U.S. Department of Transportation
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New Mexico DEPARTMENT OF TRANSPORTATION
MOBILITY FOR EVERYONE

NM 31/128

NM 31/NM 128 Phase I-A/B Alignment Study

NM 31: MP 0.5 to MP 22.67 | NM 128: MP 0.0 to MP 59.90

CN 2104330 | JUNE 2022

WSP Parametrix

IN ASSOCIATION WITH:
COLLIERS ENGINEERING AND DESIGN; SOUDER, MILLER, AND ASSOCIATES; SWCA; T2 UTILITY ENGINEERS; AND WOOD

NM 31/NM 128 Phase I-A/B Alignment Study

NM 31: M.P. 0.5 to M.P. 22.67
NM 128: M.P. 0.0 to M.P. 59.90

NMDOT CN 2104330

Eddy County and Lea County, New Mexico

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1.0 Introduction

This report summarizes and documents the investigations, analyses, and findings for a Phase I-A/B Alignment Study of NM 31 and NM 128 in southeast New Mexico. The study encompasses the entire lengths of both roadways including NM 31 from milepost (MP) 0.5 east of the intersection of US 285 to the terminus of NM 31 at its junction with US 62 at MP 22.6, and NM 128 from its junction with NM 31 east to its terminus at the New Mexico/Texas state line at MP 59.9. The general location of the NM 31/128 Alignment Study is shown in **Exhibit 1-1** on the following page.

The lead agency for the Alignment Study is the New Mexico Department of Transportation (NMDOT). Because federal funding will be used for the project, the study is being conducted in cooperation with the Federal Highway Administration (FHWA). In addition, the study is being coordinated with other federal, state, and local agencies with jurisdiction and/or responsibility for lands and resources within the study area. While multiple agencies have been consulted, key agencies involved in the study process include the Bureau of Land Management (BLM), New Mexico State Land Office (SLO), Eddy and Lea Counties, and the City of Jal.

The primary purpose of this report is to document the process used to identify and select the preferred alternatives for NM 31 and NM 128. Alignment studies include engineering and environmental elements and serve to:

1) identify and evaluate the specific problems and conditions within the study area that are driving the need to consider improvements to the existing highways, i.e., the project purpose and need;
2) identify and evaluate ways to meet the project purpose and need; and,
3) identify the preferred alternative to advance to design and construction.

The alignment study was prepared consistent with the NMDOT *Location Study Procedures* (LSP) — the NMDOT's process for project development from the planning phase through environmental documentation and preliminary design. The LSP process is consistent with the National Environmental Policy Act (NEPA) of 1966 (as amended), FHWA's Environmental Impact and Related Procedures (23 CFR 771), and federal statewide planning regulations (23 CFR 450, Subpart B).

This report also summarizes and documents the activities used to inform and involve the public and other stakeholders in decisions. NM 31 and NM 128 are both major highways used by the general public as well as the major industries within Eddy and Lea Counties. The activities and efforts used to involve and engage the public and agencies in the NM 31/NM 128 Alignment Study are discussed in **Chapter 2** of this report.

The NMDOT proposes to implement priority segments of NM 31 and NM 128 using a design-build (DB) procurement method. Use of DB will allow the needed traffic safety, traffic operations, pavement and bridge rehabilitation improvements to be implemented sooner, while also providing NMDOT with opportunities to better manage risk by allocating it to the party best able to manage and mitigate it. This will be important for risk elements such as utilities, karst, geotechnical and pavements.

1.1 Project Setting

NM 31 and NM 128 are located in southeast New Mexico and are part of the major highway system this region. Both highways are classified as "major collectors" on the NMDOT Roadway Functional Classification System. Major Collectors connect larger traffic generators to the arterial highway network and typically have moderate driveway densities, speed limits, and traffic volumes. As an odd numbered route, NM 31 is designated as a north-south highway even though the first five miles of this highway are oriented east-west. This route connects US 285 and US 62 — both of which are principal arterial highways. NM 31 is entirely within Eddy County. This county leads New Mexico in potash, salt, and oil and gas production, almost all of which occurs east of the Pecos River. Major potash and salt mining and processing operations are accessed via NM 31 at various locations. These activities make NM 31 essential for access to production sites and for the transport of produced goods transport to outside destinations.

Industrial Site along NM 31

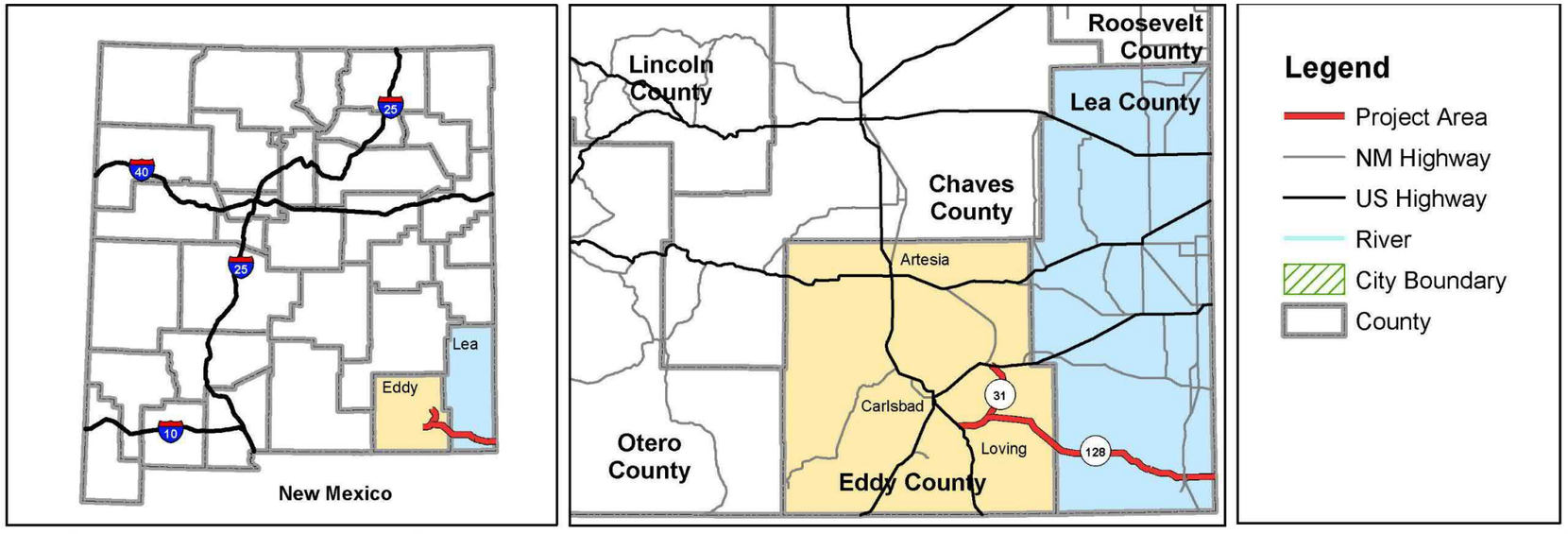
Several rail facilities exist within the NM 31 corridor. These include the BNSF Loving Industry Spur Line that originates in the community of Loving several miles south of the US 285/NM 31 intersection and travels northeast to its terminus at the United Salt Corp and Mosaic Potash plant near NM 31 MP 14. This line crosses NM 31 at four locations including MP 3.0, MP 4.0, MP 9.3, and MP 14.0. BNSF also operates a freight line that parallels US 285 just outside of the NM 31 project area.

One of several Railroad Crossings along NM 31 and NM 128

Ancillary to BNSF operations is the Rangeland Integrated Oil (RIO) System at the west end of the corridor. Access to this 300-acre facility is via NM 31 at MP 0.75. This transload operation is a truck-to-rail facility that provides storage, blending, and rail loading facilities for crude oil, as well as unloading, storage, and truck loading areas for fracking sand and other supplies. The RIO system connects to the BNSF rail network. The initial capacity of the RIO operation in 2014 was 10,000 barrels per day, but as demand increases and additional infrastructure is built, the capacity is expected to reach over 100,000 barrels per day. The RIO System is one of several similar facilities in Eddy County, which translates into further demand for freight transportation. This growth will increase truck and other traffic on NM 31.

The Waste Isolation Pilot Plant (WIPP) is located several miles east of NM 31 along NM 128. WIPP is a deep geologic repository for permanent disposal of a transuranic waste – a specific type of waste that is the byproduct of the nation's nuclear defense program. WIPP is owned and operated by the Department of Energy (DOE) and is the only operating repository for transuranic waste in the United States. Roads that serve WIPP are primarily federally owned and must comply with strict standards for safe operation.

Exhibit 1-1. Project Location and Vicinity Map



Another important element of the transportation system setting of NM 31 is the highway bypass system being planned and implemented by the City of Carlsbad and Eddy County. Increased truck freight traffic in Eddy County has created growing concern around maintenance of the road infrastructure and public safety issues associated with crashes involving trucks. The City of Carlsbad has developed a series of planned Bypass Routes around the City to minimize impacts of truck traffic on local roads. One bypass currently under design is the Southeast Bypass (Phase III). Much of this route will follow Refinery Road which intersects NM 31 at MP 5.3 and is expected to have a major influence on traffic volumes and operations on NM 31.

NM 31 also provides access to agricultural farmlands west of the Pecos River used for hay production and some cotton crops. These land uses are predominant for the first few miles of this route. Irrigation and drainage facilities are present adjacent to the highway right-of-way along with several turn-outs used to access farmlands. Range land used for cattle grazing exists east of the Pecos River and is continuous throughout the remainder of the corridor.

View of the Salt Lakes along NM 128

Vegetation in this area is a mixture of desert grasslands and arid shrubland typical of the Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands ecoregions. This ecoregion tends to be very hot and dry and requires resilient vegetation such as creosote bush, fourwing saltbush, and acacias. Large mammals including pronghorn antelope, desert mule deer, and coyote are common throughout the project area.

A short stretch of riparian habitat is present where the highway crosses the Pecos River. Numerous ephemeral waterways (arroyos) cross the highway but are generally small. In addition, a series of playa salt lakes are immediately east of NM 31 both north and south of NM 128.

NM 128 is an east-west highway that connects NM 31 to NM 18 in Jal. Like NM 31, this highway provides access to and supports the transport of materials for the oil and gas industry. This highway crosses the Delaware Basin portion of the Permian Basin with large oil fields dominating the landscape for its entire route in New Mexico. NM 128 becomes TX 128 after leaving the state at MP 59.9. The route ends in Texas near MP 15 where it intersects with the Kermit Highway (TX 115).

NM 128 enters Lea County near MP 21 (approximately) and passes through the City of Jal between MP 50.0 and MP 52.5. Jal is a small city with a population of about 2,100 residents with an economy based primarily on the oil and gas industry. The area bounding NM 128 is a mixture of residential, commercial, and industrial uses. The existing typical section of NM 128 through Jal is three lanes including a continuous center left-turn lane to provide access to the roadside businesses and residents.

Two rail lines cross NM 128 including the BNSF Loving Spur that crosses the highway at MP 0.05 and the TX-NM railway that crosses the highway in Jal just west of NM 18.

In addition to the oil fields, range lands used for cattle grazing exist throughout the project area. Vegetation is similar to that described for NM 31 and is a mixture of desert grasslands and arid shrubland typical of the Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands ecoregions. Large mammals including pronghorn antelope and coyote, and various reptiles and birds, are common throughout the project area.

Primary users of NM 31 and NM 128 include the residents and ranchers living along these routes, commuters traveling between Carlsbad, Jal and communities in West Texas, and workers involved in the oil and gas industry, salt and potash industry, and workers at the WIPP. Schools serving the area include Loving Municipal District and Jal Public School District. Both of these districts include kindergarten through grade 12.

1.2 Summary of Project Purpose and Need

Both NM 31 and NM 128 have operational, safety, and infrastructure problems that need improvement. Major problems with the existing highways are summarized below. Additional detail is provided in **Chapter 3**.

- Observation and analysis of traffic operations on both NM 31 and NM 128 show substantial problems with congestion on the highway mainline and at major intersections during the AM and PM peak periods. Analyses indicate all of the mainline segments of NM 31 south of NM 128 currently operate at level of service (LOS) C or D, depending on location in either or both of the AM and PM peak periods. Similarly, the mainline segments of NM 128 also operate at LOS C for one or both peak periods. The NMDOT State Access Management Manual (SAMM) establishes LOS of B or better for rural, two-lane highways.

- In addition to mainline congestion, unacceptable delays occur at several intersections along NM 31 and NM 128. Delays occur primarily on intersecting side roads but also affect through traffic. Intersections that do not meet SAMM criteria include Refinery Road and NM 128 on NM 31 and WIPP Road, Buck Jackson Road, Orla Road, 3rd Street, and NM 18 along NM 128. Several of these intersections currently operate at LOS D, E, or F. The intersection of NM 31 and NM 128 is particularly problematic for the northbound-to-eastbound movement in the mornings and the westbound-to-southbound in the evening. Anecdotal information and field observations show long traffic queues at this intersection.

Westbound Traffic Queue at the NM 31/NM 128 Intersection

- Crash data for the years 2014 to 2019 were reviewed for both NM 31 and NM 128. During this period, a total of 174 crashes were reported for NM 31 including 58 that resulted in injuries or fatalities. The predominant crash types were rear-end, overturn, and head-on crashes. Several intersections had crash rates higher than the corridor average including NM 31/NM 128, Donaldson Farm Road, Kelly Road, Fishermans Lane, and Refinery Road. The crash rate for the intersection of NM 31/128 was 4.5 times as high as the corridor average.

- A total of 548 crashes were reported for NM 128 including 146 that resulted in injuries or fatalities. Predominant crash types were similar to NM 31 and included rear-end crashes, right-angle crashes, and head-on crashes along with various other crash types. Several intersections had crash rates well above the corridor average including Orla Road, Red Road/Twin Wells East, Battle Axe Road, Delaware Basin Road, Brininstool/Diamond Road, and Schooley Road.
- The crash types and rates for both NM 31 and NM 128 are indicative of conflicts associated with passing maneuvers, turning conflicts, pavement condition, and narrow shoulders. Speed differential is also a contributing factor. Larger trucks, especially those associated with oil field development (drilling) and equipment transport, often travel in platoons and at slower speeds than other traffic. This condition results in a substantial amount of passing maneuvers. Because passing lanes are not available, passing occurs in the opposite direction driving lane, resulting in potential for severe conflicts.
- The pavement condition is very poor for all of NM 31 and most of NM 128. Likewise, drainage structures and other roadway infrastructure are in poor condition and in need of rehabilitation or replacement.

The traffic and safety problems with the existing facilities are expected to worsen as traffic volumes increase on NM 31 and NM 128. Per the University of New Mexico Geospatial and Population Studies, the 2020 population of Eddy County was 59,179 and Lea County was 72,618. The 2040 population for Eddy County and Lea County is projected to increase to 68,435 and 86,405, respectively, over the next 20 years.

1.3 Project Programming

NM 31 and NM 128 are both within NMDOT District 2. Because of the need for improvements discussed above, the NMDOT has advance-programmed several projects within the project limits for this Phase I-A/B Alignment Study while funding sources and timing are being determined. The Statewide Transportation Improvement Program (STIP) as of June 1, 2022, includes several projects as summarized in **Exhibit 1-2**.

Exhibit 1-2. Summary of STIP Program for NM 31 and NM 128 Improvements

Control Number	Description	Limits	Program Year	Amount
2102101	Jal Roadway Reconstruction	MP 51.5 to MP 52.6	Future FFY	$3.1M
2104330	NM 31/NM 128 Preliminary Engineering	this project	FFY 2022	$4.2M
2104331	NM 31 First Construction Phase	MP 0.5 to MP 8.0	Future FFY	$93.0M
2104332	NM 128 Design Build	MP 0.5 to MP 11.8	Future FFY	$75.0M
2104333	NM 128 Design Build	MP 50.7 to MP 53.9	Future FFY	$31.0M
2104334	NM 128 Widening	MP 11.8 to MP 50.7	Future FFY	$176.7M
2104335	NM 128 Roadway Widening	MP 53.9 to MP 59.9	Future FFY	$17.0M
2104336	NM 31 Roadway Widening	MP 8.0 to MP 22.7	Future FFY	$62.9M

The goal is to let the first phase of construction using the Design-Build procurement methodology in mid to late 2023. The timeline will be finalized once funding has been identified.

1.4 Report Organization

The remainder of this report summarizes the key elements of the data, analysis, and decision process used to identify and evaluate potential alternatives to improve NM 31 and NM 128 and to select a preferred alternative. The report is organized as follows:

- **Chapter 2** discusses the activities used to inform and involve project stakeholders such as stakeholder agencies, industry stakeholders, communities, and the general public.
- **Chapter 3** summarizes the existing conditions within the corridor including:
  - The engineering features and physical conditions of the existing highway including roadway typical sections, horizontal and vertical alignment data, drainage, major structures, posted speeds, access, and other pertinent data and conditions
  - Traffic and crash data
  - Right-of-way and land ownership
  - Environmental and cultural resources within the study area
  - The communities, businesses, and industries found within the project area
- **Chapter 4** summarizes how project alternatives were identified, screened, and evaluated in detail. Analysis findings specific to traffic performance, cost, right-of-way needs, utility impacts, drainage, constructability, access, and impacts on the natural, cultural, and human environment are also provided.
- **Chapter 5** provides an overall summary and recommendations, along with a preliminary priority implementation plan.

Supporting information is provided in the *electronic appendices* and other digital files available from the NMDOT. Other technical information developed for this project is incorporated by reference, as applicable.

2.0 Introduction

This chapter summarizes the public and stakeholder involvement and agency coordination efforts performed during Phase I-A/B for the NM 31/NM 128 Corridor Study (CN 2104330). The process for public outreach was guided by the NMDOT and the project-specific Context Sensitive Solutions Public Involvement Plan (PIP), which includes an initial list of probable stakeholders and identifies the anticipated activities to involve and engage stakeholders.

For this project, the primary stakeholders include the residents and community members, business owners predominantly related to oil, natural gas and potash extractive industries, freight and trucking companies, schools, local utilities, emergency service providers, the United States Postal Service, private landowners, federal and state land management agencies, and general users of the highway. Input from these groups and others was used to identify issues of interest and concern and to develop, evaluate, and refine project alternatives. The list of stakeholders and engagement methods was updated as the study progressed.

2.1 Public and Stakeholder Involvement

A project stakeholder list was developed to identify relevant and important issues of interest and concern so that project alternatives could be developed, evaluated, and refined. The following stakeholders were identified by researching the community governments, business associations, and agencies having jurisdiction within the study limits. Community residents, businesses, resource agencies, local jurisdictions, highway users, and others having an interest in the highway and project were informed of the study and invited to public meetings. Contact was made via a combination of email, USPS mail, telephone calls, meeting advertisements, and social media platforms.

Directly Impacted Stakeholders

- Residents and Community Members
- Business owners, in particular the extractive industries (oil, gas, potash, Waste Isolation Pilot Plant (WIPP), etc.)
- Freight and other trucking companies
- Schools (Jal Elementary School, Jal High School, Jal Municipal School, and Saint Maroon)
- School bus drivers
- Local utilities (fiber optic, electrical, sanitary sewer, water, gas, lighting systems, etc.)
- Emergency Service Providers (fire, police, ambulance, first responders)
- United States Postal Service
- Commuters
- Private landowners

Indirectly Impacted Stakeholders

- Tourists
- Local economic development groups (including chamber of commerce)
- General public
- Community groups

Impacted Stakeholders Groups

- Elected officials
- City of Jal
- City of Carlsbad
- Eddy County
- Lea County
- Bureau of Land Management
- New Mexico State Land Office
- Texas Department of Transportation (TxDOT)
- New Mexico Oil and Gas Association (NMOGA)
- Potash Industry
- Southeast New Mexico Integrated Safety Collaborative
- Southeast New Mexico Economic Development District
- Texas Department of Transportation
- New Mexico Trucking Association
- New Mexico Environmental Department
- New Mexico Radioactive Waste Consultation Task Force/WIPP Transportation Safety Working Group
- New Mexico Office of Cultural Affairs, Historic Preservation Division
- New Mexico Department of Game and Fish
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- U.S Department of Energy Waste Isolation Pilot Plant
- Burlington Northern and Santa Fe (BNSF) Railroad
- Texas-New Mexico (TX-NM) Railroad

2.2 Outreach Activities

Public involvement and consideration of the project setting and context are a fundamental component of the NMDOT Location Study Procedures. As part of this study, efforts were made to provide transparency, seek feedback, and lead collaboration with the community and stakeholders affected in the study area. A Context Sensitive Solutions Public Involvement Plan was prepared for the project and is included in the *electronic appendices*.

While precautions were/are being implemented during the COVID-19 pandemic, methods for informing the public in-person were generally not feasible. FHWA has approved use of alternative measures for achieving public input due diligence. Coordination with stakeholder agencies conducted to date has consisted of letters and email notifications, telephone discussions, and one-on-one meetings. Several stakeholder and public engagement activities have occurred and are summarized below.

A project logo was developed to distinguish the materials prepared for this project, CN 2104330, from other NMDOT projects currently under development in Eddy and Lea Counties (**Exhibit 2-1**). Additionally, a NMDOT project-specific website was created to host project information: (https://nm31-128project.nmdotprojects.org/).

Exhibit 2-1. Project Logo

2.2.1 Public Meetings

The structure and content of public meetings were scaled to the context of the local community and the project purpose and need. A total of four public meetings were held in two rounds. For each round, two meetings were held to maximize public involvement, one for the general public for the entire study corridor and one for the City of Jal tailored to the proposed improvements and impacts there.

First Round of Public Meetings

The first round of public meetings was held during the initial evaluation phase of this project. The first public meeting for the overall study occurred on August 31, 2021 at 6:00 pm and was advertised to the general public, stakeholders, and interested parties. Due to federal and state mandated COVID-19 emergency precautions, which restricted in-person gatherings, the meeting was hosted virtually over Zoom and was available for both call-in phone participation and live audio-video internet streaming.

To provide notice of the public meeting, advertisement occurred through a variety of platforms, including radio stations, newspapers, social media, a project-specific electronic mailing list, and the NMDOT's Public Information Officer's (PIO) distribution list. Considering the rural nature of the study corridor, portable message board signs were placed at strategic locations along the roadway corridor. All public meeting materials were posted on the NMDOT Projects website for public viewing.

Considering the context of the project segment through Jal, a virtual public meeting for the improvements in Jal was held on September 14, 2021 at 6:00 pm, over Zoom. This meeting focused on the existing conditions and initial conceptual options within the Jal segment. At the request from City of Jal leadership, the project team offered live Spanish translation through the Zoom platform during the public meeting event. Advertisement for this meeting consisted of United States Postal Service Every Door Direct Mailers (EDDM) sent to Jal residents abutting NM 128 within the study limits, a newspaper advertisement, social media, NMDOT's public information officer (PIO), and a targeted electronic mailing list. The City of Jal leadership distributed the notice advertisement to the business community members and residents within the city. Following the event, the Carlsbad Argus newspaper published an article about the meeting and encouraged the public to provide comments.

On the day of the first public meeting on August 31, 2021, a total of 63 people attended. The video of the meeting posted to the NMDOT YouTube channel following the meeting had 34 views for the general public meeting and 3 views for the City of Jal public meeting. The Jal-specific second public meeting had a total of 43 people in attendance.

During the August 31, 2021 public meeting event, the Project Team received nine questions and comments. During the September 14, 2021 meeting, the team received seven comments. Attendees engaged in active discussion and the questions and answer (Q&A) dialogue lasted for the scheduled duration of both meetings. Additionally, thirteen emails and three phone calls were received.

Second Round of Public Meetings

A second round of public meetings was held during the detailed evaluation phase of this project. The third public meeting for the overall study occurred on May 3, 2022 at 6:00 pm and was advertised to the general public, stakeholders, and interested parties. The meeting was hosted virtually over Zoom and was available for both call-in phone participation and live audio-video internet streaming.

To provide notice of the public meeting, advertisement occurred through a variety of platforms, including radio stations, newspapers, social media, a project-specific electronic mailing list, and the NMDOT's Public Information Officer's (PIO) distribution list. All public meeting materials were posted on the NMDOT Projects website for public viewing.

The fourth public meeting for the proposed improvements in Jal was held on May 24, 2022 at 6:00 pm, over Zoom. This virtual meeting focused on the improvement alternatives within the Jal segment. At the request from City of Jal leadership, the project team offered live Spanish translation through the Zoom platform during the public meeting event. Advertisement for this meeting consisted of EDDM sent to Jal residents abutting NM 128 within the study limits, a newspaper advertisement, social media, NMDOT's PIO, and a targeted electronic mailing list. The City of Jal leadership was asked to distribute the notice advertisement to the business community members and residents within the city.

For the third public meeting on May 3, 2022, a total of 46 people attended the event. The Jal-specific fourth public meeting on May 24, 2022 had 18 people in attendance. Following each event, a video of the meeting was posted to the NMDOT YouTube channel and an access link posted to the NMDOT project website.

Each meeting presentation was followed by a Q&A session. During the May 3, 2022 meeting, the Project Team received nine questions and comments. In advance of the May 24, 2022 Jal-specific meeting 12 questions were received and the presentation materials were modified, as appropriate, to answer these questions. During the May 24, 2022 meeting, the team received four questions and comments. Additionally, four emails were received.

Comments cumulatively received from all platforms and all four meetings were combined and organized into general themes. Review and analysis of comments indicate that the public input received falls into the following themes:

- Construction and Design
- Funding
- Public Involvement Process
- Data Requests
- Comments not related to this project (not included below)

Comments received that fell outside of the project scope or location were shared with the pertinent managing agency (e.g., City of Jal). The following summary of paraphrased cumulative comments is based on questions or comments received from the public based on the four public meetings.

Comments on Construction and Design

- Jal should have a four-lane roadway with a flush median due to heavy traffic. If a four-lane road is constructed, the relief route may not be needed.
- Will there be context sensitive solutions, bridge, or sound wall designs?
- We're excited about and look forward to these roadway upgrades and repairs. The highway is dangerous to travel on.
- There should not be a roundabout on NM 128. A roundabout would increase travel time, add a driving hazard, and increase congestion.
  - A passing lane would be better suited, such as that on US 285.
- Other than the RCUT, High-T, and RAB, what other options have been evaluated?

- For the traffic circle bypasses, do they have a dedicated lane to enter the highway?
- How will the bypass roundabout lanes work and prevent the opting out of using the roundabout? Will there be deceleration or acceleration lanes for the heavy truck vehicles?
- The State of New Mexico should spend a little more money and include the four-lane option through Jal to the Texas State Line, since a lot of the State's income comes from this area.
- In the four-lane option, is it possible to construct two new lanes, leaving the other two lanes open during construction, and then returning to the older two lanes for rebuilding?
- What is a realistic timeline for the project to be completed?
- What is the projected start date for construction on NM 128 in Jal?
- Have traffic detours during construction been identified?
- What is the benefit to traffic of widening the lanes on NM 128? Is it just to give space for oversized vehicles? How will widening the lanes improve traffic flow?
- Would it be better if the Northern Jal Relief Route were completed before widening NM 128 in Jal?
- Will plans for the alternate route around Jal affect the NMDOT's design build plans of Hwy 128 through Jal?
- Is the four-lane option going to be discussed or has the three-lane alternative been decided?
- A traffic light or four-way stop is needed near 5th Street and NM 128 because it's hard to cross with all of the congestion.
- When traffic backs up on NM 128 in Jal, people are using the turn lanes as driving lanes. Making the roadway three lanes will make the problem worse.
- Has a noise study been conducted (measured in decibels) for the area of the Hwy 128 roadway through Jal?
- Has a study been conducted on the current and anticipated air quality levels of exhaust emitted by the heavy traffic loads on the Hwy 128 roadway through Jal?
- We're concerned about noise, night lights and air quality if construction activities will be allowed during evening and night hours. Can temporary barriers be constructed to protect citizens against noise and truck/vehicle exhaust emissions (carbon monoxide gas) during the actual construction period?
- How will widening of the roadway through the Jal city limits affect private and commercial property values?
- Will there be a passing lane located at the Intrepid Potash West Plant?

Comments on Funding

- Is it true that in New Mexico, the design-build method may only be used on projects exceeding $50 million? Are federal funding matching dollars considered part of this threshold cost?
- Is there any benefit to separating NM 31 from NM 128 in the construction phase for funding purposes?
- One-third of the State's funding comes from Lea and Eddy Counties, because of this more money should be spent on constructing the 4-lane option through Jal.
- When is approved funding expected for constructing the Jal segment?
- How sure are we of the accuracy of the current cost estimates in light of ever-escalating prices for construction materials?
- What is the likelihood of "Spot Safety" improvements being funded?

Comments on Public Involvement Processes

- How do I register for the public meeting?
- Can I have a copy of the transcript of the public meeting?
- Will WSP provide the NM Transportation Commission the schedule of meetings planned with individual property owners within the City of Jal?
- Provide a recap of the property owner concerns.

Data Requests

- Can you provide the same crash data for the NM 31 corridor that you provided for the NM 128 corridor?
- There is a RAB in Chapparal, New Mexico, at the NM 213 and NM 404 intersection. What is the size data of that RAB that is already in use? Also, what are the volume of traffic data, pre-installation crash data, and post-installation crash data?

2.2.2 Stakeholder Meetings and Engagement

Stakeholder meetings and engagement occurred since mid-2020. Several persons/groups requested one-on-one meetings with the project team as follows:

- City of Jal (meetings occurred on October 1, 2020; February 23, 2021; August 5, 2021; November 30, 2021) with frequent issue-specific meetings with the Mayor and City Manager.
- Eddy County (meetings occurred on October 13, 2020; September 7, 2021; September 28, 2021; October 6, 2021)
- Lea County (meeting occurred on October 23, 2020)
- WIPP (meeting occurred on November 4, 2020)
- BLM (meeting occurred on November 5, 2020)
- City of Carlsbad (meeting occurred on November 13, 2020)
- Mosaic Potash (meeting occurred on January 12, 2021)
- NMOGA (meeting occurred on January 26, 2021)
- United Salt Corporation (meeting occurred on January 26, 2021)
- Intrepid Potash (meetings occurred on January 27, 2021 and May 26, 2022)
- TxDOT (meeting occurred on February 24, 2021)
- FHWA (meeting occurred on June 8, 2021)
- Permian Basin Strategic Partnership (PSP) (meeting occurred on September 28, 2021)
- Permian Road Safety Coalition (meeting occurred on May 3, 2022)
- Meetings with the BNSF and Texas/New Mexico Railroad. These included pre-field meetings held via Teams and in-field diagnostic meets. These meetings were held at various times in late 2021 and the first quarter of 2022.
- Property Owner interviews were conducted for the improvements on NM 128 in Jal for all property owners who responded to a request for an interview to learn more about the project (meetings were held in April and May 2022)

Each meeting was scaled to the interests of each stakeholder group. Primary topics covered for each group included a presentation on the project overview and objectives, schedule, and identified potential stakeholder-focused issues and concerns. Each meeting also included presenting information on alternative concepts. Stakeholder engagement will continue through the life of the project and additional meetings will be held at the request of the stakeholders.

Oil and Gas Industry Involvement

Outreach to oil and gas exploration and development companies was conducted to gather information about future oil field development. This information was used to identify the need for improvements at existing oil field access roads and the potential for future major access points.

TransGlobal Services, LLC (TSG) performed research on oil and gas activity within the Permian Basin including a twenty-mile corridor of NM 31 and NM 128. This included current oil and gas exploration development/activity and related infrastructure, and an overview of potential oil and gas industry build-out for five-year and ten-year increments from current data. The documentation resulting from the research by TSG is included in the *electronic appendices*. Key research topics were:

- Multiple areas have identified alternatives for mainline expansion and intersections.
- Research was performed to identify and better understand who the top oil and gas production and midstream companies are in this area.
- Geologic analysis was conducted to better understand the potential development of oil and gas in the future.
- Conversations were held with the top ten oil and gas producers (extraction and production (E&P)) and Midstream operators.

A summary of key input is provided below.

- Companies had concerns about roundabout intersections, and there was strong oil and gas Industry opposition to RCUT intersections.
- All companies expect near-term development and growth due to better commodity prices.
- E&P companies drive more of the development activity and have more traffic concerns as a result of rig moves.
- Midstream companies tended to focus on concerns regarding road widening that could affect existing pipeline locations.
- Intersections that were mentioned to having increased volume from multiple companies were Red Road and Twin Wells Road, East and West. Permit activity supports this area being very busy in the future.
- Intersections not specifically mentioned, but based on permit activity and discussions of areas that will see increased activity, include Vaca Lane and Diamond Wells Road.
- Rawhide Road was also mentioned as an increased activity intersection, however some of this activity will also be accessed from US 285.
- Delaware Basin Road was mentioned that already had heavy traffic that can back up frequently.
- Battle Axe Road was mentioned as an area that has severe accidents recently.

2.3 How Stakeholder Input Was Used

Stakeholder input was used for various elements of the project design and will inform the evaluation of alternatives. Stakeholder input will be especially pertinent for the following project considerations:

- Maintaining traffic and access in both directions during project improvements and construction
- Utility coordination
- Funding
- Safety improvement measures
- Potential right-of-way takes
- Design aspects related to vehicle types and associated needs

In May 2022, a group met to initiate discussions regarding construction phasing and maintenance of traffic for the first phase of improvements, the Design-Build procurement. Participants providing feedback included Eddy County, the City of Jal and the Permian Strategic Partnership. Follow-up coordination efforts with City of Jal leaders were facilitated for the NM 128 improvements in Jal.

2.4 Summary of Stakeholder Issues and Concerns

Throughout the project development process, stakeholder issues and concerns were compiled and documented as part of the administrative record. *Public Outreach and Comment Summary Reports* were prepared to summarize the public meetings and comments received. The materials resulting from the stakeholder involvement process that occurred during the Phase I-A/B Alignment Study are included in the *electronic appendices*.

3.0 Introduction

A review of existing conditions within the study area is important to determine the needs within the project limits and for understanding the opportunities and constraints that could influence the type and extent of improvement alternatives. Existing conditions include the traffic volumes and types of vehicles that use the roadway, crash history, engineering aspects of the corridor (e.g., roadway condition, drainage, access, right-of-way, geotechnical, etc.), land use, communities and businesses, and environmental features found within the project area. This chapter summarizes the traffic, safety, engineering, and community and environmental features that exist for the study segments of NM 31 and NM 128.

3.1 Traffic

Existing year (2019) traffic conditions were evaluated for NM 31, from east of US 285 to US 62, and for NM 128 from NM 31 to the Texas border. The key findings of the traffic analysis are summarized in this section. Supporting materials and the analysis output reports are provided in the ***electronic appendix***.

Level of Service Criteria

Exhibit 3-1 summarizes the *Minimum Acceptable Level of Service Standards (Table 15.C-1)* as found in the State Access Management Manual (SAMM). Mitigation of a traffic performance is required when levels of service (LOS) are below the minimum standards. Functional classification, location and facility type are key factors used to identify applicable LOS standards. NM 31 is characterized as a rural major collector and is currently a two-lane highway with several unsignalized intersections and access points.

Exhibit 3-1. Traffic Operations LOS Criteria from SAMM

Roadway Characteristics	SAMM LOS Criteria
Rural, Two-Lane Highways	LOS B or Better
Rural, Multi-Lane Highways	LOS B or Better
Rural, Unsignalized Intersections	LOS C or Better for all Approaches and Movements

The Highway Capacity Manual (HCM), 6th Edition, specifies LOS criteria for two-lane and multi-lane highways as well as for two-way stop-controlled (TWSC) (a.k.a., unsignalized) intersections, shown in **Exhibits 3-2, 3-3, and 3-4**.

NM 31 and NM 128 are classified as a Class I Highways because they are major links in the New Mexico state highway network. The facilities operate at high speeds and are primarily used to serve long-distance trips. The LOS criteria for two-lane highways are based on the average travel speed (ATS) and the percent time spent following (PTSF). The PTSF indicates the inability to pass which can be due to congestion and lack of passing zones or passing lanes. The LOS criteria for multi-lane highways are based on density which is defined in passenger cars per mile per lane (pc/mi/ln). The LOS criteria for unsignalized intersections are based on control delay which is defined in seconds per vehicle (s/veh). Note that control delay at unsignalized intersections is oftentimes estimated above the LOS C goal for low traffic volumes; as such, engineering judgment should be used to determine the appropriate type and extent of improvements to consider on case-by-case basis.

Exhibit 3-2. Two-Lane Highway LOS Criteria for Motorized Vehicles

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Source: Exhibit 15-3 from HCM, 6th Edition
ATS = Average Travel Speed; PTSF = Percent Time Spent Following

Exhibit 3-3. Multi-Lane Highway LOS Criteria for Motorized Vehicles

LOS	Density (pc/mi/ln)
A	≤11
B	>11–18
C	>18–26
D	>26–35
E	>35–45
F	Demand exceeds capacity OR density > 45

Source: Exhibit 12-15 from HCM, 6th Edition

Exhibit 3-4. Two-Way Stop Controlled LOS Criteria for Motorized Vehicles

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio $v/c \leq 1.0$	LOS by Volume-to-Capacity Ratio $v/c > 1.0$
0–10	A	F
>10–15	B	F
>15–25	C	F
>25–35	D	F
>35–50	E	F
>50	F	F

Note: The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.

Source: Exhibit 20-2, Exhibit 21-8, and Exhibit 22-8 from HCM, 6th Edition

3.1.1 NM 31 Existing Traffic Conditions

Traffic Volume and Classification Data

Pre-COVID pandemic traffic counts for the NM 31 corridor were available from other NMDOT and Eddy County efforts including 9-hour intersection turn movement counts and 48-hour classification counts. The intersection counts were performed in March 2019 by NMDOT for the following intersections:

- Kelly Road
- Carter Road
- Nymeyer Road
- Donaldson Road
- Fishermans Lane
- Refinery Road
- NM 128

The 48-hour classification counts were obtained by Eddy County on NM 31 east and west of Refinery Road (CR 605) and on Refinery Road north of NM 31. These counts were obtained in December 2019 as part of the Carlsbad Southeast Loop study.

Because this project is being developed during a pandemic, existing field traffic counts were not collected for this project. Instead, the available traffic count data was supplemented by StreetLight "Big Data," which was used to validate the 2019 traffic counts as well as to estimate data for additional intersections of interest along the corridor. The additional intersections along NM 31 were the entrance of the United Salt Corporation (USC)/Mosaic site and the US 62 intersection. StreetLight data was processed for typical weekdays in 2019 (pre-pandemic) and was post-calibrated based on known ADT values from the NMDOT.

Existing (2019) Peak-Hour Traffic Volumes

The peak-hour traffic volume counts along NM 31 are summarized in **Exhibit 3-5**. Final 2019 values were generated based on a combination of traffic counts and StreetLight data and normalizing the traffic flows throughout the project limits for continuity between intersections. The 2019 peak-hour traffic counts were rounded to the nearest ten vehicles per hour (vph) with five vph set as the minimum (i.e., where 1 to 5 vehicles were counted). Note that the direction of travel is due east and west at the far west end of the corridor. As the highway approaches the NM 128 intersection, the travel direction shifts to the north and south direction up to US 62. West of NM 128, eastbound volumes are greatest in the AM Peak and westbound volumes are greatest in the PM Peak.

Average Annual Daily Traffic Volumes

The Average Daily Traffic (ADT) volumes in vehicles per day (vpd) are summarized in **Exhibit 3-6**. Volumes along NM 31 are the highest between Donaldson Farm Road and Fishermans Lane. The ADT volumes decrease by 70% north of NM 128.

Vehicle Classifications

Truck use along NM 31 varies on a daily basis. Available count data reflect truck percentages on days the data was collected. For traffic analysis, peak-hour truck percentages are used when more passenger-type vehicles are in the traffic stream.

In addition to the classification counts, the intersection turn movement counts included a vehicle classification breakdown for passenger cars and trucks. Vehicle classification for NM 31 was collected for the seven intersections previously listed, from Kelly Road to NM 128. In the eastbound and westbound directions, truck percentages ranged from 5% to 35% in both AM and PM peaks. For cross street intersection approaches, average truck percentages for the northbound approaches was 50% in the AM and 10% in the PM. The average value for the southbound approaches was 10% in the AM and 35% in the PM. Overall, this corridor does see a substantial number of trucks due to its proximity to oil and gas fields. It is noted that oversized vehicles that require permits to travel state highways also use the NM 31/NM 128 corridor which may require special accommodations; these vehicle types are not included in the traffic analyses.

Exhibit 3-5. Existing (2019) Turn Movement Volumes at NM 31 Intersections

2019 Volume by Approach and Movement (vehicles per hour)													
Location Along NM 31	Peak Hour	Eastbound NM 31			Westbound NM 31			Northbound			Southbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Kelly Road	AM	30	380	-	-	140	20	-	-	-	30	-	10
	PM	20	220	-	-	340	160	-	-	-	30	-	10
Carter Road	AM	-	380	10	50	13	-	10	-	100	-	-	-
	PM	-	260	10	50	470	-	10	-	60	-	-	-
Nymeyer Road	AM	-	480	10	30	190	-	0	-	40	-	-	-
	PM	-	330	10	10	490	-	10	-	20	-	-	-
Donaldson Farm Road	AM	5	500	30	100	220	5	10	0	50	5	0	5
	PM	5	320	20	60	490	5	20	0	100	5	5	5
Fishermans Lane	AM	-	540	5	0	300	-	5	-	10	-	-	-
	PM	-	400	5	0	530	-	5	-	0	-	-	-
Refinery Road	AM	10	510	10	10	280	20	10	10	0	180	0	30
	PM	30	390	0	10	460	180	20	10	0	60	10	30
Location Along NM 31	Peak Hour	Northbound NM 31			Southbound NM 31			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
NM 128	AM	-	110	600	40	150	-	-	-	-	180	-	40
	PM	-	200	270	30	120	-	-	-	-	550	-	10
USC/Mosaic Site	AM	-	130	10	10	180	-	-	-	-	10	0	10
	PM	-	210	10	10	120	-	-	-	-	10	-	30
US 62	AM	70	-	60	-	-	-	-	490	60	130	340	-
	PM	120	-	140	-	-	-	-	430	50	70	780	-

Exhibit 3-6. Existing (2019) Average Daily Traffic Volumes for NM 31

Segment Along NM 31	Average Daily Traffic Volume (veh/day)
MP 0.0 to Kelly Rd	7,900
Kelly Rd to Carter Rd	7,900
Carter Rd to Nymeyer Rd	8,700
Nymeyer Rd to Donaldson Farm Rd	10,000
Donaldson Farm Rd to Fishermans Ln	10,900
Fishermans Ln to Refinery Rd	10,500
Refinery Rd to NM 128	10,200
NM 128 to USC/Mosaic Site	3,200
USC/Mosaic Site to MP 22.67	3,200

Existing Conditions Traffic Operations

Two-Lane Highway Operational Analysis

The Highway Capacity Software (HCS7) was used to evaluate the traffic performance of existing conditions for the NM 31 corridor. The Highways module and the Streets module of HCS7 were used. The analysis considered locations where passing is constrained and where passing zones exist. The geometric data for the two-lane highway segments along NM 31 are as follows:

- Lane Width (ft) = 12 feet
- Shoulder Width (ft) 6 feet max = 3 to 6 feet
- Grade = 2% to 4%
- Access Density (Turnouts/mile) = 4
- Speed Limit (MPH) = 55 mph

Exhibit 3-7 summarizes the LOS results for the 2019 No Build two-lane highway segments from minor street to minor street along the corridor. Overall, based on the SAMM LOS criteria, the NM 31 two-lane highway is currently deficient for traffic operations from Kelly Road to NM 128. Specifically, in the eastbound direction, the highway is operating below acceptable standards from Carter Road to NM 128 in the AM Peak and from Donaldson Road to NM 128 in the PM Peak. In the westbound direction, the highway is operating at acceptable standards in the AM Peak but below standards in the PM Peak from Kelly Road to NM 128. The segment between NM 128 and US 62 along NM 31 is currently operating at acceptable standards for both AM and PM Peak volumes with the two-lane highway configuration.

Exhibit 3-7. NM 31 Two-Lane Highway Traffic Operations Summary – Existing Conditions

Minor St. to Minor St.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
Kelly to Carter	B	A	B	C
Carter to Nymeyer	C	A	B	C
Nymeyer to Donaldson	C	A	B	C
Donaldson to Fisherman	C	B	C	C
Fisherman to Refinery	D	B	C	C
Refinery to NM 128	D	B	C	D
NM 128 to US 62	A	A	B	A

Note: Shaded values do not meet SAMM LOS criteria.

Multi-Lane Highway Operational Analysis

Because NM 31 was found to be operationally deficient as a two-lane highway, multi-lane highway analyses were performed using existing traffic volumes. The NMDOT's SAMM specifies that multi-lane highways with the functional classification of rural collector are to be designed to operate at a LOS B or better. The geometric data for the multi-lane highway segments analyses for NM 31 are as follows:

- Number of Lanes (per direction) = 2 lanes
- Lane Width =12 feet
- Median (left) Side Clearance = 6 feet
- Driver Population Familiarity = Balanced Mix
- Median Type = Divided
- Right Side Clearance = 6 feet
- Terrain Type = Level

Exhibit 3-8 details the demand data for the multi-lane highway analysis along NM 31. This data includes truck percentages, peak-hour factors (PHFs), and shoulder width for both AM and PM Peaks. Truck percentages along NM 31 from Kelly Road through NM 128 were rounded up to the nearest 5% and reflect peak-hour conditions when more passenger-type vehicles are in the traffic stream.

Exhibit 3-8. Demand Data for Multi-Lane Highway Analysis along NM 31

Minor St. to Minor St.	Truck Percentages		PHF		Shoulder width (ft)	Truck Percentages		PHF		Shoulder width (ft)
	EB	WB	EB	WB		EB	WB	EB	WB	
	AM Peak					PM Peak				
Kelly to Carter	10%	10%	0.89	0.76	4	15%	10%	0.84	0.87	4
Carter to Nymeyer	25%	20%	0.95	0.77	5	30%	15%	0.82	0.92	5
Nymeyer to Donaldson	10%	10%	0.97	0.74	6	15%	10%	0.81	0.90	6
Donaldson to Fisherman	25%	30%	0.87	0.77	6	20%	20%	0.86	0.87	6
Fisherman to Refinery	15%	10%	0.79	0.82	6	10%	10%	0.88	0.91	6
Refinery to NM 128	25%	25%	0.86	0.72	6	25%	25%	0.80	0.90	6
NM 128 to US 62	10%	15%	0.94	0.61	3	20%	35%	0.79	0.84	3

As shown in **Exhibit 3-9**, the multi-lane highway results for 2019 traffic conditions reveal that NM 31 would operate at LOS A in both AM and PM peak periods. With LOS A conditions expected, the proposed multi-lane highway would have excess capacity to accommodate the potential for higher truck volumes than were indicated by the count data.

Exhibit 3-9. NM 31 Multi-Lane Highway Traffic Operations Summary – Existing Conditions

Minor St. to Minor St.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
Kelly to Carter	A	A	A	A
Carter to Nymeyer	A	A	A	A
Nymeyer to Donaldson	A	A	A	A
Donaldson to Fisherman	A	A	A	A
Fisherman to Refinery	A	A	A	A
Refinery to NM 128	A	A	A	B
NM 128 to US 62	A	A	A	A

Unsignalized Intersections Operational Analysis

The HCS7 Two-Way Stop Control (TWSC) module was used for the existing 2019 unsignalized intersection analysis along NM 31. The major street median type was specified as undivided. The saturation flow rate was specified as 1,800 vph for through traffic and 1,500 vph for right-turn traffic. Critical headway and follow-up headway values were determined by HCS7 based on the intersection configuration. Truck percentages were calculated based on the intersection count data.

