and community resources identified by the preliminary investigation techniques used for the study are representative of the true potential impacts of the project. If these assumptions change or if new data reveals additional impacts, then the results of the screening and comparative analyses that identified the Preferred Alternative could change. A change in screening results could lead to more or fewer options meeting the Purpose and Need, which could, in turn, result in the choice of a different preferred alternative.

The most important factors that could cause a need to reconsider the Preferred Alternative are:

- The development forecasts and travel behavior that feed into the traffic projections
- The local improvement projects assumed as part of the future roadway network, particularly the Pueblo Blvd. Extension and the WPC
- The study procedures used to identify historic resources
- The study procedures used to identify low-income populations

Each of these factors is discussed in a separate section below.

2.18.1 Development forecasts and travel behavior

The PACOG travel demand model used for this PEL Study predicts trip making based on the forecasts of households to job characteristics. The 2035 traffic forecasts are based on socioeconomic forecasts that predict about 250,000 people will be living in more than 100,000 households in Pueblo County in 2035. The socioeconomic forecasts also predict just under 120,000 jobs county-wide. If the actual growth is more or less than these forecasts, the resulting traffic could be more or less congested than the model predicts.

If fewer people are traveling in 2035, then some of the options that were dropped from consideration during Level 2 screening might be able to meet the Purpose and Need. Some of these options might be more attractive than the Preferred Alternative identified here because they have a smaller footprint or lower cost. On the other hand, if more people are traveling, parts of the Preferred Alternative may become too congested and no longer meet the Purpose and Need. The diamond interchange at Purcell Blvd., the DDI at Pueblo Blvd., and the traffic signals at Baltimore Ave. are particularly vulnerable because they are predicted to operate at LOS D during one or both peak hours with the expected growth. Greater-than-predicted growth could push their LOS into the E or F categories.

To this point, this discussion has described traffic levels growing in proportion to population and employment. However, other factors also determine traffic levels. The PACOG model assumes that if a particular person makes on average, 10 trips per day today, another person from the same type of household with the same real income will also make 10 trips per day in 2035.

What could cause trip-making patterns to change? Over the past few decades, travel forecasters have noticed that people throughout the U.S. tend to combine more trip destinations each time a traveler leaves home. Modelers call this response "trip chaining," and it results in fewer trips being needed to reach the same number of destinations. Another factor that could cause travel patterns to change is the popularity of "new urbanism." Under this movement, people prefer to live in mixed use neighborhoods where they can make more trips by walking or bicycling and fewer trips by driving. Increased fuel prices associated with dwindling crude oil resources could also encourage more walking, bicycling, and car/van pooling in response to the concerns about one's "carbon footprint."

2.18.2 Pueblo Blvd. Extension and West Pueblo Connector

The Preferred Alternative was identified based on the assumption that the Pueblo Blvd. Extension and WPC would divert some traffic from US 50. If these local improvements are not constructed, the additional traffic on US 50 may cause some components of the Preferred Alternative to no longer meet certain mobility elements of the project Purpose and Need.

Level 2 mobility/traffic analysis indicated that the traffic signals at Swallows Rd. and West McCulloch Blvd., as well as the diamond interchanges at Main McCulloch Blvd. and Purcell Blvd., would continue to meet the Purpose and Need. The DDI at Pueblo Blvd. and the traffic signal at Wills Blvd. would continue to meet the Purpose and Need if only the Pueblo Blvd. Extension was built (without the implementation of the WPC). However, the signal at Baltimore Ave. and US 50 relies on the traffic reduction from both local improvements to operate effectively. Level 2 traffic analysis did not consider a scenario where the WPC was built but not the Pueblo Blvd. Extension.

The Preferred Alternative assumes that these two local improvements would be implemented. If they are not constructed by 2035, CDOT is committed to re-examining the components of the Preferred Alternative that do not meet the project Purpose and Need without these local roadway projects. This re-examination would most likely occur within the context of a traffic feasibility study followed by a new NEPA clearance document.

2.18.3 Historic resources

Historic resources are protected under Section 106 of the National Historic Preservation Act and Section 4(f) of the U.S. Department of Transportation Act of 1966. These acts specify the processes for determining the impacts that transportation projects would have on historic resources and whether these impacts are acceptable. These processes are generally incorporated into the NEPA clearance phase of transportation projects.

Because a PEL Study occurs early in the planning, design, and construction process, the techniques used to assess impacts on affected resources are preliminary. For example, historic resources were examined in **Chapter 3, Section 3.11** of this PEL Study. The assessment involved a computer search of known historic resources compiled by the Colorado Office of Archaeology and Historic Preservation (OAHP), the official repository of cultural resources records for the state. Only two such resources were found within 400 feet of US 50, but neither was determined to be eligible for listing on the National Register of Historic Places and, therefore, in need of protection. However, an OAHP database search is not sufficient for Section 106 compliance.

When specific projects reach the NEPA clearance phase (including Section 106 compliance), more extensive efforts will be required, including intensive field surveys to identify potential historic structures, properties, and artifacts. If such resources are found during the field investigation, potential impacts on historic resources as a result of the Preferred Alternative will need to be evaluated. Newly found historic resources could experience unacceptable impacts as a result of implementing the Preferred Alternative, particularly where new ROW is needed (at the Pueblo Blvd. intersection) or from noise or visual impacts. Section 4(f) specifies that an alternative that avoids historic resources—if a prudent and feasible one (as defined by that law) exists—must be selected, or else the chosen alternative must minimize harm to historic resources. Because no known historic properties were identified in this PEL Study, they are not a differentiating factor among alternatives.

2.18.4 Low-income populations

As mentioned in **Section 2.4.1**, this PEL Study used the federal poverty line as the threshold for identifying low-income populations to analyze some of the potential environmental justice issues. In NEPA studies, CDOT uses the state or county poverty threshold. When a local poverty threshold is used in future studies, more or fewer areas may be identified as having concentrations of low-income families. Using statistical areas that are smaller than Census block groups may also change the results of the environmental justice analysis.

Chapter 3. Project Context and Environmental Resource Evaluation

3.1 What does Chapter 3 cover?

Chapter 3 discusses the resources that are present along the US 50 Corridor and the evaluation of the Preferred Alternative. Descriptions of potential impacts, mitigation strategies, and implications for future National Environmental Policy Act (NEPA) studies are included. **Chapter 2** presented information on the screening of alternatives and comparisons to identify the Preferred Alternative. As explained in **Chapter 1**, the environmental studies included in this Planning and Environmental Linkages (PEL) Study provide a linkage with planning studies for the US 50 Corridor, as well as information that can be used in future NEPA studies.

Table 3-1 provides an overview of the presence of resources in the Corridor. Resources evaluated include:

- Transportation
- Water Resources – Water Quality and Surface Hydrology
- Floodplains
- Wetlands
- Vegetation and Noxious Weeds
- Threatened, Endangered, and Special Status Species (TES Species)
- Historic Properties
- Paleontological Resources
- Land Use and Socioeconomic Resources
- Bicycle and Pedestrian Facilities
- Right-of-Way (ROW)
- Utilities and Railroads
- Noise
- Visual Resources
- Hazardous Materials
- Cumulative Impacts

What's in Chapter 3?

Chapter 3 describes the project context and discusses the 16 environmental resources that are evaluated in the US 50 West PEL Study. It discusses the evaluation in terms of direct, indirect, and cumulative impacts of the No Action Alternative and of the Preferred Alternative.

Chapter 2 of this PEL Study describes impacts of the other alternatives, the alternative evaluation process, and evaluation results.

Appendix B contains detailed tables that display values of impacts and corresponding maps.

Figure 3-1a through Figure 3-1e show the Corridor, including the construction footprint of the Preferred Alternative for the US 50 West PEL Study and the affected resources.

Table 3-1 identifies the affected resources (in bold text) that were evaluated to reach a decision regarding the Preferred Alternative. Based on the listed resources, the following were not evaluated further in selecting the Preferred Alternative because they were not present or did not raise issues of concern within the Corridor for differentiating among alternatives:

- Air Quality
- Geologic Resources and Soils
- Fish and Wildlife,
- Environmental Justice
- Section 4(f) and 6(f) Properties
- Farmlands
- Energy

Table 3-1 includes future NEPA study considerations for each resource.

Table 3-1. Affected Resources or Presence of Environmental Resources in US 50 Corridor

Resource*	Resource Overview	Future NEPA Study Implications
Transportation	The following transportation resources were evaluated: • Travel time • Average delay • Levels of Service (LOS) • Safety	Update the traffic and safety data.
Air Quality	US 50 Corridor is in an attainment area that meets National Ambient Air Quality Standards (NAAQS).	Because the Preferred Alternative is not expected to cause or result in violations of any NAAQS, most mitigation would focus on controlling fugitive dust during construction, operations, and maintenance. Review status of NAAQS for any changes.
Geologic Resources and Soils	No extreme topography or geologic hazards are present. Soils and geology are characterized by generally flat to rolling terrain with alluvial or silt soils over shale with a low shrink-swell potential. Geologic resources and soil characteristics are not differentiating factors in analyzing alternatives.	Site-specific geologic conditions would be evaluated, and erosion control mitigation would be established.
Water Resources - Water Quality and Surface Hydrology	Turkey Creek, Williams Creek, and Wild Horse Dry Creek are within Region 7, Middle Arkansas River Basin of the Colorado Stream Classifications and Water Quality Standards (CDPHE, 2011). Water quality standards are in place for trace metals, nutrients, and E. coli, and site-specific selenium standards. The primary surface water resources crossed by US 50 within the study area include Turkey Creek about 0.5 mile east of Swallows Rd., as well as Wild Horse Dry Creek and Williams Creek near the intersection of Pueblo Blvd. Turkey Creek flows from north to south into the Pueblo Reservoir south of US 50. Wild Horse Dry Creek stream channel drains into the Arkansas River. Williams Creek, a smaller tributary, flows into Wild Horse Creek downstream of US 50.	Short-term construction-related water quality issues and mitigation will be required in accordance with Colorado Department of Transportation (CDOT) guidance, including a stormwater management plan (SWMP) with best management practices (BMPs) for erosion and sediment control. A specific avoidance or mitigation to minimize streambed/bank erosion, increased sediment loads, and discharge velocities. Mitigation for surface water hydrology will be coordinated with the SWMP and Municipal Separate Storm Sewer System (MS4) planning.

Resource*	Resource Overview	Future NEPA Study Implications
Floodplains	Floodplain crossings were identified and evaluated at Williams Creek and Wild Horse Dry Creek based on Federal Emergency Management Agency (FEMA) mapping.	If floodplains are modified as a result of the Preferred Alternative, FEMA requires a letter of map revision (LOMR) to be submitted for review and approval.
Wetlands	Wetlands were delineated, and impacts associated with Williams Creek and Wild Horse Dry Creek were evaluated. The Preferred Alternative would have the least impact on wetlands, approximately 0.3 acre.	Specific mitigation strategies would be developed at the site-specific project stage of the design and NEPA process, including approaches to further reduce impacts on the wetlands.
Vegetation and Noxious Weeds	The Corridor is within shortgrass prairie. Pueblo County lists the occurrence of 27 species of noxious weeds, with 2 species on the Colorado Noxious Weed List A that are designated for eradication. Many other species are on List B, which specifies species to be included in management plans to stop their spread.	A noxious weeds survey in accordance with the Colorado Noxious Weed Act will be conducted based on CDOT guidance.
Fish and Wildlife	Fish and wildlife habitats were reviewed through field reconnaissance and literature reviews. Past grazing practices and urban development have degraded habitats along US 50.	Efforts should be made to avoid or minimize impacts on fish and wildlife habitats through site-specific design.
TES Species	US Fish and Wildlife Service (USFWS) has identified a list of five Federal threatened, endangered, proposed, and candidate species. Based on habitat requirements, none of the species listed as threatened would have the potential to occur in the project area. The state has listed 15 species as threatened, endangered, or a species of concern for Pueblo County. Construction at this location would have the potential to affect: • Prairie dogs • Shortgrass prairie species, such as the burrowing owl and swift fox • More ubiquitous species such as the ferruginous hawk • Massasauga rattlesnake	Update list of T&E species. More analysis is required at the site-specific project stage to further assess the likelihood of occurrence of Federally and State-listed species in the PEL study area. Prairie dog surveys would be required.

Resource*	Resource Overview	Future NEPA Study Implications
Historic Properties	A file search of the Office of Archaeology and Historic Preservation (OAHP) Compass database identified no documented historic properties.	Little cultural resource work has been completed within the PEL study area. An intensive field inventory of the Preferred Alternative would be conducted.
Paleontological Resources	Literature and museum fossil locality searches revealed 21 existing fossil sites in the Corridor associated with the Niobrara Formation of the Late Cretaceous Age. The Niobrara Formation has low species diversity; however, the fossils found include guide fossils, which allow the dating of surrounding rock and nearby fossils of other species.	Conduct field reconnaissance.
Land Use and Socioeconomic Resources	The Preferred Alternative would be compatible with future planning objectives for the City of Pueblo and Pueblo County. It would support the economic and social needs of the Corridor and surrounding area by providing increased capacity, as well as improved vehicular and pedestrian access, while minimizing disruption to land uses outside the CDOT ROW.	Avoidance of impacts on parcels would be determined at the site-specific project phase. Refinements to parcel and CDOT ROW mapping, project footprints, and construction zones would be used in strategies to avoid land use impacts.
Environmental Justice	Minority and low-income communities were identified based on comparing Census data to the county average. Minority and low-income populations were identified between Pueblo Blvd. and Baltimore Ave. on either side of US 50 but not immediately adjacent to it. For additional information, see **Chapter 2, Section 2.4.1** of this PEL Study,	Update information on minority and low-income communities in compliance with CDOT guidance. Use an appropriate statewide or county-specific poverty threshold.
Bicycle and Pedestrian Facilities	Bicycle and pedestrian facilities were inventoried and evaluated to determine if a change in access would occur as a result of improvements on US 50. Access would be similar to or improved from existing conditions.	Coordinate with local government on updates to the Non-Motorized Vehicle Plan.
Right-of-Way (ROW) Relocation	Impacts would occur where the Preferred Alternative footprint would require additional space beyond the edge of CDOT's ROW. The total area of the Preferred Alternative footprint outside the CDOT ROW is approximately 17 acres.	Site-specific evaluation based on design refinements.

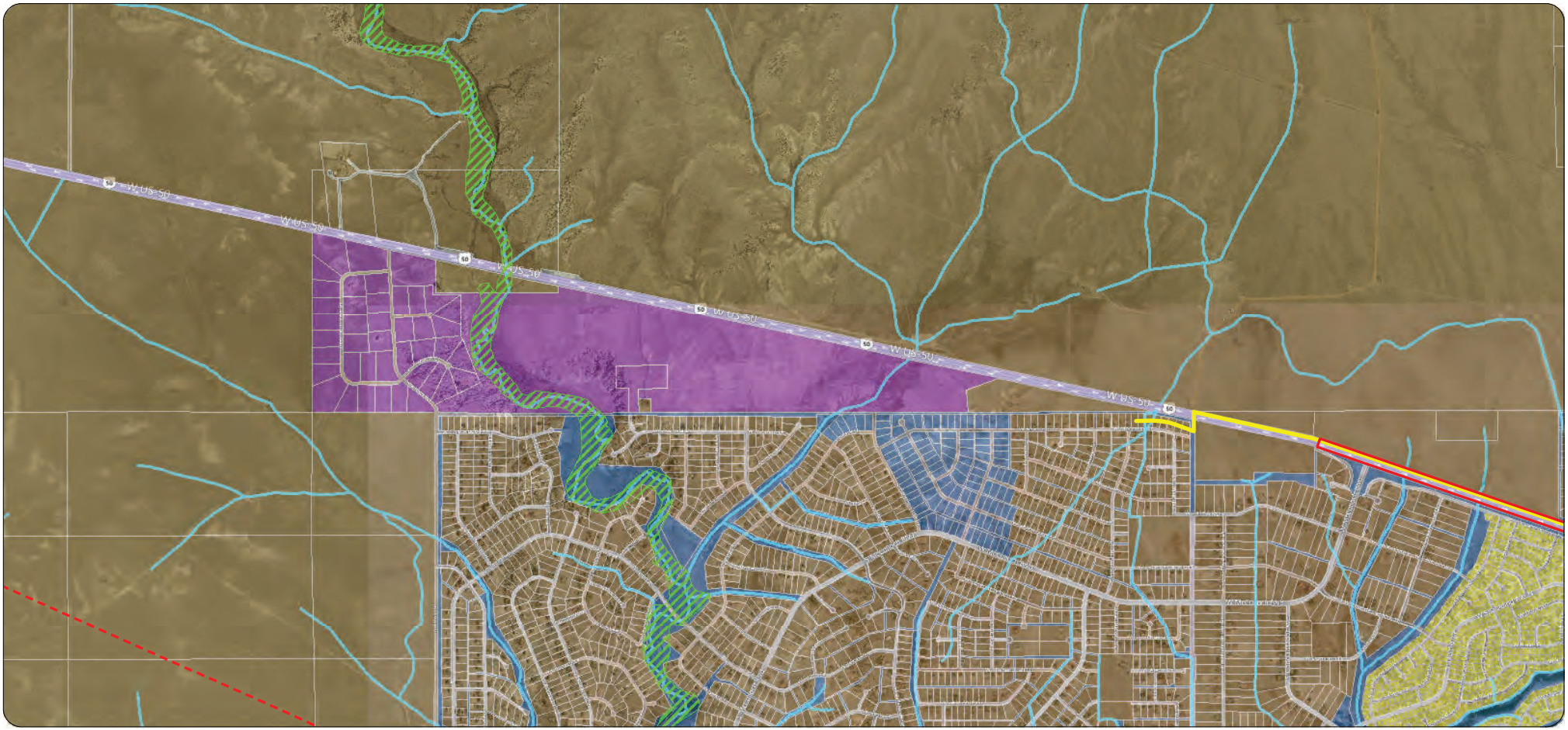
Resource*	Resource Overview	Future NEPA Study Implications
Utilities and Railroads	Utilities including electric transmission, fiber optic, gas, and sewer lines were evaluated. A grade-separated railroad crossing exists in the east end of the Corridor.	Conduct site-specific evaluations and coordinate with affected utilities and railroads.
Section 4(f) Evaluation	No Section 4(f) properties were identified. Section 4(f) refers to a portion of a law that applies only to actions of the US Department of Transportation agencies. It protects the following resources: • Publicly-owned park and recreation areas of national, state, or local significance, both existing and planned • Historic sites on the National Register of Historic Places (National Register), eligible to be on the National Register, or in some cases, of state or local significance • Publicly-owned wildlife and waterfowl refuges of national, state, or local significance • At the PEL level of study no publicly owned park and recreation areas, historic properties, or wildlife and waterfowl refuges were identified within or adjacent to the US 50 Corridor. For additional information, see **Chapter 2**, **Section 2.4.2** of this PEL Study, **Section 3.11**, **Section 3.13**, as well as the screening tables and maps found in **Appendix B**, **Section B.3, Level 3 Comparative Analysis of Intersection Options** (Environmental Impacts columns and context maps).	Update information on public parks, historic sites, and wildlife and waterfowl areas.
Section 6(f) Evaluation	No uses of Section 6(f) properties were identified. Section 6(f) of the Land and Water Conservation Fund Act protects recreational lands planned, acquired, or developed with Land and Water Conservation Funds.	Determine if any new Section 6(f) properties are present in the US 50 PEL study area.
Farmlands	No farmlands are present in the US 50 study corridor.	No additional analysis is required.

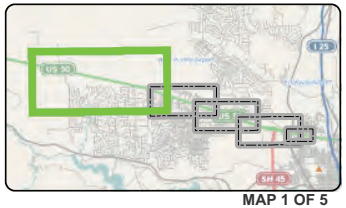
Resource*	Resource Overview	Future NEPA Study Implications
Noise	Noise receptors were inventoried, and noise impacts were evaluated based on the Traffic Noise Model (TNM, v2.5). According to CDOT guidelines and Noise Abatement Criterion (NAC), noise has an impact on a residential receptor when traffic noise levels are projected to be 66 dBA or greater, or when design-year noise levels are projected to exceed existing levels by 10 dBA or more. A total of 56 residences would be impacted. Noise impacts are discussed in **Section 3.17**. For more details on noise impact analysis, see **Appendix F**.	Conduct quantitative modeling of the interchanges that are part of the Preferred Alternative. Develop site-specific designs of noise walls.
Visual Resources	Qualitative analysis was conducted based on the interchange design configurations, including structure height and general footprint.	Develop a Corridor-wide design vision.
Energy	Because non-automobile modes of transportation (for example, car/van pooling, bicycle, and bus transit) represent such a small portion of the travel behavior in the US 50 study corridor, they are not reasonable stand-alone alternatives. Therefore, there is limited opportunity for multimodal transportation that would influence use of fossil fuels in the Corridor.	Undertake any minimal additional effort as required based on CDOT guidance.
Hazardous Materials	Existing hazardous materials sites were inventoried and evaluated. No historical records indicate a release of potential contaminants to the environment.	A Phase I Environmental Site Assessment (ESA) should be completed for any parcels that are to be acquired. These should be completed at the time of acquisition in accordance with American Society for Testing and Materials Standard E 1527-05. Before construction begins, CDOT will inspect and test for lead-based paint and hazardous materials on any bridge materials that will be removed or demolished.
Cumulative Impacts	Cumulative impacts were evaluated based on other regional studies, and none were identified.	Update information as required based on CDOT guidance.

*Note: Resources shown in **bold** were evaluated in selecting the Preferred Alternative.*

US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

Alternative E





MAP 1 OF 5

Roadway Design

- Construction Footprint

Zoning

- Agricultural
- Industrial
- Public Use
- Office
- Business
- Residential
- PUD/RULP

Waterways

- Floodplain (FEMA)
- Floodplain (City of Pueblo, 2007)
- Generalized Wetland
- Streams

Utilities

- Electric Transmission
- Underground Fiber
- Gas
- Water
- Wastewater
- Stormwater

HazMat

- RCRA Small Quantity Generator Sites
- RCRA Generator Sites
- RCRA Corrective Action Sites
- Hazardous Material Spill
- Voluntary Cleanup Program
- Underground Storage Tank Leak
- Underground Storage Tank

Map Info: Map created by J.F. Sato on 04.28.2011 using data gathered from field work (2011), Pueblo City GIS (2011), Pueblo County GIS (2011), and Goodbee and Associates (2011).

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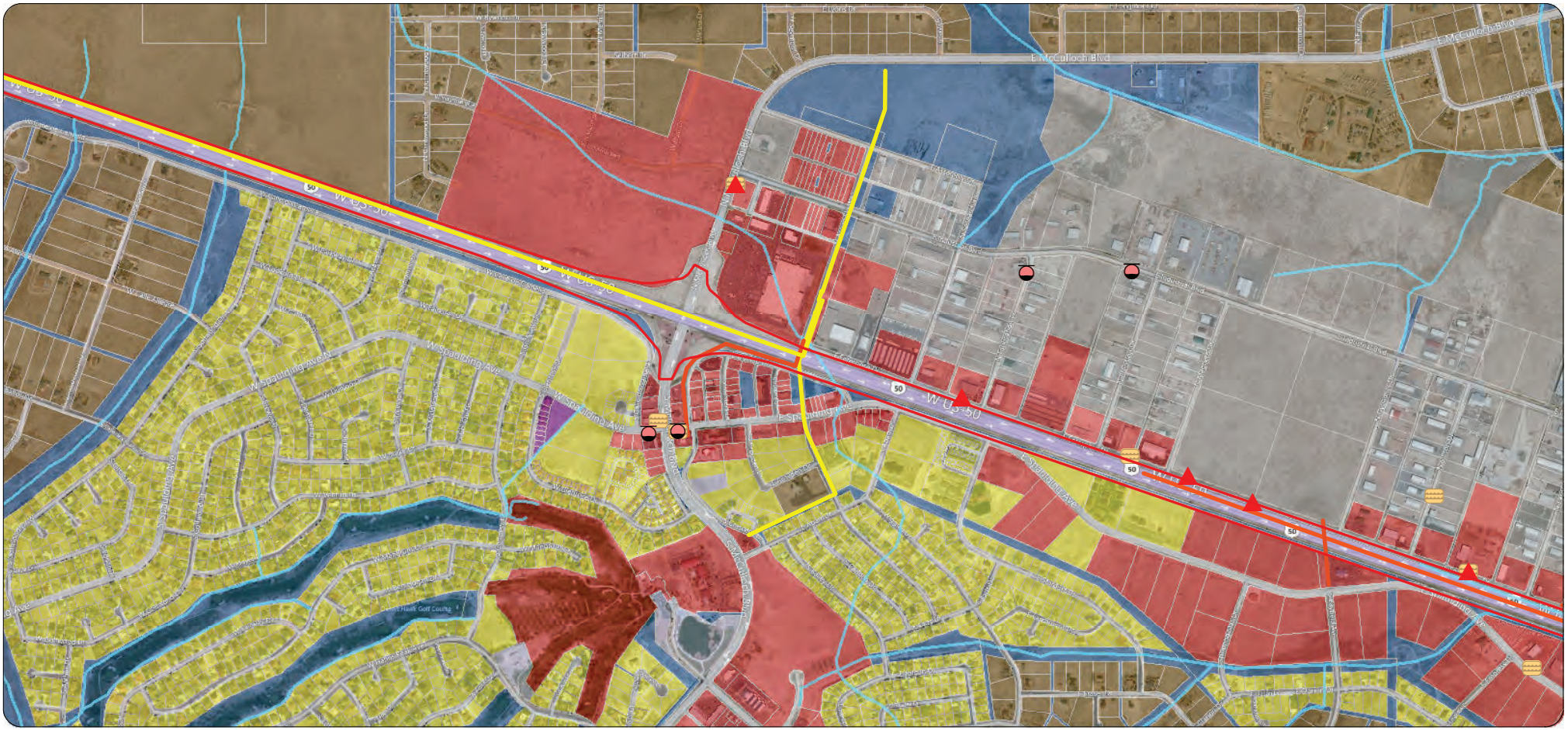
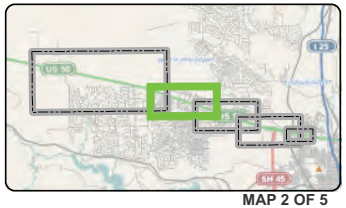
US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

Alternative E





MAP 2 OF 5

Roadway Design
- Construction Footprint

Zoning
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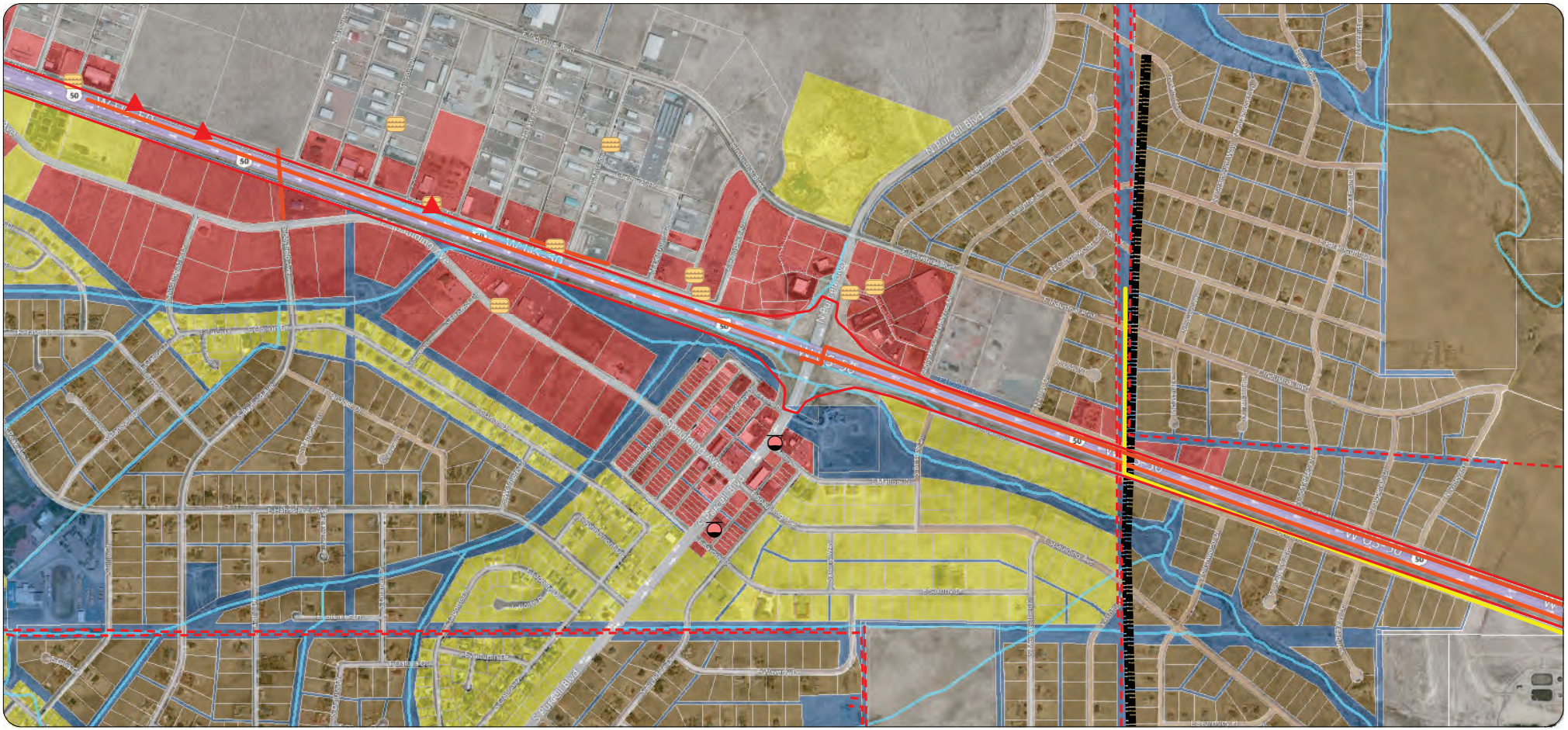
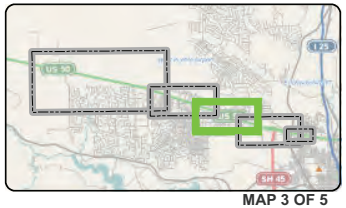
US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

Alternative E





MAP 3 OF 5

Roadway Design
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Zoning
- Agricultural
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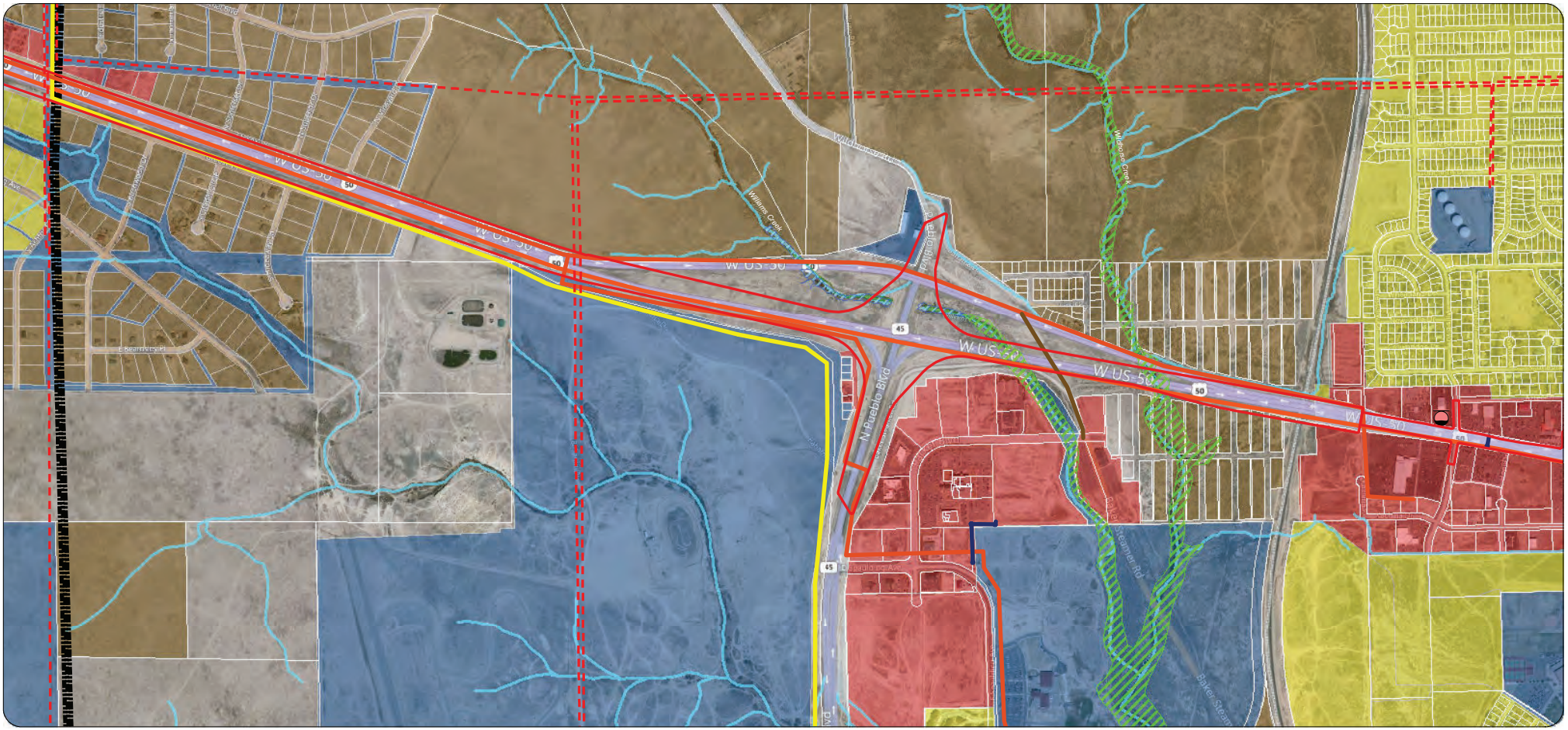
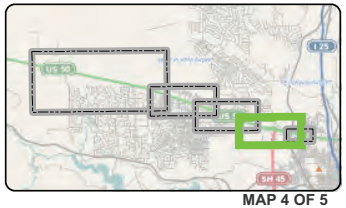
US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

Alternative E





MAP 4 OF 5

Roadway Design
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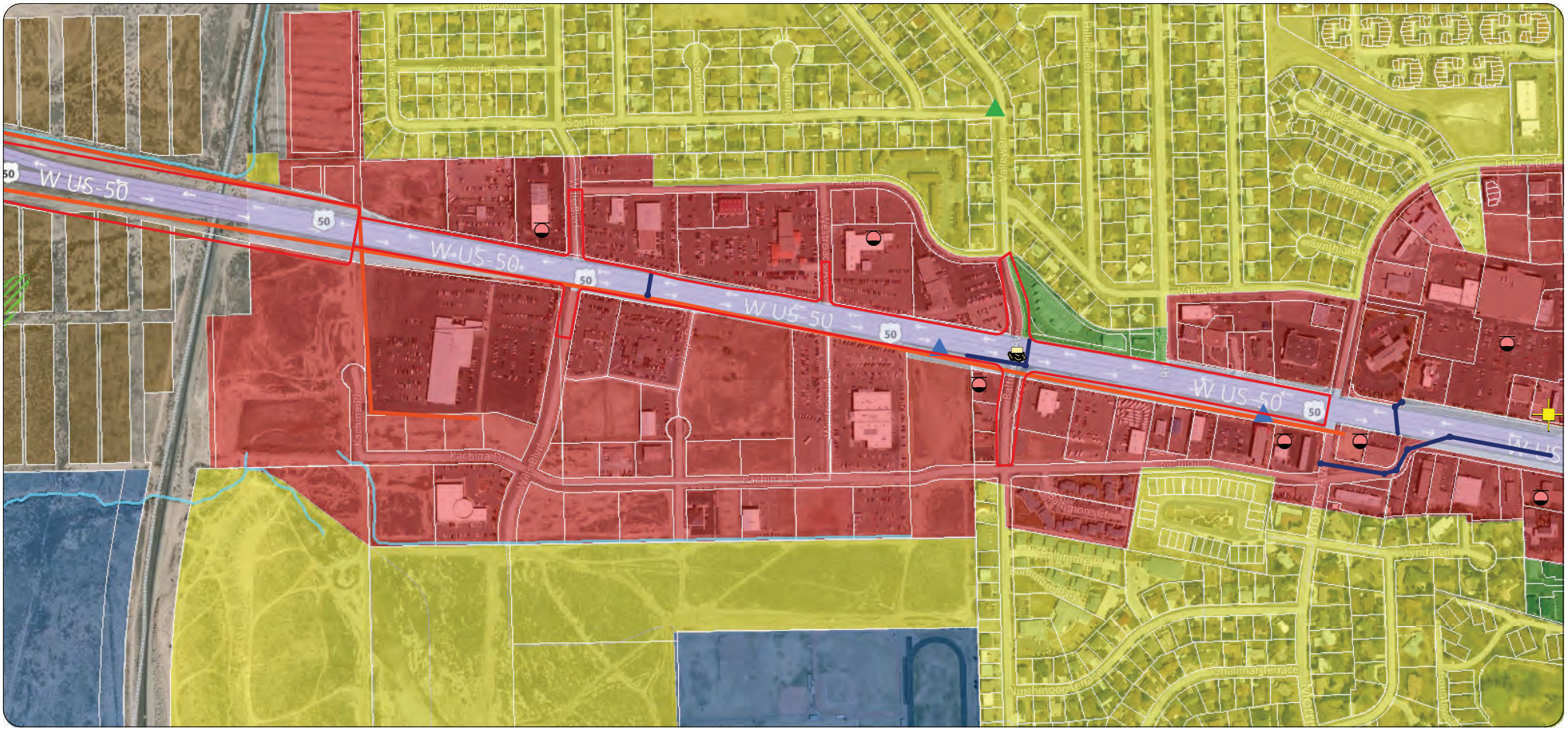
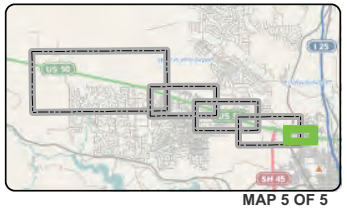
US 50 West PEL Study: Swallows Rd. to Baltimore Ave.

Alternative E





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3.2 What are the transportation characteristics of the No Action and the Preferred Alternatives?

With no improvements to US 50, the Corridor would be highly congested in 2035. During peak hours, automobiles would have to wait through multiple traffic light cycles to get through each intersection. The congestion would be particularly pronounced in the most urbanized section at the east end of the Corridor. In the west end of the Corridor, with Swallows Rd. and West McCulloch Blvd. being unsignalized, through traffic on US 50 would flow with little impediment, but traffic from the cross streets would find few gaps to enter US 50. Drivers would learn how difficult making left turns onto westbound US 50 would be, and these cross streets would effectively change to right-in/right-out only access by popular use.

The safety implications of the No Action Alternative would be less clear. Crashes along the US 50 Corridor would be associated with congestion at intersections. More congestion would suggest more crashes. However, because queues from one signal would likely back up to the previous one and the US 50 mainline would become more congested, the difference in speeds that contributes to so many rear-end crashes today would lessen. A lesser difference in speed along the Corridor would also reduce crash severity, although about 75 percent of all crashes today are the least severe property damage only type.

The Preferred Alternative would accommodate the expected growth in travel demand at travel times corresponding to LOS D or better in 2035. Building the Preferred Alternative would provide opportunities to improve safety and multimodal connectivity in the Corridor, which are discussed further in **Section 3.3** and **Section 3.4**, respectively.

3.2.1 How do the traffic operations of No Action and the Preferred Alternatives compare?

Traffic operations with the Preferred Alternative would clearly be superior to those of the No Action Alternative. Under the No Action Alternative, all seven intersections in the Corridor would operate at LOS F for at least one hour each day and travel between intersections would also be degraded. The Preferred Alternative would operate at a desirable LOS with travel demand easily below the ultimate capacity of US 50.

How does the delay compare for No Action and the Preferred Alternative?

Table 3-2 shows the average delay a driver would encounter as he or she travels between Swallows Rd. and Baltimore Ave. during the peak hours in 2035. Delay is the difference between the actual time it takes to drive the Corridor and the ideal time, based on free-flow speeds and not having to stop at signals or stop signs. Therefore, delay includes extra time spent at intersections, as well as between intersections. The average includes both eastbound and westbound travelers. With favorable signal timing, many drivers would not have to stop at the four signals under the Preferred Alternative (Swallows Rd., West McCulloch Blvd., and the two crossovers at the Pueblo Blvd. diverging diamond interchange [DDI]). Many other drivers would be stopped for only a short time.

The delay with the Preferred Alternative—35 seconds during either peak hour—would make the peak hours difficult to distinguish from other less congested times of day when it is possible to drive the speed limit.

Under the No Action Alternative, delay during the morning peak hour would be more than 3 minutes, more than six times as much as would be expected under the Preferred Alternative. Much of this delay would occur at the five traffic signals in the Corridor. No Action Alternative conditions would be even worse in the evening when more than 7 minutes of delay per vehicle is forecast. This delay would be more than 12 times as much as would be experienced under the Preferred Alternative. Also note that the No Action Alternative delay for peak-direction travelers would be even greater than those figures presented in **Table 3-2**.

Table 3-2. Average Corridor-wide Delay during 2035 Peak Hours

Peak Hour	No Action Alternative	Preferred Alternative
Morning	3 min 35 sec	35 sec
Evening	7 min 20 sec	35 sec

Source: JFSA, 2010.

How does Corridor-wide travel time compare for No Action and the Preferred Alternatives?

Table 3-3 shows the time it would take to travel between Swallows Rd. and Baltimore Ave. in 2035 under the No Action and Preferred Alternatives. The table presents a range of values based on travel times observed during 15-minute intervals of each one-hour traffic simulation.

Table 3-3. 2035 Corridor Travel Time by Time of Day and Direction

Peak Hour and Direction	No Action Alternative	Preferred Alternative
Morning Eastbound	14 to 26 min	12 to 13 min
Morning Westbound	14 to 18 min	13 to 14 min
Evening Eastbound	19 to 30 min	13 to 14 min
Evening Westbound	20 to 30 min	13 to 14 min

Source: JFSA, 2010.

In the morning, commuters leaving at the start or the end of the peak hour might do as well under the No Action Alternative as would be expected under the Preferred Alternative; however, the experience of travelers leaving during the peak of the peak hour would be different. Eastbound commuters could spend up to 26 minutes traveling the Corridor under the No Action Alternative, but only half that time with the Preferred Alternative. Reverse-commuters could see a time savings of up to 4 minutes with the Preferred Alternative.

Evening commuters would see an even bigger benefit with the Preferred Alternative. For each alternative, the range of travel times in either direction would roughly be the same. However, evening peak drivers could see a time savings of 6 minutes to as much as 16 minutes with the Preferred Alternative, depending on whether they travel during the beginning, middle, or end of the evening rush hour.

3.3 How does the Preferred Alternative address safety?

The Preferred Alternative would address safety primarily by improving the spot congestion in the Corridor that currently leads to so many crashes. Replacing the traffic signals at Main McCulloch Blvd. and Purcell Blvd. with grade-separated diamond interchanges means that US 50 through traffic would no longer need to stop, which would greatly reduce the chances of having a Rear-End collision. Installing traffic signals at Swallows Rd. and West McCulloch Blvd. would also promote safety under the Preferred Alternative as compared to the No Action Alternative. By assigning signal time for side-street and left turn movements, collisions that might occur when drivers attempt to turn if there is too short a gap in traffic could be prevented.

Making capacity improvements to US 50 would provide an opportunity to package safety improvements in the construction bid package. For example, intersection lighting could be installed with traffic signals or a median cable barrier could be installed when lanes are added to the US 50 mainline.

3.4 How does the Preferred Alternative accommodate multimodal travel?

The Preferred Alternative would promote multimodal travel by providing opportunities for building a mixed-use path in an expanded US 50 ROW. This path would connect the path and sidewalk networks in Pueblo West with the same in the city of Pueblo. As the environmental clearance and design of the Preferred Alternative progresses, it would be possible to identify park-and-ride lot locations that could be built in conjunction with Preferred Alternative improvements. The following could use the lots:

- Travelers forming carpools
- People walking or bicycling on the nearby mixed-use path
- People riding a new bus service that might be introduced in the future

The Preferred Alternative would also support that potential transit service by providing uncongested and more reliable travel times to all US 50 vehicles, including buses. Research and common sense have repeatedly shown that schedule reliability is a key factor in the attractiveness of a transit service. In fact, the *Highway Capacity Manual* (2010) identifies schedule reliability as one of the determinants of transit LOS for urban street segments.

3.5 What are the next steps regarding transportation operations of the Preferred Alternative?

CDOT has an ongoing program of counting traffic in the US 50 Corridor, as well as in other corridors state-wide. This program allows CDOT to monitor congestion in the Corridor and to determine when individual improvements identified in the **Implementation Plan** are needed. (The **Implementation Plan** is included as an addendum to this report.) This program also allows CDOT to identify any new travel patterns that were not anticipated by the travel forecasting for this study.

The travel forecasts for this study are based on the Pueblo Area Council of Governments' (PACOG's) travel demand model. As more and more detailed information from Census 2010 becomes available, PACOG will update its travel demand model in accordance with the latest federal transportation legislation. The model update will likely result in PACOG moving its base year from

2005 to 2010. The base year model run allows PACOG to verify that the model is working correctly before using it to forecast future travel.

The recent Front Range Travel Counts Survey also provides PACOG with new information to update its model. When the State Demographer's Office releases its forecasts of county population and employment for 2040, PACOG will likely move its forecast year from 2035 (used in this PEL Study) to 2040. PACOG also tracks building permits issued by local government entities to verify development data.

Appendix D includes a more detailed discussion of the current PACOG travel demand model and the updates made for this PEL study. **Appendix E** contains a letter from PACOG's administrator agreeing with the changes.

Once PACOG's model is updated, CDOT may want to review the traffic forecasts to confirm that the Preferred Alternative continues to meet the project Purpose and Need. New model forecasts may also affect when the transportation improvements that were identified in the **Implementation Plan** are needed.

3.6 What are the water resources of the Corridor?

3.6.1 Water quality

The PEL study area falls within Region 7, Middle Arkansas River Basin of the Colorado Stream Classifications and Water Quality Standards (CDPHE, 2011). Water quality standards are designated for the following:

- **Wild Horse Creek (Segment 4a) –** Wild Horse Dry Creek is classified as use-protected for aquatic life warm, recreation, and agriculture. Water quality standards are in place for trace metals, nutrients, and E. coli. Site-specific selenium standards are also in place.
- **Turkey Creek (Segment 18b) –** Turkey Creek from US 50 to Pueblo Reservoir is classified for aquatic life warm, recreation, water supply, and agriculture. Water quality standards are in place for trace metals, nutrients, and E. coli. Turkey Creek must also meet the more stringent selenium standard in this segment.
- **All tributaries draining the PEL study area (Segment 4d) –** Other tributaries draining the PEL study area are designated use-protected, and water quality standards apply only to the total recoverable form of the trace metals.

Water quality standards also protect the **Pueblo Reservoir (Segment 1)** south of the study area.

A search of the US Geological Survey data archive produced one bed sample collected from Turkey Creek in 1989 for organic chemical analysis. No water quality data were found for Turkey Creek near the study area. One water sample was collected from Wild Horse Dry Creek and Williams Creek in 2004 for selenium.

Mitigation strategies

Best Management Practices (BMPs) can reduce or eliminate water quality impacts during highway construction, operation, and maintenance by mitigating highway-related runoff. A Stormwater Management Plan (SWMP) provides appropriate BMPs for erosion and sediment control in accordance with the *CDOT Erosion Control and Storm Water Quality Guide* (CDOT, 2002).

Next steps

To prevent sedimentation and pollutants from entering the Pueblo-area Municipal Separate Storm Sewer System (MS4), CDOT will develop a SWMP and coordinate with the City of Pueblo's *Storm Water Master Plan Basin Planning Studies*. In the design phases, efforts will include minimizing impacts on water quality and other water resources to avoid impacts where feasible. A SWMP with BMPs will be required for erosion and sediment control in coordination with MS4 planning. A National Pollutant Discharge Elimination System (NPDES) permit will be required.

3.6.2 Surface hydrology

The terrain within the study area is typical of the southeastern plains of Colorado, which is flat to rolling, semi-arid, and sparsely vegetated. The average annual precipitation in the Pueblo area is 11.8 inches. The headwaters are fed from snowmelt and rainfall runoff during late fall, winter, and early spring. During the summer months, the flows result from thunderstorms or general rains over the entire watershed.

The primary surface water resources crossed by US 50 within the study area include Turkey Creek about 0.5 mile east of Swallows Rd., as well as Wild Horse Dry Creek and Williams Creek near the intersection of Pueblo Blvd.

Turkey Creek headwaters are to the north within the Fort Carson Military Reservation. Turkey Creek flows from north to south into the Pueblo Reservoir south of US 50.

