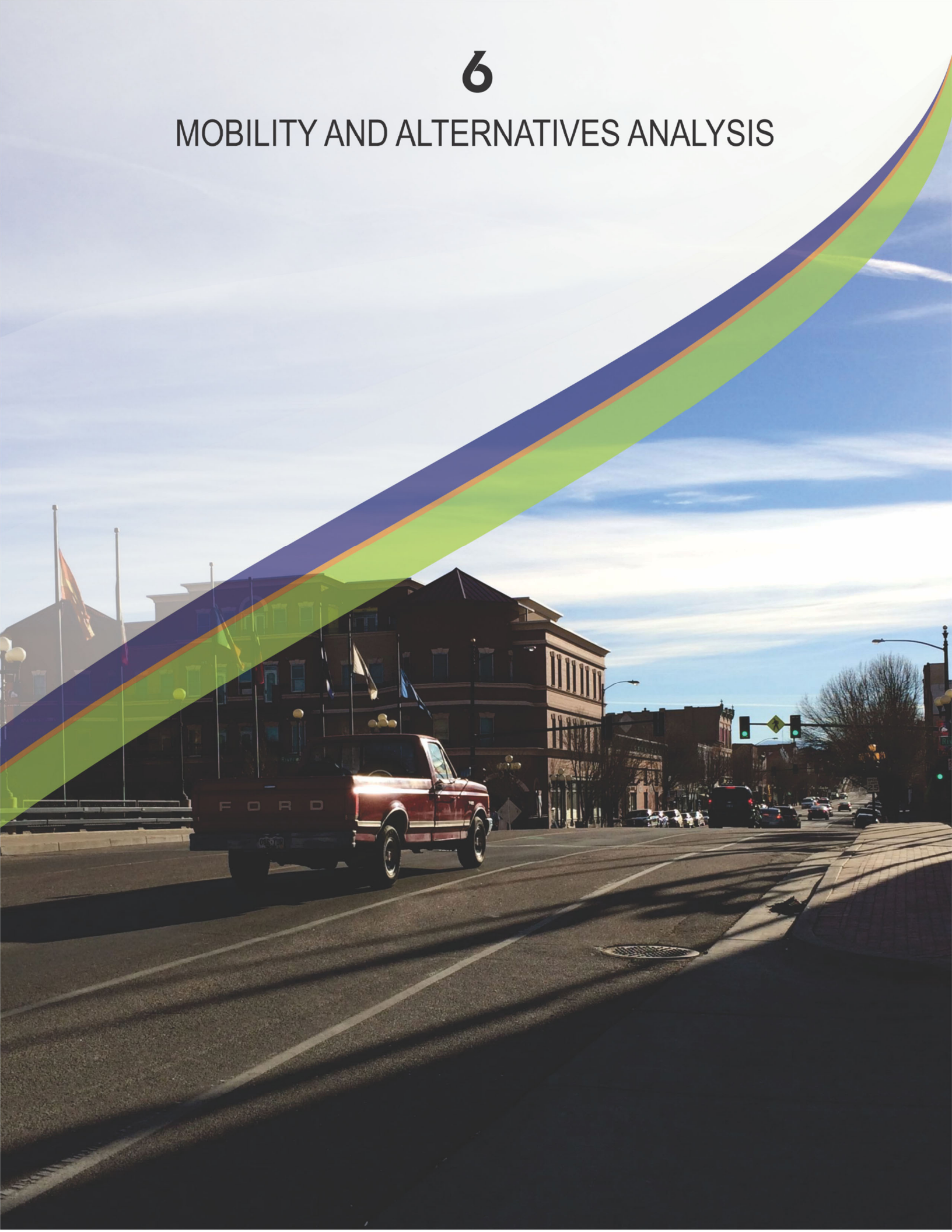


# 6

## MOBILITY AND ALTERNATIVES ANALYSIS



## 6.0 Mobility & Alternatives Analysis

Travel demand analysis provides a framework to identify transportation facilities and services that will be needed to serve future traffic demand in a region. Network-based analysis is used to identify locations where future demand is expected to approach or exceed the capacity of the existing transportation networks. This information provides a basis for developing alternative improvement projects that can be simulated and tested to determine effectiveness in meeting regional goals, including reduction of both congestion and vehicle miles traveled.

### 6.1 Forecasting Methodologies

Demand for transportation is forecast in one of two ways. The first is to examine past growth in traffic volumes along individual corridors and apply these historical growth factors to existing traffic along the same corridors. The second way is to build and utilize a network demand model. Network demand models have advantages, such as the capability to estimate the additional travel demand based on the amount and location of future growth in residential population and employment for each area within the region. Travel demand forecasting can be used to estimate traffic on complex highway networks whether statewide or within a Metropolitan Planning Organization (MPO) such as the Pueblo Area Council of Governments (PACOG) region. Each of the MPOs in the state of Colorado uses a travel demand model, which provides the most reliable forecasts for planning and project-level analysis.