Exhibit 3-10 summarizes the results for the unsignalized intersections along NM 31. Operational deficiencies occur for the northbound (low volume) and southbound approaches at Refinery Road and for the westbound NM 128 approach to NM 31.

Exhibit 3-10. NM 31 Unsignalized Intersection Traffic Operations Summary – Existing Conditions

Intersection along NM 31	2019 Unsignalized Intersection Level of Service				
Two-Way Stop Control	**Peak Period**	**Eastbound NM 31**	**Westbound NM 31**	**Northbound**	**Southbound**
Kelly Road	AM	A	-	-	B
	PM	A	-	-	C
Carter Road	AM	-	A	B	-
	PM	-	A	B	-
Nymeyer Road	AM	-	A	B	-
	PM	-	A	B	-
Donaldson Farm Road	AM	A	A	C	C
	PM	A	A	C	C
Fishermans Lane	AM	-	A	C	-
	PM	-	A	C	-
Refinery Road	AM	A	A	D	F
	PM	A	A	D	E
Two-Way Stop Control	**Peak Period**	**Eastbound**	**Westbound**	**Northbound NM 31**	**Southbound NM 31**
NM 128	AM	-	C	-	A
	PM	-	F	-	A
USC/Mosaic Site	AM	-	B	-	A
	PM	-	B	-	A
US 62	AM	-	B	C	-
	PM	-	A	C	-

Note: Shaded values do not meet SAMM LOS criteria.

3.1.2 NM 128 Existing Traffic Conditions

Traffic Volume and Classification Data

Pre-COVID pandemic traffic counts for the NM 128 corridor were available from other NMDOT and City of Jal efforts including 9-hour intersection turn movement counts and 48-hour classification counts. The intersection counts were performed in December 2019 by the City of Jal for the following NM 128 intersections:

- 3rd Street
- NM 18
- Schooley Road
- Willis Road

The 48-hour classification counts were also obtained by the City of Jal in December 2019 as part of the Jal Relief Route study. The locations used by this project include:

- NM 128 east of Jal Access Road
- NM 18 south of NM 128
- NM 18 north of NM 128
- NM 128 west of Schooley Road
- Schooley Road north of NM 128
- NM 128 west of Willis Road
- NM 128 east of Willis Road
- Willis Road north of NM 128

Because this project is being developed during a pandemic, additional existing field traffic counts were not collected for this project. Instead, the available traffic count data was supplemented by StreetLight "Big Data," which was used to validate the 2019 traffic counts as well as to estimate data for additional intersections of interest along the corridor. The additional intersections along NM 128 are listed below. StreetLight data was processed for typical weekdays in 2019 (pre-pandemic) and was post-calibrated based on known ADT values from the NMDOT.

- WIPP Road
- Red Road/Twin Wells east
- Buck Jackson Road
- Orla Road
- Delaware Basin Road
- Battle Axe Road

Existing (2019) Peak-Hour Traffic Volumes

The peak-hour traffic volume counts along NM 128 are summarized in **Exhibit 3-11**. Final 2019 values were generated based on a combination of traffic counts and StreetLight data and normalizing the traffic flows throughout the project limits for continuity between intersections. The 2019 peak-hour traffic counts were rounded to the nearest ten vehicles per hour (vph) with five vph set as the minimum (i.e., where 1 to 5 vehicles were counted).

Exhibit 3-11. Existing (2019) Turn Movement Volumes at NM 128 Intersections

2019 Volume by Approach and Movement (vehicles per hour)													
Location Along NM 128	**Peak Hour**	**Eastbound NM 128**			**Westbound NM 128**			**Northbound**			**Southbound**		
		Left	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**
WIPP Road	AM	130	500	-	-	160	50	-	-	-	120	-	70
	PM	120	180	-	-	440	250	-	-	-	20	-	50
Red Road	AM	50	530	-	-	170	60	-	-	-	80	-	20
	PM	50	170	-	-	590	140	-	-	-	40	-	60
Buck Jackson Road	AM	-	450	120	100	250	-	2	-	20	-	-	-
	PM	-	200	20	30	460	-	230	-	120	-	-	-
Orla Road	AM	-	280	150	110	340	-	30	-	30	-	-	-
	PM	-	310	30	50	310	-	210	-	15	-	-	-
Delaware Basin Road	AM	90	180	-	-	390	50	-	-	-	80	-	100
	PM	130	360	-	-	350	40	-	-	-	50	-	50
Battle Axe Road	AM	-	170	100	140	470	-	20	-	30	-	-	-
	PM	-	340	30	40	290	-	80	-	180	-	-	-
3rd Street	AM	20	150	30	30	420	10	120	40	30	20	40	100
	PM	70	450	50	50	240	30	60	70	50	20	30	30
NM 18	AM	40	110	50	40	230	40	150	120	40	20	180	80
	PM	70	300	150	40	190	40	90	170	90	30	100	40
Schooley Road	AM	10	130	0	20	270	0	0	0	15	5	0	5
	PM	10	370	0	15	240	0	0	0	35	5	0	5
Willis Road	AM	20	100	10	60	250	10	10	10	10	10	0	10
	PM	20	360	10	10	220	10	10	10	30	10	0	10

Average Annual Daily Traffic Volumes

The Average Daily Traffic (ADT) volumes in vehicles per day (vpd) are summarized in **Exhibit 3-12**. Volumes along NM 128 are the highest west of Jal.

Exhibit 3-12. Existing (2019) Average Daily Traffic Volumes for NM 128

Segment Along NM 128	2019 Average Daily Traffic Volume (veh/day)
MP 0.0 to WIPP Road	8,200
WIPP Road to Red Road	8,200
Red Road to Buck Jackson Road	8,200
Buck Jackson Road to Orla Road	8,200
Orla Road to Delaware Basin Road	9,200
Delaware Basin Road to Battle Axe Road	9,200
Battle Axe Road to 3rd Street	10,400
3rd Street to NM 18	9,400
NM 18 to Schooley Road	6,200
Schooley Road to Willis Road	6,200
Willis Road to MP 59.9	6,200

Vehicle Classifications

Similar to NM 31, truck use along NM 128 varies on a daily basis. The vehicle classification data available for NM 128 included the classification counts and intersection turn movement counts collected for the Jal relief route study, and the counts obtained for the NM 31/NM 128 intersection. Based on the Jal relief route study data, in the eastbound and westbound directions, heavy truck percentages ranged from 15% to 45%. In the northbound and southbound directions, heavy truck percentages ranged from 0% to 30%.

Based on the NM 31/NM 128 counts, the eastbound NM 128 truck percentages were calculated by combining the NM 31 northbound right-turn and southbound left-turn values resulting in 10% in the AM peak and 25% in the PM peak. Similarly, westbound truck percentages were based on the westbound approach to NM 31, which was 10% in the AM peak and 15% in the PM peak. A truck percentage of 35% was used for the minor road approaches to NM 128.

Existing Conditions Traffic Operations

Two-Lane Highway Operational Analysis

The Highway Capacity Software (HCS7) was used to evaluate the traffic performance of existing conditions for the NM 128 corridor. The Highways module and the Streets module of HCS7 were used. The analysis considered locations where passing is constrained and where passing zones exist. The geometric data for the two-lane highway segments along NM 128 are as follows:

- Lane Width (ft) = 12 feet
- Shoulder Width (ft) 6 feet max = 4 to 6 feet
- Grade = 2% to 3%
- Access Density (Turnouts/mile) = 1 to 4
- Speed Limit (MPH) = 55 to 65 mph

Exhibit 3-13 summarizes the LOS results for the 2019 No Build two-lane highway segments along the NM 128 corridor. As shown, the NM 128 two-lane highway is currently deficient for traffic operations in at least one direction in the AM and PM peak hours from NM 31 to NM Jal. The segment between Wyoming Road and MP 54.4 runs through the City of Jal and was not included in the two-lane highway analysis. Acceptable operations are provided east of Jal to the Texas border.

Exhibit 3-13. NM 128 Two-Lane Highway Traffic Operations Summary – Existing Conditions

Minor St. to Minor St.	Level of Service			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
NM 31 to MP 0.85	C	A	B	C
MP 0.85 to WIPP Road	C	A	A	C
WIPP Road to Red Road	C	A	A	C
Red Road to Buck Jackson Road	C	A	A	C
Buck Jackson Road to Orla Road	B	B	B	C
Orla Road to Delaware Basin Road	A	C	C	B
Delaware Basin Road to Battle Axe Road	A	C	B	B
Battle Axe Road to MP 48.0	A	C	C	B
MP 48.0 to Wyoming Road	A	C (D)*	C	B
Wyoming Road to MP 54.4	N/A in City of Jal			
MP 54.4 to Willis Road	A	B	B	A
Willis Road to Texas Border	A	B	B	A

Note: LOS C(D) = LOS C for the overall combined segment; LOS D for individual sections. Shaded values do not meet SAMM LOS criteria.

Multi-Lane Highway Operational Analysis

Because NM 128 was found to be operationally deficient as a two-lane highway, multi-lane highway analyses were performed. The NMDOT's SAMM specifies that multi-lane highways with the functional classification of rural collector are to be designed to operate at a LOS B or better. The geometric data for the multi-lane highway segments analyses for NM 128 are as follows:

- Number of Lanes (per direction) = 2 lanes
- Median Type = Divided
- Lane Width =12 feet
- Right Side Clearance = 6 feet
- Median (left) Side Clearance = 4 feet
- Terrain Type = Level
- Driver Population Familiarity = Balanced Mix

Exhibit 3-14 summarizes key demand data for the multi-lane highway analysis along NM 128.

Exhibit 3-14. Demand Data for Multi-Lane Highway Analysis along NM 128

Peak Hour	Direction	Peak-Hour Factor	Truck Percentage
AM Peak	EB	0.92	10%
	WB	0.78	10%
PM Peak	EB	0.88	25%
	WB	0.89	15%

As shown in **Exhibit 3-15**, the multi-lane highway results for 2019 traffic conditions indicate that NM 128 would operate at LOS A in both AM and PM peak periods and in both travel directions. These findings suggest that

favorable operational performance (LOS A/B) would be expected for a wide range of truck percentages in the vehicle stream (50% trucks or more).

Exhibit 3-15. NM 128 Multi-Lane Highway Traffic Operations Summary – Existing Conditions

Minor St. to Minor St.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
NM 31 to MP 0.85	A	A	A	A
MP 0.85 to WIPP Road	A	A	A	A
WIPP Road to Red Road	A	A	A	A
Red Road to Buck Jackson Road	A	A	A	A
Buck Jackson Road to Orla Road	A	A	A	A
Orla Road to Delaware Basin Road	A	A	A	A
Delaware Basin Road to Battle Axe Road	A	A	A	A
Battle Axe Road to MP 48.0	A	A	A	A
MP 48.0 to Wyoming Road	A	A	A	A

Unsignalized Intersections Operational Analysis

The HCS7 Two-Way Stop Control (TWSC) and the All-Way Stop Control (AWSC) modules and Transmodeler were used for the existing 2019 unsignalized intersection analysis along NM 128. The major street median type was specified as undivided. The saturation flow rate was specified as 1,800 vph for through traffic and 1,500 vph for right-turn traffic. Critical headway and follow-up headway values were determined by HCS7 based on the intersection configuration. Truck percentages were as reported above. Based on discussions with the City of Jal, pedestrian use at the 3rd Street and NM 18 intersections is minimal/negligible.

Exhibit 3-16 summarizes the results for the unsignalized intersections along NM 128 for existing conditions. Operational deficiencies occur for the stop-sign controlled minor road approaches at WIPP Road, Buck Jackson Road, and Orla Road. The AWSC intersections at 3rd Street and NM 18 in Jal are deficient for NM 128 and for minor road approaches. The AWSC intersections were evaluated using HCS7 however the output results were inconsistent with existing conditions. As such, Transmodeler was used to better reflect actual conditions which shows deficient performance levels as observed for the AWSC intersections.

3.2 Crash History

A vehicular safety analysis was performed for NM 31 from east of US 285 to US 62, which is approximately 23 miles of rural two-lane highway. The crashes recorded along the corridor for the six-year period from 2014 to 2019 were reviewed to identify trends in reported crashes and for use in conducting a Highway Safety Manual (HSM) evaluation of existing and proposed conditions. The reported crash data were provided by the New Mexico Traffic Safety Bureau in Geographic Information System (GIS) format, which is in summary form. Actual accident reports completed by public safety officers were not reviewed.

The HSM analyses used version 16.0.0 of the Federal Highway Association's (FHWA) Interactive Highway Safety Design Model (IHSDM) Crash Prediction Module (CPM) to implement the HSM Part C predictive methods for the NM 31 corridor. The purpose of the HSM evaluation was to provide an indication of how crash occurrence and the cost of crashes may change with improvements to NM 31. The HSM evaluation considered existing and estimated future daily traffic volumes for this highway corridor.

Exhibit 3-16. NM 128 Unsignalized Intersection Traffic Operations Summary – Existing Conditions

Intersection along NM 128	2019 Unsignalized Intersection Level of Service				
Two-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
WIPP Rd	AM	A	-	-	D
	PM	B	-	-	C
Red Road	AM	A	-	-	C
	PM	B	-	-	C
Buck Jackson Road	AM	-	A	C	-
	PM	-	A	E	-
Orla Road	AM	-	A	C	-
	PM	-	A	E	-
Delaware Basin Road	AM	A	-	-	C
	PM	A	-	-	C
Battle Axe Road	AM	-	A	B	-
	PM	-	A	C	-
All-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
3rd Street	AM	F	B	F	D
	PM	F	B	F	D
NM 18	AM	E (F)*	E	D	D
	PM	E (F)*	E	E	D
Two-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
Schooley Road	AM	A	A	B	B
	PM	A	A	B	B
Willis Road	AM	A	A	B	B
	PM	A	A	B	B

Note: LOS E (F) = LOS E for the approach; LOS F for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.

3.2.1 NM 31 Crash Experience

Traffic Volume Data for Crash Rate Calculations

Exhibit 3-17 summarizes the Average Daily Traffic (ADT) volumes along NM 31 used to calculate crash rates. The ADTs are two-way volumes. The ADTs for 2014 to 2019 were estimated based on available traffic count data from NMDOT and other ongoing projects in the corridor. The future-year daily traffic estimates were based on a 0.85% annual growth rate to project the 2019 volumes to the design year of 2041 (1.2 factor for 22 years of growth). The annual growth rate was based on population growth estimates for Eddy County and Lea County.

Crash Data Evaluation

The total number of crashes summarized by year and crash severity for the NM 31 corridor are shown in **Exhibit 3-18**. Crash occurrence was lowest in 2016 (8) and highest in 2019 (56). The statewide average percentage of fatal/injury (FI) and property damage only (PDO) crashes reported in the *2019 New Mexico Traffic Crash Annual Report* were 30.3%, and 69.7%, respectively. Based on the same report, the crash severity for Eddy and Lea counties combined was 29.6% FI and 70.4%% PDO. For the NM 31 corridor, while the FI severity rate varies from year to year, the six-year average was elevated but consistent with the statewide and county averages at 33.3%.

Exhibit 3-17. Average Daily Traffic Volumes along NM 31

Segment	Average Daily Traffic Volume (veh/day)						
	2014	2015	2016	2017	2018	2019	*2041*
US 285 to Kelly Rd	2,800	2,800	2,800	2,800	5,800	7,900	*10,200*
Kelly Rd to Carter Rd	2,800	2,800	2,800	2,800	5,800	7,900	*10,700*
Carter Rd to Nymeyer Rd	3,200	3,200	3,200	3,200	6,500	8,700	*11,700*
Nymeyer Rd to Donaldson Farm Rd	3,700	3,700	3,700	3,700	7,300	10,000	*13,400*
Donaldson Farm Rd to Fishermans Ln	4,200	4,200	4,200	4,200	7,600	10,900	*14,800*
Fishermans Ln to Refinery Rd	4,000	4,000	4,000	4,000	7,500	10,500	*14,000*
Refinery Rd to NM 128	3,500	3,500	3,500	3,500	7,000	10,200	*13,600*
NM 128 to USC/Mosaic Site	2,200	2,200	2,200	2,200	2,800	3,200	*4,200*
USC/Mosaic Site to US 62	2,200	2,200	2,200	2,200	2,800	3,200	*4,300*

Exhibit 3-18. Number of Crashes and Crash Severity by Year for NM 31

Crash Severity	2014		2015		2016		2017		2018		2019		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fatal/Injury (FI)	9	38%	6	23%	0	0%	5	24%	17	44%	21	38%	58	33.3%
Property Damage Only (PDO)	15	63%	20	77%	8	100%	16	76%	22	56%	35	63%	116	66.7%
Total	24	-	26	-	8	-	21	-	39	-	56	-	174	-

Exhibit 3-19 summarizes detailed crash statistics for each segment along NM 31. The NM 31 corridor was divided into segments based on locations of major cross-roads and/or roadway geometry. Crashes were categorized as segment crashes and intersection-related crashes, although crash rates were calculated as segment rates because NM 31 traffic is uninterrupted throughout the corridor. Graphics illustrating crash occurrence are provided as **Exhibit 3-20** and **Exhibit 3-21**. Key observations based on the reported crash history include:

- A total of 174 crashes were reported for the six-year analysis period, of which 53% were segment crashes and 47% were intersection-related crashes.
- The predominant crash type is the rear-end crash at 33%. The next highest are overturn at 13%, head-on at 12%, and animal at 9%. The segment from MP 7.31 to 8.0 is where the highest number of rear-end crashes occurred, which includes the intersection of NM 31 at NM 128.
- The NM 31/NM 128 intersection is considered a high-crash location because it has a crash rate 4.5 times higher than the average segment crash rate. The crash rates are notable for the segments including Donaldson Farm Road, Kelly Road, Fishermans Lane, and Refinery Road; the rates range from 1.53 to 1.71 crashes per million vehicle miles of travel (cr/MVM), which are all above the average rate for the corridor of 1.18 cr/MVM.
- Crash severity is consistent with the statewide and county averages at 33.3%.
- Four (4) fatal crashes occurred during the analysis period. Fatal crashes occurred at the intersections of NM 31 and Kelly Road and NM 31 and NM 128, and along the corridor between MP 2.71 to 3.7 and MP 15.01 to 19.0. The fatal crashes were head-on, overturn, and right-angle crashes. The cause for fatal segment crashes were alcohol/drug involved, driver inattention, driving left of center, and disregarding the stop sign.

Based on the crash history review, improvements are needed to address safety concerns along NM 31 from Kelly Road to NM 128. Crash occurrence north of the NM 128 intersection does not indicate specific safety concerns. The types of improvements may include:

- The addition of left-turn and right-turn speed change lanes at the major cross-roads to NM 31 with proper deceleration and storage lengths.
- Providing a median to provide positive separation of the opposing travel directions.
- Providing additional traffic capacity at intersections and along highway segments.
- Adding rumble strips along the outside edges of the travel lanes and along the centerline where applicable.

These results should be considered along with the traffic operations performance results to determine improvement needs. In some instances, improvements needed to address safety concerns may increase operational delay thereby resulting in a reduced level of performance from a traffic operations view (i.e., prioritize safety over traffic operations).

Highway Safety Manual Analysis

The HSM analysis was performed using the IHSDM software. The IHSDM model has an extensive list of inputs that factor into the HSM Part C predictive methods. Below is a list of the inputs and sources.

- Existing horizontal & vertical alignments (exported from Civil3D surface created from 2020 survey)
- Functional Classification (NMDOT)
- Annual Average Daily Traffic 2014-2019 (available data)
- Roadway Cross Sections (2020 survey)
- Posted Speed & Design Speed (Posted speed limits & design team decision)
- Driveway Density (Google Earth)
- No Passing zones (Google Earth)
- Outside Barrier (2020 Survey)
- Roadside Hazard Rating (FHWA Roadside Ratings)
- Curb Location (Google Earth)
- Site Specific Crash Data (NMDOT)

The above data was imported/entered into the IHSDM model and one uniform section for NM 31 as a rural, two-lane undivided (2U) collector was produced for existing conditions. Two types of intersections were recognized in the IHSDM model including 3-legged minor-road stop control (3ST) and 4-legged minor-road stop control (4ST). The cross-roads along the corridor were not analyzed – only their intersection with NM 31. The historical crashes along the cross streets were not included in the analysis unless the crash occurred at/near the intersection with NM 31.

According to the HSM, the default value for the calibration factor of a two-lane undivided segment (2U) is 1.0. The calibration factor may be manually specified or calculated using site data. Based on data for NM 31 and NM 128, a calibration factor was calculated to be 0.84 and was implemented for rural two-lane undivided (2U) sections of NM 31 for all analysis scenarios.

The IHSDM Crash Prediction Module (CPM) also utilizes data from the HSM Chapter 10, Table 10-4 and Table 10-6, as default crash distributions for rural two-lane, two-way roadway segments and intersections, respectively. Default crash distributions are specified but can be manually specified based on project data. Because the NM 31 corridor has traffic patterns revolved around the oil and gas industry that are not typical of rural two-lane highways, the default distributions were considered inapplicable for this project. As such, project-specific crash distributions were calculated to better correlate to the corridor and were utilized for rural-two lane undivided (2U) sections of NM 31 as well as for major intersections.

Exhibit 3-19. Crash Statistics for Mainline NM 31, 6 Years (2014-2019)

NM 31 Analysis Segment	Major Intersection Included	Segment Length (mi)	Segment Crashes	Intersection-Related Crashes	Total Crashes	Segment Crash Rate (Cr/MVM)	% Severity			Crash Types									
							PDO	Injury	Fatal	Animal	Dropped Load	Fixed Object	Head-On	Left-Turn	Overturn	Rear-End	Right Angle	Sideswipe	Other
MP 0 to MP 0.60	Kelly Road	0.6	1	8	9	1.65	44%	44%	11%				1	1		4	2	1	
MP 0.61 to MP 1.70	Carter Road	1.1	3	9	12	1.07	50%	50%	0%	1				1		6	2	1	1
MP 1.71 to MP 2.70	Nymeyer Road	1.0	4	1	5	0.43	80%	20%	0%							2	2		1
MP 2.71 to MP 3.70	Donaldson Farm Road	1.0	12	8	20	1.71	80%	15%	5%	1	1	1	3		1	7	3	2	1
MP 3.71 to MP 5.0	Fishermans Lane	1.3	23	3	26	1.55	69%	31%	0%	1	3	2	2	1	3	9	1	3	1
MP 5.01 to MP 6.0	US Refinery Road (County Road 605)	1.0	8	11	19	1.53	68%	32%	0%	3		2	2		3	6	1	2	
MP 6.01 to MP 7.3		1.3	4	-	4	0.27	25%	75%	0%		1	1	2						
MP 7.31 to MP 8.0	NM 128 (Jal Highway)	0.7	7	35	42	5.27	64%	33%	2%	2		5	7		3	19	3	1	2
MP 8.01 to MP 10.40		2.4	7	-	7	0.54	71%	29%	0%			2	1			3			1
MP 10.41 to MP 14.0		3.6	6	-	6	0.31	83%	17%	0%	1			1		3		1		
MP 14.01 to MP 15.0	United Salt Mines Access/Cimarron	1.0	3	-	3	0.56	100%	0%	0%	2								1	
MP 15.01 to MP 19.0		4.0	10	-	10	0.46	80%	10%	10%	5		1			3				1
MP 19.01 to MP 20.5		1.5	4	-	4	0.49	75%	25%	0%		1				2			1	
MP 20.51 to MP 22.6	US 62	2.1	1	6	7	0.62	43%	57%	0%				1		4	1	1		
TOTAL		**22.6**	**93**	**81**	**174**	**1.18**	**66.7%**	**31.0%**	**2.3%**	16	6	14	20	3	22	57	16	12	8
Note: Results are based on summarized crash data and should be considered approximate.										9.2%	3.4%	8.0%	11.5%	1.7%	12.6%	32.8%	9.2%	6.9%	4.6%

Exhibit 3-20. Crash Density along NM 31

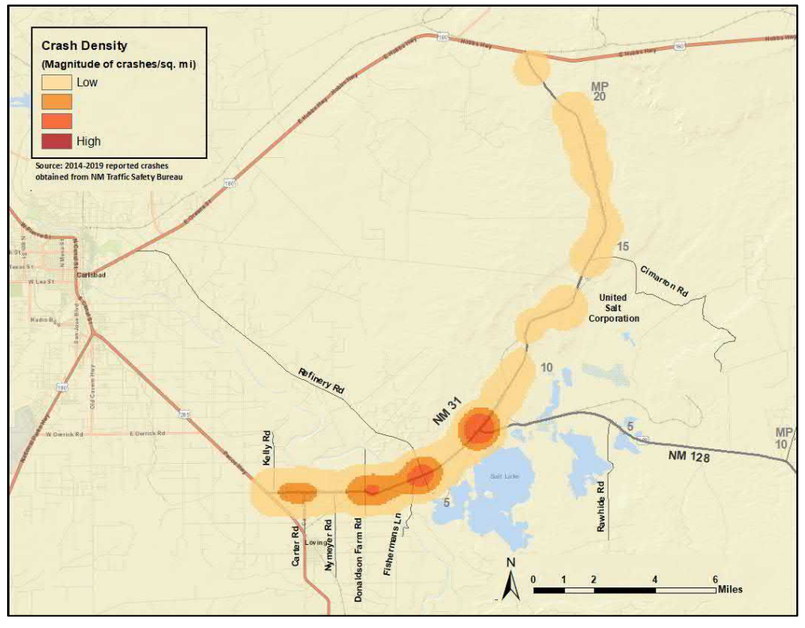
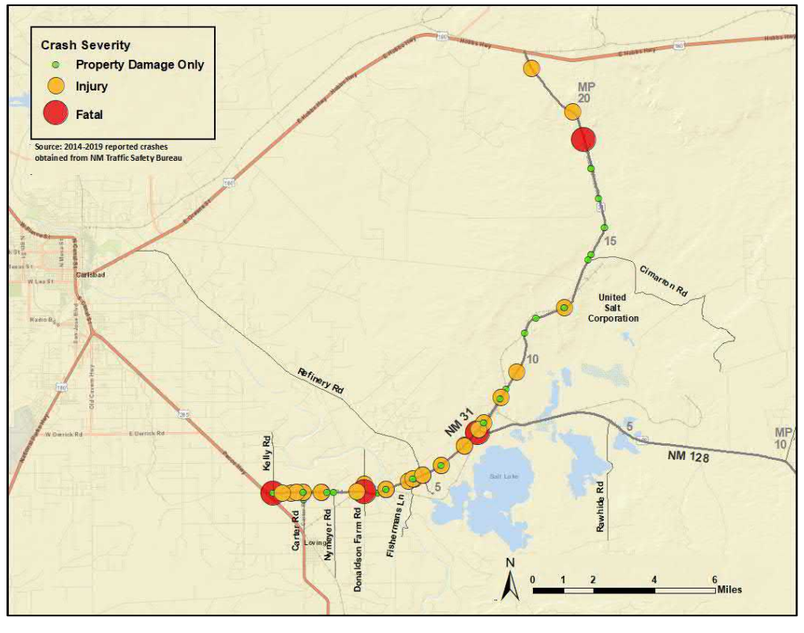


Exhibit 3-21. Crash Severity along NM 31



NM 31 Existing Conditions IHSDM Results

The IHSDM existing conditions model produces "Predicted Crash Frequencies" based on the inputs listed above. The model then performs an Empirical Bayes (EB) calibration to estimate the "Expected Crash Frequencies" which were compared to the reported/observed crashes for the corridor.

Exhibit 3-22 summarizes the results for the existing conditions along the NM 31 corridor. The expected crash frequency of 182 crashes was greater than the observed crash history of 169 crashes. Note that the IHSDM model did not recognize five of the observed crashes due to the crash type which reduced the observed crashes from 174 to 169 for the six-year period. The expected severity was 64.3% PDO and 35.7% FI, compared to 65.7% PDO and 34.3% FI based on the observed crash history. The comparisons indicate that the IHSDM model results are reasonable.

An estimate of the cost of crashes for existing conditions was made using the economic evaluation module of the IHSDM. Using the KABCO unit costs by severity level from the HSM shown in **Exhibit 3-23**, the estimated cost of crashes for the NM 31 corridor is approximately $6.8M annually. The output reports for the HSM safety analyses are provided in the ***electronic appendices***.

Exhibit 3-22. Existing Conditions IHSDM Results for NM 31

Crashes		Existing Conditions		
		2014 - 2019	Annual Average	Severity %'s
		Rural 2-Lane Undivided (2U)	Rural 2-Lane Undivided (2U)	
Calibration Factor		0.84	0.84	
Crash Distribution		Project Specific	Project Specific	
Observed	Total	169	28	
	FI	58	10	34.3%
	PDO	111	19	65.7%
Predicted	Total	196	33	
	FI	72	12	36.7%
	PDO	124	21	63.3%
Expected	Total	182	30	
	FI	65	11	35.7%
	PDO	117	20	64.3%
Cost of Crashes		$ 40,970,453.00	$ 6,828,408.83	

Exhibit 3-23. KABCO Unit Crash Costs (2016)

Severity Level	2016 Unit Crash Cost
Fatality (K)	$ 11,295,400.00
Disabling Injury (A)	$ 655,000.00
Evident Injury (B)	$ 198,500.00
Possible Injury (C)	$ 125,600.00
PDO (O)	$ 11,900.00

3.2.2 NM 128 Crash Experience

Traffic Volume Data for Crash Rate Calculations

Exhibit 3-24 summarizes the Average Daily Traffic (ADT) volumes along NM 128 used to calculate crash rates. The ADTs are two-way volumes. The ADTs for 2014 to 2019 were estimated based on available traffic count data from NMDOT, other ongoing projects in the corridor, and StreetLight Big Data. The future-year daily traffic estimates were based on a 0.85% annual growth rate to project the 2019 volumes to the design year of 2041 (1.2 factor for 22 years of growth). The annual growth rate was based on population growth estimates for Eddy County and Lea County.

Exhibit 3-24. Average Daily Traffic Volumes along NM 128

Segment	Average Daily Traffic Volume (veh/day)						
	2014	2015	2016	2017	2018	2019	*2041*
MP 0.0 to WIPP Rd	3,000	3,000	3,000	3,000	6,000	8,200	*10,600*
WIPP Rd to Red Rd	3,000	3,000	3,000	3,000	6,000	8,200	*10,600*
Red Rd to Buck Jackson Rd	3,000	3,000	3,000	3,000	6,000	8,200	*10,600*
Buck Jackson Rd to Orla Rd	3,000	3,000	3,000	3,000	6,000	8,200	*11,500*
Orla Rd to Delaware Basin Rd	3,400	3,400	3,400	3,400	7,000	9,200	*12,000*
Delaware Basin Rd to Battle Axe Rd	3,400	3,400	3,400	3,400	7,000	9,200	*12,600*
Battle Axe Rd to 3rd St	3,600	3,600	3,600	3,600	7,200	10,400	*14,000*
3rd St to NM 18	3,600	3,600	3,600	3,600	7,200	9,400	*12,600*
NM 18 to Schooley Rd	2,400	2,400	2,400	2,400	4,800	6,200	*8,300*
Schooley Rd to Willis Rd	2,400	2,400	2,400	2,400	4,800	6,200	*8,300*
Willis Rd to MP 59.9	2,400	2,400	2,400	2,400	4,800	6,200	*8,300*

Crash Data Evaluation

The total number of crashes summarized by year and crash severity for the NM 128 corridor are shown in **Exhibit 3-25**. Crash occurrence was consistent from 2014 to 2017 then doubled in 2018 and tripled in 2019. The statewide average percentage of fatal/injury (FI) and property damage only (PDO) crashes reported in the *2019 New Mexico Traffic Crash Annual Report* were 30.3%, and 69.7%, respectively. Based on the same report, the crash severity for Eddy and Lea counties combined was 29.6% FI and 70.4%% PDO. For the NM 128 corridor, while the FI severity rate varies from year to year, the six-year average was below the statewide and county averages at 26.6%.

Exhibit 3-25. Number of Crashes and Crash Severity by Year for NM 128

Crash Severity	2014		2015		2016		2017		2018		2019		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fatal/Injury (FI)	17	30%	12	22%	13	22%	15	23%	37	28%	52	28%	146	26.6%
Property Damage Only (PDO)	39	70%	42	78%	46	78%	50	77%	94	72%	131	72%	402	73.4%
Total	56	-	54	-	59	-	65	-	131	-	183	-	548	-

Exhibit 3-26 (on following page) summarizes detailed crash statistics for each segment along NM 128. The NM 128 corridor was divided into segments based on locations of major cross-roads and/or roadway geometry. In rural areas, crashes were categorized as segment crashes and intersection-related crashes, although crash rates were calculated as segment rates because NM 128 traffic is uninterrupted along the rural segments. Intersection crash rates were calculated for the two all-way stop-controlled intersections in Jal, at NM 18 and at 3rd Street. Graphics illustrating crash occurrence are provided as **Exhibit 3-27 and Exhibit 3-28**. Key observations based on the reported crash history include:

- A total of 548 crashes were reported for the six-year analysis period, of which 64% were segment crashes and 36% were intersection-related crashes.
- The predominant crash type is the rear-end crash at 28%. The next highest was for a compilation of various 'Other' types of crashes at 20%, followed by right-angle at 13% and head-on at 11%.
- The crash rates are considered higher than expected for the segments including Orla Road, Red Road/Twin Wells East, Battle Axe Road, Delaware Basin Road, Brininstool/Diamond Road, and Schooley Road. The rates range from 1.64 to 5.15 crashes per million vehicle miles of travel (cr/MVM), which are all above the average rate for the corridor of 1.29 cr/MVM.
- The segment with Orla Road has the highest crash rate, including the highest occurrence of right-angle, animal, fixed object, and 'other' crashes.
- The crash rate in Jal between 8th Street and 3rd Street is notable. Many of the crashes in this segment may be attributed to the queues that form along this segment of NM 128 west of 3rd Street due to all-way stop control.
- There were a total of 23 fatal crashes, 19 of which occurred along the corridor as a segment crash and 4 were intersection-related.
- Over 52% (12) of the fatal segment crashes occurred in the 20-mile segment from MP 28 to MP 48 (six eastbound, six westbound). Another 17% (4) occurred from NM 0.5 to MP 6 (one eastbound, three westbound).
- The segment fatal crashes were head-on, rear-end, right-angle, overturn and other-vehicle crash types, and were caused due to driver inattention, driving left of center, improper overtaking, and following too close. Nine (9) of the 19 fatal segment crashes were head-on crashes; 5 of 9 were due to driving left of center.
- The 4 fatal intersection-related crashes varied in terms of crash type and the cause of accident as follows:
  - Brininstool Road/Diamond Road: sideswipe; alcohol/drug related
  - Vaca Lane: rear-end; driver inattention
  - Delaware Basin Road: right angle; disregarded stop sign
  - Blocker Lane: head on; drove left of center

Based on the crash history review, improvements are needed to address safety concerns along NM 128. The types of improvements may include:

- The addition of left-turn and right-turn speed change lanes at the major cross-roads to NM 128 with proper deceleration and storage lengths.
- Providing a median to provide positive separation of the opposing travel directions.
- Providing additional traffic capacity at intersections and along highway segments.
- Adding rumble strips along the outside edges of the travel lanes and along the centerline where applicable.

Exhibit 3-27. Crash Density along NM 128

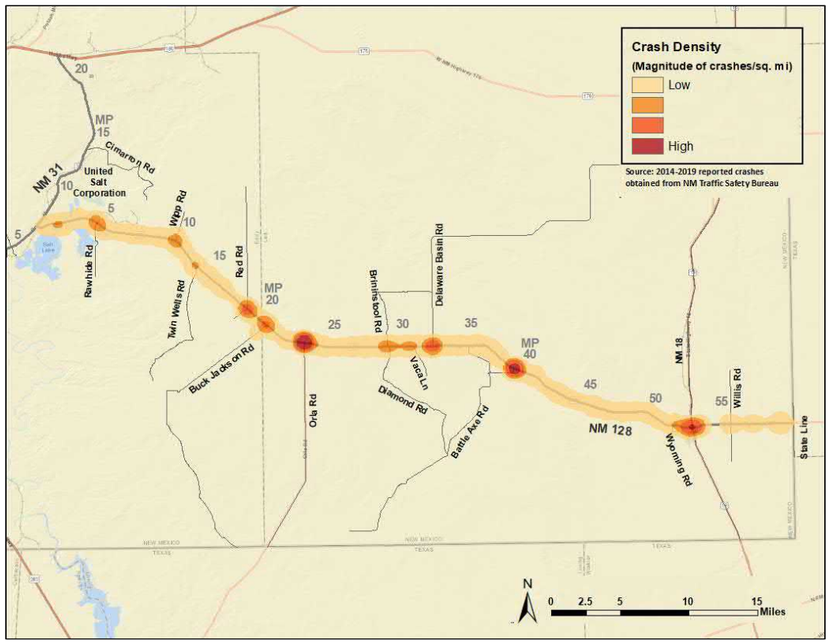


Exhibit 3-28. Crash Severity along NM 128

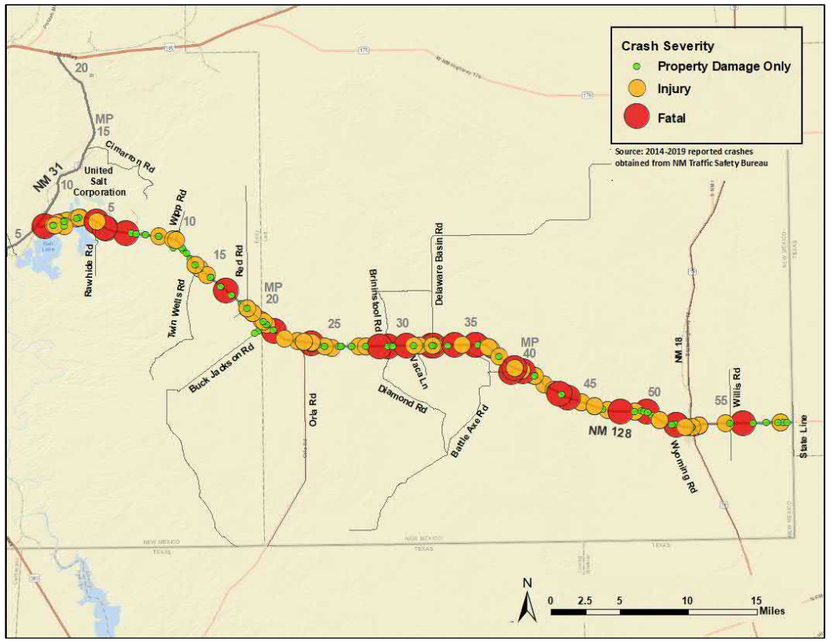


Exhibit 3-26. Crash Statistics for Mainline NM 128, 6 Years (2014-2019)

NM 128 Analysis Segment	Major Intersection Included	Segment Length (mi)	Segment Crashes	Intersection Crashes	Total Crashes	Segment Crash Rate (Cr/MVM)	Intersection Crash Rate (Cr/MEV)	Crash Severity			Crash Types										
								Property Damage Only	Injury	Fatal	Animal	Dropped Load	Fixed Object	Head On	Left-Turn	Overturn	Parked	Rear-End	Right-Angle	Sideswipe	Other
MP 0.5 to MP 4.0		3.5	33	-	33	0.99	-	67%	30%	3%	1	-	-	4	-	-	-	20	1	4	3
MP 4.01 to MP 6.0	Rawhide Road (CR 793)	2.0	15	2	17	0.89	-	47%	35%	18%	-	1	-	3	-	2	-	2	3	2	4
MP 6.01 to MP 10.0		4.0	15	-	15	0.39	-	73%	20%	7%	1	1	-	5	-	3	-	4	-	-	1
MP 10.01 to MP 12.0	Wipp Road	2.0	8	8	16	0.84	-	81%	19%	0%	1	1	2	2	-	2	1	-	4	-	3
MP 12.01 to MP 17.0	Twin Wells (West)	5.0	23	-	23	0.48	-	83%	13%	4%	5	1	1	1	-	1	-	8	1	1	4
MP 17.01 to MP 18.0	Red Road/Twin Wells (East)	1.0	8	19	27	2.82	-	74%	26%	0%	1	1	3	3	-	5	1	2	7	-	4
MP 18.01 to MP 22.0	Buck Jackson Road (CR 786)	4.0	21	13	34	0.89	-	82%	15%	3%	4	-	1	2	1	2	2	12	2	1	7
MP 22.01 to MP 23.0	Orla Road (CR 1)	1.0	19	37	56	5.15	-	84%	16%	0%	8	-	5	2	1	5	-	6	15	1	13
MP 23.01 to MP 28.0		5.0	31	-	31	0.57	-	71%	26%	3%	-	-	3	7	-	5	-	11	1	2	2
MP 28.01 to MP 29.0	Brininstool Rd/Diamond Rd	1.0	13	6	19	1.75	-	74%	16%	11%	2	1	-	4	-	2	-	3	3	2	2
MP 29.01 to MP 31.0	Vaca Lane	2.0	13	6	19	0.87	-	74%	16%	11%	1	1	-	2	-	-	-	8	3	-	4
MP 31.01 to MP 33.0	Delaware Basin Road	2.0	24	20	44	2.02	-	68%	30%	2%	8	1	1	3	-	5	1	14	4	1	6
MP 33.01 to MP 38.0		5.0	28	-	28	0.51	-	50%	39%	11%	-	1	-	2	-	1	-	9	3	3	9
MP 38.01 to MP 39.0	Battle Axe Road (CR 2)	1.0	8	24	32	2.74	-	84%	16%	0%	3	-	-	1	-	7	-	4	6	2	9
MP 39.01 to MP 48.0		9.0	36	-	36	0.34	-	56%	33%	11%	-	-	-	8	-	1	-	13	4	4	6
MP 48.01 to MP 50.60		2.6	12	-	12	0.40	-	67%	25%	8%		-	-	3	-	-	-	3	2	-	4
MP 50.61 to MP 51.90	Wyoming Road	1.3	8	6	14	0.92	-	57%	36%	7%	1	-	-	2	-	1	-	2	2	1	5
MP 51.91 to MP 52.30	8th St to 2nd St (3rd Street)	0.4	4	32	36	-	1.16	92%	8%	0%	-	-	-	2	-	-	-	15	6	2	11
MP 52.31 to MP 52.69	NM 18	0.4	-	26	26	-	0.61	81%	19%	0%	-	-	3	3	1	1	-	10	3	-	5
MP 52.7 to MP 53.40	Schooley Road	0.7	13	-	13	1.64	-	69%	31%	0%	-	-	1	-	-	-	-	6	2	-	4
MP 53.41 to MP 59.9	Blocker Lane	6.5	17	-	17	0.35	-	82%	12%	6%	3	2	-	1	-	2	1	2	1	1	4
TOTAL		**59.4**	**349**	**199**	**548**	**1.29**	**0.88**	**73.4%**	**22.4%**	**4.2%**	**39**	**11**	**20**	**60**	**3**	**45**	**6**	**154**	**73**	**27**	**110**
Note: Results are based on summarized crash data and should be considered approximate.											**7.1%**	**2.0%**	**3.6%**	**10.9%**	**0.5%**	**8.2%**	**1.1%**	**28.1%**	**13.3%**	**4.9%**	**20.1%**

These results should be considered along with the traffic operations performance results to determine improvement needs. In some instances, improvements needed to address safety concerns may increase operational delay thereby resulting in a reduced level of performance from a traffic operations view (i.e., prioritize safety over traffic operations).

Highway Safety Manual Analysis

The HSM analysis was performed using the IHSDM software. The IHSDM model has an extensive list of inputs that factor into the HSM Part C predictive methods. Below is a list of the inputs and sources.

- Existing horizontal & vertical alignments (exported from Civil3D surface created from 2020 survey)
- Functional Classification (NMDOT)
- Annual Average Daily Traffic 2014-2019 (available data)
- Roadway Cross Sections (2020 survey)
- Posted Speed & Design Speed (Posted speed limits & design team decision)
- Driveway Density (Google Earth)
- No Passing zones (Google Earth)
- Outside Barrier (2020 Survey)
- Roadside Hazard Rating (FHWA Roadside Ratings)
- Curb Location (Google Earth)
- Site Specific Crash Data (NMDOT)

The above data was imported/entered into the IHSDM model and one continuous section for NM 128 as a rural, two-lane undivided (2U) collector was produced for existing conditions. The three-lane section in Jal was modeled as a two-lane highway (2U) with a two-way left-turn lane (TWLTL). The cross-roads along the corridor were not analyzed – only their intersection with NM 128. The historical crashes along the cross streets were not included in the analysis unless the crash occurred at/near the intersection with NM 128.

Two types of intersections were recognized in the IHSDM model including 3-legged minor-road stop control (3ST) and 4-legged minor-road stop control (4ST). Two intersections with all-way stop control exist in Jal, but the IHSDM does not model all-way stop control. This limitation may result in underprediction of crashes at the NM 18 and 3rd Street intersections because of the congestion that exists in Jal at these intersections.

According to the HSM, the default value for the calibration factor of a two-lane undivided segment (2U) is 1.0. The calibration factor may be manually specified or calculated using site data. Based on data for NM 31 and NM 128, a calibration factor was calculated to be 0.84 and was implemented for rural two-lane undivided (2U) sections of NM 128 for all analysis scenarios.

The IHSDM Crash Prediction Module (CPM) also utilizes data from the HSM Chapter 10, Table 10-4 and Table 10-6, as default crash distributions for rural two-lane, two-way roadway segments and intersections, respectively. Default crash distributions are specified but can be manually specified based on project data. Because the NM 128 corridor has traffic patterns revolved around the oil and gas industry that are not typical of rural two-lane highways, the default distributions were considered inapplicable for this project. As such, project-specific crash distributions were calculated to better correlate to the corridor and were utilized for rural-two lane undivided (2U) sections of NM 128 as well as for major intersections.

NM 128 Existing Conditions IHSDM Results

The IHSDM existing conditions model produces "Predicted Crash Frequencies" based on the inputs listed above. The model then performs an Empirical Bayes (EB) calibration to estimate the "Expected Crash Frequencies" which were compared to the reported/observed crashes for the corridor.

Exhibit 3-29 summarizes the results for the existing conditions along the NM 128 corridor. The expected crash frequency of 544 crashes was greater than the 528 crashes used by IHSDM. Note that the IHSDM model did not recognize twenty of the observed crashes due to the high number of "other" crash type which reduced the observed crashes from 548 to 528 for the six-year period. The expected severity was 70.0% PDO and 30.0% FI, compared to 72.7% PDO and 27.3% FI based on the observed crash history. The comparisons indicate that the IHSDM model results are reasonable.

Exhibit 3-29. Existing Conditions IHSDM Results for NM 128

Crashes		Existing Conditions		
		2014 - 2019	Annual Average	Severity %'s
		Rural 2-Lane Undivided (2U)	Rural 2-Lane Undivided (2U)	
Calibration Factor		0.84	0.84	
Crash Distribution		Project Specific	Project Specific	
Observed	Total	528	88	
	FI	144	24	27.3%
	PDO	384	64	72.7%
Predicted	Total	546	91	
	FI	196	33	35.9%
	PDO	350	58	64.1%
Expected	Total	544	91	
	FI	163	27	30.0%
	PDO	381	64	70.0%
Cost of Crashes		$105,865,549.80	$17,644,258.30	

An estimate of the cost of crashes for existing conditions was made using the economic evaluation module of the IHSDM. Using the KABCO unit costs by severity level from the HSM shown in **Exhibit 3-23**, the estimated cost of crashes for the NM 128 corridor is approximately $17.6M annually. The output reports for the HSM safety analyses are provided in the ***electronic appendices***.