Wild Horse Dry Creek begins as two separate streams: Wild Horse Creek and Dry Creek. These two streams originate in the foothills northwest of the city of Pueblo and flow southeast to join near the Wild Horse Subdivision approximately 2 miles northwest of the city. Below this junction point, the combined Wild Horse Dry Creek stream channel passes through the City of Pueblo's northwest residential area before draining into the Arkansas River.

Williams Creek is a smaller tributary that flows into Wild Horse Creek downstream of US 50.

Floods in the study area normally originate from runoff of the entire watershed due to limited areal extent of the drainage. The steep slopes and long narrow shape of the drainage are conducive to fast rises and high peak flows of short duration. The average slope of the watershed is approximately 60 feet per mile.

No Action Alternative

There would be no changes to water quality or surface hydrology as a result of the No Action Alternative.

Preferred Alternative

Williams Creek and Wild Horse Dry Creek are within the footprint of the Preferred Alternative at Pueblo Blvd.

Mitigation strategies

The existing westbound lanes of US 50 at Pueblo Blvd. would ultimately be realigned as a part of the implementation of the proposed DDI. There is an opportunity to restore the Williams Creek and Wild Horse Dry Creek channels at the existing highway crossings. Stream channel bank stabilization

at existing and proposed new stream crossings will be included in the design phases to mitigate erosion of streambeds and to avoid changes in stream flow regimes.

Next steps

A specific avoidance or mitigation approach would be developed at the site-specific project stage of the design and NEPA process to minimize streambed/bank erosion, increased sediment loads, and discharge velocities. Mitigation for surface water hydrology will be coordinated with the SWMP and MS4 planning.

3.7 What are the floodplains of the Corridor?

Floodplains are lands on either side of a stream that are inundated when the capacity of the stream channel is exceeded during the 100-year storm event. Executive Order 11988, Floodplain Management (1977), was authorized to direct federal agencies to "provide leadership and take action to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains." This Executive Order was authorized to assist in furthering NEPA of 1969, the National Flood Insurance Act of 1968 (amended), and the Flood Disaster Protection Act of 1973.

Code of Federal Regulations (CFR), Title 23 – Highways, Chapter 1 – Federal Highway Administration (FHWA), Part 650 – Bridges, Structures, and Hydraulics, prescribes the policies and procedures that FHWA is directed to implement in the "location and hydraulics design of highway encroachments on floodplains."

CFR, Title 44 – Emergency Management and Assistance, Chapter 1 – Federal Emergency Management Agency (FEMA), contains the basic policies and procedures to regulate floodplain management and to analyze, identify, and map floodplains for flood insurance purposes. Generally, the local government (Pueblo County, in this instance), with the assistance of the Colorado Water Conservation Board (CWCB), enforce these regulations.

The US 50 Corridor crosses the Wild Horse Dry and Williams Creek floodplains at the Pueblo Blvd. intersection. Wild Horse Dry Creek flows under bridges for the US 50 westbound lanes, and through a box culvert under the US 50 eastbound lanes. Williams Creek flows through a bridge under the US 50 westbound lanes, a box culvert under Pueblo Blvd., and another box culvert under the US 50 eastbound lanes.

Starting in 2006, the City of Pueblo, in association with the CWCB, contracted with Anderson Consulting Engineers, Inc. to update the floodplain delineation and to provide Digital Flood Insurance Rate Map conversion services for several streams within the project study area. The City of Pueblo submitted a request to FEMA to revise the floodplain mapping in the downtown and Historic Union Ave. areas based on the assumption that the box culvert where Williams Creek passes under the eastbound lanes of US 50 is undersized and acts as a weir that detains floodwaters. As part of that request, the city asked the CDOT Region 2 staff hydraulics engineer to certify that US 50 is maintained as a levee. The CDOT engineer could not certify the levee request for the following reasons:

- US 50 and its embankment were designed to support the weight of vehicles, not for flood control
- CDOT maintenance crews do not have the training or experience to maintain levees

- CDOT could not assume potential financial and legal liability to downstream property owners should damage occur to their property as a result of the US 50 embankment failing during a flood
- Certifying this section of US 50 as a levee would set an undesirable precedent that could lead to requests to declare other sections of state highways for flood control

The study results and revised floodplain have not been officially released and placed on FEMA's website. Therefore, the only available data regarding floodplain determination for Wild Horse Dry Creek, Williams Creek, and Turkey Creek are from FEMA's Flood Insurance Rate Maps (FIRM) effective September 29, 1989. The FIRM Panels used to determine the floodplain impact were panel numbers 080147-0225B and –0240B.

In 2007, the City of Pueblo also conducted a *Pueblo Storm Water Master Plan Basin Planning Study*. This study identified measures to meet the storm drainage requirement established by NPDES regulations and the citizens of Pueblo. The study recommended the installation of 11 regional detention ponds and 11 storm sewer channels within the Wild Horse Dry Creek basin for flood peak control and water quality enhancement. However, the benefits of the potential reduction of 100-year flood flow and floodplains cannot be realized until a cooperative study between FEMA and the City of Pueblo has been completed and the recommended facilities installed.

For comparative purposes, the acreage of floodplain impact is determined by superimposing the alternative footprints over FEMA's floodplain maps. The floodplain areas within the alternative footprints are considered to be an impact on floodplains. The floodplain areas within the existing water crossing structures are also considered a floodplain impact if the structure is to be replaced as part of the alternative implementation.

3.7.1 No Action Alternative

With the No Action Alternative, there would be no additional floodplain impact on the existing condition.

3.7.2 Preferred Alternative

With the Preferred Alternative, the existing US 50 lanes within the Pueblo Blvd. intersection would be replaced with a DDI. The proposed DDI lanes and ramps would span approximately 1.0 acre of the Wild Horse and Williams Creek floodplains. However, the actual floodplain would be impacted only minimally because the crossing roadway surfaces would be elevated by structures over the floodplain. The crossing structure would be designed to convey the 100-year flood with no rise in the water surface elevation near the project area. A LOMR would be prepared and submitted to FEMA for review and approval if the floodplain is modified as a result of the Preferred Alternative.

It is anticipated that the Preferred Alternative would have no additional floodplain impact on the Turkey Creek crossing on US 50 because the crossing structure and channel alignment at this location would remain unchanged.

The Preferred Alternative would have the least floodplain impact among all of the action alternatives. See **Appendix B, Section B.4, Level 4 Environmental Comparative Analysis** table for details. In addition, **Appendix B, Section B.3, Level 3 Comparative Analysis of Intersection Options** provides a series of maps showing interchange footprints and floodplain locations in the Corridor.

3.7.3 Mitigation strategies

Design solutions for the Pueblo Blvd. interchange will be developed to minimize impacts on the Wild Horse and Williams Creek floodplains, in coordination with the City of Pueblo *Storm Water Master Plan Basin Planning Studies*.

3.7.4 Next steps

Experience has shown that there are benefits to starting interagency coordination before the NEPA permitting stage. CDOT would form agreements with FEMA, the US Army Corps of Engineers (USACE), Pueblo County, the City of Pueblo, the Pueblo West Metropolitan District (PWMD), and other involved entities. Together, the interagency team would develop alternatives concerning flood control, water quality, and wetlands impact to provide the least damaging, practical solution for the US 50 and Pueblo Blvd. intersection.

Floodplain impacts need to be further analyzed during a NEPA study at the US 50 and Pueblo Blvd. intersection based on conceptual level design. The exact alignment of ramps and mainlines for the future DDI was not determined at the PEL Study level. Once the detailed alignment is determined, an open-channel hydraulic analysis needs to be conducted to ensure that the Preferred Alternative would neither cause any increase in water surface elevation within the vicinity of the project site nor alter the floodplain boundaries downstream of the project site.

Encroachment on the regulatory floodplains at the Wild Horse and Williams Creek crossings requires a revision to the regulatory floodway. A LOMR would be prepared and submitted to FEMA for review and approval if the floodplain is modified as a result of the Preferred Alternative.

3.8 What are the wetlands of the Corridor?

3.8.1 Methods

Wetlands and waters of the US are part of the larger biological community for the Corridor and are regulated through a permit process administered by the USACE under Section 404 of the Clean Water Act (CWA). Wetlands are defined for regulatory purposes as follows:

> *Wetlands consist of areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adopted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (Environmental Protection Agency, 40 CFR 230.2 and USACE, 33 CFR 328.3).*

Other waters of the US include all "open waters" such are riverine (year-round flow), intermittent or seasonal tributaries, and water storage features (ponds or lakes).

The study team identified and delineated wetlands and other waters of the US in the US 50 Corridor for use in the PEL planning and development of alternatives to determine avoidance potential for the Preferred Alternative. The inventory process entailed identifying likely wetland areas from aerial photographic interpretation and then inspecting these areas in the field using USACE determination methods (USACE, 1987). A field reconnaissance was conducted on April 27, 2011, and on May 2, 2011, to identify areas meeting USACE (1987) definitions of wetlands.

The study team used Global Positioning System (GPS) to locate the boundaries of the wetlands. The study team then used these data points for geographic information system (GIS) mapping. **Figure 3-1** maps the generalized location of wetlands for Williams Creek and Wild Horse Dry Creek. **Appendix H** provides specific information on wetland delineation and mapping.

3.8.2 Wetland inventory

Williams Creek and Wild Horse Dry Creek

Two drainages in the US 50 and Pueblo Blvd. area support wetlands, including Williams Creek and Wild Horse Dry Creek. Based on the field investigation data, wetlands were identified for all of the areas along Williams Creek and Wild Horse Creek. The width of these wetlands varies depending on the width of the floodplain and the area of the floodplain that is saturated for at least part of the growing season. Because the USACE has determined that the wetlands occur as waters of the US and are connected to the Arkansas River, FHWA/CDOT will comply with Section 404 requirements that fall under the jurisdiction of the CWA.

Figure 3-2. Wetlands in Williams Creek Area at EB US 50 and N. Pueblo Blvd.

Williams Creek

Williams Creek bisects the Pueblo Blvd. intersection area, extending from the northwest to southeast under both east and westbound lanes of US 50, as well as Pueblo Blvd (see **Figure 3-2**). In April and May 2011, the creek ranged from about 2 to 40 feet wide, and 0.5 to 3 feet deep, depending on the floodplain topographic characteristics and restrictions to the flow. The wider pools occur immediately south of westbound US 50 and immediately north of eastbound US 50. The floodplain and flow channel of the creek contained surface water, and saturation extended into the lower terrace of the floodplain. Soils reflect these saturated conditions.

Vegetation that marks the riparian nature of Williams Creek includes tamarix (*Tamarisk ramosissima*) and American three-square *(Scirpus americanus*). Other vegetation includes:

- Cattail (*Typha latifolia*)
- Spikerush (*Eleocharis palustris.)*
- Manna grass (*Glyceria striata)*
- Sedge (*Carex* spp.*)*
- Wiregrass (*Juncus arcticus*)
- Golden currant (*Ribes aureum*)
- Saltgrass (*Distichlis spicata*)
- Water hemlock (*Cicuta douglasii*)
- Smooth brome (*Bromus inermis*)
- Canada thistle (*Breea arvensis*)
- Crown vetch (*Vicia villosa*)
- Prairie or common sunflower (*Helianthus* spp.)
- Curly dock (*Rumex crispus*)
- Ragweed (*Ambrosia* spp.)

Appendix H includes specific information about the vegetation and soil characteristics of the wetlands that were inventoried for Williams Creek.

Wild Horse Dry Creek

Wild Horse Dry Creek generally parallels Williams Creek and extends diagonally from northwest to southeast, at the eastern edge of the US 50 and Pueblo Blvd. intersection. The vegetation is similar to that described for Williams Creek; however, differences include scattered occurrences of squirrel tail (*Elymus elymoides*) and bouncing bet (*Saponaria officinalis*) and a higher component of weedy species including Canada thistle. Off-road vehicle trails extend into the drainage system on the south side of US 50 and under the bridge.

Soils contained a higher concentration of alkali than those found in Williams Creek but were saturated because flows of the 4- to 8-foot-wide channel were 2 to 3 inches deep at the time of field observations. This drainage is slightly more incised than that of Williams Creek, and no low-flow terrace occurs adjacent to the channel. Thus, upland conditions are prevalent on either side of the creek on an elevated terrace. As observed at Williams Creek, debris lines indicate that substantial floods have been occurring at approximately 4 feet above the low-flow channel.

Turkey Creek

Because the USACE has determined that Turkey Creek is connected to the Arkansas River, FHWA/CDOT will comply with Section 404 requirements that fall under the jurisdiction of the CWA. However, no wetlands were observed in this drainage near US 50.

3.8.3 No Action Alternative

There would be no changes to wetlands as a result of the No Action Alternative.

3.8.4 Preferred Alternative

The footprint and assumed construction area of the Preferred Alternative would have the potential to affect approximately 0.3 acre of wetlands along Williams Creek and Wild Horse Dry Creek. The Preferred Alternative would have the least impact on wetlands, as described in **Chapter 2, Section 2.14.4, Streams, wetlands, and floodplains,** of this PEL Study.

3.8.5 Mitigation strategies

The PEL level of study focuses on avoiding and minimizing impacts on wetlands and other waters of the US. Specific mitigation strategies will be developed at the site-specific project stage of the design and NEPA process, including approaches to further reduce impacts on the wetlands of Williams Creek and Wild Horse Dry Creek. It is CDOT policy to mitigate all impacts on a 1-to-1 per acre basis. Re-alignment of the westbound US 50 lanes at the Pueblo Blvd. intersection for the implementation of the proposed DDI provides an opportunity to restore existing wetlands along Williams Creek and Wild Horse Dry Creek, in coordination with the stream channel restoration and stabilization strategies described in **Section 3.6.2**.

3.8.6 Next steps

As mentioned in **Section 3.7.4**, CDOT would begin coordination with the USACE, FEMA, Pueblo County, City of Pueblo, PWMD, and others before seeking a permit to modify wetlands during

construction. Specific mitigation strategies would be developed in conjunction with the design and NEPA studies at the site-specific project stage to further reduce impacts on the wetlands. This will include analyzing wetland impacts associated with refined footprints and construction zones based on concept level design to the Preferred Alternative, as well as documentation for NEPA studies and any subsequent Section 404 permitting requirements.

The overall concept design for the diverging diamond interchange planned for the Pueblo Blvd. intersection would be analyzed as a part of site-specific NEPA studies. With USACE concurrence, a phased approach would be undertaken for Section 404 permitting. CDOT would inform USACE of the impacts of successive phases through construction of the ultimate interchange. However, CDOT would request permitting for only the first phase of the interchange and then request permit amendments once each future phase is ready for construction. It is anticipated that the first phase of development of the diverging diamond interchange would be achieved under a nationwide 404 permit. For additional information regarding the phasing of the diverging diamond at Pueblo Blvd., see the **Implementation Plan**, which is included as an addendum to this report.

3.9 What vegetation and noxious weeds occur in the Corridor?

3.9.1 Vegetation

The project area occurs in the Southern High Plains, which are dominated by the Arkansas River Valley (Weber and Whittmann, 2001). The High Plains are characterized by shortgrass prairie of blue grama (*Bouteloua gracilus*) and buffalo grass (*Buchloe dactyloides*). However, a variety of species occur in conjunction with changes in soil conditions, such as sand sagebrush (*Oligosporus filifolius*) and four-wing saltbush (*Atriplex canescens*) in sandy areas. Shortgrass prairie is also characterized by a variety of shrubs such as skunkbush (*Rhus aromatic* ssp. *pilossima*), especially on occasional outcrops with small trees (for example, junipers) (Weber and Whittmann, 2001).

The Southern High Plains has as its hallmark the candelabra cactus (cholla) (*Cylindropuntia imbricata*) and also the one-seed juniper (*Sabina monosperma*), which is often perched on rocky outcrops or ridges. Other characteristic species include yucca (*Yucca glauca*), common sunflower (*Helianthus annuus*), prairie sunflower (*H. petiolaris*), and prickly-pear (*Opuntia polyacantha*). Remnants of this prairie occur sporadically along US 50 in the project area, especially in the North Pueblo Blvd. area, north of US 50 and farther west near Swallows Rd. Otherwise, urban development has encroached and replaced much of the vegetation. The common occurrence of broom snakeweed (*Guttierrezia sarothrae*) and kochia (*Bassia* spp.) indicates that the vegetation is in a less-than optimal state, possibly from overgrazing.

No Action Alternative

There would be no changes to the prairie vegetation as a result of the No Action Alternative.

Preferred Alternative

The footprint and assumed construction zone of the Preferred Alternative would be generally within the CDOT ROW. At the PEL level of detail, GIS data indicate potential impacts on approximately 2.5 acres of land in narrow strips adjacent to the ROW.

Mitigation strategies

Steps will be taken to avoid vegetation impacts at the design phase by minimizing the footprint of the Preferred Alternative and construction zones. Where vegetation impacts are unavoidable, BMPs during construction and site restoration will be applied.

Next steps

A more in-depth analysis of vegetation is required for the next phase of design and NEPA analysis to determine vegetation losses from construction. The means to reduce such effects will be incorporated into site-specific project planning (CDOT, 2008).

3.9.2 Noxious weeds

The Colorado Noxious Weed Act (Colorado Revised Statutes [CRS] 35-5.5) requires the control of designated noxious weeds. Pueblo County lists the occurrence of 27 species of noxious weeds (Pueblo County, 2011). Of these, two species (yellow starthistle [*Centaurea solstitialis]* and myrtle spurge [*Euphorbia myrsinites]*) are on the Colorado Noxious Weed List A, which are designated for eradication (NRCS, 2011).

Numerous other species listed for Pueblo County are designated by the State as List B, which specifies species to be included in management plans to stop their spread. Such species noted in the project area include:

- Musk thistle (*Carduus nutans*)
- Canada thistle
- Houndstongue (*Cynoglossum officinale*)
- Redstem filaree (*Erodium cicutarium*)
- Salt cedar or tamarisk (*Tamarix ramosissima*)

Tamarisk and Canada thistle are especially prevalent along Williams Creek and Wild Horse Dry Creek.

Mitigation strategies

All projects should include measures to eradicate and prevent the establishment and spread of noxious weeds (CDOT, 2008).

Next steps

The locations and species of noxious weeds will need to be documented based on a survey in conformance with CDOT guidelines. This would include the identification and mapping of existing noxious weeds in the project area.

3.10 What are Threatened, Endangered and Special Status Species (TES Species) of the Corridor?

Section 3.10.1 discusses federally listed or TES species for Pueblo County. **Section 3.10.2** discusses state- listed or species of concern for Pueblo County. **Appendix H** provides additional information on federally and state-listed species for Pueblo County. In addition, **Appendix H** contains a letter dated May 11, 2011, from Susan C. Linner, US Department of Interior, USFWS, to Jeff Peterson, CDOT, which serves as guidance for TES species, wetlands, and migratory birds.

3.10.1 What are the federally listed species for Pueblo County?

As shown in **Table 3-4**, USFWS has identified a list of five federal threatened, endangered, proposed, and candidate species that may occur in the PEL study area (the area immediately surrounding the US 50 Corridor). Based on habitat requirements, none of the species listed as threatened would have the potential to occur in the project area. Greenback cutthroat trout and Canada lynx are associated with mountains, while the Mexican spotted owl is typically found in mountain and woodland canyon habitats. The nearest known habitat for the Arkansas darter is in Fountain Creek south of Colorado Springs; more habitat occurs in eastern Colorado. Mountain plover is a species of the Eastern Plains and shortgrass prairie. Based on habitat within the vicinity of the Preferred Alternative, Mountain plover would have the potential to occur in the area. However, this species has not been observed in this area of Pueblo County (Kingery, 1998).

Table 3-4. Potential for Federally Listed Species to Occur in the US 50 Project Area

Species		Status[1]	Potential to Occur in PEL Project Area[2]	Potential to be Affected by Project
Common Name	Scientific Name			
Birds				
Mexican spotted owl	*Strix occidentalis lucida*	T	No; habitat of rocky canyon with tall conifers (Kingery, 1998).	None
Mountain plover	*Charadrius montanus*	PT	Possible[3] based on shortgrass prairie habitat in the project area; may be affected by the project.	More analysis is required to assess the potential for this species to occur in the project area.
Fish				
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	T	No; requires mountain stream habitat; restricted to headwaters within the Arkansas River system (CDOW, 2011b).	None
Arkansas darter	*Etheostoma cragini*	C	Unlikely; nearest known location is in Fountain Creek, south of Colorado Springs, and Rush Creek and Big Sandy Creek in eastern Colorado (CDOW, 2011a). No locations sited in project area.	Unlikely
Mammals				
Canada lynx	*Lynx canadensis*	T	No; habitat of subalpine forest; no movement corridors in the vicinity of the project area (Fitzgerald, *et al.,* 1994).	None

Notes: [1]*Status: T = Threatened; E = Endangered, PT = Proposed Threatened, and C = Candidate*
[2]*Categories are Known to Occur; Likely; Possible; Unlikely; and No*
[3] *See Table 3-5 under Section 3.10.2 for a discussion of the potential for Mountain plover to occur in the PEL study area.*

3.10.2 What are the state-listed species for Pueblo County?

Past grazing practices and urban development have degraded habitats along US 50 (including the project area). This degradation results in decreased habitat suitability for wildlife for many state-listed species. The ecological area is transitional from shortgrass prairie to foothill and mountain habitats farther west, which appears to diminish the distribution of many state-listed species. **Table 3-5** provides the 15 species listed by the state as threatened, endangered, or a species of concern for Pueblo County and a statement of likelihood of occurrence in the PEL study area.

Table 3-5. Potential for State-Listed Species to Occur in the US 50 Project Area

Species		Status[1]	Potential to Occur in PEL Project Area[2]	Potential to be Affected by Project
Common Name	Scientific Name			
Amphibians				
Plains leopard frog	*Rana blairi*	SC	Possible with habitat present and distribution records.	Possible effects from work in restructuring conveyances of creeks; requires additional assessment.
Couch's spadefoot (a type of frog that prefers dry conditions)	*Scaphiopus couchi*	SC	Unlikely; known distribution only from Otero County, Colorado; limited to elevations below 4,500 feet.	No
Birds				
Burrowing owl	*Athene cunicularia*	T	Possible with prairie dog colonies and shortgrass prairie habitat.	Most habitat avoided by construction footprint; requires additional assessment.
Bald eagle	*Haliaeetus leucocephalus*	SC	Possible occurrence of foraging birds because of a prairie dog prey base; no nest sites or roost sites occur in the project area.	Unlikely to be affected by construction; requires additional assessment.
Long-billed curlew	*Numenius americanus*	SC	Unlikely; no damp grassy hallows or optimal shortgrass prairie; no records exist west of I-25.	No
Mountain plover	*Charadrius montanus*	SC	Possible based on shortgrass prairie along US 50; no populations reported in this area.	Most habitat avoided by construction footprint; requires additional assessment.
Ferruginous hawk	*Buteo regalis*	SC	Possible with prey base and nesting habitat in the area.	Most habitat avoided by construction footprint; requires additional assessment.
Fish				
Southern redbelly dace (a type of fish that prefers permanent small headwater streams of clear unpolluted water)	*Phoxinus erythrogaster*	E	Possible, but requires habitat of clear, unpolluted water; previous records from Arkansas River near Pueblo Blvd. and Thatcher Ave., south of project area.	Possible effects from work in restructuring drainage system conveyances; more information is needed on water quality of project streams.
Mammals				
Swift fox	*Vulpes velox*	SC	Possible, based on habitat and prey species (prairie dogs) occurring in the project area.	Most shortgrass prairie habitat avoided by construction footprint; requires additional assessment.

Species		Status[1]	Potential to Occur in PEL Project Area[2]	Potential to be Affected by Project
Common Name	Scientific Name			
Townsend's big-eared bat	*Plecotus townsendii pallescens*	SC	Unlikely, based on the lack of cave or cave-like structures in the project area.	No
Black-tailed prairie dog	*Cynomys ludovicianus*	SC	Occurs in PEL study area.	Most shortgrass prairie habitat avoided by construction footprint; requires additional assessment to determine impact level.
Wolverine	*Gulo gulo*	E	Unlikely, as no upper subalpine habitat occurs in PEL study area.	No
Reptiles				
Massasauga (a type of small rattlesnake)	*Sistrurus catenatus*	SC	Possible based on habitat and distribution.	Habitat along the drainages at N. Pueblo Blvd. could be affected; requires additional analysis.
Triploid Colorado checkered whiptail	*Cnemidophorus neotesselatus*	SC	Possible based on habitat and distribution; observed near Florence, Colorado, and Turkey Creek.	Most habitat avoided by construction footprint, requires additional assessment.
Texas horned lizard	*Phrynosoma cornutum*	SC	Unlikely, as sandy soil habitat is not present and no known distributions occur west of I-25 in Pueblo County.	No

Notes: *[1]Status: SC = Species of Concern; E = State Endangered, and T = State Threatened*
[2]Categories are Known to Occur; Likely; Possible; and Unlikely

3.10.3 No Action Alternative

There would be no changes to TES species with the No Action Alternative.

3.10.4 Preferred Alternative

It is unlikely that the Preferred Alternative would have an effect on any of the federally listed species noted here. The Preferred Alternative would unlikely affect the Arkansas darter. Based on habitat, the Mountain plover would have the potential to occur in the area. However, because the project footprint is a restricted area, the predicted amount of habitat loss from construction would likely be small. Moreover, based on known distributions, the potential for this species to occur in the PEL study area would be low. However, the occurrence of this species in the study area should be evaluated further at the next phase of the project analysis.

The Preferred Alternative would minimize the amount of construction that would occur outside the current CDOT ROW, which would reduce the potential effects on state-listed species. However, a slight encroachment would occur into shortgrass prairie and prairie dog habitat on the north side of US 50 west of Pueblo Blvd. Construction at this location would have the potential to affect:

- Prairie dogs
- Shortgrass prairie species, such as the Burrowing owl and Swift fox
- More common species, such as the Ferruginous hawk
- Massasauga rattlesnake

Work within the US 50 and Pueblo Blvd. intersection would have the potential to affect aquatic/riparian associated species, including the Southern redbelly dace and amphibian species. In all

cases, more site-specific data would be required to determine if the Preferred Alternative would affect any of the species that occur in the construction area.

3.10.5 Mitigation strategies

The site-specific project stage will require more analysis to further assess the likelihood of occurrence of federally and state-listed species in the PEL study area. The construction footprint would avoid habitats for these species.

3.10.6 Next steps

The PEL identified the potential for Federally listed and State-listed species to occur in the Corridor. Site-level analysis is required to determine the likelihood of occurrence of one Federally listed species (Mountain plover), and 10 state-listed species (Plains leopard frog, Burrowing owl, Bald eagle, Mountain plover, Ferruginous hawk, Southern redbelly dace, Swift fox, Black-tailed prairie dog, Massasauga rattlesnake, and Triploid Colorado checkered whiptail).

3.11 What historic properties are located in the Corridor?

CDOT submitted a request for listings of previously recorded sites/surveys within a 400-foot-wide area centered on US 50 to the Colorado Office of Archaeology and Historic Preservation (OAHP), the official repository of cultural resources records for the state. This 400-foot-wide study corridor was used to search the OAHP's COMPASS online site records system. PEL-level historic property evaluations consider a 400-foot-wide study corridor adequate to focus studies on the potential impact of alternatives. The footprint of alternatives was generally within or immediately adjacent to CDOT's ROW (see **Appendix B**). CDOT's ROW within the study corridor ranges from 138 to 205 feet in width and the footprint of the alternatives are well within the 400-foot study corridor for historic properties. An additional file search was made for a 1- to 1.5-mile-wide buffer around the corridor (following standard industry practice) to gather data for future studies.

3.11.1 File search results

The file search conducted by Western Cultural Resource Management, Inc. revealed no historic properties (resources eligible for or listed on the National Register of Historic Places [NRHP]) in the US 50 Corridor footprint. See the WCRM Memorandum in **Appendix K** for details.

OAHP records indicated only one site (Turkey Creek Bridge) and one isolated artifact in the Corridor. The State Historic Preservation Officer has determined officially that this site is not eligible for National Register inclusion. The isolated artifact is a piece of amethyst bottle glass from the early 20th Century, which was also determined not eligible for the NRHP.

3.11.2 No Action Alternative

No historic properties are known to occur in the US 50 Corridor. The No Action Alternative would not result in any changes or impacts on historic properties if any sites are identified in the future.

3.11.3 Preferred Alternative

Based on the lack of known historic properties along US 50, no impacts on historic properties have been identified as a result of the Preferred Alternative. The Preferred Alternative footprint would be

entirely within the 400-foot-wide historic properties study corridor where no recorded historic properties have been identified.

3.11.4 Mitigation strategies

Strategies for mitigation and compliance with Section 106 of the National Historic Preservation Act will be determined as a part of future site-specific NEPA studies. Some typical mitigation strategies would include making minor adjustments to the future US 50 alignment and constructing noise walls. Actual mitigation strategies would depend on the types of impacts identified.

3.11.5 Next steps

The first step in initiating compliance with Section 106 would be to establish the Area of Potential Effect (APE) and conduct intensive-level field surveys. Any historic properties identified in these surveys would be evaluated for National Register eligibility, and plans to avoid or mitigate any adverse effects would be developed in compliance with the Section 106 process.

3.12 What are the paleontological resources of the Corridor?

Given the known fossil productivity of the Niobrara Formation within 1 mile of the US 50 Corridor, it would appear likely that future construction within and immediately adjacent to the existing US 50 ROW will potentially have an impact on scientifically important fossils. There are 29 known fossil localities in the vicinity of US 50, 21 with an identified fauna. **Table 3-6** lists the fossil types found in the PEL study area. These 21 fossil localities are not especially scientifically important because they represent typical low-species diversity of Niobrara Formation faunas that have previously been recorded in Colorado. Only two of the 21 localities have more than four identified types of fossils. **Appendix J** contains the CDOT Paleontological Assessment for the PEL Study.

Table 3-6. Types and Locations of Fossils in the US 50 Corridor

Range, Township, and Section	Locality Number	Fossils Present
R20S T65W Sec 08	3488	• *Inoceramus stantoni* • *Volviceramus involutus* • Bone (not otherwise identified)
R20S T65W Sec 09	1289	• *Cladoceramus undulatoplicatus* • *Baculites codyensis* • *Scaphites* sp. • *Protexanites shoshoensis*
R20S T65W Sec 09	3485	• *Inoceramus stantoni* • *Volviceramus involutus* • *Baculites* sp.
R20S T65W Sec 09	3489	• *Scaphites depressus* var. *stantoni*

Range, Township, and Section	Locality Number	Fossils Present
R20S T65W Sec 09	3490	• Cf. *Inoceramus stantoni* • *Cladoceramus undulatoplicatus* • *Baculites codyensis* • *Baculites asper* • *Scaphites binneyi* • *Scaphites depressus* • Fish scales
R20S T65W Sec 10	3496	• *Inoceramus cordiformis* • *Anomia subquadrata*
R20S T65W Sec 10	3499	• Possible *Cladoceramus undulatoplicatus* • Possible *Platyceramus platinus* • *Baculites codyensis* • *Clioscaphites saxitonianus*
R20S T65W Sec 10	3500	• *Platyceramus platinus* • *Inoceramus cordiformis* • *Baculites codyensis* • *Clioscaphites vermiformis*
R20S T65W Sec 10	3501	• *Inoceramus* sp. • *Platyceramus platinus* • *Baculites* sp. • *Clioscaphites choteauensis* • *Ostrea* (oyster) sp.
R20S T65W Sec 10	3505	• *Endocostea simpsoni* • *Sphenoceramus* cf. S. *patootensis* • *Baculites* sp. (smooth) • *Ostrea* sp.
R20S T65W Sec 10	3507	• *Platyceramus platinus* • *Ostrea congesta*
R20S T65W Sec 15	3503	• *Platyceramus platinus* • *Clioscaphites choteauensis* • *Ostrea congesta*
R20S T65W Sec 15	3504	• *Platyceramus platinus* • *Clioscaphites choteauensis* • *Ostrea congesta*
R20S T65W Sec 15	3509	• *Platyceramus platinus*
R20S T65W Sec 15	3511	• *Endocostea simpsoni*
R20S T65W Sec 16	3473	• *Inoceramus* sp. (large) • *Inoceramus* sp. (small) • *Volviceramus involutus* • *Baculites codyensis*
R20S T65W Sec 16	3475	Cf. Inoceramus stantoni
R20S T65W Sec 16	3481	• *Inoceramus stantoni* • *Volviceramus involutus* • *Baculites asper* • *Pseudobaculites* sp.

Range, Township, and Section	Locality Number	Fossils Present
R20S T65W Sec 16	3482	• *Inoceramus* sp. • *Neocrioceras* sp.
R20S T65W Sec 16	3483	• *Inoceramus stantoni* • *Volviceramus involutus*
R20S T65W Sec 16	3493	• *Cladoceramus undulatoplicatus* • *Baculites codyensis* • *Scaphites depressus* var. *stantoni*

Source: CDOT, 2011

However, 15 of the 21 localities have scientific significance as producers of *guide fossils*—fossils that can be used to date their rock strata and nearby fossils. The fact that nearly 75 percent of the recorded localities include guide fossils probably indicates a bias toward formally recording fossil localities that can be reliably dated within a relatively short period of geologic time. Given that so many fossil localities have been recorded within a relatively small area adjacent to the study corridor suggests a strong potential for finding similar localities within the study corridor if and when systematic on-the-ground reconnaissance for paleontological resources is conducted in the future.

The Pierre Shale has also shown strong potential for producing scientifically important fossils in the Pueblo area (and elsewhere in Colorado). However, the Niobrara Formation that underlies the vast majority of the study corridor is buried in places underneath a relatively thin layer of much younger surface deposits, while the Pierre Shale is mapped (Scott, 1969) only within the easternmost 0.25 mile of the study corridor (near Baltimore Ave.). At most, the Pierre Shale lies shallowly buried underneath a relatively thin layer of much younger surface deposits for another 0.3 mile to the west.

The Pleistocene units mapped (Scott, 1969; 1972) within the study corridor limits have demonstrated a much lower probability of producing scientifically important fossils that could be uncovered, damaged, and/or destroyed due to future construction within the study corridor limits.

3.12.1 Mitigation strategies

Strategies to mitigate impacts on paleontological resources may include preconstruction surveys and evaluation, construction monitoring, training, and spot-check monitoring of sensitive formations during construction. The CDOT staff paleontologist or other qualified and permitted paleontologist will oversee all work and follow CDOT's *Paleontology Analysis and Documentation Procedures* (CDOT, 2006). If unanticipated fossil remains are discovered, such as unexpected concentrations of fossils, unusually large specimens, or unexpected discoveries in sediments, all ground disturbances in the area will cease immediately. The qualified paleontologist and appropriate project personnel would be notified immediately to assess the find and make further recommendations.

3.12.2 Next steps

The initial step in coordinating with the CDOT staff paleontologist would be to conduct a paleontological survey of the Corridor area associated with the Preferred Alternative.

3.13 What are the land uses and socioeconomic resources of the Corridor?

3.13.1 Methodology

This section integrates the broad framework of the PACOG *2035 Comprehensive Plan* (2002) and socioeconomic projections for regional population, employment, and economic development; as well as the compatibility of the Preferred Alternative with the US 50 land use setting. Discussion topics include:

- Evaluations of the Preferred Alternative footprint within CDOT's ROW
- Potential parcel takes
- Compatibility with future planning
- Community cohesion

The study team used GIS and MicroStation Computer-Aided Design software to evaluate the footprint. **Figure 3-1** shows the 20-foot construction zone that was established to analyze land uses in the Corridor. Aerial photography, CDOT's ROW, City of Pueblo and Pueblo County parcel boundaries, zoning classifications, and future land use planning map data identified the patterns of existing and future land use.

The study team interpreted and quantified impacts by overlaying the footprint of the Preferred Alternative on the land use data. **Chapter 2** of this PEL Study provides the results of these evaluations for alternatives. Background information on land use and socioeconomic resources is provided in the following sections:

- Corridor transportation and land use planning
- Socioeconomic profiles
- Pueblo's *Comprehensive Plan*
- Transitions in land use planning for the Corridor

Later sections discuss evaluations of the No Action and Preferred Alternative and the potential for mitigation.

3.13.2 Background

Transportation and land use planning

The 2011 PACOG *2035 Long Range Transportation Plan* (LRTP) recognizes the desirability of coordination between transportation and land use planning. Specifically in relation to interchanges, PACOG notes:

> *Interchanges become magnets for development, but unplanned development and unmanaged access can quickly lead to a breakdown of traffic conditions in the vicinity of the interchange, affecting both safety and capacity.*

This PEL report is a live planning product integrated into this assessment of the No Action and Preferred Alternatives. The process of developing this study has brought planning and assessment together through the coordination of PACOG, Pueblo County, the City of Pueblo, and PWMD.

Socioeconomic profile: population and employment

The city of Pueblo was first incorporated in 1870, and the original city is now the core of the downtown area. The city expanded in the late 1800s with the arrival of the Denver and Rio Grande Railroad in the area and growth of the steel industry. Pueblo, South Pueblo, and Central Pueblo were consolidated into the single town of Pueblo in 1886. Even though land situated on the City's north and southwest periphery had been part of Pueblo since 1948, the areas were predominantly developed in the 1950s and 1960s.

Pueblo County has three metropolitan districts:

- The PWMD, founded on September 16, 1969, encompasses an area of land slightly larger than the area of the city of Pueblo. The District is permitted to provide municipal services, such as street improvements, fire protection, recreation, and water and sewer services; however, it does not have the power to provide police services or zoning and subdivision (PACOG, 2002).
- Colorado City Metropolitan District, about 25 miles south of Pueblo on I-25, had a population of about 2,200 residents as of July 2008 (Colorado City Metropolitan District, 2011).
- ThunderVillage in the city of Pueblo, east of Colorado State University-Pueblo, was formed as a result of the election on November 4, 2008.

Since 1982, when the city's major employer CF&I Steel discontinued operations, Pueblo has worked to reinvent itself and pursue an aggressive strategy of economic development. The Pueblo Economic Development Adjustment Strategy was completed in 1984, and Pueblo opened its Business and Technology Incubator in September of that year. The *Enterprise Zone Development Plan* was completed in 1986, and Pueblo was the first enterprise zone in Colorado to take advantage of available tax incentives (Hart Adams, 2010).

Much of the economic development has focused on the central business core and areas to the north and west of the city. The PWMD has consequently been one of the fast-growing communities in southwestern Colorado. **Figure 3-3** illustrates that population growth in Pueblo West (which has been in line with County growth) has outpaced growth in the City of Pueblo.

The Pueblo Area Chamber of Commerce promotes the city as ranking third in the State for business in 2010 (Pueblo Chamber, 2011). The city ranked especially high in the following areas:

- Quality of life
- Business friendliness
- Sound economy
- Available pool of labor
- Technology innovation

According to a 2011 Kiplinger Survey, Pueblo is also the second top city across the US for its low cost of living (Browne, 2011).

The area offers a number of resources attractive to businesses. In the 1980s, the Pueblo Dam and Reservoir were completed as part of the Fryingpan-Arkansas Project, a Bureau of Reclamation project serving the Arkansas and Fryingpan Rivers. The addition of this water source enables the city to accommodate a population of more than 300,000 (PACOG, 2002). Ample undeveloped, accessible, and inexpensive land is available for commercial and residential development, and upscale improvements in developed areas provide an attractive setting.

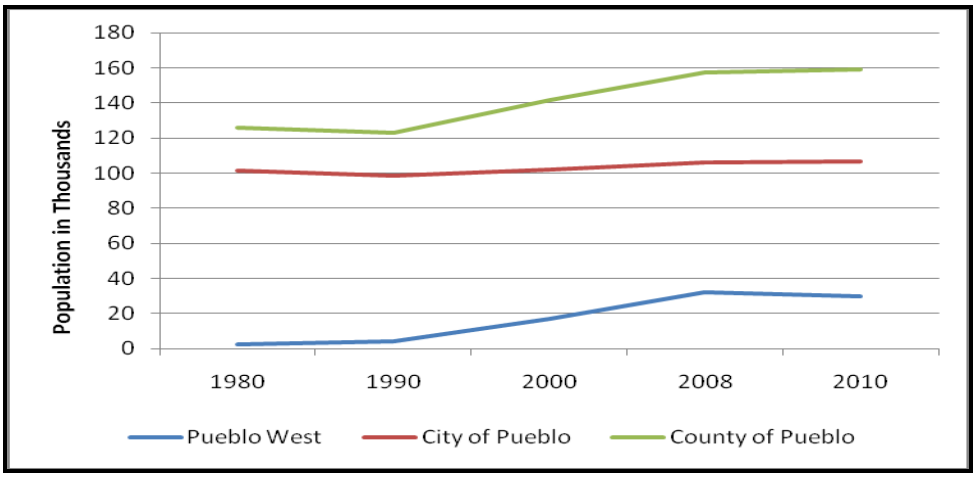


Figure 3-3. Trends in Pueblo Area Population

Sources: PACOG, 2009; Colorado Department of Local Affairs (DOLA), 2010; US Census Bureau, 2010

Table 3-7 shows PACOG's 2035 forecasts of population growth by Census tract presented in the *2035 LRTP* (2011). These estimates are indicative of the region's long-range plan to draw businesses into the area. The estimates shown represent the Census tracts that lie within the vicinity of the US 50 PEL study area. **Figure 3-4** identifies Census tracts that were selected to capture the area representing the travel network related to the Preferred Alternative.

Table 3-7 also includes PACOG's population estimates for Pueblo County. Because the PACOG estimates were generated for the LRTP, Colorado Department of Local Affairs (DOLA) estimates of Pueblo County population generated in 2010 are also included. The later DOLA estimates align fairly closely with the earlier PACOG estimates, indicating that Pueblo County forecasts for population in the area may not be substantially different.

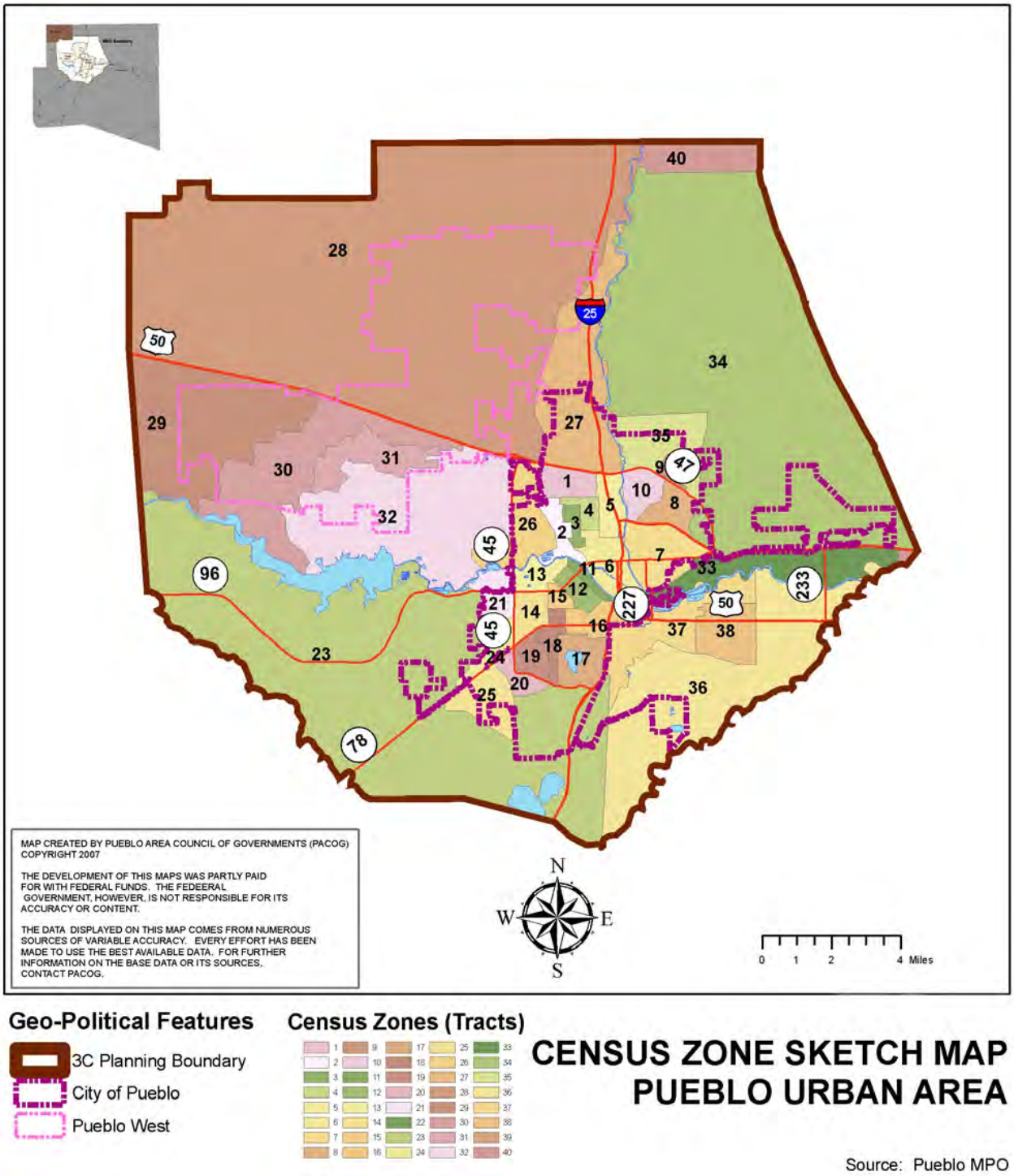
The most significant population growth through to 2035 is expected to occur in:

- Census Tract 26, adjacent on the south to US 50 and east of Pueblo Blvd.;
- Census Tract 27, extending north from US 50 along I-25; and
- Portions of Census Tract 28 within the Pueblo Urban Area adjacent to US 50 on the north and west of the Burlington Northern Santa Fe (BNSF) Railway. High growth is also expected for Census Tract 32, adjacent to US 50 on the south and west of Pueblo Blvd.

Table 3-7. PACOG Population Estimates, 2005 and 2035

Census Tract or Other Area	2005 Population Estimate	2035 Population Forecast	Numeric Change	Percentage Change
1	2,717	4,512	1,795	66.1%
26	2,288	6,063	3,775	165.0%
27	4,891	12,540	7,649	156.4%
28[1]	4,469	10,072	5,603	125.4%
29[1]	3,319	5,159	1,840	55.4%
30	6,891	11,785	4,894	71.0%
31	5,086	9,052	3,966	78.0%
32	5,343	9,989	4,646	87.0%
Total US 50 Study Area	**35,004**	**69,172**	**34,168**	**97.6%**
Pueblo County (PACOG, 2011)	151,104	248,012	96,908	64.1%
Pueblo County (DOLA, 2010c)	150,529	239,198	88,669	58.9%

[1] *Sections within Pueblo Urban Area*



Geo-Political Features

- 3C Planning Boundary
- City of Pueblo
- Pueblo West

Census Zones (Tracts)

CENSUS ZONE SKETCH MAP
PUEBLO URBAN AREA

Source: Pueblo MPO

Figure 3-4. Pueblo Urban Area Census Tracts

Comparing **Figure 3-5** and **Figure 3-6** readily shows expected changes in population distribution . Essentially, the highest population growth in the study area is expected to occur on the north side of US 50 west of I-25, and on the south side of US 50, west of Pueblo Blvd.