PACOG completed a comprehensive update of its travel demand forecasting model in 2014. In 2020 the PACOG model was again updated to a base year of 2020 to support the identification and analysis of the impacts of land use changes and roadway improvements on regional traffic flow and to serve the 2045 Long Range Transportation Plan (LRTP). The model

continues to depend on the 2010 Front Range Household Travel Survey (HHTS) for calibration targets. The inputs to the model are 2020 and 2045 socioeconomic data that has been disaggregated to the revised traffic analysis zone (TAZ) level, as well as updated network databases for the 2020 base year and 2045 planning horizon year. The 2045 planning horizon socioeconomic forecasts are consistent with county-level control totals prepared statewide by the Office of the Colorado State Demographer. Detailed information on the inputs, outputs, and the structure of the PACOG travel demand model can be found in the 2015 methodology report,<sup>23</sup> and the 2020 Model Validation Memo,<sup>24</sup> both of which are internal documents that can be requested from PACOG staff. Additional information can be found in “Appendix B: Demographic Forecasts” in this LTRP. The model results are validated using 2019 City and County of Pueblo traffic counts as well as Colorado Department of Transportation (CDOT) traffic data and growth forecasts. Two roadway networks were developed to support travel demand analysis for the 2045 LRTP. These are the 2020 model base year network and a 2045 Fiscally Constrained LRTP Network.

The goal of this chapter is to present the results of PACOG’s 2020 and 2045 mobility overview. This task will be achieved in this sequence:

1. Present the analysis framework.
2. Review existing and future congestion.
3. Introduce solutions for future congestion.

### 6.2 Roadway Analysis Approach

Roadway capacity is of critical importance when examining the growth of a region. As traffic volumes continue to increase, roadway congestion also increases, and vehicle flow deteriorates. For this reason, it is important to look at the size and configuration of the current roadways and determine if these roads need to be expanded or if a road addition is needed to accommodate future traffic needs.

<sup>23</sup> HDR and Parsons Brinckerhoff, “Pueblo Planning Model Methodology Report,” Pueblo Area Council of Governments, March 2015.

<sup>24</sup> Wilson and Company and WSP, “Final PACOG 2020 Validation Tech Memo,” Pueblo Area Council of Governments, August 13, 2020.

The capacity of a road is a function of a number of factors, including the functional class or facility type of the roadway, the number of lanes, adjacent land use, access and intersection spacing, road alignment and grade, operating speeds, turning movements, vehicle fleet mix, adequate shoulders, street network management, and effective maintenance and operations. In practice, the number of lanes is the primary factor in evaluating road capacity since any lane configuration has an upper volume limit regardless of how well the segment has been designed.

For the purpose of examining the major roadway system in the Pueblo area, the newly validated 2020 PACOG travel demand model was used. Both 2020 and 2045 scenarios were used for this purpose.

### 6.2.1 Roadway Capacity

Roadway capacity measured in vehicles per lane per hour was developed using a look-up table, and it is then used in the network building module of the PACOG travel demand model. There are two required inputs to the process: the link facility type and the area type in which the link segment lies.

#### Facility Type

There are five distinct link facility types used to estimate capacity in the PACOG network. These are shown in **Table 6.1** and described below.

1. **Interstate** – Interstates (freeways) are high-capacity roadways that accommodate high-speed, long-distance travel to, from, and through the metro area. Access is strictly controlled and limited to major arterials connected by grade-separated

interchanges at a minimum spacing set by CDOT and by the Federal Highway Administration (FHWA).

2. **Expressways** – Expressways accommodate high-speed, long-distance travel to, from, and through the metro area. Access to adjacent land uses is limited. Full movement intersections are at-grade and signalized or grade-separated interchanges.
3. **Principal Arterials** – Principal arterials provide a high level of mobility and favor mobility over access to adjacent land uses. They provide access between lower classification streets (minor arterials and collectors) and higher classification streets (interstates and expressways).
4. **Minor Arterials** – Minor arterial streets balance the mobility of through traffic with access to adjacent land uses. Travel speeds and capacity are lower than for principal arterials. Separate turn lanes, especially continuous left-turn lanes, may be used to permit access to land uses on both sides of minor arterial streets.
5. **Collectors** – These roadways gather traffic from nearby local streets. Neighborhood collectors remain in the neighborhood and are residential in character. Mixed-use collectors form the edge of neighborhoods and have a wider right-of-way to allow for future turn lanes or additional width in the future. Residential homes are typically not sited to face mixed-use collectors. Business collectors serve commercial development and may be in industrial areas, mixed-use neighborhoods, and regional commercial shopping areas.