3.3 Roadway Conditions and Features

Existing roadway conditions are based on field observations, as-built plans, right-of-way maps, and other state and county information. The pertinent roadway conditions described herein include posted speeds, typical sections, horizonal and vertical alignment, general type and extent of access, and pavement condition.

3.3.1 NM 31 Roadway Conditions

The review of existing conditions relied on As-Built plans, photogrammetry and Lidar data, and field reviews. The following As-built plans were reviewed:

- MP 0.0 to 5.25; Project No. A1-FAS-85-B(1), 1942
- MP 3.3 to 3.85; Control No. 3681, Project No. BR-0031(12)03, 2002
- MP 7.25 to 22.60; Project No.S-1206(200), 1978

As-built plans were not available for the area from MP 5.25 to MP 7.25. The age and reproduction quality of most of the as-built plans limited their use for determining horizontal and vertical alignment. For this reason, photogrammetry and Lidar data was the primary information source for determining existing conditions on NM 31.

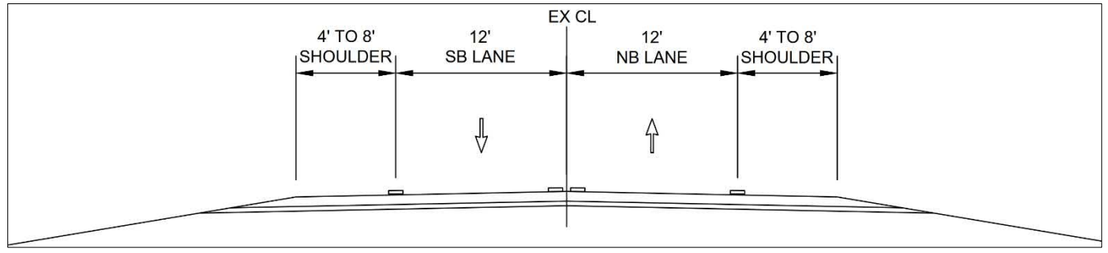
Posted Speeds

The posted speed limit along NM 31 are consistent and is 55 mph in the eastbound direction and for the majority of the westbound direction. The posted speed limit decreases from 55 mph to 50 mph after Refinery Road to US 285. Advisory speed limits of 50 mph are posted at three locations.

Typical Sections

NM 31 is a two-lane highway for the entirety of its length from its start at US 285 to its terminus at US 62. The predominant typical section consists of two 12-foot lanes and shoulders that vary between 4-feet to 8-feet wide. Turn lanes are provided at the intersections of NM 31 at Refinery Road and at NM 128. **Exhibit 3-30** depicts the predominant typical section for NM 31.

Exhibit 3-30. NM 31 Typical Section



Roadway Horizontal Alignment

The basis for the horizontal alignment was the survey centerline provided by NMDOT; this is thought to be based on right-of-way maps and as-built plans. This survey centerline was refined using photogrammetry and aerial photography as it was not always the same as apparent roadway centerline in the imagery. The horizontal alignment data that follows is of the apparent roadway centerline.

Superelevation rates (SE) were determined using the LiDAR surface of the existing pavement. In instances where the pavement had different cross slopes in each direction, an average was taken. AASHTO Green Book Table 3-9, *Minimum Radii for Design Superelevation Rates, Design Speeds, and e_{max} = 6%*, was used to determine the actual design speeds based on existing curve radii and SE rates.

The analysis identified 19 horizontal curves within the project limits with SE rates ranging from normal crown up to 8.0%. Of the 19 horizontal curves, 10 do not meet the criteria for the posted speed. **Exhibit 3-31** summarizes the locations with deficient horizontal curvature.

Exhibit 3-31. Deficient Horizontal Curves on NM 31

Existing Milepost	Radius (feet)	SE	Posted Speed	Proposed Design Speed	SE Required (6% Emax)	Actual Design Speed
3.17	1910.0	4.8%	50 mph	60 mph	5.6%	50 mph
5.21	4904.3	N.C.	50 mph	60 mph	3.2%	35 mph
5.67	5711.1	1.6%	55 mph	60 mph	2.8%	40 mph
6.90	5735.7	R.C.	55 mph	60 mph	2.8%	50 mph
8.17	5741.1	2.2%	55 mph	60 mph	2.8%	50 mph
10.27	3818.2	2.2%	55 mph	60 mph	3.8%	40 mph
12.11	5728.8	R.C.	55 mph	60 mph	2.8%	50 mph
13.07	1909.9	2.4%	55 mph	60 mph	5.6%	30 mph
14.26	3410.7	3.2%	55 mph	60 mph	4.0%	50 mph
15.77	3819.9	3.4%	55 mph	60 mph	3.8%	55 mph

Note: N.C. = normal crown; R.C. = reverse crown

Roadway Vertical Alignment

The existing vertical alignment of NM 31 was reviewed from LiDAR and photogrammetry surface data and approximated using AutoCAD Civil 3D. The following minimum K-values are recommended from the AASHTO Green Book for a design speed of 60 mph (posted speed plus 5 mph):

- Stopping sight distance (SSD): minimum K values of 151 for crest curves and 136 for sag curves were used.
- Passing sight distance (PSD): a minimum K value of 357 was used for crest curves.

Review of the data for the existing alignment of NM 31 identified a total of 105 vertical curves including 50 crest curves and 55 sag curves. Of these, 41 of the crest curves do not meet criteria for stopping site distance and/or passing site distance. Of the 41 crest curves, 12 do not meet criteria for either stopping site distance or passing site distance. **Exhibit 3-32** lists the crest curves and their performance for PSD and SSD.

Exhibit 3-32. Deficient Vertical Crest Curves on NM 31

Location (MP)	Length (feet)	Existing K-Value	Actual Design Speed (MPH)	Proposed Design Speed (MPH)	Meets SSD Criteria for Posted Speed	Meets PSD Criteria for Posted Speed	Posted for No Passing
1.65	700	253.83	70	60	Yes	No	No
2.20	1000	269.9	70	60	Yes	No	Yes
3.25	850	197.79	65	60	Yes	No	Yes
3.50	350	218.39	65	60	Yes	No	SB Direction
3.99	200	223.84	65	60	Yes	No	NB Direction
4.63	700	263.11	70	60	Yes	No	SB Direction
4.91	350	207.08	65	60	Yes	No	NB Direction
5.22	600	222.76	65	60	Yes	No	NB Direction
5.74	200	223.28	65	60	Yes	No	No
5.96	200	150.07	60	60	No	No	NB Direction
6.12	350	59.12	40	60	No	No	Yes
6.49	250	92.13	50	60	No	No	NB Direction
6.62	375	118.27	55	60	No	No	SB Direction
7.10	300	233.65	65	60	Yes	No	No
8.60	400	219.22	65	60	Yes	No	No
8.70	200	224.65	65	60	Yes	No	SB Direction
9.34	200	59.36	40	60	No	No	SB Direction
9.69	550	82.81	45	60	No	No	SB Direction
9.92	250	159.27	60	60	Yes	No	SB Direction
10.24	300	190.83	60	60	Yes	No	NB Direction
10.43	400	134.27	55	60	No	No	Yes
10.68	200	75.76	45	60	No	No	Yes
11.02	200	195.02	65	60	Yes	No	Yes
12.07	200	180.94	60	60	Yes	No	NB Direction
12.20	350	94.51	50	60	No	No	No
12.60	350	320.34	75	60	Yes	No	No
12.78	375	83.88	50	60	No	No	NB Direction
13.36	250	195.64	65	60	Yes	No	Yes
13.95	250	147.51	55	60	No	No	No
14.15	125	117.51	55	60	No	No	SB Direction
14.41	300	195.36	65	60	Yes	No	SB Direction
14.84	1100	258.46	70	60	Yes	No	SB Direction
16.19	450	283.05	70	60	Yes	No	SB Direction
17.68	950	201.59	65	60	Yes	No	NB Direction
18.45	200	165.36	60	60	Yes	No	No
18.65	300	273.58	70	60	Yes	No	No
19.01	1300	203.03	65	60	Yes	No	Yes
19.96	500	202.14	65	60 MPH	Yes	No	SB Direction
20.74	200	281.9	70	60 MPH	Yes	No	NB Direction
20.81	200	307.86	70	60 MPH	Yes	No	NB Direction
20.99	300	251.48	70	60 MPH	Yes	No	SB Direction

Pavement Conditions

Existing pavement conditions for NM 31 are documented in two separate investigations: 1) *Pavement Condition Assessment Report, NM 31 MP 0.00 – 22.67*, dated June 5, 2020, prepared by NMDOT Pavement Management & Design Bureau, and 2) Wood Environment & Infrastructure Solutions in 2020. The NMDOT investigations included pavement cores collected in 2018 between MP 0 and MP 8 in the eastbound direction. According to the report, pavement (asphalt and OGFC) thicknesses ranged from 4.75 inches to 12.75 inches, with an average of 8.4 inches. No base course was found except at MP 7.75 and MP 8 (6 inches and 4.25 inches, respectively).

Pavement cores were collected between MP 8.25 and MP 22.67 by Wood Environment & Infrastructure Solutions in late 2020. The core samples show the asphalt thickness varies between 6 and 9 inches and base course thickness ranged between 3 and 6 inches. In addition, 66 pavement borings were performed to a depth of five feet.

Pavement distress observations were recorded for the entire length of NM 31 as part of a site reconnaissance investigation performed in March 2020 by Wood personnel as well as a review of documentation provided by WSP. The findings for NM 31 are summarized below.

- Between MP 0 and MP 5, pavement distress was noted in the form of rutting, transverse and alligator cracking, and potholes in both the east and westbound lanes of traffic. There were also several areas which had evidence of patching. These conditions were located before and after the bridge over the Pecos River and in the area of the railroad crossing. Pavement conditions in this area are characterized as poor.
- Between MP 5 and MP 9, pavement conditions appear to be fair to good during the Wood reconnaissance performed in June of 2020. There were areas of minimal distress noted. Heavy truck traffic was also noted during this site reconnaissance.
- Between MP 9 and MP 11, the roadway pavement was characterized as poor with a few exceptions noted to be in fair condition. Just east of the railroad crossing around MP 9, severe alligator cracking was noted around MP 9.2. Potholes in the westbound lane were also noted. Another area of severe alligator cracking was also noted around MP 10.
- From MP 11 to MP 13, the pavement was considered to be in fair to good condition. A section of pavement at approximately MP 11.1 was noted to have some alligator cracking, but it was not noted over a substantial length.
- In the area between MP 13 and MP 16, a railroad crossing and access roads for the Mosaic Main Plant Entrance #1 and Entrance #2. Very poor roadway conditions were noted up to about MP 13.5.
- From MP 16 to the end of the NM 31 alignment at MP 22.5, the pavement was noted to be in fair condition. The WSP reconnaissance documented severe alligator cracking at the turnout in the northbound lane near MP 19 as well as in both lanes near MP 22.4 and 22.5.

NMDOT Bikeway Plan Applicability to NM 31

Per the *New Mexico Prioritized Statewide Bicycle Network Plan*, December 2018, NM 31 is a rural Tier 2 facility from US 285 to NM 128 and a rural Tier 3 facility from NM 128 to US 62. NM 31 is not a designated bike route. Tier 2 routes for rural highways with vehicle speeds over 50 mph and daily traffic over 1,500 vpd with 10% trucks or more, require a wide shoulder bikeway that is more than five-feet in width not including rumble strips. Bicycle pavement markings and bicycle buffers adjacent to right-turn lanes are not required. NM 31 currently meets these requirements from US 285 to NM 128. Tier 3 routes include highways with little to no existing or latent demand for bicycling and does not require accommodations for bicycles. Although, shoulders may be provided for vehicular safety, NM 31 north of NM 128 currently has two-foot shoulders which are not desirable for bicycle travel.

3.3.2 NM 128 Roadway Conditions

Information sources for NM 128 include the as-built plans and associated right-of-way maps listed in **Exhibit 3-33**.

Exhibit 3-33. NM 128 Highway As-Built Plans Reviewed

Control Number (CN)	Project Number	Year	Begin MP	End MP
Full Reconstruction				
G2112	AC-GRIP-(WA)-(TPM)-0128(12)	2007	0.00	11.26
G2122	AC-GRIP-(TPM)-0128(13)10	2008	10.90	24.70
G2132	TPM-(GRIP)-1271(14)22	2009	24.70	38.81
G2142	AC-GRIP-(TPM)-0128(16)47	2009	38.81	48.74
G2162	AC-GRIP-(TPM)-0128(22)48	2006	48.50	52.50
G2152	AC-GRIP-(TMP)-0128-(16)47	2005	52.61	59.98
Full Depth Reclamation (FDR)				
2104340	2104340	2020	11.800	28.838
2102100	2102100	2016	38.800	51.581
Project On-Hold				
2102101	2102101 (Jal)	N/A	51.53	52.49
Minor Project (maintenance)				
2100480	2100480	2012	1.840	24.700
Superseded (Original Highway)				
-	S-1271(4)	1955	0.0	9.15
-	S-1271(5); Ends at county line	1956	9.20	18.90
-	S-1271(3); Starts at county line	1955	18.90	28.50
-	S-1271(1)	1954	28.50	52.48

Posted Speeds

The posted speed limits along NM 128 are summarized in **Exhibit 3-34**. As shown above, much of this highway was reconstructed between 2005 and 2009 with a 70-mph design speed. Within the past 2 years, from approximately MP 0.8 to MP 48.0, the posted speed was reduced from 65 mph to 55 mph. While the posted speed was reduced, the assessment of the roadway for this segment was based on a 70-mph design speed (i.e., instead of posted plus 5 mph).

Exhibit 3-34. Posted Speed Limits on NM 128

Mile Post Begin	Mile Post End	Speed Limit (mph)	Intersections within these Segments
0.0	0.8	55	None
0.8	48.0	55	Rawhide Road, WIPP Road, Red Road, Buck Jackson Road, Orla Road, Delaware Basin Road, Battle Axe Road
48.0	51.4	55	None
51.4	51.7	45	Wyoming Road
51.7	53.1	35	Continental Road, 3rd Street, NM 18
53.1	53.8	45	Schooley Road
53.8	54.4	55	None
54.4	59.9	65	Willis Road

Typical Sections

The typical sections for the existing NM 128 highway are shown in **Exhibit 3-35** (to right). The existing highway consists of two 12-foot travel lanes with shoulders of 6.9 feet or 8.0 feet. The highway originally had 8-foot shoulders; however, it is expected that full depth reclamation (FDR) projects to rehabilitate the pavement resulted in a shoulder width reduction to 6.9 feet because the reclamation material was not sufficient to restore the full shoulder widths. In Jal, there is a three-lane section including a two-way left-turn lane (TWLTL) and five-foot sidewalks on both sides. Roadway corridor lighting is also provided in Jal.

Roadway Horizontal Alignment

The existing horizontal alignment of the NM 128 two-lane highway is comprised of long tangents and relatively few curves given the length of the project. As-built plans and right-of-way maps for the corridor indicate 34 horizontal curves and a series of Points of Intersection (PI) within the project limits. Superelevation (SE) rates range from normal crown to 6.0%. Based on a review of the as-built plans and the proposed design speed, a number of the horizontal curves do not meet horizontal alignment engineering criteria. **Exhibit 3-36** (below) summarizes the horizontal curves identified as deficient which will be further evaluated as the design of the improvements progresses. As shown in **Exhibit 3-36**, the horizontal curves are close to meeting the design standards and should not require substantive improvements to meet desired design criteria.

Exhibit 3-36. Deficient Horizontal Curves on NM 128

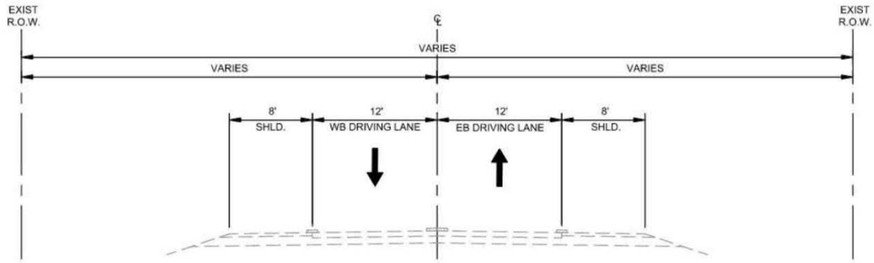
PI Station	Existing Milepost	Radius (feet)	SE	Posted Speed	Proposed Design Speed	SE Required (6% Emax)	Actual Design Speed
25+96.82	0.30	1,936	5.40%	55 mph	60 mph	5.6%	55 mph
571+89.71	10.64	2,950	5.30%	55 mph	70 mph	5.4%	65 mph
683+16.09	12.74	4,000	4.00%	55 mph	70 mph	4.6%	65 mph
892+52.65	16.67	12,000	N.C.	55 mph	70 mph	2.0% (RC)	60 mph
1137+76.93	21.30	6,250	3.00%	55 mph	70 mph	3.2%	65 mph
1245+54.33	23.32	6,000	3.00%	55 mph	70 mph	3.4%	65 mph
1299+34.33	24.33	5,645	3.00%	55 mph	70 mph	3.4%	60 mph
2589+55.07	48.53	8,000	N.C.	55 mph	60 mph	2.0% (RC)	50 mph

Roadway Vertical Alignment

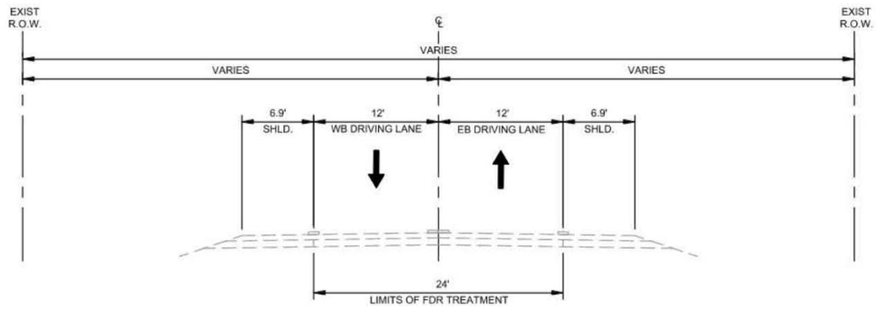
The existing vertical alignment of NM 128 has mild grades through most of the corridor. All grades are typically less than 3%, with most less than 2%. As-built plans were used to evaluate the existing vertical alignment and determine where vertical curves may be deficient for the proposed design speed. A total of 241 vertical curves were found. All of these curves were analyzed for stopping sight distance (SSD) and the crest vertical curves were analyzed for passing sight distance (PSD). The roadway is currently signed and marked "No Passing" on the vertical curves that do not meet stopping sight distance, and on most, but not all of the vertical curves that do not meet passing sight distance criteria.

Adequate SSD is provided at all crest curves and only one sag curve at MP 59.85 at the Texas border has a K-value less than that required in the AASHTO Green Book. However, the sag curve does satisfy the driver comfort criteria and does not require correction. Thirty-five (35) crest vertical curves where passing could be allowed do not meet the AASHTO Green Book PSD for the posted speed. **Exhibit 3-37** shows the relevant analysis data for the as-built documented vertical curves that are deficient for PSD criteria.

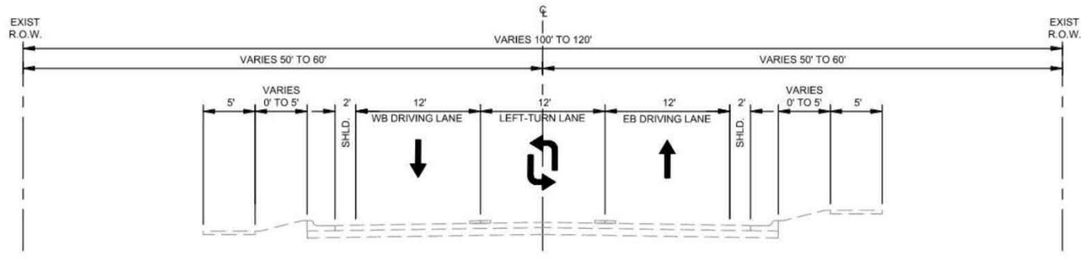
Exhibit 3-35. Existing Typical Sections for NM 128



Existing Typical Section 1
MP 0.0 to MP 11.8
MP 28.8 to MP 38.8
MP 51.5 to MP 51.8
MP 52.5 to MP 59.9



Existing Typical Section 2
MP 11.8 to MP 28.8
MP 38.8 to MP 51.5



Existing Typical Section 3 (Jal)
MP 51.8 to MP 52.5

Exhibit 3-37. Crest Vertical Curves along NM 128 Deficient for Passing Sight Distance

Vertical Curve Number	As-Built PVI Station	Approximate PVI Milepost	As-Built Grade In	As-Built Grade Out	As-Built Curve Length (feet)	Posted Speed (mph)	Design Speed (mph)	Existing K-Value	Required K-Value for PSD	Speed Provided for PSD (mph)
9	143+00	2.71	0.44%	0.22%	70	55	70	318	514	55
11	167+00	3.16	0.85%	0.17%	220	55	70	324	514	55
12	249+41	4.72	0.17%	-2.04%	1000	55	70	452	514	65
15	309+41	5.86	0.51%	-0.37%	220	55	70	250	514	50
18	377+00	7.14	2.14%	0.49%	500	55	70	303	514	55
24	458+00	8.67	2.21%	0.25%	1000	55	70	510	514	65
26	500+50	9.48	1.63%	0.78%	220	55	70	259	514	50
30	561+00	10.63	0.54%	0.27%	100	55	70	370	514	60
37	170+00	12.51	1.36%	-0.52%	800	55	70	426	514	60
42	258+32	14.19	0.40%	-0.30%	350	55	70	500	514	65
46	294+25	14.87	1.50%	0.30%	500	55	70	417	514	60
50	327+43	15.50	2.21%	0.43%	850	55	70	478	514	65
53	376+34	16.42	2.72%	0.83%	700	55	70	370	514	60
58	410+83	17.08	1.76%	-0.97%	750	55	70	275	514	50
63	452+80	17.87	0.90%	-0.49%	500	55	70	360	514	60
65	468+00	18.16	0.56%	-0.30%	400	55	70	465	514	65
68	492+60	18.62	0.30%	-0.30%	300	55	70	500	514	65
70	504+90	18.86	0.65%	-0.45%	300	55	70	273	514	50
72	527+10	19.28	1.36%	0.38%	400	55	70	408	514	60
76	572+95	20.15	1.76%	-0.30%	700	55	70	340	514	55
137	1639+50	40.35	0.20%	-1.10%	600	55	70	462	514	65
144	1731+75	42.10	0.03%	-2.24%	600	55	70	264	514	50
146	1764+00	42.71	1.01%	-1.98%	1200	55	70	401	514	60
149	1841+50	44.18	0.53%	-1.05%	800	55	70	506	514	65
157	1986+50	46.93	0.15%	-1.42%	500	55	70	318	514	55
166	2125+50	49.57	0.71%	-1.30%	500	55	60	250	357	50
169	2164+00	50.30	1.57%	-0.75%	600	55	60	258	357	50
171	2177+50	50.55	1.55%	-1.05%	800	55	60	309	357	55
200	88+250	54.49	-0.23%	-0.64%	200	65	70	488	514	65
206	89+633.52	55.35	-0.18%	-0.66%	200	65	70	417	514	60
211	90+400	55.83	0.98%	-0.84%	500	65	70	275	514	50
232	94+908.66	58.63	0.87%	0.25%	300	65	70	484	514	65
237	95+732.29	59.14	2.30%	1.00%	500	65	70	385	514	60
238	96+128.61	59.39	1.00%	-0.40%	500	65	70	357	514	60
240	96+560.95	59.66	1.20%	-1.08%	800	65	70	351	514	55

Pavement Conditions

A total of 172 pavement borings were performed to a depth of five feet for NM 128 in part to identify existing asphalt and base course thicknesses, which are summarized in **Exhibit 3-38**. Note, from MP 12.0 to MP 28.5, the thicknesses were provided by NMDOT.

Exhibit 3-38. Existing Pavement Section Thicknesses on NM 128

Mile Post Begin	Mile Post End	Number of Borings	Asphalt Thickness	Base Course Thickness
0.0	6.25	26	4.5 to 5 inches	4 inches
6.5	11.75	22	5 to 7.5 inches	3.5 to 6 inches
12.0	28.5	*	4.25 to 6.25 inches	4.75 to 12.25 inches
28.75	42.0	54	6.5 to 12 inches	3 to 4 inches
42.25	53.5	45	6 to 13 inches	2 to 4 inches
53.5	59.9	25	6 to 9 inches	5.5 to 7 inches

** Thicknesses provided by NMDOT*

Pavement distress observations were recorded during a site reconnaissance performed March 11, 2020 by Wood personnel as well as a review of documentation provided by WSP. The findings for NM 128 are summarized below.

- Between MP 0 and MP 3, this stretch of NM has a railroad crossing at about MP 0.1 and the gypsum lakes starting at about MP 1.5. The gypsum lakes are found on both the north and south sides of NM 128. During the Wood reconnaissance, it was observed that pavement conditions were typically in fair condition with one exception.
- Between about MP 2.3 and MP 2.4, there were poor pavement conditions noted in the form of alligator cracking and dipping in the roadway. During the WSP reconnaissance, it appears that severe pavement cracking and rutting was noted between MP 2.2 and MP 2.8.
- Between MP 3 and MP 12, the pavement appeared to be in fair to good condition. The entrance to WIPP was at about MP 11.5. The reconnaissance performed by WSP observed minor to severe rutting and cracking in both lanes of pavement.
- Mainly poor pavement conditions were noted between MP 12 and MP 23. The worst pavement conditions were encountered between MP 12.4 and MP 16.2. These conditions consisted of severe alligator cracking, longitudinal cracking and rutting in both the north and southbound lanes. A large oil drilling operation was noted at about MP 16.1 and poor pavement conditions were noted in the entrance to this operation. At the intersection of NM 128 with Junction 786, heavy truck traffic was noted. There were large patches noted in this roadway section. At MP 21, very poor pavement conditions were noted with severe alligator and longitudinal cracking noted in both lanes of travel. At about MP 22.7, at the intersection of Junction 1 (McCloy SWD) with NM 128, there was a heavy traffic backup in the eastbound lane which extended more than a ¼ mile. WSP's reconnaissance also reported the presence of moderate to severe cracking of pavement in this area.
- Between MP 23 and MP 26, fair to good pavement conditions were noted. It was noted that a section appeared to be re-paved between MP 24.9 and 26. The site reconnaissance performed by WSP noted minor cracking and rutting throughout this area.
- From MP 26 to MP 28.5, poor to very poor pavement conditions were encountered. There were several areas of patching, rutting and severe alligator cracking in both lanes of travel with the worst conditions at MP 26.4 and at 28.5.
- Between MP 28.5 and MP 49.7, pavement conditions were considered to be fair to good. A re-paved section between MP 29.1 and MP 39.1 was in good condition. There were several areas which encountered potholes, but overall, this section encountered good pavement conditions. There were several areas in which cuts were noted on both lanes in either soil or rock outcrops. The WSP reconnaissance encountered rutting along the shoulders between MP 39.4 and MP 40.0 and in sections of the inside part of the eastbound lane between MP 48.8 and MP 49.98.
- After MP 49.7, the exploration entered Jal city limits. Between MP 50 and MP 56.5, poor to very poor pavement conditions were encountered with severe alligator cracking and severe rutting in both lanes. A large pothole area was encountered in the area of the railroad track. WSP noted the same types of distress during their reconnaissance. The pavement showed distressed pavement through the intersection of NM 18 and NM 128.
- Between MP 56.5 and MP 58.3, fair pavement conditions were noted although some alligator cracking was noted in both lanes of travel in this section. WSP's reconnaissance noted several areas of cracking in the pavement with a few areas considered to be severe.
- Between MP 58.3 and the Texas state line (MP 59.9), very poor pavement conditions were noted in both east and westbound lanes. These conditions were consistent with the WSP's exploration.

NMDOT Bikeway Plan Applicability to NM 128

Per the *New Mexico Prioritized Statewide Bicycle Network Plan*, December 2018, NM 128 is a rural Tier 2 facility from NM 31 to the state line. NM 128 is not a designated bike route. Tier 2 routes for rural highways with vehicle speeds over 50 mph and daily traffic over 1,500 vpd with 10% trucks or more, require a wide shoulder bikeway that is more than five-feet in width not including rumble strips. Bicycle pavement markings and bicycle buffers adjacent to right-turn lanes are not required. NM 128 currently meets these requirements.

3.4 Access and Major Intersections

3.4.1 Access along NM 31

There are approximately 104 access points along NM 31. These include US and state highways, Eddy County roads, local roads, residential and business driveways, agricultural field access, and other miscellaneous access drives. Two US highways intersect NM 31 including US 285 at its west terminus and US 62 at its northern end. One state highway and seven county roads intersect NM 31. Auxiliary lanes are present at three of the intersecting roads including Refinery Road, NM 128, and US 62. **Exhibit 3-39** lists these intersecting roads and the types of auxiliary lanes present.

Ninety-five (95) local roads, driveways and turnouts exist with access directly onto NM 31. Access permits from the NMDOT are on file for 20 of the 95; the remaining 75 do not have permits on file. Thirteen driveways and turnouts serve mining and processing plants associated with salt and potash mining industries. **Exhibit 3-40** summarizes the location, side on highway, and facilities served for these local roads and driveways.

The remaining 82 driveways and turnouts serve oil and gas facilities, residences, agricultural fields, Pecos River access and other smaller uses. Efforts will be needed as part of the proposed improvements to resolve driveway permitting issues with NMDOT District 2.

Exhibit 3-39. Intersections of NM 31 with US, State, and County Roads

Location (MP)	Side	Route Number/Name	Auxiliary Lanes
1.23	Right	CR 712/Carter Road	None
2.24	Right	CR 732/Nymeyer Road	None
3.25	Left and Right	CR 740/Donaldson Farm Road	None
4.94	Right	CR 741/Fisherman's Lane	None
5.29	Left and Right	CR 605/Refinery Road	NB and SB right turn lanes
7.71	Right	NM 128	NB right and SB left turn lanes
12.97	Right	CR 801/Ruger Road	None
14.82	Right	CR 796/Cimarron Road	None
22.67	Left and Right	US 62	NB channelized free right turn lane

Exhibit 3-40. NMDOT Permitted Access Points for Mining and Processing Plants along NM 31

Location (MP)	Side	What it serves
0.70	Right	Rio Trans Load Access
4.27	Left	Pride Refinery Access
4.31	Left	Pride Refinery Access
4.39	Left	Pride Refinery Access
6.46	Right	United Salt Access
13.57	Right	Mosaic Potash Access
14.07	Right	Mosaic Potash Access
14.29	Right	United Salt Access
14.34	Right	United Salt Access
19.51	Right	Intrepid Potash Access
19.70	Right	Intrepid Potash Access
19.85	Right	Intrepid Potash Access
20.82	Right	Potash Lagoon Access

Speed Change Lanes

Speed change lanes include left-turn and right-turn deceleration and acceleration lanes. Few speed change lanes are present within the project area. Locations where speed change lanes are provided at intersections along NM 31 were summarized as part of in **Exhibit 3-39.**

3.4.2 Access along NM 128

There are over 300 access points along NM 128, including both sides of the highway, public and private. Eddy County roads occur to approximately MP 19.6 and Lea County roads occur from there to the Texas state line. Approximately 69 of the access points have NMDOT driveway permits. Efforts will be needed as part of the proposed improvements to resolve driveway permitting issues with NMDOT District 2. This section summarizes key aspects of the roadways and intersections along NM 128.

Intersecting Roadways

The Eddy and Lea County roads along NM 128 and a few other notable intersecting roadways are summarized in **Exhibit 3-41**.

Exhibit 3-41. Summary of Key Roads Intersecting NM 128

Approx. Milepost	Intersection Type	Minor Road	Side	Minor Road	Side
0.7	3-LEG	Access to Old Highway	RT.		
4.5	4-LEG	CR 793 / Rawhide Rd.	RT.	Local Access	LT.
7.3	3-LEG			Nash Draw Rd.	LT.
7.6	3-LEG	Mobley Ranch Rd.	RT.		
8.7	3-LEG			Cimarron Rd.	LT.
10.6	3-LEG			WIPP Rd.	LT.
12.8	3-LEG	Twin Wells Rd. (West)	RT.		
17.7	3-LEG	Twin Wells Rd. (East)	RT.		
17.7	3-LEG			Red Rd.	LT.
19.7	3-LEG	CR 786/ Buck Jackson Rd.	RT.		
22.8	3-LEG	CR J-1 / Orla Rd.	RT.		
27.0	3-LEG			DCP Midstream Entrance	LT.
28.9	4-LEG	CR J-2 / Diamond Rd.	RT.	CR 2-A / Brininstool Rd.	LT.
30.8	3-LEG	Vaca Ln.	RT.		
31.8	3-LEG			Delaware Basin Rd.	LT.
34.8	4-LEG	CR 2-B	RT.	CR 2-B	LT.
38.7	3-LEG	CR 2 / Battle Axe Rd.	RT.		
48.7	3-LEG			West Jal Mesquite SWD Entrance	LT.
51.0	3-LEG	CR 6a	RT.		
52.1	3-LEG	Continental Dr.	RT.		
52.3	4-LEG	3rd St. / Frying Pan Rd.	RT.	3rd St.	LT.
52.5	4-LEG	NM 18	RT.	NM 18	LT.
53.2	3-LEG	Kizzar Ln	RT.		
53.3	4-LEG	Local Access	RT.	CR 16 / Schooley Rd.	LT.
54.3	3-LEG			CR 13a / Jal Airport Rd.	LT.
55.3	4-LEG	CR 4	RT.	CR 13 / Willis Rd.	LT.
56.3	4-LEG	Blocker Ln.	RT.	Blocker Rd.	LT.
58.8	4-LEG	Local Access	RT.	CR 14 / Dollarhide Rd.	LT.

Speed Change Lanes

Speed change lanes include left-turn and right-turn deceleration and acceleration lanes. Locations where speed change lanes are provided at intersections along NM 128 are summarized in **Exhibit 3-42**.

Exhibit 3-42. Summary of Speed Change Lanes at NM 128 Intersections

Milepost	Side	Turn Lane Width (Ft)	Shoulder Width (Ft)	Street Name	Description
4.41	RT.	12	4	Rawhide Rd./ County Road 793	EB Right Turn Lane
4.54	RT.	12		Rawhide Rd./ County Road 793	WB Left Turn Lane
10.06	LT.	12		WIPP Road	EB Left Turn Lane
12.53	RT.	12		Twin Wells Road	WB Left Turn Lane
17.27	LT.	12		Red Road	EB Left Turn Lane
19.33	RT.	12		Buck Jackson Road	WB Left Turn Lane
22.43	RT.	12		County Road J-1 / Orla Rd.	WB Left Turn Lane
28.30	RT./LT.	12	4	Brininstool Rd. and Diamond Rd.	EB Left And Right Turn Lane
28.30	RT./LT.	12	4	Brininstool Rd. and Diamond Rd.	WB Left And Right Turn Lane
31.49	LT.	12		Delaware Basin Road	EB Left Turn Lane
31.49	LT.	12	4	Delaware Basin Road	WB Right Turn Lane
38.20	RT.	12		Battle Axe Road	EB Right Turn Lane
38.20	RT.	12	4	Battle Axe Road	WB Left Turn Lane
48.06	LT.	12		West Jal Mesquite SWD Entrance	EB Left Turn Lane
48.06	LT.	12	4	West Jal Mesquite SWD Entrance	WB Right Turn Lane
51.73	RT.	11	1	Continental Drive	EB Right Turn Lane/ Accel. Lane
52.44	RT.	12	1	NM 18	EB Right Turn Lane/ Accel. Lane
52.50	RT.	12	4	NM 18	WB Right Turn Lane

3.5 Railroad Crossings

3.5.1 NM 31 Railroad Crossings

There are four railroad crossings within the NM 31 project limits as listed in **Exhibit 3-43**. Of the four crossings, all cross NM 31 at-grade and have a significant skew. Rail service is operated by the BNSF and are part of the Loving Industry Spur. Crossings are located at mileposts 2.99, 4.0, 9.3, and 13.6. The Loving Industry Spur serves the potash, salt and oil extraction industries. Train frequency at each of the crossings is two to four trains per day.

3.5.2 NM 128 Railroad Crossings

Two railroad crossings are within the project limits on NM 128 as listed in **Exhibit 3-44**; they are located at milepost 0.05 and milepost 51.5. Both serve the potash, salt and oil extraction industries. The crossing at MP 0.05, just east of the NM 31 intersection, is owned by BNSF. The crossing at MP 51.5 in Jal is owned by TX/NM Railroad. Train frequency at both crossings is two to four trains per day.

Exhibit 3-43. Railroad Crossings along NM 31

Location (NM 31 MP)	Operator	USDOT Crossing Number	Track Name/Type	Type of Train Operations	Crossing Features	Comments
MP 2.99	BNSF	020228E	Loving Industry Spur	Potash, salt and oil extraction	Gates and flashing lights	West of Pecos River
MP 4.0	BNSF	020230F	Loving Industry Spur	Potash, salt and oil extraction	Gates and flashing lights	East of Pecos River
MP 9.3	BNSF	020240L	Loving Industry Spur	Potash, salt and oil extraction	Gates and flashing lights	Serves Mosaic and USC
MP 13.6	BNSF	020243G	Loving Industry Spur	Potash, salt and oil extraction	Gates and flashing lights	Serves Intrepid

Exhibit 3-44. Railroad Crossings along NM 128

Location (NM 128 MP)	Operator	USDOT Crossing Number	Track Name/Type	Type of Train Operations	Crossing Features	Comments
MP 0.05	BNSF	020238K	Loving Industry Spur	Potash, salt and oil extraction	Gates and flashing lights	At NM 31 intersection
MP 51.5	TX/NM RR	864637D	TX/NM Short Line	Oil extraction	Gates and flashing lights	At NM 18 intersection in Jal, NM

3.6 Bridges and Structures

There are three major structures within the project limits including the bridge over the Pecos River (Bridge No. 9285) and two multi-barrel concrete box culverts, one on NM 31 (Bridge No. 7976) and one on NM 128 (Bridge No. 9438). The existing conditions assessment was accomplished by:

- Review of existing as-built drawings.
- Field survey of all the structures.
- Site visit by WSP, Parametrix, and NMDOT personnel.
- The latest available bridge inspection reports as found in the ***electronic appendices***.

The inspection reports as provided by NMDOT include various ratings as defined by FHWA. With each inspection report, a series of ratings is provided based on the bridge conditions observed during the inspection. These inspection reports may include an overall Sufficiency Rating, Health Index, Appraisal Rating, Condition Rating, and Inventory and Operating Ratings. These ratings are summarized as follows:

Sufficiency Rating

Vehicular bridges are inspected, rated and assigned a Sufficiency Rating. The Sufficiency Rating is indicative of a bridge's sufficiency to remain in service. Although the Sufficiency Rating is no longer used as extensively by the FHWA, it is still considered a good indicator of overall condition of a structure because it considers many factors when being computed.

Sufficiency Ratings are determined using the Sufficiency Rating Formula. The numeric value is a percentage in which one-hundred percent (100%) represents an entirely sufficient bridge and zero (0%) percent represents a totally insufficient bridge.

Health Index

The health index is the remaining health of the bridge in percent from 0% to 100%. For example, if the health index is 50%, the bridge is worth 50% of its original worth. The health index uses the National Bridge Elements (NBE) which are all of the different elements in a bridge inspection (bridge deck, concrete abutment, wearing surface, bearing pads, etc.). The health index is not always found on inspection reports.

Appraisal Rating

Appraisal Ratings are used to evaluate the level of service a bridge provides in relation to the highway system of which it is a part. The structure is compared to a new one built to current standards for by type and function of road. Appraisal Rating values range from zero to nine. A rating of zero is used for bridges that are closed. A rating of two indicates that the bridge is far below the current standards and should have a high priority for replacement. A rating of nine indicates that the bridge is superior to present desirable criteria. Ratings 5 or less have a negative impact on overall Sufficiency Rating.

Condition Rating

Condition Ratings are used to describe the existing, in-place major structure as compared to the as-built condition. Three elements characterize the overall existing physical condition of a bridge: the Condition Ratings of the deck, superstructure, and substructure components of the bridge. A culvert rating is assigned to a concrete box culvert.

The Condition Rating is one of several values used to calculate the overall Sufficiency Rating. The Condition Rating is a numerical value ranging from zero to nine with a zero representing a failed condition and a nine representing an excellent condition. The Condition Ratings of the superstructure and substructure have a much greater influence on the overall Sufficiency Rating than the Condition Rating of the deck. The maximum allowable percentage contributed to the Sufficiency Rating is 55%. However, ratings of 5 or lower begin to negatively affect that percentage. For a bridge, the Condition Rating only considers the lower of the deck rating, super-structure rating, and the substructure rating.

Inventory and Operating Ratings

The inventory rating of a bridge reflects the safe load carrying capacity of the bridge for normal service conditions. The operating rating of a bridge is a measurement of the maximum permissible load of a bridge for occasional use. The structural adequacy and safety factor consider the Condition Rating and the Inventory Rating.

3.6.1 NM 31 Major Structures

Pecos River Bridge (#9285)

The NM 31 Bridge over the Pecos River was built in 2003 and is a five-span, prestressed girder bridge designed continuous for live load and measures 42'-6" wide x 503' long with no skew as shown in **Exhibit 3-45**. The bridge deck is jointless over the piers and abutments. The deck is crowned at the centerline of the bridge with a 2% cross slope as shown in the bridge as-built plans. The bridge deck sits on five (5) AASHTO Type BT-63 prestressed concrete girders (63" deep). The bridge superstructure is founded on concrete pier caps on concrete pier columns and drilled shafts, and concrete abutment caps on drilled shafts. As shown in **Exhibit 3-46,** the bridge typical section consists of two 11'-9" driving lanes, two 7'-11" shoulders with 42" concrete bridge rails on each side of the bridge deck. The bridge has equidistant prestressed girder lengths of 99'-0" for all spans and the girders are equally spaced at 8'-9" in all spans.

Widening of NM 31 will require the construction of a new bridge over the Pecos River at MP 3.7 on the downstream side of Bridge No. 9285. This location is in a mapped flood zone (Zone A) which is considered a high-risk zone by FEMA. The 100-year water surface elevation at the existing bridge is shown in **Exhibit 3-45**. The distance between the 100-year water surface elevation and the low chord elevation is approximately 5.2' based on as-builts.

Exhibit 3-45. Existing Bridge No. 9285 Profile from As-Built Plans

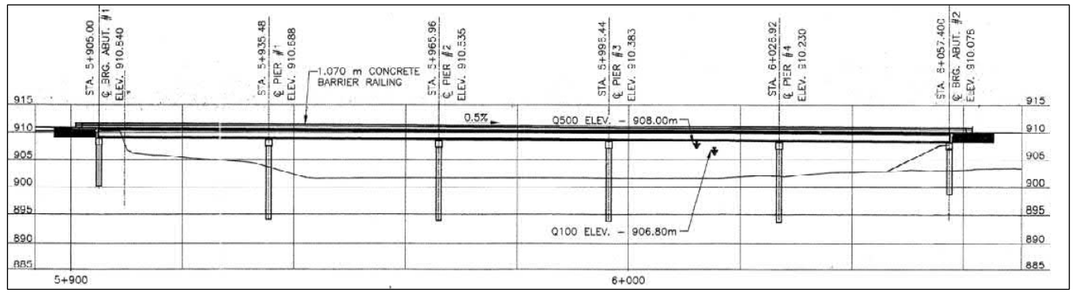
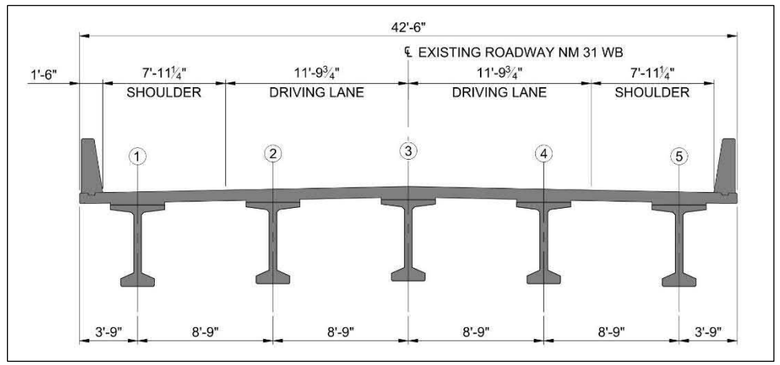


Exhibit 3-46. Existing Bridge No. 9285 Transverse Section View



Inspection Report Ratings for Bridge No. 9285

According to the NMDOT Bridge Inspection Report, the bridge is rated in good condition which is consistent with WSP's observations. The inspection report ratings for Bridge No. 9285 are shown in **Exhibit 3-47**. The structure satisfies load and posting requirements and does not require load restriction posting. The structure has an inventory load rating of HS19.1 and an operating load rating of HS31.8.

Exhibit 3-47. Existing Bridge No. 9285 Ratings

Sufficiency Ratings			
Sufficiency Rating	**Deficiency Status**	**Bridge Railing, including Approach Rail Ends and Transition**	**Approach Rail**
87.8	Not-Deficient	Meets Standards	Meets Standards

Appraisal Ratings					
Structure Evaluation	**Deck Geometry**	**Waterway Adequacy**	**Approach Alignment**	**Underclearances**	**Scour**
7	6	7	8	N/A	8

Condition Ratings			
Deck	**Superstructure**	**Substructure**	**Channel/ Channel Protection**
7	7	7	7

Preservation Repairs Needed

On October 13, 2020, WSP inspected Bridge No. 9285. Based on WSP's inspection and observation, the bridge is overall in good condition. The following are the recommended preservation repairs:

1. Remove preformed bituminous joint filler between pier caps and pier diaphragms and between abutment caps and abutment diaphragms.
2. Remove all material in front of bearing devices on pier caps.
3. Repair delaminated and spalled concrete on bridge deck, pier caps, pier diaphragms, deck edges, pier columns and prestressed girders. Provide 1" minimum gap between front faces of pier diaphragms and pier caps.
4. Epoxy inject cracks in abutment caps, abutment diaphragms, pier caps, pier diaphragms, pier columns, wingwalls, prestressed girders and, deck edges and concrete bridge rails.
5. Replace bridge joint strip seals between approach slabs and sleeper footings.
6. Remove existing overlay and place epoxy urethane polymer bridge deck overlay on entire deck, approach slabs and tops of sleeper footings.
7. Apply epoxy urethane polymer bridge deck overlay (no aggregate) on bottom 18" of inside surface of concrete bridge rails.
8. Recoat bridge rails.
9. Remove all trees and brush growing within the wire enclosed riprap and within 20 feet of Abutment No. 2. Repair riprap in isolated locations.
10. Place fill material in eroded areas around wingwalls in the NW, NE and SW corners.
11. Place flowable fill in void under the concrete bridge rail at the NE corner of the bridge.
12. Clean all dirt and debris in concrete rundowns at NE and NW corner of bridge.

Spalling and delamination on pier diaphragm of Pecos River Bridge No. 9285

Spalling on pier cap of Pecos River Bridge No. 9285

Concrete Box Culvert Major Structure (Bridge No. 7976)

Bridge No. 7976 is a 3-barrel concrete box culvert located on NM 31 at milepost 11.88 that conveys drainage flows from an unnamed waterway. This structure was constructed in 1979 and consists of a three cell 10' (span) x 6' (rise) CBC that is 54 feet in length with headwalls and wingwalls. The wingwalls appear to have some spalling and minor cracking. There is three feet of cover on top of the CBC.