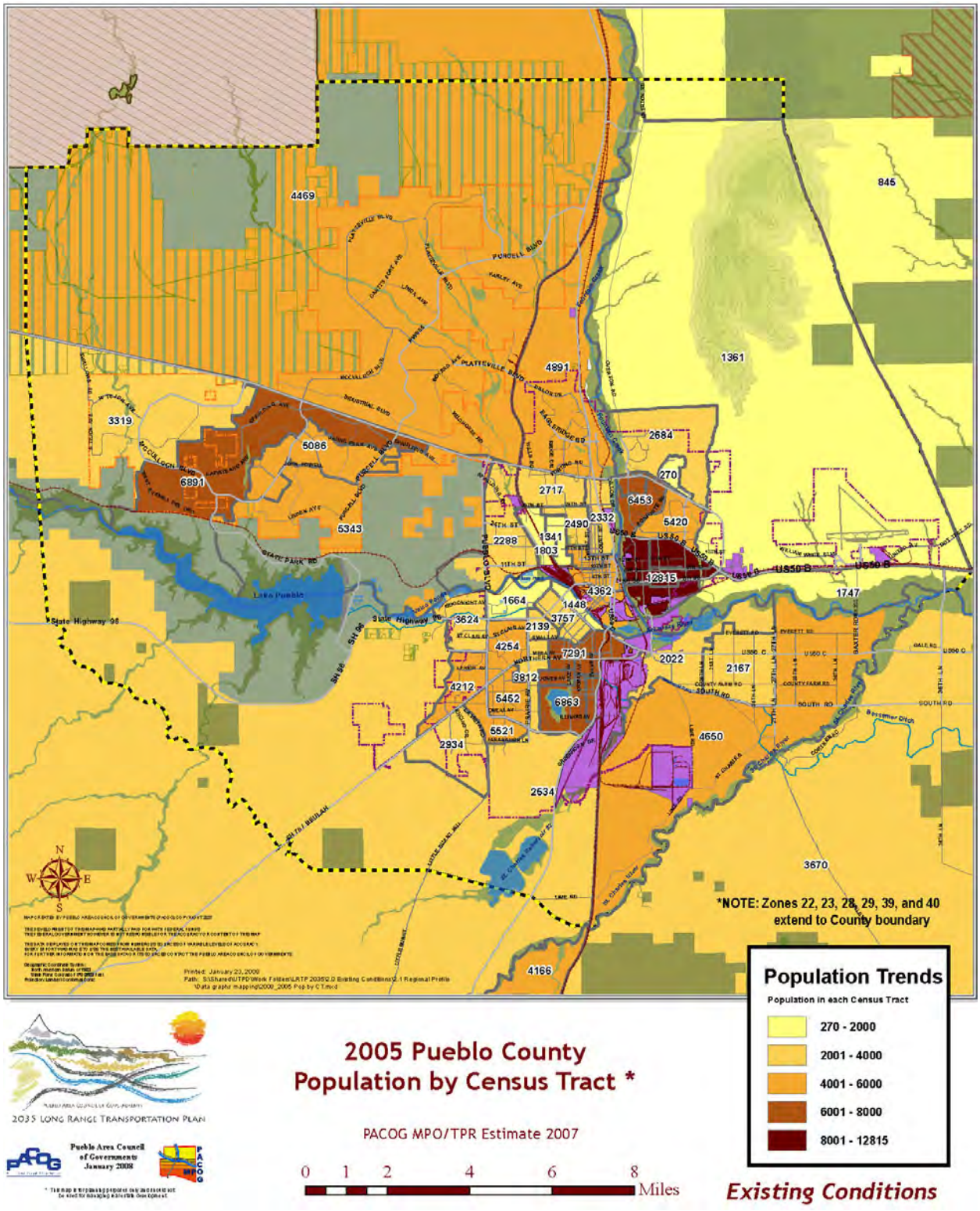
Table 3-8 lists PACOG's 2005 estimates, 2015, and 2035 forecasts of employment in the same Census tract areas described previously. The expected change in employment in the study area is even more significant than the expected population growth, with high rates of growth anticipated in the central business core that emanate north and west of the city. Job growth is expected to occur in the commercial, office, industrial, and government sectors (PACOG, 2002).

By far the highest rate of expected growth in employment is anticipated to occur in Census Tract 28, with an almost eight-fold increase occurring in the area north of US 50 west of the BNSF Railway along I-25. Other zones adjacent to US 50 on the north and south extending west from I-25 are also expected to experience high rates of growth in employment. The total expected growth in employment for the study area is more than 300 percent.

Table 3-8. PACOG Employment Estimates, 2005 and 2035

Census Tract or Other Area	2005 Employment Estimate	2035 Employment Forecast	Numeric Change	Percentage Change
1	1,004	819	-185	-18.4%
26	841	3,414	2,573	305.9%
27	5,765	19,938	14,173	245.8%
28[1]	2,334	20,895	18,561	795.2%
29[1]	117	358	241	206.0%
30	1,049	3,185	2,136	203.6%
31	484	763	279	57.6%
32	209	159	-50	-23.9%
Total US 50 Study Area	**11,803**	**49,531**	**37,728**	**319.6%**
Pueblo County (PACOG, 2011)	59,255	117,863	58.608	98.9%
Pueblo County (DOLA, 2010b)	66,419	n/a	n/a	n/a
Pueblo County (CBEF, 2007)	67,082	105,329	38,238	57.0%

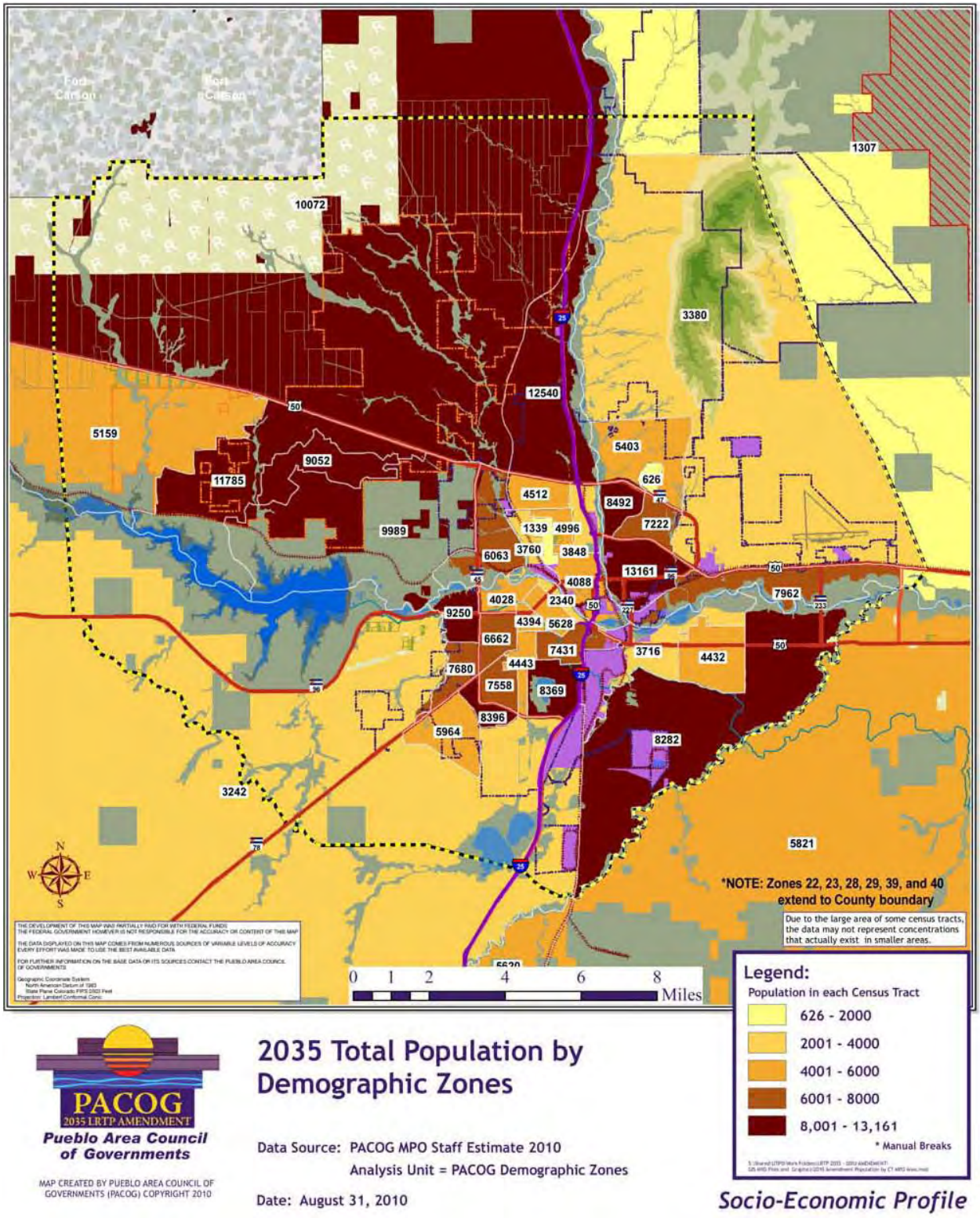
Notes: *[1] Sections within Pueblo Urban Area*
n/a = Not available



Source: *PACOG, 2010.*

Note: *Number shown on each Census tract is 2005 population.*

Figure 3-5. 2005 Population Distribution by Census Tract



Source: PACOG, 2010.

Note: Number shown on each Census tract is 2035 population.

Figure 3-6. 2035 Population Distribution by Census Tract or Demographic Zone

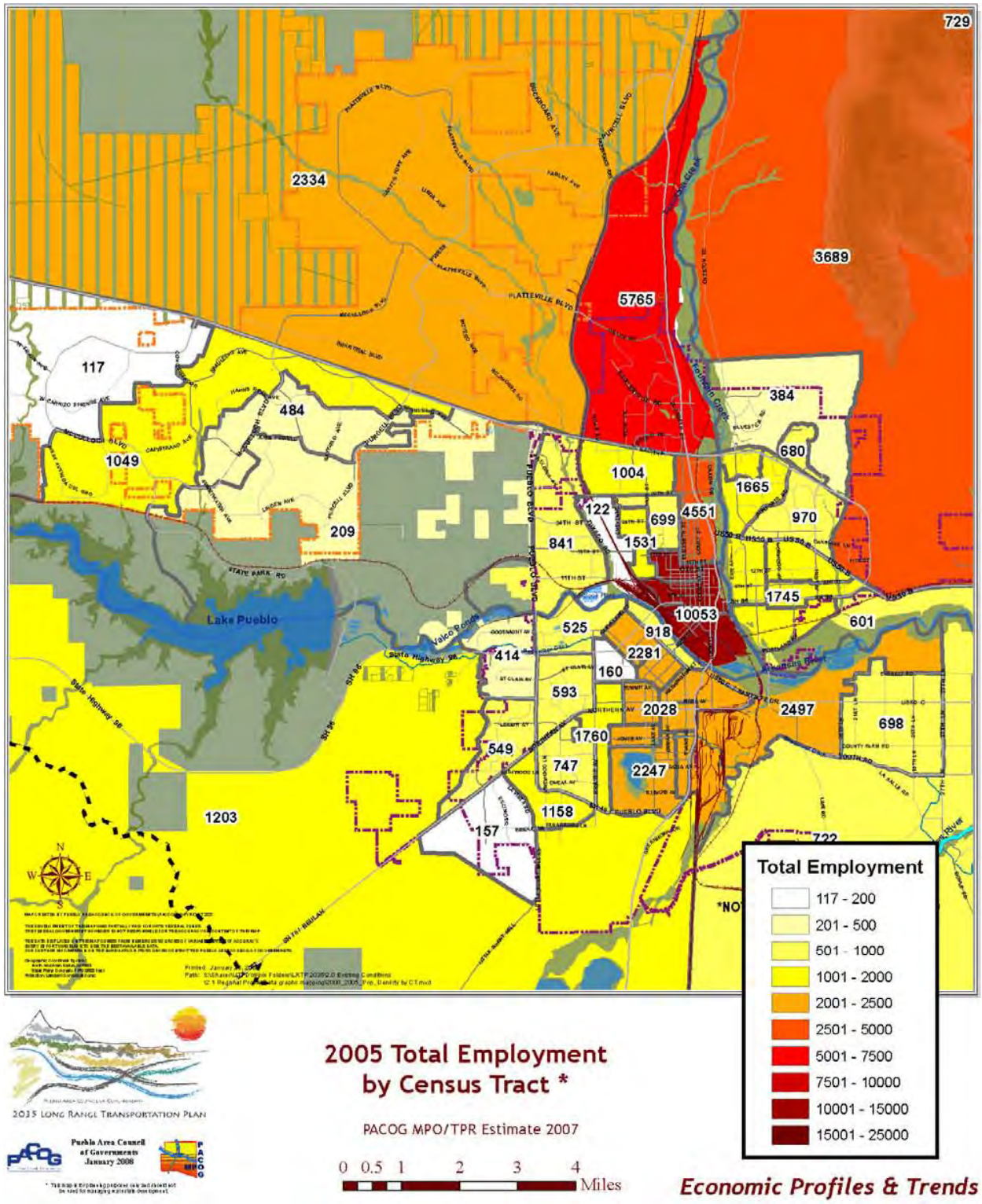
Figure 3-7 and **Figure 3-8** visually represent the forecasted change in employment in the region.

PACOG's employment forecasts that were generated for the *LRTP* were adopted in 2008, at the start of the global economic downturn. Trends in the economy that have occurred since then will likely result in revisions to the forecasts. It is interesting, however, to compare PACOG's employment forecasts generated in 2008 for Pueblo County with DOLA's forecasts for the County that were generated two years later in 2010.

Another source to confirm PACOG predictions was employment forecasts from the Center for Business and Economic Forecasting (CBEF). CBEF predicted similar trends for Pueblo County, with the same optimistic growth prediction from 2005 to 2035 at almost 100 percent.

Although the predictions for growth in population and employment in the US 50 Corridor may appear overly optimistic in light of current economic trends in the US, they are based on, and in line with, Pueblo's generally successful revitalization and commercialization strategy.

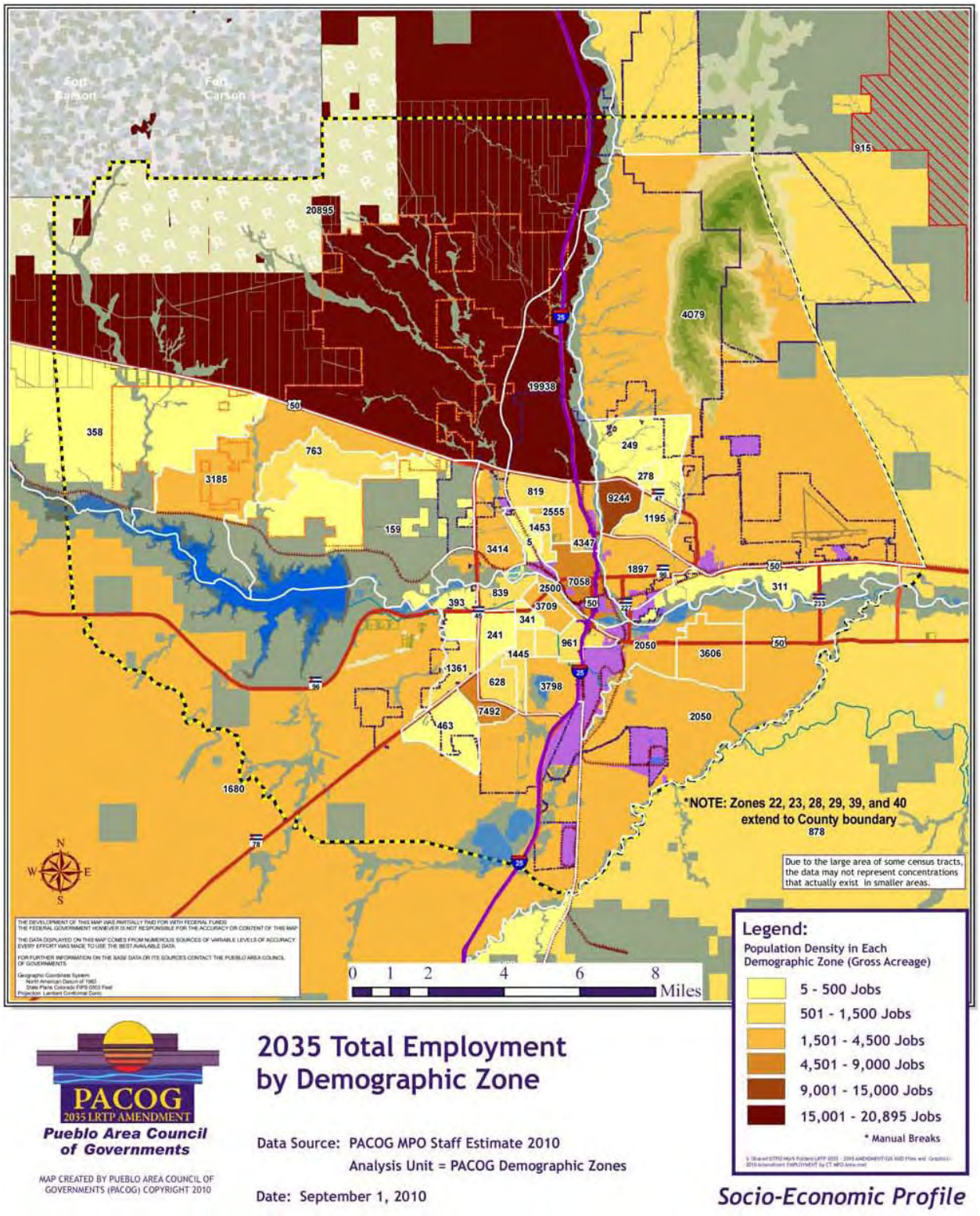
An example of this success has been Vestas Wind Systems choosing Pueblo for its new wind-turbine component manufacturing plant because of the central location and transportation structure. The Vestas Towers Factory in Pueblo is the largest wind tower manufacturing facility in the world.



Source: *PACOG, 2010.*

Note: *Number shown on each Census tract is 2005 employment*

Figure 3-7. 2005 Employment by Census Tract



Source: *PACOG, 2010*

Note: *Number shown on each Census tract is 2035 employment.*

Figure 3-8. 2035 Employment by Census Tract or Demographic Zone

Pueblo's Comprehensive Plan

The PACOG *2035 LRTP* (2011) sets out the vision for specific transportation corridors in the Pueblo area, including US 50 from West McCulloch Blvd to I-25. The primary goal for this Corridor is:

> *…to increase mobility as well as to improve safety and to maintain system quality… Users of this corridor want to preserve the urban character of the area while supporting the movement of commuters in and through the corridor while recognizing the environmental, economic and social needs of the surrounding area.*

LRTP Corridor Objectives (PACOG, 2011)

1. Reduce traffic congestion and improve traffic flow
2. Support commuter travel
3. Accommodate growth in freight transport

The *LRTP* identifies this Corridor as an urban expressway with substantial retail and commercial development at intersections and interchanges, with high development potential. Areas with high development potential in the Corridor are those areas within the city of Pueblo and those areas designated for future non-agricultural development in the 2002 *Comprehensive Development Plan*.

The *Pueblo Comprehensive Plan* discusses the future character of the Pueblo West Developing Metro Core Area as "a continuation of existing suburban development patterns…. Arterial commercial and light industrial mixed-use development will continue as planned in designated areas along Highway 50."

Transitions in land use planning for the Corridor

Figure 3-1 illustrates the existing land use patterns within the study corridor. The current City of Pueblo and Pueblo County land use zoning, and the future land use from the 2035 *Comprehensive Plan* are described at each intersection in **Table 3-9**, along with a description of the elements of the Preferred Alternative at each of these locations.

Table 3-9. Zoning and Future Land Use

Interchange	Quadrant	Existing Generalized Zoning	Future Land Use		Elements of Preferred Alternative	
Swallows Rd.	NW, NE SW, SE	Agricultural	All	Rural/Ranch	Signalized intersection	4 lanes
West McCulloch Blvd.	NW, NE	Agricultural	NW, NE	Rural/Ranch	Signalized intersection	4 lanes
			SW, SE	Country Residential		
Main McCulloch Blvd.	NW, NE, SE	Business/Commercial	NW, SE	Suburban Residential	Diamond interchange	6 lanes
			NE	Employment Center – Light Industrial Mixed Use		
	SW	Multi-family	SW	Suburban Residential		
Purcell Blvd.	All	Business/Commercial	All	Arterial Commercial Mixed Use	Diamond interchange	6 lanes

Interchange	Quadrant	Existing Generalized Zoning	Future Land Use		Elements of Preferred Alternative	
Pueblo Blvd.	NW, NE, SW	Agricultural and Public Use	NW, SW, NE	Special Development Area	Diverging Diamond interchange	6 lanes
	SE	Business/Commercial	SE	Institutional Mixed Use		
Wills Blvd.	All	Business/Commercial	All	Arterial Commercial Mixed Use	Signalized intersection	6 lanes
Baltimore Ave.	All	Business/Commercial	All	Arterial Commercial Mixed Use	Signalized intersection	6 lanes

The following summarize the zoning and future land use at each intersection.

Swallows Rd.

A large portion of developable land in the Pueblo Region is projected to remain in the category of Rural/Ranch, as a sparsely populated area devoted to traditional ranching operations, large rural land holdings, and smaller "ranchettes." The Swallows Rd. area is undeveloped and currently zoned for Agricultural land use. Future land use will maintain the existing character into the future with the PACOG designation of "Rural/Ranch." The area is planned to remain largely open-space oriented, with low-density and low-impact development.

The *Pueblo County Comprehensive Plan* for Rural/Ranch development overlays the Gary Walker Conservation Easement north of US 50. Fort Carson recently purchased the Gary Walker Conservation Easement (September 2011) as an open-space buffer between Pueblo West and Fort Carson. The land is located north of US 50, between the northwest corner of Pueblo West and the southeast corner of Fort Carson. It creates a buffer zone that separates the base from any residential growth.

As Fort Carson's partner, The Nature Conservancy completed the acquisition process for the Gary Walker Conservation Easement through the Army's Compatible Use Buffer Program. Conservation easements typically limit development and protect natural resources. The easement was completed to provide a buffer area between Fort Carson's military training areas and the rapid community development in nearby Pueblo West. The buffer will ensure that Fort Carson can protect and sustain current and future training capabilities on range areas. The conservation easements were purchased from the Walker family. The easements take precedent over the Rural/Ranch category in the *Comprehensive Plan* and are more restrictive by prohibiting future development.

West McCulloch Blvd.

The current zoning and planned Country Residential land use at West McCulloch Blvd. is in the southeast and southwest quadrants of the intersection. Existing development is in low-density 1-to-5-acre lots, with single- and two-family dwelling unit structures. The Country Residential land use allows a more rural area without public sewer service but has some suburban amenities such as public water service. Lot development is low density, and the use of clustering is encouraged.

The northeast and northwest quadrants of the intersection are undeveloped as a conservation lease area. As such, they are planned to retain and promote the use of dry range and irrigated lands to encourage open use of land in keeping with natural characteristics and agricultural functions. Future land use planning is consistent with the existing character. The Rural/Ranch land use planned to the

north is intended for sparsely populated areas devoted to ranching operations, rural land holdings, and smaller "ranchettes." See the previous discussion under **Swallows Rd.** regarding the Gary Walker Conservation Lease.

Main McCulloch Blvd.

Current Business/Commercial zoning at the intersection of Main McCulloch Blvd. and US 50 provides a setting for a commercial center and community business development on the northwest, northeast, and southeast quadrants, with maximum building heights of 2 stories and 35 feet. The southwest quadrant is zoned for Multi-family, providing areas of high-density multiple-family dwelling unit structures and limited co-mingling of other compatible uses.

PACOG's future land use map suggests a divergence from the existing land use. The northwest, southwest, and southeast quadrants would become a Suburban Residential land use, which identifies areas for residential subdivisions with densities from 1 to 3 units per acre, along curvilinear and cul-de-sac streets with complementary neighborhood businesses and public use functions. The northeast quadrant would become an Employment Center with a focus on Light Industrial Mixed Use, including manufacturing, assembling, research and development, without significant emissions, noise, odors, or hazardous materials handling. It is expected that such land use could potentially generate truck traffic to and from the Main McCulloch Blvd. intersection.

To the south of the intersection is a strip of Arterial Commercial Mixed Use along Main McCulloch Blvd. that would also generate commercial-oriented traffic through the intersection.

Purcell Blvd.

Purcell Blvd. is currently developed and zoned as a Center of Community Business Development, with a maximum building height of 2 stories and 35 feet. Future land use is compatible with the current zoning activities, which designates the area as an Arterial Commercial Mixed Use. This area is characterized as a regional retail market segment and geared toward development that provides parking and commercial center mixed uses.

Pueblo Blvd.

Current zoning at Pueblo Blvd. consists of Agricultural zoning to the north, Public Use to the southwest, and Business/Commercial development to the southeast. The future land use designation in the PACOG *Comprehensive Plan* would change from the relatively low density of current use and zoning between Pueblo Blvd. and the BNSF Railway to a Special Development Area in the northwest, southwest, and northeast quadrants of the intersection and Institutional Mixed Use in the southeast quadrant. The Special Development Area would include careful, location-specific planning on undeveloped lands for infrastructure and private development. Planning for this area has the highest level of potential for regional trip generation along the US 50 Corridor. Sited in the southeast quadrant, Institutional Mixed Use includes planning for public and semi-public uses such as hospitals, universities, and governmental complexes.

Wills Blvd. and Baltimore Ave.

The intersections at Wills Blvd. and Baltimore Ave. are most characteristic of urban-oriented development. They are currently zoned as Community Business District, which permits land uses to retain and provide areas for the sale of convenience type goods and services. Ground coverage of buildings does not exceed 35 percent, and building height does not exceed 35 feet. Future planning for Wills Blvd. and Baltimore Ave. is compatible with existing land uses. Both intersections have

been designated as Arterial Commercial Mixed Use, which provides community level shopping and services. Ground coverage is represented as a floor-area-ratio of 0.5.

Summary

Overall, Rural/Ranch development characterizes the western half of the US 50 Corridor, while planning for higher-density, urban-style development characterizes the eastern half of the Corridor. Rural Residential patterns exist from the Swallows Rd. to the West McCulloch Blvd. intersection, transition to Residential and Commercial between Main McCulloch Blvd. and Purcell Blvd., and then become Commercial development from Purcell Blvd. to Baltimore Ave., which dominates the eastern portion of the Corridor.

The largest potential for land use change occurs from current use and zoning to long-range planning at Pueblo Blvd., with the shift from existing Agricultural zoning to a Special Development Area district. The Main McCulloch Blvd. intersection will likely change from an existing Multi-family zoning in the southwest quadrant to a Suburban Residential style land use that will encourage lower density development. At Main McCulloch Blvd., existing business areas will change to Suburban Residential in the northwest and southeast quadrants, and to Light Industrial Mixed Use in the northeast quadrant, suggesting altered traffic use and patterns for the intersection as the area develops.

3.13.3 No Action Alternative

The No Action Alternative would be incompatible with the planning objectives for the area. The Corridor in its current state would not accommodate increases in traffic that are anticipated given the expected growth in population and plans for increased commercial development.

3.13.4 Preferred Alternative

The Preferred Alternative would minimize impacts on Corridor land uses, as discussed in this chapter and presented in **Appendix B**. The footprint of the interchange and six-lane elements of the Preferred Alternative would generally fit within the CDOT ROW, or within compatible PWMD buffer strips and multi-use easements (MUE), as described in **Section 3.15.4** of this PEL. In the Wills Blvd. and Baltimore Ave. area, the six-lane widening would fit within the CDOT ROW; however, the proposed sidewalk would require additional space in portions of this Corridor segment. The footprint would avoid existing structures or any total parcel takes. There would be partial impacts on seven undeveloped parcels and to a portion of CDOT's maintenance facility at the Pueblo Blvd. intersection.

The Preferred Alternative would be compatible with future planning objectives for the City of Pueblo and Pueblo County. It would support the economic and social needs of the Corridor and surrounding area by providing increased capacity with improved vehicular and pedestrian access, while minimizing disruption to land uses outside the CDOT ROW.

3.13.5 Mitigation strategies

Avoidance of impacts on parcels would be determined at the site-specific project phase. Strategies to avoid land use impacts would include refinements to parcel and CDOT ROW mapping, project footprints, and construction zones.

3.13.6 Next steps

Coordination of the ROW survey and concept design studies will provide data that is needed to identify any access and parcel impacts. The assessment of parcel impacts will address whether an easement can be acquired or whether CDOT needs to purchase part or all of the property in question. Easements may be used in certain cases, such as to construct a bicycle and pedestrian path or to build cross slopes conforming to current highway standards. Sometimes, so much of a parcel needs to be acquired that it makes the remainder unusable to the current property owner. For example, an owner may no longer be able to meet the parking requirements of local zoning codes if CDOT were to acquire the majority of the parking lot property. In these cases, CDOT will buy the entire property. The assessment of parcel impacts will also discuss whether the property to be acquired is residential or commercial.

Once designs are sufficiently detailed and ROW needs are known, CDOT ROW staff will conduct a field survey to estimate the fair market value of the property to be acquired. CDOT will follow the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, when it buys needed properties.

3.14 What are the bicycle and pedestrian facilities of the Corridor?

Chapter 1, Section 1.4.5, of this PEL Study describes the limited existing bicycle and pedestrian facilities in the Corridor. **Chapter 2, Section 2.16.3,** of this PEL Study describes the bicycle and pedestrian facility improvements that could be made in conjunction with the Preferred Alternative.

3.15 What are the right-of-way characteristics of the Corridor?

3.15.1 Methods

ROW for US 50 is the land used for transportation facilities and their maintenance. CDOT owns the ROW for existing US 50 facilities. **Chapter 1, Section 1.4.2,** of this PEL Study describes and illustrates the current cross sections and CDOT's existing ROW for US 50. **Chapter 2, Section 2.16,** of this PEL Study describes and illustrates components of the Preferred Alternative, including the proposed interchange improvements and six-lane widening.

For evaluation purposes, the study team used the City of Pueblo and Pueblo County parcel and zoning maps to represent the CDOT ROW lines. These characterizations of the US 50 ROW areas generally conform with CDOT's mapping of US 50. The ROW evaluation involved a GIS process of overlaying the footprint of the Preferred Alternative onto the City of Pueblo and Pueblo County parcel and zoning maps to identify locations where the Preferred Alternative footprint would extend beyond the assumed ROW (see **Figure 3-1** for details).

3.15.2 Right-of-way widths

The US 50 ROW width varies in the Corridor, particularly at interchanges as follows:

- Wills Blvd. to Baltimore Ave. – 138 to 176 feet
- Swallows Rd. to West McCulloch Blvd. – 205 feet
- West McCulloch Blvd. to Main McCulloch Blvd. – 185 feet
- Main McCulloch Blvd. to west of the Pueblo Blvd. interchange – 195 feet
- BNSF Railway to Wills Blvd. – 156 to 200 feet

3.15.3 No Action Alternative

There would be no changes to the US 50 ROW under the No Action Alternative.

3.15.4 Preferred Alternative

Impacts would occur where the Preferred Alternative footprint would require additional space beyond the edge of CDOT's ROW. The total area of the Preferred Alternative footprint outside the CDOT ROW would be approximately 17 acres. This would include 2.5 acres of lands for interchange improvements at Main McCulloch Blvd., Purcell Blvd., Pueblo Blvd., and Baltimore Ave.; and approximately 14.5 acres for the mainline US 50 six-lane widening. The additional lanes planned between Main McCulloch Blvd. and Pueblo Blvd. would fit within the US 50 ROW; however, drainage and the planned bicycle/pedestrian path would require additional space outside the ROW. These facilities would be located within a PWMD buffer area adjacent to the CDOT ROW, and within a PWMD MUE that was established for utility or trail uses. The PWMD buffer and MUE are considered compatible with the proposed drainage and pedestrian/bicycle path that would parallel the US 50 Corridor.

The impacts on the US 50 ROW are incorporated into the land use and socioeconomic studies that are presented in **Section 3.13**, where the compatibility of the Preferred Alternative with the US 50 ROW, existing land use parcels and zoning, and the PACOG *2035 Comprehensive Plan* is evaluated.

3.16 What are the utilities and railroads of the Corridor?

A utility is a private- or publicly owned line, facility, or system for producing, transmitting, or distributing communications, electrical power, natural gas, potable water, wastewater, and stormwater not connected with highway drainage or any other similar type of commodity that directly or indirectly serves the public. Utility lines are frequently placed along road corridors, section lines, or property boundaries to minimize ROW and easement impacts. The utilities easements along US 50 either parallel the highway or cross it perpendicularly. Early coordination would be required to ensure that the statewide transportation system considers the rights and needs of other private and public entities to accomplish the following:

- Avoid impacts on existing utilities
- Identify where relocation is needed to accommodate roadway improvements
- Minimize cost and construction delay
- Ensure that delivery of public service is not interrupted.

The following regulations and guidance apply to treatment of utilities and railroads for CDOT projects:

- State Highway Utility Accommodations Code, CFR-Title 23 Section 645, 646 and 635-309b
- Transportation Act, CRS 43-1-225
- Eminent Domain Act, CRS 38-5-101

CDOT has established procedures in the *Project Development Manual* in Section 5.03 for coordinating with utility companies and in Section 5.04 for coordinating with railroad companies when a project may have an impact on utilities and railroads (CDOT, 2001).

3.16.1 Methods

The study team conducted a records review of City, County, and utility company sources to identify existing infrastructure within the study area. A windshield survey was conducted along US 50 to identify recognizable utility crossings.

3.16.2 Context/background setting description

Utilities

Table 3-10 lists existing utilities that are within, cross, or run parallel to CDOT ROW.

Table 3-10. Existing Utilities in the Study Area

Utility	Location	Relationship to US 50
Gas Lines		
CNG gas line	3-mile road south to Moccasin Dr.	Crosses US 50
CNG gas line	3-mile road east to N. Aspen Skyway	2.3 miles within US 50 ROW
Xcel Gas FB	N. Aspen Skyway south to S. Dacona Dr.	Crosses US 50
Xcel Gas FB	3,200 feet east of Purcell Blvd.	Crosses US 50
Xcel Gas FB	3,200 feet east of Purcell Blvd. to N. Pueblo Blvd interchange then south along Pueblo Blvd.	Parallel but outside CDOT ROW
Underground Fiber (UGF)		
CDOT Traffic	Utility marking from N. Magneto Dr. east to Baltimore Ave.	4 miles within or adjacent to CDOT ROW
SECOM UGF	McCulloch Blvd. interchange	1,400 feet within CDOT ROW
SECOM UGF	S. Bayfield Ave.	Crosses US 50
SECOM UGF	N. Purcell Blvd. east to Kachina Pl.	3.2 miles within CDOT ROW
SECOM UGF	N. Pueblo Blvd. interchange	0.92 miles within CDOT ROW
Other Utilities		
Pueblo NV transmission line	3.200 feet east of Purcell Blvd.	Crosses US 50
FVA 4-inch CCP-water line	3.200 feet east of Purcell Blvd.	Crosses US 50
City 18-inch wastewater line	Baker Steamer Rd., N. Pueblo Blvd. Interchange	1,400 feet within CDOT ROW

Abbreviations: *CDOT = Colorado Department of Transportation* *CNG = Colorado Natural Gas* *CCP = concrete cylinder pipe* *ROW = right-of-way* *SECOM = Southeast Communications* *UGF = Underground fiber optic cable*

Railroad

US 50 crosses under the BNSF Railway track approximately 0.75 mile east of the Pueblo Blvd. intersection. The BNSF rail line at this location is a single-track segment serving as one of the rail lines connecting Colorado Springs and Pueblo.

The existing railroad structure is a four-span bridge. The center spans provide openings for the US 50 eastbound and westbound traffic, while the end spans are over the bridge abutment slope pavements.

The opening widths between the center piers are about 44 feet each, providing width for:

- Two 12-foot lanes each of eastbound and westbound traffic
- 2 feet of inside shoulders
- 8 feet of outside shoulders
- 10 feet of roadside drainage

3.16.3 No Action Alternative

The No Action Alternative would not affect any existing utilities or the BNSF Railway.

3.16.4 Preferred Alternative

Utilities

Buried gas pipelines, water lines, wastewater lines, and underground fiber (UGF) lines cross US 50 at five locations. These crossings are perpendicular to US 50, and it is expected that some modifications may be needed for the highway widening. However, relocation of the lines outside their existing easement or ROW would not be required. Utilities that are adjacent to US 50 or fall within the proposed footprint for intersection improvements would most likely need to be relocated.

This could affect:

- 2.3 miles of buried gas lines
- 8.4 miles of UGF
- 0.3 miles of a wastewater pipeline

Railroad

With the Preferred Alternative, there would be a total of six lanes (3 lanes each direction) of US 50 traffic at the railroad bridge. Whether the existing structure could accommodate six lanes of traffic, plus shoulders and roadside drainage, depends on the design assumptions used. Currently, the railroad bridge area is designated as rural, where 12-foot shoulders and on-ground drainage alongside the highway are standard. The existing structure is not wide enough to accommodate all these features.

The area just to the east of the railroad crossing is characterized as urban. The City of Pueblo is currently evaluating an annexation request with regard to a parcel in the southwest quadrant of US 50 and the BNSF railroad tracks. If urban design assumptions are used, including curb and gutter, and an underground storm sewer system, it may be possible to fit three lanes of traffic in each direction with minimal modifications to the current bridge. **Figure 3-9** shows a cross section with such design assumptions. Also note that bicycle and pedestrian facilities would be installed on the south side of US 50, above the existing abutment.

3.16.5 Mitigation strategies

Proper advance notice to service providers would help ensure that delivery of public service is not interrupted. Final utility locations should be surveyed before the utility design is completed. Utility plans, which may include utility relocations, should be completed and approved before construction begins. Coordination will be conducted with the BNSF Railway.

3.16.6 Next steps

Coordination of the ROW survey, utility survey, and concept design studies will provide data needed to identify any ROW or utility impacts that will require mitigation.

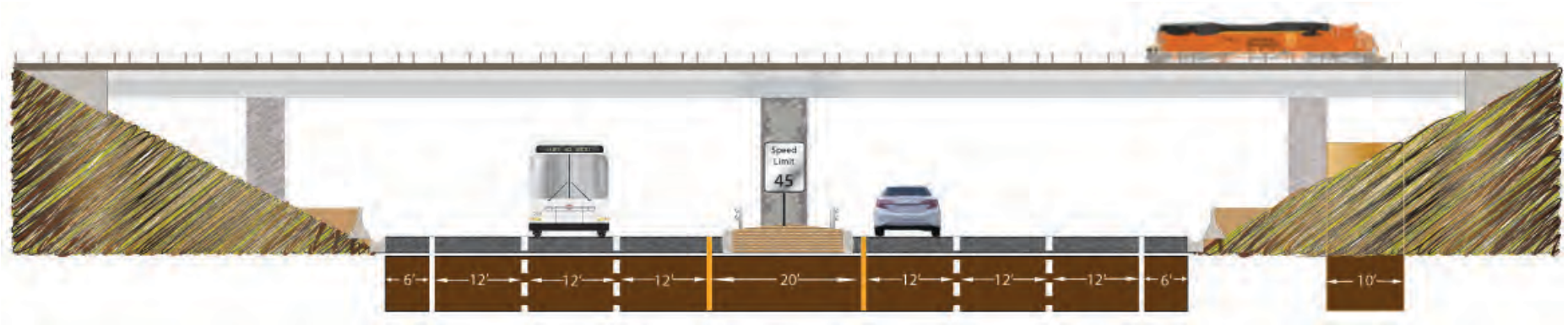


Figure 3-9. Potential Reduced-Width, Six-Lane Urban BNSF Railroad Crossing

3.17 What are the noise levels of the Corridor?

3.17.1 Noise study methodology

The study team analyzed noise impacts and mitigation according to CDOT's *Noise Analysis and Abatement Guidelines*, March 23, 2011. The team used the FHWA Traffic Noise Model (TNM, v2.5) to predict noise levels. Traffic volumes used in the model were based on the PACOG *LRTP*. Traffic speeds used in the model consist of posted US 50 speeds. The study team determined the location of roadways and residences using Google Earth and land use maps provided by Pueblo County, as well as a tour of the Corridor. Elevation was considered only in the mitigation analysis. Signalized intersections were modeled in TNM.

Noise impacts both along the US 50 mainline and near intersections/interchanges were analyzed. Noise impacts were assessed at a level of detail commensurate with the US 50 PEL level of pre-NEPA study without detailed roadway designs. The study revealed two aspects of the noise impacts on this project:

- **Absolute noise impacts –** This assessment determined if noise levels at residential land uses adjacent to US 50 within the study area were expected to equal or exceed CDOT's Noise Abatement Criteria (NAC) under any of the proposed alternatives.
- **Relative noise impacts –** Given the lack of detailed design at this point in the project, noise levels associated with the different interchange proposal were analyzed qualitatively. The goal was to contrast the noise impacts of the different interchange proposals versus predicting absolute noise levels for each. Mainline US 50 noise impacts are preliminary at this point. They were developed by first constructing a relatively simple TNM of the Corridor, including all major cross streets. Neither elevation nor barriers such as large commercial buildings was considered in the models.

Appendix F contains detailed information on the following:

- Locations of receptors
- Predicted noise levels based on existing conditions
- Predicted noise impacts in the US 50 Corridor

Appendix F also provides tables with a range of existing to future impacts with mainline improvements.

3.17.2 Existing and future noise levels

The study team modeled existing conditions using the traffic volumes measured in fall 2009. Existing (2009) noise levels vary across the US 50 Corridor.

Swallows Rd.

There are two isolated residences in the area: one is located in the southeast quadrant (1,200 feet away); and the other in the southwest quadrant (1,000 feet away). Existing noise levels at these residences are estimated to be about 50 dBA (decibels), and future levels would be approximately 56 dBA.

West McCulloch Blvd.

Residences are located approximately 600 feet to the southeast and southwest of the intersection. Existing noise levels at these residences are estimated to be 53 to 58 dBA, and future levels would be approximately 58 to 66 dBA. However, existing noise levels at residences along the US 50 mainline range from 48 to 59 dBA, and future levels would range from 56 to 69 dBA.

Main McCulloch Blvd.

The closest residences are located in the southwest quadrant, approximately 1,400 feet west of the existing intersection. The next closest residences are in the southeast quadrant, approximately 2,000 feet east of the existing interchange. Existing noise levels at these residences range from 52 to 68 dBA, and future levels would range from approximately 62 to 75 dBA.

Purcell Blvd.

The closest, and only, residential receptor is located approximately 500 feet south-southeast of the existing intersection. Existing noise levels at this residence are approximately 61 dBA, and future levels are predicted to be 65 dBA. However, existing noise levels at residences along the US 50 mainline range from 54 to 67 dBA, and future levels would range from 59 to 72 dBA.

Pueblo Blvd.

There are no residences within at least 2,000 feet of the intersection.

Wills Blvd.

The closest residences are located approximately 500 feet to the north of US 50. The view from these residences toward the highway is blocked to some degree by large commercial buildings. The area is relatively built-out, and little change is expected. Existing noise levels at the closest residences range from 56 to 64 dBA. Design-year noise levels at the closest residences would range from 61 to 66 dBA.

Baltimore Ave.

The closest residences are located in the northeast quadrant of the intersection, and the closest homes are located approximately 250 feet from US 50. Large commercial buildings somewhat block the view from these residences toward the highway. Residential neighborhoods are also located in the southeast and northwest quadrants of the existing intersection, and the closest homes in these directions are a little more than 500 feet away. The area around the interchange is mostly developed, and little land use change is expected. Existing noise levels range from 52 to 65 dBA, and future levels at the closest residences would be approximately 60 to 70 dBA.

3.17.3 Noise impact analysis results – US 50 mainline

According to CDOT guidelines and NAC, a residential receptor is considered impacted by noise when traffic noise levels are projected to be 66 dBA or greater, or when design-year noise levels are projected to exceed existing levels by 10 dBA or more. A total of 56 residences would be impacted.

Five residences are impacted under existing conditions, with 14 residences projected to be impacted under the No Action Alternative.

Locations with Noise Impacts

- Isolated residence east of West McCulloch Blvd. (1 residence)
- Large residential neighborhood in Pueblo West (24 residences)
- Three groups of residences east of Main McCulloch Blvd. (23 residences)
- Isolated residences east of Purcell Blvd. (4 residences)
- Neighborhood in northeast quadrant of Baltimore Ave. and US 50 (4 residences)

3.17.4 Noise impact analysis results – intersections

The noise impact analysis resulted in noise impacts at the intersections as follows.

Swallows Rd.

There are two isolated residences in the Swallows Rd. area:

- One located in the southeast quadrant (1,200 feet away)
- One in the southwest quadrant (1,000 feet away)

The area north of US 50 is zoned Agricultural and could include residential receptors in the future.

The area south of US 50 is zoned Agricultural and PUD/Rural Land Use and is expected to include residential receptors in the future.

Currently, there is a stop sign on Swallows Rd. at US 50. Under the Preferred Alternative, the intersection would be signalized.

West McCulloch Blvd.

The closest residences are located approximately 600 feet southeast and southwest of the West McCulloch Blvd. intersection.

The land both north and south of US 50 is currently zoned Agricultural, but there are many residences in the area south of the intersection.

Currently, there is a stop sign on West McCulloch Blvd. at US 50. Under the Preferred Alternative, the intersection would be signalized.

Main McCulloch Blvd.

The closest residences are located in the southwest quadrant, approximately 1,400 feet west of the existing intersection at Main McCulloch Blvd.

In the southwest quadrant, a large undeveloped parcel is zoned Residential.

The proposed diamond interchange would reduce noise levels if US 50 is routed under Main McCulloch Blvd., and thus, the ramps would have the possibility of shielding US 50. If a bridge for US 50 is built over Main McCulloch Blvd., noise levels could increase.

Because the primary issue is to the southwest, widening away from this direction would be advantageous, as would shielding this direction from US 50 using ramps.

Purcell Blvd.

The closest, and only, residential receptor is located approximately 500 feet south-southeast of the existing intersection at Purcell Blvd. Otherwise, the land use at the intersection is Commercial.

If US 50 is routed under Purcell Blvd., a diamond interchange could reduce noise impacts because the ramps would have the possibility of shielding US 50. Building US 50 over Purcell Blvd. could increase noise levels.

Pueblo Blvd.

Currently, no residences are located within more than 2,000 feet of the Pueblo Blvd. interchange. The land to the north in Pueblo County is zoned Agricultural, with one Public Use parcel (the CDOT maintenance facility) in the northwest quadrant. Land to the south is zoned Business and Public Use (next to the Honor Farm Park).

The proposed DDI would have the potential to decrease noise levels by 10 dBA in the area because the ramps and retaining wall required to bring Pueblo Blvd. over US 50 would shield noise from mainline US 50.

Wills Blvd.

The closest residences are located approximately 500 feet to the north of the Wills Blvd. intersection.

Currently, the Wills Blvd. intersection is signalized, and that would not change with the Preferred Alternative.

Baltimore Ave.

The closest residences are located in the northeast quadrant of the Baltimore Ave. intersection, and the closest homes are located approximately 250 feet from US 50.

Currently, the Baltimore Ave. intersection is signalized, and that would not change with the Preferred Alternative.

3.17.5 Noise mitigation analysis results

Figure 3-10 illustrates schematically the noise walls that the study team analyzed at seven locations. The position of these noise walls was selected based on which locations would provide the greatest potential benefit to residences affected by the action alternatives. The noise reduction of these walls was predicted using TNM version 2.5. The study team also used Google Earth to estimate elevation differences between US 50 and residences, a vital input to the noise model.

Walls were placed along the edge of US 50 and extended beyond each potentially affected residence or neighborhood by approximately 200 feet. Walls were modeled for heights ranging from 12 to 24 feet.

Of the seven noise wall locations identified through the analysis, only one wall location between West McCulloch Blvd. and Main McCulloch Blvd. was considered to be reasonable based on the number of residences that benefited (48 residences) and the reduction in decibels (8 dBA). The other six noise wall locations would benefit from 2 to 5 residences per location. **Appendix F** provides the results of the cost-benefit analysis for noise wall modeling using CDOT's 2011 guidelines.

3.17.6 Next steps

The next step for noise analysis would be to refine the noise assessment based on design-level alignments and elevations. Noise mitigation is expected to be limited to the wall location identified between West McCulloch Blvd. and Main McCulloch Blvd. based on the PEL-level analysis.

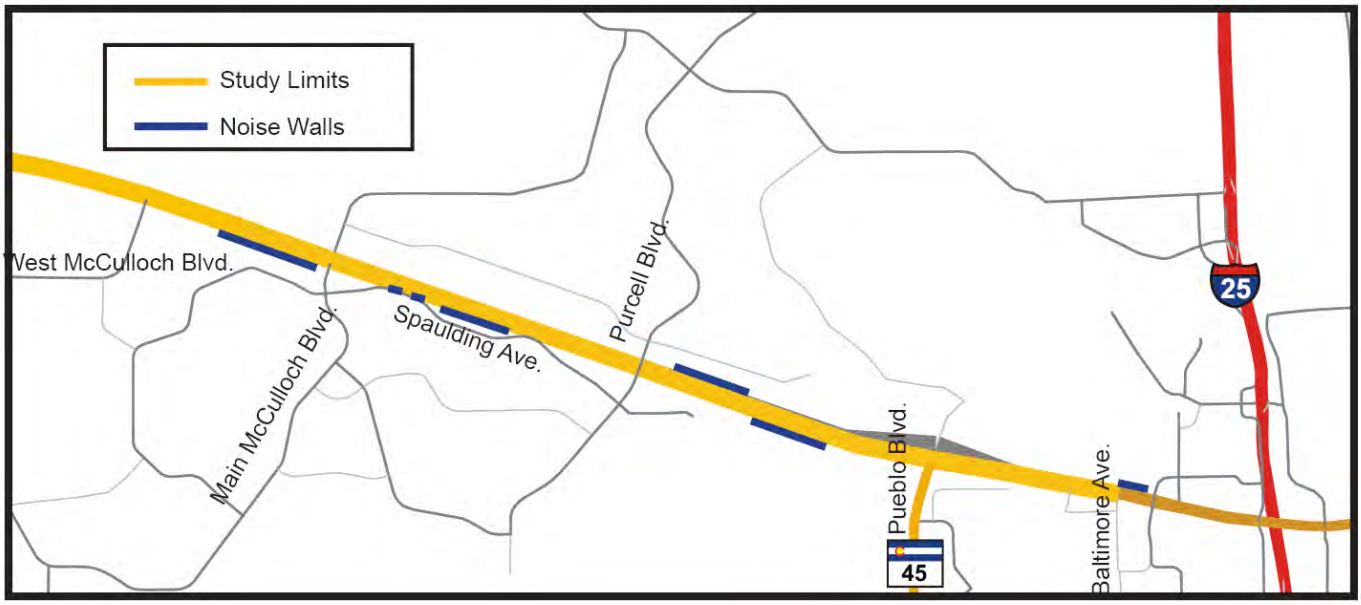


Figure 3-10. Locations of Potential Noise Walls Analyzed

3.18 What are the visual resources of the Corridor?

3.18.1 Methodology

This section describes the approach to evaluating the visual resources of the Corridor. The landscape setting of the Corridor ranges from rural to urban, and the future visual character will be influenced by land use classifications identified in the *2035 Comprehensive Plan*. **Figure 3-13** shows the relationship and visual compatibility of the elements of the Preferred Alternative and the future settings that are anticipated in the Corridor based on the intent of future land use planning. The Corridor settings are described by category and provide evaluations of the visual contrast of the elements of the Preferred Alternative at each intersection area. Mitigation strategies are suggested to

reduce visual contrast. **Figure 3-11** and **Figure 3-12** show photographs of the Corridor setting and local details.