**Table 6.1: PACOG Link Facility Type**

Facility Type	Description
1	Interstate
2	Expressway
3	Principal Arterial
4	Minor Arterial
5	Collector

## Area Type

A second dimension of link capacity estimation is the area type in which the road segment lies. There are five distinct area types in the PACOG demand model: (1) Central Business District (CBD), (2) Outlying CBD, (3) Urban, (4) Suburban, and (5) Rural. The area type designation is related to typical densities of each area type. CBD zones have a dense street grid, high walkability, and the ability to make short trips to satisfy daily needs. The CBD Outlying area type maintains some of the features of the CBD type, though slightly dampened. Urban areas have a regular street grid, though they feature less walkability. The Suburban and Rural area types move toward dominant auto driver or auto passenger travel mode. The theory behind the inclusion of area type is that roadway capacities differ based on the location of the road segment. For example, a collector in a CBD will behave differently from a collector in a rural area. Hourly lane capacity is set by roadway type and area type.

The travel model link capacity is set using a look-up table that integrates both functional class and area type to set hourly lane capacity, as presented in **Table 6.2**.

The PACOG travel model features three time periods over the 24-hour day, including one-hour AM and PM peak periods, which were designed to serve the LRTP in identifying congestion hotspots. The PM peak hour volume-to-capacity (V/C) ratio provides a powerful analysis metric, one that is focused on a known period of congestion, the evening peak. V/C ratio is calculated with road segment volume in the numerator and hourly capacity in the denominator. When the ratio reaches the number 1, with volume equal to capacity, the road is at Level of Service “F,” or very highly congested. For purposes of the travel demand analysis, the hourly V/C ratio metric was aligned with well-understood level of service (LOS) measures, as shown in **Table 6.3**.

**Table 6.2: Model Link Capacity  
Look-Up Table**

Area Type	Facility Type	Capacity
CBD	1	1,600
	2	650
	3	500
	4	450
	5	450
CBD Outlying	1	1,700
	2	700
	3	600
	4	500
	5	500
Urban	1	1,900
	2	900
	3	750
	4	650
	5	650
Suburban	1	1,900
	2	900
	3	750
	4	600
	5	600
Rural	1	1,900
	2	800
	3	650
	4	600

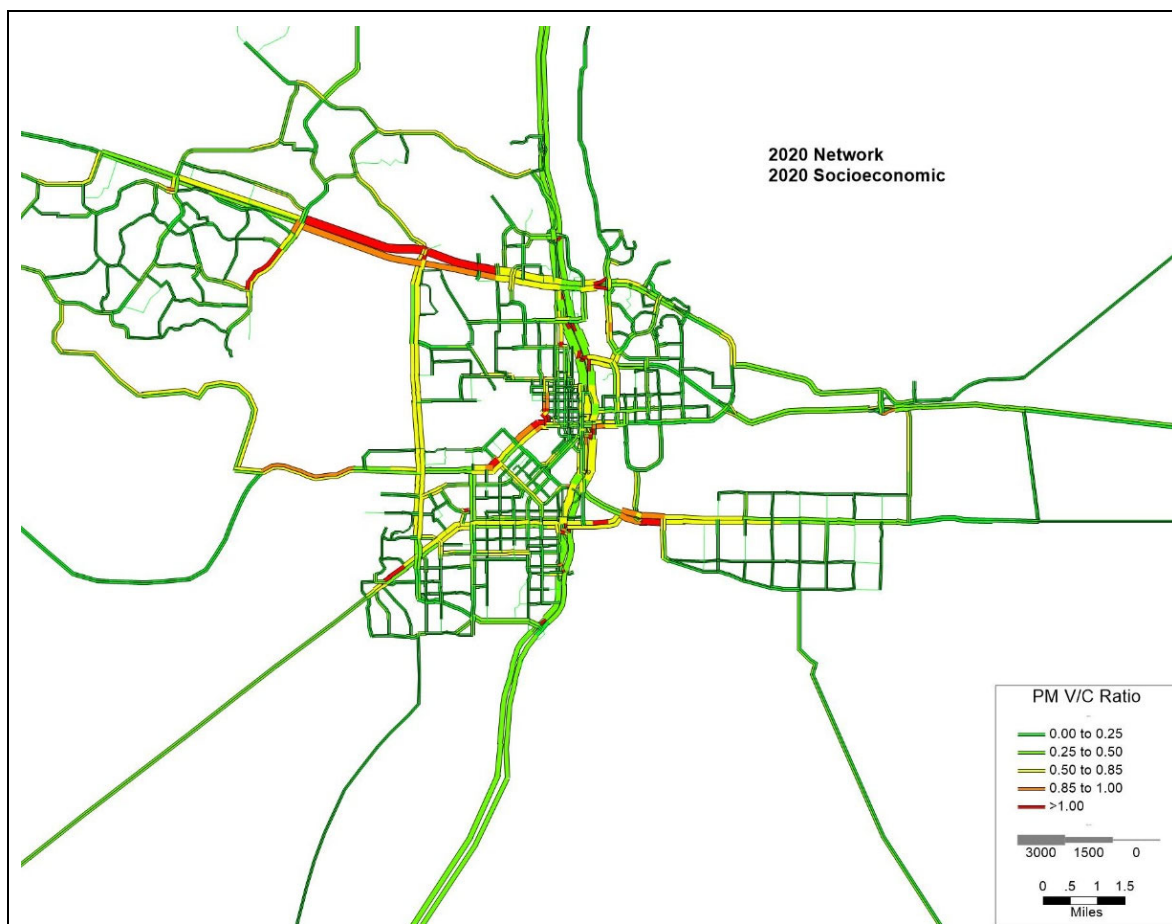
**Table 6.3: PM Peak Hour V/C Ratio  
Level of Service Equivalencies**