NM 31 3-Barrel CBC: Milepost 11.88, Bridge No. 7976

According to the NMDOT Bridge Inspection Report in April 2020, immediate repairs to the wings, parapets and riprap for outlet scour protection were needed. The inspection report ratings for Bridge No. 7976 are shown in **Exhibit 3-48**. The structure satisfies load and posting requirements and does not require load restriction posting. The structure has an inventory load rating of HS19.8 and an operating load rating of HS27.8. The bridge is on the NMDOT structure replacement list.

Exhibit 3-48. Bridge No. 7976 Inspection Ratings

Sufficiency Ratings				
Sufficiency Rating	**Health Index**	**Deficiency Status**	**Bridge Railing, including Approach Rail Ends and Transition**	**Approach Rail**
85.80	35.94	Not-Deficient	Substandard	Substandard

Appraisal Ratings					
Structure Evaluation	**Culvert**	**Waterway Adequacy**	**Approach Alignment**	**Channel**	**Scour**
5	5	7	7	4	8

Exhibit 3-49. Existing Bridge No. 9438 Ratings

Sufficiency Ratings				
Sufficiency Rating	**Health Index**	**Deficiency Status**	**Bridge Railing, including Approach Rail Ends and Transition**	**Approach Rail**
84.70	92.27	Not-Deficient	Meets Standards	Meets Standards

Appraisal Ratings					
Structure Evaluation	**Culvert**	**Waterway Adequacy**	**Approach Alignment**	**Channel**	**Scour**
6	6	8	6	7	8

3.6.2 NM 128 Major Structures

There is one major structure along NM 128. Bridge No. 9438 is a CBC allowing flow from Antelope Draw to pass under NM 128 at MP 39.70. This CBC crossing was built in 2014. It is a three cell 10’ (span) x 8’ (rise) CBC that is 99 feet long on a 45 degree skew. The outside-to-outside width is 45 feet. The CBC has minor cracks in the concrete and areas with exposed rebar. The wingwalls appear to have some spalling and minor cracking.

Bridge No. 9438 at MP 39.74 along Antelope Draw

Cracking and spalling at CBC/Wingwall joint of Bridge No. 9438

Inspection Report Ratings for Bridge No. 9438

According to the NMDOT Bridge Inspection Report, the bridge is rated in good condition with no critical findings. The inspection report ratings for Bridge No. 9438 are shown in **Exhibit 3-49**. The structure satisfies load and posting requirements and does not require load restriction posting. The structure has an inventory load rating of HS31.1 and an operating load rating of HS52.0.

3.7 Drainage

Existing drainage conditions and drainage structures were evaluated based on previous reports, field investigations, and new hydrologic analyses of the various basins and drainages within the project area. The findings of the drainage analysis are documented within preliminary drainage reports on file with the NMDOT. The drainage reports document existing drainage conditions in the corridor, provides an analysis of the adequacy of the existing drainage facilities, and identifies recommended drainage improvements. A summary of the reports is provided below.

The principal drainage feature in the NM 31 project area is the Pecos River, which crosses the highway near milepost 3.5. The Pecos River is a perennial stream that originates in the Sangre de Cristo Mountains north of Santa Fe, New Mexico and travels south through the eastern third of the state. It leaves New Mexico and enters Texas just south of Loving. There are no other perennial waterways within the project area but numerous named and unnamed ephemeral drainages cross the highway throughout the project limits.

Drainage calculations are based on Section 200 – Drainage Criteria of the New Mexico Department of Transportation (NMDOT) Drainage Design Manual, July 2018. Based on the criteria for rural conditions and collector highways with an average daily traffic flow greater than 400, the analysis was based on a 50-year design storm and a 100-year check storm. Because the drainage basins within the project area are relatively small (i.e., less than five square miles), drainage basin flows were calculated using the Simplified Peak Discharge Method. This approach is consistent with the NMDOT Drainage Manual guidance for basins less than 10 square miles. In addition, basin flows were adjusted to account for karst formations in the western portions of the project area.

3.7.1 NM 31 Drainage Conditions

The drainage analysis for NM 31 was performed in two major segments — MP 0.5 to the junction of NM 31 with NM 128 (near MP 8) and from NM 128 to the junction of NM 31 with US 62 (PM 22.7). The *Preliminary Drainage Report for State Road 31 MP 0.0 to MP 8.0*, dated April 2020, was prepared by WSP for the first 8 miles of NM 31 from US 285 to the NM 31/NM 128 intersection. That report provided the hydrology for all the structures within this segment of NM 31 and provides recommendations for structure improvements. The hydrology from the WSP report was used as the basis for the revised recommendations provided with this project with revisions made in some areas to account for new information.

Drainage basins for the remainder of the corridor (from NM 128 to US 62) were defined using Aquaveo’s WMS version 11.0. Topography, land use, and soils data were imported into the program. Basins were delineated using the program tools and exported to AutoCAD where they were refined using USGS topography for the area. WMS did

not delineate a basin for all culvert locations – some were too small or did not have a defined flow path. Basins that were not defined in WMS were defined using AutoCAD drawings.

Drainage structures on the project consist of a mixture of corrugated metal pipe (CMP), Reinforced concrete pipe (RCP), polyethylene pipe, and concrete box culverts (CBC). Most of the drainage structures using CMP and RCP range in size from 24" to 48" but several larger pipes are present. Likewise, CBC structures are generally smaller than 5 feet in height with variable width but a few larger structures are present.

An irrigation ditch crosses the highway at MP 2.31. This ditch carries irrigation water from south to north and irrigates cotton, alfalfa, and other crops located both north and south of NM 31. A head gate to divert irrigation flows to a lateral ditch is present within the highway right-of-way along the south side of the road. While the gate appears to be functional, signs of recent use were not observed. The lateral ditch follows the south side NM 31 to MP 2.75 where it ends.

Exhibit 3-50 provides a summary of the drainage structures for the first 8 miles of NM 31. As shown in this exhibit, twenty-nine drainage structures occur between MP 0.5 and MP 8. These structures include a mix of CMP and CBC and are generally smaller diameter pipes and small box culverts. Of the 29 structures, 14 have inadequate capacity to serve design year flows. One structure included in the *Preliminary Drainage Report for State Road 31 MP 0.0 to MP 8.0* could not be located. Most structures are in good condition although scour and silt problems are present for several structures and several have damage to their tops and/or end structures.

A large roadside ditch 8 to 10 feet wide and several feet deep is present along the south side of NM 31 between milepost 2.45 and 2.75. This ditch is outside of the existing highway right-of-way and drains to the east and south before intersecting with a ditch that parallels the BNSF tracks that cross NM 31 at MP 3.0. The ditch flows north following the BNSF track alignment before out-falling into the Pecos River north of the highway. The source of drainage flows that utilize this ditch are unknown but appear to be associated with existing and previously developed agricultural fields south of NM 31. Little evidence of heavy flows was observed by the field review and the ditch is heavily overgrown with shrubs and small trees.

Exhibit 3-51 provides a summary of the drainage structures from MP 8 to MP 22.50 on NM 31. As shown in this exhibit, fifty-eight drainage structures are in this segment of NM 31. These structures include a mix of CMP, HDPE, and CBC and are generally smaller diameter pipes and small box culverts. Most of the structures are in poor condition and/or have substantial silt and more than half (36) have inadequate capacity to serve design year flows.

A Draft Final Drainage Report for NM 31 was prepared in October 2021 and is available in the ***electronic appendices***.

Exhibit 3-50. NM 31 Drainage Structures between MP 0.5 and 8.0

Structure No.	MP	Type and Size	Condition	Adequate Capacity	Structure No.	MP	Type and Size	Condition	Adequate Capacity
DS-4	0.46	1-4'X4' CBC	25% Silt	N	DS-28	5.75	10-56"X38" CMP	Good	Y
DS-N1	0.93	Not Found	?	?	DS-29	6.05	5-36"X24" CMP	Good	Y
DS-5	1.96	2-30" CMP	Good	N	DS-30	6.24	1-36" CMP	Good	N
DS-6	2.31	1-30"	Irrigation	N.A	DS-31	6.35	1-36" CMP	Minor silt	N
DS-N2	2.57	NONE	Inlet silt	N	DS-33	6.59	1-18" Poly	Good	N
DS-11	2.64	1-24" CMP	Inlet silt	Y	DS-34	6.77	1-48" CMP	End silted	Y
DS-13	2.99	1-4'X4' CBC	25% silt	N	DS-35	6.82	1-48" CMP	Top damage	Y
DS-14	3.00	1-30" CMP	End silt	N	DS-36	6.97	1-42" CMP	Outlet scour	N
DS-15	3.41	1-24" CMP	Good		DS-37	7.03	1-54"CMP	Good	Y
DS-16	3.61	1-4'X4' CBC	Good	N	DS-38	7.26	1-24" CMP	Top damage	Y
DS-23	4.79	2-5'X2' CBC	Good	N	DS-39	7.37	1-30" CMP	End damage	N
DS-24	4.98	2-36" CMP	Good	Y	DS-40	7.47	1-42" CMP	Outlet scour	Y
DS-25	5.08	2-5'X2' CBC	Minor silt	Y	DS-41	7.57	1-36" CMP	Inlet damage	Y
DS-26	5.49	2-36" CMP	Good	N	DS-42	7.64	2-42" CMP	Inlet damage	Y
DS-27	5.62	1-24" CMP	Good	N					

3.7.2 NM 128 Drainage Conditions

A Draft Final Drainage Report for NM 128 was prepared by WSP in October 2021, which is available in the ***electronic appendices***. For the most part, the drainage basins for existing structures within the project area lie to the north of NM 128. Runoff flows in a southerly direction to the NM 128 roadway alignment and after crossing the roadway, permeates or eventually reaches the Pecos River or salt lakes. Given the terrain of the project area, the fill heights over the culverts range from minimum cover to eleven (11) feet.

Crossing and Turnout Culverts

In September 2020, personnel from WSP performed field inspections of the project area and noted the following:

- A total of 122 cross drainage culverts, along with 60 turnout culverts, were identified within the project limits. One of these crossings, at MP 39.74 is a 3 - 10' Span x 8' Rise concrete box culvert (CBC), and it carries Antelope Draw under NM 128. This crossing is identified as Bridge No. 9438 as stated in the previous section.
- Thirty-two (32) of the crossing culverts are circular, corrugated plastic pipes (CPPs), single or multiple barrels, ranging in size between 24" diameter to 60" diameter; two of the crossing culverts are corrugated plastic pipe arches (CPPAs), single and multiple barrels with a size of 46" span by 36" rise. Sixty-nine (69) of the crossing culverts are corrugated metal pipes (CMPs), single of multiple barrels, ranging in size between 24" diameter to 60" diameter; fifteen (15) of the crossings are corrugated metal pipe arches (CMPA), single of multiple barrels, ranging in size between 28" span x 20" rise to 77" span x 52" rise. In addition to Bridge No. 9438 referenced above, another three CBCs ranging in size from 1-6' span x 6' rise to 2-12' span x 6' rise exist on this project.
- End treatments are installed at the ends of the existing culverts; standard headwalls and wingwalls do exist at the ends of the CBCs. Most the CMP culverts are in fair condition. DS-8 at Station 83+44 is a plastic culvert, but the metal end sections show severe corrosion.
- Sedimentation issues were also identified. Approximately 101 culverts had significant sediment built up around the inlet and/or outlet, 65 of which were less than 10% silted. In addition to sedimentation, erosion issues were identified, typically at the culvert outlet where large scour holes due to head-cut were present. Approximately 15 culverts were found to have scour at their outlets. Crossings with scour issues are shown in **Exhibit 3-52**.
- Vegetation, mainly composed of tumble weeds, was also encountered at many of the crossings, which may be restricting their ability to convey flows.

Exhibit 3-51. NM 31 Drainage Structures between MP 8.0 and 22.7

Structure No.	MP	Type and Size	Condition	Meets Capacity	Structure No.	MP	Type and Size	Condition	Meets Capacity
DS-49	8.19	2- 28" HDPE	10% Silt	Y	DS-78	15.34	2-36" CMP	End damage	Y
DS-50	8.36	1-84" CMC	Corroded	Y	DS-79	15.65	1-24" CMP	Damage. 75% silt	N
DS-51	8.81	1-60" CMC	Corroded	N	DS-80	15.91	1-36" CMP	Minimal silt	Y
DS-52	8.91	1-18" HDPE	Minor Silt	N	DS-81	16.04	2-36" CMP	Minimal silt	N
DS-53	9.06	10'S x 6'R CBC	Scour and cracking	Y	DS-82	16.39	6'S x 3'H CBC	Cracked and rusted	Y
DS-54	9.32	1-48" CMP	Corroded	N	DS-83	16.46	1-24" CMP	Crushed	N
DS-55	9.78	1-18" HDPE	Corroded	Y	DS-84	16.82	5'S x 2'R CBC	Minor silt	N
DS-56	9.90	1-18" HDPE	Minor Silt	N	DS-85	17.16	1-36" CMP	Minor damage	N
DS-57	9.99	1-24" CMC	Crushed / Corroded	N	DS-86	17.59	1-24" CMP	Cracks/end damage	N
DS-58	10.47	2-18" HDPE	10% Silt	Y	DS-87	18.03	1-24" CMP	Cracked and rusted	Y
DS-59	10.75	1-24" CMC	Minor cracking	Y	DS-88	18.12	1-24" CMP	Cracked and rusted	N
DS-60	11.32	1-36" CMC	Minor corrosion	N	DS-89	18.76	1-24" CMP	Cracks/end damage	N
DS-61	11.62	1-24" CMC	Slightly crushed	N	DS-90	19.07	1-24" CMP	Damaged	Y
DS-62	11.82	3-10'S x 6'R CBC	Major cracking	Y	DS-91	19.27	1-24" CMP	Minimal silt	Y
DS-63	11.92	1-30" HDPE	10% channel	Y	DS-92	19.44	1-24" CMP	Cracks/end damage	Y
DS-64	11.98	1-30" HDPE	Minimal silt	N	DS-93	19.71	1-36" CMP	End damage	Y
DS-65	12.27	1-18" HDPE	50% silt	Y	DS-94	19.93	1-36" CMP	End damage	N
DS-66	12.38	1-18" HDPE	Minor silt	N	DS-95	19.96	1-36" CMP	Minor silt	N
DS-67	12.49	1-18" HDPE	Corroded	N	DS-96	20.08	1-36" CMP	Good	N
DS-68	12.83	1-24" HDPE	Some silt	N	DS-97	20.34	1-30" CMP	Good	N
DS-69	12.96	1-30" CMC	Minor silt	N	DS-98	20.51	1-30" CMP	Minor silt	N
DS-70	13.13	1-30" HDPE	Good	N	DS-99	20.87	1-24" CMP	End damage	N
DS-71	13.26	1-24" HDPE	25% Silt	N	DS-100	21.16	1-24" CMP	End patch	N
DS-72	13.77	2-24" HDPE	25% silt	Y	DS-101	21.51	1-24" CMP	Minimal silt	N
DS-73	14.94	1-24" CMP	End damage	Y	DS-102	21.74	1-24" CMP	End patch damage	N
DS-74	14.99	1-30" CMP	50% silt, end damage	Y	DS-103	21.87	1-36" CMP	Patch end section	N
DS-75	15.05	1-24" CMP	End damage	N	DS-104	22.04	1-36" CMP	Cracked end section	N
DS-76	15.15	7'S x 3'R CBC	100% silt	Y	DS-105	22.26	1-30" CMP	Patched end section	N
DS-77	15.22	1-24" CMP	End damage	N	DS-106	22.50	1-24" CMP	Damaged end section	Y

Exhibit 3-52. Locations of Culvert Scour along NM 128

Structure No.	Milepost	Station	Structure Size and Material
DS-3	0.65	44+24	1-60" CPP
DS-8	1.39	83+44	1-54" CPP
DS-23	6.72	364+75	1-8'X8' CBC
DS-27	9.02	486+09	1-48" CPP
DS-69	38.28	2031+18	2-36" CMP
DS-74	40.72	2160+02	2-36" CMP
DS-81	43.32	2297+30	2-48" CMP
DS-82	44.03	2334+78	3-30" CMP
DS-85	44.91	2381+25	3-48" CMP
DS-86	45.01	2386+53	1-24" CMP
DS-92	48.06	2547+57	2-12'X6' CBC
DS-97	49.97	2648+42	2-48" CMP
DS-98	50.39	2670+59	1-42"CMP
DS-99	50.74	2689+07	2-49"X33" CMPA
DS-100	51.02	2703+86	2-49"X33" CMPA

Maintenance Input

The NMDOT Highway Maintenance Supervisors for Carlsbad and Jal were contacted to identify if there are any notable drainage issues in the NM 128 corridor. Mr. Juan Ramos, the Carlsbad Patrol Supervisor, did not express any concerns related to roadway overtopping or other drainage issues within the project area. Freddie Ragaln, Patrol Supervisor for the Jal area, identified a past issue that he believed was fixed with the reconstruction of NM 128 at approximately MP 51.9. The floodplain administrators for Lea and Eddy County were also contacted to discuss any concerns they had within the project limits. The only concern was the need to keep the regulated floodways in Jal in mind during design.

Observed Corrosion

Soil corrosion levels published by the Natural Resources Conservation Service (NRCS) indicates corrosive soils throughout most of the project. The field investigation completed by WSP confirmed this information. Very corrosive soils and salt lakes exist for the first 12 miles of NM 128. The crossing structures in this stretch are corrugated plastic pipes; however, some end treatments are metal and show signs of severe corrosion. A supplemental investigation was performed by Wood E&IS to determine the corrosive properties of the soil; the findings are summarized in the following section.

3.8 Geotechnical Engineering

Several geotechnical engineering documents were prepared by Wood E&IS during the study phase, which are included in the ***electronic appendices*** and are listed as follows:

- Geotechnical Pavement Data, Prioritization 1, NM 31 from MP 0.0 to MP 8.0, letter report, March 26, 2021
- Geotechnical Pavement Data, Prioritization 3, NM 31 from MP 8.25 to MP 22.67 and NM 128 MP 53.5 to Texas State Line, letter report, April 30, 2021
- Culvert Corrosivity Testing, letter report, April 30, 2021
- Geotechnical Pavement Data, Prioritization 2, NM 128 from MP 0.0 to MP 53.25, letter report, June 4, 2021
- Geotechnical Scoping Report, NM 31 & NM 128 Pavement Exploration and Geophysics, June 22, 2021

The geotechnical scoping report presents the results of literature research and site reconnaissance, initial field exploration and laboratory testing, and seismic geophysics. The following summarizes key aspects of the geotechnical conditions within the project area. Refer to the reports for more detailed information.

3.8.1 Areawide Geotechnical Conditions

Eddy and Lea counties are part of the Great Plains province which contains one of the largest structural basins in North America, known as the Permian Basin. The Permian Basin has been extensively studied because of its production of hydrocarbons resulting in approximately 20% of the United States oil production. Most of the oil and gas from the region lies within rocks of Paleozoic age, however, rocks ranging from Cambrian to Cretaceous age have also produced hydrocarbons.

The Permian Basin is comprised of four major sub-basins which include the following: the Delaware Basin, Central Basin Platform, Midland Basin, and the Val Verde Basin. The Central Basin Platform divides the Permian Basin into two halves, the western half of the basin is thicker than that of the eastern half. The southern portion of Eddy County starting from Carlsbad, New Mexico, as well as southwest portion of Lea County, are within the Delaware basin. The southeast section of Lea County lies within the Central basin Platform and the Capitan Reef also known as the Capitan Limestone.

The geology in the area is comprised of Quaternary and Permian deposits in age. The more recent Quaternary deposits consist of sand, playa deposits, sandstone, gypsum and claystone. The Permian evaporite deposits consist of anhydrite, gypsum, halite, and salts (mainly potash salt). These formations are commonly referred to as the Rustler, Salado, and Castile formations and are susceptible to erosion and dissolution processes which form karst features such as caves, pipes and sinkholes.

Overall Recommendations

Roadway improvements to NM 31 and 128 are anticipated to be feasible based on the evaluation of field exploration and laboratory testing conducted. Re-compaction of the subgrade and improved pavement design should yield the required results for a proper rehabilitation of the roadway. However, its recommended that monitoring of the subgrade is emphasized based on the complex geologic settings of the project area. Additional testing by borings, electrical and seismic geophysics is recommended for those areas where current seismic geophysics indicate presence of anomalies likely associated with karst features. If significant karst features are located, use of geogrid reinforced fills to span over these features may be required.

3.8.2 NM 31 Geotechnical Conditions

Dynamic Cone Penetration Testing (DCPT)

A total of 66 DCPT's were performed along NM 31. The target depth of probing was established as 36 inches below the asphalt or ground surface in select locations.

Based on FHWA Geotechnical aspects of pavements (NHI-05-037), silty sands and well graded sands typically have a CBR value ranging from 20 to 40. Granular soils perform the best with typical CBR values ranging from 20 to 80. CBR values for clayey soils can range from 3 to 15 and are typically considered poor subgrade soils. In general, CBR values greater than 20 are considered excellent subgrade soils. In-situ CBR values were well above a CBR value of 20 with the exception of five borings: one at MP 1.0, three from MP 15.0 and 15.5, and one at MP 22.25.

Pavement Subsurface Conditions

A total of 66 borings were performed along NM 31 from MP 0 to 22. From MP 0 to 8 the spacing between subsequent borings was one mile. From MP 9 to 22 the spacing between subsequent borings was ¼ mile. The roadway was predominantly comprised of silty sand with gravel varying from loose to dense compactness based on blow counts recorded. A more diverse soil profile comprised of soil units A to D was observed between MP 0 to 8. Sandy silt and sandy lean clay from soil unit D were not observed again until borings at MP 14.50 and MP 19.25, respectively. The AASHTO soil classifications were predominately A-4 and A-2-4 but included A-3, A-4, A-6, A-2-6, A-1-a, and A-1-b. The groundwater was not observed in any of the borings throughout the project area.

R-Values

Between MP 0.0 and MP 8.25, the laboratory R-values ranged from 19 to 76, with the next lowest at 49. Consistent with the DCPT testing, the subgrade near MP 1.0 is where the lowest quality conditions were found. Between MP 8.25 and MP 22.67, R-values ranged between 41 and 81.

Per NMDOT Pavement Design, the Design R-Value of NM 31, MP 0.0 to MP 22.67 is 69, determined using the average of 85 samples tested by the Department's Materials Laboratory and Wood E&IS.

Seismic Investigations

Two (2) 120-foot-long combined refraction seismic and refraction microtremor (ReMi) surveys were completed on January 14 and 15, 2021 by Wood E&IS as shown in **Exhibit 3-53**. The maximum practical depth of investigation for these 120-foot-long p-wave refraction seismic lines is about 30 to 40 feet below ground surface, and considerably deeper for ReMi results. However, actual depths of investigation vary according to the subsurface profile under each line. Compression wave (p-wave) depth of investigation interpretations are included in the interpretations, are typically about 12 to 21 feet, and range as deep as 30 feet. ReMi surface wave (s-wave) depths of investigation are typically deeper than p-wave depths of investigation. Depth of information from these seismic lines is considered adequate because the presence of shallow karst features in the upper 20 feet of soils and soft rock in this area are known from published National Karst and Cave Institute (NKRCI) reports and NMDOT geotechnical reports prepared for the NMDOT's US 285 project.

Exhibit 3-53. Locations of Seismic Lines along NM 31

Seismic Line	Milepost Range	Description	Soft Shallow Pockets Encountered?
SL-1	12 to 12.25	East side of NM 31	Yes
SL-2	13.75 to 14.0	West side of NM 31	Yes

Additional geophysics investigations are recommended for development of design-build 30% plans. The focus of additional geophysics work will be to determine the extent that shallow sinkholes are present in locations where anomalies are indicated near drainage structures and near the salt/gypsum lakes.

Corrosivity Testing

Twelve soil samples were collected along NM 31 from MP 0.0 to MP 22.0 for the evaluation of corrosion potential of soils at select drainage structures. Corrosivity testing included the determination of chlorides, soluble sulfates, pH, resistivity, and organic matter content. The NMDOT Corrosion Resistance (CR) Number ranges from CR1 to CR7 and is presented in the NMDOT Drainage Design Manual, Section 800. A rating of CR1 indicates that corrosion is not likely in the tested soil and water conditions. A rating of CR7 represents a harsh environment which could significantly affect the serviceable life of a culvert.

Based upon the data, it appears that areas of corrosion potential are encountered between MP 0 to 2, MP 7 to 8, and MP 10 to 14 with the greatest corrosion potential between MP 0 to 2 and MP 12 to 14. In the locations tested, two (2) locations had a CR6 rating which indicates considerable attack on metal and concrete, 2 locations had ratings of CR4 which indicates positive attack, and the remaining 8 locations were rated between CR1 and CR3 which are negligible for attack.

3.8.3 NM 128 Geotechnical Conditions

Dynamic Cone Penetration Testing (DCPT)

A total of 172 DCPT's were performed along NM 128. The target depth of probing was established as 36 inches below the asphalt or ground surface in select locations. Based on the results, the California Bearing Ratio (CBR) values for NM 128 show soil ratings of excellent for nearly the entire corridor. Locations where the CBR was good include MP 31.75, MP 38.25, MP 39.0, and MP 57.50.

Pavement Subsurface Conditions

Along NM 128, a total of 172 borings were performed. The ¼-mile spacing was consistent throughout the 60-mile highway except for borings near the salt lakes. Safety concerns were the primary factor in avoiding boring over the salt lakes as the roadway barriers and shoulders were too narrow to allow for a proper lane closure and sufficient working space for personnel.

Soil samples from NM 128 were predominately silty sand with gravel and silty, clayey sand with gravel (i.e., SM and SC-SM). However, near the salt lakes from MP 2 to MP 6, a significant amount of dense sandy silt was observed and sampled. Most of the samples obtained within the region had a thin layer of pale brown material followed by a white sandy silt. The salt lakes lie within Nash Draw, a highly active zone where potash is mined from the surface and associated to the dissolution of Rustler-Salado formations. The presence of gypsum within the region is significant to the development of karst features through dissolution. The AASHTO soil classifications were predominately A-2-4 but included A-3, A-4, A-1-b, A-2-6, and A-2-7. Gypsum was present in some of the soil samples. The groundwater was not observed in any of the borings throughout the project area.

R-Values

Consistent with the CBR soil ratings, the R-values for NM 128 reflect favorable subgrade conditions. The laboratory R-values are summarized as follows:

- MP 2.25 and MP 6.25, R-values ranged between 45 and 81
- MP 6.5 and MP 11.75, R-values ranged between 36 and 78
- MP 28.75 and MP 42.0, R-values ranged between 60 and 67
- MP 42.25 and MP 53.5, R-values ranged between 51 and 78
- MP 53.5 and MP 59.9, R-values ranged between 59 and 73

The Design R-Values for NM 128 were determined using the average R-Value of samples tested by the Department's Materials Laboratory and Wood E&IS. The Design R-Values of NM 128 are:

- MP 0 – 11.8 = 38
- MP 11.8 – 28.8 = 67
- MP 28.8 – 38.8 = 53
- MP 38.8 – 51.5 = 65
- MP 51.5 – 54 (Jal) = 72
- MP 54 – 59.9 = 66

Seismic Investigations

Eight (8) 120-foot-long combined refraction seismic and refraction microtremor (ReMi) surveys were completed on January 14 and 15, 2021 by Wood E&IS as shown in **Exhibit 3-54**. Refer to the NM 31 seismic discussion for additional explanation.

Exhibit 3-54. Locations of Seismic Lines along NM 128

Seismic Line	Milepost Range	Description	Soft Shallow Pockets Encountered?
SL-3	MP 42.25	North side of NM 128	Yes
SL-4	MP 42.25	South side of NM 128	Yes
SL-5	MP 42.0 to 42.25	North side of NM 128	No
SL-6	MP 42.0 to 42.25	South side of NM 128	Yes
SL-7	MP 3.75	North side of NM 128	Yes
SL-8	MP 3.75	South side of NM 128	Yes
SL-9	MP 1.25 to 1.50	North side of NM 128	No
SL-10	MP 1.25 to 1.50	South side of NM 128	Yes

Corrosivity Testing

Eighteen soil samples were collected along NM 128 from MP 0.0 to MP 57.0 for the evaluation of corrosion potential of soils at select drainage structures. Based upon the data, it appears that the areas of greatest corrosion potential are between MP 1 to 2 and MP 2 to 5. The higher values for sulfates, chlorides and lower electrical resistivity between MP 1 and 5 correspond with the location of the salt lakes located on the south side of the alignment of NM 128.

In the locations tested, three (3) locations had a CR7 rating which indicates severe attack on metal and concrete, one (1) location had a rating of CR6 which indicates considerable attack, one (1) location had a rating of CR4 which indicates a positive attack, and the remaining 12 locations were rated between CR1 and CR3 which are considered negligible for attack.

3.8.4 Preliminary Foundation Requirements

Foundation borings and results and foundation requirements will be provided as part of the design phases.

3.9 Right-of-Way and Property Ownership

3.9.1 NM 31 ROW and Ownership

Existing right-of-way (ROW) widths for NM 31 vary from 150 feet to 200 feet as shown in **Exhibit 3-55**. The existing highway is generally situated in the middle of the ROW although some minor variations from this condition exist. Existing right-of-way NMDOT project numbers are BR-0031-(12)03 and ST-ERS-1206(201).

Exhibit 3-55. Existing Right-of-Way for NM 31

Milepost	ROW Widths
MP 0 to MP 1.40	150 feet
MP 1.4 to MP 2.3	200 feet
MP 2.3 to MP 3.0	150 feet
MP 3.0 to MP 3.1	175 feet
MP 3.1 to MP 5.4	200 feet
MP 5.4 to MP 14.2	150 feet
MP 14.3 to MP 22.7	200 feet

Property ownership adjacent to NM 31 is a mix of private, Bureau of Land Management (BLM), and New Mexico State Land Office (SLO). Privately-owned parcels primarily occur in the first several miles of NM 31 and include smaller residential properties and agricultural lands. In addition, some of the privately-owned parcels are associated with salt, potash, and O&G industries operating along the NM 31 corridor. Public lands managed by the BLM and SLO occur throughout the corridor but are most common between MP 5.8 and MP 22.7. **Exhibit 3-56** provides a summary of property ownership in the NM 31 corridor and property ownership maps are provided in the ***electronic appendices***.

Exhibit 3-56. Property Ownership along NM 31

Location/Milepost	Ownership	Location/Milepost	Ownership
MP 0 to MP 1.50	Private both sides	MP 8.0 to MP 15.3	BLM both sides
MP 1.5 to MP 2.2	BLM left / Private right	MP 15.3 to MP 16.0	SLO both sides
MP 2.2 to MP 3.3	Private both sides	MP 16.0 to MP 16.3	SLO left / BLM right
MP 3.3 to MP 3.8	BLM both sides	MP 16.3 to MP 16.6	Private both sides
MP 3.8 to MP 4.2	SLO both sides	MP 16.6 to MP 18.7	BLM both sides
MP 4.2 to MP 4.3	Private left / SLO right	MP 18.7 to MP 19.4	SLO both sides
MP 4.3 to MP 4.4	Private left / BLM right	MP 19.4 to MP 20.0	BLM both sides
MP 4.4 to MP 5.4	BLM both sides	MP 20.0 to MP 20.2	SLO both sides
MP 5.4 to MP 5.8	Private both sides	MP 20.2 to MP 20.8	BLM both sides
MP 5.8 to MP 6.6	BLM both sides	MP 20.8 to MP 21.4	Private both sides
MP 6.6 to MP 7.0	SLO both sides	MP 21.4 to MP 22.7	BLM both sides
MP 7.0 to MP 7.7	BLM both sides		
MP 7.7 to MP 8.0	SLO both sides		

3.9.2 NM 128 ROW and Ownership

The existing ROW along NM 128 is not consistent and ranges from 65 feet in Jal to a maximum of 240 feet at MP 22. The existing ROW is also not balanced on either side of the highway; the roadway is not centered within the ROW limits. The ROW based on the centerline of the existing two-lane highway is summarized in **Exhibit 3-57**.

Exhibit 3-57. Existing Right-of-Way for NM 128

Milepost	Left of Centerline (feet)	Right of Centerline (feet)	Total (feet)
0	50	100	150
1	100	100	200
2	50	50	100
3 - 4	100	100	200
5	105	90	195
6 - 7	100	100	200
8 - 9	100	75	175
10	100	100	200
11	120	100	220
12	120	75	195
13 - 16	120	50	170
17 - 19	120	75	195
20	100	75	175
21	125	100	225
22	140	100	240
23	100	100	200
24 - 26	75	145	220
27	75	93	168
28	75	135	210
29 - 32	75	145	220
33 - 35	75	155	230
36 - 48	75	145	220
49 - 51	70	50	110
52	35	30	100
53 - 54	50	50	100
55 - 56	75	50	125
57 - 59	50	50	100

Property ownership adjacent to NM 128 is a mix BLM, SLO, various other agencies, and private owners. Public lands managed by the BLM and SLO occur throughout the corridor, although BLM lands end in the vicinity of MP 45. Private ownership is most dense/numerous within the City of Jal. Property ownership maps are provided in the ***electronic appendices***.

3.10 Utilities

3.10.1 NM 31 Utilities

Utility types within the NM 31 corridor include overhead (OH) electric lines, underground (UG) electric lines, OH telephone lines, UG telephone lines, UG fiberoptic telephone lines, water lines, natural gas lines, oil pipelines, fuel lines, irrigation laterals, and unknown lines. Utilities can be found consistently throughout the NM 31 corridor; however, crossing frequency is much higher within the first eight miles (US 285 to NM 128). There are more parallel OH electric lines, OH telephone lines, natural gas lines, and oil pipelines from MP 0 to MP 8. The northern 14 miles (NM 128 to US 62/180) features the only instances of fiberoptic telephone lines and also has undocumented utility crossings. There is one damaged OH telephone line from MP 13.0 to 13.6, with the line laying on the ground.

Overall, there are 88 perpendicular crossings and approximately 15 miles of parallel utilities between MP 0 and MP 8. From MP 8 to MP 22.6, there are 65 perpendicular crossings and approximately 26 miles of parallel utilities. **Exhibit 3-58** summarizes each utility type and approximate location. Roadway plans that illustrate all known utilities within the project limits are included in the ***electronic appendices***.

Exhibit 3-58. Summary of Utilities within the NM 31 Corridor

Utility Type	Size	No. of Crossings	Length of Parallel Lines (mi)	Owners
OH Electric	-	27	6.2	Xcel Energy Inc., Central Valley Electric Cooperative, and other unknown owners
UG Electric	-	4	-	Burlington Northern Santa Fe Railway Company
OH Telephone	-	4	3.2	Windstream Communications
UG Telephone	-	5	9.0	Windstream Communications
UG Fiberoptic Telephone	-	3	13.6	Peñasco Valley Telephone Co-op, ATT, and General Telephone & Electronics Corporation
Water	1.25”-24”	27	5.9	BTA Oil Producers LLC, Chevron Exploration & Production, IMC Global, Intrepid Potash Inc., Malaga MDWC, Mosaic Potash Carlsbad Inc., NGL Water Solutions LLC, Oilfield Water Logistics, XTO Midstream North Operations, and other unknown owners
Natural Gas	2”-24”	57	3.1	Chevron Exploration & Production, Crestwood New Mexico Pipeline LLC, DCP-Midstream-Carlsbad, Enterprise Field Services LLC, IMC Global, Mosaic Potash Carlsbad Inc., New Mexico Gas Company LLC, Oryx Delaware Oil Transport LLC, Oxy Permian-Carlsbad, Sendero Carlsbad Midstream LLC, Targa Midstream Services, Transwestern Pipeline, XTO Midstream North Operations, and other unknown owners
Oil Pipelines	6”-16”	10	-	Centurion Pipeline LP-SE NM, Chevron Exploration & Production, Oryx Delaware Oil Transport LLC, Plains Pipeline LP, Sendero Carlsbad Midstream LLC, and XTO Midstream North Operations
Fuel	6”	1	-	XTO Midstream North Operations
Unknown	-	19	-	Chevron Exploration & Production, Sendero Carlsbad Midstream LLC, and other unknown owners
Irrigation	Open Trapezoidal Channel	1		Carlsbad Irrigation District. Crosses NM 31 at MP 2.35 (approximate)
Total		**153**	**41**	

3.10.2 NM 128 Utilities

The findings of the utility investigations are shown on the HWY 128 ASCE 38-QLB Utility Investigation Plans in the ***electronic appendices***. There are 56 utility owners within the NM 128 corridor from MP 0.0 to MP 59.9. Existing utility lines parallel NM 128 on both sides of the highway and also cross the highway at numerous locations. Utility lines may be buried, on top of ground, or on overhead poles. In some locations, utility lines are abandoned. The types of utilities include:

- Electric
- Telephone
- Fiber Optic Telephone
- Fiber Optic
- Sanitary Sewer
- Natural Gas
- Oil Pipeline
- Storm Drain
- Water
- Irrigation

All forms of utility conflicts are expected and their resolution will require extensive coordination.

3.11 Environmental and Cultural Conditions

Existing environmental conditions within the study area were assessed with the primary objective to identify conditions and constraints that could influence the type and extent of improvement alternatives being developed and evaluated. Environmental resources reviewed include general environmental setting, cultural resources, and natural resources such as wildlife and general habitat, threatened and endangered species and critical habitat, farmlands, Waters of the U.S., groundwater, paleontology, hazardous materials, air quality, noise, and visual concerns. The findings described here are based on review of available data records and databases and supplemented with preliminary biological, wetland, and cultural resources field surveys. Coordination meetings with specific agencies and stakeholders are being held as needed to discuss initial concepts and seek input to support the project development process.

This section characterizes the environmental constraints of the corridor, identifies potential considerations for evaluating alternatives, and discusses the need for additional investigations. The information below is presented separately for the NM 31 corridor and the NM 128 corridor.

3.11.1 NM 31 Environmental Conditions

The following discusses topics that are germane to the NM 31 corridor. Existing environmental conditions for the NM 128 corridor are described in **Section 3.11.2**.

General Environmental Setting

The study area lies within the northern shelf of the Permian Basin, a large oil and natural gas producing area that extends into Texas. NM 31 is fully situated within the Lower Pecos Valley, a subsection of the Great Plains physiographic province. This ecoregion is at a higher elevation and typically has higher precipitation and water retention. This in turn allows for a variety of grasses and woody plants, such as grama grass (Bouteloua sp.), dropseed (Sporobolus sp.), muhly (Muhlenbergia sp.), and creosote as well as cacti like cholla (Cylindropuntia sp.) and prickly pear (Opuntia sp.). The Pecos Valley is an expansive area bordered by the caliche caprocks of the High Plains to the east and the Basin and Range province of Central New Mexico to the west. The valley is occupied by the Pecos River, which has carved its way through the Permian-era bedrock creating a landscape of terraces and tablelands. Although the area is generally flat and does not experience a drastic elevation change, the landscape

trends gently toward the Pecos River, which crosses project area on the southeast end near the beginning of project (BOP). The lowest point of the project area is close to the river and its floodplain, while the highest point is closer to the EOP where NM 31 skirts Quahada Ridge and Tower Hill. The climate in the area is semi-arid and the average annual precipitation is approximately 14.91 inches (Western Regional Climate Center).

Cultural Resources

Cultural resources are afforded protection under various federal and state laws and generally refer to archaeological sites, historic buildings, or other objects that represent human activity.

A review of available data from the Archaeological Records Management Section (ARMS) of the New Mexico Historic Preservation Division (HPD) and the BLM Carlsbad Field Office (CFO) was completed, in conjunction with a pedestrian field survey of the NM 31 project area. The cultural resource investigations identified twenty-two previously recorded sites and nine newly recorded sites. This includes twenty-two prehistoric archaeological sites, eight historic archaeological sites, and one site with both prehistoric and historic resources. In addition, one historic building, four historic railroad segments, and five acequias were also documented. Four of the previously identified archaeological sites were not relocated, and several resources that had previously received multiple Laboratory of Anthropology (LA) or Historic Cultural Property Index (HCPI) designation numbers were combined under a single designation which was typically the lowest in the sequence. The archaeological sites are primarily concentrated between the Pecos River and the NM 128 intersection while the historic buildings, acequias, and railroad segments are scattered throughout the NM 31 corridor between NM 128 and the NM 31 BOP.

Official agency determinations of eligibility for listing in the National Register of Historic Places (NRHP) have not yet been made, though the sites have been evaluated for their eligibility (**Exhibit 3-59**). A total of thirteen sites are recommended as being, or have been determined to be, eligible for listing in the NRHP. Sixteen sites are recommended or have been determined to be not eligible for listing, while nine have an undetermined eligibility status. No determination has been made for the four sites that were not relocated. A cultural resources investigation report is being drafted to support NMDOT's Section 106 consultation. Impacts to these cultural resources will need to be considered when evaluating project alternatives, and potentially mitigated.

Section 4(f) Properties

Section 4(f) of the Department of Transportation Act of 1966, as amended (49 USC 303), states that the US Department of Transportation may not approve the use of land from a significant publicly owned park, recreation area, wildlife or wildfowl refuge, or a significant historic site unless a determination is made that:

- There is no feasible and prudent alternative to the use of land from the property; and
- The action includes all possible planning to minimize harm to the property resulting from such use.

Section 4(f) properties within the NM 31 corridor are limited to significant archaeological sites and historic properties. Several of the archaeological sites are significant, under eligibility Criterion D, solely for their ability to contribute to additional research but have minimal value for preservation in place. Per 23 CFR 774.13(b), these properties would be exempt from Section 4(f) consideration. However, the historic building, three railroad sections, and five acequias are significant under eligibility Criterion A, due to their association with the historical development of southeastern New Mexico. These may qualify under Section 4(f). If so, any adverse effects to these properties would require consideration under Section 4(f).

Exhibit 3-59. NM 31 Corridor Cultural Resources

Resource No.	Eligibility	Temporal	Site Type
LA 39178	Not Eligible	Historic	Refuse scatter/trash dump
LA 55021	Eligible (D)	Prehistoric	Artifact scatter with features
LA 112657	N/A	Prehistoric	Not relocated
LA 129214	Eligible (D)	Prehistoric	Artifact scatter with multiple features and probable habitation structures
LA 149250	Eligible (D)	Multicomponent	Prehistoric artifact scatter; historic features and artifacts
LA 149261	Not Eligible	Historic	Refuse scatter/trash dump
LA 149271	N/A	Prehistoric	Not relocated
LA 162617	Eligible (D)	Prehistoric	Artifact scatter
LA 162618	Eligible (D)	Prehistoric	Two burnt caliche features
LA 162619	Eligible (D)	Prehistoric	Artifact scatter with features
LA171850	Eligible (D)	Prehistoric	Artifact scatter with features
LA 171884	Eligible (D)	Prehistoric	Artifact scatter with features
LA 175453	N/A	Prehistoric	Not Relocated
LA 181928	Not Eligible	Historic	Refuse scatter/trash dump
LA 184320	Not Eligible	Historic	Refuse scatter/trash dump
LA 186303	Not Eligible	Prehistoric	Artifact scatter with features
LA 186304	Not Eligible	Historic	Refuse scatter/trash dump
LA 194819	Not Eligible	Historic	Refuse scatter/trash dump
LA 195239	Not Eligible	Prehistoric	Artifact scatter with features
LA 196776	Not Eligible	Historic	Not relocated
LA 196777	Not Eligible	Prehistoric	Artifact scatter with features
LA 196781	N/A	Historic	Not relocated
LA-PMX-1	Not Eligible	Prehistoric	Artifact scatter with features
LA-PMX-2	Eligible (D)	Prehistoric	Artifact scatter with features
LA-PMX-3	Not Eligible	Prehistoric	Artifact scatter with features
LA-PMX-4	Not Eligible	Prehistoric	Artifact scatter with feature
LA-PMX-5	Not Eligible	Prehistoric	Artifact scatter with features
LA-PMX-6	Not Eligible	Prehistoric	Artifact scatter with features
LA-PMX-7	Eligible (D)	Prehistoric	Artifact scatter with features
LA-PMX-8	Eligible (D)	Prehistoric	Artifact scatter with Features
LA-PMX-9	Not Eligible	Prehistoric	Artifact scatter with Features
HCPI 31512	Not Eligible	Historic	Historic house/mercantile
HCPI 31513	Eligible (A)	Historic	Railroad spur
HCPI 32260	Eligible (A)	Historic	Railroad spur
HCPI 38939	Eligible (A)	Historic	Irrigation ditch
HCPI 38948	Eligible (A)	Historic	NM 31 Alignment
HCPI 40423	Eligible (A)	Historic	Railroad spur
HCPI 40244	Eligible (A)	Historic	Irrigation ditch
HCPI 40428	Eligible (A)	Historic	Harroun Canal
HCPI 47996	Eligible (A)	Historic	Irrigation ditch
HCPI 47997	Eligible (A)	Historic	Irrigation ditch
HCPI 49686	Eligible (A)	Historic	Railroad spur
HCPI PMX-1	Eligible (A)	Historic	Irrigation ditch

Wildlife and General Habitat

The NM 31 project area is located within the Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands ecoregions (Griffith et al. 2006). The Chihuahuan Basins and Playas ecoregion spans the southwest half of the project area from the BOP to the United Salt Corporation facility. This ecoregion is defined by moderately elevated river valleys and internally-drained, sediment-filled basins. Sediments are salty and alkaline in nature and often form dunes. This ecoregion tends to be very hot and dry and requires resilient vegetation such as creosote (*Larrea tridentata*), fourwing saltbush (*Atriplex canescens*), and acacias (*Acacia* sp.*)*.

The Pecos River provides perennially flowing open water habitat as well as riparian habitat for a variety of terrestrial and aquatic species. Moreover, the NM 31 bridge structure spanning the Pecos River provides nesting habitat to cliff swallows (*Petrochelidon pyrrhonota*).

The NM 31 portion from the United Salt Corporation facility to the end of project (EOP) spans the Chihuahuan Desert Grasslands ecoregion. Vegetation beyond the ROW is heavily impacted by oil and gas wells and well pads, as well as other associated facilities including stations, de-watering areas, access roads, and piping and hoses scattered throughout the landscape.

The project area has the potential to provide foraging habitat for small mammals such as coyote as well as migratory birds, raptors and owls. Evidence of wildlife was observed throughout the corridor during the biological survey.

Threatened and Endangered Species

There is no designated critical habitat for any federally listed species in proximity to the NM 31 corridor. The closest designated critical habitat is for the Texas hornshell, approximately 5.5 miles southwest of the project area.

The U.S. Fish and Wildlife Service (USFWS), BLM, and State of New Mexico maintain lists of protected native plants and special status species. There is potentially suitable habitat for state and/or federally listed and BLM CFO special species in proximity to the NM 31 corridor. An initial pedestrian biological survey of the corridor was performed to evaluate the potential suitable habitat for special status species within the study area. During the field investigation, no special status species were observed in the existing ROW of NM 31. A Biological Evaluation is being prepared to assess potential impacts to protected species and habitats.