This visual section provides a framework of types of visual impacts that could result from the Preferred Alternative. This early recognition of potential visual impacts provides an initial characterization of the types of visual impacts and suggests possible design elements for consideration in site-specific studies. See **Section 3.18.3** for more details on the approach and results of the visual resource evaluation.

3.18.2 Corridor setting

Located on the edges of urban Pueblo, the 12-mile US 50 Corridor transitions from the western open prairie landscape at Swallows Rd, through the suburban areas of Pueblo West, to the eastern commercial development at Wills Blvd. and Baltimore Ave. The visual context for the US 50 Corridor ranges from the broad open landscape views across the prairie to the distant mountain panoramas 13 to 25 miles to the west. The Wet Mountain Range and other more distant parallel ranges of the San Isabel National Forest provide a western backdrop to the vast expanses of the eastern shortgrass prairie. Open views across the Honor Farm Open Space to the south provide a sense of the prairie area that extends to the Arkansas River Valley. This unique prairie landscape straddles the edge between the Great Plains and the Southern Rocky Mountains.

The I-25 and US 50 interchange is a gateway to the Corridor from the east. Sculptured motifs at the four corners of the I-25 bridge provide an identifying image for the Corridor entrance. Other features of local interest include the rail fence on the highway ROW edges, providing a Rural Ranch image. The wetlands along Williams Creek and Wild Horse Dry Creek within the Pueblo Blvd. intersection create a natural image within the Corridor. The architectural entrance features to Pueblo West at Main McCulloch Blvd. establish a local identity and image for the central Corridor area.

Figure 3-11 and **Figure 3-12** provide photographic images of the current setting and views from the US 50 Corridor.

This landscape is in a transition from a Rural Ranch image to a developing urbanized corridor. The visual image of the future corridor setting for the Preferred Alternative is tied to the *Comprehensive Plan*. **Figure 3-13** provides an overview of the future landscape settings based on the *Comprehensive Plan*.

Figure 3-11. Visual Character Typologies

Figure 3-12. Visual Character Existing Design Elements

1 I- 25 gateway to US 50 east of the study corridor introduces architectural elements into the corridor.

2 Existing bridge at Pueblo Boulevard uses color and distinct forms and lines that.

3 Railroad tie fence paralleling portions of the US 50 corridor provides an identifiable architectural element.

4 Colors, textures, and lines from existing signage developed by Pueblo West.

3.18.3 Visual resource evaluation

The following sections describe the four general types of future rural landscape and urban settings planned for the Corridor in the PACOG *2035 Comprehensive Plan*. The *Comprehensive Plan* describes the range of changes from rural to urban development patterns by land use category (see **Section 3.13**). **Figure 3-13** compares the visual characteristics of the Corridor settings using the categories listed below.

- T1 – Open and Rural Landscape settings
- T2 – Suburban Residential/Employment Center settings
- T3 – Business/Commercial settings
- T4 – Arterial Commercial settings

Each category describes the setting, Preferred Alternative elements, visual contrast, and mitigation strategies.

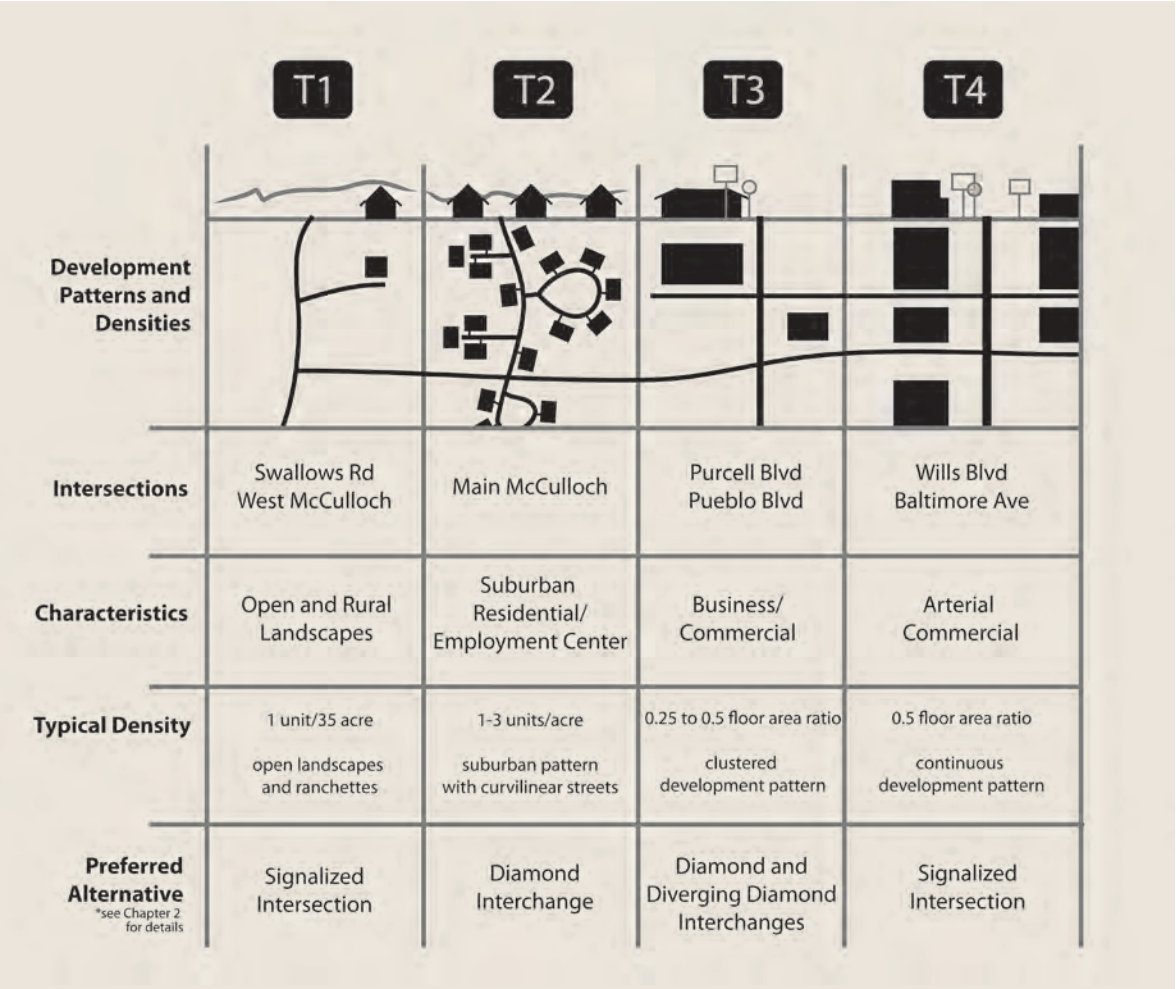


Figure 3-13. Visual Character of the Corridor Settings

The basic philosophy is to evaluate the effects of the Preferred Alternative on the visual quality of the landscape setting by describing the visual contrast created between a project and the existing landscape. The contrast is measured by comparing the project features with the major features in the existing landscape. The basic design elements of form, line, color, and texture are used to make this comparison and to describe the visual contrast created by introducing new elements into the existing landscape. This assessment process provides a means for determining visual impacts and identifying measures to mitigate these impacts.

Considerations for evaluating the visual contrast of proposed project facilities with key landscape features include changes to the form, line, color, and texture as follows:

- **Form –** Contrast in form results from changes in the shape, mass, scale, or design of landforms or structures.
- **Line –** Contrasts in line result from changes in edge types and interruption or introduction of edges, bands, and lines.
- **Color –** Changes in value and hue from the characteristic landscape colors tend to create visual contrast. Other factors such as reflectivity and uniformity also increase the contrast.
- **Texture –** Noticeable contrast in texture usually stems from differences in the grain and density. Other factors such as irregularity and directional patterns of texture may affect the rating.

Analysis Factors for Preferred Alternative

- **Relative size or scale** – Contrast is directly related to its size, its scale, and the surrounding topography as compared to the surroundings in which it is placed.
- **Visual absorption capability** – The patterning and diversity of landscape patterns and features (vegetation patterns and color, and topographic diversity such as slopes percent and aspect) influence the ability of the landscape to visually "absorb" visual changes.
- Other factors include the influence of seasonal changes, lighting conditions, and reflectivity.

Levels of visual contrast or change from the proposed project are based on the following criteria:

- **Strong –** Visual changes will be dominant and will attract attention.
- **Moderate –** Visual changes will be seen and may attract attention but are subordinate to the setting.
- **Weak –** Visual changes will be seen but not attract attention or deviate from the visual setting.

Open and rural landscape settings (T1)

Landscape characteristics

The landscape setting at Swallows Rd. is open and undeveloped prairie with mountain views to the west dominating the viewshed. Future plans for Rural Ranch development would limit residential density to 2 units per 35 acres with clustered patterns to preserve the natural and visual resource character of the open spaces.

The landscape setting at West McCulloch Blvd. is also open with residential development in Pueblo West. Mountain views are important elements of the viewshed. Future plans for Country Residential use would limit residential densities to 1-to-5-acre lot development patterns to retain the county and ranch visual character. The US 50 streetscape is open and undeveloped with sparse to no development facing the highway. The Rural Ranch and Country Rural image of this western portion of Pueblo West is

identified by the low-profile, low density patterns of residential architecture with consistent patterns of earth tone colors and by an architecturally shaped entrance sign structure.

Preferred Alternative elements – Swallows Rd. and West McCulloch Blvd.

US 50 would remain a four-lane highway, and intersections would be signalized.

Visual contrast and aesthetic mitigation – weak to moderate

The visual contrast of the signalized intersection structures would attract the attention of travelers but would not limit views of the prairie landscape or mountain vistas. The form, line, color, and texture contrast of the signal structures may be a noticeable change to future residences in proximity to the intersection but would not be expected to attract attention from rural residential views, or modify the Rural Ranch image of the area due to the low-profile dark tubular elements of the signal structures.

Suburban residential/employment center landscape settings (T2)

Landscape characteristics

The suburban image of Pueblo West at Main McCulloch Blvd. is identifiable by the Suburban Residential land use patterns with integrated schools, parks, libraries, and neighborhood commercial uses along curvilinear and cul-de-sac streets to the south of US 50. Commercial and industrial development to the northeast of US 50 and Main McCulloch Blvd. add diversity of structure sizes and heights. The currently open and undeveloped prairie landscape to the northwest of US 50 is planned for suburban development with mountain views to the northwest. Mountain views to the west are an important element of the viewshed.

Preferred Alternative elements – Main McCulloch Blvd.

US 50 would transition to a six-lane highway to the west of Main McCulloch Blvd. with a diamond interchange, including ramps and a 22-foot-high bridge structure over US 50.

Visual contrast and aesthetic mitigation – moderate to strong

The visual contrast of the proposed six-lane highway with diamond interchange facilities at Main McCulloch Blvd. would introduce a new design element into the generally open setting of the intersection and modify local views. The forms and lines of the interchange would be compatible with the scale of the Wal-Mart in the northeast quadrant of the intersection and could be designed to be compatible with the colors and textures of the local architecture of the setting.

The height and mass of the interchange ramps and overpass structure on US 50 would be a dominant element to adjacent suburban development planned for the northwest, southeast, and southwest quadrants of the intersection. By incorporating design elements of the Corridor, the interchange could be integrated into the local setting through use of local color, texture, and design features.

Business/commercial settings (T3)

Landscape characteristics

The planned Business and Commercial uses for Purcell Blvd. and Pueblo Blvd. would establish a clustered pattern of development, with the mass and scale of an urban setting.

Preferred Alternative elements – Purcell Blvd. and Pueblo Blvd.

US 50 would be a six-lane highway. A diamond interchange is proposed at Purcell Blvd., and a DDI at Pueblo Blvd. These interchanges would be similar in scale and appearance from US 50, with ramps and a 22-foot-high bridge structure over US 50.

Visual contrast and aesthetic mitigation – moderate

The proposed interchanges would be generally in scale with the planned development patterns at Purcell Blvd. and Pueblo Blvd. By incorporating design elements of the Corridor, the interchange could be integrated into the local setting through use of local color, texture, and design features.

Arterial commercial settings (T4)

Landscape characteristics

The planned Arterial Commercial uses for the Wills Blvd. and Baltimore Ave. portion of the Corridor include a more continuous pattern of Commercial Development intended for the Regional Mixed uses with an emphasis on activity nodes rather than "strip" development.

Preferred Alternative elements – Wills Blvd. and Baltimore Ave.

US 50 would be a six-lane highway with signalized intersections at Wills Blvd. and Baltimore Ave.

Visual contrast and aesthetic mitigation – weak

The visual change to US 50 would not attract attention to travelers or from adjacent viewers. Both intersections are currently signalized, and the primary change is additional US 50 travel and turning lanes.

3.18.4 Mitigation strategies – Corridor aesthetic design vision

As noted in the CDOT *NEPA Manual* (2008), project planning should consider design quality, art, and architecture if the project has potential visual impacts. Mitigation measures developed to reduce the levels of visual contrast identified in the PEL Study should be developed and incorporated into the design of the Preferred Alternative at the site-specific study stage.

Opportunities exist to establish visual continuity within the Corridor by establishing an aesthetic design vision that is in context to the local setting and future plans. Uniform visual guidelines that apply to the entire study area should be developed based on consensus and compliance with land management agencies, local agencies, and local communities. Coordination with the City of Pueblo, Pueblo County, Pueblo West, and PACOG would provide avenues for developing aesthetic guidelines as a part of the future projects.

Recommended mitigation measures to address include:

- Minimizing cut and fill, while blending the resulting changes into existing contours to avoid visual scars.
- Refining elements such as shape, color, and texture of the Preferred Alternative to blend in to the existing landscape.
- Including corridor-wide signage and architectural features that promote continuity with local image and future land use planning.

Site-specific studies should address the types of visual contrast and recommendations identified for the Corridor in the PEL Study through project design and aesthetic treatment.

3.18.5 Next steps

The next step for visual impact analysis would be to develop design-level mitigation strategies/guidelines in coordination with the concept level design of the Preferred Alternative.

3.19 What hazardous materials occur in the Corridor?

Before acquiring any property for roadway ROW, CDOT undertakes due diligence to determine whether or not the proposed project roadway ROW is contaminated with hazardous materials or petroleum products in the soil and groundwater. Encountering such material during the construction of US 50 from Swallows Rd. to Baltimore Ave. could result in the following:

- Project delays
- Increased cost
- Health and safety effects on the public, the workers, and the environment

The following regulations apply to the acquisition, investigation, and cleanup of sites containing hazardous materials:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 103, Sec.9601 et seq.)
- Resource Conservation and Recovery Act (RCRA) (40 CFR 260-299)
- Standards and Practices for all Appropriate Inquiries (40 CFR 312)
- Colorado Hazardous Waste Regulations (6 Code of Colorado Regulations [CCR] 1007-3, Part 260)
- Underground Storage Tank (UST) Remediation, Colorado Department of Labor and Employment–Division of Oil and Public Safety (7 CCR 1101-14)

3.19.1 Methods

A modified Phase I ESA was conducted in 2010 to determine whether hazardous substances and/or petroleum products could be encountered in the study area. This study was based on:

- A data file search conducted on November 4, 2010, within a 1-mile radius of the project area (FirstSearch, 2010)
- A windshield survey of the project area in 2011

No on-ground property inspection or collections of soil and water samples were conducted. No lead-based paint samples were collected from highway bridge structures or buildings that may be demolished or acquired for ROW.

3.19.2 Background setting description

The PWMD was created September 16, 1969, as a planned unit development (PUD). Before this time, the land was primarily used for agriculture and ranching activities. Pueblo West is a fast-growing community with a population of 29,637 in 2010, which showed an increase of 33 percent in the last decade. US 50 is a major east-west thoroughfare for the city, with major intersections at McCulloch Blvd., Purcell Blvd., and Pueblo Blvd. US 50 is bordered by land zoned for Agriculture, Industrial, Business, and Residential use. Businesses such as car dealerships, gas stations, and auto repair shops are located along US 50 and East Enterprise Dr., a frontage road north of US 50 between McCulloch Blvd. and Purcell Blvd. There are no known landfills, industrial, or manufacturing facilities located within the study area that would have affected the existing environmental conditions from past leaks and spills of hazardous materials or petroleum products.

The data search identified the following sites within a 1-mile radius of the project area:

- **Resource Conservation and Recovery Act Generators (RCRA GEN) –** Of the 11 sites identified, 10 are classified as conditionally exempt small quantity generators and 1 site is classified as a small quantity generator (SQG). All sites comply with federal regulations, and there is no history of a spill, leak, or corrective action.
- **Emergency Response Notification System (ERNS) –** A gasoline spill of approximately 25 gallons was reported at the Loaf-n-Jug gas station located at US 50 and Baltimore Ave. on February 2, 1994. The fire department responded, the gasoline was cleaned up, and no fuel left the property boundary.
- **Leaking Underground Storage Tank (LUST) –** Of the seven reported leaking storage tanks, six have been properly closed while one remains open. There are no additional records or identified corrective actions for the LUST listed as open.
- **Above and Underground Storage Tanks (AST, UST) –** Records show 12 active gasoline, diesel, waste oil, and liquid propane gas storage facilities at food centers, gas stations, auto repair, and business locations. Records indicate all facilities are in compliance with federal regulations. There are no records of any leaks, spills, or corrective actions.

The list of identified sites is current as of November 4, 2010. The list of recorded sites and regulatory actions are constantly being updated and may not represent the most current conditions. **Figure 3-1** shows the identified sites, and **Table 3-11** briefly summarizes the identified sites.

3.19.3 No Action Alternative

The No Action alternative would not have an impact on any properties with hazardous material concerns.

3.19.4 Preferred Alternative

The data search did not identify any properties where past activities may have resulted in soil and water contamination. All of the RCRA sites are SQGs or conditionally SQGs. No historical records indicate a release of potential contaminants in the environment. No ROW would be acquired from

any of the parcels with active UST sites. As the project moves forward, an updated review of hazardous materials records will be completed.

3.19.5 Mitigation strategies and next steps

At the discretion of the CDOT environmental project manager, a Phase I ESA or CDOT Initial Site Assessment shall be completed for any parcels to be acquired. These should be completed at the time of acquisition in accordance with American Society for Testing and Materials Standard E 1527-05. Before beginning construction, any bridge or structure materials to be removed or demolished shall be inspected and tested for heavy metal-based paint and asbestos-containing materials. Construction specifications shall be developed, as required, under Section 250 Environmental, Health and Safety Management of the *CDOT Standard Specifications for Road and Bridge Construction*.

Table 3-11. Summary of HazMat Sites Identified between Swallows Rd. and Baltimore Ave.

Site Name	Address	Type	Information	Distance Direction	Groundwater Flow	Recognized Environmental Condition
Swallows Rd. to Main McCulloch Blvd.						
Colorado Printing	447 Parkway Dr.	RCRA	Conditional exempt small quantity generator (SQG)	0.12 SW	E	None
Main McCulloch Blvd. to Purcell Blvd.						
Walmart Superstore 3382	78 N. McCulloch Blvd.	AST	Used oil	0.11 NE	E	None
Walmart Superstore 3822	78 N. McCulloch Blvd.	RCRA	Conditional exempt SQG Ignitable waste (DOO1)	0.11 NE	E	None
Texaco	18 W. Spalding Ave.	UST	Unleaded gas	0.23 SW	SE	None
Pueblo West Kwik Stop	101 S. McCulloch Blvd.	UST	Unleaded gas Diesel LPG	0.23 SW	SE	None
Loaf n Jug 82	14 W. Spalding Ave	LUST	Closed 3/28/1997	0.25 SW	SE	Low Potential
Loaf n Jug 82	14 W. Spalding Ave	UST	Unleaded gas, Diesel	0.25 SW	SE	None
Car Collisions 27	275 Enterprise Dr.	RCRA	Conditional exempt SQG Reactive waste (D003) Halogenated solvents (F001, F003) Non-halogenated solvents (F005)	0.01 NE	E	None
Badger Construction Inc	86 Fabrication Dr.	LUST	Closed 2/13/1996	0.29 NE	E	Low Potential
Precision Car Care	388 E. Industrial Way	LUST	Closed 3/6/2000, 8/19/2003	0.37 NE	E	Low Potential
Blue Flame Gas	423 E. Enterprise Dr	LPG	LPG	0.01 NE	E	None
ABRA Auto Body Shop	455 E. Enterprise Dr	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F001) Non-halogenated solvents (F003) Barium (D005) Methyl ethyl ketone (D035)	0.02 NE	E	None
Summit Co. South Colo.	32 N. Silicon Dr.	UST	Unleaded gas	0.12 NE	E	None
Southern Co Equipment	685 Enterprise Dr.	UST	Diesel, used oil	0.01 NE	E	None

Site Name	Address	Type	Information	Distance Direction	Groundwater Flow	Recognized Environmental Condition
Southern Co Machinery	685 Enterprise Dr.	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F002) Non-halogenated solvents (F004)	0.01 NE	E	None
Zabukovic Motors	701 E Spalding Ave.	UST	LPG	0.16 SW	E	None
Mar Gas Propane	805 Enterprise Dr.	UST	LPG	0.01 NE	SE	None
Tri-State G&T	Enterprise Dr.	RCRA	Conditional exempt SQG Ignitable waste (D001) Halogenated solvents (F001) Lead Cadmium Benzene	0.01 NE	SE	None
Anthony Auto Repair	58 N. Mission Dr.	UST	LPG	0.18 NE	SE	None
San Isabel Electric	893 E. Enterprise Dr.	UST	Unleaded gas	0.02 NE	SE	None
Safeway Fuel Center 1760	1008 N. Market Plaza	UST	Unleaded gas Diesel	0.14 NE	SE	None
Road King I	136 S. Purcell Blvd.	LUST	Closed 8/26/1999	0.29 SE	E	Low Potential
Purcell Blvd. to Baltimore Ave.						
Freedom Ford	2828 West US 50	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F001) Non-halogenated solvents (F003) Lead (D008) Benzene (D018)	0.09 SW	E	None
50 West Amoco	2825 West US 50	AST/UST	Unleaded gas Diesel LPG	0.03 NE	E	None
50 West Amoco	2825 West US 50	LUST	Open 7/28/2006	0.03 NE	E	Low Potential
CSI Motors Inc. Dodge	2147 West US 50	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F002) Non-halogenated solvents (F004)	0.01 NE	E	None
Spradley Chevrolet	2146 West US 50	RCRA	SQG Ignitable waste (D001) Halogenated solvent (F001)	0.01 NE	E	None
Dale Spradley Motors	2145 West US 50	LUST	Closed 4/5/1999	0.01 NE	E	Low Potential
Dale Spradley Motors	2145 West US 50	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F002) Non-halogenated solvents (F004)	0.01 NE	E	None
Pueblo Toyota	2125 West US 50	RCRA	Conditional exempt SQG Ignitable waste (DOO1) Halogenated solvents (F002) Non-halogenated solvents (F004)	0.01 NE	E	None

Site Name	Address	Type	Information	Distance Direction	Groundwater Flow	Recognized Environmental Condition
Loaf n Jug	US 50 and Baltimore Ave.	ERNS	Spill reported on 2/25/94 Cleaned up No offsite contamination	0.01SW	E	None
Loaf n Jug	3629 Baltimore Ave.	UST	Unleaded gas	0.02 SW	E	None
Loaf n Jug	3629 Baltimore Ave.	LUST	Closed 11/2/1999	0.02 SW	E	Low Potential

Source: (FirstSearch, 2010)

Abbreviations:
AST = Above ground storage tank
LPG = Liquid propane gas
SQG = Small quantity generator
ERNS= Emergency Response Notification System
RCRA = Resource Conservation and Recovery Act
UST= Underground storage tank
LUST= Leaking underground storage tank

3.20 What are the cumulative impacts of the Corridor?

Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1500–1508) established requirements for federal agencies to address direct, indirect, and cumulative impacts in the NEPA process in 1978. CDOT issued its *NEPA Manual*, Version 2 (December 2008), to provide instructions for complying with the CEQ NEPA regulations for CDOT projects.

CEQ regulations (40 CFR 1500–1508) define the impacts and effects that federal agencies must address in satisfying the requirements of the NEPA process. As defined in CEQ regulations, cumulative impacts:

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

Reasonably foreseeable future actions are examined to estimate what is likely to happen when the Preferred Alternative is implemented. These are not part of the Preferred Alternative but are projections made for estimating future impacts, cumulative and otherwise. For example, the traffic analysis for this PEL Study examined the effects that local improvement projects, such as the Pueblo Blvd. Extension and West Pueblo Connector, would have on US 50 congestion. However, the Preferred Alternative includes only specific improvements to US 50, while acknowledging the benefit of the local improvement projects. Instead, the local improvement projects are reasonably foreseeable actions of others.

Although the individual impacts of each project may not be significant, the additive effects of multiple projects could be. Cumulative effects are the total effect on a given resource or ecosystem of all actions taken or proposed (40 CFR 1508.7).

This analysis examines the potential cumulative effects of all of the current and foreseeable transportation and land use development in the area with the added effect of the Preferred Alternative.

3.20.1 Geographic scope and timeframe of cumulative analysis

Cumulative Effects Analysis Study Area

- PWMD
- Unincorporated areas extending from the edge of the District to Swallows Rd. on the west, the Honor Farm on the east, and Lake Pueblo on the south
- The portion of the City of Pueblo west of I-25

US 50 is one of the longest highways in the United States, stretching from Ocean City, Maryland, to Sacramento, California, and passing through central Colorado. The US 50 route through Colorado began in 1821 with Captain William Becknell's Santa Fe Trail. In 1911, a continuation of the Santa Fe Trail along the "Rainbow Route" from Pueblo heading west to Montrose was proposed and later constructed. Ultimately these routes were incorporated into the current US 50, which was created in 1926 as part of the original US Highway system.

The PWMD was created in 1969 and is situated approximately 7 miles west of the limits of the City of Pueblo (see **Figure 3-14**). It is located immediately north of the Pueblo Dam and Reservoir (Lake Pueblo), which were constructed in 1975. US 50 bisects the district, which is touched on its eastern border (north of Pueblo) by I-25.

The timeframe for past projects is tied to the modernization of Pueblo's highway system with the construction of I-25 through Pueblo between 1947 and 1959, and the construction of the US 50 bypass in 1957. Reasonably foreseeable future projects are based on plans and projections out to 2035.

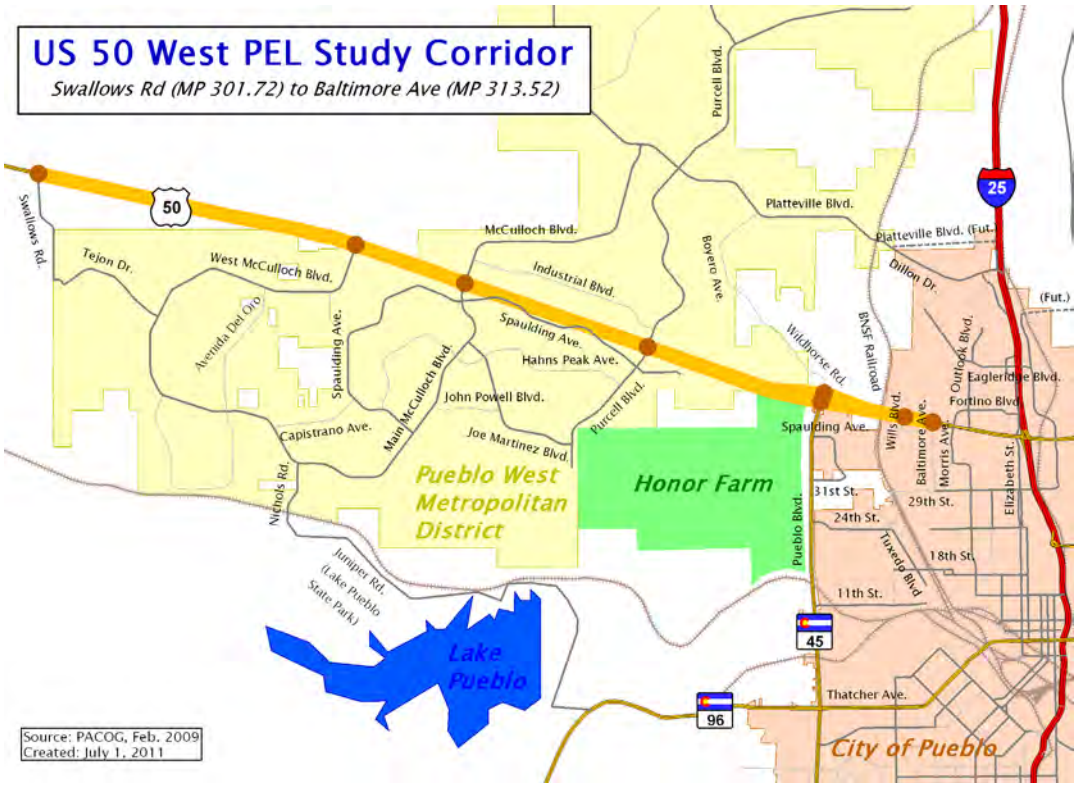


Figure 3-14. Study Corridor and Vicinity

3.20.2 Past, present and foreseeable future projects and relevant factors

The Preferred Alternative would meet the projected transportation demand associated with growth in the area and is not anticipated to induce growth. Therefore, population growth is not a factor taken into account in the cumulative analysis. **Table 3-12** presents the factors and projects taken into account in this cumulative effects assessment.

Table 3-12. Past, Present, and Reasonably Foreseeable Future Projects and Relevant Factors

Project	Timeframe	Description
Regional Planning		
Honor Farm Park and Open Space Master Plan Pueblo, Colorado	Adopted November 2007	The Honor Farm Master Plan establishes a long-term master plan for the phased development and operation of 2,373 acres of public park and open space property located in unincorporated Pueblo County west of Pueblo Blvd. (SH 45) and south of US 50 West.
PACOG *2035 Long Range Transportation Plan* (LRTP)	Adopted January 2008	The *LRTP* is a 25+ year plan for the development of transportation programs and projects within the Pueblo area.
PACOG Pueblo's *Comprehensive Plan: Pueblo Regional Development Plan*	Adopted July 2002	The plan serves as an advisory document to assist the Pueblo Region in accommodating a future population of 200,000 people (2030 projection). The plan is an evolving document that provides guidance for growth-related issues. The plan is general in nature, offering broad development principles, policies, and strategies to guide land use decisions that shape the Region's pattern of physical development.
Pueblo West: Community Living in a Rural Setting	Date unknown	This publication is designed as a guide for those considering moving to Pueblo West, as well as for those who already reside in the community. Information is gathered from sources within the community, including staff of the PWMD, as well as outside sources and other publications and reports (for example, *Code of the West*, Larimer County Planning Division, and *Rural Living Handbook,* compiled by the Turkey Creek Soil Conservation District, Pueblo, Colorado).
Transportation Projects		
I-25	Past	Construction of the Pueblo Freeway through Pueblo between 1947 and 1959.
US 50B	Past	Construction of US 50 expressway bypass east of I-25 in 1957.
SH 96	Past	Rerouted south in 1971 to accommodate Pueblo Reservoir (now Lake Pueblo).
SH 47	Past	Regional connection for northeastern Pueblo: Construction of SH 47 from I-25 to Bonforte Blvd. in 1971; Bonforte Blvd. to US 50/SH 96 in 1979; and US 50/SH 96/SH 47 interchange in 1982.
I-25/US 50/SH 47	Past	Interchange improvements to US 50/SH 47 in 2002. Includes extension of Dillon Dr., improvements to Eagleridge, Gateway, 29th St. interchanges; improved stormwater conveyance.

Project	Timeframe	Description
Pueblo Transit Center	Past	Transportation hub constructed in 2004 in downtown Pueblo.
US 50 West Congestion Relief	Past	Expansion of US 50 from four lanes to six lanes between Baltimore Ave. and Morris Ave., completed in 2011.
4th Street Bridge Replacement	Present	Safety improvements and replacement of existing bridge completed July 1, 2011.
Dillon Drive/Eden-Platteville Blvd. Interchange	Future	Planned construction of new interchange at Dillon Dr. with I-25 to facilitate east-west regional movement. Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) approved in 2011.
I-25 Improvements - The New Pueblo Freeway	Future	Widening to six lanes between the US 50/State Highway (SH) 47 interchange to just south of the Pueblo Boulevard interchange on the south side of Pueblo. This improvement would add 7 miles of increased capacity.
US 50 Tiered Environmental Impact Statement (TEIS)	Future	Upgrading to a four-lane expressway for the 150 miles between I-25 and the Kansas state line. New bypasses would be built to avoid impacts on town centers.
Pueblo Blvd. Extension	Future	Planned construction of a four-lane expressway north of US 50 that would connect to Purcell Blvd. and a rebuilt interchange at I-25.
Development Projects		
Pueblo Memorial Airport	Past	Originally constructed in 1942, Pueblo Army Air Base becomes city-owned Pueblo Memorial Airport for commercial flights in 1953.
Southern Colorado State College (today Colorado State University – Pueblo)	Past	College relocated from its Orman campus downtown to its current campus at SH 47 and Bonforte Blvd. in 1964; 275 acres, 5,000 students currently; Crestone Residence Hall constructed 2009 (253-student capacity); Greenhorn and Culebra Residence Halls opened fall 2010 (500-student capacity).
Pueblo West	Past, Present, and Future	Establishment of the unincorporated community of Pueblo West in 1969; development and expansion of community continues.
Pueblo Dam	Past	One of five reservoirs constructed under the Fryingpan-Arkansas Project for flood control purposes and winter water storage in 1970.
Lake Pueblo State Park	Past	Became state recreational facility in 1974; third most visited recreational site in Colorado.
Pueblo Mall	Past	Original construction of 561,000 square feet of enclosed retail in 1976.
Eagleridge Shopping Center	Past	Regional shopping center constructed at the Eagleridge/ I-25 interchange in 1997.
Vestas Towers	Past	World's largest wind tower manufacturing plant facility featuring nearly 13 million square feet of space and 8 miles of onsite railway tracks for the transport of materials and finished tower components. Opened October 2010.
Seranto	Future	New 1,200-acre mixed-use development north of Pueblo.
Sol Plaza	Future	Development of 20,000 square feet of retail on Pueblo Blvd. near Mirror St.
Southern Delivery System	Future	Construction of a pipeline to carry drinking water from Lake Pueblo north to the City of Colorado Springs.

3.20.3 Development patterns

At the time of its creation in 1969, the PWMD had no population. From 1990 to 2000, however, the District has experienced rapid growth, nearly quadrupling from 4,396 residents to almost 17,000. The population at the 2010 census was 29,843.

PACOG has projected trends in population and employment densities for the city of Pueblo and Pueblo West (see **Figure 3-15** through **Figure 3-17** for details). The maps show the number of residents and employees per acre in a given Census tract.

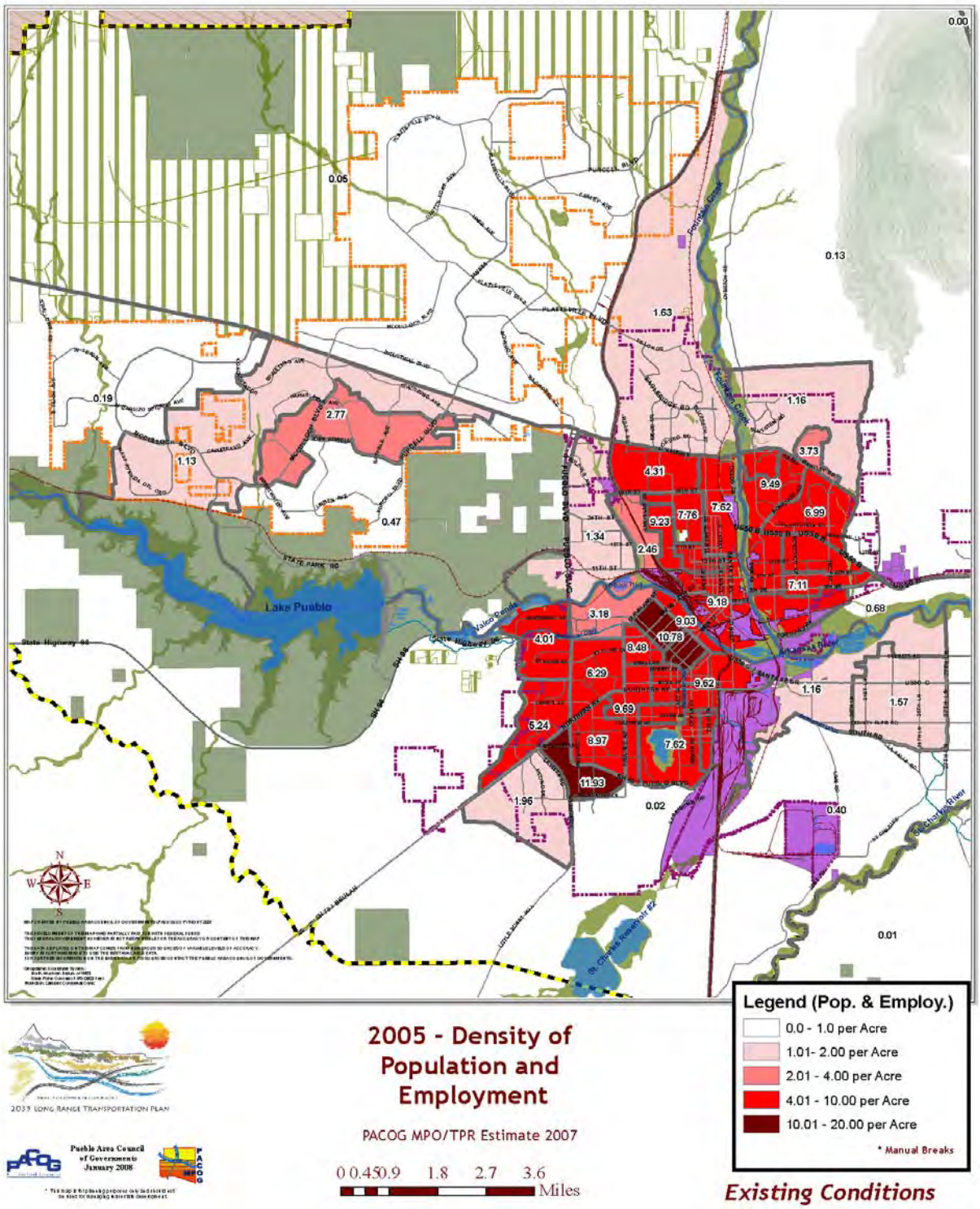
As indicated by the numbers within the tracts on **Figure 3-15** through **Figure 3-17**, densities in Pueblo are relatively low in most areas. Some of the older developed areas and regional commercial centers, such as the Pueblo Mall, have higher densities due to either employment centers or denser housing development. Projections for 2035 suggest that employment densities will increase from medium to high within the central business core and along SH 78 and SH 47. Employment density is expected to increase from low to medium primarily along I-25 at the north end of the City (PACOG, 2011).

3.20.4 Cumulative impact analysis

The Preferred Alternative would unlikely have negative cumulative impacts on environmental resources in the area. With mitigation measures, there is the potential for positive impacts, particularly on the wetlands and wildlife habitats associated with Wild Horse and Williams Creeks in the Pueblo Blvd. intersections area.

All lands adjacent to the interchange improvements planned at Swallows Rd., West McCulloch Blvd., Main McCulloch Blvd., Purcell Blvd., Pueblo Blvd., Wills Blvd., and Baltimore Ave. are built out, planned for development, or in conservation easements. The potential for direct impacts resulting from the Preferred Alternative on adjacent land uses, social and economic resources, and biological resources at these locations would be minimized because the footprint of the proposed interchanges and US 50 mainline capacity improvements would generally fall within CDOT ROW. Mitigation strategies are available for other potential resource impacts associated with wetlands, biological resources, water resources, noise, visual resources, hazardous materials, utilities, and the BNSF Railway.

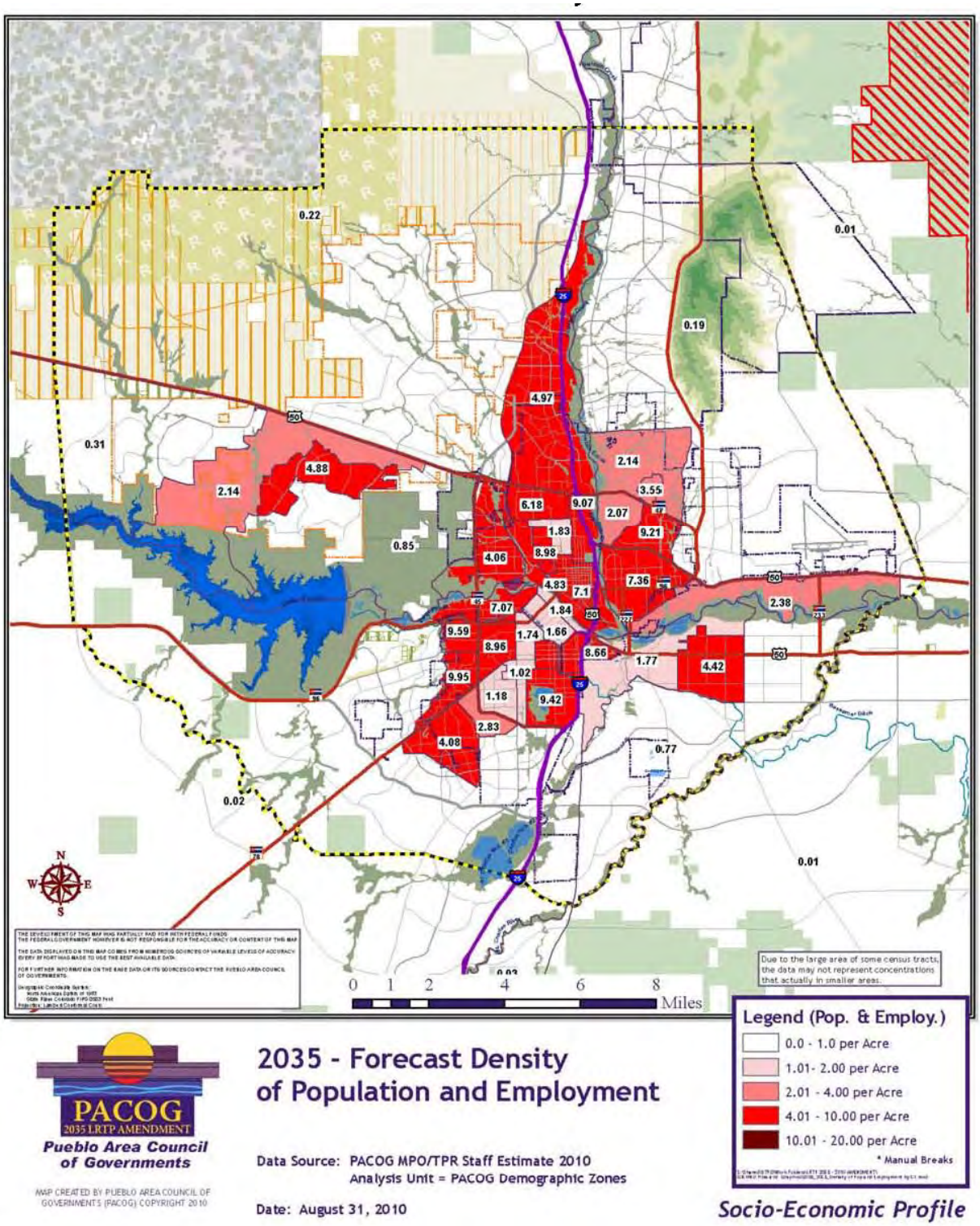
The Preferred Alternative would reduce congestion and accommodate expected trends in population and employment growth. The proposed interchange improvements would not be disruptive to future development and would have a positive cumulative effect on traffic congestion and safety, while contributing to local community cohesion. The Preferred Alternative would also be in line with Pueblo's comprehensive planning aims to "continue existing suburban development patterns…. Arterial commercial and light industrial mixed-use development will continue as planned in designated areas along Highway 50" (PACOG, 2002).



Source: *PACOG, 2010.*

Note: *Number shown on each Census tract is the sum of 2005 population and 2005 employment, divided by the number of acres in the tract.*

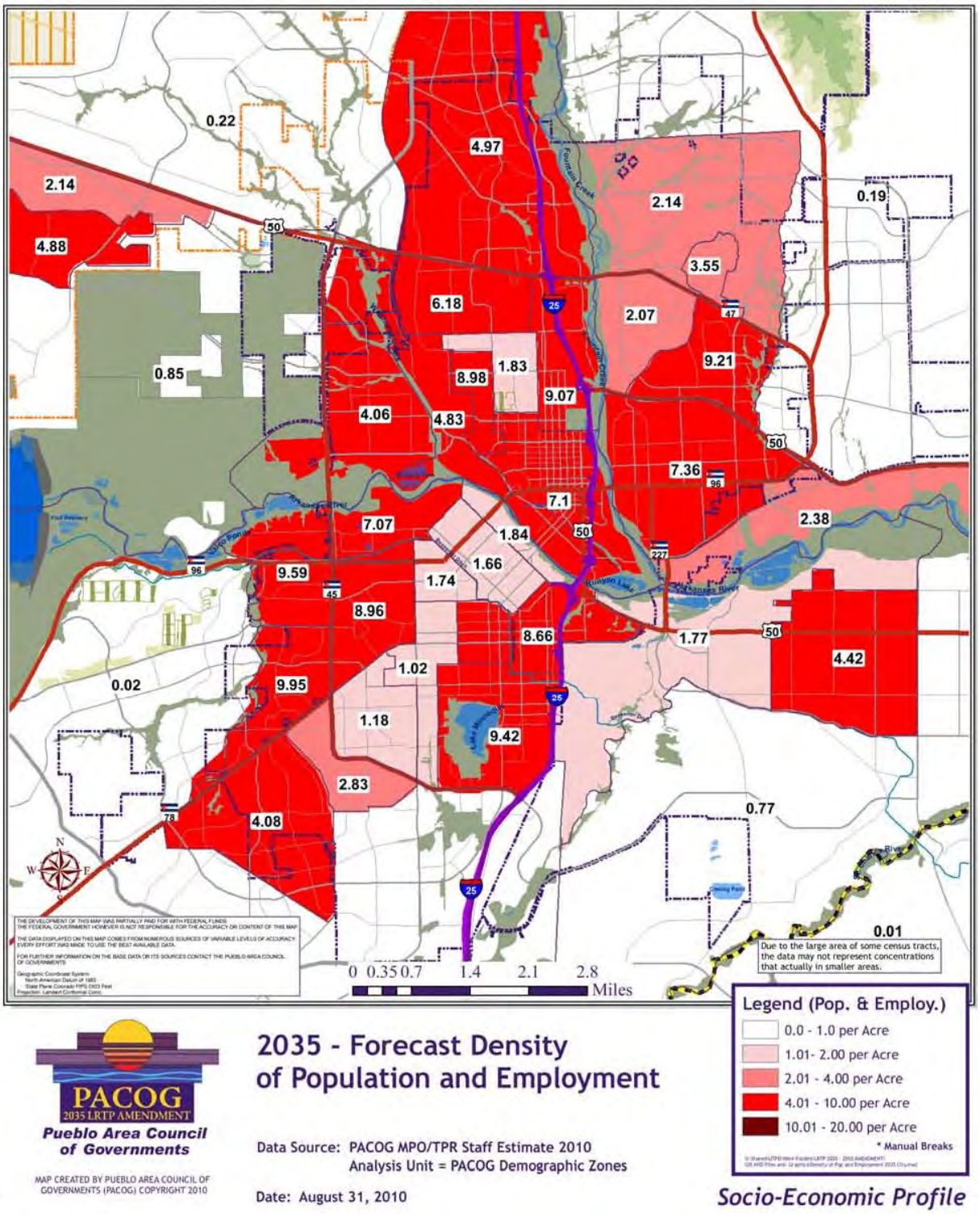
Figure 3-15. 2005 Density of Population and Employment



Source: *PACOG, 2010*

Note: *Number shown on each Census tract is the sum of 2035 population and 2035 employment, divided by the number of acres in the tract.*

Figure 3-16. 2035 Projected Density of Population and Employment



Source: *PACOG, 2010*

Note: *Number shown on each Census tract is the sum of 2035 population and 2035 employment, divided by the number of acres in the tract.*

Figure 3-17. 2035 Projected Density of Population and Employment, City of Pueblo

3.20.5 Mitigation strategies

During the PEL Study process, mitigation for many environmental resources is strategic and conceptual. Detailed mitigation plans usually cannot be developed until later stages of design have been completed. Consequently, **Chapter 3** discusses mitigation strategies with the corresponding resources. The analysis for this PEL Study allowed the study team to consider mitigation activities for a few resources and to include estimates of mitigation costs in the cost of the alternatives. These resources include noise, utilities, railroads, as well as bicycle and pedestrian access.