V/C Ratio Range	Level of Service
0.00 to 0.25	A
> 0.25 to 0.50	B
> 0.50 to 0.85	C/D
> 0.85 to 1.00	E
> 1.00	F

The PACOG travel demand model provides a visual representation of PM hourly congestion for three scenarios: 2020 Existing Conditions, 2045 No Build, and 2045 Fiscally Constrained. These scenarios are described in the next two sections.

## 6.3 Existing Roadway Congestion

The PACOG travel demand model was used to evaluate 2020 Existing Conditions, that is, existing levels of roadway congestion for the 2020 PM peak period. **Figure 6.1** shows that PM congestion primarily affects U.S. Highway 50 West and Interstate 25 (I-25) with some congestion on CO 96. Note that I-25 tends to become lightly congested in both directions in downtown Pueblo. U.S. Highway 50, however, has a high level of use throughout, but the critical need for capacity enhancements is westbound in the PM peak period in the areas west of Pueblo. A factor in congestion that affects these two facilities is the lack of available alternative relief routes in the existing roadway network.



**Figure 6.1: 2020 Base Year Scenario – PM Peak Volume to Capacity Ratio**

## 6.4 Future Roadway Congestion

### 6.4.1 Future No Build Roadway Congestion

The PACOG travel demand model was used to evaluate future levels of roadway congestion for the PM peak period if no improvements were made to the existing transportation network. For this No Build. condition, the 2020 network

was modeled with 2045 socioeconomic data/travel demand. The model results, shown in **Figure 6.2**, highlight significantly worsened congestion that continues to affect U.S. Highway 50 and I-25 and spreads to other facilities such as CO 47, 78, and 96 as well as Overton Road. Again, a factor in congestion that affects these facilities is the lack of available alternative relief routes in the existing roadway network.

