

# Chapter 1

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Purpose and Need





# Chapter 1. Purpose and Need

## 1.1 Introduction

State Highway 402 (SH 402) is a heavily used two-lane, east-west arterial connecting United States Highway 287 (US 287, also known as Lincoln Avenue) and Interstate 25 (I-25).<sup>1</sup> This 4-mile highway is located south of the city of Loveland in Larimer County, Colorado. SH 402 serves local residents and businesses and is used as a commuter route to I-25. The project location is shown in Figure 1-1.

Access to a carpool lot (approximately 88 spaces) located at the southwest quadrant of the SH 402 and I-25 interchange was included as a part of this study. Potential improvements at the I-25 interchange are being addressed under the current *North I-25 Environmental Impact Statement*.

SH 402 begins at US 287 and ends at I-25. An existing four-lane highway extends west of US 287 and is known as 14th Street in the city of Loveland. East of I-25, a rural two-lane county highway segment extends east through the edge of Johnstown and into the town of Evans, where it ends.

This Environmental Assessment (EA) encompasses the 4-mile length of SH 402 although improvements are not needed for the area between US 287 and CR 13C (St. Louis Avenue), which was widened by developers in coordination with the city of Loveland and the Colorado Department of Transportation (CDOT) under a Categorical Exclusion (CE) dated

<sup>1</sup> An urban cross section has been developed and partially built from US 287 east to CR 13C; the interim condition will remain until the development on the south side of SH 402 is constructed. This section was constructed by developers in coordination with the city of Loveland and CDOT under a Categorical Exclusion, dated September 18, 2003. Impacts related to widening between US 287 and CR 13C are not included in this analysis, and the existence of this developed portion of SH 402 did not restrict consideration of alternatives.

September 18, 2003. The EA was undertaken to investigate mobility and safety improvements along the SH 402 corridor. Analysis included assessment of both current travel conditions and projections for 2030 to identify and address both current and future travel demand needs.

The **purpose** of this project is to improve mobility and safety along the existing SH 402 from the US 287 intersection east to the I-25 interchange.

The **need** for this project is established by identifying and analyzing the 2030 travel demand and expected growth and development. The existing two-lane highway's substandard design from CR 13C to I-25 includes no turn lanes, narrow shoulders, and poor sight distances (how far ahead a driver can see from the road), resulting in mobility and safety concerns.

Mobility and safety concerns will worsen as traffic increases between now and 2030. Currently, traffic congestion and slowing are observed during peak periods. Public experiences of safety problems are common. Failure to address these problems will result in a highway with heavy congestion, significant delays, and exacerbated safety problems before 2030.

The eastbound morning peak traffic and westbound afternoon peak traffic indicate that SH 402 is used heavily by commuters for access to I-25.

The following terms are used throughout this document. *Corridor* refers to a highway and associated right-of-way only. *Study area* refers to an area larger than the corridor width and associated with a particular resource. The study area varies with the resource being analyzed.

This EA was conducted in accordance with the National Environmental Policy Act. The Federal Highway Administration (FHWA) is the lead agency, and CDOT is the applicant. FHWA requires completion of this study before initiation

of any improvements using federal money. Should improvements be warranted, FHWA will make the final decision on the appropriate action to be taken.

The project is included in the *Statewide Transportation Improvement Program (STIP)*. The STIP identifies necessary transportation improvements throughout Colorado that currently have funding available.

The North Front Range Transportation and Air Quality Planning Council (NFRT & AQPC) *2030 Regional Transportation Plan (RTP)* also shows improvement of SH 402 between US 287 and the I-25 interchange on its list of priorities within the *corridor vision #13 US 34 urban* category. The primary investment need for this corridor is mobility, which is consistent with this EA.

The 2005 update to the *Loveland 1994 Comprehensive Master Plan* cites the highway as a "significant arterial corridor." This formal recognition of the importance of SH 402 and its future mobility and safety indicate that improvements to SH 402 are part of the local and regional goals. SH 402 will be inconsistent with local plans and policies if improvements are not implemented.

The following sections support the project purpose and need.