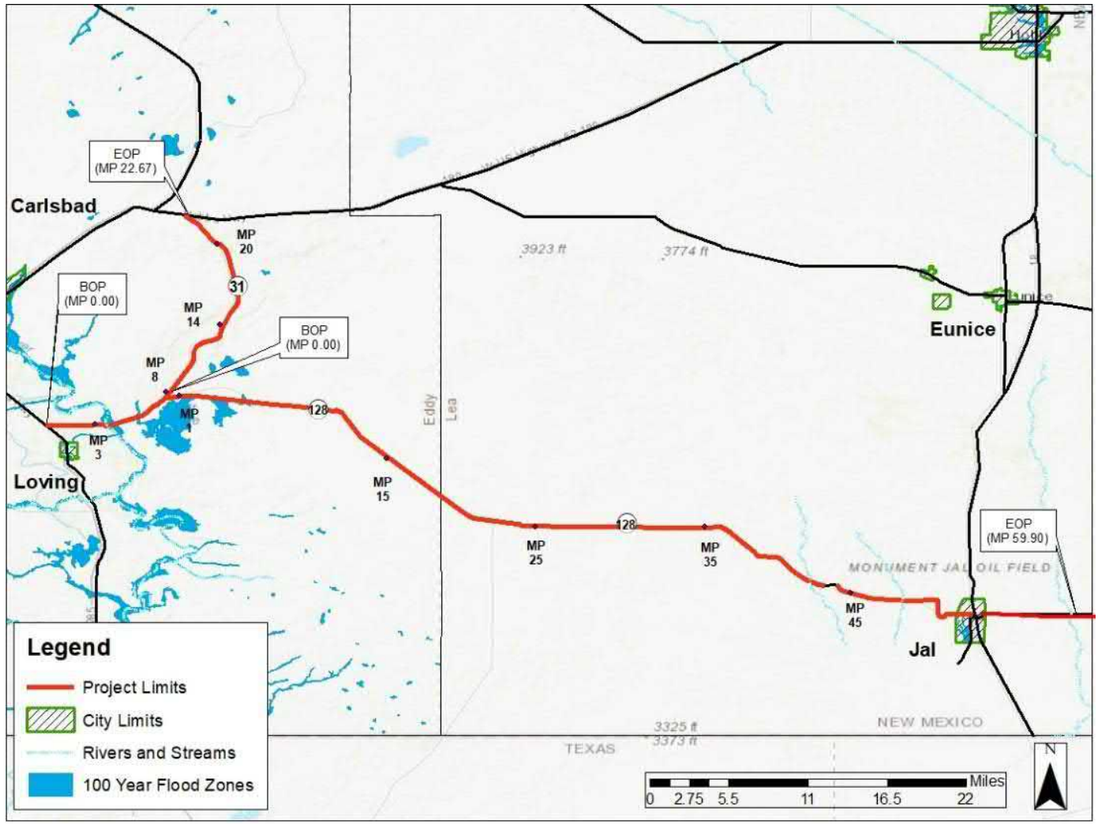
The BLM CFO has designated wildlife management areas near the study area, none of which overlap with the NM 31 segment.

If potential impacts to protected species are identified, consultation with the USFWS, the New Mexico Department of Game and Fish (NMDGF), and the BLM CFO will be needed.

Waters of the U.S., Wetlands, Playas and Floodplains

The Pecos River, near MP 4, is the only perennial flowing surface water feature in the study area (**Exhibit 3-60**). It is anticipated to be considered a Water of the U.S. (WOTUS) and regulated by the US Army Corps of Engineers (USACE) under the Clean Water Act (CWA). Based on the current regulatory interpretation, any ephemeral waterways along NM 31 would also meet the current criteria of WOTUS and fall under jurisdictional oversight by the USACE for Clean Water Act 404 permit authorization. Any construction or disturbance within the Ordinary High-Water Mark (OHWM) of the waterway will require coordination and a CWA permit from the USACE. During the biological survey, unnamed ephemeral drainage channels were observed. These potential water features are being reviewed to determine whether the features would be considered WOTUS and require permitting.

Exhibit 3-60. Floodplains and Surface Waters



The USFWS National Wetlands Inventory (NWI) dataset displays Freshwater Forested/Shrub Wetlands and Freshwater Emergent Wetlands in association with the Pecos River in the area. Additionally, NWI indicates eight riverine wetlands present adjacent to ephemeral drainages that cross the study area. During the preliminary wetland survey at the Pecos River, fringe wetlands were identified in spot locations along the river banks. Habitat surrounding the Pecos River within the project area is classified as Freshwater Forested/Shrub Wetlands and Freshwater Emergent Wetlands. The proposed alternative for the new Pecos bridge will shift the alignment south to minimize potential impacts to wetlands. Further analysis will be performed during Phase IC to determine any minimization or mitigation needs.

The formation of temporal playas during summer monsoon rains is common in Southeastern New Mexico. These ephemeral open water features are not considered WOTUS.

The Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) identifies two flood zones occurring within the study area, Zone X and Zone A. Zone X covers most of the NM 31 corridor and is classified as an area with a 0.2 % annual chance floodplain (500-year flood). The area surrounding the Pecos River and an

arroyo a few miles east of the river are designated as Zone A floodplains, which are areas with a 1% (100-year flood) annual flood chance. Although floodplains will need to be addressed, the proposed improvements are not expected to adversely affect the function of the floodplains or support incompatible development.

Groundwater and Cave/Karst/Geologic Voids

The depth to groundwater was reviewed for several wells near the NM 31 study area (Water Resources of the United States—National Water Information System (NWIS) Mapper (usgs.gov) accessed 10/13/2021). In general, wells near the village of Loving and closer to the Pecos River experience groundwater between 20 and 55 feet below the surface while wells along the northern portion of the study area, further away from the Pecos River, recorded depth of groundwater at up to 135 feet below the surface.

Caves, karst topography, and other subsurface geologic voids are common for this portion of the state. According to GIS shapefile data from the BLM CFO, the NM 31 study area between the BOP and approximately MP 14 is composed of a gypsum-based geology where fissures, tubes, and caves are common. These features are often over 1,000 feet long and over 250 feet deep. Moreover, the area from MP 8.5 to MP 13 and MP 18 to the intersection with US 62 are rated as high karst potential by the BLM CFO. Cave and Karst field investigations are ongoing.

Farmlands

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) maintains the Web Soils Survey database which provides information on farmlands in the United States. A search of the NRCS database indicates that, for land adjacent to the project limits, approximately 8.1% is designated as farmland of statewide importance, 1.1% is designated as prime farmland, and 0.3% is “prime farmland if irrigated.” None of the land within or adjacent to the study limits is being used for agriculture. Special considerations may be required if any prime farmland or farmland of statewide importance will be permanently converted to transportation use as part of the project.

Hazardous Materials

The Hazardous Materials Transportation Act defines hazardous material as substances or materials that when transported in commerce may create a risk to health, safety, and property. A preliminary investigation using the U.S. Environmental Protection Agency (EPA) EnviroMapper database shows a total of four locations within 200 feet of the NM 31 corridor currently reporting air emissions to the EPA and/or the New Mexico Environment Department (NMED) including:

- Mosaic Carlsbad Facility
- Mosaic Potash Carlsbad Inc.
- Intrepid North Compaction Plant West Floatation and HB Plant
- Intrepid Potash West Floatation Plant

These facilities also contain inactive storage tank facilities. There are no leaking underground storage tanks (LUTs) or Superfund sites located within the project area or vicinity. Additional hazardous material investigations are on-going.

Air Quality

Air quality regulations pertinent to transportation projects are found in the Clean Air Act Amendments of 1990 (CAA) and the Final Transportation Conformity rule (40 CFR Parts 51 and 93). Eddy County is classified by the EPA as being in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. The Air Quality Bureau of the NMED does not perform ambient air quality monitoring in the project area. The nearest monitor is located in Carlsbad and has not recorded violations of the NAAQS in recent years. Local air quality issues related to the extractive industries is a concern in southeastern New Mexico; however, the transportation industry does not substantially contribute to these the local air quality concerns. Air quality is not expected to be a concern for the project and additional investigations are not anticipated.

Noise

The FHWA has established noise abatement criteria for assessing potential noise impacts associated with transportation projects. The abatement threshold criteria for uses within the corridor is 67 dB(A), although the NMDOT considers abatement when the sound level reaches 66 dB(A).

Land use along the NM 31 corridor includes agricultural, industrial, commercial, residential uses, non-residential uses, and undeveloped lands. The most noise-sensitive receptors include residential and commercial properties. Field measurements were taken to determine existing noise conditions within the NM 31 corridor. Findings showed that noise levels ranged from 63.0 db(A) to 67.9 db(A) and were primarily the result of vehicle traffic. Predominant vehicle types were noted to be large oil industry trucks and other large 18-wheel trucks.

Visual Resources

The FHWA has developed guidance to assist with visual resource impact assessments. Publication FHWA-HI-88-054, *Visual Impact Assessment for Highway Projects*, provides a general framework for the identification and assessment of visual resources. Project visual impacts are seen both from the road and of the road.

Additionally, the BLM has a Visual Resources Management (VRM) Program that classifies visual resources based on their ability to convey scenic beauty while providing for multiple land uses. The VRM categories range from 1 to 4 with VRM Class 1 having the most stringent consideration of scenic values and VRM Class 4 supporting land use activities that create major modifications to the existing visual character of an area. Within the NM 31 corridor, the area in the immediate vicinity of the Pecos River is classified as VRM Category 2. The remainder of the corridor is VRM Category 4. The nearest VRM Category 3 lands are located between 1.5 and 3 miles to the east. Category 2 lands require the level of visual and land use change to be low while VRM Category 4 allows for a high degree of visual change in support of previously established land uses.

The viewshed consists of approximately 23 miles of rural environment with visually open spaces. Land adjacent to the project area is typically used by ranchers as open range land or by the oil, natural gas and potash industries for extraction services and disposal of wastewater. The proposed improvements would not be expected to significantly alter the horizonal and vertical profile of the roadway.

3.11.2 NM 128 Environmental Conditions

The following discusses environmental topics that are germane to the NM 128 corridor.

General Environmental Setting

The general environmental setting along the NM 128 corridor is consistent with the general environmental setting for the NM 31 corridor. Refer to **Section 3.11.1**.

Cultural Resources

A review of the available data available from ARMS and the BLM CFO was completed, in conjunction with pedestrian field surveys of the NM 128 project area. During the investigation, three new sites were discovered, thirty-

seven previously recorded sites were revisited, three previous recorded sites were not located, and thirty-one historic structures were recorded. Only LA 129214 is recommended eligible for listing to the NRHP.

A cultural resources investigation report is being drafted to support NMDOT's Section 106 consultation. Any impacts to LA 129214 will need to be considered when evaluating project alternatives, and potentially mitigated.

Section 4(f) Properties

Similar to the NM 31 corridor, Section 4(f) properties within the NM 128 corridor are limited to the eligible archaeological site, LA 129214. As such, any adverse effects to this property would require consideration under Section 4(f).

Wildlife and General Habitat

Similar to the NM 31 corridor, the NM 128 project area is located within the EPA Level IV Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands ecoregions with vegetative cover dominated by desert grassland and arid shrubland (Griffith et al. 2006). The dominant vegetation characteristic of these ecoregions was observed during the preliminary site investigation.

The Salt Lake near the NM 128 intersection with NM 31 and temporal playas provide ephemeral open water habitat for a variety of terrestrial and aquatic species seasonally during summer monsoon rains. Vegetation within the project ROW is generally disturbed by roadside vehicle activity, mowing, as well as litter and comprised of small mesquite trees, scrub-shrub, yucca, grasses and weeds. Vegetation beyond the ROW is heavily impacted by oil and gas wells and well pads, as well as other associated facilities including stations, de-watering areas, access roads, and piping and hoses scattered throughout the landscape.

The project area has the potential to provide foraging habitat for small mammals such as coyote as well as migratory birds, raptors and owls. Evidence of wildlife was observed throughout the corridor during the biological investigation.

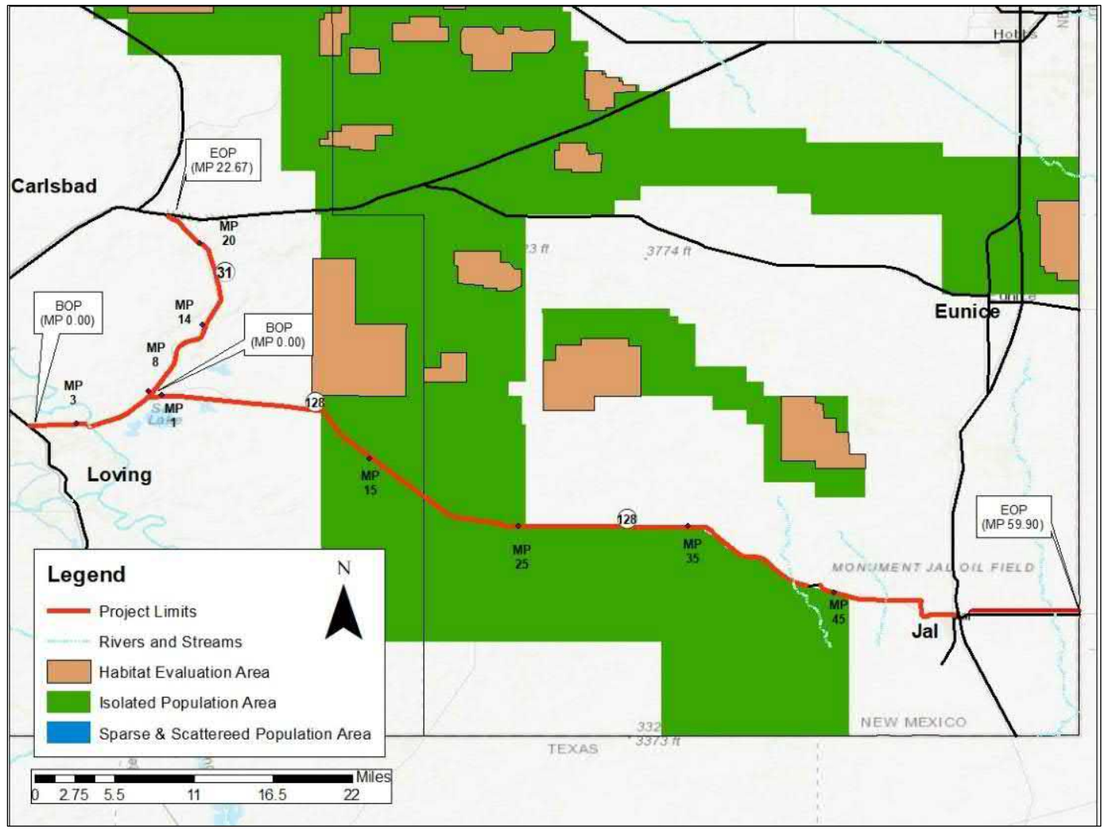
Threatened and Endangered Species

There is no designated critical habitat for any federally listed species in proximity to the NM 128 corridor. Similar to NM 31, the closest designated critical habitat is for Gypsum wild-buckwheat over 50 miles northwest and the nearest proposed critical habitat is for the Texas hornshell), approximately 30 miles southwest.

The USFWS, BLM, and State of New Mexico maintain lists of protected native plants and special status species. There is potentially suitable habitat for state and/or federally listed and BLM CFO special species in proximity to the NM 128 corridor. An initial pedestrian biological survey of the corridor was performed to evaluate the potential suitable habitat for special status species within the study area. During the field investigation, a BLM CFO special status plant species, Scheer's beehive cactus (*Coryphantha robustispina var. scheeri*), was found in the existing ROW of NM 128.

The BLM CFO has designated wildlife management areas that overlap with the study corridor. According to the BLM's 2018 Resource Management Plan Amendment, areas of NM 128 between MP 10 and MP 46 intersect with the Isolated Population Area and the Habitat Evaluation Area for the Lesser Prairie Chicken (LPC), a BLM sensitive species (**Exhibit 3.61**). The LPC inhabits shinnery oak and sand sagebrush habitats. No signs of LPC were observed during the biological survey. Two other species with potential habitat, dunes sagebrush lizard and Texas hornshell mussel were reviewed against known habitat. The project is outside the known habitat and occurrence for those two species.

Exhibit 3-61. Mapped Habitat Areas for Special Status Species



If potential impacts to protected species are identified, consultation with the USFWS, NMDGF, and BLM CFO will be needed.

Waters of the U.S., Wetlands, Playas, Floodplains

The NM 128 corridor is situated in the Nash Draw watershed, which is a closed basin with no connection to the Pecos River watershed. A system of natural saline playa lakes, springs, and seeps are present in the area east of the NM 31 and NM 128 intersection. The system drains from northeast to southwest. These surface water features are also part of a brine water disposal system operated by Mosaic Potash Mine. A 24-inch buried pipeline underneath NM 128 provides connection between some of the playas and mining-related settling ponds. The salt playas in the study corridor do not qualify as WOTUS and are not subject to USACE jurisdiction.

A search of the NWI indicates that there are two riverine and small freshwater wetlands and ponds in the easterly portion of the NM 128 corridor between MP 42 and MP 49, associated primarily with playas such as Salt Lake. A preliminary desktop investigation of the area shows that three lakes, two riverine and one potential freshwater

emergent wetland have been mapped in proximity to the west end of the project. On the east end of the NM 128 study limits, there are two named ephemeral drainages, Antelope Draw near MP 42 and Fight in Hollow Draw near MP 49. Other roadside channels may potentially exhibit wetland hydrology as well as playas.

The Federal Management (FEMA) Digital Flood Insurance Rate Map (DFIRM) identified one flood zone occurring in the NM 128 study area, Zone A. The Pecos River and Salt Lake are designated as Zone A floodplains, which are areas within a 1% (100 year flood) annual chance of flooding. The remainder of the NM 128 corridor is designated as "undetermined flood hazard" area. Although floodplains will need to be addressed, the proposed improvements are not expected to adversely affect the function of the floodplains or support incompatible development.

Groundwater and Cave/Karst/Geologic Voids

The depth to groundwater was reviewed for several areas by accessing the United States Geological Survey (USGS) national water information system mapper (Water Resources of the United States—National Water Information System (NWIS) Mapper (usgs.gov) accessed 12/8/2021). Ground water depth was reviewed for wells near the NM 128 project area. On the eastern portion of the project area, northwest of Jal, there is a recorded well depth of 100 feet below the surface. There were no other wells on the USGS national water information system mapper near the project area.

Caves, karst topography, and other subsurface geologic voids are common for this portion of the state. According to GIS shapefile data from the BLM CFO, the NM 128 study area between MP 5 and MP 7 is composed of a gypsum-based soils where fissures, tubes, and caves are common. These features are often over 1,000 feet long and over 250 feet deep. Moreover, the area from MP 0 to MP 11 is rated as high karst potential by the BLM CFO. Cave and Karst field investigations are ongoing.

Farmlands

A search of the NRCS Web Soils Survey database indicates that within 500-feet of the NM 128 study limits approximately 9.7% of the area is designated as farmland of statewide importance and none of the area is designated as prime farmland or prime farmland if irrigated. None of the land within or adjacent to the study limits is being used for agriculture. Special considerations may be required if farmland of statewide importance will be permanently converted to transportation use as part of the project.

Hazardous Materials

A preliminary investigation using the EPA EnviroMapper data shows no locations within 200 feet of the NM 128 corridor currently reporting hazardous waste to the EPA. There are no LUTs or Superfund sites located within the project area or vicinity. Additional hazardous material investigation are on-going.

Air Quality

Eddy and Lea Counties are classified by EPA as being in attainment of the NAAQS for all criteria pollutants. The Air Quality Bureau of the New Mexico Environment Department (NMED) does not perform ambient air quality monitoring in the project area. The nearest monitors, located in Carlsbad approximately 10 miles northwest, and Hobbs approximately 40 miles northeast, have not recorded violations of ambient air quality standards in recent years. Local air quality issues related to the extractive industries is a concern in southeastern New Mexico; however, the transportation industry does not substantially contribute these the local air quality concerns. Air quality is not expected to be a concern for the project and additional investigations are not anticipated.

Noise

Land use along most parts of NM 128 consist of agricultural grazing lands and industrial properties associated with oil, gas, potash, and salt mining. Traffic noise is not of concern for these types of development and, for this reason, was not evaluated. However, the portion of NM 128 through the City of Jal consists of industrial, commercial, and residential development. Residential uses fall within FHWA Noise Abatement Category B which require an assessment of impact and, when needed, consideration of noise abatement. Given the proximity of residential development to the edge of NM 128 and the high percentage of trucks traveling on this route, existing noise levels are elevated.

Improvement projects that propose substantial roadway capacity increases and/or significant changes to horizontal or vertical alignment are considered a Type 1 project according to the FHWA *Procedures for Abatement of Highway Traffic Noise and Construction Noise* and would require a noise study. However, the proposed improvements are not considered a Type 1 project because the improvements utilize the existing alignment and the existing three-lane section will be reconstructed with one continuous through lane in each direction as is currently provided. Therefore, a noise study is not warranted.

Visual Resources

Within the NM 128 corridor, the study area is within BLM VRM Category 4 which allows for a high degree of visual modification to the landscape. Similar to the NM 31 corridor, the viewshed consists of approximately 60 miles of rural environment with visually open spaces. Land use adjacent to the project area is typically used by the oil, natural gas and potash industries for extraction services and disposal of wastewater. The eastern portion of the NM 128 study corridor intersects with the City of Jal and can be described as having a rural business and residential viewshed. The proposed improvements would not be expected to significantly alter the horizonal and vertical profile of the roadway.

3.12 Communities, Businesses and Industry

This section describes the community resources within the study corridor, including characterizations of the area demographics, general lands use, local communities, and industries. As with the earlier sections, the NM 31 corridor and NM 128 corridor are presented separately.

3.12.1 NM 31 Communities, Businesses and Industry

The NM 31 corridor demographics, land uses, communities, and industries are presented below.

Demographics and Environmental Justice

The Demographic characteristics of the project area population were reviewed to identify groups that may require special consideration consistent with Title VI and Executive Order 12898. Data from the American Community Survey website and EPA's Environmental Justice Screening and Mapping Tool (EJSCREEN) was reviewed to characterize the economic and demographic make-up of the study area. This tool uses the most recent data available from the United States Census Bureau at the block-group level to identify demographic characteristics of a study area defined by the user.

As summarized in **Exhibit 3-62**, the population in the NM 31 study area and nearest community, Loving, is relatively small with 43 percent of the people identifying as a minority race or ethnicity (people of color), which is less than the statewide average of 62 percent and the Eddy County average of 52 percent. Approximately 30 percent are classified as low income compared with 19.1 percent in the state overall and 14.6 percent in Eddy County (**Exhibit 3-63**). The age distribution within the study area is relatively similar to that of the State and County. Environmental justice will be considered when evaluating the proposed improvements as part of the environmental phase.

Exhibit 3-62. NM 31 Corridor Demographics

	New Mexico	Eddy County	Loving	NM 31 Study Area
Total Population	2,092,454	57,732	1,214	69
Ethnicity				
White	37.4%	46.8%	15%	56%
African American	1.8%	1.4%	0%	1%
Native American	8.7%	1.4%	9%	3%
Asian	1.5%	0.5%	0%	0%
Some Other Race	0.3%	0%	0%	0%
Two or More Races	1.6%	0.7%	0%	1%
Hispanic or Latino	48.8%	49.1%	75%	39%
Age				
Under 5	6%	7.3%	7%	5%
0-17	23.3%	26.5%	21%	17%
18 and Over	76.7%	73.5%	79%	83%
65 and Over	16.9%	14.3%	18%	14%

Source: EPA 2021

Exhibit 3-63. NM 31 Income Demographics

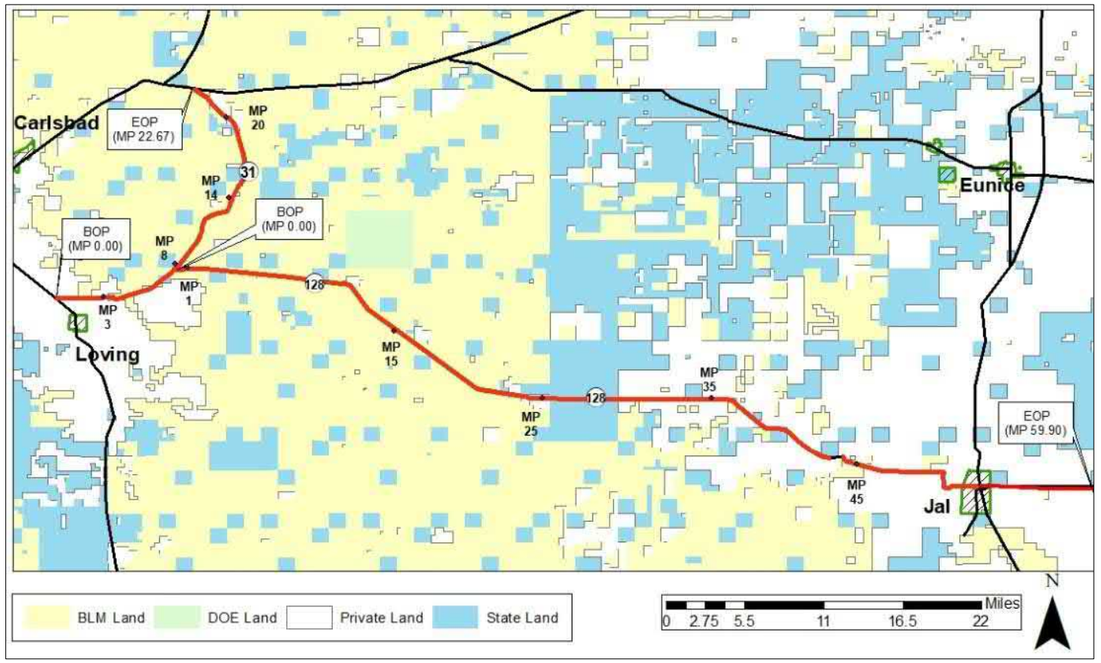
Income	New Mexico	Eddy County	Loving	NM 31 Study Area
Per Capita Income	$27,230	$30,246	$28,268	$34,401
Percent Unemployed	3.8%	2.8%	3%	5%
Percent Below Poverty	19.1%	14.6%	48%	30%

Source: EPA 2021

General Land Use

Land ownership in the general area consists of a checkerboard of private, state, and federal land parcels (**Exhibit 3-64**). In the Permian Basin, sub-surface mineral ownership can be different than the surface. Approximately 68 percent of the land in the NM 31 study area is managed by the BLM CFO, 26 percent is private, and 6 percent is managed by the New Mexico State Land Office (SLO). Land use in study area includes farming, ranching, and extractive industries such as oil, natural gas, and potash facilities. Both the BLM and SLO lands are managed for multiple uses including extractive industries, rangeland, and wildlife habitat.

Exhibit 3-64. Land Ownership



Communities

The community of Loving is located just west of the NM 31 BOP at the intersection of NM 31 and US 285. Carlsbad is located 12 miles north of Loving and 17 miles west of the project EOP at the intersection of NM 31 and US 62. These communities provide access to resources such as schools, parks, emergency response providers, and government services (e.g., post office, motor vehicle department, etc.). While these resources are not located directly in the study area, NM 31 provides primary access to these services in both Loving and Carlsbad. Continued access to these facilities during construction is expected to be a topic of concern to the general public.

There are three school districts that operate within the proximity of the study corridor. School bus activity in the area consists of The Jal School District and The Carlsbad School District. Jal public schools operates in the eastern section of the NM 31/128 corridor from NM 128 and 8th Street to NM 128 and Dollarhide Road. The Carlsbad School District operates in the western section of the NM 31/128 corridor from the intersection of US 62 and NM 31 to NM 31 and MP 16. Both school districts operate in the morning from 6:30 a.m. to 7:40 a.m. and in the afternoon from 3:30 p.m. to 4:30 p.m. Although the Loving School District does operate in the project vicinity, school busses currently do not travel on any portion of NM 31 or NM 128.

Industries

NM 31 is an important highway that provides connections to additional regionally significant highways such as US 285, US 60, and NM 128. This combined roadway network provides critical access for the region's extractive

industries of oil, gas, and potash mining. The Waste Isolation Pilot Plant (WIPP), a geological repository for radioactive waste, is an industry important to the local community. It is located along NM 128 near the NM 31 corridor.

Additional industries such as retail, hospitality, and tourism are a secondary consideration for the NM 31 corridor as retail opportunities and hotels are found in the nearby communities of Loving and Carlsbad. While not in the NM 31 corridor, the corridor provides vital access to these goods and services for people traveling from Texas and the City of Jal. Similarly, Carlsbad Caverns National Park and other regional attractions are located near the project area and draw travelers from around the country who rely on this local transportation network.

3.12.2 NM 128 Communities, Businesses and Industry

The NM 128 corridor demographics, land uses, communities, and industries are presented below.

Demographics and Environmental Justice

Data from the U.S. Census Bureau was obtained via the American Community Survey website and the EPA's EJSCREEN and reviewed to determine the demographic characteristics of the NM 128 study area.

As summarized in **Exhibit 3-65**, the population in the NM 128 study area and nearest community, Jal, is relatively small with 65% of the people identifying as a minority race or ethnicity (people of color), which is similar to the averages for Eddy County and Lea County and higher than the State average. Approximately 31 percent of the population surrounding the study area is below the poverty level which is higher than the State average of 19 percent (**Exhibit 3-66**). The age distribution within the study area is relatively similar to that of the State and Counties. Environmental justice will be considered when evaluating the proposed improvements as part of the environmental phase.

Exhibit 3-65. NM 128 Corridor Demographics

	New Mexico	Eddy County	Lea County	Jal	NM 128 Study Area
Total Population	2,092,454	57,732	70,277	1,977	401
Ethnicity					
White	37.4%	46.8%	35.4%	37%	35%
African American	1.8%	1.4%	3.4%	0%	0%
Native American	8.7%	1.4%	0.8%	1%	0%
Asian	1.5%	0.5%	0.6%	0%	0%
Some Other Race	0.3%	0%	0.2%	0%	0%
Two or More Races	1.6%	0.7%	0.9%	1%	0%
Hispanic or Latino	48.8%	49.1%	58.7%	61%	65%
Age					
Under 5	6%	7.3%	7.9%	9%	13%
0-17	23.3%	26.5%	30.1%	25%	31%
18 and Over	76.7%	73.5%	69.9%	75%	69%
65 and Over	16.9%	14.3%	11.1%	17%	16%

Source: EPA 2021

General Land Use

Land ownership in the general area consists of a checkerboard of private, state, and federal land parcels (**Exhibit 3-64**). The mix of surface ownership in the NM 128 study area is approximately 28 percent BLM CFO, 48 percent private, 13 percent SLO. A portion of the corridor is owned by the Department of Energy (DOE) for the WIPP facility. The State of New Mexico has designated specific roadways to carry WIPP shipments. Land use in the study area is generally includes farming, ranching, and extractive industries such as oil, natural gas, and potash facilities.

Communities

The City of Jal is located in the southern portion of Lea County near the Texas border and EOP for the NM 128 segment. Jal is a rural community with residential housing, local business oil and gas industry-related activity, and some ranching. The City has minimal hospitality services, such as hotels and retail stores, and is much more focused on providing services to the extractive industries. However, some community resources, such as schools and government services (e.g., post office, etc.) are available. While not located directly in the study area, NM 128 provides primary access to community services in Loving and Carlsbad, as well as Odessa, Texas, and other Texas communities.

Exhibit 3-66. NM 128 Income Demographics

Income	New Mexico	Eddy County	Lea County	Jal	NM 128 Study Area
Per Capita Income	$27,230	$30,246	$25,585	$24,541	$28,764
Percent Unemployed	3.8%	2.8%	3.8%	4%	2%
Percent Below Poverty	19.1%	14.6%	15.8%	34%	31%

Source: EPA 2021

There are three school districts that operate within the proximity of the study corridor. School Bus activity in the area consists of The Jal School District and The Carlsbad School District. Jal public schools operates in the eastern section of the NM 31/128 corridor from NM 128 and 8th Street to NM 128 and Dollarhide Road. The Carlsbad School District operates in the western section of the NM 31/128 corridor from the intersection of US 62 and NM 31 to NM 31 and MP 16. Both school districts operate in the morning from 6:30 a.m. to 7:40 a.m. and in the afternoon from 3:30 p.m. to 4:30 p.m. Although the Loving School District does operate in the project vicinity, school busses currently do not travel on any portion of NM 31 or NM 128.

Industries

NM 128 is a critical east to west regional transportation corridor that provides connections to communities, private properties and business between Jal and Loving by way of NM 31. This combined roadway network provides critical access for the region's extractive industries of oil, gas, and potash mining. NM 128 also serves as an economic connection for transportation beyond New Mexico. NM 128 provides a connection to the Texas border east of Jal. Additional industries such as retail, hospitality, and tourism are a secondary consideration for the NM 128 corridor.

4.0 Introduction

This chapter summarizes the process followed to identify and evaluate alternatives that were deemed reasonable to consider for the NM 31/128 corridor. For highway projects, the term "alternative" generally is defined as design, operational, or other ways of meeting the improvement needs of the corridor under investigation. **Chapter 1** provides an overview of the purpose and need for improving NM 31 and NM 128 and **Chapter 3** provides additional details for the various aspects of the existing facilities that warrant improvement.

The evaluation process included two tiers of evaluation. The process started with the identification and screening of reasonable alternatives for both the highway mainline segments and major intersections. The development of alternatives focused on approaches that address the three main project needs including improving safety, reducing congestion, and improving the condition of pavement, bridge, and drainage infrastructure. In addition to the identification of alternatives, this step also developed the criteria and metrics used for the first tier of the evaluation process.

The second step consisted of a more detailed assessment and comparison of alternatives advanced from the screening phase. This step included the development of each alternative in greater engineering detail followed by the evaluation of each alternative using specific metrics and criteria.

Each step of the above process is discussed in the remaining sections of this chapter.

4.1 Alternatives Identification

The first step in the evaluation process included the identification of a range of potential improvement alternatives that could address the various needs affecting both NM 31 and NM 128, and the identification of criteria and metrics that could be used to compare and assess their performance. The various alternatives identified, the screening criteria and methodology, and screening findings and recommendations are summarized below.

4.1.1 Alternatives Considered

For the initial evaluation, project alternatives were developed for two primary elements of the NM 31/128 corridor including: 1) highway mainline segments; and 2) major intersections. Because the corridor is mostly rural except for the segment that passes through the City of Jal, mainline alternatives were separated by rural and urban settings. Both NM 31 and NM 128 have numerous intersections with other state and county roads as well as local roads and access driveways. For the purposes of the screening analysis, "major intersections" were defined as state, county, and local roads that connect to NM 31 or NM 128 and having traffic operational concerns or a high crash rate. These routes generally are those used to access the larger oilfields, salt and potash mines, and processing plants within the corridor. The alternatives identified for the highway mainline, the City of Jal, and major intersections are described below.

Because the screening process is based on major differences between alternatives and is intentionally high level, the conceptual design is limited to typical sections, representations of the types of improvements based on existing aerial images, and limited plan view details. Additional detail is developed for alternatives advanced to the next phase of the assessment.

NM 31 and NM 128 Rural Mainline Segments

Four alternatives were identified for the NM 31 and NM 128 rural mainline segments. These ranged from enhanced two-lane concepts and various four-lane concepts. The rural concepts considered by the screening evaluation are described below and illustrated in **Exhibit 4-1** through **Exhibit 4-4**.

Enhanced Two-Lane Alternative

The Enhanced Two-Lane Alternative would reconstruct NM 31 and NM 128 as two-lane highways consistent with their current configuration. The primary difference is the reconstruction would widen shoulders to 10 feet, add speed change lanes (i.e., acceleration, deceleration, and turn-lanes) at major intersections as determined necessary by the traffic operations and safety analyses, provide periodic passing lanes, and correct vertical and horizontal alignment deficiencies to achieve a consistent design speed. This alternative would also reconstruct the roadway pavement, drainage structures, and other associated roadway infrastructure, as needed.

The primary benefit of the Enhanced Two-Lane Alternative is the safety benefits provided by the passing lanes and intersection improvements. **Exhibit 4-1** illustrates the typical section for the Enhanced Two-Lane Alternative.

Super 2 Alternative

The Super 2 Alternative is similar to the Enhanced Two-Lane Alternative in that it maintains the existing two-lane configuration of NM 31 and NM 128. The primary difference is the Super 2 Alternative includes continuous alternating passing lanes at approximate two-mile intervals, i.e., a passing lane in one direction that transitions to a passing lane in the opposite direction. This pattern continues for the entire length of the project except in areas where widening is constrained by bridges and other major structures or features. Improvements to roadway shoulders, intersections, horizontal and vertical alignment, pavement, drainage, and other roadway-associated infrastructure would be the same as described for the Enhanced Two-Lane Alternative.

Compared to the Enhanced Two-Lane Alternative, this alternative provides the same shoulder and intersection-related safety improvements, but passing safety is improved with the more frequent passing opportunities provided. **Exhibit 4-2** shows the Super 2 Mainline alternative typical section.

Four-Lane Flush Median Alternative

This alternative would reconstruct the existing two-lane highway as a four-lane section. It includes two driving lanes in each direction, 10-foot wide shoulders, a 14-foot wide paved median separating opposing traffic, and speed change lanes at most major intersections. The paved median is flush with adjacent driving lanes and can be striped to allow left-turns. Use of the median outside of intersections would be restricted by yellow striping and rumble strips. The vertical and horizontal alignment would be improved to achieve passing and stopping sight distance consistent with a desired design speed of 60 mph for the first four miles of NM 31 and 70 mph for the remainder of NM 31 and NM 128. This alternative would also correct problems with pavement condition, drainage structures, and other associated roadway infrastructure, as needed. It would also include a new two-lane bridge across the Pecos River that would be constructed adjacent and parallel to the existing bridge.

Compared to either of the two-lane alternatives, this alternative would provide the same shoulder related safety improvements, but passing safety is further improved by the elimination of passing maneuvers in both directions. **Exhibit 4-3** shows the Four-Lane Flush Median Mainline alternative typical section.

Four-Lane Depressed Median

This alternative provides two driving lanes in each direction, a depressed median of variable width ranging from 38 feet to 60 feet (as measured from the outside edges of driving lanes), 10-foot wide outside shoulders, and 4-foot wide inside shoulders. Compared to the Four-Lane Flush Median alternative, this alternative provides the same shoulder safety benefits and elimination of passing maneuvers but may provide better safety due to the wider median. Left-turns are provided by constructing auxiliary lanes and median cross-overs. **Exhibit 4-4** shows the Four-Lane Depressed Median Mainline alternative typical section.

Exhibit 4-1. Enhanced Two-Lane Mainline Typical Sections

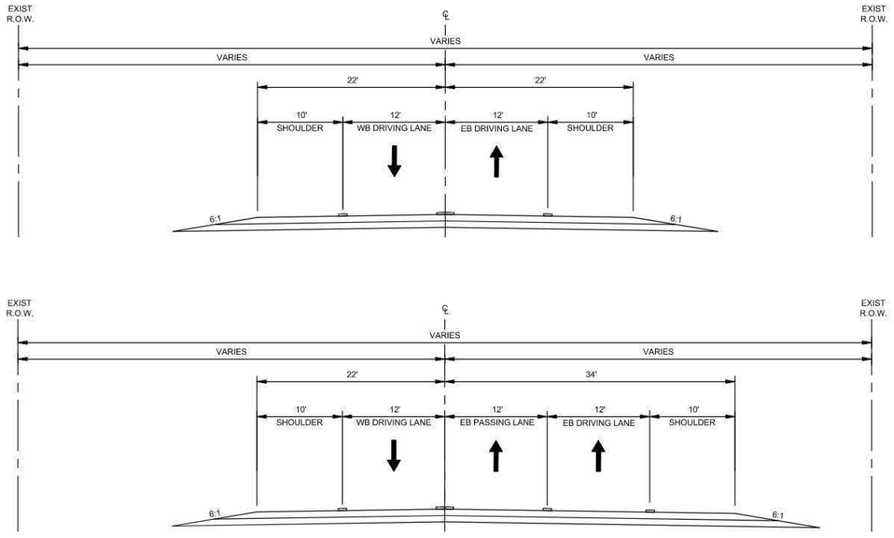


Exhibit 4-2. Super 2 Mainline Typical Section

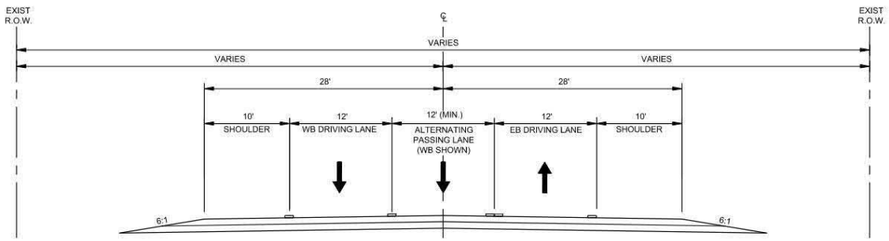


Exhibit 4-3. Four-Lane Flush Median Mainline Typical Section

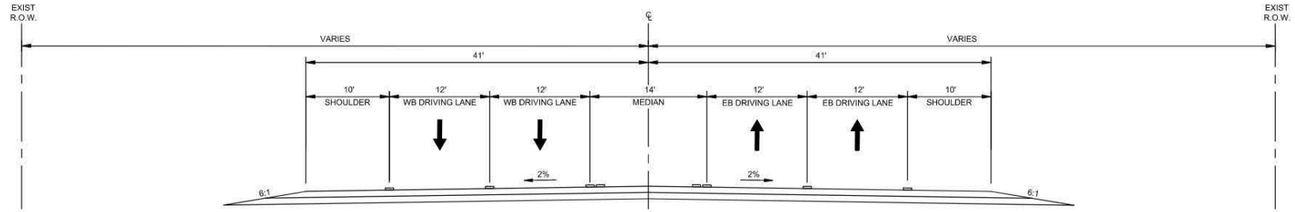
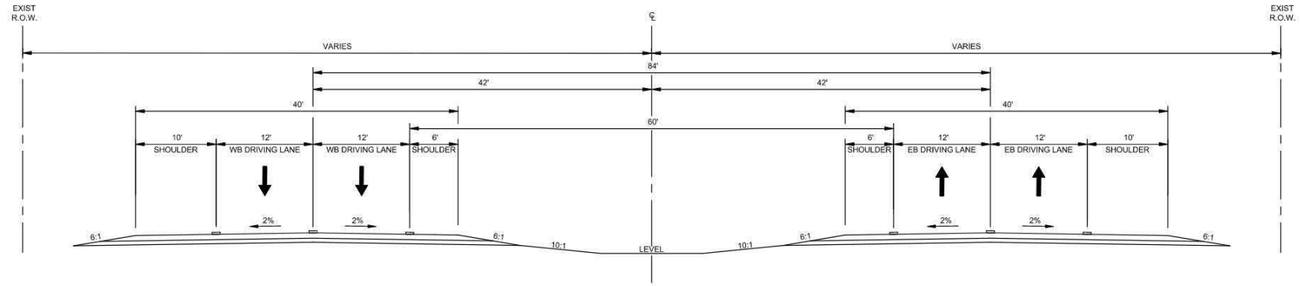
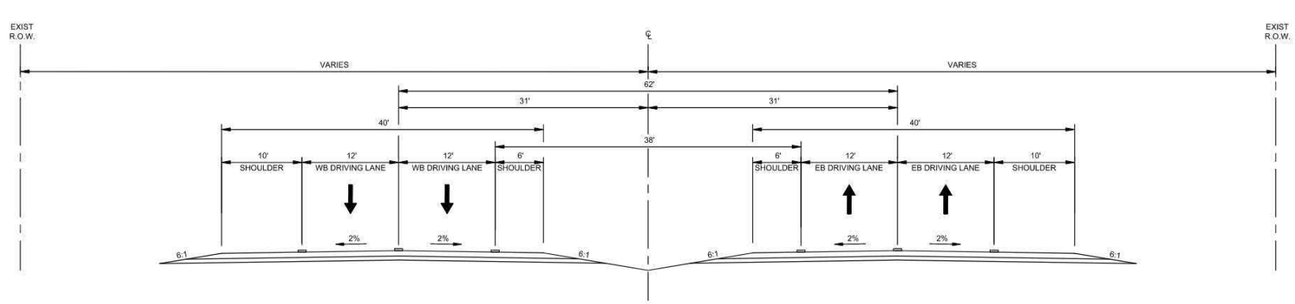


Exhibit 4-4. Four-Lane Depressed Median Mainline Typical Sections





NM 128 through the City of Jal

The segment of NM 128 that passes through the City of Jal differs from the other segments of NM 31 and NM 128 in that it passes through an urbanized area. This segment begins at MP 51, extends through MP 53, and includes the key intersections of NM 128 and NM 18 and NM 128 and 3rd Street. Three alternatives were identified for this segment and include a 3-lane, 4-lane, and 5-lane section. The concepts through the City of Jal are described below and illustrated in **Exhibit 4-5** through **Exhibit 4-7**.

Jal 3-Lane Alternative

The Jal 3-Lane Alternative would reconstruct NM 128 similar to its existing configuration and include a single 13-foot driving lane in each direction, a 14-foot continuous two-way left-turn lane (TWLTL), 6-foot shoulders, curb and gutter, a 3-foot buffer, and 5-foot sidewalks. This alternative would reconstruct the roadway pavement, drainage structures, and other associated roadway infrastructure, as needed.

Jal Undivided 4-Lane Alternative

The 4-Lane Alternative would reconstruct NM 128 as a 4-lane urban section. The improvements with this alternative include two 12-foot driving lanes in each direction of NM 128, 2-foot shoulders, curb and gutter, a 3-foot buffer, and 5-foot sidewalks. Other improvements include reconstruction of the roadway pavement, drainage structures, and other associated roadway infrastructure, as needed.

Jal 5-Lane Alternative (Divided 4-Lane)

The 5-Lane Alternative would reconstruct NM 128 as a 4-lane urban section with a median for left turns. The improvements with this alternative include two 12-foot driving lanes in each direction of NM 128, a 14-foot continuous TWLTL, 2-foot shoulders, curb and gutter, a 3-foot buffer, and 5-foot sidewalks. Other improvements include reconstruction of the roadway pavement, drainage structures, and other associated roadway infrastructure, as needed.

Exhibit 4-5. NM 128 Jal Segment: 3-Lane Alternative

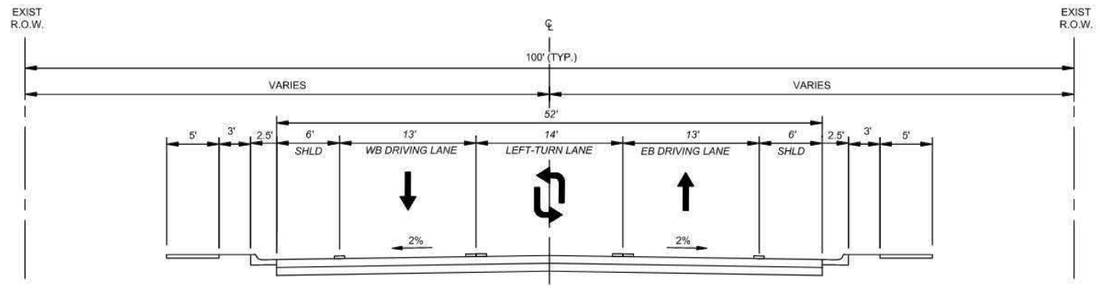


Exhibit 4-6. NM 128 Jal Segment: Undivided 4-Lane Alternative

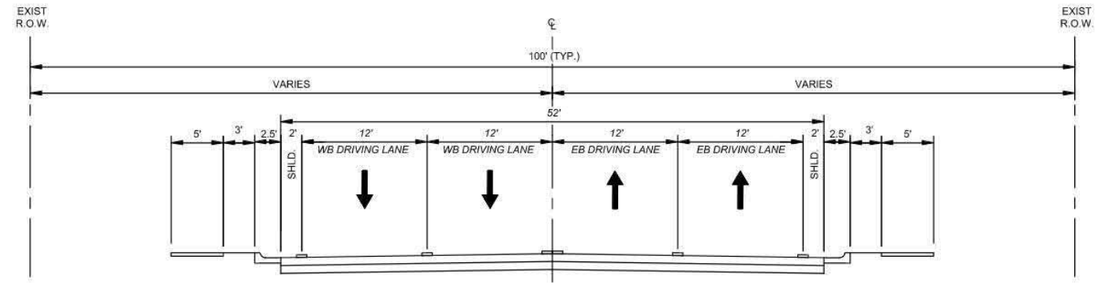
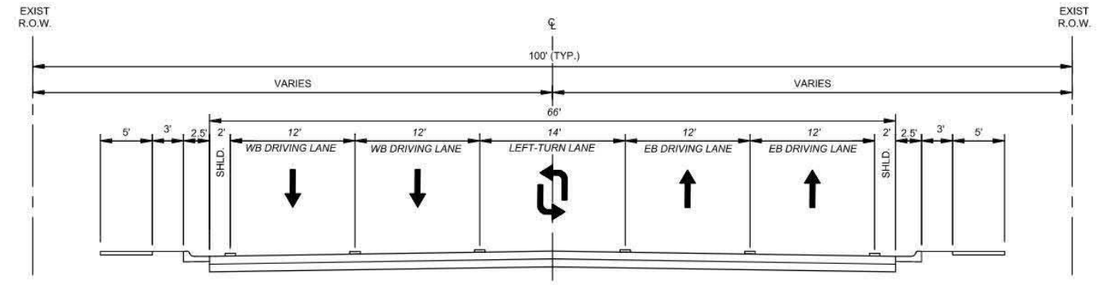


Exhibit 4-7. NM 128 Jal Segment: 5-Lane Alternative (Divided 4-Lane)



Major Intersections - Rural

All of the rural intersections along NM 31 and NM 128 are currently stop-sign controlled with stop signs on the minor road approaches. Motorist delay at the major intersections is a key concern along the corridor, such as at the intersections of NM 31 at Refinery Road and at NM 128, and the intersections of NM 128 at WIPP Road, at Buck Jackson Road, and at Orla Road. Several configurations were considered for the major stop-controlled intersections including both conventional and unconventional intersection configurations including:

- Two-way Stop-controlled intersection (TWSC; unsignalized)
- High-T intersection (one continuous through movement on major road) (High-T)
- Roundabout intersection (RAB)
- Restricted Crossing U-Turn (RCUT) Intersection (a.k.a., J-turns, Superstreet)

Grade-separated interchanges were considered as a potential intersection improvement strategy. However, they were not advanced as a general intersection treatment because of the relatively low traffic volumes, increased capital and maintenance costs, and the right-of-way requirements. Grade separation of NM 128 at the railroad crossing east of NM 31 was also considered as a potential alternative but was not advanced for the same reasons.