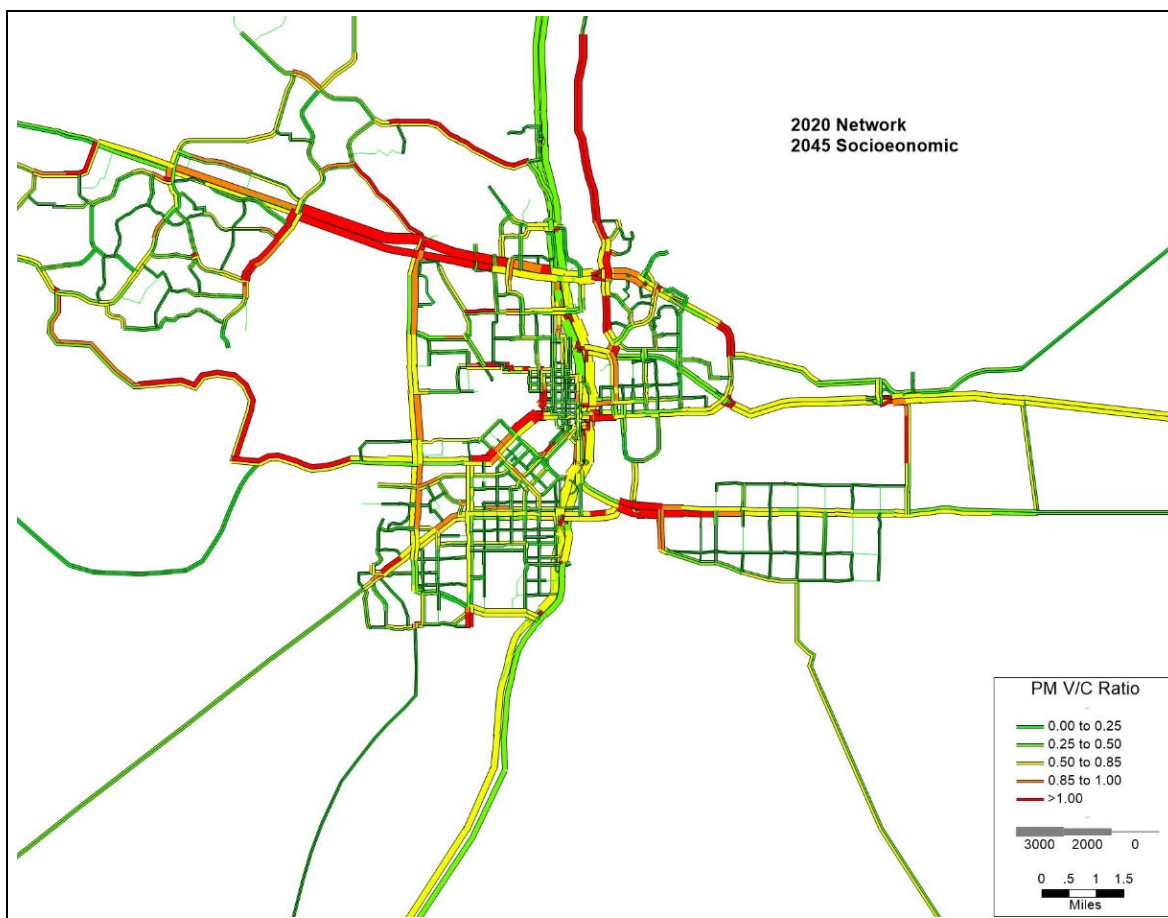


Figure 6.2: 2045 No Build Scenario – PM Peak Volume to Capacity Ratio

### 6.4.2 Future 2045 Fiscally Constrained Roadway Congestion

Supported by analyses of existing and future No Build travel demand and roadway congestion, and consistent with fiscal constraints, PACOG developed a 2045 Fiscally Constrained highway network scenario that focuses on high priority needs and available resources. This network was then evaluated using the PACOG travel demand model in the PM peak period. Model PM V/C ratio results are shown in **Figure 6.3**. The 2045 Fiscally Constrained improvements

provide some improvement over the 2045 No Build scenario but do not fully keep pace with the forecast growth in travel demand. Selected facilities, such as U.S. Highway 50 and I-25 would be somewhat improved over existing conditions even with increased 2045 travel demand. Other facilities, such as CO 45 and CO 96 encounter additional congestion due to the growth in residences and employment. U.S. Highway 50 continues to encounter congestion in the westbound direction in the PM peak.

