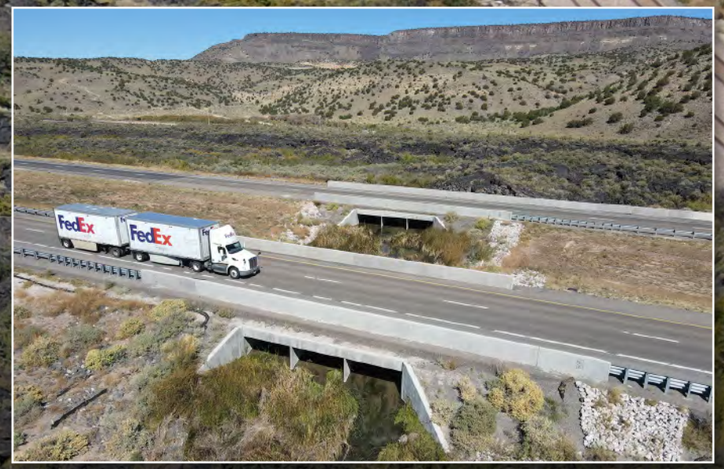
I-40 Phase I-A/B Corridor Study

MILEPOST 0 to 150

OCTOBER 2024 | CN 6101580



New Mexico DEPARTMENT OF TRANSPORTATION
MOBILITY FOR EVERYONE

U.S. Department of Transportation
Federal Highway Administration

Parametrix

I-40 Phase I-A/B Corridor Study, Arizona to Albuquerque, Milepost 0 to 150, CN 6101580

Prepared for
New Mexico Department of Transportation

Concurrence:

DocuSigned by:
Summer Herrera
9AF402990311464...
Summer Herrera, P.E.
Project Development Engineer, NMDOT Central Region Design

10/2/2024
Date

DocuSigned by:
Paul Brasher
C7D2D4672C5143A...
Paul Brasher, P.E., NMDOT District 3 Engineer

10/3/2024
Date

DocuSigned by:
Joseph Casares
16CCB801000D4FD...
Joseph Casares, P.E.
Design Manager, NMDOT Central Region Design

10/3/2024
Date

DocuSigned by:
1AA2FA4553374C7...
Lisa Vega, P.E, NMDOT District 6 Engineer

10/3/2024
Date

DocuSigned by:
David Quintana
C83920AB3826474...
David Quintana, P.E., NMDOT Chief Engineer

10/4/2024
Date

October 2024

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APPENDICES

Acronyms and Abbreviations

#

2045 NMFP.....2045 New Mexico Freight Plan Update

A

AADT.....average annual daily traffic

AASHTO.....Association of State Highways and Transportation Officials

APL.....Approved Product List

ARC-IT..... Architecture Reference for Cooperative and Intelligent Transportation

ASCE.....American Society of Civil Engineers

ATMS.....Advanced Traffic Management System

ATRs..... automated traffic recorders

B

BIA.....Bureau of Indian Affairs

BLM..... Bureau of Land Management

C

CAD .....computer aided design

CAMP.....Culvert Asset Management Program

CBCs.....concrete box culverts

CCTV..... closed circuit television

CMFs.....crash modification factors

CMP..... corrugated metal pipe

CWB .....concrete wall barrier

D

DMS ..... dynamic messaging signs

DOD.....Department of Defense

DPAS ..... dynamic parking availability signs

DUI ..... drivers under the influence

E

EB..... eastbound

EMC2 ..... EMC Squared

F

FAC.....Freight Advisory Committee

FAF.....Freight Analysis Framework

FAF5 ..... Freight Analysis Framework version 5

FEMA ..... Federal Emergency Management Agency

FHWA.....Federal Highway Administration

FIRM .....Flood Insurance Rate Map,

G

GLP ..... Gallup Land Partners LLC

H

HCM ..... Highway Capacity Manual

HCS7.....Highway Capacity Software

HDPE ..... high-density polyethylene

HOV.....high-occupancy vehicle

HPMS.....Highway Performance Monitoring System

HSM .....Highway Safety Manual

I

I-10 .....Interstate 10

I-25 .....Interstate 25

I-40 .....Interstate 40

ITS.....intelligent transportation systems

L

LOS .....level of service

LRFD ..... Load and Resistance Factor Design

M

M-E.....Mechanistic-Empirical

MOT .....Maintenance of Traffic

MP..... milepost

Acronyms and Abbreviations (Continued)

mph ..... miles per hour
MRCOG ..... Mid-Region Council of Governments
MRMPO ..... Mid-Region Metropolitan Planning Organization
MSE ..... mechanically stabilized earth

N

NEPA ..... National Environmental Policy Act
NHFN ..... National Highway Freight Network
NM DPS ..... New Mexico Department of Public Safety
NHNM ..... National Heritage New Mexico
NMDOT ..... New Mexico Department of Transportation
NMSA ..... New Mexico Statute Annotated
NPMRDS ..... National Performance Management Research Data Set
NRHP ..... National Register of Historic Places
NWRTPO ..... Northwest Regional Transportation Planning Organization

O

O/D ..... origin-destination
ODOT ..... Oregon Department of Transportation

P

PCE ..... passenger car equivalent
PCR ..... Pavement Condition Ratings
PDO ..... property damage only

Q

QL-D ..... Quality Level D

R

RCP ..... reinforced concrete pipe
RTMC ..... Regional Traffic Management Center
RTPO ..... regional transportation planning organization
RWIS ..... roadside weather information systems

S

SAMM ..... State Access Management Manual
SD ..... standard deviation
SUE ..... subsurface utility engineering
SUT ..... single unit trucks
SWRI ..... Southwest Research Institute

T

TDM ..... travel demand management
TMC ..... traffic management center
TPAS ..... truck parking availability system
TPOs ..... regional transportation planning organizations
TRB ..... Transportation Research Board
TT ..... heavy trucks
TTTR ..... truck travel time reliability

U

USGS ..... United States Geological Survey

V

VSAS ..... variable speed limit advisory sign
vph ..... vehicles per hour

W

WB ..... westbound

1. Introduction

1.1 Introduction and Background

New Mexico has 3 major interstate highways that include:

- I-40, which runs west to east from Arizona to Texas
- I-25, which runs south to north from I-10 in Las Cruces to Colorado
- I-10, which runs west to east in southern New Mexico, from Arizona to Texas

I-40 near Exit 89, Quemado in Grants, NM.

I-40 is the primary west to east route to and through central New Mexico and is a primary freight route to and through New Mexico. I-40 traverses more than 2,500 miles of the United States beginning in the west in Barstow, California continuing east to Wilmington, North Carolina.

This Phase I-A/I-B report summarizes and documents the investigations, analyses, findings, and recommendations for the I-40 Corridor Study from the Arizona State Line at milepost (MP) 0 to the Atrisco Vista Interchange in Albuquerque at MP 150. This I-40 Corridor Study covers a 150-mile section of I-40 and adjacent alternate routes/frontage roads, as shown in Exhibit 1-1. The primary purpose of the I-40 Corridor Study is to document the process used to identify the preferred alternative for needed improvements to the I-40 corridor consistent with the New Mexico Department of Transportation's (NMDOT) *Location Study Procedures* — the NMDOT process for project development from the planning phase through environmental documentation and preliminary design. The corridor study process serves to (1) identify and evaluate the specific problems and conditions within the study area that may require improvements to the existing highway; (2) identify and evaluate improvement options; and (3) identify the preferred alternative.

The NMDOT *Location Study Procedures* process is consistent with the National Environmental Policy Act (NEPA) of 1966 (as amended), the Federal Highway Administration's (FHWA) Environmental Impact and Related Procedures (23 CFR 771), and federal statewide planning regulations (23 CFR 450, Subpart B). This report also documents the activities used to inform and involve the public in decisions.

The lead agency for the I-40 Corridor Study is the NMDOT, with oversight and funding provided by the FHWA. In addition, the study is being coordinated with area tribes and federal, state, and local agencies with jurisdiction and/or responsibility for lands and resources within the study area. Key governments, agencies, and organizations invited to participate in the study process include area tribes, including the Acoma, Laguna, Navajo, and Zuni; the Bureau of Indian Affairs (BIA); regional transportation planning organizations, including the Mid-Region Metropolitan Planning Organization (MRMPO) and the Northwest Regional Transportation Planning Organization (NWRTPO); elected officials; and several federal, state, county, and local government agencies.

1.2 Project Setting

1.2.1 Landscape and Historic Context

The study area is located in western New Mexico and crosses the Arizona/New Mexico Plateau and the Arizona/New Mexico Mountains. As such, the elevation in the I-40 corridor varies, with several uphill and downhill grades. At the Arizona state line at MP 0, the elevation is at about 6,600 feet above sea level. It rises to about 7,250 feet at the continental divide near MP 48 and then descends to about 5,500 feet near Albuquerque.

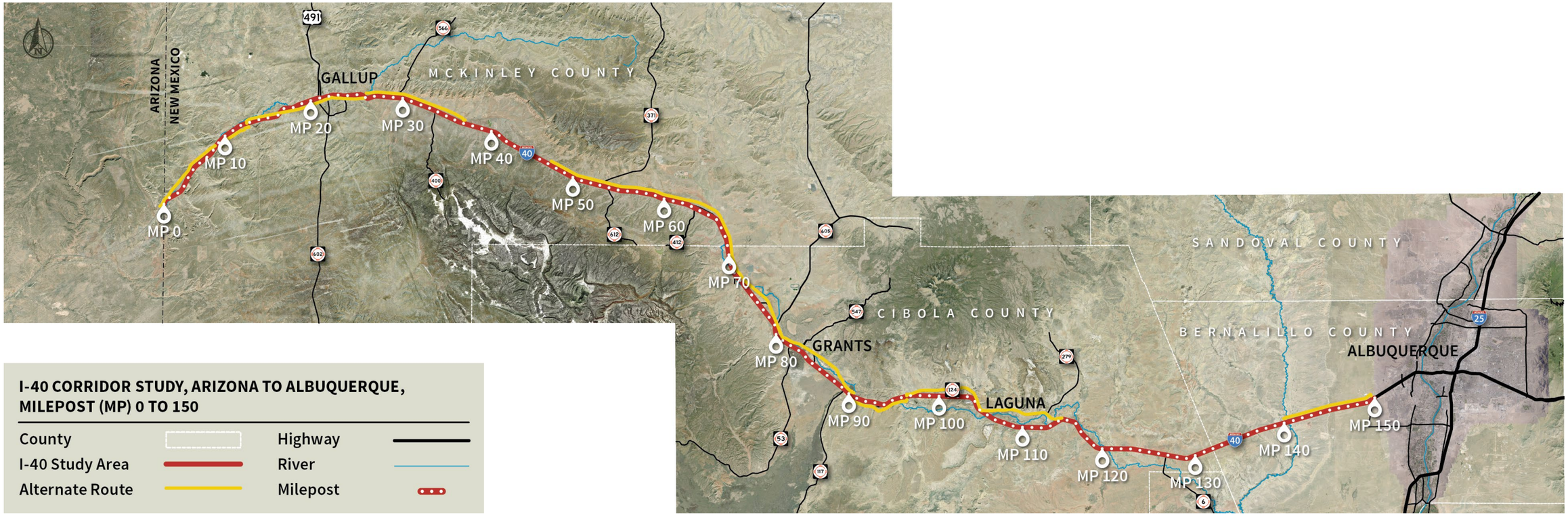
Volcanic malpais formations near Grants, NM.

The Arizona/New Mexico Plateau is considered a transitional zone between its surrounding ecoregions that include the Colorado Plateaus, the Mojave Basin, and forested mountains. The area includes topographic features, such as mesas, plateaus, valleys, and volcanic features, such as malpais and volcanic rocks. Vegetation includes grasses, shrubs, and junipers.

This environmental variability provides access to a variety of natural resources that have been used throughout prehistory. As a result of this access to natural resources, the study area and surrounding vicinity have been inhabited for millennia. Paleoindian hunter/gatherers traveled through the area as early as 10,000 B.C., with permanent habitation dating back to 6,500 B.C., and the remains of prehistoric pueblo residences that date to 100 A.D. Native American presence along the corridor is still prominent with modern Native American communities in the general vicinity, including the Acoma, Laguna, and Zuni pueblos, as well as Navajo communities, including Lupton, Manuelito, Church Rock, Iyanbito, Thoreau, Ramah, Prewitt, and To'hajiilee.

The study area forms a natural west-to-east travel corridor, ranging from prehistoric trails to stagecoach routes, railroads, and modern highways. Modern transportation first came to the area in the 1880s when the railroad was established to facilitate movement of livestock and access to mining resources throughout this part of New Mexico. Later, in 1926, the first alignment of Route 66 was developed along a route that mostly paralleled the railroad. Then, beginning in 1957, I-40 slowly began replacing Route 66 as the primary route through this part of the state. These modern travel modes encouraged the development of cities along the route, such as Gallup and Grants. Gallup was initially a small stage stop, and Grants was a homestead until the arrival of the railroad and later Route 66, which spurred their growth into the towns seen today. Development of Route 66 began in the mid-1920s. By the end of 1937, Route 66 was paved throughout New Mexico, making Route 66 New Mexico's first fully paved highway (New Mexico Museum of Art 2022). I-40 was built in the late 1950s and through the 1960s, replacing some sections of the former Route 66. In other areas, I-40 took a modified route, and old sections of Route 66 became frontage roads or became parts of other state highways, county, or tribal roads. Route 66 is a tourist destination for many, and is identified as a State and National Scenic Byway and has buildings, districts, and road segments listed on the National Register of Historic Places.

Exhibit 1-1. I-40 Corridor Study Location Map



I-40 CORRIDOR STUDY, ARIZONA TO ALBUQUERQUE, MILEPOST (MP) 0 TO 150

County		Highway	
I-40 Study Area		River	
Alternate Route		Milepost	

1.2.2 Transportation

Today, I-40 through most of the study area is a 4-lane roadway with 2 eastbound lanes and 2 westbound lanes in each direction. Posted speed limits on I-40 are 75 miles per hour (mph), with the exception of the section in Gallup that is posted at 65 mph. Traffic volumes on I-40 in the study area average about 27,000 vehicles per day based on traffic counts conducted in 2022. Traffic volumes are lowest between the Arizona state line and Gallup, where they average about 23,000 vehicles per day. Traffic volumes gradually increase throughout the study area to about 30,000 vehicles per day near the western edge of Albuquerque.

Example of rock formations in the study area. Mt. Taylor's peak is seen in the background along with a BNSF Railroad bridge near MP 94.

Motorized vehicles travelling on I-40 include passenger vehicles, freight, and buses. I-40 through New Mexico is a critical west-to-east freight route across the United States. As such, heavy truck volumes for semi-trucks average about 11,000 vehicles per day, or about 40% of average daily traffic. Transit services using I-40 include bus service provided by Greyhound, local transit service, and school buses. Bicyclists are permitted to ride on the shoulders of I-40 in the study area as well as adjacent frontage roads/alternate routes. Pedestrian facilities, such as sidewalks, are limited to frontage roads near more urban areas, such as Grants and Gallup.

As shown in Exhibit 1-1, there are several frontage roads/alternate routes that parallel I-40 through about 120 miles of the study area. These roadways serve local traffic, including transit and bikes, and are sometimes used by vehicles as detour routes if there is an incident or closure on I-40. The frontage roads are lower-volume roadways that typically have 1 lane in each direction that provide access to neighboring communities. Posted speed limits on these routes range from 35 mph to 55 mph. Many of these frontage roads are portions of the historic Route 66 that was built before I-40 or have become parts of other state highways. There are about 30 miles of the study area that do not have an adjacent alternate route.

I-40 parallels a major railroad owned and operated by the BNSF that provides critical transcontinental rail service through the southern United States. Amtrak passenger service is provided along I-40 via the Southwest Chief route connecting Chicago to Los Angeles, with train stations in Gallup and Albuquerque.

1.2.3 Communities, Land Use, and Economics

There are several communities located along I-40, the largest of them include the towns of Gallup, the Grants/Milan area, and the western portion of Albuquerque. Gallup has a population of about 22,000 and about 12,000 people live in Grants and Milan combined. Gallup, Grants, and surrounding areas are still used for mining operations and natural gas extraction. In addition, there are several Native American communities in the general vicinity, including the Acoma, Laguna, and Zuni pueblos, as well as the Navajo communities of Lupton, Manuelito, Church Rock, Iyanbito, Thoreau, Prewitt, Ramah, and To'hajiilee.

In addition to residential areas, land use is primarily composed of recreational, mining and oil, ranching and grazing, retail, medical, hospitality, and energy industries. Recreational areas include Mt. Taylor, Bluewater Lake, El Malpais and El Morro National Monuments, and other state parks and landmarks of interest. Several trails intersect or are located near the I-40 corridor, the most prominent being the Continental Divide Trail near Grants.

1.3 I-40 Phase I-A/B Corridor Study Organization and Supporting Resources

This section explains how the I-40 Phase I-A/B Corridor Study is organized and identifies available supporting information and resources:

- This **I-40 Phase I-A/B Corridor Study** summarizes the data, analysis, and decision process used to identify and evaluate potential alternatives to improve I-40 and adjacent alternate routes and to select a preferred alternative. There is also a stand-alone Executive Summary to this I-40 Phase I-A/B Corridor Study. The supporting appendices to this I-40 Corridor Study provide detailed information that can be used to advance the design and implementation of the preferred alternative, including Appendix A, Highway Operations Improvement Plan.
- **Appendix A, Highway Operations Improvement Plan** and supporting attachments provide a road map for implementing the preferred alternative identified in this I-40 Phase I-A/B Study.
- **Other Supporting I-40 Resources** are summarized in this section, including available GIS and survey data for the I-40 corridor are also summarized in this section.

1.3.1 I-40 Phase I-A/B Corridor Study Organization and Supporting Appendices

Exhibit 1-2 provides a listing and description for information contained in the I-40 Phase I-A/B Corridor Study.

Exhibit 1-2. I-40 Phase I-A/B Corridor Study Information and Resources

Item	Description
Executive Summary	▪ Stand-alone document that provides a summary of the I-40 Phase I-A/B Corridor Study.
Chapter 1, Introduction	▪ Introduces the study area and explains how the document is organized.
Chapter 2, Stakeholder Coordination and Public Involvement	▪ Describes public and stakeholder engagement, comments, and input received.
Chapter 3, Existing Conditions and Project Future Traffic	▪ Describes existing conditions for I-40 and adjacent frontage roads. Provides a discussion of roadway, bridges, drainage, geotechnical conditions, utilities, intelligent transportation systems (ITS), freight, traffic, crashes, and environmental considerations.
Chapter 4, Alternatives Development and Phase I-A Screening	▪ Identifies the purpose and need, initial alternatives, and the initial alternatives screening process.
Chapter 5, Phase I-B Detailed Alternatives Analysis	▪ Provides a detailed analysis, screening, and comparison of viable alternatives.
Chapter 6, Phase I-B Operational Enhancements	▪ Provides a detailed analysis of operational enhancements including ITS, alternate routes, incident management, and approaches and benefits of minimizing lane closures.
Chapter 7, Phase I-B Recommendations and Implementation	▪ Provides a summary of recommendations, including the preferred alternative and proposed operational enhancements.
Chapter 8, References	▪ Provides a list of references.

(Table Continues)

Exhibit 1-2. I-40 Phase I-A/B Corridor Study Information and Resources (Continued)

Item	Description
Appendix A – I-40 Highway Operations Improvement Plan	▪ Provides a roadmap for implementing the preferred alternative on the I-40 corridor from MP 0 to 150.
Appendix B – Environmental Scoping Report	▪ Provides environmental considerations in the I-40 corridor, including a discussion of existing conditions, potential environmental impacts, and environmental considerations for future projects.
Appendix C – Ramp Turning Movement Counts	▪ Provides turning movement counts that were collected in July and August 2022 at exits 16, 20, 22, and 26 in Gallup; 79, 81, and 85 in Grants; and 140 at the Route 66 Casino.
Appendix D – Geometrics	▪ Provides information on horizontal and vertical curve deficiencies. Provides proposed reconstruction limits by combining pavement condition and vertical and horizontal curve corrections.
Appendix E – Geotechnical Scoping Report	▪ Provides scoping-level information on geological and pavement conditions.
Appendix F – Bridges	▪ Provides information on I-40 and frontage road bridges, including locations, condition, construction year, material type, and clearances.
Appendix G – Drainage	▪ Provides a summary of drainage reports.
Appendix H – Utilities	▪ Includes maps showing subsurface utility engineering Quality Level D information compiled in 2022 on I-40 and adjacent frontage roads.
Appendix I, I-40 Existing Typical Sections	▪ Provides existing typical sections for the I-40 mainline, bridges, and overpasses from MP 0 to 150.
Appendix J, I-40 Proposed Typical Sections	▪ Includes an overview of where widening is proposed; provides proposed typical sections and construction sequencing; shows proposed roadway layouts for incident, maintenance, and construction; and provides a typical section and plan for proposed crossovers.
Appendix K, I-40 Conceptual Alternatives	▪ Provides conceptual design plans including proposed typical sections; right-of-way limits; pavement condition; deficient horizontal and vertical curves; proposed reconstruction limits; bridges in poor condition; existing and proposed crossover locations; and potential terrain constraints.
Appendix L, I-40 Interchange Layouts	▪ Provides results of the interchange and ramp analysis. Identifies ramps that do not meet current guidelines and need additional length. Provides information on the estimated ramp lengths needed and provides plans showing needed lengths.
Appendix M, Alternate Routes	▪ Provides information on I-40 alternate routes/frontage roads including typical sections, posted speeds, access points, bridges in poor condition, vertical clearance constraints for trucks, and land ownership.
Appendix N, Preliminary Costs	▪ Provides preliminary cost estimates for the No Build and Build Alternatives identified in Chapter 5.
Appendix O, Public Meeting #1 Summary	▪ Provides notes, comments, and responses for the first public meeting held on November 15, 2022.
Appendix P, Public Meeting #2 Summary	▪ Provides notes, comments, and responses for the second public meeting held on April 25, 2023.
Appendix Q, Public Meeting #3 Summary	▪ Provides notes, comments, and responses for the third public meeting held on February 27, 2024.
Appendix R, Stakeholder Outreach	▪ Provides meeting notes from stakeholder discussions that occurred with tribes, Regional Transportation Planning Organizations, and State Patrol from 2022 through 2024. Includes information presented to elected officials from 2022 to 2024.

1.3.2 Appendix A, I-40 Highway Operations Improvement Plan Organization and Supporting Attachments

Exhibit 1-3 provides a listing and description for information contained in the Highway Operations Improvement Plan.

Exhibit 1-3. Appendix A, I-40 Highway Operations Improvement Plan

Item	Description
Section 1, Report Purpose and Organization	▪ Summarizes the report purpose and organization and provides a summary of available I-40 corridor information.
Section 2, Preferred Alternative Overview and Recommendations	▪ Identifies the key findings from the I-40 Corridor Study, elements of the I-40 preferred alternative, and other recommendations for minimizing lane closures during construction and maintenance activities, improving incident management, and improving alternate routes.
Section 3, Design Guidance	▪ Provides design guidance for I-40 corridor from MP 0 to 150.
Section 4, Project Phasing and Prioritization Framework	▪ Provides a framework for phasing and prioritizing projects in the I-40 corridor.
Attachment A, I-40 Culvert Risk Assessment, Priorities, and Recommendations	▪ Explains the methods, results, and limitations of culvert information collected, assessed, and evaluated to identify culvert and drainage priorities, risks, and recommendations in the I-40 corridor.
Attachment B, Intelligent Transportation Systems (ITS)	▪ Provides guidance and recommendations for short-term (0 to 5 years) and long-term (5 to 25 years) ITS improvements in the I-40 corridor from MP 0 to 150.
Attachment C, Design Criteria	▪ Provides detailed design criteria for the I-40 mainline.
Attachment D, 2013 Incident Management Plan	▪ Provides the signed District 3 Incident Management Program for I-40 that was developed by the NMDOT in 2013 between MP 134 and 148. This information could serve as a useful tool for incident management planning in the I-40 corridor.

1.3.3 Other Supporting Resources

In addition to the resources listed above, there is supporting GIS and survey information available through the NMDOT that is described in Appendix A, I-40 Highway Operations Improvement Plan.

2. Stakeholder Coordination and Public Involvement

2.1 Introduction

The goals of stakeholder coordination and public involvement for the I-40 Corridor Study are to inform, engage, and involve the public, elected officials, Native American tribes, agencies, and key stakeholders throughout the study as it pertains to the analysis of I-40 and adjacent alternate routes; development of alternatives, recommendations, and corridor priorities; and the selection of a preferred alternative. Involving the public, communities, and community leaders in the development of the I-40 Corridor Study helped the study team develop recommendations that reflect community values; integrates the needs and safety of I-40 users and the communities served by I-40; and results in long-term improvements to I-40 that are in accord with the environment, are sustainable, and provide lasting value.

Public involvement activities conducted, and informational tools used as part of the I-40 Corridor Study are summarized below and are discussed in greater detail in this chapter.

- I-40 Corridor Study Website – The New Mexico Department of Transportation (NMDOT) developed and maintained an I-40 Corridor Study website where information was available to the public throughout the duration of the I-40 Corridor Study.
- Public Meetings – The NMDOT hosted 3 virtual public meetings throughout the I-40 Corridor Study to present key findings and invite public comments and feedback.
  - → Meeting 1 was a virtual public meeting that occurred on Tuesday, November 15, 2022, at 6:30 PM. The focus of the meeting was to introduce the study, explain the study process and timeline, provide information on how people can be involved, share information on existing conditions, provide information on the types of alternatives that would be developed, answer questions, and provide people an opportunity to identify corridor concerns and needs via public comments or an online survey.
  - → Meeting 2 was a virtual public meeting that occurred on Tuesday, April 25, 2023, at 6:30 PM. The focus of the meeting was to present key findings and project needs, discuss initial concepts considered and the results of the screening process used to identify alternatives, provide a description of alternatives moving forward for detailed analysis, answer questions, and provide an opportunity for questions and comments on the information presented and alternatives moving forward.
  - → Meeting 3 was a virtual public meeting that occurred on February 27, 2024. The focus of the meeting was to provide information on the alternatives analyzed, the preferred alternative, the approach for identifying priorities and recommendations, and an opportunity for people to ask questions and provide comments.
- Freight Survey – In addition to information gathered through the initial public survey conducted in November 2022, the study team conducted a freight survey in December 2022 and January 2023 to identify key issues in the corridor related to freight.
- Stakeholder Outreach – Project information sharing and coordination occurred throughout the I-40 Corridor Study with area tribes, the Bureau of Indian Affairs (BIA), and regional transportation planning organizations (RTPOs). The purpose of this coordination was to share information and obtain input from neighboring communities and governments.
- Elected Officials Outreach – Updates were provided throughout the I-40 Corridor Study to the NMDOT leadership and elected officials.

2.2 Identification of Key Stakeholders and the Public

A stakeholder contact list for the I-40 Corridor Study was developed in consultation with the NMDOT, area tribes, and RTPOs to identify elected officials, agencies, local governments, businesses, and community groups that would be interested in or could be affected by the study. Contacts on this list receive invitations to public meetings. An initial contact list was created in October 2022, which included just under 300 individuals, organizations, and elected officials, as summarized below:

- Representatives from the BIA and Acoma, Laguna, Navajo, and Zuni tribes, including Governors and Councilmembers, and engineering, public works, planning, natural and cultural resource, police, fire, and emergency personnel staff
- RTPOs that cover the study area, including the Mid-Region Council of Governments (MRCOG) and the Northwest Regional Transportation Planning Organization (NWRTPO)
- New Mexico State Senators and Representatives; County Commissioners from McKinley, Cibola, and Bernalillo counties; and Councilmembers from Gallup, Grants, Milan, and Albuquerque
- County and city staff, law enforcement, fire departments, and school districts
- New Mexico State Patrol
- Landownership and regulatory agencies.
- Freight industry members, economic development groups (such as the Chamber of Commerce), interested businesses, and members of the public

In addition, the NMDOT has an extensive media contact list that includes newspapers, television news stations, and radio stations, as well as social media outlets on Facebook and Twitter that also received public meeting announcements and press releases.

As the study progressed, the contact list was updated with people and organizations who asked to be included on the list. At the end of the study, the contact list included over 400 individuals and organizations.

2.3 I-40 Corridor Study Website

The I-40 Corridor Study website was developed to provide information in both English and Spanish. The website included public meeting announcements and meeting links; public meeting presentations, notes, summaries, and videos of past public meetings; a study map and overview; schedule; contact information; and information on how people could be added to the contact list. The website was launched on October 24, 2022, prior to the first public meeting and was updated throughout the study.

2.4 Public Meeting #1 and Public Survey

2.4.1 Overview

Public Meeting #1 was a virtual public meeting that occurred on Tuesday, November 15, 2022, at 6:30 PM. The focus of the meeting was to introduce the study, explain the study process and timeline, provide information on how people can be involved, share information on existing conditions, provide information on the types of alternatives that would be developed, answer questions, and provide people an opportunity to identify corridor concerns and needs via public comments or an online survey.

Public meeting #1 was announced in October 2022.

- The I-40 Corridor Study website was launched on October 24, 2022.
- Public meeting invitations, advertisements, social media posts, and a press release inviting people to visit the website, complete a public survey, and attend the public meeting were provided beginning October 31, 2022.
- Public meeting #1 was held on November 15, 2022, and the public comment period and opportunity to complete a survey occurred from October 31, 2022, to December 14, 2022.

An overview of how the meeting was announced, website information, a public meeting summary, and public survey results are discussed below. More detailed information including meeting advertisements, the public meeting notes and presentation, and public survey results are provided in Appendix O, Public Meeting #1 Summary.

2.4.2 Meeting Advertisements and Announcements

Virtual public meeting #1, the study website launch, and an invitation to complete a public survey and/or submit comments were announced, as summarized below:

- Newspaper advertisements were published in the *Gallup Independent* on October 31, 2022, and the *Cibola Citizen* on November 2, 2022.
- A meeting announcement was emailed to 277 people and was sent via postal mail to 9 people on October 31, 2022. Individuals included in the distribution are discussed in Section 2.2.
- A social media plan was developed and implemented through the NMDOT social media accounts on Facebook and Twitter, with multiple messages beginning on October 31, 2022, and continuing through December 14, 2022.
- Public meeting #1 was also announced via the I-40 Corridor Study website and the NMDOT website, and the NMDOT issued a press release to their media contacts in Districts 3 and 6.

2.4.3 Website Information

The I-40 Corridor Study website was launched on October 24, 2022. Information contained on the website at the time of its launch included a public meeting announcement and meeting link; a study map and overview; schedule; information on how to submit comments and complete a survey; contact information; and information on how people could be added to the contact list. On November 16, 2022, a copy of the public meeting presentation and a video of the presentation was posted on the website for people to view.

From the web launch on October 24, 2022, through December 14th, 2022, there were a total of 566 sessions on the website, which included 389 individual users (people who viewed the website), meaning that people visited the website multiple times.

The website could be accessed in several ways, with most site views (54%) originating via direct access (people had a link to the website or typed in the address). Social media was responsible for 28% of the web visits that originated from a link via a social media post. About 10% of the site views originated via an organic search of the web (Google or other search). Approximately 8% of visitors accessed the site through web referrals, which occurs when people access the I-40 page from another webpage (such as the NMDOT website).

Web visitors came from many locations, with about 21% coming from Albuquerque. A smaller number of visitors came from several towns in New Mexico, including Quincy, Gallup, and Grants. Several website viewers originated from other cities that can be accessed at least partly by I-40, including Los Angeles, Las Vegas, Phoenix, San Antonio, and others.

2.4.4 Summary of Public Meeting #1

The NMDOT hosted a virtual public meeting on November 15, 2022. In addition to the NMDOT and consultant presenters and panelists, a total of 56 people attended the meeting. A total of 3 meeting participants called in via the phone and the 53 remaining participants attended online. Because the meeting was conducted virtually, a formal sign-in sheet was not provided, thus full names and contact information are not available.

Of the 56 attendees:

- 2 were elected officiations, including New Mexico State Senator Shannon Pinto (District 3) and Cibola County Commissioner Christine Lowery
- 22 were members of the public
- 15 were agency or tribal staff representatives
- 16 were part of the NMDOT or consultant team
- 1 was affiliated with a news organization

Appendix O, Public Meeting #1 Summary, contains the presentation that was given, meeting notes, and comments received. Information on questions asked and responses to comments are provided in Section 2.4.5.

2.4.5 Questions and Comments Received during the Public Comment Period

The NMDOT received 84 comments on the proposed project through the first comment period from October 31, 2022, through December 14, 2022, as summarized below:

- 7 people asked questions or made comments at the November 15, 2022, online public meeting.
- 7 people provided written comments via email.
- 70 people completed the public survey.

Comments received at the public meeting and in writing are provided below in Exhibit 2-1 and Exhibit 2-2 along with responses. Responses to the comments from public meeting #1 were provided at the meeting, and responses to written comments were emailed to commentors and made available on the study website. A summary of public survey results is provided in Section 2.4.6.

Exhibit 2-1. Comments, Questions, and Responses from Public Meeting #1

#	Theme	Comment	Response
1	Wall Barrier	Any chance a barrier will be installed in the median to prevent head on collisions?	There are several areas where barriers have been placed, near Laguna. We will be looking at roadway geometry of different alternatives. The number of lanes and width of the medians will play a role in determining if media barriers can be implemented. There is potential for barriers in the plans, but nothing has been determined. Current NMDOT policy is that if a median is greater than 50 feet, a barrier is not required. However, each section will be investigated independently to determine if the barrier could/should be implemented.
2	118th Street	Does this include a proposed exit at 118th street?	118th is outside of the project area to the east and is not part of this study.
3	Trucks	Is it true that the DOT hour per day limit for truckers is 16 hours? And if so, does that place these large trucks in the 102 Exit to the Albuquerque area at the time most truckers are hitting their limitation after leaving the LA ports? Will this driver hour data be taken into account? Gallup is within the hours-of-service limit from the seaports complex in LA.	Various ports along the west coast and their travel times to and from are being investigated by our team. This is to determine if I-40 currently has sufficient parking and rest areas along the corridor. There is 14-hour work limit but an 11-hour driving limit and this puts LA just outside of our project area, for the majority of the project area though it is possible that the western most portion is within the limits. We are looking at other ports such as central California, Dallas, Kansas City etc. We are studying travel times from these port areas to determine if a truck driver might reach their driving limit in the study area and if there are sufficient amenities for these drivers in this section of I-40.
4	Rail	Is the FRA going to assist with cost where tracks cross I-40	Depending on what alternatives are developed and what is needed, it may be considered. At this point we do not anticipate moving rail lines, but all potential funding sources will be considered in regard to future alternatives.
5	Flooding	Is there a number to call to discuss comment, I would like to discuss flooding in the Fort Wingate area.	You can call 505.445.5464. Note that the individual did call and we noted his concerns about flooding that repeatedly occurs in the Fort Wingate area.
6	Alternatives	If the number of cars is projected to increase, what sorts of infrastructure ideas are being considered to address handling the increased capacity to make it safer for drivers and pedestrians?	Some things that will be considered include potentially adding lanes, improvements to interchanges, and auxiliary lanes. At this point, we are focusing on understanding the existing traffic conditions to better understand what sorts of improvements may need to be implemented. This includes considering things such as autonomous vehicles, and other technology that are being implemented into the traffic fleets. Depending on what funding comes through, part of the plan will prioritize some areas. Improvements will likely be prioritized in the areas that will see improved traffic flow or safety from implemented alternatives. It is likely that different portions of the corridor will have different solutions. Each area will need to be analyzed individually to determine what would benefit each area the most. Our goal is to get the best results across the corridor, not a uniform solution across the entire corridor
7	General	Great presentation. you did your homework it is all correct. I have lived in Gallup most of my life and all the traffic counts I would say are correct. Modern IT is great and the graphs.	Thank you for the comment and it lets us know that we are doing the right thing when it comes to creating and displaying content to the public.

Exhibit 2-2. Written Comments and Responses from Public Comment Period #1

#	Theme	Comment	Response
1	Frontage Roads	Regarding Exit 131 into To'hajiilee. How could we avoid traffic entering our reservation from I-40? In the past, outside traffic would enter our community causing major concerns. One semi knocked down 15 power lines and caused power loss in the community for 3-10 days. We recently paved Tribal Road Navajo 57 and it is unable to handle the weight. Please discuss options to not allow I-40 traffic to cross through our community.	Thank you for your interest in the project and for your comments and questions. We acknowledge your comments and the concerns you raise. We will take these concerns into account and consideration as we develop and evaluate alternatives for both I-40 and adjacent frontage roads.
2	Alternatives	A few suggestions: future proofing the highway for 'smart tech'; add a dedicated truck lane or maybe several mile long stretches where non-truck traffic can pass; an education campsite for rural area drivers on the dangers of driving too slow.	Thank you for your comments. These ideas will be considered as we develop alternatives.
3	Coordination	We are from a firm that develops large-scale logistics/investment corridors and hub developments along some key cargo movement corridors. We are working on two projects in New Mexico, one on I-10 and one on I-40. a project that would focus on developing the LA ports complex-to-Albuquerque as the first leg of a national east-west TradePort system. Partners in the project include the Ports of Los Angeles and Long Beach, a number of truck manufacturers, hydrogen interests, infrastructure investors, Sandoval and Bernalillo Counties, and others in the ABQ region. McKinley County has also indicated interest to join the project. We watched your presentation about the I-40 study and thought it would be a good idea to compare notes.	Thank you for attending the presentation and for bringing this project to our attention. We will continue to keep you appraised of project developments and will connect with you to learn more about this potential project.
4	Alternatives	Living in Gallup my entire life and mostly commuting Gallup and Albuquerque I have the following thoughts: 1. I really like the idea of having a minimum of two lanes available at all times. These long back-ups on I-40 are not acceptable and not only are cause for major inconvenience but also jeopardize life and safety. This requires immediate attention and should be a high priority from the Governor's desk on down to the districts. Painted lines, wider lanes, lighting were needed would all help the flow of traffic along the route in construction zones. 2. I love the three-lane concept provided around the continental divide. A third lane should be placed at all steep rises in elevation. These trucks act like they own the road and we need to provide them a safe lane so the rest of the traffic could flow smoother. There are several locations along this route where a third lane would be extremely beneficial to all. 3. McKinley County has some of the worst sections of I-40 in the US. You know exactly even with your eyes closed that you have entered into District 6 McKinley County. Make long term repairs and give us roads we can be proud of and do it right the first time. This is a federally funded project and we should be much more adamant about demanding descent roads in good repair and smooth in McKinley county as well as across our state. This is especially important where we have such safety corridors and elevations to contend with. There is no acceptable reason our section of the I-40 Corridor should be second or third priority quality of pavement. We deserve better! 4. Replace signage with new, maintained, modern, legible, and appropriate signage the entire length of this corridor. Add special signage to tell travelers what services are available in Gallup, Grants, Laguna and so on. Food, lodging, gas are all necessities and every other state does so much better than we are doing with this. Let our travelers know they are on a New Mexico section of I-40 for the good reasons, not the bad ones. 5. Add appropriate signage for medical, safety, and universities both in Grants and Gallup. There are many commuters for these alone and a constant complaint we hear is we don't know what exit to get off on. If I were having a medical condition, it would sure be helpful to know the path to the nearest hospital off of the freeway. 6. Raise the elevation of or provide proper drainage for the section of road east of Gallup that gets impacted by the heavy rains. I am surprised we have allowed this to go on for so long. Get our politicians to get our problems identified and on track for a higher level of federal funding. Thank you for listening and allowing input. It would really be nice to see improvement and progress especially on the section between Grant and west Gallup.	Thank you for your comments. These ideas will be considered as we develop alternatives.

(Table Continues)

Exhibit 2-2. Written Comments and Responses from Public Comment Period #1 (Continued)

#	Theme	Comment	Response
5	Safety, Alternatives	I am a daily commuter on I-40 from the Pueblo of Acoma to Gallup, Monday through Friday. I have seen may issues arise over the last 8 years and I have been driving this corridor for more than 20 years. My concerns focus around the amount of semi-trucks that utilize I-40. I understand their importance and significance but have noticed an increase in accidents, especially before construction zones in which traffic comes to a sudden halt. I have had many close calls with semis who have slammed on their brakes. I have also experienced semi-trucks who have held up traffic for miles because they will not allow cars to pass them, especially when approaching construction zones. I have been stuck behind slow moving semis and it will take 11 miles to pass one semi (believe me I have counted). I have almost been side-swiped by semis and larger vehicles when I was in the lane trying to merge or was already in the lane and they forcefully cut me off because they were bigger. I have witnessed many accidents, some of which were fatal. I have also witnessed out of state drivers and/or semi-truck drivers fly past me when the road conditions are not favorable, especially during winter in the area between Prewitt and Continental Divide. I have sat for many hours on the interstate stuck in traffic due to accidents, weather, and construction. My suggestions: 1. Offer Railrunner commuter train type services for the western half of the state. 2. Increase road taxes for semi drivers so that road improvements could be made. 3. Install cameras to monitor flow of traffic and ticket drivers who impede traffic and cause dangerous situations. 4. Create a truck route so that semis stay off I-40. 5. Extend Route 66 so that when traffic is at a standstill, traffic is not stuck with nowhere to go. Create a "trucker lane only"	Thank you for explaining some of the issues that you have encountered and for your suggestions for the I-40 Corridor. These ideas will be considered as we develop alternatives.
6	New Interchange	There is a spot on I-40 at approximately at mile marker 18 where I think an Interstate exit should be considered. It appears to be an economical option where the natural landscape could support such a project, and unlike Allison road, it is more than a mile from the next exit. Frontage roads could be extended both north and south of I-40 west of Walmart offering more retail and commercial frontage exposure to busy interstate, boosting economic development. This location would also be advantageous to the creation of affordable housing and industrial development creating jobs in the region. Connecting Carbon Coal Road to the north and the Gallup Municipal Airport to the south would create rapid access between the proposed IHS Hospital site and air ambulance service. Another eventuality if Gallup grows seems to be an I-40 exit at Boardman. A Northside connector to Carbon Coal Road; and a southerly route along Boardman to 602 to Mendoza would create a beltway completely around Gallup. Finally, I'm not sure a roundabout at I-40 and US 491 is the greatest idea. Lots of folks drive to town from remote communities that don't even have traffic signals. I have driven several roundabouts, but never in one with the volume of traffic that this intersection handles daily.	Thank you for your comments. These suggestions will be included in our project documentation. This Corridor Study is focused on improving safety and operations on I-40 overall and will not be evaluating the potential for additional access points to I-40 for future development. Any new interchange locations will need to be approved by the Federal Highway Administration and New Mexico Department of Transportation per requirements of Interstate Access Change Request Procedures.
7	New Interchange	Gallup Land Partners LLC (GLP) appreciates the opportunity to provide public comment on the I-40 Corridor Study. GLP asks the New Mexico Department of Transportation (NMDOT) to consider the proposed Exit 18 as part of the I-40 corridor transportation improvements.	Thank you for your comments. These suggestions will be included in our project documentation. This Corridor Study is focused on improving safety and operations on I-40 overall and will not be evaluating the potential for additional access points to I-40 for future development. Any new interchange locations will need to be approved by the Federal Highway Administration and New Mexico Department of Transportation per requirements of Interstate Access Change Request Procedures.

2.4.6 Summary of Public Survey Results

The NMDOT invited people to participate in a survey to understand public perspectives on the I-40 Corridor Study. A total of 70 people responded to the survey. The survey contained 13 questions with a mix of multiple-choice responses and fill-in-the blank responses. The survey responses helped the study team identify and better understand key issues, project needs, and community concerns related to travel on I-40 and adjacent frontage roads (alternate routes). The input was used to develop the study purpose and need statement, provided in Chapter 4, to shape the development of improvements concepts and alternatives. The text below provides a summary of key survey findings but does not list every question. Questions omitted from the summary include questions 11 and 13, which asked people to provide their contact information if they wanted to be added to the contact list and how they heard about the public meeting. Not all of the 70 survey participants responded to all of the survey questions. The percentages provided were calculated based on the total number of people who responded to each question. Appendix O, Public Meeting #1 Summary, contains the responses to all survey questions and detailed survey information.

Question 1: Where do you live?

- The majority of participants (93%) noted that they live in the study area, with the majority living in Gallup, Grants, or Albuquerque. A total of 7% of respondents indicated that they do not live in the study area.

Question 2: Where does your trip begin and end?

- Between Albuquerque and Gallup = 36%
- Between Grants and Albuquerque = 21%
- The remaining 43% of responses involved a range of locations including Laguna Acoma, El Morro, Thoreau, and other destinations

Question 3: How often do you travel on I-40?

- Daily = 12%
- Weekly = 36%
- Other = 52%
  - → Other responses frequently indicated that they traveled within the project area, monthly, twice a month, twice a week, and a few times a year.

Question 4: What time/s of day do you typically travel?

- Morning, 6:00 AM to 9:00 AM = 36%
- Midday, 9:00 AM to 3:00 PM = 42%
- Evening, 4:00 PM to 7:00 PM = 20%
- Night, 7:00 PM to 6:00 AM = 2%

Question 5: Are there days or times when you try to avoid driving on I-40?

This was an open-ended question, meaning multiple-choice answers were not provided. A total of 60 people responded to the question:

- I do not avoid travel = 15%
- Always = 12%
- Evenings = 15%
- Midday = 8%
- Morning and evening peak hours = 7%
- Mornings = 4%
- On weekends = 14%
- When construction is ongoing = 12%
- When there is inclement weather = 5%
- Other responses included:
  - → When there is a known accident (4%)
  - → Holidays (3%)
  - → Nighttime (1%)

Question 6: What highway or safety issues do you typically encounter while driving on I-40 between the Arizona State Line and the Atrisco Vista Interchange in Albuquerque?

Respondents could choose more than 1 response for this question. The most critical issues identified were traffic backups, roadway and lane closure due to accidents or construction, and conflicts with large commercial trucks.

- Traffic backups = 91%
- Roadway/lane closures due to accidents = 82%
- Lane closure due to construction = 78%
- Conflicts with large commercial trucks = 68%
- Poor road or pavement condition = 51%
- People driving too fast = 51%
- Slow-moving vehicles in both lanes, resulting in multiple vehicles lined up behind = 51%
- Drivers attempting to make unsafe passing moves = 49%
- Poor weather conditions = 23%
- Inadequate shoulder areas to pull off the highway = 14%
- Other = 23%
  - → Dangerous semi driving
  - → Distracted drivers (phones)
  - → Lack of police
  - → Not enough frontage road access

Question 7: What type of improvements to I-40 would you like NMDOT to consider?

Respondents could choose more than one response for this question. The top 4 suggestions included maintaining 2 lanes of traffic during construction, adding lanes, improving frontage roads/alternate routes, and improving pavement.

- Improved construction work zones, maintaining 2 lanes of traffic during construction = 74%
- Adding lanes = 71%
- Improving I-40 parallel/frontage roads = 65%
- Improving pavement = 55%
- Improving emergency travel notifications or electric message signs = 54%
- Improving incident management and response = 42%
- Widening roadway shoulders = 23%
- Adding electrical vehicle charging stations = 9%
- Other responses (38%) included:
  - → Complete frontage roads
  - → Better signage
  - → Higher speed limits
  - → Additional off ramps
  - → Concrete barriers
  - → More camera coverage for the NMDOT traffic updates
  - → Better accident management
  - → Truck lanes or stricter truck rules
  - → Construction management

Question 8: Do you drive on any frontage/parallel roads in the area?

A total of 44 people responded to this question. Responses were varied; however, the following locations were most frequently mentioned:

- Through Albuquerque
- Gallup to Albuquerque or Acoma
- Grants to Albuquerque
- Laguna to Grants
- Thoreau to multiple locations

Question 9: How often do you make this trip?

- Daily = 6%
- Weekly = 30%
- Other = 64%
  - → Occasionally
  - → As needed
  - → Twice a week
  - → During construction or an accident
  - → Twice a month

Question 10: What roadway or safety issues do you typically encounter while driving on frontage/parallel roads?

Respondents could choose more than one response for this question and were as follows:

- Poor pavement condition = 63%
- Inadequate shoulder areas = 50%
- Traffic backups = 41%
- Conflicts with large commercial trucks = 35%
- Drivers attempting to make unsafe passing moves = 35%
- People driving too fast = 33%
- Other = 33%
  - → Additional lanes are needed
  - → Additional signs are needed
  - → Route not connected to I-40

Question 12: Do you have any other comments related to this section of I-40 and the adjacent frontage/parallel roads?

This open-ended question received 43 responses that are provided in Exhibit 2-3. Responses varied, with the most common responses relating concerns about reliability, safety, and a desire for frontage roads as an option for incident management.

Exhibit 2-3. Summary of Public Survey Responses to Question 12

#	Theme	Comment
1	Access	I hate roundabouts. They are confusing and feel unsafe. You never know what lane to be in. Please do not add more round-a-bouts like at mile marker 102.
2	Access	Please don't make loop exits New Mexico always had easy on and off exits and now they are making them all long and confusing.
3	Access	Overall, the I-40 road is in good condition. There are a few historical areas where one cannot visit. I am also interested in photo ops of the different pueblos.
4	Access	Yes, abandon any plans for an exit at Allison Road, it is too close to NM 491-602. Instead, make an exit at Mile Marker 18, extending frontage access for commercial development west of the Walmart area.
5	Construction	Have construction work 20 hours a day 7 days a week to get the work done. Let's pay the price to get it done and do a concrete pavement so it will last 25 years before re-work.
6	Construction	When you put this out to bid, have some timelines for the contractor to finish and give them some incentive to finish on time and penalties if they're not on time. Have two construction companies, one going east and one going west, that way they'll work a little bit faster. And make sure that the companies are from New Mexico, not companies that just have an office In New Mexico and say they are in New Mexico but their main company is like a different state like for example Arizona or Colorado. And get companies with a track record of finishing projects on time and being good companies. And don't give them 10 years to complete it, like the 550 in Bernalillo they gave them 600 days to do that job. Like I said before give him some incentive to complete the job early and on time.
7	Enforcement	Against widening roadway, suggest increased police presence and improved roadways that don't need constant repair.
8	Flooding	The Ft. Wingate exit at NM 400 area often gets flooded, with sometimes 4 to 6 feet of sand deposits on NM 118 / Rt. 66 alongside of I-40; Need some attention toward drainage along I-40 corridor.
9	Frontage Roads	Need more continuous frontage/parallel roads. There are a few sections which don't have any and then result in large detours/long waits during crashes/construction.
10	Frontage Roads	Please improve all I-40 frontage roads and make a continuous relief road for I-40.
11	Frontage Roads	Route 66 doesn't go all the way to Albuquerque, it would be nice if it did.
12	Frontage Roads	It is only a matter of time before someone in the traffic standstill has a medical emergency and dies because there are no alternative routes through some portions of I-40 between Grants and Albuquerque.
13	Frontage Roads	The worst part is always by Laguna Acoma. It needs an adequate other road and exit from freeway to that road in case of accidents.
14	Frontage Roads	When they built I-40 over the top of a lot of the old Route 66 they had no foresight as to needing it to remain a single connected roadway.
15	Frontage Roads, Prohibit Access	Need to get another road route going for traffic backups or accidents near the Pueblo of Acoma. Too many unwanted big trucks or traffic coming off I-40 and going on Route 66 NM 124 through the reservation.
16	Frontage Roads	Need to look at adding frontage roads parallel to the interstate in areas that don't have a road already. Having alternatives for when the interstate is shut down is a must.
17	Incident Management	It would be nice if police would give you notice as you leave that there is an accident or closure before we get stuck in traffic, especially when traveling with elderly or children. Need some organization especially in bad weather, cold or hot, both are deadly.
18	Incident Management, Rest Areas	Importance of incident management, traffic back-of-queue, speed management (speed differentials, truck lanes, etc.), type/severity of crash analysis, and need for additional rest areas (specifically for commercial vehicles) maybe closer to Albuquerque.
19	Maintenance	The NMDOT needs to do a better job of mowing the sides of the roadway and removing debris.
20	Maintenance	Road needs to be paved in many places between Grants and Albuquerque.
21	Maintenance	Check for potholes on a weekly basis and repair them immediately.
22	Maintenance	Seems to me on the stretch of road (driven daily from Thoreau to Gallup) that it gets fixed/repaved yearly while other areas just get patched up. I wish I knew the mile maker. In particular is both east and west bound I-40 near the McGaffey/Wingate exit.
23	Maintenance	Issues with litter and weed control. Improved lighting at off ramps. Fix potholes and add basic lane striping.
24	More Lanes	Having a semi-route might help.
25	More Lanes, Trucks	We need to have more lanes and maybe even a trucker lane. We have a lot of commercial truckers who are horrible drivers and cause lots of accidents.
26	More Lanes, Trucks	I think there should be designated lanes for semi-trucks. They're bullies to the passenger cars and they hold up traffic.
27	More Lanes, Trucks	It would be really helpful, if possible, to add a third lane dedicated strictly for semis. Semis are terrible at holding traffic back in the fast lane with zero consideration for other drivers.
28	Reliability	Have lived here 12 years. In the last year I have come to dread travel to/from Albuquerque due to frequency of backups and truck accidents. Never know if the drive will be 2 hours or 4 to 5 hours.
29	Reliability	I have missed many appointments because of accidents and construction. I also travel with my 2-year-old grandson and it's hard on him to be sitting for an extra hour or more in car seat. Also, a lot of times we are in middle of nowhere and there is no place to pull off and go to bathroom.
30	Reliability	Closures and backups are becoming too common.
31	Reliability, More Lanes	More lanes or alternative routes to improve safety and predictability. Also, better treatment over black ice conditions in the winter. Regulating semi-truck volume and timing. Probably the most important thing… They are dangerous!

(Table Continues)

Exhibit 2-3. Summary of Public Survey Responses to Question 12 (Continued)

#	Theme	Comment
32	Reliability, Safety, Frontage Roads	I and a friend operate a Facebook group that started in regard to the traffic issues between Zuni and Albuquerque. We both have so many community members traveling and during major construction wait times were hours. So, we started a message board for people to post delays or accidents. We now have over 800 members and it is growing every day. We have been posting and have data from over 3 years of accidents on I-40. The wait times average 2 to 4 hours. I myself have sat in traffic once at standstill for over 6 hours. The frontage roads become unpassable for local traffic through our villages in Acoma. You get semi's doing well over 50 mph in residential areas. Route 66 is not built to handle that load and is deteriorating more every day. Some sort of relief route from Mesita to Los Lunas and connecting to Laguna land at the Route 66 Casino must be made.
33	Reliability, More Lanes	I strongly recommend adding more lanes to improve travel. I've stayed in traffic for more than 4 hours due to an accident. After a long day of work the last thing I want to be doing is be stuck with no other way to get home. In an emergency situation, if I-40 is closed, what other way is there?
34	Safety	I've driven this stretch of road for over 20 years and in the last 5 years have really noticed an increase in accidents, closures, and fatalities. Supply chain issues may have resulted in many more commercial trucks on the road. There is a large community of locals who regularly use this route as well for work and school. I've tried to ride the Amtrak train at times to avoid driving but the train is not very consistent.
35	Safety	It can be a perilous trip.
36	Safety	Something definitely needs to be done to improve the safety on this stretch of road. Too many accidents and lives lost. It is scary to drive on I-40. I dread it every time I travel on it.
37	Safety	For a road that is wide open in many places there seems to be way too many accidents.
38	Safety, Congestion	The amount of traffic has greatly increased over the past few years. What was once a pleasant drive is now stressful with heavy commercial traffic. It feels less safe.
39	Safety, Construction	Make it safer on I-40 during construction.
40	Safety, Trucks	I rarely drive I-40 when there has not been an accident caused by a semi-truck. The semi-truck drivers drive irresponsibly, swerving in and out of their lane, texting while driving, eating and not watching the road, falling asleep, and endangering other drivers lives.
41	Safety, Trucks	It’s very scary these days. Too many trucks going over the speed limit.
42	Safety, Trucks	The commercial drivers are becoming more and more dangerous. Movement from the north to south side in Gallup is a mess because of I40 and the trains
43	Truck Route	Need to figure out alternative routes/roads for truck traffic before they get into the city.

2.5 Public Meeting #2

2.5.1 Overview

Public meeting #2 was a virtual public meeting that was held at 6:30 PM on April 25, 2023. The focus of the meeting was to identify key findings and project needs; discuss initial concepts considered and the results of the screening process used to identify alternatives; provide a description of alternatives moving forward for detailed analysis; answer questions; and provide an opportunity for questions and comments on the information presented and alternatives moving forward. Details regarding public meeting #2 are provided below. Appendix P, Public Meeting #2, provides meeting information and materials.

2.5.2 Meeting Advertisements and Announcements

Virtual public meeting #2, web updates, and an invitation to submit comments were announced as discussed below. Appendix P, Public Meeting #2, Attachment A contains the advertisements, meeting announcement, radio announcement and plan, and social media plan announcing the public meeting.

- The virtual public meeting, project website, and public comment information were advertised in the *Gallup Independent* on April 10, 2023, and the *Cibola Citizen* on April 12, 2023.
- The NMDOT sent a press release announcing the meeting and the opportunity to provide comment to their media list on April 10, 2023.
- A total of 24 radio advertisements announcing the public meeting and the opportunity to provide input ran on KTNN (AM 660/FM 101.5) and KWRK/KCAZ (FM 96.1 and 99.5) beginning on Tuesday, April 11, 2023, continuing through Friday, April 21, 2023. A total of 12 announcements were made on each radio station; 6 of the announcements were in the Navajo language of Diné, and 6 were in English. KTNN's catchment area covers the Navajo Nation and Gallup in the western portion of the study area in McKinley County. KWRK/KCAZ covers the I-40 study area from the Arizona State line to Grants.
- The meeting announcement was emailed to 334 people and was sent via postal mail to 15 people on April 10, 2023. Individuals included in the distribution included representatives from tribes; RTPOs; state and local elected leaders; federal, state and local government staff; members from the freight industry; area businesses; and members of the public. In addition, 2 people contacted the study team and requested a hard copy of the public meeting presentation materials. The presentation materials were sent to these individuals as requested.
- A social media plan was developed and implemented through the NMDOT social media accounts on Facebook and Twitter, with multiple messages beginning on April 10, 2023, continuing through May 24, 2023.
- The meeting was also announced via the I-40 Corridor Study website and the NMDOT website.

2.5.3 Website Information

The I-40 Corridor Study website was updated to provide information on the public meeting and how to provide input on the I-40 Corridor Study. The web updates were launched on April 5, 2023. From April 5, 2023, through May 24, 2023, there were a total of 762 sessions on the website, which included 564 individual users (people who viewed the website), meaning that some people visited the website multiple times. A recording and presentation slides from the April 25, 2023, meeting was provided for people to view on April 26, 2023.

The website had several avenues by which it could be accessed. The percentage of people accessing the site through these various methods includes:

- 55% of people used direct access, meaning they clicked on a link to the website or typed in the address.
- About 19% of the site views originated via an organic search of the web (Google or other search).
- Social media was responsible for 18% of the web visits that originated from a link via a social media post.
- Approximately 8% of visitors accessed the site through web referrals, which occurs when people access the I-40 page from another webpage (such as the NMDOT project website).

Web visitors came from many locations, with the highest number, about 22%, coming from Albuquerque. A smaller number of visitors came from Phoenix (7%), Gallup (5%) and Grants (4%). The remaining users came from cities and locations both within New Mexico, such as Santa Fe, Rio Rancho, Las Cruces, Los Lunas, and Farmington, as well as from outside of New Mexico, including Tucson, Los Angeles, San Antonio, Dallas, Las Vegas, and Denver.

During the public comment period, 16 people requested to be added to the project mailing list to receive future project updates. A total of 2 people requested a printed copy of the meeting materials, and the study team sent the materials as requested.

2.5.4 Summary of Public Meeting #2

The NMDOT hosted a second virtual public meeting discussing the I-40 Corridor Study on April 25, 2023, at 6:30 PM. Not including the 13 public meeting panelists, 76 people attended the meeting. A total of 12 meeting participants called in via phone, and the 64 remaining participants attended online. Because the meeting was conducted virtually, a formal sign-in sheet was not provided, thus full names and contact information are not available.

Of the 76 attendees:

- 4 were elected officials, including New Mexico State Representatives Patty Lundstrom (District 9) and Harry Garcia (District 69) and Grants City Councilmembers Beverly Michael and George Garcia.
- 53 were members of the public.
- 6 were agency or tribal staff representatives.
- 13 were part of the NMDOT or consultant team.

A copy of the presentation given, meeting notes, and comments received are provided in Appendix P, Public Meeting #2. A summary of comments received during the meeting and public comment period is provided in Section 2.5.5.

2.5.5 Questions and Comments Received during the Public Comment Period

The public comment period began on April 10, 2023, and ran through May 24, 2023. Comments could be provided at the meeting, in writing, or via a public comment form. A total of 57 comments were received:

- 15 people asked questions or made comments at the April 25, 2023, meeting.
- 8 people submitted written comments.
- 34 people completed the online comment form.

Comments received at the public meeting and in writing are provided in Exhibit 2-4 and Exhibit 2-5 along with responses. Responses to the comments from public meeting #2 were provided at the public meeting, and responses to written comments were emailed to commentors and made available on the study website. A summary of information and comments provided in the online comment forms is provided in Section 2.5.6.

Exhibit 2-4. Comments, Questions, and Responses from Public Meeting #2

#	Theme	Comment	Response
1	Coolidge Construction	What about the corridor at Coolidge, is anyone looking at the construction in this area to see what has been happening over the last year? I live in Thoreau. Sometimes it takes 1.5 to 2 hours to travel 10 miles eastbound from Jamestown toward Albuquerque. There have been so many accidents and potholes, driving in the westbound lanes is like a washboard. Construction was supposed to be done, but it doesn't look like people are working on it. Also, in your presentation you stated that there had been 9 closures, we've had more than 2 dozen closures over the past year. At Fort Wingate you said there was 1 closure last year, that's not true, there have been at least 4 or 5. The NMDOT has huge piles of sand along the roadway in this area on both sides of the road. There are a lot of things happening between Gallup and Thoreau that you are not talking about.	I can understand the frustration of the travelling public. Part of the reason for this study is to look at improvements and practices that can help avoid some of the difficulties that are currently being experienced at Coolidge and elsewhere. Regarding the closures, I agree that there have been more than 9 closures on I-40. The information we presented documented 9 closures that occurred over a specific 2-month timeframe last summer (2022) and does not include closures that occurred in 2023 or other time periods. The NMDOT is aware of other closures that have occurred on I-40 and they are working hard to manage the situation with the resources they have. Part of what we are looking at in this corridor study is how to maintain 2-lanes of traffic during construction so we can avoid 1-lane closures like the one at Coolidge. As for the flood area/location with the piles of sand. There are two projects in the early design phase to improve the flooding conditions. The design phase takes about a year, and it will take two to three years to construct the improvements. NMDOT is aware of the conditions on I-40 and are doing everything we can to make sure that the traveling public is safe and able to get through the Coolidge area during construction. Two overnight closures were done earlier this year to completely overlay pavement in the Coolidge area to fix potholes and pavement conditions and there have not been any closures since that work was done. Some of the work that has been done more recently on the Coolidge project has been temperature sensitive and has had to occur when weather conditions would allow to make sure that quality work occurs and to adhere to the standards and specifications that we have. NMDOT is expecting the construction at Coolidge to be completed by the end of the year and then the eastbound lanes will be open and construction will shift to the westbound lanes. If you have additional comments or questions, please reach out to us.
2	Construction Phasing, Potholes	Would it be possible to start rehabilitation from the Arizona state line, and also start at the end of the road from Grants and meet in the middle? Road construction from Albuquerque to Grants is going great, continue with the pace, and hopefully communities can be patient. I can't believe it has gone this far; third world countries have better road conditions. Potholes that cause accidents and make it hard to navigate safely to your destination, it's worse at nighttime. This puts a black eye on NMDOT transportation department.	Regarding phasing of improvements, starting from the Arizona state line is one possibility. To date, we have not looked at how projects will be phased, but we will be looking at this and the best ways to implement projects in a timely matter. There are portions of that 150 miles of the study area that have been recently constructed and other areas under construction, so that will be taken into consideration. The improvements projects that will be recommended as part of this study will take many years to fund and implement. As part of next steps, we will be looking at identifying improvements and prioritizing those improvements based on the condition of I-40, safety, and where improvements could address the biggest needs.
3	Roundabouts	Is this study considering roundabouts as a solution to interchange congestion in Gallup? For example, at US 491?	We are primarily looking at congestion and merging and diverging of traffic from the I-40 mainline and the interchanges. We are aware that NMDOT has several projects and studies underway that are focused on looking at I-40 intersections and cross-streets. Roundabouts may be considered at those locations once traffic is on and off of I-40.
4	Safety	In 9 days, it will be a year since my son was killed at mile marker 137. He was killed in a single vehicle rollover accident. He was 35 and died with a 19-year-old friend. They were heading home from a job in Gallup late one night. I know now that this stretch of highway is known and they refuse to do anything about people driving over the sides. Is this being considered and what is planned for the specific section of I-40 from maybe mile marker 130 to 145? Too many people are being injured and are dying there and it's preventable. Things like lights, a cable, or concrete barrier may have helped. What is intended on this specific stretch of I-40?	I am very sorry for your loss and appreciate your comment and question. Aside from looking at crashes and traffic volumes, we are looking at the roadway sections and are doing a detailed analysis of slopes and recovery areas along I-40 and the landscape of the roadway to see if it is traversable and recoverable. This analysis will help us to make recommendations of provisions to keep drivers on the roadway, which could include barriers.
5	Public Outreach	Thank you for having this meeting. We have been working with your group for months and our invite list is over 30 to 40 people for this meeting. My question is, in Phase B will you be participating in community type in-person meetings? We have had virtual meetings, but it would be important to our communities to meet in-person. Is that going to be available and can you coordinate with Laguna Public Works?	Thank you for your question. We have a formal plan with the NMDOT for this study on how we reach out to communities. That plan includes meetings like this one where we have virtual meetings, since it's difficult to have in-person meetings in every community. We have been holding individual meetings with other stakeholders, including tribes. If it would benefit a tribal community to have an in-person meeting then please contact us and we can work out sending staff to attend an in-person make a presentation. We are scheduling meetings with the tribes in May and June of this year and we will contact you after this meeting to discuss setting up an in-person meeting.
6	Alternate Routes	Have alternative routes (traffic) been measured while they are in use during closures? I am concerned about the impact those diversions will have on these roads such as Santa Fe Ave/Rt. 66 in Grants. These diversions cause great stress on our main drive and hinder our local economy.	Alternate routes that parallel I-40 are not designed to carry I-40 volumes or speeds. We are considering how we maintain or quickly establish traffic flow on I-40 after an incident. The goal is to minimize disruption and impacts to alternate routes and the communities they travel through when they are used. We are continuing to look at this and can hopefully develop recommendations to mitigate your concerns. Part of the idea of widening shoulders and proposing crossovers is to provide options to keep more traffic off of alternate routes and on I-40. We are not doing traffic counts on alternate routes when incidents occur because we know these routes do not have the capacity to carry I-40 volumes and speeds, because the routes were not designed to be an interstate highway. What we are looking at is how do we keep things moving on I-40 and get it open to traffic as quickly as possible when there is a crash or other incident. The other challenge is even if we do have a nearby alternate route, how do we get I-40 traffic to that route? It requires state police/traffic control to direct I-40 traffic to these alternate routes and there are pinch points, such as stop signs, traffic lights etc. that impede getting traffic to/from I-40 and those alternate routes. Our focus is on how we keep traffic moving on I-40.
7	General	Good presentation, you are doing your homework. Thanks.	Thank you.
8	Holiday Traffic, Intelligent Transportation Systems (ITS)	I appreciate the opportunity to provide input. Thank you for the great work you are doing. I recently had a terrifying experience driving on I-40 about a week before Thanksgiving between Laguna and Albuquerque. There was an extraordinary volume of traffic and a high percentage of heavy trucks. The trucks were following too closely and speeding. Is heavy holiday traffic being considered? Could ITS be utilized to help in this situation?	There are normal, typical day-to-day traffic operations and there are other isolated events, such as holidays where traffic may increase. NMDOT is trying to look at best practices in the corridor to improve consistency with the level of operations. Improved ITS could help to improve travel for isolated events such as holidays to help people better plan trips and to minimize driver frustration which can lead to aggressive driving behavior such as driving to close or speeding.

(Table Continues)

Exhibit 2-4. Comments, Questions, and Responses from Public Meeting #2 (Continued)

#	Theme	Comment	Response
9	Alternate Routes	Will the project address frontage road improvements and safety enhancements which provide visitor access to rest areas specifically at MP102?	We are looking at deficiencies on frontage roads/alternate routes, such as ramps and interchanges that provide access to alternate routes. In particular we are looking at interchanges where traffic would get on and off of I-40 to access frontage roads. Interchanges are areas where we see more conflicts and crashes due to the merging and weaving movements getting on and off of the freeway. We're looking at all of the interchanges (access points) on I-40, which includes the interchange at MP 102.
10	Alternate Routes	As a Laguna Tribal member, you say the roads through the Pueblo aren't for interstate traffic, but the semis and others do go on 66 when the interstate is backed up due to road construction or accident. The traffic doesn't follow the speed limit and it's scary because our houses are right there by the road and especially when buses are dropping kids off. How are you going to keep us safe from the interstate traffic? Also, the semis have messed up our roundabout at the 114 exit when they are trying to use the Route 66 frontage road.	The goal is to keep the majority of traffic on I-40 and not have I-40 traffic using the alternate routes. Heavy trucks and other vehicles are not prohibited to use the frontage roads and alternate routes. We have identified this as a concern as part of the study and we are looking at policies and other things we can do to mitigate impacts. During the construction project on I-40 in Laguna, the NMDOT had issues with trucks and vehicles using the frontage roads and speeding and not driving safely. The NMDOT partnered with Laguna Police Department and State Police to try and help enforce the laws and speed limits on the frontage roads during the Laguna reconstruction. For future projects we will look at partnering with local law enforcement to keep communication open and focus on how to keep the roads safe.
11	Alternate Routes	Thank you for providing this information. The Navajo Nation has been working with NMDOT on the options to help relieve flooding in the Fort Wingate area. In addition, we have seen the challenges and impacts of traffic on alternate routes when I-40 traffic is at a standstill. Trucks will get off of I-40 at NM 566 (near Church Rock) and will travel north to get on BIA route N11 and N49 to Smith Lake. They will then travel south on NM 371 to Thoreau to get back onto I-40. We have heard concerns about heavy truck traffic on these routes when I-40 is shut down. We have also had challenges in the To'hajiilee area and heard that people will get off of I-40 and head westbound on BIA Route 57 in the and will get back on I-40. I know you have said that this study will hopefully address keeping traffic on I-40 and making improvements and enhancements, but the reality is that this won't happen overnight. It will take well over 10 years. Prioritization will be critical for many of the tribes. We will be pushing for enhancements to come first to keep traffic on the interstate and not use our local roads. I'm looking forward to the prioritization portion of the study. Safety and moving traffic is a challenge on I-40. I drive this section regularly and heavy truck traffic and narrow shoulders are an issue. I don't think I've ever seen a highway where there are so many guard rail end sections hit. I attribute this to a lack of shoulders and the road is windy, which adds to the challenges. I look forward to future presentations.	Thank you, we appreciate your comments. We will continue to work on the issues. Any time we get comments where people can share their experiences it helps to bolster our data and what we are looking at from an analytical perspective. This helps our technical evaluation and will inform our recommendations, phasing, and priorities.
12	Alternate Routes	There are concerns about the underpass between mile marker 89 to the mile marker 96 on Acoma lands. When accidents occur on I-40, traffic uses this alternate route and trucks get stuck crossing through the box culvert under I-40. These routes are not designed for the heavy truck traffic. There is a similar issue from mile marker 114 to 126 where there are no frontage roads, the only place you can go is to use NM 6. When there are issues on I-40 and traffic uses the alternate routes, damage occurs to these alternate routes. Questions I get from constituents are who compensates for damages to these roads, especially on tribal lands?	For the area that you mention near mile marker 89, NMDOT is actively working to remove this constraint. The NMDOT is working on plans with the Acoma to create a new roadway that will bypass the low clearance area. The Acoma have indicated that they would prefer the new road to be a state road. The details are being worked out, but NMDOT is fine with it becoming a state route. Regarding damage done to frontage roads, the NMDOT does not have a policy to compensate for damage caused by the semis and other traffic. Most of the frontage roads/alternate routes are state highways that NMDOT repairs as they can get to it. The NMDOT cannot speak to what occurs on local or tribal routes. As to the issue of damage to alternate routes when traffic re-directs itself to these routes when there is an incident on I-40. One of the challenges that NMDOT has is that we can't control or restrict drivers from using these routes, since they are publicly funded with state and federal funds. In most cases drivers direct themselves to these routes. We can advise traffic and try to post information ahead of time but we cannot restrict traffic from using these routes unless there are specific height and weight limits.
13	Nighttime	What is being considered for nighttime use on this project?	Different issues arise during nighttime use, including overnight semi parking on the roadway, proper signing and lighting, and visibility. ITS is one solution considered for informing truckers where stops can be had.
14	General	Wonderful presentation, thank you.	Thank you
15	Transit	Why is the Railrunner not considered in this model, there is more population than you think on this side of the state and it should not be considered a money issue but a quality-of-life issue. In northern New Mexico they have the same populations we do and it is widely used by them, build it and they will use it.	In our initial alternatives analysis, we looked at commuter rail and commuter bus service and found it would not address the majority of the needs we have on I-40 related to safety and operations. Even if we did run trains, it would not pull enough vehicles off of I-40 to create a noticeable reduction of traffic. Commuter rail or bus improvements are not precluded by this study and could be considered as a solution or project outside of this study for reasons like quality of life.

Exhibit 2-5. Written Comments and Responses from Public Comment Period #2

#	Theme	Comment	Response
1	Traffic Volumes	Are there figures on the increase/decrease in vehicles that has occurred on I-40 over the last 3 or 4 years, and, if so, was that divided to show the increase/decrease for large trucks vs other vehicles including passenger cars?	Information on the specific increase/decrease in vehicles that has occurred over the last 3 or 4 years is limited. The long-term trend (10+ years) shows that annual growth rates on this section of I-40 have ranged from a low of 1.1 % to a high of 2.8%. More recent data has suggested higher growth rates for the last 3 or 4 years, but that data is skewed by the COVID-19 pandemic. Most roadways nationally saw a decrease in traffic volumes in 2020 and then an increase afterward. Interestingly, freight traffic has appeared to have maintained strong growth despite the pandemic. Port of entry data in Gallup shows a truck traffic increase of about 6% a year between 2017 and 2022. The study team is considering these factors as part of determining expected growth in the future.
2	General, Alternatives	I would like to thank you for the extensive research and presentation of information that you have completed in the initial phases of the study. I live in Gallup but have driven I-40 between Gallup and Albuquerque literally hundreds of times over the years dating back to the 1960's, sometimes as much as 5 - 6 times a week. I think some of those attending the meeting this evening did not understand the scope of this study but were trying to include lots of other issues into the meeting. Since the beginning of Covid, traffic volume has definitely increased - both passenger cars and trucks. The truck traffic has increased due to supply chain issues and there have been 'new' truck drivers. As car drivers, we like to blame the truckers for everything, but there are many very good truck drivers and probably a proportional number of bad car drivers. As airlines have decreased the number of flights/seats available, car traffic also increased. This past winter has seen an unusual level of weather-related problems, just as I've seen in Wyoming, Idaho, and in areas of the Pacific Northwest. As the number of law enforcement officers have decreased over the past few years and the assignment of the remaining number of officers to other duties - due primarily to Covid - I have also noticed an increase in traffic violations. When I see a law enforcement presence along I-40, the traffic violations decrease just as they increase when there is no presence, but I understand that isn't really within the scope of the study. As I watched/read the recommendations that are suggested to go forward, I saw many good ideas. Two that really stood out for me were the wider lanes AND shoulders to allow two lanes of traffic to continue through construction zones and around many accidents. I-40 just can't be shut down to one lane for any length of time without major issues, so the ability to keep 2 lanes is a great idea. The other is to focus, through design and technology, on getting the interstate open as quickly as possible, rather than utilizing side roads whenever possible. All in all, an excellent presentation and I especially appreciated the courtesy and professionalism that both the NMDOT and Parametrix staff members utilized in responding to questions.	Thank you for sharing your experiences driving on I-40 and your support of concepts to widen shoulders on I-40, maintain 2-lanes of traffic.
3	Freight Lane, Reliability	Our family travels to Albuquerque at least 4 times a month for doctor appointments. We have been delayed four hours at one time because of a traffic accident. We also missed an appointment because of a traffic accident backup that was over an hour. Returning from appointment a semi pulled out in passing lane in front of me and I had to drive off on the shoulder. A lane for semi traffic would be a huge improvement.	Thank you for sharing your concerns on I-40 and your suggestion of adding a third lane that would be dedicated to freight. As part of our initial alternatives analysis, the study team considered adding a third lane that would be dedicated to trucks. The study team found that while there could be some benefits to having a dedicated freight lane, overall traffic volumes and composition do not meet the criteria from the Federal Highway Administration (FHWA) where freight-only lanes are desirable. These criteria include truck volumes that exceed 30%, and peak traffic volumes that exceed 1,800 vehicles per lane-hour, and off-peak volumes exceed 1,200 vehicles per lane hour. The study team found that needs on I-40 would be better met by other concepts, such as widening roadway shoulders or adding a third lane for all travelers. For these reasons, alternatives being advanced for additional analysis include: 1) Enhanced 2-Lane Alternative with added lanes, which would address roadway deficiencies, widen roadway shoulders, improve pavement, and add a lane to I-40 in areas where a third lane is needed to provide capacity or improve safety and 2) A 3-Lane Alternative that would widen I-40 to 3 lanes.
4	Alternate Routes, Freight Lane	In the last year, MANY MORE trucks have been traveling the alternate route from Arizona to Albuquerque via Highway 53 (Zuni/Ramah/El Morro) which is a NM State Scenic Byway. Are these commercial semi-trucks allowed to use this Scenic Byway? Are they trying to avoid the weigh stations? They are having and causing wrecks along this route just like they do on I-40. We drive to Albuquerque every 2 weeks or so on the study portion of I-40 and there is almost always a truck wreck on the highway. Why? We are scared to death of the trucks and often take the alternative Route 66. I think the trucks should have their own lane and stay in it and be prohibited to drive when it is raining or snowing. Too many people are dying because of them. These issues should be addressed, please. Thank you.	Highway 53 is a public state highway that is open for public use by vehicles, including commercial semi-trucks. The Scenic Byway status of NM 53 does not prohibit semi-trucks from using this route. Improving safety on I-40 is a purpose of the I-40 Corridor Study. Safety improvements being considered include widening roadway shoulders, providing longer merge lanes at interchanges, adding lanes in areas where there are steep grades. In addition, the study team is continuing to evaluate an alternative that would add a third lane on this section of I-40. The study team considered the idea of building a freight-only lane as part of our initial alternatives analysis. However, a freight-only lane was not recommended for additional consideration for reasons described in the response to Comment #3 of this table.

(Table Continues)

Exhibit 2-5. Written Comments and Responses from Public Comment Period #2 (Continued)

#	Theme	Comment	Response
5	Reliability, Safety, Road Condition	This is a comment submitted by Ms. Janice Begay via a phone conversation on 4/12/2023. Janice's comments include: ▪ She regularly drives from Gallup to Albuquerque. ▪ She mentioned the new legislation requiring semis to be in the right lane and suggested that she thought this new legislation would be helpful. ▪ Her primary concern is safety and that truck drivers need to be more respectful. She says safety is an issue, particularly in the winter. ▪ I-40 needs to be free of potholes. ▪ A key issue for her and many people who live in Gallup is the need to drive to Albuquerque to receive medical care. There is a shortage of doctors and specialists in Gallup, so people who live in Gallup often have to drive to Albuquerque for medical care. The number of backups on I-40 has increased over time, so it is difficult to predict how long the trip will take, which can cause people to miss critical medical appointments. ▪ I-40 needs to be safe. We didn't used to have a problem with trucks and safety, but this has become an issue.	Thank you for your comments. Reliability and safety are critical issues that have been identified in this corridor. The alternatives being developed and evaluated are focused on improving roadway safety and reliability by identifying improvements that will minimize delays on I-40 by improving incident management, minimizing lane closures during construction, improving roadway and pavement condition, and improving driver safety.
6	Road Condition	My daughter and I just finished a road trip from Gallup to Kansas City, traveling through Oklahoma, Texas, Kansas, and Missouri in addition to our own New Mexico. I was embarrassed again at the condition of our highways compared to all of those states. Do we simply ask for contractors to build a less durable asphalt? Those states have the same extreme temperature fluctuations that we do, and in some cases even heavier traffic. What is the reason for the poor road surfaces? I have lived in Gallup for over 34 years, and we have to be mindful of potential delays on I-40 due to road accidents, especially if we are facing time pressure such as getting to the Albuquerque airport on time for a flight. How many of these accidents could be prevented by a better road? Thank you for reading my thoughts, and I look forward to any improvements you and your team can deliver.	As part of this study, NMDOT is considering the pavement condition on I-40 and adjacent alternate routes and areas where improvements are needed will be identified.
7	Rest Area	Would like to see at least one more rest area.	Thank you for your comment and interest in an additional rest area.
8	Alternate Routes	My wife and I drive I 40 to Gallup or Grants twice a week. We are frustrated by the lack of frontage roads. Without frontage roads, we can be stuck on the highway for hours with no alternative routes available.	As part of this corridor study, the NMDOT is considering improvements to alternate routes and improvements to incident and construction management to minimize delays on I-40. Improvements being considered for alternate routes include removing clearance constraints for trucks, pavement improvements, and addressing areas where alternate routes are not provided such as continental divide and the area east of Laguna.

2.5.6 Summary of Public Comment Form Responses from Public Meeting #2

A public comment form was made available through the I-40 Corridor Study website. A total of 34 people provided responses using the comment form as discussed below.

2.5.6.1 Question 1: How did you hear about this project and/or the public meeting?

A total of 32 people responded to this question and their responses were as follows:

- Social media, either through the NMDOT or another group = 25% (8 people)
- Email, either directly from the NMDOT or a forwarded email or link = 25% (8 people)
- News article = 19% (6 people)
- Newspaper advertisement = 12.5% (4 people)
- Other, including a web search, because they work for the NMDOT, or the source was unspecified = 12.5% (4 people)
- NMDOT website = 6% (2 people)

2.5.6.2 Question 2: What do you like or dislike about the alternatives being considered?

This was an open-ended question, and 22 people provided a response. A total of 6 people indicated that they were unaware of or unclear about the alternatives that are moving forward for additional analysis in Phase I-B. Information on the alternatives is available in the public meeting presentation slides and the video recording for public meeting #2 that is available on the I-40 Corridor Study website. In addition, the NMDOT added information to the website that summarizes the alternatives that moved forward for additional analysis in Phase I-B. Comments that were provided in response to Question 2 are provided below in Exhibit 2-6.

Exhibit 2-6. Responses to Question 2

Issue	Comment
Improve I-40	Fix the road. Don't just put up signs that say "Take turns"
Improve I-40	Worry about it now! This is a very busy stretch of road, and road conditions are very much overlooked and the crashes and tire issues are not considered. The states around us have roads! It's gotten out of hand.
3-Lanes, Alternate Routes	Have to have at least a 3-lane highway whenever possible, with posted signs every 100 feet NO TRUCKS LEFT LANE and enforce it. Also need to improve and reopen alternate routes, like the road between Route 6 and Mesita. The people who live out there, and in Alamo, are pretty much cut off.
3 Lanes, Transit	I like the third lane, or at least every couple of miles a pull-off lane so slower vehicles can move over so others can pass. Plus, we need alternative transportation like the Railrunner or buses. That would be very beneficial to the people on this side of the state.
Alternate Routes	My first priority is to look for alternatives that offer frontage roads in the sections where there currently aren't any. Of particular interest is the area from Ft. Wingate to Coolidge. My family lives in Jamestown and we often sit in traffic on I-40 for literal hours to get through that section.
Alternate Routes, ITS	We desperately need a few major things. We need side roads built to bypass I-40 and help locals access communities for slower traffic! This is perhaps the most important around continental divide, Grants to Laguna, state line and east of Laguna. We also need more electric signs that can post warnings to drivers, and alternative routes. We need more physical and electric signs to warn drivers, especially truckers, of fines when they block the passing lanes. Finally, we need more physical barriers in areas where vehicles can easily cross over to opposing lanes.
Alternate Routes, Climbing Lanes	I would like it if providing a through alternative route and adding truck climbing lanes were among the priorities. I would dislike it if they were not being considered important in this overall study.
Transit	No Railrunner or bus service has been proposed. This would elevate a lot of traffic and move us into modern times.
Construction	Zipper merge signs need to be posted and the public needs to be more informed of how to use it and follow rules of the highway and be courteous while driving.
Coolidge Construction, Alternate Routes, Freight Lane	The one-lane backup in McKinley County is at its all-time worst. The bridge construction at Coolidge is taking a long time. Heavy one-lane traffic results in accidents, road damage, vehicle damage, cracked windshield and frustrated drivers. I don't know who hired those people, but they've been known to work intermittently. Re-routing traffic results in damage to those backroads that are hardly equipped to handle heavy traffic. Cost saving measures results in shoddy road work. The construction near Coolidge should have been completed a long time ago. A truck lane could alleviate semi-loads damaging the roads. In the meantime, who compensates the road damage to the alternative routes? The backup and forced closures come at an expense. Unfortunately, I-40 in McKinley County is the reason New Mexico is referred to as an "Orange Barrel" and "Pothole" state.
Freight Lane	Dedicated trucker lane
Road Condition, Trucks	I like that potholes are being worked on little at a time. I dislike that drivers of big trucks have no respect for smaller vehicles.
Road Condition	I am highly upset that the Interstate highway has massive potholes on it considering I've hit one while driving in my car. The damage caused is in the thousands of dollars, with both passenger tires being destroyed and the rims being bent, suspension and alignment damaged, and am lucky my car didn't flip over because of this road. Again highly upset!!!
Congestion	I don't like the traffic build up on the freeway while students are on their bus run in the morning and afternoons. Also, congestion is a problem for family and elderly people who are in transport to and from doctor visits which causes missed doctor appointments.
Snow Removal	I-40 from Grants to the AZ state line shuts down because of ice and snow in the winter months. And I'm talking about a small amount of precipitation!!! Could you please invest in some more road salt or other mitigation techniques to address this when weather happens?

2.5.6.3 Question 3: What improvement do you think is needed the most?

For this question, people were asked to select one item from the list below. A total of 34 people responded to this question as follows:

- Add lanes on I-40 = 20% (7 people)
- Minimize lane closures during construction or perform construction at night = 18% (6 people)
- Improve alternate routes = 15% (5 people)
- Improve pavement = 12% (4 people)
- Widen shoulders on I-40 = 6% (2 people)
- Improve travel notifications to inform people of poor weather conditions or lane closures due to crashes or construction = 3% (1 response)
- Improve incident management and response = 3% (1 response)

A total of 23% (8 people) had other recommendations, which included:

- Everything listed above, mainly notifications so we can keep traffic flowing.
- Keep and maintain all present rest stops as open, with all toilets open. Recently, toilets have been closed, and sometimes the entire rest stop is closed.
- Improve planning and implementation to keep a 1:45 hour drive from becoming a 5-hour drive!
- Improve alternate routes, force compliance to keep alternate routes open, and add lanes to I-40.

- Add a third lane for truckers only. And slow the speed limit for truckers to 65 miles per hour or less in construction work areas.
- Add Railrunner and bus service to our part of the state.
- I-40 needs frontage roads to divert traffic when there is a car crash. Often times, travel is halted for over 2 or 3 hours trying to get to a rest stop or past an accident. There should be another lane just for semi-trucks. They take all the lanes.

2.5.6.4 Question 4: Do you have any questions or concerns about the information presented?

This was an open-ended question. A total of 18 people responded to this question as listed in Exhibit 2-7.

Exhibit 2-7. Responses to Question 4

Theme	Comment
General	I think our comments will fall on deaf ears. It's been like that for 5 years!
General	The information presented is excellent, good job to the team.
General	I'd very much appreciate comment suggestions to stay open monthly and to avoid the harsh input others offer.
Improve I-40	I would suggest to folks responsible for this study, quickly assess their data and present their findings as soon as they can. We need solutions (yesterday). Folks cannot handle a lengthy study only to find that time and money was wasted. We need solutions that will be put into effect immediately and we need to best companies to make it all happen.
Improve I-40	Many concerns! We have never faced such a blatant lack of coordination on this stretch of highway. Our alternative routes are long and dangerous!
Improve I-40	Fix this thing already!! This road causes major damage and people have been hurt already.
Alternate Routes	Other routes used, they damage roads with weight of big trucks, they are not made for commercial roads, so when you repair I-40 then the other roads are damage, it's a circle of roads.
Alternate Routes	How are you going to work with tribal partners on side road development?
Alternate Routes	Is a through alternative route being considered? I travel from Farmington south on NM 371 to NM 122 to Grants several times a year and I purposely take NM 122 instead of I-40 because of all the traffic and issues. Most often I am towing a camper and would like to be able to stay on a through alternative route to NM 6 in order to avoid Albuquerque when traveling to Socorro and points south and east on US 60.
Alternate Routes, Rest Areas, Safety	I would like to know if through this project to improve I-40, should there be a push towards improving alternate routes that go through rural communities and tribes, will NMDOT put funds towards improving those corridors? We need better signage that keeps semis out of tribal villages. Old 66 does not have a shoulder, we need better mileage signs, sign for cattle, and to slow traffic down. I also think NMDOT needs to look at rest areas, some of these accidents are occurring during hours when people are tired. Arizona has large pullouts at rest areas that accommodate semis, well-lit with dog runs, and restrooms. Trash is becoming a burden to communities living by the highway. The plan must not be just about how to get traffic from point a to b. It has to be how do we create a safer pathway for folks to travel, to do it efficiently, but also not make the rural communities carry the burden of increased traffic.
Safety	I am a nurse who travels frequently on I-40 for work. I am concerned about my safety when I travel on I-40 to Gallup due to the numerous accidents I see. I feel that the construction on 1-40 has been more hazardous to the drivers of New Mexico.
Safety, Reliability	There are many improvements needed. I live outside of Ramah, so am obliged to take I-40 to get to Albuquerque There are times when I don't go because I don't want to deal with 1) all the trucks and the accidents they often cause, 2) the lane closures due to construction and/or accidents and the excessive delays that that causes. That section of the highway is very heavily traveled and yet there are always problems on it.
Trucks	Why is the law prohibiting tractor trailers from driving in the left lane not enforced? Traveling I-40 in other states, this is not really an issue. But semi-truck drivers routinely travel in the left lane across New Mexico, while pretty much abstaining from this dangerous practice in other states. It must be because they recognize that they are unlikely to get pulled over in New Mexico.
Trucks	Emergency ambulances, helicopters and police should always have an opening to and from accidents along the freeway. But again, truckers use every and all exits blocking these emergency exits.
Congestion, Road Condition	When we have accidents or construction, getting around is a nightmare. When access to the frontage roads is blocked, it's even worse. The potholes are extremely dangerous and they are not fixed for weeks even in areas where highway techs are sitting in their trucks, they need to at least call them in.
Construction	Have contractors work 6 days a week and finish projects before winter.
Transit	Please consider other options such as the Railrunner.
Gallup Overpass	A north to south Cliff Street overpass is needed with no on or off ramps for local residents to reduce the traffic from the on and off overpasses.

2.5.6.5 Question 5: Please list any additional comments below.

This was an open-ended question. A total of 18 people responded to this question as listed in Exhibit 2-8.

Exhibit 2-8. Responses to Question 5

Theme	Comments
Construction	No police monitors construction sites so more road rage happens
Construction	I know many people who have stopped making trips to Albuquerque because the stretch between Gallup and Albuquerque is pretty much always backed up due to construction.
Construction	We would suggest that the FHWA FDR Demonstration Project that took place on I-40 be revisited as it eliminated the need to detour traffic across the freeway median and restrict traffic during construction to only one lane in each direction. Estimated cost savings for this Full Depth Reclamation approach were in the range of 40% of conventional. https://www.stabilizationproducts.net/docs/18789.pdf
Construction, Road Condition	Please use night to work on I-40 as it would be a little more safe for the construction workers and NMDOT. Fix the deep, dangerous potholes that cause tire damage and alignment wear and tear to our vehicles. It is unsafe and undrivable at times. Thank you for listening, safety first.
Construction, Alternate Routes, Road Condition	Closing the highway for repairs in unacceptable! The lack of quality repairs on potholes is disturbing and can cause (and has caused) accidents and is also costing taxpayers extra money to repair our vehicles due to damage caused by the huge potholes. Forcing travelers to "alternate routes" in these areas is not feasible because of the distance and dangers posed by the condition of alternate roads. It is your responsibility to ensure safe travel by providing drive-around access in the same area of construction! No one should be stuck in a vehicle for 5 hours consistently on a normal 1 hour 45-minute drive! Please figure it out!
Coolidge Construction	Have contractor in mile parker 44 project finish it and not let them work on the west bound side. They have taken way too long and have destroyed confidence in their ability and NMDOT management of that project.
Coolidge Construction	Just fix the roads so there can be 2 lanes going eastbound at continental divide!
Alternate Routes	It would be nice to have nearby alternative routes such as frontage roads versus extended detours that add many miles and/or hours.
Alternate Routes	Creating a through alternative route and numbering it NM 66 would benefit local and recreational through traffic all of the time, and all traffic could benefit in cases of accidents, construction, and other times of congestion.
Road Condition	Improve pavement please, it's in terrible shape.
Road Condition	Roads in all of District 6 are very bad no matter where you travel from 550, 1-40, back roads, down south or up north. They are bad everywhere.
General	Call or text me because these concerns need to be addressed, instead of ignored.
General	Provide a summary of what was discussed on your website and inform the news agency's about the outcome.
Cultural Resources	I would like to see more on how NMDOT is considering impacts to historic and cultural resources, also how it may plan to assist communities in preserving the rural aesthetic of their communities.
Flooding	Increase the height of the frontage road and I-40 east side of Gallup to reduce the chances of flooding.