Two-way stop controlled (unsignalized) intersections are consistent with the existing condition for both NM 31 and NM 128 and is generally consistent with driver expectations at rural intersections. With this configuration, stop signs are used on the minor road approaches to the main highway and motorists select gaps in traffic to enter or cross the highway (see **Exhibit 4-8.A** on page 4-5). This concept was considered for all major and minor intersections within the rural segments of the NM 31 and NM 128 corridors.

High-T intersections are only applicable to three-legged intersections with moderate to low left-turns from the minor road. Stop-sign control is utilized and channelization is provided to separate the minor road left-turn movement from the far-side through movement on the major road. Left turns from the major road approaches are accommodated the same as a conventional intersection. The minor road left-turn movement merges into the mainline traffic flow downstream of the intersection (**Exhibit 4-8.B** on page 4-5). The operational advantage is the stop-controlled minor road left-turn only has to have an adequate gap to cross the near-side major road through movement. Potential concerns in a rural highway setting include the need for access management on the major road within the downstream merge area, including both median openings and access points along the outside of the highway, and the high-speed merge of the traffic streams. Depending on access locations within the merge area, lane changing and weaving maneuvers may also occur at high speeds.

Roundabout (RAB) intersections consist of a circular intersection controlled by yield signs on each approach leg, see example in **Exhibit 4-8.C** on page 4-5). Variations to the circular layout can be made but are less common. Vehicles within the circulatory part of the RAB have the right-of-way with traffic entering the intersection yielding to this traffic before entering the roundabout. Operationally, RABs are among the most efficient intersection configurations, and have proven safety benefits because the number of conflict points at the intersection is reduced and their geometric design requires lower travel speeds.

Restricted Crossing U-Turn Intersections (RCUT) prohibit left-turn and through movements from minor road approaches. The prohibited movements are required to turn right onto the major road and then make a U-turn maneuver at a one-way median opening 400 to 2,000 feet downstream of the intersection, depending on the posted speed of the major roadway. Left turns from the major road approaches are accommodated the same as a conventional intersection. In general, an RCUT requires extra travel time for the minor-road left-turn and through movements resulting in higher travel times for these movements but delays for the major-road movements are reduced. An example of an RCUT is shown in **Exhibit 4-8.D** on page 4-5.

Per FHWA, guidance for the applicability of RCUT intersections includes:

- Relatively low to medium through volumes on the minor road approaches.
- Heavy left-turn volumes from the major road.
- The volume ratio of the minor road total volume to total intersection volume is typically less than or equal to 0.20.

For intersections with very high left-turn and through volumes from the minor road approaches, the RCUT intersection should not be considered.

NM 31 / NM 128 Intersection

The above intersection configurations are applicable to all the major intersections within the rural segments of NM 31 and NM 128 including NM 31 at Refinery Road and the intersections of NM 128 at WIPP Road, Buck Jackson Road, and Orla Road. Additional configurations were considered for the intersection of NM 31 at NM 128. The existing configuration of this intersection is a Tee with stop-control for westbound NM 128. The predominant traffic pattern at this location in the morning peak period is northbound-to-eastbound (i.e., right turns from NM 31 onto NM 128) and westbound-to-southbound (i.e., left turns from NM 128 onto NM 31) in the evening peak period. NM 31 traffic volumes north of NM 128 are substantially less than traffic on NM 31 south of the intersection. For these reasons, reconfiguring this intersection was considered to improve traffic flow to better accommodate the primary movements and to reduce collisions. Increasing the distance to the railroad crossing was considered to provide more separation between the intersection and the crossing.

The concepts and alignments considered for the NM 31/128 intersection started with reconfiguring the intersection to make the south leg of NM 31 continuous with NM 128 and making the north leg of NM 31 stop-controlled at NM 31/128 (see **Exhibit 4-9.A** on page 4-6). The new intersection was shifted several hundred feet south of the existing intersection to increase the distance between the intersection and the BNSF railroad spur in this area. Four configurations were considered for the realigned intersection including stop-controlled, High-T, RCUT, and a roundabout (**Exhibit 4-9.B** through **4-9.D)**. These configurations were evaluated assuming an at-grade and a grade-separated crossing of the BNSF railroad tracks east of the intersection. Using a grade-separation does not improve traffic flow at the intersection but adds considerable cost. **Exhibit 4-9.E** on page 4-7 illustrates this concept. Only one intersection type is shown but this concept was evaluated for all of the intersection types and has a similar footprint.

Major Intersections – City of Jal

All-way stop control is currently utilized at the NM 128 intersections with 3rd Street and with NM 18. All other intersections are two-way stop-controlled intersections. As shown in **Chapter 3**, the all-way stop-control does not provide acceptable levels of traffic performance at NM 18 and at 3rd Street. Because of the short distance between these intersections, traffic queues routinely back through and beyond each intersection demonstrating the need for coordinated operations at these intersections. As such, traffic signal control is being considered for these two intersections along with turn lane improvements, and traffic signal warrant studies have been prepared.

4.2 Screening Criteria and Evaluation

The mainline and intersection alternatives described above were evaluated using a screening process. The screening evaluation served to identify alternatives that are either not viable or that have substantial performance shortcomings. Alternatives recommended by the screening evaluation were advanced for detailed assessment (see **Section 4.3**). The screening evaluation included both quantitative and qualitative analysis.

As described in **Chapter 3**, the primary needs for improvement to NM 31 and NM 128 include poor traffic performance, crash history, and condition of existing pavement and other roadway infrastructure. Roadway infrastructure is corrected by all alternatives, regardless of their configuration. In contrast, traffic operations and safety benefits can be substantially different for a two-lane and multi-lane highway and for different intersection configurations. For this reason, traffic operations and safety were two primary metrics used for the screening evaluation. In addition, the alternatives were evaluated for other major factors associated with their implementation including impacts to roadside development, the feasibility of an alternative given the context of the project, and general cost-effectiveness. The assessment for these other factors was primarily qualitative although some quantitative analysis was included. The screening evaluation methodology, assumptions, and findings are discussed in the following sections.

4.2.1 Safety Considerations for Screening Analysis

Based on the crash history review summarized in **Chapter 3**, improvements are needed to address safety concerns along NM 31 and NM 128. On NM 31, the intersection at NM 128 is considered a high-crash location indicating a need for more investment there (as discussed above), while the crash occurrence north of the NM 128 intersection does not indicate specific safety concerns.

On NM 128, the crash rates are considered higher than expected for the highway segments including the following intersections: Orla Road, Red Road/Twin Wells East, Battle Axe Road, Delaware Basin Road, Brininstool/Diamond Road, and Schooley Road. Within Jal, rear-end crash occurrence is elevated likely due to congestion and extensive traffic queues associated with the all-way stop controlled intersections.

Exhibit 4-8.A. Example of a Two-Way Stop Controlled Intersection at Refinery Road

Exhibit 4-8.B. Example of a High-T Intersection at Refinery Road

Exhibit 4-8.C. Example of a Roundabout Intersection at Refinery Road

Exhibit 4-8.D. Example of a RCUT Intersection at Refinery Road

Exhibit 4-9.A. NM 31/NM 128 Intersection Realignment Alternative

Exhibit 4-9.B. NM 31/NM 128 Intersection Realignment Alternative with High-T

Exhibit 4-9.C. NM 31/NM 128 Intersection Realignment Alternative with RCUT

Exhibit 4-9.D. NM 31/NM 128 Intersection Realignment Alternative with Roundabout

Exhibit 4-9.E. NM 31/NM 128 Intersection Realignment Alternative with RCUT and BNSF Grade-Separation

In addition to unconventional intersection types discussed above, including the RCUT and modern Roundabouts, the types of safety improvements may include:

- The addition of left-turn and right-turn speed change lanes at the major crossroads to NM 31 and NM 128 with proper deceleration and storage lengths.
- Providing a median to provide positive separation of the opposing travel directions.
- Providing a passing lane in each direction where a two-lane highway provides sufficient capacity.
- Providing additional traffic capacity at intersections and along highway segments.
- Adding rumble strips along the outside edges of the travel lanes, as well as along the centerline of two-lane highways.

Safety enhancements are expected with the improvements to update NM 31 and NM 128 to current standards. All improvements considered and/or developed for this project will be designed to current AASHTO and NMDOT design standards and will satisfy nominal safety needs. Nominal safety refers to the design standard of the facility such as adequate sight distance for the design speed, the slope rates used for the clear zone and embankment tie-ins, drainage culvert end treatments, wider shoulders, and intersection turn lanes with proper lengths. Because all improvements will be designed to current standards, whether a two-lane highway, a four-lane highway or alternative intersection types, safety will be enhanced and is not a major differentiator for the screening evaluation.

4.2.2 Design-Year Traffic Analysis

The traffic operations analysis of alternatives was performed for a 20-year design, i.e., the year 2041. The methodology and assumptions used to estimate design year traffic volumes and evaluate traffic operations for each of the mainline and intersection alternatives are summarized in this section. Refer to **Chapter 3** for the SAMM and the Highway Capacity Manual level of service (LOS) criteria. Supporting materials and the analysis output reports are provided in the *electronic appendices*.

NM 31 Design-Year (2041) Traffic Operations

Design-Year (2041) Peak-Hour and Daily Volumes

Design-year daily traffic estimates were based on a 0.85% annual growth rate to project the 2019 volumes to the design year of 2041 (1.2 factor for 22 years of growth). The annual growth rate was based on population growth estimates for Eddy County and Lea County. While traffic volumes fluctuate with the various industries in southeast New Mexico, application of an annual growth rate was used to provide a conservative evaluation of design year conditions. The growth rate of 1.2 was applied to the final 2019 traffic volumes and the resulting design-year (2041) traffic volumes are summarized in **Exhibit 4-10**. The design-year traffic estimates reflect the expected demand and are not based on the number of lanes/capacity.

The Average Daily Traffic (ADT) volumes for 2041 conditions in vehicles per day are summarized in **Exhibit 4-11**. Volumes along NM 31 are the highest between Donaldson Farm Road and Fisherman's Lane. The daily traffic volume decreases by 70% north of NM 128.

Traffic Operations for 2041 Conditions

The Highway Capacity Software (HCS7) was used to evaluate design-year traffic performance including two-lane highway segments, multi-lane highway segments, and unsignalized intersections along the study corridor. The 2041 traffic operations along NM 31 were analyzed for the existing two-lane highway, or No Build conditions, and for the pertinent alternatives identified to address operational deficiencies of the No Build condition.

Two-Lane Highway Segments Operational Analysis

Exhibit 4-12 summarizes the LOS results for the 2041 No Build two-lane highway segments along the corridor. Consistent with the findings of the existing conditions analysis, NM 31 as a two-lane highway is deficient from Kelly Road (approximately MP 0.25) to NM 128. In contrast, the segment between NM 128 and US 62 is expected to perform at acceptable standards for both AM and PM Peak volumes with the two-lane highway configuration.

The analysis considered locations where passing is constrained and where passing zones exist. As described in **Section 4.1.1**, passing lanes are an element of the Enhanced Two-Lane Alternative and Super 2 Alternative. In addition, other site safety improvements are proposed at the Mosaic, Intrepid and United Salt Corporation industrial sites. The combination of passing lanes, auxiliary lanes, and wider shoulders would enhance traffic operations along NM 31 north of NM 128 with LOS A/B expected.

Exhibit 4-10. Design-Year (2041) Turn Movement Volumes at NM 31 Intersections

2019 Volume by Approach and Movement (vehicles per hour)													
Location Along NM 31	Peak Hour	Eastbound NM 31			Westbound NM 31			Northbound			Southbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Kelly Road	AM	40	460	-	-	180	30	-	-	-	40	-	20
	PM	30	270	-	-	410	200	-	-	-	40	-	20
Carter Road	AM	-	460	20	60	170	-	20	-	120	-	-	-
	PM	-	310	20	60	570	-	20	-	80	-	-	-
Nymeyer Road	AM	-	570	20	40	240	-	0	-	50	-	-	-
	PM	-	390	20	20	590	-	20	-	30	-	-	-
Donaldson Farm Road	AM	10	59	40	150	270	10	20	0	60	10	0	10
	PM	10	390	30	80	590	10	30	0	120	10	10	10
Fishermans Lane	AM	-	640	10	0	370	-	10	-	20	-	-	-
	PM	-	490	10	0	650	-	10	-	0	-	-	-
Refinery Road	AM	20	600	20	20	330	30	20	20	0	220	0	40
	PM	40	470	0	20	560	220	30	20	0	80	20	40
Location along NM 31	**Peak Hour**	**Northbound NM 31**			**Southbound NM 31**			**Eastbound**			**Westbound**		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
NM 128	AM	-	140	700	50	180	-	-	-	-	220	-	50
	PM	-	240	330	40	150	-	-	-	-	660	-	20
USC/Mosaic Site	AM	-	160	20	20	210	-	-	-	-	20	-	20
	PM	-	250	20	20	150	-	-	-	-	20	-	40
US 62	AM	90	-	80	-	-	-	-	590	80	150	410	-
	PM	150	-	160	-	-	-	-	520	60	100	940	-

Exhibit 4-11. Design-Year (2041) Average Daily Traffic Volumes on NM 31

Segment along NM 31	Average Daily Traffic Volume (veh/day)
MP 0.0 to Kelly Rd	10,200
Kelly Rd to Carter Rd	10,700
Carter Rd to Nymeyer Rd	11,700
Nymeyer Rd to Donaldson Farm Rd	13,400
Donaldson Farm Rd to Fishermans Ln	14,800
Fishermans Ln to Refinery Rd	14,000
Refinery Rd to NM 128	13,600
NM 128 to USC/Mosaic Site	4,200
USC/Mosaic Site to MP 22.67	4,300

Exhibit 4-12. NM 31 Two-Lane Highway Traffic Operations Summary – 2041 No Build

Minor Rd. to Minor Rd.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
Kelly to Carter	C	A	B	C
Carter to Nymeyer	C	B	C	D
Nymeyer to Donaldson	C	B	C	C
Donaldson to Fishermans	D	C	C	C
Fishermans to Refinery	D (E)	C	C (D)	C
Refinery to NM 128	E	C	C (D)	D (E)
NM 128 to US 62	A	B	B	A

Note: The critical LOS is reported for each segment. When LOS D (E) is shown, the LOS D is for the passing zone and LOS E is for the passing constrained segment. Shaded values do not meet SAMM LOS criteria.

Multi-Lane Highway Segments Operational Analysis

Based on the results of the two-lane highway analysis findings, a divided, four-lane highway was evaluated for NM 31 from Kelly Road to NM 128. The geometric data for the multi-lane highway segments analyses for NM 31 are as follows:

- Number of Lanes (per direction) = 2 lanes
- Lane Width =12 feet
- Median (left) Side Clearance = 6 feet
- Driver Population Familiarity = Balanced Mix
- Median Type = Divided
- Right Side Clearance = 6 feet
- Terrain Type = Level

The demand data for the multi-lane highway segments along NM 31 were summarized in **Chapter 3**, **Exhibit 3-8**. As shown in **Exhibit 4-13**, the multi-lane highway segment results show that LOS B or better operations is expected for both the AM and PM peak periods under design-year conditions.

Exhibit 4-13. NM 31 Multi-Lane Highway Traffic Operations Summary – 2041 Build

Minor Rd. to Minor Rd.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
Kelly to Carter	A	A	A	A
Carter to Nymeyer	A	A	A	A
Nymeyer to Donaldson	A	A	A	A
Donaldson to Fisherman	A	A	A	B
Fisherman to Refinery	A	A	A	A
Refinery to NM 128	B	A	A	B

Summary Findings of the NM 31 Mainline Traffic Operational Analysis

The findings and recommendations resulting from the analysis of the NM 31 highway mainline are:

- Neither the Enhanced Two-Lane Alternative or Super 2 Alternative would achieve acceptable traffic level of service or adequate safety improvements for the segment of NM 31 south of NM 128. For this reason, the four-lane alternatives are recommended for this segment of NM 31.

- The two-lane alternatives would achieve acceptable traffic operations for NM 31 north of NM 128. Shoulder widening, addition of speed change lanes, and passing lanes common to both the Enhanced Two-Lane and Super 2 alternatives would achieve safety needs. For this reason, the two-lane alternatives are recommended for this segment of NM 31.

Unsignalized Intersections Operational Analysis

The Streets and Roundabout modules of HCS7 were used for the design-year unsignalized intersection analyses along NM 31 for both the No Build and Build scenarios.

2041 No Build Results

The 2041 No Build scenario consists of the unsignalized intersection configurations along the existing two-lane highway. **Exhibit 4-14** summarizes the 2041 No Build results for the unsignalized intersections for each approach. Acceptable traffic performance would be expected at Carter Road, Nymeyer Road and at the USC/Mosaic Site. However, deficiencies are expected under 2041 two-lane highway scenario for the following intersections:

- NM 31/Kelly Road
- NM 31/Donaldson Farm Road
- NM 31/Fishermans Lane
- NM 31/Refinery Road
- NM 31/NM 128
- US 62/NM 31

Exhibit 4-14. NM 31 Unsignalized Traffic Performance – 2041 No Build

Intersection along NM 31	Two-Lane Highway – Level of Service				
Two-Way Stop Control	**Peak Period**	**Eastbound NM 31**	**Westbound NM 31**	**Northbound**	**Southbound**
Kelly Road	AM	A	-	-	C
	PM	A	-	-	D
Carter Road	AM	-	A	C	-
	PM	-	A	C	-
Nymeyer Road	AM	-	A	B	-
	PM	-	A	C	-
Donaldson Farm Road	AM	A	B	D	D
	PM	A	A	D	E
Fishermans Lane	AM	-	A	C	-
	PM	-	A	D	-
Refinery Road	AM	A	A	F	F
	PM	B	A	F	F
Two-Way Stop Control	**Peak Period**	**Eastbound**	**Westbound**	**Northbound NM 31**	**Southbound NM 31**
NM 128	AM	-	C	-	B
	PM	-	F	-	A
USC/Mosaic Site	AM	-	B	-	A
	PM	-	B	-	A
US 62	AM	-	B	C (D)*	-
	PM	-	B	D (E)*	-

Note: LOS C (D) = LOS C for the approach; LOS D for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.

2041 Build Results

Consistent with the results of the two-lane and multi-lane highway segments analysis, the 2041 Build condition includes a divided, four-lane highway for NM 31 from US 285 to NM 128 and a two-lane highway from NM 128 to US 62 (note: US 62 is an existing four-lane highway). The evaluation of intersection improvement alternatives for Build conditions included conventional as well as unconventional intersections as described earlier in this chapter. The findings of the conventional unsignalized intersections scenario are discussed next to identify where alternative intersection configurations should be considered.

Exhibit 4-15 summarizes the design-year traffic performance for the NM 31 unsignalized intersections assuming a four-lane highway from US 285 to NM 128 and a two-lane highway from NM 128 to US 62. This is considered the 2041 Base Case for the improved conditions. The results indicate that a conventional unsignalized intersection can be expected to perform at acceptable levels for the NM 31 intersections with Kelly Road, Carter Road, Nymeyer Road, Donaldson Farm Road, Fishermans Lane, and USC/Mosaic Site. The results show operational concerns at the following intersections:

- NM 31/Refinery Road
- NM 31/NM 128
- US 62/NM 31

Exhibit 4-15. NM 31 Unsignalized Traffic Performance – 2041 Build Base Case

			Level of Service			
NM 31 Intersection	**Peak Period**	**Configuration**	**Eastbound NM 31**	**Westbound NM 31**	**Northbound**	**Southbound**
Kelly Road	AM	4-Lane Conventional	A	-	-	B
	PM		A	-	-	C
Carter Road	AM	4-Lane Conventional	-	A	B	-
	PM		-	A	B	-
Nymeyer Road	AM	4-Lane Conventional	-	A	B	-
	PM		-	A	B	-
Donaldson Farm Road	AM	4-Lane Conventional	A	B	C	B
	PM		A	A	B	C
Fishermans Lane	AM	4-Lane Conventional	-	A	C	-
	PM		-	A	B	-
Refinery Road	AM	4-Lane Conventional	A	B	D	F
	PM		B	A	D	E (F)*
NM 31 Intersection	**Peak Period**	**Build Scenario**	**Eastbound**	**Westbound**	**Northbound NM 31**	**Southbound NM 31**
NM 128	AM	4-Lane Conventional	-	B	-	B
	PM		-	F	-	A
USC/Mosaic Site	AM	4-Lane Conventional	-	B	-	A
	PM		-	B	-	A
US 62	AM	4-Lane Conventional	-	B	C (D)*	A
	PM		-	B	D (E)*	A

*Note: *LOS C(D) = LOS C for the approach; LOS D for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.*

For these three locations, alternative intersection configurations were evaluated to assess expected traffic performance for roundabout, High-T and RCUT intersections. In addition, at the NM 31/NM 128 intersection, operational analyses were performed for the existing intersection configuration and for a realigned intersection that provides continuous flow from NM 31 to NM 128 (see **Exhibit 4-9**).

The HCM6 LOS criteria for Alternative Intersections, specifically for RCUT intersections, is shown in **Exhibit 4-16** and is adjusted from the TWSC criteria to account for the estimated travel time for the U-turn movements.

Exhibit 4-16. LOS Criteria for Alternative Intersections based on Estimated Travel Time (ETT)

ETT (s/veh)	Condition: $v/c \leq 1$ and $R_Q \leq 1$ for Every Lane Group	Condition: $v/c > 1$ for Any Lane Group	Condition: $R_Q > 1$ for Any Lane Group
≤10	A	F	F
>10–20	B	F	F
>20–35	C	F	F
>35–55	D	F	F
>55–80	E	F	F
>80	F	F	F

Rq = Average queue-to-storage ratio

The results of the traffic performance for the alternative intersection configurations for design-year Build conditions are summarized in **Exhibit 4-17**. **Exhibit 4-18** summarizes the minor road/total intersection volume ratios for 2041 conditions, which provides insight into the traffic volume levels on the minor roads intersecting NM 31 and are also used to inform the applicability of an RCUT to an intersection based on traffic volumes. The results of the intersection alternatives traffic analysis are discussed below.

NM 31/Refinery Road

As shown in **Exhibit 4-17**, a roundabout configuration would provide LOS B or better for all major movements except the northbound movement in the AM peak when LOC C is expected. The analysis assumed a multi-lane roundabout configuration with two entry lanes on NM 31, two lanes in the circulatory roadway for the east/west movements within the roundabout, and one entry lane on the minor road approaches with one lane in the circulatory roadway for north/south movements within the roundabout.

A High-T configuration would require closure of the south leg of the intersection with access provided by a local roadway connection to form a 3-legged intersection. With this configuration, LOS C or better is expected.

An RCUT intersection would not meet SAMM LOS criteria for two primary movements in the AM peak hour and one movement in the PM peak hour. LOS D is expected due to the additional travel time required for the U-turn maneuver. Traffic volume ratios are also not favorable for an RCUT at the Refinery Road intersection. This finding combined with the types of vehicles that routinely use the intersection, which are large vehicles with relatively slow acceleration and less maneuverability to change lanes, results in the RCUT not recommended for this intersection.

NM 31/US 62

A High-T intersection would provide acceptable performance at this intersection, while the additional travel time associated with the RCUT configuration results in unacceptable performance. While the volume ratios shown in **Exhibit 4-18** are conducive to a RCUT, the high northbound left-turn from NM 31 to US 62 is not favorable for this intersection type. As such, similar to the Refinery Road intersection findings, the RCUT is not recommended for further consideration at this location.

Exhibit 4-17. NM 31 Alternative Intersection Configurations Traffic Performance – 2041 Build Scenarios

Intersection	Peak Period	Configuration	Eastbound NM 31	Westbound NM 31	Northbound	Southbound
NM 31 @ Refinery Road	AM	Roundabout	B	A	C	B
	PM		A	A	B	B
	AM	High-T	A	-	-	C
	PM		B	-	-	C
	AM	RCUT	A	B	D	D
	PM		A	A	C	C (D)*
Intersection	**Peak Period**	**Configuration**	**Eastbound**	**Westbound**	**Northbound NM 31**	**Southbound NM 31**
US 62 @ NM 31	AM	RCUT	-	A	C (D)*	-
	PM		-	B	C (D)*	-
	AM	High-T	-	B	C	-
	PM		-	B	C	-
NM 31 / NM 128 Existing Configuration	AM	Roundabout	-	A	A	A
	PM		-	A	A	A
	AM	RCUT	-	C (D)*	-	B
	PM		-	F	-	B
	AM	High-T	-	B	-	B
	PM		-	F	-	A
	Peak Period	**Configuration**	**Eastbound NM 31**	**Westbound NM 128**	**Northbound**	**Southbound NM 31**
NM 31 / NM 128 Realigned Configuration	AM	Conventional	A	-	-	B
	PM		B	-	-	C (D)*
	AM	High-T	A	-	-	B
	PM		B	-	-	B
	AM	Roundabout	A	A	-	A
	PM		A	A	-	B

*Note: *LOS C(D) = LOS C for the approach; LOS D for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.*

Exhibit 4-18. 2041 Volume Ratio of Minor Road to Entire Intersection, NM 31

Intersection	All Minor Movements	Excluding Right Turns	All Minor Movements	Excluding Right Turns
	AM PEAK		PM PEAK	
NM 31 @ Kelly Rd	0.08	0.06	0.06	0.05
NM 31 @ Carter Rd	0.16	0.03	0.09	0.02
NM 31 @ Nymeyer Rd	0.05	0.00	0.05	0.02
NM 31 @ Donaldson Farm Rd	0.09	0.03	0.14	0.04
NM 31 @ Fishermans Ln	0.03	0.01	0.01	0.01
NM 31 @ Refinery Rd	0.23	0.21	0.13	0.12
NM 31 @ NM 128 (existing)	0.20	0.37	0.47	0.61
NM 31 @ NM 128 (realigned)	0.17	0.12	0.13	0.04
NM 31 @ US 62 (US 62 major/NM 31 minor)	0.12	0.07	0.16	0.09

Note: Shaded values signify that the intersection volumes may not be appropriate for a RCUT.

NM 31/NM 128

This intersection was evaluated for two scenarios: 1) the intersection is improved in its current location (i.e., NM 31 continuous north/south and NM 128 intersecting on the east side) and, 2) the intersection of NM 31 and NM 128 is relocated and NM 31 and NM 128 are realigned, i.e., the north-to-east and west-to-south traffic movements are made continuous and NM 31 north of the intersection tees into the new alignment.

For the existing intersection location, the RCUT and High-T intersections do not achieve acceptable performance levels. Volume ratios, as shown in **Exhibit 4-18,** are excessively high during the PM peak. As such, the RCUT and High-T are not recommended if the intersection remains in its same location and configuration.

A roundabout would provide LOS A operations with the existing intersection configuration. The roundabout configuration at the existing intersection location consisted of the following:

- NM 31 South Leg: Two entry lanes including one through and one right-turn bypass lane; two-lane exit
- NM 31 North Leg: Two entry lanes including a shared left/through lane and a through short lane (i.e., 100-foot lane introduced at the RAB); one-lane exit
- NM 128 East Leg: Three entry lanes including two left-turn lanes and a yield right-turn lane; two-lane exit with the right-turn bypass lane from NM 31 continuing as an add-lane to eastbound NM 128
- Circulatory Roadway Lanes: two lanes westbound and southbound; one lane eastbound and northbound

The roundabout intersection would be within 600 feet from the BNSF railroad track crossing to the east. This proximity is not of concern because vehicle queues would not be expected to extend into the tracks based on the LOS A operations.

Realigning the intersection was also evaluated. This configuration would make NM 31/NM 128 a continuous movement and teeing in the north leg of NM 31. With this concept, LOS C is expected for southbound NM 31; however, LOS D is expected for the southbound left-turn movement during the PM peak. A High-T configuration would achieve LOS B or better for all movements within this intersection. A roundabout would also provide LOS B or better traffic performance assuming the following layout:

- NM 31 South Leg: Two entry lanes including a shared left-turn/through lane and a through lane; two-lane exit
- NM 31 North Leg: Two entry lanes including a shared left/through lane and a through short lane (i.e., 100-foot lane introduced at the RAB); two-lane exit
- NM 128 East Leg: Two entry lanes including a left-turn lane and a shared left/right-turn lane; two-lane exit
- Circulatory Roadway Lanes: two lanes eastbound, westbound and southbound; one lane northbound
- Inscribed diameter of 230 feet to provide design flexibility for accommodating large trucks.

The roundabout and High-T configurations with intersection realignment would operate at a high level of service and would not present a traffic queuing concern relative to the railroad tracks. Traffic would flow efficiently under both scenarios. Further improvement such as a grade separation of NM 128 over the railroad tracks would not appreciably improve traffic operations or safety at the intersection. Conventional railroad crossing traffic control would provide a reasonable level of safety consistent with the other railroad crossing locations on NM 31. Furthermore, while a roundabout would provide acceptable traffic performance for the existing intersection configuration, realignment to provide continuous flow for the dominant traffic movements on NM 31 and NM 128 is the preferred alternative.

NM 128 Design-Year (2041) Traffic Operations

Design-Year (2041) Peak-Hour and Daily Volumes

Consistent with NM 31, a growth rate of 1.2 was applied to the final 2019 traffic volumes for NM 128 and the resulting design-year (2041) traffic volumes are summarized in **Exhibit 4-19**. The Average Daily Traffic (ADT) volumes for 2041 conditions in vehicles per day are summarized in **Exhibit 4-20**. The design-year traffic estimates reflect the expected demand and are not based on the number of lanes/capacity.

Exhibit 4-19. Design-Year (2041) Turn Movement Volumes at NM 128 Intersections

2041 Volume by Approach and Movement (vehicles per hour)													
Location Along NM 128	Peak Hour	Eastbound NM 128			Westbound NM 128			Northbound			Southbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
WIPP Road	AM	160	580	-	-	200	60	-	-	-	150	-	8
	PM	150	220	-	-	530	300	-	-	-	30	-	70
Red Road/Twin Wells	AM	60	630	-	-	210	80	-	-	-	100	-	30
	PM	60	210	-	-	710	170	-	-	-	50	-	80
Buck Jackson Road	AM	-	540	150	130	300	-	30	-	30	-	-	-
	PM	-	240	3	40	560	-	280	-	150	-	-	-
Orla Road	AM	-	350	180	140	410	-	40	-	40	-	-	-
	PM	-	370	40	6	370	-	26	-	180	-	-	-
Delaware Basin Road	AM	110	240	-	-	470	80	-	-	-	100	-	120
	PM	160	420	-	-	410	50	-	-	-	60	-	60
Battle Axe Road	AM	-	230	120	170	570	-	30	-	40	-	-	-
	PM	-	400	40	50	350	-	90	-	220	-	-	-
3rd Street	AM	30	190	50	40	500	20	150	50	40	30	50	120
	PM	80	540	60	60	290	40	80	90	60	30	40	30
NM 18	AM	50	150	60	50	280	50	180	150	50	30	220	100
	PM	90	360	180	50	230	50	110	210	110	40	120	50
Schooley Road	AM	20	180	20	30	330	0	30	0	20	10	0	10
	PM	20	440	40	20	290	0	20	0	40	10	0	10
Willis Road	AM	30	140	20	80	300	20	20	20	20	20	0	20
	PM	30	430	20	20	250	20	20	20	40	20	0	20

Exhibit 4-20. Design-Year (2041) Average Daily Traffic Volumes for NM 128

Segment Along NM 128	2041 Average Daily Traffic Volume (veh/day)
MP 0.0 to WIPP Road	10,600
WIPP Road to Red Road	10,600
Red Road to Buck Jackson Road	10,600
Buck Jackson Road to Orla Road	11,500
Orla Road to Delaware Basin Road	12,000
Delaware Basin Road to Battle Axe Road	12,600
Battle Axe Road to 3rd Street	14,000
3rd Street to NM 18	12,600
NM 18 to Schooley Road	8,300
Schooley Road to Willis Road	8,300
Willis Road to MP 59.9	8,300

Traffic Operations for 2041 Conditions

The Highway Capacity Software (HCS7) was used to evaluate design-year traffic performance including two-lane highway segments, multi-lane highway segments, unsignalized intersections, and signalized intersections along the study corridor. The 2041 traffic operations along NM 128 were analyzed for the existing two-lane highway, or No Build conditions, and for the pertinent alternatives identified to address operational deficiencies of the No Build condition.

Two-Lane Highway Segments Operational Analysis

Exhibit 4-21 summarizes the LOS results for the 2041 No Build two-lane highway segments along the corridor. The analysis considered locations where passing is constrained and where passing zones exist. Consistent with the findings of the existing conditions analysis, NM 128 as a two-lane highway is deficient from NM 31 to Jal. The segment between Jal and the Texas border is expected to perform at acceptable standards for both AM and PM peak volumes with the two-lane highway configuration.

While the two-lane highway segment from east of Jal is expected to perform at acceptable levels, passing lanes are being considered to enhance the safety conditions of this segment of NM 128. With passing lanes, the expected level of performance would be LOS A/B.

Exhibit 4-21. NM 128 Two-Lane Highway Traffic Operations Summary – 2041 No Build

Minor Rd. to Minor Rd.	Level of Service			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
NM 31 to MP 0.85	D	B	B	D
MP 0.85 to WIPP Road	C	B	B	C
WIPP Road to Red Road	C	A	A	D
Red Road to Buck Jackson Road	C	B	A	D
Buck Jackson Road to Orla Road	C	C	B	C
Orla Road to Delaware Basin Road	B	C	C	B
Delaware Basin Road to Battle Axe Road	A	C	B	B
Battle Axe Road to MP 48.0	A	D	C	B
MP 48.0 to Wyoming Road	B	D	D	B
Wyoming Road to MP 54.4	N/A in City of Jal			
MP 54.4 to Willis Road	A	B	B	B
Willis Road to Texas Border	A	B	B	A

Note: Shaded values do not meet SAMM LOS criteria.

Multi-Lane Highway Segments Operational Analysis

Based on the results of the two-lane highway analysis findings, a divided, four-lane highway was evaluated for NM 128 from NM 31 to the west side of Jal. The geometric data for the multi-lane highway segments analyses for NM 128 are as follows:

- Number of Lanes (per direction) = 2 lanes
- Lane Width =12 feet
- Median (left) Side Clearance = 4 feet
- Driver Population Familiarity = Balanced Mix
- Median Type = Divided
- Right Side Clearance = 6 feet
- Terrain Type = Level

The demand data for the multi-lane highway segments along NM 128 were summarized in **Chapter 3**, **Exhibit 3-14**. As shown in **Exhibit 4-22**, the multi-lane highway segment results show that LOS A operations is expected for both the AM and PM peak periods under design-year conditions. These findings suggest that favorable operational performance would be expected for a wide range of truck percentages in the vehicle stream.

Exhibit 4-22. NM 128 Multi-Lane Highway Traffic Operations Summary – 2041 Build

Minor Rd. to Minor Rd.	Level of Service (LOS)			
	Eastbound	Westbound	Eastbound	Westbound
	AM PEAK		PM PEAK	
NM 31 to MP 0.85	A	A	A	A
MP 0.85 to WIPP Road	A	A	A	A
WIPP Road to Red Road	A	A	A	A
Red Road to Buck Jackson Road	A	A	A	A
Buck Jackson Road to Orla Road	A	A	A	A
Orla Road to Delaware Basin Road	A	A	A	A
Delaware Basin Road to Battle Axe Road	A	A	A	A
Battle Axe Road to MP 48.0	A	A	A	A
MP 48.0 to Wyoming Road	A	A	A	A

Summary Findings of the NM 128 Mainline Traffic Operational Analysis

The findings and recommendations resulting from the analysis of the NM 128 highway mainline are:

- Neither the Enhanced Two-Lane Alternative or Super 2 Alternative would achieve acceptable traffic level of service for the segment of NM 128 between NM 31 and Jal. For this reason, the four-lane alternatives are recommended for this segment of NM 31.
- The two-lane alternatives would achieve acceptable traffic operations for NM 128 east of Jal. For this reason, the 2-lane alternatives are recommended for this segment of NM 128.

Unsignalized Intersections Operational Analysis

The Stop and Roundabout modules of HCS7 were used for the design-year unsignalized intersection analyses along NM 128 for the No Build and Build scenarios. The Streets module of HCS7 was used for the design-year signalized intersection analysis in Jal.

2041 No Build Results

The 2041 No Build scenario consists of the conventional stop-controlled intersection configurations along the existing two-lane highway and all-way stop controlled (AWSC) intersections at two intersections in Jal. **Exhibit 4-23** summarizes the results for the stop-controlled intersections along NM 128 for 2041 No Build conditions. For the two-lane highway, operational deficiencies occur for the stop-controlled minor road approaches at WIPP Road, Red Road, Buck Jackson Road, Orla Road, Delaware Basin Road, and Battle Axe Road, which represents all unsignalized intersections evaluated from NM 31 to Jal. In Jal, the AWSC intersections at 3rd Street and NM 18 are deficient for NM 128 and for minor road approaches. The results for the AWSC intersections are based on the existing conditions Transmodeler results which shows deficient performance levels as expected for the AWSC intersections. Acceptable performance can be expected for the Schooley Road and Willis Road conventional unsignalized intersections.

Exhibit 4-23. NM 128 Unsignalized Traffic Performance – 2041 No Build

Intersection along NM 128	2041 No Build Unsignalized Intersection Level of Service				
Two-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
WIPP Rd	AM	A	-	-	F
	PM	B	-	-	C
Red Road	AM	A	-	-	C
	PM	B	-	-	D
Buck Jackson Road	AM	-	B	C	-
	PM	-	A	F	-
Orla Road	AM	-	A	C	-
	PM	-	A	F	-
Delaware Basin Road	AM	A	-	-	D
	PM	A	-	-	C
Battle Axe Road	AM	-	A	C	-
	PM	-	A	D	-
All-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
3rd Street	AM	F	B	F	D
	PM	F	B	F	D
NM 18	AM	E (F)*	E	D	D
	PM	E (F)*	E	E	D
Two-Way Stop Control	**Peak Period**	**Eastbound NM 128**	**Westbound NM 128**	**Northbound**	**Southbound**
Schooley Road	AM	A	A	B	B
	PM	A	A	C	C
Willis Road	AM	A	A	C	C
	PM	A	A	C	C

Note: LOS E(F) = LOS E for the approach; LOS F for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.

2041 Build Results

The No Build results show that corridor improvements are needed on NM 128 from NM 31 to Jal. Accordingly, a divided four-lane highway was evaluated for NM 128. In Jal, traffic signal control for the 3rd Street and NM 18 intersections would address the deficient AWSC intersections. Traffic signal control is expected to provide acceptable performance with auxiliary lane enhancements and without widening to a divided, four-lane because there is insufficient right-of-way in Jal to do so. Traffic signal warrant evaluations of the NM 128/NM 18 intersection and the NM 128/3rd Street intersection were prepared which indicate that traffic signal control is justified at these intersections. The warrant studies are provided in the *electronic appendices*.

Consistent with the results of the two-lane and multi-lane highway segments analysis, the 2041 Build condition includes a divided, four-lane highway for NM 128 from NM 31 to Jal and a two-lane highway from Jal to the state line. The evaluation of intersection improvement alternatives for Build conditions included conventional as well as unconventional intersections as described earlier in this chapter. The findings of the conventional unsignalized intersections scenario are discussed next to identify where alternative intersection configurations should be considered.

Exhibit 4-24 summarizes the design-year traffic performance for the NM 128 unsignalized intersections based on a four-lane highway from NM 31 to Jal and a two-lane highway from Jal to the Texas state line. This is considered the 2041 Base Case for the improved conditions. The results indicate that a conventional unsignalized intersection can be expected to perform at acceptable levels for the NM 128 intersections with Red Road/Twin Wells Road, Delaware Basin Road, Battle Axe Road, Schooley Road, and Willis Road. The results show operational concerns at the following intersections:

- WIPP Road
- Buck Jackson Road
- Orla Road

Exhibit 4-24. NM 128 Unsignalized Traffic Performance – 2041 Build Base Case

Unsignalized Intersection along NM 128	Peak Period	Configuration	Eastbound NM 128	Westbound NM 128	Northbound	Southbound
WIPP Road	AM	4-Lane Conventional	A	-	-	C (D)*
	PM		B	-	-	B
Red Road / Twin Wells Road	AM	4-Lane Conventional	A	A	C	C
	PM		B	A	B	C
Buck Jackson Road	AM	4-Lane Conventional	-	B	B	-
	PM		-	A	C (D)*	-
Orla Road	AM	4-Lane Conventional	-	A	B	-
	PM		-	A	C (D)*	-
Delaware Basin Road	AM	4-Lane Conventional	A	-	-	C
	PM		A	-	-	C
Battle Axe Road	AM	4-Lane Conventional	-	A	B	-
	PM		-	A	B	-
Schooley Road	AM	2-Lane TWSC with Turn Lanes	A	A	B	B
	PM		A	A	C	B
Willis Road	AM	2-Lane TWSC with Turn Lanes	A	A	B	B
	PM		A	A	B	C

*Note: *LOS C(D) = LOS C for the approach; LOS D for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.*

For these three locations, alternative intersection configurations including roundabout, High-T and RCUT intersections were evaluated to assess expected traffic performance. The results of the traffic performance for the alternative intersection configurations for design-year Build conditions are summarized in **Exhibit 4-25**. The HCM6 LOS criteria for Alternative Intersections, including RCUT intersections, was shown in **Exhibit 4-16**.

Exhibit 4-26 summarizes the minor road/total intersection volume ratios for 2041 conditions, which provides insight into the traffic volume levels on the minor roads intersecting NM 128 and are also used to inform the applicability of an RCUT to an intersection based on traffic volumes. Of note, the Orla Road and Buck Jackson Road minor road left-turns are over 250 vph in the PM peak, and the WIPP Road minor road left-turn is 150 vph in the AM peak. The ratios for the NM 18 intersection in Jal are balanced and are consistent with the need for traffic signal control. The results of the alternatives analysis are discussed next for the three intersections.

NM 128/WIPP Road

A conventional unsignalized intersection is not expected to perform at acceptable levels during the AM peak due in part to an estimated eastbound left-turn volume of 160 vph and southbound left-turn volume of 150 vph. However, an unsignalized High-T would provide LOS B or better operations.

Exhibit 4-25. NM 128 Alternative Intersection Configurations Traffic Performance – 2041 Build Scenarios

Unsignalized Intersection along NM 128	Peak Period	Configuration	Eastbound NM 128	Westbound NM 128	Northbound	Southbound
WIPP Road	AM	Roundabout	A	A	-	A
	AM	RCUT	A	-	-	D (E)*
	AM	High-T	A	-	-	B
Buck Jackson Road	PM	Roundabout	A	A	B	-
	PM	RCUT	-	A	D (E)*	-
	PM	High-T	-	A	B	-
Orla Road	PM	Roundabout	A	A	C	-
	PM	RCUT	-	A	D (E)*	-
	PM	High-T	-	A	C	-

*Note: *LOS C(D) = LOS C for the approach; LOS D for the critical movement on the approach. Shaded values do not meet SAMM LOS criteria.*

Exhibit 4-26. 2041 Volume Ratio of Minor Road to Entire Intersection, NM 128

Minor Road to NM 128	All Minor Movements	Excluding Right Turns	All Minor Movements	Excluding Right Turns
	AM PEAK		PM PEAK	
WIPP Road	0.19	0.14	0.08	0.03
Red Road / Twin Wells Road	0.13	0.11	0.12	0.06
Buck Jackson Road	0.05	0.03	0.33	0.25
Orla Road	0.07	0.04	0.34	0.25
Delaware Basin Road	0.20	0.11	0.10	0.06
Battle Axe Road	0.06	0.03	0.27	0.10
3rd Street	0.35	0.27	0.24	0.20
NM 18	0.53	0.52	0.40	0.40
Schooley Road	0.11	0.07	0.09	0.04
Willis Road	0.14	0.10	0.13	0.08

Note: Shaded values signify that the intersection volumes may not be appropriate for a RCUT.

Because there is some conservatism built into the analysis, an iterative analysis was performed for the conventional unsignalized intersection to determine what southbound left-turn volume would result in LOS C holding all other input values constant. The result was 125 vph, or a reduction of 25 vph. A field traffic count at the WIPP Road intersection may help decide if an alternative type of intersection control should be considered. Also, the crash history for the existing intersection does not suggest a safety-related issue at this intersection.

A roundabout would provide LOS A operations during the critical AM peak at this intersection. The roundabout configuration consisted of two entry lanes on NM 128 with two lanes in the circulatory roadway for the east/west movements within the roundabout, and one entry lane on the minor road approach with one lane in the circulatory roadway for north/south movements within the roundabout.

The RCUT shows LOS D in AM peak for the minor road approach, LOS E for the left-turn volume. A key assumption in the RCUT design for intersections along NM 128 is a spacing of 2,000 feet from the minor road to the U-turn to accommodate acceleration, merging and lane changing. While the volume ratios shown in **Exhibit 4-26** are conducive to a RCUT, the left-turn volumes at this intersection are not favorable for an RCUT. This finding combined with the types of vehicles that routinely use the intersection, which are large vehicles with relatively slow acceleration and less maneuverability to change lanes, results in the RCUT being eliminated at this location.

Overall, a roundabout would provide acceptable operations under a wide range of traffic volume conditions and a High-T would provide acceptable operational performance with stop-sign control.

NM 128/Buck Jackson Road

A conventional unsignalized intersection is not expected to perform at acceptable levels during the PM peak due in part to an estimated northbound left-turn volume of 280 vph. Unlike WIPP Road, the PM peak major street left-turn volume is much lower at 40 vph which results in more capacity for the left-turn from the minor road however LOS D was shown. However, an unsignalized High-T would provide LOS B or better operations.