- Project Purpose: Mobility and Safety
  - Existing SH 402 cross section
  - Level of service (LOS)
  - Crash analysis
- Project Need: Travel Demand and Growth
  - Travel demand
  - Land use and growth
- Photographic Essay

## 1.2 Project Purpose: Mobility and Safety

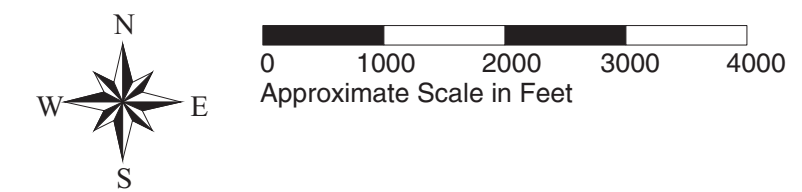
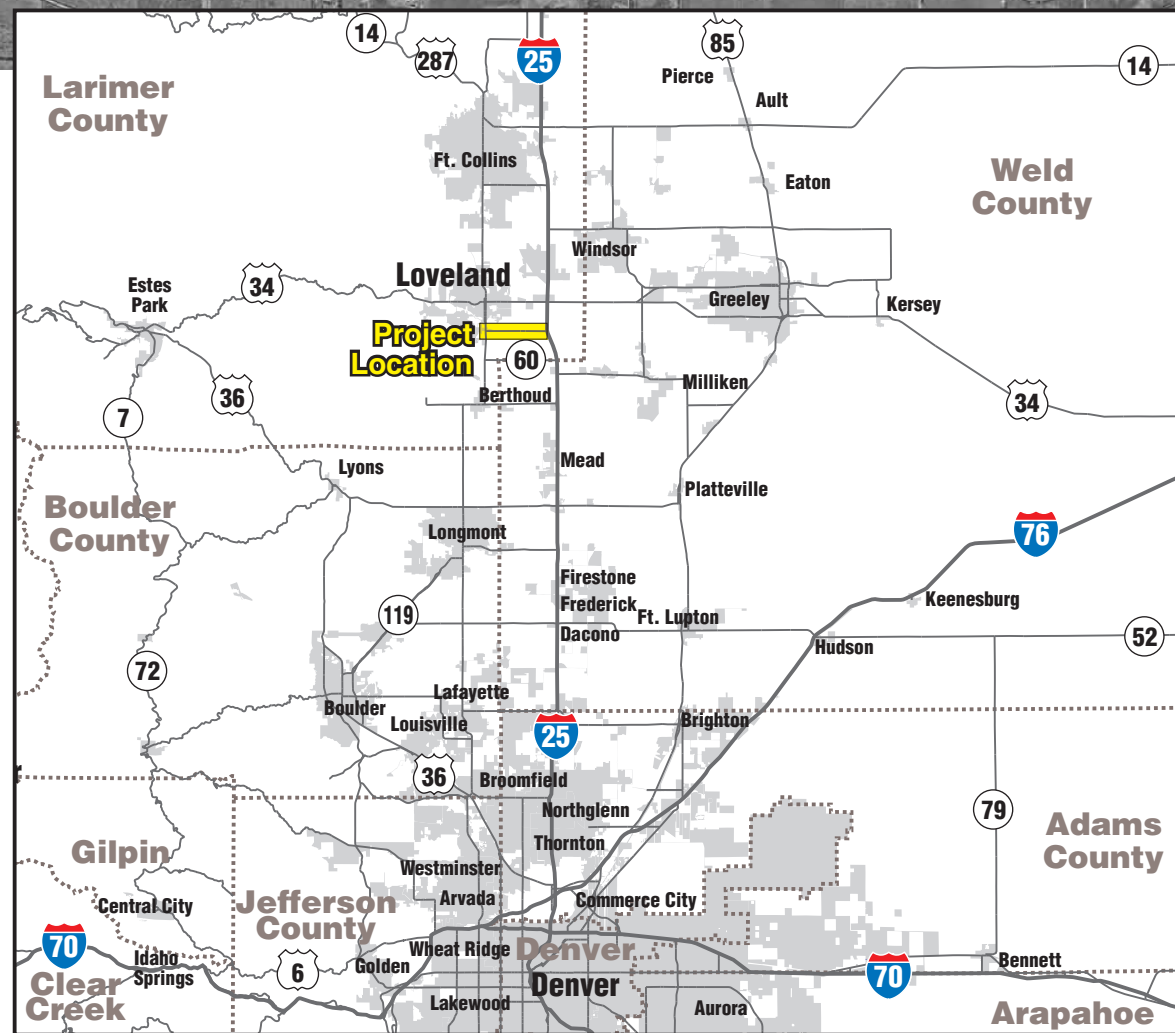
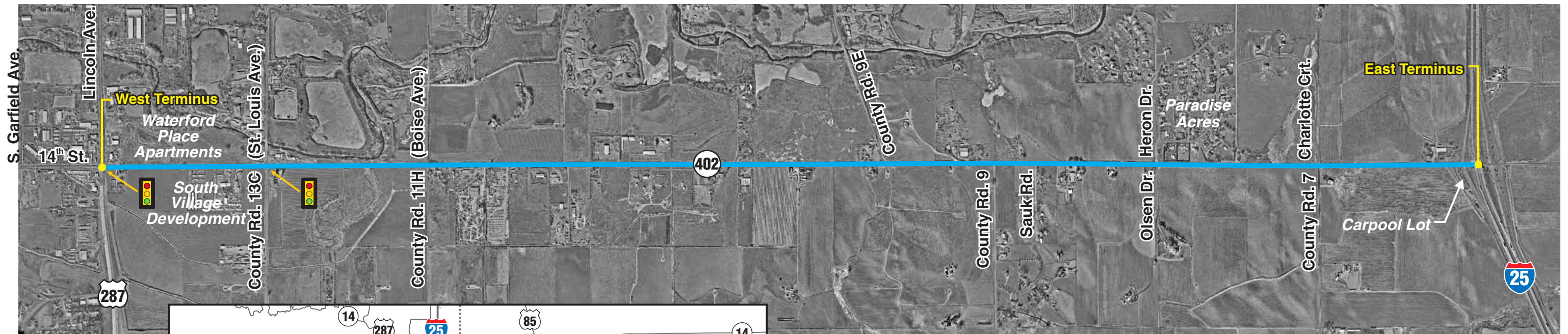
Mobility involves connecting more people and vehicles in less time with their work, school, community services, marketplaces, and each other. Congestion has a significant effect on mobility. Congestion is directly related to the ability of the highway to carry traffic efficiently. Key elements for identifying congestion are the cross section of the highway and the level of service (LOS). The cross section identifies the number and width of lanes and shoulders, as well as other typical highway features such as turn lanes and medians. LOS is a qualitative measure of the operational characteristics of the traffic stream. This section provides information on the existing cross section and the appropriate LOS for SH 402.