(Table Continues)

Exhibit 2-8. Responses to Question 5 (Continued)

Theme	Comments
Incident Management	There also needs to be quicker responses to clear blocked roads to get traffic moving. If it has to be dragged to the median, or some way to redirect bidirectional traffic onto the opposing lanes when one direction gets shut down from a crash.
Safety, Trucks	I avoid I-40 at all costs. I have had numerous close calls, especially with trucks. It's impossible to have good mileage with trucks constantly in left lane
Transit	We would like to see some type of alternate transportation like the Railrunner or buses running to this side of the state

2.6 Public Meeting #3

2.6.1 Overview

Public meeting #3 was a virtual public meeting that was held at 6:30 PM on February 27, 2024. The focus of the meeting was to discuss the alternatives analyzed in detail, proposed operational enhancements, the recommended Enhanced 2-Lane With Added Lanes Alternative, and provide an opportunity for questions and comments. Details regarding public meeting #3 are provided below, and Appendix Q, Public Meeting #3, provides meeting information and materials.

2.6.2 Meeting Advertisements and Announcements

Virtual public meeting #3, web updates, and an invitation to attend the meeting and submit comments were announced as discussed below. Appendix Q, Public Meeting #3, Attachment A contains the meeting announcement, press release, newspaper advertisements, radio announcement and plan, and social media plan for the announcing the public meeting:

- The virtual public meeting, project website updates, and public comment information were advertised in the *Gallup Independent* on February 12, 2024, and the *Cibola Citizen* on February 14, 2024.
- The NMDOT sent a press release announcing the public meeting and the opportunity to provide comment to their media list on February 19, 2024.
- A total of 24 radio advertisements announcing the public meeting and the opportunity to provide input ran on KTNN (AM 660/FM 101.5) and KWRK/KCAZ (FM 96.1 and 99.5) beginning on Tuesday, February 13, 2024, continuing through Thursday, February 22, 2024. A total of 12 announcements were made on each radio station; 6 of the announcements were in the Navajo language of Diné and 6 were in English. KTNN's catchment area covers the Navajo Nation and Gallup in the western portion of the study area in McKinley County. KWRK/KCAZ covers the I-40 study area from the Arizona State line to Grants.
- The meeting announcement was emailed to 404 people and was sent via postal mail to 9 people on February 12, 2024. Individuals included in the distribution included representatives from tribes; regional transportation planning organizations; tribal, state, local elected leaders; federal, state and local government staff; members from the freight industry; area businesses, and members of the public. In addition, 2 people contacted the project team and requested a hard copy of the public meeting presentation materials. The presentation materials were sent to these individuals as requested.
- A social media plan was developed and implemented through NMDOT social media accounts on Facebook and Twitter with multiple messages beginning on February 16, 2024, continuing through March 20, 2024.
- The meeting was also announced via the project website and the NMDOT website.

2.6.3 Website Information

The I-40 Corridor Study website was updated to provide information on the public meeting and how to provide input on the I-40 Corridor Study. The web updates were launched on February 12, 2024. From February 12, 2024, through March 27, 2024, there were a total of 831 sessions on the website, which included 625 individual users (people who viewed the website), meaning that some people visited the website multiple times. A recording and presentation slides from the February 27, 2024, meeting was provided for people to view on February 29, 2024.

The website had several avenues by which it could be accessed, the percentage of people accessing the site through these various methods include:

- 71% of people used direct access, meaning they clicked on a link to the website or typed in the address.
- About 15% of the site views originated via an organic search of the web (Google or other search).
- Approximately 9% of visitors accessed the site through web referrals, which occurs when people access the I-40 page from another webpage (such as the NMDOT website).
- Social media was responsible for 5% of the web visits that originated from a link via a social media post.

Web visitors came from many locations, with the highest number, about 18%, coming from Albuquerque. A smaller number of visitors came from Phoenix (6%), San Antonio (5%), Grants (3%) Gallup (2%) and Los Angeles (2%). Many remaining users came from cities within New Mexico, including Santa Fe, Rio Rancho, Socorro, Laguna, Clovis and Deming. Users visiting from areas outside of New Mexico included Dallas, Houston, San Diego, Flagstaff, Durango, and Denver.

2.6.4 Summary of Public Meeting #3

The NMDOT hosted a third virtual public meeting discussing the I-40 Corridor Study on February 27, 2024, at 6:30 PM. In addition to the 12 NMDOT and consultant presenters and panelists, 52 people attended the meeting. A total of 2 meeting participants called in via phone and the 50 remaining participants attended online. Because the meeting was conducted virtually, a formal sign-in sheet was not provided, thus full names and contact information are not available.

Of the 52 attendees:

- 15 were members of the public.
- 2 were elected officials, including New Mexico State Representatives Garcia (District 69) and Grants City Councilmember Beverly Michael. Tribal elected officials were also in attendance and are discussed below.
- 8 were from area tribal nations, including 4 tribal staff members and 4 elected officials, including the Acoma Pueblo's 1st and 2nd Lieutenant Governors (Wendell Chino and Ted Ortiz), the Laguna Acting Governor (Gaylord Siow), and the Navajo Nation Church Rock Chapter President (Larry King).
- 8 represented various federal, county, and local agencies.
- 1 member of the media was in attendance.
- 18 represented FHWA, the NMDOT, or various engineering consulting firms.

A copy of the presentation given, meeting notes, and comments received are provided in Appendix Q, Public Meeting #3. A summary of comments received during the meeting and public comment period is provided in Section 2.6.5.

2.6.5 Questions and Comments Received during the Public Comment Period

The public comment period began on February 12, 2024, and continued through March 27, 2024. Comments could be provided at the public meeting, in writing, or via an online comment form. A total of 52 comments were received:

- 21 people asked questions or made comments at the February 27, 2024, meeting.
- 10 people or organizations submitted written comments.
- 21 people completed the online comment form.

Comments received at the public meeting and the responses provided at the public meeting are listed in Exhibit 2-9. Exhibit 2-10 summarizes written comments and provides responses. A full version of the written comments are provided in Appendix Q, Public Meeting #3, Attachment C. Responses to the written comments were emailed to commentors. A summary of information and comments provided in the public comment forms is provided in Section 2.6.6.

2.6.6 Summary of Public Comment Form Responses from Public Meeting #3

A public comment form was made available through the I-40 Corridor Study website. A total of 21 people provided responses using the comment form as discussed below.

2.6.6.1 Question 1: What areas of I-40 do you think should be the highest priority for improvements? (select one)

A total of 19 people responded to this question and their responses were as follows:

- Arizona State Line to Gallup (MP 0 to 16) = 5% (1)
- Gallup (MP 16 to 26) = 16% (3)
- East Gallup to Iyanbito Exit (MP 26 to 37) = 16% (3)
- Continental Divide/Coolidge (MP 37 to 48) = 5% (1)
- Continental Divide to Milan/Grants (MP 48 to 72) = 10.5% (2)
- Grants (MP 72 to 89) = 0% (0)
- Grants to Cubero (MP 89 to 105) = 10.5% (2)
- Cubero to NM 6 (MP 105 to 126) = 5% (1)
- NM 6 to Route 66 Casino (MP 126 to 140) = 10.5% (2)
- Route 66 Casino to Atrisco Vista/Albuquerque (MP 140 to 150) = 21% (4)

2.6.6.2 Question 1a: If you answered Question 1, please explain what you are most concerned about in this area. (select all that apply)

A total of 20 people responded to this question. Participants could select more than 1 answer, so the results add up to more than 100%. Responses were as follows:

- This is the section I drive the most = 0% (0)
- I experience delays in this area = 20% (4)
- I see a lot of crashes in this area = 20% (4)
- The roadway shoulders are narrow = 20% (4)
- There are no nearby frontage roads/alternate routes = 20% (4)
- The on- and off-ramps are challenging to drive = 20% (4)
- The pavement is in poor condition = 35% (7)
- Other (please specify) = 55% (11), as provided below:
  1. Why is there no center median barrier on I-40 west of Albuquerque? I-25 has at least steel cable barrier. I have traveled both I-40 and I-25 for last 4 years. I-40 had narrow median and NO barrier. Saves lives. The one on I-25 has been hit often.
  2. There are very few rest stops with bathrooms, and when you come across them, they are always closed.
  3. The curves.
  4. Surface lane painting (solid white lane stripes, center lane demarcation, ramp painting).
  5. I had to select something. I'm not sure which section should be the priority.
  6. Hills cause semis to intermittently block the flow of traffic and dangerous sudden slowdowns on a heavily traveled road.
  7. High volume of traffic, particularly trucks. An additional lane is very important given how many trucks there are.
  8. During snowstorms and at night the off-ramp to the weigh station is poorly marked and wider than the highway, making it easy to get disoriented and stray out of the lane onto the shoulder/off-ramp. Better lighting and signage is needed.
  9. As Albuquerque continues to spread west, the traffic in this area increases and strains the current infrastructure.
  10. Aggressive truck drivers are the cause of most accidents, which needs the utmost attention immediately. Dedicated lanes for trucks traffic only, cameras to observe and control aggressive drivers would bring immediate relief.
  11. No explanation provided.

Exhibit 2-9. Comments, Questions, and Responses from Public Meeting #3

#	Theme	Comment	Response
1	Freight Parking	Any considerations on commercial motor vehicle parking? Fatigue is a major contributor to crashes.	We looked at the existing truck parking and availability in the corridor since the corridor is located across an area when truck drivers need to stop per federal regulations. It appears that on some peak travel days (Wednesday and Thursday) some additional parking could be warranted. NMDOT is taking a broader look across the State at the issue as part of their long-term freight planning. We are not proposing any expansion of existing facilities or specific truck parking locations. Recommended ITS improvements would help truck drivers identify where truck parking is available.
2	Wildlife Crashes	How many of the crashes on I-40 involved collisions with wildlife?	Just under 5% of crashes on the corridor are wildlife crashes. There are some areas where wildlife collisions that occur more frequently, and these tend to be on the west side of the corridor.
3	ITS	Can you elaborate on the ITS traffic management center? Where would that be developed?	It would be developed in District 6. There is a traffic management center in Albuquerque that covers the greater metro area, but not one in District 6.
4	Wildlife Corridors	Will the proposed actions involve improvements to habitat connectivity to benefit wildlife movement/migration?	Each individual project will have detailed environmental studies will be done for the specific project area that will look at wildlife habitats. There may be specific recommendations that come out in some of those locations that could direct a change in what type of structure there is to allow for habitat crossings. These crossing are important and there are areas where there are wildlife crossings.
5	Overpass	What did the study come up with for the I-40 by Sky City Casino for the road between the east and west overpass?	For Exit 102, the study looked at the entrance and exit ramps, not the overpass or roads on either side of the overpass. For areas adjacent to frontage roads, we looked at how and where they connect into I-40 and if there was (or was not) an available frontage road. There are no specific improvements proposed on the frontage roads near Exit 102.
6	Alternate Routes	Is there a plan to construct frontage roads in areas where there are sections missing?	We are not recommending construction of new frontage roads. There are currently 37 miles of I-40 that do not have adjacent frontage roads including 11 miles at the continental divide (milepost [MP] 37 to 48) and another section between MP 114 to 140. While frontage roads can be helpful when I-40 is closed, challenges arise for people having access to these roads from I-40. Frontage roads have lower speeds, generally don't have shoulders, and are not conducive to heavy truck traffic. We have heard mixed things from the public on these roads. People living in the communities adjacent to the frontage roads have expressed concerns when I-40 traffic uses these routes. The Enhanced 2-lane concept has wider shoulders over the entire corridor that would provide space to allow at least one lane to be opened more quickly in instances when there are crashes. One of the challenges with the existing frontage roads is that interchanges are sometimes more than 5 miles apart. This means that just because there is a frontage road available, doesn't mean that people can get to it from I-40 if a crash has occurred. In addition, areas where we don't currently have frontage roads are not necessarily areas where roads are needed for other purposes. The section that spans from MP 114 to 140 is all on tribal lands. We know additional right of way would be needed in this area to build a new frontage road. Additionally, the Enhanced 2-lane Alternative would require about 22-feet of extra space to be implemented. Implementing additional frontage roads would require about 40 feet (2, 12-ft lanes and 2, 8-ft shoulders). These new frontage roads still wouldn't address many of the needs on I-40 and some of the other reasons why we need widened shoulders.
7	Bridges, Laguna	Are there any bridge replacements or repairs that are planned for areas in Laguna Pueblo, specifically exits 108 through 140?	There is one bridge/overpass that is slated for improvements in the Laguna area, at MP 119, frontage road 4012. For the overpass at MP 114, the ultimate plan is to reconstruct the bridge to remove the skew and ramps can enter without loops. This bridge does not have sufficient width underneath to fit the Enhanced 2-Lane or 3-Lane alternatives. It also appears that the overpass at MP 108 has been identified as potentially having insufficient widths for the proposed alternatives. These overpasses may not necessarily be replaced but could need widening to fit alternatives.
8	Pavement	Have you conducted a review of the average frequency over the entire I-40 Corridor that full-depth reconstruction of segments of pavement have been required over the past 20 years, and wouldn't extending pavement service life also be fundamental to improving highway safety?	NMDOT assesses pavement condition along I-40 and changes have been observed in pavement conditions over the last few years. More detailed information indicates that some areas have existing pavement that still has an additional service life and can be improved using other methods. There are areas where pavement needs to be fully reconstructed. It is a combination that is needed, and it will be an ongoing process and evaluation and it will be used to determine and prioritize areas as projects are implemented along the 150-mile corridor.
9	Pavement	What are the plans for better quality blacktop materials to be used throughout the I-40 Corridor?	NMDOT continually looks at what the industry has and what methodologies are being used to make the best pavement choices. Those recommendations get worked through the NMDOT's general office and applied to projects. As projects go forward and new technologies are adopted by NMDOT, they will be employed. It is a continuous process.
10	Railroad Bridges	What are the plans for railroad crossings along I-40 at McCarty, Seama, and Mesita?	The structures there fall into a couple of different categories. Some are highway bridges crossing over railroad tracks. There is an instance where the railroad crosses over I-40. Many of the bridges are narrow and need to be widened. When those projects are done, there is coordination with the railroad and future railroad plans including planned expansion, upgrades to structural systems, or other safety needs are considered. These bridges would be improved as individual projects and they would have their own specific design and coordination with the railroad. To dive into each specific crossing would require more specific information. We don't have a specific plan or layout for all the bridges (there are 154 bridges in the corridor). I think the specific bridges you are talking about is one near MP 95, that one would have to be replaced for I-40 widening to occur. Similarly, there is design work underway to look at the bridge at Seama near MP 106.
11	Freight-Only Lanes	Because there is a such a high percentage of trucks on I-40, has a study been done to have truck only lanes?	Our initial alternatives considered these. Truck lanes have been talked about for decades on US highways; however, very few of them exist. Part of the reason for this is when we look at FHWA criteria for locations where truck lanes make sense, we find that the traffic volume and split on I-40 doesn't match the criteria. One criterion is when truck volumes exceed 30% (ours do in this corridor). However, the peak traffic volumes need to exceed about 1,800 vehicles per lane hour. When we look at projected 2050 numbers on I-40, we expect to be about half that. Therefore, current traffic conditions on I-40 are not at the point where truck lanes would meet FHWA criteria. Other considerations include who pays for the truck-only lanes and who benefits from them. We don't have any other freight only lanes in New Mexico, and there are few found throughout the country.

(Table Continues)

Exhibit 2-9. Comments, Questions, and Responses from Public Meeting #3 (Continued)

#	Theme	Comment	Response
12	Multiple Questions and Comments	Option 1 says it will cost $3.9 billion and Option 2 will cost about $4.5 billion, am I correct? I come up with a $600 million dollar difference using the lower cost for the 3-Lane.	The difference in cost you mentioned is on the lower end. As shown in the slides, there is about a $900 million dollar difference between the Enhanced 2 Lane and 3 Lane Alternatives.
		Also, you say that that the 2-lane works until 2050, is that correct?	Yes, that is correct, based on current projections, we expect 2-lanes to sufficient in most areas until 2050.
		As you know, at the Port of California they have extensive cargo that can't be moved yet. Have you taken that into consideration?	We have looked at what is expected through FHWA's data on expected future increases in freight. FHWA is expecting a freight increase in this corridor and that was taken into consideration.
		You also mentioned areas where there are no frontage roads, from the 114 to the 140, we have the same problem from MP 89 to 96, also at Continental Divide. A couple of weeks ago we had an accident that involved several semis, this is happening more often and it's getting worse and worse with wrecks with semis. I've seen back-ups of 10 or 15 miles and people sitting on this interstate for 8 to 10 hours trying to go from Gallup to Albuquerque. These are real concerns of mine, I know its money, but we're looking at a $900 million difference to make it a 3-lane rather than patching it as a 2-lane. We really need to see what is going to happen down the road or we're just going to be having the same conversation 5 or 10 years from now and will say we should have done this differently. Patching it is not fixing it. Cheaper is not better. We need to take into consideration the people who travel this road every day, between Gallup and Albuquerque for doctor's appointments and they get stuck on the highway. These can be life threatening situations that we need to look at. I know it is all about money. If you have a comment on that I would like to hear it.	You mentioned a lot of important issues in this corridor. What needs to occur on this corridor is something that can't happen overnight. There are 150-miles of roadway that need improvements such as implementing policies, procedures, and improvements that will help eliminate the need to reduce I-40 to one lane of traffic. Reductions to one lane of traffic cause the backups that you mentioned. When an incident causes the closure of both lanes, backups can extend many miles. This study is looking at how we can start implementing enhancements to reduce impacts to drivers right now and can be completed in the short-term. It is not practical to turn 150 miles of interstate into a construction zone at one time. We need to start incrementally to get I-40 up to an improved condition. Traffic projections are showing that in most areas (exceptions made for steep grades and Gallup) if I-40 has two travel lanes that are open and operating, capacity is sufficient. NMDOT indicated that one of the things that needed to be part of the vision for I-40 is the ability to build in flexibility and the ability to adapt into the proposed improvements. The Enhanced 2-Lane with Added Lanes Alternative meets the current federal and state requirements while providing the ability to expand. The Enhanced 2-Lane would take the typical section that currently exists and getting I-40 into position to be expanded for shoulder or additional lanes. The Enhanced 2-Lane potentially serves as a first phase of implementing a 3-Lane roadway as a lot of the work needed for the 3-Lane Alternative would be completed by building the Enhanced 2-Lane. The difference in cost between the price of the Enhanced 2-lane and the 3-Lane is what would be needed to expand to 3-lanes once the Enhanced 2-Lane is built. When the data and analysis has been completed and a decision is made to expand to 3-lanes, these changes could be made easily if the Enhanced 2-Lane is in place. Changes would require converting one of the 12-ft shoulders into a travel lane and adding a new shoulder. This conversion could be completed while maintaining 2-lanes. For a variety of reasons, it is difficult to project when 3-lanes will be needed. However, if we apply a consistent growth rate, we may need 3-lanes at some point, maybe around 2060, but it is very difficult to accurately project traffic beyond the horizon year of 2050. There are a lot of things that could change in this corridor by then including autonomous vehicles, different technologies, and different ways of doing things. We don't know how those things could affect I-40 in the future. That is why NMDOT thinks it is important for any solutions to have the ability to adapt. What we are recommending are the steps that will get the corridor into an improved condition, with improved reliability. This is a long-term plan; these improvements are not something that are going to be made quickly in a couple of years.
		The weight of the electric vehicles that are coming out is around 30% heavier than gas-operated vehicles. Freight vehicles will be significantly overweight when they come into operation. Is it in your scope of work to address the weight capacities on I-40?	That is diving a little bit deeper into the design than what we do at the study level. Those are things that the NMDOT general office is continuing to look at, and they are using the data they have to make sure pavement thicknesses and the materials used are appropriate. Those are considered with the final designs.
		Last year we passed legislation requiring that trucks stay in the right lane except to pass. Hopefully, that will alleviate some of the problems we're facing. Thank you for the presentation. Let's work together to get this done.	I think that was a major step forward, and we appreciate it.
13	Laguna, 3 Lanes	The design used at the MP 114 interchange was outstanding. Additionally, I would highly recommend we build 3-lanes from Albuquerque to Gallup. In the future we will have a lot more traffic and I think using barrier wall and using 3-lanes is the way we should look for the future. I would like to discuss the drainage at Fort Wingate and how to correct it.	Thank you for your comment and for the positive feedback on the improvements at MP 114. What we are looking at with the Enhanced 2-Lane, is how we can accommodate 3-lanes in the future when needed. Regarding Fort Wingate, it is a key area as it floods not only I-40 but also the frontage road. There is currently a project that is under development to effectively raise elevation and improve drainage in the area. It is something currently being worked on and is a project that hopefully the public will see in the near future.
14	I-40 and NM 118 East of Gallup	At the casino east of Gallup, there is a community on the south side of I-40, then NM 118 frontage road. The tunnel connection between this community and NM 118 is a concern. The toe of the embankment on I-40 extends too far out. So, when people are coming out of the community on the south side and go under the tunnel and to get to 118, you have to almost pull out onto NM 118 to get sight of incoming traffic. Is this something that could be done to move the embankment back towards the I-40 lanes?	When a project goes through that area the structure will have to be looked at because it currently does not accommodate the Enhanced 2-Lane or the 3-Lane. We will keep this in mind and District 6 will consider it when working on this project and will also assess. As it currently sits that project is outside of what we are looking at with this study but you bring up a good point.
15	Climbing Lanes	Is the recommendation in the steeper grade areas to be 3-lane? Did the slide reference 13 miles of such areas?	To clarify, 10-miles needs to be expanded to 3-lanes in Gallup to provided needed capacity. The climbing lanes total 3 miles, with short sections proposed on either the westbound or eastbound lanes of I-40. For example, there is 1-mile proposed for the westbound lanes from MP 76.5 to 77.5. A total of 4 sections of climbing lanes are proposed on the westbound side, and 1 on the eastbound side. These total 6 miles of 3-lane sections on just one side of I-40, so 3 miles total.
16	General	Please consider keeping the politics out of decisions in improvements along I-40. Rural areas are just as important as the urban locations	Thank you for the comment.
17	Bridges	What are the contingency plans for the railroad overpass at the McCarty Village in Acoma, along with the tunnel bridge just before the Quemado exit? Regarding the proposed 2 and 3 lane increase proposal and replacing the tunnel bridge?	The tunnel bridge you mention was on the list of studies we had at MP 90.6 for a frontage road and there are no formal plans at this time. With the McCarty railroad overpass (near MP 95), there is no specific plan for that bridge, but the bridge would have to be replaced for any widening to occur even to go to the Enhanced 2-lane. In that particular location, the bridge spans the frontage road and I-40 and there is no space to widen either of them. It is likely that this bridge would have to be replaced entirely

(Table Continues)

Exhibit 2-9. Comments, Questions, and Responses from Public Meeting #3 (Continued)

#	Theme	Comment	Response
18	Signs	With the passing of legislation to force semi-trucks to use right-lane only, is there a plan to post regulatory signs along the interstate to inform the drivers of this change?	There are already signs posted saying “Trucks use right lane” and signs that say, “Use right lane except to pass”.
19	Bridges	When bridges get replaced, will they be built to 6-lanes?	Each bridge will be evaluated individually. There is a procedure in place that NMDOT is using and continuing to refine. It starts with the bridge providing 2-lanes and 2, 12-ft shoulders. We are looking at the possibility of making the bridges a little bit wider. In addition, there is an evaluation that looks at constructability issues and lifecycle costs and potential phasing to determine if it makes sense to put in 6-lane bridges (3-lanes in each direction). To reiterate, for the Enhanced 2-Lane, bridges are being looked at on a case-by-case basis with the forethought of how they could be expanded in the future. Those considerations are being made so we don’t have a loss of investment.
20	Signs	I think signs to tell commuters stay on right lane (slow traffic) except to pass (left lane) should be posted along the I-40 corridor. When I travel to Albuquerque, I always encounter vehicles blocking both lanes.	Comment is duly noted.
21	Rio San Jose River	What are the plans for the Rio San Jose river that goes under I-40, infrastructure above and below along with runoff?	These will be determined by a site-by-site and project-by-project basis. This is a high-level corridor study that sets the vision for what would get built in the future. We haven’t looked at specifics, we have mostly focused on the bigger picture. The structures and drainage work will have a detailed analysis to set the parameters of what the bridges will need to accommodate, and the drainage work will determine what needs to be accommodated under the bridges. Each individual project will require a detailed engineering and environmental analysis. In addition, we did look at culverts in the corridor and we found several culverts that need to be expanded to accommodate flows in the area and many culverts also need maintenance. NMDOT will use this information as they develop projects, which will be woven into each individual project so these issues get addressed.

Exhibit 2-10. Summary of Written Comments and Responses from Public Comment Period #3

#	Theme	Summary Comment	Response
1	3 Lanes, Safety,	My suggestion is to build a 3rd lane since the wider shoulder costs $3.9 billion, then it's better to find an additional $0.9 billion and don't return to this issue in future. Next step with 3 lanes - no trucks/SEMIs in the left lane, SEMIs the middle lane for passing only. I frequently travel on I-40, and a major safety concern arises when large trucks abruptly merge in front of you while you're in the right lane, passing other trucks. The slight speed differential between the trucks often results in extended attempts to overtake one another, leading to miles-long stretches where they may not successfully complete the passing maneuver. This, in turn, creates a significant congestion of passenger cars in the left lane, all attempting to maintain the maximum speed allowed by the posted speed limits. Additionally, many of these cars often fail to maintain a safe following distance, compounding the safety risks on the road.	Thank you for sharing your experiences driving on I-40 and your comments supporting the 3-Lane Alternative. The preferred alternative includes ramp extensions to improve safety and provide more space for all vehicles to merge at many on- and off-ramps. Climbing lanes are being proposed in areas with uphill grades, which will to mitigate speed differentials between passenger vehicles and trucks.
2	3 Lanes, Construction Concerns	In my opinion, three lanes in each direction WITH a wider shoulder is absolutely necessary. As a person who has frequently driven I-40 between Albuquerque and Los Angeles, this proposed project is long overdue. New Mexico has been under a state of perpetual construction between Grants and Gallup for over 25 years. No progress has been made in that construction project resulting in at least a 2 to 3 hour wait just to get between those two cities. This wait has never been insignificant to commuters, commerce, or vacationers. Sadly, the State of New Mexico has long been lazy and lackadaisical with making an improvements in that they are by tolerating incompetent construction companies who take advantage of the taxpayers by feigning actual work while actually doing nothing but causing unnecessary traffic jams while NO WORK is actually underway! Whoever in the State is overseeing this decades-long project is just another corrupt lacky who has their own personal self-interests in mind! The State has demonstrated its incompetence with its perpetual construction between Grants and Gallup (again over 25 years) that it in incapable of managing construction projects. I have extreme doubt that the State can do anything without exacerbating its current management failure along the country's principal transportation corridor. I added as a second exemplar the 1-mile section of La Bajada Hill which has been under construction for three years. Governor Lujan Grisham is an embarrassment. If the state is actually going to represent itself as a progressive and pro-commerce State, then it needs to aggressively implement this construction project and vigorously oversee it such that it doesn't take more than two decades to complete. Otherwise, this proposal is just a lot of wasted hot air and BS.	Thank you for sharing your experiences driving on I-40 and your comments supporting the 3-Lane Alternative. A primary recommendation of this study is to minimize traffic delays to the traveling public during construction, maintenance, and incidents. This includes keeping 2 lanes open during construction projects in the future; minimizing lane closures for maintenance activities or shifting it work to off-peak hours; and improving incident management. Wider shoulders are also proposed, which will help to maintain more space on I-40 to keep lanes open. Improving 150 miles of interstate is a complicated endeavor that requires obtaining funding and completing design, environmental consultation and review, and construction. Effects to the traveling public can be minimized by working to keep 2 lanes open as much as possible.
3	3 Lanes	I have driven between Grants and Albuquerque approximately 300 times in the past 6 years. I have seen it all, which includes a few fatalities. I fully support putting an extra lane. I rarely go between Grants and Gallup, so I can't comment on that. Along with this improvement, I believe there should be heavy enforcement to make sure truckers stay in the far-right lane. If they pass, they must return to the right lane immediately. I have seen many backups because truckers drive side-by- side for long stretches. There are also too many short on-ramps, so many vehicles don't have a chance to move over. The circle on-ramps are extremely dangerous because there is there is no way to increase your speed to the proper amount when entering I-40. The one at Route 66 Casino has been stretched out, which is good. I've seen too many wrecks at that one. The entry lane going east at Exit 85 in Grants is way too short. I've almost been run off the road trying to get onto the freeway. I know this construction will take a long time, but there should be incentives to get it done early. I also believe part of the general backup is caused by closing down the whole I-40 or parts of it way too long. If the police know what happened, it seems there is no need to keep it closed for so long. Ideally, it would be great if there was also a big enough shoulder, so if there is a wreck, that can handle as another lane. Thank you for reading my opinions.	Thank you for sharing your experiences driving on I-40 and your comments supporting the 3-Lane Alternative between Grants and Albuquerque and increased enforcement on I-40. The preferred alternative includes ramp extensions to improve safety and provide more space for all vehicles to merge at on- and off-ramps. Ramp extensions are proposed for the ramps you mention at Exit 140 for the Route 66 Casino and Exit 85 in Grants. Thank you for your support of widening shoulders and improving incident management. As part of project design and construction, the NMDOT will work to minimize construction effects to the traveling public, which could include contractor incentives or other traffic management solutions.

(Table Continues)

Exhibit 2-10. Summary of Written Comments and Responses from Public Comment Period #3 (Continued)

#	Theme	Summary Comment	Response
4	New Mexico Department of Game and Fish (NMDGF)	The NMDGF submitted a formal comment letter as summarized below. Since the proposed highway project includes bridge or road construction activities, the NMDGF recommends implementation of its *Bridge and Culvert Construction Guidelines for Stream, Riparian, and Wetland Habitats* for any rivers, streams, washes, springs, seeps, or riparian areas that are fall within the impact footprint of this project. These guidelines should assist in minimizing impacts to the river or wetland and should be incorporated into the standard best management practices for these types of construction activities. The NMDGF also recommends that preconstruction bat surveys be conducted during summer months to determine if bats occur. If bats are determined to occur at bridge sites, work should be scheduled to avoid impacting bats that may roost there (i.e., conduct work in winter months). All migratory birds are protected against direct take under the federal Migratory Bird Treaty Act (16 U.S.C. Sections 703-712), and hawks, falcons, vultures, owls, songbirds, and other insect-eating birds are protected under New Mexico State Statutes (17-2-13 and 17-2-14 NMSA). To minimize the likelihood of adverse impacts to migratory birds, nests, eggs, or nestlings, the NMDGF recommends that ground disturbance and vegetation removal activities be conducted outside of the primary migratory bird breeding season of April 15-September 1. If ground disturbing and clearing activities must be conducted during the breeding season, the area should be surveyed for active nest sites (with birds or eggs present in the nesting territory) and avoid disturbing active nests until young have fledged. The list of New Mexico Species of Greatest Conservation Need and the federal list of Birds of Conservation Concern should be reviewed to fully evaluate potential effects to migratory birds from your proposed project. Federal agencies are also required under Executive Order 13186 to implement standards and practices that lessen the amount of unintentional take attributable to agency actions. These conservation measures are strongly recommended to ensure persistence of migratory bird species whose populations are small and/or declining within New Mexico. Pronghorn antelope attempting to cross the highway have been found to become trapped within the highway right-of-way along this stretch of I-40, partially because of their aversion to jump fences, and becoming hit by a vehicle. To prevent wildlife and big game from entering the highway right-of-way, and to minimize the potential for wildlife-vehicle collisions, the NMDGF recommends improving fencing along the I-40 corridor wherever possible. In conjunction with this, the NMDGF also recommends constructing overpasses or large underpasses wherever new construction or improvements to roads, bridges, and culverts occur. For more information on wildlife corridors across highways please refer to the *New Mexico Wildlife Corridors Action Plan*.	Thank you for submitting these comments. The NMDOT will identify needed wildlife surveys, requirements, and best management practices in coordination with federal and state agencies as part of project development on a project-by-project basis. Improvements to fencing and/or improving wildlife crossings will be considered, where appropriate, as projects are designed and constructed.
5 & 6	Laguna Department of Education	The NMDOT received 2 comment letters with the following summarized comments on behalf of the Laguna Department of Education. While many of us that travel I-40 frequently agree that upgrades for safety and traffic flow are imperative, our concern lies in the use of alternative roads during incidents (such as accidents) and congestion that necessitate routing vehicles through our Reservation lands, particularly state road NM 124. Our Transportation Team includes bus routes to service our six villages and we have observed over the years that many drivers do not heed flashing bus lights at stops or attempt to go around the stopped bus which creates a grave safety hazard for our children both boarding and exiting the bus. Additionally, we have received numerous reports of commercial and private vehicles traveling at high speeds on NM 124 during I-40 closures, which creates additional danger for our community members. Lastly, NM 124 does not have adequate black top surfacing, nor shoulder space, to accommodate highway volume or accident detour for any length of time. We propose several suggestions to improve public safety during this project: ▪ Signage: Please consider adding additional signs that state road NM 124 is a bus route. ▪ Add signs that refer to state law 66-7-347 that it is illegal to over-take or go around a stopped school bus. ▪ Police escort: Please provide a police or DOT escort to follow each bus to ensure compliance and prevent an accident. ▪ Consider an alternative road that is more suited to heavy traffic and accessible for emergency vehicles. Thank you for the opportunity to hear our concerns	Thank you for your comments and for sharing your concerns about safety and frontage road use during lane closures on I-40. A primary recommendation of this study is to minimize traffic delays to the traveling public on I-40 during construction, maintenance, and incidents. This includes keeping 2 lanes open during construction projects in the future; minimizing lane closures for maintenance activities or shifting it work to off-peak hours; and improving incident management. Wider shoulders are also proposed on I-40, which will help to maintain more space on I-40 to keep lanes open. These proposed improvements will improve traffic flow on I-40, which should result in fewer I-40 drivers choosing to drive on local frontage roads. We appreciate the suggestion for NM 124 from the Laguna Department of Education and will consider these suggestions as improvements are made on adjacent frontage roads. We look forward to future discussions regarding I-40 and adjacent frontage roads with Laguna Pueblo leadership; Laguna Pueblo entities, including law enforcement, public works, and the school district; and community members.
7	Eastern Navajo Agency Council	The Eastern Navajo Agency Council submitted Resolution 03-2024-006 supporting NMDOT's I-40 Corridor study and making certain recommendations. The Resolution was voted upon by representatives of 31 Navajo Nation Chapters in Eastern Navajo Agency. The Council also requested to be involved with future I-40 projects so they may contribute to the conversation. Resolution No. ENAC-03-2024-006 Supporting NMDOT's Highway Corridor Study of I-40 and recommending the construction of a third lane from the Arizona State Line to Grants, NM as the first phase, a summary of the resolution and recommendations are provided below. ▪ The current I-40 has become a crowded highway with intrastate and interstate traffic; and ▪ Many semi-trucks use I-40 for transporting goods, supplies or products. At times, it seems like there are more semi- trucks than cars. People have complained about trucks not allowing passage especially if they are in group or convoy. It gets to be unsafe when passenger cars are boxed in; and ▪ Many Navajo persons or families from Arizona communities go to Gallup, NM, for shopping and for necessities and they use I-40 in New Mexico portion from Arizona State Line; and ▪ Navajo families will use I-40 to get home from work and shopping trips. If I-40 is closed, it becomes unsafe when they are stuck in a traffic backup, and because they have to get home, they try to find an alternate or side road or make u- turns; and ▪ There are many medical transports who take patients to the medical appointments on a daily basis. When I-40 is closed, this become a safety hazard and a health concern; and ▪ I-40 asphalt has become unsafe due to many potholes and other structural defects like guardrail damages; and ▪ There needs to be well-maintained resting areas for the semi-truckers and other vehicles. Currently, they just park dangerously on the ramps or on the interstate itself; and ▪ All underpasses should be redesigned for passage by local traffic but not semi-trucks. More such underpasses need to be built for local traffic; and ▪ Because the I-40 is heavily used, the redesign of the road should exceed the minimum standards as to prolong the life of the road; and more reflectors need to be added near curves and there should be more streetlights for off-ramps; and ▪ There should be more signage showing routes to Navajo communities and Chapterhouses. (if Navajo wording is used, former or parallel English word should be included). Navajo words are not in Google maps and tourists have trouble finding the right destination; and ▪ More message alert overhead digital signs should be installed advising drivers of road conditions or closures; and ▪ Three lane traffic has become a necessity for I-40 interstate highway and has helped to promote safety near Jamestown east of Gallup.	The NMDOT thanks the Eastern Navajo Agency Council for your interest and comments on the I-40 Corridor Study. We acknowledge your preference for the 3-Lane Alternative and your suggestion for a first phase between the Arizona State line and Grants. At this time, the NMDOT's preferred alternative is to construct the Enhanced 2-Lane with Added Lanes Alternative, which includes adding a lane in each direction for about 10 miles in Gallup, as identified in the public meeting held on February 27, 2024, and information shared via our website at https://www.dot.nm.gov/projects/i40-west-new-mexico/. Improving 150 miles of interstate is a complicated endeavor that requires obtaining funding and completing design, environmental consultation and review, and construction. Project phasing will occur based on allocated funding and infrastructure needs. Throughout the study, many people have expressed concerns about delays on I-40. A primary recommendation of this study is to minimize traffic delays during construction, maintenance, and incidents. This includes keeping 2 lanes open during construction projects in the future; minimizing lane closures for maintenance activities or shifting it work to off-peak hours; and improving incident management. Wider shoulders are also proposed, which will help to maintain more space on I-40 to keep lanes open. Effects to the traveling public and emergency response vehicles can be minimized by working to keep 2 lanes open as much as possible. The preferred alternative also includes addressing concerns mentioned in this resolution, including pavement condition, damaged guardrail, and message alert systems. The NMDOT will continue to design local road improvements for New Mexico State Routes (such as Route 66, NM 124, and NM 118) to meet NMDOT design standards and provide adequate clearance for passenger vehicles and commercial trucks. The NMDOT looks forward to additional coordination with the Navajo Nation, Navajo Nation leadership, Chapter Houses, and staff as projects are developed and implemented.

(Table Continues)

Exhibit 2-10. Summary of Written Comments and Responses from Public Comment Period #3 (Continued)

#	Theme	Summary Comment	Response
8	Various	1. ROW agreements must be negotiated with the informed consent of tribal governments like the Pueblo of Acoma and its federal trustee, the United States. a. The Bureau of Indian Affairs, as well as other federal agencies, must be involved when issues of cultural sites and cultural resources such as waterways, homes, and farmlands are involved.	Thank you for your comments. At this time, no right-of-way needs have been identified for the proposed improvements. However, if right-of-way is needed on Acoma lands, the NMDOT will work with the Acoma Pueblo and the Bureau of Indian Affairs (BIA), as required. Impacts to cultural, natural, or other tribal resources will be identified on a project-by-project basis, and the NMDOT will conduct all required government-to-government consultation and obtain required permits and approvals from the BIA and other federal, state, and local agencies as required.
		2. State and Tribal government consultations may cover other matters, such as: a. Utility corridors and roads which cross through the exterior boundaries of Acoma Pueblo require special consideration. b. Acoma may impose special restrictions on the height, weight, and types of materials that can be transported through Acoma lands on alternate routes for the safety of its resident community members and the protection of its waterways, farmlands and other cultural resources.	Comment noted.
		3. A speed limit of 65 mph should be imposed on traffic proceeding through the Pueblo of Acoma on I-40 to reduce the occurrence of accidents through this narrow traffic corridor.	The NMDOT is not considering reducing posted speed limits in the study area at this time. The posted speed limit on I-40 is 75 miles per hour through the study area from the Arizona State line (MP 0) to the Atrisco Vista Interchange in Albuquerque (MP 150), with the exception of the urban area of Gallup from MP 15.5 to 26.5. I-40 near Laguna at MP 115 had previously been the only other portion of I-40 in the study area with a posted speed of 65 miles per hour. In 2021, roadway improvements were made in this area, and the speed was increased to 75 miles per hour. Initial traffic data indicates that crashes in this area have decreased since the I-40 improvements were made and the speed limit was increased.
		4. Alternate routes parallel to I-40 at Acoma are in need of improvement. a. Fatima Hill Road is uneven, with cracked pavement and patches. b. Exit 100 frontage road that runs parallel to I-40 on the south side needs to be raised to allow the installation of drainage culverts. Storm runoff from Mt. Taylor floods the roadway, causing the concrete blocks in the road to separate from the asphalt. c. NM 124, west of McCartys, resurfaced a few years ago, was stripped down last year, and needs to be resurfaced or repaved. d. NM 124 under I-40 at MP 90.6 was dripping water down the west wall causing water to pool on the road surface under the bridge after a dry week on March 23, 2024 e. Any re-routing of NM 124 must avoid sensitive wetland areas, springs, and habitat for threatened and endangered species.	a. Thank you for providing this information. Fatima Hill Road is not a state highway and is not owned, operated, or maintained by the NMDOT. b. As individual projects are implemented and proceed into the design phase, a Drainage Analysis will be completed to determine specific site needs including changes to the roadway grade. Based on a preliminary drainage assessment of this area, the natural drainage path travels through 2 arroyos and associated floodplains from north to south. I-40 has been built over the drainage path and runoff flows under 2, I-40 bridges and a large concrete box culvert. During high rain and flood events, water travels through these arroyos, under the bridge and through the box culvert to discharge to the south side of I-40. The frontage road has concrete panels to be able to withstand occasional flooding that likely occurs during high rain events. c. Pavement resurfacing was done in 2023 on sections of NM 124 at McCartys and areas west. Based on the field assessment done for this study in 2022, additional pavement resurfacing is not proposed at this time, but will continue to be monitored by the NMDOT in accordance with State and FHWA performance measures. d. The NMDOT inspects the concrete box culvert at MP 90.6 regularly as part of their bridge inspection program. The last report indicated that this structure is in fair condition. e. At this time, there is no proposal to reroute NM 124.
		5. A Joint Powers Agreement should be negotiated between Acoma Law Enforcement and the New Mexico State Police for the I-40 Corridor through Acoma. a. Special wireless alerts and emergency notifications for accidents involving hazardous materials on or near Acoma will allow time for some traffic to be diverted to facilities west of Acoma at Exits 85, 89, and west of Laguna at Exit 102. b. Hazmat manifests should be provided to Acoma Law Enforcement in advance of shipments through Acoma on I-40 and on alternate routes through Acoma in case an incident occurs that endangers the Acoma community or its tribal homelands.	Thank you for these suggestions. The NMDOT is not an enforcement agency and any such agreement would need to be negotiated between Acoma Law Enforcement and the New Mexico Department of Public Safety. State statutes, laws, and federal regulation regarding hazardous waste including compliance with the Environmental Protection Agency's national system for tracking hazardous waste shipments, is overseen by the New Mexico Environment Department. Information about the Hazardous Waste Bureau is available at https://www.env.nm.gov/hazardous-waste/.
		***Recommendation for an Acoma Alternative to enhance 2 lanes through the Pueblo of Acoma with improved drainage, possibly with permeable pavement below overpasses that allows the roadway to absorb some moisture and eliminate puddles. Widening of existing shoulders through Acoma is not recommended due to the unavailability of land in this narrow transportation corridor. Lowering the speed limit through the Pueblo of Acoma is advisable to protect this historic community and provide more opportunity for traffic to safely exit I-40 and explore the sights and unique landscape of Acoma Pueblo, especially during traffic incidents or delays on I-40. Some shoulders can be widened and extended at on and off ramps, permitting improved entry and exit off I-40 at Exit 102 (Sky City Casino, commercial district); Exit 100 (San Fidel); and Exit 89.44 (State Road 117), similar to the on and off ramps at Exit 96 (McCartys). Thank you	Thank you for these comments and support of the preferred alternative, the Enhanced 2-Lane with Added Lanes Alternative. Our initial review indicates that widening the I-40 shoulders through Acoma would not require additional right-of-way. Please see the response to item #3 above, as it relates to your suggested change to lower the speed limit. Please note other comments received from our meetings with the Acoma Pueblo indicate that many Acoma members have expressed concern about detours that result in I-40 traffic being rerouted through the Acoma Pueblo.

(Table Continues)

Exhibit 2-10. Summary of Written Comments and Responses from Public Comment Period #3 (Continued)

#	Theme	Summary Comment	Response
9	Preferred Alternative, Pavement	I agree with your team's recommendation for the adequacy of the Enhanced 2-Lane design with the addition of the third lanes through Gallup and the addition of the three westbound climbing lanes. The 12-foot shoulders will be very practical improvement and a huge safety enhancement for I-40 commuters.	Thank you for your support of the preferred alternative.
		It's my comment that the study has a major omission. The need to improve the safety of highway users was presented as the driving force that ultimately justified all the proposed improvements: Improved ramps, corrected curves, and wider road shoulders. I gather that these potential improvements were all subjects that received a significant amount of attention within the overall I-40 Corridor Study. I recall brief mention during the presentation that "Pavement needs to be improved." But there was no deeper dig into the subject of improving pavement performance. No percentage of safety improvement was offered for a choice of alternative pavement designs that would provide pavement structural sections designs that would realistically double, triple, or even quadruple the service life of pavements. For the purpose of a deeper dig into the percentage safety improvements that could be achieved by extending pavement service life throughout the I-40 Corridor, I would recommend starting by formally defining "Pavement Service Life" for the purpose of the I-40 Corridor Study. My suggestion for that definition: Pavement Service Life is the number of years during which the pavement does not require any dig out repairs or pothole repairs, no full depth pavement reconstruction, and no asphalt pavement overlays. Note that pavement maintenance operations would not be included in this definition of Pavement Service Life. Based upon rehabilitation of the entire I-40 Corridor to the standard that Parametrix is recommending, with the widened road shoulders, future pavement maintenance operations should be able to be scheduled and conducted at greatly reduced risk to highway users. Since my two questions asked during public meeting #3 remain unanswered, I am going guess for the average frequency over the entire I-40 Corridor that traffic back-ups have been generated by either (1.) full-depth reconstruction of failed segments of pavement, (2.) repair of localized pavement failures, or (3.) installation of asphalt pavement overlays applied to pavements exhibiting signs of premature distress. Given any evidence to the contrary, I am going to propose that the I-40 Corridor Study will ultimately determine that traffic back-ups related to pavement dig out repairs and pothole repairs, pavement reconstruction, and pavement overlays have historically occurred on an average of once every 8 years. It would be fair to state that a pavement design that with a service life of 24 years, instead of 8 years, would provide a huge percentage improvement in improving highway safety that would be appropriate to feature within the I-40 Corridor Study as delivering the greatest bang for the buck. Deserving special mention in your report is the fact that a pavement design has been proven in service on the I-40 Corridor that has already quadrupled pavement service life at no increase in original construction costs. Given the depth of nature of the reviews that Parametrix has conducted into the other topics during the I-40 Corridor Study, it should not be impossible to coordinate with NMDOT and dig back twenty to thirty years and answer the most fundamental question regarding the I-40 pavements. How often have traffic-backups within the I-40 Corridor related to pavement repairs, reconstruction, or overlays been experienced? Once it's been determined that the study will make available the historical frequency of traffic back-ups related to this group of pavement repair measures, then it becomes possible to present the percentage of safety improvement made available by simply extending Pavement Service Life. Let me know if there is anything contained in "The New Mexico I-40 Corridor Turf Wars" submittal that you would like to give further discussion.	Thank you for your questions and comments related to pavement performance. The NMDOT has received the information you have provided in "The New Mexico I-40 Corridor Turf Wars." The I-40 Corridor Study is a high-level study on a 150- mile corridor that identifies corridor needs, identifies and evaluates corridor-wide alternatives to address corridor needs, and identifies a preferred alternative. Pavement condition was considered as part of the I-40 Corridor Study, but pavement performance is a design-level detail that is considered and determined as part of project development and design. As stated in the responses from the public meeting, the NMDOT continually evaluates pavement design and performance and incorporates improved solutions as specific projects are designed. Specifically, the NMDOT Pavement Management and Design assesses current and future pavement conditions according to New Mexico and Federal Highway Administration performance measures (identified in Title 23 of the Code of Federal Regulations Part 490) and will identify pavement treatments on an individual project basis that optimize the use of available funding.
10	Preferred Alternative, Pavement (Same Commentor as #9)	This email serves as additional public input to the I-40 Corridor Study and as a formal retraction of my previously stated support for the Enhanced 2-Lane Option. **I-40 Corridor Reconstruction - Safety Concerns Deserve Greater Attention** While widening the shoulders for the existing 2-lane highway configuration would be a valuable safety enhancement, a reconstructed I-40 pavement with only 2 lanes with widened shoulders is going to insufficient to address the level of safety hazards that are unique to I-40 and other highways with high daily traffic counts dominated by heavy truck traffic. Recent driving experience on two major California highways (Interstate 5 and US Highway 99) through Central California rekindled my awareness that while the 2-lane design proposed for I-40 in New Mexico might be considered sufficient on a shear functionality basis (just looking at the total number of trucks and cars that the road can handle), that is not the case when you factor in the high percentage of heavy trucks, and the human factor – the erratic behavior of too high a percentage of car and truck drivers on the highways today. When the mix of cars and trucks is so heavily weighted with truck traffic, the 2-lane design is nothing less than a death trap, even at current traffic levels, let alone the traffic volume that will be using the I-40 Corridor by Year 2050. If Intelligent Traffic Systems (ITS) controls were implemented in conjunction with the new Enhanced 2-Lane and I-40 were dedicated exclusively to robotically controlled trucks and cars, with cars and trucks driven by human drivers (the Human Factor) completely eliminated from the equation, then an Enhanced 2-Lane highway could be considered safe and functional. Instead, the reality is that 2-lane interstate highways have their traffic flow constantly being backed up by long lines of heavy trucks driving bumper to bumper in the drive lane, with individual truck drivers darting into the first available space between the faster moving automobiles in the passing lane in order to pass slower moving truck drivers. Now you have 20 to 30 automobiles moving at high speeds in the passing lane rapidly braking behind the truck that has just pulled into the passing lane, setting up a situation where cars that were previously safely spaced are now bumper to bumper, and being endangered by frantic car drivers trying to pass them in the drive lane and cut into the passing lane between cars that are already too tightly spaced. Add into this mix of cars and trucks the drivers who are either taking methamphetamines, or driving as if they are on drugs that make them absolutely frantic drivers. Given this reality, the 2-lane configuration is no longer an option that competently addresses the all-important human factors that impacts highway safety. Based in the Central Valley of California, I frequently travel 2-lane segments of Interstate 5, and the mix of 2-lane and 3 lanes sections of US Highway 99, which is being improved to a 3-Lane Interstate highway. The sections of these highways that are 2-lanes are congested and hazardous nightmares to drive. The newly constructed 3-lane segments are facilitating safer interaction. While far from eliminating every possible safety hazard, there is a day and night difference in safety. New Mexico State Representative Patricia Lundstrom from Gallup has good reason to make public statements that the Enhanced 2-Lane is inadequate as a response to addressing the safety concerns.	Thank you for your additional comments. The NMDOT acknowledges that you retracted your support for the preferred alternative and now support the 3-Lane Alternative. As stated in public meetings, the traffic analysis conducted for the I-40 Corridor Study considered existing and future traffic volumes and the high percentage of large commercial trucks that drive on I-40 as part of the capacity analysis done for the study. As such, the higher percentage of trucks observed on this section of I-40 was taken into account as part of the evaluation and 2 lanes were found to be sufficient in most areas in 2050. Areas where 3 lanes are proposed include 10 miles through Gallup and climbing lanes on roadway inclines where the speed differences between semi-trucks and passenger vehicles can impede traffic flow and traffic speeds. In response to your comments related to highway safety, as presented at the public meeting, adding a third lane can improve safety on an uncongested highway by up to 10%. Note that other improvements proposed, such as widening the inside shoulder from 4 feet to 12 feet, has been found to improve highway safety by up to 12%.

(Table Continues)

Exhibit 2-10. Summary of Written Comments and Responses from Public Comment Period #3 (Continued)

#	Theme	Summary Comment	Response
10	Preferred Alternative, Pavement (Continued, Same Commentor as #9)	**I-40 Corridor Reconstruction - Economic Concerns Related to DOT Inertia** As previously submitted and summarized in the PDF Attachment titled The New Mexico I-40 Corridor Turf Wars: The results achieved by utilization of a revolutionary product technology that was recommended by the New Mexico Division Office of the FHWA in Year 2000 for demonstration within the I-40 Corridor, and then again for a second segment of I-40 in Year 2002, continue to be ignored by NMDOT, in spite of the excellent results reported in field performance monitoring. Major cost savings would be realized in reconstruction of the I-40 Corridor if pavement designs incorporating the advantages offered by this advanced stabilizer technology were being implemented by the DOT. With cost savings in pavement construction available in the range of 50% for reconstruction of the I-40 pavements based upon using EMC SQUARED System stabilizer products during in-place pavement recycling operations, or 25% when applied to subgrade soils and base materials and used as the input for modern Mechanistic-Empirical (M-E) Pavement Designs capable of making more efficient use of costly hot mix asphalt pavement materials, there is no reason that the 3-Lane Alternative is not an affordable option. If NMDOT and FHWA can fund reconstruction of the I-40 Corridor based upon the 2-Lane Enhanced Option built according to conventional pavement design, then they can also modernize their design and construction process and build the much safer 3-Lane Alternative with the same amount of funding. Given the tragic history and inordinate number of traffic fatalities that continue to be experienced on this length of interstate highway in New Mexico, the public deserves to have DOT's practice of ignoring cost-saving options, options that have previously been demonstrated within the I-40 Corridor, questioned and discussed in the I-40 Corridor Study reporting. As part of this review, an investigation should also be conducted into how and why the EMC SQUARED System stabilizer product technology (EMC2) that was reviewed and approved for statewide use by the DOT's Product Evaluation Committee in 1998, and then successfully demonstrated in NMDOT construction projects at two locations on Interstate 40 in 2000 and 2002, with sponsorship and participation of the FHWA, mysteriously taken off NMDOT's Approved Product List (APL) following completion of the two FHWA Demonstration Projects. With the Year 2000 FHWA demonstration Project having now outperformed NMDOT's previous pavement installation, constructed according to its conventional pavement design, by a factor of 8 times, it is time to be asking questions. Why hasn't NMDOT already taken responsibility to restore this break-through product technology to its previously approved status so that current projects can be taking advantage of this cost-saving technology to build safer, longer-lasting highway pavements? With the Year 2000 FHWA Demonstration Project having now outperformed NMDOT's previous pavement installation, constructed according to its conventional pavement design, by a factor of 8 times, it is time to be asking questions. Why hasn't NMDOT already taken responsibility to restore this break-through product technology to its previously approved status so that current projects can be taking advantage of this cost-saving technology to build safer, longer-lasting highway pavements?	Thank you for your questions and comments related to pavement performance. As stated previously, the NMDOT has received the information you have provided in "The New Mexico I-40 Corridor Turf Wars." We appreciate your comments and questions related to pavement performance. As stated in our previous response, pavement performance is a design-level detail that is considered and determined as part of project development and design. Specifically, the NMDOT Pavement Management and Design assesses current and future pavement conditions according to State and FHWA performance measures (identified in Title 23 of the Code of Federal Regulations Part 490). Pavement treatments identified on an individual project basis optimize the use of available funding and are required by New Mexico Statute 13-1-164 be drafted so as to ensure maximum practicable competition that will fulfill the performance requirements. Specific products, such as the EMC SQUARED System are evaluated under the NMDOT's Product Evaluation Program in accordance with the current NMDOT Specifications for consideration on the Approved Products List.

2.6.6.3 Question 2: What do you like the most about the recommended Enhanced 2-lane with Added Lanes Alternative? (select up to 3 items)

For this question, people were asked to select up to 3 items from the list below. Participants could select more than 1 answer, so the results add up to more than 100%. A total of 21 people responded to this question as follows:

- Wider roadway shoulders = 19% (4)
- Improved pavement = 52% (11)
- Longer on-and off-ramps = 29 (6)
- Adding a third lane in Gallup = 38% (8)
- Adding climbing lanes = 38% (8)
- Keeping 2-lanes open on I-40 as much as possible during construction and maintenance = 43% (9)
- Improved alternate routes = 19% (4)
- Improved Intelligent Transportation Systems (ITS)/Traveler Information Systems = 14% (3)
- Improved incident management = 14% (3)
- Other (please specify) = 14% (3), as provided in the list below:
  - → Widening roads is always a bad idea. I don't understand why you would do this.
  - → Three lanes is the best solution.

2.6.6.4 Question 3: What are the most useful ways for NMDOT to provide updates as projects occur on I-40? (select all that apply)

Participants could select more than 1 answer, so the results add up to more than 100%. A total of 20 people responded to this question and their responses were as follows:

- Facebook = 35% (7)
- X/Twitter = 5% (1)
- Email = 30% (6)
- Press release/newspaper = 80% (16)
- Other (please specify) = 20% (4), as provided below:
  - → Updates on Google maps.
  - → Tiktok.
  - → Posts on a dedicated website.
  - → Direct communications to people that have signed up with NMDOT to be informed as part of NMSTUDY.

2.6.6.5 Question 4: Did you find the project website and information shared at the meeting to be informative and easy to understand?

A total of 18 people responded to this question and their responses were as follows:

- Yes = 94. % (17)
- No = 6% (1)

2.6.6.6 Question 5: Please provide any additional comments. (open ended)

This was an open-ended question. A total of 16 people responded to this question as listed in Exhibit 2-11.

Exhibit 2-11. Responses to Question 5

Theme	Comments
3 Lanes	While there are added costs, I think it's critically important to increase to 3 lanes in each direction from Albuquerque west to the Arizona State Line. Commerce has changed dramatically since the interstate system was created. The volume of truck traffic has increased significantly. An additional lane creates better ability for everyone to maneuver safely in normal conditions, and will help keep things passable when there is construction or accidents/weather conditions
3 Lanes	Improvement projects considered by NMDOT should always consider the long-term impact and how the demands of the roadway are anticipated to change in the next 5 years. While expanding the shoulders would have the intended impact now, in the long term it would prove to be a band aid. For 3.8 billion versus 5 billion dollars (I may not be recalling these figures 100% accurately), it makes sense to spend the extra money for a longer-term solution.
3 Lanes	Having 3 lanes available and possibly keeping 1 lane as a "no 18 wheelers allowed" will assist with the flow of traffic as this is highly traveled by 18 wheelers and they cause a lot of slowdowns, plus they are not all considerate of smaller vehicles and will make lane changes regardless of speed or weather.
3 Lanes, Safety	Wide shoulders are needed if a third lane cannot be afforded, or you can't add limited third lane zones to assist with passing and moving traffic jams. Dangerous passing and sharing the road with big rigs makes for very dangerous, nerve-wracking driving conditions, much less during bad weather or crowded summer travel season.
3 Lanes, Safety	I consider I-40 the most dangerous road I drive on. In addition to all the obvious problems that people report (including my comment herein about semis not keeping speed on hills and causing sudden and dangerous speed changes). The entire highway needs to be widened to 3 lanes. I have driven the highway on windy days (which New Mexico has many) and HAD SEMIs GET *BLOWN* INTO MY LANE!!!!!! There are so many needs, it's hard to pick just a few. Yes, alternate routes and advanced warnings for long construction delays would be very useful, too. I've definitely experienced those needs.
Safety	Why is there no center median barrier on I-40 west of Albuquerque? I-25 has at least steel cable barrier. I have traveled both I-40 and I-25 for the last four years. I-40 has a narrow median and NO barrier. You see different places on I-25 where barrier was damaged, but the vehicle did not cross into other lane.
Safety, Ramps	Suggest modifying the on-ramp from Gallup Exit 20 to westbound I-40. The poor signage and short merging of traffic lanes confuses the tourists and large vehicles and can cause accidents.
Ramps	Set of questions are restrictive to what may be planned for selected sites, which is fine, but I think we need to "look further down the road". I would like to see planning and design on: 1) completing the "clover leaf" on the north side of Exit 26 that would provide greater and easier traffic relief; and 2) plan for a new interchange about 3.8 miles east of Exit 26 (so new Exit 30?) to relieve flow traffic into Gallup. The new interchange would match up with State Highway 566. These improvements would aid greater economic development for East Gallup and nearby Navajo Nation communities.
Incidents, 3 Lanes	I travel this section of road of I-40 between ABQ and Gallup, which is a national embarrassment. I have to allow an extra 2 hours to my plans because of the likelihood of an "incident". It is unsafe. When an incident happens, the road shuts down for incredibly long delays. Other parts of the nation can clear incidents far quicker because they have wider lanes and broad shoulders to facilitate. Widen this entire section to 3 lanes AND add a shoulder. Anything less is a band-aid, and we will be having this conversation again in ten years. It is cheaper do it right the first time.

(Table Continues)

Exhibit 2-11. Responses to Question 5 (Continued)

Theme	Comments
Incidents	I believe that all along the I-40 corridor, there should be some way for traffic to continue to move when a collision occurs. If a collision happens on any part of I-40, traffic is at standstill for hours on end. Also, zipper merges do not work. No one knows how to zipper merge! Keep at least 2 lanes of traffic open in both directions during construction, please!
Incidents, Weather	My family and I see a lot of serious accidents around the Continental Divide area during winter. These accidents often back up traffic and prevent emergency services from reaching people in need. People traveling on the road also end up stuck for hours unable to move, especially in the snow. One accident stopped traffic for several hours in the snow and my family had to call roadside assistance to ensure our car stayed warm and fueled.
Construction	There is constant construction in the areas east and west of Gallup. I find this headache in no other section of I40 so much. Why? I cross it a lot. I am trying to use alternatives now as it is too frustrating. Why constant construction just here? Something is very very wrong in this corridor!
Speed	The obvious, but politically impossible, solution is to LOWER THE SPEED LIMIT (and enforce it, lol). It's too bad we have to waste all this taxpayer money on something that can't work. People will drive even faster after the lanes are widened.
Speed, Pavement, Infrastructure	I-40 Texas to Arizona; not good. Eastbound I-40 in Texas is well graded, smooth, not rough driving. NM builds portions of Interstates with a light scratch and surface method; minimal grading and leveling. Interstates in NM are "wavy"; north of NM 165 exit on I-25 is a roller coaster. Surfaces of I-40 and I-25 are not safe. Road markings are faded and non-existent due to weathering. Signs (faded) mirror the markings. Exits in Gallup are too short for normal acceleration lane merging to the freeway. Rest areas generally, and restrooms specifically, are dirty and poorly kept. The one "at-expectation-restroom" in New Mexico is US 285 west of Roswell. I-40 in Albuquerque is a rough as a "cow path": concrete potholes filled with "asphalt" are repairs that only last a few weeks, Everyone speeds! 65 mph zones are a "concept"! Everyone travels 75 or 85 in Albuquerque. Top speed should be 60 mph. NO CITY, COUNTY, OR STATE LAW ENFORCEMENT VEHICLES ATTEMPTING TO CONTROL SPEEDING ARE EVER SEEN!
Connectivity	There needs to be better connectivity from I-40 to NM 6 and to I-25. Los Lunas is experiencing and will continue to experience traffic from I-40 through town onto I-25 to avoid the traffic in Albuquerque Big-I. Improvements to NM 6 and expansion will be needed in the immediate future to offset traffic from I-40 heading south.
Wildlife	Please build one or more wildlife corridors along this expanse.

2.7 Freight Survey Results

The NMDOT invited freight community members to participate in a survey to understand the issues and challenges they encounter on the I-40 corridor through the study area. The survey was distributed through the New Mexico Trucking Association from January 11, 2023, through January 31, 2023. During that time, 32 people responded to the survey. Note that not all of the 32 survey participants responded to all of the questions. The percentages provided below were calculated based on the total number of people who responded to each question. The input was used to develop the study purpose and need statement provided in Chapter 4 to shape the development of improvements concepts and alternatives. A summary of the questions and responses received are provided below:

Question 1: Typically, how often do you travel on I-40 between Albuquerque and the Arizona state line?

- Daily = 16%
- Weekly = 41%
- Monthly =28%
- Rarely = 12%
- Other = 3%

Question 2: Which days of the week do you typically travel on this segment of I-40?

Respondents were asked to select all answers that apply:

- Monday = 22%
- Tuesday = 31%
- Wednesday = 31%
- Thursday = 28%
- Friday = 31%
- Saturday = 9%
- Sunday = 16%
- It depends = 56%

Question 3: In a typical week, how often do you need long-term truck parking on this segment of I-40?

- Never = 44%
- About once per week = 28%
- 2-4 times a week = 6%
- 5 or more times per week =13%
- Other = 9%

Question 4: On this segment of I-40, where do you most prefer to park for your required rest or sleep?

- Private truck stops = 52%
- Casinos = 16%
- Public rest areas = 6%
- Exit ramps or shoulder = 0%
- I never make a long-term stop on I-40 = 20%
- Other = 6%

Question 5: Select the top three reasons why you prefer to park there.

- Personal hygiene (showers, laundry) = 55%
- Safety/security = 45%
- Hot food = 45%
- Fuel is available = 31%
- Convenient access = 31%
- Lighting = 14%
- Entertainment = 10%
- Quiet/limited disturbances = 7%
- Truck maintenance/repair facilities = 3%
- Other = 17%

Question 6: On this segment of I-40, how frequently at the following locations can you typically find available truck parking?

Public Rest Areas

- Never = 7%
- Rarely = 30%
- Sometimes = 50%
- Often = 10%
- Always = 3%

Private Truck Stops

- Never = 7%
- Rarely = 23%
- Sometimes = 44%
- Often = 23%
- Always = 3%

Question 7: Which segments of I-40 do you see the most crashes?

Respondents were asked to select all answers that apply:

- Arizona State line to Gallup (junction U.S. Highway 491/State Route 602) = 19%
- Gallup to Grants (junction State Routes 53/547, Highway 491/State Route 602) = 44%
- Grants to western edge of Albuquerque = 34%
- Unknown/I do not regularly encounter crashes on I-40 = 22%

Question 8: Which of the following situations do you typically encounter on this section of I-40?

Respondents were asked to select all answers that apply:

- Poor road or pavement condition = 72%
- Lane closures due to construction = 69%
- People driving too fast = 56%
- Traffic backups = 56%
- Poor weather conditions = 53%
- Roadway/lane closures due to accidents = 50%
- Drivers attempting to make unsafe passing moves = 50%
- Slow moving vehicles = 31%
- Illegally parked vehicles along on/off ramps = 16%
- Other = 13%

Question 9: When and how frequently do you typically encounter congestion on this segment of I-40?

Monday to Wednesday

- Never = 3%
- Rarely = 6%
- Sometimes = 41%
- Often = 22%
- Always = 28%

Thursday to Friday

- Never = 3%
- Rarely = 3%
- Sometimes = 41%
- Often = 22%
- Always = 31%

Saturday to Sunday

- Never = 9%
- Rarely = 13%
- Sometimes = 39%
- Often = 13%
- Always = 26%

Question 10: On this segment of I-40, where do you typically encounter congestion?

Respondents were asked to select all answers that apply:

- Construction zone = 88%
- Crash location = 72%
- Uphill grades = 34%
- Port of Entry = 16%
- Interchanges = 13%
- Rarely or never encounter congestion on this segment of I-40 = 3%
- Other = 3%

Question 11: What type of improvements to this segment of I-40 would you like the NMDOT to consider?

Respondents could select up to 3 responses:

- Maintaining 2 lanes of traffic during construction = 53%
- Improving pavement = 47%
- Build more truck parking spaces at public rest areas = 38%
- Build more truck parking spaces at private truck stops = 28%

- Adding climbing lanes = 22%
- Improving I-40 parallel/frontage roads = 22%
- Improving incident management and response capabilities = 22%
- Improving emergency travel notifications or electronic message signs = 16%
- Adding travel lanes = 13%
- Widening roadway shoulders = 6%
- Adding electrical vehicle charging stations = 0%
- Other = 6%

Question 12: Imagine I-40 was closed west of Gallup, which route or routes would you likely choose to detour around the closure?

Respondents could select all answers that apply:

- Not applicable/my company tells me where to detour/I don't know = 25%
- I would not try to detour = 9%
- NM Route 53 = 28%
- NM Route 118/Historic Route 66 = 22%
- NM Route 602 = 13%
- NM Route 264 = 6%
- U.S. Route 491 = 3%
- Other = 9%

Question 13: Imagine I-40 was closed between Gallup and Grants, which route or routes would you likely choose to detour around the closure?

Respondents could select all answers that apply:

- Not applicable/my company tells me where to detour/I don't know = 22%
- I would not try to detour = 22%
- NM Route 53 = 31%
- NM Route 602 = 16%
- NM Route 122 = 6%
- Other = 16%

Question 14: Imagine I-40 was closed between Albuquerque and Grants, which route or routes would you likely choose to detour around the closure?

Respondents could select all answers that apply:

- Not applicable/my company tells me where to detour/I don't know = 29%
- I would not try to detour = 10%
- I-25 = 19%
- US Route 550 = 16%
- US Route 60 = 16%
- NM Route 6= 16%
- NM Route 45= 0%
- Other= 7%

Question 15: Do you have any other comments related to this section of I-40 and the adjacent frontage/parallel roads?

This open-ended question received 10 responses that are provided at the end of this section in Exhibit 2-12. Responses varied, with the most common responses relating to issues relating to construction and accidents.

Exhibit 2-12. Summary of Freight Survey Responses to Question 15

#	Theme	Comment
1	Construction	I purposely avoid I-40 because it's rough and has been under constant construction for the 27 years I've been driving. I'll drop down to I-10 via Hwy 54 to go the west coast. The only time I use I-40 is if I'm going to Bakersfield or north of there. I-10 isn't much better but the backups aren't as bad.
2	Construction	Construction causes huge back-ups most times and accidents occur.
3	Construction	This stretch of road is very dangerous. Continuous construction and poor driver inattention to upcoming lane closures causes crashes, which then usually cause more crashes.
4	Construction	Limit the number of construction projects allowed to be active at the same time.
5	Construction, Incidents	This section of 40 is terrible. Often times when accidents happen there is no way around, traffic back-ups during construction are very bad. Numerous vehicles treating the highway as a racetrack. Lack of communication in electronic road signs.
6	Construction, More Lanes, Rest Areas	Please do a better job on the road construction. Fix the potholes and cement I-40. Some part make it three lanes east/west bound. More rest areas for trucks.
7	Frontage Road	Frontage road all I-40.
8	Maintenance	Pavement markings need to be visible at night in pouring rain.
9	Maintenance, Incident Management	I am a NM resident and when the snow hits the I-40 why does it take so long for NM highway department to get going. Their always has to be a fatality before the state will even start cleaning up the roads. Plus, why does the NM highway block off all ramps and parking lots along the I-40. As a fellow truck driver, I think the state of NM dislikes truck drivers. The state needs a lot of improvements with all the highway departments
10	Traffic Volume, Truck Parking	Interstate 40 coast to coast has the roadway, state facilities, commercial truck stop parking to service the truck volume of the 1960's. It is 2023. The volume of truck traffic along the I 40 corridor coast-to-coast is ten times the design volume. This is the real problem. The questions of this survey were valid in 1980, not 2023. The roadway should have a minimum of 4 lanes in each direction. 6 lanes in each direction in metropolitan areas. Please build some 18-wheeler only parking lots like Wyoming and Nebraska build a long Interstate 80. Pavement is not needed. Staffing is not needed. Basic needs are lights, trash dumpsters, thumb sized gravel on entrance and exit. Parking for 100 plus trucks. Chemical toilets would be a plus. The few commercial truck stops are full prior to the dark of the night. Parking on ramps is better than driving illegally through the night. The NO PARKING signs alongside of ramps are rude. Thank You.

2.8 Stakeholder Outreach

Stakeholder outreach with RTPOs, area tribes, and BIA occurred throughout the I-40 Corridor Study, as discussed in this section. Outreach with the RTPOs, tribes, and BIA occurred in a timeframe similar to the public meetings in fall 2022, spring 2023, and spring 2024. In addition, the study team met with State Police as part of initial outreach to inform them of the study and better understand key challenges they encounter on I-40. Appendix R, Stakeholder Outreach, contains meeting notes and additional information shared as part of these meetings.

2.8.1 Initial Outreach, Fall 2022 and January 2023

Study team staff from the NMDOT and consultant team met with key stakeholders in fall 2022 and January 2023, as summarized below.

2.8.1.1 Regional Transportation Planning Organizations

Study team members hosted separate meetings on September 20, 2022, with the 2 RTPOs in the study area that are involved with regional transportation planning efforts These RTPOs include the NWRPTO, which leads regional planning in McKinley and Cibola counties, covering the area on I-40 from milepost (MP) 0 to 132, and the MRCOG, which leads regional planning in Bernalillo County, covering the area on I-40 from MP 132 to 150.

At these meetings, the study team provided an overview of the study and schedule, discussed the best way to engage the RTPOs and their members in the study, obtained contact information to include RTPO contacts in the stakeholder contact list, and discussed any issues or concerns on I-40 or adjacent frontage roads. A summary of issues identified in the meetings is provided in Exhibit 2-13 and meeting notes are provided in Appendix R, Stakeholder Outreach.

2.8.1.2 Tribes and Bureau of Indian Affairs

In fall 2022, study team members met with area tribes and BIA on the dates listed below:

- Acoma Pueblo, September 8, 2022
- Laguna Pueblo, September 12, 2022
- Zuni Pueblo, September 15, 2022, and November 9, 2022
- BIA, October 13, 2022

The study team reached out to the Navajo Nation several times to offer the opportunity to meet in the fall of 2022 but did not receive a response. The study team was able to meet with representatives from the Navajo Nation as part of the meetings conducted in spring 2023.

The purpose of the initial meetings was similar to the purpose for the meetings with the RTPOs. At these meetings, the study team provided an overview of the study and schedule, discussed the best way to engage the tribes and their members in the study; obtained contact information for tribal contacts to include in the stakeholder contact list, and discussed any issues or concerns on I-40 or adjacent frontage roads. A summary of issues identified in the meetings is provided in Exhibit 2-13, and meeting notes are provided in Appendix R, Stakeholder Outreach.

2.8.1.3 State Police

The study team met with New Mexico State Patrol Lieutenants from Districts 3 and 6 on January 11, 2023. In the I-40 study area, District 6 State Patrol covers from MP 0 to 117 at Mesita, and District 3 covers from MP 117 to 150. The purpose of the meeting was to inform State Patrol of the I-40 Corridor Study, share key findings related to traffic volumes and crashes, understand how State Patrol responds to incident and detours traffic when I-40 closures are needed, discuss challenges they face on I-40, and discuss ideas for the challenges encountered. A summary of issues identified in the meetings is provided in Exhibit 2-13, and meeting notes are provided in Appendix R, Stakeholder Outreach.

2.8.2 Spring 2023 Outreach

Study team staff from the NMDOT and consultant team met in spring 2023 with the key stakeholders summarized below.

2.8.2.1 Regional Transportation Planning Organizations

Study team members provided a total of 3 presentations to the 2 RTPOs in the study area to give an update on study findings and obtain feedback on the alternatives being evaluated. Committee members had few questions, and there were no comments on the alternatives being evaluated. Meeting notes are provided in Appendix R, Stakeholder Outreach. Presentations were made to the following RTPOs as follows:

- MRCOG Transportation Coordinating Committee as part of their May 5, 2023, meeting
- MRCOG Metropolitan Transportation Board as part of their May 19, 2023, meeting
- NWRTPO Joint Policy and Technical Committee as part of their June 14, 2023, meeting

2.8.2.2 Tribes and Bureau of Indian Affairs

Study team members met with area tribes and BIA on the dates listed below:

- BIA, May 18, 2023
- Zuni Pueblo, May 22, 2023
- Acoma Pueblo, June 1, 2023
- Laguna Pueblo, June 1, 2023
- Navajo Nation, July 5, 2023

The purpose of these meetings was similar to the purpose for the meetings with the RTPOs, which was to provide an update on study findings and obtain feedback on the alternatives being evaluated. A summary of key issues discussed in the meetings is provided in Exhibit 2-14 and meeting notes are provided in Appendix R, Stakeholder Outreach.

Exhibit 2-13. Summary of Initial Stakeholder Outreach, Fall 2022 and January 2023

Organization	Comment/Key Issue
NWRTPO	1. In the Fort Wingate area near MP 33, there have been instances where the frontage road and I-40 are closed due to flooding, and there are a few feet of sediment piled adjacent to frontage road. District 6 has ongoing projects to address these drainage issues. 2. When crashes on I-40 result in lane closures, frontage roads and alternative routes become extremely important. It's important for drivers to be aware of the locations of frontage roads and alternative routes available. 3. Generally, community growth along I-40 is stable. These communities have populations of 20,000, or less, and no major growth is anticipated.
MRCOG	1. The Navajo To'hajiilee Chapter (located near Albuquerque) has received funding for some pavement work on roads. When traffic is backed up on I-40, commuters are detoured through this area along gravel and dirt roads. It could be helpful to coordinate with the Navajo Department of Transportation on this topic. 2. There are land holdings for a large future development called Santolina that will be located in the vicinity of the Atrisco Vista Interchange. 3. Near the Paseo del Volcan interchange, there is a planned north-south corridor. The right-of-way process is underway, and a corridor study and environmental analysis has been completed. 4. A climate change impact analysis has been conducted recently, and much of the area from MP 130 to 150 is within a 100-year floodplain.
Acoma Pueblo	1. The NMDOT should consider how to keep traffic moving during construction of any kind of I-40. Business from truckers is an important source of income. If there are long backups, truck drivers could choose to take a different interstate or route. 2. The Acoma have concerns about using NM 124 as a detour. Heavy commercial vehicles will impact the Acoma Tribal Lands and the residents. The following specific items were noted. (1) On NM 124 from about MP 89.4 to 90.6, the box culvert at MP 90.6 doesn't meet height requirements for commercial vehicles, and there have been ongoing discussions with the NMDOT for a new proposed road on the south of I-40. (2) From MP 90.6 to 98, the frontage road is narrow with no shoulders, and a couple of bridges may be too narrow for commercial vehicles to pass side-by-side. This section is used as a school bus route, which should be considered if it is used as a detour route. 3. Near MP 100, south of I-40, there are box culverts that impact Acoma lands when it rains. 4. Before MP 102 on I-40, there is a hill where trucks try to pass one another. This often leads to traffic congestion because trucks will fill both lanes trying to pass.
Laguna Pueblo	1. During previous construction from MP 104 to 117, there was a lot of traffic congestion. Using the frontage road as a detour route is a concern due to traffic buildup and guardrail maintenance. 2. There is ongoing planning at MP 106.4 to replace the box culvert with a bridge. 3. When exiting at MP 108 and driving along US 66 in Paraje, there is a blind spot that has led to accidents. Near Paraje, there have been many accidents during I-40 construction. There is currently signage and no traffic signal. There was a plan to install a signal and lighting, but the funding was lost due to delays caused by COVID. 4. At Exit 108, where the Dancing Eagle Travel Center, Supermarket, and Casino are located, improvements to the NM 23 overpass are being looked into. Studies have been completed, and the project is shovel ready but not funded. The overpass is very narrow, and there is a concern about whether the pavement can hold commercial vehicles. There have also been problems when truckers park in the Pueblo's right-of-way. 5. Frontage Road/NM 124, near MP 114 – There is a roundabout that does not work well for commercial vehicles. 6. Frontage Road/NM 124 MP 115 to 117 – Several issues were noted here due to sharp curves and steep terrain. 7. There are plans to remove the Rito Road overpass just east of MP 120. It is currently too low, and a semi-truck hit and damaged the bridge. The bridge deck is thin. 8. There is a blind spot (near MP 122) going westbound over the railroad, where drivers tend to rear-end commercial vehicles. There have been several accidents here.
Zuni Pueblo	1. Property ownership in the Fort Wingate area is in the process of being transferred to the Zuni and Navajo Nation. There may be interest in future development, including adding additional access and an interchange in this area. 2. Flooding in the Fort Wingate area is an ongoing concern. 3. The Zuni have concerns about the number of accidents that occur along I-40 and traffic that detours to NM 602 and eventually NM 53 in the Zuni village. In particular, there are concerns about hazardous materials trucks using this route and how spill response would be handled since Zuni personnel do not have this training. 4. In the scenario where additional right-of-way is needed, Zuni would like for the tribes to be made aware of any potential for cultural/archeological impacts and needed surveys and approvals.
BIA	1. Flooding leading to road closures in the Fort Wingate area in an ongoing issue. 2. When I-40 is shut down, traffic enters the To'hajiilee community, and the heavy traffic causes damage to area roads. It is used as a detour route for heavy trucks, but the infrastructure in this area is not designed to withstand this level of traffic and heavy commercial traffic. The NMDOT has placed signs stating that the To'hajiilee exit is "For local traffic only."
State Police	1. Staffing – Staffing is a challenge in both districts. Enforcement is difficult with limited personnel. The State Patrol is seeing an increase in commercial vehicle traffic and are trying to increase enforcement in District 6 for commercial vehicles. 2. Crash response, moving vehicles off the road – There are limited tow truck providers in the I-40 Corridor, and owners are having a harder time getting staff. State Patrol, tribal, county, and local police use the same tow truck resources. Tow truck response times can range from 30 to 60 minutes. This situation is likely to continue to become more of a challenge over time. One solution would be for the NMDOT to have a staffed/dedicated tow truck/front loader to push vehicles off the roadway; however, under current state law, the NMDOT is not permitted to push vehicles off the road, so a legislative change would be needed. Other helpful resources could be a trailer with traffic control devices and NMDOT support for setting up traffic control during incidents. 3. Weather warnings – It could be helpful to announce severe weather warnings earlier using the existing dynamic message signs in the corridor, press releases, and social medial posts to help drivers with more discretionary trips to get off the road sooner or postpone their trip.

Exhibit 2-14. Summary of Key Issues Discussed at Meetings with the Tribes and Bureau of Indian Affairs, Spring 2023

Organization	Comment/Key Issue
Acoma Pueblo	1. There are no emergency medical services available on the Acoma Pueblo, so ambulance services are provided to transport people to from the Acoma Pueblo to Albuquerque 3 or 4 times a day via I-40. It was noted by meeting attendees that keeping 2 lanes of traffic open during construction and maintenance are critical issues, particularly for ambulance traffic. 2. A meeting participant who had worked previously for State Patrol mentioned that NMDOT District 6 used to have a crash response trailer with traffic control equipment. State Patrol would call the NMDOT to request support to help with traffic control during incidents, and this was helpful in incident response. Additionally, it was noted that the narrow bridges on I-40 are restrictive and make it difficult to get to incidents. 3. Discussion topics included potential improvements to a section of NM 124 from about MP 89.4 to 90.6, where the existing box culvert is a height restriction for semi-trucks and tall vehicles. Acoma meeting participants indicated that the idea of a realignment has been part of initial conversations with staff, but additional conversations are needed with leadership. The Acoma would like this to be a state-funded project/initiative, not a Pueblo project. There are a lot of cultural resources in this area, and it would require obtaining right-of-way/tribal trust lands. It was noted that trucks can fit under the box culvert, and truckers typically know how much clearance they need. The bigger issues are RVs, since the drivers sometimes don't realize their height. The challenge with this box culvert is the approaches on both sides and the narrow culvert width. 4. The Acoma suggested that widening Route 66/NM 124 be considered. There is a concern about the speeds that drivers travel on these roads. Law enforcement cannot enforce speed/traffic laws because there are no shoulders to safely pull vehicles over. If there is a crash on NM 124, traffic on both I-40 and NM 124 end up being affected. 5. When NM 124 has been used as a detour for a crash, law enforcement officers need to be stationed in areas to direct traffic. 6. The roundabout at Exit 114 on Route 66 is challenging for large trucks to drive through. 7. Some of the trucking companies will not allow drivers to park overnight at a casino. Litter is a big issue when there are not enough overnight spots for trucks and the drivers decide to park on the shoulders of I-40 or the ramps. 8. The study team asked whether the Acoma have development plans for their lands that would generate additional traffic at interchanges. The Acoma indicated that they were not sure at this time. Paid truck parking and electric vehicle charging are things that could be economic development opportunities.
Laguna Pueblo	1. A meeting participant asked approximately how wide the right-of-way is for I-40 and whether the NMDOT can build right up to the right-of-way line or whether there is a buffer. It was also inquired whether the NMDOT would get permission for more land if it is needed to build 3 lanes in each direction. Study team staff indicated that the right-of-way varies, is wider at interchanges, and sometimes includes both I-40 and the area where the old Route 66 is located. The NMDOT could build up to the right-of-way line. The team is working to minimize possible right-of-way needs for any of the alternatives, including building 3 lanes. 2. Concerns were raised about the condition of bridge 3091 on NM 124 and its ability to support commercial truck traffic in the case of a temporary detour. 3. Meeting participants mentioned that truck traffic has been increasing. When rest areas are shut down or truck stops are full, the truckers park on the off- and on-ramps. This is a concern, due to trash and safety for other drivers using the ramps. It is unclear as to who is responsible for cleanup of the property near Exit 126 from the cattle guard to the fence line (the NMDOT or the tribe). In addition, the rest area at Exit 102 has been closed at times due to vandalism. 4. Meeting participants mentioned the bridge on I-40 at the Rito Road (near MP 120) underpass has been hit twice by a semi. Participants indicated that there are plans to remove this I-40 bridge and also indicated that the bridge deck is thin. 5. The study team asked whether there were future development plans that could affect interchange traffic. Meeting participants mentioned that there are plans for housing — apartments, condominiums, and about 25 homes off of Exit 114. In addition, at NM 124 and Bay Tree Road, which has only one egress to/from the hospital, a wider area is needed for ingress/egress. There are also plans to connect the bike path from roughly where US 66/NM 124 crosses the railroad tracks to the roundabout at Exit 114. In addition, Exit 108 is narrow. The Laguna are interested in having a bike route that would cross Exit 108, and this should be a consideration if improvements are made since this overpass is narrow.
Navajo Nation	1. A meeting participant expressed support for providing alternate routes in areas along I-40 where there are no alternate routes, particularly in the Coolidge/Continental Divide area. In addition, the information on traffic congestion for areas where I-40 is reduced to one lane was helpful. The idea of widening shoulders received favorable feedback. 2. The group discussed flooding and coordination in the Fort Wingate area, and meeting participants provided contact information for future communications. 3. The study team responded to questions regarding which NMDOT personnel would be responsible for coordinating activities related to asphalt millings. 4. A meeting participant asked about what was considered in the initial alternatives evaluation for enhanced commuter bus service. The study team explained that expanded bus service was considered but was found to not address needs on I-40 in the study area.
Zuni Pueblo	1. A meeting participant asked whether a study or data has been put together regarding SR 53 and whether the NMDOT would consider SR 53 as an alternate route? The study team explained that SR 602/NM 53 is not being considered as an alternate/detour route and that the NMDOT is not currently doing a study on NM 53. Meeting participants indicated that SR 602/NM 53 is often used by drivers as an alternate/detour route, and Council Members have received complaints when this occurs. The study team acknowledged that drivers often seek alternate routes, including NM 53, and the study team is working on solutions to keep I-40 traffic on the interstate. 2. A meeting participant Inquired whether there were any plans to add any truck pullouts and/or rest stops. The study team explained that the NMDOT is looking at this issue in their long-term freight plan and information on truck stop parking is being considered in the I-40 Corridor Study. 3. The study team asked whether the Zuni have plans for potential future development in the Fort Wingate area. Meeting participants explained that they are in the preliminary phases of planning for the economic development of the area. It was mentioned that environmental cleanups are taking place, which is causing some delay. 4. A meeting participant expressed support for the project study and indicated a preference for the 3-lane alternative.
BIA	1. A meeting participant asked if there are plans to divert traffic through NM 53. The study team explained that NM 53 is not being considered as an alternate/detour route and acknowledged that drivers often seek alternate routes when there are I-40 closures. 2. A meeting participant asked whether the Pueblo of Acoma and Pueblo of Laguna have been involved and informed. The study team indicated that they have been meeting with them throughout the study. 3. A meeting participant indicated a preference for 3 lanes from Grants to Albuquerque. 4. A meeting participant asked whether right-of-way would be needed in the Fort Wingate area. The study team indicated that it isn't known yet whether additional right-of-way will be needed for the alternatives being considered, but the design team is trying to avoid right-of-way impacts. Potential right-of-way impacts will be identified as part of the next phase of the study. 5. A meeting participant asked whether recent traffic studies have been completed on routes SR 566, SR 371, N41, and N49. Recently there have been several complaints from community members about an increase in truck traffic and truck speeding. The study team explained that traffic studies have not been done for possible frontage roads/alternate routes because those roads would only be used in an emergency situation when lanes of I-40 are closed due to an incident. For frontage roads/alternate routes, the study team has been looking at pavement condition, bridge condition, bridge load capacity, and horizontal and vertical clearance on bridges. 6. A meeting participant asked whether the NMDOT could put up signs to restrict heavy truck traffic on the state routes. The study team indicated that state routes are open to all travelers and that bridge use can only be restricted if there are specific limitations. 7. A meeting participant requested that the team ask the participating tribes whether they have planned development that would affect interchanges with I-40. The study team agreed and asked this question when meeting with the tribes. In addition, the meeting participant asked why there wasn't information on I-40 interchanges that are on pueblo lands and asked whether that could be considered. The study team agreed to look into this issue. 8. A meeting participant asked why the meetings with the tribes and BIA were being held separately. The study team indicated that this was a question that had not been brought up by the BIA or tribes up to this point. The intent is to make sure that the meetings are useful and informative for both parties. The study team will coordinate with the tribes and will consider joint meetings in the future.

2.8.3 Spring 2024 Outreach

Study team staff from the NMDOT and consultant team met in spring 2024 with the key stakeholders summarized below.

2.8.3.1 Regional Transportation Planning Organizations

Study team members provided a total of 3 presentations to the 2 RTPOs in the study area to give an update on study findings and obtain feedback on the preferred alternative and I-40 project priorities. Committee members had few questions, and there were no comments on the preferred alternative. Meeting notes are provided in Appendix R, Stakeholder Outreach. Presentations were made to the following RTPOs as follows:

- MRCOG Transportation Coordinating Committee as part of their March 1, 2024, meeting
- NWRTPO Joint Policy and Technical Committee as part of their March 13, 2024, meeting
- MRCOG Metropolitan Transportation Board as part of their March 15, 2024, meeting

2.8.3.2 Tribes and Bureau of Indian Affairs

Study team members met with area tribes and BIA on the dates listed below. BIA staff attended each of the meetings that were held with area tribes. Note that there are 3 separate BIA divisions in the study area that represent different tribes.

- Acoma Pueblo and BIA Southwest Region, March 6, 2024
- Laguna Pueblo and BIA Southwest Region, March 6, 2024
- Navajo Nation and BIA Eastern Navajo Region, April 3, 2024
- Zuni Pueblo and BIA Zuni, April 4, 2024

The purpose of these meetings was similar to the purpose for the meetings with the RTPOs, which was to provide an update on study findings and obtain feedback on the preferred alternative and I-40 project priorities. A summary of key issues discussed in the meetings is provided in Exhibit 2-15, and meeting notes are provided in Appendix R, Stakeholder Outreach.

The following themes were heard consistently from the tribes and BIA throughout the discussions held as part of the I-40 Corridor Study. Meeting notes have been shared with NMDOT staff and recommendations related to these themes have been incorporated into in Appendix A, I-40 Highway Operations Improvement Plan.