Because there is some conservatism built into the analysis, an iterative analysis was performed for the conventional unsignalized intersection to determine what left-turn volume would result in LOS C. The result was 275 vph, or a reduction of 5 vph. This suggests that the LOS D result is sensitive/marginal. A field traffic count at this intersection may help decide if an alternative type of intersection control should be considered. Also, the crash history for the existing intersection does not suggest a safety-related issue at this intersection.

A roundabout would provide LOS B operations during the critical PM peak at this intersection. The roundabout configuration consisted of two entry lanes on NM 128 with two lanes in the circulatory roadway for the east/west movements within the roundabout, and one entry lane on the minor road approach with one lane in the circulatory roadway for north/south movements within the roundabout.

The RCUT also shows LOS D in PM peak for the minor road approach, LOS E for the left-turn volume. A key assumption in the RCUT design for intersections along NM 128 is a spacing of 2,000 feet from the minor road to the U-turn to accommodate acceleration, merging and lane changing. Traffic volume ratios are also not favorable for an RCUT at the Buck Jackson Road intersection. This finding combined with the types of vehicles that routinely use the intersection results in the RCUT being eliminated at this location.

Overall, a roundabout would provide acceptable operations under a wide range of traffic volume conditions and a High-T would provide acceptable operational performance with stop-sign control.

NM 128/Orla Road

A conventional unsignalized intersection is not expected to perform at acceptable levels during the PM peak due in part to an estimated northbound left-turn volume of 260 vph. The PM peak major street left-turn volume is 60 vph. An unsignalized High-T would provide LOS C or better operations.

Because there is some conservatism built into the analysis, an iterative analysis was performed to determine what left-turn volume would result in LOS C. The result was 245 vph, or a reduction of 15 vph. A field traffic count at this intersection may help decide if an alternative type of intersection control should be considered. The crash history for the existing intersection does indicate a higher incidence of right-angle crashes compared to other intersections in the corridor suggesting a need to consider safety improvements at this intersection including alternative intersection configurations.

A roundabout would provide LOS C operations during the critical PM peak at this intersection. The roundabout configuration consisted of two entry lanes on NM 128 with two lanes in the circulatory roadway for the east/west movements within the roundabout, and one entry lane on the minor road approach with one lane in the circulatory

roadway for north/south movements within the roundabout. If separate left-turn and right-turn lanes are provided on the minor road approach, LOS B would be expected.

The RCUT also shows LOS D in PM peak for the minor road approach, LOS E for the left-turn volume. A key assumption in the RCUT design for intersections along NM 128 is a spacing of 2,000 feet from the minor road to the U-turn to accommodate acceleration, merging and lane changing. Traffic volume ratios are also not favorable for an RCUT at the Orla Road intersection. This finding combined with the types of vehicles that routinely use the intersection results in the RCUT being eliminated at this location.

Overall, a roundabout would provide acceptable operations under a wide range of traffic volume conditions, and a High-T would provide acceptable operational performance with stop-sign control.

Signalized Intersections in Jal

Exhibit 4-27 summarizes the 2041 Build results for the proposed signalized intersections at 3rd Street and NM 18 in Jal. To provide continuity of traffic flow through Jal with the close spacing between the NM 18 intersection and the 3rd Street intersection, signalization of both intersections is needed. The substantial queues that form under the existing all-way stop control illustrates the need to provide continuity of flow between these intersections.

Exhibit 4-27. NM 128 Signalized Intersection Traffic Operations Summary – 2041 Build Scenarios

Signalized Intersection	Peak Period	Build Scenario	2041 Build – Level of Service				
			Eastbound NM 128	Westbound NM 128	Northbound	Southbound	Intersection
NM 128/3rd Street	AM	3-Lane TWLTL	B	B	C	C	C
	PM		F	B	C	C	F
	AM	2 EB Lanes; 1 WB Lane	B	B	C	C	C
	PM		B	C	C	C	C
NM 128/NM 18	AM	3-Lane, w/EB Right -turn	C	C	C	C	C
	PM		B	C	C	C	C
	AM	2 EB Lanes; 1 WB Lane	C	C	C	C	C
	PM		C	C	C	C	C

Note: Shaded values do not meet SAMM LOS criteria.

The basic 3-Lane Alternative was evaluated to determine if acceptable performance could be expected for the segments including the 3rd Street and NM 18 intersections. The analysis shows that one eastbound lane cannot provide the capacity needed at the 3rd Street intersection during the PM peak. As such, a second eastbound lane was added upstream of 3rd Street, creating a four-lane section including the painted median, which continues to NM 18 where it drops as a right-turn lane (modified 3-Lane Alternative).

With the **modified 3-Lane Alternative**, LOS C is expected for both intersections. A signal cycle length of 85 seconds was used for both peak hours and timing was optimized for overall delay. Protected left-turn phases were used for all four directions at NM 18 and for the northbound and eastbound left-turns at 3rd Street. The only volume-to-capacity ratios between 0.85 and 0.90 were the westbound through movement at 3rd Street in the AM peak and the eastbound through movement at NM 18 in the PM peak.

4.2.3 Major Structures

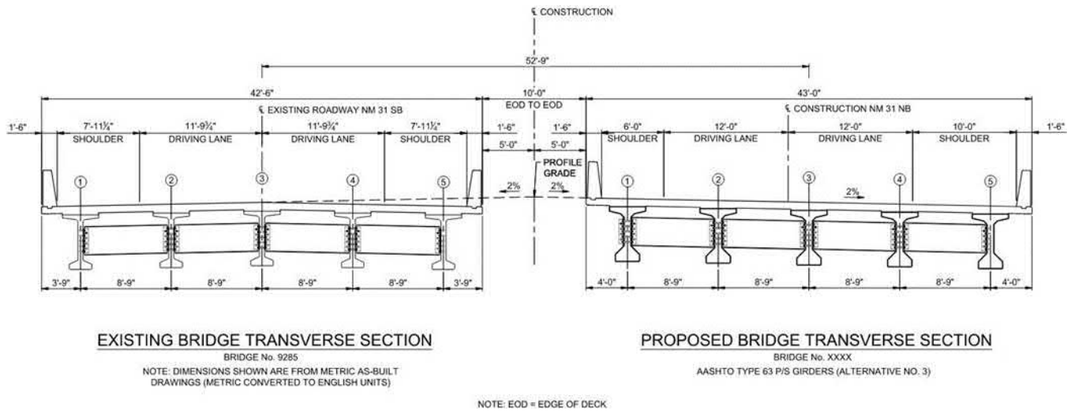
New Pecos River Bridge

Widening of NM 31 will require the construction of a new bridge over the Pecos River at MP 3.7. An evaluation of bridge alternatives was performed to select an appropriate bridge type to build on the south side of the existing NM 31 Bridge over the Pecos River (Bridge No. 9285). Bridge No. 9285 is a 5-span bridge 503'-8" in length utilizing Type BT-63 prestressed concrete girders and currently carries two-way two-lane traffic. Each span is 100' in length. The intent of the proposed bridge is to improve river crossing capacity by supporting two lanes of northbound traffic while existing Bridge No. 9285 will be converted to support two lanes of southbound traffic. **Exhibit 4-28** shows the proposed bridge location relative to existing Bridge No. 9285. Refer to the Bridge Type Selection Report, NM 31 over the Pecos River, November 17, 2021, for more information regarding the alternatives analysis for the new bridge.

Exhibit 4-28. Proposed Bridge Layout Relative to Existing Bridge No. 9285

The design requirements for the proposed bridge include a 500-foot opening for stream flow and maintaining a finished grade that will match existing Bridge No. 9285. This location is in a mapped flood zone (Zone A) which is considered a high-risk zone by FEMA. Since in a high-risk zone, raising the water surface elevation should be avoided. The proposed bridge will have an identical span arrangement as existing Bridge No. 9285 to prevent the water surface elevation from rising. The width will be 43'-0" comprised of two 12-foot driving lanes with one 10-foot outside shoulder, one 6-foot inside shoulder plus 1.5-foot concrete bridge rails on both sides. The proposed bridge rails will be 42" tall concrete bridge rails. **Exhibit 4-29** shows the existing and proposed bridge typical sections. The proposed bridge will be built at an offset alignment of 10'-0" from edge of deck of existing Bridge No. 9285 to edge of deck (EOD) of the proposed bridge.

Exhibit 4-29. Existing Bridge and Proposed Bridge Typical Sections



Pecos Bridge Alternatives Analysis

Various span configurations were investigated that would best align with the existing piers to minimize/prevent the water surface elevation from rising. A 3-span alternative would align with the existing piers but would require a 300' middle span and two 100' end spans. The 300' middle span would be uneconomical and not feasible for this particular crossing. A 4-span alternative was also investigated; however, the new piers could not be aligned with the existing piers, which would result in increasing the water surface elevation. A 5-span alternative could be designed to match the piers of existing Bridge No. 9285 and therefore is the preferred span configuration. The proposed bridge will be built at a 26-degree right-forward skew to be in alignment with the Pecos River flow as shown in **Exhibit 4-28**.

Four bridge type alternatives were considered in the Bridge Type Selection (BTS) assessment. They included three prestressed concrete girder alternatives and one steel girder alternative, including:

1. Five-span bridge utilizing AASHTO Type BT-63 prestressed concrete girders
2. Five-span bridge utilizing AASHTO Type 54 prestressed concrete girders
3. Five-span bridge utilizing AASHTO Type 63 prestressed concrete girders
4. Five-span bridge utilizing 60" steel plate girders

A comparison was made of the bridge type alternatives based on functional requirements, economics, future maintenance, construction feasibility, aesthetics, and accelerated bridge construction as outlined in the *2018 NMDOT Bridge Procedures and Design Guide*. The bridge types evaluated in detail are known to be serviceable, constructible, and economical while meeting the project's functional requirements.

The bridge type alternatives are summarized in the evaluation matrix in **Exhibit 4-30**. As noted in **Exhibit 4-30**, a raw score of 5 is considered most desirable and a raw score of 1, least desirable. Functional requirements, economics, future maintenance, construction feasibility, aesthetics and accelerated bridge construction are summarized below. The anticipated bridge life is expected to be similar for all alternatives.

Exhibit 4-30. Bridge Type Alternative Matrix for Pecos River Bridge

Alternatives		AASHTO Type BT-63 Girders (five-span)		AASHTO Type 54 Girders (five-span)		AASHTO Type 63 Girders (five-span)		60" Steel Plate Girders (five-span)	
Evaluation Criteria	**Weighting Factor**	**Raw Score**	**Weighted**	**Raw Score**	**Weighted**	**Raw Score**	**Weighted**	**Raw Score**	**Weighted**
Functional Requirements	8	4.0	32.0	4.5	36.0	5.0	40.0	5.0	40.0
Economics	8	4.91	39.3	5.0	40.0	4.98	39.8	4.67	37.4
Future Maintenance	8	5.0	40.0	5.0	40.0	5.0	40.0	5.0	40.0
Construction Feasibility	7	5.0	35.0	5.0	35.0	5.0	35.0	4.5	31.5
Aesthetics	4	5.0	20.0	4.5	18.0	5.0	20.0	4.0	16.0
Total Score		**166.3**		**169.0**		**174.8**		**164.9**	

Functional Requirements

The functional requirements for this bridge will include items such as lane and bridge deck width, capacity ratings, waterway conveyance, freeboard requirements and scour potential.

Bridge Deck Widths: The proposed improvements include adding a new bridge to accommodate two northbound lanes of traffic. All bridge type alternatives considered will accommodate these improvements and meet the functional requirement of the project.

Capacity Ratings: The Permian Basin is an oil-and-gas producing area located in southeastern New Mexico. In a conversation with the NMDOT Bridge Management Section, there has been a large increase in oversized/overweight (OS/OW) vehicle permitting in the last few years, particularly in the Permian Basin. Such OS/OW vehicles as coil tubing units weighing over 350,000 lbs. travel frequently in the southeastern portion of New Mexico. There have been several studies done nationwide that indicate OS/OW vehicles are increasing the risk to failure of bridges by causing stresses above those specified in design specifications and by reducing bridge service (fatigue) lives through repetitive overloading. It is anticipated the proposed bridge will be utilized frequently by OS/OW vehicles and girder capacity is an important factor to consider for the proposed bridge. With increased truck weight limits being anticipated in the future, a girder type with greater capacity is recommended. Girders with greater capacity typically will have a longer service life. Alternative No. 3 - AASHTO Type 63 prestressed girders and Alternative No. 4 – 60" steel girders can be designed to provide greater capacity than the Type 54 and BT-63 alternatives. The Type 54 and BT-63 were deducted a ½ point for less capacity.

Prestressed Girders: In a discussion with the NMDOT Bridge Bureau, there have been fabrication issues with the bulb-tee (BT) girders. Issues include shipment and damage to the top flanges of these girders. The BT-63 girders have the thinnest top flanges with a thickness of 3.5 inches. The thinner top flange tends to crack/spall during transport due to chains that anchor and stabilize the girder to the truck bed. Also, the webs of the BT-63 girders are 6 inches thick whereas the Type 54 and Type 63 girders are 8 inches. For webs 6 inches thick, Section 5.3.1 of the *NMDOT Bridge Procedures and Design Guide* recommends draped strands spaced at a minimum of 6 inches at the ends of the girders if possible. The wide spacing of the draped strands will have impacts in achieving the desired load carrying capacity for the proposed bridge. The BT-63 girder alternative was deducted a 1/2 point for the thinner top flange and thinner web.

Economics
At this point, the foundation type has not been determined, so a consistent assumption was made for each bridge alternative. The assumption used for preliminary construction cost proposals were drilled shafts with depths corresponding to the existing Bridge No. 9285 bridge type and drilled shaft lengths. The deck estimate includes items such as the concrete deck, reinforcement bars and bridge barrier rails. The superstructure estimate includes items such as girders, diaphragms, reinforcement bars, bridge joints and bearing devices. The substructure estimate includes items such as pier caps, abutment caps, reinforcement bars, drilled shafts and testing. The estimated costs are for comparison purposes only and not for budget or funding estimation; they exclude riprap and aesthetics among other things. The estimated cost per square foot (sq ft) are listed below:

1. Five-span bridge utilizing AASHTO Type BT-63 prestressed concrete girders: $192/sq ft
2. Five-span bridge utilizing AASHTO Type 54 prestressed concrete girders: $184/sq ft
3. Five-span bridge utilizing AASHTO Type 63 prestressed concrete girders: $186/sq ft
4. Five-span bridge utilizing 60” steel plate girders: $215/sq ft

Future Maintenance
The alternatives included in this study were chosen considering future maintenance. Span arrangements were chosen to minimize the number of expansion joints, as expansion joints are often one of the large contributors to future maintenance costs. Based on review of the FHWA’s Steel Bridge Design Handbook, the proposed NM 31 Bridge is a good candidate for weathering steel. Weathering steel is recommended for the steel plate girder alternative to eliminate the maintenance costs associated with the recoating of painted steel.

Since each alternative have the same number of girder lines and piers and the expansion joints can be built off of the bridge, all alternatives received a score of 5 points. It should be noted that the future maintenance comparisons here are qualitative only, and a detailed life cycle cost analysis was not performed for each alternative as part of this project.

Construction Feasibility
All bridge alternatives are constructible, but some alternatives are more cost-effective and feasible. Prestressed concrete girders can be easily provided from within New Mexico. A half-point deduction was given for the steel-plate alternatives as they would require additional staging for the splices and specialized bracing. Furthermore, steel plate girders, require large lead times to ensure girders are fabricated and arrive to the construction site on time.

Aesthetics
Existing Bridge No. 9285 is a 5-span Type BT-63 prestressed concrete girder bridge. Alternative No. 1 and No. 3 are given a raw score of 5 since they match in girder type and size with existing Bridge No. 9285. Alternative No. 2 was deducted a half-point since it is a concrete girder bridge but does not match the girder size of existing Bridge No. 9285. Alternative No. 4 was deducted a point since it is a steel girder bridge and does not match in girder type nor size to existing Bridge No. 9285. The existing bridge only has aesthetic treatment on the concrete bridge railings. It is anticipated the proposed bridge will have the same aesthetic treatment.

Accelerated Bridge Construction
To evaluate whether Accelerated Bridge Construction (ABC) techniques will be utilized on this bridge, an ABC decision-making tool based on the FHWA decision-making framework flowchart and the Wisconsin DOT decision-making tool was used. The decision tool indicates that there are few reasons to consider ABC for this bridge design. The use of precast elements in construction will be the most cost-effective ABC alternative for all bridge type alternatives being considered. Since the existing bridge currently carries all traffic and offline construction is available for the proposed bridge, sliding or launching the superstructure is not cost-effective nor required. Therefore, ABC is not advised and not included in the evaluation matrix.

Alternative Advanced
As a result of the BTS assessment, Alternative 3 - Five-Span Bridge utilizing AASHTO Type 63 prestressed concrete girders scores the highest when all evaluation criteria are considered. Based on these findings Alternative 3 is the preferred alternative for the proposed new NM 31 bridge over the Pecos River.

4.2.4 Other Considerations

As discussed in **Section 4.2**, the screening evaluation also considered the project setting and context. This metric was limited to the highway mainline segments and considered roadside impacts, access, passing lane feasibility, and cost-effectiveness. The screening evaluation was used to differentiate between the Enhanced Two-Lane Alternative and the Super 2 Alternative for segments where a two-lane highway was identified by the traffic analysis, and between the Four-Lane Flush Median Alternative and Four-Lane Depressed Median where a four-lane alternative was recommended. The assessment was primarily qualitative although some quantitative analysis was included.

NM 31 and NM 128 Roadside Impacts and Access

As described in **Section 4.1**, the Four-Lane Flush Median Alternative would add two lanes immediately adjacent to the existing two-lane section and would have an overall width of approximately 82 feet from the outside edge of the shoulders. In comparison, the Four-Lane Depressed Median Alternative would construct two new lanes plus the inside and outside shoulders and a depressed median of 38 feet to 60 feet. This typical section would have an overall width of 106 feet to 128 feet. The additional width of the Four-Lane Depressed Median Alternative would extend well outside of the existing highway right-of-way and could impact development adjacent to the highway.

NM 31 passes through a mixture of agricultural, industrial, and oil and gas fields. Lands from the BOP to MP 4 (just east of the Pecos River) are predominantly agricultural farmlands intermixed with property developed for oil and gas extraction. Development in this segment includes several residences, agricultural and industrial buildings and structures, and several irrigation canals and drainage ditches serving the adjacent fields. These facilities may be impacted because of their proximity to the existing highway right-of-way. In addition, a large transload facility serving the oil extraction industry is located south of NM 31 near the BOP. This facility has a main access driveway onto NM 31 and two rail lines less than 100 feet from the edge of existing highway right-of-way. BNSF spur lines cross NM 31 at MP 3.0 and MP 4.0. This segment of NM 31 also has frequent driveways and local roads intersecting the highway with approximately 35 access points.

In contrast to the first four miles of NM 31, land use and development for the portion of NM 31 from MP 4.0 to NM 128 and the segment of NM 128 from NM 31 to the western edge of Jal is predominantly industrial and consists of oil and gas fields. No residential development or agricultural farmlands are present in these areas, although various infrastructure associated with oil and gas mining are present. This infrastructure is generally scattered and consists of oil tank batteries, pump sites, electrical and gas transmission stations, and other similar structures. Access is also less frequent and consists of county roads and local roads used to access oil fields and salt and potash mining sites.

Both four-lane alternatives would achieve traffic operational and safety needs. A key difference between the two four-lane alternatives is the extent of impact associated with the wider footprint of the Four-Lane Depressed Median Alternative. Analysis indicates at least three residential developments (at MP 2.4 and MP 2.75), a lateral irrigation ditch, and a drainage ditch would be impacted by the depressed median alternative for NM 31 from the

BOP to MP 4). The depressed median would also restrict access at multiple locations and require motorists to travel out-of-direction and make U-turns to travel to their desired destinations. Because of this, the Four-Lane Depressed Median Alternative is not recommended for the segment of NM 31 from the BOP to the Pecos River (~MP 3.65); the Four-Lane Flush Median Alternative is preferable. The area from the river to MP 4.0 would serve as a transition zone. Because roadside development is infrequent on NM 31 after crossing the river and along NM 128 between NM 31 and Jal, the Four-Lane Depressed Median is preferred because of its greater safety and ability to construct under traffic.

Passing Lane Suitability

The two-lane alternatives were recommended for the segment of NM 31 north of NM 128 and for NM 128 east of Jal. Both would achieve the traffic operational and safety needs of the project but because of the more frequent passing lanes, the Super 2 would be expected to have lower risk than the Enhanced Two-Lane Alternative. Important considerations in addition to passing lanes is the length of roadway available for the unique segments and the presence of entering traffic at major intersections.

The segment of NM 31 recommended for a two-lane roadway begins at MP 8.0 and extends to the EOP at US 62, a distance of 14.7 miles. This segment of NM 31 includes two at-grade railroad crossings (MP 9.3 and MP 13.6) and two major industrial sites with relatively high volume driveways (USC and Mosaic near MP 14) and Intrepid near MP 20. The Two-Lane Enhanced Alternative would include two northbound and two southbound passing areas with passing lanes varying from about 1.5 miles to 2 miles in length. The Super 2 Alternative would have alternating passing lanes at approximate two-mile intervals; thus, this concept would have six passing lanes in each direction. Because the overall segment length is about 13 miles when the approaches to the NM 31/NM 128 intersection and US 62 are considered, two passing areas in each direction would leave approximately 5 miles (less than 5 minutes) before an opportunity to use a passing lane is available. Other passing opportunities would be available where adequate passing sight distance is provided. This approach would also provide flexibility to locate passing lanes that avoid major driveways where auxiliary lanes are needed. In contrast, the Super 2 concept would be difficult to locate passing lanes that do not conflict with major driveways and railroad crossings. Given the lower traffic volumes and lower existing crash history, the Enhanced Two-Lane is recommended as a more cost-effective treatment for this segment of NM 31.

The segment of NM 128 recommended for a two-lane roadway begins on the east side of Jal at MP 53.5 and extends to the EOP at the New Mexico/Texas state line, a distance of approximately 6.4 miles. The shorth length of this segment is not conducive to the use of a Super 2 concept but does allow for a single passing lane in each travel direction. For this reason, the Super 2 Alternative is not recommended and the Enhanced Two-Lane is recommended as the preferred alternative.

4.2.5 Screening Summary and Findings

The screening analysis of alternatives for the mainline and major intersections identified substantive differences in performance, safety, right-of-way, and other major factors that diminish their suitability. Alternatives with excessive impact or notably lower performance were eliminated from further consideration. These alternatives are listed as "Not Recommended" in **Exhibit 4-31** and **Exhibit 4-32** and will not be advanced for further evaluation and consideration as part of the detailed evaluation. The analyses also identified roadway mainline and intersection alternatives that require further analysis and are recommended for further evaluation and consideration. These are designated in the Exhibits as "Advance."

Exhibit 4-31. Summary of Recommendations for NM 31 and NM 128 Mainline Alternatives

Roadway Segment/Alternative	Enhanced Two-Lane	Super 2	Four-Lane Flush Median	Four-Lane Depressed Median
NM 31: BOP to NM 128	Not Recommended	Not Recommended	Advance	Advance
NM 31: NM 128 to US 62	Advance	Not Recommended	Not Recommended	Not Recommended
NM 128: NM 31 to Jal	Not Recommended	Not Recommended	Not Recommended	Advance
NM 128: NM 18 to EOP	Advance	Not Recommended	Not Recommended	Not Recommended

Exhibit 4-32. Summary of Recommendations for NM 31 and NM 128 Major Unsignalized Intersections

Intersection/Alternative	Conventional Stop Control	High-T	RCUT	Roundabout
NM 31 Intersections				
Carter Rd	Advance	Not Recommended	Not Recommended	Not Recommended
Donaldson Farm Rd	Advance	Not Recommended	Not Recommended	Not Recommended
Nymeyer Rd	Advance	Not Recommended	Not Recommended	Not Recommended
Fisherman's Lane	Advance	Not Recommended	Not Recommended	Not Recommended
Refinery Rd	Not Recommended	Advance	Not Recommended	Advance
NM 128	Not Recommended	Advance	Not Recommended	Advance
USC/Mosaic Site	Advance	Not Applicable	Not Applicable	Not Recommended
US 62	Advance	Advance	Not Recommended	Not Recommended
NM 128 Intersections				
WIPP Road	Not Recommended	Advance	Not Recommended	Advance
Red Road / Twin Wells Road	Advance	Not Applicable	Not Recommended	Not Recommended
Buck Jackson Road	Not Recommended	Advance	Not Recommended	Advance
Orla Road	Not Recommended	Advance	Not Recommended	Advance
Delaware Basin Road	Advance	Not Recommended	Not Recommended	Not Recommended
Battle Axe Road	Advance	Not Recommended	Not Recommended	Not Recommended
Schooley Road	Advance	Not Applicable	Not Recommended	Not Recommended
Willis Road	Advance	Not Applicable	Not Recommended	Not Recommended

As summarized in **Exhibit 4-31**, the Enhanced 2-Lane Alternative was not recommended for further consideration for the segment of NM 31 from the BOP to NM 128 and the segment of NM 128 from its junction with NM 31 to the west side of Jal. The primary reasons for this finding were the inability of the Enhanced 2-Lane to achieve acceptable level of service and provide adequate safety benefits. Likewise, the Super 2 Alternative was not recommended for these segments for the same reasons. While both alternatives would provide substantial improvement over the No-Build condition, the 4-lane alternatives have much stronger performance and stakeholder support.

The Enhanced 2-Lane Alternative was recommended for the segment of NM 31 from NM 128 to the EOP and NM 128 from the east side of Jal to the New Mexico/Texas state line. Traffic volumes are much lower on both segments and acceptable level of service and safety goals can be achieved with the Enhanced 2-Lane. The Super 2 Alternative and the 4-lane alternatives were not recommended for either of these segments because the higher cost and right-of-way needs were not offset by their added safety benefits and traffic operational performance.

The 4-Lane Flush Median was only recommended for the first eight miles of NM 31 from the BOP to the NM 31/128 intersection. This segment of NM 31 has numerous access drives and intersections with other state and local roads with several residences, agricultural and industrial buildings, and irrigation facilities close to the existing right-of-way. Analysis found the 4-Lane Flush Median Alternative would achieve acceptable traffic and safety performance;

therefore, the additional right-of-way and impacts to the community that would result from the 4-Lane Depressed Median Alternative were not found to justify its minor benefits over the flush median concept.

Within Jal, the **basic 3-Lane Alternative** and a **modified 3-Lane Alternative** with traffic signals at the NM 128/3rd Street and NM 128/NM 18 intersections are recommended for advancement. The modification is an eastbound auxiliary lane from approximately 4th Street to NM 18. The Undivided 4-Lane Alternative and the 5-Lane Alternative (Divided 4-Lane) were not recommended because of their impacts to the businesses and residents along NM 128 within Jal, and acceptable traffic performance can be provided with traffic signal control at NM 18 and at 3rd Street.

For major intersections, a TWSC/stop-sign configuration achieves acceptable traffic level of service and safety objectives for ten of the sixteen major intersections (see **Exhibit 4-32**). The need to assess alternative configurations was not necessary for these ten locations. Alternative configurations were considered for the remaining six intersections, including NM 31 at Refinery Road, NM 128, and US 62, and NM 128 at WIPP Road, Buck Jackson Road, and Orla Road. High-T, RCUT, and roundabout configurations were considered for these intersections. As a result of traffic and safety analyses for these locations, the High-T Alternative and Roundabout Alternative were advanced for further consideration for the intersections of NM 31/Refinery Road, NM 31/NM 128, NM 128/WIPP Road, NM 128/Buck Jackson Road, and NM 128/Orla Road. A High-T was also recommended for further consideration at NM 31/US 62. The RCUT Alternative was not advanced for further analysis because of the out-of-direction travel, potential problems with large trucks having to cross the two travel lanes to enter the turn-around lane, and strong opposition from industry partners.

4.3 Detailed Evaluation of Alternatives

Highway mainline and intersection alternative elements recommended for detailed analysis (see **Section 4.2**) were combined into proposed Build Alternatives specific to NM 31 and NM 128. Enhanced conceptual design (ECD) plans were developed for each alternative that included sufficient detail to identify and evaluate the roadway footprint, right-of-way needs, environmental impacts, costs, constructability, and general impacts. Based on the screening evaluation in **Section 4.2**, a single proposed build concept was identified for the mainline of each major route segment (not including transition areas). The major route segments are shown in **Exhibit 4-33** on the following page.

- Segment #1: NM 31 from the BOP to NM 128 including the NM 31/NM 128 intersection
- Segment #2: NM 31 from the NM 31/NM 128 intersection to the EOP at US 62

- Segment #1: NM 128 from MP 0.0 to the western edge of Jal at MP 50.5
- Segment #2: NM 128 through Jal from MP 50.5 to 53.5
- Segment #3: NM 128 east of Jal from MP 53.5 to the EOP at MP 59.9

The proposed Build Alternative concepts for the NM 31 and NM 128 segments assume a specific intersection type as part of the base including conventional unsignalized, High-T, RCUT or Roundabout intersections depending on the specific needs at each major intersection. In some instances, because more than one intersection type could achieve the traffic operational needs and were recommended as reasonable for several of the major intersections along NM 31 and NM 128, these are included and discussed as intersection options for the Build Alternative.

Enhanced conceptual design plans used for the detailed evaluation of alternatives are presented in the *electronic appendices*. For purposes of describing and discussing project alternatives, the discussion in this section is presented for two major segments of NM 31 first followed by the three segments of NM 128.

4.3.1 Design Criteria

The design criteria used for development of the enhanced conceptual design plans are summarized below for each of the major segments described above. The criteria cover all aspects of roadway design and utilize the standard guideline documents required by NMDOT including:

- AASHTO, A Policy on Geometric Design of Highways and Streets (Green Book, 2018)
- AASHTO, Roadside Design Guide (2011)
- AASHTO, Guide for the Development of Bicycle Facilities (4th Edition, 2012)
- AREMA, Manual for Railway Engineering, (2021)
- FHWA, Manual On Uniform Traffic Control Devices (MUTCD, 2009)
- FHWA, Highway-Rail Crossing Handbook (Third Edition, 2019)
- FHWA-SA-15-073, Evaluation of Geometric Parameters that Affect Truck Maneuvering and Stability (2015, updated 2020) [Part of the series: FHWA Accelerating Roundabout Implementation in the United States, Volumes I-VII]
- FHWA, Restricted Crossing U-Turn Intersection Informational Guide (2019)
- NMDOT, Design Manual (2016)
- NMDOT, State Access Management Manual (SAMM, 2001)
- NMDOT, Drainage Design Criteria (2018)

In addition to the above documents, information from other sources was used to address some elements of the project. These sources include the National Cooperative Highway Research Program (NCHRP), Texas A&M Transportation Institute, and two states with guidelines for the design of roundabouts used by over dimension vehicles — Wisconsin DOT and Kansas DOT.

- NCHRP Report 672 Roundabouts: An Informational Guide, Second Addition (2010)
- WisDOT Facilities Development Manual FDM-11-26 Design-Roundabouts (2021)
- KDOT K-TRAN:KSU-10-1 Final Report Accommodating Oversize/Overweight Vehicles at Roundabouts (2013)
- Texas A&M Transportation Institute, Tools and Strategies to Mitigate Impacts of Energy and Natural Resources Development (2019)

The key design criteria are discussed below.

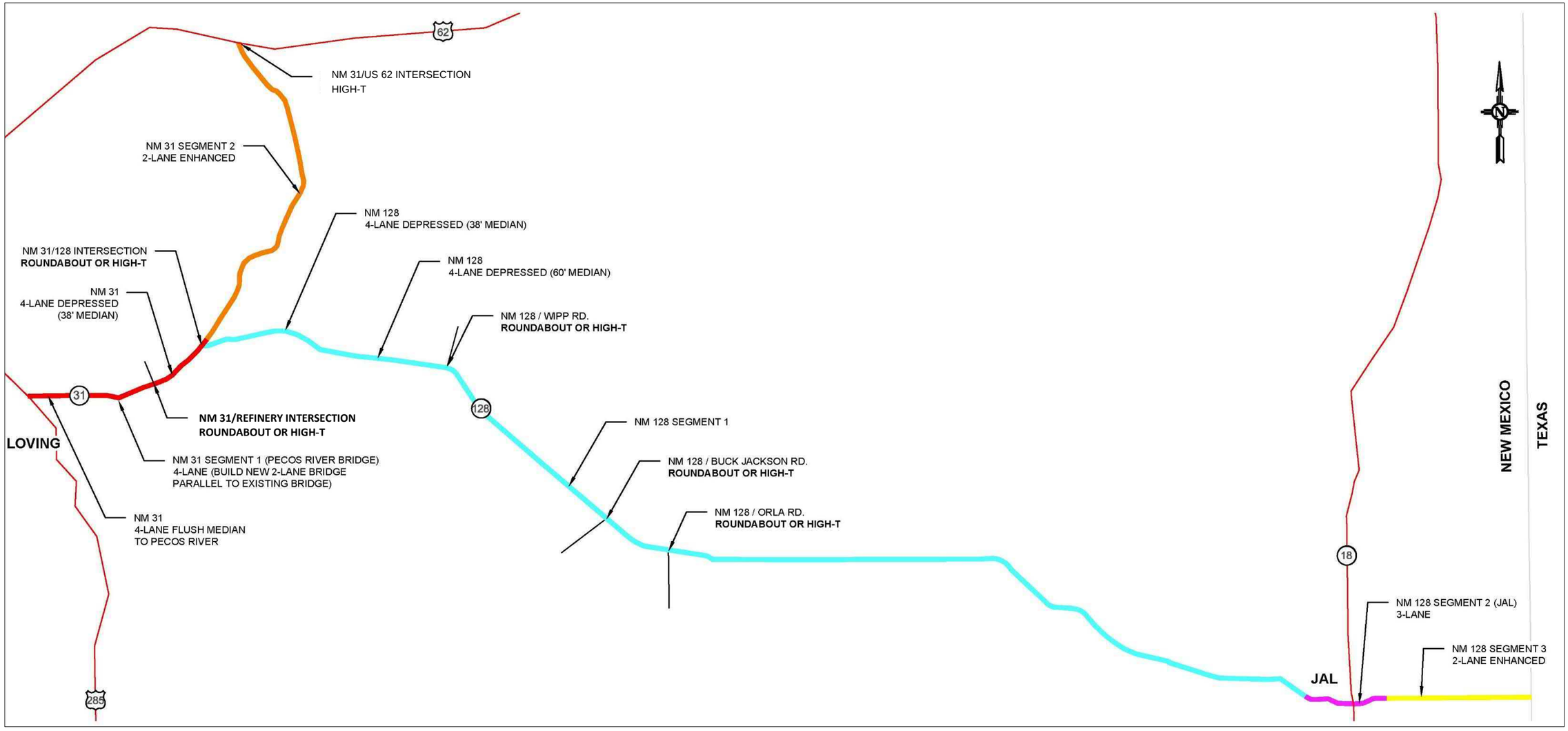
Design Speed/Posted Speed

The proposed roadway alignment is based on a design speed consistent with the project context and setting for each major segment of NM 31 and NM 128. **Exhibit 4-34** lists the design speed and planned posted speed for the roadway mainline segments. The roundabout intersection at NM 31 and NM 128 is located on several curves. For this intersection a design speed of 40 mph was used for the south leg, 30 mph for the north leg, and 40 mph for the east leg of the intersection. The posted speed will be 30 mph for all roundabout intersections included in this project.

Exhibit 4-34A. Assumed Design Speeds and Posted Speeds for NM 31 Segments

Segment	Design Speed	Planned Posted Speed	Comments
NM 31: BOP to MP 7.2	60 mph	55 mph	Design speed of 55 mph at MP 3.4 for curve transition to Pecos Bridge
NM 31: MP 7.2 to MP 8.0	50 mph (mainline)	45 mph (mainline)	Reduced design speed through transition from NM 31 to NM 128
NM 31: MP 8.0 to MP 22.6	60 mph	55 mph	

Exhibit 4-33. Major Segments of NM 31 and NM 128



NM 31 CORRIDOR				
SEGMENT		MILEPOST	TYPICAL SECTION	KEY FEATURES
	1	0.5 TO 8.0	4-LANE FLUSH MEDIAN TO PECOS RIVER AND 38' DEPRESSED MEDIAN FROM THERE TO NM 31-128 INTERSECTION	PECOS RIVER BRIDGE: BUILD NEW 2-LANE BRIDGE PARALLEL TO EXISTING BRIDGE, NM 31/REFINERY RD. INTERSECTION: **ROUNDABOUT OR RCUT**, NM31/NM 128 INTERSECTION: **ROUNDABOUT OR HIGH-T**
	2	8.0 TO 22.7	2-LANE ENHANCED	2-LANE ENHANCED NORTH OF NM 128 INTERSECTION. NM 31/US 62 INTERSECTION: **HIGH-T**

NM 128 CORRIDOR				
SEGMENT		MILEPOST	TYPICAL SECTION	KEY FEATURES
	1	0.0 TO 50.5	4-LANE DEPRESSED (38' MEDIAN), 4-LANE DEPRESSED (60' MEDIAN)	NM 128/WIPP RD., NM 128/BUCK JACKSON & NM 128/ORLA RD. INTERSECTIONS: **ROUNDABOUT OR HIGH-T**
	2	50.5 TO 53.5	3-LANE	
	3	53.5 TO 59.9	2-LANE ENHANCED	

Exhibit 4-34B. Assumed Design Speeds and Posted Speeds for NM 128 Segments

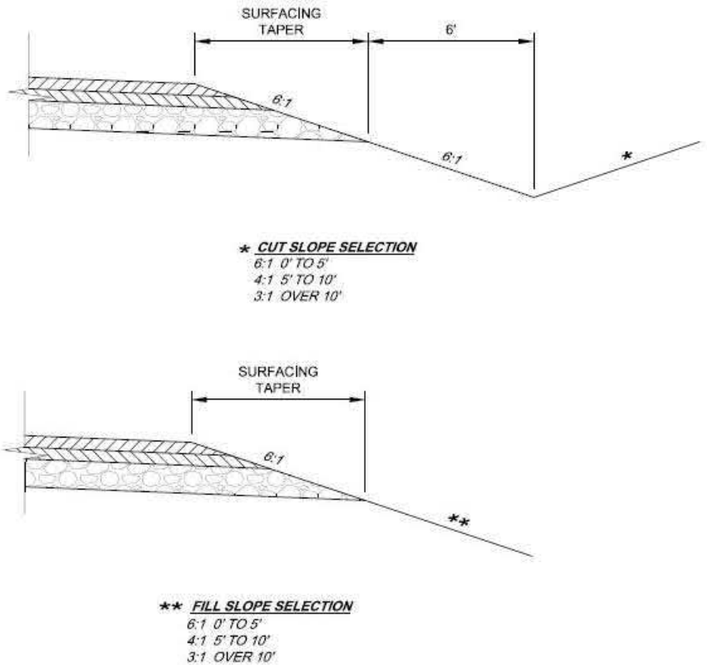
Segment	Design Speed	Planned Posted Speed*	Comments
NM 128: MP 0.5 to MP 0.7	60 mph	55 mph	Salt Lakes area, roadway geometry
NM 128: MP 0.7 to MP 48.0	70 mph	65 mph	
NM 128: MP 48.0 to MP 51.4	60 mph	55 mph	Approaching Jal
NM 128: MP 51.4 to MP 51.7	50 mph	45 mph	Transitioning into Jal
NM 128: MP 51.7 to MP 53.0	40 mph	35 mph	City of Jal
NM 128: MP 53.0 to MP 53.8	50 mph	45 mph	Transitioning out of Jal
NM 128: MP 53.8 to MP 54.3	60 mph	55 mph	Schooley and Willis Intersections
NM 128: MP 54.3 to EOP	70 mph	65 mph	

** Actual posted speed to be determined by NMDOT based on an engineering study*

Mainline Roadside Slopes

Roadside slopes varied from 6:1 to 3:1 depending on the distance available between the surfacing taper and edge of right-of-way or other features that limit the area available. The design of both cut and fill slopes used 3:1 grades in areas where more than 10 feet was available, 4:1 in areas with 5 feet to 10 feet, and 6:1 in locations with less than 5 feet available (see **Exhibit 4-35**). Steeper slopes (2:1) were used in a few areas with major constraints that precluded the use of less steep slopes (e.g., curve at west edge of the Pecos River bridge). Guardrail was included in areas when this occurred.

Exhibit 4-35. Roadside Slope Rates along NM 31 and NM 128



Pavement Section Design

Preliminary pavement designs were provided by the NMDOT based on traffic volumes and equivalent single axle loads (ESALs) for NM 31 near Refinery Road, and the criteria set by the NMDOT Design Manual and AASHTO 1993 Guide for the Design of Pavement Structures. This project will involve full reconstruction of existing highways, new construction of additional lanes, overlays, and full-depth reclamation (FDR) of existing pavements. The following pavement sections were used for the Phase I-A/B Enhanced Conceptual Engineering Design and cost estimates (which are subject to change in final design):

- In areas requiring flexible pavement for reconstruction or widening, the pavement section was assumed to be 8 inches of asphalt concrete over 9 inches of aggregate base course with 5/8" rubberized open-graded friction course (R/OGFC).
- In areas where rigid pavement is specified (i.e., NM 31 roundabouts, intersections in Jal), 10.5 to 11 inches of plain jointed concrete over 6 inches of aggregate base course was assumed.
- For Full Depth Reclamation, the pavement section was assumed to be 3 inches of asphalt concrete over 8 inches of foamed asphalt base course with 5/8" rubberized open-graded friction course (R/OGFC).

The R-values for this project vary by location. There are locations along both highways with R-values less than 50 including two segments on NM 31 and five segments on NM 128. Soils in these locations are sandy clay and may require remediation during construction. The design R-values range from 50 to 69 on NM 31 and range from 38 to 72 on NM 128.

Design Vehicles

The highway alignment was set assuming the following design vehicles:

- WB-67 (Interstate Semitrailer): For major turnouts including state highways, county roads, and major oil field access roads
- SU-30 (Single Unit truck): For minor commercial turnouts
- P (Passenger car): For minor turnouts, residential or ranch access

In addition to the above, the roundabouts were designed to accommodate a design vehicle that is consistent with the largest vehicle the NMDOT will permit, which is 200 feet long and 22 feet wide. To replicate a vehicle of this size, a 19-axle, 199-foot long and 22-foot wide design vehicle was used.

Superelevation for Horizontal Curvature

Horizontal curves where superelevation (e) is needed will be designed using the superelevation rates in **Table 3-9** of the AASHTO Green Book. This table is based on an e_{max} of 6%.

Auxiliary Lanes at Intersections

The NMDOT's State Access Management Manual (SAMM) specifies in Chapter 17 the criteria for left-turn and right-turn deceleration lanes on rural two-lane and multi-lane highways which was used to determine where auxiliary lanes are needed. Auxiliary lane length, including deceleration lanes for left turn and right-turn lanes, was set based on criteria in the SAMM. Note that acceleration lanes are not proposed because LOS A/B operations are expected for design-year proposed conditions for the divided four-lane section from the BOP at MP 0.5 to NM 128 as well as for the two-lane highway from NM 128 to US 62. The capacity provided where two lanes are proposed, whether a mainline lane or a passing lane, offsets the need for acceleration lanes. Also, the safety analysis does not indicate a need for acceleration lanes for the two-lane highway segment. Because the specified deceleration lane lengths are long based on speed, additional length for storage was not included.

4.3.2 NM 31 Alternatives

The limits of NM 31 for this project begin at MP 0.5 (approximately) and end at MP 22.6 where NM 31 intersects US 62. The NM 31 BOP is at the EOP of a separate project being advanced to reconstruct the US 285/NM 31 intersection. The eastern leg of that project realigns NM 31 several hundred feet south of its existing alignment and uses a horizontal curve to tie back into the proposed centerline of the NM 31 project.

One alternative for NM 31 was evaluated in detail. In addition to the base Build Alternative, options were evaluated for the intersections at Refinery Road and at NM 128. The major design elements of NM 31 Alternative 1 are described below and are illustrated in the NM 31 Enhanced Concept Design Plans.

In addition to the mainline highway, drainage improvements and other elements of the roadway infrastructure are described including access management changes, railroad crossings, and major structures.

Typical Sections

The typical sections used for NM 31 are summarized in **Exhibit 4-36** and illustrated in **Exhibit 4-37.A** through **Exhibit 4-37.C**. The exhibits are limited to major segments of the NM 31 corridor — numerous transitions and variations of each typical section will occur.

Exhibit 4-36. NM 31 Typical Sections for Major Segments

Segment	Roadway Milepost	Travel Lanes	Median	Shoulders	Other Elements
NM 31 from BOP to MP 8.0	MP 0.5 to MP 3.25	4, 12-ft. lanes	14-ft. Flush	10-ft	Auxiliary Lanes at major intersections
	MP 3.25 to MP 4.0	4, 12-ft. lanes	Transition from flush to depressed	10-ft	Auxiliary Lanes at major intersections
	MP 4.0 to MP 7.0	4, 12-ft. lanes	38-ft. Depressed	10-ft	Auxiliary Lanes at major intersections
NM 31/ NM 128 Intersection	MP 7.0 to MP 8.0	See description under Major Intersections			
NM 31 from MP 8.0 to EOP at MP 22.6	MP 8.0 to MP 22.6	2, 12-ft. lanes	None	10-ft	2 NB and 2 SB Passing Lanes

Overall, the Build Alternative utilizes three major typical sections. The first typical section would reconstruct NM 31 from its existing 2-lane section to a 4-Lane with 12-foot travel lanes, a 14-foot flush median, and 10-foot shoulders. Shoulders are reduced to 6 feet in areas where right-turn lanes are present. This section is used from the BOP to Donaldson Farm Road because of the higher number of driveways present and development that is adjacent to the highway. While not proposed as part of the Build Alternative, a positive barrier could be constructed within the flush median. This barrier could be concrete wall barrier or high-tension cable barrier to prevent traffic from entering the opposing travel lanes. The advantages and disadvantages of a median barrier with the 4-Lane Flush Median concept are summarized in the discussion of traffic and safety later in this chapter.

The second typical section would reconstruct NM 31 from its existing 2-lane section to a 4-Lane with 12-foot travel lanes, a 38-foot depressed median, and 6-foot inside and 10-foot outside shoulders. Outside shoulders are reduced to 6 feet in areas where right-turn lanes are present. This section is used from Donaldson Farm Road to the intersection of NM 31 and NM 128. This area has fewer intersecting roads and driveways and little development adjacent to the highway.

An enhanced two-lane section with passing lanes and intersection improvements is used north of the intersection of NM 31 and NM 128 and continues to the EOP at US 62 (MP 22.6). This typical section would reconstruct NM 31 from its existing 2-lane section to a 2-lane highway with 12-foot travel lanes and 10-foot outside shoulders. Speed change lanes (right and left-turn lanes) are included at all major intersections and driveways. Shoulders are reduced to 6 feet in areas where right-turn lanes are present. Passing lanes include two in the northbound direction at MP 9.1 to MP 11.0 and MP 14.3 to MP 16.6, and two in the SB direction at MP 12.6 to 14.7 and 17.5 to 19.8. A short passing lane is also provided southbound starting at the intersection of US 62 and NM 31 and extends about 0.8 miles to MP 21.7. This lane is intended to allow slower-moving vehicles turning onto NM 31 from US 62 to be passed by faster vehicles before entering the longer stretches of this highway.

The typical sections described above include several alignment shifts to minimize impacts to existing development and to facilitate maintenance of traffic during construction. **Exhibit 4-38** below summarizes locations where the NM 31 alignment was shifted to minimize ROW impacts.