Mobility and safety are closely tied together. As congestion builds, crash rates increase, and as crashes increase, there is more congestion. This section also summarizes crash information and related corridor characteristics for SH 402.

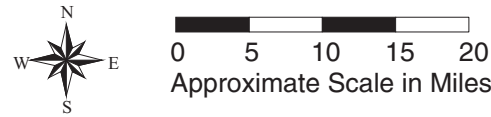
### 1.2.1 Existing SH 402 Cross Section

The existing SH 402 between US 287 and CR 13C is a four-lane highway with two signalized intersections and a raised median allowing limited access and associated turn lanes. Between CR 13C and the I-25 interchange, it is a two-lane highway with seven unsignalized intersections (see Figure 1-1). SH 402 is classified as a minor urban arterial for its entire length.

Substandard narrow shoulders extend for most of the length of the existing highway, with numerous direct residential and business accesses. Figure 1-2 illustrates the cross section of the existing SH 402 east of CR 13C. Although right-of-way width varies along SH 402, it is generally 60 feet to the east of CR 13C.

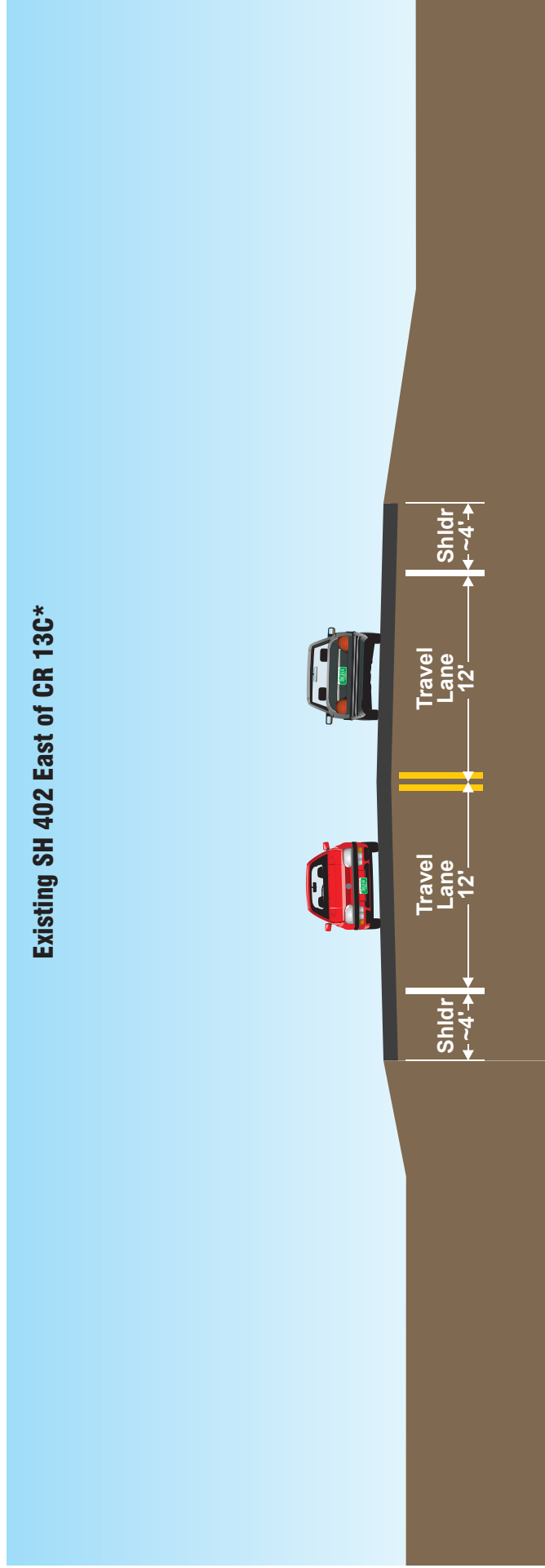


Note: SH 402 project does not include I-25 interchange improvements at the east terminus. SH 402 project does include intersection improvements at US 287, the west terminus. These improvements extend west of the intersection to tie into existing 14th Street.



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**Existing SH 402 East of CR 13C\***



\*Existing right of way is approximately 60'

## 1.2.2 Level of Service

LOS is a qualitative measure of the operational characteristics of a traffic stream, ranked from A (best) to F (worst). LOS is described in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Highway LOS ratings are as follows:

LOS A	free-flow operations
LOS B	reasonably free-flow operations
LOS C	noticeable traffic
LOS D	declining speeds and congestion beginning to form
LOS E	maximum service flow (full capacity)
LOS F	heavy congestion, significant delays, stop-and-go-traffic

The factors used to determine LOS differ with the type of highway and intersection:

- ❑ Highway segment LOS is generally based on the ratio of volume over capacity.
- ❑ Intersection LOS is based on vehicle seconds of delay.

For two-lane highways, the percentage of no-passing zones is also taken into consideration when determining LOS. The LOS shown in this document is for the peak morning and evening hours.

The Rural and Urban Arterials category from the American Association of State Highway and Transportation Officials (AASHTO) design guide applies to SH 402. According to AASHTO (*AASHTO Green Book*, 2004, fifth edition), rural and urban arterials and their auxiliary facilities (turning lanes, intersections, interchanges) should generally be designed for LOS C. However, LOS D is more appropriate in heavily developed areas. Therefore, the design goal for SH 402 for the US 287 intersection to CR 13C is LOS D, with LOS C for the remainder of SH 402 east of CR 13C. This also complies with city of Loveland transportation plan requirements.