- **Improved coordination –** There is a strong desire for improved coordination between the NMDOT and all of the tribes and BIA on a variety of issues, as summarized below.
  - → **Use of adjacent frontage roads** – This is a concern of many BIA staff and the tribal representatives. The traffic from I-40 diverts to frontage roads when there are I-40 lane closures. These local roads are not designed for the volume of traffic or the high number of semi-trucks. This leads to increased wear and tear on the frontage roads, additional costs, and community impacts. There are concerns about costs that the tribes incur, reimbursement for those costs, and the impacts to tribal communities.
  - → **Emergency vehicle access on I-40** – There is concern, particularly with the Acoma and Laguna tribes, about traffic delays on I-40 and emergency vehicle transport. The Acoma do not have emergency medical services on the Pueblo, and their ambulances use I-40 to get to Grants and Albuquerque for critical medical care. Excessive delays on I-40 are a problem and concern. Keeping 2 lanes open during peak travel hours is critical to managing potential delays.
  - → **Truck parking on ramps and overpasses** – This issue was brought as a safety concern for drivers, but also as a litter, traffic management, and law enforcement concern.
  - → **Flooding at Fort Wingate** – Flooding issues at Fort Wingate were acknowledged by both the Navajo Nation and the Zuni Pueblo who have property that is affected by the flooding. Land that was previously Department of Defense land is going to transfer ownership to the Navajo Nation and Zuni Pueblo. Coordinating with both tribes will be needed to address the flooding issues.
  - → **Location-specific issues** – The following location-specific issues that were identified:
    - ▶ Acoma Pueblo – There are concerns about various frontage road issues, including the low clearance of the box culvert at MP 90.6 and flooding on frontage roads near MP 100 and 102.
    - ▶ Laguna Pueblo – Laguna law enforcement does not typically get enough advance notification when construction projects are beginning that affect I-40 in Laguna; thus, they do not have sufficient time to notify staff or inform tribal members. There are concerns about various frontage road issues, including frontage road use during closures on I-40 and safety concerns for school district buses, the condition of bridges on NM 124 (note that improvements to 3 of the bridges discussed in meetings with the Laguna are included in recommendations identified in Chapters 6 and 7), and semi-truck use of the roundabout at MP 114. In addition, there is desire to consider adding bike paths on overpasses at MP 108 and 114 when improvements are made.
    - ▶ Navajo Naton – There are concerns about frontage road use, flooding issues and solutions at Fort Wingate, and coordination with Navajo Chapter Houses.
    - ▶ Zuni Pueblo – There are concerns about traffic that detours onto NM 53/AZ 61 and NM 602, and hazardous material transport that may occur through the Pueblo when traffic detours.

2.9 Outreach to Elected Officials

Outreach to elected officials has occurred throughout the study. Elected officials from the State Legislature and government leaders from area tribes, counties, and cities were sent invitations to public meetings. In addition, the study team provided updates to elected officials in the New Mexico State Legislature, as summarized below. Appendix R, Stakeholder Outreach, includes copies of materials that was shared with elected officials:

- **October 2022** – A written update was provided to the NMDOT leadership to share with New Mexico State Senators and Representatives. The update included an overview of the I-40 Corridor Study and schedule, a discussion of completed and planned work, a notification about the November 2022 public meeting, and an overview of planned public and stakeholder coordination.
- **February 2023** – A written update was provided to the NMDOT leadership to share with New Mexico State Senators and Representatives. The update identified the study purpose and provided and updated schedule; summarized information on traffic volumes, expected traffic growth, safety and crashes; and identified critical issues on I-40 including the need to improve incident response, manage construction, address flooding at Fort Wingate near MP 33, identify solutions for alternate routes, and accommodate changing technologies.
- **November 2023** – A presentation was given to the Transportation Infrastructure Revenue Subcommittee on November 13, 2023. The purpose of the presentation was to provide an update on the study findings, discuss the alternatives evaluated, and identify the preferred alternative.
- **January 2024 –** The study team gave a presentation to the New Mexico Transportation Commission at their January 11, 2024, meeting. The purpose of the presentation was to provide an update on the study findings, discuss the alternatives evaluated, and identify the preferred alternative.
- **March 2024** – I-40 study team members attended the March 21, 2024, New Mexico Transportation Commission meeting.

Exhibit 2-15. Summary of Key Issues Discussed at Meetings with the Tribes and BIA, Spring 2024

Organization	Comment/Key Issue
Acoma Pueblo and BIA Southwest Region	1. Meeting participants included Acoma Pueblo leadership, staff, and community members; BIA Southwest Region staff; and study team members from the NMDOT and Parametrix. 2. Improved coordination is needed. Please have the district engineers, law enforcement, and others work with Acoma community leaders and other agencies to get everyone working together. These projects influence our communities, and the Acoma and the NMDOT could work together to get funding from Washington D.C. and other sources. There might be ways to address the issues we are talking about, but it will require government-to-government collaboration. All of these issues need to be discussed with tribal leadership as the land that I-40 crosses is part of our homeland. 3. Traffic on frontage roads and the condition of the frontage roads in an ongoing issue. When traffic is backed up on I-40, the cars enter our village, and our roads can't handle this. If side routes are used for detours, the frontage roads need to be improved. 4. There was continued discussion about the height restriction of the box culvert at MP 90.6. There have been discussions for years about increasing the height or relocating the roadway, but improvements still have not been made. Acoma members have different opinions about what should be done. There are a variety of constraints and challenges in this area. Discussions with Acoma leadership are critical. 5. There are concerns about speeds on I-40 through Acoma and hazardous materials transport. Consider a speed limit in the Acoma area that is similar to Albuquerque and Gallup. Speeds are very fast on I-40, and this makes more people use the frontage road. Highly hazardous materials are shipped on the interstate, and the governments (local and others) need to be notified when these materials are being transported through Acoma. 6. I-40 is our lifeline to Grants, where our hospital is located. On the interstate, there are often issues with emergency vehicles being blocked by traffic. Additionally, trains block roads as we are trying to get to the hospital. Keeping roads open to Grants and Albuquerque for emergency vehicles is a critical issue for our community. 7. The NMDOT fences along the right-of-way are not maintained. 8. There are drainage issues in the MP 100 and 102 area. 9. There is an education component of this project. We want additional signs for trucks indicating that they need to stay right except to pass. Additionally, some signs could be implemented that say that "do not block the shoulders during an emergency." Trucks block all lanes when trying to access an emergency scene. 10. This project may focus on I-40, but all of these other issues — such as side streets, access for emergency vehicles, getting to jobs, etc. — need to be considered. Waterways, springs, and other natural resources that the interstate crosses through Acoma lands need to be protected. There are other improvements that can be made instead of widening, such as improved information sharing.
Laguna Pueblo BIA Southwest Region	1. Meeting participants included Laguna Pueblo leadership and staff, BIA Southwest Region staff, and study team members from the NMDOT and Parametrix. 2. How does the NMDOT plan to meet with other agencies on I-40 improvements and implementation? The Laguna have been involved in coordination meetings with District 3 up until 2023, but since 2023, connecting with District staff has been challenging. We are trying to reach someone from District 3 to help us implement some signage. We have had to lobby with the Santa Fe office to get communication going from District 3 and District 6. The Laguna Pueblo Governor commented that, with a new transportation lead in place, he is hoping that communications improve. The Laguna Pueblo would like to have discussions with both NMDOT districts at the same time rather than individual meetings. They would also like to include law enforcement and BIA in these discussions. The Laguna would like to see more partnership from the State, for example, helping to pay for increasing resources that Laguna staff expend for incident response as a result of I-40 closures (overtime for law enforcement, frontage road maintenance, equipment needs, extra staff, etc.). Law enforcement does not typically get enough advance notification when construction projects are beginning or happening. The Laguna have been trying to work with District 6, but it isn't working well. Having 1 to 2 weeks' notice about when and where construction or maintenance will take place would be helpful so we can inform the public and have staff prepared. 3. Truck parking on ramps continues to be an issue. Will anything be done to mitigate this problem? It is a concern, due to trash and safety for other drivers using the ramps. The Laguna indicated they have a lot of issues at the MP 117 exit. There are a lot of challenges that law enforcement faces when they are on the scene responding to truck parking. 4. Laguna to Albuquerque has no parallel relief routes for people to use, so when backups happen on I-40, it hits Laguna hard. When traffic is diverted to NM 124, the road is not safe and has many issues. NM 124 includes bus routes, and there have been incidents where semi-trucks have passed buses. The roundabout at the MP 114 exit is not conducive to use by semi-trucks. 5. One participant indicated that he would like to see consideration of wildlife corridors. There are a lot of antelope on the south side of I-40, and they should be able to move to the north side freely.
Navajo Nation and BIA Eastern Navajo Region	1. Meeting participants included Navajo Nation staff, BIA Eastern Navajo Region staff, and study team members from the NMDOT and Parametrix. 2. Meeting participants indicated that they would like more coordination with Navajo stakeholders, specifically with the Chapter Houses, to ensure that local issues are understood and considered. As projects move forward, it will be important to have meetings with affected Chapter Houses to get their input. Meeting participants asked how the Chapter Houses and others have been included up to this point. The NMDOT provided a response and indicated that meetings with affected communities will occur as individual projects advance. 3. Construction in the Coolidge area has taken a long time, and there are often backups. At MP 39 near Coolidge, trucks park on overpasses and ramps. Truck lane restrictions are needed. 4. Meeting participants indicated that there needs to be resolution on impacts from closures. When large trucks and increased traffic travel on local frontage roads, it causes the pavement to fail. Other agencies are paying for pavement repairs when this happens. The NMDOT needs to take financial responsibility, and this should be part of the planning process. Meeting participants indicated that costs incurred include patching holes, law enforcement time, and impacts to signs. Transportation funding from tribes is not meant to maintain roads for I-40 bypass traffic. How will the Navajo Nation be reimbursed? This is a real issue. There are several examples of I-40 closures that result in traffic being rerouted onto Navajo roads. Meeting participants indicated that the Chapter Houses also have concerns about traffic and impacts to frontage roads.
Zuni Pueblo and BIA Zuni	1. Meeting participants included Zuni Pueblo staff, BIA Zuni staff, and study team members from the NMDOT and Parametrix. 2. Meeting participants had questions about the preferred alternative and continue to have concerns about traffic increases on frontage roads when I-40 is closed. When I-40 is closed, traffic diverts to NM 602 and NM53/AZ 61 traffic volumes are high. It damages these roads and causes congestion and crashes. Coordination with Arizona Department of Transportation is important when there are closures of I-40 that affect both states. 3. In the Fort Wingate area, there are no firm development plans at this time. However, a feasibility study is underway to determine how the land might be developed and what improvements may be needed to improve access to/from Fort Wingate and I-40. Flooding issues in this area are being taken into consideration. The feasibility study should be completed towards the end of 2024. The Zuni are interested in any proposed improvements in the Fort Wingate area.

3. Existing Conditions and Projected Future Traffic

3.1 Introduction

This chapter describes and documents existing conditions within the I-40 study area limits, including existing conditions for engineering (roadway, bridges and structures, drainage, and utilities); traffic and safety; property ownership and environmental considerations. This chapter also discusses expected traffic growth on I-40 between now and 2050 and assesses existing and projected future highway capacity for I-40 and adjacent ramps.

3.2 I-40 Roadway Conditions

3.2.1 Functional Class

The functional classification of a roadway affects applicable design standards such as speed and the horizontal and vertical alignment. Factors that affect the determination of functional classification include mileage, traffic volume, speed, capacity, and existing and future land uses (NMDOT 2014). Most of I-40 in the study area is identified as a rural interstate highway, with areas near Gallup and Grants described as urban interstate based on the criteria developed by the Federal Highway Administration (FHWA) (NMDOT 2014).

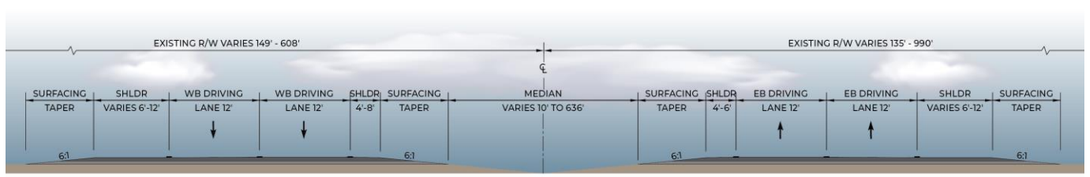
3.2.2 Posted Speeds

Posted speeds through most of the I-40 project limits are 75 miles per hour (mph), with the exception of I-40 through Gallup, which has a posted speed of 65 mph from approximately milepost (MP) 15.5 to 26.5.

3.2.3 Typical Sections

Roadway typical sections vary throughout the corridor, as shown in Appendix I, I-40 Existing Typical Sections. Exhibit 3-1 provides a general typical section that is representative of the roadway section throughout the study area. In general, I-40 has 2, 12-foot lanes in each direction with an outside shoulder width of 6 to 12 feet and an inside shoulder width of 4 to 6 feet; however, there are locations where the inside shoulder is less than 4 feet, particularly on bridges. As shown in Exhibit 3-1, the median width in the study area varies throughout from 10 feet to more than 600 feet. The wide median of more than 600 feet is located between MP 82 and 84, where there is a large malpais lava formation. Median widths in remaining portions of the study area range from a width of 10 feet to just over 100 feet. Medians in the study area are used in many areas for drainage. In addition, there are many areas where I-40's eastbound and westbound lanes are not at the same elevation.

Exhibit 3-1. Existing Typical Section



3.2.4 Climbing Lanes

The study team identified existing climbing lanes in the study area and areas where I-40 highway grades are over 3%. Grades over 3% were identified to understand areas that could be problematic for truck traffic and might be candidates for climbing lanes. The American Association of State Highways and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* ("*AASHTO Green Book*") (AASHTO 2018) considers grades above 3% to be rolling rather than level. In addition, 3% grades with a minimum length of 1,800 feet and 4% grades with a minimum length of 1,300 feet are identified as candidates for climbing lanes. These grade and length values are derived from Figure 3-28, Critical Lengths of Grade for Design, in the *AASHTO Green Book* (AASHTO 2018), which indicate a typical reduction of 10 mph or more in truck travel speed for 3% or 4% grades at or over these lengths.

There are 3 locations where climbing lanes (or a third lane) are provided on I-40, as shown in Exhibit 3-2. In the eastbound direction, approximately 4.75 miles of climbing lanes are provided where I-40 has some of its steepest grades of over 4% at MP 40 and MP 143. In the westbound direction, the climbing lane is approximately 3.87 miles long and extends out of the study area to MP 153. About 2.3 miles of the climbing lane is located in the study area between MP 148 and 150.

Exhibit 3-2. I-40 Existing Climbing Lanes

Start MP	End MP	Direction	Length (ft)	Max Grade (%)	Length of Max Grade (ft)	Critical Length of Grade (ft)
40.0	42.1	Eastbound	11,197	4.62%	1,763	1,050
143.1	145.7	Eastbound	13,793	4.69%	2,409	1,050
148.1	150.4	Westbound	20,457[a]	4.47%	2,000	1,120

ft = feet. Critical grade lengths were determined from Figure 3-21 of the *AASHTO Green Book* (AASHTO 2018).
a This climbing lane extends beyond the limits of the study area by 8,190 feet to exit 153 at 98th Street.

In the eastbound direction, there are 9 areas where grades are over 3%, as shown in Exhibit 3-3. A total of 4 of these are located in areas where an existing climbing lane is provided.

Exhibit 3-3. I-40 Eastbound Grades over 3%

No.	Start MP	End MP	Length (ft)	Grade	Remarks
1	5.2	5.4	1,345	3.09%	Less than critical length of grade
2	24.4	24.5	809	3.03%	Less than critical length of grade
3	40.1	40.6	2,526	3.23%	Within an existing climbing lane
4	41.1	41.4	1,763	4.62%	Within an existing climbing lane
5	115.9	115.9	61	3.12%	Less than critical length of grade
6	121.7	121.7	135	3.03%	Less than critical length of grade
7	141.4	142.2	4,176	3.01%	Greater than critical length of grade
8	143.7	144.3	3,170	4.01%	Within existing climbing lane
9	144.3	144.8	2,409	4.69%	Within existing climbing lane

ft = feet. Entries shaded in gray are located within existing climbing lanes. Critical grade lengths were determined from Figure 3-21 of the *AASHTO Green Book* (AASHTO 2018)

In the westbound direction, there are 10 areas where grades are over 3%, as shown in Exhibit 3-4. One of these is located in an area where an existing climbing lane is provided on I-40.

Exhibit 3-4. I-40 Westbound Grades over 3%

No.	Start MP	End MP	Length (ft)	Grade	Remarks
1	26.0	26.0	203	3.03%	Less than critical length of grade
2	76.5	77.1	2,889	3.02%	Greater than critical length of grade
3	103.7	104.4	3,580	3.83%	Greater than critical length of grade
4	112.8	113.0	746	3.02%	Less than critical length of grade
5	114.9	114.9	405	4.00%	Less than critical length of grade
6	115.2	115.6	2,136	4.01%	Greater than critical length of grade
7	136.6	136.6	269	3.03%	Less than critical length of grade
8	138.6	139.2	2,977	3.99%	Greater than critical length of grade
9	145.6	145.7	131	3.03%	Less than critical length of grade
10	148.1	150.4	20,457[a]	4.47%	Within an existing climbing lane

ft = feet. Entries shaded in gray are located within existing climbing lanes. Critical grade lengths were determined from Figure 3-21 of the *AASHTO Green Book* (AASHTO 2018)

a Note that this climbing lane extends beyond the limits of the study area by 8,190 feet to exit 153 at 98th Street.

3.2.5 Horizontal Alignment

3.2.5.1 Methods

The horizontal alignments were established for eastbound and westbound I-40 mainline lanes from MP 0 to 150. The alignments are the best fit of the inside lane stripe, based on project-specific orthophotography mapping. Through the horizontal curves, the best fit of the existing stripe was used to establish the curvature, and the radius was rounded to nearest 5-foot interval. If as-built information was available, it was used to verify the radius of the existing alignment. Digital terrain mapping from lidar scanning was used to determine the existing superelevation of each curve. The existing superelevation was measured by taking a cross section of the study's raw lidar data every 2-feet through the middle one-third of each curve and averaging the results per curve to best represent the superelevation felt by a driver. The radii and superelevation for each curve was used to determine the existing design speed for each curve assuming a maximum superelevation rate of 6%. The existing design speed was established using only criteria within the *AASHTO Green Book* (AASHTO 2018), this analysis did not use other information sources or studies to establish the existing design speed.

3.2.5.2 Findings

In the study area, I-40 has 73 horizontal curves eastbound and 72 horizontal curves westbound. The posted speed for the I-40 mainline is 75 mph, with the exception of the area in Gallup, which is posted at 65 mph. The desired design speed for the I-40 mainline in the study area is 80 mph; however, for purposes of this analysis, a design speed of 75 mph for the mainline and 65 mph for the area in Gallup was considered sufficient, since it meets posted speeds. A listing of the mainline horizontal curves and deficiencies can be found in Appendix D, Geometrics.

Existing design speeds for horizontal curves within the study area vary, with results ranging from as low as 40 mph up to the desired design speed of 80 mph.

Of the 73 horizontal curves analyzed for the eastbound alignment:

- 15 meet or exceed the desired 80 mph design speed
- 19 meet the posted speed limit
- 39 do not meet the posted speed

Of the 72 horizontal curves analyzed for the westbound alignment:

- 16 meet or exceed the desired design speed of 80 mph
- 25 are sufficient to meet the posted speed limit
- 31 do not meet the posted speed

One of the reasons that some of the curves do not meet the current AASHTO criteria could be that the interstate was built in the late 1950s and early 1960s, and the criteria have changed over time. The design speed is highly dependent on the superelevation rate within the curve, and pavement maintenance activities over the years could have unintentionally modified the superelevation to less than what is needed to meet current AASHTO design criteria. Curves not meeting the desired design speed or the posted speed will be evaluated to determine the best course of corrective action.

3.2.6 Vertical Alignment

3.2.6.1 Methods

The vertical alignment was established by overlaying the horizontal alignment on the digital terrain mapping from the lidar scan to get a best fit for the profile in both the eastbound and westbound direction. The vertical curves were estimated using the best fit profile. At several locations, a grade-break was added to help best-fit the vertical profile. These grade breaks were generally only located where the change in grade is 0.5% or less. The existing vertical curves were evaluated using only criteria from the *AASHTO Green Book* (AASHTO 2018). This analysis did not use other information sources or studies to establish the existing design speed. The crest vertical curves were compared against minimum K-values for stopping sight distance, and sag vertical curves were compared to K-values for headlight sight distance.

3.2.6.2 Findings

Through the study area, the eastbound alignment has 401 vertical curves:

- 335 vertical curves meet or exceed the desired 80 mph design speed
- 41 meet the posted speed
- 25 result in a design speed that is less than the posted speed

The westbound alignment has 387 vertical curves:

- 344 of the vertical curves meet or exceed the desired 80 mph design speed
- 20 meet the posted speed
- 23 result in a design speed that is below the posted speed

A complete listing of the vertical curves identified can be found in Appendix D, Geometrics. Curves not meeting the desired design speed or the posted speed will be evaluated to determine the best course of corrective action.

3.2.7 Interchanges

3.2.7.1 Methods

An analysis was completed to look at the characteristics of each interstate access through the study area (MP 0 to 150). This analysis began with placing an alignment to describe the path a vehicle would take when either entering or exiting the I-40 mainline. Once these paths were established, a controlling feature along

those paths was located; this could have been a design speed dictated by a horizontal curve or an intersection at the beginning or end of the lane. To determine the speed at each controlling feature, the radius along with an assumed 6% maximum superelevation was used to find the corresponding maximum design speed of a horizontal curve. A stop condition was assumed where an intersection exited at the end of an off-ramp, and a 15-mph design speed was assumed at the intersection at the beginning of an on-ramp. With each ramp having several options for what the controlling feature could be, the measured lengths available from where the controlling feature is located and the point at which a vehicle has to enter or exit traffic were used to select the feature that controls a vehicle's acceleration or deceleration most. Criteria for acceleration lengths, deceleration lengths, and horizontal curve design speed were referenced using only the *AASHTO Green Book* (AASHTO 2018), this analysis did not use other information sources or studies. Additionally, all auxiliary lanes were assumed to be located on grades between +3% and -3%, which is a reasonable (even conservative) assumption, given that the majority of interchanges are overpasses and the I-40 mainline profile is generally less than 3%.

For each on-ramp, both the required acceleration length (La) and gap acceptance length (Lg) were assessed. These were compared to existing conditions, and the controlling value was used to determine recommended modifications. For each off-ramp, the deceleration length (Ld), along with the AASHTO's recommended deceleration length of 800 feet for parallel off-ramps, was compared to existing conditions. The controlling value was used to determine recommendations. Appendix L, I-40 Interchange Layouts provides the results of the analysis.

3.2.7.2 Findings

Through the study area, there are 30 unique access points for I-40. Of these, 28 are interchanges, and 2 of these access points are associated with a rest area, eastbound at MP 3 and the Port of Entry located eastbound at MP 12. At these 30 unique access points, there are a total of 119 on- or off-ramps split in the eastbound and westbound directions. Out of these 119 ramps:

- 28 (24%) meet AASHTO guidelines
- 87 (73%) do not meet AASHTO guidelines
- 4 of the ramps were under construction and could not be assessed

3.2.8 Obstructions

3.2.8.1 Methods and Findings

Potential obstructions within the clear zone of I-40 were evaluated and are listed in Exhibit 3-5. A clear zone is defined as an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Required clear zone widths were identified from the AASHTO *Roadside Design Guide*, 4th edition (AASHTO 2011). For roadside slopes of 1:6 or flatter, required widths are 30 to 34 feet. For slopes of 1:5 or 1:4, a width of 38 to 46 feet is specified. Potential obstructions were identified through a field evaluation. The field team looked for permanent fixed objects or unshielded steep slopes (cut or fill) within approximately 50 feet of the edge of the driving lane. Once a potential hazard was identified, it was measured to confirm its offset from the driving lane. A maximum clear zone width of 46 feet was generally used as a starting place for identifying potential hazards. If the field team was confident that the entire roadside slope was flatter than a 6:1, the reduced clear zone width was considered. Hazards that were maintenance concerns were noted; however, not all maintenance concerns were documented. Maintenance concerns included vegetation encroaching into the clear zone, large debris, and other temporary obstructions.

This analysis revealed that there are relatively few obstructions in the clear zone, and all of them are located adjacent to the westbound lanes. Potential obstructions identified include utility features and topographic features. One traffic monitoring utility box owned by the New Mexico Department of Transportation (NMDOT) was observed within the clear zone, offset about 25 feet from the edge of the driving lanes. Several rock cuts occur in the study area; some are protected with wall barrier while others lie within the clear zone or just outside of it. Other areas of concern were unprotected drop-offs or steep slopes occurring within the extreme outer limits of the clear zone or just past the limits of it; these occurred infrequently, with only a few instances observed.

Other concerns noted during the evaluation included vegetation. Several bushes, shrubs, or trees were inventoried, with several more locations observed but not inventoried. Vegetation of concern was typically found at the limits of the clear zone and showed no evidence of vehicle impacts. Concerns with vegetation would best be confirmed and, if needed, addressed by means of routine roadside maintenance.

Based on this evaluation, the occurrence of unprotected roadside hazards within the study area is low risk and of minimal concern. Obstructions that are not easily mitigated by maintenance activities will be further evaluated during the design phase and remedied as necessary during construction.

Exhibit 3-5. I-40 Obstructions

ID	MP	Direction	Length From Driving Lane (feet)	Notes
1	2.5	West	33	Tree with multiple trunks > 4 inches
2	22.1	West	40	Rock cut
3	24.3	West	42	Unprotected slope (possibly greater than 3:1). Possible obstruction at bottom of slope
4	25.5	West	40	Unprotected slope, possibly steeper than 3:1
5	36.1	West	32	Bush with trunk > 4 inches
6	70.5	West	22	22 feet to 30-inch wall barrier, another 5 feet to a rock cut. May not meet current design standards.
7	76.0	West	10	10 feet to 28-inch wall barrier plus an extra 10 feet to a rock cut. May not meet current design standards.
8	88.8	West	35	Lava flow rock outcropping within the clear zone
9	96.0	West	24.5	NMDOT Traffic monitoring utility box
10	130.4	West	18	Rock cut protected by temporary concrete wall barrier

3.2.9 Pedestrian and Bicycle Facilities

Pedestrian travel is not a key consideration on the I-40 mainline since it is a high-speed interstate route. There is a pedestrian bridge that crosses over I-40 at MP 79.64 near Milan. For bicyclists, I-40 is identified as an interstate facility in the NMDOT *New Mexico Prioritized Statewide Bicycle Network Plan* (NMDOT 2018a), and bicyclists are permitted to ride on the shoulders of I-40, except within the boundaries of cities with a population of 50,000 or more. NMDOT does not designate interstates as part of the priority bicycle network in New Mexico because the current design of these facilities includes shoulders and rumble strips that provide reasonable separation between motorists and bicyclists (NMDOT 2018a), and this should be maintained. The section of I-40 from approximately MP 114 near the NM 124/Laguna Pueblo to MP 150 at Atrisco Vista in Albuquerque is on the proposed United States Bicycle Route System (NMDOT 2018a).

Even though bicyclists are allowed to ride on I-40 in the study area, high vehicle speeds and the high volume of truck traffic on I-40 may detract from the number of people who feel safe using I-40 as a bikeway. Adjacent frontage roads in the study area are lower-volume and lower-speed roadways that may provide an alternative to bicycle travel on the interstate, depending on the location. Bicycle facilities on adjacent routes are discussed in Section 3.9.3.

3.2.10 Transit

Transit services using I-40 include intercity bus service provided by Greyhound and local and tribal transit, though most of the local and tribal transit use adjacent local roads, including frontage roads adjacent to I-40. Intercity transit service is not provided by any of the public transit agencies operating within I-40 study area but is provided by Greyhound. Greyhound bus service includes daily early morning and early or late evening routes with stops in Gallup, Grants, and Albuquerque (Greyhound 2023).

Local bus service within the corridor is currently provided by Gallup Express, Cibola Rockin' 66 Express (Grants/Milan area), Shaa'srk'a Transit (Laguna Pueblo), and Rio Metro Route 66 (Albuquerque). The service provided by these operators is limited to fixed-route and demand-response service within the surrounding areas of Gallup, Zuni, Grants/Milan, and Laguna Pueblo. Shaa'srk'a Transit and Rio Metro Route 66 also provide commuter routes to the Route 66 Casino and use I-40, which effectively provides a connection between Laguna Pueblo and the Central Avenue/Unser Boulevard Park and Ride station on Albuquerque's westside. In addition to the above services, non-emergency transportation to regional medical services outside of the areas served by local transit is available by private providers.

Passenger rail service is provided by Amtrak. Amtrak offers one daily round-trip from Gallup to Albuquerque and a one-way daily trip from Albuquerque to Gallup as part of the Southwest Chief route that runs from Chicago to Los Angeles (Amtrak 2023). There are no stations in other locations between Gallup and Albuquerque, so service is limited to travel between these two cities. According to Amtrak's schedule, the travel time is 3 hours and 14 minutes from Gallup to Albuquerque and 2 hours and 27 minutes from Albuquerque to Gallup.

3.2.11 Other Roadside Amenities

The NMDOT currently operates two rest areas in the study area.

- MP 3 near the Arizona/New Mexico state line at Manuelito. This rest area is open for eastbound traffic only; there is no access for westbound traffic.
- MP 102 off the Acomita/Sky City Exit. This rest area is generally open from 8:00 a.m. to 2:30 p.m. and is closed after 2:30 p.m. due to issues with vandalism.

There are two permanently closed rest areas located at MP 40 (Ciniza) and MP 93 (Malpais). In addition, there is a Port of Entry/weigh station for eastbound traffic near MP 12. In the westbound direction, there is a pullout for large vehicles.

3.2.12 Right-of-Way

As shown in the I-40 typical section in Exhibit 3-1, the right-of-way in the corridor varies from about 300 feet to as much as 1,600 feet. Right-of-way lines for the existing roadway are shown in Appendix K, I-40 Conceptual Alternatives.

3.2.13 Pavement and Geotechnical Conditions

A geologic and geotechnical literature search, review of as-built plans, and site reconnaissance were performed for I-40 and the adjacent alternate routes. The purpose of this work was to identify existing conditions in the study area and identify key issues and considerations for construction. Appendix E, Geotechnical Scoping Report, documents the methods and findings of this work, which is summarized here. The geotechnical and geological conditions that would impact design and construction are specifically documented in Appendix E, Geotechnical Scoping Report. Additional geotechnical details are contained in Appendix B of Appendix E, the Summary of Geological, Geotechnical, and Pavement Conditions Spreadsheet. The following text summarizes findings from Appendix E:

3.2.13.1 Earthquake Faults

Appendix E, Geotechnical Scoping Report, shows faults potentially located in the study area from approximately MP 142 west of the Rio Puerco River to MP 150 near Atrisco Vista. Detailed geotechnical analysis conducted as part of roadway design would be needed to determine if structures designed in this area would require special consideration. For subsequent, detailed site-specific design studies, each proposed bridge or major structure will need to address seismic conditions and considerations at the respective project location. The design will need to account for impacts of seismicity and will need to be performed in accordance with current AAHSTO Load and Resistance Factor Design (LRFD) Specifications.

3.2.13.2 Site Soils and Bedrock

Site surface and subsurface conditions will likely consist of interbedded clays, silts, sands, and gravels in alluvial and piedmont deposits. Bedrock is anticipated to be encountered at depths as shallow as 1 foot to greater than about 100 feet below existing site grade. The surface and shallow subsurface soils in the study area will likely exhibit a tendency for low to moderate compression and/or no to low expansion with increasing load and when elevated in moisture content. It is anticipated that shallow soils exhibit low to moderate bearing capacity. Deeper soils and bedrock are anticipated to exhibit moderate to high load bearing capability. Shallow soils may be recompacted to increase bearing capacity and reduce settlement. Soils are expected to have very poor to good quality pavement support characteristics.

3.2.13.3 Groundwater

Groundwater along most of the alignment is anticipated to be encountered at depths greater than about 50 to 100 feet below existing site grade, excluding areas located within and adjacent to existing drainages. Regional groundwater is anticipated to have significant seasonal variations and may be encountered at depths near the ground surface when drainages, arroyos, and irrigation canals are flowing. In addition, due to the relatively shallow clays and bedrock along most of the alignment, development of perched groundwater conditions is likely with seasonal variations.

3.2.13.4 Construction and Excavation

On-site well- and poorly graded sands and silty sands and gravels are anticipated to be suitable for use as structural backfill beneath the bridge structures, wingwalls, mechanically stabilized earth (MSE) or cast-in-place retaining walls, and pavements. On-site clays (if encountered) will not be suitable for use as structural backfill. Shallow excavations into the on-site soils are expected to be accomplished with conventional earthwork equipment. Caving soils should be anticipated due to loose, granular soil conditions. Dense to very dense gravels or very hard bedrock may be encountered and may require additional effort, heavy-duty, and/or specialized equipment for excavation and deep foundation construction or installation. Rock excavation will likely be needed during construction along the central and western portions of the alignment where strongly cemented sandstones and igneous basalt bedrock, such as the lava flows in Grants, are exposed at the ground surface or exposed in existing highway cut slopes.

3.2.13.5 Slopes

For permanent slopes in compacted fill and cut areas with maximum heights of less than about 20 feet, recommended preliminary maximum configurations for on-site soils and bedrock materials range from 0.5:1 to 3:1 (horizontal: vertical).

3.2.13.6 Foundations

The bridge structures are anticipated to be supported on shallow footings/foundations or deep foundations consisting of driven piles or drilled shafts. Dense to very dense soils and gravel and very hard bedrock will likely impede pile-driving installation and require pre-drilling for installation. Very hard bedrock will likely impact drilled shaft construction and require specialized equipment and tooling for installation. Supporting the bridge structures on footings bearing on MSE abutments could also be considered, depending upon the magnitude of long-term settlement of existing subsurface soils. The wing walls, cast-in-place retaining walls, and other ancillary structures are anticipated to be supported by shallow foundations that bear on native undisturbed soils or structural backfill.

3.2.13.7 Pavement Condition

Pavement condition was provided by a *Pavement Condition Assessment Report* developed by the NMDOT Pavement Management and Design Bureau in September 2023 (NMDOT 2023b). The Pavement Condition Ratings (PCR) along I-40 indicated values ranging from 10 to 87. These values correspond to Very Poor to Very Good pavement conditions.

Per NMDOT, the suggested pavement treatment for a PCR of Very Poor (PCR 0 to 25) is pavement reconstruction. For a PCR rating of Poor (26 to 45), the NMDOT suggested pavement treatment consists of major rehabilitation. However, due to the timeframe that will likely occur for start of new construction projects in the I-40 study area and the further deterioration of the pavements over time, consideration should also be given to reconstruction in areas currently identified with a Poor (PCR = 26 to 45) pavement condition rating. Rehabilitation measures would generally be considered applicable for areas exhibiting PCR ranging from At Risk to Fair (PCR 46 to 65) at the time of future evaluation.

Based on information presented in the *Pavement Condition Assessment Report* and summarized in Exhibit 3-6 and Exhibit 3-7, pavement reconstruction is recommended for approximately 36 miles of the existing I-40 mainline in the eastbound direction and 39 miles in the westbound direction. These areas represent existing PCR values of Very Poor (PCR 0 to 25 are highlighted in red) or Poor (PCR 26 to 45, indicating probable reconstruction areas, are highlighted in orange). Areas with PCR values of Very Poor and Poor are identified in proposed project reconstruction limits identified in Appendix D, Geometrics, and are shown in Appendix K, I-40 Conceptual Alternatives.

Exhibit 3-6. I-40 Pavement Condition Reconstruction Recommendations – Eastbound [a]

MP	Direction	Reconstruction Recommended [b]
0 to 8	EB	No
8 to 12	EB	Yes
12 to 26	EB	No
26 to 27	EB	Probable
27 to 54	EB	No
54 to 55	EB	Yes
55 to 56	EB	No
56 to 57	EB	Probable
57 to 61	EB	No
61 to 63	EB	Probable
63 to 82	EB	No
82 to 85	EB	Probable
85 to 93	EB	No
93 to 94	EB	Yes
94 to 99	EB	No
99 to 100	EB	Yes
100 to 106	EB	No
106 to 107	EB	Yes
107 to 116	EB	No
116 to 119	EB	Probable
119 to 122	EB	Yes
122 to 124	EB	Probable
124 to 126	EB	Yes
126 to 131	EB	Probable
131 to 132	EB	Yes
132 to 137	EB	Probable
137 to 150	EB	No

EB = eastbound, 36 miles total, 14 miles = yes, 22 miles probable

Notes:

a Pavement reconstruction recommendations are based on the NMDOT *Pavement Condition Assessment Report* dated September 26, 2023. Pavement conditions can change rapidly, and recommendations need to be assessed regularly. The pavement recommendations do not reflect pavement rehabilitation that occurred after the NMDOT 2023 pavement assessment from MP 9.2 to 16, MP 89 to 95.5, spot locations from MP 95.5 to MP 132, or other maintenance activities.

b No = PCR of At Risk (PCR 46) or higher; Probable = PCR of 26 to 45, and Yes = PCR of 0 to 25. Areas identified as requiring probable reconstruction fall into the Poor PCR category and will likely deteriorate to the Very Poor PCR category within a short period of time (a few years). Therefore, for budget, planning, and constructability purposes, the probable reconstruction areas should be included in the total length of pavement reconstruction.

Exhibit 3-7. I-40 Pavement Condition Reconstruction Recommendations – Westbound [a]

MP	Direction	Reconstruction Recommended [b]
0 to 8	WB	No
8 to 12	WB	Yes
12 to 26	WB	No
26 to 27	WB	Probable
27 to 30	WB	No
30 to 31	WB	Probable
31 to 38	WB	No
38 to 39	WB	Probable
39 to 50	WB	No
50 to 51	WB	Probable
51 to 56	WB	No
56 to 57	WB	Yes
57 to 58	WB	Probable
58 to 66	WB	No
66 to 67	WB	Probable
67 to 78	WB	No
78 to 80	WB	Probable
80 to 81	WB	Yes
81 to 92	WB	No
92 to 93	WB	Probable
93 to 95	WB	No
95 to 96	WB	Probable
96 to 105	WB	No
105 to 106	WB	Yes
106 to 109	WB	Probable
109 to 116	WB	No
116 to 118	WB	Probable
118 to 119	WB	Yes
119 to 124	WB	Probable
124 to 125	WB	Yes
125 to 132	WB	Probable
132 to 136	WB	No
136 to 138	WB	Probable
138 to 148	WB	No
148 to 149	WB	Yes
149 to 150	WB	No

EB = eastbound; WB = westbound. 39 miles total: 10 miles = yes; 29 miles = probable.

Notes:

a Pavement reconstruction recommendations are based on the NMDOT *Pavement Condition Assessment Report* dated September 26, 2023. Pavement conditions can change rapidly, and recommendations need to be assessed regularly. The pavement recommendations do not reflect pavement rehabilitation that occurred after the NMDOT 2023 pavement assessment from MP 9.2 to 16, MP 89 to 95.5, spot locations from MP 95.5 to MP 132, or other maintenance activities.

b No = PCR of At Risk (PCR 46) or higher; Probable = PCR of 26 to 45, and Yes = PCR of 0 to 25. Areas identified as requiring probable reconstruction fall into the Poor PCR category and will likely deteriorate to the Very Poor PCR category within a short period of time (a few years). Therefore, for budget, planning, and constructability purposes, the probable reconstruction areas should be included in the total length of pavement reconstruction.

3.3 I-40 Bridges and Major Structures

3.3.1 Methods and Findings

Existing bridge structure conditions were assessed based on the most recent NMDOT bridge inspection reports available, information provided from FHWA from LTBP InfoBridge (FHWA 2023b), and field observation. The NMDOT inspection database was made available to the study team and contains records on bridge identification, geometry, inspections, load ratings, and condition.

Existing bridge 6226 carries the BNSF railroad tracks over I-40 at MP 94.77. Condition ratings and other data for this bridge were not available, and horizontal clearances are limited by the piers.

There are 154 bridges along this section of I-40. These include 92 conventional bridges with typical vertical foundations and horizontal girders and decks. The remaining 62 bridges consist of rectangular or rounded culverts that are classified as bridges due to their large size, typically a 20-foot or larger width opening. Some bridges carry both eastbound and westbound lanes of I-40 on a single structure, while others carry eastbound and westbound lanes on separate structures with an opening in the median.

Of the 154 existing bridges, 128 carry I-40 over waterways, crossing roadways, and BNSF railroads, sometimes with multiple parallel facilities. A total of 79 bridges carry I-40 over waterways exclusively. A total of 33 I-40 bridges cross over other roads or waterways; and 16 bridges cross over BNSF railroad tracks, roads, or waterways. The other 26 bridges carry roadways or BNSF railroads over the top of I-40, and pedestrian bridge 7316 crosses over I-40 at MP 79.64 near Milan.

The bridges were constructed or reconstructed between 1957 and 2019. Of the 154 bridges, 148 (96%) are in good or fair condition and 5 (3%) are described as being in poor condition. The condition ratings are based on the lowest rating of the major bridge components (deck, superstructure, substructure, or culvert) from the inspection reports. “Good” condition represents minor defects, “fair” represents moderate defects, and “poor” represents major defects that may affect bridge performance. The condition of bridge 6226 (owned by the BNSF railroad) is unknown (FHWA 2023b). The 5 bridges identified as being in poor condition are:

- Bridge 6365 carrying the I-40 westbound lanes at MP 31.03
- Bridge 6366 carrying the I-40 eastbound lanes at MP 31.04
- Bridge 6388 carrying the I-40 eastbound lanes and ramp at MP 99.84
- Bridge 6389 carrying the I-40 westbound lanes at MP 99.87
- Bridge 6122 carrying Frontage Road 4012 near MP 119.38

The study team compiled the structural capacity of the bridges based on the inspection reports to confirm the bridges have capacity for typical vehicles. This capacity is reported as inventory and operating load ratings. The inventory rating represents the weight of vehicle that can be accommodated during normal use. The operating rating represents the weight of vehicle that can be accommodated for infrequent heavy loads. The required

inventory and operating ratings are HS-20 and HS-33, respectively. "HS" refers to a standardized tractor-trailer combination truck used for the ratings. The bridges along the corridor all have acceptable vehicle load ratings.

Vertical and horizontal clearances are critical to the safe operation of bridges to prevent collisions. The typical minimum vertical clearances required for interstate, railroad, and local road bridges are 16 feet, 23.5 feet, and 14.5 feet, respectively. In total, 24 of the existing 154 bridges may have horizontal or vertical clearance deficiencies, as summarized below. The clearances for Bridge 6226 were checked in the field, and the vertical clearances appeared adequate. Information on all 154 bridges is contained in Appendix F, Bridges.

- 2 of the 24 bridges over I-40 have less than 16 feet vertical clearance.
- 11 of the 16 I-40 bridges over railroads have less than 23.5 feet vertical clearance. Note that the NMDOT may accept a minimum vertical clearance of 22.5 feet for existing bridges; however, 7 of the 16 I-40 bridges over railroads have less than this clearance.
- 11 of the 33 I-40 bridges over crossroads have less than 14.5 feet vertical clearance. In addition, 7 of these crossroad bridges have less than 2 feet of horizontal clearance, which is considered the minimum for acceptable operation.

3.4 I-40 Drainage

3.4.1 Drainage Structures and Basin Overview

3.4.1.1 Methods

The study team conducted a field inventory of existing drainage culverts located on I-40 from MP 0 to 150 as part of the NMDOT's Culvert Asset Management Program (CAMP). The CAMP program is an ongoing data collection effort across New Mexico. The field inventory included documenting culvert size, material, inlet and outlet type, condition, evidence of scour, corrosion, other damage to the culvert, and the channel type and condition. ESRI ArcGIS Field Maps was used for the data collection, with the GIS schema provided by the NMDOT. The culvert inventory was conducted in June and July of 2022. The quality control methodology was developed and reviewed by NMDOT before implementation and the quality of the data was reviewed as part of the culvert inventory process, as documented in Appendix A, I-40 Highway Operations Improvement Plan, in Attachment A, I-40 Culvert Risk Assessment, Priorities, and Recommendations.

ESRI ARCGIS Field Maps was loaded onto tablets for data inventory in the field. The NMDOT requested one point be located for each culvert at the outlet. Crews located inlet points, where possible, for use in conceptual-level hydrologic or hydraulic capacity analysis. When an inlet could not be located, an outlet point was collected and noted. In addition, photos were taken of each culvert and attached to the GIS data point. The collected data were provided to the NMDOT in a file GIS geodatabase format.

USGS Regression Equation Regions, Waltemeyer 2008.

3.4.1.2 Findings

Drainage culverts and bridges are in place to convey drainage flows from storms and streams to cross under I-40. The continental divide is a natural boundary in the study area located near MP 48. Flows west of the continental divide flow west to Arizona via the Puerco River watershed, and flows east of the continental divide flow east to the Rio San Jose watershed. Drainage basins from MP 0 to 35 generally flow to the Puerco River. which crosses I-40 repeatedly. The existing drainage basins flow from north to south and from south to north across I-40 depending on the location of the Puerco River. From MP 35 to 93 the drainage basins flow from south to north across I-40. There are a few small basins that flow from north to south in that stretch of roadway, but the vast majority of the basins flow from south to north. From MP 94 to 106, the basins switch and flow from north to south towards the Rio San Jose located south of I-40. At MP 106, the Rio San Jose switches to the north side of I-40, and the drainage basins also change to flowing from south to north. At MP 120, the Rio San Jose changes again to the south side of I-40, with the drainage basins following. From MP 120 to the end of the study area at MP 150, the drainage basins flow from north to south.

The field survey found a total of 821 culvert locations in the I-40 study area from MP 0 to 150, ranging from small 16-inch culverts to large concrete box culverts (CBCs). In some cases, there is more than 1 culvert at a culvert location. There are 120 median drop inlets that were identified on I-40 as part of the culvert inventory. Drainage structures with widths greater than 20 feet are considered bridges and are included in Section 3.3, Bridges. A summary of the various types and sizes of drainage structures along I-40 from MP 0 to 150 are listed in Exhibit 3-8. Due to various accessibility issues (culverts outside of the right-of-way fence, culvert silted over 90%, etc.), not all culvert data were documented for every culvert, including the size and material for several culverts in the study area.

Exhibit 3-8. Drainage Structure Summary

Structure Type	Culvert Span Under 48-inches	Culvert Span 48 inches and Over	CBCs	Unknown	Total
RCP	78	55	122	2	257
Plastic/HDPE	3	2	–	–	5
CMP	481	63	–	1	545
Other	12	–	–	2	14
Total Culvert Locations	574	**120**	**122**	**5**	**821**

CBC = concrete box culvert, CMP = corrugated metal pipe, HDPE = high-density polyethylene, RCP = reinforced concrete pipe

3.4.2 Hydrology

3.4.2.1 Methods

The study team delineated drainage basins along I-40 from MP 0 to 150. The drainage basin delineation was developed using GIS tools to automate as much of the process as possible. Due to the length of the study area and the number of culverts, delineating each basin individually was considered too time intensive. In addition, the NMDOT plans to use a similar automated process to delineate drainage basins for other areas of the state. The basin delineation process developed for this study has limitations and is not completely automated due to the irregularities in terrain and nearby facilities, such as the adjacent frontage roads/alternate routes and the railroad, but the process was found to deliver sufficient results to be able to conduct a conceptual-level hydraulic capacity analysis.

Regression equations from the United States Geological Survey (USGS) were used to estimate the drainage flows for each basin. Regional regression equations are based on the USGS report *Analysis of the Magnitude*

and Frequency of Peak Discharge and Maximum Observed Peak Discharge in New Mexico and Surrounding Areas (Waltemeyer 2008). The western portion of the corridor from MP 0 to approximately MP 48 is located within the Northeastern Arizona Flood Region 9, shown on the Regression Equation Regions map, and the eastern portion from MP 48 to 150 is within Central Mountain-Valley Region 6. Region 9 requires 2 parameters — area and slope — to be input into the equations, while Region 6 only requires an area.

The drainage calculations are based on Section 200, Drainage Criteria, of the NMDOT *Drainage Design Manual* (NMDOT 2018b). Based on the criteria for interstate highways, the design storm is a 50-year storm, and the check storm is the 100-year storm.

3.4.2.2 Findings

The study team delineated 421 drainage basins for the 821 culvert locations that were identified in the study area. A drainage basin was not identified for each culvert for reasons summarized below. Culverts without an upstream basin were excluded from the basin delineation process.

- Basins for culverts that function as outlets for median drop inlets were not identified because they do not have an upstream basin, median flows are typically minor, and these pipes are expected to have capacity for the median flows that they are conveying. There are approximately 120 median drop inlets in the study area.
- Only inlet pipes were used for the analysis, so points labeled as an outlet were excluded. There are a total of 190 outlets identified in the study area (though several of these outlets were associated with median drop inlets).
- Culverts associated with bridge rundowns were excluded because these culverts typically convey local flows near the bridges and interchanges and do not have an upstream basin.
- In some locations, culverts were inventoried individually but act in concert to pass basin flows. For the hydrologic analysis, only 1 culvert from each culvert bank was used to identify drainage basins and the excess culverts were excluded. For the hydraulic capacity analysis, all culverts in a culvert bank were included. Note that a single drainage basin may flow to more than 1 culvert location, so the number of culvert locations assessed for hydraulic capacity is greater than the number of drainage basins.

3.4.3 Hydraulics

3.4.3.1 Methods and Findings

A conceptual-level analysis was conducted to identify the hydraulic capacity of culverts with identified drainage basins. The conceptual-level analysis was developed by conducting an inlet control analysis of the culverts identified in the CAMP field inventory using equations and nomographs given in *Hydraulic Design of Highway Culverts,* Third Edition, Appendix A (FHWA 2012). This approach was reviewed and approved by the NMDOT Drainage Division. An excel spreadsheet was used for the analysis with the culvert data, such as size and material, input from the completed CAMP culvert inventory. The flows calculated in Section 3.4.2 were input into the spreadsheet with the culvert size, material, and end section type. Culverts were assumed to be under capacity if the ratio of headwater depth to culvert rise was less than 2. This is a conceptual, high-level analysis and should not be used for drainage design. Additional analysis of the culverts will need to be performed before developing plans for any culvert replacements or rehabilitations. Exhibit 3-9 provides a summary of the drainage structure capacity for culvert locations in the I-40 study area based on the conceptual-level analysis. Note that the number of culvert locations do not correspond exactly to the number of culverts that have identified drainage basins since some culverts work in conjunction with other nearby culverts to convey one basin's flows, while in other locations, more than one basin may flow to a single culvert.

Exhibit 3-9. Drainage Structure Capacity Summary

Structure Type	Meets ALL Criteria	Meets 50-year Storm Criteria, Does Not Meet 100-year Storm Criteria	Does Not Meet EITHER Criterion	Total
RCP	8	31	42	81
Plastic (HDPE)	2	0	2	4
CMP	73	13	209	295
CBC	63	15	24	102
Total	**146**	**59**	**277**	**482**

CBC = concrete box culvert, CMP = corrugated metal pipe, HDPE = high-density polyethylene, RCP = reinforced concrete pipe

As shown in Exhibit 3-9, up to 277 drainage locations) may be under capacity for both the 50-year and 100-year storm criteria based on the conceptual-level hydraulic analysis. A total of 59 drainage locations meet the 50-year storm, but do not meet the 100-year storm. In total, there are up to 336 drainage locations that were identified as potentially not meeting hydraulic capacity needs. Culverts that do not meet capacity should be investigated further as described in Appendix A, I-40 Highway Operations Improvement Plan.

3.4.4 Patrol/Maintenance Observations and Review of Drainage Reports

3.4.4.1 Methods

The NMDOT Patrol/Maintenance staff for both District 3 and 6, who oversee maintenance operations for the study area, were contacted to identify notable drainage issues along I-40 and the adjacent alternate routes. NMDOT patrol staff in District 6 cover the area from MP 0 to MP 132, and District 3 NMDOT staff cover the area from MP 133 to MP 150. In addition, previous drainage reports for the I-40 study area were reviewed as part of data collection and are summarized in Appendix G, Drainage. These reports were provided to Parametrix by the NMDOT, and one report was provided by Bohannan-Huston.

CBC clogged with sediment at MP 31.7.

3.4.4.2 Findings

NMDOT Patrol/Maintenance staff observations on I-40 are summarized below. Drainage reports are summarized in Appendix G, Drainage.

- From the Arizona State line at MP 0 to the Port of Entry near MP 12 – Erosion control has been used to protect I-40.
- MP 4 to 4.5 – The rest area has a drainage issue along Lupton Road, which is south of I-40. There is no V-ditch for drainage, so it comes across Lupton Road; sediment clogs the drainage structures, and water runs across I-40. Lupton Road is not identified as one of the potential alternate routes since there is a state route, NM 118/Historic Route 66, located on the north side of I-40.

- MP 22 to MP 22.5 eastbound and MP 24.5 westbound – Erosion control has been used to protect I-40.
- MP 29.5 – There is a rockfall area I-40 eastbound.
- MP 32 to MP 34 (Fort Wingate area) – Flooding occurs every year on the frontage road (NM 118) at this location, and water often runs onto the I-40 lanes and can cause closures on I-40. Bohannon Huston has studied the area from MP 29.5 to 36.5, and improvements have been recommended to help alleviate flooding. A brief summary of the report is provided in Appendix G, Drainage.
- MP 134 to MP 137 – Flooding occurs at the twin bridges (bridge 5815 and 5816). The NMDOT Maintenance staff go out when it rains to look for washouts around the embankments on the north side of the bridge. The roadway shoulders in this area erode when there is heavy rainfall.
- MP 144 to MP 145 – The median erodes near the hillside due to heavy rainfall.

3.4.5 Floodplains

3.4.5.1 Methods

Floodplains mapped by the Federal Emergency Management Agency (FEMA) were identified along the I-40 study area and are summarized in Exhibit 3-10. In several locations, the floodplains listed in Exhibit 3-10 and the observed flooding identified by NMDOT maintenance crews identified in Section 3.4.4 correspond, but there are many floodplain locations listed in Exhibit 3-10 that have not been noted as overtopping. This may be due to the floodplain only overtopping I-40 during very large storm events that have not occurred in recent years. In addition, the floodplain may no longer exist due to changes to the topography or drainage flows, but the FEMA mapping (Flood Insurance Rate Map [FIRM]) has not been updated to reflect those changes.

3.4.5.2 Findings

There are 48 locations where floodplains either intersect or include I-40. Exhibit 3-10 shows the MP of the floodplain, the structure involved, the FIRM Map, and the flooding source. Rows with red text are the 25 locations where I-40 is located within the floodplain and the travel lanes have the potential to be flooded. Some of these locations are not associated with a crossing structure, such as a bridge or culvert. These locations should be evaluated in more detail to determine if the flooding potential can be reduced or eliminated with the addition of new drainage structures. Locations with black text are areas where the floodplain intersects I-40 but I-40 is not within the floodplain. The locations with black text have bridges or culverts to convey flood waters under I-40, and the roadway is not affected by the waterway.

The flood zones found in the study area are categorized as follows:

- Flood zones A, AE, or AO. These zones are considered high risk areas with at least a 1% annual chance of flooding (100-year flood event). All of the 48 flood zones except for 1 intersect with I-40 in the study area are in flood zones A, AE, or AO. The 1 flood zone that is in flood zone X is located at MP 21.73.
  - → Flood zone A does not have a base flood elevation (also called BFE).
  - → Flood zone AE has established base flood elevation.
  - → Flood zone AO has a 1% chance of shallow floods (typically sheet-flow flooding) and are typically located in or near rivers and streams where the water level can rise quickly and create flash floods.
- Flood zone X. This is considered to be an area of low flood risk, experiencing a flood probability of 0.2% annually (500-year flood event).

Exhibit 3-10. Mapped FEMA Floodplains for I-40

#	MP	Structure ID	Flood Zone	Flood Insurance Rate Map	Community	Effective Date	Flooding Source
1	1.08	Bridge 6295 and 6296	A	35031C2225E	McKinley County	2/17/2010	Puerco River
2	7.35	I40-53, 54, 55, and 57	A	35031C1875E	McKinley County	2/17/2010	Burned Out Canyon
3	7.96	Bridge 6281 and 6282	A	35031C1875E	McKinley County	2/17/2010	Puerco River
4	9.25	Bridge 3487, 6128	A	35031C1875E	McKinley County	2/17/2010	Puerco River
5	11.37	Bridge 6130, 6131	A	35031C1875E	McKinley County	2/17/2010	Saltwater Wash
6	15.45	I40-109 to I40-124	A	35031C1515E	McKinley County	2/17/2010	Twin Buttes Wash
7	16.50 to 16.68	I40-133	A	35031C1515E	City of Gallup	2/17/2010	Unnamed Arroyo
8	17.36 to 18.0	Bridge 8852, 8845, 8846	AE	35031C1520E	City of Gallup	2/17/2010	Bread Springs Wash, Rio Puerco
9	20.0 to 20.37	I40-145, 146	A	35031C1520E	City of Gallup	2/17/2010	Puerco River
10	21.0 to 21.58	Bridge 7447, 7611, 7612	AO, AE, X	35031C1520E	City of Gallup	2/17/2010	Gamerco Wash, Puerco River
11	21.73	Bridge 7615, 7616	X	35031C1540E	City of Gallup	2/17/2010	N/A
12	23.9 to 24.04	None	A	35031C1540E	City of Gallup	2/17/2010	Puerco River
13	24.28 to 24.32	None	A	35031C1540E	City of Gallup	2/17/2010	Puerco River
14	24.53 to 24.55	None	A	35031C1540E	McKinley County	2/17/2010	Puerco River
15	25.35 to 25.85	Bridge 7669, 7670, 7870, 7871	A	35031C1545E	McKinley County	2/17/2010	Puerco River
16	29.77	Bridge 5394, 6561	A	35031C1565E	McKinley County	2/17/2010	Puerco River South Fork
17	33.67	Bridge 6086	A	35031C1575E	McKinley County	2/17/2010	Unnamed Arroyo
18	35.09	Bridge 5848, 5849	A	35031C1575E	McKinley County	2/17/2010	Puerco River South Fork
19	38.67	Bridge 6005	A	35031C1975E	McKinley County	2/17/2010	Sixmile Canyon
20	41.0	Bridge 6006	A	35031C1975E	McKinley County	2/17/2010	Fourmile Canyon
21	43.61	Bridge 6007	A	35031C1975E	McKinley County	2/17/2010	Smith Canyon
22	46.24	I40-257	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
23	46.39	I40-258	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
24	47.78	Bridge 3068	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
25	50.56	I40-276	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
26	52.01	Bridge 6503, 6504	A	35031C2025E	McKinley County	2/17/2010	Unnamed Arroyo
27	53.06 to 54.65	Bridge 6506, 6507, I40-285, I40-286	A	35031C2025E	McKinley County	2/17/2010	Unnamed Arroyo
28	67.87	Bridge 6522	A	35031C2450E	McKinley County	2/17/2010	Mitchell Draw
29	71.14 to 72.0	I40-355	A	35006C0125C	Cibola County	12/17/2010	Middle Ditch

(Table Continues)

Exhibit 3-10. Mapped FEMA Floodplains for I-40 (Continued)

#	MP	Structure ID	Flood Zone	Flood Insurance Rate Map	Community	Effective Date	Flooding Source
30	72.54 to 73.80	Bridge 7253, 7254, I40-356 to I40-359	A	35006C0125C	Cibola County	12/17/2010	Middle Ditch
31	79.34 to 81.0	I40-405 to I40-410	AE, X	35006C0392C	Village of Milan	12/17/2010	Rio San Jose
32	81.0	I40-411	X	35006C0392C	City of Grants	12/17/2010	Rio San Jose
33	85.86 to 86.03	Bridge 6098	A	35006C0680C	Cibola County	12/17/2010	Agua Fria Creek
34	89.14 to 89.22	I40-431	A	35006C0700C	Cibola County	12/17/2010	Unnamed Arroyo
35	89.43 to 89.64	Bridge 5973	A	35006C0700C	Cibola County	12/17/2010	Unnamed Arroyo
36	90.7	None	A	35006C0700C	Cibola County	12/17/2010	Rio San Jose
37	91.0 to 93.15	Bridge 1776, 9686, 9687. I40-436, I40-437, I40-818	A	35006C0725C	Acoma Indian Reservation	12/17/2010	Rio San Jose
38	93.37 to 93.67	I40-438	A	35006C0725C	Acoma Indian Reservation	12/17/2010	Rio San Jose
39	93.37 to 93.67	Bridge 1779	A	35006C0725C	Acoma Indian Reservation	12/17/2010	Rio San Jose
40	97.51	Bridge 6889	A	35006C0725C	Cibola County	12/17/2010	Rinconada Creek
41	99.61 to 99.87	Bridge 6890, 6388, 6389	A	35006C0750C	Cibola County	12/17/2010	Unnamed Arroyo
42	104.54	Bridge 6883	A	35006C0750C	Pueblo of Laguna	12/17/2010	Unnamed Arroyo
43	106.11 to 106.29	Bridge 6896, I40-510	A	35006C0750C	Pueblo of Laguna	12/17/2010	Rio San Jose
44	140.09 to 140.16	Bridge 6995, 5668	A	35001C0287G	Bernalillo County	9/26/2008	Unnamed Arroyo
45	140.52	Bridge 8756, 9545	AE	35001C0287G	Bernalillo County	9/26/2008	Rio Puerco
46	140.86	I40-718, 719, 720	AE	35001C0287G and 35001C0291G	Bernalillo County	9/26/2008	Unnamed Arroyo
47	145.31 to 145.40	I40-760 to I-40 763	A	35001C0315G	Bernalillo County	9/26/2008	Unnamed Arroyo
48	146.85	I40-775	A	35001C0315G	Bernalillo County	9/26/2008	Unnamed Arroyo

Red text = Portions of I-40 that are in the flood plain.

3.5 I-40 Utilities

3.5.1 Methods

The study team provided an American Society of Civil Engineers (ASCE) Quality Level D (QL-D) analysis of existing utility records and created a computer aided design (CAD) file and GIS geodatabase of existing utility records for I-40 and existing frontage roads in the study area. Utility records and as-built information were requested from state, county, municipal, and tribal utility owners. The utility owners within the study area were identified through NM 811 via a notice of design conference. The study team used industry contacts and made reasonable efforts to identify utility owners within the study area that were not members of NM 811. The utility records gathered were in various formats. including shapefiles, KMZ, and PDF. Digital records were converted into DWG format and placed on the appropriate layer identifying owner, size, utility, and material (if applicable). PDF information was plotted in the CAD drawing and tied to surface features visible from image overlay and lidar data. Utility linework was then scaled and georeferenced into a web portal hosted by the NMDOT. Accompanying PDF utility files were compiled and placed on an additional layer and attached for refence by the end user.

3.5.2 Findings

There are numerous utilities located in the study area that will be an important part of design as projects move forward. Utilities located in the study area are shown in Appendix H, Utilities, and include:

- Communications/telephone, overhead and underground
- Natural gas
- Electric power, overhead and underground
- Wastewater
- Water
- Fiber optic
- ITS, see discussion under Section 3.6

3.6 I-40 Intelligent Transportation Systems

Intelligent transportation systems (ITS) are advanced applications that provide information to improve traffic management and enable roadway users to be better informed to make safer, more coordinated use of transportation networks. Examples of ITS include messaging signs or traffic cameras.

3.6.1 Methods and Findings

Existing ITS infrastructure in the I-40 study area was identified in consultation with the NMDOT ITS Group; the NMDOT Traffic Monitoring Program staff manager (data collection and equipment are managed as part of the Traffic Monitoring Program and not the ITS Group), and a review of the NMDOT Statewide ITS Architecture (NMDOT 2019b).

Current ITS and traffic monitoring infrastructure in the I-40 study area includes 9 closed circuit television (CCTV) traffic cameras, 2 roadside weather information systems (RWIS), 2 license plate readers, 5 dynamic messaging signs (DMS), and 4 data stations/automated traffic recorders (ATRs), as shown in Exhibit 3-11 and listed in Exhibit 3-12. The 3 of the 4 existing data stations are currently not operational, though NMDOT is in the process of getting these data stations reinstated. Additionally, there are 16 electric vehicle chargers: 12 are located in Gallup, and 4 are located in Grants.

Exhibit 3-11. Map of Existing ITS Equipment and Fiber Optic Network

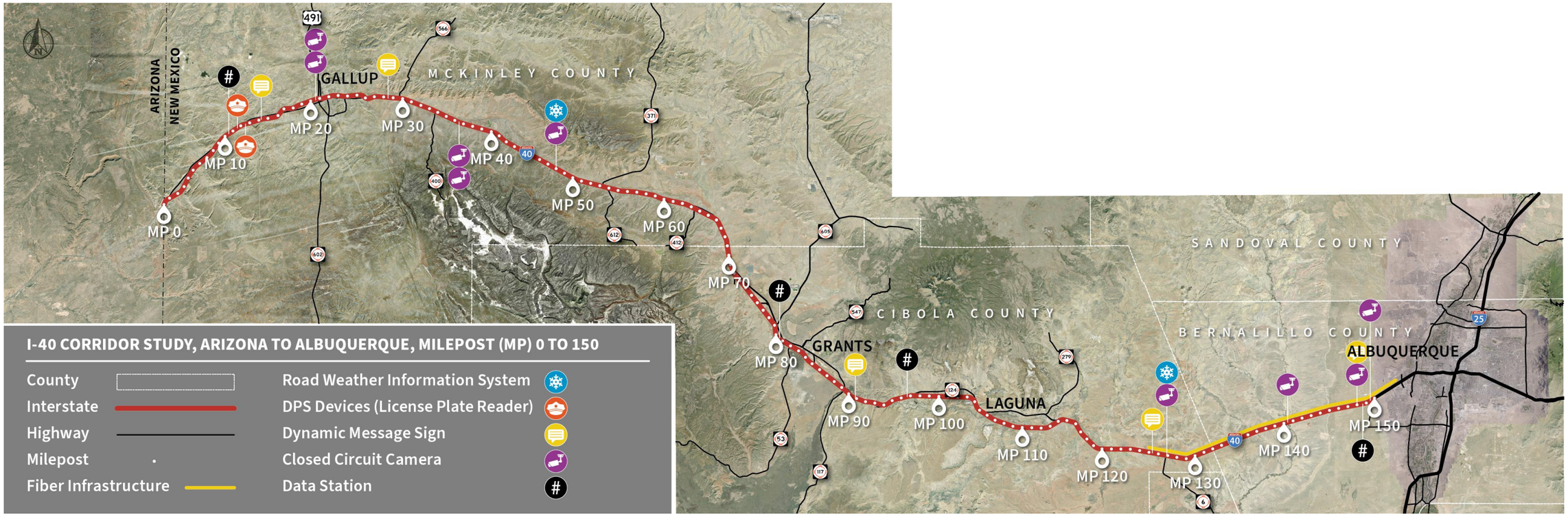


Exhibit 3-12. Existing ITS Inventory

Location	MP	Data Stations	CCTV	DMS	RWIS	License Plate Reader
West of Port of Entry	10.7	1	–	–	–	–
EB Port of Entry	11.8	–	–	–	–	1
WB Port of Entry	12.7	–	–	–	–	1
EB West of Gallup	14.2	–	–	1 (EB)	–	–
Gallup/US 491	20.8	–	2 (EB/WB)	–	–	–
WB at Fire Rock Casino	28.5	–	–	1 (WB)	–	–
EB/WB at Exit 36	36.8	–	2 (EB/WB)	–	–	–
Continental Divide	48.0	–	1	–	1	–
Milan	80.7	1	–	–	–	–
WB East of Grants	90.8	–	–	1 (WB)	–	–
East of Grants	96.9	1	–		–	–
EB West of NM 6	125.3	–	–	1 (EB)	–	–
NM 6	126.9	–	1	–	1	–
Rio Puerco	140.4	–	1	–	–	–
West of Atrisco Vista	148.0	–	1	1 (EB)	–	–
West of Atrisco Vista	148.9	1	–	–	–	–
East of Atrisco Vista	149.5	–	1	–	–	–
Total	–	**4**	**9**	**5**	**2**	**2**

CCTV = closed-circuit camera, DMS = dynamic message sign, EB = eastbound, RWIS = roadside weather information system, WB = westbound

3.6.2 Existing Communication Network

As mentioned in the utilities section, NMDOT has a fiber optic line that runs from just east of MP 125 near NM 6 to beyond the study area limits at MP 150 in Albuquerque. Outside of this area, ITS systems are connected via cellular networks. Exhibit 3-11 shows the location of the fiber optic network.

3.6.3 Existing Operations

Statewide ITS operations are managed centrally by the NMDOT ITS Bureau out of the Regional Traffic Management Center (RTMC), a centralized traffic management center with multi-agency coordination operating on 24 hours a day, 7 days a week. Most of the ITS system is run through RoadRunner, a Southwest Research Institute Advanced Traffic Management System application built out of active ITS that has been tailored to meet NMDOT needs. ITS Bureau operations staff maintain and operate RoadRunner from the RTMC and field calls and reports via phone, email, and mobile application. Functions of this system include displays of traffic conditions, accidents, construction, CCTV snapshots, DMS displays, and traveler information such as rest areas and weather. NMDOT subscribes to Bing Traffic Services to supplement traffic monitoring in the study area.

3.6.4 Existing ITS Architecture

This section provides a summary of existing ITS services in the I-40 corridor as identified in the NMDOT ITS Architecture. The New Mexico Statewide ITS Architecture was updated in 2019 and is based on the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) V8.2. Exhibit 3-13 lists ITS service packages that are identified in the New Mexico ITS Architecture that are relevant to I-40 in the study area. These include CCTV and DMS installations along I-40.

Exhibit 3-13. Existing ITS Service Packages in I-40 Study Area

ITS Service Package	Description
CVO03 Electronic Clearance	Provides for automated commercial vehicle clearance at roadside check facilities.
CVO04 CV Administrative Processes	Supports program administration and enrollment and provides for electronic application, processing, fee collection, issuance, and distribution of credential and tax filing.
MC06 Work Zone Management	Manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using closed caption television (CCTV) cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers.
TM01 Infrastructure-Based Traffic Surveillance	Includes CCTVs installed along I-40 in the study area and the supporting field equipment and communications to transmit the collected data back to the Regional Traffic Management Center. Generated data enables NMDOT to monitor traffic and road conditions, identify and verify incidents, and collect data for traffic management.
TM06 Traffic Information Dissemination	Provides driver information using roadway equipment, such as DMS.
TM07 Regional Traffic Management	Provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional and statewide travel operations centers distribute road and travel conditions to the public via New Mexico Roads data portal.
TM08 Traffic Incident Management System	Manages both unexpected incidents and planned events so that the impact to the I-40 corridor and traveler safety is minimized. Includes incident detection capabilities through roadside surveillance devices such as CCTV and traffic management centers.
WX01 Weather Data Collection	Collects current road and weather conditions using roadside weather information systems installed along I-40 in the study area.
WX02 Weather Information Processing and Distribution	Processes and distributes weather information collected from the weather data collection service package. Can be used to deploy road maintenance resources more effectively, issue travel advisories, issue location-specific warnings to drivers using the traffic information dissemination service package, and aid operators in scheduling work activity.

3.7 I-40 Traffic Volumes, Vehicle Classifications, Ramp Turning Movements, and Connected Vehicle Data

Existing traffic on I-40 reflects the function of this highway and its importance to the transportation system in New Mexico. I-40 travels through the entire state from west to east and is one of the primary west-to-east freeways in the south-central portion of United States, connecting California, Arizona, New Mexico, Texas, Oklahoma, Arkansas, Tennessee, and North Carolina.

Existing traffic volumes and composition are important elements in determining the need, type, and extent of highway improvements. Traffic volumes, vehicle classifications (composition), turning movements at ramps, and I-40 study area traffic information gleaned from connected vehicle data is discussed below.

3.7.1 Traffic Volumes and Vehicle Classifications

3.7.1.1 Traffic Volumes and Vehicle Classifications Methods

Several methods and technologies were used to acquire current and historic traffic data for this study. A draft and final data collection methodology and plan was developed with and approved by the NMDOT prior to collecting traffic data in June 2022. The methods and data collected are discussed below.

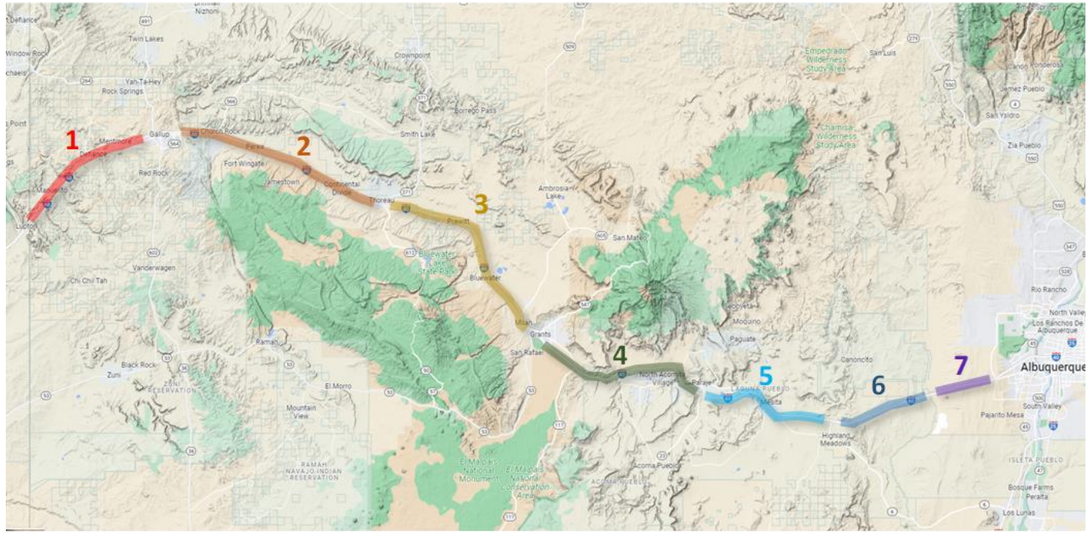
For safety, the study team used non-intrusive video collection methods to collect eastbound and westbound I-40 traffic volumes and vehicle classifications. Traffic count locations were selected in consultation with the NMDOT to represent various origins and destinations throughout the study area. Count equipment was positioned sufficiently outside major communities (Gallup, Grants, Albuquerque, etc.) so that intra-community traffic would not influence the count. The data collected used 2 separate systems to collect count durations of 14-day and 28-day for the 7 selected freeway segments listed in Exhibit 3-14 and shown in Exhibit 3-15. The 14-day counts were completed on 5 segments, and the 28-day vehicle counts were deployed on 2 segments. The segments were created by breaking the corridor at points where traffic volumes are expected to change the most, such as urban areas (Gallup and Grants) and major highways (NM 371, NM 23, and NM 6).

Exhibit 3-14. I-40 Traffic Count Locations

	Area	MP	Duration	Note
1	Arizona State Line to Gallup	0 to 16	14-day	MP 15.25 (Overpass)
2	Gallup to NM 371	26 to 53	28-day	MP 48 (Continental Divide)
3	NM 371 to Grants	53 to 79	14-day	MP 63.5 (Prewitt)
4	Grants to NM 23	85 to 108	14-day	Existing ATR at MP 93 within this interval. Location is MP 94.77 (Railroad structure)
5	NM 23 to NM 6	108 to 126	14-day	MP 120.25 or 121.8 (Drainage)
6	NM 6 to Rio Puerco	126 to 140	28-day	MP 131.3 (Canoncito School Rd)
7	Rio Puerco to Atrisco Vista	140 to 149	14-day	MP 141.25 (Westbound Exit 140, Rio Puerco Sign Structure)

ATR = automated traffic recorder

Exhibit 3-15. I-40 Traffic Count Map



28-Day Traffic Volumes and Vehicle Classifications Methods

The study team attempted to collect 28-day vehicle counts and vehicle classifications on mainline I-40 for 2 freeway segments, as described in Exhibit 3-14 and shown in Exhibit 3-15. The 28-day counts were collected from July 11, 2022, to August 31, 2022. For the 28-day counts, Neovision video units placed roadside were used. Neovision units were selected for the 28-day counts because they actively process the data as it is being collected. Because of this, they do not record video. However, the data collection requirements of the rural divided freeway proved too diverse for the system to produce 24-hour traffic and classification counts. Specifically, the quality of the data collected in the far-side lanes during dark hours did not meet the study's quality control standards. As such, the traffic counts and analysis were generated from the 14-day counts.

14-Day Traffic Volumes and Vehicle Classifications Methods

The study team collected 14-day vehicle counts and vehicle classifications on mainline I-40 for 5 freeway segments, as described in Exhibit 3-14 and shown in Exhibit 3-15. The 14-day counts were conducted using Miovision cameras placed roadside. The Miovision units collect 3-bin classifications of lights, mediums, and articulated trucks. Light vehicles include motorcycles, passenger cars, and light goods vehicles (FHWA vehicles classes 1 through 3). Medium vehicles include single unit trucks (SUTs) and buses (FHWA vehicle classes 4 through 7). Articulated trucks include truck tractors and other heavy vehicles (FHWA classes 8 through 13). Miovision units were selected for the 14-day counts because they provide videos that can be reviewed. Data post-processing is done as part of a separate step after the data are collected. The 14-day counts were collected between July 11, 2022, to August 3, 2022. Throughout the data collection process, the data collection units had occasional interruptions for battery voltage, weather, etc. In these instances, the counters were refreshed and redeployed. The interruptions extended the data collection period beyond 2 weeks so that a full 14 full days of data could be collected at each segment.

3.7.1.2 Traffic Volumes and Vehicle Classification Summary

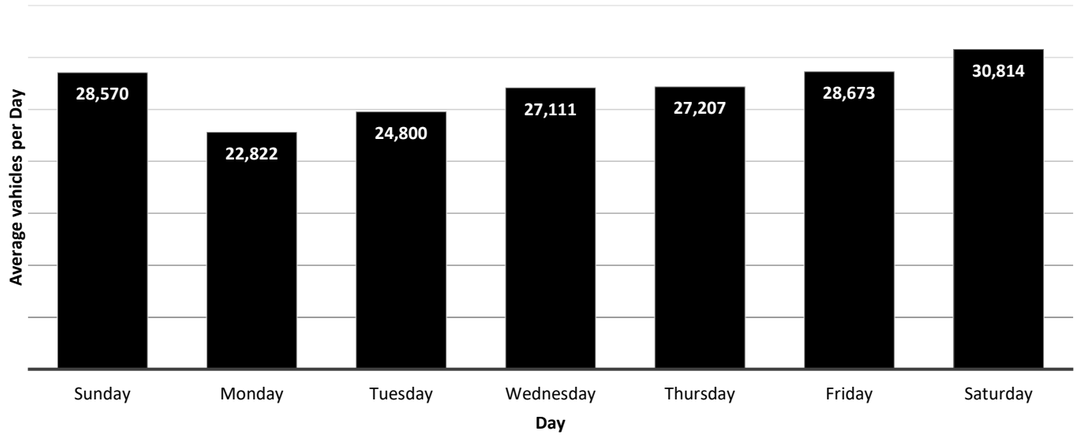
This summarizes the traffic volume and vehicle classifications findings that are described in this section:

- Traffic volumes increase throughout the week (Monday through Sunday), with a peak on Saturday and the lowest volume on Monday.
  - → Heavy vehicle (truck tractor/articulated truck) volumes are lowest on Monday and highest on Wednesday.
- Traffic volumes increase as you travel further east on I-40.
  - → Heavy vehicle volumes are relatively stable throughout the corridor, but light/passenger vehicle volumes increase toward Albuquerque, possibly because of travel to and from Albuquerque.
- I-40 carries more traffic in the spring and summer (March through August) than January and February, which is likely due to weather conditions.
- Light vehicle (passenger vehicle) PM peak hours shift to later in the day as you head east, potentially timed to reach Albuquerque by the end of a business day or before dark.
- Light and heavy vehicles have similar AM peak hours but different PM peak hours, likely due to light vehicles commuting back home after work.

Traffic Volume Findings

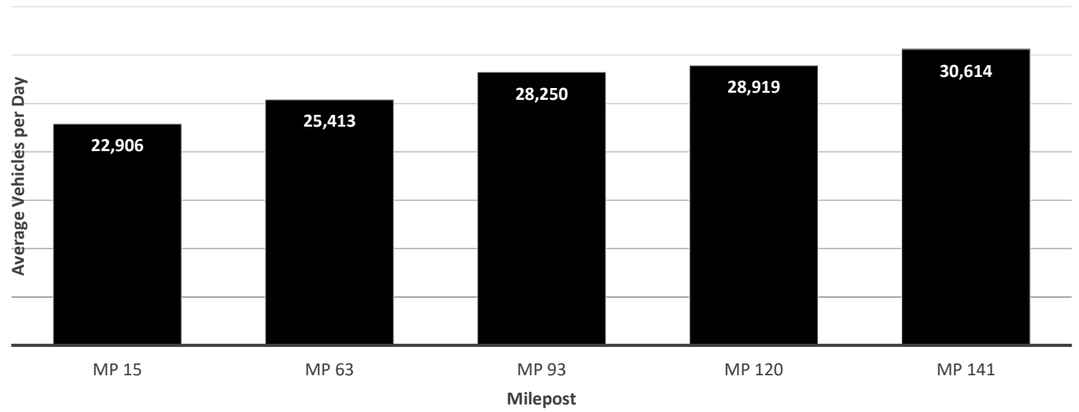
Based on the 14-day traffic counts, the study team calculated the average number of vehicles per day, as shown in Exhibit 3-16. The average number of vehicles per day across the I-40 in the study area is 27,293. Traffic volumes are at their lowest on Mondays, increasing to a peak on Saturdays.

Exhibit 3-16. I-40 Average Vehicle Volumes by Day of the Week



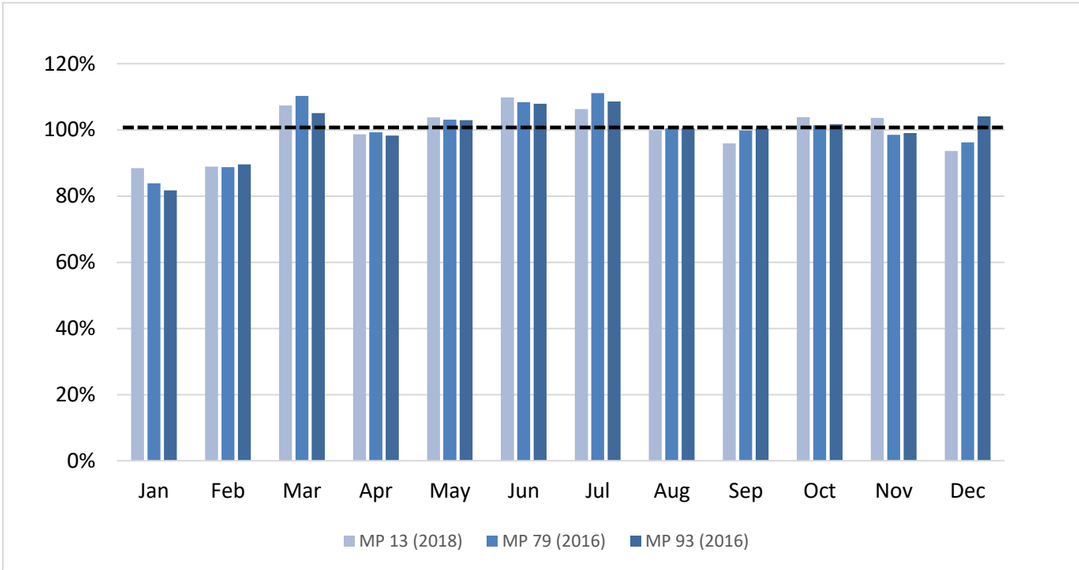
Analysis was also done to understand the average number of vehicles per day at each data collection location. Daily traffic volumes increase from west to east on I-40, with lower traffic volumes at the Arizona State line near MP 15, increasing to a peak of 30,614 vehicles per day at MP 141 near the Route 66 Casino, as shown in Exhibit 3-17.

Exhibit 3-17. I-40 Average Vehicle Volumes by MP



Seasonal traffic volume averages were calculated based on historical traffic data provided by NMDOT at MP 13 (west of Gallup), MP 79 (Grants), and MP 93 (east of Grants). Based on these historical averages, it was determined that I-40 carries more traffic during the spring and summer months, and vehicle volumes drop in January and February, as shown in Exhibit 3-18.

Exhibit 3-18. I-40 Traffic Volume Seasonality – Monthly Average as a % of Annual Averages

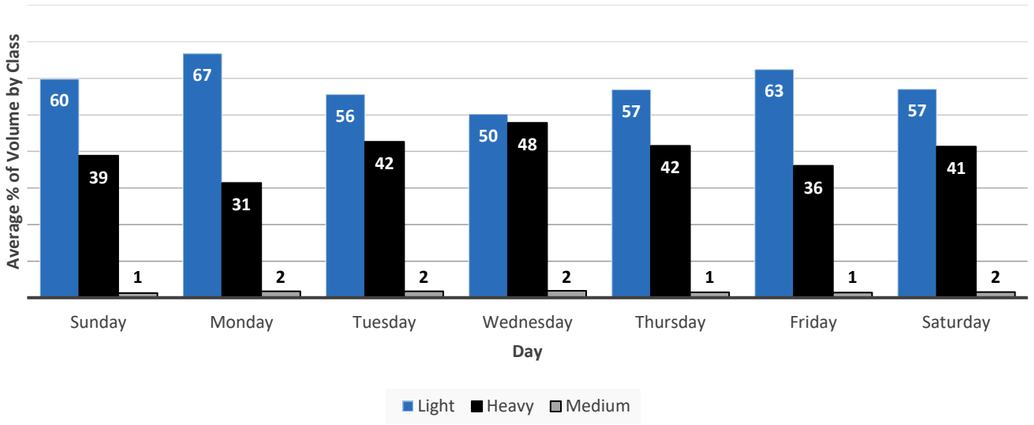


Vehicle Classification Findings

Based on vehicle classifications, the average percentage of passenger vehicles in the study are about 58% (15,777 vehicles per day), heavy vehicles comprise about 41% (11,081 vehicles per day), and medium vehicles are about 1% (435 vehicles per day).

As shown in Exhibit 3-19, the vehicle make-up by class changes depending on the day of the week. Passenger vehicles range from between 50% and 67% of daily traffic with Monday as a peak travel day and Wednesday as the lowest volume travel day for passenger vehicles. Heavy vehicles range between 31% and 48% throughout the week, peaking on Wednesdays, with their lightest days occurring on Mondays. Medium vehicles contributed minimally (1% to 2%) to daily traffic regardless of the day.

Exhibit 3-19. I-40 Average Vehicle Volume % by Class per Day



Another key finding is that the number and percentage of passenger vehicles increases from the western portion of I-40 near Gallup to the eastern portion near Albuquerque, as shown in Exhibit 3-20, In addition, vehicle volumes increase from Gallup to Albuquerque, as shown in Exhibit 3-21.

Exhibit 3-20. I-40 Average Vehicle Volume % by Class and MP

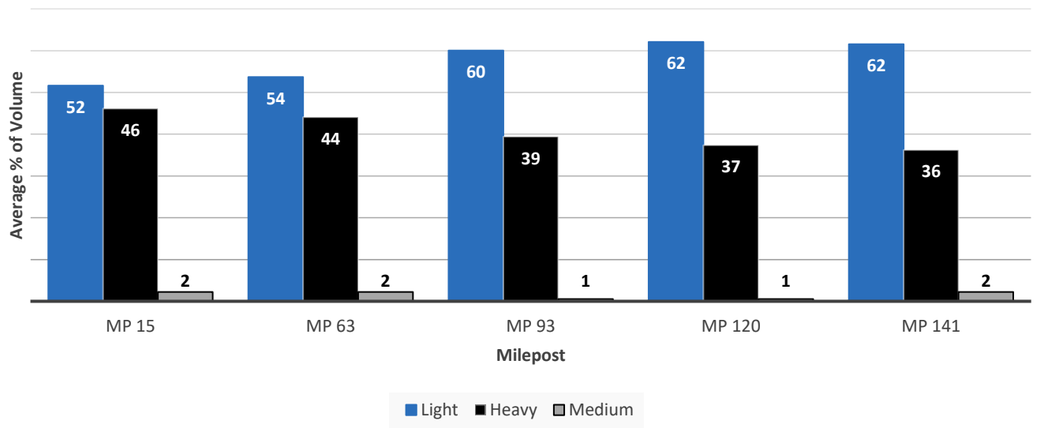
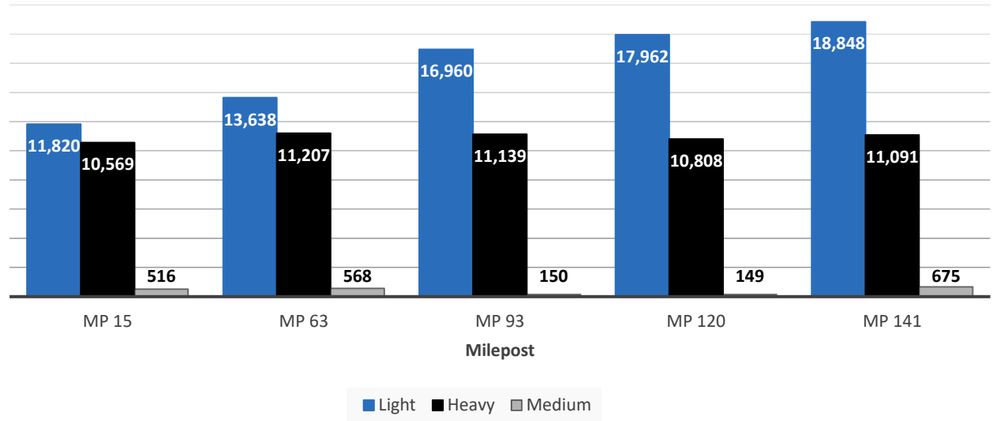


Exhibit 3-21. I-40 Average Vehicle Volume by Class and MP



The AM and PM peak hours by vehicle classification for each MP location where data were collected for Tuesday, July 12, 2022, and Wednesday, July 13, 2022, are shown in Exhibit 3-22. These dates were chosen because comprehensive data were available for each 14-day data collection location. Heavy (articulated trucks) and light vehicles (passenger vehicles) had similar AM peak hours but varied in the PM. For passenger vehicles, it was observed that the PM peak hour would shift to later in the day for eastbound traffic. The closest city to each MP is Gallup for MP 15, Grants for MP 63 and 93, and Albuquerque for MP 120 and 141. Note that light vehicles are passenger vehicles, medium-sized vehicles are single-unit trucks (such as a UPS truck) and buses and heavy vehicles are semi-trucks (truck tractors/articulated trucks).

Exhibit 3-22. AM and PM Peak Hours by MP and Vehicle Classification (Times Indicate When the Peak Hours Begin)

AM Peak Hour (Tuesday, 7/12/22)				AM Peak Hour (Wednesday, 7/13/22)			
MP	Heavy	Medium	Light	MP	Heavy	Medium	Light
15	10:30 AM	10:15 AM	11:45 AM	15	11:15 AM	11:30 AM	11:30 AM
63	11:45 AM	9:30 AM	11:30 AM	63	10:30 AM	11:30 AM	11:45 AM
93	11:45 AM	10:30 AM	11:00 AM	93	11:45 AM	9:00 AM	11:15 AM
120	11:30 AM	9:30 AM	11:00 AM	120	11:15 AM	8:45 AM	9:00 AM
141	11:45 AM	10:45 AM	11:45 AM	141	11:00 AM	7:45 AM	11:45 AM
PM Peak Hour (Tuesday, 7/12/22)				**PM Peak Hour (Wednesday, 7/13/22)**			
MP	Heavy	Medium	Light	MP	Heavy	Medium	Light
15	3:30 PM	3:45 PM	12:30 PM	15	2:30 PM	1:30 PM	12:00 PM
63	4:30 PM	2:15 PM	2:00 PM	63	12:00 PM	12:00 PM	2:30 PM
93	1:45 PM	2:45 PM	2:15 PM	93	12:00 PM	1:00 PM	2:15 PM
120	1:15 PM	1:30 PM	4:45 PM	120	12:00 PM	1:15 PM	4:00 PM
141	6:30 PM	3:00 PM	4:15 PM	141	12:30 PM	1:00 PM	4:30 PM

3.7.2 Ramp Volumes and Intersection Turning Movement Counts

3.7.2.1 Methods and Findings

I-40 ramp junction/intersection turning movement counts were collected at 8 of the 28 interchanges in the study area. This includes all interchanges in urban areas (Grants and Gallup areas) and the interchange at the Route 66 Casino outside Albuquerque. The Atrisco Vista interchange at MP 149 was not included in the urban ramps because a study was completed by the NMDOT at this interchange to determine future needs and coordination with NMDOT and local agencies for needs at this interchange are ongoing. The intent was to select the interchanges more likely to experience capacity issues on the corridor. Urban interchanges are more likely to experience congestion due to higher volumes both on the ramps and mainline I-40 compared to rural interchanges.

The turning movement counts were collected over a 24-hour period on Wednesdays or Thursdays from July 13 through August 10, 2022. Miovision units were secured to light poles, and multiple units were deployed at each interchange to see each approach. Miovision 3-binned classifications were provided. Bicycle and pedestrian counts were also collected. The breakdown for each interchange is shown in Exhibit 3-23.

Exhibit 3-23. Ramp Intersection Turning Movement Count Summary

City	Exit	Deployment Date	Number of Miovision Units
Gallup	Exit 16, NM 118	Wednesday, 8/10/22	2
	Exit 20, US 491/NM 602	Thursday, 7/28/22	4
	Exit 22, Montoya /Miyamura	Wednesday, 7/27/22	2
	Exit 26, East Gallup/NM 118/Route 66	Wednesday, 7/27/22	3
Grants	Exit 79, NM 122	Wednesday, 7/27/22	2
	Exit 81, NM 53	Wednesday, 8/10/22	4
	Exit 85, NM 547	Wednesday, 7/31/22	5
Albuquerque	Exit 140, at the Route 66 Casino	Thursday, 8/4/22	9

Turning-movement count data are provided in Appendix C, Ramp Turning Movement Counts. This data were used to determine the existing capacity and level of service (LOS) of the interchanges as discussed in Section 3.7.6.