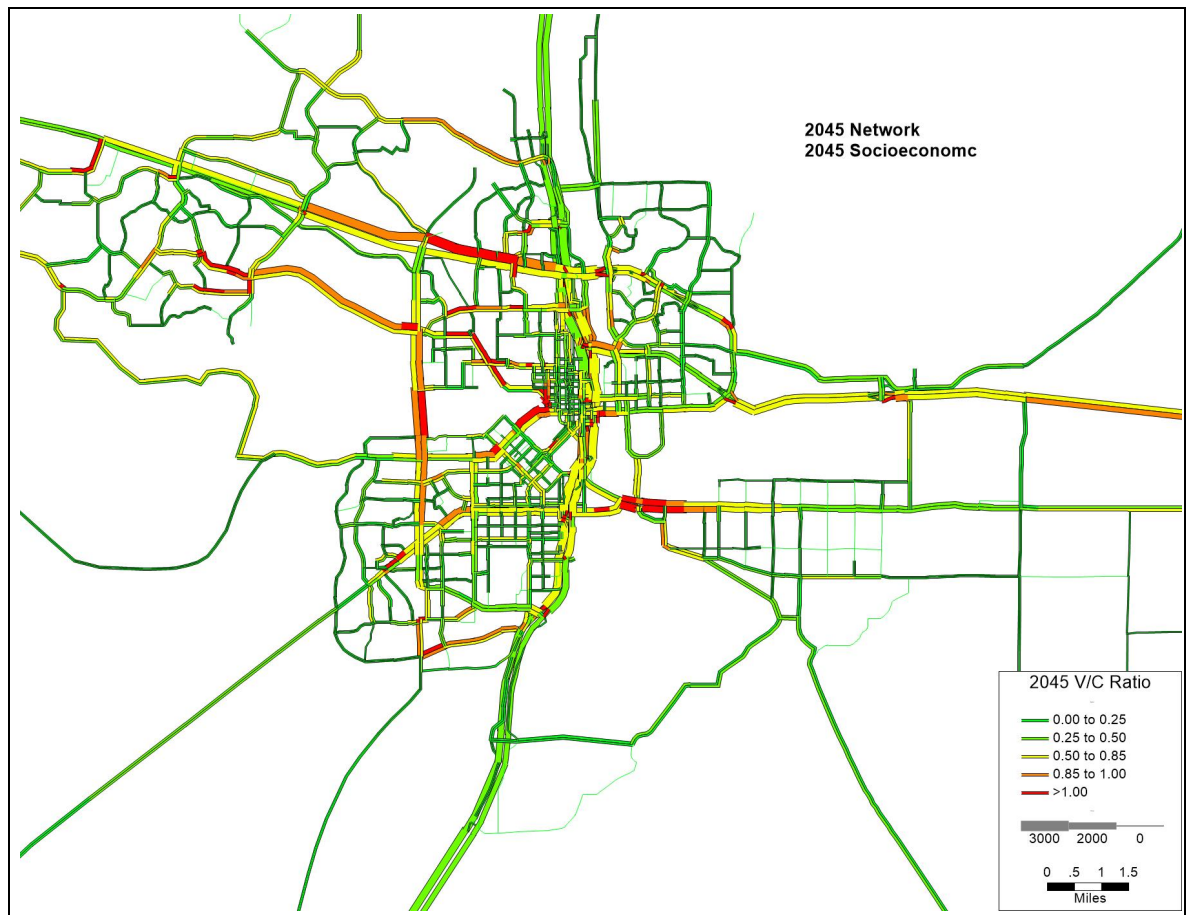


Figure 6.3: 2045 Fiscally Constrained Scenario – PM Peak Volume to Capacity Ratio

### 6.4.3. Future Congestion Summary of Findings

The three PACOG travel demand model scenarios—2020 Existing Conditions, 2045 No Build, and 2045 Fiscally Constrained—behave in a consistent manner with respect to the socioeconomic inputs and the chosen networks. The existing 2020 scenario shows congestion in the locations and direction observed by local planners, engineers, and citizens. The two projected 2045 scenarios extend this logic by first showing a progression of congestion in the future if no action is taken (No Build) and then showing the impact of fiscally constrained highway build solutions. The following was noted:

- In the 2020 PM peak, there is congestion on U.S. Highway 50 West in both eastbound and westbound directions. This pattern remains in place, at differing levels, in the 2045 No Build and the 2045 Fiscally Constrained scenarios. The U.S. Highway 50 West corridor is a key connector and warrants investment in capacity.
- Congestion on I-25 in the PM peak is similar between the three scenarios; PM

traffic congestion is medium (V/C between .50 and .85) and bidirectional.

- The interchanges that serve Pete Jimenez Parkway at both ends suffer some congestion in all scenarios.

While visual analysis is valuable, it is best supported by a metric that tabulates both congested and uncongested vehicle miles over the PACOG region. One useful metric is the PM vehicle miles traveled (VMT); this period is selected because it features the highest level of congested miles and thus operates as a “stress test.” Both VMT and congested VMT are tabulated from the PM traffic assignment. Congested VMT is defined as all road segments operating at V/C greater than .85 in the PM peak.

Summaries are shown in **Table 6.4**. In 2020, there are 332,784 VMT in the PM peak with 7.8% of these miles congested. In 2045, the No Build total is 515,240 VMT with 10.2% congested, signaling that the network is less able to handle the demand. With the improvements in the 2045 Fiscally Constrained scenario, the percent congested PM VMT drops to 8.2%, with more than 10,000 fewer congested miles when compared to the No Build scenario.