Section 3.17.5 describes the results of the noise analysis that was performed for this study based on 2035 forecasts of traffic volumes. The noise study tested seven noise wall locations at varying heights. The analysis showed that a 12-foot-high noise wall at one of the locations would meet CDOT's cost-effectiveness guidelines. This 3,970-foot-long wall would span from west of Golfwood Dr. near West McCulloch Blvd. to east of Golfview Dr. near Main McCulloch Blvd. It would be located in CDOT ROW between US 50 and Calle de Camelia. The wall is estimated to cost $2.14 million and was included in all action alternatives.

Alternative E would minimize utility conflicts, particularly at the Purcell Blvd. and Pueblo Blvd. intersections. Utility relocation costs are estimated to be about 4 percent of construction costs, or about $4.6 million.

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Chapter 4. Public and Agency Coordination

4.1 What local entities were consulted during the study?

What's in Chapter 4?

Chapter 4 describes the public and agency coordination process for the US 50 West PEL Study. More specifically, it

- identifies local entities consulted during the study;
- identifies state and federal agencies involved in the process; and
- describes how the public was engaged in the study.

Colorado Department of Transportation (CDOT) Region 2 and J.F. Sato and Associates invited representatives of the City of Pueblo, Pueblo County, the Pueblo West Metropolitan District (PWMD), and the Pueblo Area Council of Governments (PACOG) to form the Technical Advisory Team (TAT) on April 1, 2010. TAT participants signed a Memorandum of Understanding (MOU) on April 20, 2010, to encourage cooperation and collaboration (informed consent) during the US 50 West Planning and Environmental Linkages (PEL) Study process. **Appendix I** contains a copy of this key stakeholder MOU. The TAT met periodically to discuss the development, screening, and comparison of alternatives.

CDOT formed the Policy Advisory Team (PAT) by inviting a representative of the Pueblo West Metropolitan District to ongoing bimonthly coordination meetings with Pueblo County and the City of Pueblo. The PAT met periodically to provide guidelines for the PEL process.

Coordination with local governments occurred through multiple TAT and PAT meetings. Representatives of local entities that were involved in the PEL process included:

- City of Pueblo – Departments of Planning & Community Development, Public Works, and Pueblo Transit
- Pueblo County – Department of Public Works, Engineering Division
- PWMD – Public Works Department
- PACOG staff

4.2 What state and federal agencies were coordinated with during the study?

The PEL process required the involvement of several state and federal agencies. CDOT Region 2 periodically met with the Federal Highway Administration (FHWA) Colorado Division about the progress of the PEL process, holding coordination meetings with the FHWA Colorado Division on May 24, 2011, and on August 16, 2011. FHWA also provided periodic guidance and granted final acceptance of this PEL Study. **Appendix N** contains a copy of a letter in which FHWA acknowledges completion of the US 50 West PEL Study.

The study team also contacted or consulted with the following federal agencies:

- US Fish and Wildlife Service to identify species of concern in the study area. A letter requesting information was sent May 3, 2011, with a response received on May 11, 2011. While species with habitat in Pueblo County were identified, none of these species have habitat near the US 50 Corridor.

- The Advisory Council on Historic Preservation to provide new guidance regarding consultation with Native American tribes. The study team chose to defer tribal consultations until the NEPA clearance stage.
- Federal Emergency Management Agency (FEMA) to obtain Flood Insurance Rate Maps (FIRM). The only available data for floodplain determination in the study area were for Wild Horse Dry Creek, Williams Creek, and Turkey Creek, which comes from FEMA's FIRM effective September 29, 1989. The FIRM used to determine the floodplain impact is panel numbers 080147-0225B and -0240B.
- US Geological Survey (USGS) to obtain surface water flow data for Wild Horse Creek and Turkey Creek. No flow data were available for Wild Horse Creek. Data show that there has been little or no flow at the Turkey Creek gage station in recent years. Regarding water quality standards, a search of the USGS data archive produced one bed sample collected from Turkey Creek in 1989 for organic chemical analysis.

As well as coordinating with CDOT Region 2 and Headquarters, the study team contacted the following state agencies:

- Colorado Department of Natural Resources, Colorado Division of Parks and Wildlife, to discuss species of state concern, obtain travel demand information for Lake Pueblo State Park, and identify properties in the study area protected under Section 6(f).
- Colorado Department of Public Health and the Environment (CDPHE), Hazardous Materials and Waste Management Division, to conduct a file search on hazardous materials sites (locations and remediation status).
- CDPHE, Water Quality Control Division, to conduct a file search on water quality standards. No water quality data were found for Turkey Creek near the study area.
- Colorado Office of Archaeology and Historic Preservation to conduct a file search for cultural resources using the COMPASS online database. No previously recorded sites were found within the 400-foot wide study corridor along US 50.

4.3 How did the study get public participation and feedback?

4.3.1 Business walk-abouts and one-on-one meetings

The project public involvement (PI) team conducted walk-abouts along the entire US 50 Corridor from Swallows Rd. to Baltimore Ave. The PI team stopped at all businesses located along the US 50 Corridor route and approximately 0.125 mile in both directions at every intersection along the Corridor. The PI team delivered fliers about the project and notices of the April 2011 community work sessions as they visited with business owners and managers.

4.3.2 Public meeting notification

The PI team developed a 5-inch by 5-inch newspaper advertisement for the work sessions (shown in **Appendix I**). The PI team placed this paid advertisement, announcing the meeting dates/times/locations, in the *Pueblo Chieftain* on Wednesday, March 30, 2011, and on Sunday, April 3, 2011. The PI team also placed the advertisement in the *Pueblo West View* on Thursday, March 31, 2011.

The PI team prepared a news (press) release and a media advisory announcing the April 2011 community work sessions. The PI team issued the press release and media advisory to the following news media:

- *Pueblo Chieftain*
- *Pueblo West View*
- *Cañon City Daily Record*
- *Florence Citizen*
- KRDO TV
- KCSJ Radio
- Fox 21 TV news
- KOAA TV

Figure 4–1. Pueblo Public Library Community Work Session on April 5, 2011

Ron Nies explains the range of intersection options studied.

Appendix I contains a copy of the press release.

Participating agencies also posted the meeting notice on their websites and distributed the notice through other communications tools.

4.3.3 Community work sessions

CDOT hosted community work sessions (public meetings) at the Pueblo West Public Library on April 5, 2011, and at Centennial High School in Pueblo on April 7, 2011. CDOT distributed comment forms to participants at the public meetings to gather information associated with travel on US 50, concerns with US 50, and alternatives to US 50. **Appendix C** contains a summary of the form responses and comments received from these public meetings.

Organizations represented at the community work sessions included the following:

- Pueblo County Planning Commission
- PWMD
- City of Pueblo
- PACOG Transportation Advisory Commission
- Honor Farm Enterprise Citizens Advisory Board
- San Isabel Electric Association
- Pueblo Active Community Environments
- League of Women Voters of Pueblo
- *Pueblo Chieftain*
- HyMark Motorsports Inc.

Project officials obtained public input and feedback on potential US 50 West safety and capacity improvement at these community work sessions.

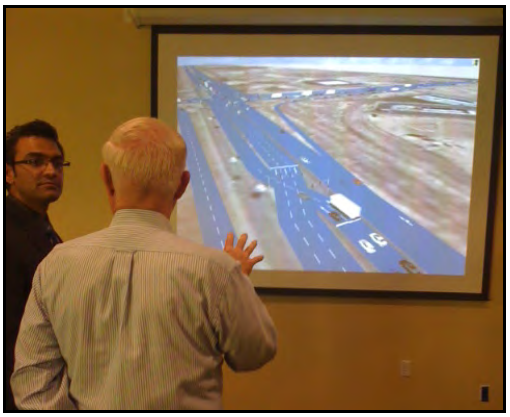

Figure 4–2. Community Work Session, Public Open House Period

Gaurav Vasisht explains a video simulation of a continuous flow intersection's operations during the open house period of a community work session.

4.3.4 Public/agency access to the report

The PEL Report will be posted on the CDOT website, with links made available to the report on each of the TAT agency websites. Another press release will be issued to the same news media once the PEL Report has been posted to the CDOT website to let citizens know how they can view the report online or in hard copy form at the various TAT agency offices, Pueblo public libraries, and local print shops.

4.4 What private entities did the study team contact?

The study team contacted several private entities to obtain data for the study and to keep stakeholders informed of the study's progress. Coordination with private entities included:

- A representative of Bicycle Colorado stayed after a PWMD Board of Directors meeting, which included a presentation by the study team, to discuss current conditions for bicyclists on US 50 and the need for future improvements.
- Colorado Natural Gas provided maps of their distribution system in Pueblo West.
- Connexion Technologies responded to an email from the study team asking about utilities in the study area.
- Comcast provided facility maps.
- Fountain Valley Authority provided images showing the location of the Fountain Valley Conduit, a 42-inch water pipeline.
- Qwest Communications (now Century Link) responded to an email asking about their national fiber optic network.
- The Southeast Colorado Power Association (SECPA) and its Southeast Communications (SECOM) provided CAD and geographic information system files showing the approximate locations of their fiber optic lines.
- Xcel Energy provided maps of their gas distribution lines.

In addition, the study team contacted Black Hills Energy, MCI, and Unite but did not receive any responses from them.

For additional information, see **Appendix G** for a list of utility references.

Chapter 5. Next Steps

5.1 How does a Memorandum of Agreement adopt the Preferred Alternative?

The project team, in consultation with Federal Highway Administration (FHWA) and the planning partners, developed the Memorandum of Agreement (MOA), which:

- Includes all documents, exhibits, and resolutions describing the recommendation of the Preferred Alternative.
- Briefly describes the process for recommending the Preferred Alternative and the parties involved, including federal, state, and local agencies, as well as the general public.

What's in Chapter 5?

Chapter 5 identifies the next steps for the US 50 West PEL Study. This chapter:

- discusses the purpose for the MOA;
- identifies the plan needed to implement the Preferred Alternative; and
- describes the actions that must be taken before construction can begin.

This agreement was submitted to each signatory for comment, legal review, and compliance review with the elected officials. The signatories are the Colorado Department of Transportation (CDOT), the City of Pueblo, Pueblo County, and the Pueblo West Metropolitan District. After all involved parties agreed on the language of the agreement, the project team prepared the final agreement for signature. All parties signed the agreement, indicating that they officially adopt the Preferred Alternative through this MOA. **Appendix M** presents the MOA and the City of Pueblo resolution approving the agreement.

The MOA will then be incorporated into the unconstrained Pueblo Area Council of Governments (PACOG) *2035 Long Range Transportation Plan* and the *Statewide Transportation Improvement Plan*.

5.2 What plans are needed to implement the Preferred Alternative?

In addition to CDOT and its partners adopting the Preferred Alternative in the *Statewide Transportation Improvement Plan* and the PACOG *Long Range Transportation Plan*, CDOT has developed an **Implementation Plan** for US 50, which has been included as an addendum to this report.

The **Implementation Plan** consists of components of intermediate year improvements and includes the priorities of all components that constitute the Preferred Alternative.

Because the funding stream for this project is uncertain and the funding sources have not been unidentified, the size of each improvement component would be completed at cost to take advantage of any funds that become available to this Corridor. The purpose of dividing the Preferred Alternative into components is to identify segments of independent utility for future National Environmental Policy Act activities and construction. Segments will be identified to avoid or minimize having to remove parts of earlier segments when later segments are built.

The priorities of the components will be determined primarily based on the urgency of traffic congestion. Traffic movement that becomes unbearably congested at a particular location will

receive the first and highest priority. However, the project team will also coordinate with Technical Advisory Team (TAT) members when establishing the priorities of the components.

The recommendation of the Preferred Alternative is based on the assumption that several local improvement projects will be completed before 2035. Therefore, the priorities of the components of the Preferred Alternative will also be contingent upon the timing of the completion of these local improvement projects.

5.3 What actions are required before construction can start?

The following actions are required before the final design and construction of any component of the Preferred Alternative can begin:

1. Complete a site-specific environmental clearance in the form of either a categorical exclusion or an environmental assessment depending on the complexity of the project.
2. Because most of the environmental resources will have already been analyzed and mitigation strategies identified during the PEL process, the site-specific environmental clearance only needs to adopt the PEL analyses, determine if any environmental resources require more detailed study than was performed for the PEL, and verify if any new regulations exist that would influence the decision-making process on the recommendation of the Preferred Alternative.
3. Involve TAT members and the general public during the environmental clearance process. The TAT members will also develop corridor design guidelines.
4. Once FHWA approves the environmental clearance and funding becomes available, begin the final design, followed by construction.

The **Implementation Plan** contains more detailed information about the activities leading up to construction.

References

American Association of State Highway and Transportation Officials (AASHTO). 2010. *Highway Safety Manual*, 1st edition. Washington, DC.

—. 2004. *A Policy on Geometric Design of Highways and Streets*. Washington, DC.

Barton-Aschman Associates. 1990. Pueblo Area Council of Governments travel demand model documentation.

Browne, A.N. 2011. Kiplinger. Kiplinger.com. 10 U.S. Cities with Cheapest Cost of Living. June.

Center for Business and Economic Forecasting (CBEF). 2007. Colorado Jobs and Labor Force. July. URL: https://dola.colorado.gov/demog_webapps/jcbef_parameters.jsf. Accessed August 30, 2011.

Colorado City Metropolitan District. 2011. URL: http://www.coloradocitymetro.us/demographics.html. Accessed December 5.

Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission. 2011. Regulation No. 32. Stream Classifications and Water Quality Standards for Middle Arkansas River Basin, Region 7.

Colorado Department of Transportation (CDOT), 1999. *Preferred Alternative, Eden Interchange/Pueblo Boulevard Feasibility Study*. December.

—. 2001. *Project Development Manual*. Section 5 Materials. July 10.

—. 2008. *NEPA Manual*. Chapter 9 – Resource Considerations, Vegetation and Noxious Weeds (pp 9–64) and EJ (pp 131–135). Version 2.

—. 2011. URL: http://apps.coloradodot.info/dataaccess/. Accessed August 2011.

—. 2012. Personal communication between Mr. Yates Opperman (CDOT) and Scott Ramming, PhD, PE (JFSA) regarding Section 6(f) properties in the US 50 study area. March 14.

Colorado Division of Wildlife (CDOW). 2011a. Wildlife Arkansas Darter Page. Natural Diversity Information Source. URL: http://ndis.nrel.colostate.edu/wildlifespx.asp?SpCode=010617. Accessed August 25, 2011.

—. 2011b. Cutthroat Trout. URL: http://wildlife.state.state.co.us/Research/Aquatic/CutthroatTrout/Pages/CutthroatTrout.aspx. Accessed August 25, 2011.

Colorado Division of Parks and Wildlife (CPW). 2012. Personal communication between Ms. Melanie Gose (CPW) and Scott Ramming, PhD, PE (JFSA) regarding Section 6(f) properties in the US 50 study area. March 22.

Department of Local Affairs (DOLA) State Demography Office. 2010a. Population Totals for Colorado Municipalities, City and County of Pueblo, 1980–2008. Accessed August 30, 2011.

—. 2010b. November Economic Forecasts. Accessed August 30, 2011.

—. 2010c. September Population Forecasts. Accessed August 30, 2011.

FirstSearch Technology Corporation (FirstSearch). 2010. Environmental FirstSearch™ Report, Pueblo, Colorado. November 4.

Federal Highway Administration (FHWA). 2009. *Manual on Uniform Traffic Control Devices for Streets and Highways*. Washington, DC.

—. 2010. *Alternative Intersections/Interchanges: Informational Report*. April.

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. *Mammals of Colorado*. Niwot, Colorado: University Press of Colorado, 467 pp.

Greater Pueblo Chamber of Commerce (Pueblo Chamber) website. URL: http://www.pueblochamber.org/. Accessed August 30, 2011.

Hart Adams, Tucker. 2010. Coloradobiz, cobizmag.com. The Economist. Pueblo: A lesson in how to reinvent a city. March 1.

Honor Farm Master Plan Advisory Committee, City of Pueblo, and Design Concepts, Inc. 2007. *Honor Farm Park and Open Space Master Plan*. November.

Kingery, H. Ed., 1998. *Colorado Breeding Bird Atlas*. Published by Colorado Bird Atlas Partnership and Colorado Division of Wildlife. 636 pp.

Macbeth. 1992. Munsell Soil Color Charts. Division of Kollmorgen Instruments, Corp. Newburg, New York.

Parsons Brinckerhoff, Inc. 2009. *Colorado Rail Relocation Implementation Study Final Report*. In association with Felsburg Holt & Ullevig, Inc., CRL Associates, Inc., RMC Consultants, Inc., H.C. Peck & Associates Inc., Xcelente Marketing Group, LLC, and Doc.1 Solutions, LLC. Prepared for Colorado Department of Transportation. January.

Persaud and Lyon, Inc., FHU. 2009. *Safety Performance Functions for Intersections*, Report No. CDOT-2009-10, December.

Pueblo Area Council of Governments (PACOG). 2002. *2035 Comprehensive Plan: Pueblo Regional Development Plan*. July.

—. 2008. *2035 Long-Range Transportation Plan*. Adopted January 24.

—. 2009. Meeting the Challenges of Demographic Change: 1980 – 2008. March 4.

—. 2010a. *Pueblo West Bike and Trails Map*, April 3.

—. 2010b. *Pueblo Bicycle and Trails Map*, April 3.

—. 2011. *2035 Long-Range Transportation Plan (Amended)*. Adopted April 28.

Pueblo County, Colorado. 2011. Noxious Weeds found in Pueblo County. URL: http://www.co.pueblo.co.us/planning/landuse/weed_management.aspx?id=783. Accessed August 29, 2011.

Pueblo County School District 70. 2010. School attendance area maps downloaded from URL: http://www.district70.org/. Accessed January 21, 2010.

Pueblo West Metropolitan District (PWMD). 2011. Community Development from 1990 to 2000. URL: http://www.pueblowestmetro.com/commdevelophome.php. Accessed August 29, 2011.

Reed, P.B., Jr., R.Theriot, W. Sipple, and N. Melvin. 1996. 1996 National List of Vascular Plant Species That Occur in Wetlands. US Fish and Wildlife Service. National Wetlands Inventory. St. Petersburg, Florida.

Scott, G. R. 1969. General and Engineering Geology of the Northern Part of Pueblo, Colorado. US Geological Survey Bulletin 1262, 131p., geologic map at the 1:24,000 scale.

—. 1972. Reconnaissance geologic map of the Swallows Quadrangle, Pueblo County, Colorado. US Geological Survey Miscellaneous Field Studies Map MF-354. 1:24,000 scale.

Transportation Research Board (TRB). 1982. Authors: Pedersen, N J and Samdahl, D R. National Cooperative Highway Research Program Report. Issue Number: 255. Highway Traffic Data for Urbanized Area Project Planning and Design. 191pp.

—. 2010. *Highway Capacity Manual*. Washington, DC.

US Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. USACE Waterways Experiment Station, Vicksburg, Mississippi.

US Census Bureau 2010. American Factfinder. URL: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=addr&refresh=t. Accessed August 29, 2011.

USDA Natural Resources Conservation Service (NRCS). 2011. Invasive and Noxious Weeds: Colorado State Noxious Weeds List. URL: http://plants.usda.gov/java/noxious?rptType=State&statefips=08. Accessed August 29.

Weber, W.A. and R.C. Whittmann. 2001. *Colorado Flora: Eastern Slope* (3rd ed). University Press of Colorado. Boulder, Colorado.

Western Cultural Resource Management, Inc. (WCRM). 2011. US 50 West PEL Study Environmental Studies Memorandum. To: U.S. 50 West PEL Study File. Date: 28 February 2011. From: Steve Mehls, Ph.D., Historian/Architectural Historian. RE: Cultural Resource File Search.

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Addendum
Implementation Plan

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List of Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
Ave.	Avenue
Blvd.	Boulevard
BNSF	Burlington Northern Santa Fe (Railway)
Cat. Ex.	Categorical Exclusion
CDOT	Colorado Department of Transportation
EB	eastbound
FHWA	Federal Highway Administration
FIR	Field Inspection Review
FOR	Final Office Review
ft.	feet/foot
I-25	Interstate 25
LOS	Level of Service
MHT	Method of Handling Traffic
mon	month(s)
MS4	Municipal Separate Storm Sewer System
NB	northbound
NE	northeast
NEPA	National Environmental Policy Act
NW	northwest
PACOG	Pueblo Area Council of Governments
PAT	Policy Advisory Team
PBE	Pueblo Blvd. Extension
PEL	Planning and Environmental Linkages
Rd.	Road
ROW	right-of-way
SB	southbound
SE	southeast
seq.	sequence
SH	State Highway (numbered highway route)
St.	Street
SW	southwest
US	United States (also numbered highway route)
WB	westbound
WPC	West Pueblo Connector
y	year(s)

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Implementation Plan Addendum

1. Executive Summary

The study team developed this Implementation Plan by sorting the elements of the Preferred Alternative based on the traffic need. **Section 4** describes in detail how this plan was developed. Intermediate year traffic volumes were estimated using the 2035 forecasts developed for the US 50 Planning and Environmental Linkages (PEL) study, the time elapsed, and how much of the Preferred Alternative was forecasted to be built. **Section 5** explains how the traffic forecasts were made and **Section 6** provides tables of the turning movement forecasts.

Table IP-1 summarizes the sequence of transportation improvements for the US 50 Corridor. **Figure IP-1** illustrates the timing of improvements, with those needing to be completed soonest shown in shades of green. Those improvements that could be completed latest (around the study horizon year of 2035) are depicted in shades of orange. Transportation improvements that are needed in the intermediate term are shown in shades of blue. Flexible, low construction cost improvements at the west end of the corner are shown in purple. **Section 11** discusses the sequence of improvements in more detail. **Section 8** provides information about traffic needs at individual intersections.

The first phase of US 50 improvements involves widening the highway to six lanes from west of Pueblo Blvd. to Wills Blvd., including the construction of new westbound lanes at the Pueblo Blvd. intersection just north of the existing eastbound lanes. The first phase also converts the Pueblo Blvd. intersection to a jughandle operation. Westbound US 50 traffic turning south onto Pueblo Blvd. would exit along the existing westbound lanes and turn left as they do today. Northbound Pueblo Blvd. traffic turning left onto westbound US 50 would drive past the first intersection, where eastbound and westbound through traffic cross, and continue to the intersection with the existing westbound lanes.

Table IP-1. Summary of Transportation Improvement Priorities

Year of Critical LOS Failure without Improvement[1]	Estimated Design Duration	Estimated Construction Duration	Transportation Improvement Description[2]	Estimated Construction Cost (Current $)
2013	2 y 3 mon[3]	1 y 6 mon	West of Pueblo Blvd. to Wills Blvd. • Widen EB US 50 to 3 lanes • Widen WB US 50 east of BNSF crossing to 3 lanes • Build 3 WB lanes at Pueblo Blvd. just north of EB lanes • Convert existing WB lanes to jughandle	$16.2 million
2013	1 y 6 mon	1 y	West of Purcell Blvd. to west of Pueblo Blvd. • Widen US 50 to 3 lanes each direction	$9.8 million
2017	2 y 3 mon[4]	3 mon	At Pueblo Blvd. • Construct 3rd NB lane at mainline US 50 intersection • Construct a dedicated through lane at jughandle intersection	$600,000

Year of Critical LOS Failure without Improvement[1]	Estimated Design Duration	Estimated Construction Duration	Transportation Improvement Description[2]	Estimated Construction Cost (Current $)
2021	1 y 6 mon[4]	6 mon	At Purcell Blvd. • Construct jughandle in NW & NE quadrants • Construct 3rd SB lane at mainline US 50 intersection	$3.4 million
2023	2 y 3 mon[4]	3 mon	At Pueblo Blvd. • Construct 4th NB & 3rd SB lane at mainline US 50 intersection • Continue new NB lane as 2nd through lane past jughandle intersection	$1.0 million
2023	1 y 6 mon[4]	6 mon	At Purcell Blvd. • Construct jughandle in SW & SE quadrants	$3.7 million
2025	1 y 6 mon	1 y 3 mon	West of Main McCulloch Blvd. to West of Purcell Blvd. • Widen US 50 to 3 lanes in each direction At Main McCulloch Blvd. • Construct noise wall in SW quadrant • Construct jughandle in NE quadrant • Convert 2nd NB & SB left turn lanes to SB through lane	$18.0 million
2027	6 y[3, 5]	4 y[5]	Construct Pueblo Blvd. Extension to Platteville Blvd.	N/C[5]
2027	2 y 3 mon[4]	1 y 9 mon	At Pueblo Blvd. • Construct diverging diamond interchange	$27.0 million
2029	1 y 6 mon[4]	6 mon	At Main McCulloch Blvd. • Construct jughandle in SW & SE quadrants	$3.1 million
2029	1 y 6 mon[4]	6 mon	At Purcell Blvd. • Construct grade separation to complete diamond interchange	$11.3 million
2029 to 2035[6]	6 y[3, 5]	3 y[5]	Construct West Pueblo Connector	N/C[5]
2029 to 2033	1 y 6 mon	TBD	At Baltimore Ave. • To be determined from four options	TBD
2033	1 y 6 mon[4]	6 mon	At Main McCulloch Blvd. • Construct ramp in NW quadrant & grade separation to complete diamond interchange	$16.2 million
			Total Cost of US 50 Improvements • Excluding ROW • Excluding improvements at Baltimore Ave. to be determined • Including Municipal Separate Storm Sewer System (MS4) requirements • Including pedestrian and bicycle facilities	$125 million

Notes: Corridor-wide MS4 requirements would need to be built before any improvement project could begin. These requirements are estimated to cost $2 to 3 million and require additional ROW near Swallows Rd. and Turkey Creek.

[1] Improvements could be completed sooner as funding becomes available.

[2] Complimentary accommodation of pedestrian and bicycle facilities would occur as corresponding improvements are made to US 50. Additional ROW would be required for pedestrian and bicycle facilities. These facilities are estimated to cost a total of $12 to 14 million.

[3] Duration is uncertain because of the time required to coordinate with railroads.

[4] Many design activities are completed during the first phase of improvements at each location.

[5] No exact estimates were made for the design and construction duration or the construction cost of the two off-US 50 improvements because other studies beyond the scope of this PEL Study would be required.

[6] The timing of the West Pueblo Connector depends on the improvements made at US 50 and Baltimore Ave.

Abbreviations:	EB = eastbound	LOS = levels of service	mon = month(s)	NB = northbound	N/C = not calculated
	NE = northeast	NW = northwest	ROW = right-of-way	SB = southbound	SE = southeast
	SW = southwest	TBD = to be determined	WB = westbound	y = year(s)	

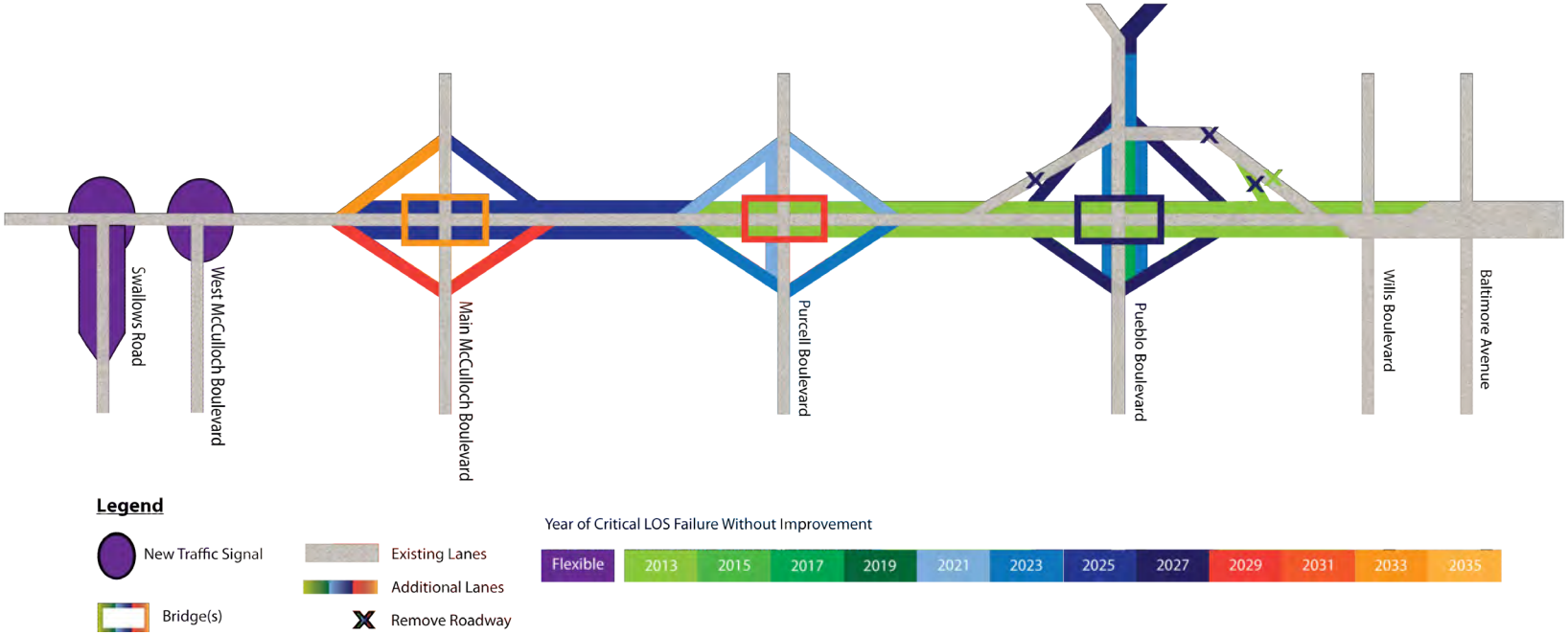
The timing for the two local improvement projects, the Pueblo Blvd. Extension and the West Pueblo Connector, was driven by traffic conditions at the US 50 intersection with Baltimore Ave. The Pueblo Blvd. Extension to Platteville Blvd. needs to be completed by 2027. The length of the West Pueblo Connector needs to be completed between 2029 and 2035, depending on what additional improvements are made to the Baltimore Ave. intersection. (Individual segments of the West Pueblo Connector could be built sooner and would provide the benefit of an alternate route during US 50 construction.)

2. What's in the Implementation Plan?

This Implementation Plan describes the steps to build the Preferred Alternative for the US 50 Corridor and the timing of each step based on traffic needs. It also describes the decision process used to develop the plan and includes the traffic forecasts that establish the needs over time. It also discusses the levels of service (LOS) corresponding to those traffic patterns, which indicates when individual improvement projects are needed at various locations. The plan describes specific improvements and how long those improvements will meet the growing traffic needs. The plan also presents a Corridor-wide sequence of improvements that reflect the priorities based on traffic operation needs. The plan also discusses safety and multimodal improvements. Finally, the plan describes factors that may cause it to change and the process for making changes to the plan.

3. Why does the US 50 Corridor need an Implementation Plan?

The US 50 Corridor needs an Implementation Plan because the Preferred Alternative is expected to cost more than $120 million, and it is unlikely the Colorado Department of Transportation (CDOT) will have the funds available to build the Preferred Alternative all at once. CDOT will more likely have a stream of smaller amounts of funds to build the Preferred Alternative in phases over time. In the future, other corridors, such as the I-25 New Pueblo Freeway, may also compete for available funding. By dividing the Preferred Alternative into segmented improvement projects, CDOT will be able to use these smaller fund amounts. Phasing construction of the Preferred Alternative also lets CDOT be responsive to traffic needs, which may grow differently than forecasted for this study.



Notes: Improvements could be completed sooner than shown if funding becomes available.

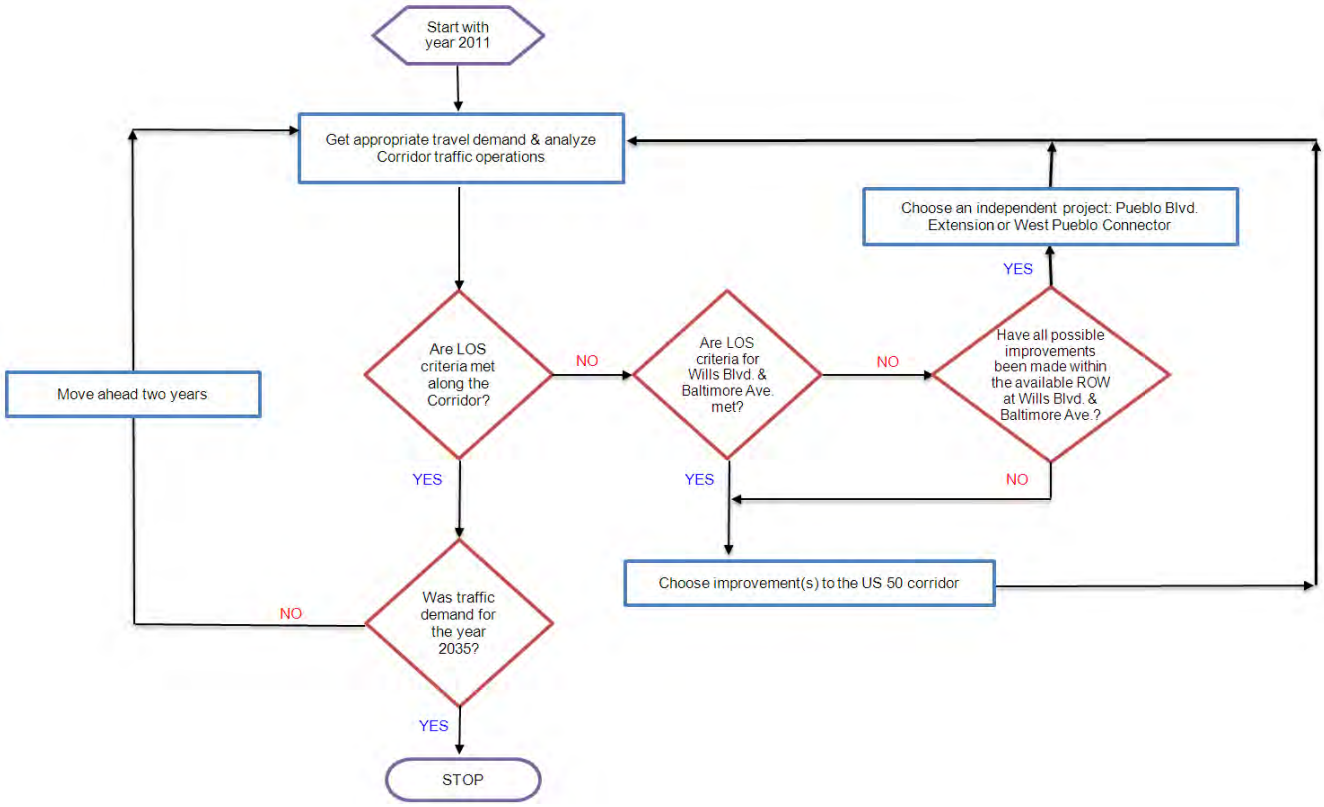
The timing of the West Pueblo Connector (not shown) depends on the improvements made at US 50 and Baltimore Ave.

Figure IP–1. Schematic Map Showing Timing of Improvement Needs

4. How was the Implementation Plan developed?

The study team developed the Implementation Plan by looking at traffic operations beginning in 2011 and moving to 2035 two years at a time. If operations at a certain location did not meet the Purpose and Need criteria during a certain year, the team proposed and examined possible improvement projects. Where possible, the team created improvement projects to build parts of the Preferred Alternative in phases. However, "throw-away" improvements were made in a few locations. Note that failure to meet the traffic operations criteria somewhere does not necessarily mean that improvements must be made at that location. Because the Preferred Alternative recognizes the benefit that the Pueblo Blvd. Extension and West Pueblo Connector have on US 50 traffic, the study team also considered these independent improvement projects.

Figure IP-2 shows a detailed flowchart of the process used to develop the Implementation Plan. It begins at the top center left with the purple hexagon showing that the process starts with year 2011 conditions. Traffic volumes for 2011 are computed (as described in **Section 5**) and the morning peak hour LOS and evening peak hour LOS are calculated for intersections and mainline segments as part of a Corridor-wide traffic operations analysis, as shown in the blue box. The process proceeds down the column to check if the calculated LOS values are consistent with the study Purpose and Need. If so, the process loops back up along the left side of **Figure IP-2** to then examine traffic operations in 2013. If some locations do not meet the Purpose and Need criteria for LOS, then the process moves to the right half of **Figure IP-2**.



Notes: LOS = level(s) of service ROW = right of way

Figure IP-2. Process to Prioritize Implementation Plan Components

For the US 50 PEL Study, the process worked as follows. First, the study team examined whether the LOS deficiencies occurred at Wills Blvd. or Baltimore Ave., or elsewhere farther west in the Corridor. Poor traffic operations west of the Burlington Northern Santa Fe (BNSF) railroad crossing were generally addressed by making improvements at that location, as shown by the blue box at the lower center portion of **Figure IP-2**. However, because of the close business development near the Wills Blvd. and Baltimore Ave. intersections, congestion relief there required more careful consideration. First, the study team tried to make limited improvements on site that would require no additional right-of-way (ROW), as shown by the "NO" branch below the rightmost red diamond of **Figure IP-2**. Once all the possible improvements had been made at Wills Blvd. and Baltimore Ave., the study team identified the need for the local improvement projects that support the Preferred Alternative, the Pueblo Blvd. Extension, and the West Pueblo Connector. Because of potential ROW, environmental, and community concerns associated with the West Pueblo Connector south of 18th St., the study team assumed that the Pueblo Blvd. Extension would be completed before the West Pueblo Connector.

Once potential improvements were identified to address all the LOS deficiencies, the process looped back along the upper right side of **Figure IP-2** to examine the LOS in the Corridor with those improvements in place. Improvements were modified if they were not able to bring traffic operations within the Purpose and Need criteria. Once all the LOS issues were addressed, the process moved to the next two years in the future, as shown along the left side of **Figure IP-2**.

After multiple loops corresponding to the left or right sides of **Figure IP-2**, the process eventually reached the year 2035, when the Preferred Alternative would be complete.

5. How were traffic forecasts developed to assess the traffic needs?

The study team needed traffic volumes for every two years between 2011 and 2035 to develop the Implementation Plan. Turning movement counts taken in September 2009 were available, as were 2035 forecasts developed earlier in this PEL study. The team used a different procedure to estimate current turning movements than they did for the forecasts for 2013 to 2033.

The study team used counts collected continually at CDOT's automated traffic recorder west of Swallows Rd. to factor the 2009 turning movement counts to 2011. Three sets of factors were used:

- One for eastbound traffic
- One for westbound traffic
- One based on the two-way total

If a turning movement began or ended eastbound, its volume was brought to 2011 using the eastbound factor. The same process was used for westbound movements. The northbound and southbound through movements were brought to 2011 using the two-way factor. **Table IP-2** summarizes the factors used for each movement.

Table IP–2. Factors Used to Convert 2009 Turning Movements to 2011

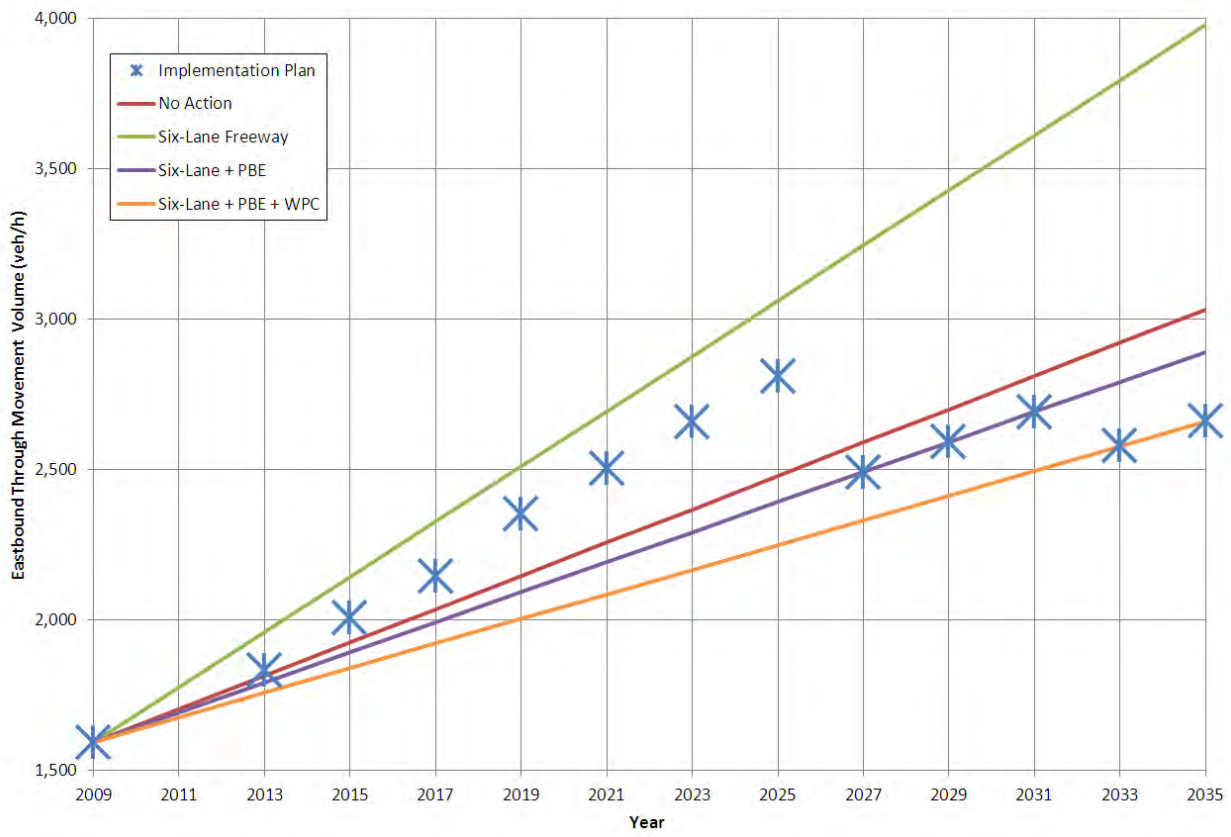
Turning Movement	Direction of Factor Used	Turning Movement	Direction of Factor Used
Eastbound Left	Eastbound	Northbound Left	Westbound
Eastbound Through	Eastbound	Northbound Through	Two-Way
Eastbound Right	Eastbound	Northbound Right	Eastbound
Westbound Left	Westbound	Southbound Left	Eastbound
Westbound Through	Westbound	Southbound Through	Two-Way
Westbound Right	Westbound	Southbound Right	Westbound

The process to make the 2013 to 2033 forecasts can be thought of as drawing paths on a graph of volume over time, such as the one shown in **Figure IP-3** for the morning peak hour eastbound through movement at Pueblo Blvd. The study team used linear interpolation—equivalent to drawing a straight line—to draw four paths between the 2009 counts and the 2035 forecasts for four demand scenarios:

1. No Action (shown as the red line in **Figure IP-3**)
2. Six-Lane Freeway (Action Plan 5, the green line)
3. Six-Lane Expressway with Pueblo Blvd. Extension (Action Plan 6, the purple line)
4. Six-Lane Expressway with Pueblo Blvd. Extension and West Pueblo Connector (Action Plan 7, the orange line)

Also, because new lanes will be added to US 50 in segments, volumes were further interpolated between the No Action and Six-Lane Freeway paths based on how many of the roughly 14 lane-miles (7 miles in each direction) added by the Preferred Alternative were expected to be built by that year. The study team used forecasts from the No Action path to determine a preliminary estimate of when the added lanes would be needed.

In **Figure IP-3,** blue stars represent the final set of forecasts. In 2013, the star is near the No Action path because little of the additional lanes have been built by then. The stars representing the forecasts fall between the red No Action path and the green Six-Lane Freeway path until 2025, with the forecasts being closer to the Six-Lane Freeway path in later years. **Figure IP-3** shows the Pueblo Blvd. Extension being completed in 2027, at which point the forecasts track the purple path. Finally, **Figure IP-3** shows the West Pueblo Connector being built by 2033, when the forecasts jump to the orange path.



Source: JFSA, 2011

Notes: PBE = Pueblo Blvd. Extension WPC = West Pueblo Connector

Figure IP-3. Method to Forecast Intermediate Year Turning Movements

6. What are the turning movement forecasts?

The turning movement forecasts are presented below in a series of tables, grouped by intersection, from west to east. At each intersection, one table presents the turning movements for the morning peak hour and the second for the evening peak hour. The years of each forecast are given along the first column of each table. Movements are shown in the remaining columns, grouped by the approach shown in the top header row.

The body of the table has three sections relating to the network associated with the demand scenarios. Each section is headed by a full row across describing the demand scenario:

- Phased improvements to US 50, relating to adding a third lane in either direction
- Six-Lane Expressway with Pueblo Blvd. Extension
- Six-Lane Expressway with Pueblo Blvd. Extension and West Pueblo Connector

Some years are shown in two sections to document the demand that shows the need for completion of the two local improvement projects. Because CDOT will be tracking conditions on US 50 to determine the precise timing of needed improvements, the tables allow for comparison against

future traffic counts. Years in multiple sections also provide some flexibility in completing the local improvement projects earlier or later than the year established in this Implementation Plan.

Swallows Rd.

Table IP-3 shows the forecasted turning movements during the morning peak hour at US 50 and Swallows Rd. Note that while eastbound through traffic is currently the heaviest movement, it soon becomes second to westbound through traffic as more Pueblo area residents take jobs in Cañon City and Florence. After completion of the West Pueblo Connector, westbound left turning traffic drops considerably, as travel patterns shift to use the Joe Martinez Blvd. Extension and other arterials in Pueblo West, while some traffic remaining on US 50 makes the left turn at intersections to the east of Swallows Rd. A similar, but less pronounced drop occurs in northbound right turning traffic.

Table IP–3. Forecasted Morning Peak Hour Turning Movements at US 50 and Swallows Rd.

	Eastbound		Westbound		Northbound	
Year	Through	Right	Left	Through	Left	Right
Demand with Phased Improvements to US 50						
2009	340	8	15	330	40	35
2011	420	10	15	380	45	40
2013	370	8	15	380	50	55
2015	390	8	20	400	55	70
2017	400	10	20	420	55	85
2019	420	10	25	450	60	100
2021	440	10	25	470	65	120
2023	460	10	30	490	70	130
2025	470	10	30	510	75	140
2027	490	10	35	530	75	160
Demand with Pueblo Blvd. Extension						
2027	490	10	55	540	75	180
2029	510	10	60	560	75	190
2031	520	10	65	590	80	210
2033	540	10	70	610	85	230
2035	560	10	75	630	85	240
Demand with Pueblo Blvd. Extension and West Pueblo Connector						
2033	540	10	8	610	85	190
2035	560	10	8	630	85	200

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-4 shows the forecasted turning movements at US 50 and Swallows Rd. during the evening rush hour. Westbound through traffic is consistently the heaviest movement, followed closely by eastbound through traffic. Initially, westbound left turning traffic grows quickly as some drivers switch to making the left at Swallows Rd. rather than at more congested intersections to the east. However, after completion of the West Pueblo Connector, the westbound left and northbound right volumes drop as a result of the same shifting traffic patterns that occurred during the morning peak.

Table IP-4. Forecasted Evening Peak Hour Turning Movements at US 50 and Swallows Rd.

	Eastbound		Westbound		Northbound	
Year	Through	Right	Left	Through	Left	Right
Demand with Phased Improvements to US 50						
2009	370	20	20	410	35	35
2011	400	20	20	450	35	40
2013	420	25	60	460	40	40
2015	440	30	80	490	40	45
2017	470	30	100	520	45	50
2019	490	35	130	540	50	60
2021	510	40	160	570	50	65
2023	530	40	180	600	55	70
2025	560	45	200	620	55	75
2027	580	50	230	650	60	85
Demand with Pueblo Blvd. Extension						
2027	600	35	370	650	55	90
2029	620	35	410	680	60	95
2031	650	35	450	710	65	100
2033	670	40	490	740	65	110
2035	700	40	530	760	70	120
Demand with Pueblo Blvd. Extension and West Pueblo Connector						
2033	650	60	330	740	65	45
2035	670	65	350	760	70	45

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

West McCulloch Blvd.

Table IP-5 shows that the northbound right turn from West McCulloch Blvd. to eastbound US 50 is the heaviest movement during the morning rush hour and is expected to remain so for the foreseeable future. As many or more people are traveling through westbound on US 50 as traveling through eastbound on US 50 until 2017, when eastbound travel becomes more dominant. This change in travel patterns likely corresponds with increased development in the southwest section of Pueblo West near Swallows Rd.

Table IP-5 shows that turning movements at US 50 and West McCulloch Blvd. during the morning peak hour are relatively unaffected by the completion of the Pueblo Blvd. Extension. However, completion of the West Pueblo Connector results in fewer eastbound through, westbound through, and northbound right movements. Not only does the West Pueblo Connector create an alternative route to US 50 between Purcell Blvd. and Pueblo Blvd. but it also encourages Pueblo West residents who live south of US 50 to use arterial streets within the metro district to reach the West Pueblo Connector.