In addition, daily ramp volumes were collected at the remaining interchanges using data provided by the NMDOT MS2 website (https://nmdot.public.ms2soft.com/tcds/tsearch.asp?loc=Nmdot). Interchanges with ramps carrying 1,000 or more vehicles per day were also included in the ramp capacity analysis. This resulted in adding an additional 8 ramps, as listed in Exhibit 3-24. The ramp volumes represent counts collected by NMDOT for a variety of years, and 2022 estimated volumes were developed by using growth rates supplied by NMDOT.

Exhibit 3-24. Additional Interchanges Ramp Counts Summary

Interchange Name	Exit
McGaffey	Exit 33, NM 400
Refinery	Exit 39, Maverick Rd
Thoreau	Exit 53, Co Rd 14/NM 37
Quemado	Exit 89, Hwy 117
Acomita/Sky City	Exit 102, Silver Dollar Rd
Casa Blanca/Paraje	Exit 108, Casa Blanca Rd
Laguna (MP 114)	Exit 114, US Route 66
Los Lunas (Hwy 6) Exit 126	Exit 126, Hwy 6

3.7.3 Connected Vehicle Data – Wejo and Geotab

Connected vehicle data were purchased from the vendors, Wejo and Geotab, to enable the study team to draw insights and analyze current traffic operations and transportation conditions for a sample of vehicles that travel on I-40 in the study area. The study team ran data queries on MoonShadow's DB4IoT analysis platform for Wejo passenger data and the Altitude analysis platform for Geotab commercial vehicle data. The study team exported static data queries and results summaries from the MoonShadow and Altitude platforms to use in further analyses and archiving of summarized traffic data.

3.7.3.1 Methods Overview – Wejo Passenger Vehicle Data

Connected passenger vehicle data were provided from Wejo, which offered 2 datasets: 1) vehicle movement and 2) event data. Wejo data are accessed through Moonshadow's DB4Iot platform. DB4IoT allows the user to geospatially visualize, analyze, query, and extract Wejo data. The DB4IoT platform allows the user to load additional datasets for analysis. The study team disaggregated the study corridor into 1,200 quarter-mile segments — 600 westbound and 600 eastbound. Moonshadow uploaded and assigned the Wejo data to the 1,200 segments. The segments also contained roadway grades and curvature data. One month of movement data from July 11, 2022, to August 10, 2022, included 139 million data points containing insight into origin-destination traffic flows, speeds, and congestion. The event data included events recorded by the vehicle within the trip, such as harsh braking, hard acceleration, and speed change. The event data provided information on safety-related events for 7 months, from January 11, 2022, to August 11, 2022. The timeframe for this data coincides with the movement data and the traffic counts that were collected in July and August 2022. The event data spans periods before and during the 2022 construction season. The Wejo data represent an approximate 7% share of the passenger vehicle travel stream

3.7.3.2 Methods Overview – GeoTab Commercial Vehicle Data

Commercial vehicle data for McKinley, Cibola, and Bernalillo counties was acquired from the vendor Geotab. Geotab provided access to their data via the Altitude Platform. Altitude Platform allows the user to visualize and analyze Geotab data geospatially. Additionally, anonymized raw data are queried and extracted via the Altitude Platform. These data are assigned to segments of I-40. Open street map road segmentation was used to derive 187 westbound and 195 eastbound segments (or Edge IDs) along I-40 from MP 0 to 150. Geotab's data offered insights into origin-destination, traffic flow, and speeds. One month of origin-destination data, from July 1, 2022, to July 31, 2022, were acquired to provide insights into predominant commercial vehicle origin and destination hubs. Additionally, Geotab data allowed analysis of speed trends between March 1, 2022, and July 31, 2022.

Geotab completed an expansion factors report in July 2022 to estimate their dataset's representation of the commercial vehicle population on various roadways. Within the study area, the study's control point was near MP 96, just west of the McCarty's interchange. The Geotab report document states their data represents an approximate 5% share of the commercial vehicle travel stream, which includes heavy, articulated trucks and single-unit trucks.

3.7.3.3 Methods – Connected Vehicle Speed Profiles

Wejo movement data provide parallel speed metrics like Geotab but presents the mean, standard deviation, maximum, and minimum speeds. Passenger vehicle speeds were queried for each unique journey ID or trip. Wejo documentation defines a journey ID as a unique identifier for an individual vehicle between ignition on-and-off events. The study team grouped these data by segment and time. The resulting dataset provided speed and volume data disaggregated by I-40 corridor segment and second of the day. The study team used these data to calculate standard speed metrics such as the 50th, 85th, and 95th percentile speeds. Percentile speeds indicates the speed at which a certain percentage of speeds fall below that number. For example, a 95th percentile speed of 75 mph means 95% of vehicles are traveling slower than 75 mph.

Geotab commercial vehicle data provides speed metrics by Edge ID as part of their dataset. Data of interest to this study include the speed limit, sample size (traffic volume), free flow speed, and spot speed. These data were aggregated by the hour of the day for each Edge ID. Spot speed data contain the mean speed; standard deviation from the mean; 50th, 85th, and 95th percentile speeds of light (FHWA Class 1 and 2 <10,000 pounds); medium (FHWA Classes 3 through 6, 10,001 to 26,000 pounds); and heavy (FHWA Class 7 and 8, > 26,001 pounds).

Both datasets were used to create individual corridor-wide speed profiles for passenger and commercial vehicles. These data were then used for further analysis.

3.7.3.4 Wejo and GeoTab Speed Data Findings

I-40 Speed Profile

The study team developed a speed profile of I-40 traffic in the study area. The speed profile data were grouped by hour and spatially related to segments in the I-40 study area. The speed profile summary in Exhibit 3-25 indicates that passenger vehicle speeds are generally higher than commercial vehicles and display greater variability in mean speed. The mean speed for passenger vehicles through the entire study area is 75.6 mph and the mean speed for commercial vehicles is 70.9 mph. Speed limits on I-40 in the study area are 75 mph, with the exception of a section of Gallup from approximately MP 15.5 to MP 26.5, where the speed limit is 65 mph. In areas where the speed limit is 75 mph, mean speeds for passenger vehicles are 76.2 mph and 71.3 mph for commercial vehicles. In the Gallup area where the speed limit is 65 mph, mean speeds drop to 68.4 mph for passenger vehicles and 67.5 mph for commercial vehicles.

Exhibit 3-25. I-40 Study Area Speed Profile Summary

	Vehicle Type	Mean Speed (mph)	SD (mph)	50th Percentile (mph)	85th Percentile (mph)	95th Percentile (mph)
Full I-40 Study Area	Passenger	75.6	8.3	77.3	81.1	83.8
	Commercial	70.9	4.8	70.5	75.6	78.5
65 mph Zone (Gallup [a])	Passenger	68.4	8.0	69.6	74.4	77.7
	Commercial	67.5	4.4	67.9	71.3	74.3
75 mph Zone	Passenger	76.2	8.1	77.6	81.3	84.0
	Commercial	71.3	4.8	70.8	76.1	78.9

mph = miles per hour, SD = standard deviation

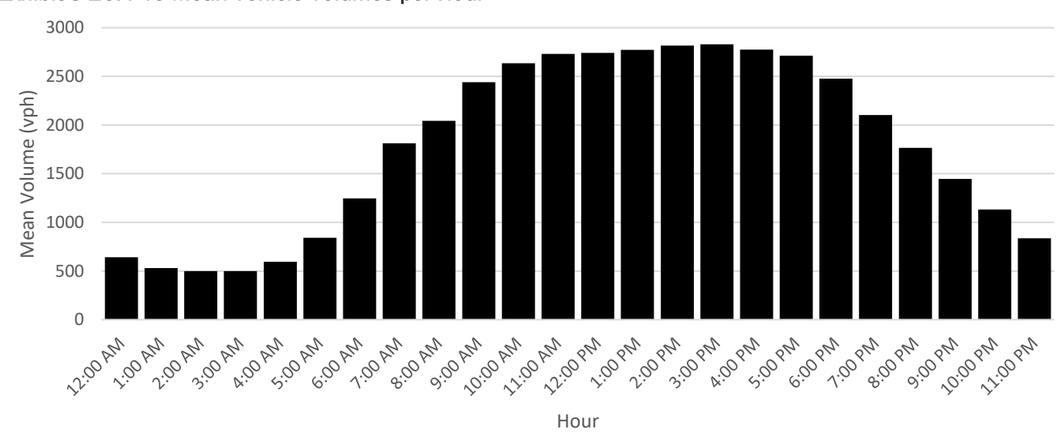
a The Gallup Zone extends from approximately MP 15.5 to MP 26.5.

Hours of Interest (High-8)

Traffic friction is the impediment that vehicles face while driving on a roadway. Traffic friction can result from road dynamics such as traffic volumes, geometric design, topography, and weather. High traffic friction may result in increased travel time, reduced mobility, increased emissions, increased fuel consumption, and driver frustration. Traffic friction may also indicate strained road capacity. This analysis intends to identify traffic friction on I-40 in the study area by evaluating and comparing the mean vehicle speeds during the busiest times of day between passenger and commercial vehicles.

For the I-40 study area, the busiest hours of the day have mean traffic volumes exceeding the 75 percentile traffic volume of the day. The 8 busiest hours for I-40 in the study area occur between 10:00 AM and 6:00 PM; those hours are identified as the High-8 for the study area. Exhibit 3-26 shows a histogram of mean vehicle volumes by the hour.

Exhibit 3-26. I-40 Mean Vehicle Volumes per Hour



vph = vehicles per hour

Comparison of Mean Speeds

The study team analyzed and compared the mean traffic speeds on I-40 in the study area by splitting the speed data by the High-8 hours of interest and the other 16 hours of the day. Exhibit 3-27 summarizes the mean speeds for passenger and commercial vehicles throughout the day during High-8 hours and the remaining 16 hours. The mean speed of passenger vehicles is 75.6 mph throughout the day, and similar mean speeds occur between 10:00 AM and 6:00 PM at 75.2 mph and 75.9 mph during all other times. A similar trend emerges for the mean speeds of commercial vehicles. Commercial vehicles generally travel at a mean speed of 70.9 mph, and similar mean speeds of 71.1 mph and 70.8 mph are seen during the High-8 hours and the hours of midnight and 10:00 AM and 6:00 PM to midnight. These observations suggest that the I-40 in the study area experiences minimal traffic friction in the study area.

Exhibit 3-27. I-40 Comparison of Mean Speeds by Time Period and Vehicle Type

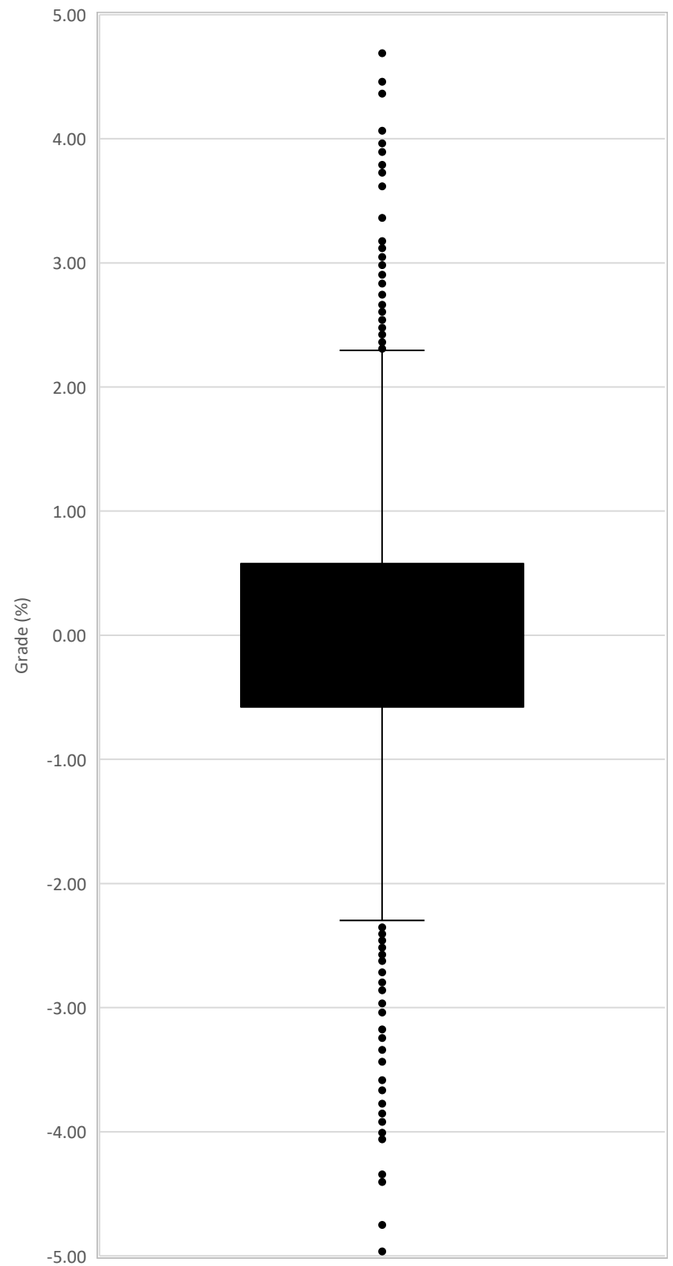
Period	Mean Speed (mph)	
	Passenger	Commercial
12:00 AM – 12:00 AM	75.6	70.9
10:00 AM – 6:00 PM (High-8 hours)	75.2	71.1
12:00 AM to 10:00 AM and 6:00 PM to 12 AM	75.9	70.8

mph = miles per hour

Topography and Mean Speeds

The study team sought to evaluate mean vehicle speeds related to topography because traffic friction results from various roadway attributes, not solely traffic volumes. The study team hypothesized that mean vehicle speeds decrease as the road grade increases. With the available elevation data for I-40, a variable for grade percentage was determined for each of the 1,200 quarter-mile segments. Exhibit 3-28 shows the distribution of grades by segment for I-40 in the study area.

Exhibit 3-28. I-40 Road Grade Distribution



The study team used this distribution to disaggregate I-40's segments into 3 grade types: flat, ascending, and descending. Segments are considered flat if the grade is between -0.6% and 0.6%, while ascents and descents have grades greater than 0.6% and less than -0.6%, respectively.

Exhibit 3-29 plots the mean passenger vehicle speed per segment by road grade. This plot shows a trend line indicating a negative relationship between mean speed and road grade. In other words, the mean passenger vehicle speed decreases as the road grade increases.

Exhibit 3-29. I-40 Passenger Vehicle Speeds by Roadway Grade

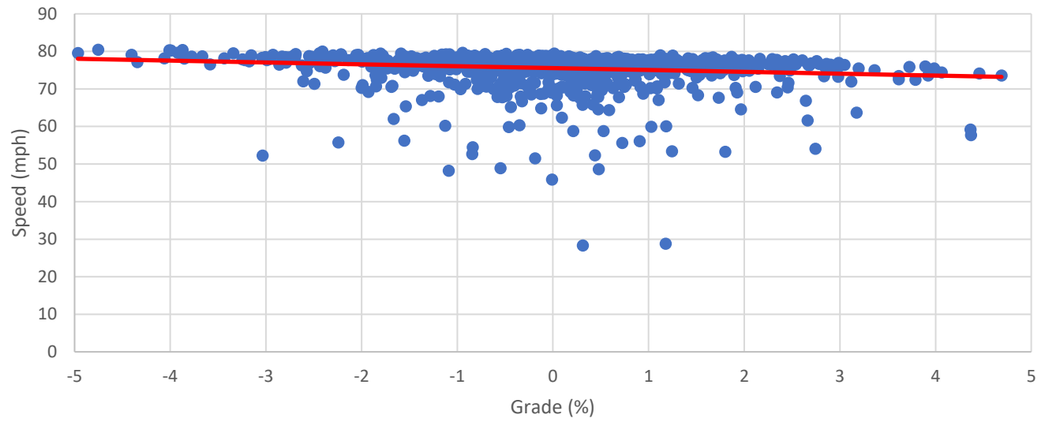
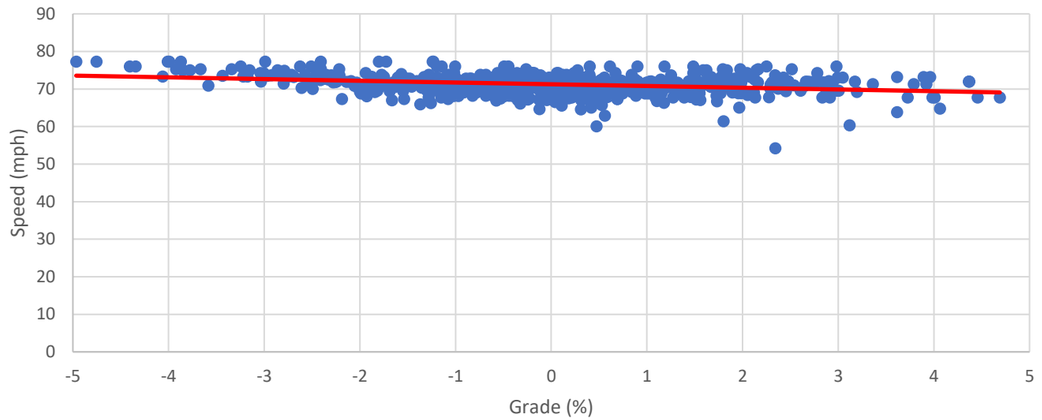


Exhibit 3-30 plots the mean commercial vehicle speed per segment by road grade. Like the passenger vehicle speeds, this plot shows that mean commercial vehicle speeds decrease as the road grade increases. Note that speed data for commercial and passenger vehicles were segmented using different methods. Commercial vehicle segmentation was spatially related to the Wejo segmentation containing bearing and grade data for the grade and curve analyses. By relating 382 segments to 1,200 segments, some granularity and accuracy of mean speeds are lost for commercial vehicles. However, this method acts as an exploratory tool to view trends related to roadway topography and curvature.

Exhibit 3-30. I-40 Commercial Vehicle Speeds by Roadway Grade



Road Curvature and Mean Speeds

The study team also evaluated mean vehicle speeds related to road curvature under the hypothesis that mean vehicle speeds decrease as the road's curvature increases. The study team used the available curvature data to determine a variable for bearing change for each of the 1,200 quarter-mile segments. Exhibit 3-31 and Exhibit 3-32 show the mean passenger and commercial vehicle speeds per segment by bearing change. This plot shows a negative relationship between mean speed and bearing change. In other words, the mean vehicle speed decreases when the road's curvature increases for all vehicles traveling the corridor.

Exhibit 3-31. I-40 Passenger Vehicle Speeds by Roadway Curvature

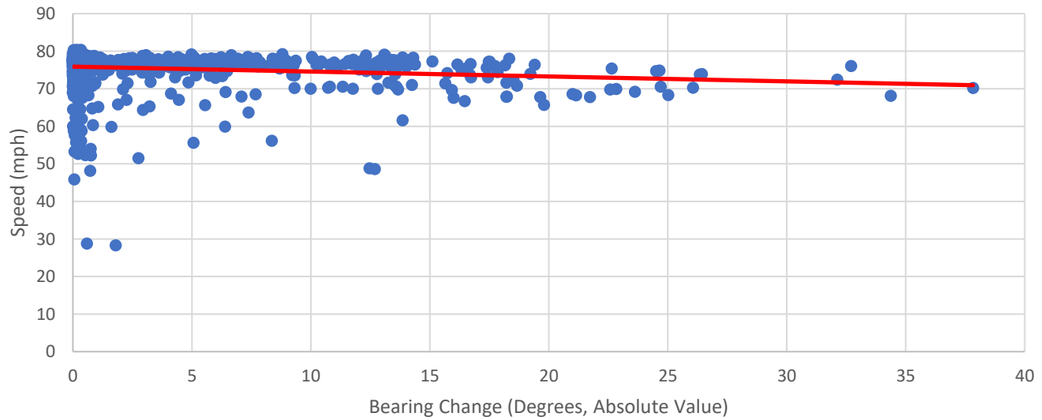
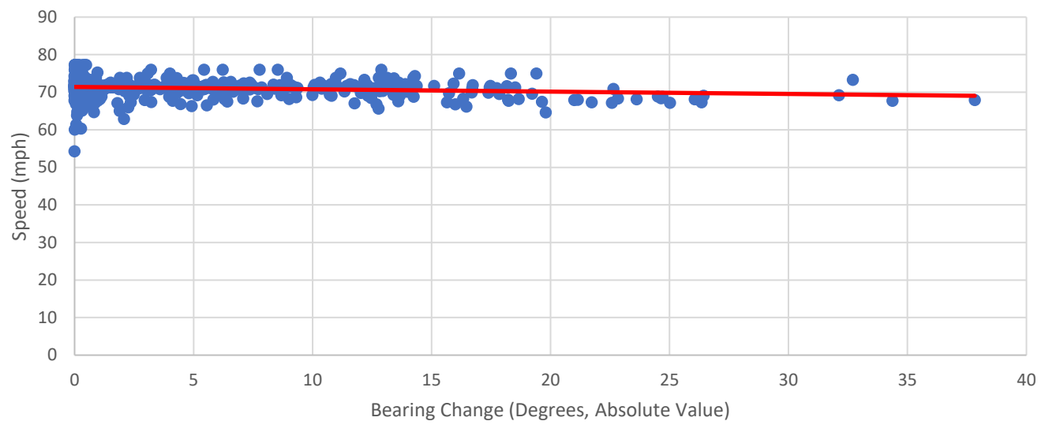


Exhibit 3-32. I-40 Commercial Vehicle Speeds by Roadway Curvature



3.7.3.5 Origin and Destination Findings

An origin-destination (O/D) analysis was used to understand how traffic moves within the I-40 study area, identify travel patterns, and determine which origins and destinations are significant trip generators and attractors. The analyses are based on data available in Wejo and Geotab datasets.

Passenger Vehicle O/D

O/D data were collected from vehicle movement data at 9 target locations in the I-40 study area. Vehicle movement data are available for short distances on either side of the associated interchanges. Using these interchange approaches and departures, polygons were drawn directly off interchanges and assumed that if vehicles exit/enter from that interchange, they are originating there or have that as their destination. Vehicles with a heading (direction of travel) towards I-40 were counted as originating from that location. Vehicles with a heading (direction of travel) away from I-40 were counted as having that location as their destination.

From the passenger vehicle analysis, the 3 largest trip generators are the 3 largest attractors: Arizona, Gallup, and Albuquerque. The O/D trip with the most volume originates in Arizona, traveling eastbound on I-40 to NM 602/491, with Gallup as the destination, as shown in Exhibit 3-33. Inversely the second highest volume originates in Albuquerque, traveling west with Arizona as the destination, as shown in Exhibit 3-34. For passenger vehicles, the subsequent highest volumes are vehicles originating in Arizona or Albuquerque, with Gallup or Arizona as the destination.

Exhibit 3-33. O/D Proportions of Eastbound Passenger Vehicles

	Destination						
Origin	EB I-40 @ AZ	EB I-40 to NM 602/491	NM 53	NM 117	NM 6	EB I-40 @ ABQ	Other
EB I-40 @ AZ	1%	57%	1%	0%	1%	39%	~1%

ABQ = Albuquerque, AZ = Arizona, EB = eastbound, O/D= origin-destination, NM = New Mexico

Exhibit 3-34. O/D Proportions of Westbound Passenger Vehicles

	Destination						
Origin	WB I 40 @ AZ	WB I40 to NM 602/491	NM 53	NM 117	NM 6	WB I 40 @ ABQ	Other
WB I 40 @ ABQ	49%	29%	8%	3%	2%	10%	~0%

ABQ = Albuquerque, AZ = Arizona, NM = New Mexico, O/D = origin-destination, WB = westbound

Commercial Vehicle Data

Commercial O/D data evaluation focused on state and US highways in the I-40 study area. Commercial vehicle traffic primarily travels through the I-40 study area as opposed to destinations within the I-40 study area. Exhibit 3-35 summarizes eastbound trips made by commercial vehicles. These data indicate that nearly 90% of commercial vehicle trips originate west of New Mexico and terminate east of the I-40 study area beyond MP 150, whether in Albuquerque or beyond. These data also show that Gallup is an important destination in the corridor.

Exhibit 3-35. O/D Proportions of Eastbound Commercial Vehicles

From/To	Gallup	Grants	NM 6	Through
EB I-40 @ AZ	11.8%	0.0%	0.8%	87.4%

AZ = Arizona, O/D = origin-destination

A similar trend emerges in the westbound direction, with approximately 80% of commercial trips originating and terminating outside of the study area between the Arizona State line and Albuquerque. Exhibit 3-36 summarizes westbound commercial vehicle trips. Like eastbound trips, Gallup is an important destination for westbound traffic.

Exhibit 3-36. O/D Proportions of Westbound Commercial Vehicles

From/To	Gallup	Grants	NM 6	Through
WB I-40 @ ABQ	16.4%	1.9%	0.6%	81.1%

ABQ = Albuquerque, O/D = origin-destination

3.7.4 Freight

3.7.4.1 Overview

The study team acquired and evaluated national and state freight movement datasets related to I-40. These included the:

- Freight Analysis Framework version 5 (FAF5) data from the FHWA
- National Performance Management Research Data Set (NPMRDS) to help identify freight bottlenecks on I-40 by calculating the truck travel time reliability (TTTR) index
- Truck volume and permit information from the Gallup Port of Entry

This information, along with the traffic counts and vehicle classification, provides comparison data to understand truck freight movement on I-40 within the study area.

In addition, the study team:

- Reviewed the NMDOT *2045 Freight Plan Update* (NMDOT 2023a) that was under development at the time of the freight assessment.
- Developed truck travel time maps to show potential truck driving distances to/from the I-40 study area.
- Conducted a field visit to better understand available truck parking and available resources.
- Met with the New Mexico Trucking Association and conducted a truck driver survey to better understand key issues and challenges for the freight community. Results of the freight survey are discussed in Chapter 2.

3.7.4.2 Freight Analysis Framework (FAF)

FAF Methods

The FAF5 is a model that was jointly developed by the Bureau of Transportation Statistics and the FHWA. It is intended to generate a comprehensive picture of origin-to-destination freight movements broken out by mode and commodity. The primary model inputs are a Commodity Flow Survey as well as datasets from other industries designed to produce comprehensive results. "The FAF5 provides estimates for tonnage and value by regions of origin and destination, commodity type, and mode for base year 2017 and 30-year forecasts. FAF5 forecasts provide a range of future freight demands at five-year increments [...] by various modes of transportation." The FAF website and data viewer were used in this analysis and are located at https://ops.fhwa.dot.gov/freight/freight_analysis/faf/ (FHWA 2023a).

Highway Network Assignment

The FAF5 also includes the Highway Network Assignment Model. The highway network is comprised of the National Highway System, Strategic Highway Network, and the National Highway Freight Network. The development of this model was "a multi-step process to disaggregate FAF [origin-destination] commodity flows to a more detailed zone system, convert commodity flows to truck trips, and assign those truck trips to a model highway network" (FHWA 2023a).

To convert commodity flows to estimated truck trips by type of truck, the model uses payload factors to estimate the number of tons a single truck could transport of a given commodity type. A sample of some of the payload factors are displayed in Exhibit 3-37.

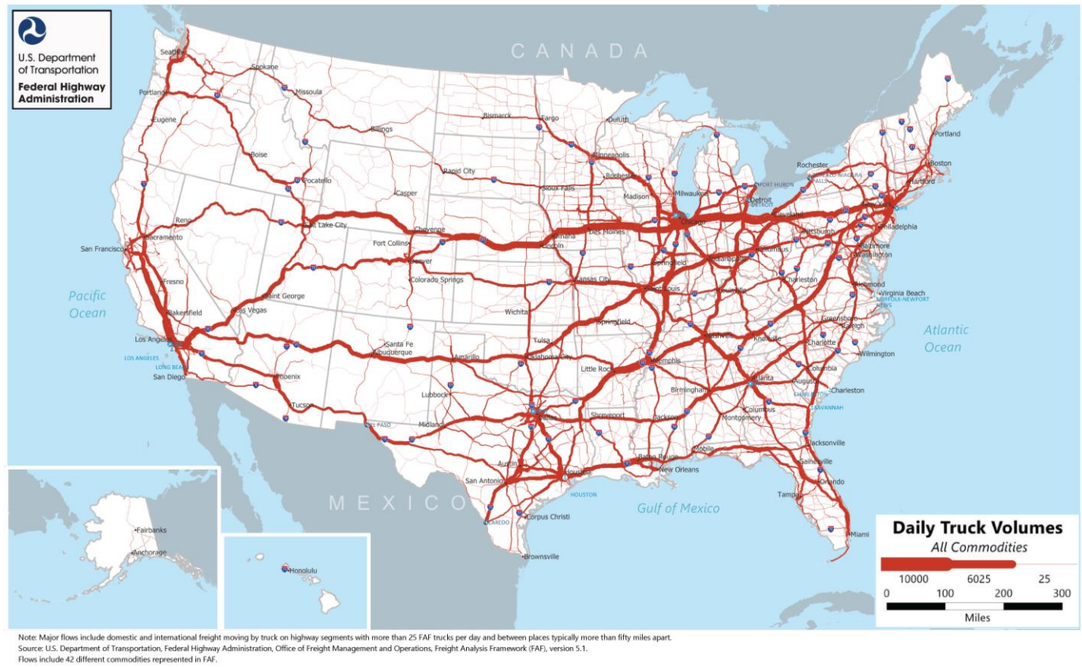
Exhibit 3-37. Sample Average Payload Factors in Tons per Truck

Commodity	Single Unit Trucks	Combination Unit Trucks
Meat/seafood	11.37	20.17
Pharmaceuticals	8.51	21.03
Wood products	15.45	22.12
Electronics	9.12	14.74
Mixed freight	10.21	19.21

Source: FHWA 2023a

The extrapolated number of trucks traveling between each origin and destination zone were grounded in reality by the model by assigning these truck volumes to the national highway system. To mimic the traffic conditions that influence truck routing decisions, 2017 traffic data from the National Performance Management Research Data Set (NPMRDS) was incorporated in the model network. Exhibit 3-38 displays the estimated daily truck volumes on the model network from FAF5. Note that when comparing parallel east-west interstate routes in the west to I-40 in New Mexico, only I-80 in Wyoming has a higher estimated daily truck volume.

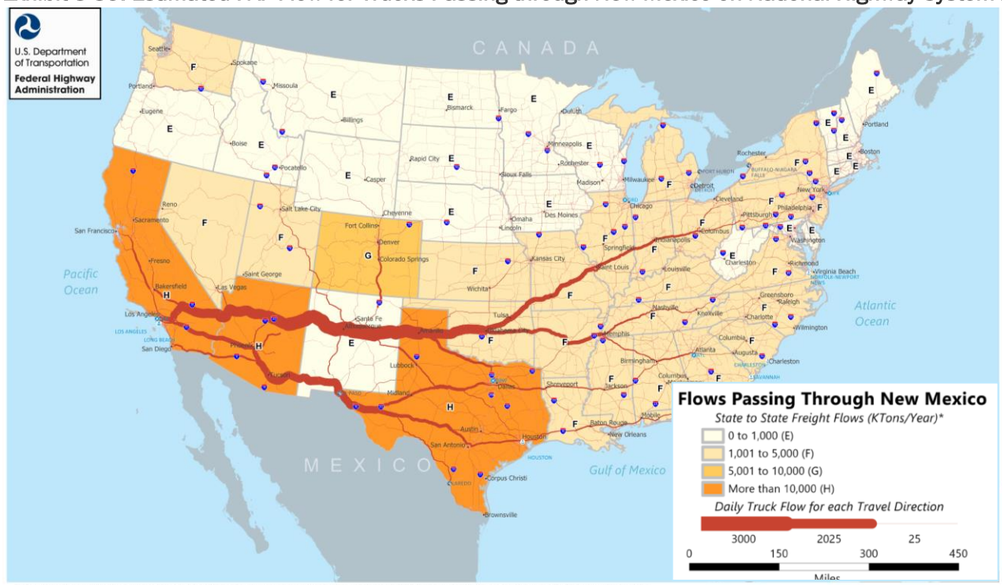
Exhibit 3-38. Estimated Average FAF Daily Volumes for Trucks on National Highway System 2017



Source: https://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/index.htm

Exhibit 3-39 and Exhibit 3-40 show the estimated truck flow results as they specifically relate to New Mexico's truck traffic. Exhibit 3-39 shows that the I-40 corridor predominantly serves truck traffic passing through New Mexico, particularly when compared to truck flows that that begin and/or end within the state. This is consistent with the information on commercial vehicle data that were shown in the Commercial Vehicle Data O/D analysis shown previously in Exhibit 3-35 and Exhibit 3-36. The primary sources of this truck traffic are southern California, Arizona, and Texas.

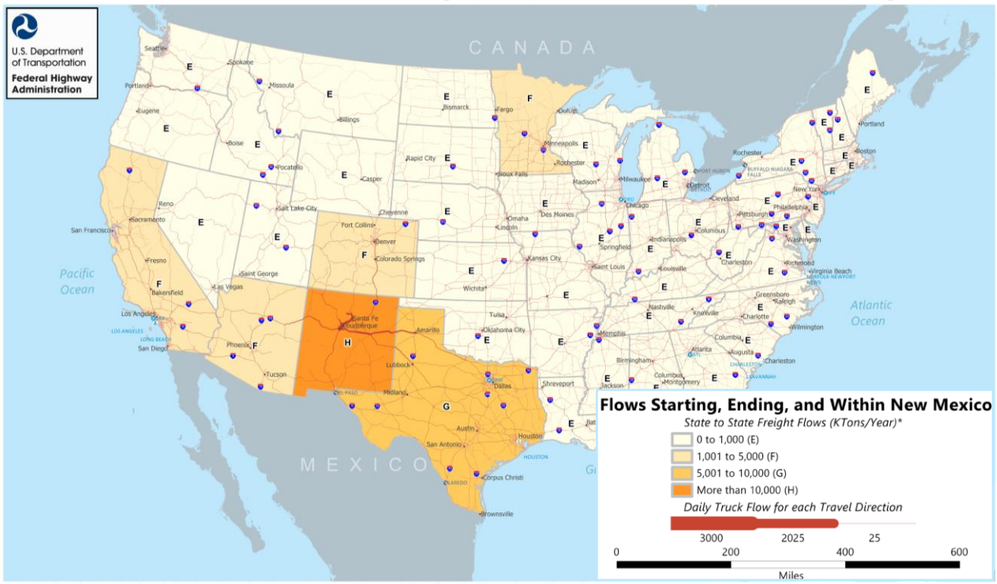
Exhibit 3-39. Estimated FAF Flow for Trucks Passing through New Mexico on National Highway System 2017



Note: Major flows include domestic and international freight moving by truck on highway segments with more than twenty-five FAF trucks per day and between places typically more than fifty miles apart.
Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1. Flows include 42 different commodities represented in FAF.
*State to State flows represent annual KTons of freight transported by trucks that pass through New Mexico including imports and exports that use New Mexico as the gateway port.

Source: https://ops.fhwa.dot.gov/freight/freight_analysis/state_info/new_mexico/nm.htm

Exhibit 3-40. Estimated FAF Flow for Trucks Going to, from, and within New Mexico on National Highway System 2017



Note: Major flows include domestic and international freight moving by truck on highway segments with more than twenty-five FAF trucks per day and between places typically more than fifty miles apart.
Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 5.1. Flows include 42 different commodities represented in FAF.
*State to State flows represent annual KTons of freight transported by trucks within New Mexico, and between New Mexico and other States. Flow does not include imports and exports that use New Mexico as the gateway port and go out of the state.

Source: https://ops.fhwa.dot.gov/freight/freight_analysis/state_info/new_mexico/nm.htm

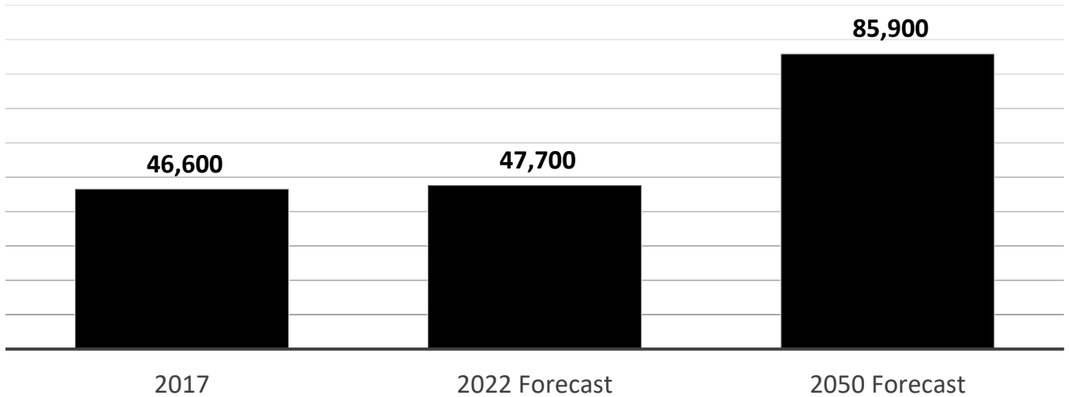
I-40 Specific Estimation

The highway network with estimated commodity flows are available for download in GIS. To arrive at a single figure for the whole study corridor, the total mass of cargo transported was averaged and weighted based on the component segment's length. The results for the eastbound and westbound directions were summed to produce the values displayed below. The same calculation methodology was applied to parallel segments of I-80 in Wyoming and I-10 in New Mexico.

FAF Findings

Exhibit 3-41 shows that in 2017 the national freight network model assignment estimated that the I-40 study area transports approximately 46,600 thousand tons of cargo per year. These values slightly increase in the forecasted model year of 2022. By 2050, the model estimates that cargo mass will grow by 84.3% to 85,900 thousand tons per year. Given that the vast majority of the truck traffic within the I-40 study area is passing through the state, there will be an increased need for long-term truck parking. However, where parking will be needed within the study area specifically will depend on where most truck trips begin their 9 to 11 hours of daily driving. This is a subject that is explored in greater depth in a subsequent section.

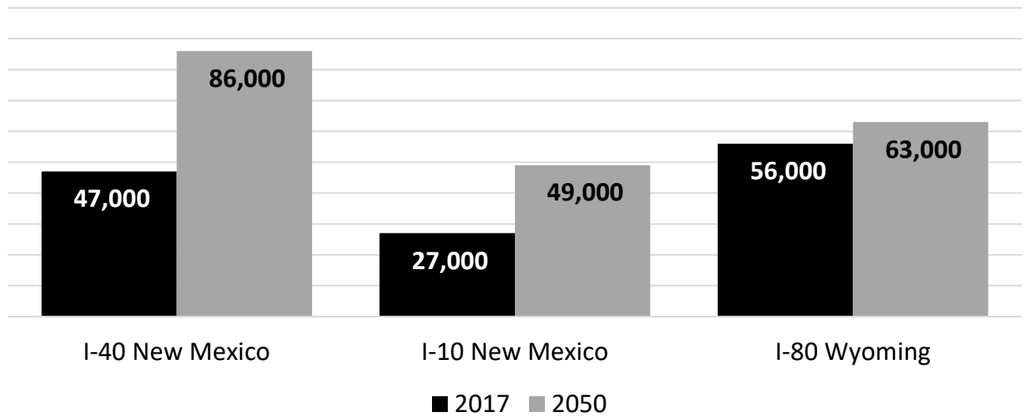
Exhibit 3-41. I-40 Average Commodity Flows in Thousand Tons by Year



Comparable Corridors and Forecasts

To provide additional context for these figures, the same calculation methodology was applied to parallel segments of I-80 in Wyoming and I-10 in New Mexico. Exhibit 3-42 shows that in 2017 base year, I-80 is estimated to transport slightly more cargo per year than I-40. By comparison, I-10 in New Mexico carries approximately half as much cargo as I-40. However, in the forecast year of 2050, tonnage on I-40 and I-10 both grow by over 80%, while I-80 increases by 19%.

Exhibit 3-42. I-40 Commodity Flows in Thousand Tons per Year



3.7.4.3 Freight Data from the National Performance Management Research Data Set (NPMRDS)

NPMRDS Methods

The NPMRDS is a dataset provided by FHWA for state and local transportation agencies to assess the performance of the National Highway System. The dataset includes vehicle probe-based travel time and speed data. TTTR is one of the common measures derived from NPMRDS data and is a comparison of free-flow speeds versus average speeds experienced by heavy trucks.

NPMRDS Findings

In the New Mexico State Freight Plan Update, statewide TTTR, along with other technical factors such as truck average annual daily traffic (AADT) and delay, was combined with stakeholder feedback to identify freight bottlenecks on the New Mexico interstate and state highway system. Two bottlenecks occurred within the I-40 study area:

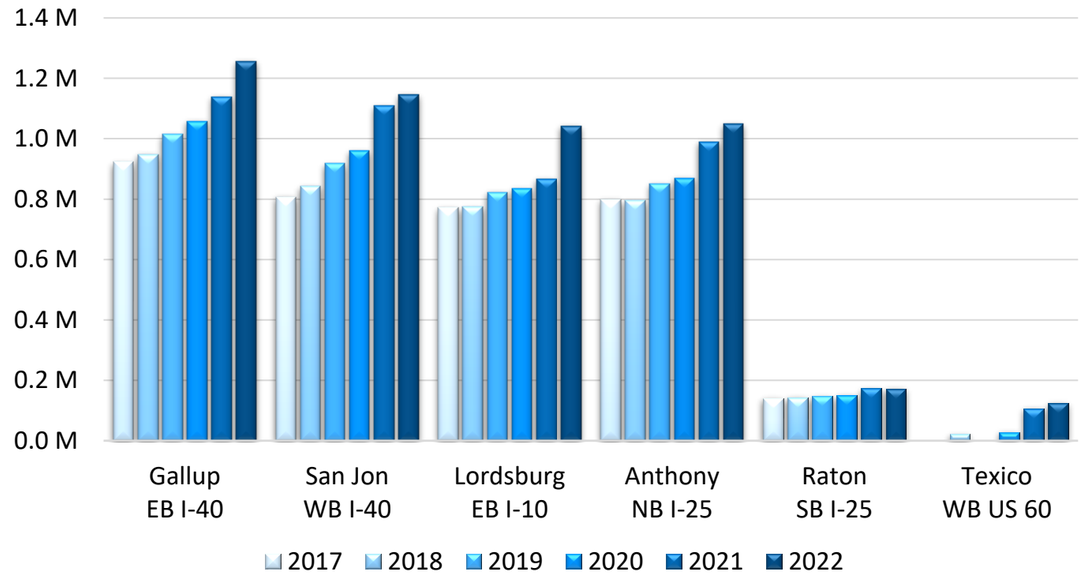
- I-40 Eastbound MP 108 to 114
- I-40 Westbound MP 126 to 121

Both identified bottlenecks are likely related to construction activity on I-40 near the Laguna Pueblo occurring during the timeframe reflected in the NPMRDS dataset. The construction activity corrected curve deficiencies and installed a concrete barrier in the median. The bottleneck area should continue to be monitored as new data becomes available to determine if the TTTR data were skewed by the construction-related slowdowns or if the highway project mitigated a previous bottleneck condition.

3.7.4.4 Gallup Port of Entry Data

The study team explored Port of Entry freight volume data at 6 locations in New Mexico highways for the last 6 years (2017 to 2022). One Port of Entry is within the study area on eastbound I-40 near Gallup (MP 12). The other I-40 Port of Entry is on westbound I-40 near San Jon (MP 358). The Port of Entry data for eastbound I-40 near MP 12 indicates a 36% volume increase with 6% annual growth rate from 2017 to 2022 for vehicles processed by the Port of Entry. Exhibit 3-43 summarizes the annual volumes processed by each Port of Entry.

Exhibit 3-43. Port of Entry Freight Volumes



3.7.4.5 Considerations from the NMDOT *Freight Management Plan*

The NMDOT completed the 2045 New Mexico Freight Plan Update (2045 NMFP) in March 2023. The 2045 NMFP contains the following items relevant to the I-40 study area.

A Freight Advisory Committee (FAC) consisting of public and private stakeholders was formed to provide input on the 2045 NMFP process. The FAC was asked about safety and security related needs on the New Mexico freight system. Responses included the following themes that have relevance to the I-40 study area:

- Truck parking: setting truck parking capacity on public parking rest areas, prohibiting truck parking on ramps and along roadways unless there is an emergency, matching hours of service requirements with provision of safe truck parking.
- Infrastructure: deteriorated road surface conditions that lead to vehicle control issues, tire shreds from truck tire blowouts.
- Other: distracted driving, susceptibility of traffic control devices to cyber security attacks, insufficient Port of Entry and weigh stations to manage illegal freight.

The 2045 NMFP cites the 2021 New Mexico Highway Safety Plan as noting that 5.7% of crashes statewide involved a heavy truck in 2018. This value is a sizable difference from what is experienced in the I-40 study area where heavy truck-involved crashes accounted for about 50% of all crashes in 2021 (discussed in Section 3.8.3).

The 2045 NMFP also conducted a network safety data screening of the National Highway Freight Network (NHFN) in New Mexico. The screening identified several Tier 1 locations within the I-40 study area meaning these road segments have the highest potential for safety improvement on the NHFN.

Implementation strategies within the 2045 NMFP include completing a comprehensive truck parking study to evaluate the location, availability, and utilization of rest areas and truck stops and prioritize truck parking investment decisions. An additional strategy is to develop methods to identify and prioritize key freight bottlenecks that lack redundancy. The I-40 corridor was specifically mentioned by FAC members as lacking redundancy.

The 2045 NMFP outlines a freight investment plan to prioritize National Highway Freight Program funds. Currently, the freight investment plan does not include any projects within the I-40 study area.

3.7.4.6 Truck Travel Time Analysis

Methods

To better understand the truck parking needs along the I-40 corridor, it is important to consider both the freight network and the regulatory environment that drivers operate within. According to the Federal Motor Carrier Safety Administration, truck drivers hauling freight long distance may drive a maximum of 11 hours after 10 consecutive hours off duty (FMCSA 2023). These 11 hours of driving can also include time lost in traffic congestion, warehouse delays, or stopping for breaks. Thus, a truck driver will require safe, legal parking for their required long rest period after spending roughly 9 to, at most, 11 hours on the road. Due to New Mexico's proximity to major freight origins, this often involves parking within the I-40 study area.

The network analyst functionality of GIS was utilized to estimate how far a truck could travel from common freight origins in 9 to 11 hours of driving. Nine hours of driving was selected to form the lower end of the range to account for delays beyond the driver's control. Since trucks move more slowly and in some locations are subject to a lower speed limit, truck travel time data were applied to the highway freight network. This data came from the NPMRDS dataset, which is a source of transportation system performance measures. It "contains field-observed travel time and speed data collected anonymously from a fleet of probe vehicles (cars and trucks) equipped with mobile devices" (NPMRDS 2023). The data include the average amount of time that trucks traveled along each subsegment of the network for a given period of time. This analysis is based in truck travel time figures from August 2021. August was selected because it is the busiest time of year for trucking.

Each simulated day of driving originated in the industrial areas of 11 cities in the western and midwestern states. From these points, a simulated truck trip propagates out into the network, accumulating time as the truck "travels" along the highway network. When the threshold of 9 and 11 hours is reached, the simulated driver will need to park somewhere between these 2 areas. In cases when there is major traffic congestion, drivers will need to park closer to the origin than 9 hours.

Truck Travel Time Findings

The following cities were analyzed but did not have their drive time contour overlap with the I-40 corridor study extents:

- Kansas City, MO
- Bakersfield, CA
- San Antonio, TX
- Las Vegas, NV
- Albuquerque, NM

Salt Lake City was also analyzed; however, due to being the furthest north, trucks traveling from this origin would be unlikely to drive along the I-40 corridor. Drivers with a route that involves I-40 in New Mexico and who begin their day of driving in the following 5 cities may require parking in the study area:

- San Diego, CA
- Long Beach, CA
- Riverside, CA
- Dallas, TX
- Oklahoma City, OK

As shown, in Exhibit 3-44, trucks traveling from San Diego may reach the western extents of the I-40 study corridor. However, given the notorious traffic in southern California, it is likely that trucks would struggle to reach the New Mexico portions of I-40.

San Diego, CA

Exhibit 3-44. One Truck Driving Day from San Diego, CA

Long Beach, CA

As shown in Exhibit 3-45, under the right conditions, trucks coming from the port of Long Beach would be able to reach at most the western third of I-40 in the study area. Similar to San Diego, this line would also shift further west into Arizona when traffic congestion is worse than what was captured in the August 2021 NPMRDS data.

Exhibit 3-45. One Truck Driving Day from Long Beach, CA

Riverside, CA

Trucks that begin the day driving from Riverside, CA, could likely reach the western two-thirds of the I-40 study corridor, as shown in Exhibit 3-46.

Exhibit 3-46. One Truck Driving Day from Riverside, CA

Dallas, TX

Trucks traveling from Dallas, TX, would likely be able to reach the eastern third of the I-40 study area, as shown in Exhibit 3-47.

Exhibit 3-47. One Truck Driving Day from Dallas, TX

Oklahoma City, OK

Trucks coming from Oklahoma City would likely reach the western third of the I-40 study area, as shown Exhibit 3-48.

Exhibit 3-48. One Truck Driving Day from Oklahoma City, OK

3.7.4.7 Truck Parking and Facilities

Truck Parking Inventory

A truck parking inventory was performed to determine the existing number of truck parking spaces on the I-40 corridor within the study boundaries. The truck parking inventory evaluated existing truck parking locations, amenities, and number of available truck parking spaces on I-40.

Existing truck parking spaces were determined through an on-site field visit and inspection of commercial truck stops, rest areas, and ports of entry along the corridor in July 2022, as well as an evaluation of aerial imagery and data gathered from the Trucker Path app. The majority of truck parking is located at commercial truck stops, but there are also several casinos with commercial truck stop facilities that provide truck parking spaces. The 3 casinos are the Sky City Casino at Exit 102, the Dancing Eagle Casino at Exit 108, and the Route 66 Casino at Exit 140. It is worth mentioning that, as part of stakeholder interviews, the study team was informed that some trucking companies may not allow trucks to part at casinos. Two rest areas near the Arizona border also provide truck parking spaces. There is also an eastbound Port of Entry near MP 12 near Gallup, but there are no overnight truck parking spaces at this location.

Exhibit 3-49 shows the existing truck parking inventory and is separated into 2 categories: commercial truck stops spaces and rest area spaces. As shown in Exhibit 3-49, there are 1,389 existing truck parking spaces at commercial truck stops and 31 existing truck parking spaces at rest areas, for a total of 1,420 truck parking spaces on I-40 between the Arizona border at MP 0 and Atrisco Vista Boulevard at MP 150 in Albuquerque.

Exhibit 3-49. Truck Parking Inventory

Truck Stop Name	Exit/MP	Location	Number of Truck Spaces
Speedy's Truck Stop (Arizona)	359	Arizona border	20
Love's Travel Stop	16	Gallup	36
TA Travel Center	16	Gallup	76
U-Save Truck Stop	16	Gallup	48
Flying J Travel Center	39	Jamestown	185
Bowlin's Bluewater Outpost/DQ	72	Bluewater	10
Love's Travel Stop	79	Milan	29
Petro Travel Center	79	Milan	200
Sky City Travel Center	102	Acoma Pueblo	175
Dancing Eagle/Route 66 Travel Center	108	Casa Blanca	195
Route 66 Casino/Route 66 Travel Center	140	Albuquerque	172
Love's Travel Stop	149	Albuquerque	63
Flying J Travel Center	153	Albuquerque	180
		Total Truck Stop Spaces	*1,389*
Lupton, AZ (WB) Public Rest Area (Arizona)	359	Lupton, AZ	10
Manuelito (EB) Public Rest Area	3	Manuelito	21
		Total Rest Area Spaces	*31*
		Grand Total	**1,420**

AZ = Arizona, EB = eastbound, WB = westbound

Several commercial truck stops are clustered at Gallup and Milan, accounting for 160 truck parking spaces and 239 truck parking spaces, respectively. Most of the other commercial truck stops are located at the casinos between Exit 102 and Exit 140, which accounts for 542 of the 1,420 total truck spaces, and in west Albuquerque on the far east end of the corridor where there are 243 truck parking spaces.

Truck Parking Space Availability

Truck parking space availability was evaluated during a field visit of the I-40 corridor on Thursday, July 28, and Friday, July 29, 2022. General observations of available truck parking spaces in the I-40 study area include the following.

1. Truck parking is available at the casinos.
2. There are fewer available truck parking spaces at commercial truck stops.
3. Both public rest areas were closed.
4. Trucks were observed parking on the shoulders.
5. Trucks were observed parking on both entrance and exit ramps.

Truck parked on shoulder of I-40.

The NMDOT recognizes the safety issues of trucks parking on entrance and exit ramps and has deployed several solutions to prohibit trucks from parking on the ramps. They include signing the ramps with various signs clearly stating no parking and installing delineators, berms, and concrete barriers on the ramps. In addition to the solutions deployed by the NMDOT, additional law enforcement may also help to administer the no parking law on ramps. However, fines for parking on ramps are generally much lower than federal hours of service violations, which can exceed $20,000. For some drivers, additional law enforcement may not be a deterrent if parking on ramps is an effort to avoid an hours-of-service violation.

Truck parked on ramp at Exit 100 on I-40.

Truck parking space availability was analyzed using the Trucker Path application, which gives daily and weekly reports that detail truck parking space availability at each of the truck parking locations. Truck parking data were observed over several weeks in August and September 2022. The Trucker Path application reports truck parking availability in 3 categories: Full (Red), Not Too Full (Yellow), and Usually Not Full (Green). Note these data are based on user input and have not been validated.

The data showed that generally the truck parking areas on the corridor were considered "Full" most often on Friday, Saturday, and Sunday nights. The truck parking lots were considered "Not Too Full" most often on Tuesday and Thursday nights, and the truck parking lots were considered "Usually Not Full" most often on Monday nights.

Signs, delineators, and concrete barriers prohibit truck parking on ramp.

The commercial truck stops where the truck parking lot was reported as "Full" on 3 or more nights per week were the Love's Travel Stop, TA Travel Center, and the U-Save Truck Stop in Gallup; the Flying J Travel Center in Jamestown at Exit 39; the Love's Travel Center and Petro Travel Center in Milan at Exit 79; and the Love's Travel Stop and Flying J Travel Center in Albuquerque at Exits 149 and 153. Generally, the 3 casino truck parking sites at the Sky City Casino (Exit 102), Dancing Eagle Casino (Exit 108), and Route 66 Casino (Exit 140) were reported as "Not Too Full" or "Usually Not Full" the majority of the time and only rarely reported as "Full." Exhibit 3-50 shows the general daily truck parking availability at each of the commercial truck stops on the corridor as reported on the Trucker Path application.

Exhibit 3-50. Truck Parking Availability on I-40 (Trucker Path App User Input Data)

Exit	Commercial Truck Stop	Location	Truck Parking Availability (Night)						
			Mon	Tues	Wed	Thu	Fri	Sat	Sun
359	Speedy's Truck Stop	AZ border							
16	Love's Travel Stop #215	Gallup							
16	TA Travel Center Gallup #8	Gallup							
16	U-Save Truck Stop	Gallup							
39	Flying J Travel Center #305	Jamestown							
72	Bowlin's Bluewater Outpost	Bluewater							
79	Love's Travel Stop #257	Milan							
79	Petro Milan Travel Center #313	Milan							
102	Sky City Travel Center	Acoma Pueblo							
108	Dancing Eagle/Route 66 TC	Casa Blanca							
140	Route 66 Casino/Route 66 TC	Albuquerque							
149	Love's Travel Stop #614	Albuquerque							
153	Flying J Travel Center #689	Albuquerque							

Source: Trucker Path Application. AZ= Arizona, Green = Usually Not Full, Orange = Not Too Full, Red = Full, Gray = Incomplete Data

Truck Parking Demand Analysis

Truck parking demand for I-40 within the study area was calculated using a parking demand model formula developed by the FHWA. A simplified version of the formula is: $D = THT * P_{avg}$, where D = truck parking demand, THT = truck hours of travel per day on the analysis segment, and P_{avg} = the average parking time per truck hour of travel. The formula predicts peak hour truck parking demand based on the number of truck hours traveled per segment of highway, adjusting for seasonal variance, percent of long-haul versus short-haul trucks, and park-to-drive time per week.

Using the parking demand formula, predicted peak hour truck parking demand was calculated for I-40 from the Arizona State line (MP 0) to I-25 in Albuquerque (MP 160). The average daily truck volume on I-40 is about 11,000 trucks per day. There are 1,420 existing truck parking spaces in the I-40 study area, and the predicted peak hour truck parking demand for the I-40 analysis area is 1,540 truck parking spaces. Therefore, the truck parking demand model predicts that there is a deficit of 120 truck parking spaces on the I-40 corridor. Exhibit 3-51 details truck parking demand for the I-40 study area.

Exhibit 3-51. Truck Parking Demand

Segment of I-40	Truck Average Annual Daily Traffic	Existing Truck Parking Spaces	Peak Hour Truck Parking Demand	Shortage/Surplus
Arizona State Line to Atrisco Vista Boulevard	11,000	1,420	1,540	-120

The results of the truck parking demand analysis indicate that there currently exists a potential deficit of truck parking spaces in the I-40 study area between Arizona and Atrisco Vista Boulevard to accommodate the peak hour truck parking demand. This correlates with the truck parking availability analysis from the Trucker Path app that shows that, at certain times and locations, truck parking does appear to be full (most likely at facilities near Gallup and Albuquerque). As truck volumes on the I-40 corridor continue to grow in the future, additional truck parking will be needed to accommodate future truck parking demand.

3.7.4.8 Freight Survey

A freight survey was conducted as part of the study. Methods and findings of the survey are discussed in Chapter 2, Section 2.7.

3.7.5 Growth and Future Traffic Projections

3.7.5.1 Methods

The study team reviewed the NMDOT MS2 System to access historic traffic data from the existing NMDOT ATRs for the I-40 corridor study area. The ATR data were used to evaluate historical traffic patterns and trends and develop a growth rate for traffic projections to the year 2050. There are 4 ATR locations within the study area, located at MPs 13, 80, 93, and 144. Additionally, the study team evaluated one I-40 ATR station at MP 222, east of Albuquerque near Clines Corners, to compare volumes and safety-related trends. The NMDOT ATRs are not actively counting, but historical data are available.

Other data sources used to establish historic trends include truck volume data from the NMDOT Port of Entry systems across the state and I-40 ATR data in Texas and Arizona maintained by the Texas Department of Transportation and the Arizona Department of Transportation. Additionally, the study team acquired traffic growth projections from the NMDOT Highway Performance Monitoring System (HPMS) data and Mid-Region Council of Governments (MRCOG) regional travel demand model data, and the New Mexico Northwest Regional Transportation Planning Organization (NWRTPO) to provide further context.

3.7.5.2 Findings

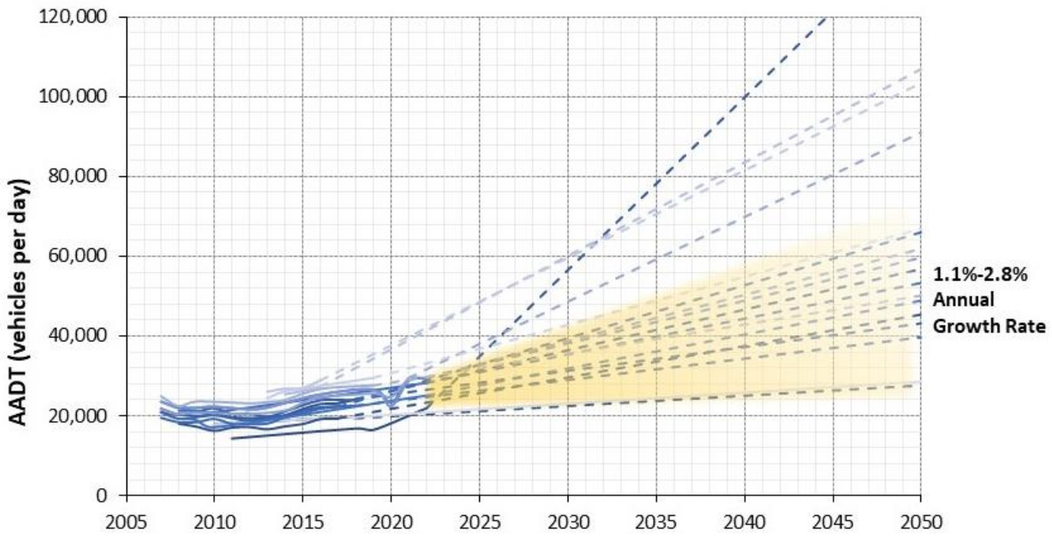
ATR Data

The NMDOT MS2 system was explored to obtain I-40 ATR data as far into the past as possible. The study team discovered that the years ATR data are available, as well as the times of year data are available, is intermittent. Some ATRs supplied data as far back as 2007. The shortest duration for ATR data was back to 2013. In all cases, no ATR provided continuous data across multiple years for more than a few years at a time. In particular, no single ATR features a single, continuous year of data since 2017.

To analyze historic trends as best as possible, the study team identified several windows of time where NMDOT ATR data were consistently available across multiple years. For example, at MP 80 (ATR 34331), data were available for the 74-day period from May 19 to July 31 for the years 2007 to 2018. Multiple windows of time were selected for each ATR and historic trendlines were developed.

Using multiple historic trendlines of ATR volume for I-40, the study team extrapolated AADT volumes to the year 2050. Exhibit 3-52 illustrates historic ATR volumes and the extrapolated growth. The extrapolated lines reflect a variety of growth rates. Analysis shows that the higher growth rates tend to arise from historic trendlines based on fewer years of data, more recent years of data, or both. For example, most ATRs experience steep growth following a dip in 2020 volumes due to the COVID-19 pandemic. A growth rate skewed heavily by post-COVID-19 traffic volume growth may not accurately reflect the long-term trend. The growth rates based on longer-term historic data tend to cluster around growth rates ranging from 1.1% to 2.8%.

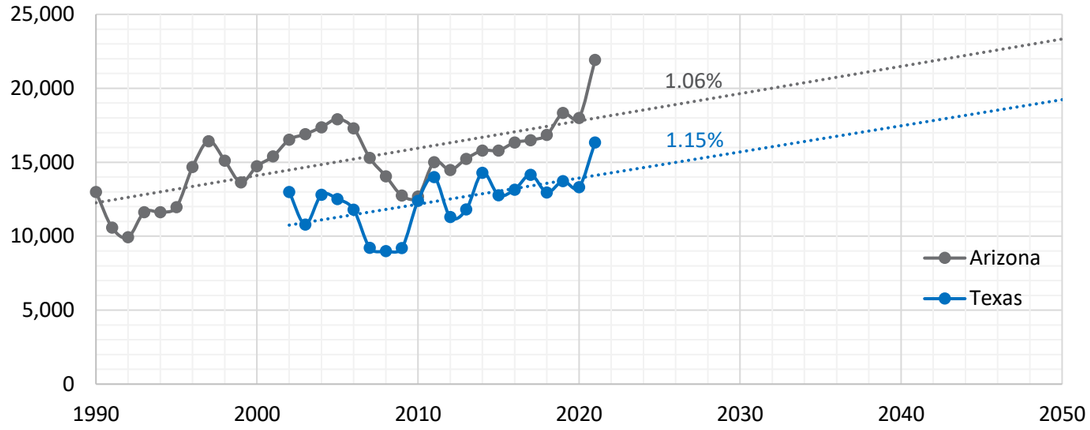
Exhibit 3-52. I-40 Historic AADT Data and Extrapolated Growth



AADT = average annual daily traffic

The study team evaluated historic data from 2 I-40 ATRs in Arizona and Texas near the New Mexico border. Exhibit 3-53 summarizes the ATR data for the past several years. The ATR data in Arizona and Texas shows low annual growth rates for the last 20 to 30 years — 1.06% for Arizona and 1.15% for Texas. However, both states also show a sharp increase in 2021.

Exhibit 3-53. I-40 Historic AADT in Arizona and Texas



Port of Entry Data

As discussed previously in Section 3.7.4 and shown in Exhibit 3-43, the Gallup Port of Entry for eastbound I-40 has seen a 36% volume increase with 6% annual growth rate from 2017 to 2022 for vehicles processed by the Port of Entry. This data suggest that the freight growth has been strong over the past several years.

NMDOT HPMS

Finally, the study team obtained data from the 2022 NMDOT HPMS submittal to FHWA. The data include current year volume and a forecast to the year 2041 for all interstates and state highways in New Mexico. The study team calculated that forecasts for I-40 in the study area assume a 1.55% annual growth rate. It should be noted that HPMS traffic forecasts are based on an analysis of historic ATR data.

MRCOG Travel Model Forecasts

MRCOG maintains a regional travel demand model for the Albuquerque metro area that extends west on I-40 to NM 6 (MP 126). The study team obtained base year (2016) and forecast year (2040) volumes on I-40 from the travel demand model for the I-40 area from NM 6 to Atrisco Vista Boulevard. Analyzing traffic volumes, the study team determined the travel demand model estimates a 1% to 2% annual growth rate on I-40.

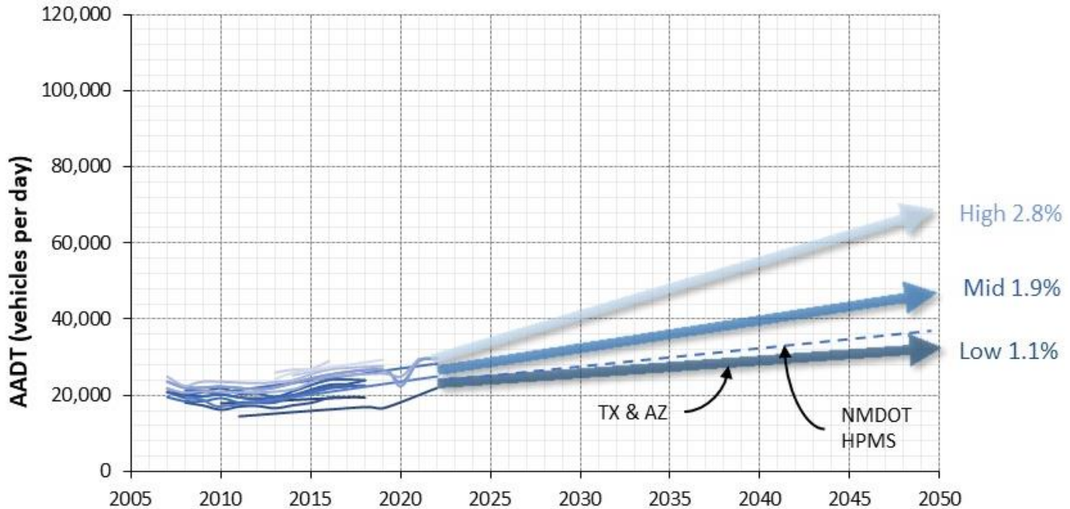
NWRTPO Population Forecasts

The NWRTPO is the regional transportation planning organization for Northwest New Mexico, covering McKinley, Cibola, and San Juan counties. The I-40 study area is located in the NWRTPO's planning area as it travels through McKinley and Cibola counties. As such, the study team obtained population forecasts from the Northwest New Mexico Regional Transportation Plan (NWRTPO 2022) to consider as part of providing an estimated growth rate. Based on this data, population growth is not expected in McKinley County through 2040, and annual population growth is expected to be less than 1% in Cibola County through 2040. As such, population growth in the communities surrounding I-40 is not expected to contribute much to overall vehicle volume growth in the I-40 study area.

Growth Rate Findings for the I-40 Study Area

Due to the variability in historic ATR data and other sources, the study team developed a range of scenarios (low, mid, and high) to bracket the most plausible future growth rates. The range was based on the most concentrated cluster of extrapolated ATR trendlines and informed by volume data from the other sources discussed in this section. The "high" scenario was established at an annual growth rate of 2.8%, which is an aggressive growth rate in the context of all data sources but also omits trendlines that appeared to be outliers. It was determined that trendlines with growth rates higher than 2.8% were often based on limited years of ATR data. The "low" scenario was set at an annual growth rate of 1.1%, which is the lowest growth rate derived by ATR and is similar to data from ATRs in Arizona and Texas. The "mid" scenario was set at an annual growth rate of 1.9%. The mid scenario is higher than the growth rate used for the HPMS scenario but also considers the steeper uptick in traffic volumes in recent years seen at both NMDOT ATRs as well as Port of Entry volumes. Because of this, the mid-growth rate of 1.9% was selected as being most representative of expected growth in the I-40 study area for 2050 HCM capacity projections discussed in Section 3.7.6 . Exhibit 3-54 depicts the 3 growth scenarios.

Exhibit 3-54. I-40 AADT Developed Growth Rates



AADT = average annual daily traffic, AZ = Arizona, HPMS = Highway Performance Monitoring System , NMDOT = New Mexico Department of Transportation, TX = Texas

All growth scenarios result in a substantial increase in traffic volumes by 2050. Under the low growth scenario, traffic volumes on I-40 would increase by about 35% compared to today's volumes. The mid-growth scenario of 1.9% correlates with an overall 64% increase in volumes, whereas the high growth rate of 2.8% would result in today's volumes doubling by 2050. This results in a forecasted range of AADT on I-40 from about 30,000 to 60,000 vehicles per day, depending on the growth scenario and the location on I-40 in the study area. Following the mid-growth scenario, total daily truck traffic would increase from about 11,000 heavy trucks per day to about 18,600 heavy trucks per day.

3.7.6 Highway Capacity/Level of Service

3.7.6.1 Methods

The Highway Capacity Manual (HCM) 7th Edition published by the Transportation Research Board (TRB) provides the state-of-the practice methodology for evaluating freeway operations (TRB 2022). HCM methodologies use a density-based assessment to define an operating LOS.

The methodology for freeway density-based analysis for basic freeway segments involves the following steps:

1. Identify the sections of freeway to be analyzed and define the study area's boundaries. This typically includes the length of the freeway segment, the number of lanes, and any on and off-ramps.
2. Collect traffic data, including traffic volumes, vehicle classification, and speed, for both peak and non-peak periods.
3. Determine the freeway density. Density is calculated by dividing the number of vehicles on the freeway by the length of the roadway using established formulas.

   $D = V_p/S$

   D = density (passenger cars per hour per lane [pc/mi/ln])

   S = average passenger-car speed (mph)

   V_p = demand flow rate under equivalent base condition (pc/h/ln)

   $V_p = V / (PHF \times N \times f_{hv})$

   V = demand volume under prevailing condition (vehicles per hour [veh/h])

   PHF = peak hour factor

   N = number of lanes in analysis direction (ln), and

   f_{hv} = adjustment factor for presence of heavy vehicles

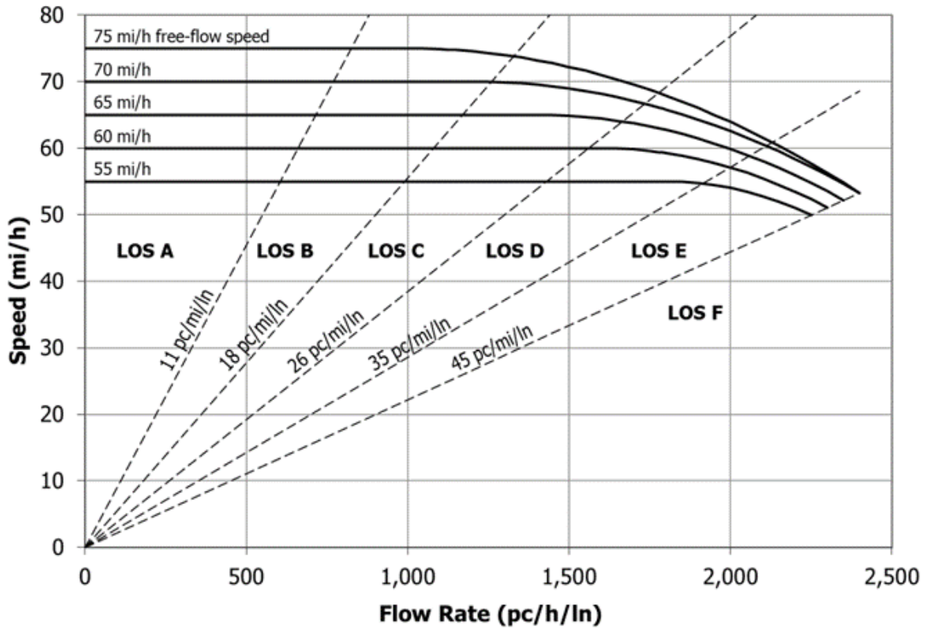
   $F_{hv} = 1 / (1+P_t(E_t-1))$

   P_t = proportion of single unit trucks (SUTs and heavy trucks (TT) in traffic stream

   E_t = passenger car equivalent (PCE) of one heavy vehicle in the traffic stream

4. Determine LOS, based on the calculated density according to Exhibit 3-55.

Exhibit 3-55. LOS Criteria and Speed–Flow Curves for Basic Freeway Segments (HCM)

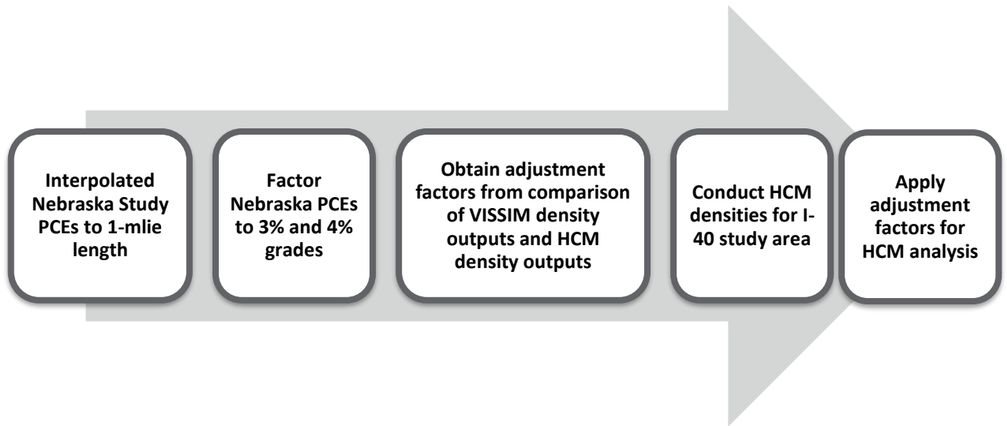


Source: Exhibit 12-16 LOS Criteria and Speed–Flow Curves for Basic Freeway Segments (HCM 7th Edition)
HCM = Highway Capacity Manual, LOS = level of service, mi/h = miles per hour, pc/h/ln = passenger cars per hour per lane

Rural western interstates present challenges to the HCM methods of calculating freeway capacity. As identified by a 2019 research study using data from I-80 in western Nebraska, HCM methods cannot consider truck percentages over 25%, and they assume heavy trucks and passenger cars have similar operating speeds, assume trucks have shorter lengths than currently observed, and are based on having 3 lanes in each direction (Zhou et al. 2019).

In the case of I-40 between the Arizona State line and Albuquerque, many of these assumptions are not valid. For example, truck percentages typically range from 30% to 50%, heavy truck lengths tend to be longer than assumed in HCM due to the proliferation of long-haul freight vehicles, the 75 mph speed limit results in passenger cars and heavy trucks having disparate speeds, and I-40 is primarily 2 lanes in each direction.

Because of the limitations of HCM methodologies identified by the 2019 Nebraska study, the study team developed a modified approach to evaluate I-40 operations. The modified approach centered on 2 major steps. First, the team used data and conclusions from the 2019 study to adjust the HCM PCE factor used in HCM computations. Second, the team used custom VISSIM traffic microsimulation models to develop factors to adjust HCM outputs across the I-40 study area.



2019 Nebraska Study PCE Adjustments

The 2019 Nebraska study examined the conditions on I-80 through Nebraska and developed PCE values that better reflect western interstate conditions. The conditions on I-80 that challenge HCM methodologies are similar to the I-40 study area, such as high heavy truck percentages, differences between heavy truck and vehicle operating speeds, and having 2 freeway lanes (rather than 3) in each direction.

The 2019 Nebraska study provided a variety of PCE values for a range of analysis lengths and SUT/TT percent splits. The Nebraska PCE values also were only derived for level sections of freeway. The study team obtained the Nebraska study PCE values with the highest SUT/TT split (30% SUT/70% TT) and interpolated to a 1-mile analysis length. Then, the study team calculated adjustment factors to develop PCE estimates for 3% and 4% grades.

Exhibit 3-56 illustrates the Nebraska research output for the PCEs values for level segments with a 30% SUT/70% TT spilt for varying overall truck percentages and analysis lengths. The PCE values for the 1-mile analysis length was interpolated by the study team from the PCEs values at 0.875 and 1.25 miles.

Exhibit 3-56. 2019 Nebraska Research Output

Grade	Segment Length	Truck %				
		25%	35%	45%	55%	65%
0%	0.875	2.82	2.81	2.86	2.97	3.13
	1[a]	2.83*	2.81*	2.87*	2.98*	3.14*
	1.25	2.84	2.82	2.88	2.99	3.15

* PCE values at 1 mile have been interpolated from the PCEs values at 0.875 and 1.25 mile

Since the 2019 Nebraska study does not include PCEs values for segments with grades, an adjustment was made to estimate PCE values for 3% and 4% grades. This was done by first calculating the difference in HCM PCEs values for level segments and segments with grades. This “delta difference” was then applied to the Nebraska PCE values for level segments to approximate a study-adjusted PCE for 3% and 4% grade segments.

Exhibit 3-57 documents the calculation of the delta adjustment factors between HCM PCEs for level segments and 3% and 4% grades. Exhibit 3-58 documents the application of the delta adjustment factors to Nebraska PCE values for level segments in Exhibit 3-59 to arrive at the study-adjusted PCEs for 3% and 4% grade segments.

Exhibit 3-57. PCEs for a Mix of 30% SUTs and 70% TTs (HCM-7 Exhibit 12-26)

Grade	Segment Length (miles)	PCEs Values with > 25% Truck
0%	0.875	1.97
	1	*1.97*
	1.25	1.97
2.5%	0.875	2.28
	1	*2.29*
	1.25	2.31
3.0%*	0.875	2.37
	1	2.38
	1.25	2.41
3.50%	0.875	2.46
	1	*2.47*
	1.25	2.5
4.0%*	0.875	2.57
	1	2.59
	1.25	n/a**
4.50%	0.875	2.67
	1	2.7
	1.25	n/a**
Difference between 0% and 3%	0.875	0.40
	1	0.41
	1.25	0.44
Difference between 0% and 4%	0.875	0.60
	1	0.62
	1.25	n/a**

HCM = Highway Capacity Manual, PCE = passenger car equivalent, SUT = single unit truck, TT = heavy truck

*PCE values from HCM-7 at 3% and 4% grades have been interpolated since these 2 grades were not included in the HCM-7 Exhibit 12-26.

**HCM-7 does not provide values above 1 mile segment length at 4.5% grade

Exhibit 3-58. Adjusted PCE Values for a Mix of 30% SUTs and 70% TTs at 3% Grades with Delta from 0% Grade

PCEs Values with Delta Adjusted from 0% Grade						
		Truck %				
Grade	Length	25%	35%	45%	55%	65%
3.00%	0.875	3.22	3.21	3.26	3.37	3.53
	1	3.24	3.23	3.28	3.39	3.55
	1.25	3.28	3.26	3.32	3.43	3.59

HCM = Highway Capacity Manual, PCE = passenger car equivalent, SUT = single unit truck, TT = heavy truck

Exhibit 3-59. Adjusted PCE Values for a Mix of 30% SUTs and 70% TTs at 4% Grades with Delta from 0% Grade

PCEs Values with Delta Adjusted at 0% Grade						
		Truck %				
Grade	Length	25%	35%	45%	55%	65%
4.0%	0.875	3.42	3.41	3.46	3.57	3.73
	1	3.44	3.43	3.48	3.59	3.75
	1.25*	n/a	n/a	n/a	n/a	n/a

HCM = Highway Capacity Manual, PCE = passenger car equivalent, SUT = single unit truck, TT = heavy truck

*HCM-7 does not provide values above 1 mile segment length at 4.5% grade

VISSIM Microsimulation

The study team developed VISSIM models for rural interstate conditions similar to I-40 to further address the study area conditions that challenge HCM methodologies. Traffic density outputs were calculated from the VISSIM models and compared to HCM density outputs for similar input conditions. The result was a set of adjustment factors that could be applied to HCM outputs across the I-40 study area. The process is explained in detail in the following sections.

VISSIM Model Inputs

The VISSIM model was coded with a 2-lane, 15-mile freeway segment with different scenarios to represent varying grades, percentage of trucks, and volume inputs as summarized below. The combination of variables resulted in 45 unique model runs.

- Grades: Level (0%), 3%, and 4%
- Percent trucks: 25%, 35%, 45%, 55% and 65%
- Input volumes: 800 vehicles per hour (vph), 1,000 vph, and near-failure volume (2,000 vph, 2,100 vph, or 2,250 vph, depending on grade)

The level segment analysis was coded in VISSIM as a 15-mile network with no grades. Scenarios with grades were also a 15-mile network divided into a 2-mile level segment followed by 3 pairs of a 0.75-mile grade segment and a 3.5-mile level recovery segment.

Driver Behavior Model

The VISSIM models were coded with the “use slow lane rule” driver behavior model in which drivers remain in the right lane unless overtaking a slower vehicle. The study team used the default parameters of this driver behavior model except for one of the land change factors. The “to slower lane if collision time is above” parameter was changed from the default of 10 seconds to 60 seconds as part of the calibration process.

SUT % vs TT %

The total truck split between percent SUT versus percent TT was coded as 2% SUT and 98% TT, according to I-40 study area data collection.

Passenger Car Speed Profiles

A passenger car speed profile was developed from the Wejo speed dataset and integrated into the VISSIM model. These speed profiles were discussed in Section 3.7.3.

Heavy Truck Speed Profiles

Heavy truck speed profiles were developed from manual truck speed data collection in the I-40 study area. Truck speeds were measured for a level segment as well as a 3% grade and a 4% grade. The distribution of measured truck speeds were used to create the truck speed profiles for level segments as well as 3% and 4% grades. Exhibit 3-60 documents the speed profiles for heavy trucks within the VISSIM modeling.

Exhibit 3-60. Truck Speed Distributions for VISSIM Microsimulation

	Speed (mph)				
Grade	5th Percentile	15th Percentile	Median	85th Percentile	95th Percentile
Level	62	65	69	74	76
3%	56	59	65	70	73
4%	47	52	63	71	74

VISSIM Results

The link evaluation output from VISSIM was used to determine the volume and speeds for analysis segments. Using the PCEs developed in the previous step to convert VISSIM Link Evaluation volumes to a PCE, the study team then calculated a density output for each model.

Adjustment Factor

Next, the same 45 VISSIM model run scenarios were evaluated with HCM methodologies using the same inputs for grades, percent trucks, and input volumes. The resulting HCM densities were compared with corresponding VISSIM output densities. Comparing the density results from VISSIM models to HCM output for the same conditions, it was found that HCM methodology underestimates the density on conditions similar to the I-40 study area. Exhibit 3-61 shows the differences between the HCM density values and VISSIM model density outputs for 1,000 vph and varying truck percentages at 0%, 3% and 4% grades.

The ratio between the density outputs from VISSIM models to HCM was calculated for all scenarios. These ratios are presented in Exhibit 3-62. These ratios were used to adjust HCM density outputs for the I-40 study area analysis.

Exhibit 3-61. Density Output from VISSIM Model and HCM-7 with 1,000 vph at Different Grades and Truck Percentages

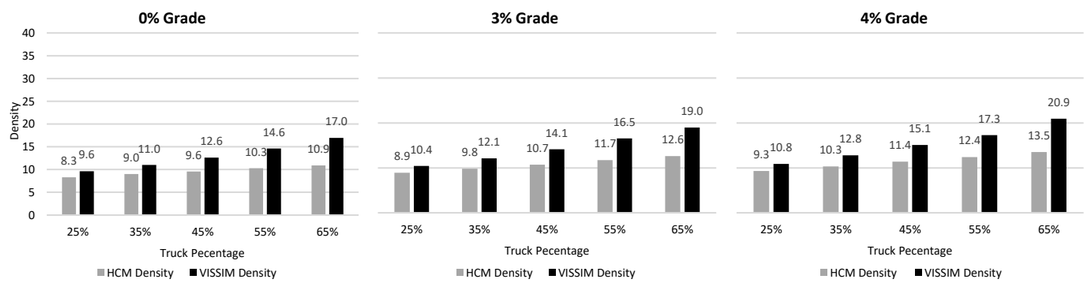
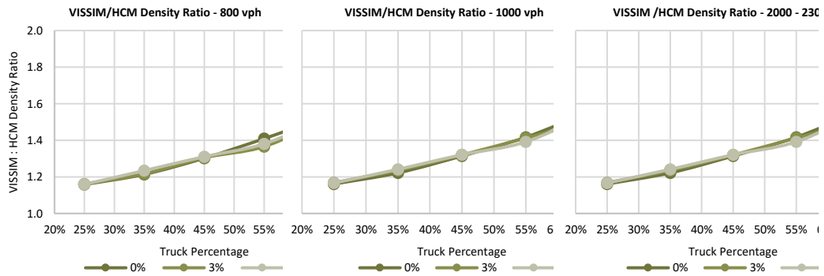


Exhibit 3-62. Ratio between Density Outputs from VISSIM Model and HCM-7



Determining Traffic Volumes in Gallup and Grants

Since mainline traffic volumes were not collected in Grants and Gallup, the study team used the ramp turning movement counts to derive vehicle volumes in Gallup and Grants.

Interchange Ramp Merge/Diverge Analysis

Capacity analysis was conducted for freeway merge/diverge areas at 16 interchanges in the study area. This included 4 interchanges in the Gallup area, 3 in the Grants area, and the interchange at the Route 66 Casino. In addition, it included 8 interchanges exhibiting at least 1 ramp with a daily volume exceeding 1,000 vehicles, as identified in Section 3.7.2.

Like basic freeway segment analysis, the HCM uses a density-based method to define an operating LOS for ramp merge/diverge areas. Lane-change maneuvers at merge and diverge areas at on-ramp or off-ramp cause turbulence that reduces capacity. The HCM methodology evaluates the ramp influence area defined as the outside 2 lanes adjacent to the acceleration lane at an on ramp up to 1,500 feet. For an off-ramp, the influence area is the outside 2 lanes adjacent to the deceleration lane up to 1,500 feet. The density thresholds for LOS are slightly different than for basic freeway segments and are presented in Exhibit 3-63.

Exhibit 3-63 LOS Criteria for Freeway Merge and Diverge Segments (HCM Exhibit 14-3)

LOS	Density (pc/mi/ln)
A	≤ 10
B	> 10–20
C	> 20–28
D	> 28–35
E	> 35
F	Demand exceeds capacity

HCM Exhibit 14-3.
HCM = Highway Capacity Manual, LOS = level of service, pc/mi/ln = passenger cars per hour per lane

The same PCEs and microsimulation-derived adjustment factors developed for the basic freeway segment analysis were applied to the ramp merge/diverge analysis.

3.7.6.2 Findings

HCM capacity analysis was performed for the I-40 study area for existing and future year 2050. I-40 in the study area was divided into 7 segments identified for traffic count data collection, as discussed in Section 3.7.1.1. The highest hourly volume with the highest truck percentages for eastbound and westbound was selected for analysis based on collected traffic count data. For 2050 conditions, the study team used the mid-growth projection of 1.9%. This rate was identified, in collaboration with the NMDOT, as being most representative of expected growth in the I-40 study area.

As mentioned previously, LOS is an indicator of how well a transportation facility is operating. It includes 6 levels designated by the letters A through F with LOS A representing the best operating conditions and LOS F the worst. LOS D is considered the failure threshold for rural interstate highway and ramp segments located in areas where the population is less than 5,000 as established by the *State Access Management Manual* (SAMM) (NMDOT 2001, Table 15.C-1). LOS E is considered the failure threshold for urban interstate highway and ramp segments located in areas where the population is 5,000 people or more per the *SAMM*. Urban area boundaries are identified by the FHWA based on 2020 United States Census Bureau data and include Gallup from about MP 13.5 to 29.7, Grants from about MP 78.5 to 85.6, and the eastern edge of Albuquerque near MP 144.5 (NMDOT 2024).

Level segments, segments with grades, and areas where ramps merge and diverge in the I-40 study area were analyzed using Highway Capacity Software (HCS7) software (an implementation of HCM methodologies) using project-derived PCEs and results were factored with the VISSIM-HCM results ratios to obtain freeway density values and the corresponding LOS.

Exhibit 3-64 illustrates the assessed basic segment's LOS results with existing volume, future 2050 with the mid-growth scenario. The analysis indicates that all segments operate at LOS A and LOS B with existing conditions. A few segments in Gallup would reach LOS D under the mid-growth scenario. I-40 through the rest of the study area is expected to reach LOS C.

Exhibit 3-64. I-40 Mainline Capacity Analysis

Approach	Segment	2022 Hourly Volume	Existing 2022 LOS	Future 2050: Mid-Growth 1.9%
EB	From Arizona border to W Gallup Interchange (MP 0-16)	800	LOS A	LOS C
	From W Gallup Hwy 66 Interchange to US-491 Interchange (MP 16-20)	864	LOS B	LOS C
	From US-491 Interchange to Miyamura Interchange (MP 20-22)	1006	LOS B	LOS D
	From Miyamura Interchange to E Gallup Hwy 66 Interchange (MP 22-26)	921	LOS B	LOS C
	From E Gallup Hwy 66 Interchange to Thoreau Interchange (MP 26-53)	850	LOS A	LOS C
	From Thoreau Interchange to Milan Hwy 605 Interchange (MP 53-79)	850	LOS A	LOS C
	From Milan Hwy 605 Interchange to Grants NM 53 Interchange (MP 79-81)	873	LOS A	LOS C
	From Grants Hwy 53 Interchange to Grants Santa Fe Ave Interchange (MP 81-85)	903	LOS B	LOS C
	From Grants Santa Fe Ave Interchange to Casa Blanca/Paraje Interchange (MP 85-108)	975	LOS B	LOS C
	From Casa Blanca/Paraje Interchange to NM 6 Interchange (MP 108-126)	975	LOS B	LOS C
	From NM6 Interchange to Route 66 Casino Interchange (MP 126-140)	970	LOS B	LOS C
	From Route 66 Casino Interchange to Atrisco Vista Blvd (MP 140-149)	1000	LOS B	LOS C
WB	From Atrisco Vista Blvd to Route 66 Casino Interchange (MP 149-140)	1100	LOS B	LOS C
	From Route 66 Casino Interchange to NM 6 Interchange (MP 140-126)	1019	LOS B	LOS C
	From NM 6 Interchange to Casa Blanca/Paraje Interchange (MP 126-108)	1050	LOS B	LOS C
	From Casa Blanca/Paraje Interchange to Grants Santa Fe Ave Interchange (MP 108-85)	1000	LOS B	LOS C
	From Grants Santa Fe Ave Interchange to Grants NM 53 Interchange (MP 85-81)	961	LOS B	LOS C
	From Grants NM 53 Interchange to Milan Hwy 605 Interchange (MP 81-79)	945	LOS B	LOS C
	From Milan Hwy 605 Interchange to Thoreau Interchange (MP 79-53)	950	LOS B	LOS C
	From Thoreau Interchange to E Gallup Hwy 66 Interchange (MP 53-26)	950	LOS B	LOS C
	From E Gallup Hwy 66 Interchange to Miyamura Interchange (MP 26-22)	1159	LOS B	LOS D
	From Miyamura Interchange to US-491 Interchange (MP 22-20)	1232	LOS B	LOS D
	From US-491 Interchange to W Gallup Hwy 6 Interchange (MP 20-16)	1101	LOS B	LOS D
	From W Gallup Hwy 66 Interchange to Arizona border (MP 16-0)	1000	LOS B	LOS C

EB = eastbound, LOS = level of service, WB = westbound

Exhibit 3-65 shows the LOS results for the evaluated sections at grades with existing volume, future 2050 with the mid-growth scenario. The analysis indicates that all sections with grades operate at LOS A or LOS B with existing volumes. Sections under the mid-growth scenario will operate at LOS B or LOS C.

Exhibit 3-65. I-40 Mainline Capacity Analysis for Sections with Grades over 3%

Direction	MP	Grade %	Truck %	2022 Existing		Future 2050: Mid-Growth 1.9%	
				Hourly Volume	LOS	Hourly Volume	LOS
EB	5.2 to 5.4	3.09%	45%	800	LOS A	1360	LOS C
EB*	40.1 to 40.6	3.23%	45%	850	LOS A	1440	LOS B
EB*	41.1 to 41.4	4.62%	45%	850	LOS A	1440	LOS B
EB	141.4 to 142.3	3.01%	45%	1000	LOS B	1690	LOS C
EB*	143.7 to 144.4	4.01%	45%	1000	LOS A	1690	LOS B
EB*	144.4 to 144.8	4.69%	45%	1000	LOS A	1690	LOS B
EB*	143.7 to 144.8	4.69%	45%	1000	LOS A	1690	LOS C
WB	76.5 to 77.1	3.02%	42%	950	LOS B	1610	LOS C
WB	103.7 to 104.4	3.83%	40%	1000	LOS B	1690	LOS C
WB	115.2 to 115.6	4.01%	35%	1050	LOS B	1780	LOS C
WB	138.6 to 139.2	3.99%	35%	1100	LOS B	1860	LOS C
WB*	150.0 to 150.4	4.47%	35%	1100	LOS A	1860	LOS B

*Within extents of existing climbing lane.
EB = eastbound, LOS = level of service, MP = milepost, WB = westbound

Merge and diverge segments are areas of unusual instability on freeways as drivers maneuver either to an appropriate lane from which to exit the highway (diverge) or other drivers enter the highway (merge). Reductions in speed on freeways, with corresponding increases in density on-ramps and off-ramps, occur in the immediate surrounding area of the merge or diverge segment.