## 1.2.3 Crash Analysis

Data collected by CDOT between January 1, 1998, and December 31, 2002, were used to perform a crash analysis. CDOT crash rates calculated for SH 402 cover the entire length of the highway between US 287 and I-25 but do not include I-25 crashes. During the five years analyzed, 194 crashes occurred: 112 involved property damage only, 81 involved injuries, and 1 involved a fatality. The most common crash types were rear-end (48 percent), collisions with fixed objects (21 percent), and broadsides (14 percent). Rear-end and broadside crashes typify the design deficiencies of the existing SH 402, including poor sight distance and inadequate turn lanes and shoulders.

The highest percentage of crashes (83 percent or 143) involved travel along SH 402. Most of the overall crashes on SH 402 (52 percent) were at intersections or intersection-related, and 20 percent were driveway-related. The remainder (17 percent) occurred in driveways and at intersections (mainly US 287, CR 13C, and CR 9E).

Analysis of crash data, together with a preliminary field safety inspection, reveals the following SH 402 corridor characteristics:

- ❑ The shoulders along SH 402 are typically about 4 feet wide, although this varies. The standard width for a highway of this type is 10 feet.
- ❑ Numerous residential and business driveways are located along the highway in the study area. Some of these driveways are very close to intersections.
- ❑ Turning onto side roads and driveways requires slowing that can catch drivers by surprise. Because speeds are fast, a sudden drop in speed by a vehicle turning left or right creates a high-speed differential, increasing the risk of rear-end accidents.



- ❑ Sight distance problems were observed at several locations. Some unsignalized intersections (for example, SH 402 and CR 9E) require vehicles to stop well beyond a stop sign in order to see traffic on SH 402. In the eastern section of the study area with its rolling terrain, Sauk Road, Heron Drive/ Olsen Drive, and CR 7 access SH 402 with inadequate stopping sight distance due to the terrain.
- ❑ Restricted sight problems exist for some driveways, including one at the northeast end of the intersection of SH 402 and CR 13C. The line of westbound vehicles at the intersection blocks sight of vehicles traveling east on SH 402.
- ❑ Traffic volumes are high and are expected to increase in the future. Increased traffic, combined with high speeds, unexpected stops, inadequate shoulders, and restricted or inadequate sight distances, makes this section of SH 402 a candidate for safety improvements.

Table 1-1 provides safety information for the SH 402 corridor. Note that the Weighted Hazard Index (WHI) is -2.56 for the entire project length, which is less than the statewide average. However, WHI for the rural section (CR 13C to I-25) is 1.98, which is worse than the statewide average for this type of highway.