Table IP-5. Forecasted Morning Peak Hour Turning Movements at US 50 and West McCulloch Blvd.

	Eastbound		Westbound		Northbound	
Year	Through	Right	Left	Through	Left	Right
Demand with Phased Improvements to US 50						
2009	300	95	15	330	50	440
2011	370	120	15	370	55	550
2013	360	100	35	380	50	510
2015	400	100	45	410	45	550
2017	440	110	60	430	45	590
2019	480	110	70	470	45	630
2021	520	110	80	490	45	660
2023	550	110	95	520	45	700
2025	590	120	110	550	45	740
2027	630	120	120	580	45	770
Demand with Pueblo Blvd. Extension						
2027	660	110	180	610	45	780
2029	700	120	190	650	45	820
2031	740	120	210	680	40	860
2033	780	120	230	710	40	890
2035	820	120	250	740	40	930
Demand with Pueblo Blvd. Extension and West Pueblo Connector						
2033	720	130	160	620	40	850
2035	760	130	170	650	40	880

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-6 shows that westbound left turning vehicles are currently the heaviest movement at US 50 and West McCulloch Blvd. during the evening rush hour, but westbound through traffic will soon outnumber the westbound left movement. **Table IP-6** shows a noticeable jump in westbound traffic following completion of the Pueblo Blvd. Extension. However, these forecasts are more of a result of the demand scenario that includes six lanes on US 50 east of Main McCulloch Blvd. Similarly, forecasts show that completion of the West Pueblo Connector is expected to draw traffic off US 50 during the morning rush hour.

Table IP-6. Forecasted Evening Peak Hour Turning Movements at US 50 and West McCulloch Blvd.

	Eastbound		Westbound		Northbound	
Year	Through	Right	Left	Through	Left	Right
Demand with Phased Improvements to US 50						
2009	320	40	430	400	10	160
2011	350	45	470	450	10	170
2013	370	40	500	510	10	200
2015	400	40	550	570	10	220
2017	420	40	590	620	10	230
2019	450	35	640	690	10	250
2021	480	35	680	740	10	270

	Eastbound		Westbound		Northbound	
Year	Through	Right	Left	Through	Left	Right
2023	500	35	720	800	10	290
2025	530	35	770	860	10	310
2027	550	30	810	910	10	330
Demand with Pueblo Blvd. Extension						
2027	580	20	920	1,100	10	370
2029	610	15	980	1,160	10	390
2031	640	15	1,040	1,240	10	420
2033	670	10	1,100	1,320	10	440
2035	700	10	1,140	1,400	10	460
Demand with Pueblo Blvd. Extension and West Pueblo Connector						
2033	580	20	930	1,120	10	410
2035	600	20	970	1,180	10	430

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Main McCulloch Blvd.

Table IP-7 shows that the heaviest movement at US 50 and Main McCulloch Blvd. during the morning rush hour is the northbound right turn to eastbound US 50. This movement is expected to be surpassed by eastbound through traffic by 2025, as more parcels in the western areas of Pueblo West are developed. The increased northbound through traffic occurring with completion of the Pueblo Blvd. Extension is likely destined to Platteville Blvd., which was assumed to be improved in conjunction with the Pueblo Blvd. Extension. A smaller reverse pattern is also noticeable: With the Pueblo Blvd. Extension, westbound left traffic decreases, while southbound through traffic increases, as more people use Platteville Blvd. as an alternate route to US 50. With the West Pueblo Connector completed and serving as a third alternate route, some of the Platteville Blvd. traffic returns to US 50, which is shown by decreasing southbound through traffic and increased westbound left traffic.

Table IP-8 shows that during the evening rush hour, westbound left-turning vehicles outnumber westbound through vehicles at the Main McCulloch Blvd. intersection until 2013, again consistent with continuing development farther west. With the Pueblo Blvd. Extension and improvements to US 50 assumed at the same time, about 260 vehicles change from making their left turn at Main McCulloch Blvd. to West McCulloch Blvd. or Swallows Rd., even though the improved part of US 50 is east of Main McCulloch Blvd. As expected, completing the West Pueblo Connector reduces eastbound and westbound through traffic here. At the same time, westbound left traffic increases—many of these vehicles used to turn left at Purcell Blvd. Also note that northbound and southbound through volumes drop after the West Pueblo Connector is built as some drivers switch to Pueblo Blvd. and the Joe Martinez Blvd. Extension.

Purcell Blvd.

Table IP-9 shows that eastbound through traffic dominates the morning rush hour at the US 50 and Purcell Blvd. intersection and will continue to do so for the foreseeable future. As expected, the West Pueblo Connector results in a decline of westbound left and northbound right traffic, as people switch to the new alternate route. The West Pueblo Connector has a more modest effect on

US 50 through traffic. If completed in 2033, the Joe Martinez Blvd. Extension would result in just under a 6 percent reduction to eastbound through traffic.

The evening peak hour turning movements shown in **Table IP-10** mirror those of the morning rush hour in **Table IP-9**: Westbound through traffic is and will continue to be the heaviest movement. Completion of each local improvement project results in lower westbound left volumes as traffic continues farther west before entering the metro district or—in the case of the West Pueblo Connector—diverts to a southern alternate route. Interestingly, the West Pueblo Connector has little impact on US 50 through traffic at Purcell Blvd. Reductions by drivers switching to the Joe Martinez Blvd. Extension are offset by other people driving longer distances on US 50.

Pueblo Blvd.

Table IP-11 shows that, as expected, eastbound through traffic is the heaviest movement at US 50 and Pueblo Blvd. (SH 45) during the morning peak hour. The eastbound right turn to southbound Pueblo Blvd. is currently the second heaviest movement and remains so until 2019, when westbound through traffic volumes move into second place. The ranking changes with the completion of the Pueblo Blvd. Extension in 2027, when northbound through traffic becomes the second heaviest movement. At this point, westbound through traffic volumes drop as cars from I-25 switch to using Platteville Blvd. and the Pueblo Blvd. Extension (making the southbound right turn) instead of driving through the commercial section of US 50. Volumes of most movements in the intersection drop once the West Pueblo Connector is built, as some traffic moves south to that alternate route.

Table IP-7. Forecasted Morning Peak Hour Turning Movements at US 50 and Main McCulloch Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	120	700	45	230	270	45	75	330	840	45	190	80
2011	150	860	55	260	310	50	90	390	1,040	55	230	90
2013	170	810	45	270	290	55	75	470	910	55	280	120
2015	180	880	45	300	310	65	70	520	960	110	310	140
2017	200	940	40	330	320	70	70	590	1,000	130	350	160
2019	220	1,020	40	370	350	90	65	630	1,060	200	370	180
2021	240	1,080	40	390	360	100	65	690	1,100	230	400	200
2023	250	1,140	40	420	380	110	60	750	1,140	260	440	220
2025	270	1,200	35	450	390	120	60	810	1,180	290	470	240
2027	290	1,280	35	480	410	130	55	860	1,240	340	510	260
Demand with Pueblo Blvd. Extension												
2027	150	1,440	35	380	550	70	55	1,120	1,180	220	650	180
2029	160	1,520	35	390	590	70	55	1,200	1,200	240	700	190
2031	160	1,600	35	410	620	75	50	1,280	1,240	260	750	210
2033	160	1,680	35	430	650	80	50	1,380	1,280	270	810	220
2035	170	1,760	30	440	680	80	45	1,460	1,320	290	860	230
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	330	1,440	30	580	460	95	50	940	1,300	470	580	290
2035	340	1,500	25	610	481	100	50	990	1,340	500	610	310

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-8. Forecasted Evening Peak Hour Turning Movements at US 50 and Main McCulloch Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	75	350	85	650	560	140	45	300	360	70	480	120
2011	80	370	90	720	620	150	50	320	390	75	520	140
2013	140	400	85	700	700	150	50	360	390	110	630	160
2015	170	430	80	760	790	180	50	380	420	170	640	170
2017	200	460	80	790	860	190	50	410	440	200	700	190
2019	220	500	75	870	960	220	50	420	480	270	670	190
2021	250	530	75	910	1,040	240	50	450	500	310	710	210
2023	280	560	70	960	1,120	260	55	480	520	350	750	220
2025	310	590	70	1,000	1,200	270	55	500	550	390	790	240
2027	340	620	65	1,060	1,300	300	55	520	570	440	810	250
Demand with Pueblo Blvd. Extension												
2027	200	720	110	800	1,560	230	35	590	600	160	810	250
2029	210	760	110	820	1,680	240	35	620	630	170	850	270
2031	220	800	120	830	1,780	240	35	660	650	180	890	280
2033	240	850	120	850	1,900	250	35	690	680	190	930	300
2035	250	890	120	870	2,000	260	35	720	710	200	960	310
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	420	710	45	1,200	1,580	250	55	590	670	520	600	260
2035	440	740	40	1,260	1,660	260	55	610	711	560	610	270

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-9. Forecasted Morning Peak Hour Turning Movements at US 50 and Purcell Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	150	1,500	30	270	450	300	45	370	840	290	160	50
2011	180	1,860	40	310	510	350	50	440	1,040	350	190	55
2013	220	1,660	30	290	500	430	45	420	910	360	190	60
2015	250	1,780	30	290	550	500	45	450	940	390	210	65
2017	280	1,880	30	300	580	560	45	470	970	420	230	75
2019	320	2,040	30	290	650	620	50	510	990	450	250	80
2021	350	2,140	30	300	690	680	50	530	1,020	480	260	85
2023	390	2,260	30	300	730	740	50	560	1,040	510	280	95
2025	420	2,360	30	310	760	810	50	590	1,080	550	300	100
2027	450	2,480	35	310	810	870	50	620	1,100	580	310	110
Demand with Pueblo Blvd. Extension												
2027	450	2,540	30	260	790	850	40	720	1,040	480	380	100
2029	480	2,640	30	260	830	910	40	760	1,080	500	410	110
2031	520	2,760	30	260	870	970	40	800	1,100	520	430	120
2033	550	2,880	35	260	900	1,020	40	840	1,120	540	450	120
2035	580	2,980	35	250	940	1,080	40	880	1,140	560	480	130
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	550	2,720	35	85	870	1,060	50	840	860	580	460	130
2035	580	2,820	40	70	900	1,120	50	880	860	610	480	140

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-10. Forecasted Evening Peak Hour Turning Movements at US 50 and Purcell Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	95	630	25	760	1,300	130	30	150	430	360	360	95
2011	100	680	30	850	1,440	150	30	160	450	390	400	100
2013	110	730	30	830	1,440	230	25	170	450	530	400	120
2015	110	830	40	840	1,580	270	25	180	460	580	420	150
2017	120	890	45	860	1,660	320	25	200	470	660	440	170
2019	130	1,020	65	860	1,820	370	30	210	480	690	460	210
2021	140	1,100	70	870	1,940	410	30	230	490	750	480	230
2023	140	1,160	80	890	2,050	460	30	240	500	820	500	260
2025	150	1,240	85	910	2,150	510	30	250	510	880	510	280
2027	160	1,340	95	920	2,250	550	30	270	510	940	530	310
Demand with Pueblo Blvd. Extension												
2027	160	1,240	35	780	2,300	520	30	300	440	950	660	230
2029	160	1,320	35	780	2,400	560	35	320	440	1,020	690	240
2031	170	1,380	35	780	2,550	610	35	340	440	1,080	720	260
2033	180	1,440	40	780	2,650	650	35	350	440	1,140	750	270
2035	180	1,520	40	780	2,750	690	35	370	440	1,220	790	280
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	180	1,520	150	460	2,600	700	35	350	260	1,120	710	380
2035	190	1,600	160	430	2,700	750	35	370	240	1,180	740	400

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-11. Forecasted Morning Peak Hour Turning Movements at US 50 and Pueblo Blvd.

		Eastbound			Westbound			Northbound			Southbound		
Year	Dir	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50													
2009	EB	1	1,600	910	-	-	-	-	450	400	65	450	-
	WB	-	-	-	370	630	10	430	15	-	-	150	5
2011	EB	1	1,960	1,120	-	-	-	-	530	490	80	530	-
	WB	-	-	-	420	720	15	490	20	-	-	170	6
2013	EB	5	1,840	980	-	-	-	-	590	430	80	520	-
	WB	-	-	-	410	750	35	510	110	-	-	210	10
2015	EB	8	2,000	990	-	-	-	-	660	450	85	560	-
	WB	-	-	-	430	840	45	520	170	-	-	240	15
2017	EB	10	2,150	1,020	-	-	-	-	720	460	90	590	-
	WB	-	-	-	450	910	55	550	220	-	-	270	20
2019	EB	15	2,350	1,020	-	-	-	-	780	450	85	630	-
	WB	-	-	-	470	1,020	55	550	280	-	-	290	20
2021	EB	15	2,500	1,040	-	-	-	-	840	500	90	670	-
	WB	-	-	-	490	1,100	65	570	340	-	-	320	25
2023	EB	20	2,650	1,060	-	-	-	-	910	520	95	710	-
	WB	-	-	-	510	1,180	75	600	390	-	-	350	30
2025	EB	20	2,800	1,080	-	-	-	-	970	540	100	750	-
	WB	-	-	-	530	1,260	85	620	440	-	-	380	30
2027	EB	25	3,000	1,100	-	-	-	-	1,040	560	100	780	-
	WB	-	-	-	550	1,340	90	640	500	-	-	400	35
Demand with Pueblo Blvd. Extension													
2027	Both	250	2,500	1,080	460	1,180	65	510	1,740	400	35	940	550
2029	Both	280	2,600	1,100	470	1,240	70	510	1,920	410	30	1,040	610
2031	Both	310	2,700	1,120	480	1,300	75	520	2,100	410	30	1,140	670
2033	Both	340	2,800	1,140	490	1,360	85	530	2,300	410	25	1,240	730
2035	Both	360	2,900	1,160	500	1,400	90	540	2,500	410	20	1,320	790
Demand with Pueblo Blvd. Extension and West Pueblo Connector													
2033	Both	330	2,600	940	440	1,280	85	370	2,250	430	25	1,160	740
2035	Both	360	2,650	940	450	1,340	90	370	2,450	430	25	1,240	810

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011
Note: - Indicates turning movements that are not possible with the existing split intersection configuration.
Abbreviations: EB = eastbound WB = westbound

Table IP-12 shows the evening rush hour traffic volumes at US 50 and Pueblo Blvd., where westbound through traffic is currently the heaviest movement, followed by eastbound through traffic. This pattern continues until the Pueblo Blvd. Extension is built, when Pueblo Blvd. through volumes rise dramatically (more than double for southbound through traffic). At the same time, US 50 through volumes decline, so the ranking with the Pueblo Blvd. Extension in place becomes southbound through traffic, then westbound through traffic, then northbound through traffic, with eastbound through traffic in fourth place. As with the morning rush hour, the West Pueblo Connector generally reduces traffic volumes here.

It is interesting to note that while volumes to and from Wildhorse Rd. to the north of US 50 are small today (at most about 150 vehicles per hour), these volumes would increase in response to development in the northern part of Pueblo West to as much as 800 vehicles per hour in 2027, before completion of the Pueblo Blvd. Extension.

Another interesting pattern is that traffic on US 50 is relatively balanced between the two peaks—about the same number of cars going east in the morning return west in the evening, and similarly for the less dominant through movement. While Pueblo Blvd. traffic is more northbound in the morning and southbound in the evening, both directions have higher volumes during the evening peak hour. Increased traffic on Pueblo Blvd. during the evening rush hour may result from greater congestion on I-25.

Wills Blvd.

Table IP-13 for the morning peak hour and **Table IP-14** for the evening peak hour show that the US 50 through movements are the dominant travel at the Wills Blvd. intersection, with side street movements never more than 200 vehicles per hour. The eastbound left and right turns are two heavy morning movements, likely representing Pueblo West residents headed to the commercial area along US 50. A third important morning movement is the southbound right turn from residents of the neighborhood north of US 50. The reverse patterns can be seen in the evening when the eastbound left, northbound left, and southbound right are the most important turning movements.

The most noticeable impact of the Pueblo Blvd. Extension and West Pueblo Connector is to reduce through volumes on US 50. The Pueblo Blvd. Extension also has a more subtle impact by reducing the eastbound left and southbound right turning volumes. This effect likely results from the new alternate route for the neighborhood north of US 50 that is provided by the Eagleridge Blvd. Extension and the Pueblo Blvd. Extension.

Table IP-12. Forecasted Evening Peak Hour Turning Movements at US 50 and Pueblo Blvd.

		Eastbound			Westbound			Northbound			Southbound		
Year	Dir	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50													
2009	EB	3	850	670	-	-	-	-	830	370	45	590	-
	WB	-	-	-	550	1,640	80	760	70	-	-	85	2
2011	EB	3	900	710	-	-	-	-	900	390	50	640	-
	WB	-	-	-	610	1,820	90	850	75	-	-	90	2
2013	EB	6	990	800	-	-	-	-	960	400	95	660	-
	WB	-	-	-	550	1,880	120	830	180	-	-	240	5
2015	EB	8	1,100	830	-	-	-	-	1,020	410	110	710	-
	WB	-	-	-	560	2,050	120	830	240	-	-	320	8
2017	EB	10	1,180	890	-	-	-	-	1,080	420	130	760	-
	WB	-	-	-	570	2,200	130	860	300	-	-	400	8
2019	EB	10	1,320	900	-	-	-	-	1,120	430	130	820	-
	WB	-	-	-	580	2,400	130	840	380	-	-	480	10
2021	EB	15	1,400	950	-	-	-	-	1,180	440	150	870	-
	WB	-	-	-	590	2,550	140	860	440	-	-	550	10
2023	EB	15	1,500	1,000	-	-	-	-	1,220	450	170	920	-
	WB	-	-	-	590	2,700	150	870	500	-	-	630	15
2025	EB	15	1,600	1,040	-	-	-	-	1,280	460	180	960	-
	WB	-	-	-	600	2,850	160	890	570	-	-	710	15
2027	EB	15	1,700	1,080	-	-	-	-	1,340	470	200	1,020	-
	WB	-	-	-	610	3,000	170	900	630	-	-	790	15
Demand with Pueblo Blvd. Extension													
2027	Both	300	1,080	960	450	2,550	100	790	2,100	360	120	2,800	250
2029	Both	330	1,120	990	440	2,650	100	790	2,350	360	130	3,100	280
2031	Both	360	1,140	1,020	430	2,750	100	800	2,550	350	140	3,400	300
2033	Both	400	1,160	1,060	420	2,850	110	800	2,800	350	150	3,700	330
2035	Both	430	1,200	1,080	410	2,950	110	800	3,000	350	160	4,000	360
Demand with Pueblo Blvd. Extension and West Pueblo Connector													
2033	Both	390	1,540	870	430	2,650	120	630	2,800	330	120	3,650	360
2035	Both	420	1,600	890	420	2,750	120	620	3,000	320	130	3,950	390

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011
Note: - Indicates turning movements that are not possible with the existing split intersection configuration.
Abbreviations: EB = eastbound WB = westbound

Table IP-13. Forecasted Morning Peak Hour Turning Movements at US 50 and Wills Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	55	1,540	45	15	660	15	8	8	8	35	10	40
2011	65	1,900	55	20	760	15	10	8	10	45	10	45
2013	70	1,740	50	15	800	15	10	10	8	40	10	55
2015	85	1,860	60	20	890	15	15	10	8	40	8	65
2017	95	1,960	60	20	960	15	15	10	10	40	8	75
2019	110	2,100	70	20	1,060	20	15	10	10	40	8	85
2021	120	2,250	75	20	1,140	20	20	10	10	40	6	90
2023	130	2,350	80	20	1,220	20	20	10	10	40	5	100
2025	140	2,450	85	20	1,300	20	20	15	10	45	5	110
2027	150	2,600	90	20	1,380	20	25	15	10	45	4	120
Demand with Pueblo Blvd. Extension												
2027	110	2,050	70	20	1,160	20	30	15	15	45	15	85
2029	110	2,150	75	25	1,220	25	30	15	20	45	15	90
2031	120	2,200	80	25	1,280	25	35	15	20	45	20	95
2033	120	2,250	80	25	1,340	25	35	20	20	45	20	100
2035	130	2,300	85	25	1,380	25	40	20	20	45	20	110
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	140	2,100	75	25	1,240	25	35	25	10	45	15	100
2035	150	2,150	80	25	1,280	25	40	30	15	45	15	110

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-14. Forecasted Evening Peak Hour Turning Movements at US 50 and Wills Blvd.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	60	1,180	15	25	1,920	40	55	2	25	25	8	85
2011	65	1,260	15	25	2,150	45	60	2	25	30	8	95
2013	80	1,360	15	25	2,150	45	55	2	25	25	8	100
2015	90	1,480	20	30	2,300	45	60	2	30	30	8	110
2017	100	1,580	20	30	2,450	45	60	1	30	30	8	120
2019	110	1,720	20	35	2,650	50	65	1	30	30	10	130
2021	120	1,820	25	35	2,750	50	70	1	30	30	10	140
2023	130	1,920	25	35	2,900	50	70	1	30	30	10	150
2025	140	2,050	25	40	3,050	55	75	1	35	30	10	160
2027	150	2,150	30	40	3,200	55	75	1	35	35	10	170
Demand with Pueblo Blvd. Extension												
2027	110	1,660	35	40	2,600	55	60	3	40	35	15	130
2029	120	1,720	35	40	2,700	55	60	3	45	35	15	130
2031	120	1,780	35	45	2,750	60	60	3	45	40	15	140
2033	130	1,820	40	45	2,850	60	60	3	45	40	15	140
2035	130	1,880	40	45	2,900	60	60	3	50	40	15	150
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2033	130	1,800	40	45	2,700	60	60	6	40	35	20	150
2035	130	1,840	40	45	2,750	60	60	6	40	35	20	160

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Baltimore Ave.

Table IP-15 shows that at the Baltimore Ave. intersection, as at the Wills Blvd. intersection, eastbound through traffic is the heaviest movement during the morning rush hour, followed by westbound through traffic. However, volumes to and from Baltimore Ave. are higher than those to and from Wills Blvd. Two currently heavy turning movements are the eastbound right and the westbound left, both to southbound Baltimore Ave. These vehicles may be going to Centennial High School. The northbound right movement is expected to grow in the future, possibly with more activity in the neighborhood south of US 50.

As expected, the Pueblo Blvd. Extension and West Pueblo Connector result in declines to the through traffic volumes on US 50. Interestingly, the Pueblo Blvd. Extension results in growth to the westbound left, westbound right, northbound right, and southbound left turning movements. An explanation for this growth may be that with longer distance through traffic diverting to the Pueblo Blvd. Extension and Platteville Blvd., residents on either side of US 50 here who had been using parallel roads such as Fortino Blvd. or 29th St. may switch to using US 50 now that it is less congested.

Table IP-16 shows the expected pattern of a heavy westbound through movement at Baltimore Ave. during the evening rush hour, with eastbound through traffic being the other dominant movement. The northbound left and right turns are the heaviest movements to and from Baltimore Ave., and they mirror the traffic destined to Centennial High School in the morning. Movements expected to grow in the future are the westbound left—the reverse direction of the northbound right movement expected to grow during the morning rush hour—and the southbound left.

As was seen with the morning rush hour, completion of the Pueblo Blvd. Extension results in more turning travel between Baltimore Ave. and locations to the east. Both the Pueblo Blvd. Extension and West Pueblo Connector reduce evening peak hour through volumes on US 50.

7. How do we know when we need the Pueblo Blvd. Extension and the West Pueblo Connector?

The LOS at US 50 and Baltimore Ave. drives the need for the Pueblo Blvd. Extension and West Pueblo Connector. (These two local improvements are described briefly in **Chapter 1, Section 1.7,** of the PEL Study. The Pueblo Blvd. Extension is described in more detail in the *Preferred Alternative, Eden Interchange/Pueblo Boulevard Feasibility Study* prepared for CDOT in 1999 by Kimley-Horn and Associates.) The Preferred Alternative acknowledges the benefits of the Pueblo Blvd. Extension and West Pueblo Connector in allowing continued use of signalized intersections at Wills Blvd. and Baltimore Ave., and, therefore, avoiding the need for more expansive intersection options involving grade separation where ROW is limited. The Baltimore Ave. intersection has higher turning volumes than Wills Blvd., as can be seen by comparing **Table IP-15** against **Table IP-13** and **Table IP-16** against **Table IP-14**. Therefore, LOS at Baltimore Ave. would fail the Purpose and Need criteria before it does so at Wills Blvd., indicating the benefit that would occur from congestion relief from the local improvement projects.

Table IP-15. Forecasted Morning Peak Hour Turning Movements at US 50 and Baltimore Ave.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	40	1,740	210	180	860	60	80	55	140	50	110	15
2011	50	2,150	260	210	970	70	90	65	170	60	130	15
2013	35	1,940	220	200	1,000	80	75	70	180	45	140	15
2015	35	2,100	230	200	1,080	90	110	75	190	45	150	15
2017	35	2,200	230	210	1,160	100	110	80	210	45	160	15
2019	35	2,400	240	210	1,260	110	130	85	210	40	170	15
2021	30	2,500	240	210	1,340	120	140	90	230	40	180	15
2023	30	2,650	250	220	1,420	130	150	100	240	35	200	15
2025	30	2,750	250	220	1,500	140	160	100	260	35	210	15
2027	30	2,900	260	220	1,600	150	170	110	270	35	220	10
Demand with Pueblo Blvd. Extension												
2027	30	2,300	280	270	1,360	170	150	90	320	65	180	10
2029	30	2,350	280	280	1,420	180	160	95	340	65	180	10
2031	25	2,450	290	290	1,460	190	170	100	360	70	190	10
2033	25	2,500	300	300	1,520	200	180	100	380	70	200	10
2035	25	2,550	300	310	1,580	210	190	110	400	70	200	10
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2029	30	2,250	260	270	1,340	180	150	100	350	70	180	10
2031	25	2,300	270	270	1,380	190	150	110	370	70	190	10
2033	25	2,350	270	280	1,440	200	160	110	390	75	200	10
2035	25	2,400	280	290	1,480	210	160	110	410	75	200	10

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

Table IP-16. Forecasted Evening Peak Hour Turning Movements at US 50 and Baltimore Ave.

	Eastbound			Westbound			Northbound			Southbound		
Year	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
Demand with Phased Improvements to US 50												
2009	50	1,220	75	150	2,050	80	110	45	130	90	50	35
2011	55	1,300	80	170	2,300	90	130	50	140	100	50	35
2013	55	1,420	90	180	2,300	85	120	55	150	120	60	35
2015	55	1,540	110	180	2,450	85	130	60	160	140	70	35
2017	55	1,640	120	200	2,600	85	130	65	170	150	75	35
2019	55	1,760	130	200	2,750	85	140	70	180	170	85	40
2021	55	1,860	150	200	2,900	85	150	75	190	180	90	40
2023	60	1,980	160	210	3,050	85	150	80	200	200	100	40
2025	60	2,100	170	220	3,200	90	160	85	210	210	110	40
2027	60	2,200	190	230	3,350	90	170	90	210	220	110	45
Demand with Pueblo Blvd. Extension												
2027	55	1,720	150	300	2,700	120	200	90	220	250	100	45
2029	55	1,780	160	320	2,750	120	210	95	240	270	110	45
2031	55	1,820	170	340	2,800	130	220	100	250	290	110	45
2033	60	1,880	180	350	2,900	130	220	110	260	310	120	45
2035	60	1,940	190	370	3,000	140	230	110	270	320	120	45
Demand with Pueblo Blvd. Extension and West Pueblo Connector												
2029	55	1,740	180	300	2,650	130	170	70	240	270	110	45
2031	60	1,780	190	310	2,700	130	180	70	250	280	120	45
2033	60	1,840	200	330	2,750	140	190	75	260	300	120	45
2035	60	1,880	210	340	2,800	140	190	75	270	320	130	45

Sources: CDOT, 2009, 2010, 2011; JFSA, 2011

8. What is the traffic need at the US 50 intersections and what short-term improvements can be made to address those needs?

This section presents current and future LOS estimates for the intersections along the US 50 Corridor. The intersections are discussed in order moving east through the Corridor, from Swallows Rd. to Baltimore Ave. Within each section for a particular intersection, the tables indicate when the local improvement projects, the Pueblo Blvd. Extension and the West Pueblo Connector, are in place. Because the timing of these projects are related to the LOS at Baltimore Ave., interested readers may want to skip ahead to that section.

Each section presents a series of LOS tables for the intersection being discussed. The first table always addresses the existing configuration of the intersection. The table goes into the future only until the LOS criteria from the study Purpose and Need are no longer met. The text will discuss why traffic operations no longer meet the Purpose and Need criteria and present a possible remedy. Another LOS table starts from the last year of the previous table and goes to 2035 or until that proposed intersection configuration no longer satisfies the Purpose and Need. The process continues until the Preferred Alternative is built at that location.

The Purpose and Need criteria for signalized intersections, based on American Association of State Highway and Transportation Officials (AASHTO) guidance and CDOT practice, are:

- LOS for the intersection as a whole should be D or better.
- LOS for any turning movement from US 50 should be E or better.
- LOS for any crossing street approach should be E or better.

Criteria for unsignalized intersections are similar, although there is no overall intersection LOS defined for an unsignalized intersection. LOS for unsignalized intersections is defined for individual turning movements and is shown with lower-case letters.

Swallows Rd.

The intersection of US 50 and Swallows Rd. is currently an unsignalized three-leg or T intersection. Swallows Rd. has two lanes, so the northbound left and right turn movements share the same lane. **Table IP-17** shows the LOS of the current Swallows Rd. intersection for the next few years. The year being considered is given in the leftmost column. Then three columns address the morning peak hour, followed by three columns addressing the evening peak hour. The first two of the three columns are LOS measures for certain turning movements—westbound left and the shared northbound left and right. Because the eastbound right turn is relatively free flowing, its LOS is not shown in **Table IP-17**. The third of the three columns for each peak hour is the average intersection delay in seconds for all movements, including the US 50 through movements.

Table IP-17 shows that during either rush hour, the westbound left turn experiences relatively good LOS, since it must yield only to eastbound through traffic. LOS for the shared northbound approach is currently at "b" and "c," but worsens to "e" and "f" by 2027. Northbound left-turning traffic must yield to eastbound and westbound through traffic, as well as to westbound left-turning vehicles. Northbound right-turning vehicles must yield to eastbound through traffic but must also wait behind any northbound left-turning vehicles at the intersection. The northbound approach LOS shows more delay during the evening rush hour, when there are more westbound through and left-turning vehicles.

Table IP-17. Traffic Operations of Existing Configuration at Swallows Rd.

Year	Morning Peak Hour LOS		Average Morning Peak Hour Intersection Delay (s)	Evening Peak Hour LOS		Average Evening Peak Hour Intersection Delay (s)
	Westbound Left	Northbound Left & Right		Westbound Left	Northbound Left & Right	
2011	a	c	1.7	a	b	1.2
2013	a	b	1.9	a	b	1.5
2015	a	c	2.2	a	c	1.9
2017	a	c	2.5	a	c	2.2
2019	a	c	3.0	a	c	2.7
2021	a	c	3.4	a	d	3.2
2023	a	c	4.0	a	d	3.8
2025	a	d	4.7	a	**e**	4.8
Pueblo Blvd. Extension Built by 2027						
2027	a	**e**	7.0	b	**f**	25.3

Source: JFSA, 2011

Notes: LOS at unsignalized intersections is defined only for individual movements and is designated with a lowercase letter. Average intersection delay is calculated including through vehicles on US 50, which experience no delay.
Bold red text indicates operations inconsistent with the study Purpose and Need.

The *Manual on Uniform Traffic Control Devices* (2009) describes eight situations called *warrants* that indicate when traffic signals are justified. Some relate to safety considerations or pedestrian volumes. One, Warrant 3, considers traffic during the peak hour and so it is quite relevant to the LOS discussion here. Warrant 3 may be met in a couple of ways. One way is based on peak hour turning movements, with criteria that consider whether the intersection has three or four legs and the speed of the major road. Another way is based on the total hours of delay for all vehicles entering the intersection. CDOT typically expects multiple warrants to be met before installing traffic signals.

The US 50 and Swallows Rd. intersection in its current configuration would meet the volume criterion of Warrant 3 in 2019. Both the morning and evening peak hour volumes would meet this criterion. The intersection would meet the delay criterion of Warrant 3 during the evening peak hour of 2027, when the LOS of the Swallows Rd. approach would be "f." However, because installing signals at Swallows Rd. could potentially cause a safety concern with through traffic on US 50 not being used to stopping, the study team proposed another improvement first.

The Phase 1 improvement at US 50 and Swallows Rd. is to widen Swallows Rd. so that the northbound approach has two lanes, one for left turns and one for right turns. A similar improvement was made at US 50 and West McCulloch Blvd. in 2010. This configuration would reduce delays and improve LOS for northbound right-turning vehicles as they would no longer have to wait for northbound left-turning vehicles, which require gaps in both eastbound and westbound US 50 traffic. The right turn from Swallows Rd. could be made free-flowing by providing a sufficiently long acceleration lane on eastbound US 50.

Table IP-18 shows LOS for this Phase 1 configuration . Note that with separate left turn and right turn lanes on Swallows Rd., there are now separate columns for these movements in the table. Note that the northbound left turn reaches LOS "e" during the evening peak hour of 2023, compared to the Swallows Rd. approach of the existing configuration not reaching LOS "e" until the evening peak hour of 2025. This result occurs because the existing configuration essentially averages the

delay and LOS of the northbound left and northbound right movements. The average intersection delay provides a more useful comparison here. During a 2023 evening rush hour, the existing configuration is expected to result in an average of 3.8 seconds of delay (including the through vehicles on US 50, which have no delay), while the Phase 1 configuration would result in an average of 2.8 seconds of delay.

Table IP-18. Unsignalized Traffic Operations with Widened Swallows Rd. Approach

	Morning Peak Hour LOS			Average Morning Peak Hour Intersection Delay (s)	Evening Peak Hour LOS			Average Evening Peak Hour Intersection Delay (s)
Year	West-bound Left	North-bound Left	North-bound Right		West-bound Left	North-bound Left	North-bound Right	
2013	a	c	b	1.7	a	c	a	1.5
2015	a	c	b	2.0	a	c	a	1.8
2017	a	c	b	2.2	a	c	b	2.1
2019	a	c	b	2.3	a	d	b	2.2
2021	a	c	b	2.4	a	d	b	2.5
2023	a	c	b	2.6	a	**e**	b	2.8
2025	a	d	b	3.2	a	**f**	b	4.0
Pueblo Blvd. Extension Built by 2027								
2027	a	**e**	b	3.9	b	**f**	b	13.6
2029	a	**e**	b	4.4	b	**f**	b	21.5
2031	a	**e**	b	5.0	b	**f**	b	33.3
2033	a	**f**	b	5.7	b	**f**	b	**>80**
West Pueblo Connector Built by 2033 or 2035								
2033	a	d	b	3.8	b	**f**	b	14.9
2035	a	**e**	b	4.1	b	**f**	b	21.5

Source: JFSA, 2011

Notes: LOS at unsignalized intersections is defined only for individual movements and is designated with a lowercase letter. Average intersection delay is calculated including through vehicles on US 50, which experience no delay.
Bold red text indicates operations inconsistent with the study Purpose and Need.

During the evening peak hour, the northbound left movement is expected to operate at LOS "f" in 2025, and to continue to do so after the Pueblo Blvd. Extension and West Pueblo Connector are built. The intersection would continue to meet the delay criterion of Warrant 3 during the 2027 evening rush hour.

The northbound left movement is also the most delayed movement during the morning rush hour. In 2027, after the Pueblo Blvd. Extension is completed, the LOS for this movement would be "e" during the morning peak hour. This movement's LOS would fall to "f" in 2033 if the West Pueblo Connector is not completed by then. Completing the West Pueblo Connector would reduce the delay to northbound left-turning vehicles in the morning because of the reduction in westbound left-turning vehicles.

The Phase 2 improvement at US 50 and Swallows Rd. is to install traffic signals. One option that would minimize delay is called a "Florida T," as shown in **Figure IP-4**. With a Florida T, a low barrier separates the westbound left turn from the westbound through traffic. An acceleration lane is provided for northbound left-turning vehicles to merge with westbound through traffic. Traditional signals are provided on the eastbound and northbound approaches, as well as for the westbound left

movement. However, because of the barrier and acceleration lane, westbound through traffic would not have to stop. Instead a signal head with a single green arrow would be shown over each lane of westbound US 50 to help drivers anticipate the signal when they make the return eastbound trip.

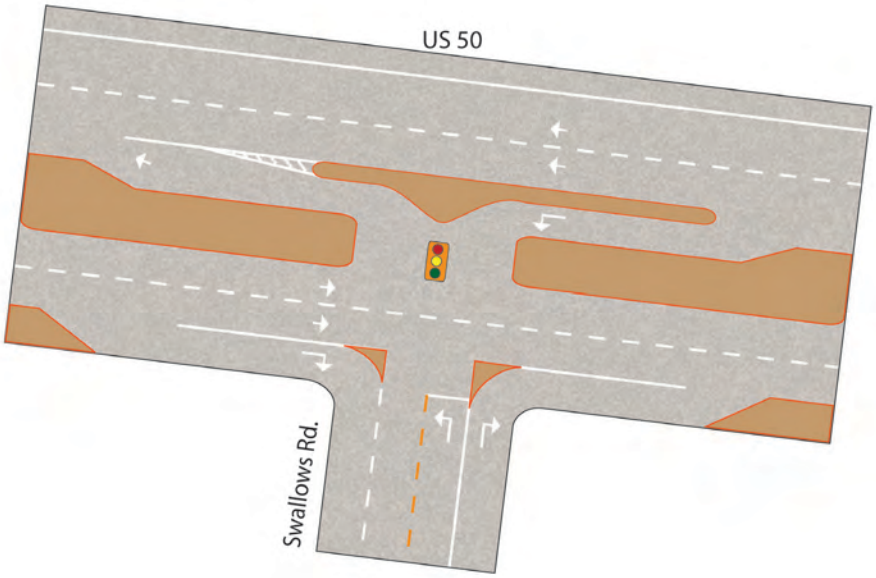


Figure IP-4. Florida T Option for US 50 and Swallows Rd.

Table IP-19 summarizes the anticipated traffic operations of a traditional signalized intersection at US 50 and Swallows Rd. The table contains three columns for each peak hour, corresponding to the three Purpose and Need criteria for the LOS of (1) the intersection as a whole, (2) individual turning and through movements from US 50, and (3) the crossing road approach(es). **Table IP-19** shows that a signalized intersection at US 50 and Swallows Rd. would operate at LOS A during the morning rush hour, and at LOS A or B during the evening rush hour. As mentioned previously, because a Florida T would eliminate the delay to westbound through traffic, the LOS of the Florida T option would be better than what is shown in **Table IP-19**.

Table IP-19. Signalized Traffic Operations with Widened Swallows Rd. Approach

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Is Swallows Rd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Is Swallows Rd. Approach at LOS F?
Pueblo Blvd. Extension Built by 2027						
2027	A	No	No	A	No	No
2029	A	No	No	B	No	No
2031	A	No	No	B	No	No
2033	A	No	No	B	No	No
West Pueblo Connector Built by 2033 or 2035						
2033	A	No	No	A	No	No
2035	A	No	No	B	No	No

Source: JFSA, 2011

Notes: LOS is calculated assuming all movements are signalized. LOS would be further improved using a "Florida T" configuration, in which westbound US 50 through traffic would not stop.
Bold red text (not shown in this table) would indicate operations inconsistent with the study Purpose and Need.

West McCulloch Blvd.

The intersection of US 50 and West McCulloch Blvd. currently has three legs, and West McCulloch Blvd. has four lanes, so separate northbound left turn and right turn lanes are provided. **Table IP-20** shows the LOS of the existing configuration here. The northbound left turn currently operates at LOS "f" during the evening rush hour, though as **Table IP-6** shows, this affects a small number of cars.

Table IP-20. Traffic Operations of Existing US 50 and West McCulloch Blvd. Intersection

	Morning Peak Hour LOS			Average Morning Peak Hour Intersection Delay (s)	Evening Peak Hour LOS			Average Evening Peak Hour Intersection Delay (s)
Year	West-bound Left	North-bound Left	North-bound Right		West-bound Left	North-bound Left	North-bound Right	
2011	a	c	c	9.7	b	**f**	b	5.2
2013	a	c	c	8.4	b	**f**	b	5.9
2015	a	c	d	10.5	b	**f**	b	6.1
2017	a	c	**e**	13.9	b	**f**	b	6.9
2019	a	d	**f**	20.6	b	**f**	b	9.0
2021	a	d	**f**	30.3	c	**f**	b	10.8
2023	a	d	**f**	42.4	c	**f**	b	14.4
2025	a	**e**	**f**	56.5	c	**f**	b	52.4

Source: JFSA, 2011

Notes: LOS at unsignalized intersections is defined only for individual movements and is designated with a lower-case letter. Average intersection delay is calculated including through vehicles on US 50, which experience no delay. Bold red text indicates operations inconsistent with the study Purpose and Need.

Although the northbound right movement is free-flowing here (that is, an acceleration lane is provided), free-flow right turns have a finite capacity related to the ability to merge after making the turn. Because the eastbound through and northbound right movements are both heavy during the morning rush hour, the northbound right movement is expected to reach LOS "e" by 2017 and LOS "f" by 2019. The northbound left movement would reach LOS "e" during the morning peak hour by 2025.

The US 50 and West McCulloch Blvd. intersection currently meets the volume criterion of signal Warrant 3 if northbound right volumes are included. The intersection meets the delay criterion of the warrant during the morning peak hour of 2017. During the evening peak hour, the intersection is expected to meet the delay criterion in 2023 if the northbound right movement is included and in 2025 otherwise.

The sole improvement project here is to convert US 50 and West McCulloch Blvd. to a signalized intersection, which completes the Preferred Alternative here. As with the Swallows Rd. intersection, building a Florida T is also an option here. **Table IP-21** shows that the signalized intersection would continue to meet the Purpose and Need criteria through 2035. The LOS would be A during the morning peak hour and would range from A to C during the evening peak hour. The evening peak hour LOS would be C starting in 2029 until the West Pueblo Connector is built.

Table IP-21. Traffic Operations of Signalized US 50 and West McCulloch Blvd. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Is West McCulloch Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Is West McCulloch Blvd. Approach at LOS F?
2013	A	No	No	A	No	No
2015	A	No	No	A	No	No
2017	A	No	No	A	No	No
2019	A	No	No	A	No	No
2021	A	No	No	B	No	No
2023	A	No	No	B	No	No
2025	A	No	No	B	No	No
Pueblo Blvd. Extension Built by 2027						
2027	A	No	No	B	No	No
2029	A	No	No	C	No	No
2031	A	No	No	C	No	No
2033	A	No	No	C	No	No
West Pueblo Connector Built by 2033 or 2035						
2033	A	No	No	B	No	No
2035	A	No	No	B	No	No

Source: JFSA, 2011

Notes: LOS is calculated assuming all movements are signalized. LOS would be further improved using a "Florida T" configuration, in which westbound US 50 through traffic would not stop.
Bold red text (not shown in this table) would indicate operations inconsistent with the study Purpose and Need.

Main McCulloch Blvd.

The signalized intersection at US 50 and Main McCulloch Blvd. currently operates at LOS C during both peak hours, as shown in **Table IP-22**. The LOS is expected to fall to D in 2021 for the morning rush hour and in 2023 for the evening rush hour. In 2025, the morning peak hour LOS is expected to fall to E, no longer meeting the Purpose and Need criteria. At this point, the eastbound through movement and the westbound left turn are expected to operate at LOS F. Because these two movements conflict (that is, they cannot both be shown a green signal at the same time), the only way to improve their LOS would be to give them more green time by either taking it from the Main McCulloch Blvd. approaches or by using a longer cycle (the series of green signals to serve all the movements at the intersection). Either option worsens the LOS for other movements.

Table IP-22. Traffic Operations of Existing US 50 and Main McCulloch Blvd. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?
2011	C	No	No	C	No	No
2013	C	No	No	C	No	No
2015	C	No	No	C	No	No
2017	C	No	No	C	No	No
2019	C	No	No	C	No	No
2021	D	No	No	C	No	No
2023	D	No	No	D	No	No
2025	**E**	**Yes**	No	D	No	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Phase 1: Six-Lane US 50 and Single-Quadrant Jughandle

The Phase 1 improvement at US 50 and Main McCulloch Blvd. addresses the need for more eastbound through and westbound left capacity by widening US 50 to six lanes and providing a jughandle in the northeast quadrant. This phase also reallocates the left turn bays on Main McCulloch Blvd. into a single left turn lane for either direction, and a third southbound through lane, shown in **Figure IP-5**. The figure shows the new lane construction and new lane stripes with yellow lines. The jughandle would ultimately become the exit ramp for the diamond interchange specified here by the Preferred Alternative. Westbound left- and right-turning traffic would use the jughandle to reach Main McCulloch Blvd. Westbound left-turning traffic would continue through the main intersection of US 50 with Main McCulloch Blvd. with the southbound through traffic.

Table IP-23 summarizes traffic operations of the Phase 1 intersection with a jughandle here. In 2025, the LOS of the north (jughandle) intersection is B during either peak hour. The main intersection has an LOS of C during the morning rush hour and D during the evening rush hour. Building the Pueblo Blvd. Extension results in some LOS improvement. However, by 2029, this configuration no longer meets the Purpose and Need because the westbound left turn movement experiences LOS F as it goes through the main intersection with the southbound through traffic.

Table IP-23. Traffic Operations of Phase 1 Main McCulloch Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?
2025	North	B	No	No	B	No	No
	Main	C	No	No	D	No	No
Pueblo Blvd. Extension Built by 2027							
2027	North	A	No	No	B	No	No
	Main	C	No	No	C	No	No
2029	North	A	No	No	B	No	No
	Main	C	No	No	D	**Yes**	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Optional Phase 2: Three-Quadrant Jughandle

Optional Phase 2 at US 50 and Main McCulloch Blvd. builds jughandles in the southwest and southeast quadrants, as shown in **Figure IP-6**. The eastbound left and right turns use the jughandle in the southwest quadrant, while the northbound right and southbound left turns use the jughandle in the southeast quadrant. As with the northeast quadrant jughandle of Phase 1, these jughandles ultimately become ramps for the diamond interchange here.

Table IP-24 summarizes traffic operations for the Phase 2 configuration here. Individual intersections function at LOS A through C until the West Pueblo Connector is built, when the main intersection is expected to operate at LOS E during the evening peak hour. The southbound approach is expected to operate at LOS F; therefore, westbound left-turning vehicles also experience LOS F.

The ability of the Phase 2 configuration to meet the Purpose and Need depends on whether the criteria are interpreted to apply to the three intersections here individually or as a complex. If the criteria should apply to the complex as a whole—as some members of the study team advocated—this phase will not meet the Purpose and Need as long. While the westbound left movement experiences LOS E or better at each of the three intersections, if the delays at the three intersections are summed, it may be sufficient for this movement to reach LOS F as early as 2029. The study team did not conduct the traffic simulations to confirm the delay estimates for the complex as a whole. This issue merely determines whether the final phase configuration—the diamond interchange illustrated in **Figure IP-7**—is needed by 2029 or 2033.