Exhibit 3-66 shows the LOS results with existing and future 2050 with the mid-growth scenario for merge and diverge sections at 16 interchanges between MP 16 and MP 140. The analysis indicates that all merge and diverge areas operate at LOS A or LOS B, with 1 diverge area in Gallup operating at LOS C for existing conditions. The LOS results with the mid-growth scenario show that there are several interchange merge and diverge ramps that are expected to operate at LOS D or Eby 2050.

Exhibit 3-66. Capacity Analysis for Merge and Diverge Areas at Interchanges

Interchange Location	Direction	Count MP	Truck %	2022 Existing			Future 2050: Mid-Growth 1.9%		
				Hourly Volume Main	Hourly Volume Ramp	LOS	Hourly Volume Main	Hourly Volume Ramp	LOS
West Gallup Hwy 66 Interchange (Exit 16)	EB (Merge)	15	45%	659	205	LOS A	1120	350	LOS B
	EB (Diverge)	15	45%	800	141	LOS A	1360	240	LOS B
	WB (Merge)	15	40%	885	115	LOS A	1500	190	LOS C
	WB (Diverge)	15	40%	1101	216	LOS B	1860	370	LOS C
Gallup US-491 Interchange (Exit 20)	EB (Merge)1	15	45%	690	261	LOS A	1170	440	LOS C
	EB (Merge)2	15	45%	951	55	LOS B	1610	90	LOS D
	EB (Diverge)	15	45%	864	174	LOS B	1460	290	LOS D
	WB (Merge)	15	40%	885	216	LOS B	1500	370	LOS D
	WB (Diverge)	15	40%	1232	347	LOS B	2090	590	LOS E
Gallup Miyamura Interchange (Exit 22)	EB (Merge)	15	45%	835	86	LOS B	1410	150	LOS C
	EB (Diverge)	15	45%	1006	171	LOS B	1700	290	LOS D
	WB (Merge)	15	40%	1061	171	LOS B	1800	290	LOS D
	WB (Diverge)	15	40%	1159	98	LOS B	1960	170	LOS D
E Gallup Hwy 66 Interchange (Exit 26)	EB (Merge)	15	45%	769	146	LOS B	1300	250	LOS D
	EB (Diverge)	15	45%	921	152	LOS B	1560	260	LOS D
	WB (Merge)	15	40%	1015	144	LOS B	1720	240	LOS D
	WB (Diverge)	15	40%	1159	144	LOS C	1960	240	LOS E
McGaffey Interchange (Exit 33)	EB (Merge)	63	45%	800	50	LOS B	1360	80	LOS C
	EB (Diverge)	63	45%	850	50	LOS B	1440	80	LOS D
	WB (Merge)	63	42%	910	40	LOS B	1540	70	LOS D
	WB (Diverge)	63	42%	920	10	LOS B	1560	20	LOS D
Refinery Interchange (Exit 39)	EB (Merge)	63	45%	745	90	LOS A	1260	150	LOS B
	EB (Diverge)	63	45%	850	105	LOS B	1440	180	LOS C
	WB (Merge)	63	42%	865	85	LOS B	1470	140	LOS C
	WB (Diverge)	63	42%	965	100	LOS B	1630	170	LOS C
Thoreau Interchange (Exit 53)	EB (Merge)	63	45%	775	55	LOS A	1310	90	LOS B
	EB (Diverge)	63	45%	850	75	LOS A	1440	130	LOS B
	WB (Merge)	63	42%	855	95	LOS A	1450	160	LOS C
	WB (Diverge)	63	42%	900	45	LOS A	1520	80	LOS B
Milan Hwy 605 Interchange (Exit 79)	EB (Merge)	93	45%	709	164	LOS B	1200	280	LOS C
	EB (Diverge)	93	45%	862	153	LOS B	1460	260	LOS D
	WB (Merge)	93	40%	813	142	LOS B	1380	240	LOS C
	WB (Diverge)	93	40%	945	132	LOS B	1600	220	LOS D
Grants NM 53 Interchange (Exit 81)	EB (Merge)	93	45%	822	81	LOS B	1390	140	LOS C
	EB (Diverge)1	93	45%	873	18	LOS B	1480	30	LOS C
	EB (Diverge)2	93	45%	855	33	LOS B	1450	60	LOS C
	WB (Merge)	93	40%	920	25	LOS B	1560	40	LOS C
	WB (Diverge)	93	40%	961	41	LOS B	1630	70	LOS D
Grants Santa Fe Ave Interchange (Exit 85)	EB (Merge)1	93	45%	881	94	LOS B	1490	160	LOS B
	EB (Merge)2	93	45%	860	21	LOS B	1460	40	LOS B
	EB (Diverge)	93	45%	903	43	LOS B	1530	70	LOS D
	WB (Merge)	93	40%	897	64	LOS B	1520	110	LOS B
	WB (Diverge)	93	40%	1000	103	LOS B	1690	170	LOS D
Quemado (HWY 117) (Exit 89)	EB (Merge)	93	45%	950	55	LOS B	1610	90	LOS D
	EB (Diverge)	93	45%	975	25	LOS B	1650	40	LOS D
	WB (Merge)	93	40%	950	50	LOS B	1610	80	LOS D
	WB (Diverge)	93	40%	1010	60	LOS B	1710	100	LOS C
Acomita/Sky City Interchange (Exit 102)	EB (Merge)	93	45%	880	125	LOS B	1490	210	LOS C
	EB (Diverge)	93	45%	975	95	LOS B	1650	160	LOS B
	WB (Merge)	93	40%	860	140	LOS A	1460	240	LOS B
	WB (Diverge)	93	40%	940	80	LOS B	1590	140	LOS C
Casa Blanca/Paraje Interchange (Exit 108)	EB (Merge)	120	45%	895	110	LOS B	1520	190	LOS C
	EB (Diverge)	120	45%	975	80	LOS B	1650	140	LOS D
	WB (Merge)	120	40%	905	95	LOS A	1530	160	LOS B
	WB (Diverge)	120	40%	1035	130	LOS B	1750	220	LOS D
Laguna Interchange (Exit 114)	EB (Merge)	120	45%	970	75	LOS B	1640	130	LOS C
	EB (Diverge)	120	45%	1000	30	LOS A	1690	50	LOS B
	WB (Merge)	120	35%	1000	50	LOS A	1690	80	LOS B
	WB (Diverge)	120	35%	1060	60	LOS A	1800	100	LOS C
Los Lunas Interchange (HWY 6) (Exit 126)	EB (Merge)	120	45%	900	25	LOS B	1520	40	LOS C
	EB (Diverge)	120	45%	1000	100	LOS B	1690	170	LOS D
	WB (Merge)	120	35%	1005	45	LOS B	1700	80	LOS C
	WB (Diverge)	120	35%	1025	20	LOS B	1740	30	LOS C
Route 66 Casino Interchange (Exit 140)	EB (Merge)	140	45%	606	394	LOS A	1030	670	LOS C
	EB (Diverge)	140	45%	917	311	LOS B	1550	530	LOS C
	WB (Merge)	140	35%	968	88	LOS B	1640	150	LOS C
	WB (Diverge)	140	35%	1100	132	LOS B	1860	220	LOS C

EB = eastbound, LOS = level of service, WB = westbound

3.7.7 I-40 1-Lane Capacity Analysis for Construction and Maintenance Zones

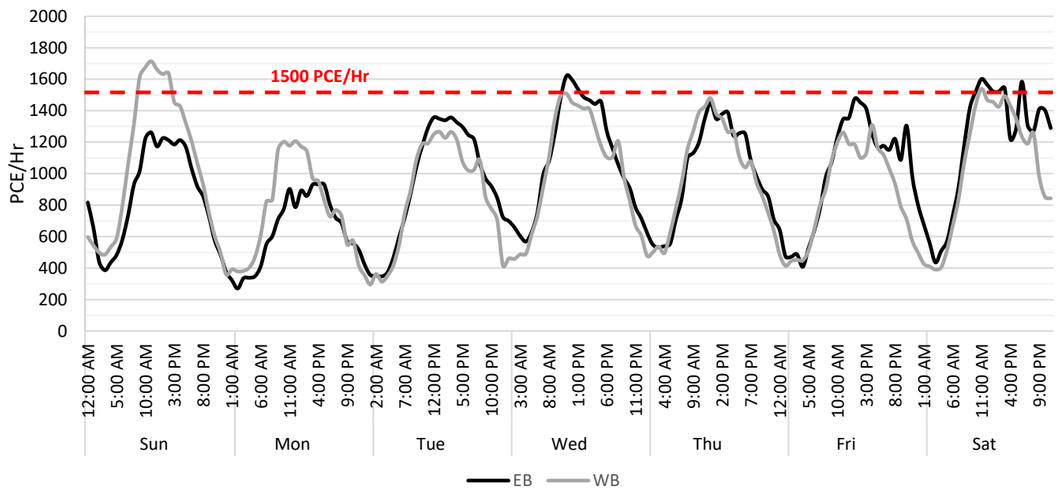
3.7.7.1 Methods

Analysis was conducted to investigate the expected performance of I-40 with 1-lane in the study area to understand how lane reductions during construction and maintenance affect performance. Hourly volumes on I-40 from traffic counts collected during the study were compared to a planning-level capacity for a 1-lane freeway through a construction zone of 1,500 PCEs per hour. The 1,500 PCEs per hour lane capacity was derived from the Oregon Department of Transportation (ODOT) *Work Zone Traffic Analysis Manual* (ODOT 2023). This capacity is used by ODOT for work zone planning purposes to understand expected delays and queue lengths for future projects. To convert I-40 hourly volumes to PCE, the study team applied the set of PCE factors derived for capacity analysis discussed in Section 3.7.6.

3.7.7.2 Findings

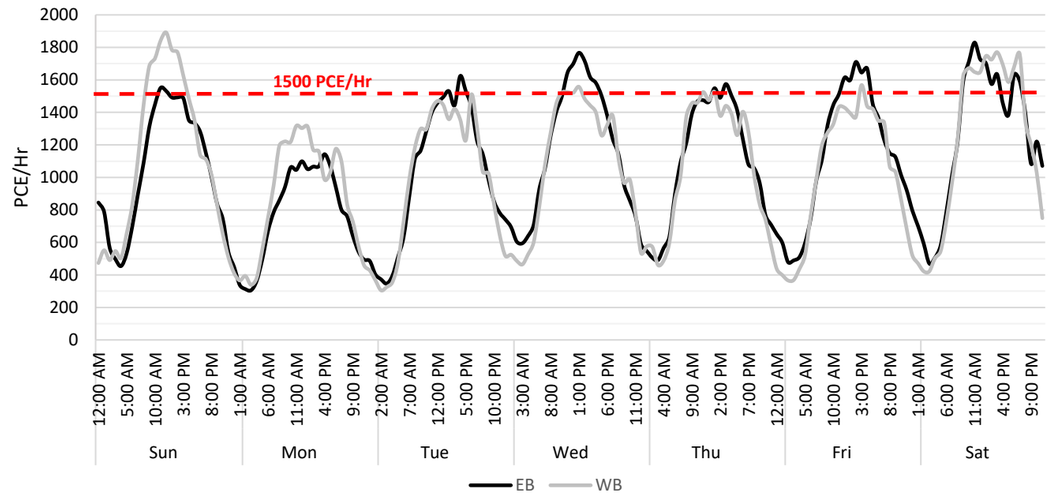
Exhibit 3-67 and Exhibit 3-68 summarize the hourly PCE calculated at two of the study area count locations (MP 63 and MP 141) during July 2022 compared to the planning-level 1-lane capacity of a freeway work zone of 1,500 PCEs per hour. Results show that volumes reach or exceed the 1-lane capacity threshold around midday on weekends and sometimes midweek at MP 63. At MP 141, where traffic volumes are higher, the 1,500 PCEs per hour threshold is exceeded every day of the week except Monday. The data suggest that if I-40 is to be reduced to 1 lane of travel for construction projects or maintenance during daytime hours, traffic backups are likely to form some or most days of the week, depending on the construction location.

Exhibit 3-67. July 2022 PCE Volumes at MP 63



EB = eastbound, hr = hour, PCE = passenger car equivalent, WB = westbound

Exhibit 3-68. July 2022 PCE Volumes at MP 141

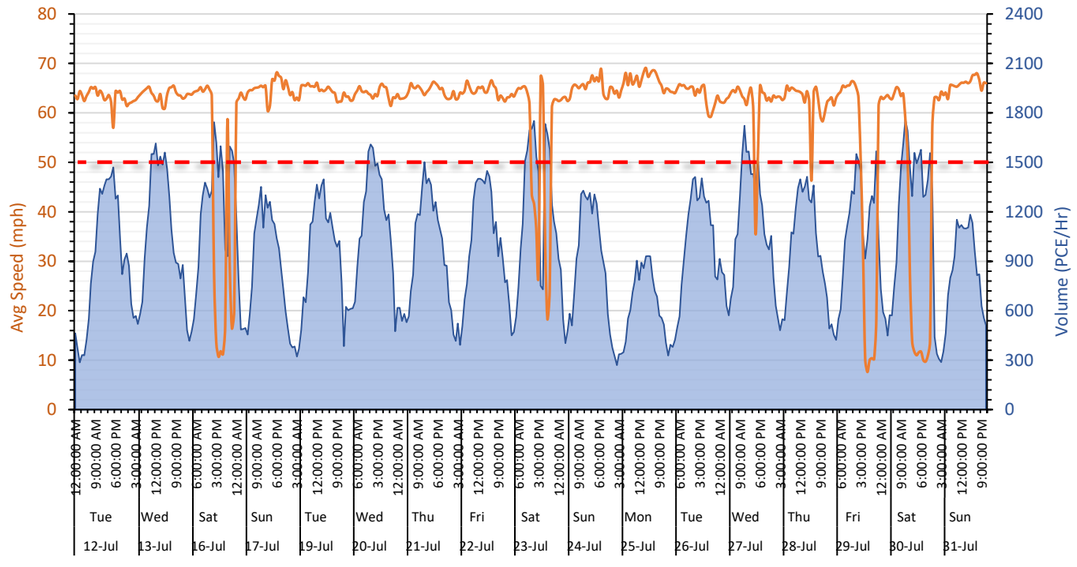


EB = eastbound, hr= hour, PCE = passenger car equivalent, WB = westbound

To further validate the planning-level capacity analysis for work zones, speed data for eastbound traffic through the active Coolidge-area construction zone was compared to the PCE traffic volumes at MP 63. The speed data were collected from Bluetooth signal sensors and represent the eastbound average speeds between MP 40 and MP 48. Though the speed data and volume data are offset by about 15 miles, there is only 1 interchange (Thoreau) between the 2 locations, so volumes are expected to stay relatively similar.

Exhibit 3-69 compares the volume data (PCE per hour) and average speed data for eastbound I-40 for portions of July 2022. As shown, the time periods where volumes approached or exceeded the 1,500 PCEs per hour frequently correlate with a reduction in average speeds, suggesting congested conditions. This data validate that the 1,500 PCE threshold is a reasonable approximation for 1-lane capacity on I-40. In summary, volumes on I-40 can be expected to exceed the estimated 1-lane capacity regularly depending on location and time of day, suggesting that maintaining 2 lanes on I-40 as much as possible will minimize delay and back-ups.

Exhibit 3-69. July 2022 PCE Eastbound Volumes at MP 63 versus Eastbound Speeds from MP 40 to 48



Avg = average, hr = hour, mph = miles per hour, PCE = passenger car equivalent

3.8 I-40 Safety

3.8.1 Methods

This section of this report provides a review of crash records and identifies trends for the I-40 study area extending from MP 0 to MP 150. Crash records specific to the I-40 study area were assembled from data maintained by the Traffic Safety Bureau of the NMDOT. The review included all reported crashes for the 6-year period from 2016 through 2021. This crash analysis provides a general overview of crashes across the study area, including crash types, crash severity, contributing factors to crashes, and a comparison of crash rates to similar roadways in New Mexico and I-40 in the neighboring states of Arizona, and Texas. To identify specific areas of concern and understand crash trends across the I-40 study area, NMDOT crash information was evaluated with GIS software. NMDOT crash data provides coordinates of approximate crash locations that can be entered into GIS to visualize crash locations in the study area. These approximate crash points assist in identifying areas along I-40 where crashes may occur at a higher-than-average rate or crash hot spots. Crash points in GIS can be filtered as necessary to identify trends among various categories of crashes. Identified hot spots help determine where specific types of crashes are occurring in the corridor, and potential contributing factors to these crashes.

It is important to note that crash locations identified in the NMDOT crash database are approximate. Crash locations are reported by responding police officers in the field who have access to approximate locations (such as nearby MP markers, roadway exits, etc.). This means that the data represent an approximate location of a crash but may not be a precise GIS location.

3.8.2 Summary of Findings – Safety and Crashes

Findings from the traffic analysis are summarized in this section and are explained in more detail in Sections 3.8.3, 3.8.4, 3.8.5, 3.8.6, and 3.8.7.

3.8.2.1 Findings from Section 3.8.3, Crash Trends by Year, Month, Day, and Time of Day

- Crashes on I-40 increased from 2016 to 2019 and have been decreasing since 2019.
- Crashes involving a heavy vehicle have been substantially increasing from a low of 34% (177 crashes) in 2016 to a high of 52% (309 crashes) in 2021. About half of the crashes that occurred in the study area on I-40 involved a heavy vehicle in 2020 and 2021.
- The number of crashes increases during the winter months of December to March, even though vehicle volumes tend to be lower during the winter months. This is likely due to weather-related conditions.
- The highest number of crashes typically occurs on Saturdays and Sundays, which correlates to days of the week with higher traffic volumes.
- Crashes occur most frequently from 6 AM to 10 PM when vehicle volumes are highest, and they drop off substantially from 11 PM to 5 AM when traffic volumes are lower.

3.8.2.2 Findings from Section 3.8.4, Crashes by Severity

- 70% of all crashes in the study area are property damage only (PDO), minor to moderate injury crashes account for 24% of the crashes, while fatal crashes and serious injury crashes each account for 3% of all crashes.
- Fatal and serious injury crashes vary each year but have not been increasing over the 6-year period from 2016 to 2021. An average of 18 fatal crashes occurred each year from 2016 to 2021 and about 17 serious injury crashes occurred.
- The crash fatality rate on I-40 in the study area, on both the rural and urban sections, is consistently higher in all sections analyzed than the New Mexico average, except the area from Thoreau to Grants.
- Serious injury crash rates on I-40 are below state averages in the urban areas of Gallup and Grants. In the rural areas, the serious injury rate is above averages in New Mexico across the rural portions of I-40 and in the sections located from the Arizona to Gallup and Grants to Laguna.

3.8.2.3 Findings from Section 3.8.5, Crashes by Type

- The most common crash types in the study area are:
  - → Crashes with fixed objects (20%)
  - → Crashes involving sideswipes or from the same direction (17%)
  - → Overturns (14%)
  - → Rear-end crashes (13%)
- Fixed-object crashes, same direction sideswipes and overturns can be indicative of unsafe passing maneuvers or challenges moving on and off interchanges. Rear-end crashes can indicate spot congestion or challenges moving on and off interchanges.

3.8.2.4 Findings from Section 3.8.6, Contributing Crash Factors

- 21% of crashes in the I-40 study area list weather as a contributing factor, and 6% of the crashes in the study area involve driving under the influence (DUI). Approximately 35% of fatal crashes involved a DUI.
- Of the weather-related crashes, 48% occur in the first 50 miles, or one-third of the study area.

3.8.2.5 Findings from Section 3.8.7, Other Crash Observations

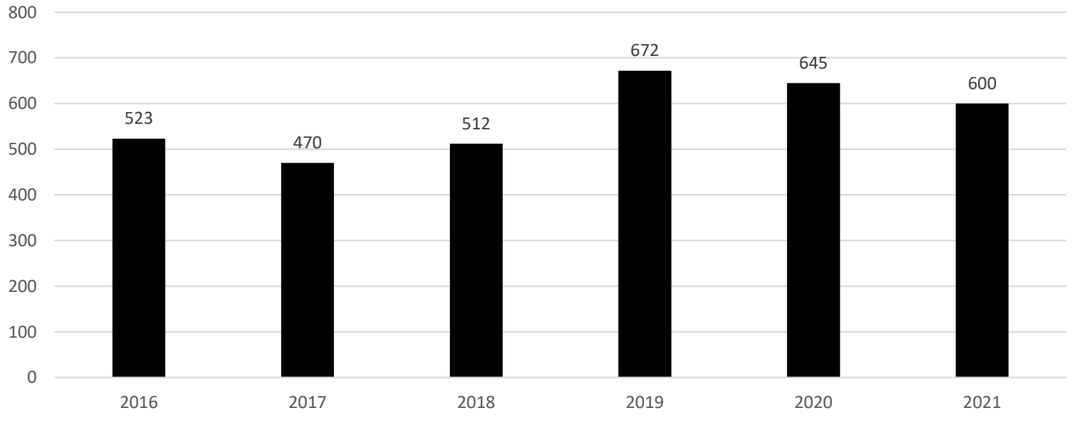
- There are 10 locations in the I-40 study area that have noticeably more crashes than other areas. These areas are located near interchanges. The interchange areas with the higher number of crashes include the area near East Gallup Exit 26, Refinery Exit 39, and Exit 140 at the Route 66 Casino.
- For the years 2020 to 2021, when work zone-related crash data were available, work zone-related crashes accounted for 7% of all crashes. Of the work zone crashes, 70% involved a heavy vehicle, 2 crashes involved fatalities, and 1 crash involved a serious injury.

3.8.3 Crash Trends by Year, Month, Day, and Time of Day

3.8.3.1 Crashes by Year

As shown in Exhibit 3-70, the number of crashes in the I-40 study area were similar from 2016 to 2018 and raised to the highest number over the 6-year study period in 2019. Crashes from 2019 to 2021 have decreased since the 2019 high but have remained higher than the total number of crashes that occurred from 2016 to 2018. While this increase can be partly attributed to weather events (see the weather-related crash section), other contributing factors are unknown.

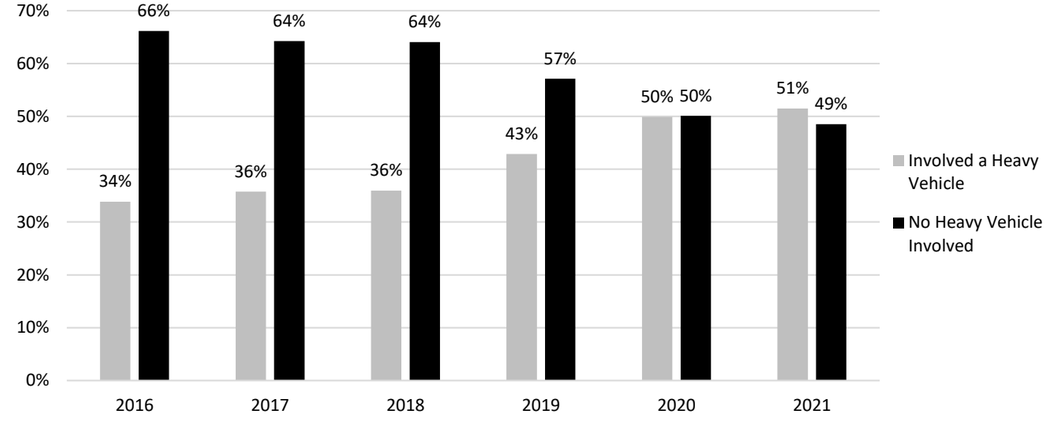
Exhibit 3-70. I-40 Crashes 2016 to 2021



3.8.3.2 Crashes Involving Heavy Vehicles By Year

As shown in Exhibit 3-71, the percentage of heavy vehicles involved in crashes has increased from a low of 34% in 2016 to a high of 51% in 2021. According to traffic data collected in 2022, about 40% of the traffic on I-40 is comprised of heavy trucks (semis), which is lower than the percentage of heavy trucks that have been involved in crashes in 2020 and 2021. The increase in heavy vehicle crashes is likely related to the increase in freight traffic and could be attributed to other unknown factors, such as driver experience or familiarity with the roadway.

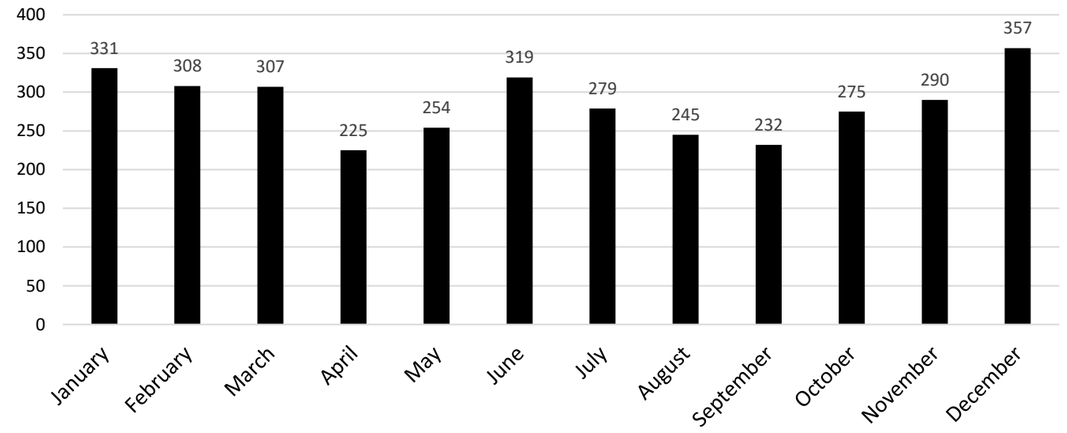
Exhibit 3-71. I-40 Crashes Involving Heavy Vehicles as a Percentage



3.8.3.3 Crashes by Month

As shown in Exhibit 3-72, the number of crashes increases during the winter months of December to March, which is likely related to weather-related conditions due to colder temperatures and snow and ice. A small increase in crashes is observed in June and July, which may reflect higher traffic volumes that travel through the area during these months.

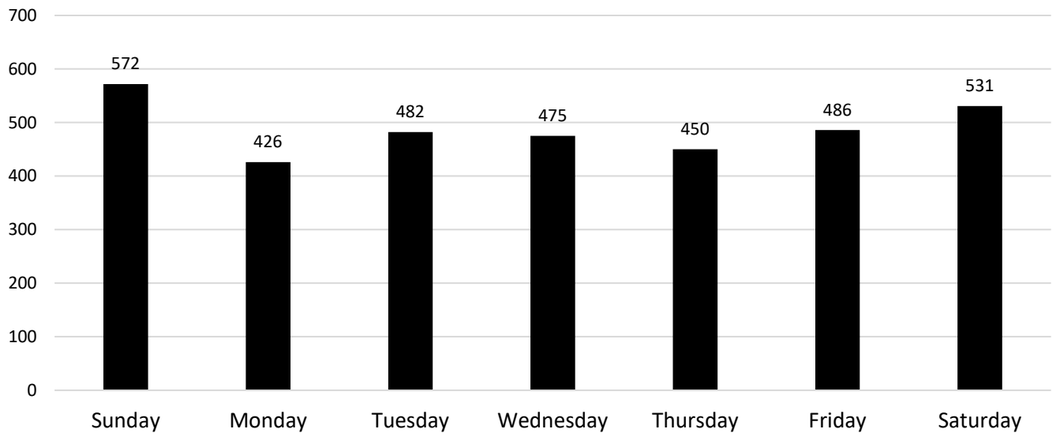
Exhibit 3-72. I-40 Crashes by Month 2016 to 2021



3.8.3.4 Crashes by Day of the Week

As shown in Exhibit 3-73, the highest number of crashes occur on Saturday and Sundays, with crashes reducing on weekdays, particularly Mondays. These crash trends reflect traffic volumes in the study area that are highest on I-40 on the weekends and lowest on Mondays.

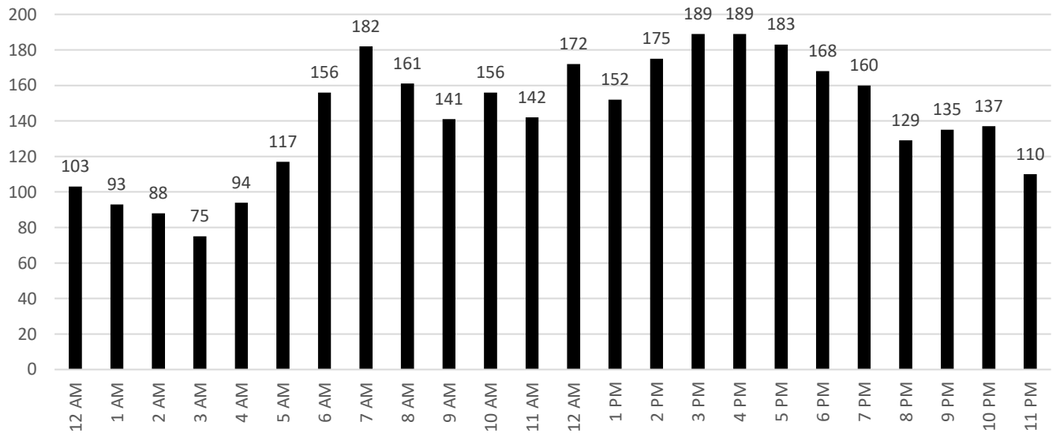
Exhibit 3-73. I-40 Crashes by Day of the Week 2016 to 2021



3.8.3.5 Crashes by Time of Day

As shown in Exhibit 3-74, most crashes occur between the hours of 6 AM and 10 PM, with a significant drop off in crashes observed between 11 PM and 5 AM. These crash numbers generally mirror the times of day with higher traffic volumes, since traffic volumes are higher from 6 AM to 10 PM and lower in the nighttime hours from 11 PM to 5 AM.

Exhibit 3-74. I-40 Crashes Time of Day, 2016 through 2021



3.8.4 Crashes by Severity

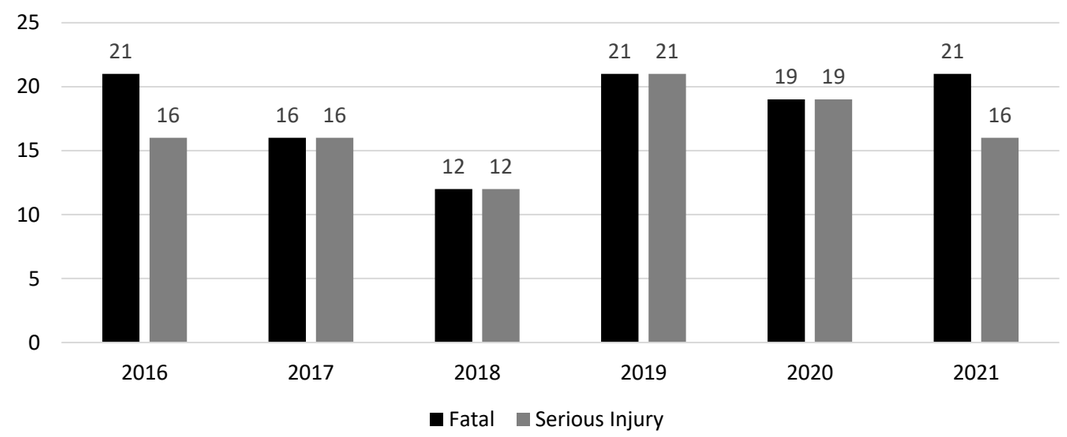
Exhibit 3-75 lists the number of crashes that occurred in the I-40 study area from 2016 to 2021. The majority of crashes that occurred were PDO crashes, which accounted for 70% of all crashes. Minor to moderate injury crashes account for 24% of the crashes, while fatal crashes and serious injury crashes each account for 3% of all crashes.

Exhibit 3-75. I-40 Crashes by Severity from 2016 to 2021

Crash Severity	Number of Crashes	% of Total
Property damage only	2,387	70%
Minor injury	445	13%
Moderate injury	380	11%
Serious injury	100	3%
Fatal	110	3%
Totals	**3,422**	**100%**

As shown in Exhibit 3-76, fatal and serious injury crashes vary each year but did not increase over the 6-year period from 2016 to 2021. An average of 18 fatal crashes occurred each year from 2016 to 2021, and about 17 serious injury crashes occurred.

Exhibit 3-76. I-40 Fatal and Serious Injury Crashes from 2016 to 2021



- From 2016 to 2021, the number of fatal crashes ranged from a low of 12 in 2018 to a high of 21 in 2016, 2019, and 2021.
- From 2016 to 2021, the number of serious injury crashes ranged from a low of 12 in 2018 to a high of 21 in 2019. Serious injury crashes have decreased since 2019 to 16 in 2021.

Of the 110 fatal crashes that occurred from 2016 to 2021, key findings for different attributes are as follows (note that crashes may be associated with more than 1 attribute from the list):

- 49% involved a heavy vehicle
- 35% involved a DUI
- 18% involved a pedestrian

Of the 100 crashes involving serious injuries that occurred from 2016 to 2021, key findings for different attributes are as follows (note that crashes can be associated with more than 1 attribute from the list):

- 45% involved a heavy vehicle
- 10% involved a DUI
- 4% involved a pedestrian

A total of 30 crashes involving pedestrians occurred throughout the study area from 2016 to 2021. Of the 30 pedestrian crashes, approximately 37% (11 pedestrian crashes) occurred in the area near Gallup between MP 15 and MP 27. Of the 30 pedestrian crashes that occurred (note that crashes may be associated with more than 1 attribute from the list):

- 67% were fatal, and 13% involved a serious injury
- 53% involved a heavy vehicle
- 50% involved a DUI
- 77% occurred during non-daylight conditions

As shown in Exhibit 3-77, when looking at serious injury and fatal crashes, there are 12 locations along the I-40 study area where 4 or more fatal crashes occurred. When these 12 locations were compared to all crashes by MP, there is not a strong pattern between locations with high total number of crashes (Exhibit 3-78) and the areas with the highest number of fatal and serious injury crashes. Two exceptions are MP 39 and MP 140. Both these areas are located near interchanges and are discussed in 3.8.7.

Exhibit 3-77. I-40 Fatal and Serious Injury Crashes by MP, 2016 through 2021

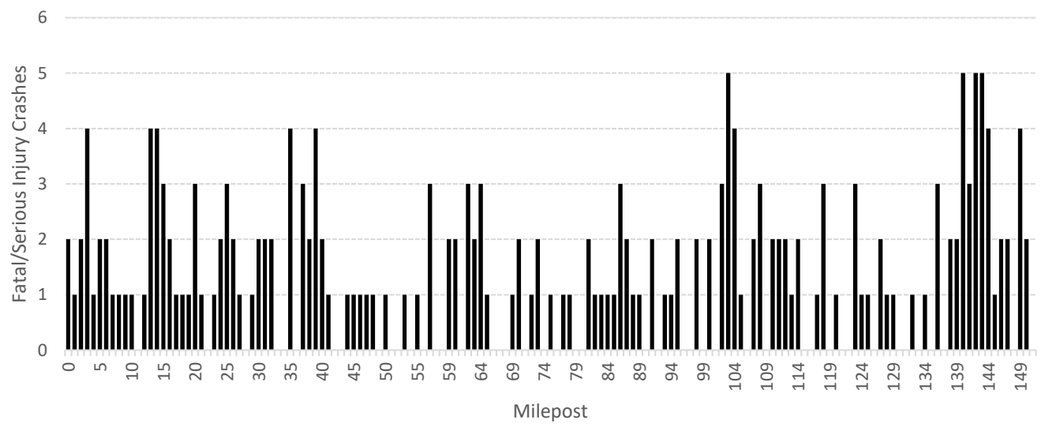
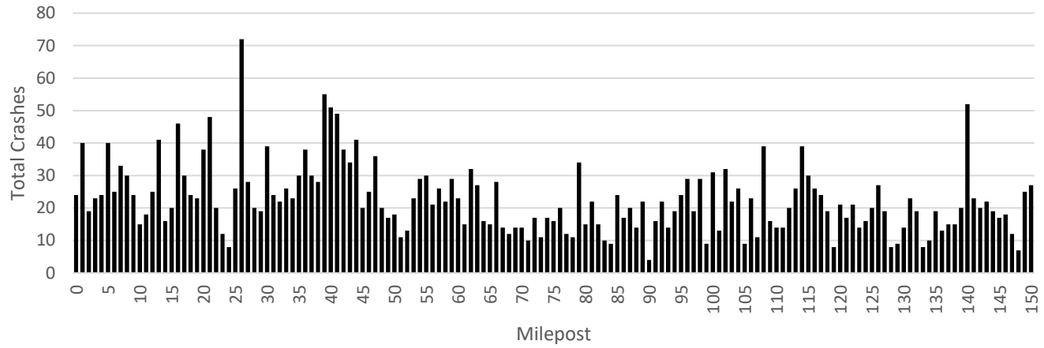


Exhibit 3-78. I-40 Total Crashes by MP, 2016 through 2021



Two locations showed the highest number of fatal and serious injury crashes: MP 102 to 104 and MP 140 to 144. Both locations had a higher number of crashes involving DUIs than the rest of the I-40 study area, potentially leading to more fatal and serious crashes at these locations. Of the 12 fatal and serious injury crashes at MP 102 to 104, 7 (or more than half) involved DUIs. From MP 140 to 144, 8 of 22 total crashes (about a third) involved DUIs.

3.8.4.1 Fatal and Severe Injury Crash Rates

The fatal and severe injury crash rates across the I-40 study area were calculated and compared to averages across New Mexico, Arizona, and Texas. As shown in Exhibit 3-79, when compared to averages across New Mexico, Arizona, and Texas, the fatality rate experienced on I-40 in the study area on both the rural and urban sections was consistently higher in all sections analyzed except the area from Thoreau to Grants. As shown in Exhibit 3-80, the serious injury rates are below state averages in the urban areas. In the rural areas, the serious injury rate is consistently below the average in the state of Texas but is above averages in New Mexico across the rural portions of I-40 and in the sections located from Arizona to Gallup and Grants to Laguna.

Exhibit 3-79. I-40 Fatal Crash Rates, 2016 through 2021

Freeway Type	Location	Fatality Rate (Fatalities /year/ HMVM)			
		Actual	NM Average[2]	AZ Average[3]	TX Average[4]
Rural	Rural I-40 MP 0 to 150	***1.76***	1.17	0.13	1.09
	AZ to Gallup MP 0.0 to 16.1	***1.84***			
	Gallup to Thoreau MP 26.3 to 53.0	***2.08***			
	Thoreau to Grants MP 53.0 to 78.9	*1.06*			
	Grants to Laguna MP 85.6 to 114.7	***1.69***			
	Laguna to MP 150 MP 114.7 to 150.0	***1.99***			
Urban[1]	Grants Urban Area MP 78.9 to 85.6	***1.81***	1.10	0.08	0.91
	Gallup Urban Area MP 16.1 to 26.3	***1.19***			

AZ = Arizona, HMVM = hundred-million vehicle-miles, NM = New Mexico, TX = Texas

1 For this analysis, urban areas are defined as the limits between interchanges in Gallup and Grants.

2 NMDOT 2020a, 3 ADOT 2020, 4 TXDOT 2020

Exhibit 3-80. I-40 Serious Injury Crash Rates, 2016 through 2021

Freeway Type	Location	Serious Injury Rate (Serious Injury/Year/ HMVM) Actual	NM Average[2]	AZ Average[3]	TX Average[4]
Rural	Rural I-40 MP 0 to 150	*1.79*	1.70	0.32	3.00
	AZ to Gallup MP 0.0 to 16.1	*2.50*			
	Gallup to Thoreau MP 26.3 to 53.0	*1.36*			
	Thoreau to Grants MP 53.0 to 78.9	*1.63*			
	Grants to Laguna MP 85.6 to 114.7	*2.02*			
	Laguna to MP 150 MP 114.7 to 150.0	*1.75*			
Urban[1]	Grants Urban Area MP 78.9 to 85.6	*1.15*	3.83	0.27	3.5
	Gallup Urban Area MP 16.1 to 26.3	*1.10*			

AZ = Arizona, HMVM = hundred-million vehicle-miles, NM = New Mexico, TX = Texas

1 For this analysis, urban areas are defined as the limits between interchanges in Gallup and Grants.

2 NMDOT 2020a, 3 ADOT 2020, 4 TXDOT 2020

3.8.5 Crashes by Type

As shown in Exhibit 3-81, crash types varied across the study area, with only fixed-object, same-direction sideswipes, overturns, and rear-end crashes exceeding more than 10% of all crashes. These crashes were investigated further to determine if there were locations in the study area that experienced a higher instance of these crash types.

Exhibit 3-81. I-40 Crashes by Classification 2016 through 2021

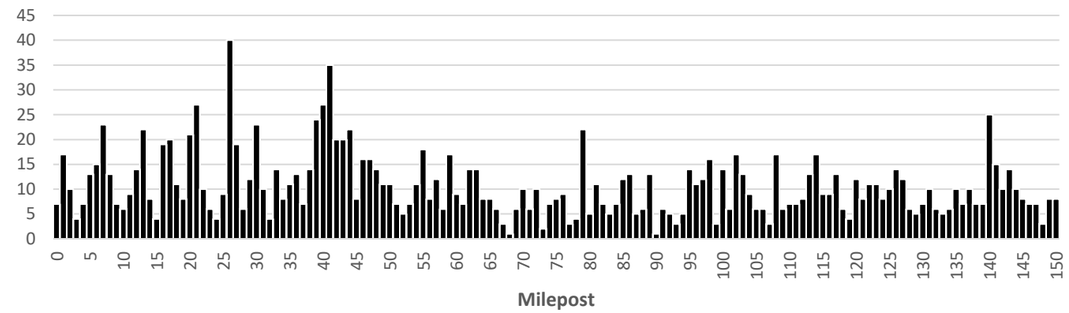
Crash Class/Event	Number of Crashes	% of Total
Crashes with fixed objects (e.g., signs, fences)	684	20%
Crashes involving sideswipes or from the same direction	590	17%
Overturns	466	14%
Rear-end crashes	449	13%
Non-collision crashes	269	8%
Crashes involving other objects	255	7%
Crashes occurring at an angle	202	6%
Other crash types*	219	6%
Crashes involving animals	159	5%
Crashes involving unknown motor vehicles	129	4%
Totals	**3,422**	**100%**

*Other crash types include head-on, other, parked vehicle, other run off road, pedestrian, unknown, backing up, and pedalcycle

3.8.5.1 Fixed-Object Crashes

As shown in Exhibit 3-82, the highest number of fixed-object crashes (27) occurred at MP 26. Most fixed-object crashes (45%) involved hitting guardrail. Other common objects reported being struck in a fixed-object crash include barricade (9%) and signs (7%).

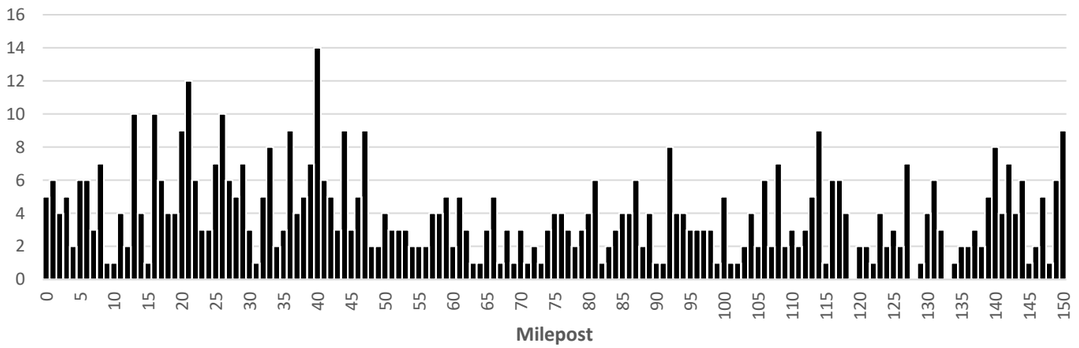
Exhibit 3-82. I-40 Fixed Object Crashes by MP, 2016 through 2021



3.8.5.2 Sideswipes

Regarding sideswipe collisions in the same direction, as shown in Exhibit 3-83, the highest number of sideswipe crashes occurred at MP 40, followed by MP 21. In general, more sideswipe crashes appear to occur in the Gallup area, where there is a higher density of interchange ramps and higher entering and existing traffic volumes. Heavy vehicles are involved in 62% of sideswipe crashes, which is higher than the total percentage of heavy vehicle crashes. The length of heavy vehicles may contribute to increased risk of sideswipe crashes during merging and lane change maneuvers.

Exhibit 3-83. I-40 Sideswipe Crashes by MP, 2016 through 2021

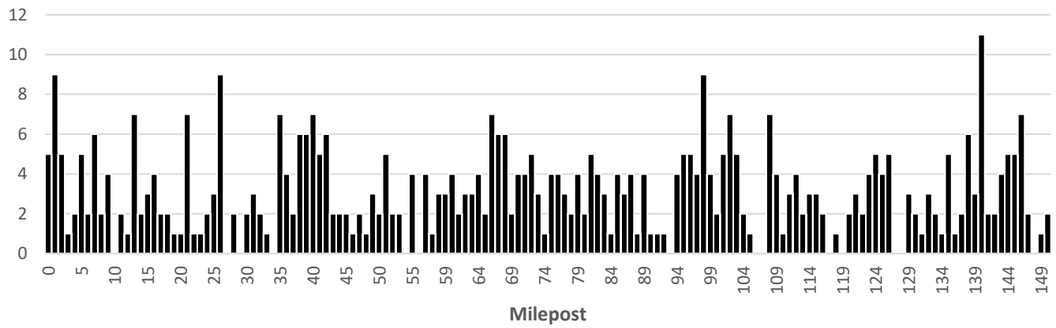


3.8.5.3 Overturn Crashes

Overturn crashes accounted for about 14% of all crashes in the corridor, including hot spots at MP 1, MP 26, MP 40, MP 66, MP 98, and MP 140. As shown in Exhibit 3-84, the crash hot spots at MP 40 and 140 are indicative of the overall trend of higher crash numbers at these locations. However, at MP 1, 54% of overturn

crashes occurred in an area where there are vertical curves in both directions. Similarly, at MP 26, 77% of the overturn crashes occurred on a horizontal curve at the Gallup interchange. MP 66 had 83% of its overturn crashes occurring in the eastbound direction at a downhill grade and horizontal curve with a depressed median that slopes towards the westbound lanes. This creates a situation where vehicles traveling at high speeds can potentially lead to overturns. The high number of overturn crashes at MP 98 does not have any apparent vertical or horizontal curves that could be a contributing factor to the overturns that have occurred.

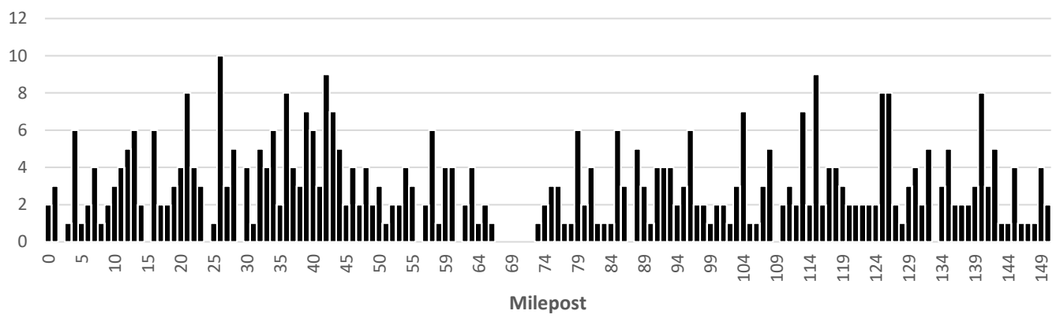
Exhibit 3-84. I-40 Overturn Crashes by MP, 2016 through 2021



3.8.5.4 Rear-End Crashes

Rear-end crashes occur across the study area, as shown in Exhibit 3-85, with no single location appearing to be a hot spot. Other contributing factors were investigated to better understand potential contributing factors to rear-end crashes. Upon examination, rear-end crashes were frequently related to heavy vehicles (60% of rear-end crashes involved a heavy vehicle) and the year 2021 (37 % of all rear-end crashes). It is unclear why these factors seem to contribute to a higher number of rear-end crashes, and further analysis may be necessary. Rear-end crashes can often be attributed to secondary crashes or can occur due to abrupt slowdowns or hard braking.

Exhibit 3-85. I-40 Rear-End Crashes by MP, 2016 through 2021



3.8.6 Contributing Crash Factors

3.8.6.1 Weather-Related Crashes

As shown in Exhibit 3-86, weather was a contributing factor for approximately 21% of crashes in I-40 study area. As shown in Exhibit 3-87, a higher number of weather-related crashes occur in the western portion of the study area from MP 0 to 50, which is the portion of the study area that has higher elevation and travels over the continental divide. As shown in Exhibit 3-88, 2019 had the highest number of weather-related crashes with 176 (27% of all crashes), while 2017 had the fewest with 66 (14% of all crashes).

Exhibit 3-86. Crashes by Weather, 2016 through 2021

Weather	Number of Crashes	% of Total
Non-weather related	2,716	79%
Weather related	706	21%
Totals	**3,422**	**100%**

Exhibit 3-87. I-40 Weather-Related Crashes by MP, 2016 through 2021

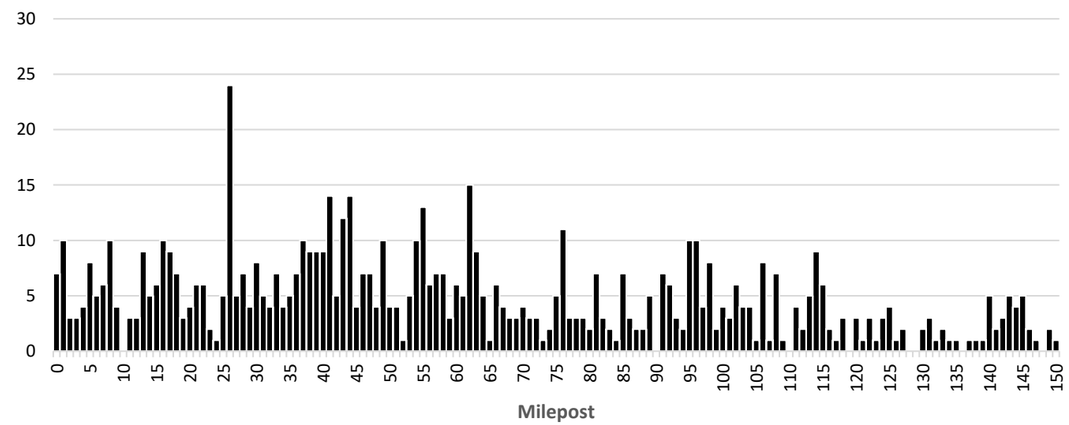


Exhibit 3-88. I-40 Weather-Related Crashes by Year, 2016 through 2021

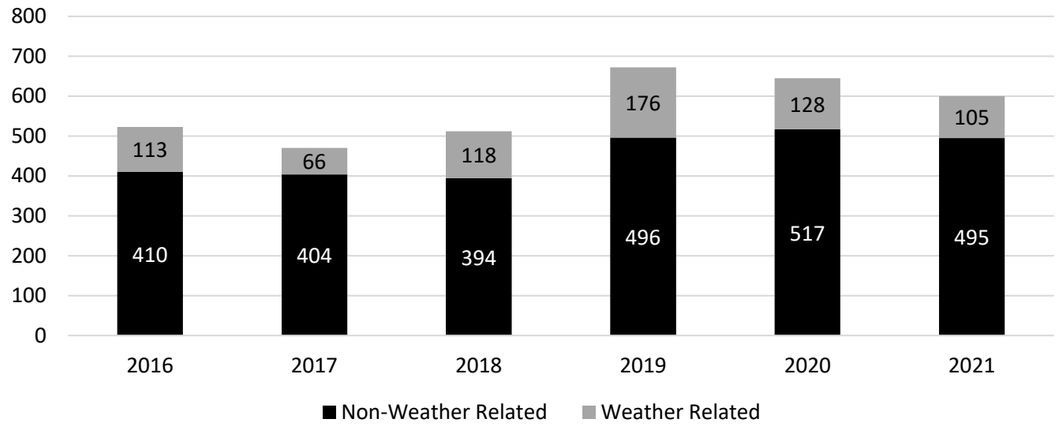


Exhibit 3-89 shows the total number of weather-related crashes, and the type of conditions when the highest number of weather-related crashes occurs. Approximately 73% of crashes occur during events with snow or blowing snow, followed by 21% of crashes that occur during rain events.

Exhibit 3-89. I-40 Weather-Related Crashes by Weather Type, 2016 through 2021

Month	Snow	Blowing Snow	Rain	Fog, Smog, Smoke	Severe Crosswind	Sleet or Hail	Grand Total
January	125	7	1	3	–	1	137
February	111	3	4	2	–	3	123
March	50	1	14	–	–	12	77
April	4	–	14	–	–	3	21
May	2	–	11	–	–	6	19
June	–	–	8	–	–	–	8
July	–	–	28	–	–	–	28
August	–	–	14	1	–	1	16
September	–	–	17	–	–	5	22
October	17	12	17	–	–	1	47
November	69	–	14	–	–	3	86
December	99	14	6	1	1	1	122
Total	**477 (68%)**	**37 (5%)**	**148 (21%)**	**7 (1%)**	**1 (0%)**	**36 (5%)**	**706**

3.8.6.2 Crashes Involving Drivers Driving under the Influence

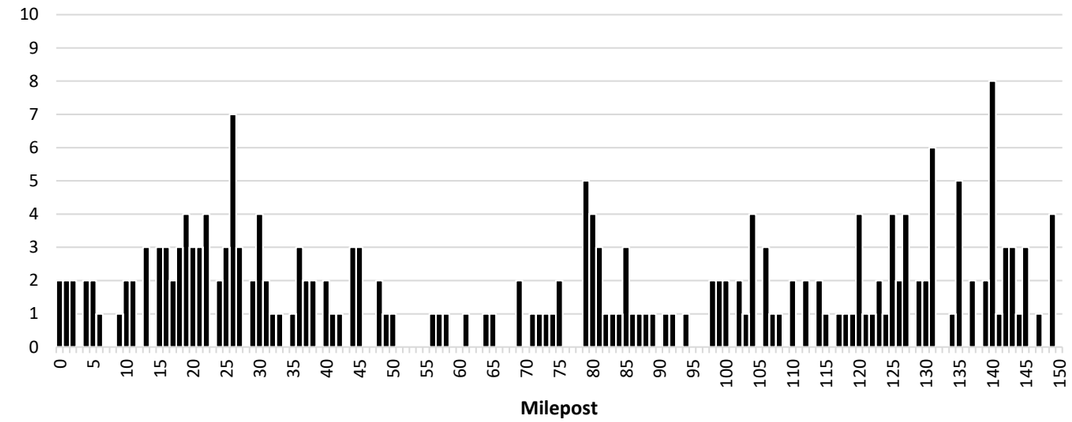
Exhibit 3-90 provides and overview of DUI-related crashes in the study area from 2016 to 2021. During that 6-year time period, about 6% of the crashes in the study area involved DUIs. However, about 35% of fatal crashes involved a DUI and 10% of serious injury crashes.

Exhibit 3-90. I-40 Crashes Involving DUIs from 2016 to 2021

	Fatal	Serious Injury	Total
DUI crashes	38	10	221
All crashes	110	100	3,422
Percent of Total	35%	10%	6%

Exhibit 3-91 shows the DUI-related crashes in the study area from 2016 to 2021. DUI-related crashes cluster near the more populated areas of the corridor (Gallup, Grants, major casinos, Laguna Pueblo).

Exhibit 3-91. I-40 DUI-related Crashes by MP, 2016 through 2021



3.8.7 Other Crash Observations

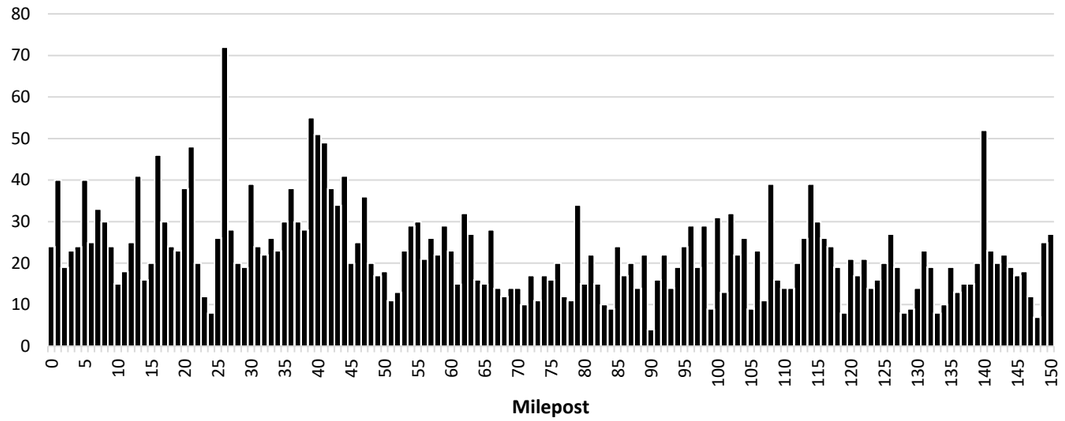
Crashes by Location

Analyzing all crashes across the I-40 study area can help identify potential crash hot spots where more detailed analysis should be conducted to determine if there are any notable factors contributing to higher crash rates. As shown in Exhibit 3-92, crashes along the entire I-40 study area average between 15 and 40 crashes per mile for the 6-year analysis period, though there are specific locations that exceed this average. Areas that include noticeably higher number of crashes are listed below and include:

- MP 1
- MP 5
- MP 13
- MP 16
- MP 21
- MP 26
- MP 39 to 44
- MP 108
- MP 114
- MP 140

All of the areas listed above are located at or near interchanges with the exception of MP 1 and 5.

Exhibit 3-92. I-40 Crashes by MP, 2016 through 2021



MP 1 and MP 5

Both of these locations are located near structures such as bridges and experience a number of fixed-object crashes. This may be indicative of narrow shoulder width or other roadway geometry, such as horizontal curves, leading to conditions where vehicles are put in positions where they might hit guardrails or other fixed objects. At MP 1, 38% of crashes were fixed-object crashes, with 53% of these crashes involving a vehicle striking guardrail. Additionally, at MP 1, 54% of overturn crashes occurred in an area where there are vertical curves in both directions. At MP 5, 45% of crashes were fixed-object crashes with 33% involving a vehicle striking guardrail.

MP 13

This location is near the Port of Entry and has a vertical grade for vehicles traveling in the eastbound lanes. There is a third auxiliary lane provided in the eastbound direction. A higher number of crashes in this area occur in the eastbound lanes. The combination of traffic exiting and entering traffic flow and the challenges of the vertical incline may contribute to a higher number of crashes at this location. The most common crash type is sideswipe crashes (25%)

MP 16, MP 21, and MP 26

There are a higher number of crashes at MP 16, 21, and 26. These locations are areas where interchanges are located in Gallup. Fixed-object crashes and sideswipe crashes are the most common crash types at each location. A total of 27 fixed-object crashes occurred at MP 26. Of these crashes, 44% involved hitting a guardrail, including 63% of these crashes occurring in the westbound direction. This might indicate that the westbound on-ramp merge lane at MP 26 is not of sufficient length, forcing drivers to swerve and hit the guardrail on either side of the lane. At MP 26, 50% of the sideswipe crashes happened in the westbound direction. This could be attributed to the short westbound on-ramp merge lane, which was mentioned earlier as a possible factor for fixed-object crashes. At MP 26, 77% of the overturn crashes occurred on a horizontal curve at the Gallup interchange. Investigating the data further did not reveal any concerning trends regarding heavy vehicles or weather-related crashes. A combination of higher traffic volumes through Gallup, traffic weaving on and off the freeway, and short acceleration/deceleration lane lengths may contribute to a higher number of crashes at these interchange locations.

MP 39 to 44

Between MP 39 and 44 there is another noticeable increase in the total number of crashes. This location spans 2 interchanges: the Refinery and Flying J Truck Stop Interchange at Exit 39 and the Coolidge Interchange at Exit 44. Analysis of weather, heavy vehicle crashes, and geometry did not reveal obvious patterns potentially leading to higher crash numbers at this location. However, multiple roadway improvements have been completed in this area over the past 6 years in addition to an ongoing multi-year project to replace the bridges at the Coolidge interchange. As such, the role of work zone crashes at this location may be a factor. Work zone crashes were only documented between 2020 and 2021; therefore, it is unknown how many crashes prior to these dates can be attributed to work zones. Trends at this location likely require several more years of crash data with the reconstructed configuration to determine effects that recently constructed improvement will have on crash patterns. Additional information on work zone crashes for 2020 and 2021 is discussed later in this section.

MP 108

This location is at an interchange providing access to the Laguna Pueblo. Access at this interchange creates movements that are likely a major contributor to a high number of crashes at this location. Overturn, angle, and sideswipe crashes are the most common crash types. However, the interchange ramps and mainline I-40 were recently improved.

MP 114

Interchange movements at MP 114 may be a contributor to the higher number of crashes at this location. In addition, construction and various roadway improvements have been made in this area over the past several years, making it difficult to determine if crashes at this location were a result of work zones or geometric deficiencies that were recently addressed in this area. Recent improvements include the addition of a concrete wall barrier in the median, addressing geometric curve deficiencies, and widening roadway shoulders. With much of the construction now completed, reviewing crash data in future years will help to understand the effect that the recently constructed improvements will have on crash patterns.

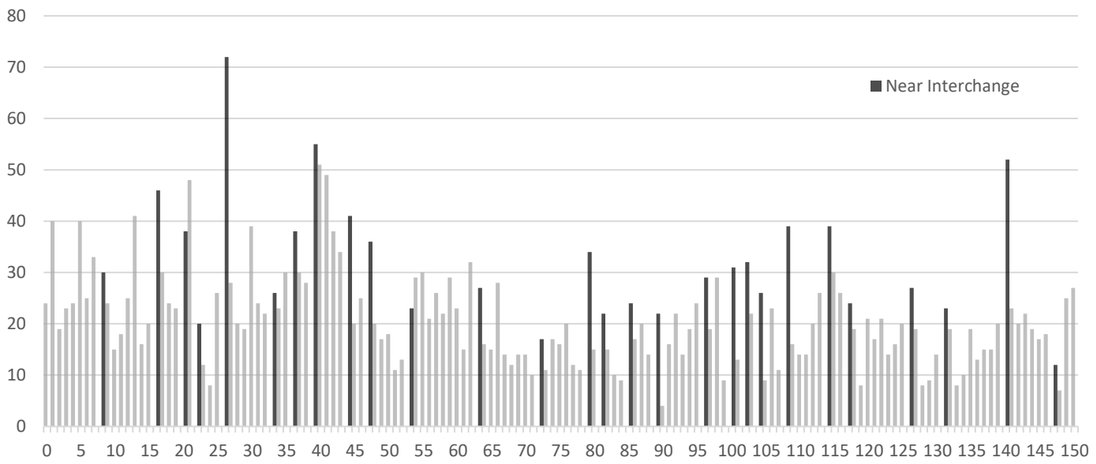
MP 140

This crash hot spot is located near the Route 66 Casino and hotel. This location not only has a high number of overall crashes but also a high number of fatal and serious injury crashes, as discussed in Section 3.8.4. This location has a higher number of crashes with DUIs, which may contribute to the higher number of crashes. There were no identified vertical or horizontal deficiencies at this location, and no noted work zones crashes occurring during the analyzed period. However, the eastbound on-ramp is noted as having a deficient merge length. When analyzing the crash type types at this location, high numbers of sideswipes, overturns, and fixed-object crashes were observed compared to other crash types at this location. This could be indicative of the merge lane deficiency, roadway grade changes, and limited recovery areas on the inside shoulder. Though there are no vertical deficiencies, there are grades on either side of the interchange. Truck drivers may elect to increase speeds on the downhill area in preparation for the climb opposite the interchange. This would create a higher speed differential for drivers slowing to access the MP 140 exit ramp. This is particularly of note in the eastbound direction where the exit ramp is short, and the ramp advisory speed is 20 mph.

Crashes and Interchange Locations

As shown in Exhibit 3-93, the study team identified that crash hot spots occurred near interchanges ,and 23 of the 28 interchanges experienced more crashes than the MPs immediately before and after the interchanges. Interchanges near MP 26 in Gallup and MP 140 near the Route 66 Casino had the highest number of crashes. Crashes at interchanges can be indicative of geometric deficiencies, friction between merging or exiting vehicles, or a lack of specificity in recording crash locations.

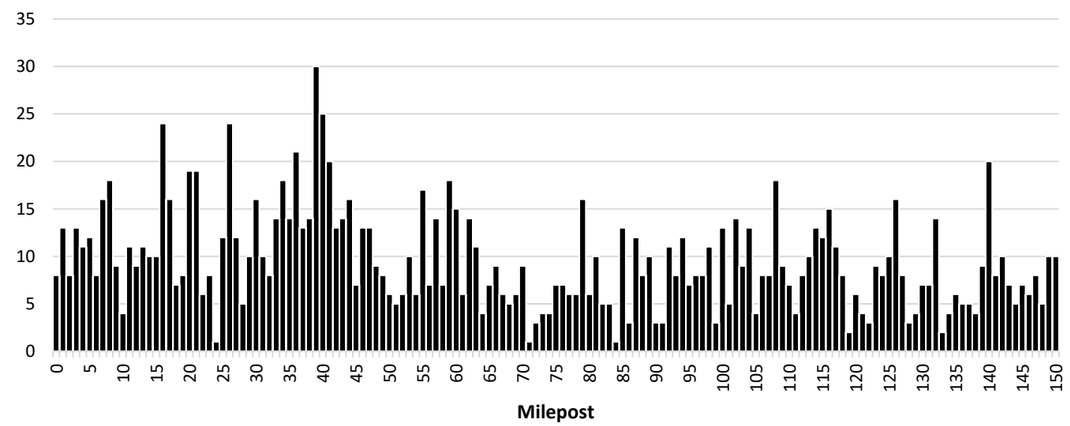
Exhibit 3-93. I-40 Crashes near Interchanges, 2016 through 2021



Heavy Vehicle Crash Locations

When heavy vehicle crashes were examined by location as shown in Exhibit 3-94, the trends observed matched those seen across all I-40 crashes in Exhibit 3-92. This includes a higher number of crashes occurring on the west end of the I-40 study area, possibly due to higher elevations and more frequent weather events. Sideswipe (25%) and rear-end (19%) are the most common heavy vehicle crashes. Consistent with the total crash trends is a noticeable increase in crashes at and around MP 40 and in the Gallup area near MP 21 and 26 Gallup. The most common crash types at these locations are sideswipe crashes and rear-end crashes.

Exhibit 3-94. I-40 Heavy Vehicle Crashes by MP, 2016 through 2021



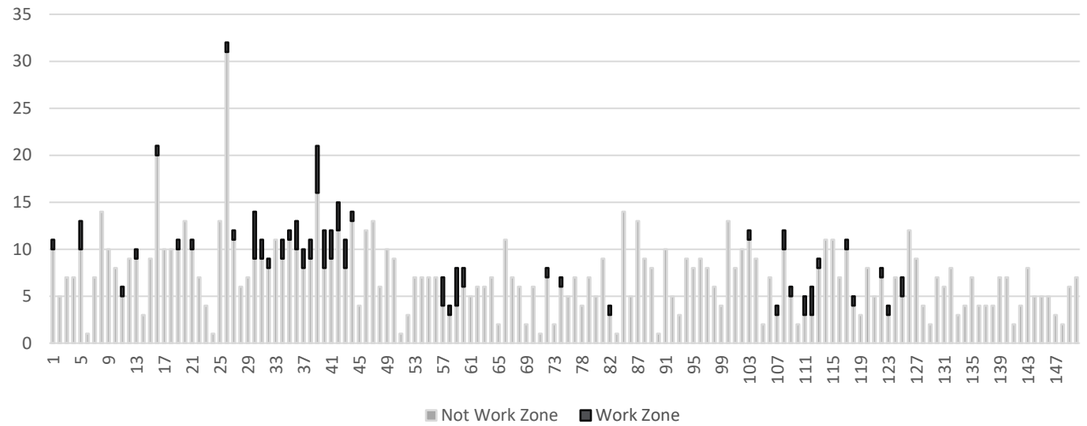
3.8.7.2 Crashes and Roadway Geometrics

While analyzing crashes, geometric issues were considered across the corridor. Crash analysis indicated that there are horizontal curves in the eastbound and westbound directions between MP 0 to 1, and 54% of all overturn crashes in this area occur on a curve. At MP 66, 83% of the overturn crashes occur in the eastbound direction where there is a curve on a downhill slope and the median slopes down to the westbound lanes. Vehicle speed and roadway curvature may be contributing factors.

Crashes in Work Zones

Work zone crashes were only available for the crash years of 2020 and 2021. Exhibit 3-95 shows work zone crashes by MP. In 2020 and 2021 a total of 81 crashes occurred in work zones accounting for approximately 7% of all crashes during that time period. Of the work zone crashes, 57 (70%) involved a heavy vehicle. A total of 2 fatal crashes occurred in these work zones, 1 in 2020 and another in 2021. One additional crash involved a serious injury in 2021.

Exhibit 3-95. I-40 Work Zone Crashes by MP (2020 to 2021)



A total of 3 known work zone areas were investigated to understand the influence on overall crash patterns. Exhibit 3-96 through Exhibit 3-98 plot total crashes over time against the estimated duration of construction activity for MP 35 to 44, MP 55 to 60, and MP 105 to 115. In these exhibits, vertical bars indicate the number of crashes per MP. For 2020 and 2021, the known work zone crash frequencies are shaded with a darker color. Horizontal lines represent the estimated duration of various construction projects. Construction duration was estimated from NMDOT projects logs and Google Streetview imagery. Rear-end crashes are the most common type of crashes that occurred at the work zone.

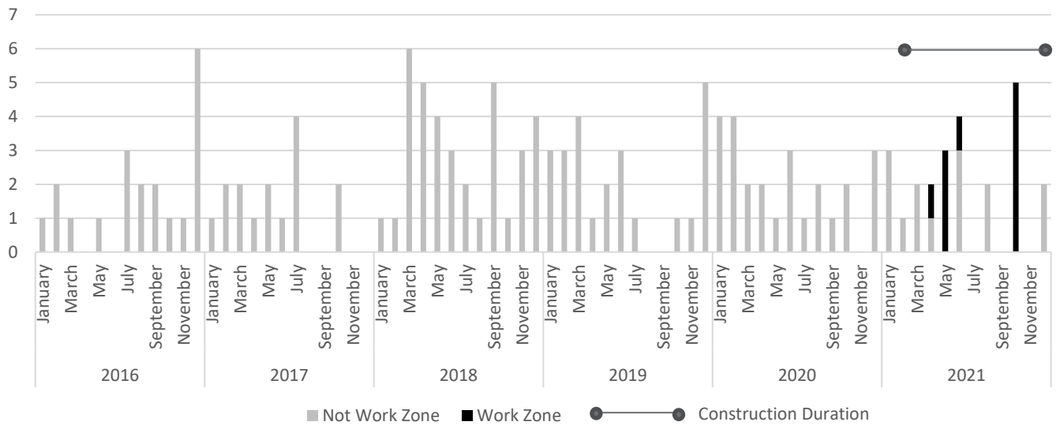
When viewing the work zone crashes in comparison to documented construction locations in 2020 and 2021, work zone crashes generally match up with known construction projects. However, some of these construction projects occurred prior to 2020 (before work zone crashes were reported); therefore, it is difficult to know if crashes occurring prior to 2020 were attributed to work zones.

As shown in Exhibit 3-96, from MP 35 to 44, the share of work zone-related crashes is highest in late 2020, coinciding with 2 construction projects. Construction activity was also present in 2021, but work-zone crashes diminished. The year 2019 features more crashes than other years and though construction activity was present, the contribution of work-zone crashes to total crashes cannot be determined because data are not available.

Exhibit 3-96. I-40 Work Zone Crashes MP 35 to 44 (horizontal lines indicate estimated project duration)

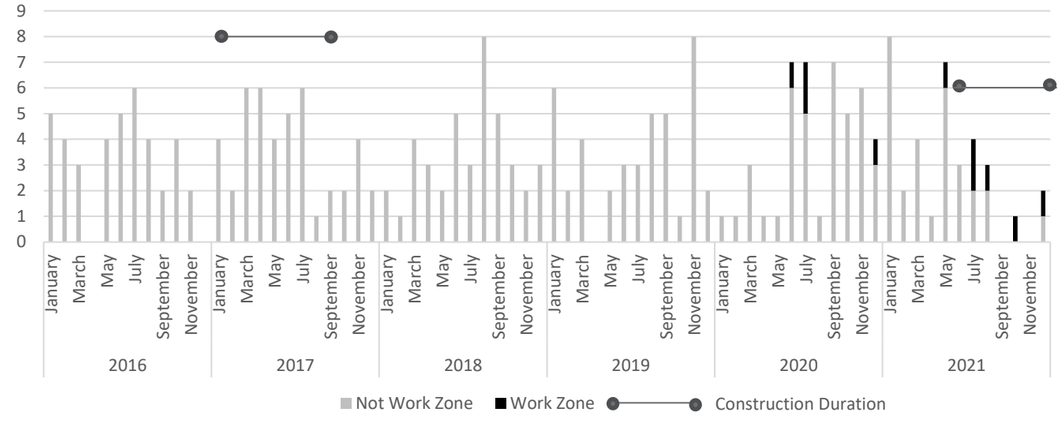
As shown in Exhibit 3-97, at MP 55 to 60, the work zone crashes in 2021 appear to strongly correlate with a construction project. However, total crash frequencies in 2021 do not appear to be much higher than in other years when there was no confirmed project.

Exhibit 3-97. I-40 Work Zone Crashes MP 55 to 60 (horizontal lines indicate estimated project duration)



As shown in Exhibit 3-98, at MP 105 to 115, work zone related crashes occur in the second half of 2021 during an active project. However, work zone crashes are also shown during 2020, which did not coincide with a recorded construction project available to this study.

Exhibit 3-98. I-40 Work Zone Crashes MP 105 to 115 (horizontal lines indicate estimated project duration)



3.9 I-40 Alternate Routes

3.9.1 Alternate Routes Overview

Routes adjacent to I-40 were considered as part of this corridor study to understand their condition, number of lanes, roadway configuration, and opportunities and limitations for serving as potential alternate routes during an incident, such as a crash that would cause a closure of all lanes of I-40 or both lanes in a single direction. In most cases, these routes are 2-lane roadways with limited shoulders, speed limits that range from 35 to 55 mph, and roadways that contain multiple access points, such as intersections and driveways, that have much less capacity to carry high-speed traffic than I-40.

Exhibit 3-99 shows alternate routes/frontage roads that are located adjacent to I-40 additional details about these routes are provided in Appendix M, Alternate Routes. As shown in Exhibit 3-100, there are currently 2 sections of about 37 miles total along the I-40 corridor where there are no existing alternate routes. The first section is an 11-mile stretch that begins at MP 37.0 and extends to MP 48. The second section is 25.70 miles, beginning at MP 114.4 continuing to MP 140.1. Exhibit 3-101 lists the ramp locations where the alternate routes connect to the I-40 mainline.

Exhibit 3-99. I-40 Alternate Routes

I-40 CORRIDOR STUDY, ARIZONA TO ALBUQUERQUE, MILEPOST (MP) 0 TO 150

County		Highway	
I-40 Study Area		River	
Alternate Route		Milepost	

Exhibit 3-100. Areas with No Alternate Routes

MP	Length (Miles)	Description
37.0 to 48.0	11.0	No existing alternate route
114.4 to 140.1	25.7	No existing alternate route
Total	**36.7**	

Exhibit 3-101. Alternate Route Connections to Mainline I-40

MP	Location (EB I-40/WB I-40)	Local Road? (Y OR N)	Description
0	EB & WB	N	On- and off-ramp for Grant Road/NM 118
8.2	WB	N	On-ramp for NM 118
8.3	WB	N	Off-ramp for NM 118
8.4	EB	N	Off-ramp for NM 118
8.7	EB	N	On-ramp for NM 118
16	EB & WB	N	On- and off-ramp for Historic Hwy 66
16.3	EB	N	On-ramp for Historic Hwy 66
16.6	WB	N	Off-ramp for Historic Hwy 66
20.5	EB	N	Off-ramp for NM 602 then either US Rt 66 or Maloney Ave
20.6	WB	N	On-ramp for NM 602 from either US Rt 66 or Maloney Ave
20.8	EB	N	On-ramp for NM 602 from either US Rt 66 or Maloney Ave
21	WB	N	Off-ramp for NM 602 then either US Rt 66 or Maloney Ave
21.1	EB	N	On-ramp for NM 602 from either US Rt 66 or Maloney Ave
22.4	EB & WB	Y	On- and off-ramp for Ford Drive then onto US Route 66
23	WB	Y	On- and off-ramp for Ford Drive then onto US Route 66
25.9	EB & WB	N	On- and off-ramp for US Route 66
26.2	EB	N	On--ramp for US Route 66
26.5	WB	N	Off-ramp for US Route 66
33.3	WB	N	On-ramp for US Route 66
33.4	EB	N	Off-ramp for NM 400
33.9	EB & WB	N	On-ramp for NM 400, off-ramp for US Route 66
36.4	WB	N	On-ramp for US Route 66
36.8	EB	N	Off-ramp for US Route 66
37	EB & WB	N	On- and off-ramp for US Route 66 (frontage road ends EB and starts WB)
47.5	EB & WB	N	On- and off-ramp for NM 122
48.1	EB & WB	N	On- and off-ramp for NM 122
52.8	EB & WB	N	On- and off-ramp for NM 612 then NM 122
53.5	EB & WB	N	On- and off-ramp for NM 612 then NM 122
63.0	EB & WB	N	On- and off-ramp for NM 412 then NM 122
63.5	EB & WB	N	On- and off-ramp for NM 412 then NM 122
71.8	EB & WB	N	On- and off-ramp for NM 606 then NM 122
72.4	EB & WB	N	On- and off-ramp for NM 606 then NM 122
78.8	EB & WB	Y	On- and off-ramp for Horizon Boulevard to NM 122
79.3	EB & WB	Y	On- and off-ramp for Horizon Boulevard to NM 122
81.6	EB & WB	N	On- and off-ramp for NM 122
81.9	EB	N	Off-ramp for NM 122
82.1	EB & WB	N	On- and off-ramp for NM 122
84.8	EB & WB	Y	On- and off-ramp for Santa Fe Avenue
85.1	EB	Y	On-ramp for Santa Fe Avenue
85.5	EB & WB	Y	On- and off-ramp for Santa Fe Avenue
89.1	EB & WB	N	On- and off-ramp for NM 117 them US Route 66
89.7	EB & WB	N	On- and off-ramp for NM 117 them US Route 66
96.2	EB & WB	N	On- and off-ramp for NM 124
96.8	EB & WB	N	On- and off-ramp for NM 124
99.8	EB & WB	Y	On- and off-ramp for Acomita Road then US Route 66
100.3	EB & WB	Y	On- and off-ramp for Acomita Road then US Route 66
104.3	EB & WB	N	On- and off-ramp for US Route 66
105	EB & WB	N	On- and off-ramp for US Route 66
107.7	EB & WB	N	On- and off-ramp for NM 23 then US Route 66
108.1	EB & WB	N	On- and off-ramp for NM 23 then US Route 66
113.7	WB	N	On-ramp for US Route 66
114.1	EB	N	Off-ramp for US Route 66
114.5	EB & WB	N	On- and off-ramp for US Route 66
139.9	EB & WB	Y	On- and off-ramp for Central Avenue
140.2	EB	Y	On-ramp for Central Avenue
141.1	WB	Y	Off-ramp for Central Avenue
149.2	EB & WB	Y	On- and off-ramp for Atrisco Vista then either Bluewater Road or Central Avenue
149.8	EB & WB	Y	On- and off-ramp for Atrisco Vista then either Bluewater Road or Central Avenue
151.8	EB	Y	On-ramp for 98th Street then Central Avenue
151.9	WB	Y	On-ramp for 98th Street from Central Avenue
152.2	EB	Y	Off-ramp for 98th Street then Central Avenue
152.6	EB & WB	Y	On- and off-ramp for 98th St then Central Avenue

AZ = Arizona; EB = eastbound, WB = westbound

3.9.2 Alternate Routes Description

Exhibit 3-102 provides an overview of the alternate route locations, length, posted speeds, typical sections, and restrictions. Additional details regarding adjacent land uses, access points (driveways and neighborhoods), bridges, land ownership, and other information is provided in maps found in Appendix M, Alternate Routes.

Exhibit 3-102. Alternate Routes Overview

MP	Length (miles)	Location (S or N of I-40)	Road Name	Posted Speed (mph)	Typical Section	Access Points	Truck Limitations		Cattle Guards
							Structure	Description	
0 to 8.4	8.4	N	NM 118/Historic Route 66/Grant Road	40 mph	▪ 2, 2-foot shoulders and 2, 12-foot lanes	Commercial area with multiple access points in addition to 14 residential access points	Box culvert at MP 8.4	Structure does not meet height requirements for commercial vehicles (box height is 13.6 feet). Structure is narrow; only 1 truck can go through it at a time.	AZ state line, MP 8.2
8.4 to 12.7	4.3	S	NM 118/Historic Route 66/Rocky Point Road	55 mph	▪ 2, 2-foot shoulders and 2, 12-foot lanes	15 access points			MP 12.70
12.7 to 16.3	3.6	N	NM 118/Historic Route 66/ W I-40 Frontage Road	45 mph	▪ 2, 2-foot shoulders and 2, 12-foot lanes (ends at MP 15.7) ▪ No shoulders; 4, 11-foot lanes; 1, 11-foot center turn lane; curb and gutter; and a 40-foot landscape buffer (MP 15.7 to 16.3). A 6-foot WB sidewalk begins at MP 15.9	Commercial area with multiple access points in addition to 18 residential access points			
16.3 to 25.9	9.6	S	NM 118/US Route 66/Allison Road	35 mph	▪ 2, 8-foot shoulders; 4, 12-foot lanes; 1, 20-foot center turn lane; periodic curb and gutter; periodic 6-foot sidewalks (ends at MP 20.8) 1, 6-foot WB shoulder; 4, 11-foot lanes; 1, 11-foot center turn lane; curb and gutter; a 6-foot EB sidewalk; (begins at MP 20.8 and ends at MP 21.9); 1, 6-foot WB sidewalk begins at MP 21.6 ▪ No shoulders; 4, 11-foot lanes; 1, 11-foot center turn lane; curb and gutter; 6-foot sidewalks (begins at MP 21.9 and ends at MP 22.9) 2, 8-foot shoulders; 4, 12-foot lanes; 1, 12-foot center turn lane; EB curb and gutter; a 6-foot EB sidewalk (begins at MP 22.9 and ends at MP 25.9)	Urban section has multiple access points including 12 signalized intersections			
25.9 to 37	11.1	N	Historic Route 66/I-40 Frontage	55 mph	▪ 2, 12-foot shoulders; 4, 12-foot lanes; 1, 16-foot median (ends at MP 26.1) ▪ 2, 8-foot shoulders; 4, 12-foot lanes; 1, 12-foot center turn lane; EB curb and gutter; a 6-foot EB sidewalk (begins at MP 26.1 and ends at MP 26.4) ▪ 2, 8-foot shoulders; 4, 12-foot lanes; 1, 12-foot center turn lane (begins at MP 26.4 and ends at MP 27.5) ▪ 2, 2-foot shoulders and 2, 12-foot lanes (begins at MP 27.5 and ends at MP 37)	Multiple access points to commercial and residential areas in Gallup, a signalized intersection, and 3 additional access points			MP 33.40 and 33.75 I-40 entrance and exit ramps
48.0 to 84.6	36.6	N	Old US 66/NM 122/Frontage Road/Historic Route 66/ Santa Fe Avenue	55 mph	▪ 2, 2-foot shoulders and 2, 12-foot lanes (ends at MP 70.5) ▪ 2, 2-foot shoulders; 4, 12-foot lanes, 1, 36-foot median; periodic curb and gutter; periodic 6-foot sidewalks (begins at MP 70.5 and ends at MP 84.6)	Multiple access points, including commercial and residential areas in Prewitt, Bluewater, Milan, Grants and more than 50 additional access points.			
84.6 to 90.6	6	N	McBride Road/Historic Route 66	55 mph	▪ 2, 2-foot to 8-foot shoulders and 2, 11-foot lanes	Multiple access points to commercial and residential areas in Grants	Box culvert at MP 90.6	Structure does not meet height requirements for commercial vehicles (box height: 13.6 feet); width is also narrow.	
90.6 to 96.6	6	S	NM 124/Historic Route 66	55 mph	▪ 2, 2-foot shoulders and 2, 11-foot lanes	Multiple access points at McCarty's Village and 7 additional access points			

(Table Continues)

Exhibit 3-102. Alternate Routes Overview (Continued)

MP	Length (miles)	Location (S or N of I-40)	Road Name	Posted Speed (mph)	Typical Section	Access Points	Truck Limitations		Cattle Guards
96.6 to 114.4	17.8	N	NM 124/Historic Route 66	55 mph	▪ 2, 2-foot shoulders and 2, 11-foot lanes (ends at MP 112.3) ▪ 1, 10-foot separated shared-use path (begins at MP 108, ends at MP 108.8) ▪ 1, 10-foot separated shared-use path (begins at MP 109.2 and ends at MP 112) ▪ 2, 2-foot shoulders; 2, 11-foot lanes; 1, 5-foot EB Bike Lane Buffer; 1, 6-foot bike lane (begins at MP 112.3 and ends at MP 112.5) ▪ 2, 2-foot shoulders; 1, 11-foot EB lane; 2, 11-foot WB lanes; 1, 5-foot EB bike lane buffer; 1, 6-foot bike lane (begins at MP 112.5 and ends at MP 113.5) 1, 6-foot to 22-foot median begins at MP 113 ▪ 2, 2-foot shoulders; 2, 11-foot lanes; 1, 22-foot to 32-foot median (begins at MP 113.5 and ends at MP 113.7) ▪ 2, 2-foot shoulders; 2, 11-foot lanes; 1, 22-foot to 32-foot median (begins at MP 113.7 to 114.4)	Multiple access points through various commercial and residential areas			
140.1 to 149.6	13	N	Central Ave/I-40W Frontage/Bluewater Road	40 mph	▪ 2, 2-foot shoulders and 2, 12-foot lanes	5 access points			MP 139.9 and 140
149.6 to 150	0.4	S	Central Avenue/US Route 66	40 mph	▪ 4, 8-foot shoulders; 4, 12-foot lanes, and a 22-foot median; note that the road goes to MP 153.4	Various access points to commercial areas			

AZ = Arizona, EB = eastbound, mph = miles per hour, N = north, S = south, W = west, WB = westbound

3.9.2.1 MP 0 to MP 8.4

Beginning at MP 0 near the Arizona State line, there is an 8.4-mile-long adjacent roadway from MP 0 to MP 8.4. This road, named NM 118/Historic Route 66/Grant Road, is composed of 2, 2-foot shoulders and 2, 12-foot driving lanes in each direction and has a 40-mph posted speed limit. NM 118 starts off north of I-40 then transitions south of I-40 at MP 8.4 through a CBC (bridge 6502) that has height (13.6 feet) and width restrictions, as shown in Exhibit 3-103. Semi-trucks traveling or diverted to the alternate route would not be able to drive through the CBC, so the use of this route is limited to vehicles that meet the height limitation. According to FHWA standards, the minimum vertical clearance for a bridge or structure over a roadway is 16 feet for freeways and 14.5 feet to 16 feet for arterial roads. Typical semi-trucks have an average height of 13.6 feet; therefore, not only is truck traffic not recommended to travel through the culvert because of the curve geometry and the tight box width, but it is physically not possible since the box culvert and semi-trucks are the same height (13.6 feet). This section of roadway also has cattleguards present at MP 0 and MP 8.2. In addition, there is another local road south of I-40 called Lupton Road that runs parallel to I-40 that starts at MP 0 and extends to MP 8.2 where it merges with NM 118. The intersection of Lupton Rd. and NM 118 has pavement conditions with many potholes, failed patches, and pavement bleeding present.

Exhibit 3-103. CBC (Bridge 6502) at MP 8.4, Height, and Width Restrictions

3.9.2.2 MP 8.4 to MP 12.7

The next alternate route section is a 4.3-mile-long stretch that begins south of the CBC at MP 8.4 and continues to MP 12.7. This section, named NM 118/Historic Route 66/ Rocky Point Road, has a 55-mph posted speed limit and is also composed of 2, 2-foot-wide shoulders and 2, 12-foot driving lanes in each direction. At MP 9.21, bridge 6129 on the alternate route has poor pavement approaches as well as narrow shoulders, as shown in Exhibit 3-104. This section also has cattleguards present at MP 12.70, as shown in Exhibit 3-105.

Exhibit 3-104. Bridge 6129 Crossing at MP 9.21 with Narrow Shoulder and Poor Pavement Approach

Exhibit 3-105. Cattle Guards at MP 12.70 on NM 118

3.9.2.3 MP 12.7 to MP 16.3

The following section is a 3.6-mile-long stretch that begins at MP 12.7 and continues to MP 16.3. This section, named NM 118/Historic Route 66/ W I-40 Frontage Road, is located north of I-40, has a 45-mph posted speed limit and a variable typical section. The road starts off having 2, 2-foot shoulders and 2, 12-foot driving lanes as it passes through a residential zone outside of Gallup. Then the road transitions into a typical section with curb and gutter; 4, 11-foot driving lanes; and a 11-foot center turn lane as it passes through a commercial zone approaching the City of Gallup.

3.9.2.4 MP 16.3 to MP 25.9

The next section is 9.6 miles and is located south of I-40 that begins at MP 16.3 and continues through the City of Gallup until it reaches MP 25.9. This section, named NM 118/Historic Route 66/Allison Road, has a posted speed limit of 35 mph through the City of Gallup. The typical section varies as described in Exhibit 3-102. Land use through the City of Gallup is primarily zoned commercial.

3.9.2.5 MP 25.9 to MP 37

The next section is 11.1-miles-long and is located north of I-40, beginning at MP 25.9 and continuing to MP 37. This section, named Historic Route 66, has a posted speed limit of 55 mph and a variable typical section, as described in Exhibit 3-102. The Fort Wingate area from MP 33 to MP 35 has a substantial amount of soil piled along the shoulders of the alternate route, as shown in Exhibit 3-106. The piled-up soil stretches for over a mile and is stacked up to 8 feet high. There were also several CBCs in this area that were completely covered in soil from flooding events. The soil deposits reached the top of the CBC, completely blocking the drainage structure and impeding the water flow, thus resulting in the storm water overtopping the road, as shown in Exhibit 3-107. This is a clay material that has been carried and deposited from the storm events that flood the alternate route and occasionally the I-40 mainline. The alternate route ends at MP 37 as it merges into the I-40 on-ramp.

Exhibit 3-106. Clay Deposits from Storm Events Covering the Drainage Structures

Exhibit 3-107. Clay Deposits from Severe Storm Events Covering the Drainage Structures

3.9.2.6 MP 48 to MP 84.6

The next section is 36.6 miles long and is located north of I-40, beginning at MP 48 at the Continental Divide interchange and continuing to MP 84.6. This section has several names, such as Historic Route 66/NM-122/W Frontage Road/Santa Fe Avenue, and it has a posted speed limit of 55 mph. This section of roadway begins with 2, 2-foot-wide shoulders and 2, 12-foot lanes. It then transitions to a roadway with 2, 2-foot shoulders; 4, 12-foot driving lanes; and a 36-foot median through the town of Milan and Grants. This section does not have any truck limitations.

3.9.2.7 MP 84.6 to MP 90.6

The next section is 6 miles-long, located north of I-40, and begins at MP 84.6 and continues to MP 90.6. This section, named McBride Road/Historic Route 66, has a posted speed limit of 55 mph and is composed of 2, 2- to 8-foot shoulders and 2, 11-foot driving lanes. In addition, this section also has a CBC (bridge 6307) at MP 90.6 that transitions the alternate route to south of I-40, as shown in Exhibit 3-108. This CBC is a limitation for trucks since it does not meet minimum height requirements, thus making this section inaccessible to large commercial vehicles.

Exhibit 3-108. CBC (Bridge 6307) at MP 90.6, Height, and Width Restrictions

3.9.2.8 MP 90.6 to MP 114.4

The subsequent section is located 6 miles south of I-40, from MP 90.6 to MP 96.6, named NM 124/Historic Route 66. NM-124 has a posted speed limit of 55 mph and is composed of 2, 2-foot shoulders and 2, 11-foot driving lanes. This section has a series of very narrow bridges at MP 91 (bridge 1776), 92.8 (bridge 1777), and 92.9 (bridge 1778) that have practically no shoulders and pose width limitations, as shown in Exhibit 3-109 and Exhibit 3-110. Truck traffic would have to significantly slow down to cross the bridges and avoid collisions. In addition, near MP 94.77 there is an overhead railroad bridge (bridge 6226) that meets the minimum vertical clearance but has a narrow width, thus also posing width limitations, as shown in Exhibit 3-110. It should be noted that based on field measurements, the vertical clearance under bridge 6226 on the frontage road was found to be 16 feet, 2 inches at its lowest point, which is lower than the posted

clearance of 16 feet 4 inches. The alternate route then crosses back to the north side of I-40 from MP 96.6 to MP 114.4, for a total length of 17.8 miles. This section also has 2, 2-foot shoulders and 2, 11-foot lanes, with a posted speed limit of 40 mph.