**Table 1-1. 1998–2002 Safety Records: SH 402 Averages per MVMT and WHI**

Safety Criteria	SH 402
Property Damage Only per MVMT	5.32
Injury Crashes per MVMT	3.85
Fatalities per 100 MVMT	0.05
Total Crashes per MVMT	9.22
Weighted Hazard Index	-2.56

*MVMT = million vehicle miles traveled*

WHI compares the frequency and severity of crashes to the statewide average. WHI values greater than zero exceed the statewide average, and values less than zero are below the statewide average.

## 1.3 Project Need: Travel Demand and Growth

Travel demand is calculated by identifying trip generation (sources of trips such as commute to work, shopping, home), distribution (where trips go), mode choice (automobile, bus), and traffic assignment (uses this information to generate trips on various highway networks). For this project, travel demand was forecast for 2030. Because travel demand is forecast based on assumptions about land use and growth, additional information is provided in this section on land use and growth.

### 1.3.1 Travel Demand

Volumes for current average daily traffic (two-way traffic in number of vehicles per day, or ADT) were based on traffic counts taken in November 2001. ADT volumes in 2001 were 16,100 between US 287 and CR 13C, and ranged from 13,400 to 14,000 between CR 13C and the I-25 interchange. Existing conditions are represented in this study using 2001 traffic counts.

To investigate 2030 travel conditions, a “best fit” linear regression line for a data set that included past, present, and future (2025) ADT was applied. Additional information on 2030 traffic can be found in the *Traffic Report: State Highway 402 Environmental Assessment from US 287 (MP 0.00) to I-25 (MP 4.00)* prepared by J.F. Sato and Associates in July 2004.

The 2030 traffic projections identify ADT volumes ranging from 36,700 between US 287 and CR 13C to 37,150 between CR 13C and the I-25 interchange on a typical weekday during a school year. These calculations indicate a 128 percent increase in traffic volumes in the western portion of the project area near the intersection with

US 287, and a 170 percent increase in the eastern portion of the project area near the I-25 interchange.

Increases in 2030 traffic result from local and regional population growth and travel demands along SH 402. Travel projections for SH 402 are increasing at a higher rate than the area population as one new person generates more than one new trip. In addition to population projections, traffic forecasts for SH 402 include NFRT & AQPC, Larimer County, and city of Loveland planning assumptions, area employment opportunities, retail development patterns, and through traffic movements.

Traffic volumes are expected to increase 128 percent in the western portion of the project area near the intersection with US 287, and 170 percent in the eastern portion of the project area near the I-25 interchange.

Table 1-2 and Table 1-3 show LOS values for intersections and through traffic for the existing highway (No Action Alternative). LOS values were determined as follows. Future turning movement counts were calculated using the SIMTRAFFIC model and calibrated from traffic counts taken in November 2001. Average delay values for intersections were also obtained from the SIMTRAFFIC model of the traffic analysis software. The SYNCHRO HCM (Highway Capacity Manual) model then uses the average delay to define LOS for signalized and unsignalized intersections. Thus, the delay limits in HCM were used to determine LOS at the intersections and carpool lot.

The traffic composition on SH 402 includes 6 percent trucks. Of that 6 percent, two-thirds are single-unit trucks and one-third are semitrailer trucks. The percentage of truck traffic indicates that this highway is used to transport goods, as well as people. Peak travel times are 7:00 AM to 8:00 AM and 4:00 PM to 5:00 PM. The morning peak hour direction is eastbound, and the afternoon peak direction is westbound. Figure 1-3 illustrates 2001 and 2030 through

traffic (ADT), through traffic LOS, and intersection LOS.