**Table 6.4: Comparison of 2020, 2045 No Build, and 2045 Fiscally Constrained Congested VMT**

Type of VMT	2020 Network		2045 No Build (2020 Network with 2045 SE)		2045 Fiscally Constrained LRTP Network	
	PM VMT	% of Total	PM VMT	% of Total	PM VMT	% of Total
Congested VMT	26,088	7.8%	52,455	10.2%	42,030	8.2%
Uncongested VMT	306,696	92.2%	462,785	89.8%	468,549	91.8%
Total	332,784	100.0%	515,240	100.0%	510,578	100.0%

Centerline Miles	659	659	964
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## 6.5 Addressing Roadway Congestion

Reducing or minimizing future congestion is one of the most important goals to consider in planning the transportation system. Based on the review of current and future forecasts of congestion, one feature is significant: Areas with limited connectivity have greater levels of congestion than do areas with multiple access points. This will be a significant factor in planning for the future development of the areas around I-25 and U.S. Highway 50. Traditionally, increases in the capacity of existing facilities and/or the development of alternate or parallel facilities are tested to reduce areas of congestion. However, local agencies can also implement measures to reduce the demand for transportation services. PACOG is mindful of Travel Demand Management (TDM) strategies, including the development of incentives for using alternate modes of travel such as carpooling, public transportation, traveling off-peak, and telecommuting.

## 6.6 Roadway Alternatives

This section presents the funded highway projects cited by CDOT with descriptions of their locations and extent. The projects emerged from multiple cycles of planning and engineering review and are keyed to the congestion locations shown in **Figures 6.1 through 6.3**. The solutions are presented by facility name. The roadway discussions are framed using CDOT's 2045 Statewide Transportation Plan project listing.<sup>25</sup> The three goals of the statewide plan are mobility, safety, and asset management, which echo the goals of PACOG's LRTP.

Project categories, all of which are applicable to PACOG, include:

- Improving interstates
- Relieving traffic
- Improving rural access statewide

- Fixing rural roads (e.g., rural paving)
- Improving roadway system condition (e.g., road maintenance, bridge repairs)

Using funding provided by the state legislature through Senate Bill (SB) 262, SB 1 and SB 267, CDOT will be able to implement projects in the 10-Year Strategic Project Pipeline. The following comprehensive project listing identifies the funded and unfunded projects CDOT is proposing in Pueblo County.

1. U.S. Highway 50 and Purcell Drive Interchange: Constructs a grade-separated interchange to improve safety and mobility of U.S. Highway 50. Adds one lane on U.S. Highway 50 westbound to better connect Pueblo and Pueblo West. Improves pedestrian and bike accessibility. Cost is \$37 million.
2. I-25 through Pueblo New Freeway: Reconstructs U.S. Highway 50 and I-25 interchange and realigns U.S. Highway 50 to the east over Fountain Creek. The preferred project with greatest impact will replace three poor bridges along I-25 and U.S. Highway 50, streamline on and off ramps, and raise the bridge height. Cost is \$60 Million.
3. I-25 Exit 108 (Purcell Boulevard) Replace Single Box Culvert Crossing Under I-25: Replaces a single box culvert crossing under I-25 at Exit 108 (Purcell Boulevard). Cost is \$11 million.
4. I-25 at Exit 104 - Dillon Drive Improvements: Includes constructing a new two-lane facility and a roundabout at Exit 104. Cost is \$3 million.
5. I-25 Improvements between 13th Street and U.S. Highway 50: Includes I-25 improvements between 13th Street and U.S. Highway 50, which are likely to include on-ramp/off-ramp improvements and a possible new interchange reconfiguration at U.S. Highway 50B. Cost is \$28 million.

<sup>25</sup> Colorado Department of Transportation, "Vision for Colorado's Transportation System, Statewide Transportation Plan: 10-Year Strategic Project Pipeline," June 2020,

<https://www.codot.gov/programs/your-transportation-priorities/assets/ylp-10yearvision.pdf>.

6. SH 96 West of Pueblo: Includes shoulder widening, bridge rail replacement, bike lanes, and other safety improvements on SH 96 west of Pueblo. Cost is \$11.5 million.
7. Business U.S. Highway 50 Drainage Improvements at 36th Lane: Includes U.S. Highway 50 drainage improvements at 36th Lane. Cost is \$5.5 million.
8. SH 47 Four-Lane Extension to U.S. Highway 50: Widens SH 47 to four lanes to U.S. Highway 50. Cost is \$8 million.

These projects address the known Pueblo traffic corridors that will grow in congestion between 2020 and 2045.

### Interstate-25

The purpose of investment in I-25 is to improve safety for north-south travel and to improve local and regional mobility within and through the Pueblo County to meet existing and future travel demands. Much of I-25 through Pueblo was built between 1949 and 1959 as U.S. 85/87 before the creation of the Interstate Highway System in 1956. As a result of its age and outdated design standards, this segment of I-25 has contained structural and operational deficiencies. These deficiencies are historically linked to high accident rates, areas of reduced speed, traffic congestion, and poor traffic operations. Many needed improvements have been completed on I-25 in the last 25 years.