Exhibit 3-109. Narrow Roadway through Bridges at MP 91 and MP 92.8

Exhibit 3-110. Narrow Roadway Width at MP 94.77, Bridge 6226 Due to Overhead Railroad Bridge

3.9.2.9 MP 140.1 to MP 149.6

The following section is 9.5 miles long, located north of I-40 from MP 140.1 to MP 149.6, and named Central Ave/I-40 W Frontage/Bluewater Road. This section has a posted speed limit of 40 mph and is composed of 2, 12-foot shoulders and 2, 11-foot driving lanes. The pavement in this section is also in an extremely poor condition; it has many pavement distresses, overgrown vegetation, and debris on the road, as shown in Exhibit 3-111. Based on a field inspection, it appears the road has been abandoned and not serviced in years. This section also has cattle guards located near MP 140 and MP 142.

Exhibit 3-111. Central Ave/I-40 W Frontage Road Conditions from MP 136.6 to MP 140.3

3.9.2.10 MP 149.6 to MP 150

The last section is 0.4 miles, located south of I-40, and starts at MP 149.6 and ends at MP 150, the Atrisco Vista interchange. This section is named Central Avenue/Historic Route 66, has a posted speed limit of 40 mph, and is composed of 8-foot shoulders; 4, 12-foot driving lanes; and a 22-foot median. In addition, there is another local road south of I-40 named Speedway Park Boulevard/Central Avenue that starts at MP 145.54 and merges into Route 66 as it enters the City of Albuquerque.

3.9.3 Pedestrian and Bicycle Facilities

Due to the mostly rural nature of the surrounding area, pedestrian facilities are limited on adjacent alternate routes/frontage roads in the study area. Sidewalks are provided along some urban areas near Gallup near MP 16 to MP 26 and Grants between MP 70 and 84, as summarized in Exhibit 3-102.

As indicated in Exhibit 3-102, shoulder areas for bicyclists are limited on alternate routes through much of the study area because the available shoulder area is about 2 feet in most areas and the paved shoulder is less than 2 feet in many areas, as shown in the photos of alternate routes. Shoulder widths that are less than 2 feet are often located in areas with bridges and box culverts, as shown in the previous photos. Areas with shoulders wider than 2 feet, which are more accommodating to bicyclists, include:

- NM 118/US Route 66/Allison Road in Gallup from MP 16.3 to MP 25.9, shoulders range from 6 to 8 feet.
- Route 66/I-40 Frontage in Gallup from MP 25.9 to MP 27.5, shoulders range from 8 to 12 feet.
- Central Avenue/US Route 66 near Albuquerque from MP 149.6 to MP 150 (note that the road extends to MP 153.4).

The *New Mexico Prioritized Statewide Bicycle Network Plan* identifies locations where bikeway infrastructure would be most beneficial and provides design guidance for State and US highways in New Mexico. Typically, interstate frontage roads and alternate routes are excluded from the NMDOT priority bicycle network, though in some cases, the frontage roads and alternate routes are also state highways and are included (NMDOT 2018a). In the study area, alternate routes located in District 6 along I-40 between the Arizona State line and approximately MP 114 in Laguna, including NM 118, NM 112, and NM 124, are designated as Tier 1 routes (NMDOT 2018a). Tier 1 routes are a high priority for bikeways because they provide intra-community and statewide connections between New Mexico's communities for cross-state travel. Alternate routes are limited in the area adjacent to I-40 from MP 114 to MP 150. As such, this area does not have any priority bike networks identified, though the section of I-40 from NM 124/Laguna Pueblo at approximately MP 114 to Atrisco Vista in Albuquerque at MP 150 is on the proposed United States Bicycle Route system (NMDOT 2018a).

3.9.4 Transit

See Section 3.2.10 for a discussion of transit services provided in the study area on both I-40 and adjacent alternate routes.

3.9.5 Pavement and Geotechnical Considerations

Pavement and geotechnical considerations for both I-40 and adjacent alternate routes were summarized previously in Section 3.2.13 and are described in greater detail in Appendix E, Geotechnical Scoping Report. As summarized in Exhibit 3-112, probable reconstruction (highlighted in red) is recommended for approximately 9 miles of the existing I-40 alternate routes, based on areas with poor observed pavement condition during a field reconnaissance conducted in 2022. More detailed analysis is recommended to confirm these field observations.

Exhibit 3-112. Summary of Pavement Condition Reconstruction Recommendations for Alternate Routes

Approximate I-40 MP	Reconstruction Recommended
0 to 4	No
4 to 8	No
8 to 9	Probable
9 to 12	Probable
12 to 24.5	No
24.5 to 25	No
25 to 30	Probable
30 to 37	No
47 to 56	No
56 to 65	No
65 to 80	No
80 to 90	No
90 to 96	No
96 to 105	No
105 to 114.4	No
140 to 150	No

3.9.6 Bridges and Major Structures

3.9.6.1 Methods

Parametrix reviewed existing bridges, which includes CBC structures with opening widths of 20 feet or more, along routes adjacent to I-40 to determine the feasibility of using these roadways as short-term detour routes when incidents occur. Existing bridge structure conditions were assessed based on the most recent NMDOT bridge inspection reports available, information provided from FHWA from LTBP InfoBridge (FHWA 2023b), and limited field observation. The NMDOT inspection database was made available to the study team and contains records on bridge identification, geometry, inspections, load ratings, and condition. There were several structures that cross over alternate routes that appeared to be narrower than the reported values. Because of this, the study team provided an estimated measurement based on a visual evaluation using Google Earth. For this evaluation, these estimated values were also considered and are reported as part of the analysis in this section and the information presented in Appendix F, Bridges.

The primary focus of the review is described below:

- Structures carrying the alternate route:
  - → Is there sufficient structural load capacity to accommodate truck traffic?
    - ▶ A minimum inventory rating of ≥ HS-20 was used to determine if there is sufficient capacity to accommodate truck loads.
  - → Is there sufficient horizontal clearance to allow 2-way traffic across the structure?
    - ▶ A horizontal clearance of ≥ 28 feet was used as a desired width to accommodate 2, 12-foot lanes and 2-foot shy distances for each lane. Bridges having less than a 28-foot width were identified for additional consideration, since these bridges could operate adequately as a short-term, emergency detour.
- Structures crossing over the alternate route:
  - → Is there sufficient vertical clearance to accommodate truck traffic?
    - ▶ A minimum vertical underclearance of ≥ 14.5 feet was used to determine if there is sufficient vertical underclearance for trucks.
- Is there sufficient horizontal clearance to allow 2-way traffic under the structure?
  - ▶ A horizontal clearance of ≥ 28 feet was used as a desired width to accommodate 2 12-foot lanes and 2-foot shy distances for each lane. Areas having less than a 28-foot width were identified for additional consideration, since these bridges could operate adequately as a short-term, emergency detour.

3.9.6.2 Findings

There are 88 structures along potential alternate routes adjacent to I-40. A total of 10 structures cross over alternate routes, and 78 structures carry the alternate route. The 88 structures consist of conventional bridges and CBCs. All the structures have at least 20-foot-wide openings, and no culverts narrower than 20 feet were considered in this review. Information for the structures was gathered from NMDOT and FHWA bridge inventory records.

For the 78 structures carrying the potential alternate route, the 2 primary criteria considered were the inventory load rating and total horizontal clearance. The intent of reviewing the load rating was to verify if the structure can carry a standard HS-20 design truck (note HS-20 indicates a 20-ton axle weight — the NMDOT rates structures based on total weight on the front axles of the design vehicle, so the 20-ton rating is not the entire weight of the truck). Similarly, the intent of reviewing the total horizontal clearance was to verify if the structure can accommodate 2, 12-foot lanes side-by-side and 2-foot shy widths. Of the 78 bridges, all of them meet the inventory rating criteria of HS-20. The minimum rating along the frontage road was HS-24.8 for bridge 1779. A total of 21 structures had less than 28-foot widths. The minimum horizontal clearance along the frontage road was 22.3 feet, which may still be sufficient to accommodate 2-way traffic using reduced lane widths. Vertical clearances for bridges over I-40 and railroad tracks were also checked. These meet the required minimums.

For the 10 structures crossing over the potential alternate routes, the 2 primary criteria considered were the minimum vertical underclearance, and the inventory route total horizontal clearance. The goal was to verify that there was at least 14.5 feet of vertical clearance, and at least 28 feet of horizontal clearance. Of the 10 bridges, 3 of them did not have sufficient horizontal clearance, and 2 of those 3 did not have sufficient vertical clearance. The 2 structures that had insufficient vertical and horizontal clearance are CBCs located at MP 8.4 (bridge 6502) and MP 90.6 (bridge 6307). Their minimum vertical clearance is listed as 13.9 feet and 13.40 feet, and their minimum horizontal clearance was measured in Google Earth to be 18.75 feet and

20.95 feet, respectively. The third structure is a railroad bridge (bridge 6226) over the alternate route at MP 94.77, which has a listed horizontal clearance of 25 feet.

The bridge conditions for the 78 bridges along the alternate routes are as follows: 72 (92%) are in good or fair condition and 6 are in poor condition (8%). For the 10 bridges that cross over the alternate routes, 9 of the 10 bridges (90%) are in good or fair condition, and the condition of the railroad bridge at MP 94.77 is unknown (FHWA 2023b). Information on all 88 bridges is provided in Appendix F, Bridges. Bridges identified as being in poor condition include:

- Bridge 5664 carrying NM 122 at MP 27.08 (near I-40 MP 74)
- Bridge 1778 carrying NM 124 at MP 3.567 (near I-40 MP 93)
- Bridge 3091 carrying NM 124 at MP 19.35 (near I-40 MP 108)
- Bridge 3089 carrying NM 124 at MP 22.82 (near I-40 MP 112)
- Bridge 3088 carrying NM 124 at MP 22.95 (near I-40 MP 112)
- Bridge 6122 carrying Frontage Road 4012 at MP 0.004 (near I-40 MP 119.38)

3.9.7 Drainage

3.9.7.1 Methods

A culvert inventory and a hydraulic analysis were not performed for the alternate routes/frontage roads as part of this study. NMDOT Patrol/Maintenance staff for both District 3 and 6, who oversee maintenance operations for the study area, were contacted to identify notable drainage issues along I-40 and the adjacent alternate routes. In addition, previous drainage reports for the I-40 study area were reviewed as part of data collection and are summarized in Appendix G, Drainage. These reports were provided to Parametrix by the NMDOT, and 1 report was provided by Bohannan-Huston. Finally, floodplains mapped by the FEMA were identified along adjacent alternate routes.

3.9.7.2 Findings

Patrol/Maintenance Observations

NMDOT Patrol/Maintenance staff observations on adjacent alternate routes are summarized below:

- Overtopping on alternate routes occurs in several locations because the roads are too low or the existing drainage structures are undersized.
- MP 5 and MP 10: Rockfall area on NM 118 due to rainfall – NM 118 is typically closed for months at a time for this issue.
- MP 32 to MP 34 – Flooding occurs every year on the frontage road (NM 118) at this location, and water often runs onto the I-40 lanes. Bohannon Huston has studied the area from MP 29.5 to 36.5 recently and recommended improvements to help alleviate the problems. A brief summary of the report is provided in Appendix G, Drainage.
- Laguna (vicinity of MP 113 to MP 116) - Water ponds on the frontage road (NM 124)

Floodplains

Floodplains mapped by FEMA exist in several areas along the alternate routes as summarized in Exhibit 3-113. In several locations, the floodplains listed in Exhibit 3-113 and the NMDOT maintenance crew observations discussed above correspond, but there are many floodplain locations listed that have not been noted as overtopping. This may be due to the floodplain only overtopping the alternate routes during very large storm events that have not occurred in recent years. In addition, the floodplain may no longer exist due to changes to the topography or drainage flows, but the FIRM has not been updated to reflect those changes.

There are 39 locations where floodplains either intersect or include alternate routes. Exhibit 3-113 shows the MP of the floodplain (as it relates to I-40), the structure involved, FIRM map information, and the flooding source. Rows with red text are the 29 locations where the highway is within the floodplain and the travel lanes have the potential to be flooded. Some of these locations are not associated with a crossing structure, such as a bridge or culvert. These locations should be evaluated in more detail to determine if the flooding can be reduced or eliminated with the addition of new drainage structures. Locations with black text are where the floodplain intersects the alternate route, but the travel lanes are not within the floodplain. The locations with black text have bridges or culverts to convey the flood waters under the alternate route, and the roadway is not affected by the waterway.

The flood zones found in the study area are categorized as follows:

- Flood zones A, AE, or AO. These zones are considered high risk areas with at least a 1% annual chance of flooding (100-year flood event). All 40 flood zones that intersect with alternate routes in the study area are in flood zones A, AE, or AO.
  - → Flood zone A does not have a base flood elevation.
  - → Flood zone AE has established flood elevations.
  - → Flood zone AO has a 1 % chance of shallow floods (typically sheet flow flooding) and is typically located in or near rivers and streams.
- Flood zone X. This is considered to be an area of low flood risk, experiencing a flood probability of 0.2% annually (500-year flood event).

Exhibit 3-113. Mapped FEMA Floodplains for I-40 Alternate Routes

#	MP*	Structure ID	Flood Zone	Flood Insurance Rate Map	Community	Effective Date	Flooding Source
1	5.63	Bridge 3479	A	35031C1875E	McKinley County	2/17/2010	Unnamed Arroyo
2	6.30	Unknown	A	35031C1875E	McKinley County	2/17/2010	Unnamed Arroyo
3	9.25	Bridge 6129	A	35031C1875E	McKinley County	2/17/2010	Puerco
4	11.45	Bridge 3480	A	35031C1875E	McKinley County	2/17/2010	Saltwater Wash
5	15.43 to 15.54	Bridge 5386	A	35031C1515E	McKinley County	2/17/2010	Twin Buttes Wash
6	17.43 to 21.68	Bridge 7010, 5389, 7384, 10045	AE, X	35031C1515E, 35031C1520E, 35031C1540E	City of Gallup	2/17/2010	Puerco
7	21.86 to 22.53	Unknown	AE, X	35031C1540E	City of Gallup	2/17/2010	Puerco
8	25.0 to 25.64	Unknown	AO, X	35031C1545E	McKinley County	2/17/2010	Puerco
9	29.77	Bridge 6560	A	35031C1565E	McKinley County	2/17/2010	Puerco South Fork
10	33.79	Bridge 4279	A	35031C1575E	McKinley County	2/17/2010	Unnamed Arroyo
11	35.72 to 35.89	Bridge 10037	A	35031C1575E and 35031C1950E	McKinley County	2/17/2010	Puerco South Fork
12	47.78	Bridge 3068	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
13	50.56	I40-276	A	35031C2000E	McKinley County	2/17/2010	Unnamed Arroyo
14	52.01	Bridge 3056	A	35031C2025E	McKinley County	2/17/2010	Unnamed Arroyo
15	53.38 to 54.3	Bridge 3058	A	35031C2025E	McKinley County	2/17/2010	Unnamed Arroyo
16	67.87	Bridge 9426	A	35031C2450E	McKinley County	2/17/2010	Mitchell Draw
17	71.35 to 71.63	Unknown	A	35006C0125C	Cibola County	12/17/2010	Middle Ditch
18	71.72 to 72.0	Unknown	A	35006C0125C	Cibola County	12/17/2010	Middle Ditch
19	73.07 to 74.27	Bridge 5664	AE, X	35006C0125 C and 35006C0400C	Cibola County	12/17/2010	Middle Ditch
20	79.0	Unknown	AE, X	35006C0392C	Village of Milan	12/17/2010	Unnamed Arroyo
21	79.15	Unknown	AE, X	35006C0392C	Village of Milan	12/17/2010	Unnamed Arroyo
22	83.00	Bridge 5494	AE, X	35006C0413C	City of Grants	12/17/2010	Rio San Jose
23	83.8 to 84.00	Unknown	AE, X	35006C0413C	City of Grants	12/17/2010	Rio San Jose
24	84.50 to 84.7	Bridge 5981, 5982	AE, X	35006C0414C	City of Grants	12/17/2010	Rio San Jose
25	84.7 to 85.0	Bridge 9074	AE, X	35006C0414C	City of Grants	12/17/2010	Rio San Jose
26	85.8 to 86.0	Bridge 3104	A	35006C0420	Cibola County	12/17/2010	Unnamed Arroyo
27	88.9	Bridge 9075	A	35006C0700C	Cibola County	12/17/2010	Rio San Jose
28	89.25 to 89.64	Unknown	A	35006C0700C	Cibola County	12/17/2010	Unnamed Arroyo
29	91.0 to 93.15	Bridge 1776, 1777, I40-436	A	35006C0725C	Pueblo of Acoma	12/17/2010	Rio San Jose
30	94.49 to 94.57	Bridge 1779	A	35006C0725C	Pueblo of Acoma	12/17/2010	Rio San Jose
31	97.50	Bridge 3100	A	35006C0725C	Pueblo of Acoma	12/17/2010	Rinconada Creek
32	99.65	Bridge 3096	A	35006C0750C	Cibola County	12/17/2010	Unnamed Arroyo
33	99.90	Bridge 3095	A	35006C0750C	Cibola County	12/17/2010	San Jose Canyon
34	103.75	Bridge 3092	A	35006C0750C	Pueblo of Laguna	12/17/2010	Unnamed Arroyo
35	113.63	Bridge 5475, 5476	A	35006C0775C	Pueblo of Laguna	12/17/2010	Unnamed Arroyo
36	140-09 to 140.16	Bridge 2980	A	35001C0287G	Bernalillo County	9/26/2008	Unnamed Arroyo
37	140.50 to 140.95	Bridge 9234, I40-718, I40-720	AO, AE, X	35001C0287G	Bernalillo County	9/26/2008	Rio Puerco and Unnamed Arroyo
38	145.31 to 145.40	I40-760, 761, 762, 763	A	35001C0315G	Bernalillo County	9/26/2008	Unnamed Arroyo
39	146.85	I40-775	A	35001C0315G	Bernalillo County	9/26/2008	Unnamed Arroyo

FEMA = Federal Emergency Management Agency, All MP for alternate routes locations are based on I-40 MP locations.
Red text – Portions of I-40 that are in the flood plain.

3.9.8 Utilities

A Level D subsurface utility engineering (SUE) was performed for I-40 and alternate routes. Based on available records, there is a full complement of utilities through the study area, as discussed previously in Section 3.5. Available utilities for the alternate routes is provided in Appendix H, Utilities.

3.10 Environmental Existing Conditions and Considerations

Parametrix completed a desktop review of existing environmental conditions and environmental considerations for the study area as part of the Phase I-A/B analysis. The methods and findings of this analysis are provided in Appendix B, Environmental Scoping Report. A summary of the resources evaluated and key findings and considerations for existing conditions are provided in Exhibit 3-114. Further detailed environmental analysis will be needed as part of Phase I-C once projects are identified, funded, and planned and designed for implementation and construction.

Exhibit 3-114. Summary of Environmental Existing Conditions and Considerations

Resource	Summary
Land Ownership and Land Use	The study area crosses or approaches land owned by the Bureau of Land Management (BLM), New Mexico State Land Office, Department of Defense (DOD) , National Park Service, several Native American tribes, and multiple private landowners. A large portion of the study area is located on tribal lands owned by the Laguna Pueblo, Acoma Pueblo, and the Navajo Nation. The Zuni Reservation is located several miles south of the study area, and they have traditionally used lands in the study area and are in the process of a land transfer involving portions of land currently owned by the DOD adjacent to I-40 near MP 33. In addition to residential areas, land use is primarily composed of recreational, mining and oil, ranching and grazing, retail, medical, hospitality, and energy industries. At this time, it is not anticipated that additional right-of-way will be needed to build proposed improvements to I-40, but this will need to be verified on a project-by-project basis.
Visual Resources	Visual components include background and middle-ground views of various landscape and historic or culturally significant buildings along the I-40 mainline and other highways that parallel the interstate. Background views include mesas and bluffs, such as the red sandstone cliffs in Red Rock Park east of Gallup and Mount Taylor near Grants. Middle-ground views include visual components such as the basalt flows east of Grants, the stream and small water pools ponds that meander in an out of the highway right-of-way in this area, historic pueblos associated with the various tribal lands between Grants and Albuquerque, and the various components of Historic Route 66, such as historic buildings and bridges. Because the study area already includes a 4-lane interstate highway and various parallel state and local routes, the visual environment is unlikely to be impacted substantially by proposed improvements such as widening shoulders, adding a traffic lane and/or median barrier, or ramp extensions at interchanges. Parts of adjacent frontage roads pass near and through small communities. The potential for impact to visual resources is greater in these areas if major reconstruction occurs.
Noise	There are several communities that contain clusters of noise-sensitive land uses located within 500 feet of I-40 or alternate routes where proposed improvements could require a noise study. Improvements to I-40 could meet criteria for a Type I project improvement, which would require a noise analysis. Type I projects include adding a travel lane or substantially changing the horizontal or vertical alignment of the roadway. Projects such as replacing pavement and widening shoulders are unlikely to require additional noise analysis.
Air Quality	Air quality is not anticipated to be an issue since air quality in the study area is in attainment with federal air quality requirements. In addition, greenhouse gas analysis may be required for specific projects as part of environmental analysis required for Phase I-C.
Hazardous Materials	There are no identified hazardous waste or mine facilities within 1,000 feet of I-40 and its adjacent alternate routes. However, there are over 400 locations with potential to contain hazardous material within 1,000 feet. Most of these locations are areas where oil and gas product storage tanks may exist. Improvements that are proposed in areas with potential hazardous materials may require additional investigation.
Demographics and EJ	Residents in the study area have a notably higher minority population, Native American population, and low-income population than the state of New Mexico. The minority population in the study area is about 82% as compared to a state average of 63%. Native American communities in the study area include Laguna Pueblo, Acoma Pueblo, and the Navajo Nation. The Zuni Reservation is located several miles south of the study area. The study area crosses 20 census tracts, 13 of which are identified as disadvantaged. As such, ongoing engagement with the tribes and adjacent communities and consideration of potential effects will be critical as the study moves forward and individual projects are advanced. Efforts need to be taken to avoid alternatives that have potential to impact disadvantaged populations. This includes impacts through land acquisitions, increased traffic, and reduced access to community facilities that could negatively impact community cohesion.
Cultural and Historic Resources	The study area traverses an area that has been inhabited for millennia by Paleoindian hunter/gatherers and prehistoric pueblo residencies. Several Native American tribes live in the study area study area. Additionally, the study area is located along a natural east-west travel corridor that has been used across the ages. Given this history, nearly 800 previously documented cultural and historical resources have been previously identified in the study area, which extends about 500 meters (1,640 feet) from I-40 and alternate routes. Of the nearly 800 resources, there are 7 sections of Route 66 that are listed on the National Register of Historic Places (NRHP). These NRHP-listed sections of the roadway span approximately 90 miles, much of which include frontage roads/alternate routes adjacent to I-40. Specific improvements to I-40 or adjacent alternate routes will require further analysis and consultation to identify impacts and avoidance and minimization measures under the New Mexico Cultural Properties Protection Act, National Historic Preservation Act, and Section 4(f) under the United States Department of Transportation Act of 1966.
Section 4(f) Resources	4(f) properties located in the study area include the Old Bowlin's Trading Post, the We the People/Babe Ruth Park, the Continental Divide Trail crossing, the El Malpais Conservation Area, and several sections of Historic Route 66. Additionally, there are 2 archeological sites, the Manuelito Archeological Complex and the Fort Wingate Ruin, that should be considered as potential 4(f) properties. These areas will require review as part of project development.
Wetlands and Waterways	There are 212 waterways that intersect with I-40 and adjacent alternate routes in the study area, including 17 named waterways. The Rio San Jose is the only perennial river; the other waterways in the study area are intermittent or ephemeral. A total of 93 wetlands were identified in the study area. Any impacts to wetlands and waterways from proposed improvements to I-40 and adjacent alternate routes would need to be identified, permitted, and mitigated to meet requirements under the Clean Water Act.
Floodplains	A total of 58 flood zones intersects with I-40 or adjacent alternate routes. Of these 58 flood zones, 48 intersect with I-40. The alternate routes intersect with 39 flood zones, which includes 9 additional floodplains that are not crossed by I-40, for a total of 58 unique flood zones crossed. Any proposed improvements to I-40 and adjacent routes should consider impacts to floodplain elevation as part of roadway and drainage design.
Threatened and Endangered Species	A total of 94 sensitive species were identified as having the potential to occur within the study area. These sensitive species include flora and fauna that are identified as threatened and endangered at the federal and state levels, species listed as endangered by the Navajo Nation, and species of concern to the BLM and Natural Heritage New Mexico. ■ 8 animal and 3 plant species are identified as being threatened, endangered, or a candidate species regulated under the Endangered Species Act. ■ 5 animal species and 2 plant species are uniquely listed (are not already listed federally) as threatened or endangered by the state. New Mexico State threatened and endangered animal species are established and managed by the New Mexico Department of Game and Fish, and plant species are regulated by the New Mexico Energy, Minerals and Natural Resources Department. ■ 10 animal species and 18 plant species that are uniquely listed (meaning they are not already state or federally listed) as endangered by the Navajo Nation. ■ 12 animal species and 9 plant species are uniquely listed by the BLM as sensitive. ■ Natural Heritage New Mexico reports there are 20 rare plant species that potentially occur in the study area in addition to 4 sensitive animal species, and 3 sensitive plant species that have been observed. Any species listed as threatened or endangered at either the federal, tribal, or state level are most critical and would require assessment, documentation, and consultation as part of environmental review if they or their critical habitat are located in areas on I-40 or alternate routes where improvements are proposed. Potential improvements to I-40 or adjacent frontage roads would also need to consider impacts to listed species of concern, such as those identified by the BLM and Natural Heritage New Mexico.
Farmland Soils	Most of the soil in the study area is classified by the United States Department of Agriculture web soil survey as "not prime farmland." However, there are several small areas where soils are classified as "farmlands of local importance" and "prime farmland if irrigated." These soils could be impacted by proposed improvements, which may require additional investigation and consultation with the United States Department of Agriculture Natural Resources Conservation Service.

4. Alternatives Development and Phase I-A Initial Screening

4.1 Introduction

This chapter summarizes and documents I-40 corridor issues and needs and includes a purpose and need statement. It also identifies alternatives and operational enhancements that could meet I-40 corridor needs, provides the findings of the initial Phase I-A screening analysis, and identifies alternatives that are further developed, analyzed, and compared in Phase I-B as discussed in Chapter 5.

4.2 Purpose and Need

The purpose of the I-40 Corridor Study is to improve traveler safety, traffic operations and reliability, and the condition of the roadway and associated infrastructure on I-40.

Meeting the above project purpose requires consideration of:

- Expected traffic growth, especially as it relates to forecasted growth in freight transport.
- Accommodating and adapting to changing technologies that may substantially influence how vehicles operate and how traffic is managed (e.g., autonomous vehicles and advanced Intelligent Transportation Systems [ITS]).

The primary factors contributing to the need for improving I-40 are summarized below:

- **Geometrics**
  - → As described in Chapter 3, Sections 3.2.5, 3.2.6, and 3.2.7, 48% of the horizontal curves, 6% of the vertical curves, and 73% of interchange access ramps do not meet current interstate highway design requirements. In addition, while shoulder widths in most areas meet guidelines established in the American Association of State Highways and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* (“*AASHTO Green Book*”; AASHTO 2018), which includes inside shoulder widths of at least 4 feet and outside shoulder widths of at least 10 feet, there are many areas, such as bridges, where inside and outside shoulder widths do not meet these guidelines as shown in Appendix I, I-40 Existing Typical Sections.
- **Infrastructure Condition**
  - → There are many undersized drainage structures that need to be addressed to accommodate 50-year and 100-year storm criteria as discussed in Chapter 3, Section 3.4. A long-term solution is needed in the Fort Wingate area near milepost (MP) 33 due to ongoing flooding that causes closures of both I-40 and parallel alternate route NM 118.
  - → A total of 5 bridges are currently in poor condition as described in Chapter 3, Section 3.3.
  - → There are several areas as described in Chapter 3, Section 3.2.13 where the pavement is in poor condition and needs to be addressed.
- **Future Traffic Growth**
  - → Traffic growth, in particular with heavy trucks, may affect future traffic operations. On most of I-40 in the study area, the existing capacity of 2 lanes is expected to be sufficient to meet LOS C or better through 2050. However, there are spot locations in Gallup and at on-ramps and off-ramps that are expected to degrade below LOS C by 2050 if improvements are not made as discussed in Chapter 3, Section 3.7.6. LOS D is considered the failure threshold for rural interstate highway and ramp segments located in areas where the population less than 5,000 as established by the *State Access Management Manual (SAMM)* (NMDOT 2001, Table 15.C-1). LOS E is considered the failure threshold for urban interstate highway and ramp segments located in areas where the population is 5,000 people or more per the *SAMM*. Urban area boundaries in the I-40 study area include Gallup from about MP 13.5 to 29.7, Grants from about MP 78.5 to 85.6, and the eastern edge of Albuquerque near MP 144.5 (NMDOT 2024). While there is some variation between areas identified as rural or urban on this section of I-40, the desired LOS for I-40 from MP 0 to 150 in the study area is identified as being LOS C, since the majority of the study area is defined as rural, and the majority of trips in the corridor including more than 80% of commercial truck trips and 40% of passenger vehicle trips are through trips, meaning they are beginning and ending outside of the 150-mile I-40 corridor. LOS C was identified as being an appropriate target LOS, since the desire is to have similar operating conditions through the I-40 corridor between the Arizona State line and the eastern edge of Albuquerque at the Atrisco Vista Interchange at MP 150.
- **Safety**
  - → Crashes on I-40 were revised from 2016 to 2021 and they have increased since 2016. This increase is most prevalent with crashes involving heavy trucks, which have substantially increased from a low of 34% (177 of 523 crashes) in 2016 to a high of 51% (309 of 600 crashes) in 2021. Fatal and serious injury crash rates on many sections of I-40 in the study area are higher than averages for similar roadways in New Mexico, Arizona, and Texas as shown in Exhibit 4-1 and Exhibit 4-2. A high number of crashes involve sideswipes (17%), rear-end collisions (13%), and overturn crashes (14%). These crash types are indicative of spot congestion, lane changes, and insufficient recovery areas.

Exhibit 4-1. I-40 Fatal Crash Rates, 2016 through 2021

Freeway Type	Location	Fatality Rate (Fatalities /year/ HMVM) Actual	NM Average [2]	AZ Average [3]	TX Average [4]
Rural	Rural I-40 MP 0 to 150	***1.76***	1.17	0.13	1.09
	AZ to Gallup MP 0.0 - 16.1	***1.84***			
	Gallup to Thoreau MP 26.3 - 53.0	***2.08***			
	Thoreau to Grants MP 53.0 - 78.9	*1.06*			
	Grants to Laguna MP 85.6 - 114.7	***1.69***			
	Laguna to MP 150 MP 114.7 – 150.0	***1.99***			
Urban[1]	Grants Urban Area MP 78.9 - 85.6	***1.81***	1.10	0.08	0.91
	Gallup Urban Area MP 16.1 - 26.3	***1.19***			

AZ = Arizona, HMVM = hundred-million vehicle-miles, NM = New Mexico, TX = Texas
1 For this analysis, urban areas are defined as the limits between interchanges in Gallup and Grants
2 NMDOT 2020a, 3 ADOT 2020, 4 TXDOT 2020

Exhibit 4-2. I-40 Serious Injury Crash Rates, 2016 through 2021

Freeway Type	Location	Serious Injury Rate (Serious Injury/ year/ HMVM) Actual	NM Average [2]	AZ Average [3]	TX Average [4]
Rural	Rural I-40 MP 0 to 150	*1.79*	1.70	0.32	3.00
	AZ to Gallup MP 0.0 - 16.1	*2.50*			
	Gallup to Thoreau MP 26.3 - 53.0	*1.36*			
	Thoreau to Grants MP 53.0 - 78.9	*1.63*			
	Grants to Laguna MP 85.6 - 114.7	*2.02*			
	Laguna to MP 150 MP 114.7 – 150.0	*1.75*			
Urban[1]	Grants Urban Area MP 78.9 - 85.6	*1.15*	3.83	0.27	3.5
	Gallup Urban Area MP 16.1 - 26.3	*1.10*			

AZ = Arizona, HMVM = hundred-million vehicle-miles, NM = New Mexico, TX = Texas

1 For this analysis, urban areas are defined as the limits between interchanges in Gallup and Grants

2 NMDOT 2020a, 3 ADOT 2020, 4 TXDOT 2020

- **Traffic Operations and Reliability**

  → The I-40 corridor provides critical national infrastructure for freight traffic and there is minimal existing ITS infrastructure in the corridor for a facility of this type. Identified deficiencies include limited closed-circuit television (CCTV) monitoring, dynamic messaging signs to broadcast traveler information, and traffic data collection. Expanding the ITS infrastructure would improve operations and safety. Additionally, there is currently no continuous fiber optic/broadband communication network from the Arizona State line to Albuquerque. Expanding the fiber optic network in the study area is needed to support effective ITS.

  → Construction projects and maintenance activities on I-40 often result in eastbound or westbound traffic being reduced to a single lane through the work zone. Reducing traffic to 1 lane in the eastbound or westbound direction is challenging with existing traffic volumes during peak travel hours and days, as discussed previously in Section 3.7.7. Rear-end crashes account for 13% of crashes in the I-40 study area, but in construction zones, approximately 27% of crashes are rear-end crashes, which is indicative of congestion or long traffic queues.

  → The rural and remote nature of some parts of the I-40 corridor makes it difficult to respond quickly to crashes and weather-related events and restore traffic flow. Moreover, narrow shoulders limit the ability to divert traffic around crashes and incidents. Adjacent local roads and highways provide alternate routes that cover about 113 of the 150 miles of the study area, but adjacent alternate routes are not available in about 37 miles of the study area. On the existing alternate routes there are roadway capacity and other limitations (such as vertical and horizontal bridge clearances for trucks). In most areas, alternate routes are 2-lane roadways with narrow shoulders and posted speeds of 35 to 55 miles per hour (mph). These roadways travel through rural areas, pueblos, and small communities with multiple access points (driveways and adjacent roadways) and have limited connections to and from I-40.

4.3 Alternatives Development

Improvements for the I-40 corridor were identified by the study team through consultation with NMDOT, the Strategic Corridor Development Team, stakeholders, and the public. Potential alternatives identified and evaluated as part of the Phase I-A process are described and discussed below, including:

1. Alternatives Considered but Eliminated
2. Proposed Build Alternatives
3. Operational Enhancements Common to All Alternatives

What is the Strategic Corridor Development Team?

The Strategic Corridor Development Team is an advisory group of NMDOT project leadership and transportation leaders that have extensive transportation experience in New Mexico and other states. The purpose of the Strategic Corridor Development Team is to engage professionals with extensive experience to provide additional perspectives and input on possible solutions and recommendations for the I-40 Corridor. This group convened at key points during the Phase I-A/B process and met twice during the initial alternatives development phase to provide input on alternatives.

4.3.1 Alternatives Considered but Eliminated

As part of alternatives development, the study team considered the possibility of travel demand management (TDM) strategies that could shift travel by time of day or to a different travel mode to reduce peak-hour and/or daily traffic demand on I-40. TDM strategies can include carpooling and vanpooling services, transit, commuter rail, and other similar strategies, such as remote work schedules. While the number of remote workers increased significantly during the Covid-19 pandemic, opportunities to work from home are not practical for all job types or employers. In addition, the NMDOT does not have the ability to influence schedules of business and commercial operations, especially goods transport, which is a major part of I-40 traffic. For this reason, the discussion of alternative travel modes for the I-40 corridor is limited to 2 alternatives:

- Commuter Rail Service
- Enhanced Commuter Bus Service

The study team considered these alternatives as part of initial work to identify a possible range of alternatives that would be developed and screened as part of the Phase I-A initial alternatives analysis. These concepts were eliminated from additional screening analysis in Phase I-A because it was found that the benefits that they would provide would not meet critical needs identified for I-40 including:

- Addressing geometric, drainage, bridge, and pavement deficiencies
- Improving safety
- Improving traffic operations and reliability

In addition, development and implementation of improved commuter rail or bus services could be developed at any time as stand-alone projects. A description of these 2 alternatives and a discussion of the initial analysis that was done to determine that they would be eliminated from further consideration is provided below.

4.3.1.1 Commuter Rail Service

The Commuter Rail Service alternative would develop commuter rail in the I-40 study area on the existing rail lines used by Amtrak, similar to the Rail Runner service between Santa Fe and Belen. Service would be more frequent than current Amtrak service, which offers a once-daily round trip from Gallup to Albuquerque and a once-daily trip from Albuquerque to Gallup (Amtrak 2023). The existing station in Gallup would remain, but additional stations would be added likely in Grants/Milan and the Laguna Pueblo.

This alternative would not meet needs specific to I-40, including addressing geometric, drainage, bridge, and pavement deficiencies; improving safety; and improving traffic operations and reliability. In addition, based on the initial analysis, it was determined that the potential reduction of passenger cars on I-40 from this alternative would be low because the number of people commuting to/from McKinley and Cibola counties to Albuquerque that would potentially use the service on a regular basis is low. According to US Census Bureau 2011–2015 5-Year American Community Survey Commuting Flows commuting data, fewer than 400 workers living in Cibola County work in Bernalillo County, and about 750 residents work in McKinley County. For McKinley County residents, approximately 500 work in Cibola County, and 183 work in Bernalillo County (US Census Bureau 2023). Travel data on specific work locations in Bernalillo County and McKinley County are not readily available, and locations with a high number and concentration of jobs are not present in any of the communities served by I-40. The Route 66 Casino is a major employer, and transit service to this destination is already served by Shaa'srk'a Transit and Rio Metro Route 66. Even with a 10% mode share assumption — a high level not achieved by any transit service in New Mexico — commuter rail would result in only a small reduction of traffic on I-40 and would not be expected to result in notable reductions of travel demand/vehicles that would use I-40. In summary, effective commuter service requires adequate passenger demand, and the long distance of the I-40 study area and low population and job density limit the cost-effectiveness of commuter service.

In addition, existing, affordable rail service is currently provided in the I-40 study area, and it appears that there is available capacity for additional travelers on this route (Amtrak 2023). While it may be possible to operate new commuter rail service on the existing tracks, the costs would be high since it would require the NMDOT secure rights to use the tracks and invest in necessary safety upgrades, construct stations, purchase trains, and make other investments, such as train and track maintenance. Finally, expanding commuter rail service would not be precluded by proposed roadway improvements to I-40 as part of this corridor study and could be pursued in the future as a separate project if conditions change. For these reasons, an alternative to develop commuter rail service was eliminated from further consideration as either a stand-alone alternative or a supporting improvement.

4.3.1.2 Enhanced Commuter Bus Service

The Enhanced Commuter Bus Service alternative assumes intercity commuter bus operates from park-and-ride facilities similar to the service provided by the NMDOT between Albuquerque and Santa Fe and between Santa Fe and Los Alamos. This alternative would include state-operated commuter bus augmented by park-and-ride facilities within Gallup, Grants/Milan, and Laguna Pueblo.

Similar to the Commuter Rail Service alternative, the Enhanced Commuter Bus Service alternative would not meet needs specific to I-40, including addressing geometric, drainage, bridge, and pavement deficiencies; improving safety; and improving traffic operations and reliability. However, existing bus service in the corridor would benefit from any roadway improvements made in the I-40 corridor. In addition, based on initial analysis, it was determined that the potential reduction of passenger cars on I-40 from this alternative would be low because the number of people commuting to/from McKinley and Cibola counties to Albuquerque that would potentially use the service on a regular basis is low. As summarized for the Commuter Rail Service alternative, the number of intercity trips that could be captured by commuter bus and park and ride would be low. For state-operated commuter bus service to be viable, users must be destined to a major employment site. While commuter bus service is effective within the I-25/US 285 corridors between Albuquerque and Santa Fe and between Santa Fe and Los Alamos, these corridors have both a high number and density of employees (e.g., the state government complexes in Santa Fe and the National Laboratories in Los Alamos). For comparison purposes, US Census Bureau 2011–2015 5-Year American Community Survey Commuting Flows commuting data show 3,658 workers residing in Bernalillo County who work in Santa Fe County and 3,703 workers residing in Santa Fe County who work in Los Alamos County (US Census Bureau 2023) — values that are 5 to 10 times greater than intercity work trips within the I-40 study area. The low number of trips that could be shifted to transit in combination with the absence of large and dense employment centers makes commuter bus service unlikely to capture a mode shift adequate to make this type of transit service successful and able to result in notable reductions of travel demand/vehicles that would use I-40. In summary, the lengthy distance of the I-40 study area and the low population and job density limit cost-effectiveness of commuter service.

In addition, existing local bus service is currently provided in the I-40 study area by Gallup Express, Cibola Rockin' 66 Express (Grants/Milan area), Shaa'srk'a Transit (Laguna Pueblo), and Rio Metro Route 66 (Albuquerque). The service provided by these operators is limited to fixed-route and demand-response service within the surrounding areas of Gallup, Zuni, Grants/Milan, and Laguna Pueblo. Shaa'srk'a Transit and Rio Metro Route 66 also provide commuter routes to the Route 66 Casino, which provides a connection between Laguna Pueblo and the Central Avenue/Unser Boulevard Park and Ride station on the Albuquerque west side. Intercity transit service is not provided by any of the public transit agencies operating within the I-40 corridor but is available by Greyhound. This service includes daily early morning and early or late evening routes with stops in Gallup, Grants, and Albuquerque (Greyhound 2023). In addition to the above services, non-emergency transportation to regional medical services outside of the areas served by local transit is available by private providers.

This alternative was eliminated from further consideration as either a stand-alone alternative or a supporting improvement because benefits to traffic operations on I-40 would be negligible, the cost to implement would be high, and expanding commuter bus service is not precluded and could be pursued in the future as a separate project if conditions change. However, vanpool programs could be an effective strategy for the I-40 study area. Programs that provide financial support for individuals desiring to initiate this type of service are available through the NMDOT. Opportunities to support the formation of vanpool operations or other smaller scale transit services can be investigated as individual projects are advanced.

4.3.2 Proposed Build Alternatives

A total of 7 build alternatives were identified as part of the alternatives development process described in the following text:

4.3.2.1 Enhanced 2-Lane

The Enhanced 2-Lane would include the following improvements:

- Geometric deficiencies (horizontal, vertical, and interchange access ramps) would be addressed.
- Drainage, bridge, and pavement deficiencies would be addressed.
- 2 lanes would continue to be provided in each direction and the inside and outside shoulders would be widened to 12-feet on both sides.
- Crossovers would be built throughout the I-40 study area.

Roadway shoulders on I-40 currently range from an outside shoulder width of 6 to 12 feet and an inside shoulder width of 4 to 8 feet. However, there are some areas, such as on bridges, where the inside shoulder is less than 4 feet or the concrete wall barrier or guard rail is located within the 4-foot shoulder. On 2-lane interstate highways, the *AASHTO Green Book* (AASHTO 2018) specifies an outside shoulder width of at least 10 feet and indicates that a width of 12 feet should be considered in areas where large tractor-trailer truck volumes exceed a daily hourly volume of 250 large trucks per hour. Truck volumes in the study area exceed 250 trucks per hour for several hours each day. For inside shoulders on 2-lane facilities, the *AASHTO Green Book* specifies widths of at least 4 feet. This alternative would widen both shoulders to 12 feet, which would provide multiple options for maintaining 2 lanes of traffic in each direction during construction or maintenance activities. It would also provide space for the shoulder to be used temporarily to get at least 1 or sometimes

2 lanes open to traffic as soon as possible when there are incidents or crashes that require closing 1, 2, or a single direction of travel on I-40.

Crossovers would be constructed approximately every 2 miles throughout the I-40 corridor to provide a pathway to allow state police and the NMDOT to set up temporary detours that would provide a connection for vehicles to cross the I-40 median into the eastbound or westbound lanes as part of a temporary detour in the event of a crash. Crossovers are proposed about every 2 miles to make it feasible to have enough traffic control devices to set up a temporary detour in the case of an incident. This distance was established as part of an incident management program developed in 2013 that built crossovers on I-40 from MP 134 to MP 148 in District 3 (NMDOT 2013).

4.3.2.2 Enhanced 2-Lane with Added Lanes

This alternative would include all of the elements of the Enhanced 2-Lane plus the following enhancements:

- A third travel lane would be built in targeted areas of I-40 to address specific capacity needs.

The purpose of adding the third lane in targeted areas would be to address capacity constraints, including areas in Gallup where LOS is expected to degrade below LOS C by 2050 without improvements and areas such as steep grades where travel speeds drop.

4.3.2.3 Enhanced 2-Lane with a Part-Time Shoulder Running Lane

This alternative would include all of the elements of the Enhanced 2-Lane plus the following enhancements:

- Once the roadway shoulders were expanded and supporting ITS elements were added where needed, sections of I-40 would be regularly operated as a part-time shoulder-running lane in a select area or areas as part of daily or weekly roadway operations.

A part-time shoulder-running lane is a congestion management strategy that uses roadway shoulders as temporary traffic lanes during periods of recurring congestion. Part-time shoulder-running can be limited to specific vehicle types, such as passenger vehicles, or can be open to all traffic. Part-time shoulder-running lanes can be implemented using static or dynamic methods. Access to a statically controlled part-time shoulder lane is allowed during peak periods determined by traffic count data and observation. Generally, a sign will be posted that announces the hours that the lane is available for use (e.g., 6 to 9 AM and 3 to 6 PM daily). For a dynamic system, access to a part-time shoulder lane is allowed when sensors installed on the system detect congested traffic conditions. In this case, digital signs will alert drivers when the lane is open for travel.

A part-time shoulder-running lane is different than temporarily using a shoulder for incident management or to maintain highway capacity during construction, as described for the Enhanced 2-Lane Alternative. Temporary use of shoulders for incident or construction management can occur at any location of a highway where the shoulders are wide enough for short-term use, and they are built to withstand vehicle use. A part-time shoulder-running lane is a congestion management strategy that is used in a specific area, usually for shorter segments of highway where recurring congestion is known to occur at certain times of the day (such as peak travel hours on urban freeways) or days of the week (such as weekends on the I-70 corridor in Colorado). Part-time shoulder-running lanes require supporting enforcement, signage, and overhead lane controls to indicate when vehicles are permitted in the shoulder; pavement markings to indicate the presence of the part-time shoulder lane; monitoring (through the use of cameras) to make sure the lanes are clear for use; and consideration of emergency turnouts. They may be coupled with supporting ITS, such as traffic detectors, variable message signs, or a weigh-in-motion system.

4.3.2.4 Enhanced 2-Lane with Passing Lane at Consistent Intervals

This alternative would include all of the elements of the Enhanced 2-Lane plus the following enhancements:

- A third travel lane/passing lane would be constructed every 5 miles to provide a space for faster-moving vehicles to pass. Consistently spaced passing lanes provide drivers with a known interval before a passing lane is available. This can help prevent risky passing maneuvers when the next passing opportunity is unknown.

4.3.2.5 3-Lane Alternative

This alternative would include all of the elements of the Enhanced 2-Lane plus the following enhancements:

- A third travel lane would be added in each direction for the full 150-mile corridor.

As described for the Enhanced 2-Lane, shoulders would be widened to 12 feet on both sides. For interstate roadways with 3 lanes in each direction, the *AASHTO Green Book* specifies a minimum shoulder width of 10 feet on both sides but recommends consideration of a 12-foot shoulder on both sides when truck volumes are as high as they are on this section of I-40.

4.3.2.6 Add a Managed Lane in Each Direction

This alternative would include all of the elements described under the 3-Lane Alternative, but the third lane would be a managed lane and could be managed in several different ways. Common types of managed lanes include high-occupancy vehicle (HOV) lanes, toll lanes, or special-use lanes (such as express, bus-only, or a freight-only lane). While managed lanes can have application on both rural and urban freeways, these lanes are typically used to manage congestion in areas where congestion is high and occurs regularly at the same time each day or on particular days of the week.

4.3.2.7 Reversible 2-Lane in Median

This alternative would include all of the elements of the Enhanced 2-Lane with the following modifications and enhancements:

- Roadway shoulders on the mainline would be widened, where needed, to achieve an I-40 mainline typical section with 2, 12-foot driving lanes, a 12-foot outside shoulder, and a 4-foot inside shoulder (note that a 12-foot inside shoulder would not be provided with this alternative).
- A reversible 2-lane section would be built in the median of I-40. The reversible 2-lane section would be comprised of 2, 12-foot driving lanes and 12-foot inside and outside shoulders, for a total width of 48 feet.

The reversible lane section could be used to maintain 2 lanes of traffic for construction that would occur in either the eastbound or westbound lanes. The reversible section could also be used to accommodate eastbound or westbound traffic during lane closures from crashes or other incidents. During normal operations, these lanes could accommodate either eastbound or westbound traffic, depending on the direction of travel that would benefit from the additional lanes. Development and use of the reversible lanes would require building multiple entry and exit points where drivers could get into and out of the lanes to access on and off-ramps. It would also require a high-level of management, monitoring, and supporting ITS improvements to inform drivers of when the lanes could be used and by which direction of travel.

4.3.3 Operational Enhancements Common to All Alternatives

The following operational enhancements will be incorporated as part of all build alternatives to meet needs identified in Section 4.2 related to improving traffic operations and reliability. These operational enhancements would not serve as independent, stand-alone alternatives, but would add value to improving operations and reliability on I-40. These operational enhancements were developed based on discussions with and input from the NMDOT, the Strategic Corridor Development Team, stakeholders, and the public.

4.3.3.1 ITS Improvements

Potential ITS improvements were developed in consultation with the NMDOT ITS Bureau and NMDOT Broadband liaison. The proposed ITS improvements include a range of ITS solutions including basic and enhanced solutions as summarized in Exhibit 4-3.

Exhibit 4-3. ITS Improvements Overview

Traffic Management	Traveler Information	Maintenance & Construction	Road & Weather Conditions	*Active Traffic Management**	*Commercial Vehicles**
▪ Freeway and traffic monitoring ▪ CCTV and traffic sensor monitoring ▪ Freeway operations ▪ DMS roadside information ▪ Incident management support ▪ Traffic data collection	▪ Broadcast traveler information ▪ EV charging station information	▪ Work zone management ▪ Maintenance and construction information dissemination ▪ *Work zone safety monitoring, such as smart construction work zones*	▪ Weather data collection ▪ Weather information processing and distribution	▪ *Dynamic lane management* ▪ *Variable speed limits* ▪ *Dynamic roadway warning* ▪ *Service patrol support*	▪ *Commercial vehicle parking* ▪ *Commercial vehicle EV charging station information* ▪ *Dynamic travel planning, such as a Truck Parking Availability System*

CCTV = closed-circuit camera, DMS = dynamic message sign, EV = electric vehicle, ITS = intelligent transportation system
Italicized text indicates additional enhanced ITS services

Basic ITS improvements would improve traffic operations and safety by implementing services for traffic management, monitoring, and data collection and provide traveler information, work zone management, and weather data collection and processing. Enhanced ITS Improvements would include additional services to provide additional active traffic management services (variable message signs, dynamic lane management, service patrol support, etc.), specific support for commercial vehicle operations, and expanded data management services in work zones.

4.3.3.2 Minimize Lane Closures During Construction and Maintenance

This would include developing and implementing construction approaches to minimize disruptions to traffic during construction and maintenance activities. This could include several options, such as:

- Developing concepts to maintain 2 travel lanes in each direction on I-40 during construction and maintenance activities
- Reducing I-40 to 1 travel lane, when necessary, only during off-peak days and times, such as nighttime

4.3.3.3 Incident Management Improvements

This concept would include improving incident management to formalize policies and procedures and could include the following components:

- Developing and implementing a corridor-wide incident management plan (with identified detours and best management practices) for responding to incidents and getting traffic moving as quickly as possible
- Providing additional traffic control support to State Patrol and local police during incidents
- Providing a courtesy patrol at specific times in the corridor to assist drivers of disabled vehicles or those involved with crashes

4.3.3.4 Alternate Route Improvements

This concept would include improving and/or building new alternate routes adjacent to I-40 to provide roadway access adjacent to I-40 when I-40 is closed in one or both directions to respond to incidents and could include the following:

- Considering improvements on either I-40 or building new parallel roadways within the right-of-way for the 37 miles where alternate routes are not provided
- Reconstructing or rehabilitating pavement on existing alternate routes, where needed
- Removing vertical clearance constraints for trucks on alternate routes (box culverts at MP 8.4 and MP 90.6)
- Considering improvements to bridges with limitations (such as horizontal clearance limitations) as they approach the end of their service life

4.4 Phase I-A Initial Screening Criteria, Analysis, and Findings

The 7 alternatives were evaluated using qualitative and quantitative screening criteria that were developed to assess the ability of an alternative to meet needs identified in Section 4.2. The screening criteria used in the initial Phase I-A screening analysis include:

- **Criteria 1: Address Geometric Deficiencies** – The ability of an alternative to address identified horizontal and vertical deficiencies and interchange acceleration/deceleration length deficiencies on I-40. Geometric deficiencies were identified using the *AASHTO Green Book*, as described in Chapter 3.
- **Criteria 2: Infrastructure Deficiencies** – The ability of an alternative to address identified drainage, bridge, and pavement deficiencies on I-40. Drainage, bridge, and pavement deficiencies were identified as described in Chapter 3.
- **Criteria 3: Improve Safety** – A qualitative discussion of the ability of an alternative to improve safety on I-40.
- **Criteria 4: Accommodate Future Traffic Growth –** The degree to which an alternative could accommodate future traffic growth. To accommodate future traffic growth, it was assumed that an alternative should maintain at least LOS C or better.
- **Criteria 5: Improve Traffic Operations and Reliability –** Improvements to traffic operations and reliability were qualitatively assessed by considering the degree to which the alternative could improve traffic operations during construction, maintenance, incident management, and address ITS needs.

The 7 alternatives were compared to the screening criteria to determine if they could meet identified needs. Based on this assessment, the most favorable alternatives were recommended for further consideration, development, and evaluation in Phase I-B. Concepts that did not meet the screening criteria were not recommended for further consideration. The results of the screening evaluation are discussed in Exhibit 4-4.

Exhibit 4-4. I-40 Improvements Screening Analysis

Alternative	Screening Evaluation
1. Enhanced 2-Lane	▪ Criteria 1: This alternative would address identified geometric deficiencies on I-40. ▪ Criteria 2: This alternative would address identified drainage, bridge, and pavement deficiencies on I-40. ▪ Criteria 3: Safety would be expected to improve on I-40 as a result of correcting geometric deficiencies. Wider roadway shoulders would improve safety by providing space to clear crashes and maintain 2 lanes of traffic when roadway construction or maintenance is needed. Supporting improvements related to ITS would improve safety by providing information on crashes, weather, construction, or other issues. This information can influence driver behavior, encouraging them to be alert, slow down, or consider alternate routes. Improvements to incident management would reduce incident response times, which could decrease the likelihood of secondary crashes that can occur due to lane closures or abrupt slowdowns. ▪ Criteria 4: In most of the I-40 corridor, this alternative would accommodate future traffic growth and maintain at least LOS C operations on I-40; however, there are spot locations that are expected to degrade below LOS C by 2050 without capacity improvements, so it would not meet Criteria 4. ▪ Criteria 5: This alternative would improve traffic operations and reliability on I-40 by providing wider shoulders and crossovers that could be used to provide temporary capacity to keep traffic moving during incident response and to maintain 2 lanes of traffic during construction or maintenance activities. In addition, supporting enhancements for ITS, incident management, and minimizing lane closures during construction and maintenance would improve reliability on I-40. Improvements to alternative routes would improve the ability of alternative routes to serve as temporary, short-term routes for drivers when one or both direction of I-40 are closed due to an incident. This alternative would meet needs identified for Criteria 1, 2, and 3 and 5. However, **this alternative is not recommended** for further consideration because it would not maintain at least LOS C or better as required for Criteria 4.
2. Enhanced 2-Lane with Added Lanes	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 1, Enhanced 2-Lane In addition, a third lane would be provided in areas where capacity is constrained, which could reduce the number of congestion-related crashes, such as sideswipes or rear-end crashes. ▪ Criteria 4: This alternative would widen sections of I-40 to 3 lanes, where needed, to maintain at least LOS C or better on I-40. ▪ Criteria 5: Same as Alternative 1, Enhanced 2-Lane. **This alternative is recommended** for further consideration because it would meet needs identified for all 5 criteria.
3. Enhanced 2-Lane with a Part-Time Shoulder-Running Lane	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 4: Same as Alternative 1, Enhanced 2-Lane, except this alternative may be able to accommodate future traffic growth and maintain at least LOS C if it were used in the areas that are expected to degrade below LOS C by 2050. However, part-time shoulder-running lanes require congestion to be severe, recurring, and consistent, and there are currently no known areas in the I-40 study area where this occurs. ▪ Criteria 5: Same as Alternative 1, Enhanced 2-Lane. This alternative would meet the needs identified for Criteria 1, 2, 3, and 5 and could possibly meet capacity needs identified under Criteria 4. However, **this alternative is not recommended** for further consideration because Alternative 2, Enhanced 2-Lane with Added Lanes, would better meet identified needs by addressing specific areas where additional capacity is necessary. In addition, this alternative is not precluded and could be accommodated if future data indicate that there are specific, relatively short segments of recurring congestion that would benefit from the implementation of this congestion management strategy.
4. Enhanced 2-Lane with Passing Lane at Consistent Intervals	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 4: Same as Alternative 1, Enhanced 2-Lane, except this alternative may be able to accommodate future traffic growth and maintain at least LOS C if it were used in the areas that are expected to degrade below LOS C by 2050. ▪ Criteria 5: Same as Alternative 1, Enhanced 2-Lane. This alternative would meet the needs identified for Criteria 1, 2, 3, and 5 and could meet capacity needs identified under Criteria 4 if 3-lanes were provided in all areas of Gallup that would not maintain LOS C by 2050 (about 10 miles). **This alternative is not recommended** for further consideration because it adds capacity and additional costs and impacts in areas where additional capacity is not needed. In addition, this alternative is not precluded and an additional lane could be accommodated in specific areas or specific intervals at a later time, should additional capacity needs be identified in the future.
5. 3-Lane Alternative	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 2, Enhanced 2-Lane with Added Lanes. ▪ Criteria 4: Same as Alternative 2, Enhanced 2-Lane with Added Lanes, only this alternative would provide an additional lane in each direction for the full 150 miles of the I-40 study area, which would improve corridor-wide LOS to a greater degree than Alternative 2. ▪ Criteria 5: Same as Alternative 1, Enhanced 2-Lane, a wider highway typical section with 3 lanes in each direction and wider shoulders would provide substantially more space on the highway to keep traffic moving and manage incident response and maintenance, or construction activities. **This alternative is recommended** for further consideration because it would meet needs identified for all 5 criteria and it has strong support from members of the public and some elected officials. Because of this, this alternative should be analyzed in more detail to be able to compare it to other alternatives and address comments from stakeholders even though highway capacity analysis indicates that widening to 3 lanes in each direction is not needed in most areas between now and 2050, and adding a third lane would increase costs and impacts compared to the Enhanced 2-Lane with Added Lanes alternative. In addition, though a third lane is not needed in the reasonably foreseeable future, providing a conceptual layout for a highway with 3 lanes in each direction would help ensure that spot improvements made on I-40 to meet capacity needs do not preclude the ability to add lanes to specific areas or through the entire 150 miles if needed in the future.

(Table Continues)

Exhibit 4-4. I-40 Improvements Screening Analysis (Continued)

Alternative	Screening Evaluation
6. Add a Managed Lane in Each Direction	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 2, Enhanced 2-Lane with Added Lanes. ▪ Criteria 4: Same as Alternative 5, 3-Lane Alternative, only this alternative would not add a general-purpose lane for all traffic; rather, it would add a managed lane, such as an HOV lane, toll lane, or a dedicated freight lane. Typically, toll facilities and HOV lanes are used as management strategies in areas with severe, recurring congestion. Congestion on I-40 in the study area does not occur on a consistent basis or location; therefore, a toll lane would be underutilized since there would be few benefits to paying to use the lane. HOV lanes are typically used to encourage people to carpool to limit the number of vehicles on the road. This would not be a viable strategy for managing freight trips in the study area, which represent about 40% of the traffic. For passenger trips, HOV lanes would have limited value to the public because congestion is low, and given the rural nature of I-40, drivers may have limited ability to carpool. While there could be some benefits to having a dedicated freight lane, overall traffic volumes and composition do not meet the typical criteria where freight-only lanes may be desirable (such as areas where truck volumes exceed 30%, AND peak volumes exceed 1,800 vehicles per lane-hour, AND off-peak volumes exceed 1,200 vehicles per lane hour [FHWA 2004]). The percentage of truck traffic on I-40 exceeds 30%, but projected peak traffic volumes in 2050 are expected to be well below 1,800 vehicles per lane hour. In 2050, projected peak traffic volumes are expected to be between 1,600 and 1,900 vehicles per hour in 2-lanes, or 800 to 950 vehicles per lane-hour. ▪ Criteria 5: Same as Alternative 5, 3-Lane Alternative. This alternative could meet the needs identified for all 5 criteria; however, **this alternative is not recommended for** further consideration because Alternative 5, 3-Lane Alternative would better meet identified I-40 corridor needs by providing an additional lane to all travelers. Managed lanes, including toll and HOV lanes require severe, recurring congestion to provide a travel time advantage, and these traffic conditions are not found in the I-40 study area. In addition, traffic conditions do not meet guidelines for providing a freight-only lane. Also, this alternative is not precluded and could be accommodated if conditions change over time and future data indicate that traffic operations would benefit from managing a third lane.
7. Reversible 2-Lane In Median	▪ Criteria 1: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 2: Same as Alternative 1, Enhanced 2-Lane. ▪ Criteria 3: Same as Alternative 1, Enhanced 2-Lane with Added Lanes. ▪ Criteria 4: It is possible, but uncertain if this alternative would meet the NMDOT LOS requirements in areas expected to degrade below LOS C by 2050. This alternative would build 2 additional lanes in the median, which would provide additional capacity; however, reversible lanes are only an effective strategy when traffic patterns consistently have substantially more traffic in one direction for a part of the day and the opposite direction for another part of the day. Currently, eastbound and westbound traffic volumes are relatively balanced on I-40, so adding a reversible lane would not be an effective strategy to manage traffic. In addition, designing entry/exit points would be challenging and could limit movements to on- and off-ramps for travelers using the reversible lanes and would require a high level of ongoing management and ITS. ▪ Criteria 5: Having a reversible 2-lane section for the entire length of the study area would provide an option to provide 2 lanes of traffic during construction activities and keep traffic moving if one direction of travel were closed on I-40. This alternative would meet Criteria 1,2, 3, and 4 and could potentially meet Criteria 4; however, **this alternative is not recommended** for further consideration because it is uncertain if it could meet long-term LOS needs since traffic volumes are relatively balanced in the I-40 study area and, therefore, would not be an effective traffic management strategy in this corridor. It would also have a high cost and large footprint and would require a high-level of management and supporting ITS. Alternative 2, Enhanced 2-Lane with Added Lanes, and Alternative 5, 3-Lane Alternative, would better meet I-40 corridor needs.

4.5 Alternatives Recommended for Detailed Analysis

Based on the Phase I-A screening evaluation, the following alternatives are recommended for further development and evaluation in Phase I-B:

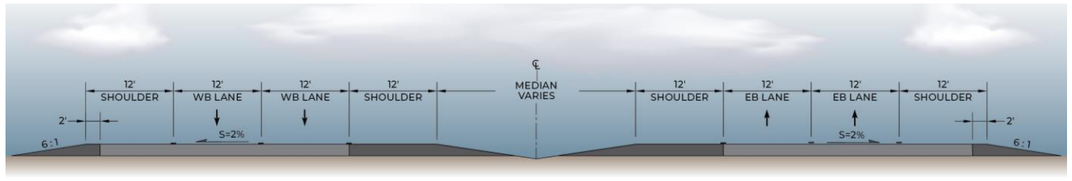
Build Alternatives

- Enhanced 2-Lane with Added Lanes Alternative
- 3-Lane Alternative

4.5.1 Enhanced 2-Lane with Added Lanes Alternative

This alternative is described in Section 4.3.2.2 and an example typical section is shown below in Exhibit 4-5. Please see Chapter 5 for a discussion of proposed typical sections throughout the study area.

Exhibit 4-5. Example I-40 Typical Section: Enhanced 2-Lane with Added Lanes

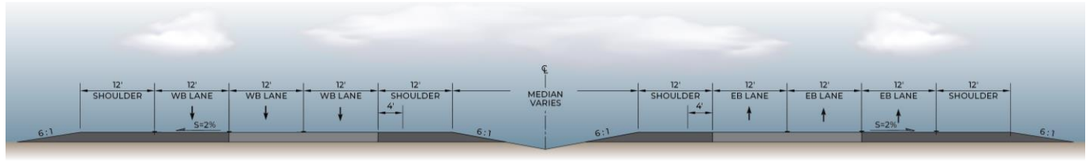


This example section shows widening to the inside of I-40. A third lane would be provided in areas where capacity is constrained or where it could benefit safety. An example of a 3-lane typical section is provided in Exhibit 4-6.

4.5.2 3-Lane Alternative

This alternative is described in Section 4.3.2.5 and is shown below in Exhibit 4-6. Please see Chapter 5 for a discussion of proposed typical sections throughout the study area.

Exhibit 4-6. Example I-40 Typical Section: 3-Lane Alternative



This example section shows widening to the median, in some areas of the I-40 study area, widening may occur to the outside.

4.5.3 Operational Enhancements Common to Both Alternatives

Both alternatives include incorporating the following supporting elements. These operational enhancements were refined as part of Phase I-B and are discussed in Chapter 6.

- ITS improvements
- Minimize lane closures during construction and maintenance
- Incident management improvements
- Alternate route improvements

5. Phase I-B Detailed Analysis of the Build Alternatives

5.1 Introduction

This chapter provides a more detailed analysis of the proposed build alternatives that were carried forward. The purpose of the detailed screening process is to identify notable differences between the proposed build alternatives that affect their viability and identify a recommended alternative. This chapter describes the screening evaluation, including the criteria used to evaluate the build alternatives and the results. Proposed typical sections are provided in Appendix J, I-40 Proposed Typical Sections; conceptual plans for the proposed build alternatives are provided in Appendix K, I-40 Conceptual Plans; and proposed interchange layouts are provided in Appendix L, I-40 Interchange Layouts. These plans served as the basis for the detailed analysis of the build alternatives, which include the Enhanced 2-Lane with Added Lanes Alternative and the 3-Lane Alternative.

5.2 No Build Alternative

The No Build Alternative (or No Action Alternative) is always considered to be an option for any project; however, the No Build would not meet the purpose and need identified in Chapter 4 because it would not accommodate expected traffic growth in Gallup or on ramps, meet current design requirements for on- and off-ramps, or improve reliability and operations during maintenance and incidents. The objective of this detailed analysis is to compare the build alternatives and select the recommended build alternative that will move forward for additional design and environmental analysis. Because of this, the No Build Alternative is not considered in most of the comparisons provided in this Chapter. There are 2 exceptions: the No Build is discussed as part of the traffic operations and future traffic growth discussion in Section 5.5, and it is also discussed in Section 5.12 as part of the cost comparison.

The No Build is discussed in the traffic operations section because it serves as a useful comparison to understand how traffic operations are expected to change between existing conditions (2022) and the year 2050 if I-40 is maintained to keep it operational. For costs, estimates were provided for the No Build Alternative because there will be costs associated with maintaining I-40 and keeping it operational. A true No Build Alternative (or an alternative that would maintain it in its current state) does not exist as an option, since between now and 2050, pavement will have to be reconstructed in many areas, and bridges and drainage infrastructure will have to be repaired or replaced. In areas where infrastructure will fail and must be replaced, the New Mexico Department of Transportation (NMDOT) would be required rebuild that infrastructure to meet current design requirements for curves, shoulder widths, and bridge widths. As such, the No Build costs provide a comparison between likely expenditures on I-40 if it is maintained. For cost, it was assumed the No Build Alternative would include:

- Reconstructing pavement or rehabilitating pavement in the study area, since this will be needed over the 25+ year timeline of this study
- Correcting horizontal and vertical curve deficiencies in areas where pavement is reconstructed. In areas where pavement is rehabilitated, horizontal curve-deficient cross-slopes should be corrected to meet current American Association of State Highway and Transportation Officials (AASHTO) design guidelines, where feasible.
- Replacing bridges in poor condition (5 bridges total).
- In areas where bridges require replacement due to their condition, they would be replaced with bridges that have a minimum width of 42 feet to meet current AASHTO design standards that require 2, 12-foot lanes; a 10-foot outside shoulder and a 4-foot inside shoulder; and barriers of 2 feet on each side (4 feet total). It is assumed that bridges in the study area would need some type of rehabilitation between now and 2050.
- Upsizing potentially undersized culverts at up to 336 locations where pavement would be reconstructed.

5.3 Refining the Build Alternatives

The proposed build alternatives are described in this section. In general, the Enhanced 2-Lane with Added Lanes Alternative would maintain the existing 2 lanes on I-40 in each direction and would widen inside and outside shoulders to 12 feet. This alternative also includes addressing bridge, pavement, interchange ramp, and geometric deficiencies as described in Section 5.3.1. The Enhanced 2-Lane with Added Lanes Alternative would also add a and auxiliary lane or a third lane through Gallup between milepost (MP) 16 and 26, and it would provide climbing lanes as discussed in Section 5.3.1.1. One of the key assumptions for the Enhanced 2-Lane Alternative is that it would be built on a 3-lane footprint. What that means is that the conceptual design for the Enhanced 2-Lane with Added Lanes Alternative provides flexibility in case conditions change and future widening is needed.

The 3-Lane Alternative would add a lane in each direction of I-40 through the entire corridor, from MP 0 to 150. Roadway shoulders would be widened to 12 feet, per AASHTO requirements for 3-lane facilities (AASHTO requires 10-foot shoulders for 3-lane highway facilities and recommends consideration of 12-foot shoulders for highways with truck volumes found on I-40, as described in Section 5.13). The 3-Lane Alternative also includes addressing bridge, pavement, interchange ramp, and geometric deficiencies, as described in Section 5.3.1.

The proposed typical sections for either of the build alternatives vary depending on the width of the existing median. There are 3 basic typical sections that are proposed as described and shown below. Appendix J, I-40 Proposed Typical Sections, provides more detailed drawings of the proposed typical sections and identifies the locations where each typical section would apply.

Exhibit 5-1 shows the first typical section that applies to about **50 miles** of I-40 in the study area. This typical section applies to I-40 segments with a narrow existing median (i.e., medians that are 26- to 64-feet wide). In these areas, the Enhanced 2-Lane typical section would be built by widening and realigning I-40 to the median and building a concrete wall barrier (CWB) in the median to maintain safe separation of opposing traffic. For the 3-Lane Alternative, the third lane would be constructed to the outside.

Exhibit 5-1. Enhanced 2-Lane Alternative with Flush Median and Concrete Wall Barrier, Future 3-Lane Widening to the Outside of I-40

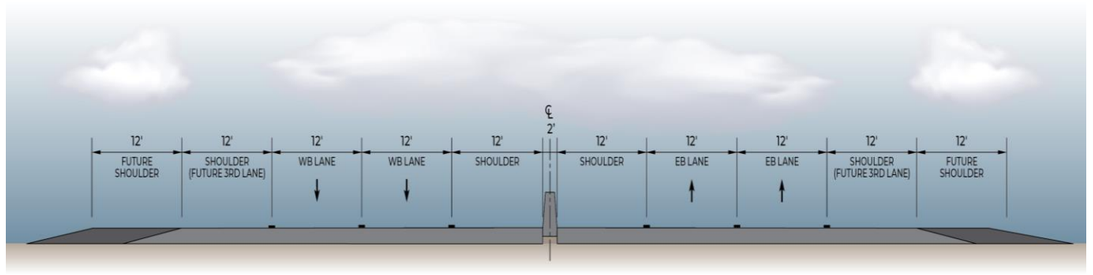


Exhibit 5-2 shows the second typical section that applies to about **41 miles** of I-40 in the study area. This typical section applies to I-40 segments that have existing median widths of 54 to 64 feet. In these areas, the Enhanced 2-Lane typical section would be built by widening and realigning I-40 to the median while maintaining a 50-foot minimum separation between opposing lanes (measured from outside edges of driving lanes). A third lane could be added to the median but will require construction of CWB to maintain safe separation of opposing traffic lanes.

Exhibit 5-2. Enhanced 2-Lane Alternative with Depressed Median, Future 3-Lane Widening to the Inside of I-40, Flush Median with Concrete Wall Barrier

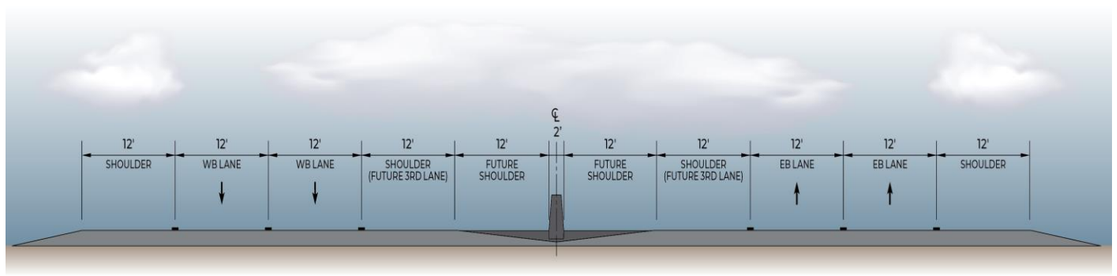
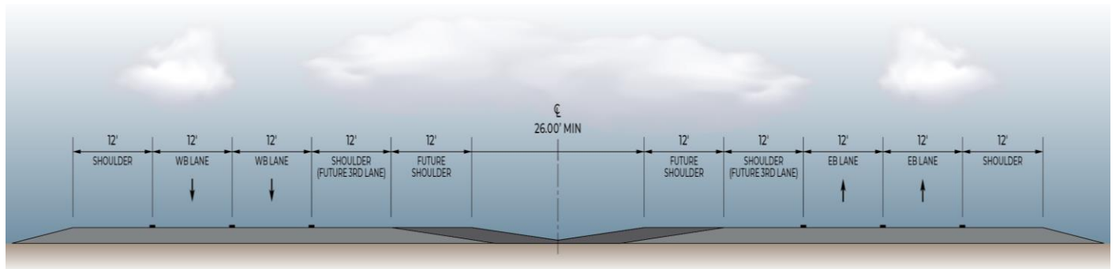


Exhibit 5-3 shows the third typical section that applies to about **59 miles** of I-40 in the study area. This typical section applies to I-40 segments with median widths of 80 feet or more. In these areas, all widening would occur to the median for both build alternatives, and a minimum of 50 feet of separation would be maintained between opposing lanes, so CWB would not be needed.

Exhibit 5-3. Enhanced 2-Lane Alternative with Depressed Median, Future 3-Lane Widening to the Inside of I-40



5.3.1 Enhanced 2-Lane with Added Lanes Alternative

The Enhanced 2-Lane with Added Lanes Alternative would include the following improvements to I-40 in the study area between MP 0 and 150. This alternative would:

- Widen inside and outside shoulders on I-40 to 12 feet on both sides and continue to provide 2 lanes travel in each direction.
- Address future I-40 roadway capacity constraints in Gallup by building auxiliary lanes or a third lane for up to 10 miles between interchanges located between MP 16 and 26.
- Address I-40 capacity constraints by adding a truck climbing lane on isolated steep grades at 5 locations.
- Lengthen interchange ramps at 87 locations to address design deficiencies and improve ramp capacity. These 87 interchange ramps do not meet current AASHTO requirements for acceleration length, gap acceptance length, or AASHTO recommended deceleration length. Appendix L, I-40 Interchange Layouts, identifies the specific on- and off-ramps that do not meet AASHTO guidelines and provides recommendations for the additional ramp and taper lengths needed.
- Address geometric deficiencies on the I-40 mainline, which includes 48 vertical curves and 70 horizontal curves. All of the vertical curves would require roadway reconstruction, and the horizontal curves would require either reconstruction or improving the superelevation of the curve with a mill and inlay. Recommended corrections for the horizontal curves are provided in Appendix D, Geometrics.
- Address bridge, pavement, and drainage deficiencies, which includes replacing 5 bridges that are identified as being in poor condition; reconstructing pavement identified as being in poor or very poor condition; and addressing drainage needs, including damaged drainage structures and culverts not meeting hydraulic capacity needs for the 50-year or 100-year design storm.
- Build crossovers throughout the I-40 study area to accommodate snowplows and emergency vehicles to reverse directions on I-40. The crossovers would also provide a pathway to allow law enforcement to set up a connection for vehicles from one side of I-40 to cross to the other side to keep traffic moving in the event of a crash that requires a closure of 1 direction of I-40. The combination of 12-foot shoulders on both sides of the travel lanes and periodic crossovers would provide flexibility for how I-40 could be managed in cases of lane closures related to incidents, maintenance, or construction, as shown later in this chapter in Exhibit 5-11 to Exhibit 5-18. Crossovers are proposed about every 2 miles in order to make it feasible to have enough traffic control devices to set-up a temporary detour. Proposed crossover locations are provided in Appendix K, I-40 Conceptual Alternatives.

5.3.1.1 Areas Where Additional Travel Lanes Are Proposed with the Enhanced 2-Lane with Added Lanes Alternative

As part of the detailed analysis of alternatives, the study team looked at areas where either 3 lanes or auxiliary lanes may be required to address future capacity constraints for the I-40 mainline, in Gallup between MP 16 and 26 where the I-40 mainline level of service (LOS) is expected to degrade below LOS C by 2050. . In this area, the study team analyzed building auxiliary lanes between the Gallup ramps in both the eastbound and westbound direction as well as a contiguous 3-lane section through Gallup and found that future, 2050 LOS would be LOS C or better if either the auxiliary lanes or a full 3-lane section were constructed.

A contiguous third lane may eventually be built in Gallup in both directions between approximately MP 16 and 26. However, initially it is assumed that ramps would be extended first, followed by the construction of auxiliary lanes, which is different than building a contiguous 3-lane section. The difference is that the auxiliary lanes would provide a third lane between on- and off-ramps and would not provide a third lane under overpasses between the interchange off-ramps and on-ramps where there is no merging traffic. As improvements are made to I-40 overpasses, they should be built with the assumption that they would need a minimum of 60 feet of clear-span width for each direction of travel (a total of 120 feet). For purposes of the capacity analysis, it was assumed that auxiliary lanes would be built in the locations summarized in Exhibit 5-4 and Exhibit 5-5. A total of 8.7 miles of auxiliary lanes are proposed for eastbound I-40, and 8.4 miles is proposed in the westbound direction.

Exhibit 5-4. I-40 Proposed Auxiliary Lanes - Eastbound

Description	Length
EB On-Ramp at Exit 16, W Gallup to EB Off-Ramp at Exit 20, US 491	4.2 miles
EB On-Ramp at Exit 20, US 491 to EB Off-Ramp at Exit 22, Miyamura	1.6 miles
EB On-Ramp at Exit 22, Miyamura to EB Off-Ramp at Exit 26, E. Gallup	2.9 miles
Total	**8.7 miles**

EB = eastbound

Exhibit 5-5. I-40 Proposed Auxiliary Lanes - Westbound

Description	Length
WB On-Ramp at Exit 26, E. Gallup to WB Off-Ramp at Exit 22, Miyamura	3.0 miles
WB On-Ramp at Exit 22, Miyamura to WB Off-Ramp at Exit 20, US 491	1.4 miles
WB On-Ramp at Exit 20, US 491 to WB Off-Ramp at Exit 16, W Gallup	4.0 miles
Total	**8.4 miles**

WB = westbound

In addition, following *AASHTO Green Book* guidance for climbing lanes on freeways and multilane highways (AASHTO 2018), sections of I-40 with grades over 3% were reviewed to determine if climbing lanes would be warranted. Areas of I-40 with grades over 3% were identified previously in Section 3.2.4. Grades over 3% were identified because AASHTO considers grades above 3% to be rolling rather than level. In addition, 3% grades with a minimum length of 1,800 feet and 4% grades with a minimum length of 1,300 feet are identified in the *AASHTO Green Book* as candidates for a climbing lane. These grade and length values are derived from *AASHTO Green Book* Figure 3-28, Critical Lengths of Grade for Design (AASHTO 2018), which indicates a typical reduction of 10 miles per hour (mph) or more in truck travel speed for 3% or 4% grades at or over these lengths. These travel speed reductions are problematic for both trucks and passenger vehicles in the I-40 corridor based on field observations and public comments received. Based on the AASHTO guidance, climbing lanes are recommended at the following 5 locations listed in Exhibit 5-6, which includes 4 westbound climbing lanes and 1 eastbound climbing lane:

Exhibit 5-6. I-40 Proposed Climbing Lanes

Start MP	End MP	Direction	Length (ft)	Grade	Remarks
76.5	77.1	WB	2,889	3.02%	Climbing lane proposed in the vicinity of MP 76.5 to 77.5
103.7	104.4	WB	3,580	3.83%	Climbing lane proposed in the vicinity of MP 103.5 to 104.5
115.2	115.6	WB	2,136	4.01%	Climbing lane proposed in the vicinity of MP 115 to 116, should incorporate the 4% grade at MP 114.9 that is 405 feet long.
138.6	139.2	WB	2,977	3.99%	Climbing lane proposed in the vicinity of MP 138.5 to 140
141.4	142.2	EB	4,176	3.01%	Climbing lane proposed in the vicinity of MP 141.5 to 143. Should extend to the existing eastbound climbing lane at MP 143.1

ft = feet, Critical grade lengths were determined from Figure 3-21 of the *AASHTO Green Book* (AASHTO 2018)

5.3.2 3-Lane Alternative

The 3-Lane Alternative includes all of the elements described in Section 5.3.1 for the Enhanced 2-Lane with Added Lanes Alternative. The only difference is that with the 3-Lane Alternative:

- 3 lanes would be provided in the entire study area from MP 0 to 150.

5.4 Alternatives Evaluation Methods and Metrics

Qualitative and quantitative metrics were used to evaluate and compare the proposed build alternatives. These metrics include:

- **Traffic Operations and Future Traffic Growth** – Comparison of expected LOS for the proposed build alternatives and No Build Alternative; would the proposed alternative meet LOS C or better by 2050?
- **Safety** – Explanation of how safety would be improved based on crash modification factors (CMFs).
- **Maintenance of Traffic (MOT) during Construction** - Discussion of the ability to maintain open 2 lanes on I-40 in each direction during construction.
- **MOT during Incidents, Maintenance Activities, and Construction Once Built** – Discussion of how traffic could be maintained once improvements are made during incidents, maintenance activities, and construction.
- **Right-of-Way Impacts** – A comparison of right-of-way needs.
- **Environmental Considerations** – Discussion and comparison of environmental considerations, including potential impacts to natural and cultural resources and communities.
- **Bridges and Drainage Considerations** – Discussion and comparison of effects to bridges and drainage structures.
- **Cost** – Cost of the proposed improvements and long-term maintenance considerations.

5.5 Traffic Operations and Future Traffic Growth

5.5.1 Methods

Capacity analysis using methods from the Highway Capacity Manual (HCM) and Highway Capacity Software (HCS7) was performed for the I-40 study area for existing and future year 2050 as discussed in Section 3.7.6. For 2050 conditions, the study team used the mid-growth projection of 1.9%. This rate was identified in collaboration with the NMDOT as being most representative of expected growth in the I-40 study area.

HCM analysis provides a LOS determination based on anticipated traffic volumes. LOS is an indicator of how well a transportation facility is operating. It includes 6 levels designated by the letters A through F, with LOS A representing the best operating conditions and LOS F the worst. To accommodate future traffic growth, it was assumed that the alternatives should maintain at least LOS C or better.

Level segments, segments with grades, and areas where ramps merge and diverge in the I-40 study area were analyzed using HCS7 software (an implementation of HCM methodologies) based on project-derived passenger car equivalents (PCEs) to obtain freeway density values and the corresponding LOS, as described in Section 3.7.6.1. The results of the capacity analysis are provided in the discussion below.

5.5.2 I-40 Capacity Analysis Results

5.5.2.1 I-40 Mainline Capacity Analysis

Exhibit 5-7 provides the assessed mainline segment LOS results, with existing traffic volumes and projected 2050 traffic volumes assuming the mid-growth scenario of 1.9% for three different alternatives: No Build, the Enhanced 2-Lane with Added Lanes, and 3-Lane.

Under existing conditions, all segments of I-40 are currently shown to be operating with acceptable LOS at LOS A and LOS B. With the 2050 No Build, all segments are expected to operate at an accepted LOS of C, with the exception of the following segments that are expected to operate at LOS D:

- Eastbound I-40 in Gallup from MP 20 to 22 from the US 491 interchange to the Miyamura Interchange, representing a total of 2 miles of I-40 eastbound.
- Westbound I-40 in Gallup from MP 26 at the East Gallup interchange to MP 16 at the West Gallup interchange, representing a total of about 10 miles of I-40 westbound.

The I-40 mainline capacity results for the Enhanced 2-Lane with Added Lanes Alternative would build an auxiliary lane eastbound and westbound from MP 16 to 26 to increase capacity. As shown in Exhibit 5-7, this would improve the LOS in Gallup to an acceptable level of LOS C in both directions. With the exception of about 8 miles of the eastbound lanes in Gallup that are expected to operate at LOS B in 2050, the Enhanced 2-Lane with Added Lanes Alternative is expected to operate at LOS C on the I-40 mainline through the study area.

For the 3-lane Alternative, Exhibit 5-7 shows that all mainline eastbound and westbound segments will operate at LOS C or better with all segments operating at LOS B except for Gallup segments from MP 20 to 22 eastbound and from MP 16 to 26 westbound.

Exhibit 5-7. I-40 Mainline Capacity Analysis

Approach	Segment	2022 Existing LOS	2050 No Build LOS	2050 Enhanced 2-Lane with Added Lanes LOS	2050 3-Lane LOS
EB	From Arizona border to W Gallup Interchange (MP 0–16)	LOS A	LOS C	LOS C	LOS B
	From W Gallup Hwy 66 Interchange to US 491 Interchange (MP 16–20)	LOS B	LOS C	LOS B	LOS B
	From US 491 Interchange to Miyamura Interchange (MP 20–22)	LOS B	LOS D	LOS C	LOS C
	From Miyamura Interchange to E Gallup Hwy 66 Interchange (MP 22–26)	LOS B	LOS C	LOS B	LOS B
	From E Gallup Hwy 66 Interchange to Thoreau Interchange (MP 26–53)	LOS A	LOS C	LOS C	LOS B
	From Thoreau Interchange to Milan Hwy 605 Interchange (MP 53–79)	LOS A	LOS C	LOS C	LOS B
	From Milan Hwy 605 Interchange to Grants NM 53 Interchange (MP 79–81)	LOS A	LOS C	LOS C	LOS B
	From Grants Hwy 53 Interchange to Grants Santa Fe Ave Interchange (MP 81–85)	LOS B	LOS C	LOS C	LOS B
	From Grants Santa Fe Ave Interchange to Casa Blanca/Paraje Interchange (MP 85–108)	LOS B	LOS C	LOS C	LOS B
	From Casa Blanca/Paraje Interchange to NM 6 Interchange (MP 108–126)	LOS B	LOS C	LOS C	LOS B
	From NM6 Interchange to Route 66 Casino Interchange (MP 126–140)	LOS B	LOS C	LOS C	LOS B
	From Route 66 Casino Interchange to Atrisco Vista Blvd (MP 140–149)	LOS B	LOS C	LOS C	LOS B
WB	From Atrisco Vista Blvd to Route 66 Casino Interchange (MP 149–140)	LOS B	LOS C	LOS C	LOS B
	From Route 66 Casino Interchange to NM 6 Interchange (MP 140–126)	LOS B	LOS C	LOS C	LOS B
	From NM 6 Interchange to Casa Blanca/Paraje Interchange (MP 126–108)	LOS B	LOS C	LOS C	LOS B
	From Casa Blanca/Paraje Interchange to Grants Santa Fe Ave Interchange MP 108–85)	LOS B	LOS C	LOS C	LOS B
	From Grants Santa Fe Ave Interchange to Grants NM 53 Interchange (MP 85–81)	LOS B	LOS C	LOS C	LOS B
	From Grants NM 53 Interchange to Milan Hwy 605 Interchange (MP 81–79)	LOS B	LOS C	LOS C	LOS B
	From Milan Hwy 605 Interchange to Thoreau Interchange (MP 79–53)	LOS B	LOS C	LOS C	LOS B
	From Thoreau Interchange to E. Gallup Hwy 66 Interchange (MP 53–26)	LOS B	LOS C	LOS C	LOS B
	From E. Gallup Hwy 66 Interchange to Miyamura Interchange (MP 26–22)	LOS B	LOS D	LOS C	LOS C
	From Miyamura Interchange to US 491 Interchange (MP 22–20)	LOS B	LOS D	LOS C	LOS C
	From US 491 Interchange to W Gallup Hwy 6 Interchange (MP 20–16)	LOS B	LOS D	LOS C	LOS C
	From W Gallup Hwy 66 Interchange to Arizona border (MP 16–0)	LOS B	LOS C	LOS C	LOS B

EB = eastbound, LOS = level of service, WB = westbound

5.5.2.2 I-40 Mainline Capacity Analysis for Areas with Grades of 3% or Higher

Exhibit 5-8 provides LOS results on grades greater than 3% for existing conditions, 2050 No Build, Enhanced 2-lane with Added Lanes Alternative, and 2050 3-Lane Alternative. Areas with grades over 3% were analyzed because the *AASHTO Green Book* identifies 3% as the grade where a roadway transitions from level to rolling and could start to become problematic for larger vehicles, such as semi-trucks. The results indicate that all I-40 mainline segments with grades over 3% will continue to operate at LOS C or better for all of the alternatives in 2050. Even though LOS is expected to meet acceptable levels on grades by 2050, climbing lanes are recommended in 5 locations with the Enhanced 2-Lane with Added Lanes Alternative, as previously discussed in 5.3.1.1. Areas with existing climbing lanes, proposed climbing lanes, or the 3-Lane Alternative are expected to operate at LOS B in most areas by 2050 as compared to LOS C for the 2050 No Build.

Exhibit 5-8. I-40 Mainline Segments with Grades Capacity Analysis

Direction	MP	Grade %	Truck %	2022 Existing LOS	2050 No Build LOS	2050 Enhanced 2-Lane with Added Lanes LOS	2050 3-Lane LOS
EB	5.2 to 5.4	3.09%	45%	LOS A	LOS C	LOS C	LOS B
EB[a]	40.1 to 40.6	3.23%	45%	LOS A	LOS B	LOS B	LOS B
EB[a]	41.1 to 41.4	4.62%	45%	LOS A	LOS B	LOS B	LOS B
EB[b]	141.4 to 142.3	3.01%	45%	LOS B	LOS C	LOS B	LOS B
EB[a]	143.7 to 144.4	4.01%	45%	LOS A	LOS B	LOS B	LOS B
EB[a]	144.4 to 144.8	4.69%	45%	LOS A	LOS B	LOS B	LOS B
EB[a]	143.7 to 144.8	4.69%	45%	LOS A	LOS C	LOS C	LOS C
WB[b]	76.5 to 77.1	3.02%	42%	LOS B	LOS C	LOS B	LOS B
WB[b]	103.7 to 104.4	3.83%	40%	LOS B	LOS C	LOS B	LOS B
WB[b]	115.2 to 115.6	4.01%	35%	LOS B	LOS C	LOS B	LOS B
WB[b]	138.6 to 139.2	3.99%	35%	LOS B	LOS C	LOS B	LOS B
WB[a]	150.0 to 150.4	4.47%	35%	LOS A	LOS B	LOS B	LOS B

EB = eastbound, LOS = level of service, WB = westbound

a Within the extents of existing climbing lane.

b Proposed climbing lane for the Enhanced 2-Lane with Added Lanes Alternative.

5.5.2.3 I-40 Capacity Analysis at Interchanges

Exhibit 5-9 shows the LOS for the alternatives for merge and diverge sections at 16 interchanges between MP 16 and 140. As described previously in Section 3.7.2, these 16 ramp locations were selected by identifying interchanges with the highest vehicle volumes, where at least one ramp of the interchange had 1,000 or more vehicles per day. The LOS results for the 2050 No Build in Exhibit 5-9 show that several interchange ramps are expected to operate below LOS C at LOS D or E. All of the ramps that are expected to operate at LOS D or E for the 2050 No Build also occur at ramp locations that do not meet AASHTO guidelines for ramp lengths. The proposed build alternatives would increase ramp lengths to meet AASHTO guidelines, which would also improve ramp LOS.