**Table 1-2. Intersection LOS, No Action Alternative**

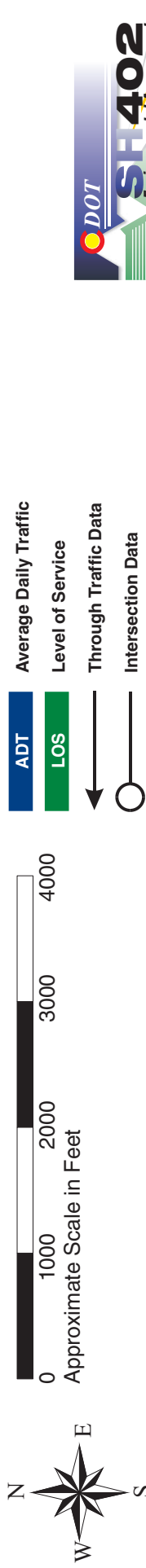
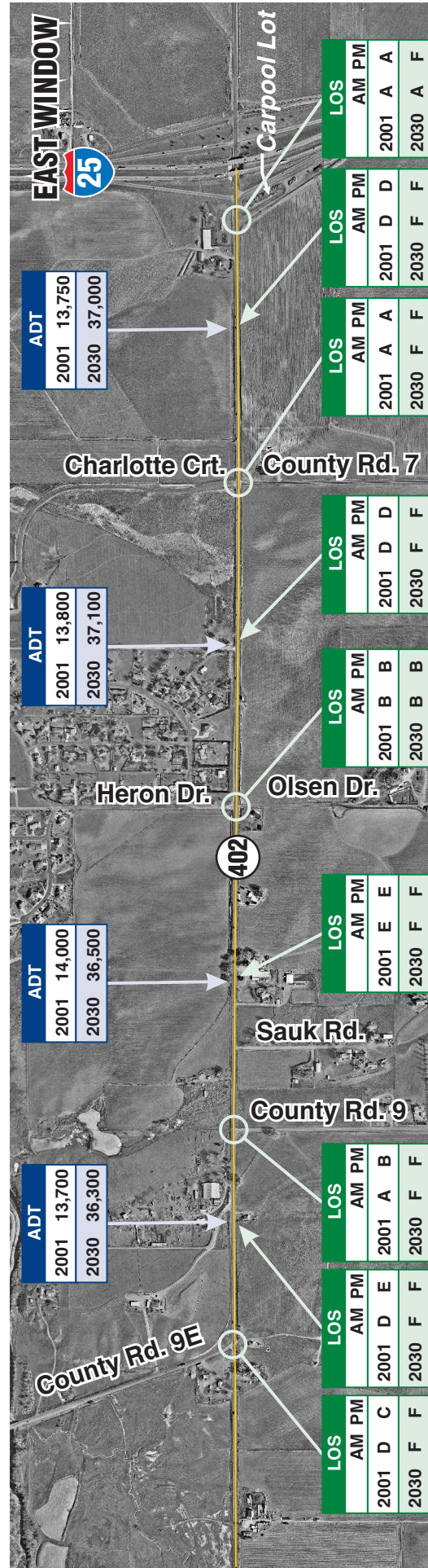
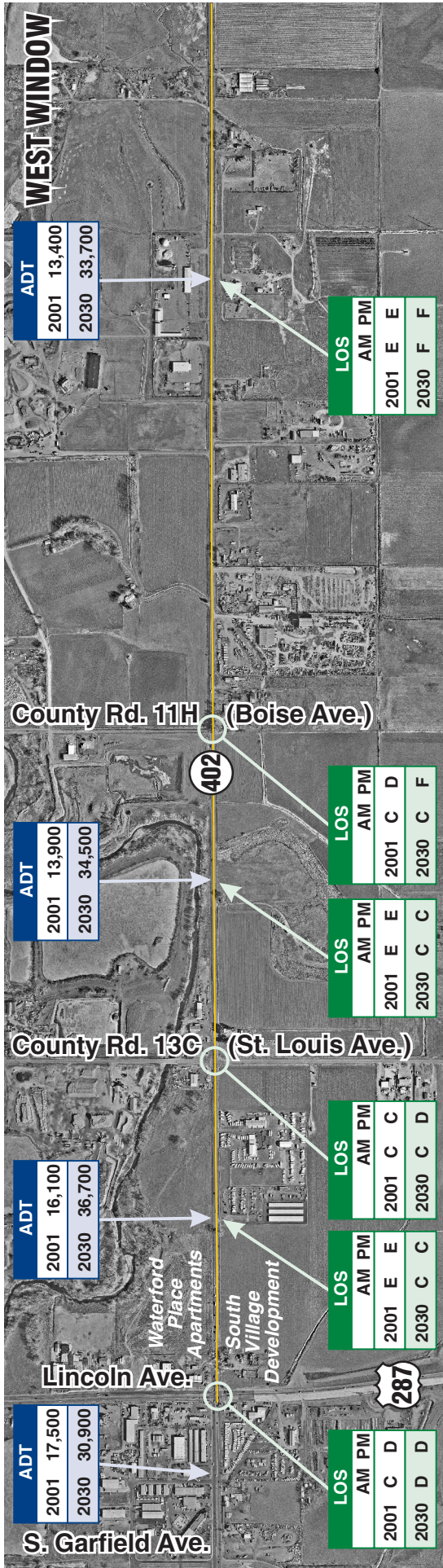
Intersection	Existing 2001		2030	
	AM	PM	AM	PM
US 287 (Lincoln Avenue)	C	D	D	D
CR 13C (St. Louis Avenue)	C	C	C	D
CR 11H (Boise Avenue)	C	D	C	F
CR 9E	D	C	F	F
CR 9	A	B	F	F
Heron Drive/Olsen Drive	B	B	B	B
CR 7 (Charlotte Court)	A	A	F	F
Carpool Lot Access Road	A	A	A	F