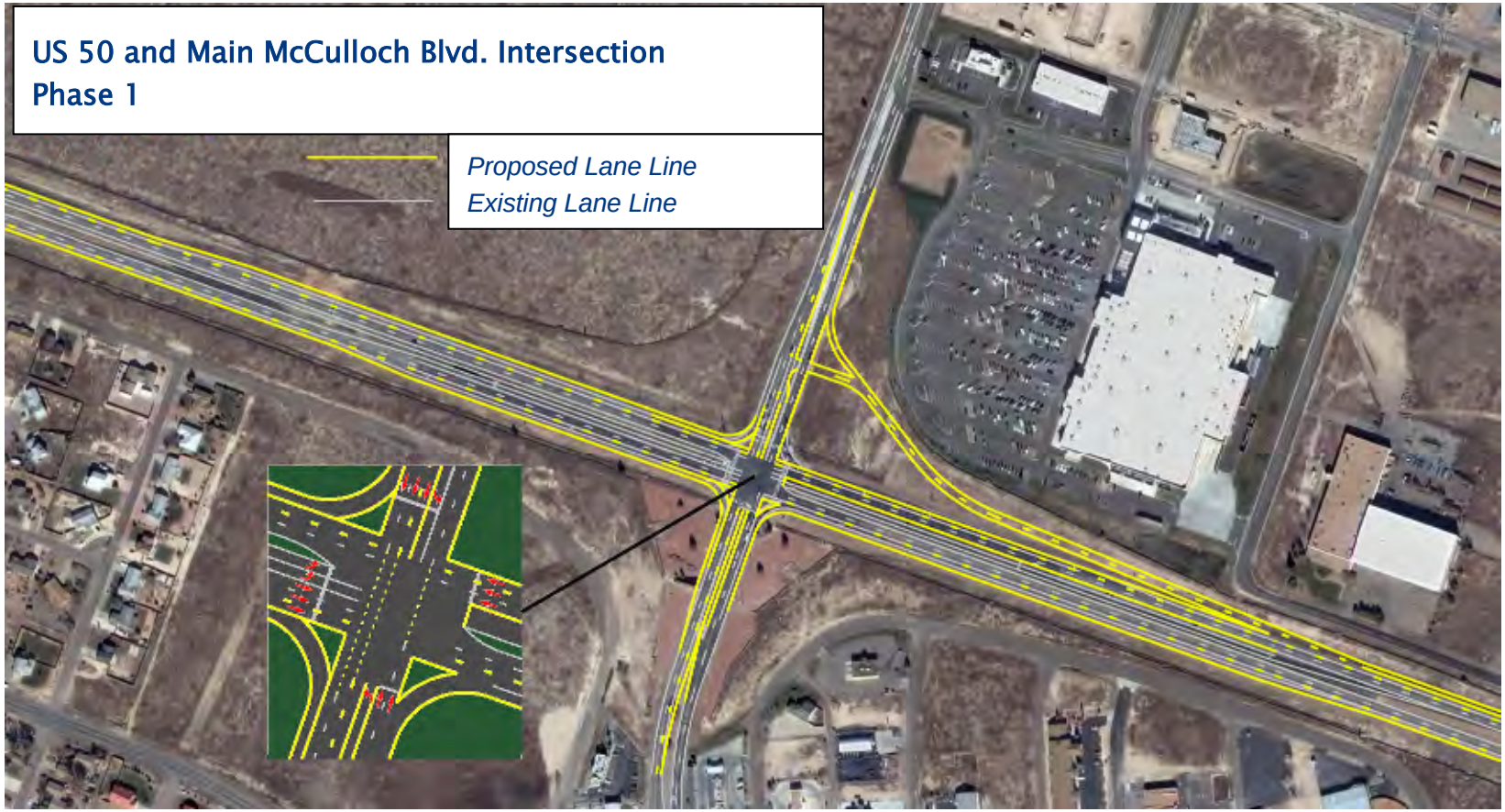


Figure IP-5. Phase 1 Improvements at US 50 and Main McCulloch Blvd.

Table IP-24. Traffic Operations of Phase 2 Main McCulloch Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Main McCulloch Blvd. Approach at LOS F?
2029	North	A	No	No	B	No	No
	Main	C	No	No	C	No	No
	South	B	No	No	A	No	No
2031	North	A	No	No	B	No	No
	Main	C	No	No	C	No	No
	South	B	No	No	B	No	No
2033	North	B	No	No	B	No	No
	Main	C	No	No	C	No	No
	South	B	No	No	B	No	No
West Pueblo Connector Built by 2033 or 2035							
2033	North	B	No	No	C	No	No
	Main	C	No	No	**E**	**Yes**	**Yes**
	South	B	No	No	B	No	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Level 3 evaluation assumed that the diamond interchange configuration would have Main McCulloch Blvd. on a bridge crossing over US 50. However, the Technical Advisory Team (TAT) decided during the development of this Implementation Plan that US 50 should cross over Main McCulloch Blvd. because this configuration will have fewer impacts for the following reasons:

- This configuration allows all existing business accesses to Main McCulloch Blvd. to remain open.
- This configuration will not require relocating a trail parallel to Main McCulloch Blvd. that is being built with Enhancement funds.
- Construction phasing would be less complex, with US 50 through traffic using the future ramps as detours. Through traffic on Main McCulloch Blvd. would not need to use detours.
- Although elevating US 50 would result in greater noise levels, the commercial uses abutting the interchange would shield residences in the area from this noise.

The entities implementing this plan have already begun making decisions on development, business access, pedestrian and bicycle trails, and other infrastructure improvements by relying on this decision for US 50 to cross over Main McCulloch Blvd.

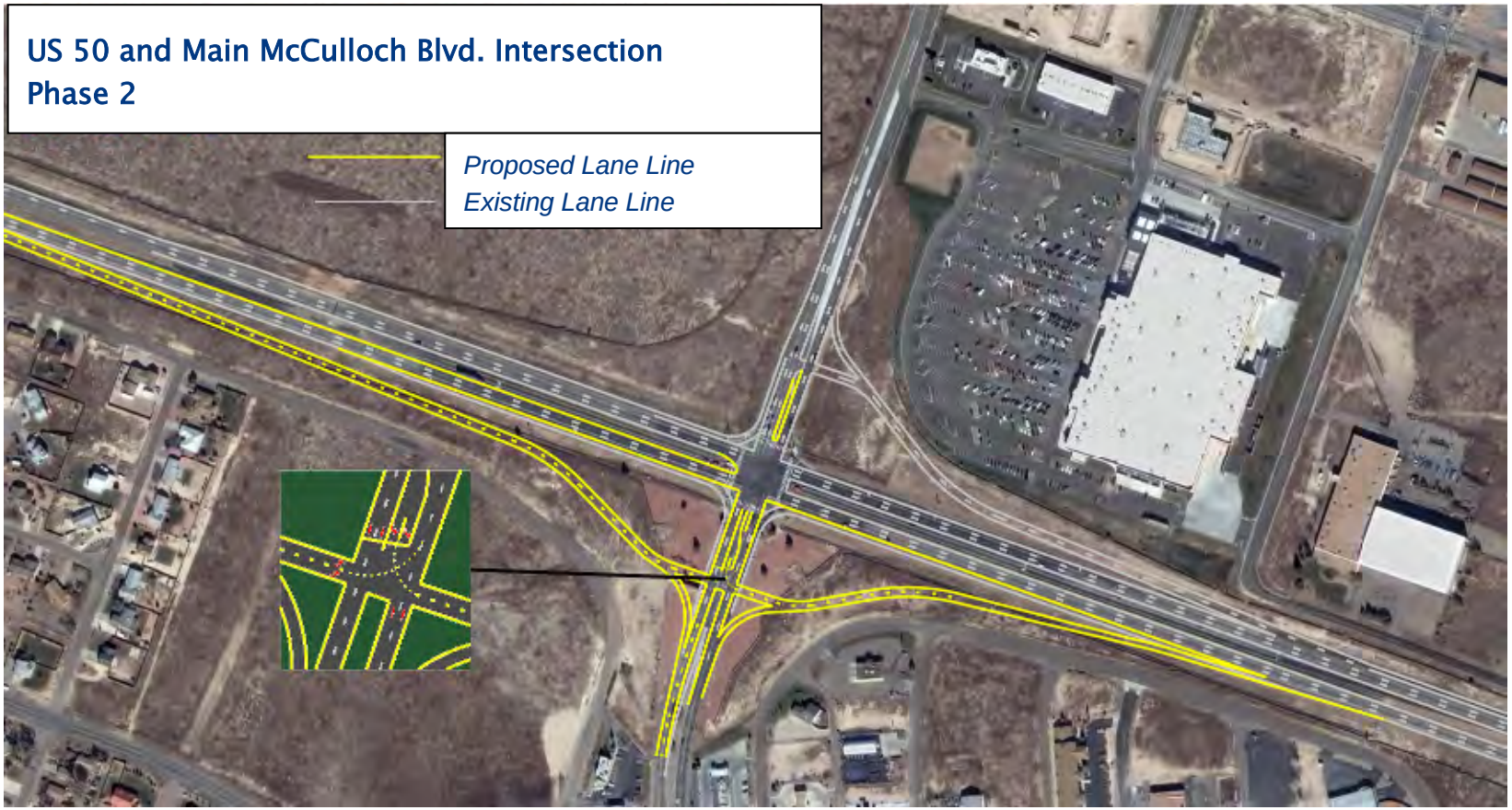


Figure IP-6. Phase 2 Improvements at US 50 and Main McCulloch Blvd.

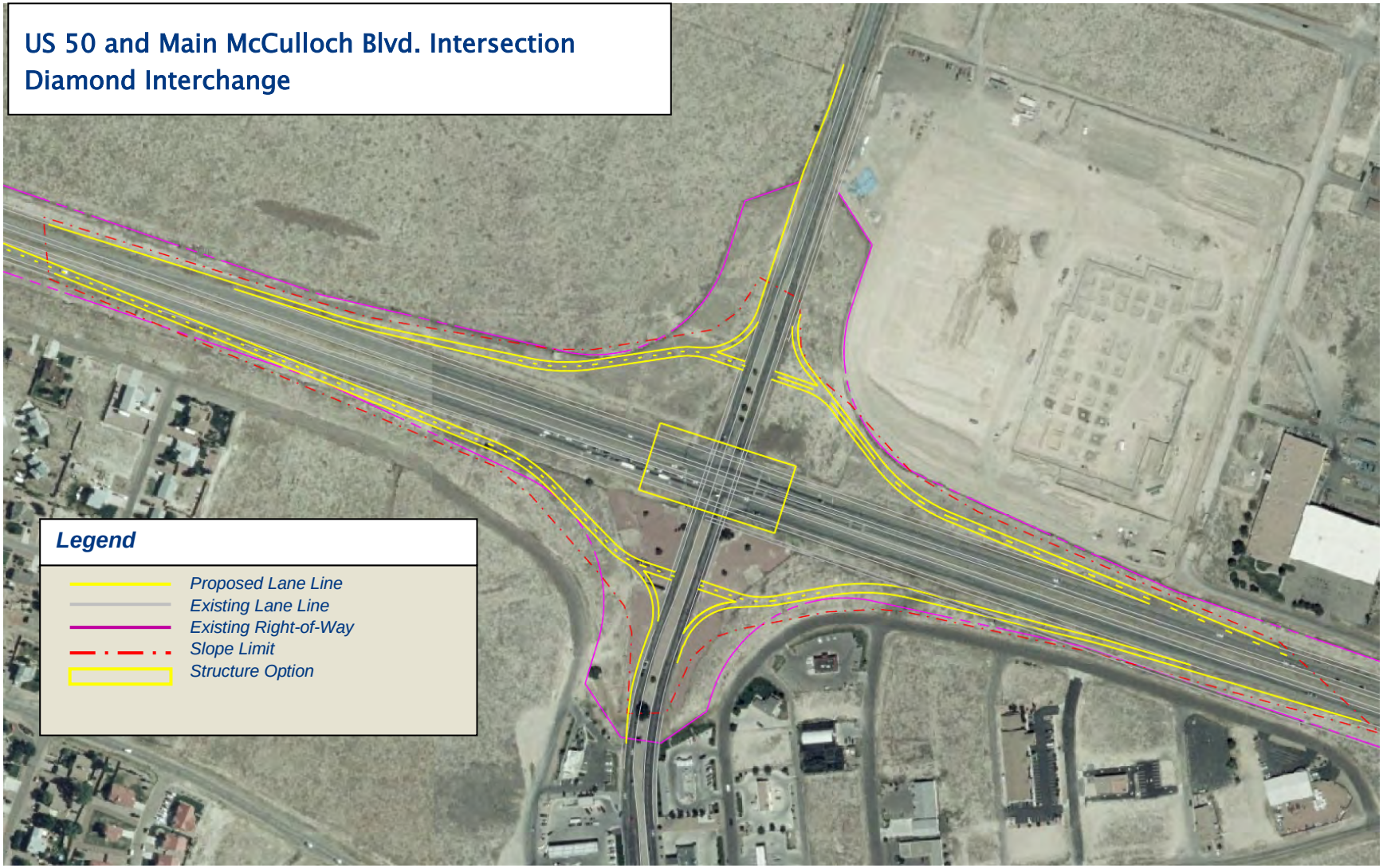


Figure IP-7. Final Phase at US 50 and Main McCulloch Blvd.

Purcell Blvd.

Table IP-25 shows that the signalized intersection at US 50 and Purcell Blvd. currently operates at LOS E during the morning rush hour. The eastbound left turn, eastbound through movement, and westbound left turn operate at LOS F. Also, the southbound approach operates at LOS F during the morning rush hour.

Table IP-25. Traffic Operations of Existing US 50 and Purcell Blvd. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?
2011	**E**	**Yes**	**Yes**	D	No	No

Source: JFSA, 2011
Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Phase 1: Widen US 50

The Phase 1 improvements at US 50 and Purcell Blvd. widen US 50 to six lanes, as shown in **Figure IP-8**. By improving the eastbound through movement capacity, green time from the eastbound through movement can be given to the other over-capacity movements during the morning peak hour to bring the intersection into compliance with the Purpose and Need criteria, as shown in **Table IP-26**. With six lanes on US 50, this intersection is expected to operate at LOS C during either peak hour in 2013, and at LOS D during either peak hour from 2013 to 2019. In 2021, the morning peak hour LOS is expected to fall to E. At the same time, the westbound left movement and the southbound approach are anticipated to operate at LOS F.

Table IP-26. Traffic Operations of Phase 1 Purcell Blvd. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?
2013	C	No	No	C	No	No
2015	D	No	No	D	No	No
2017	D	No	No	D	No	No
2019	D	No	No	D	No	No
2021	**E**	**Yes**	**Yes**	D	No	No

Source: JFSA, 2011
Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

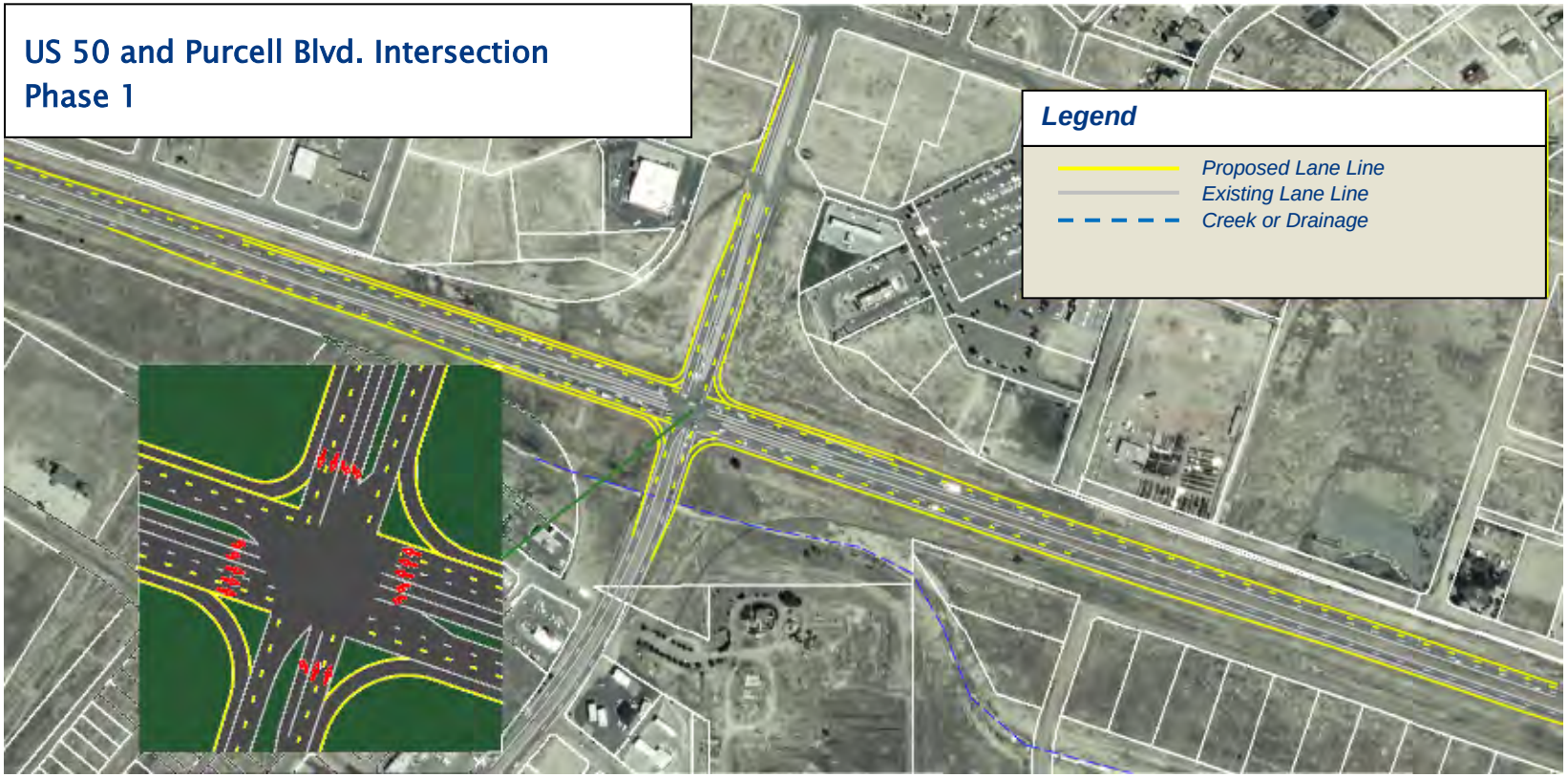


Figure IP-8. Phase 1 Improvements at US 50 and Purcell Blvd.

Phase 2: Two-Quadrant Jughandle

The Phase 2 improvements for US 50 and Purcell Blvd. are to build jughandles in the northwest and northeast quadrants, as shown in **Figure IP-9**. Left and right turns from westbound US 50 will use the jughandle in the northeast quadrant. Northbound left-turning traffic and southbound right-turning traffic will use the jughandle in the northwest quadrant. Phase 2 also includes building a third southbound through lane on Purcell Blvd., which would be dropped at or before Spaulding Ave.

Table IP-27 summarizes the traffic operations of the Phase 2 improvements here. In 2021, the north (jughandle) intersection would operate at LOS B during either peak hour, and the main intersection would operate at LOS D. However, during the evening peak hour of 2023, the LOS of each intersection falls by a letter grade. At the main intersection, the westbound through movement and the southbound approach are anticipated to operate at LOS F.

Table IP-27. Traffic Operations of Phase 2 Purcell Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?
2021	North	B	No	No	B	No	No
	Main	D	No	No	D	No	No
2023	North	B	No	No	C	No	No
	Main	D	No	No	**E**	**Yes**	**Yes**

Source: JFSA, 2011
Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Phase 3: Four-Quadrant Jughandle or At-Grade Diamond

The Phase 3 improvements here are to build jughandles in the remaining quadrants, to the southwest and southeast of the main intersection. These improvements are highlighted by the yellow lines in **Figure IP-10**. Because this configuration has all four of the future diamond interchange ramps built and only lacks grade separation for the main intersection of US 50 and Purcell Blvd., it could also be called an at-grade diamond.

Traffic operations of the four-quadrant jughandle or at-grade diamond here are summarized in **Table IP-28**. The north intersection operates at LOS B during both peak hours for the four years between 2023 and 2029 shown in the table. Likewise, the south intersection consistently operates at LOS B during the morning rush hour and LOS A during the evening rush hour. The main intersection is expected to operate at LOS C during both peak hours in 2023 and 2025. It would continue to operate at LOS C during the evening peak hours of 2027 and 2029. However, during the morning peak hour, the LOS of the main intersection changes to D in 2027 and to E in 2029. During the 2029 morning rush hour, the eastbound left and through movements would operate at LOS F, as would the northbound approach.

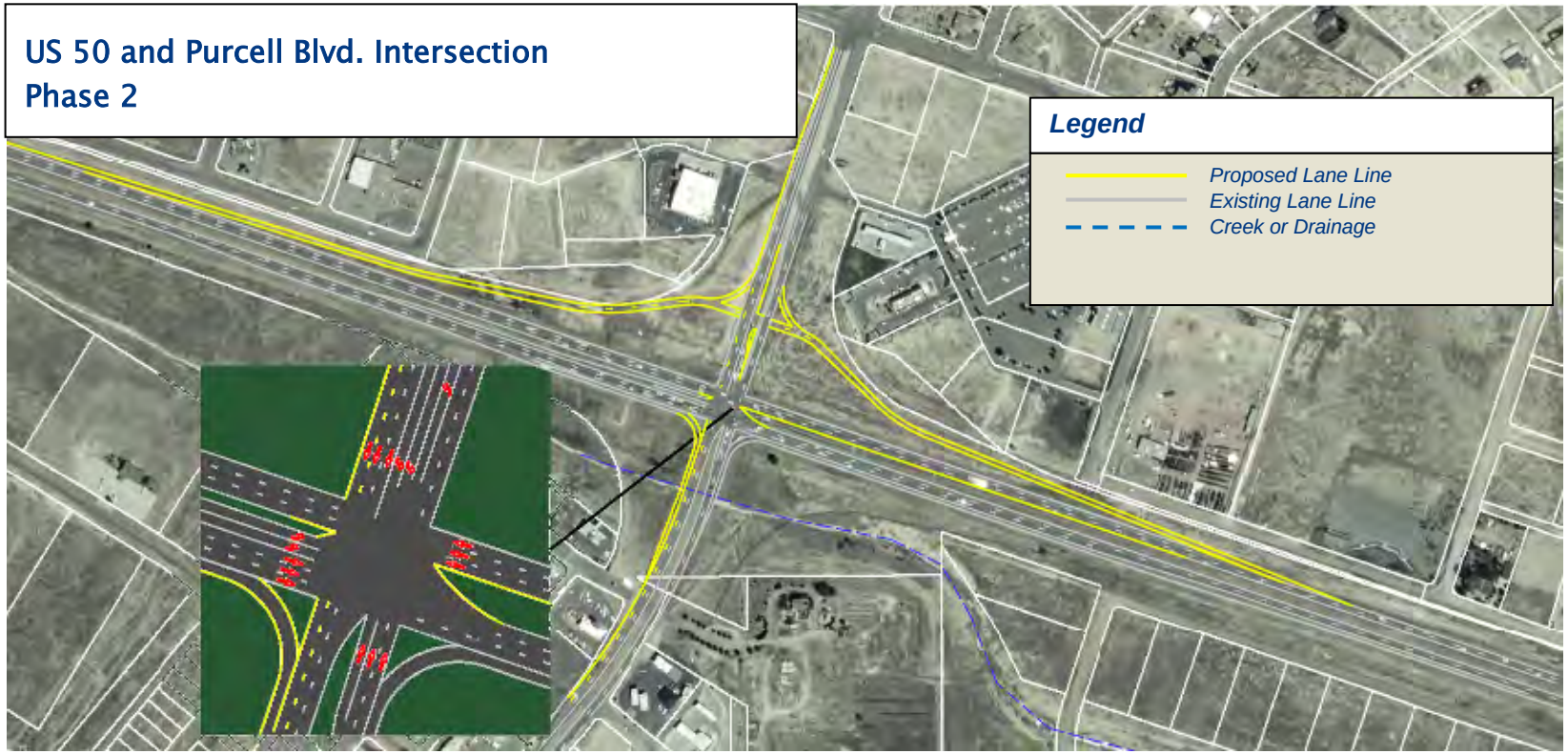


Figure IP-9. Phase 2 Improvements at US 50 and Purcell Blvd.

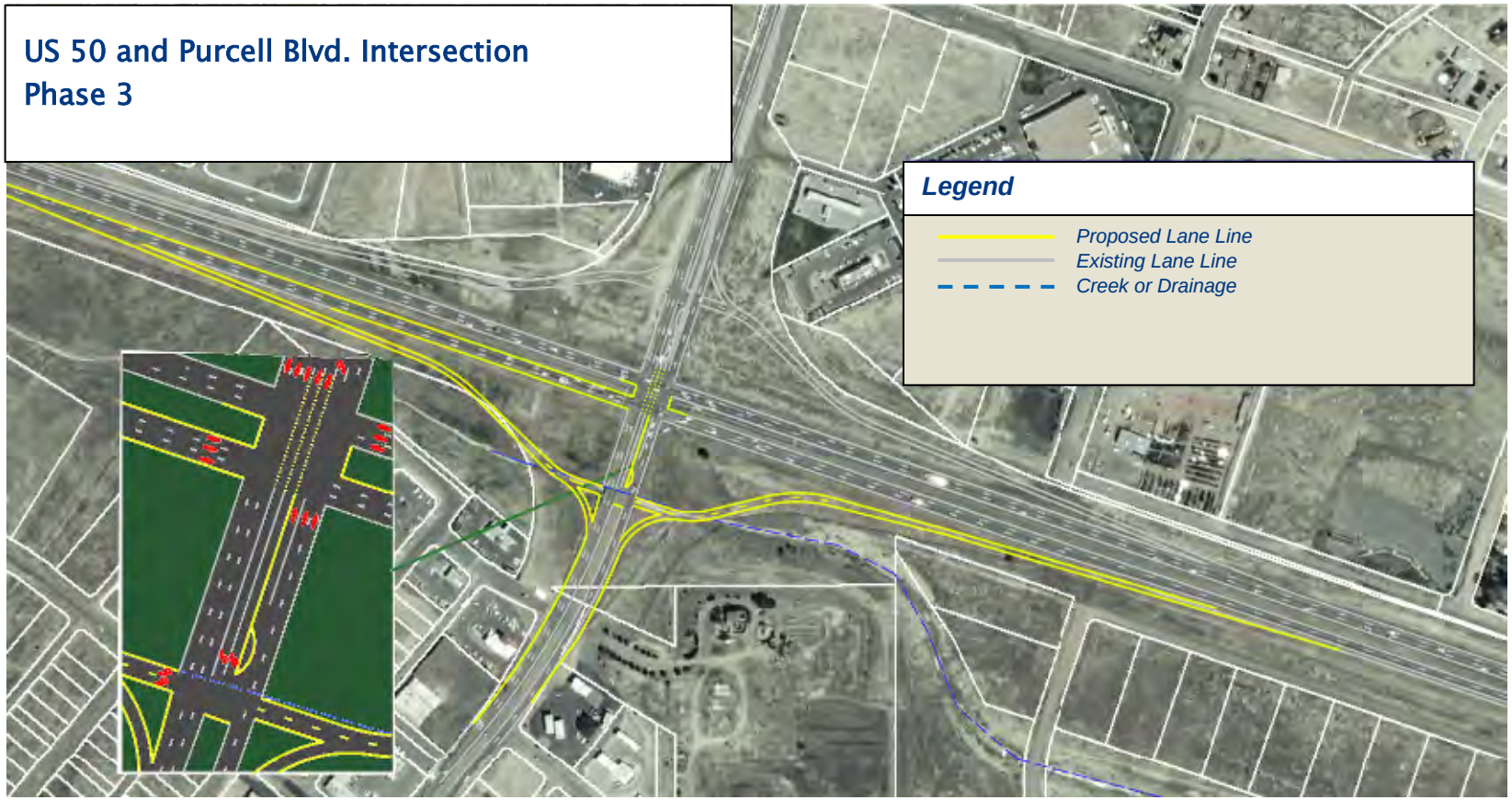


Figure IP-10. Phase 3 Improvements at US 50 and Purcell Blvd.

Table IP-28. Traffic Operations of Phase 3 Purcell Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Purcell Blvd. Approach at LOS F?
2023	North	B	No	No	B	No	No
	Main	C	No	No	C	No	No
	South	B	No	No	A	No	No
2025	North	B	No	No	B	No	No
	Main	C	No	No	C	No	No
	South	B	No	No	A	No	No
Pueblo Blvd. Extension Built by 2027							
2027	North	B	No	No	B	No	No
	Main	D	No	No	C	No	No
	South	B	No	No	A	No	No
2029	North	B	No	No	B	No	No
	Main	**E**	**Yes**	**Yes**	C	No	No
	South	B	No	No	A	No	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

The fourth and final phase here is to complete the diamond interchange by grade separating the main intersection, as shown in **Figure IP-11**. Similar to decision making process for the Main McCulloch Blvd. interchange, the TAT decided that a bridge will be built for US 50 to cross over Purcell Blvd. for similar reasons (maintaining business accesses, simplifying construction phasing, and having businesses shield residences in the area from noise increases). Eastbound and westbound traffic could use the ramps as detours during construction.

Pueblo Blvd.

The two directions of US 50 currently meet Pueblo Blvd. (SH 45) at two intersections about 600 feet apart. The current US 50 alignment was originally intended to become the ramps of a diamond interchange once a bridge for US 50 through traffic is built over Pueblo Blvd. However, more recent traffic forecasts for this study suggest that with the Pueblo Blvd. Extension, Pueblo Blvd. might carry more traffic than US 50 in the future. (See the turning movement forecasts in **Table IP-11** and **Table IP-12**. The forecasts for Action Plan 4 in **Appendix B** may also be of interest.) Therefore, it might be more appropriate to have ramps exiting and entering Pueblo Blvd., with signals on US 50, as is illustrated for the Preferred Alternative. Final determination of the interchange configuration (whether the signalized cross-over intersections will be on US 50 or Pueblo Blvd.) will be made during the design and NEPA clearance phase. In making this decision, the analysis will compare the following aspects of the various configurations:

- Phase costs
- Total cost of all phases
- Cost of throw-away improvements
- LOS and delay during construction
- LOS and delay after completion
- Accident reduction
- Variability or uncertainty of volumes inherent in travel demand forecasting

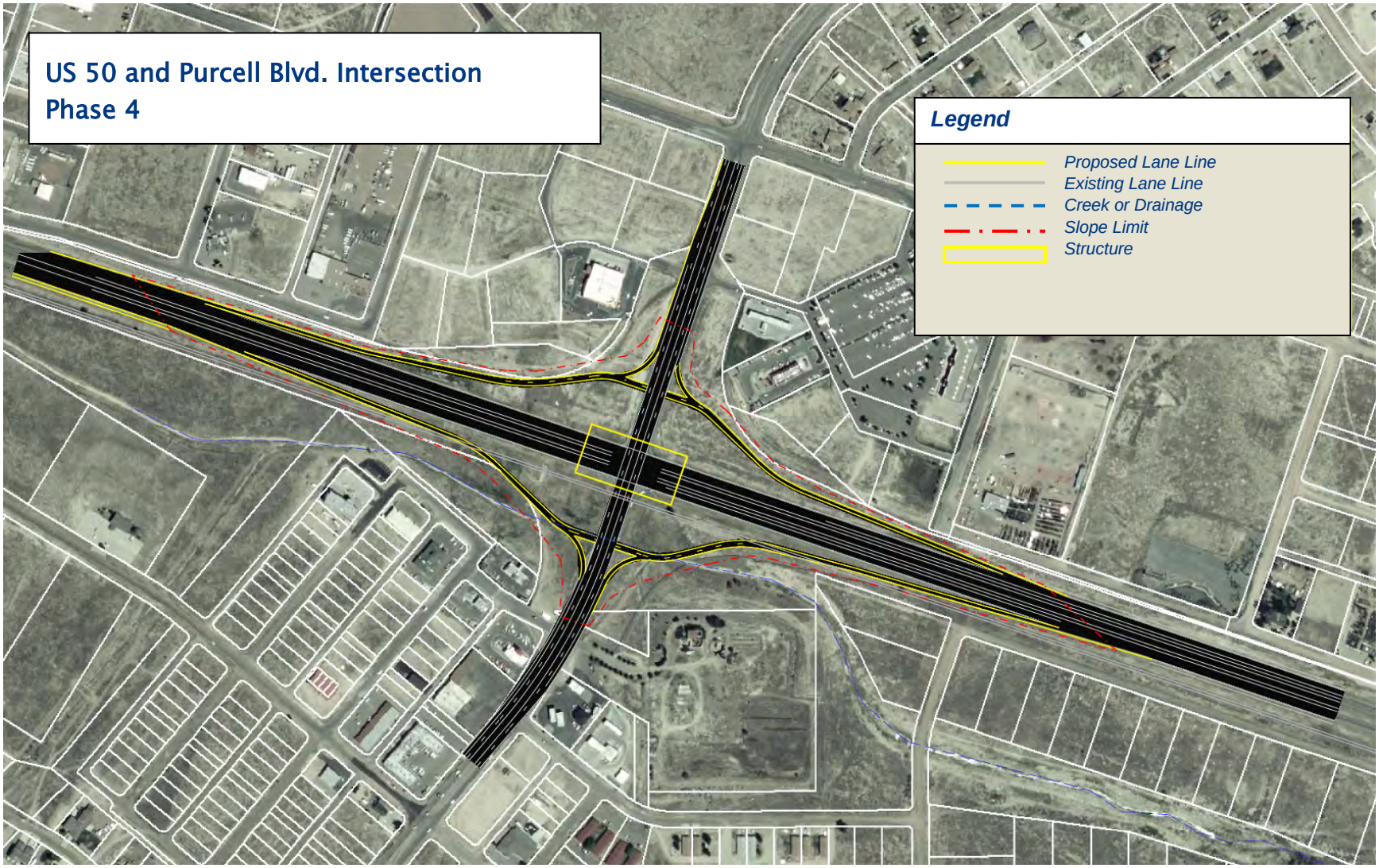


Figure IP-11. Final Phase at US 50 and Purcell Blvd.

Table IP-29 shows that while the south (eastbound US 50) intersection with Pueblo Blvd. currently operates at LOS C during both peak hours, the north (westbound US 50) intersection operates at LOS E during the evening rush hour. Westbound through traffic currently operates at LOS F.

Table IP-29. Traffic Operations of Existing US 50 and Pueblo Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?
2011	EB	C	No	No	C	No	No
	WB	B	No	No	**E**	**Yes**	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Phase 1: Two-Quadrant Jughandle

The Phase 1 improvement for US 50 and Pueblo Blvd. is to convert the existing two intersections to a two-quadrant jughandle by building three new westbound lanes north of the existing eastbound lanes, which will be widened to three lanes, as shown in **Figure IP-12**. Widening to six lanes will require extending the existing box culvert at Williams Creek and building two new bridges over Wild Horse Creek. Because the existing westbound bridge over Wild Horse Creek has a cracked abutment, it will be removed at this phase. Westbound US 50 traffic wanting to turn left to Pueblo Blvd. or right to Wildhorse Rd. will use a new ramp alignment between Williams Creek and Wildhorse Creek to reach the existing westbound lanes that now form the jughandle. The left of the two current through lanes will become a second dedicated left turn lane, to match the two southbound Pueblo Blvd. lanes.

Northbound Pueblo Blvd. traffic wanting to turn left to westbound US 50 will be directed by overhead signs to go through the main (south) intersection and turn left at the north intersection, much as they would today. Other signs will indicate that left turns from northbound Pueblo Blvd. are prohibited at the main intersection. Up arrow signals could be used to reinforce the turn prohibition.

The eastbound left turn to northbound Wildhorse Rd., which is currently protected for the duration of the eastbound through signal phase, would likely receive permissive phasing once westbound traffic also uses this intersection. At present, there does not appear to be sufficient demand to justify a protected, green arrow left turn phase for this movement.

Table IP-30 summarizes the traffic operations of this first phase at US 50 and Pueblo Blvd. Both intersections are forecast to operate at LOS B during the morning rush hour in 2013, changing to LOS C by the morning rush hour of 2017. During the 2013 evening rush hour, the main intersection is expected to operate at LOS D while the north (jughandle) intersection operates at LOS C. By the 2017 evening peak hour, however, LOS at the main intersection would fall to E, with westbound through traffic experiencing LOS F conditions.

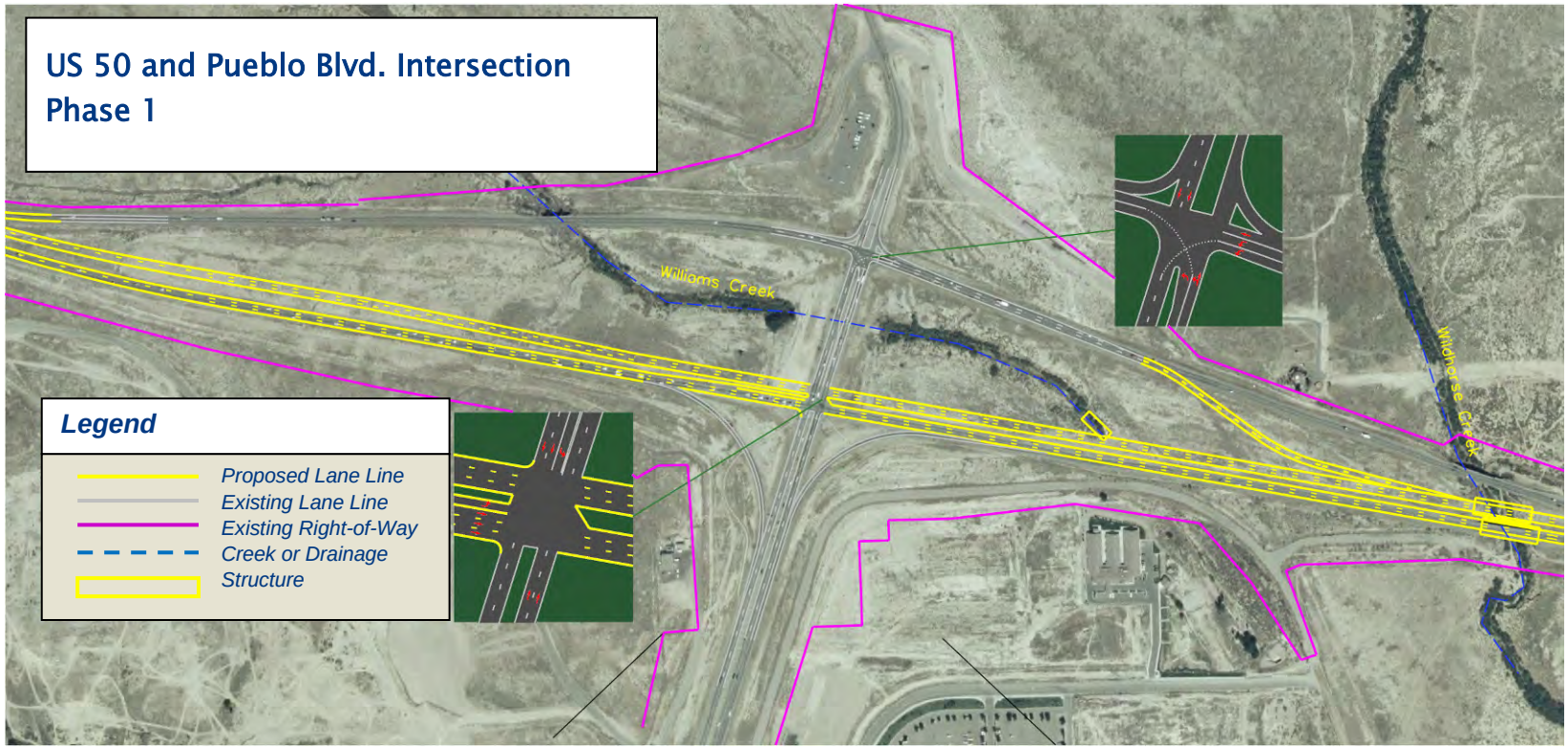


Figure IP-12. Phase 1 Improvements at US 50 and Pueblo Blvd.

Table IP-30. Traffic Operations of Phase 1 Pueblo Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?
2013	North	B	No	No	C	No	No
	Main	B	No	No	D	No	No
2015	North	B	No	No	C	No	No
	Main	C	No	No	D	No	No
2017	North	C	No	No	C	No	No
	Main	C	No	No	**E**	**Yes**	No

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

Phase 2: Additional Northbound Pueblo Blvd. Lane

The Phase 2 improvement here is to add a third northbound through lane to Pueblo Blvd. at the main intersection. North of the intersection, the third lane would become a dedicated through lane to Wildhorse Rd., while the current shared left turn and through lane would become a dedicated left turn lane. **Figure IP-13** shows each of these improvements. The additional northbound lane allows green signal time to be given to the eastbound and westbound US 50 movements.

Table IP-31 summarizes the traffic operations at US 50 and Pueblo Blvd. during this phase. During the morning rush hour, the main intersection is expected to operate at LOS C and the north intersection at LOS B from 2017 to 2023. During the evening rush hour, the main intersection would operate at LOS D and the north intersection would operate at LOS C until 2023, when each drops a letter grade. During the 2023 evening rush hour, the westbound and northbound approaches both experience LOS F conditions. (Recall that at the main intersection, the through movement of these two directions is the only movement allowed.)

Table IP-31. Traffic Operations of Phase 2 Pueblo Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?
2017	North	B	No	No	C	No	No
	Main	C	No	No	D	No	No
2019	North	B	No	No	C	No	No
	Main	C	No	No	D	No	No
2021	North	B	No	No	C	No	No
	Main	C	No	No	D	No	No
2023	North	B	No	No	D	No	No
	Main	C	No	No	**E**	**Yes**	**Yes**

Source: JFSA, 2011

Note: Bold red text indicates operations inconsistent with the study Purpose and Need.

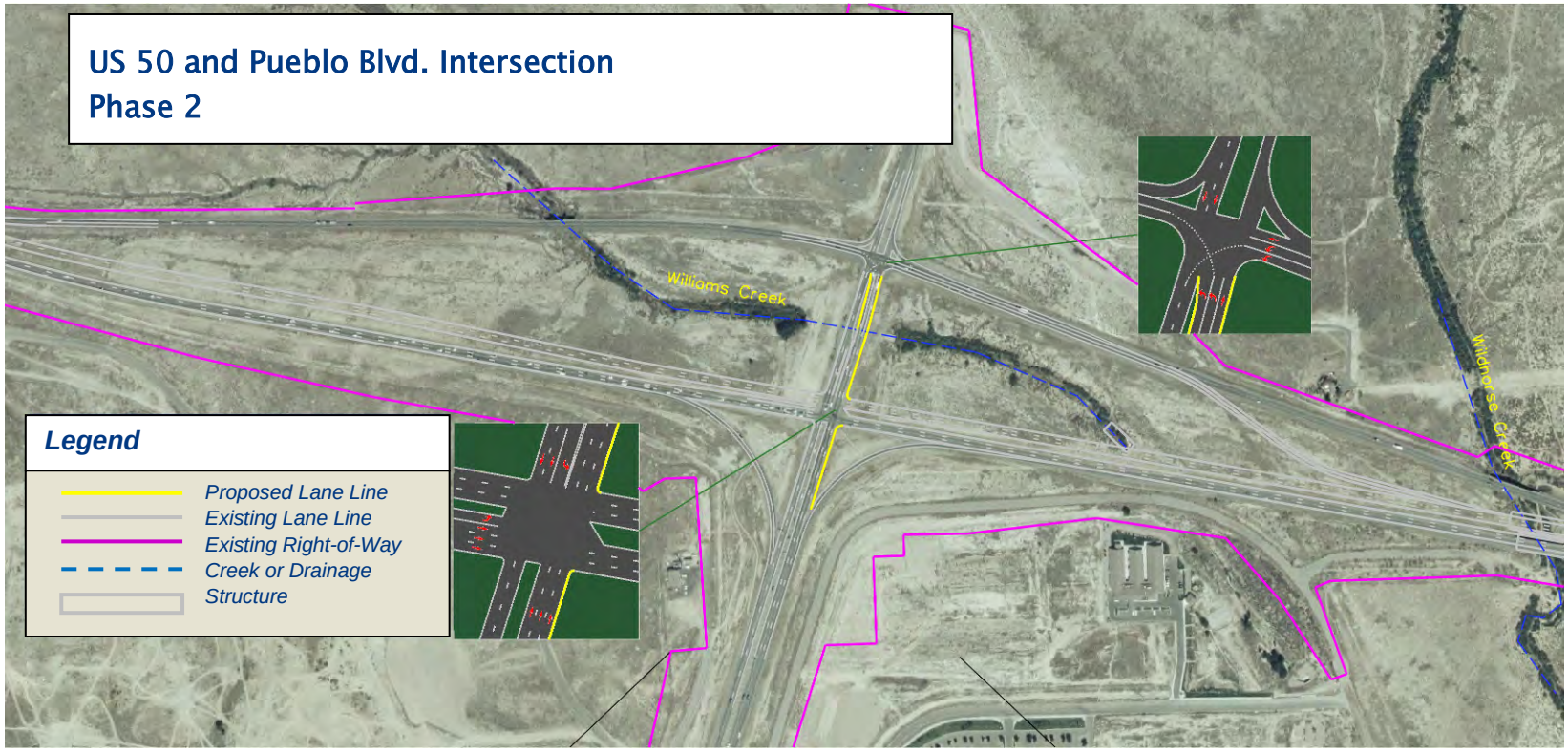


Figure IP-13. Phase 2 Improvements at US 50 and Pueblo Blvd.

Phase 3: Additional Northbound and Southbound Pueblo Blvd. Lanes

The Phase 3 improvement to the Pueblo Blvd. intersection adds a fourth northbound and third southbound through lane at the main intersection with US 50, as shown in **Figure IP-14**. The four northbound lanes become two left turn lanes and two through lanes at the north (jughandle) intersection. Wildhorse Rd. must also be widened to two lanes northbound for a sufficient distance for traffic to merge. (Also refer to **Table IP-12**, which shows that by 2023, around 500 vehicles make the northbound through movement to Wildhorse Rd. during the evening peak hour.) The third southbound lane could be merged before or dropped at the Spaulding Ave. intersection.

Table IP-32 shows the traffic operations at the two Pueblo Blvd. intersections after the Phase 3 improvements. In 2023, the main intersection is anticipated to operate at LOS C during either peak hour, while the north (jughandle) intersection would operate at LOS B during the morning rush hour and LOS C during the evening rush hour. In 2025, the north (jughandle) intersection would operate at LOS C during either peak hour. That same year, the main intersection would experience LOS C conditions during the morning peak hour and LOS D conditions in the evening.

Table IP-32. Traffic Operations of Phase 3 Pueblo Blvd. Intersection

		Morning Peak Hour			Evening Peak Hour		
Year	Inter-section	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?	Inter-section LOS	Any US 50 Movement at LOS F?	Any Pueblo Blvd. Approach at LOS F?
2023	North	B	No	No	C	No	No
	Main	C	No	No	C	No	No
2025	North	C	No	No	C	No	No
	Main	C	No	No	D	No	No

Source: JFSA, 2011
Note: Bold red text (not present in this table) would indicate operations inconsistent with the study Purpose and Need.

As will be seen, the need for the Pueblo Blvd. Extension in 2027 is established by traffic operations at Baltimore Ave. Once Pueblo Blvd. is extended to the north in 2027, a minimum of a diamond interchange is required, although it may be advantageous to build the final diverging diamond interchange configuration at this time. The diverging diamond interchange for Pueblo Blvd. and US 50 is shown in **Figure IP-15**.