Exhibit 5-9. I-40 Capacity Analysis for Interchange Merge and Diverge Areas

Interchange Location	Direction	2022 Existing LOS	2050 No Build LOS	2050 Enhanced 2-Lane with Added Lanes LOS	2050 3-Lane LOS
West Gallup Hwy 66 Interchange (Exit 16)	EB (Merge)	LOS A	LOS B	LOS B	LOS B
	EB (Diverge)	LOS A	LOS B	LOS B	LOS A
	WB (Merge)	LOS A	LOS C	LOS C	LOS B
	WB (Diverge)	LOS B	LOS C	LOS C	LOS B
Gallup US 491 Interchange (Exit 20)	EB (Merge)1	LOS A	LOS C	LOS B	LOS B
	EB (Merge)2	LOS B	LOS D	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS B	LOS B
	WB (Merge)	LOS B	LOS D	LOS C	LOS B
	WB (Diverge)	LOS B	LOS E	LOS C	LOS C
Gallup Miyamura Interchange (Exit 22)	EB (Merge)	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS C	LOS B
	WB (Merge)	LOS B	LOS D	LOS C	LOS B
	WB (Diverge)	LOS B	LOS D	LOS C	LOS B
E. Gallup Hwy 66 Interchange (Exit 26)	EB (Merge)	LOS B	LOS D	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS B	LOS B
	WB (Merge)	LOS B	LOS D	LOS C	LOS B
	WB (Diverge)	LOS C	LOS E	LOS C	LOS B
McGaffey Interchange (Exit 33)	EB (Merge)	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS B	LOS B
	WB (Merge)	LOS B	LOS D	LOS B	LOS B
	WB (Diverge)	LOS B	LOS D	LOS B	LOS B
Refinery Interchange (Exit 39)	EB (Merge)	LOS A	LOS B	LOS B	LOS A
	EB (Diverge)	LOS B	LOS C	LOS B	LOS B
	WB (Merge)	LOS B	LOS C	LOS B	LOS B
	WB (Diverge)	LOS B	LOS C	LOS C	LOS B
Thoreau Interchange (Exit 53)	EB (Merge)	LOS A	LOS B	LOS B	LOS B
	EB (Diverge)	LOS A	LOS B	LOS B	LOS B
	WB (Merge)	LOS A	LOS C	LOS C	LOS B
	WB (Diverge)	LOS A	LOS B	LOS B	LOS B
Milan Hwy 605 Interchange (Exit 79)	EB (Merge)	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS B	LOS B
	WB (Merge)	LOS B	LOS C	LOS B	LOS B
	WB (Diverge)	LOS B	LOS D	LOS B	LOS B
Grants NM 53 Interchange (Exit 81)	EB (Merge)	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)1	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)2	LOS B	LOS C	LOS B	LOS B
	WB (Merge)	LOS B	LOS C	LOS B	LOS A
	WB (Diverge)	LOS B	LOS D	LOS B	LOS B

(Table Continues)

Exhibit 5-9. I-40 Capacity Analysis for Interchange Merge and Diverge Areas (Continued)

Interchange Location	Direction	2022 Existing LOS	2050 No Build LOS	2050 Enhanced 2-Lane with Added Lanes LOS	2050 3-Lane LOS
Grants Santa Fe Ave Interchange (Exit 85)	EB (Merge)1	LOS B	LOS B	LOS C	LOS B
	EB (Merge)2	LOS B	LOS B	LOS B	LOS A
	EB (Diverge)	LOS B	LOS D	LOS B	LOS B
	WB (Merge)	LOS B	LOS B	LOS B	LOS B
	WB (Diverge)	LOS B	LOS D	LOS C	LOS B
Quemado (HWY 117) (Exit 89)	EB (Merge)	LOS B	LOS D	LOS C	LOS B
	EB (Diverge)	LOS B	LOS D	LOS C	LOS B
	WB (Merge)	LOS B	LOS D	LOS B	LOS B
	WB (Diverge)	LOS B	LOS C	LOS C	LOS B
Acomita/Sky City Interchange (Exit 102)	EB (Merge)	LOS B	LOS C	LOS C	LOS B
	EB (Diverge)	LOS B	LOS B	LOS C	LOS B
	WB (Merge)	LOS A	LOS B	LOS B	LOS B
	WB (Diverge)	LOS B	LOS C	LOS B	LOS B
Casa Blanca/Paraje Interchange (Exit 108)	EB (Merge)	LOS B	LOS C	LOS C	LOS B
	EB (Diverge)	LOS B	LOS D	LOS C	LOS B
	WB (Merge)	LOS A	LOS B	LOS B	LOS B
	WB (Diverge)	LOS B	LOS D	LOS C	LOS B
Laguna Interchange (Exit 114)	EB (Merge)	LOS B	LOS C	LOS C	LOS B
	EB (Diverge)	LOS A	LOS B	LOS B	LOS A
	WB (Merge)	LOS A	LOS B	LOS B	LOS B
	WB (Diverge)	LOS A	LOS C	LOS C	LOS B
Los Lunas Interchange (HWY 6) (Exit 126)	EB (Merge)	LOS B	LOS C	LOS B	LOS B
	EB (Diverge)	LOS B	LOS D	LOS C	LOS B
	WB (Merge)	LOS B	LOS C	LOS B	LOS B
	WB (Diverge)	LOS B	LOS C	LOS C	LOS B
Route 66 Casino Interchange (Exit 140)	EB (Merge)	LOS A	LOS C	LOS C	LOS B
	EB (Diverge)	LOS B	LOS C	LOS C	LOS B
	WB (Merge)	LOS B	LOS C	LOS C	LOS B
	WB (Diverge)	LOS B	LOS C	LOS C	LOS B

EB = eastbound, LOS = level of service, WB = westbound

5.6 Safety

Exhibit 5-10 presents several CMFs for various potential highway improvements obtained from the *Highway Safety Manual* (HSM) (AASHTO 2014). In many cases the CMF is obtained from one or more equations that are dependent on several highway and crash characteristics. Sample characteristics similar to I-40 existing conditions or proposed improvements were assumed to generate the estimated CMFs. These CMFs are estimates only and actual results are subject to variation and local site-specific conditions.

When assessing the combined effect of independent improvements, it is not appropriate to add the CMFs together because it may overestimate benefits of treatments. CMFs have a specific application and are contingent on specific local conditions.

Exhibit 5-10. Example Highway Improvement Crash Modification Factors with Highway Safety Manual References

	Treatment	Before	After	CMF	% Crash Reduction
Lengthen Ramp Acceleration/ Deceleration Lanes	Lengthen Entrance Ramp Acceleration Lane (HSM Equation 18 46)	300 feet	1,000 feet	0.71	29%
	Lengthen Exit Ramp Deceleration Lane (HSM Equation 18-47)	300 feet	1,000 feet	0.95	5%
Improve Horizontal Curves	Increase Superelevation (HSM Equation 10-16) [a]	1.9%	4.2%	0.93	7%
Widen Shoulders	Widen Inside Shoulder (HSM Equation 18-26)	2 feet	8 feet	0.91	9%
			12 feet	0.85	15%
		4 feet	8 feet	0.94	6%
			12 feet	0.88	12%
	Widen Outside Shoulder (HSM Equation 18-35)	6 feet	12 feet	0.86	14%
		8 feet	12 feet	0.91	9%
		10 feet	12 feet	0.95	5%
Widen Freeway	Add Travel Lane (HSM Equation 18-15 and 18-18)	2 lanes	3 lanes		10% [b]

CMF = crash modification factor, HSM = Highway Safety Manual
a CMF applies to rural, 2-lane highways. Results may differ for rural interstates
b Derived from a Safety Performance Function rather than a CMF

5.6.1 Enhanced 2-Lane with Added Lanes Alternative

The widened shoulders as part of the Enhanced 2-Lane with Added Lanes Alternative have the potential to reduce crashes. The potential crash reduction varies according to whether the inside or outside shoulder is widened and the pre-widening and post-widening width of the shoulder. In the CMFs provided, widening the inside shoulder may reduce crashes by 6% to 15%, and widening of outside shoulder may reduce crashes by 5% to 14%, depending on the shoulder width. Therefore, the shoulder widening associated with the Enhanced 2-lane with Added Lanes Alternative may see crash reductions of up to 15% compared to existing conditions.

Ramp acceleration/deceleration lane lengthening treatments are predicted to have a varied benefit to safety, as well. As shown in Exhibit 5-10, lengthening entrance ramp acceleration lanes results is a greater crash reduction than lengthening exit ramp deceleration lanes. The actual amount of each potential reduction is a function of the length of the acceleration/deceleration lane added. In the CMFs provided, lengthening entrance and exit ramp acceleration/deceleration lanes from 300 feet to 1,000 feet may achieve a 29% reduction and 5% reduction, respectively. Therefore, lengthening ramp acceleration/deceleration lanes could result in a range of crash reductions, depending on the type of improvement. It is important to note these potential crash reductions apply only to the immediate area around the ramp.

In most areas of I-40, horizontal curves would be corrected by increasing the superelevation, which is predicted to improve safety. The potential crash reduction varies depending on the existing superelevation and the amount the superelevation is increased. In the CMF provided in Exhibit 5-10, increasing the horizontal curve superelevation from 1.9% to an AASHTO guideline of 4.2% could provide up to a 7% crash reduction. Note this CMF applies to rural 2-lane highways, so results may differ for rural interstates.

5.6.2 3-Lane Alternative

The 3-lane Alternative would provide the same safety enhancements as the Enhanced 2-Lane with Added Lanes Alternative, so similar safety benefits would be anticipated. Additionally, adding a third travel lane to I-40 has the potential to offer an additional safety benefit. As previously mentioned, CMFs are not additive, so it is difficult to estimate the additional safety benefit provided by the third lane or what that benefit might be. This is further complicated by the fact that shoulder widening (usually to at least 10 feet on either side) often accompanies the addition of a third lane on a rural freeway. Thus, the safety benefit of widening shoulders may already capture some of the safety benefit of adding a third lane. Nevertheless, adding a lane could provide some additional benefit to safety, potentially reducing crashes by up to 10%.

5.7 Maintenance of Traffic during Construction

Proposed MOT for the build alternatives is provided in Appendix J, I-40 Proposed Typical Sections. These proposed typical sections and construction approaches show the sequence of how the roadway could be built for either build alternative for each of the different typical sections proposed; however, there are other approaches that could be used for maintaining traffic, and the construction approaches will be determined on a case-by-case basis, as specific projects are designed and constructed. The proposed construction sequences show that either of the proposed build alternatives could be built while providing 2 lanes in each direction during construction. The proposed construction sequencing and steps are similar between the build alternatives. Differences between the build alternatives include:

- For both alternatives, much of the widening would be done to the median. Because of this, there are locations in the study area where both alternatives would end up removing a portion of pavement on the outer pavement edge. The Enhanced 2-Lane with Added Lanes Alternative would end up with more pavement removal than the 3-Lane Alternative since it has a smaller overall footprint. The 3-Lane Alternative would build an extra lane in each direction.
- Both of the build alternatives would require detour pavement. However, the Enhanced 2-Lane with Added Lanes Alternative would require more detour pavement than the 3-Lane Alternative to maintain 2 lanes of traffic open in each direction during construction. This has been accounted for in the cost estimates. The amount of needed detour pavement would vary by alternative and location.

5.8 Maintenance of Traffic during Incidents, Maintenance Activities, and Construction Once Built

5.8.1 Possible Incident Response

This section shows how the wider roadway footprint for either of the build alternatives could be used to get traffic moving sooner in cases where there are I-40 lane closures due to incidents.

5.8.1.1 Open I-40 Lanes Using the Roadway Shoulder

Exhibit 5-11 and Exhibit 5-12 show that the 12-foot shoulder could be used to get at least 1-lane of traffic open to I-40 traffic if an incident were blocking the travel lanes. For either the Enhanced 2-Lane with Added Lanes or 3-Lane Alternatives, temporary traffic control devices (i.e., traffic barrels or traffic panels) could be placed on the outer edge of the westbound travel lane, and drivers would be able to use the outside shoulder until the crash could be cleared. This same approach could be applied to the inside shoulder. For this case, both the Enhanced 2-Lane with Added Lanes Alternative and 3-Lane Alternative would provide a single travel lane in the affected travel direction, though the 3-Lane Alternative offers added flexibility by providing about 12 extra feet for incident response than the Enhanced 2-Lane with Added Lanes Alternative. Note that outside shoulders typically include rumble strips; thus, in cases where the outside lane is used as a travel lane, rumble strips would be present.

Exhibit 5-11. Open 1-Lane Using the Shoulder – Enhanced 2-Lane with Added Lanes Alternative

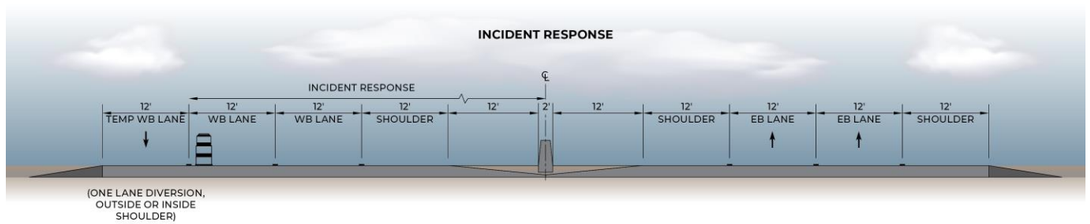
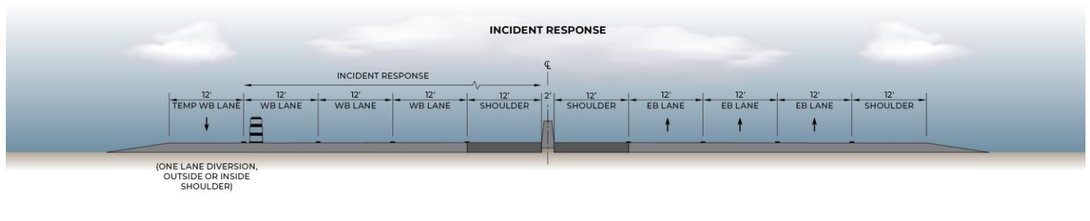


Exhibit 5-12. Open 1-Lane Using the Shoulder – 3-Lane Alternative



5.8.1.2 Provide 2-Way Traffic Operations if One Direction of I-40 is Closed

Exhibit 5-13 and Exhibit 5-14 show how 2-way traffic could use one side of I-40 if a single direction were closed. For either alternative, the 2-way traffic detour could be established by using one of the proposed crossovers to move 1-lane of traffic from one side of I-40 to the other side. For either build alternative, only 1 lane could be moved to the opposite side of the freeway since the crossovers would provide a connection for 1 lane of traffic. These crossover locations would be designed for low speed operation during incidents.

Exhibit 5-13. Provide 2-Way Traffic Operations – Enhanced 2-Lane with Added Lanes Alternative

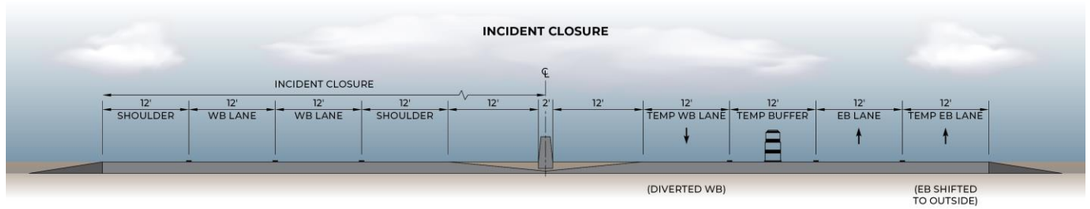
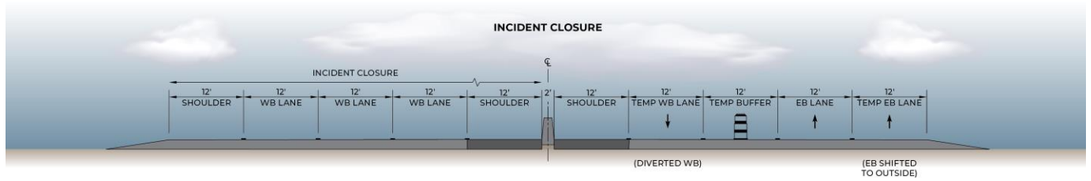


Exhibit 5-14. Provide 2-Way Traffic Operations – 3-Lane Alternative



5.8.2 Maintaining 2-Lanes in Each Direction During Maintenance or Construction

Exhibit 5-15 and Exhibit 5-16 show how the proposed build alternatives would provide space to maintain 2 lanes of traffic in each direction during maintenance or construction activities by temporarily using either the outside or inside shoulders as travel lanes. The wider roadway section for both of these alternatives would offer a significant benefit to provide adequate roadway capacity during routine maintenance and construction projects. Both alternatives would provide the option to maintain 2 lanes, but the 3-Lane Alternative offers added flexibility by providing an additional 12 feet that would not be provided by the Enhanced 2-Lane with Added Lanes Alternative.

Exhibit 5-15. Maintaining 2-Lanes During Maintenance or Construction – Enhanced 2-Lane Alternative

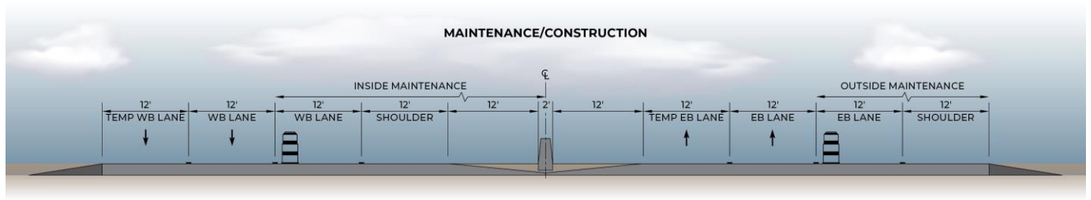
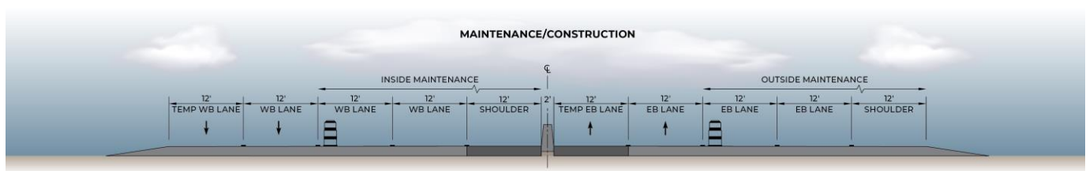


Exhibit 5-16. Maintaining 2-Lanes During Maintenance or Construction – 3-Lane Alternative



5.8.3 One-Direction Construction Closure

Exhibit 5-17 and Exhibit 5-18 provide an option for how construction could occur on one side of I-40 while the other side provides 2-travel lanes in each direction for either of the build alternatives. To make this work, crossovers would need to be temporarily widened to provide passage for 2 lanes of traffic. With the Enhanced 2-Lane with Added Lanes Alternative, about 3 feet of detour pavement would be needed on either side of the inside and outside shoulders to provide sufficient shy distance between 2-way traffic down the center and a buffer/narrow shoulder on the outside of the travel lanes. This detour pavement would not be needed with the 3-Lane Alternative.

Exhibit 5-17. Possible Construction Closure in One-Direction – Enhanced 2-Lane with Added Lanes Alternative

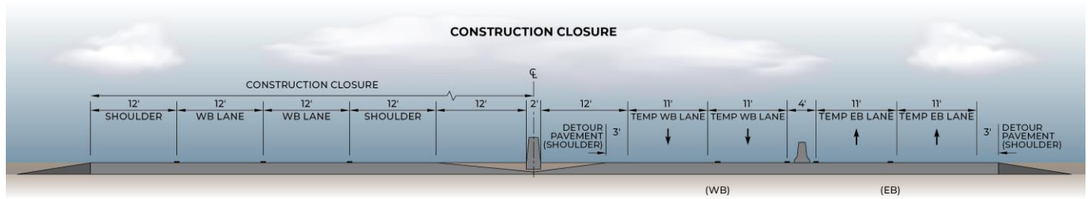
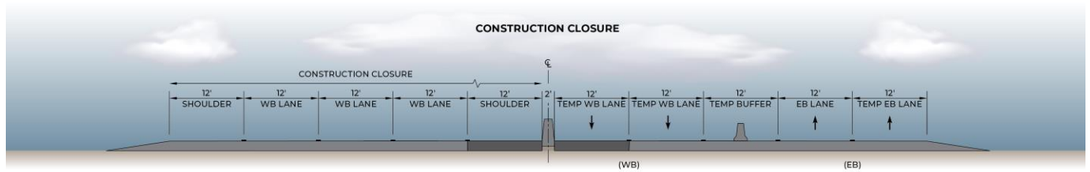


Exhibit 5-18. Possible Construction Closure in One-Direction – 3-Lane Alternative



5.9 Right-of-Way Impacts

Based on the current conceptual designs for the build alternatives, it appears that the proposed I-40 improvements with either alternative can be constructed within the existing right-of-way, so there are no anticipated right-of-way needs at this time. It is possible that small slivers of right-of-way may be needed in scattered areas throughout the study area for individual projects; however, at this time no additional right-of-way needs have been identified. Specific right-of-way needs would be identified as part of preliminary design and environmental analysis as projects are identified and advanced.

5.10 Environmental Considerations

Appendix B, Environmental Scoping Report, provides a detailed analysis of the proposed build alternatives that is summarized in this section. The build alternatives for I-40 were evaluated for their potential impacts to environmental, cultural, and community resources. Because of the large geographic coverage of the study area, engineering design details used for the analysis were preliminary and limited to concepts only — detailed plan and profile drawings will be prepared as individual projects are advanced for implementation. For this reason, the environmental analysis for Phase I-B was based on assumed construction footprints of the two build alternatives identified for I-40. A summary of the analysis is provided in Exhibit 5-19. Potential environmental impacts from construction of the fiber optic line and alternate route improvements are discussed in Chapter 6.

Exhibit 5-19. Phase I-B Build Alternatives Evaluation Summary

Resource	Summary
Land Ownership and Land Use	Improvements proposed with either of the build alternatives are not expected to adversely impact land use or ownership. Based on the current conceptual designs for the build alternatives, it appears that the proposed I-40 improvements with either alternative can be constructed within the existing right-of-way, so there are no anticipated right-of-way needs at this time. It is possible that small slivers of right-of-way may be needed in scattered areas throughout the study area for individual projects, but these would be limited to areas adjacent to the existing highway and would not be expected to affect land use. If small areas of additional right-of-way are needed, they will be identified as part of preliminary design and environmental analysis conducted under Phase I-C. Adverse impacts to state or local land use and transportation plans and policies have not been identified. However, updates to plans, such as the NMDOT's Statewide Transportation Plan (*New Mexico 2045 Plan*), and regional transportation plans, including the *Connections 2040 Metropolitan Transportation Plan* and *Northwest New Mexico Regional Transportation Plan,* will be needed to reflect changes to the assumptions in these plans specific to the number of lanes on I-40.
Visual Resources	Neither build alternative is expected to adversely impact major visual components found in the study area. Background views and mid-ground views from the highway and towards the highway from adjacent communities would not be affected substantially by either build alternative. Minor adverse impacts to visual could result in several areas, including: ▪ Areas within the right-of-way where wetlands and basalt flows are removed to accommodate the wider footprint. This impact will be temporary until impacted wetlands are replaced. ▪ Views from communities that are near I-40 and that are at a higher elevation would see a wider roadway than currently exists. However, wider shoulders or the addition of a third lane are not expected to have a substantial impact because it affects an existing component of the viewshed. ▪ Existing aesthetic bridge treatments could be affected for bridges that require replacement. However, impacted structures will be replaced in-kind or with new aesthetic treatments developed in collaboration with the affected communities.
Noise	Noise assessments would be required on a case-by-case basis for both build alternatives, depending on improvements proposed. The 3-lane Alternative would require an analysis of the entire corridor due to the addition of a travel lane. The Enhanced 2-Lane with Added Lanes Alternative would require analysis on a case-by-case basis. For the Enhanced 2-Lane with Added Lanes Alternative, adding auxiliary lanes (or a third lane in Gallup) would require noise analysis. Additional improvements, such as widening shoulders, correcting geometric deficiencies, building climbing lanes, or extending ramps, are unlikely to require noise analysis. However, the proposed eastbound climbing lane from MP 141.5 to 143 or reconstructing interchanges and overpasses could require noise analysis and should be considered on a case-by-case basis. Locations likely to warrant noise abatement and meet cost-effectiveness criteria are identified in Appendix B, Environmental Scoping Report, and include most of the communities adjacent to the highway with moderately dense development. Areas with low-density development may meet Federal Highway Administration (FHWA) and NMDOT thresholds that warrant the consideration of abatement but are unlikely to meet cost-effectiveness criteria.
Air Quality	Adverse impacts to air quality and greenhouse gas emissions have not been identified for either build alternative. The build alternatives are expected to have a positive impact on air quality and greenhouse gases as compared to the existing conditions because of a reduction in stop-and-go traffic operations in areas where there are lane reductions due to construction, maintenance, or incidents. Air quality is not anticipated to be an issue in the study area, although per policy, greenhouse gas analysis will likely still be required as individual projects are advanced.
Hazardous Materials	Major differences between the proposed build alternatives regarding hazardous materials are not anticipated. Potential impacts associated with hazardous materials may be present throughout the study area, particularly in areas within and near Gallup, Fort Wingate, Thoreau, Grants/Milan, Laguna, and the industrial area just west of Albuquerque. Because the improvements will occur within the existing highway right-of-way, major impacts are not anticipated. An initial site assessment for hazardous materials will be necessary when individual projects are advanced to the environmental and preliminary design phase of project development.
Demographics and Environmental Justice	Neither of the proposed build alternatives are expected to adversely impact any of the 13 disadvantaged communities in the study area. The proposed build alternatives will not substantially increase pollutants or take businesses or other community resources, and they are not expected to require additional right-of-way used by disadvantaged communities. Improved traffic flow, travel time predictability, and safety are expected to benefit the residents of disadvantaged communities by improving access to services, jobs, education, and medical services. Ongoing engagement with the tribes and adjacent communities and consideration of potential effects and benefits will be critical as the individual projects are advanced.
Cultural and Historic Resources	Adverse impacts to cultural resources are likely to occur with either of the proposed build alternatives. The Enhanced 2-Lane with Added Lanes Alternative intersects up to 69 resources and the 3-Lane Alternative intersects up to 91 resources. The extent of impacts, if any, to these previously recorded resources is unknown. As individual projects are advanced to the environmental and preliminary design phase of project development, pedestrian surveys will be needed to identify and document all cultural resources, and consultation with the State Historic Preservation Officer and Tribal Historic Preservation Officers will be completed, as applicable. Resources discovered by the pedestrian survey will be evaluated for their eligibility for listing on the National Register of Historic Places (NRHP) and specific mitigation needed.
Section 4(f) Resources	In most instances, I-40 roadway construction is proposed within the existing right-of-way and use of Section 4(f) resources is not expected as summarized below. Potential impacts from the proposed fiber optic line and frontage road improvements are discussed in Chapter 6. ▪ A total of 2 potential impacts to Section 4(f) resources were identified, including the Manuelito Archeological Complex and the crossing of the Continental Divide Trail. ▪ The Manuelito Archeological Complex is listed on the NRHP and is considered a significant historic property under Section 4(f). If the property is listed for its data recovery potential, then it would likely be exempt from 4(f) considerations. However, this property may possess qualities that lend itself to interpretation and preservation in place and, as such, should be considered. If this property requires 4(f) consideration, both build alternatives and the proposed fiber optic line would potentially impact the Manuelito Archeological Complex. Additional investigation would be required to determine if the property merits 4(f) consideration, evaluate a potential 4(f) use, and identify potential measures to minimize harm. This would occur when individual projects advance to the environmental and preliminary design phase. ▪ In the case of the Continental Divide Trail, trail users cross I-40 at an interchange, and there is an interpretive historic marker adjacent to the interchange at this location. Because the trail does not have physical features within the highway right-of-way, and there is no additional right-of-way required, neither build alternative would constitute a use of this 4(f) property. Further, I-40 is an existing facility in this area, and there would be no substantial alignment change. As such, neither build alternative or the installation of the fiber optic line would constitute a constructive 4(f) use of the trail.

(Table Continues)

Exhibit 5-19. Phase I-B Build Alternatives Evaluation Summary (Continued)

Resource	Summary
Waterways	The build alternatives will cross intermittent and perennial waterways at 22 locations, including 5 culvert pipe structures, 6 concrete box culverts, and 11 bridges. While dozens of ephemeral waterways will also be affected by the proposed build alternatives, recent revisions to the definition of Waters of the United States will not require Clean Water Act permits for construction at these locations. In most instances, construction activities will consist of reconstructing or extending drainage structures. Impacts at waterways will include the loss of vegetation from channel reconstruction to accommodate the new or extended structures and associated bank stabilization, as needed. The Enhanced 2-Lane with Added Lanes Alternative is expected to require structure extensions at 47 drainage locations. The 3-Lane Alternative would require culvert extensions for an estimated 261 drainage locations. Both build alternatives will require culvert replacements to increase their capacity where they do not currently meet design flows. The 3-Lane Alternative will have greater effects to waterways since it has a wider footprint and will require more culvert extensions than the Enhanced 2-Lane with Added Lanes Alternative. All waterways should be considered and field verified further when individual projects are advanced to the environmental and preliminary design phase of project development. Impacts to intermittent and perennial waterways will require coordination with the United States Army Corps of Engineers to determine the need for and type of Section 404 permit required and with state and tribal EPA representatives for a 401 water quality certification. Because the magnitude of improvements within the ordinary high-water mark at any one waterway will be relatively small, construction will likely be authorized under a nationwide permit. The specific impacts at waterways and permit requirements will be determined as individual projects are advanced for design and construction.
Wetlands	A total of 6 wetland resources, including 3 freshwater ponds and 3 freshwater emergent wetlands, occur within the footprint of the proposed build alternatives. In general, these wetland resources are outside of the anticipated construction limits of the proposed roadway widening for either build alternative but could be impacted by drainage structure improvements. The actual presence and boundaries of wetland resources at these and other locations will need to be verified as individual projects are advanced to the environmental and preliminary design phase of project development. Because of its wider footprint, impacts to wetlands are likely greater with the 3-Lane Alternative as compared to the Enhanced 2-Lane with Added Lanes Alternative. The specific impacts to wetlands and permit requirements will be determined as individual projects are advanced for design and construction.
Floodplains	Impacts to floodplains are not likely to occur with either build alternative because existing drainage flows will be preserved by proposed drainage improvements and floodplain locations, and elevations would not be affected.
Threatened and Endangered Species	Review of threatened, endangered, and other special status species with the potential to occur within the study area included species protected by the United States Fish and Wildlife Service, the Bureau of Land Management, the Navajo Nation, and several New Mexico state agencies. The potential for these species to occur within the impact area for the build alternatives was determined considering their habitat requirements. A total of 2 species, the Monarch Butterfly and Pecos Sunflower, were identified to likely occur within the impact area in addition to migratory birds and bats. Additional investigations will be necessary as design details are defined and individual projects are advanced.
Farmland Soils	Impacts to prime farmlands would not occur with either alternative. Because this status could change, further analysis to verify their status at that time should be undertaken as individual projects are advanced to the environmental and preliminary design phase of project development.

Differences in impacts between the 2 build alternatives are generally minor, except for potential impacts to noise, cultural resources, and waterways and wetlands. For these resources, the 3-Lane Alternative will have greater impacts due to its wider footprint.

For the 3-Lane Alternative, noise analysis would be required due to the addition of a through travel lane in each direction. The Enhanced 2-Lane with Added Lanes Alternative would likely only require noise analysis for projects that include auxiliary lanes longer than 1.5 miles (e.g., proposed lanes through Gallup and potentially the eastbound climbing lane from MP 141.5 to 143) or substantial changes to interchanges. Traffic noise impacts may be slightly greater with the 3-Lane Alternative in areas where widening occurs to the outside. The feasibility of noise abatement will be determined as part of environmental review for projects as they advance.

In the case of cultural and historic resources, the 3-Lane Alternative may impact 91 resources, compared to 69 for the Enhanced 2 Lane with Added Lanes Alternative, but impact and significance cannot be determined until pedestrian field surveys are conducted.

Impacts to waterways and wetlands are also greater with the 3-Lane Alternative due to its larger footprint. However, it is unlikely the impacts to this resource will be substantial, and Section 404 permits will likely still fall under the threshold for a nationwide permit. Drainage improvements are proposed as part of both of the build alternatives and include a mixture of structure replacements, repairs, and extensions. The Enhanced 2-Lane with Added Lanes Alternative is expected to require structure extensions for 47 drainage locations. The 3-Lane Alternative will require culvert extensions for an estimated 261 drainage locations. Both build alternatives will require culvert replacements to upsize culverts that are undersized or cannot accommodate expected flows. With regard to wetlands, the analysis is based on limited field data. It may be possible to avoid wetlands once further design details are known.

While differences were found in the impacts of the build alternatives, none of the differences are substantial or expected to result in a significant impact. Therefore, based on the information available at the time of the analyses, neither alternative is identified as environmentally preferred.

5.11 Bridges and Drainage Considerations

5.11.1 Bridges

Of the 154 bridges in the study area, 128 of them carry I-40 over waterways, crossing roadways, and BNSF railroads. The 128 bridges include a combination of in-line bridges and concrete box culverts that are classified as major structures. Many of the 128 bridges or major structures carrying I-40 would need to be widened, regardless of the alternative that is proposed. Because the 3-Lane Alternative is wider than the Enhanced 2-Lane with Added Lanes Alternative, footprint impacts and costs with widening bridges on I-40 would be higher for the 3-Lane Alternative. Any relevant differences to environmental impacts are discussed in Section 5.10, and differences in costs are discussed in Section 5.12.

The remaining 26 bridges in the I-40 study area are overpasses that carry roadways, railroads, and pedestrians over I-40. A preliminary analysis was done to identify potential conflicts with these overpasses, due to either widening to the inside or outside of I-40. Potential widening conflicts that cannot be avoided were identified for 6 of the 26 bridges crossing over I-40 for the Enhanced 2-Lane with Added Lanes Alternative and 11 of 26 bridges crossing over I-40 with the 3-Lane Alternative. The costs of replacing these overpasses is assumed in the cost estimates for the build alternatives. These I-40 overpasses would all likely need to be replaced with either of the proposed build alternatives:

1. Bridge 9616 at MP 36.80, carrying NM 118, includes the I-40 interchange at Exit 36 Iyanbito
2. Bridge 6380 at MP 63.4 carrying NM 412, includes the interchange at Exit 63 Prewitt
3. Bridge 7143 at MP 81.94 carrying NM 53, includes the interchange at Exit 81 A/B Grants/San Rafael
4. Bridge 6226 at MP 94.77 carrying the BNSF Railroad
5. Bridge 6490 at MP 108 carrying 06-C12A, includes the interchange at Exit 108 Casa Blanca/Paraje
6. Bridge 6491 at MP 114.26 carrying NM 124, includes the interchange at Exit 114 Laguna

For the 3-Lane Alternative, the following 7 additional bridges over I-40 would likely require replacement:

1. Bridge 9659 at MP 48.0 carrying NM 122, includes the interchange at Exit 47 Continental Divide
2. Bridge 5973 at MP 89.47 carrying NM 117, includes the interchange at Exit 89 Quemado
3. Bridge 6390 at MP 100.09 carrying Frontage Road 4011, includes the interchange at Exit 100 San Fidel
4. Bridge 6121 at MP 117.76 carrying Frontage Road 4012, includes the interchange at Exit 117 Mesita
5. Bridge 6122 at MP 119.38 carrying Frontage Road 4012

In addition, bridge 9330 at MP 20.84 carrying US 491 is a potential conflict with inside widening for both of the build alternatives. This overpass, which includes the I-40 interchange at US 491, is a potential conflict, but it is assumed that impacts to this overpass could potentially be avoided as part of additional design for either of the proposed build alternatives.

5.11.2 Drainage

The impacts to drainage and associated costs would be higher with the 3-Lane Alternative than those needed for the Enhanced 2-Lane with Added Lanes Alternative. There are 821 culvert locations in the study area, and based on the alternative chosen, all or some of these culverts will require replacements, repairs, and/or extensions. The Enhanced 2-Lane with Added Lanes Alternative is expected to require structure extensions for 47 drainage locations in some of the areas where 3 lanes are proposed (e.g., Gallup and climbing lanes at MP 103.5 and 115). The existing depressed median will be regraded and/or paved to accommodate the additional pavement. This would require that the existing median drop inlets be removed and replaced. In addition, CWB is proposed at some median locations and may require additional median or shoulder inlets to accommodate drainage flows.

The 3-Lane Alternative will also widen I-40 to the inside where feasible, but for about 50 miles of the study area, widening will also be required to the outside. Because of this, it is estimated that about 261 drainage locations would require culvert extensions. CWB is proposed at some median locations and may require additional median or shoulder inlets to accommodate drainage flows.

In addition, for both alternatives it is assumed that up to 336 culvert locations may need to be upsized to accommodate 50-year and/or 100-year flows. The number of culverts requiring improvements would be the same for both alternatives, but the length of the pipe needed to upsize culverts for the 3-Lane Alternative would be longer. This has been accounted for in the cost estimates.

5.12 Cost

5.12.1 Construction Costs for the Proposed Alternatives

Estimated costs for the alternatives are summarized in Exhibit 5-20. Important notes about the cost assumptions are listed below, and more detailed cost information is provided in Appendix N, Preliminary Costs.

- Estimated costs include a 20% contingency and are calculated in 2022 dollars.
- They do not include costs for New Mexico gross receipts tax, project development (includes design and environmental review), or right-of-way.
- They do not include specific costs for building ramp extensions and crossovers. Preliminary estimates for the crossovers are provided in Appendix N, Preliminary Costs.
- They do not include costs for proposed operational enhancements identified in Chapter 6, including improvements to intelligent transportation systems (ITS), alternate routes, or incident management.

Exhibit 5-20. Cost Comparison

	No Build	Enhanced 2-Lane with Added Lanes Alternative	3-Lane Alternative
Cost Per Mile[1]	$12.5 million to $14.5 million	$25 million to $27 million[2]	$31 million to $33 million
I-40 Assumptions	▪ All pavement would be rehabilitated or reconstructed. ▪ Bridges identified as being in "poor" condition would be replaced. ▪ The remaining bridges would be rehabilitated. ▪ Undersized culverts at up to 336 locations would be upsized.	▪ All pavement would be rehabilitated or reconstructed, and geometric deficiencies would be addressed. ▪ Bridges identified as being in "poor" condition would be replaced. ▪ Bridges would be widened to 56 feet (52 feet for the roadway from barrier to barrier, plus 2 feet on each side for barriers). ▪ Undersized culverts at up to 336 locations would be upsized, and culverts would be extended at up to 47 locations.	▪ All pavement would be rehabilitated or reconstructed and geometric deficiencies would be addressed. ▪ Bridges identified as being in "poor" condition would be replaced. ▪ Bridges would be widened to 64 feet (60 feet for the roadway plus 2 feet on each side for barriers). ▪ Culverts would require extensions at 261 drainage locations. ▪ Undersized culverts at up to 336 locations would be upsized, and culverts would be extended at up to 261 locations.

1 Costs include a 20% contingency and do not include costs for right-of-way acquisition, New Mexico gross receipts tax, project development, interchange ramp extensions, or crossovers. Costs also do not include investments identified in Chapter 6 for improvements to ITS, alternate routes, or incident management.

2 Per mile costs for the Enhanced 2-Lane with Added Lanes Alternative include the cost of building 3 lanes in Gallup and the proposed climbing lanes.

For comparison purposes, a cost is provided for the No Build Alternative. A No Build cost was developed because even if the improvements proposed with the build alternatives are not made, investments will be needed over the 25+ year planning horizon of this study so that it can continue to serve travelers across New Mexico and the West.

5.12.2 Long-Term Maintenance Considerations

Maintenance costs will increase based on the footprint of the roadway, since there will be more pavement and larger bridge and drainage structures to maintain. In general, the overall footprint of the Enhanced 2-Lane with Added Lanes Alternative is about 26% wider than the No Build, and it would be expected that it would cost about 26% more to maintain it. Similarly, the footprint of the 3-Lane Alternative is about 58% wider than the No Build, and it would be expected to cost about 58% more to maintain.

5.13 Additional Considerations

The following additional items were considered as part of the development of the proposed build alternatives and serves as the basis for the recommended inside and outside shoulder widths of 12 feet for both build alternatives.

5.13.1 Recommendation for 12-Foot Outside Shoulder Widths

For both of the build alternatives, the study team is recommending the construction of 12-foot outside shoulders. The *AASHTO Green Book* (AASHTO 2018) recommends an outside shoulder width of at least 10 feet for roadways with 2 or 3 lanes and indicates that a width of 12 feet should be considered in areas where large tractor-trailer truck volumes exceed a daily hourly volume of 250 large trucks per hour. Tractor-trailer truck volumes in the study area exceed 250 trucks per hour for several hours each day at various locations in the study area, as shown in Exhibit 5-21 to Exhibit 5-25. In addition, as shown previously in Exhibit 5-10, widening outside shoulders from 10 to 12 feet has a safety benefit of reducing crashes by up to 5%. Based on this information, 12-foot outside shoulders are recommended for both of the build alternatives.

Exhibit 5-21. MP 15 Heavy Truck Volumes by Hour and Direction

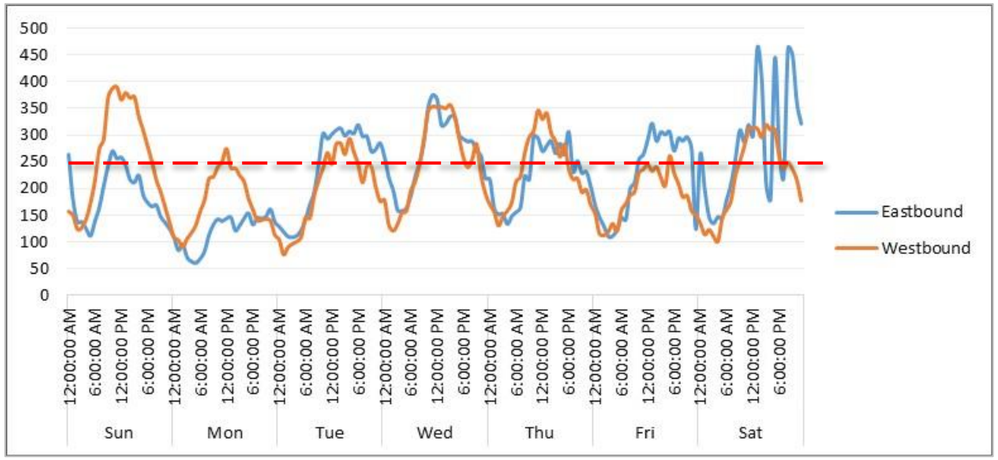


Exhibit 5-22. MP 63 Heavy Truck Volumes by Hour and Direction

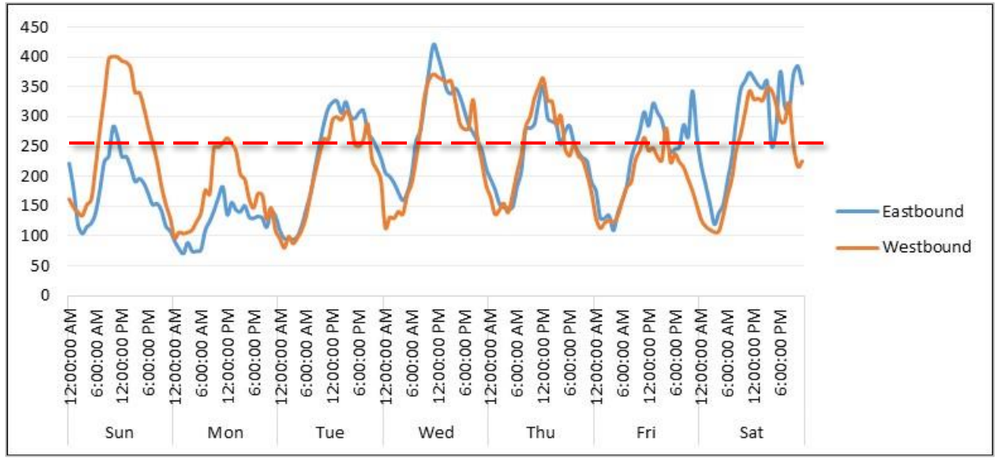


Exhibit 5-23. MP 93 Heavy Truck Volumes by Hour and Direction

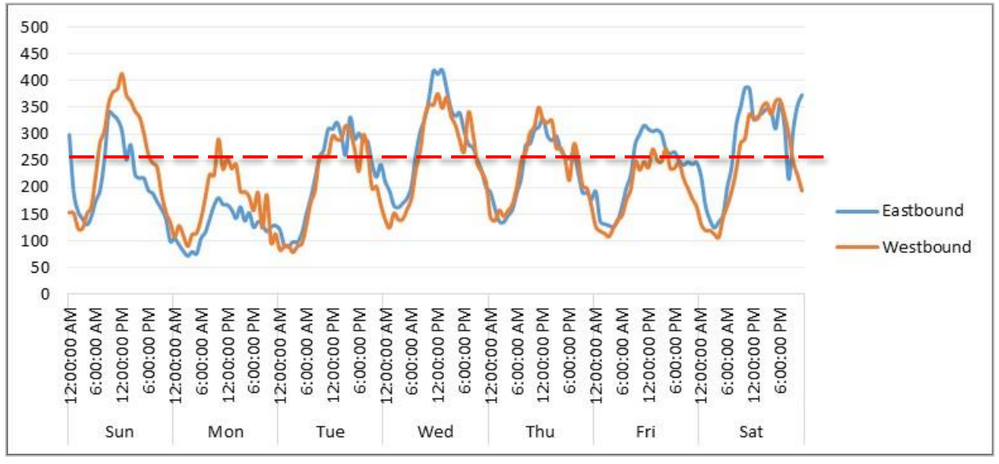


Exhibit 5-24. MP 120 Heavy Truck Volumes by Hour and Direction

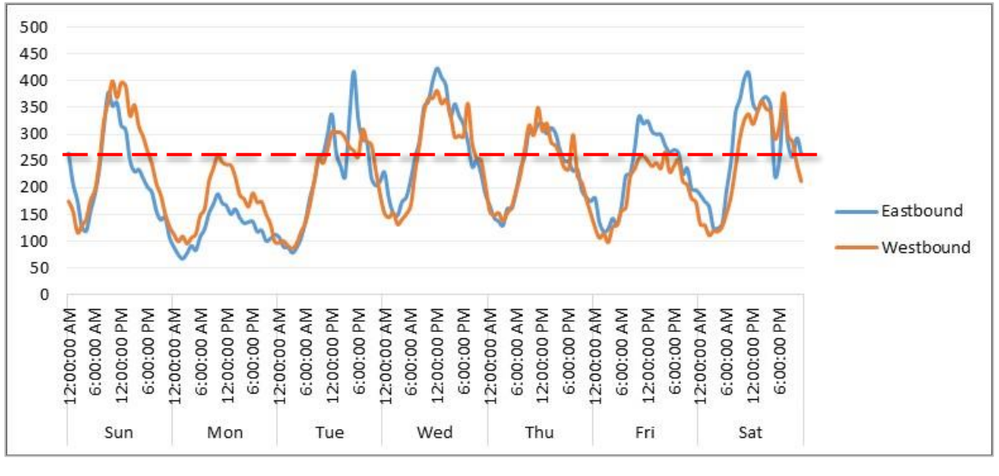
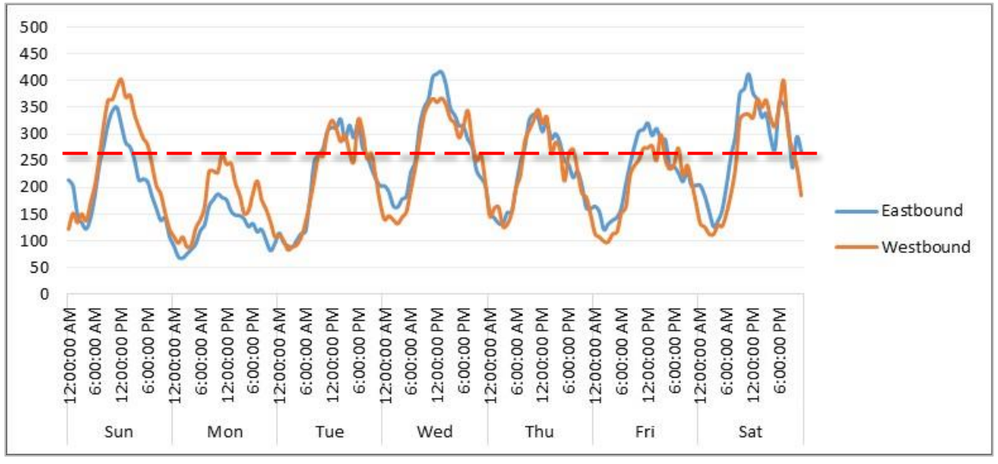


Exhibit 5-25. MP 141 Heavy Truck Volumes by Hour and Direction



5.13.2 Inside Shoulder Width

For the 3-Lane Alternative, 12-foot inside shoulders are recommended for reasons discussed above in Section 5.13.1. For highways with 3 lanes in each direction, the minimum outside shoulder width recommended by the *AASHTO Green Book* is also 10 feet, but given truck volumes and potential safety benefits, the study team recommends a 12-foot inside shoulder.

The *AASHTO Green Book* recommends inside shoulder widths of at least 4 feet on 2-lane roadways However, the study team is recommending 12-foot inside shoulders to improve safety and also provide the NMDOT with the ability to use the 12-foot shoulders as temporary travel lanes in instances where they are needed to provide a way for traffic to keep moving during incidents and to be able to provide 2 lanes on I-40 during routine maintenance or future construction projects (once the Enhanced 2-Lane footprint is established). This recommendation is based on the benefits listed in Exhibit 5-26.

Exhibit 5-26. 12-Foot vs. 8-Foot inside Shoulder Widths for the Enhanced 2-Lane with Added Lanes Alternative

Consideration	12-Foot inside Shoulder Width	8-Foot inside Shoulder Width
Agency Acceptance	12 feet is wider than what is required by AASHTO guidance but is considered acceptable.	AASHTO guidance assumes a minimum inside shoulder width of 4 feet.
Safety	Estimated crash reduction of up to 12% when going from 4 feet to 12 feet or up to 15% when going from 2 feet to 12 feet.	Estimated crash reduction of up to 6% when going from 4 feet to 8 feet and -9% when going from 2 feet to 8 feet.
MOT Construction	Provides option to maintain 2 lanes in each direction on a single side of I-40 with limited detour pavement (6 feet) and no restriping.	Would require 10 to 12 feet of detour pavement and restriping to provide an option to maintain 2 lanes in each direction on a single side of I-40.
MOT Maintenance	Provides space to move 2 lanes to either the north or south, and there's still up to 24 feet left to work with. No restriping is needed since all shoulders and travel lanes are 12 feet.	The 8-foot inside shoulder only allows 2 lanes to the outside. An 8-foot inside shoulder is too narrow for traffic.
MOT Incidents	Provides more space to manage incidents. Lane markings allow traffic to temporarily use the shoulders on the inside or outside as a travel lane.	Provides less space to manage incidents. Shoulder lane markings would not be compatible.
Future Expansion to 3-Lanes	Allows for faster expansion and easier construction MOT since it only requires adding a new shoulder to either the inside or outside of I-40.	Higher cost and would result in 1 to 2 feet of throw away pavement to expand to 3 lanes since a new 12-foot shoulder plus 6 feet of additional pavement will be needed.
Cost	The shoulder pavement cost is about 11% higher than the 8-foot shoulder. Maintenance costs will be higher since there is more pavement to maintain.	Costs would be reduced for construction and maintenance since there would be less pavement to build and maintain.

AASHTO = Association of State Highways and Transportation Officials, MOT = maintenance of traffic

5.14 Preferred Alternative Recommendation

Exhibit 5-27 provides a summary of the screening evaluation discussed in this chapter. Based on the screening evaluation, the recommended alternative is the Enhanced 2-Lanes with Added Lanes Alternative for reasons discussed below and summarized in Exhibit 5-27.

Both build alternatives meet the corridor purpose and need identified in Chapter 4, which include improving traveler safety, traffic operations and reliability, and the condition of the roadway and associated infrastructure on I-40. Specifically, both alternatives:

- Accommodate expected future traffic growth and meet LOS C or better by 2050
- Improve safety
- Improve traffic operations and reliability by providing space to maintain 2 lanes during construction and maintenance activities and provide improved conditions for incident response
- Address identified geometric deficiencies
- Address bridges identified as being in poor condition
- Address pavement identified as being in poor condition
- Address undersized drainage structures

The alternatives evaluation determined that both build alternatives can meet the I-40 corridor needs, and there are no fatal flaws with either build alternative. Both alternatives:

- Meet expected I-40 capacity and performance needs
- Improve safety
- Propose improvements to reduce the main causes of traffic backups, which are construction, maintenance, and incidents

The 3-Lane Alternative offers better overall operations on I-40 with the addition of a third lane, but it does so at an increased cost of about 24% percent when compared to the Enhanced 2-Lane with Added Lanes Alternative. In addition, the 3-Lane Alternative would have a larger footprint, which would result in greater impacts to cultural and natural resources, additional bridges that require replacement or widening, and an increased impact to drainage. The Enhanced 2-Lane with Added Lanes Alternative addresses the purpose and need and does not preclude the eventual construction of a 3-Lane Alternative. Rather, it is future-ready and could be easily expanded to 3 lanes with minimal disruption to traffic if conditions change and 3 lanes are needed. This would allow the NMDOT to make a data-driven decision in the future to expand to 3 lanes in targeted areas to meet needs if conditions warrant.

Exhibit 5-27. I-40 Build Alternatives Detailed Evaluation Summary

Metric	Enhanced 2-Lane with Added Lanes	3-Lane Alternative
Traffic Operations and Future Traffic Growth ▪ Would the alternative meet LOS C or better by 2050?	▪ Accommodates expected future traffic volume growth between now and 2050. ▪ Meets the performance threshold of operations of LOS C or better by 2050 for the I-40 mainline, areas with grades over 3%, and interchange areas access ramps.	▪ Accommodates expected future traffic volume growth between now and 2050. ▪ Meets the performance threshold of operations of LOS C or better by 2050 for the I-40 mainline, areas with grades over 3%, and interchange access ramps. ▪ Provides an extra lane and additional capacity in the study area, which results in improved LOS on the I-40 mainline, grades over 3%, and interchange access ramps. In most areas, the additional capacity would result in an LOS of B as compared to LOS C for the Enhanced 2-Lane with Added Lanes Alternative.
Safety ▪ Explanation of how safety would be improved, based on CMFs.	▪ Improves safety by lengthening interchange ramps, improving horizontal curves, and widening shoulders where needed to meet AASHTO guidelines, and adds travel lanes where needed in Gallup and on steep grades.	▪ Improves safety by lengthening interchange ramps, improving horizontal curves, and widening shoulders where needed to meet AASHTO guidelines, and adds a travel lane from MP 0 to 150.
MOT during Construction ▪ Discussion of the ability to maintain 2 lanes in each direction during construction	▪ Can be built while maintaining 2 lanes on I-40. ▪ Requires more detour pavement than the 3-Lane Alternative to maintain 2 lanes of traffic during construction. ▪ Widens I-40 to the median, which results in a narrower overall footprint.	▪ Can be built while maintaining 2 lanes on I-40. ▪ Requires less detour pavement than the Enhanced 2-Lane with Added Lanes Alternative to maintain 2 lanes of traffic during construction. ▪ Widens I-40 to the median, in most areas, and requires widening to the outside of the existing I-40 footprint for about 50 miles, which results in a wider overall footprint.
MOT during Incidents, Maintenance and Construction Once Built ▪ Discussion of how traffic could be maintained during incidents, maintenance activities, and construction	▪ Provides at least 10 extra feet in each direction of I-40 compared to existing conditions, allowing the 12-foot inside and outside shoulders to be used as temporary travel lanes to provide needed space to maintain 2 lanes on I-40 during construction and maintenance activities. Provides additional space and wider shoulders that can be used to open one or more lanes to traffic faster when responding to incidents.	▪ Benefits are similar to the Enhanced 2-Lane with Added Lanes Alternative, only the 3-Lane Alternative provides more space (at least 22 extra feet in each direction) to be able to maintain 2 lanes of traffic during construction and maintenance activities. The additional space with the 3-Lane Alternative offers more flexibility in how to keep traffic moving than the Enhanced 2-Lane with Added Lanes Alternative.
Right-of-Way Impacts ▪ Comparison of right-of-way needs	▪ Right-of-way needs are not anticipated with either alternative.	▪ Right-of-way needs are not anticipated with either alternative.
Environmental Considerations ▪ Discussion and comparison of environmental considerations	▪ Differences in impacts between the two build alternatives are generally minor except for potential impacts to noise, cultural resources, and waterways and wetlands. While differences were found, neither alternative is identified as environmentally preferred. ▪ The Enhanced 2-Lane with Added Lanes Alternative would likely only require noise analysis of the proposed additional lanes in Gallup, potentially the eastbound climbing lane from MP 141.5 to 143 or substantial changes to interchanges. ▪ For cultural resources, 69 resources may be impacted. ▪ Impacts to waterways and waterways will be reduced compared to the 3-Lane Alternative because of its smaller footprint. However, it is unlikely the impacts to this resource will be substantial for either alternative, and Section 404 permits will likely still fall under the threshold for a nationwide permit.	▪ Differences in impacts between the two build alternatives are generally minor, except for potential impacts to cultural resources, waterways and wetlands, and noise. While differences were found, neither alternative is identified as environmentally preferred. ▪ For the 3-Lane Alternative, noise analysis would be required throughout the study area when the third lane in constructed. Traffic noise impacts may be slightly greater with the 3-Lane Alternative in areas where widening occurs to the outside of the existing I-40 footprint. ▪ For cultural resources, 91 resources may be impacted. ▪ Impacts to waterways and wetlands are also greater with the 3-Lane Alternative due to its larger footprint. However, it is unlikely the impacts to this resource will be substantial for either alternative, and Section 404 permits will likely still fall under the threshold for a nationwide permit.
Bridges and Drainage Considerations ▪ Discussion and comparison of effects to bridges and drainage structures	▪ Requires widening 6 bridge overpasses. ▪ Requires culvert extensions at approximately 47 culvert locations. ▪ Both alternatives require the same number of culvert locations to be upsized, but the length of pipe needed would be shorter for the Enhanced 2-Lane with Added Lanes Alternative, which would lower costs and impacts to drainages.	▪ Requires widening 11 bridge overpasses. ▪ Requires culvert extensions at approximately 261 culvert locations. ▪ Both alternatives require the same number of culvert locations to be upsized, but the length of pipe needed would be longer for the 3-Lane Alternative, which would increase costs and impacts to drainage areas.
Cost ▪ Comparison of construction costs ▪ Long-term maintenance considerations	▪ Estimated at $25 to $27 million per mile based on 2022 dollars. Costs include a 20% contingency and do not include costs for right-of-way acquisition, New Mexico gross receipts tax, project development, interchange ramp extensions, or crossovers. Costs also do not include investments identified in Chapter 6 for improvements to ITS, alternate routes, or incident management. ▪ Long-term maintenance costs would be less than costs needed to maintain the wider footprint of the 3-Lane Alternative.	▪ Estimated at $31 to $33 million per mile based on 2022 dollars, which is about 24% more than the Enhanced 2-Lane with Added Lanes Alternative. Costs include a 20% contingency and do not include costs for right-of-way acquisition, New Mexico gross receipts tax, project development, interchange ramp extensions, or crossovers. Costs also do not include investments identified in Chapter 6 for improvements to ITS, alternate routes, or incident management. ▪ Long-term maintenance costs would be about 25% higher than the Enhanced 2-Lane with Added Lanes Alternative.

6. Phase I-B Detailed Analysis of Operational Enhancements

6.1 Introduction

This chapter provides discussion of recommended operational enhancements proposed to meet I-40 corridor needs identified in Chapter 4 related to improving traffic operations and reliability. These operational enhancements would not meet the corridor needs on their own but would add value to improving operations and reliability on I-40. These operational enhancements are proposed with either of the build alternatives described in Chapter 5. The operational enhancements were developed based on discussion with and input from the New Mexico Department of Transportation (NMDOT), the Strategic Corridor Development Team, I-40 corridor stakeholders, and the public. The operational enhancements were described in concept in Section 4.3.3 and have been developed in more detail as described in this chapter. They include:

- Intelligent transportation systems (ITS) improvements
- Minimize lane closures during construction and maintenance
- Incident management improvements
- Alternate route improvements

6.2 Intelligent Transportation Systems Improvements

6.2.1 ITS Recommendations Summary

ITS improvements were identified based on a review of existing ITS conditions, as described in Section 3.6, and the following: a review of the New Mexico Broadband Plan (State of New Mexico Office of Broadband Access and Expansion 2023), the NMDOT *Strategic ITS Plan for the State of New Mexico* (NMDOT 2019a), the NMDOT Statewide ITS Architecture (NMDOT 2019b), a needs assessment conducted by the study team, and input from the NMDOT ITS Group and the NMDOT Traffic Monitoring Program Staff Manager. Identified ITS service area needs for I-40 include:

1. Traffic management (includes data collection)
2. Road and weather information
3. Traveler information
4. Commercial vehicle operations
5. Maintenance and construction
6. Active traffic management

Exhibit 6-1 provides summary of proposed ITS devices recommended in the study area from milepost (MP) 0 to 150.

Exhibit 6-1. Summary of Existing and Proposed ITS Devices

Location	MP	Data Station	CCTV	DMS	VSAS	DPAS/ TPAS	RWIS	License Plate Reader
Manuelito	1.8					P (2 EB+WB)		
West of Port of Entry	10.7	R						
EB Port of Entry	11.8							E
Port of Entry	12.0		P					
WB Port of Entry	12.7							E
EB West of Gallup	14.2			R (EB)				
Gallup/US 491	20.8	P	E (2 EB+WB)					
WB at Fire Rock Casino	28.5			R (WB)				
East of Gallup	30.0	P						
EB/WB at Exit 36	36.8		E (2 EB+WB)					
Refinery Exit	39.0	P	P	P (EB)	P (EB)			
Near Continental Divide	45.0				P			
Continental Divide	48.0		E				E	
West of Thoreau	50.0				P			
East of Thoreau	54.0	P	P	P (WB)	P (WB)			
Near Prewitt	63.0	P	P					
EB West of Milan	78.8			P (EB)				
Milan	80.7	R						
Grants	82.0		P (Dual)					
WB East of Grants	90.8			R (WB)				
East of Grants	96.9	R	P					
West of Mesita*	115.5	P	P					
EB West of NM 6	125.3			R (EB)				
NM 6	126.9		E				E	
East of NM 6	130.0	P						
Rio Puerco	140.4	P	E					
West of Atrisco Vista	148.0		E	R (EB)				
West of Atrisco Vista	148.9	R						
East of Atrisco Vista	149.5		E					
Total Proposed or Replaced		**12**	**7**	**8**	**4**	**2**	**0**	**0**
Total Proposed + Existing		**12**	**16**	**8**	**4**	**2**	**2**	**2**

CCTV = closed-circuit television; E = existing; EB = eastbound ; DMS = dynamic message sign; DPAS = dynamic parking availability sign; ITS = intelligent transportation system, P = proposed; R = replace; RWIS = road weather information system ; TPAS = truck parking availability system; VSAS = variable speed advisory sign location, WB = westbound

*Potential alternate location near MP 118 if MP 115.5 is not feasible.

In addition to the proposed devices summarized above, the study team recommends other supporting improvements that are described in the sections that follow and include:

- **Fiber Optic Communication Network** – A high-speed fiber optic communication network is proposed to connect ITS devices throughout the study area. Completing the fiber optic network in the study area would require adding fiber optic cable from MP 0 to 125. The NMDOT has existing fiber optic cable along I-40 from MP 125 to 150.
- **District 6 Traffic Management Center (TMC)** – Development of a TMC in District 6 is proposed to enable remote ITS operations and management and to coordinate with key stakeholders, such as police state patrol, emergency services, and other NMDOT TMCs.
- **Truck Parking Availability System (TPAS)** – The TPAS system would add ITS devices at parking and truck rest stops, wireless or wireline communications, and a back-end application to provide information on available truck parking in the study area. Truck parking is currently available for eastbound drivers in New Mexico at the Manuelito rest area near MP 3 and westbound drivers in Arizona just west of the Arizona/New Mexico border. Dynamic parking availability signs (DPAS) would be placed in both the eastbound and westbound direction near MP 1.8 to inform drivers of how many spaces are available.
- **Applications and Integration** – Application and integration is needed to configure, connect, and integrate proposed ITS systems with the NMDOT Southwest Research Institute (SWRI) Advanced Traffic Management System (ATMS) platform.

The proposed ITS recommendations and short-term and long-term priorities are presented in Appendix A, I-40 Highway Operations Improvement Plan, Attachment B, Intelligent Transportation Systems.

6.2.2 Proposed ITS Devices

6.2.2.1 Data Collection

The highest-priority enhancement need identified for the I-40 study area is a series of data collection stations that can provide real-time traffic data, such as hourly and daily traffic counts, vehicle classification per Federal Highway Administration (FHWA) standards, and traffic speeds. The I-40 study area has 4 existing data stations, and 1 of them is currently operational. The immediate recommendation is to replace all 4 existing data collection stations with new ones that provide video analytics. Additional data collection stations are recommended to create a more complete data collection system that can be used to establish and evaluate long-term traffic trends. Having a sufficient operational data collection system will provide needed information to the NMDOT so they can monitor I-40 traffic and operations and adjust their transportation projects as needed to meet changes in traffic demand or vehicle composition. It will also provide updated traffic data to evaluate when and where 1-lane maintenance closures could have the fewest effects to travelers. In the long term, it is recommended that data collection stations be installed at additional locations throughout the corridor, with a suggested spacing of approximately every 10 to 15 miles. Recommended locations for data collection stations are provided in Exhibit 6-2.

Exhibit 6-2. Recommended Locations for Data Collection Stations

#	Location	MP	Need	Available Utilities
1	West of Port of Entry*	10.7	Monitoring Port of Entry traffic volumes and speeds, vehicle classification, etc.	Power, data
2	Gallup/NM 491	20.8	Monitoring Gallup traffic volumes and speeds, vehicle classification, etc.	Power, data
3	East of Gallup	30.0	Monitoring east of Gallup traffic volumes and speeds, vehicle classification, etc.	Power, data
4	Refinery Exit	39.0	Monitoring Continental Divide and NM 371 traffic volumes and speeds, vehicle classification, etc.	Power
5	East of Thoreau	54.0	Monitoring Continental Divide and NM 371 traffic volumes and speeds, vehicle classification, etc.	Power (within 0.5 miles), phone, data
6	Near Prewitt	63.0	Spacing and location with other devices	Power, phone
7	Milan*	80.7	Monitoring Grants and west of NM 117 traffic volumes and speeds, vehicle classification, etc.	Power, phone. data
8	East of Grants*	96.9	Monitoring Grants and east of NM 117 traffic volumes and speeds, vehicle classification, etc.	Power, phone, data are closer to MP 96 at Santa Maria Drive
9	West of Mesita**	115.5	Monitoring west of NM 6 traffic volumes and speeds, vehicle classification, etc.	Power, phone, data
10	East of NM 6	130.0	Spacing, capture volumes east of NM 6	Power, phone, data
11	Rio Puerco	140.4	Spacing	Power, phone, data
12	West of Atrisco Vista*	148.9	Monitoring east of NM 6 and west Albuquerque traffic volumes and speeds, vehicle classification, etc.	Power, phone, data

*Indicates locations of existing NMDOT data stations.
** Potential alternate location near MP 118 if MP 115.5 is not feasible.

The NMDOT is currently evaluating the use of video analytics using artificial intelligence to collect traffic data using video sensors (cameras). It is recommended that the NMDOT adopt this technology for data collection at all data collection locations in the I-40 corridor for several reasons:

- It is non-intrusive: it does not require equipment installation in the pavement, which disrupts traffic and poses safety concerns.
- The video analytics software technology allows for the collection of other operational data that the NMDOT might find useful in the future, including, but not limited to, automatic incident detection, wrong-way driving, stopped vehicles, and travel times.
- Data processing can be done at the edge (on site), at the NMDOT Monitoring Program or in the cloud, depending on the locally available communication network and/or local versus remote processing availability and capability.
- Video cameras are commercial, off-shelf equipment that can be leveraged by multiple video analytics software companies, allowing the NMDOT to use multiple vendors and not get locked into a single vendor.

It is assumed that 2 video cameras would be needed for each data collection location to capture traffic data from both the eastbound and westbound lanes of I-40. A preference would be given to locating the cameras on bridges or on the outer edge of the highway shoulder for access and maintenance purposes. Cameras should be tested to ensure they maintain accuracy during nighttime/dark conditions.

6.2.2.2 Closed-Circuit Television

Existing closed-circuit television (CCTV) devices are located on the eastern and western portions of the study area, with no coverage from approximately MP 48 to 126. In the short term, additional CCTVs are recommended where there is currently no coverage in Grants and locations where there are steep grades. In the long term, it is recommended that CCTVs be installed at regular intervals of every 10 to 15 miles. Based on these criteria and in consultation with NMDOT staff, CCTVs are recommended at key locations as noted in Exhibit 6-3.

Exhibit 6-3. Recommended Locations for CCTV

#	Location	MP	Need	Available Utilities
1	Port of Entry	12.0	Spacing	Power, data
2	Refinery Exit	39.0	NMDOT initial recommendation	Power
3	East of Thoreau	54.0	Spacing and location with other devices	Power (within 0.5 miles), phone, data
4	Near Prewitt	63.0	Spacing and location with other devices	Power, phone
5	Grants	82.0	NMDOT initial recommendation	Power, phone, data
6	East of Grants	96.9	Spacing	Power, phone
7	West of Mesita*	115.5	Monitoring traffic in location with steep grades	Power, data

CCTV = closed-caption television

* Potential alternate location near MP 118 if MP 115.5 is not feasible.

6.2.2.3 Dynamic Message Signs

Dynamic message signs (DMS) are currently used in the study area to provide travel information to the driving public. The NMDOT is in the process of upgrading the existing DMS equipment, so all existing DMS in the I-40 study area will need to be replaced. Additional recommendations are noted in Exhibit 6-4.

Exhibit 6-4. Recommended Locations for DMS

#	Location	MP	Need	Available Utilities
1	EB West of Gallup	14.2	Existing to be replaced	Power, data
2	WB at Fire Rock Casino	28.5	Existing to be replaced	Power, data
3	EB at Refinery Exit	39.0	Part of proposed variable speed advisory segment to notify drivers of possible speed changes	Power
4	WB East of Thoreau	54.0	Part of proposed variable speed advisory segment to notify drivers of possible speed changes	Power, phone, data
5	EB West of Milan	78.8	Notify drivers of adverse road conditions so they can get off in Milan/Grants if desired.	Power, phone, data
6	WB East of Grants	90.8	Existing to be replaced	Power, phone, data
7	EB West of NM 6	125.3	Existing to be replaced	Power, data
8	EB West of Atrisco Vista	148.0	Existing to be replaced	Power, phone, data

DMS = dynamic message signs, EB = eastbound, WB = westbound

6.2.2.4 Variable Speed Advisory Sign System

The NMDOT ITS group suggested that a variable speed limit advisory sign (VSAS) system be developed in the Continental Divide area between MP 40 and 55 due to variable weather conditions that occur due to the increase and decrease in elevation as drivers travel over the Continental Divide. A VSAS system typically is part of a larger alert system as shown in Exhibit 6-5 and includes a combination of DMS and VSAS. VSAS would be located approximately every 5 miles along the Continental Divide area, where speed reductions may be advised due to weather or other conditions, such as incidents, congestion, or construction. New Mexico state law does not allow enforcement of variable speed limits; therefore, the VSASs will be advisory signs with yellow sign faces. Recommendations for the VSAS locations are noted in Exhibit 6-6. Supporting DMS is listed in Exhibit 6-4.

Exhibit 6-5. Variable Speed Advisory Sign System

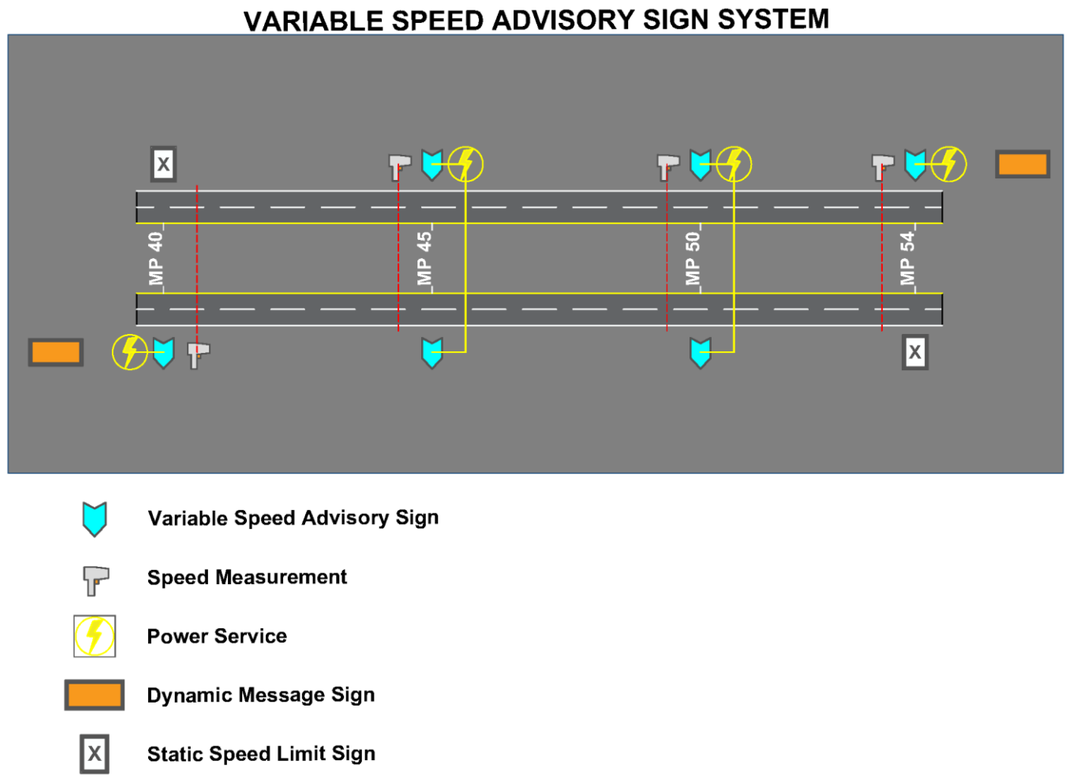


Exhibit 6-6. Recommendations for VSAS

Location	MP	Need	Available Utilities
EB at Refinery Exit	39.0	Regulating travel speeds for EB traffic approaching Continental Divide	Power
Near Continental Divide	45.0	Regulating travel speeds for EB/WB traffic at Continental Divide	Power, phone
West of Thoreau	50.0	Regulating travel speeds for EB/WB traffic at Continental Divide	Power, phone
WB East of Thoreau	54.0	Regulating travel speeds for WB traffic approaching Continental Divide	Power (within 0.5 miles), phone, data

EB = eastbound, VSAS = variable speed advisory sign, WB = westbound

6.2.3 Fiber Optic Communications Network

The communication network is essential to any ITS system, enabling the exchange of data, video, and control signals between field devices and traffic management/operation centers. I-40 currently has a limited high-speed fiber optic communication network that stretches from MP 125 to 150. This network connects field devices to the Regional TMC in Albuquerque. The remaining 125 miles of the I-40 study area lacks a high-speed fiber communication network.

I-40 is a major commercial east-west route, particularly for freight, and it is therefore critical that a high-speed fiber optic backbone be constructed in the long term. Most likely this would be done in phases and based on available funding resources. The installation of fiber along the entire corridor could benefit from a coordinated effort from multiple state agencies and possibly the private sector.

This fiber will support implementation of several ITS devices and systems to enhance planning, operations, and maintenance along the corridor. In addition to the fiber optic network, commercial cellular networks (4G and 5G) are available along the length of the highway. The commercial cellular network can be used to connect to low bandwidth field devices, such as data collections stations, DMS, or RWIS devices to central TMCs and cloud-based ITS applications.

It is recommended that the fiber optic communication network utilize industrial standard ethernet protocols with minimum backbone speeds of 10 gigabit per second. The network topology, protocols, and speed should be revisited during the design and construction phases of any future fiber optic backbone communication system. For purposes of assessing potential environmental impacts of proposed fiber, the study team assumed a possible trench that would be up to 2-feet wide and 3-feet deep that would be constructed within the right-of-way about 5 feet from the proposed roadway shoulder. As projects are constructed, it is recommended that conduit be placed to help advance the construction of the full fiber network. The fiber network should not be placed in the median of I-40 because the proposed improvements will widen to the median and the median is less accessible for maintenance. In general, it is recommended that the fiber line be constructed on the north side of I-40, though there may be areas where it would cross to the south side to avoid environmental or other impacts. Currently, the existing fiber optic cable is located in the median from MP 125 to 150, about 8 feet off the inside I-40 eastbound shoulder. This fiber optic may need to be rebuilt to the north or south if it would be located under I-40 travel lanes. For planning purposes, the study team is assuming that it may need to be relocated, but additional design is needed to make this determination.

6.2.3.1 Environmental Considerations

Fiber optic cable is proposed along the entire study area from MP 0 to 150 to support future ITS enhancements. The fiber optic alignment will be determined as individual projects are advanced from the I-40 Phase 1-A/B Corridor Study and the I-40 Highway Operations Improvement Plan. As discussed above, construction of a fiber optic line is assumed to occur within the existing highway right-of-way, about 5 feet to either the north or south of the proposed I-40 roadway shoulder. To understand potential environmental impacts, the study team identified potential environmental effects of an area of 50 feet to the north and south of the edge of the existing I-40 roadway. The size of the fiber footprint will vary depending on the construction technique, but in general it was assumed that a trench up to 2-feet wide by 3-feet deep would be constructed. Constructing a fiber optic line for the full 150-mile corridor would have the same impacts for both build alternatives but could potentially impact various environmental resources, and there could be opportunities to avoid impacts by identifying potential environmental resources early. Because of this, potential environmental impacts for the proposed fiber optic line were considered as part of the Phase I-B environmental analysis.

Appendix B, Environmental Scoping Report, provides an evaluation of specific resources that could be affected by the proposed fiber optic line if it were built on either the north or south side of I-40. Impacts from both alignments were found to be minor and, while there are slight differences between the alignment options, none were identified that would suggest 1 alignment over the other. As such, it is recommended that the fiber line be constructed on the north side of I-40, though there may be specific locations where the line would cross to the south side to avoid environmental or other impacts.

Differences in environmental impacts between the 2 alignments are summarized below:

- For cultural resources, the northern alignment was found to potentially impact a few more resources than the southern alignment (103 versus 98 resources).
- The proposed fiber optic line could potentially impact Section 4(f) resources, depending on the alignment, as shown in Exhibit 6-7.
  - → Both build alternatives and either of the fiber alignments could potentially affect the Manuelito Archeological Complex. Additional investigation would be required to determine if the property merits 4(f) consideration, evaluate a potential 4(f) use, and identify potential measures to minimize harm. This would occur when individual projects advance to the environmental and preliminary design phase.
  - → In the case of the Continental Divide Trail, neither build alternative or the installation of fiber optic cable for either alignment would constitute a constructive 4(f) use of the trail.
- Potential impacts to the remaining Section 4(f) resources from the proposed fiber optic line could potentially be avoided by routing the fiber optic line to the south side of I-40 near We the People Park, the Fort Wingate Ruin, and Old Bowlin's Trading Post and to the north side near the El Malpais Conservation Area.

Exhibit 6-7. Section 4(f) Properties Potentially Affected by the Proposed Build Alternatives

Location	4(f) Property	Alternatives Affected
Near Arizona Border	Manuelito Archeological Complex	All alternatives; either fiber optic alignment
MP 22 to 23	We the People Park/Babe Ruth Park	Northern fiber optic footprint
East of Gallup	Fort Wingate Ruin	Northern fiber optic footprint
MP 48	Continental Divide Trail/Campbell Pass	All alternatives; either fiber optic alignment
MP 84 to 89	El Malpais Conservation Area	Southern fiber optic footprint
Near Bluewater	Old Bowlin's Trading Post	Northern fiber optic footprint
Multiple locations (see Historic Route 66 section)	Historic Route 66 Segments	All alternatives

Avoidance measures and additional 4(f) analysis will be investigated when individual projects are advanced to the environmental and preliminary design phase of project development.

6.2.4 District 6 Traffic Management Center

NMDOT ITS staff indicated there is a desire to establish TMCs within each NMDOT district to provide local (within district) central ITS device management to enhance traffic operations and maintenance. NMDOT District 6, which is responsible for I-40 from MP 0 to 132 in the study area, currently does not have a TMC, so this need was identified and incorporated into the ITS recommendations. The main functions of the TMC are to provide local (within district) central ITS device management to enhance traffic operations and maintenance. The TMC would be set up in an existing NMDOT District 6 office. The following elements are recommended to enable the operations of the proposed TMC in District 6:

- Two workstations with high-speed internet access.
- SWRI ATMS Cloud Platform user accounts with 2-factor authentication enabled.
- Connectivity to other NMDOT TMCs. This could be accomplished via a secure high-speed internet connection.
- Communication connections to the field ITS devices in District 6. Communication connections will take place incrementally over time as ITS devices are deployed. The communication connection could be a wireline or wireless depending on communication infrastructure availability.

As ITS system growth occurs in the study area, the District 6 TMC will need to be expanded. This may include more workstations/operators, expanded connectivity to ITS devices, and enhanced connectivity with other TMCs and/or emergency operation centers in addition to adding more functionality at the TMC via new ITS applications (cloud or locally based). Therefore, for cost planning purposes, it is assumed that occasional system upgrades and expansion would occur over the approximately 25-year planning period.

6.2.5 Truck Parking Availability System

I-40 currently has a high volume of commercial vehicle activity since it provides connectivity from west coast seaports to the Midwest, South, and East Coast of the U.S. It is recommended that a real-time truck parking information system be implemented to assist truck drivers and dispatchers in making informed parking decisions and to improve safety, mobility, and operations in the study area. The NMDOT has deployed such systems on I-10 through the I-10 Corridor Coalition. A TPAS on I-40 could be integrated into these existing TPAS systems, thus providing commercial vehicle operators with valuable information for safer and efficient operations and information on available parking/rest facilities for commercial truck operators. A TPAS would ideally be implemented in coordination with adjacent states for continuity for commercial vehicle operations along the corridor.

The TPAS system consists of data collection and aggregation technologies, such as video analytic cameras located at truck stops and/or rest areas to count and classify traffic entering/existing the rest area in addition to providing parking occupancy data. Once this information is collected and processed it is transmitted via a communication device (wired or wireless) to a cloud-based or on-premise server that can push parking availability information in real time to truckers using DPAS and/or mobile applications. A typical TPAS system overview is shown below in Exhibit 6-8. For planning purposes, it is assumed that the NMDOT would build a TPAS system similar to the one that is currently functioning in New Mexico on I-10.

Exhibit 6-8. TPAS Overview

TPAS = truck parking availability system, Source: https://i10connects.com/overview-tpas

6.2.6 Applications and Integration

Back-end ITS applications are necessary to effectively manage ITS field devices and services such as traffic management, data collection, and traveler information. The NMDOT has procured an ATMS platform from the SWRI. The platform is currently online but is in the process of being migrated to a cloud-based system, which will enable secure connectivity to field devices and operators with internet connection. This cloud-based solution is ideal for I-40 since the corridor currently has limited connectivity to central operations centers. Once this platform is fully migrated to the cloud, short- and long-term ITS field deployments can be interconnected to the cloud-based application, using either commercial cellular networks that are commonly available along the corridor and/or dedicated communication networks. This solution also allows for simultaneous multiuser access from various geographic locations, allowing the NMDOT to provide redundancy in operational coverage for I-40.

Custom server-based applications being operated from central offices or TMCs also require cellular communication if a dedicated ITS communication network does not exist, such as is the case on I-40 between MP 0 and 125. As more and new ITS field devices are installed along I-40, there will be a need to integrate these devices into existing and future back-end ITS applications and solutions. This could include the integration into the SWRI ATMS cloud platform or new specialized applications, such as TPAS or other solutions.

The integration between various applications, systems, subsystems, devices, and third-party solutions is where the NMDOT can maximize the benefits of its existing and future ITS investments. It is critical that applications and any integration follow national and open standards and protocols, such as National Transportation Communications for Intelligent Transportation System Protocol, to avoid custom and proprietary solutions.

6.2.7 Other ITS Considerations

Smart construction work zones are another ITS application that the NMDOT could consider. This solution has not been incorporated into the cost estimates for the recommended ITS improvements in the study area, but it could be considered on a case-by-case basis for individual projects as they are implemented.

6.2.7.1 Smart Construction Work Zones

Construction work zones are a major source of added delay and sometimes result in increased crash rates. The NMDOT could implement Smart Construction Work Zones when construction takes place. This would be accomplished by requiring contractors to implement smart construction work zones on construction projects as part of project specifications or special provisions. These special provisions could include the desired functionality for smart work zones, such as dynamic speed advisory, advanced queue warning, detection and alerting of high-speed approaching vehicles. The cost for implementing smart construction work zones depend on each specific construction zone, including the length of the construction zone and the duration of construction, but could add anywhere from $40,000 per project to as much as $250,000. These systems typically involve installing monitoring cameras and communications equipment.

Mobile CCTV systems can monitor user-defined zones in construction work zones in real-time. These cameras are connected to video analytics processors that use machine vision/machine learning algorithms and techniques to monitor user-defined vehicle behavior, such as location, speed and direction. The system monitors dangerous driving behaviors in real time (up to 10 times per second) and triggers warning flashing signs and/or audible warning systems wirelessly providing an effective solution to prevent accidents in or around construction work zones.

In addition, there are hosted services that enhance the ability of the NMDOT to manage construction work zones more efficiently and share information with the traveling public. The NMDOT is currently using Payver, a hosted service that can digitally monitor and document construction work zones to ensure contractor compliance and to enhance safety in these zones. The NMDOT is currently considering another hosted service called One.Network that can create safer work zones and enhance travel in New Mexico through a solution that centralizes the planning, coordination, and communication of disruptions on the road network. These hosted solutions, in combination with the proposed work zone solution mentioned earlier in this section, provide the NMDOT with a set of tools that can be used to enhance safety in work zones.

6.2.8 Cost Estimates

The exhibits below provide planning-level estimates for the proposed ITS recommendations. For planning and cost-estimating purposes, the cost-estimates have been split to show the costs proposed short-term ITS improvements (0 to 5 year timeframe), shown in Exhibit 6-9, and the costs of proposed long-term ITS improvements (5 to 25 year timeframe), listed in Exhibit 6-10. Total costs for the proposed ITS recommendations are about $35 million. Detailed recommendations regarding proposed short-term and long-term improvements are provided in Appendix A, I-40 Highway Operations Improvement Plan, Attachment B, Intelligent Transportation Systems.

Exhibit 6-9. Short-Term ITS Improvements Estimated Costs

Item	Unit Cost	Quantity	Subtotal
Data stations [a]	$100,000	9	$900,000
CCTV	$130,000	3	$390,000
DMS (assumes mounting on W-Beam supports)	$150,000	8	$1,200,000
VSAS	$100,000	4	$400,000
Fiber optic	$125,000/mile	44 miles	$5,500,000
District 6 TMC [b]	$100,000	1	$100,000
DPAS/TPAS	$1,000,000	1	$1,000,000
Applications and integration [c]	$250,000	1	$250,000
		Rounding and 20% Contingency [d]	$2,260,000
		Total [d]	**$12,000,000**

CCTV = closed-caption television, DMS = dynamic message signs, DPAS = dynamic parking availability sign, ITS = intelligent transportation system, TPAS = truck parking availability sign, VSAS = variable speed limit advisory sign

a Includes replacement for existing data stations. The cost includes 2 video cameras.

b Assumes server and communication equipment in an existing NMDOT facility to connect to field devices, cloud platform, and other districts. Does not include cost of labor or annual operation costs.

c Includes applications and integration to provide linkages to field devices, cloud platform, and other districts.

d Total is rounded and includes a 20% contingency. Costs do not include right-of-way, project development, or New Mexico Gross Receipts Tax.

Exhibit 6-10. Long-Term ITS Improvements Estimated Costs

Item	Unit Cost [d]	Quantity	Subtotal
Data stations [a]	$130,000	3	$390,000
CCTV	$170,000	4	$680,000
Fiber optic (new)	$162,500/mile	81 miles	$13,162,500
Fiber optic (relocate MP 125 to 150)	$162,500/mile	25 miles	$4,062,500
District 6 TMC [b]	$300,000	1	$300,000
Applications and integration [c]	$325,000	1	$325,000
		Rounding and 20% contingency [e]	$ 4,080,000
		Total [e]	**$23,000,000**

ITS = intelligent transportation system, TMC = traffic management center

a Cost includes 2 video cameras.

b Cost for future expansion as ITS system expands along I-40. Assumes server and communication equipment in an existing NMDOT office to connect to field devices, cloud platform, and other districts. Does not include cost of labor or annual operation costs.

c Includes applications and integration to provide linkages to field device, cloud platform, and other districts.

d Long-term unit costs are adjusted +30% to account for future pricing.

e Total is rounded and includes a 20% contingency. Costs do not include right-of-way, project development, or New Mexico Gross Receipts Tax.

6.3 Minimize Lane Closures during Construction and Maintenance

6.3.1 Methods

One of the key findings of this I-40 Corridor Study is that reducing I-40 to 1 lane for any reason (construction, maintenance, or crash response) is problematic and leads to congestion and traffic queues. Additional analysis was completed in Phase I-B to help understand the potential effects of lane reductions through the I-40 study area at various locations, times of day, and up to the year 2050. This information was used to develop recommendations.

As described in Section 3.7.7, hourly volumes on I-40 from traffic counts collected in 2022 during the study were compared to a planning-level capacity of 1,500 passenger car equivalents (PCEs) for a 1-lane freeway through a construction zone. The 1,500 PCE per lane capacity was derived from the Oregon Department of Transportation (ODOT) *Work Zone Traffic Analysis Manual* (ODOT 2023). This capacity is used by ODOT for work zone planning purposes to understand potential delays and queue lengths for future projects. To convert I-40 hourly volumes to PCE, the study team applied the set of PCE factors derived for capacity analysis discussed previously in Section 3.7.6.

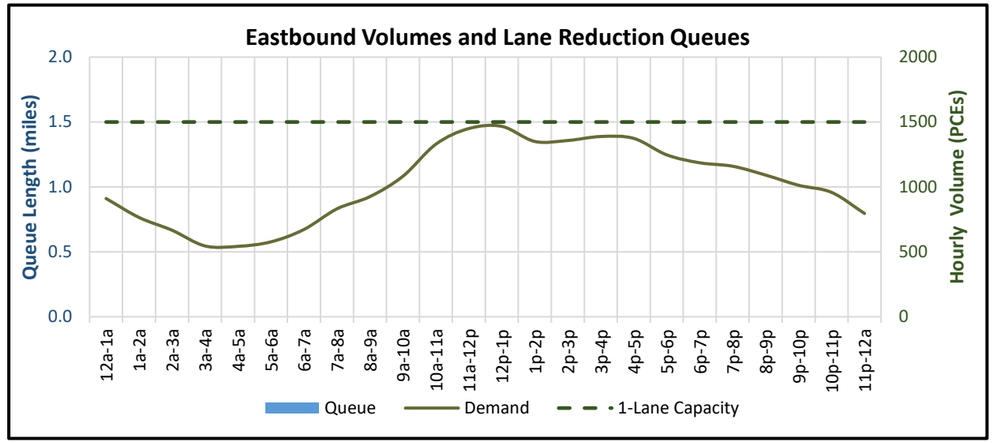
The study team used the ODOT Work Zone Traffic Analysis Tool Version 1.6 to provide a planning-level estimate of how a 1-lane closure might operate with existing traffic volumes over the course of a 24-hour period at various locations throughout the study area. Traffic volumes in the I-40 corridor study area are lowest at MP 15 west of Gallup and continue to increase as travelers move east toward Albuquerque. Therefore, the study team considered several locations in the study area, beginning at MP 15 west of Gallup, continuing east to MP 63 near Prewitt, MP 93 east of Grants, MP 120 near Mesita, and MP 141 near the Route 66 Casino. An analysis of potential traffic backups due to 1-lane closures were developed using vehicle volumes that were obtained on a Wednesday. Vehicle volumes on I-40 in the study area are highest on Saturday, lowest on Monday, and rise throughout the week. The study team selected Wednesday as a representative day to conduct an analysis of a 1-lane reduction because vehicle volumes are relatively balanced between passenger vehicles and heavy trucks and eastbound and westbound traffic. Therefore, it would be expected that a 1-lane closure on a Saturday would have longer queues than those discussed below because vehicle volumes are higher on Saturday. Queues on a Monday would be expected to be shorter because vehicle volumes are lower on Mondays.