**Table 1-3. Through Traffic LOS, No Action Alternative**

Highway Segment	Existing 2001		2030	
	AM	PM	AM	PM
US 287 to CR 13C	E	E	C	C
CR 13C to CR 11H	E	E	C	C
CR 11H to CR 9E	E	E	F	F
CR 9E to CR 9	D	E	F	F
CR 9 to Heron Drive	E	E	F	F
Heron Drive to CR 7	D	D	F	F
CR 7 to Carpool Lot Access Road	D	D	F	F

As illustrated in Table 1-2, the intersections with the worst performance for 2001 (LOS C or D) were US 287, CR 13C, CR 11H, and CR 9E. As illustrated in Table 1-3, through traffic operated between LOS D and E along the entire length of SH 402 for year 2001.

Without improvements to SH 402 east of CR 13C, by 2030, most intersections and through traffic east of CR 11H would experience LOS F during both morning and afternoon peak periods.

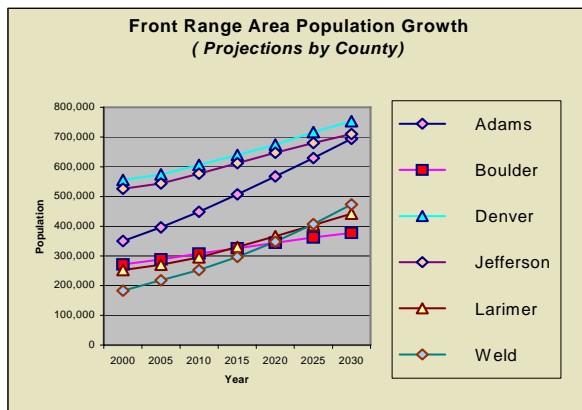


## 1.3.2 Land Use and Growth

### Population Growth Rates

Land use patterns influence the travel demand on transportation corridors, and future land use plans shape how each corridor will be maintained and potentially improved. Projected land use for a corridor is taken into account when examining the need for transportation improvements. The following discussion addresses growth and development expected in the SH 402 project area regardless of improvements to SH 402 between US 287 and the I-25 interchange.

As with other Colorado Front Range counties, Larimer County has experienced substantial growth since the 1970s. County population grew 66 percent between 1970 and 1980, then slowed to 25 percent growth rate between 1980 and 1990, and rose again to 35 percent between 1990 and 2000. While state forecasts for Larimer County population (Colorado Department of Local Affairs [DOLA], Demography Section, 2003) show a conservative 75 percent growth between 2000 and 2030 (25 percent every 10 years), actual growth could be as much as 100 percent (closer to the current trend of 35 percent every 10 years). See Figure 1-4.



Source: DOLA 2003

**Figure 1-4. Front Range Area Population Growth**

The city of Loveland has also experienced tremendous growth since the 1970s. Population grew 86 percent between 1970 and 1980, 24 percent between 1980 and 1990, and 35 percent between 1990 and 2000. City of Loveland population trends are estimated to follow or exceed county trends between 2000 and 2030.

For additional information on population and related topics, see *Section 3.1*. A detailed discussion of land use can be found in *Section 3.4*.

### Land Use Plans and Policies

Local planners anticipate population and employment growth in this area. In the 1980s an Intergovernmental Agreement (IGA) between Larimer County and the city of Loveland resulted in development of the Loveland Growth Management Area (GMA). The primary purpose of the GMA is to focus urban development adjacent to cities and towns in areas that could be annexed. The IGA was updated in January 2004.

In 1997 the SH 402 study area was categorized as rural land in the *Larimer County Master Plan and Partnership Land-Use System* (November 1997), and had not yet been incorporated into the GMA. However, the *Loveland, Colorado 1994 Comprehensive Master Plan* identified SH 402 as part of the GMA and as an important arterial associated with potential plans for a neighborhood activity center. The *IGA for Growth Management* between the city of Loveland and Larimer County (January 12, 2004) also includes SH 402 in the GMA boundaries. Additional information on specific land uses in the SH 402 study area is located in *Section 3.4*.

## **Transportation Plans**

SH 402 is included in the STIP and is listed as a priority project in the 2030 RTP.

The 2030 RTP also shows SH 402 as a four-lane arterial with signalized intersections at CR 11H (Boise Avenue), CR 9, and CR 7 (Charlotte Court). This plan also shows SH 402 with on-street bikeways and as a proposed transit route. SH 402 is an integral part of the area's transportation network, providing linkage between I-25 and the city of Loveland to the north, and to businesses and residences between and to the west of I-25 and US 287.