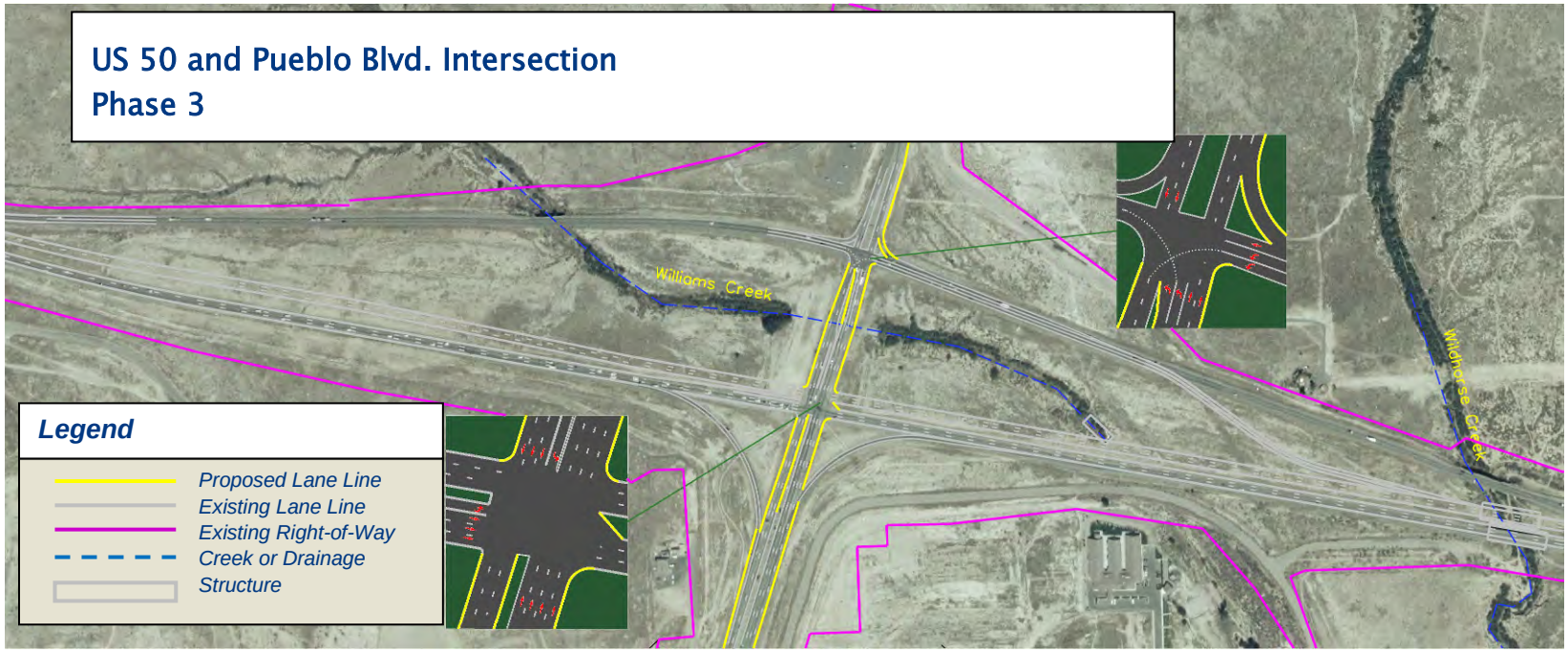
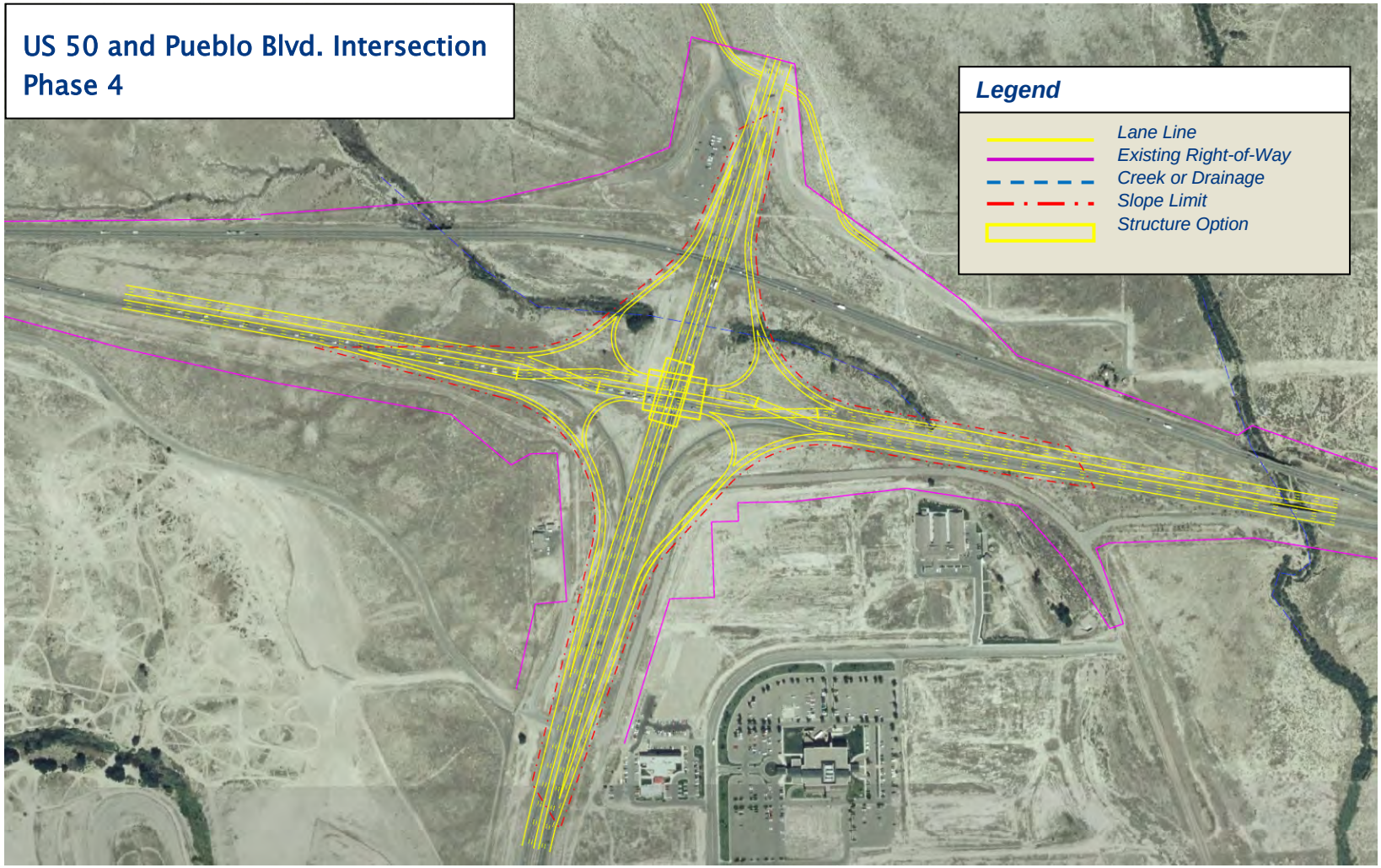


Figure IP-14. Phase 3 Improvements at US 50 and Pueblo Blvd.



Note: The question of whether US 50 will pass over or under Pueblo Blvd. will be decided as part of future design and NEPA clearance processes.

Figure IP-15. Final Phase of Improvements at US 50 and Pueblo Blvd.

Wills Blvd.

US 50 at Wills Blvd. currently has three eastbound through lanes and two westbound through lanes. Both directions of US 50 have dedicated left turn and right turn lanes. Construction scheduled for later this year will create a third westbound through lane on US 50. Both of the Wills Blvd. approaches have three lanes, one for each of the left turn, through, and right turn movements.

Table IP-33 shows that the US 50 and Wills Blvd. intersection currently operates at LOS A during either peak hour and is expected to continue to do so through 2019. In fact, the intersection is forecast to operate at LOS A during the morning rush hour through the study horizon of 2035. However, during the evening peak hour, the LOS would fall to B in 2021 and C in 2025.

Table IP-33. Traffic Operations at US 50 and Wills Blvd. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?
2011	A	No	No	A	No	No
2013	A	No	No	A	No	No
2015	A	No	No	A	No	No
2017	A	No	No	A	No	No
2019	A	No	No	A	No	No
2021	A	No	No	B	No	No
2023	A	No	No	B	No	No
2025	A	No	No	C	No	No
Pueblo Blvd. Extension Built by 2027						
2027	A	No	No	A	No	No
2029	A*	No	No	A*	No	No
2031	A*	No	No	A*	No	No
2033	A*	No	No	B*	No	No
West Pueblo Connector Built by 2033 or 2035						
2033	A*	No	No	B*	No	No
2035	A*	No	No	B*	No	No

Source: JFSA, 2011

*Notes: * LOS is calculated assuming left arrow signal heads are provided on Wills Blvd., allowing for protected and permitted left turn phasing. These signal heads improve the LOS of the northbound and southbound left turn movements—which would otherwise be F—while resulting in little change to the Wills Blvd. approach LOS.*
Bold red text (not present in this table) would indicate operations inconsistent with the study Purpose and Need.

After the Pueblo Blvd. Extension is built in 2027, the evening peak hour LOS returns to A through 2031. Around 2029, one improvement may be justified, though not required by the study Purpose and Need. With Wills Blvd. only having circular green traffic signals, left-turning traffic would have to wait longer as traffic volumes build over time. Left arrow signals with protected and permissive phasing would allow the delay to be more equitably split between Wills Blvd. left-turning traffic and through traffic.

In 2033, the evening peak hour LOS is expected to be B before the West Pueblo Connector is built. **Table IP-33** shows that the impact of the West Pueblo Connector on traffic operations here isn't large enough to result in an LOS letter grade change. The evening peak hour LOS would be B in 2033 and 2035 with the West Pueblo Connector.

Baltimore Ave.

As discussed in **Section 7**, the need for the Pueblo Blvd. Extension and West Pueblo Connector is driven by the LOS at US 50 and Baltimore Ave. The existing intersection here has a left turn lane, three through lanes, and a right turn lane on either direction of US 50. The northbound Baltimore Ave. approach has two left turn lanes, a through lane, and a free-flow right turn lane to eastbound US 50. The southbound Baltimore Ave. approach has two left turn lanes and a shared through and right turn lane. CDOT is investigating the possibility of purchasing additional ROW for one more southbound lane.

Table IP-34 shows the traffic operations of the existing US 50 and Baltimore Ave. intersection. The intersection currently operates at LOS C during the morning rush hour and LOS B during the evening rush hour. The intersection is expected to continue operating at LOS C in the morning through 2017. The evening peak hour LOS is expected to be C from 2013 through 2019, and then D through 2027. LOS D conditions are expected during the morning peak hour of 2019 through 2025. In 2027, the morning rush hour LOS drops to E and no longer meets the Purpose and Need criteria. Also, the southbound approach operates at LOS F during the 2027 morning peak hour. These deficiencies establish that the Pueblo Blvd. Extension to Platteville Blvd. is needed by 2027.

Once the Pueblo Blvd. Extension is completed, the 2027 LOS for each peak hour raises a letter grade, to D in the morning and C in the evening. In 2029, LOS D conditions are expected during both peak hours. However, during the 2029 morning rush, the southbound approach operates at LOS F, indicating the need for additional improvements.

Table IP-34. Traffic Operations at US 50 and Baltimore Ave. Intersection

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?
2011	C	No	No	B	No	No
2013	C	No	No	C	No	No
2015	C	No	No	C	No	No
2017	C	No	No	C	No	No
2019	D	No	No	C	No	No
2021	D	No	No	D	No	No

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Wills Blvd. Approach at LOS F?
2023	D	No	No	D	No	No
2025	D	No	No	D	No	No
2027	**E**	No	**Yes**	D	No	No
Pueblo Blvd. Extension Needed by 2027						
2027	D	No	No	C	No	No
2029	D	No	**Yes**	D	No	No

Source: JFSA, 2011

Notes: Bold red text indicates operations inconsistent with the study Purpose and Need.

The study team considered four options affecting operations at US 50 and Baltimore Ave. in an attempt to balance the potential impacts at the intersection itself against those associated with the West Pueblo Connector. Three options make improvements at the intersection first, while one, Option 2, assumes the West Pueblo Connector is built before making improvements at US 50 and Baltimore Ave. The four options considered are:

1. Additional through lanes on Baltimore Ave.
2. Early completion of the West Pueblo Connector
3. Reallocation of the existing southbound approach lanes
4. Addition of a single southbound lane

The effect each option has on the intersection LOS is described in the following sections. The study team chose not to recommend any particular option because of uncertainty of future development in the area and to allow the most flexibility in implementation.

Option 1: Additional Baltimore Ave. Through Lanes

Option 1 brings each Baltimore Ave. approach to five lanes: two left turn lanes, two through lanes, and a right turn lane, as shown in **Figure IP-16.** This option requires the most ROW. In the northeast corner of the intersection, ROW is constrained by the parking and landscaping requirements of Pueblo zoning codes. Acquiring additional ROW in this corner would likely require purchasing the whole parcel outright. Alternatively, ROW may be available in the northwest corner, which is currently a Toyota dealership. There has been some speculation about whether the Toyota dealer plans to move in the future but not of enough certainty to make assumptions for this Implementation Plan.

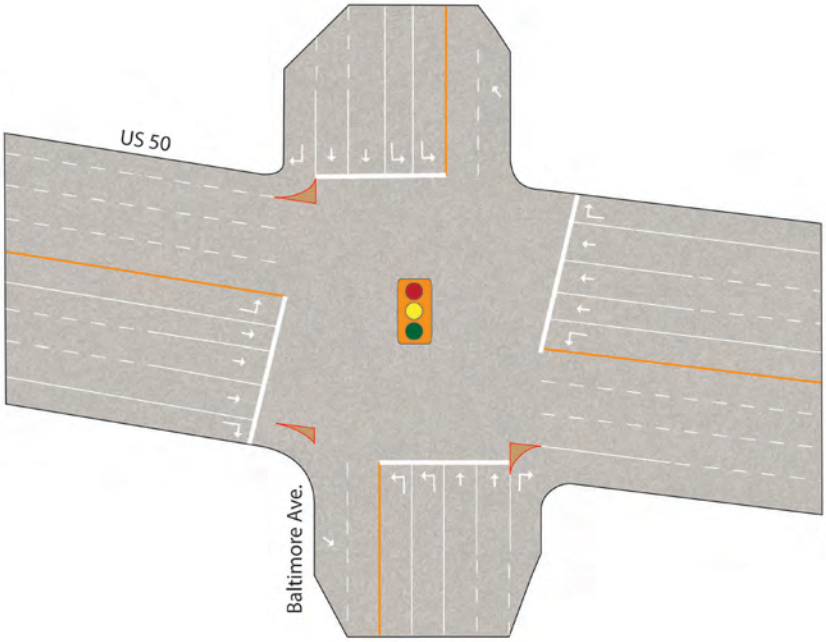


Figure IP-16. US 50 and Baltimore Ave. Intersection Improvements for Option 1

Table IP-35 shows that with the Option 1 improvements, the Baltimore Ave. intersection operates at LOS C during the morning peak hour in 2029 and LOS D during the evening peak hour. In 2031 and 2033, the LOS of either peak hour is D. However, during the 2033 morning rush hour, the westbound left movement and the southbound approach both experience LOS F conditions. Completing the West Pueblo Connector by 2033 ensures that the intersection will meet the Purpose and Need criteria through 2035.

Table IP-35. Traffic Operations for Baltimore Ave. Intersection Option 1

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?
2029	C	No	No	D	No	No
2031	D	No	No	D	No	No
2033	D	**Yes**	**Yes**	D	No	No
West Pueblo Connector Needed by 2033						
2033	D	No	No	D	No	No
2035	D	No	No	D	No	No

Source: JFSA, 2011

Notes: Bold red text indicates operations inconsistent with the study Purpose and Need.

Option 2: Early Completion of the West Pueblo Connector

Option 2 was motivated by a desire to see if further improvements at US 50 and Baltimore Ave. would be unnecessary after the Pueblo Blvd. Extension and West Pueblo Connector were completed. Therefore, it assumed completion of the West Pueblo Connector in 2029. **Table IP-36** shows traffic operations of the existing US 50 and Baltimore Ave. intersection with both local improvement projects in place.

Table IP-36. Traffic Operations for Baltimore Ave. Intersection Option 2 with West Pueblo Connector

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?
2029	D	No	No	C	No	No
2031	D	No	No	C	No	No
2033	D	No	No	D	No	**Yes***
2035	**E**	No	**Yes**	D	No	**Yes***

Source: JFSA, 2011

*Notes: * Excludes an unusually high (more than half of the total approach volume) northbound right movement—which is provided a free-flowing turn channel—from calculation of the northbound approach LOS.*
Bold red text indicates operations inconsistent with the study Purpose and Need.

During the morning peak hour, the intersection is expected to operate at LOS D from 2029 through 2033, and at LOS E in 2035. Both approaches of Baltimore Ave. operate at LOS F during the 2035 morning rush hour. This congestion is driven by the relatively high volumes of the northbound left turn and southbound through movement.

The evening peak hour LOS is expected to be C in 2029 and 2031, and D in 2033 and 2035. However, in 2033 and 2035, both the northbound left and through movements operate at LOS F during the evening peak hour. The LOS for the northbound approach is D because the northbound left and through delay is averaged with a large number of right-turning vehicles that experience minimal delay through the free-flow turn. The study team thought that the right-turning traffic—which accounts for more than half of the northbound approach volume—obscured serious operational deficiencies for other traffic. Therefore, the team concluded that improvements would be required by 2033 at Baltimore Ave. even with the West Pueblo Connector.

The intersection improvement selected for this option was to add a lane to the southbound approach so that two lanes could be used through the intersection, as shown on **Figure IP-17**. **Table IP-37** shows that these improvements would result in LOS D operation during either peak hour in 2033 or 2035.

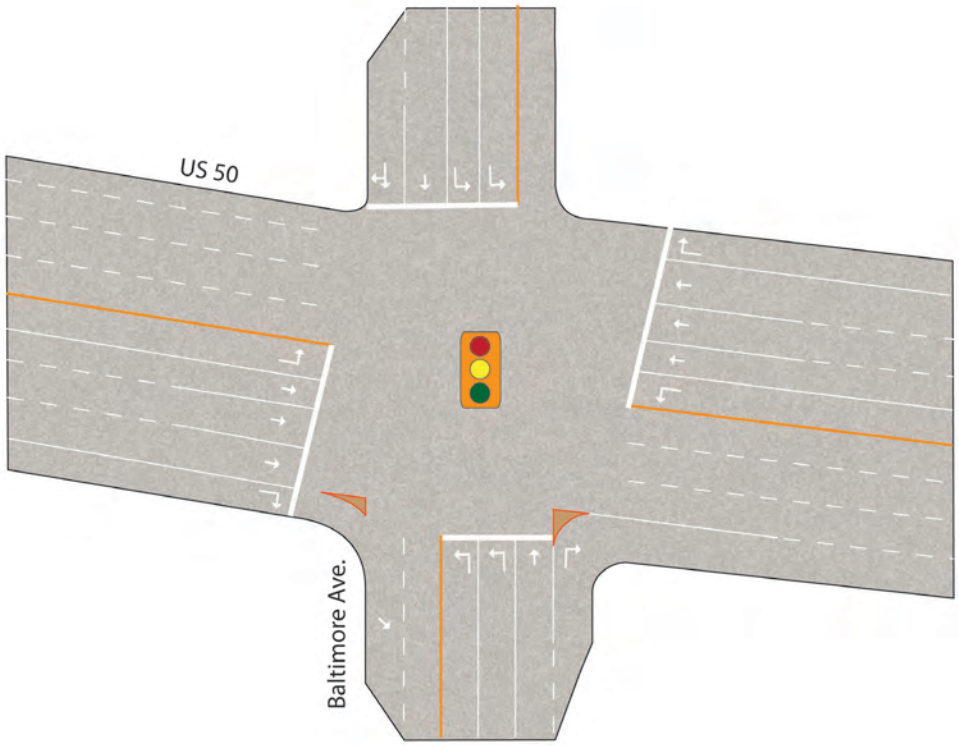


Figure IP-17. US 50 and Baltimore Ave. Intersection Improvements for Option 2

Table IP-37. Traffic Operations for Baltimore Ave. Intersection Option 2 with Intersection Improvements

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?
2033	D	No	No	D	No	No
2035	D	No	No	D	No	No

Source: JFSA, 2011

Notes: Bold red text (not present in this table) would indicate operations inconsistent with the study Purpose and Need.

Option 3: Reallocated Southbound Approach Lanes

Option 3 assumes no additional ROW is available at US 50 and Baltimore Ave. It converts the middle of the existing three southbound lanes from an exclusive left turn lane to a shared left and through lane. This conversion also requires that the southbound receiving lane for the free-flow eastbound right turn now receive traffic from the second southbound through lane. Therefore the eastbound free-flow right turn would be eliminated. The Option 3 configuration is shown in **Figure IP-18**.

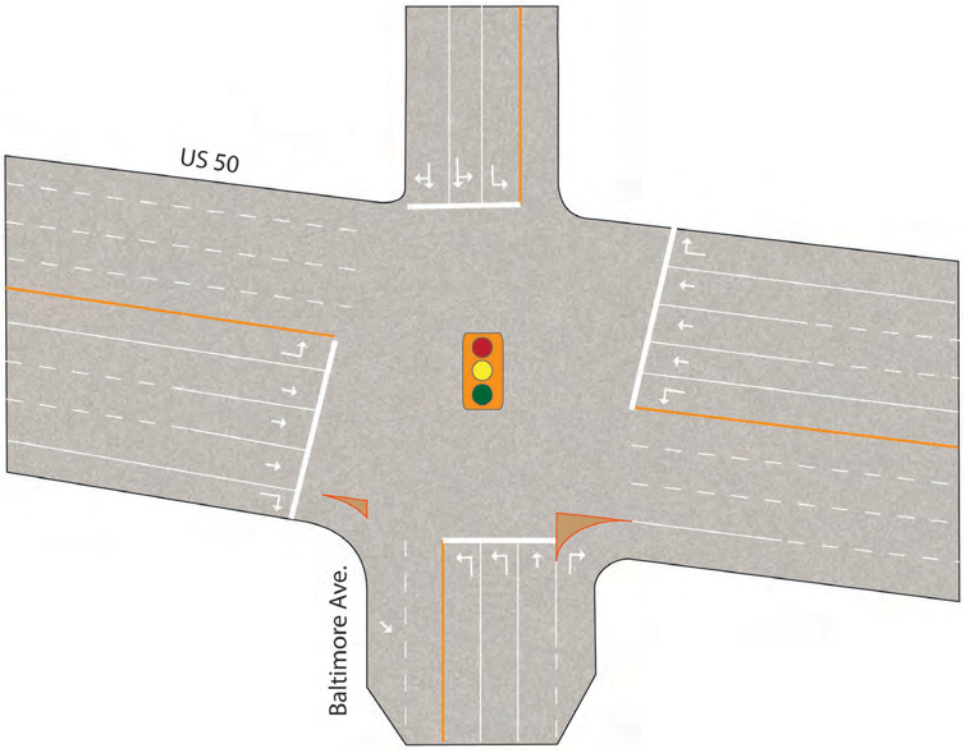


Figure IP-18. US 50 and Baltimore Ave. Intersection Improvements for Option 3

Because of the combined southbound left and through turn lane, the northbound and southbound approaches here would need to use split signal phasing, where all northbound movements get green signals at one time, then all southbound movements get green signals at a different time.

Table IP-38 shows that after constructing Option 3 in 2029, the LOS during either peak hour would be D that year and in 2031. However, the evening peak hour LOS is expected to fall to E in 2033, when the West Pueblo Connector would be needed. Once the West Pueblo Connector is built, LOS D is expected during either peak hour.

Table IP-38. Traffic Operations for Baltimore Ave. Intersection Option 3

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?
2029	D	No	No	D	No	No
2031	D	No	No	D	No	No
2033	D	No	No	**E**	No	No
West Pueblo Connector Needed by 2033						
2033	D	No	No	D	No	No
2035	D	No	No	D	No	No

Source: JFSA, 2011

Notes: Bold red text indicates operations inconsistent with the study Purpose and Need.

Option 4: Additional Southbound Approach Lane

Option 4 assumes that CDOT completes its plan to acquire ROW for an additional southbound lane. The four southbound lanes would be allocated as two exclusive left turn lanes, an exclusive through lane, and a shared through and right turn lane, as shown in **Figure IP-19**. This is the same configuration as Option 2, with the difference being the timing of improvements. For Option 2, the West Pueblo Connector is built before improvements are made at US 50 and Baltimore Ave. For Option 4, improvements are made at US 50 and Baltimore Ave. first.

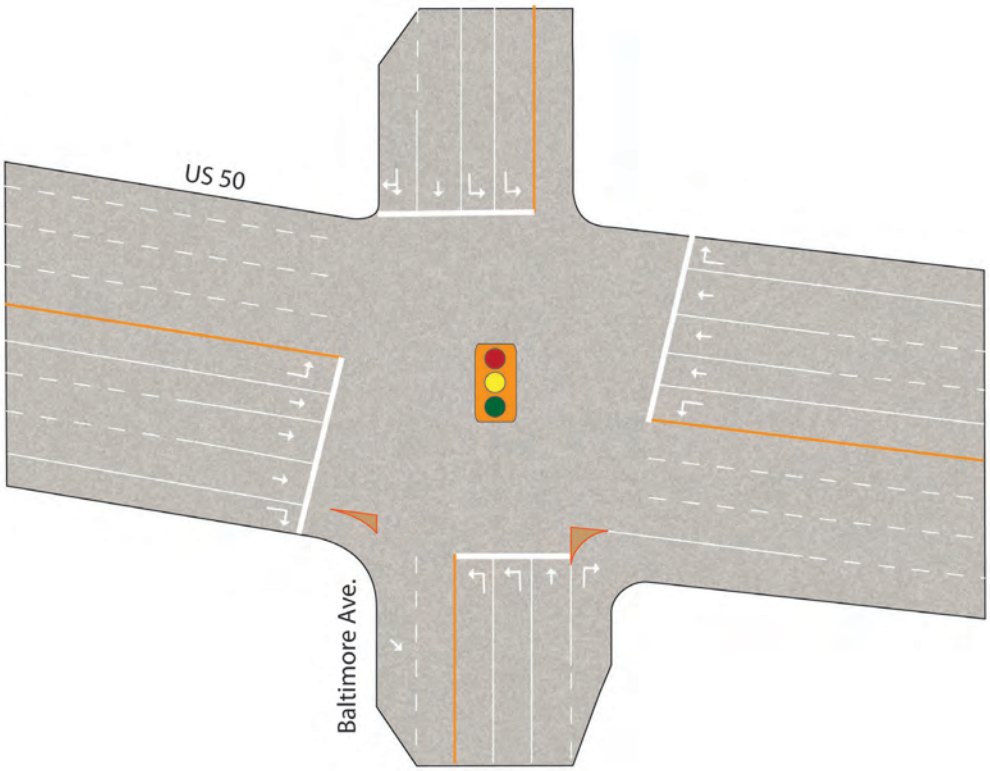


Figure IP-19. US 50 and Baltimore Ave. Intersection Improvements for Option 4

Table IP-39 summarizes the traffic operations for Option 4. In 2029, the intersection is forecasted to operate at LOS C during the morning rush hour and LOS D during the evening rush hour. In 2031 and 2033, LOS D conditions are anticipated during either peak hour. However, in 2035 the intersection would no longer operate within the Purpose and Need criteria. During the morning peak hour, the northbound left and through movements would operate at LOS F. During the 2035 evening peak hour, the intersection is expected to operate at LOS E. Therefore, with Option 4, the West Pueblo Connector would be needed by 2035.

Table IP-39. Traffic Operations for Baltimore Ave. Intersection Option 4

	Morning Peak Hour			Evening Peak Hour		
Year	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?	Intersection LOS	Any US 50 Movement at LOS F?	Any Baltimore Ave. Approach at LOS F?
2029	C	No	No	D	No	No
2031	D	No	No	D	No	No
2033	D	No	No	D	No	No
2035	D	No	**Yes***	**E**	No	No
West Pueblo Connector Needed by 2035						
2035	D	No	No	D	No	No

Source: JFSA, 2011

*Notes: * Excludes an unusually high (more than half of the total approach volume) northbound right movement—which is provided a free-flowing turn channel—from calculation of the northbound approach LOS.*
Bold red text indicates operations inconsistent with the study Purpose and Need.

9. How was the timing of mainline improvements determined?

The timing of mainline improvements was determined by considering both traffic operations between intersections and when intersections at both ends of a segment need more through lanes. Generally, improvements need to be made to eastern intersections before western intersections; therefore, the western intersection of a segment is the one determining when widening may be needed. **Table IP-40** shows when the Purpose and Need criteria would no longer be met for three segments identified for six-lanes by the Preferred Alternative. The segment between Wills Blvd. and Baltimore Ave. already has three lanes eastbound and is scheduled to get three lanes westbound as a result of a construction project planned for later this year. Therefore, this easternmost segment is not shown in **Table IP-40**.

The third column of **Table IP-40** shows when eastbound mainline US 50 LOS becomes E during the morning rush hour. The fourth column shows the similar year based on westbound travel in the evening. Note that mainline considerations show a need for three lanes in either direction no sooner than 2029. In contrast, the fifth column of **Table IP-40** shows that improvements are needed soon at Purcell Blvd. and Pueblo Blvd., as discussed in **Section 8**. The timing for widening US 50 between Main McCulloch Blvd. and Purcell Blvd. is also driven by the need for three through lanes in either direction at the Main McCulloch Blvd. intersection in 2025.

Table IP-40. Timing of Mainline Improvements

US 50 Mainline Segment		Earliest Need for 3 Lanes Based on			
West Intersection	East Intersection	Morning Peak Hour Eastbound	Evening Peak Hour Westbound	Year 3 Through Lanes Needed at West Intersection	Year Selected for Widening
Main McCulloch Blvd.	Purcell Blvd.	After 2035	After 2035	2025	2025
Purcell Blvd.	Pueblo Blvd.	2029	2033	2013	2013
Pueblo Blvd.	Wills Blvd.	After 2035	2031	2013	2013

Source: JFSA, 2011

10. How were individual improvements prioritized?

The improvement projects or phases were prioritized solely by traffic need. Because the traffic operations analysis established the year each phase would be needed based on the traffic forecasts, the priorities were determined by sorting the improvement projects by the year they are needed. Because the traffic operations and signal warrant analysis did not establish clear dates for the improvements to the Swallows Rd. and West McCulloch Blvd. improvements, these projects are excluded from the main prioritization and tabulated separately. The relatively low cost of the improvements at these two intersections give them great flexibility regarding when they are built.

11. What is the Corridor-wide list of improvement priorities?

Table IP-41 shows the prioritized list of transportation improvement projects to address corridor congestion, safety, and other issues. **Table IP-42** shows three more flexible, lower cost projects.

Of the 14 projects shown in **Table IP-41**, 12 make improvements in the US 50 Corridor itself and the remaining two are off-corridor local improvement projects; that is, the Pueblo Blvd. Extension (sequence 8) and the West Pueblo Connector (sequence 14). The sequence number in the left column indicates the order in which the projects are expected to be built based on their timing to maintain traffic operations within the Purpose and Need criteria (the second column) and the relative levels of need for improvements at different locations within the same year. Estimates of the time required to design and construct the improvements are listed in the third and fourth columns, respectively. The time when design needs to begin so that an improvement is completed before it is needed is calculated based on the information in the second, third, and fourth columns. **Section 17** describes some of the assumptions that were used to calculate the design and construction duration.

The fifth column is the location of the improvements (for example, at an intersection or along a stretch of the highway). The sixth column briefly describes the improvements associated with each project. Multimodal improvements would also be made in conjunction with highway improvements in the same area. The seventh column indicates that ROW is needed for the two local improvement projects, for multimodal improvements, and possibly at the Baltimore Ave. intersection, depending on the improvement option selected. The final column provides the construction cost estimate, not including any ROW costs. Design costs, which are typically 10 percent of construction costs, are also not included in the construction cost estimates.

Before any improvements in **Table IP-41** are built, MS4 requirements must be built for the whole US 50 Corridor. These improvements would likely involve detention ponds near Turkey Creek, Williams Creek, and Wild Horse Creek. Sufficient ROW should be available for these ponds near Pueblo Blvd., although additional ROW may be required near Swallows Rd. for the Turkey Creek pond(s).

Table IP-41 shows that the top priority is to widen US 50 to six lanes east of Pueblo Blvd. and to convert the Pueblo Blvd. intersection into a jughandle. The next highest priority is to widen US 50 to six lanes between Purcell Blvd. and Pueblo Blvd. The first improvement at Main McCulloch Blvd. involves widening and a jughandle, at sequence 7. Improvements at Baltimore Ave. are prioritized as sequence 11.

Note that these sequences are based on the traffic operation needs established from the turning movement forecasts discussed in **Section 6**. Traffic counts should be made to confirm operation needs before beginning any construction project. CDOT's regular count program will also identify changing traffic patterns that may indicate a need to revisit the priorities.

Table IP-41. Corridor-wide Sequence of Transportation Improvement Priorities

Seq.	Year of Critical LOS Failure without Improvements[1]	Estimated Design Duration	Estimated Construction Duration	Location	Transportation Improvement Description[2]	Is ROW needed?[2]	Construction Cost Estimate (Current $)
1	2013	2 y 3 mon[3]	1 y 6 mon	Diverge point west of Pueblo Blvd. to Wills Blvd.	• Widen EB US 50 to three lanes[2] • Widen WB US 50 east of the BNSF crossing to three lanes • Construct three WB lanes to north of EB lanes in vicinity of Pueblo Blvd. • Convert existing WB lanes to jughandles	No[2]	$16.2 million
2	2013	1 y 6 mon	1 y	West of Purcell Blvd. to diverge point west of Pueblo Blvd.	• Construct third EB and WB lanes on US 50[2]	No[2]	$9.8 million
3	2017	2 y 3 mon[4]	3 mon	At Pueblo Blvd.	• Construct third NB lane at intersection with mainline US 50 • Construct a dedicated through lane at intersection with a jughandle	No	$600,000
4	2021	1 y 6 mon[4]	6 mon	At Purcell Blvd.	• Construct a jughandle in NW and NE quadrants (future diamond ramps) • Construct third SB through lane at mainline US 50 intersection	No	$3.4 million
5	2023	2 y 3 mon[4]	3 mon	At Pueblo Blvd.	• Construct fourth NB lane and third SB lane at intersection with mainline US 50 • Continue new NB lane as a second through lane past the north (jughandle) intersection	No	$1.0 million
6	2023	1 y 6 mon[4]	6 mon	At Purcell Blvd.	• Construct a jughandle in SW and SE quadrants to create an "at-grade" diamond"	No	$3.7 million
7	2025	1 y 6 mon	1 y 3 mon	West of Main McCulloch Blvd. to west of Purcell Blvd.	• Widen US 50 to three lanes each direction[2] • Construct noise wall SW of Main McCulloch Blvd. intersection • Construct a jughandle (future diamond ramp) in NE quadrant of intersection • Convert second NB and SB left to SB through lane	No[2]	$18.0 million

Seq.	Year of Critical LOS Failure without Improvements[1]	Estimated Design Duration	Estimated Construction Duration	Location	Transportation Improvement Description[2]	Is ROW needed?[2]	Construction Cost Estimate (Current $)
8	2027	6 y[3, 5]	4 y[5]	Off US 50	• Construct Pueblo Blvd. Extension to Platteville Blvd.	Yes	N/C[5]
9	2027	2 y 3 mon[4]	1 y 9 mon	At Pueblo Blvd.	• Construct diverging diamond interchange	No	$27.0 million
10	2029	1 y 6 mon[4]	6 mon	At Main McCulloch Blvd.	• Construct a jughandle in SW and SE quadrants (optionally complete diamond interchange)	No	$3.1 million (for jughandle)
11	2029	1 y 6 mon[4]	6 mon	At Purcell Blvd.	• Construct grade separation to complete the diamond interchange	No	$11.3 million
12	2029 to 2035[6]	6 y[3, 5]	3 y[5]	Off US 50	• Construct West Pueblo Connector	Yes	N/C[5]
13	2029	1 y 6 mon	TBD	At Baltimore Ave.	• To be determined from four options	TBD	TBD
14	2033	1 y 6 mon[4]	6 mon	At Main McCulloch Blvd.	• Construct diamond interchange (if not completed by 2029)	No	$16.2 million

Notes: *Corridor-wide MS4 requirements would need to be built before any improvement project could begin. These requirements are estimated to cost $2 to 3 million and require additional ROW near Swallows Rd. and Turkey Creek.*

This list does not include an independent utility project to construct a third westbound lane in the vicinity of Wills Blvd., already scheduled for Fall 2012.

[1] Improvements (or portions of thereof) could be completed sooner as funding becomes available. There may be additional benefits to constructing the two off-US 50 improvements, the Pueblo Blvd. Extension and the West Pueblo Connector, sooner because they would provide alternate routes during construction on US 50.

[2] Complimentary accommodation of pedestrian and bicycle facilities would occur as corresponding improvements are made to US 50. Additional ROW would be required for pedestrian and bicycle facilities. These facilities are estimated to cost a total of $12 to $14 million.

[3] Duration is uncertain because of the time required to coordinate with railroads.

[4] Many design activities are completed during the first phase of improvements at each location.

[5] No exact estimates were made for the design and construction duration or the construction cost for the two off-US 50 improvements because other studies beyond the scope of this PEL Study would be required.

[6] The timing of the West Pueblo Connector depends on the improvements made at US 50 and Baltimore Ave.

Abbreviations: *EB = eastbound* *LOS = Levels of Service* *mon = month(s)* *NB = northbound* *N/C = not calculated* *NE = northeast* *NW = northwest* *ROW = right-of-way* *SB = southbound* *SE = southeast* *Seq. = sequence* *SW = southwest* *TBD = to be determined* *WB = westbound* *y = year(s)*

The three flexible improvement projects in **Table IP-42** involve installing traffic signals at the two currently unsignalized intersections in the Corridor and creating separate left and right turn lanes at Swallows Rd. Compared to many of the improvement projects prioritized in **Table IP-41**, these projects have relatively low costs and might be built with federal safety funds.

Table IP-42. Flexible, Low-Capital Improvements

Location	Improvement Description	Is ROW needed?	Construction Cost Estimate (Current $)
At West McCulloch Blvd.	• Install traffic signals (optionally add pavement barriers to form "Florida T")	No	$1 million or less (signals only)
At Swallows Rd.	• Construct separate NB left and right turn lanes	No	$300,000
At Swallows Rd.	• Install traffic signals (optionally add pavement barriers to form "Florida T")	No	$1 million or less (signals only)

Abbreviations: NB = northbound ROW = right-of-way

12. Do US 50 improvements have to be built in this order or can the Implementation Plan change?

This Implementation Plan was developed based on the traffic operations needs resulting from certain traffic volume forecasts. If traffic volumes do not grow as forecast—they may grow more rapidly in one area and less rapidly at another location—then the Implementation Plan can and should be changed to respond to the evolving traffic needs. This Implementation Plan contains the detailed tables of traffic turning movement forecasts in **Section 6** so that they can easily be compared against traffic counts taken in the future.

Also, if funding becomes available, some phases may be built earlier than they are absolutely needed. Two phases in the same area might also be combined to gain efficiencies from only having to mobilize the construction workers and equipment once. Such a combination would also prevent the perception that a particular area is continually under construction. Safety issues or other considerations may also change the priority for a particular project.

13. How would the Implementation Plan be changed?

Before changing the Implementation Plan, CDOT would consult with its local governmental partners through existing coordination channels, such as the Pueblo Area Council of Governments' (PACOG's) Transportation Technical Committee and the bimonthly city and county coordination meetings that served as the Policy Advisory Team (PAT) for this PEL study. CDOT would present information on how traffic patterns have grown differently than expected and suggest some possible responses resulting in changes to the Implementation Plan. Local partners would have the opportunity to suggest other potential responses.

14. What safety improvements may be made with each project?

What safety improvements may be made with each project depends on the nature of that project. For example, a project to widen US 50 to six lanes might also install median barrier and flatten the side slopes of the grassy area beyond the roadway shoulders. Six-lane widening also provides an opportunity to bring shoulders up to current standards. Rumble strips might be cut into the shoulders if cars running off the road become a concern.

Another example of an associated safety improvement is that installing signals at Swallows Rd. or West McCulloch Blvd. provides an opportunity to add intersection lighting as well. Advance warning of stopped traffic—like the "be prepared to stop when flashing" signs at Pueblo Blvd.—may also be included with traffic signal projects.

Some types of safety improvements, such as intersection lighting, are a matter of good practice. Other improvements may be in response to specific safety needs. For example, guard rail may need to be placed around a particular obstacle close to the road. CDOT's safety assessment procedures should be followed to identify cost-effective improvements.

15. What multimodal improvements may be made with each project?

The multimodal improvements identified by the Preferred Alternative include a multiple use pedestrian and bicycle path and the potential for park-and-ride lots. The multiple use path would be south of US 50 starting at Main McCulloch Blvd. and connecting to the existing sidewalk east of Wills Blvd. It would be built in conjunction with the six-lane widening projects (sequences 1, 2, and 7 of **Table IP-41**). While final park-and-ride lots are yet to be identified, they would most likely be associated with intersection improvements. When signals are installed at jughandle intersections, Swallows Rd., and West McCulloch Blvd., they would also have pedestrian signal heads with symbolic walk and don't walk indicators. Crosswalk striping would be a cost-effective component of any intersection improvement.

16. Why are local improvement projects not included in the Implementation Plan?

While this Implementation Plan identifies times when the local improvement projects (the Pueblo Blvd. Extension and the West Pueblo Connector) are needed, they are not formally part of this plan, because they are not part of the state highway system and therefore are beyond CDOT's jurisdiction. CDOT wants to provide its local governmental partners with the maximum flexibility to construct all or part of these local improvement projects according to their own timeline.

17. What happens next?

The first step to improving US 50 would be to conduct traffic counts because the traffic operations analyses (based on current forecasts from historical traffic counts) revealed that transportation improvements are needed right away. CDOT routinely measures traffic volumes in the Corridor. More recent traffic counts will allow the LOS analysis to be updated and may result in adjustments to the timing of improvement needs.

CDOT plans two related efforts to begin implementation of the US 50 improvements: One effort involves Corridor-wide planning activities; and the other is project specific and focuses on the first improvement project in the vicinity of Pueblo Blvd.

Corridor-wide planning

Corridor-wide planning activities include developing MS4 and Corridor design vision, as well as collecting data for future National Environmental Policy Act (NEPA) and design studies.

Current CDOT policy creates MS4 plans for an entire corridor or drainage basin, rather than on a project-specific basis. Therefore, these activities would occur before beginning any road construction project. Water quality ponds may be built as a stand-alone project before any construction begins, or combined with the first improvement project to US 50.

The Corridor design vision process would develop general design guidelines for the Corridor. CDOT would engage Corridor stakeholders to develop the Corridor design vision. The document would address general features such as architectural treatments, landscaping, and aesthetics. For example, the stakeholders may establish a color scheme to be used on US 50 bridges. The process might also establish whether any special structural details are used for street lights or overhead signs. The landscaping element might specify what types of plants would be used. Design guidelines might be chosen to complement the existing features in the Corridor, such as the rail tie fence in Pueblo West or the Pueblo West welcome sign at Main McCulloch Blvd. **Figure IP-20** illustrates how such design guidelines were used at the I-25 interchange with Eagleridge Blvd. in Pueblo.

Historical field surveys, soil sampling, and topographical surveys are some of the Corridor-wide data collection activities that will support future improvement projects. Historical field surveys involve examining structures and other objects to determine if they might be eligible for protection under federal law. Geotechnical engineers will examine soil samples in the lab to determine its structural, drainage, and other properties. The information they obtain will be used to determine the most appropriate pavement design for US 50. Pavement designers determine what thicknesses and materials to use for the various layers of pavement and base course (underlying pavement support). Various utilities in the Corridor will be located and marked so they can be included in the topographical survey. Locations of structures, trees, driveways, streams, and other features are also included in the topographical survey. That information allows roadway designers to establish horizontal and vertical alignments for future US 50, crossing streets, and interchange ramps.

Figure IP-20. Example of Design Guidelines Applied at I-25 and Eagleridge Blvd. Interchange

Project design

Figure IP-21 shows several categories of design tasks, including how long each task takes and the sequence in which tasks are completed. Before design can begin, various data needs to be collected, as discussed earlier. Data collection typically takes about three months. Preliminary design would first establish a general horizontal and vertical alignment. Traffic studies would confirm the need for lanes and establish details such as turn bay lengths. By drawing cross sections along the horizontal alignment, roadway designers establish the width of the highway and its embankment. When a footprint is established, typically after about three months of design, NEPA clearance can begin.

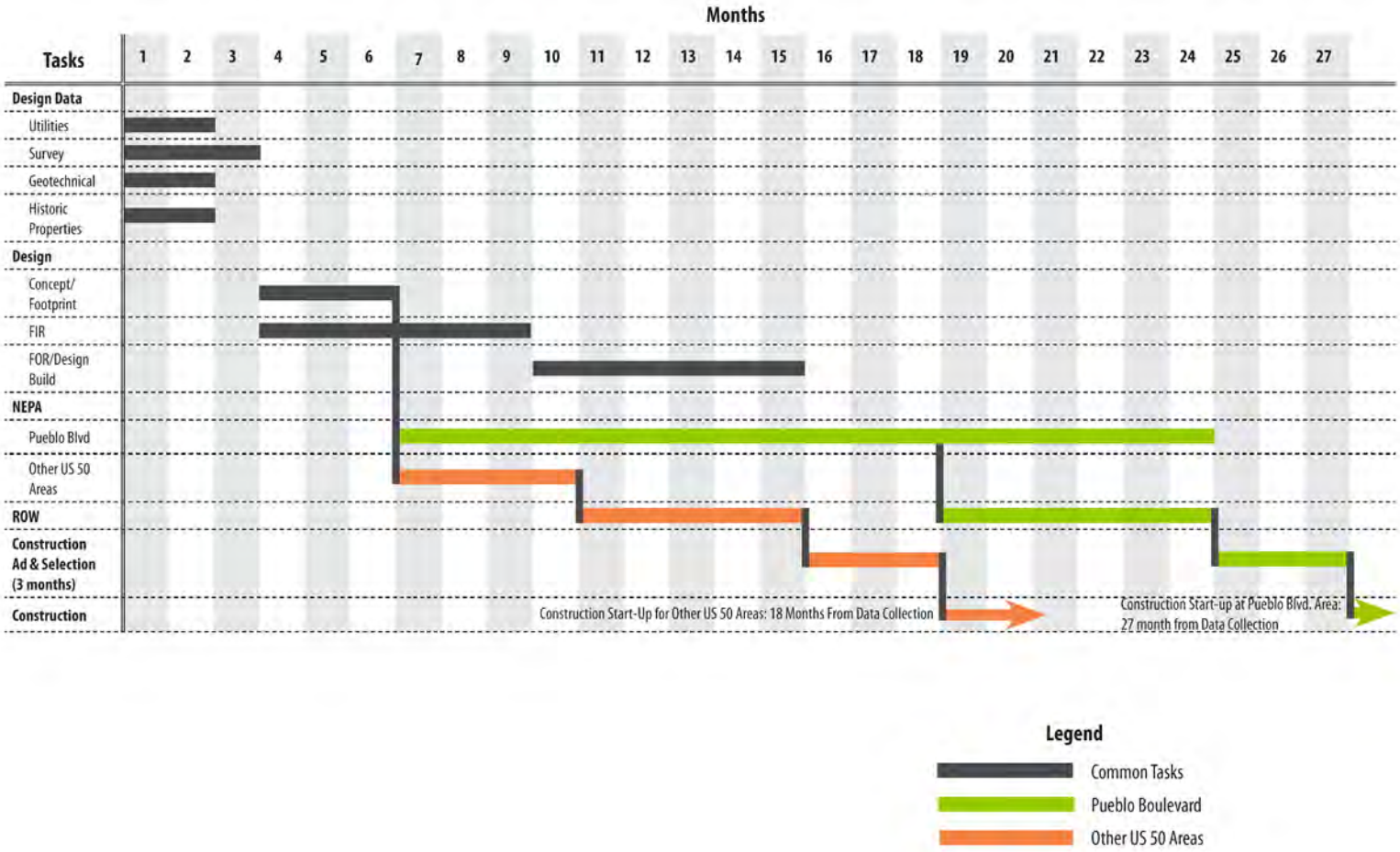
NEPA clearances for US 50 transportation improvements will most likely require a Categorical Exclusion (Cat. Ex.). This effort may include a documented Cat. Ex. at Pueblo Blvd., or possibly an Environmental Assessment, if warranted. The NEPA process will examine the environmental and community concerns identified in this PEL study in more detail. In areas where there are few or no environmental concerns, a simple Cat. Ex. may take about four months to complete. A documented Cat. Ex. for the Pueblo Blvd. intersection may require about 18 months to complete. Once funding for a construction project is obtained, CDOT and the Federal Highway Administration (FHWA) will make a decision on what type of NEPA document to prepare.

The Cat. Ex. document follows a government form (CDOT Form # 128) that has two main parts. The upper part is for environmental clearance actions, indicating that environmental concerns are understood and addressed. The lower part records the permits that CDOT must obtain before construction begins. For example, if a project will disturb an acre or more of wetlands, CDOT must obtain a Section 404 permit from the U.S. Army Corps of Engineers. Other agencies issue other types of permits. If federal funds are used to purchase ROW—which is a common practice for transportation projects—then this activity may begin after the environmental clearance (top) part of the form is completed and approved. **Figure IP-21** shows that this activity is expected to occur about four months after NEPA study begins for a typical project, and about 12 months after the study for the Pueblo Blvd. intersection begins.

Design can continue while NEPA clearance is ongoing. During preliminary engineering cost estimates can be completed in more detail so that funding can be obtained. Designs will also address construction phasing and traffic detours. Although only one phase of improvements will initially be built at each location, the design will consider the final intersection configuration and the other improvement phases to develop the best design for the overall timeframe. About six months after design starts, it reaches a stage called Field Inspection Review (FIR).

After the FIR stage, design plans can be used to request design-build proposals, or the design effort can continue for about another six months to develop sets of plans that can be sent out to bid to general contractors. Under this latter option, the plans for general contractors are called Final Office Review (FOR). Under a design-build arrangement, CDOT enters into a single contract for both design and construction services. Because the designers and general contractors are part of the same team, some design tasks can occur at the same time as other construction activities, which can shorten the total design and construction duration.

CDOT is planning to create design plans for all the segments of US 50 improvements so that new construction could begin as soon as funding is obtained.



Notes: Times shown above are approximate and represent the time duration required for a typical design task. Times for specific improvement projects may be longer or shorter depending on project complexity.

Figure IP-21. Estimated Duration of Preconstruction Tasks

Once plans are developed, NEPA documents are completed and accepted, and ROW is purchased, CDOT can advertise a project for general contractors to bid on. It may take CDOT about a month to prepare the documents for the advertisement based on the FOR plans. It may take another two months for contractors to respond to the advertisement, for CDOT to evaluate the contractors' bids, and for CDOT to negotiate a contract with the successful bidder.

Figure IP-21 shows that the elapsed time required between beginning data collection and beginning construction is about 18 months for a less involved project at most US 50 locations and about 27 months for the more complicated Pueblo Blvd. intersection. These timeframes are reflected in the Corridor-wide list of improvement priorities found in **Table IP-41**.

When a project is ready to begin construction, CDOT will involve Corridor stakeholders in making several decisions on how best to proceed. For example, night construction is one technique that reduces the duration of construction, but it can have noise and light impacts.

CDOT has an established Lane Closure Policy that will determine how many lanes in each direction need to remain open during peak and off-peak hours to accommodate existing traffic.

At intersections, accommodating all turning movement directions may result in additional construction phases and longer construction duration. CDOT and stakeholders will weigh the access impacts of detours against the benefits of shorter construction.

CDOT will also develop a traffic management plan for the construction project, which will include plans called Methods of Handling Traffic (MHTs) for each construction phase. The MHTs include such details as which signs will be placed in various locations and how driving lanes will be marked.

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