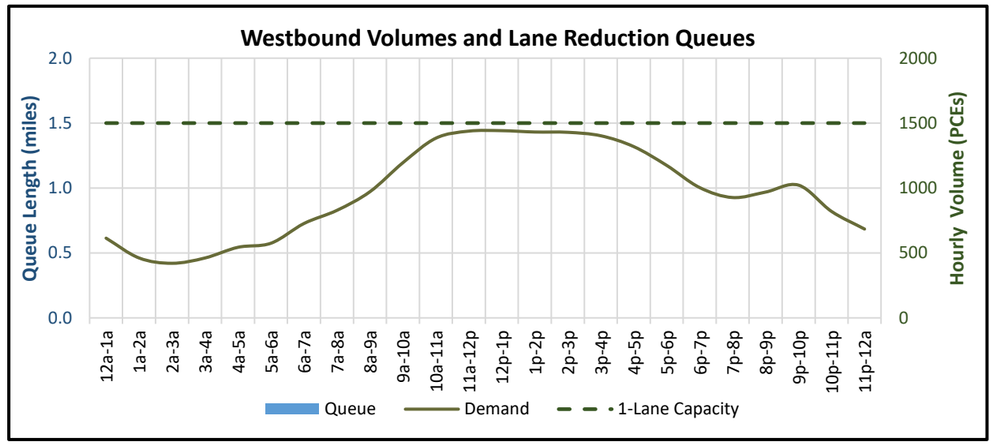
In addition to the analysis completed for existing conditions, the study team analyzed 1-lane closures at 2 locations (MP 63 and MP 120) with projected 2035 and 2050 traffic volumes. Traffic volumes for 2035 and 2050 were projected using traffic volumes obtained in 2022, assuming a 1.9% annual growth rate as discussed in Section 3.7.5.

6.3.2 Findings at MP 15 West of Gallup

At MP 15, 2022 traffic volumes approach the 1,500 PCE threshold around midday (noon to 1:00 PM eastbound direction and 11 AM to 3 PM westbound) but do not currently exceed the existing roadway capacity, even after 1-lane closure, as shown in Exhibit 6-11. Therefore, no queue is expected to form at MP 15 with existing conditions. However, this section is nearing capacity midday, and it is expected that 1-lane closures could start to result in queues and delay midday in the near future if growth continues as in past years.

Exhibit 6-11. I-40 MP 15, 1-Lane Closure Queues, Existing Conditions, Wednesday





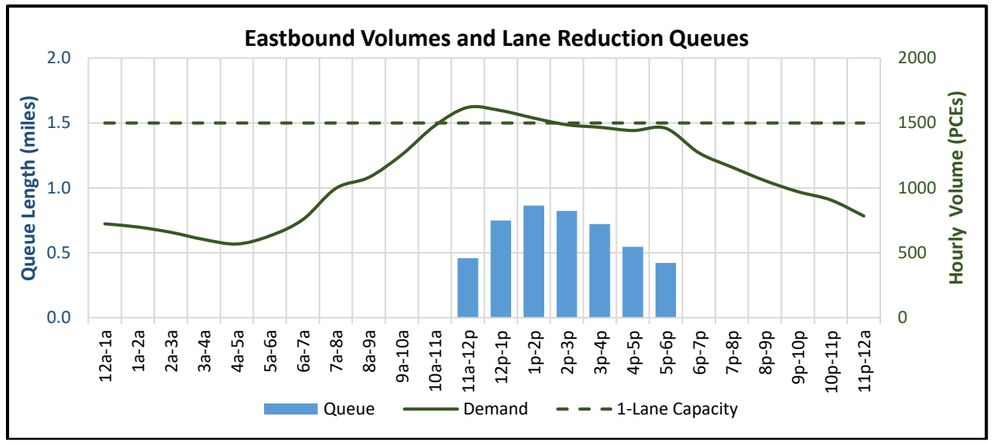
PCE = passenger car equivalent

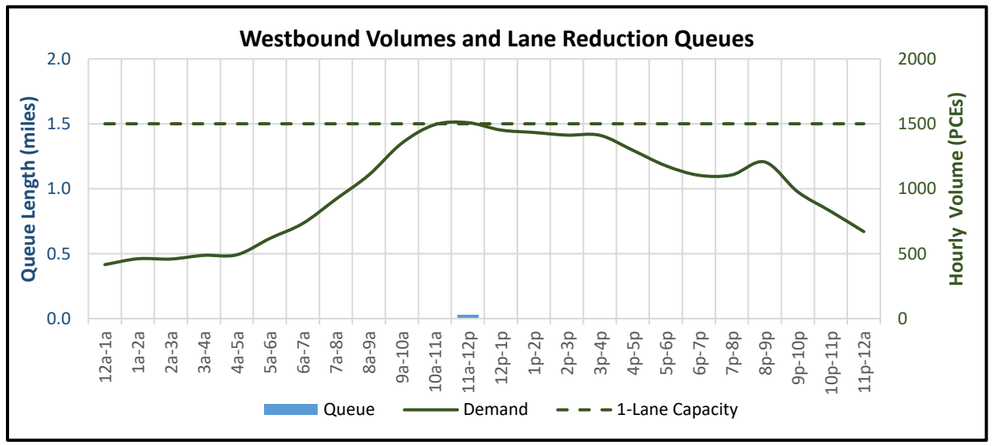
6.3.3 Findings at MP 63 near Prewitt

6.3.3.1 Projected Traffic Queues at MP 63 near Prewitt, Existing Conditions

At MP 63, 2022 demand exceeds the capacity from 11 AM to 2 PM for the eastbound direction and creates a queue of about 0.5 miles to about 1 mile and takes an additional 4 hours, until 6 PM, to clear the queue, as shown in Exhibit 6-12. For the westbound direction, demand slightly exceeds the capacity from 11 AM to noon, and it creates a small queue of 0.03 miles.

Exhibit 6-12. I-40 MP 63, 1-Lane Closure Queues, Existing Conditions, Wednesday



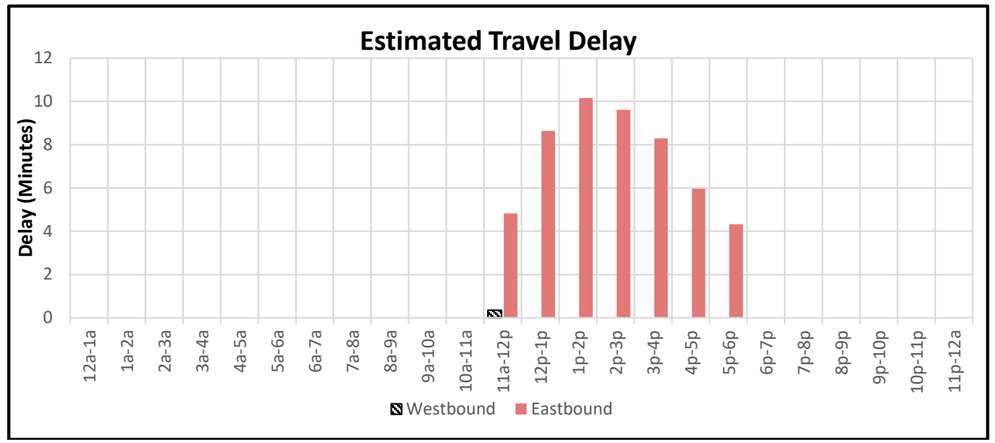


PCE = passenger car equivalent

6.3.3.2 Estimated Delay at MP 63 near Prewitt, Existing Conditions

The estimated delay in the eastbound direction from 11 AM to 6 PM is between 4 and 10 minutes, as shown in Exhibit 6-13. There is only a slight expected delay of less than 1 minute for westbound traffic.

Exhibit 6-13. I-40 MP 63, 1-Lane Closure Delay, Existing Conditions, Wednesday

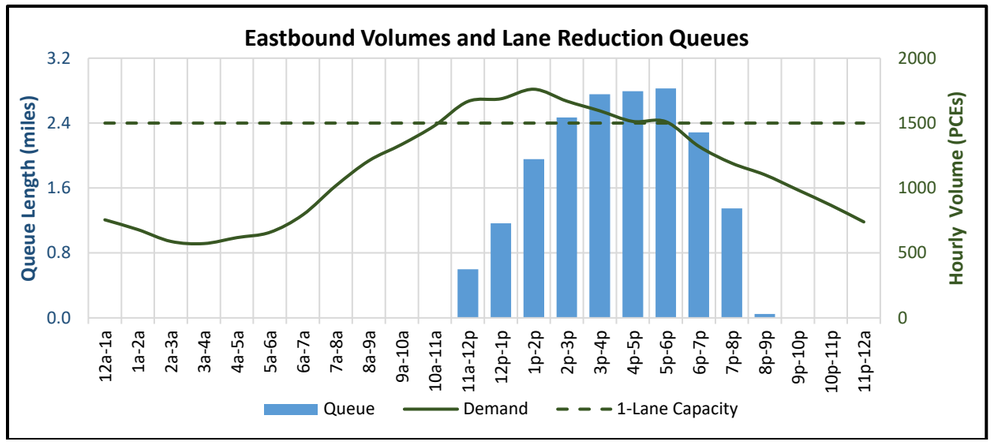


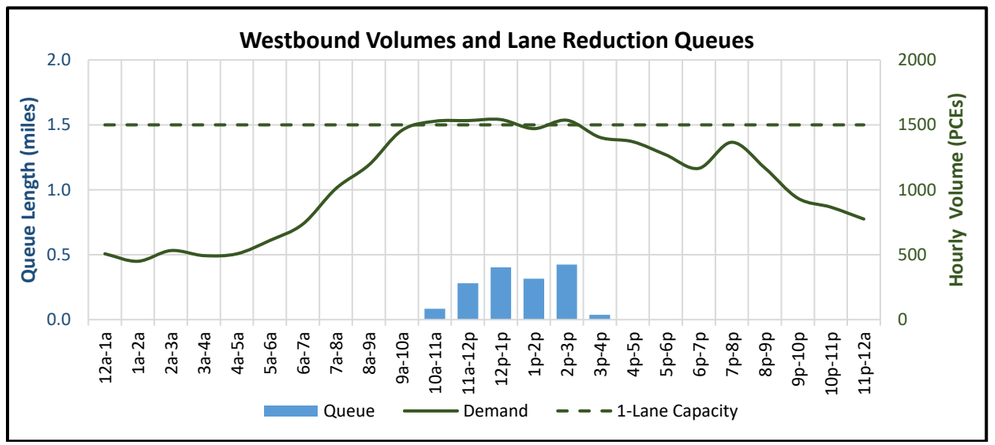
6.3.4 Findings at MP 93 East of Grants

6.3.4.1 Projected Traffic Queues at MP 93 East of Grants, Existing Conditions

At MP 93, 2022 demand exceeds the capacity from 11 AM to 6 PM for eastbound direction. This results in a queue from 0.6 to 2.8 miles long and takes additional 3 hours, until 9 PM, to clear, as shown in Exhibit 6-14. For the westbound direction, demand exceeds from 10 AM to 1 PM and 2 PM to 3 PM and creates a queue of 0.1 to 0.4 miles between 10 AM to 4 PM.

Exhibit 6-14. I-40 MP 93, 1-Lane Closure Queues, Existing Conditions, Wednesday



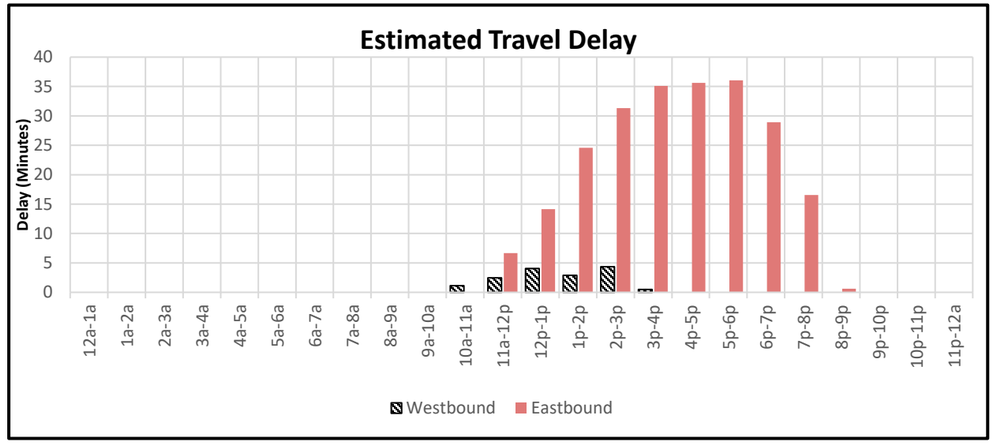


PCE = passenger car equivalent

6.3.4.2 Estimated Delay at MP 93 East of Grants, Existing Conditions

As shown in Exhibit 6-15, the estimated delay in the eastbound direction ranges as high as 35 to 36 minutes from 3 PM to 6PM. Estimated delay for westbound traffic is about 1 to 4 minutes.

Exhibit 6-15. I-40 MP 93, 1-Lane Closure Delay, Existing Conditions, Wednesday

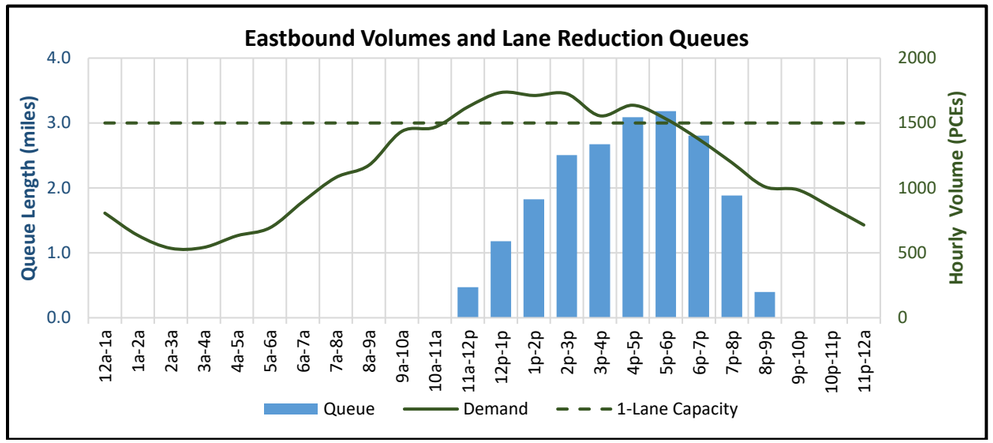


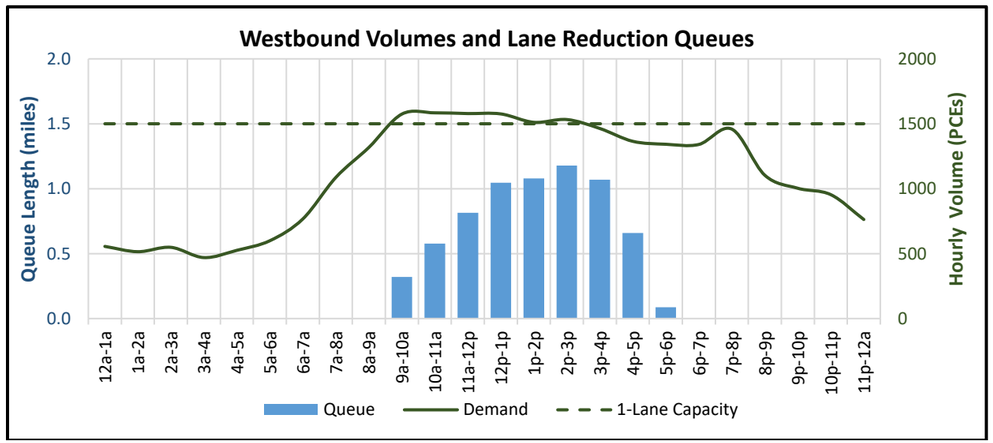
6.3.5 Findings at MP 120 near Mesita

6.3.5.1 Projected Traffic Queues at MP 120 near Mesita, Existing Conditions

At MP 120, 2022 demand exceeds the capacity from 11 AM to 6 PM for eastbound direction, and it creates queues over 3 miles long and takes additional 3 hours, until 9 PM, to clear, as shown in Exhibit 6-16. For the westbound direction, demand exceeds the capacity from 9 AM to 3 PM and creates a queue of 0.3 to 1.2 miles long and takes additional 3 hours, until 6 PM, to clear the queue, as shown in Exhibit 6-16.

Exhibit 6-16. I-40 MP 120, 1-Lane Closure Queues, Existing Conditions, Wednesday



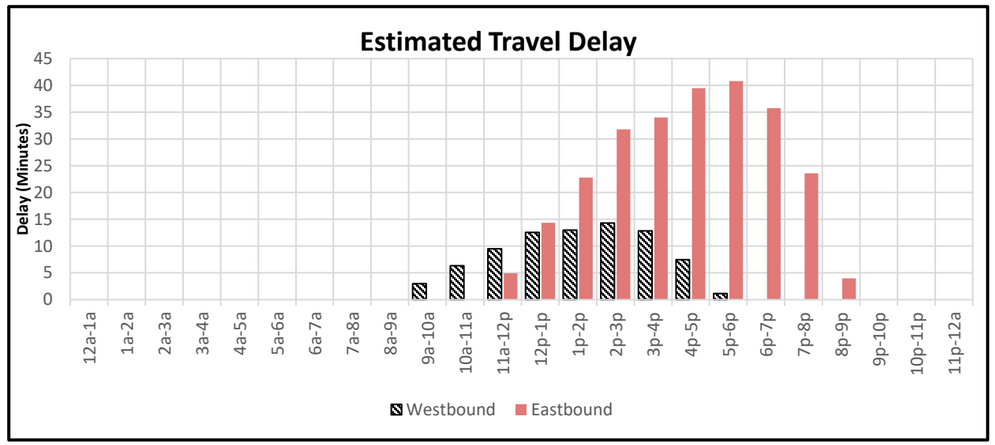


PCE = passenger car equivalent

6.3.5.2 Estimated Delay at MP 120 near Mesita, Existing Conditions

The estimated delay in the eastbound direction ranges from about 5 minutes at 8 PM to as high as 40 minutes from 4 PM to 6PM, as shown in Exhibit 6-17. The estimated delay in the westbound direction ranges from about 1 minute at about 6PM to a high of 13 to 14 minutes from noon to 4 PM.

Exhibit 6-17. I-40 MP 120, 1-Lane Closure Delay, Existing Conditions, Wednesday

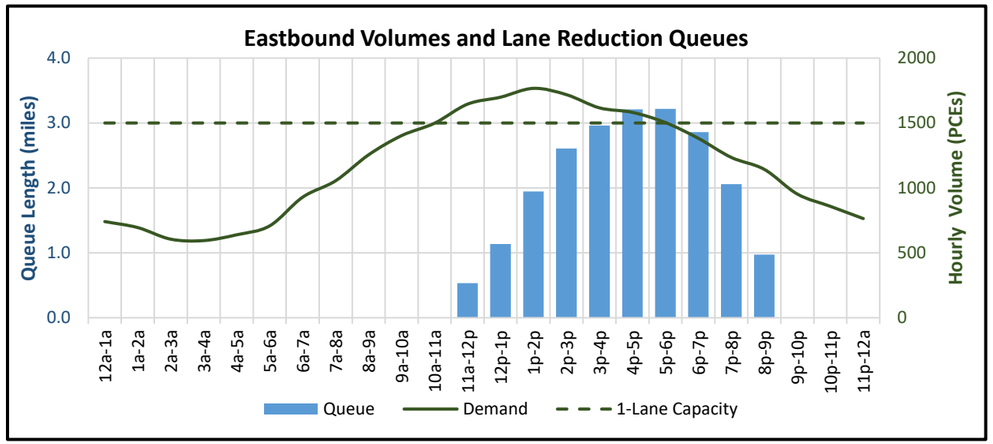


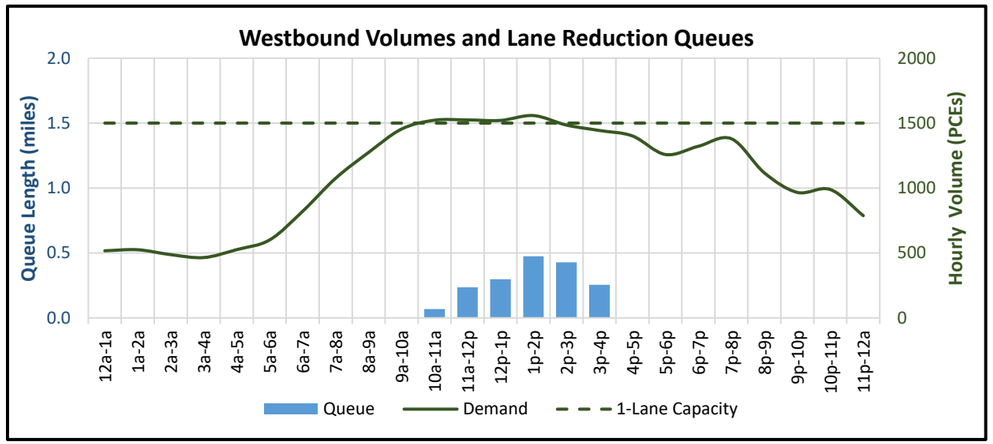
6.3.6 Findings at MP 141 near the Route 66 Casino

6.3.6.1 Projected Traffic Queues at MP 141, Route 66 Casino, Existing Conditions

At MP 141, 2022 demand exceeds the capacity from 11 AM to 6 PM for eastbound direction, and it creates a queue over 3 miles long and takes additional 3 hours, until 9 PM, to clear, as shown in Exhibit 6-18. For the westbound direction, demand exceeds capacity from 10 AM to 2 PM and creates a queue of 0.1 to 0.5 miles long and takes additional 2 hours, until 4 PM, to clear, as shown in Exhibit 6-18.

Exhibit 6-18. I-40 MP 141 1-Lane Closure Queues, Existing Conditions, Wednesday



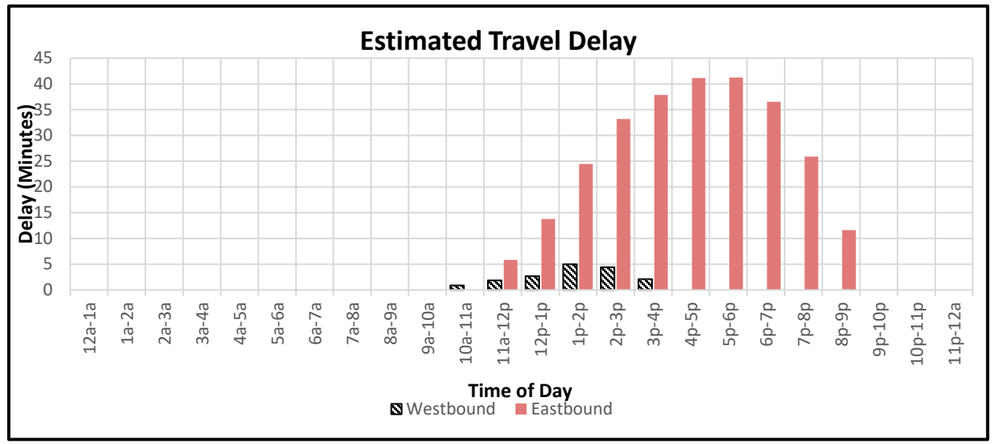


PCE = passenger car equivalent

6.3.6.2 Estimated Delay at MP 141, Route 66 Casino, Existing Conditions

The estimated delay in the eastbound direction ranges from about 6 minutes at 11 AM to as high as 41 minutes from 4 PM to 6 PM, as shown in Exhibit 6-19. The estimated delay in the westbound direction ranges from about 1 to 5 minutes.

Exhibit 6-19. I-40 MP 141, 1-Lane Closure Delay, Existing Conditions, Wednesday



6.3.7 Existing Conditions Findings Overview

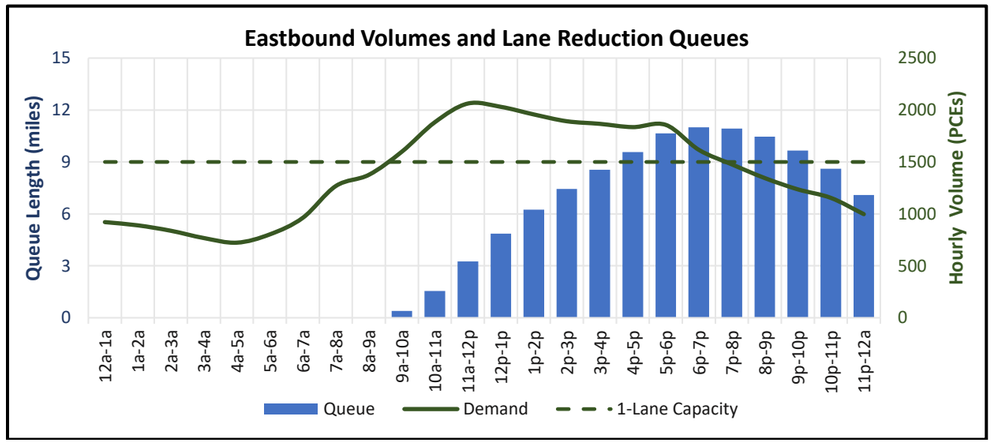
In general, Wednesday traffic demand in the eastbound direction is higher than the westbound direction for all 5 locations and, thus, exceeds the 1-lane capacity more frequently and causes a longer queue. The eastbound queues at MPs 93, 120, 141 are the longest and are expected to take up to 10 hours to clear. Based on data collected and presented in Chapter 3, the study team would expect longer queues in the westbound direction on Sundays, when westbound traffic demand exceeds eastbound demand.

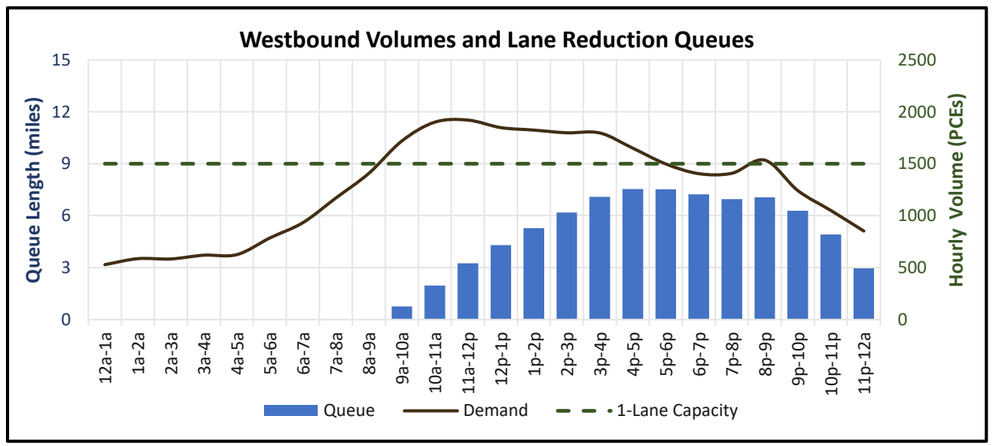
6.3.8 Findings at Milepost 63 in 2035 and 2050

6.3.8.1 Projected Traffic Queues at MP 63, 2035 and 2050

MP 63 was analyzed for a 1-lane closure with projected 2035 and 2050 traffic volumes, as shown in Exhibit 6-20 and Exhibit 6-21. Traffic volumes for 2035 and 2050 were projected using traffic volumes obtained in 2022, assuming a 1.9% annual growth rate as discussed in Section 3.7.5. As expected, demand for the future years in 2035 and 2050 will increase and exceed the capacity for longer periods of time and, thus, will generate longer traffic queues that will take more time to clear. For example, the highest eastbound queue at MP 63 is less than 1 mile under 2022 conditions. This traffic queue is expected to increase to up to 11 miles in year 2035, as shown in Exhibit 6-20, and up to 34 miles in year 2050, as shown in Exhibit 6-21. Similarly, the negligible queue in the westbound direction is expected to increase to up to 8 miles by 2035 and 29 miles in year 2050.

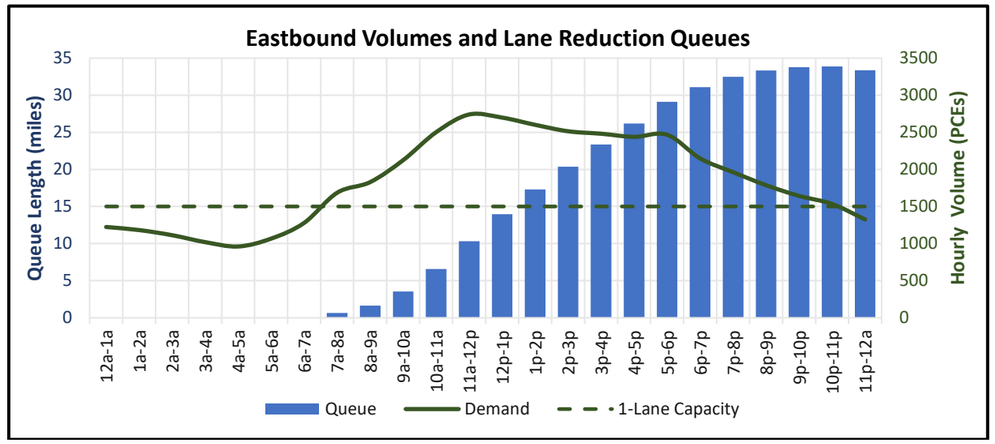
Exhibit 6-20. I-40 MP 63 1-Lane Closure Queues, 2035, Wednesday

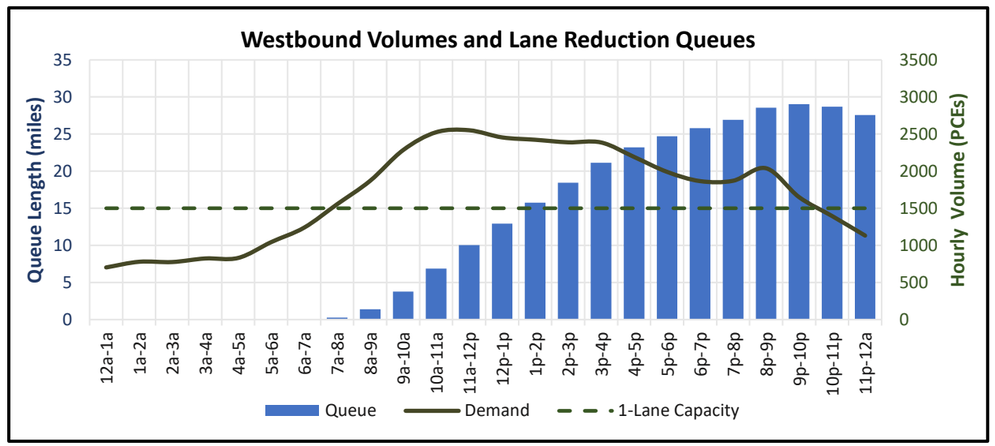




PCE = passenger car equivalent

Exhibit 6-21. I-40 MP 63 1-Lane Closure Queues, 2050, Wednesday





PCE = passenger car equivalent

6.3.8.2 Estimated Delay at MP 63, 2035 and 2050

The estimated delay in the eastbound direction at MP 63 is expected to be as high as 144 minutes (over 2 hours) in 2035, as shown in Exhibit 6-22, and rises to as much as 446 minutes (over 7 hours) in 2050, as shown in Exhibit 6-23. The estimated delay in the westbound direction is expected to be as high as 98 minutes (about 1.5 hours) in 2035 and rises to as much as 382 minutes (over 6 hours) in 2050.

Exhibit 6-22. I-40 MP 63, 1-Lane Closure Delay, 2035, Wednesday

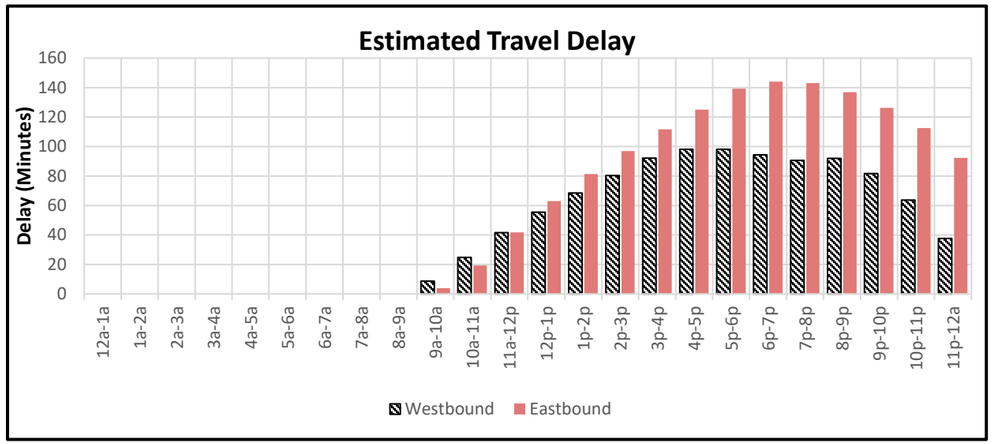


Exhibit 6-23. I-40 MP 63, 1-Lane Closure Delay, 2050, Wednesday

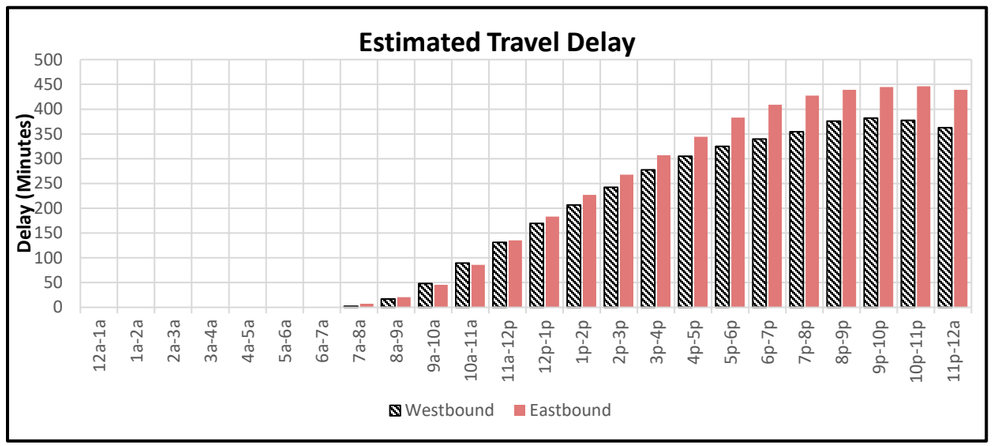
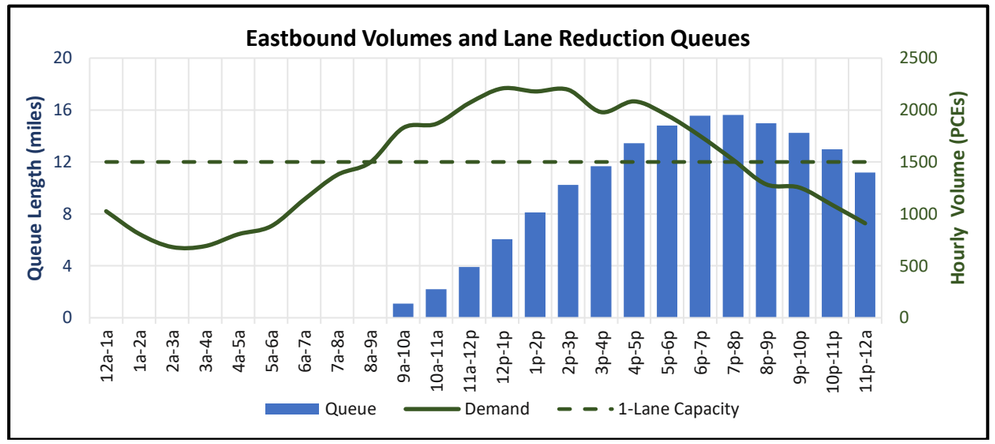
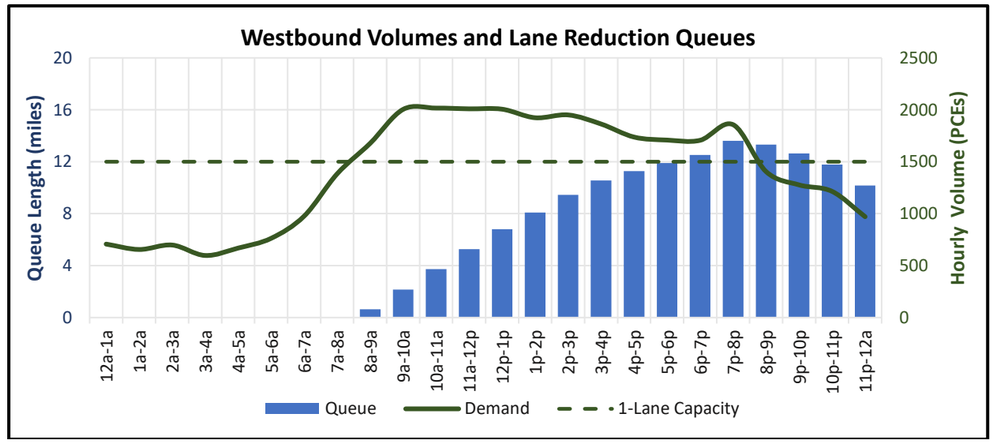


Exhibit 6-24. I-40 MP 120 1-Lane Closure Queues, 2035, Wednesday





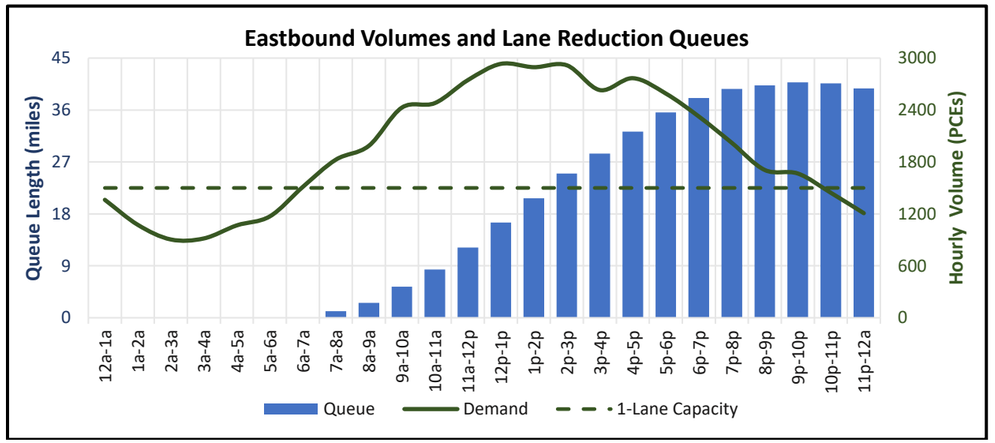
PCE = passenger car equivalent

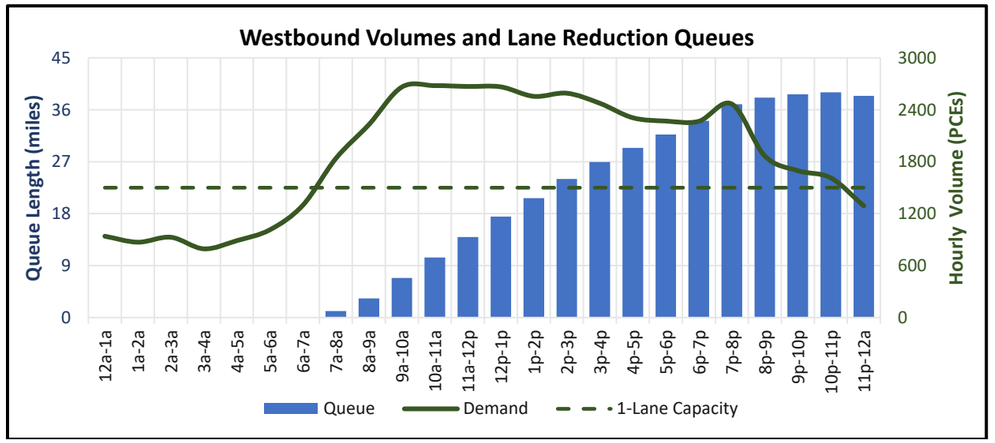
6.3.9 Findings at MP 120 in 2035 and 2050

6.3.9.1 Projected Traffic Queues at MP 120, 2035 and 2050

A similar upward trend in traffic queues and delays with 1-lane closures are expected at MP 120 with projected 2035 and 2050 traffic volumes. The highest eastbound queue at MP 120 is just over 3.2 miles under 2022 conditions. This traffic queue is expected to increase to as much as 15.5 miles in year 2035, as shown in Exhibit 6-24, and up to 40 miles in year 2050, as shown in Exhibit 6-25. Similarly, the queue of just over 1 mile in the westbound direction is expected to increase to as much as 13.5 miles by 2035 and up to 39 miles in year 2050.

Exhibit 6-25. I-40 MP 120 1-Lane Closure Queues, 2050, Wednesday





PCE = passenger car equivalent

6.3.9.2 Estimated Delay at MP 120, 2035 and 2050

The estimated delay in the eastbound direction at MP 120 is expected to be as high as 205 minutes (over 3 hours) in 2035, as shown in Exhibit 6-26, and rises as much as 537 minutes (about 9 hours) in 2050, as shown in Exhibit 6-27. The estimated delay in the westbound direction is expected to be as high as 178 minutes (about 3 hours) in 2035 and rises to as much as 514 minutes (about 8.5 hours) in 2050.

Exhibit 6-26. I-40 MP 120, 1-Lane Closure Delay, 2035, Wednesday

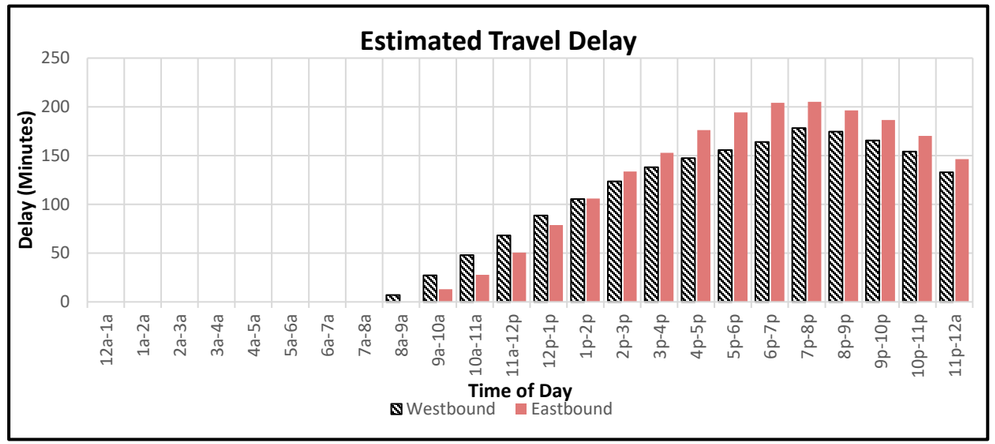
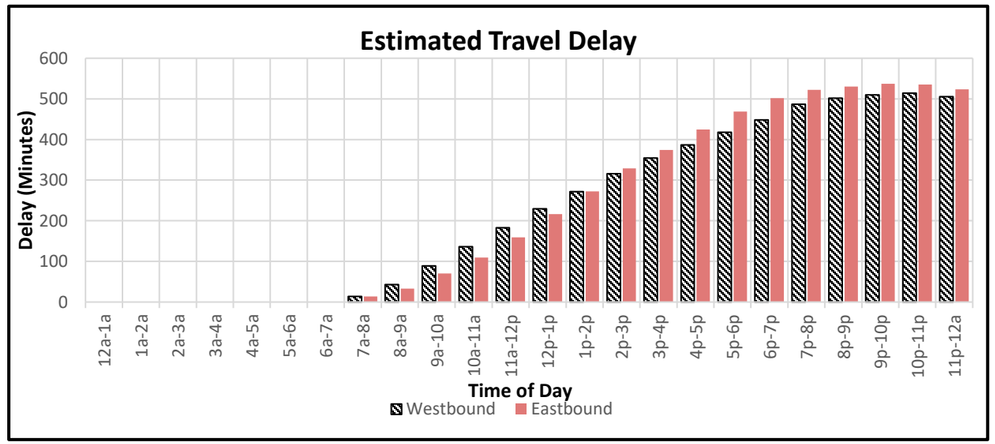


Exhibit 6-27. I-40 MP 120, 1-Lane Closure Delay, 2035, Wednesday



6.3.10 Recommendations for Minimizing Lane Closures during Construction and Maintenance Activities

It is important to note that the lane reduction scenarios discussed in Section 6.3 provide an estimate of possible traffic queues and delays based on traffic volume information collected at 5 locations over a 14-day period in July of 2022. This represents a limited data set, and additional data collection and validation are recommended as lane closures are implemented in the study area in the future.

The recommendations in this section are provided as guidelines to consider. Basic trends and conclusions from our traffic analysis indicate that:

- Congestion and delay on I-40 is caused by lane reductions on I-40 that can be due to construction, maintenance, or incidents (such as crashes or flooding).
- Reducing I-40 to 1 lane when traffic volumes exceed 1,500 PCEs per hour in a single direction is problematic.
- Traffic volumes are lowest west of Gallup near the Arizona State line, and they increase moving east toward Albuquerque.
- The lowest volume travel days are Monday and Tuesday. Traffic volumes start to rise on Wednesday and peak on the weekends. Travel volumes are highest during the midday hours from about 9 AM to 5 PM.
- As traffic volumes increase between now and 2035 or 2050, potential queues from I-40 lane closures are expected to increase substantially and cause extensive delay.

6.3.10.1 Recommendations for Construction and Planned Maintenance Activities

The following recommendations are proposed for both construction and planned maintenance activities:

- Assess the applicability of work zone planning requirements for federal-aid projects on a project-by-project basis as construction and maintenance projects are planned and built. Work zone requirements are outlined in 23 CFR Part 360 Subpart J and the NMDOT *Design Manual* in Section 900 (NMDOT 202b).
- Observe construction work zone conditions and collect information on traffic delays and other observations as maintenance occurs and projects are constructed. Consider using work zone planning tools, such as the ODOT Work Zone Traffic Analysis Tool (ODOT 2023) or other microsimulation applications, to inform work zone and traffic management planning. Use this data to refine and modify practices, when needed, as projects are implemented and conditions change over time.
- Improve communication and coordination, both internally within the NMDOT and with affected stakeholders, when there are construction and maintenance activities and planned lane closures.
  - → Improve NMDOT internal coordination between Districts 3 and 6 for I-40 planned lane closures, maintenance, and construction activities. The majority of trips on I-40 in the study area are through trips, with origins and destinations beyond Albuquerque and Gallup. As such, understanding and coordinating construction and maintenance to avoid having multiple maintenance or construction activities with lane closures in a single direction of travel would help minimize delays for roadway users.
  - → Improve notification and the accuracy of lane closure information on NMRoads. Work with contractors and maintenance crews to provide accurate locations and times of expected lane closures.
  - → Improve stakeholder communication and outreach, particularly with local and tribal law enforcement and emergency providers, about planned construction projects, maintenance activities, and lane closures. As part of stakeholder outreach conducted for this study, neighboring tribal law enforcement agencies requested improved coordination and notification.

6.3.10.2 Recommendations for Construction Activities

The following recommendations are proposed for construction activities:

- Maintain 2 lanes in each direction during construction. Appendix J, I-40 Proposed Typical Sections, provides construction approaches for the study area that would maintain 2 lanes of traffic in each direction for the proposed build alternatives. Implementing this policy over the next 25+ years will be critical to minimizing backups and delays, particularly since traffic volumes are expected to increase between now and 2050. In cases where 2 lanes in each direction cannot be maintained, nighttime, or off-hours construction should be considered.
- Consider implementing Smart Construction Work Zones, as discussed in previously in Section 6.2.7.1, on construction projects as part of project specifications or special provisions. These special provisions could include the desired functionality for smart work zones, such as dynamic speed advisory, advanced queue warning, and detection and alerting of high-speed approaching vehicles.

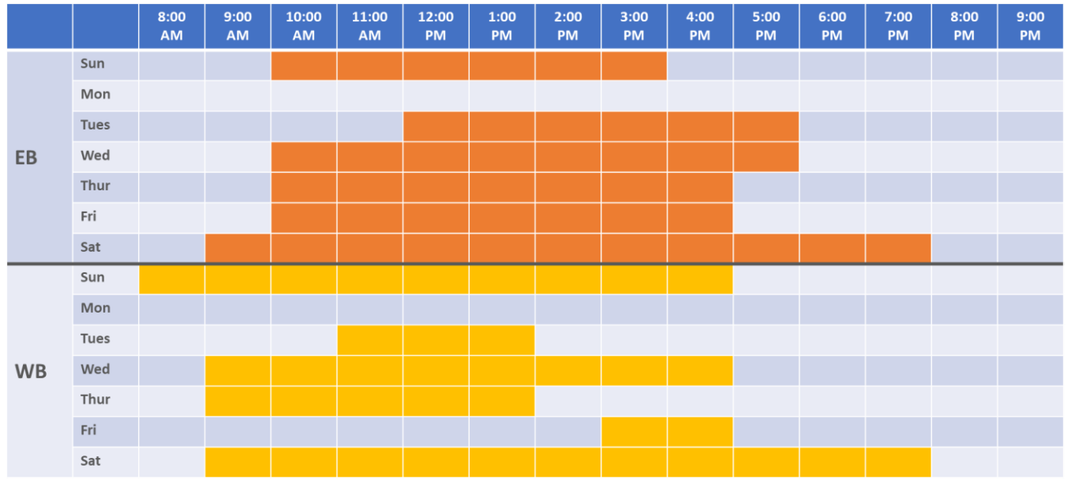
6.3.10.3 Recommendations for Planned Maintenance Activities

Maintenance activities include both planned maintenance for activities such as cable-barrier repair or paving operations and also include emergency repairs, such as pothole repair, that must be made immediately. The recommendation below is focused on planned maintenance activities since emergency repairs must be made immediately:

- Where possible, maintain 2 lanes in each direction during maintenance activities. In cases when it is not possible to maintain 2 lanes, work to conduct maintenance operations during off-peak or nighttime hours (i.e., when traffic volumes are less than 1,500 vehicles per hour in a single direction). Please see the text below for specific considerations:

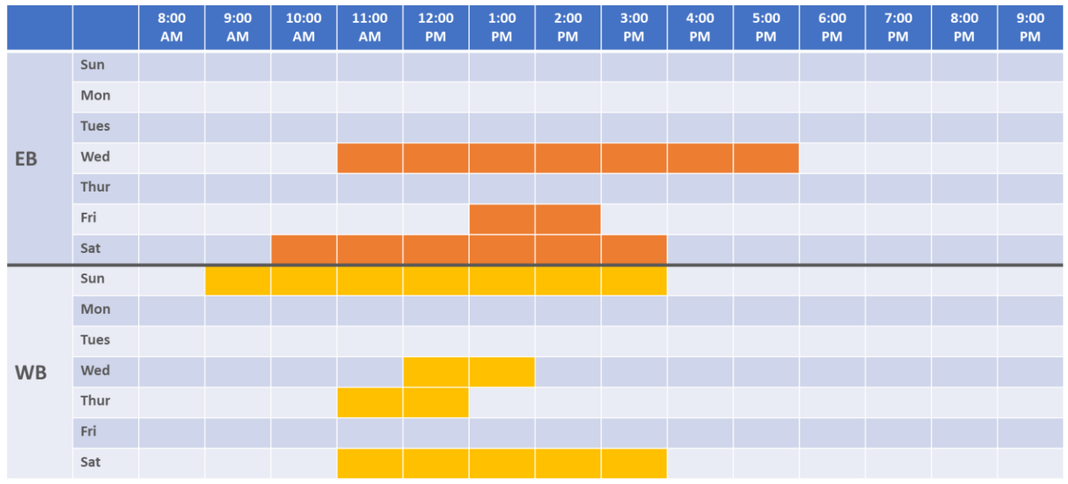
Exhibit 6-28 shows daily time periods that are expected to be above the threshold of 1,500 PCEs per hour in a single direction based on the July 2022 traffic counts. These are time periods when the anticipated traffic volumes are likely to cause traffic backups and delays. As shown in Exhibit 6-28, hourly traffic volumes on I-40 in the study area may exceed 1,500 PCEs per hour in a single direction for many days of the week and several hours per day. The information presented in Exhibit 6-28 is a conservative review and represents all areas studied, including MPs 15, 63, 93, 120, and 141. As stated previously, lower traffic volumes are documented on I-40, closer to the Arizona State line, and traffic volumes increase as drivers head east toward Albuquerque. Exhibit 6-29 shows traffic volumes at MP 63 near Prewitt, where traffic volumes are lower and there are more times when I-40 is not expected to exceed a capacity of 1,500 PCEs per hour in a single direction.

Exhibit 6-28. I-40, MP 0 to 150 Times when Existing (2022) Traffic Volumes Exceed 1,500 PCEs per Hour



EB = eastbound shown in orange, WB = westbound shown in yellow

Exhibit 6-29. I-40, MP 63 Daily Times when Existing (2022) Traffic Volumes Exceed 1,500 PCEs per Hour



EB = eastbound shown in orange, WB = westbound, shown in yellow

Based on the information presented in Exhibit 6-28 and Exhibit 6-29, the following recommendations are made for the NMDOT to consider anytime 2 lanes cannot be maintained on I-40 through the study area. Note that traffic volumes are dynamic and vary depending upon the location, year, month, day, and time; therefore, traffic management practices during maintenance activities should be monitored, evaluated, and modified on a regular basis to best meet needs in the study area. The recommendations provided below will need to be updated as conditions change over time.

- No routine maintenance should be planned on Saturdays or Sundays.
- The best days for lane closures for maintenance activities are Mondays and Tuesdays.
- If possible, limit 1-lane reductions to off-peak or nighttime hours. Avoid reducing I-40 to 1 lane for planned maintenance activities between the hours of 10 AM and 5 PM Wednesdays through Fridays, particularly between Grants and Albuquerque.

6.4 Incident Management Improvements

This operational enhancement concept includes additional information on incident management and possible concepts that could be developed further to reduce the number of lane closures and/or the duration of closures on I-40 due to crashes in the I-40 study area. As previously stated, one of the key findings of this Phase I-A/B Corridor Study is that:

- Congestion and delay on I-40 is caused by lane reductions that can be caused by construction, maintenance, or incidents (such as crashes).

There are 2 primary ways that lane reductions due to incidents could be improved in the I-40 study area:

1. Reducing incidents on I-40
2. Improving incident response

6.4.1 Reducing Incidents on I-40

The ultimate goal is to reduce the overall number of incidents occurring on I-40. Improvements proposed with both of the build alternatives would improve safety, with the goal of reducing the number of incidents that occur in the study area. Reducing the overall number of crashes in the study area is something that will take time, but many of the proposed improvements are expected to reduce crashes once constructed. Specific improvements that are expected to reduce incidents include:

- Addressing geometric deficiencies and lengthening interchange on- and off-ramps and merge areas.
- Widening roadway shoulders to improve recovery areas.

In addition, improvements proposed with both build alternatives would improve incident response efforts as described below:

- Wider shoulders would provide more space for emergency response vehicles to be able to get to crash sites. Current shoulder widths on some areas of I-40, particularly on bridges, are constrained, and it can be difficult for emergency responders to get to crash sites once a crash has occurred and traffic is backing up.
- A wider roadway section would provide emergency responders more space to maneuver I-40 traffic around crashes, as shown previously in Chapter 5, Exhibit 5-11 to Exhibit 5-18.

- In cases where I-40 is closed in a single direction due to an incident, proposed crossovers would provide a way to move traffic from one side of I-40 to the other, potentially opening up at least 1 lane of traffic in each direction until the incident could be cleared. Note that this benefit is possible but would take additional planning and traffic control resources to implement, including the development and adoption of an incident management plan.
- Proposed ITS improvements, including additional CCTVs and DMSs, would provide improved opportunities to warn drivers of lane or roadway closures in advance of a crash. In addition, establishing a District 6 TMC, as proposed with the recommended ITS improvements, would provide additional resources to help monitor I-40 traffic operations.

6.4.2 Improving Incident Response

Incident response is challenging in a rural area given the time it can take to get police, medical services, and tow trucks to the location where a crash has occurred. It also requires coordination between multiple agencies, including the New Mexico Department of Public Safety (NM DPS), local and tribal law enforcement agencies, emergency responders, tow truck operators, and the NMDOT. The NMDOT supports incident response efforts in the I-40 study area, and communication with the NM DPS and other agencies is ongoing. The NM DPS has authority and jurisdiction for incident response and traffic enforcement, and the NMDOT supports these efforts as directed by the NM DPS. Any efforts specifically related to implementing new policies and procedures related to incident response would require additional collaboration and coordination with the NM DPS, as the lead agency; the state legislature; and other key partners to fund, develop, and implement changes to existing protocols.

There are numerous ways to improve incident response, but funding, coordination, and implementation can be challenging. Potential incident management approaches and solutions that could be considered are discussed below.

6.4.2.1 Develop a Corridor-Wide Incident Management Plan

As part of discussions with NM DPS, the I-40 study team learned that State and local law enforcement agencies have limited resources to establish traffic control on I-40 when crashes occur. Per discussions with law enforcement, when a crash occurs, there is typically 1 officer and patrol car that respond to the incident. If there are available resources, 2 officers and patrol cars may be provided. Resources for setting up detours and clearing accidents are limited since there may be just 1 officer able to be on the scene. The responding officer uses roadway shoulders to get to the crash site if traffic is backed up. Officers use their patrol lights to warn people of the crash and use their vehicles as barriers at crash sites. Officers do not have any equipment other than their vehicle and LED pucks to manage traffic (they also cannot use flares). The officer dispatches the needed resources (e.g., ambulances and tow trucks) to the area. In some cases, it can take 30 to 60 minutes for a tow truck to be able to get to the site. Law enforcement may contact the NMDOT to assist with providing traffic control devices; however, the NMDOT may or may not be able to assist, depending on their proximity to the crash, the time of the crash, and the availability of staff and traffic control devices. Responding law enforcement officers do what they can to keep traffic moving, but there are times when they must close I-40 in 1 or both directions to respond to the crash.

There are ways that incident management could be improved in the I-40 study area, but any efforts specifically related to implementing new policies and procedures related to incident response would require additional collaboration and coordination with the NM DPS, as the lead agency; the state legislature for funding; and other key partners to fund, develop, and implement changes to existing protocols. Possible solutions that could be considered include:

- Developing an I-40 Corridor Incident Management Plan – A corridor-wide incident management plan could be established to formalize cross-agency incident management protocols, clarify roles and responsibilities, and/or establish consistent corridor-wide training. Aside from established law enforcement protocols for responding to incidents, there are not currently formal multiagency plans that are well established in New Mexico, particularly in rural areas. An *Incident Management Plan for the Albuquerque Metropolitan Planning Area* (MRCOG 2022a) and a *Traffic Incident Management Concept of Operations* (MRCOG 2022b) were developed and led by the Mid-Region Council of Governments. This type of plan could be developed specifically for I-40 in the study area to formalize roles, relationships, protocols, and improve overall incident response. The development and implementation of incident management plans requires extensive multiagency coordination, a champion and established lead agency, funding, and resources. This could be considered for the I-40 corridor study area, and it could be done in phases as suggested below.

  → Phase 1 - Refine, formalize, and implement the 2013 District 3 Incident Management Program developed by the NMDOT in 2013. This plan is provided in Appendix A, Highway Operational Improvement Plan, Attachment D, District 3 Incident Management Program. The 2013 District 3 Incident Management Program provides procedures for managing incidents on I-40 through District 3 in cases when a complete closure of 1 direction of travel is required between MP 134 and 148. To date, the crossovers identified in the 2013 District 3 Incident Management Program have been constructed and could be used to run 2-way traffic on a single side of I-40; however, this portion of the plan has not been practiced or implemented. This plan could be a useful tool and initial concept for improving incident management in the I-40 corridor study area. An incident management program will be required in order to use the proposed crossovers to establish 2-way traffic on 1 side of I-40 in the case of an incident that requires a closure for multiple hours.

  → Phase 2 - Build additional crossovers in District 6 and develop and implement an Incident Management Program that provides for establishing 2-way traffic on I-40 in cases when a single direction of I-40 is closed due to an incident. Prioritize areas where there are no existing alternate routes (e.g., MP 37 to 48 and MP 114 up to the District 3/6 border at MP 132).

  → Phase 3 – Establish additional incident management protocols, including traffic control support, training, or other desired actions. This could include stocking trailers at NMDOT patrol yards with additional traffic control devices that could be used at crash sites when needed. It could also include having NMDOT staff assist in establishing traffic control in these cases. Some formalized plan for storing and deploying temporary traffic control devices (such as traffic barrels or traffic panels) would be needed in order to establish 2-way traffic as discussed above in Phases 1 and 2 or to be able to setup an I-40 lane detour using the wider shoulders once the wider Enhanced 2-Lane typical section is constructed. This phase could also include specific training for law enforcement personnel, including NMDOT staff and local and tribal police or providing a courtesy patrol to assist drivers of disabled vehicles or those involved with crashes.

6.4.2.2 Push/Pull Legislation

Currently, New Mexico state law does not provide a provision permitting NMDOT employees to move wrecked vehicles from I-40 and other roadways at the scene of a crash. As such, wrecked vehicles on I-40 are currently moved by tow truck operators under the direction of law enforcement personnel, as specified in New Mexico Statute Annotated (NMSA) 66-7-350. When the I-40 study team met with State Patrol officers to discuss incident management in the study area, they indicated that tow truck resources are limited and it can take 30 to 60 minutes to get a tow truck to a crash site to keep travel lanes open. In rural areas, providing law enforcement with the option to contact the NMDOT and request assistance could reduce incident response times in instances where tow truck vehicles are unavailable. Having additional resources available through the NMDOT could help improve incident response, not only on I-40, but throughout New Mexico, particularly in rural areas. Providing this provision in state law would require legislative action but could help improve incident management and reduce response times by providing law enforcement with other options to remove crashed vehicles from I-40 and other roadways. In the 2023 legislative session, House Bill 334 was introduced, which would have amended NMSA 66-3-852 to include a provision to allow the NMDOT or anyone acting under the direction of an NMDOT employee to remove vehicles, cargo, and debris that are obstructing traffic from travel lanes. This bill passed in the House of Representatives but did not pass through the Senate, so it was not signed into law in 2023.

6.4.2.3 Incident Management Recommendations

Specific incident management recommendations are not provided as part of this Phase I-A/B Study and the I-40 Highway Operations Plan because the NMDOT's jurisdiction is limited as it pertains to providing incident response. However, based on the discussion provided in Section 6.4.2, traffic operations and incident response in the study area would benefit from:

- **Establishing incident management as a priority in the I-40 study area and working with the state legislature, the NM DPS, the NMDOT, and other law enforcement agencies to improve incident response** – As described in Section 6.4.2, there are multiple ways that incident response could be improved and formalized in the study area, but it would require direction at the legislative level to establish it as a priority and provide funding resources. Reducing incident response times will become more critical as traffic volumes increase on I-40 between now and 2050. In addition, a formal incident response plan will be needed to develop and implement incident management strategies, such as establishing 2-way traffic detours on I-40 or using the proposed wider shoulders for traffic.
- **Push/pull legislation** – Continue to work with the legislature to support push/pull legislation.

6.5 Alternate Route Improvements

6.5.1 Overview

As part of Phase I-B, the study team conducted additional analysis to better define the improvements proposed as part of this operational enhancement to improve alternate routes. Routes adjacent to I-40 were considered as part of this Phase I-A/B study to understand their existing condition, capacity, opportunities, and limitations for serving as potential alternate routes during an incident, such as a crash that would cause a closure of all lanes of I-40 or both lanes in a single direction. These routes are not designed to handle I-40 traffic volumes and heavy truck traffic and would have negative impacts on the roadway and adjacent communities. As described previously in Section 3.9 and shown in Appendix M, Alternate Routes, in most cases, adjacent alternate routes are 2-lane roadways with limited shoulders, speed limits ranging from 35 to 55 mph, and multiple access points, such as intersections and driveways. Because of this, these adjacent roadways have much less capacity to carry high-speed traffic and high volumes of large commercial trucks than I-40. Nearby alternate routes are available for just over 113 miles of the 150-mile corridor. Areas where there are no alternate routes include:

- MP 37 to 48 at Continental Divide
- MP 114.4 to 140.1 from Laguna to the Route 66 Casino

Previously in Section 4.3.3.3, this operational concept was described as improving and/or providing alternate routes adjacent to I-40 to provide a short-term detour for I-40 traffic when I-40 is closed in 1 or both directions and could include a combination of solutions, such as:

- Considering improvements on I-40 or building new parallel roadways within the right-of-way for the 37 miles where alternate routes are not provided
- Reconstructing or rehabilitating pavement on existing alternate routes, where needed
- Improving bridges, where needed, and removing vertical clearance constraints for trucks on alternate routes
- Considering improvements to bridges with limitations (such as horizontal clearance limitations) as they approach the end of their service life

Additional analysis was done to consider the feasibility, impacts, and benefits of providing alternate routes in areas where they are not provided the study area, as discussed below in Section 6.5.2.

6.5.2 Building New Parallel Roadways in Areas Where Alternate Routes Are Not Provided

As part of the Phase I-B detailed alternatives analysis, the I-40 study team considered the feasibility, impacts, and benefits of building new parallel roadways in areas where alternate routes are not provided. Stakeholder views on alternate routes are varied. Drivers get frustrated when I-40 is periodically closed in 1 or both directions or when there are backups on I-40. These stakeholders want alternate routes for the entire length of I-40 in the study area so they can get to their destination in a timely manner when I-40 comes to a standstill. Conversely, there are multiple communities, including tribal communities and villages, that the 113 miles of roadways adjacent to I-40 travel through. Community members along I-40 include various tribes, including the Navajo Nation (which has several chapters along I-40), Acoma, Laguna, and Zuni, that expressed concerns about the impacts that occur in their communities when I-40 is closed or restricted. Concerns that were expressed during various discussions were:

- Impacts associated with wear and tear to local roadways potentially caused by detouring traffic, including damaged pavement, bridges, signs, and adjacent power lines.
- Safety concerns due to the high volume of traffic and trucks, particularly in areas where there are school bus stops or other areas with pedestrians.
- Impacts to communities due to increased traffic and congestion, including increased travel times, increased noise, and reduced or challenging access to properties adjacent to alternate routes. This includes making turns onto or off of existing local roadways to adjacent driveways and intersections. Accessing properties and businesses adjacent to alternate routes can be challenging if there are high volumes of drivers using adjacent routes during incidents on I-40.

6.5.2.1 Demonstrating a Need for New Alternate Routes

The I-40 study team considered the feasibility of providing new alternate routes for the 37 miles adjacent to I-40 where alternate routes do not currently exist. These areas include the Continental Divide from MP 37 to 48 and Laguna to the Route 66 Casino from MP 114.4 to 140.1.

There are several important considerations to establish a need for these routes. These include the following questions:

- Is additional roadway capacity needed to meet existing and projected traffic demands?
- How and where would I-40 drivers be able to access these new routes?
- What benefits could alternate routes provide to relieve traffic backups when I-40 is closed?
- What is the footprint of these new routes?
- Would additional right-of-way be needed to accommodate the new routes?
- What are environmental and community considerations for these new routes?
- What are other implications, such as cost and timelines?
- What are the conclusions of the analysis of building new alternate routes?

Is additional roadway capacity needed to meet existing and projected traffic demands?

A highway capacity analysis was completed for the I-40 mainline, and the results are provided in Section 3.7.6 of this report. The capacity analysis concluded that I-40 is expected to have sufficient capacity to carry projected traffic between now and 2050 in most areas of the corridor, including the areas where alternate routes do not currently exist. In addition, areas that do not currently have alternate routes have other roadways that provide access where needed, so there are no identified short- or long-term roadway capacity

needs in the areas between MP 37 to 49 and MP 114.4 to 140.1. Therefore, the primary purpose of these new roadways would be to provide an alternate route when I-40 is periodically closed in 1 or both directions or when there are backups on I-40. It is unknown how often these potential alternate routes would be used for this purpose.

How and where would I-40 drivers be able to access the new alternate routes?

Even though there are 113 miles of roadways that, in most areas, run parallel to I-40, there are limited interchanges that provide drivers access to get to the adjacent routes from I-40, as discussed previously in Section 3.9. For example, there are 8 miles of adjacent alternate routes from MP 0 to 8.4, but there are only 2 interchanges in this area to provide access to the alternate route. This means that if a crash occurs at MP 5, drivers will need to exit at MP 0 or the ramps near MP 8 in order to be able to bypass I-40. Thus, even in areas where alternate routes are provided, there are limitations on how and where drivers can access these routes.

If alternate routes were built in the Continental Divide area between MP 37 and 48, I-40 drivers could potentially access the new route from the interchanges listed below. The potential access points are spaced about 3 miles apart.

- Exit 36 Iyanbito
- Exit 39 Refinery
- Exit 44 Coolidge
- Exit 47 Continental Divide

If an alternate route were built from Laguna to the Route 66 Casino between MP 114.4 to 140.1, I-40 drivers could potentially access the new route from the interchanges listed below. These access points are more widely spaced, offering fewer potential locations for drivers to avoid I-40 roadway or lane closures:

- Exit 114 Laguna
- Exit 117 Mesita
- Exit 126 Los Lunas (Highway 6)
- Exit 131 To'hajiilee
- Exit 140 Route 66 Casino

What benefits could alternate routes provide to relieve traffic backups on I-40 if it is closed?

The I-40 team used the ODOT tool described in Section 6.3.1 to help understand the potential benefits that alternate routes might provide in the case of a full closure of I-40. The analysis of a full I-40 closure was developed using vehicle volumes that were obtained on a Saturday, reflecting existing traffic volumes from 11 AM to noon. This day and time was selected because vehicle volumes on I-40 in the study area are highest on Saturday during daytime hours, as described previously in Section 3.7.1. The team analyzed 2 conditions for each possible area: 1 in an area where an alternate route is available and 1 in an area where an alternate route is not available. The purpose of this exercise was to try to compare how long the backup would be on I-40 if it were closed for 1 hour and how long it would take to clear the traffic queues for areas with and without alternate routes.

For purposes of this analysis, it was assumed that the capacity of the alternate routes would be limited by the number of vehicles that could make the turn that drivers would need to make to get to or from the I-40 interchanges to the alternate routes. For drivers coming from either direction, the limiting factor would be the unsignalized left-turning movement they would need to make at some point during their trip. The capacity of that movement was estimated to be about 550 to 650 PCEs per hour, depending on the location. It is important to note that the length of the backups and the time to clear the queues are approximations based on limited data collection points and would be expected to vary depending on the location and time of the crash. A summary of the analysis results is provided in Exhibit 6-30 and Exhibit 6-31.

Exhibit 6-30. I-40 Estimated Traffic Queues and Time to Clear for an I-40 Closure at MPs 42 and 65

Route	I-40 EB Queue	I-40 WB Queue	Expected Time to Clear the Queue
I-40 closure near MP 65 with an alternate route	5.8 miles	5.7 miles	EB 37 minutes; WB 35 minutes
I-40 closure near MP 42 without an alternate route	9.8 miles	9.4 miles	EB 63 minutes; WB 60 minutes

EB = eastbound, WB = westbound

Exhibit 6-31. I-40 Estimated Traffic Queues and Time to Clear for an I-40 Closure at MPs 106 and 122

Route	I-40 EB Queue	I-40 WB Queue	Expected Time to Clear the Queue
I-40 closure near MP 106 with an alternate route	7.2 miles	6.6 miles	EB 44 minutes; WB 41 minutes
I-40 closure near MP 122 without an alternate route	11.1 miles	10.3 miles	EB 70 minutes; WB 65 minutes

EB = eastbound, WB = westbound

The scenarios considered show that the backups on I-40 would be reduced by about 4 miles in either direction if an alternate route were available. The I-40 queues would clear about 25 minutes faster in areas where an alternate route is available as compared to areas where alternate routes are not available. This information shows that there is a benefit to having a way for a small volume of traffic to be able to keep moving in the case of a closure. However, given the capacity constraints of getting to the alternate routes, impacts to local communities, potential impacts to the alternate route infrastructure, and impacts of constructing new alternate routes, these benefits would be relatively modest.

What is the footprint of these new routes?

A key consideration was understanding the footprint impacts associated providing new routes adjacent to I-40 as compared to widening I-40 to provide either the Enhanced 2-Lane typical section, with wider 12-foot shoulders on each side that could serve as temporary travel lanes in the case of an emergency, or 3 lanes in each direction with wider shoulders. Exhibit 6-32 compares the roadway widths needed to build new alternate routes with the area required to widen I-40 to the Enhanced 2-Lane or 3-Lane footprints. Building an entirely new roadway would require impacting an area adjacent to I-40 that would be at least 40 feet wide to accommodate 1 lane of traffic in each direction plus shoulders, in addition to any widening that would occur on I-40 with the proposed build alternatives. Comparatively, building the Enhanced 2-lane footprint would add about 20 feet to the existing roadway footprint, and the 3-lane footprint would add about 44 feet to the existing footprint.

Exhibit 6-32. Comparison of Roadway Widths Needed for New Alternate Routes

Roadway Type	Inside Shoulder Width	Travel Lane Width	Travel Lane Width	Travel Lane Width	Outside Shoulder Width	Total Width	Total Added Width
Existing I-40	4 ft	12 ft	12 ft	NA	10 ft	38 ft X 2 directions = 78 ft	0 ft
Enhanced 2-Lane	12 ft	12 ft	12 ft	NA	12 ft	48 ft x 2 directions = 96 ft	+20 ft
3-Lane	12 ft	12 ft	12 ft	12 ft	12 ft	60 ft x 2 directions = 120 ft	+44 ft
New alternate route	8 ft	12 ft	12 ft	NA	8 ft	40 ft + I-40	+40 ft + additions to I-40

ft = feet, NA = not applicable

Would additional right-of-way be needed to accommodate the new routes?

If new routes were built, the NMDOT would use its existing right-of-way wherever feasible; however, additional right-of-way would be needed in many areas along the 37 miles of new alternate routes in order to provide sufficient width for the new alternate route, proposed widening on I-40, and separation between I-40 and the new adjacent roadway. Affected lands between MP 37 and 48 have multiple landowners and include tribes, multiple private property owners, and a small portion of state-owned lands. Affected areas between MP 114.4 and 140.1 are all tribal lands. Obtaining additional right-of-way in these areas would likely take many years and would add to project costs.

What are environmental and community considerations for these new routes?

Building an entirely new 40-foot roadway adjacent to I-40 between either MP 37 and 48 or between MP 114 and I-40 would have significant environmental impacts to the natural and human environment. Extensive environmental review and approvals from multiple agencies would be required to establish these new roadways. New access to areas where roads currently do not exist would be a substantial change to existing land uses, which could be viewed by affected as either positive or negative to adjacent landowners and communities. The United States Council on Environmental Quality Climate and Economic Justice Screening Tool identifies communities adjacent to the Continental Divide and the area between MP 114 to 131 as disadvantaged communities. As such, impacts to these communities would need to be carefully considered as part of environmental review. Current land use plans do not propose building adjacent local roadways in these areas, so this would represent a substantial change to existing land use. While many of the potentially affected areas are sparsely populated, building a new road would increase noise to surrounding properties. There are multiple impacts to natural resources that would occur. There are multiple drainages that would be crossed, and floodplains located in the Continental Divide area would need to be taken into consideration. The new roadway would require new bridges and drainage structures to be built, which would affect various drainages that may include wetland areas and associated habitat. Farmland soils of local importance would be affected in the Continental Divide area, and there are 2 small areas of soils that are identified as being prime farmland if irrigated near MP 116 to 120. There are multiple previously documented cultural sites that have been identified within 500 meters (1,640 feet) of the existing I-40 right-of-way, which is the area where these new roads would be constructed. Natural and cultural resource surveys would be required to determine potential impacts and determine avoidance measures.

What are other implications, such as cost and timelines?

It would take many years to identify new roadway alignments, assess and obtain required environmental approvals, obtain right-of-way, and construct new alternate routes in areas where they currently do not exist. It is likely that there could be environmental impacts and community concerns that could be insurmountable given the overall impacts. In addition, pursuing these new roadways would be expected to cost as much or more than widening the existing I-40 roadway or improving incident management, since right-of-way would be needed and they would represent significant new roadways, bridges, and drainage structures that would require ongoing maintenance. It would be many years before these new roadways would be operational and could provide benefits to drivers in the case of I-40 closures. The overall benefit of these new roadways would be low since the only direct need that these roadways would be providing is to serve as a detour route for traffic in the case of a short-term closure of I-40 due to an incident.

What are the conclusions of the analysis of building new alternate routes?

In conclusion, the proposed I-40 build alternatives address the many needs identified on I-40, and they would provide additional width to better manage incidents and get traffic moving when there are closures compared to existing conditions. While new alternate routes could help relieve some congestion in cases where I-40 is closed in 1 or both directions, the overall costs and impacts of building these routes to the human and natural environment would be high and would not address many of the safety, operations, and infrastructure needs identified on I-40. While it is helpful to have fully redundant transportation networks, there are many other areas along interstate highways in New Mexico and other states where redundancy is not provided because of the costs and various constraints. Based on information discussed in this section, the recommendation for this study is as follows:

- New alternate routes are not recommended in areas where existing alternate routes do not exist, given their limited benefits and overall costs and impacts. These routes are not precluded and could be considered if needs change in the future. However, areas where alternate routes do not currently exist should be a consideration in prioritizing the locations where I-40 widening might occur first to provide additional space to manage traffic in the case of I-40 closures.
- Maintaining the existing network of alternate routes is recommended, since these are existing roadways that provide a critical network needed to provide access to existing adjacent communities. In many cases, these adjacent alternate routes were the historic Route 66, which was the predecessor to I-40. These alternate routes do provide benefits to drivers traveling on I-40 in instances when I-40 is periodically closed. In addition, it is recommended that existing adjacent alternate routes **not** be used as construction detours when work is being done on I-40, given the impacts to the local communities served by these roadways.

Section 6.5.3 describes the proposed improvements that are proposed as operational enhancements for alternate routes.

6.5.3 Alternate Route Recommendations

Critical infrastructure needs for alternate routes were discussed in Section 3.9. Based on the needs identified, recommended improvements for alternate routes include the following:

6.5.3.1 Pavement Reconstruction

The following areas listed below are identified as having poor pavement condition that may require reconstruction based on a visual field reconnaissance conducted in 2022. Additional analysis will be required to confirm these areas and determine if full reconstruction is needed or if pavement rehabilitation is feasible.

Alternate route pavement recommendations for reconstruction by approximate I-40 MP:

- MP 8 to 12
- MP 25 to 30

6.5.3.2 Addressing Bridges

The following alternate route bridges have been identified as being in poor condition. Maintenance, rehabilitation, and/or replacement should be considered:

- Bridge 5664 carrying NM 122 at MP 27.08 (near I-40 MP 74)
- Bridge 1778 carrying NM 124 at MP 3.567 (near I-40 MP 93)
- Bridge 3091 carrying NM 124 at MP 19.35 (near I-40 MP 108)
- Bridge 3089 carrying NM 124 at MP 22.82 (near I-40 MP 112)
- Bridge 3088 carrying NM 124 at MP 22.95 (near I-40 MP 112)
- Bridge 6122 carrying Frontage Road 4012 at MP 0.004 (near I-40 MP 119.38)

In addition, there are 2 structures that cross over alternate routes that do not meet vertical clearance requirements of 14.5 feet and provide less than 28 feet of horizontal clearance:

- Bridge 6502 carrying I-40 at MP 8.4, intersecting with NM 118 – This concrete box culvert has a vertical clearance of 13.90 feet and an estimated total horizontal clearance of 18.75 feet, based on a review of Google Earth.
- Bridge 6307 carrying I-40 at MP 90.58, intersecting with NM 124 – This bridge has a vertical clearance of 13.4 feet and an estimated total horizontal clearance of 20.95 feet, based on a review of Google Earth.

Addressing such vertical and horizontal constraints should be considered for these structures in the long term. In the short term, these vertical restrictions are listed in the NMDOT 2012 Bridge Map (NMDOT 2012), which is a resource for the trucking industry to use when planning routes so that they can plan to avoid these bridges if their trucks exceed the height requirements.

These recommendations are included as part of Appendix A, I-40 Highway Operations Improvement Plan. These proposed improvements will require additional analysis to determine potential costs and should be prioritized by the Districts based on the context of how these improvements fit in with other District priorities and needs.

6.5.3.3 Environmental Considerations

Recommended improvements to alternate routes would include maintenance activities to keep these routes operational, such as pavement reconstruction and bridge maintenance, rehabilitation, or replacement. Environmental impacts associated with these improvements would be the same for both build alternatives and will be assessed as specific projects are advanced.

Approximately 90 miles of the frontage roads adjacent to I-40 are listed on the National Register of Historic Places, which includes 41 historic structures (e.g., bridges and box culverts). Specific improvements to adjacent alternate routes will require further analysis and consultation to identify impacts and avoidance and minimization measures under the New Mexico Cultural Properties Protection Act, National Historic Preservation Act, and Section 4(f).

7. Phase I-B Recommendations and Implementation

7.1 Introduction

This chapter summarizes the recommendations from this Phase I-A/B Study and identifies next steps. Appendix A, I-40 Highway Operations Improvement Plan, provides detailed information on recommendations, implementation, suggested I-40 corridor priorities, and I-40 corridor design criteria. Conceptual plans for the proposed I-40 improvements are provided in Appendix J, I-40 Proposed Typical Sections; Appendix K, I-40 Conceptual Alternatives; and Appendix L, I-40 Interchange Layouts.

7.2 Preferred Alternative Recommendation

The preferred alternative identified for I-40 from milepost (MP) 0 to 150 is to construct the Enhanced 2-Lane with Added Lanes Alternative. Detailed information about this alternative is provided in Appendix A, I-40 Highway Operations Improvement Plan and Chapter 5 of this Phase I-A/B Report. Recommendations for the I-40 mainline would:

- Widen inside and outside shoulders on I-40 to 12 feet on both sides and continue to provide 2 lanes of travel in each direction.
- Address future I-40 roadway capacity constraints in Gallup by building auxiliary lanes or a third lane for up to 10 miles between interchanges from MP 16 and 26.
- Address I-40 capacity constraints by adding a truck climbing lane on isolated steep grades at 5 locations.
- Lengthen interchange ramps at 87 locations to address design deficiencies and improve ramp capacity.
- Address geometric deficiencies on the I-40 mainline, which includes 70 horizontal curves and 48 vertical curves.
- Address bridge, pavement, and drainage deficiencies, which include replacing 5 bridges that are identified as being in poor condition; reconstructing pavement identified as being in poor or very poor condition; and addressing drainage needs that include damaged drainage structures and culverts not meeting hydraulic capacity needs for the 50-year or 100-year design storm.
- Build crossovers to accommodate snowplows and emergency vehicles to reverse directions on I-40. The crossovers would also provide a pathway to allow law enforcement to set up a connection for vehicles from one side of I-40 to cross to the other side to keep traffic moving in the event of a crash that requires a closure of 1 direction of I-40. The combination of 12-foot shoulders on both sides of the travel lanes and periodic crossovers would provide flexibility for how I-40 could be managed in cases of lane closures related to incidents, maintenance, or construction.

7.3 Operational Enhancements

The preferred alternative also includes the following operational enhancements to address I-40 corridor needs. Detailed information about these recommendations are provided in Appendix A, I-40 Highway Operations Improvement Plan, and Chapter 6 of this Phase I-A/B Report.

- Intelligent Transportation System (ITS) improvements
- Minimize lane closures during construction and maintenance
- Incident management improvements
- Alternate route improvements

7.3.1 Intelligent Transportation Systems Improvements

The proposed ITS recommendations include the following:

- **Proposed ITS devices** include data stations, closed-circuit television cameras, dynamic messaging signs, and a variable speed advisory sign system. These devices and their locations are provided in Chapter 6, Exhibit 6-1.
- **Fiber Optic Communication Network** – A high-speed fiber optic communication network is proposed to connect ITS devices throughout the study area. Completing the fiber optic network in the study area would require adding fiber optic cable from MP 0 to 125. The New Mexico Department of Transportation (NMDOT) has existing fiber optic cable along I-40 from MP 125 to 150.
- **District 6 Traffic Management Center (TMC)** – Development of a TMC in District 6 is proposed to enable remote ITS operations and management and to coordinate with key stakeholders, such as police state patrol, emergency services, and other NMDOT TMCs.
- **Truck Parking Availability System (TPAS)** – The TPAS system would add ITS devices at parking and truck rest stops, wireless or wireline communications, and a back-end application to provide information on available truck parking in the study area. Truck parking is currently available for eastbound drivers in New Mexico at the Manuelito rest area near MP 3 and for westbound drivers in Arizona just west of the Arizona/New Mexico border. Dynamic parking availability signs would be placed in both the eastbound and westbound direction near MP 1.8 to inform drivers of how many spaces are available.
- **Applications and Integration** – Application and integration is needed to configure, connect, and integrate proposed ITS systems with the NMDOT Southwest Research Institute Advanced Traffic Management System platform.

7.3.2 Minimize Lane Closures during Construction and Maintenance

7.3.2.1 Recommendations for Construction and Planned Maintenance Activities

The following recommendations are proposed for both construction and planned maintenance activities:

- Assess the applicability of work zone planning requirements for federal-aid projects on a project-by-project basis as construction and maintenance projects are planned and built. Work zone requirements are outlined in 23 CFR Part 360 Subpart J and the NMDOT *Design Manual* in Section 900 (NMDOT 2020b).
- Observe construction work zone conditions and collect information on traffic delays and other observations as maintenance occurs and projects are constructed. Consider using work zone planning tools, such as the Oregon Department of Transportation (ODOT) Work Zone Traffic Analysis Tool(ODOT 2023) or other microsimulation applications, to inform work zone and traffic management planning. Use this data to refine and modify practices when needed as projects are implemented and conditions change over time.

- Improve communication and coordination, both internally within the NMDOT and with affected stakeholders, when there are construction and maintenance activities and planned lane closures.
  - → Improve NMDOT internal coordination between Districts 3 and 6 for I-40 planned lane closures, maintenance, and construction activities. The majority of trips on I-40 in the study area are through trips, with origins and destinations beyond Albuquerque and Gallup. As such, understanding and coordinating construction and maintenance efforts to avoid having multiple maintenance or construction activities with lane closures in a single direction of travel would help minimize delays for roadway users
  - → Improve notification and the accuracy of lane closure information on NMRoads. Work with contractors and maintenance crews to provide accurate locations and times of expected lane closures.
  - → Improve stakeholder communication and outreach, particularly with local and tribal law enforcement and emergency providers, about planned construction projects, maintenance activities, and lane closures. As part of stakeholder outreach conducted for this study, neighboring tribal law enforcement agencies requested improved coordination and notification.

7.3.2.2 Recommendations for Construction Activities

The following recommendations are proposed for construction activities:

- Maintain 2 lanes in each direction during construction. Appendix J, I-40 Proposed Typical Sections, provides construction approaches for the study area that would maintain 2 lanes of traffic in each direction for the proposed build alternatives. Implementing this policy over the next 25+ years will be critical to minimizing backups and delays, particularly since traffic volumes are expected to increase between now and 2050. In cases where 2 lanes in each direction cannot be maintained, nighttime, or off-hours construction should be considered.
- Consider implementing Smart Construction Work Zones on construction projects as part of project specifications or special provisions. These special provisions could include the desired functionality for smart work zones, such as dynamic speed advisory, advanced queue warning, and detection and alerting of high-speed approaching vehicles.

7.3.2.3 Recommendations for Planned Maintenance Activities

Maintenance activities include both planned maintenance for activities such as cable-barrier repair or paving operations and also include emergency repairs, such as pothole repair, that must be made immediately. The recommendation below is focused on planned maintenance activities since emergency repairs must be made immediately:

- Where possible, maintain 2 lanes in each direction during maintenance activities. In cases when it is not possible to maintain 2 lanes, work to conduct maintenance operations during off-peak or nighttime hours (i.e., when traffic volumes are less than 1,500 vehicles per hour in a single direction).

The following recommendations are made for the NMDOT to consider anytime 2 lanes cannot be maintained on I-40 through the study area. Note that traffic volumes are dynamic and vary depending upon the location, year, month, day, and time; therefore, traffic management practices during maintenance activities should be monitored, and evaluated, and modified on a regular basis to best meet needs in the study area. The recommendations provided below will need to be updated as conditions change over time.

- No route maintenance should be planned for Saturdays or Sundays.
- The best days for lane closures for maintenance activities are Mondays and Tuesdays.
- If possible, limit 1-lane reductions to off-peak or nighttime hours. Avoid reducing I-40 to 1 lane for planned maintenance activities between the hours of 10 AM and 5 PM Wednesdays through Fridays, particularly between Grants and Albuquerque.

7.3.3 Incident Management Improvements

Specific incident management recommendations are not provided as part of this Phase I-A/B Study and the I-40 Highway Operations Plan, since the NMDOT jurisdiction is limited as it pertains to providing incident response. However, based on the discussion provided in Chapter 6, traffic operations and incident response in the study area would benefit from:

- **Establishing incident management as a priority in the I-40 study area and working with the state legislature, the New Mexico Department of Public Safety, the NMDOT, and other law enforcement agencies to improve incident response** – There are multiple ways that incident response could be improved and formalized in the study area, but it would require direction at the legislative level to establish it as a priority and provide funding resources. Reducing incident response times will become more critical as traffic volumes increase on I-40 between now and 2050. In addition, a formal incident response plan will be needed to develop and implement incident management strategies, such as establishing 2-way traffic detours on I-40 or using the proposed wider shoulders for traffic.
- **Push/pull legislation** – Continue to work with the legislature to support push/pull legislation.

7.3.4 Alternate Route Improvements

Recommended improvements for alternate routes are summarized below.

7.3.4.1 Pavement Reconstruction

The following areas listed below are identified as having poor pavement condition that may require reconstruction based on a field reconnaissance conducted in 2022. Additional analysis will be required to confirm these areas and determine if full reconstruction is needed or if pavement rehabilitation is feasible.

Alternate route pavement recommendations by approximate I-40 MP:

- MP 8 to 12
- MP 25 to 30

7.3.4.2 Addressing Bridges

The following alternate route bridges have been identified as being in poor condition. Maintenance, rehabilitation, and/or replacement should be considered:

- Bridge 5664 carrying NM 122 at MP 27.08 (near I-40 MP 74)
- Bridge 1778 carrying NM 124 at MP 3.567 (near I-40 MP 93)
- Bridge 3091 carrying NM 124 at MP 19.35 (near I-40 MP 108)
- Bridge 3089 carrying NM 124 at MP 22.82 (near I-40 MP 112)
- Bridge 3088 carrying NM 124 at MP 22.95 (near I-40 MP 112)
- Bridge 6122 carrying Frontage Road 4012 at MP 0.004 (near I-40 MP 119.38)

In addition, there are 2 structures that cross over alternate routes that do not meet vertical clearance requirements of 14.5 feet and provide less than 28 feet of horizontal clearance as shown below:

- Bridge 6502 carrying I-40 at MP 8.4 intersecting with NM 118 – This concrete box culvert has a vertical clearance of 13.90 feet and an estimated total horizontal clearance of 18.75 feet, based on a review of Google Earth.
- Bridge 6307 carrying I-40 at MP 90.58 intersecting with NM 124 that has a vertical clearance of 13.4 feet and an estimated total horizontal clearance of 20.95 feet, based on a review from Google Earth.

Addressing these vertical and horizontal constraints should be considered for these structures in the long term. In the short term, these vertical restrictions are listed in the NMDOT 2012 Bridge Map (NMDOT 2012), which is a resource for the trucking industry to use when planning routes so that they can plan to avoid these bridges if their trucks exceed the height requirements.

7.4 Additional Considerations

A potential deficit of truck parking spaces was identified in Section 3.7 and is shown in Exhibit 7-1.

Exhibit 7-1. Truck Parking Demand

Segment of I-40	Truck Average Annual Daily Traffic	Existing Truck Parking Spaces	Peak Hour Truck Parking Demand	Shortage/Surplus
Arizona State Line to Atrisco Vista Boulevard	11,000	1,420	1,540	-120

The results of the truck parking demand analysis indicate that there currently exists a potential deficit of truck parking spaces in the I-40 study area between Arizona and Atrisco Vista Boulevard to accommodate the peak hour truck parking demand. This correlates with the truck parking availability analysis discussed in Section 3.7.4 from the Trucker Path app, which shows at certain times and locations, truck parking does appear to be full (most likely at facilities near Gallup and Albuquerque). As truck volumes on the I-40 corridor continue to grow in the future, additional truck parking will be needed to accommodate future truck parking demand. The NMDOT plans to study truck parking on critical freight routes throughout New Mexico, including this section of I-40. Recommendations from the NMDOT freight parking study should be incorporated into long-term plans for this corridor. In addition, one of the ITS recommendations of this study is to build a TPAS to provide real-time information to truck drivers to help them identify available truck parking in the study area.

7.5 I-40 Corridor Priorities and Implementation

Improvements in the I-40 corridor will be built over time in phases as funding becomes available. Appendix A, I-40 Highway Operations Improvement Plan, identifies I-40 corridor priorities and detailed information to guide implementation over time.

7.6 Next Steps

Next steps include developing and implementing policies and procedures as it pertains to minimizing lane closures during construction and maintenance and improving incident management as well as working to obtain funding for specific projects and maintenance activities, as identified in Appendix A, I-40 Highway Operations Improvement Plan.

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