A carpool lot with approximately 88 parking spaces, including 4 handicap spaces, is located on the southwest corner of the SH 402 and I-25 interchange. This lot is not currently serviced by public transportation but is used by private carpools and vanpools. Vehicle counts taken in October 2001 indicated approximately 40 to 60 vehicles per day at the carpool lot during the week.

The *City of Loveland 2020 Transportation Plan* includes the SH 402 and I-25 interchange as a transit center that is "an important feeder point for south Loveland residents using regional transit in the I-25 corridor and seeking access to planned commercial and employment facilities to be developed in the vicinity of the interchange."

CDOT is currently investigating improvements to US 34, a parallel highway approximately 2 miles to the north. The two parallel corridors provide a different means of connectivity in the area and serve different markets. US 34 serves city of Loveland and adjacent commercial-business development, as well as provides a direct route to Rocky Mountain National Park to the west, while SH 402 is a primary east-west route for residents and businesses located along the highway and further to the west. High morning and evening peak traffic on SH 402 indicates that this highway is also used heavily by commuters for access to I-25. Continued development in the area around SH 402 will only increase the need for improvements to the highway, regardless of whether improvements to US 34 are pursued.

## **1.4 Photographic Essay**

Figure 1-5 provides a descriptive photographic essay of the SH 402 study area.



View east along SH 402 at US 287



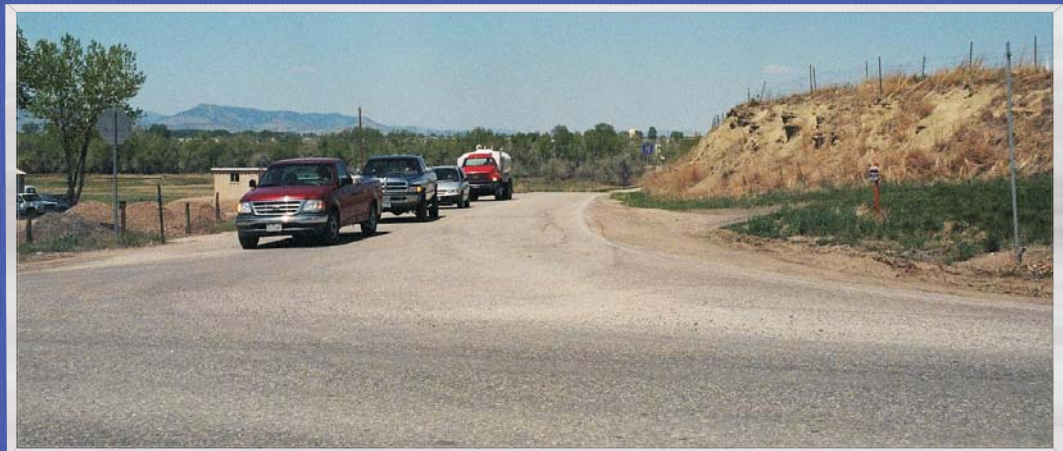
View east just west of CR 13C (St. Louis Avenue)



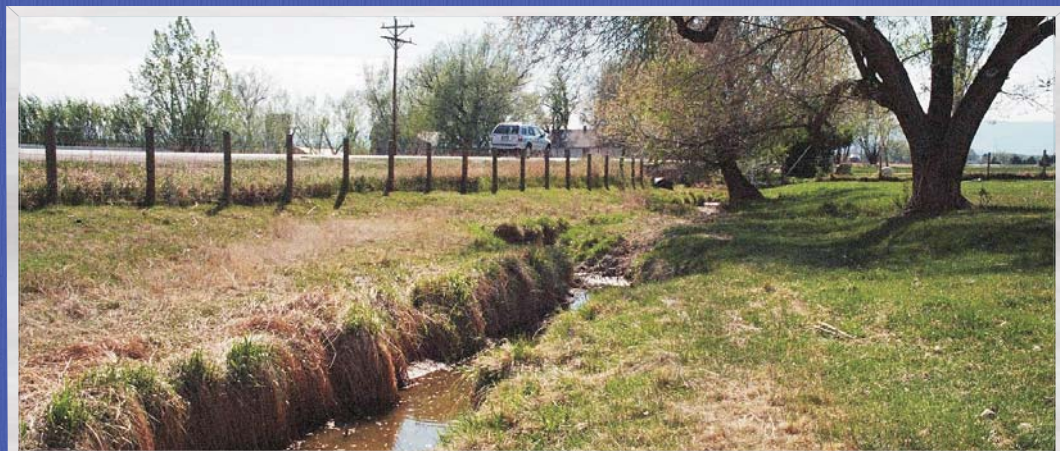
Cattail marsh and agricultural land along SH 402



Big Thompson River east of CR 13C (St. Louis Avenue)



View north at CR 9E



Irrigation ditch A, north of SH 402



View east toward the I-25 interchange



Carpool lot in the SW quad of I-25 and SH 402