Recent projects on I-25 include the I-25 Corridor Access and Hazmat Study from Ilex Street to 29th Street; I-25 Intelligent Transportation System (ITS), which installed traffic cameras from MP 109 to MP 114.8; I-25 North from 13th Street to the U.S. Highway 50B Interchange; and I-25 Eastside Frontage Road from the Dillon Interchange to the Eden Interchange.

Ten-year CIP projects on I-25 as of 2020 from the comprehensive CDOT list above that are CDOT funded are:

1. I-25 through Pueblo New Freeway U.S. Highway 50 to the east over Fountain Creek.
2. I-25 Exit 108 (Purcell Boulevard).

3. I-25 at Exit 104 - Dillon Drive Improvements.
4. I-25 Improvements between 13th Street and U.S. Highway 50.

### U.S. Highway 50

U.S. Highway 50 is the only existing route between I-25 and the major business and population centers in areas west of I-25. Investment in U.S. Highway 50 would enhance travel times and connectivity east-west by eliminating congestion in the AM and PM peaks.

Previously funded projects on U.S. Highway 50 include:

1. Eastbound U.S. Highway 50A West) from Wills Boulevard to McCulloch Boulevard: Add the third lane and trail facilities and improve pedestrian crossings at signalized intersections.
2. Westbound U.S. Highway 50A West from Wills Boulevard to McCulloch Boulevard: Complete the EA from Wills Boulevard to McCulloch Boulevard, add the third lane from Wills Boulevard to the hill just west of Pueblo Boulevard, realign to be parallel to the eastbound alignment, construct a new bridge, rebuild the signal at U.S. Highway 50/Pueblo Boulevard to accommodate the new WB alignment and traffic flow, and improve pedestrian crossings at signalized intersections.
3. Several projects to enhance traffic flow include:
  - a. U.S. Highway 50C from 4th Street to Baxter Road from Aspen Road to 21st Lane (MP 0.0 to 7.4): overlay and drainage work.
  - b. U.S. Highway 50 from Bonforte Boulevard to Hudson Avenue: intersection upgrades.
  - c. U.S. Highway 50B (MP 332.1 and 333.9): Construct continuous left lane where U.S. Highway 50C and U.S. Highway 50B meet.
  - d. U.S. Highway 50 Access Management Plan from Interstate 25 to Fortino Boulevard.

Ten-year CIP projects on U.S. Highway 50 as of 2020 from the comprehensive CDOT list above that are CDOT funded are:

1. U.S. Highway 50 and Purcell Drive Interchange.
2. Business U.S. Highway 50 Drainage Improvements at 36th Lane.

### State Highway 96

Traffic along SH 96 is expected to increase as population centers continue to grow west of SH 45 and south of the Arkansas River. This vital link to/from downtown Pueblo will require both safety and capacity improvements.

Previously funded projects on SH 96 include:

1. SH 96A at Abriendo Avenue: Intersection improvements (signal update, ADA ramps, and pedestrian crossing improvements).
2. SH 96A at Chester Avenue: Adds a left-turn lane and replace the signal.
3. SH 96 at Acero Avenue and at Bradford Avenue: Improvements.
4. SH 96A West of Pueblo: Widens shoulder, replaces bridge rail, and includes bike lane and other safety improvements.

A 10-year CIP project on SH 96 as of 2020 from the comprehensive CDOT list above that is CDOT funded is:

1. SH 96 West of Pueblo: This project will include shoulder widening, bridge rail replacement, bike lanes, and other safety improvements on SH 96 west of Pueblo.

### State Highway 47

Traffic along SH47 is expected to increase as population centers continue to grow east and north of SH 47 and east of Fountain Creek. Colorado State University at Pueblo also lies adjacent to this facility. This vital link connects Pueblo West via U.S. Highway 50 to the Airport Industrial Park (AIP) via Pete Jimenez Parkway. If large-scale development is built in the northeast quadrant of Pueblo County, major freeway/expressway corridors, as well as supporting arterials and collectors, will be required to accommodate future traffic growth.

A previously CDOT funded project on SH 47 is:

1. SH 47 Junction at I-25/ U.S. Highway 50 to East of Troy (MP 0.035 to 0.29)

A 10-year CIP project as of 2020 from the comprehensive CDOT list above that is CDOT funded is:

1. SH 47 Four-Lane Extension to U.S. Highway 50

Additional Highway projects on a range of Pueblo area roads include work on SH 96 and SH 45.

### Summary of Roadway Alternatives

Addressing existing and future congestion in the Pueblo Area has required a careful assessment of facility needs with available revenue, driven by the local planning and engineering knowledge gathered over decades in the region. Congestion on I-25 and U.S. Highway 50, both on the ground and as mirrored in the PACOG 2020 and 2045 travel demand model scenario results, has driven the projects screened and selected for this LRTP.