Exhibit 4-38. NM 31 Alignment Shifts

Number	Milepost	Direction	Reason
1	0.5 to 2.5	Right (South)	Avoid residences on left (north) side of the highway
2	2.5 to 3.2	Left (North)	Avoid residence on right (south) side of the highway
3	3.2 to 4.6	Right (South)	Align with existing and new bridge across Pecos River
4	4.6 to 5.3	Left (North)	Avoid oil tank battery in southeast quadrant of Refinery Rd
5	5.3 to 5.8	Right (South)	Avoid newly constructed water reservoir on left side
6	5.8 to 7.5 (NM 128)	Left (North)	Avoid gas facility on right side
7	7.5 (NM 128) to 19.1	Left (West)	Avoid utility impacts on right side
8	19.1 to 19.8	Right (East)	Avoid large overhead power poles of left side
9	19.8 to 22.6	Left (West)	Avoid salt drying beds on right side

Major Intersections

There are eighteen major intersections along NM 31 with existing or projected traffic volumes that warrant speed change lanes. All of these intersections will be constructed to include auxiliary lanes as shown in **Exhibit 4-39**. Except for the intersections at Refinery Road and NM 128, all intersections would be configured as stop-controlled for the side streets. Two alternative configurations were evaluated in detail for the intersections of NM 31 at Refinery Road and NM 128, as described below.

The intersection at Refinery Road is proposed to be configured as a roundabout intersection with a High-T configuration as an alternative. These two configurations are shown in **Exhibit 4-40.A** and **Exhibit 4-40.B**. The roundabout alternative would be sized and configured to accommodate vehicle types typical of traffic on NM 31 and NM 128 and would accommodate vehicles as large as WB-67 tractor-trailer trucks. This size of vehicle could operate within the roundabout using the proposed lane configuration and at the planned design speed. Most over-dimension vehicles common to the oil-field industry (e.g., drilling rigs) and other large vehicles traveling through the corridor (e.g., trucks transporting wind turbine blades) could also use the roundabout intersection but will have considerable off-tracking that would encroach into the median and shoulders. For this reason, the proposed configuration includes by-pass lanes (see **Exhibit 4-40.A**). These lanes will only be accessible by NMDOT permitted vehicles and for traffic control by emergency management personnel if crashes block the roundabout. Access to the bypass lanes by other traffic will be prevented by gates.

Exhibit 4-37.A. NM 31 Alternative 1 and 2 Typical Section BOP to MP 3.25 (Donaldson Farm Road)

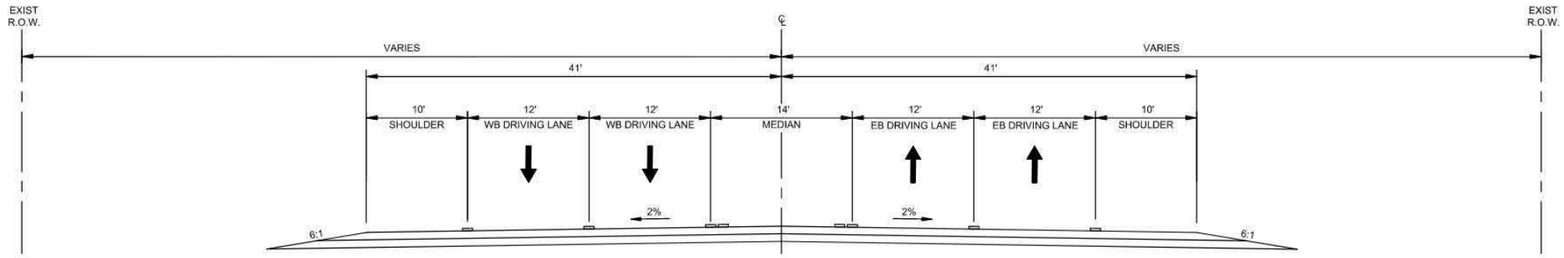


Exhibit 4-37.B. NM 31 Alternative 1 and 2 Typical Section MP 3.25 to NM 31/NM 128 Intersection

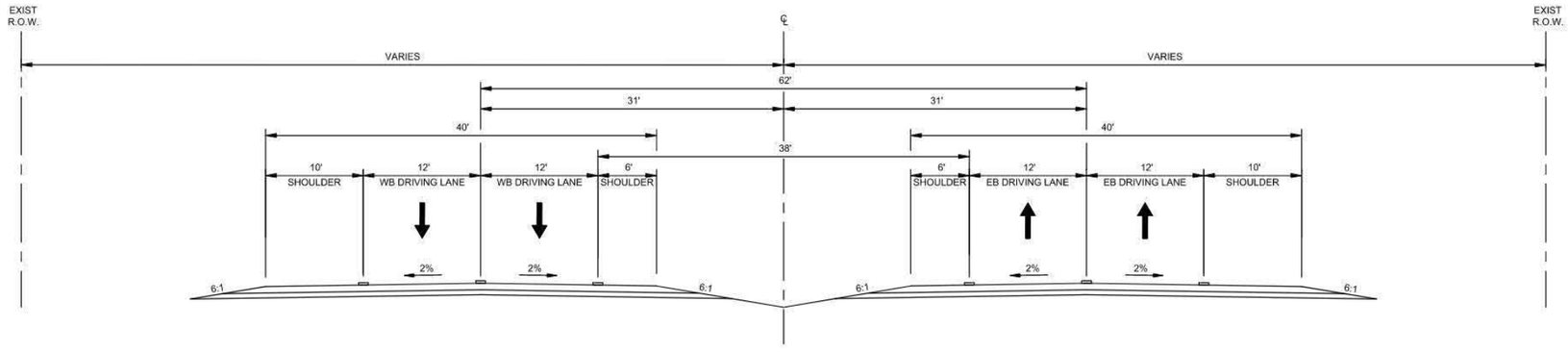


Exhibit 4-37.C. NM 31 Alternative 1 and 2 Typical Section from NM 31/NM 128 Intersection to EOP

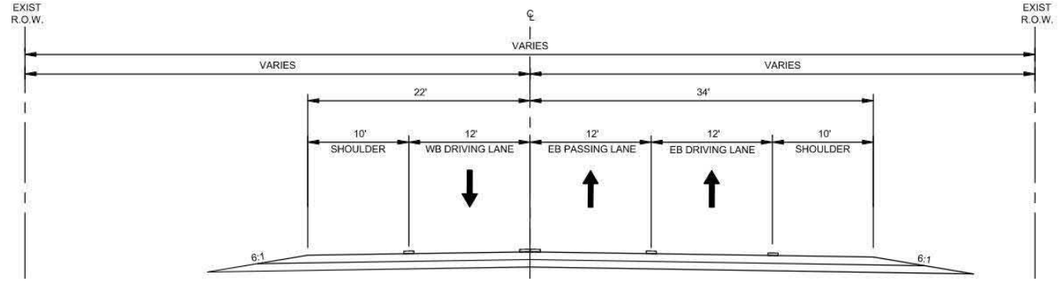


Exhibit 4-39. Proposed Improvements for Major Intersections along NM 31

Milepost	Intersection and Side of Highway	Intersection Configuration and Auxiliary Lanes
0.7	RIO Transload Facility (Right)	Stop-sign with left-turn and right-turn deceleration lanes
1.2	Carter Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
2.2	Nymeyer Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
3.2	Donaldson Farm Road (Left/Right)	TWSC with left-turn and right-turn deceleration lanes
4.4	Centurion Main Access (Right)	Stop-sign with left-turn and right-turn deceleration lanes
4.9	Fishermans Lane (Right)	Stop-sign with left-turn and right-turn deceleration lanes
5.3	Refinery Road	Roundabout with By-pass Lanes
6.5	USC Lake Plant Access (Right)	Stop-sign with left-turn and right-turn deceleration lanes
7.6	NM 128	Roundabout with By-pass Lanes
13.0	Ruger Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
13.6	Mosaic Potash Access Rd. #1 (Right)	Stop-sign with right-turn deceleration lane
14.1	Mosaic Potash Access Rd. #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.3	USC Access #1 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.3	USC Access #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.8	Cimarron Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
19.5	Intrepid Potash Access #1 (Right)	Stop-sign with right-turn deceleration lane
19.7	Intrepid Potash Access #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
19.8	Intrepid Potash Access #3 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
21.4	Power Grid Facility (Left)	Stop-sign with right-turn deceleration lane
22.6	US 62/180 (NM 31 minor leg)	Stop-sign on NM 31; left-turn and right-turn deceleration lanes on US 62/180

The roundabout alternative does not include special provisions for bicyclists however the shoulders along the highway would continue through the roundabout. Traffic counts collected at this intersection did not identify any pedestrians or bicycles during the count period. Bicyclists would pass through the roundabouts using the shoulder.

The High-T alternative for NM 31/Refinery Road would require closure of the south leg of Refinery Road. If this alternative is advanced, a new gravel road will be constructed to provide access via the USC Lake Plant Access Road at milepost 6.8, approximately 0.35 miles south of Refinery Road (see **Exhibit 4-40.B**).

The intersection of NM 31 and NM 128 would be reconfigured to make NM 31 south of NM 128 continuous with NM 128. NM 31 north of NM 128 would then tee into the realigned portion. This configuration would be consistent with the primary northbound-to-eastbound traffic flows in the morning and the westbound-to-southbound flows in the evening. This would eliminate conflicts with the westbound left-turn movement in the evening and would better manage the heavy right-turn movement in the morning.

This intersection would be constructed as a roundabout with bypass lanes and would accommodate over-dimension vehicles and bicyclists the same as described for the intersection of NM 31 and Refinery Road. The configuration is shown in **Exhibit 4-41.A**. The alternative configuration for this intersection is a High-T intersection with an at-grade crossing of the BNSF railroad crossing. This configuration is shown in **Exhibit 4-41.B**.

Railroad Crossings

The Build Alternative for NM 31 includes five railroad crossings operated by the BNSF Railroad including four crossings of the NM 31 mainline and one at the realignment of the NM 31/NM 128 intersection. The crossing designs are shown in **Exhibit 4-42.A** through **4-42.E**. The design concepts for the Build Alternative were developed in collaboration with the BNSF and are consistent with their requirements. Key features of the crossings include:

- All crossings will include advance signage, signals, flashers, and gates. The 4-lane section and shoulder widths used at NM 31 MP 3.0 and MP 4.0 and at NM 128 MP 0.05 will require dual gates at these locations (i.e., one gate installed in the median and a second gate installed along the outside edge of the highway for each direction of travel). Single gate arms for each travel direction are used for the crossings at MP 9.3 and MP 13.6.
- Gate foundations will be protected with crash attenuators consistent with the requirements of American Railway Engineering and Maintenance-of-Way Association (AREMA) standards and AASHTO design criteria. Median curbs will be designed consistent with the posted speed of the highway.
- Warning flashers will be installed on signal masts using cantilever structures. Overhead structures will not be used because of the frequency of over-sized trucks using NM 31 and NM 128.
- Because of the skew angle, the shoulder design for crossings at MP 3.0 and 4.0 will use bulb-outs to allow bicyclists to cross the tracks at a skew greater than 75 degrees.
- The roadway alignment at the NM 31/NM 128 intersection may change depending on discussions with the BNSF. Regardless of the alignment, the crossings will be designed consistent with AREMA and AASHTO criteria and in collaboration with the BNSF.

NM 31 Access Management

Access management for the proposed Build Alternative includes several changes to existing access. These include turn restrictions and changes to some of the existing highway turnouts. Turn restrictions include:

- Left-turn restrictions at locations where safe turns cannot be accommodated. This change primarily affects the segment of NM 31 from Donaldson Farm Road to the NM 31/NM 128 intersection. The turnouts near the bridge across the Pecos River are affected because of limited sight distance. In these locations, right-in/right-out access will be provided. Right-turning vehicles will be able to make U-turns are the next available full access intersection that are within one-half mile of the restricted access intersection.
- In general, full access is provided from the BOP to Donaldson Farm Road and from the NM 31/NM 128 intersection to the EOP at US 62. In these segments, turn restrictions are limited to areas where other auxiliary lanes will be constructed such as at the plant entrances to USC, Mosaic, and Intrepid.

In addition to the above, the access management plan for NM 31 includes modifications to several existing turnouts. The locations affected and reasons for proposed changes are summarized below and listed in **Exhibit 4-43**.

- As a general design approach, turnouts used by large trucks will be designed with radii sufficient to prevent truck-trailer off-tracking. This approach is limited to turnouts where heavy truck use currently occurs or is expected to occur in the future. The design approach is illustrated in **Exhibit 4-44.**
- Several existing turnouts will be closed without providing replacement access. This approach is proposed for locations where other, nearby access is available and/or the existing access does not show signs of recent use, e.g., no apparent visible signs of vehicle use or the access has been abandoned because alternative access has already been constructed.
- Several existing access points will be closed and new access will be provided. In some instances, the intersecting road may require minor realignment.
- Partial closure to restrict turns to right-in/right-out only to improve safety where left-turns cannot be accommodated

Exhibit 4-40.A. NM 31 at Refinery Road – Build Alternative with Roundabout Intersection

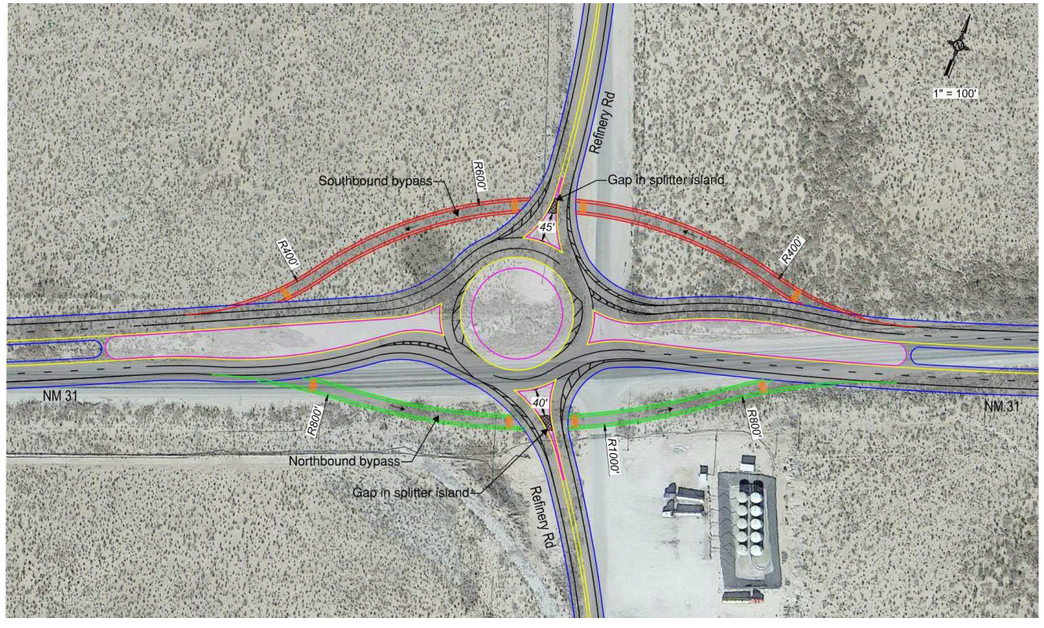


Exhibit 4-40.B. NM 31 at Refinery Road – Build Alternative with High-T Intersection Option

Exhibit 4-41.A. NM 31 at NM 128 – Build Alternative with Roundabout Intersection

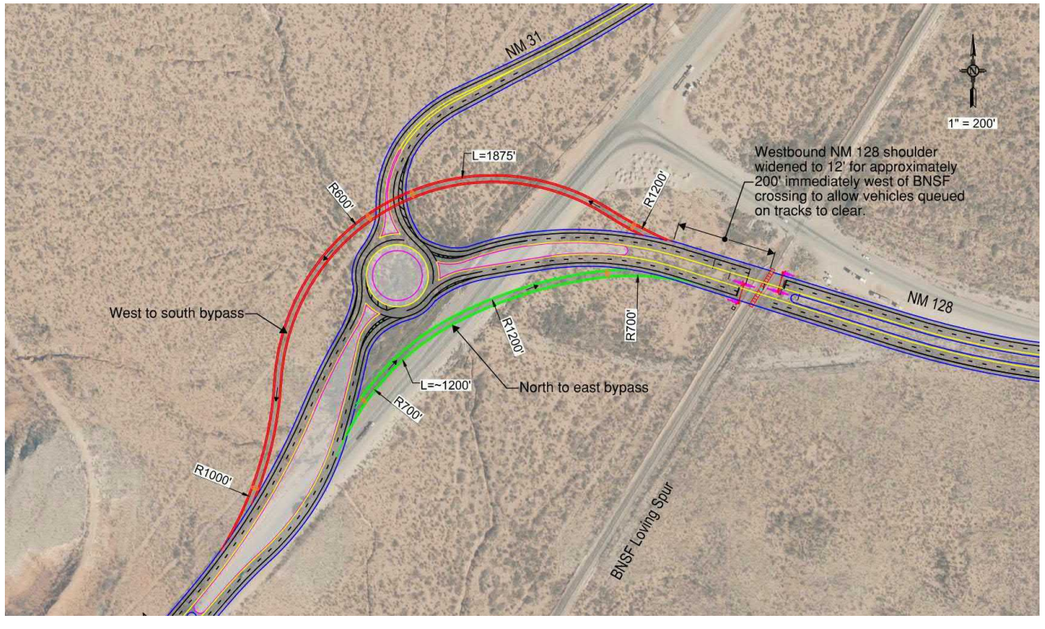


Exhibit 4-41.B. NM 31 at NM 128 – Build Alternative with High-T Intersection Option

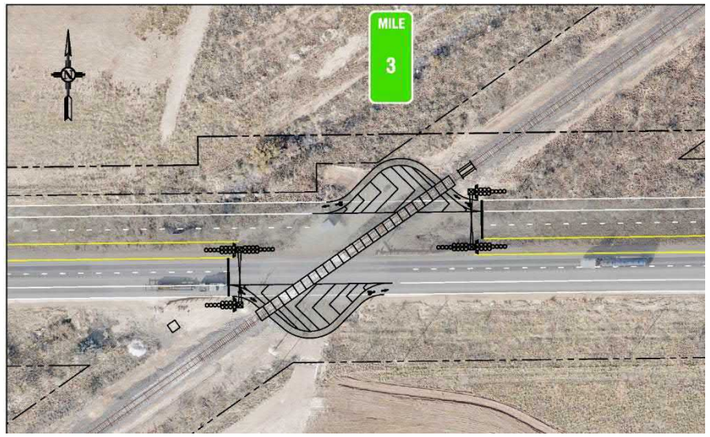


Exhibit 4-42.A. BNSF Crossing at MP 3.0

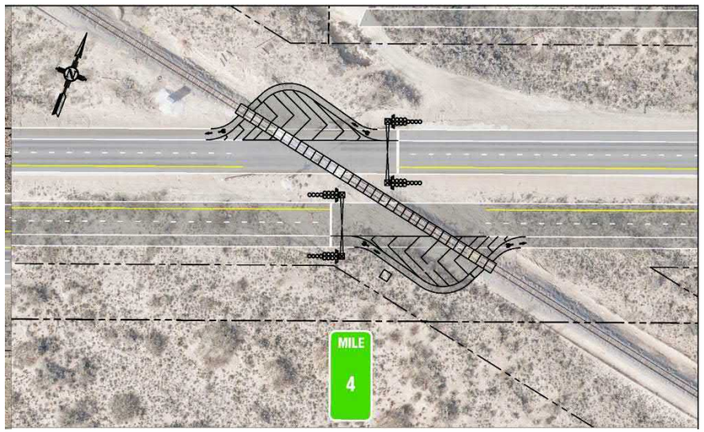


Exhibit 4-42.B. BNSF Crossing at MP 4.0

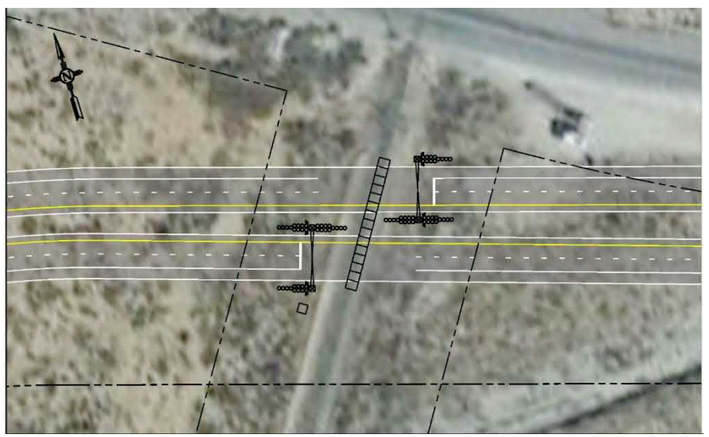


Exhibit 4-42.C. BNSF Crossing at NM 128 MP 0.5

Exhibit 4-42.D. BNSF Crossing at MP 9.3

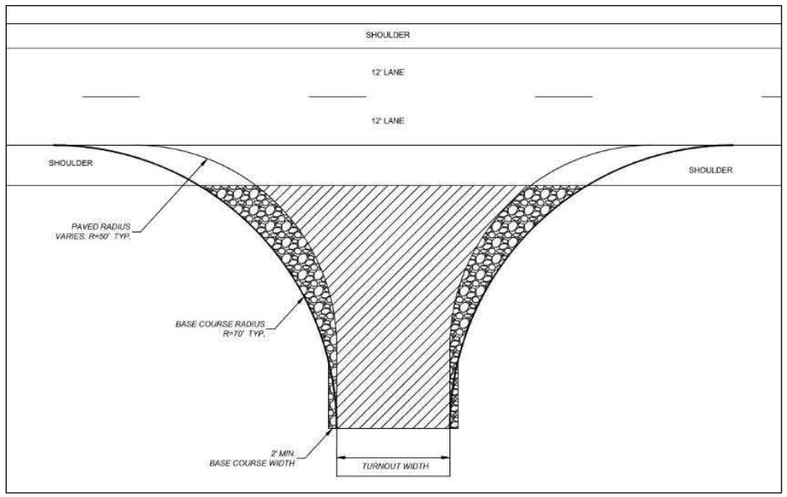
Exhibit 4-42.E. BNSF Crossing at MP 13.6

Exhibit 4-43. NM 31 Proposed Access Changes

Milepost	Side of Highway	Proposed Change	Comment
2.14	Right	Closure	Access is provided via Nymeyer Road
2.32	Right	Closure	Access is provided via Nymeyer Road
2.42	Right	Closure	Access via existing TO at STA 138+28 (MP 2.58)
2.72	Left	Closure	Access via existing TO at STA 145+24 (MP 2.71)
2.90	Right	Realign	Realign access to STA 150+33 (MP)
2.97	Right	Closure	Access via existing TO at STA 163+47 (MP 3.07)
3.12	Left	Closure	Access via Donaldson Farm Road
3.50	Left	Realign	Realign access to STA 187+70 (MP 3.5) requires construction of new tie-in)
3.51	Right	Realign	Realign access to STA 187+70 (MP 3.5) requires construction of new tie-in)
3.52	Left	Realign	Realign access to STA 187+70 (MP 3.5) requires construction of new tie-in)
3.82	Right	Closure	Access via exist. TO at STA 206+72 (MP 3.9, requires construction of new tie-in)
4.02	Left	Closure	Realign access to STA 218+73 (MP 4.1,requires construction of new road and TO)
4.30	Left	Closure	Access via STA 226+51 (MP 4.3) and STA 233+33 MP 4.4)
6.37	Right	Closure	Access via existing TO at STA 342+63 (MP 6.5)
8.74	Left	Closure	Access via existing TO at STA 569+78 (MP 8.9
8.76	Left	Closure	Access via existing TO at STA 569+78 (MP 8.9
13.63	Left	Closure	Access via existing TO at STA 838+63 (MP 13.9)
15.59	Left	Closure	Access via existing TO at STA 932+72 (MP 15.7)
22.50	Left	Closure	Access via existing TO STA 1272+79 (MP 22.2)

Existing access at Mileposts 4.41, 4.46, 6.60, 9.22, 12.41, 14.30, 18.92, 20.14, 20.82, 21.02, 22.10, and 22.49 will be closed. These turnouts do not show signs of use and are do not have driveways permits from the NMDOT

Exhibit 4-44. Typical Turnout Design for intersections Used by Large Trucks



NM 31 Proposed Drainage Conditions

Draft Final Drainage Reports were prepared for NM 31 and NM 128. These reports provide an assessment of existing drainage conditions in the corridor, identifies deficient drainage structures, and recommends improvements to comply with NMDOT drainage design requirements. These reports are provided in the *electronic appendices*. The drainage improvements recommended for NM 31 are summarized below.

Cross Drainage Structures

The condition and needs of existing drainage structures for NM 31 are discussed in **Chapter 3**. Proposed drainage improvements for the Build Alternative include the rehabilitation and extension of existing structures, the replacement of structures that are in poor condition and cannot be repaired and/or structures that are undersized to meet hydrologic conditions, and the addition of new structures needed to meet projected flows. **Exhibit 4-45** lists the proposed improvements for major cross drainage structures along NM 31 from the BOP to NM 128 and **Exhibit 4-46** lists major drainage structures along NM 31 from NM 128 to US 62. Culverts consisting of single or double culverts 30 inches or smaller are not included. A complete listing of drainage structures is included in the Enhanced Design Plans included the *electronic appendices*.

The existing drainage structure at MP 11.88 on NM 31 is classified as a major structure. Structure #7976 exists as a 3-barrel concrete box culvert. Field assessment of this structure found signs of significant scour and deterioration of the barrels and wing walls at the downstream end of the structure. The location of this structure presents challenges to maintenance of traffic if this structure is replaced. Follow-up discussion with NMDOT District personnel determined that this structure could be extended and repaired and gabions added to mitigate scour issues.

Exhibit 4-45. NM 31 Major Drainage Structures from MP 0.5 to MP 8.0

Structure Number	Milepost	Existing Culvert Size	Proposed Improvements
DS-4	0.46	1-4’ X 4’ CBC	Remove, build 1-10'x4' CBC
DS-N1	0.93	NONE	Construct linear pond
DS-5	1.96	2-30” CMP	Remove, build 4-36" culverts
DS-13	2.99	1-4’X4’ CBC	Remove, build 2-42” culverts
DS-14	3.00	1-30” CMP	Remove, build 3-45”S x 29”R elliptical pipes
DS-16	3.61	1-4’X4’ CBC	Extend
DS-28	5.75	10-56”S X 38”R CMPA	Remove, build 3-60"Sx38"R elliptical
DS-29	6.05	5-36”S X 24”R CMPA	Remove, build 2-34"Sx22"R elliptical
DS-30	6.24	1-36” CMP	Remove and replace 2-36" culvert
DS-34	6.77	1-48” CMP	Remove, build 3-30" culvert
DS-35	6.82	1-48” CMP	Remove, build 1-36" culvert
DS-36	6.97	1-42” CMP	Remove and replace 2-36" culvert
DS-37	7.03	1-54” CMP	Remove, build 1-36" culvert
DS-40	7.47	1-42” CMP	Remove, build 1-36" culvert
DS-41	7.57	1-36” CMP	Remove, build 2-42" culvert

Turnout Drainage Structures

Drainage structures are also included at all turnout locations. All these structures are 24” corrugated metal pipes.

Major Structures

Pecos River Bridges – Existing and Proposed

The Build Alternative will include construction of a new 2-lane bridge. The existing bridge will be rehabilitated and a new bridge will be constructed parallel to and south of the existing 2-lane bridge with a 10-foot offset. The new bridge is proposed as a 5-span structure with 12-foot travel lanes, 6-foot inside shoulders, and 10-foot outside shoulders. The bridge typical section and plan view are illustrated in **Exhibit 4-47** and **Exhibit 4-48** respectively.

Exhibit 4-46. NM 31 Major Drainage Structures from MP 8.0 to MP 22.5

Structure Number	Milepost	Existing Culvert Size	Proposed Improvements
DS-50	8.36	1-84" CMP	Replace with 1-54” culvert
DS-51	8.81	1-60" CMP	Replace w/ 2 - 42" culvert
DS-52	8.91	1-18" HDPE Pipes	Replace w/ 3 - 24" culvert
DS-53	9.06	10'S x 6'R CBP	Extend
DS-54C	9.50		Replace with 5-6’W x 3’H CBC
DS-57	9.99	1-24" CMP	Replace with 6- 34"R x 53"S Elliptical RCP
DS-60	11.32	1-36" CMP	Replace w/ 2-36" CMP
DS-62 – Bridge No. 7976	11.82	3-10'S x 6'R CBC	Extend and repair and add scour protection
DS-66	12.38	1-18" HDPE Pipes	Replace with 4- 68"S x 43"R Elliptical RCP
DS-68	12.83	1-24" HDPE Pipes	Replace w/ 3 - 30" CMP
DS-70	13.13	1-30" HDPE Pipes	Replace w/ 3-36" CMP
DS-76	15.15	7'S x 3'R CBC	Replace w/ 4-30" CMP
DS-77A-C	15.20	1-24" RCP	Replace with 3- 45"S x 29"R Elliptical RCP
DS-78	15.34	2-36" RCP	Replace w/ 1-36" CMP
DS-79	15.65	1-24" RCP	Replace w/ 4-24" CMP
DS-80	15.91	1-36" RCP	Replace with 1-36" CMP
DS-81	16.04	2-36" RCP	Replace w/ 4 - 42" CMP
DS-82	16.39	6'S x 3'H CBC	Replace w/ 2 - 6'S x 3'R CBC
DS-83	16.46	1-24" RCP	Remove
DS-84	16.82	5'S x 2'R CBC	Replace w/ 6 - 76"S x 48"R Elliptical RCP
DS-85	17.16	1-36" RCP	Replace w/ 3 - 24" CMP
DS-86	17.59	1-24" RCP	Replace w/ 3 - 38"S x 24"R Elliptical RCP
DS-88	18.12	1-24" RCP	Replace w/ 6 - 42" CMP
DS-89	18.76	1-24" RCP	Replace w/ 2 - 36" CMP
DS-94	19.93	1-36" RCP	Replace w/ 4-30" CMP
DS-95	19.96	1-36" RCP	Replace w/ 2- 36" CMP
DS-96	20.08	1-36" RCP	Replace w/ 3 - 36" CMP
DS-98	20.51	1-30" RCP	Replace w/ 2-10' x 4' CBC
DS-99	20.87	1-24" RCP	Replace w/ 3-24" CMP
DS-100	21.16	1-24" RCP	Replace w/ 3 - 45"S x 29"R Elliptical RCP
DS-101	21.51	1-24" RCP	Replace w/ 5 - 45"S x 29"R Elliptical RCP
DS-103	21.87	1-36" RCP	Replace w/ 2 - 36" CMP
DS-104	22.04	1-36" RCP	Replace w/ 5 - 68"S x 43"R Elliptical RCP
DS-105	22.26	1-30" RCP	Replace w/ 3 - 30" CMP

Exhibit 4-47. NM 31 Proposed Bridge Layout for New Pecos River Bridge

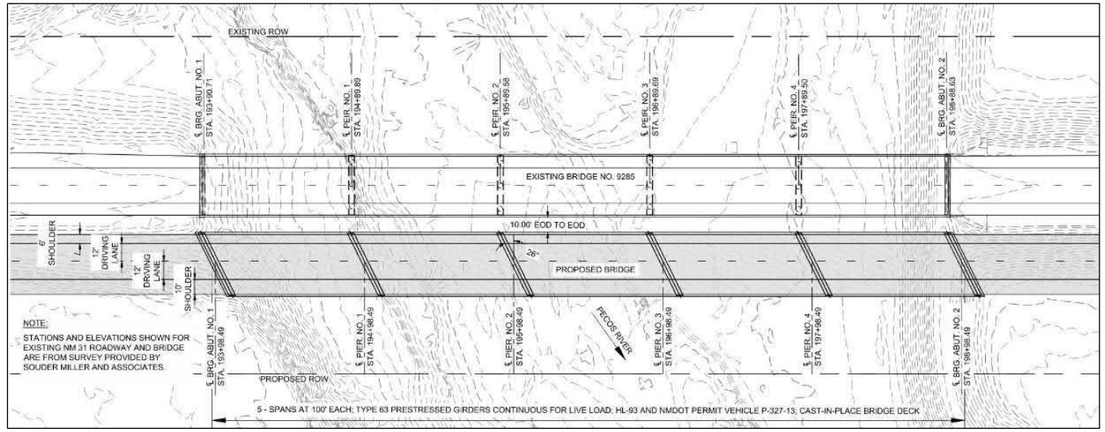
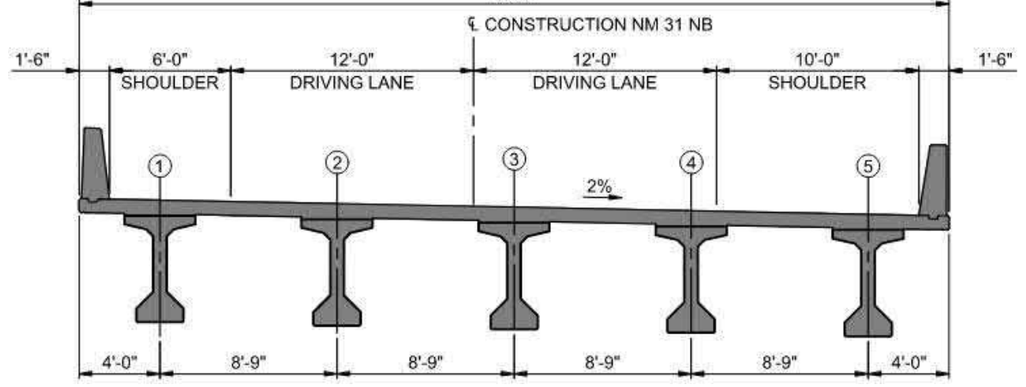


Exhibit 4-48. NM 31 Proposed Pecos River Bridge Typical Section



Truck Pullouts

Because of the high volume of large commercial trucks traveling within the corridor, a truck pullout (one in each direction) will be provided along NM 31 between NM 128 and US 62. The purpose of the pullouts are to provide a location for drivers to pull off the highway for vehicle checks, emergency purposes, short breaks, communication needs, and other activities. Providing this facility will improve overall safety by providing a safe place for vehicle checks and emergency needs, and an opportunity for rest breaks to reduce driver fatigue. Pullouts could be accommodated at two locations along NM 31 including a northbound location at approximate MP 11.5 and a southbound location at approximate MP 9.1. Pullouts would be approximately 500 feet in length, would include asphalt or gravel surfacing and trash receptacles, and would be designed to provide safe separation from the highway.

4.3.3 NM 128 Alternatives

The limits of NM 128 for this project begin at MP 0.5 (NM 31) and end at MP 59.9 (Texas state line). Within this reach, there are four unique segments each of which has one primary alternative which includes the mainline highway, the drainage improvements, the access management changes, and the major structures. The first and second segments consider alternatives for the major intersections where a conventional unsignalized intersection will not provide acceptable performance. Intersection alternatives are considered at WIPP Road, Buck Jackson Road and Orla Road. The improvements for the other two segments are represented by one alternative that is evaluated in this chapter.

The major design elements of NM 128 are described below and are illustrated in the NM 128 Enhanced Concept Design Plans included in the *electronic appendices*.

Typical Sections

The typical sections proposed for NM 128 are summarized in **Exhibit 4-49** and illustrated in **Exhibit 4-50.A** through **Exhibit 4-50.E** (on the following pages). The exhibits are limited to the major segments of the NM 128 corridor — numerous transitions and variations of each typical section will occur. The transition areas are shown in the enhanced conceptual design plans.

Exhibit 4-49. NM 128 Typical Sections for Major Segments

Segment	Roadway Milepost	Travel Lanes	Median	Shoulders	Other Elements
NM 128 from BOP to MP 50.5	MP 0.5 to MP 6.4	4, 12-ft. lanes	38-ft. Depressed	10-ft	Auxiliary Lanes at major intersections
	MP 6.4 to MP 50.5	4, 12-ft. lanes	60-ft. Depressed	10-ft	Auxiliary Lanes at major intersections
NM 128 in the City of Jal	MP 50.5 to MP 53.5	2, 13-ft. lanes	14-ft. flush TWLTL	6-ft	Additional 12-ft. eastbound lane from 4th St. to NM 18, 5-ft. sidewalks on both sides
NM 128 from MP 53.5 to EOP at MP 59.9	MP 53.5 to MP 59.9	2, 12-ft. lanes	None	10-ft	1 Passing Lane in both directions

The typical section for the first segment would reconstruct NM 128 from its existing 2-lane section to a 4-Lane with 12-foot travel lanes, a 38-foot depressed median, and 6-foot inside and 10-foot outside shoulders. Outside shoulders are reduced to 6 feet in areas where right-turn lanes are present.

The typical section for the second and longest segment would reconstruct NM 128 from its existing 2-lane section to a 4-Lane with 12-foot travel lanes, a 60-foot depressed median, and 6-foot inside and 10-foot outside shoulders. Outside shoulders are reduced to 6 feet in areas where right-turn lanes are present.

The typical section within Jal improves upon the existing 3-lane section by providing 13-foot travel lanes, a 14-foot continuous TWLTL, 6-foot shoulders, and 5-foot sidewalks with 3-foot buffers on both sides of the highway. For the modified 3-Lane section, the typical section elements are the same width except for the two eastbound lanes which are both 12-feet wide.

For the fourth segment, an enhanced two-lane section with passing lanes and intersection improvements is used east of Jal and continues to the EOP at MP 59.9. This typical section would reconstruct NM 128 from its existing 2-lane section to a 2-lane highway with 12-foot travel lanes and 10-foot outside shoulders. Speed change lanes (right and left-turn lanes) are included at major intersections. Shoulders are reduced to 6 feet in areas where right-turn lanes are present. Passing lanes include one in the eastbound direction at MP 54.2 to MP 56.0, and one in the westbound direction at MP 58.2 to MP 59.9.

Intersection Alternatives

There are numerous intersections along NM 128 most of which will be controlled by stop signs. West of Jal, there are six intersections considered to be major, as listed in **Exhibit 4-51**. Within Jal, 3rd Street and NM 18 are the major intersections. East of Jal, the Schooley Road and Willis Road intersections are considered major. Nonetheless, left-turn and right-turn speed change lanes are proposed for most public roads and major industrial access points. Refer to the NM 128 ECD plans for locations of speed changes lanes.

Exhibit 4-51. Proposed Improvements for Major Intersections along NM 128

NM 128 Intersection	Intersection Improvements
	Base Alternative
BOP to Jal	
WIPP Road	High-T (Typ. **Exhibit 4-52.B**)
Red Road / Twin Wells Road	TWSC with left-turn and right-turn deceleration lanes
Buck Jackson Road	High-T (Typ. **Exhibit 4-52.B**)
Orla Road	High-T (Typ. **Exhibit 4-52.B**)
Delaware Basin Road	Stop-sign with left-turn and right-turn deceleration lanes
Battle Axe Road	Stop-sign with left-turn and right-turn deceleration lanes
Within Jal	
3rd Street	Signalized Intersection with left-turn lanes and a second eastbound lane
NM 18	Signalized Intersection with left-turn lanes and an eastbound right-turn lane
East of Jal	
Schooley Road	TWSC with left-turn and right-turn deceleration lanes
Willis Road	TWSC with left-turn and right-turn deceleration lanes

Typical layouts for conventional unsignalized, High-T and roundabout intersections are shown in **Exhibit 4-52.A**, **Exhibit 4-52.B** and **Exhibit 4-52.C** on **page 4-32**. Based on stakeholder input, the preferred intersection type for the intersections at WIPP Road, Buck Jackson Road and Orla Road is an unsignalized High-T intersection. Roundabout intersections are viable and are an option to the High-T configuration.

For the High-T, stop-sign control is utilized and a raised channelization island is provided to separate the minor road left-turn movement from the far-side through movement on the major road. Left turns from the major road approaches are accommodated the same as a conventional intersection. The minor road left-turn movement merges into the mainline traffic flow downstream of the intersection. The acceleration and deceleration lane lengths are based on a 70-mph design speed for passenger vehicles.

The conceptual roundabout layouts were designed considering the high-speed rural environment in which they will be located. Horizontal curvature in design-speed increments is provided on the NM 128 approaches to convey to motorists to reduce travel speeds approaching the roundabout. Within the roundabout, the fastest-paths were considered for a design speed of 30 to 40 mph. Additional paved width on the outside of the inscribed diameter is also provided for over-sized, heavy commercial vehicles.

Exhibit 4-50.A. NM 128 Typical Section MP 0.5 to MP 6.4

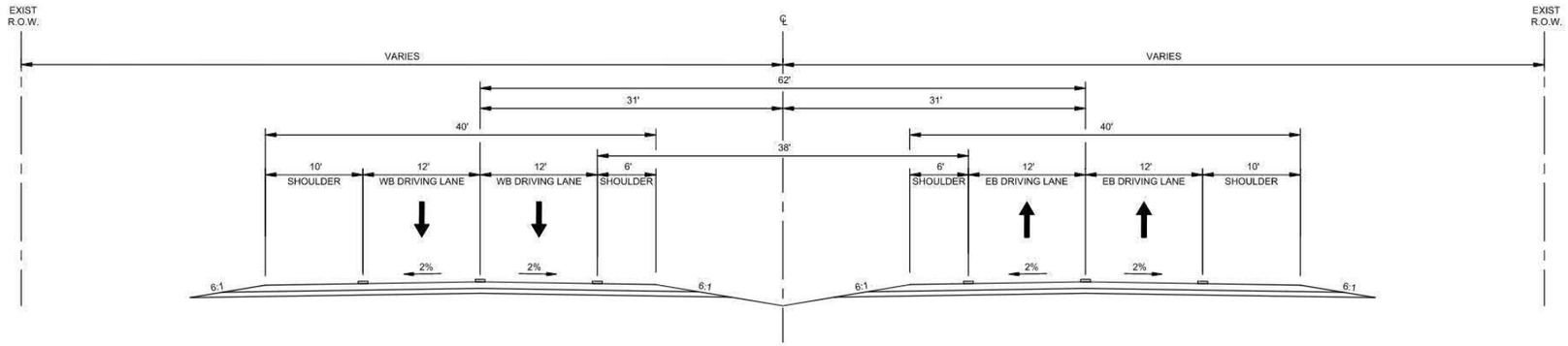


Exhibit 4-50.B. NM 128 Typical Section MP 6.4 to MP 50.5

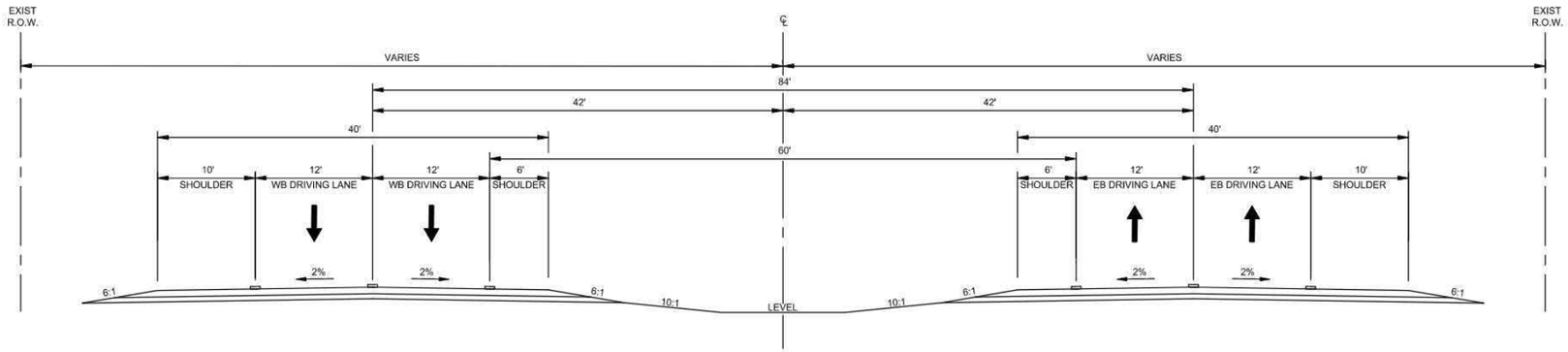


Exhibit 4-50.C. NM 128 Typical Section in the City of Jal – Basic 3-Lane

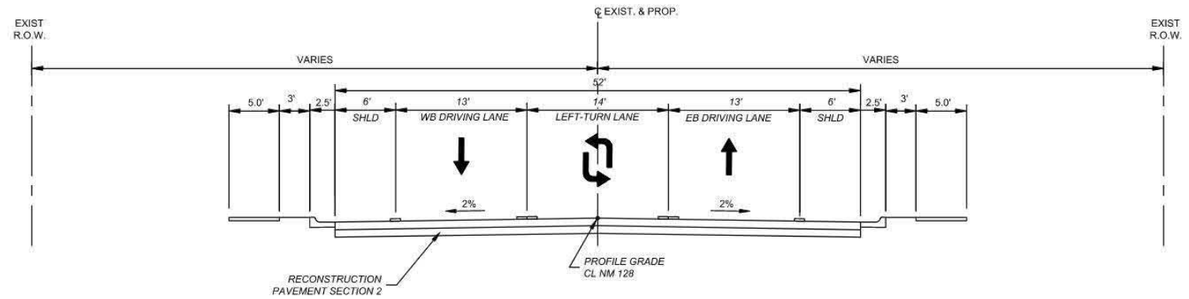


Exhibit 4-50.D. NM 128 Typical Section in the City of Jal – Modified 3-Lane

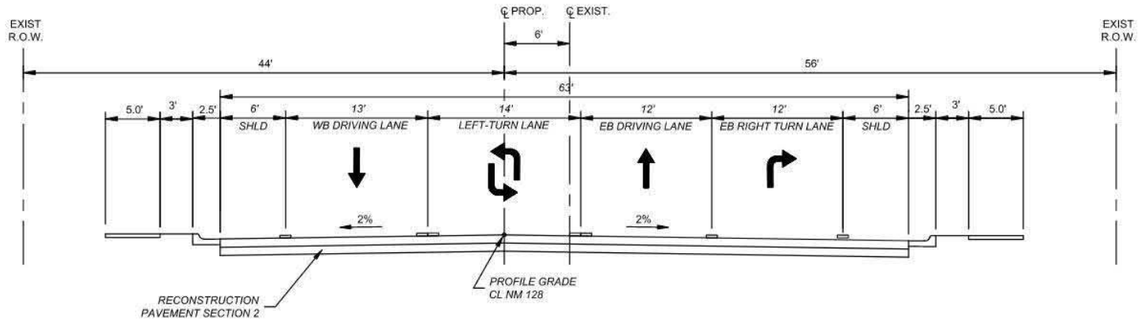
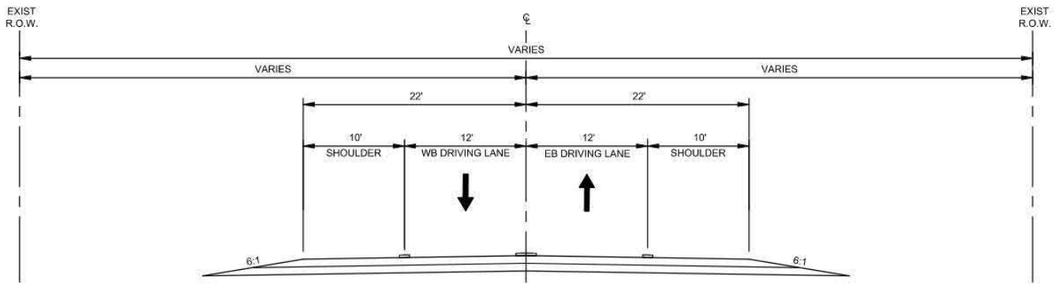
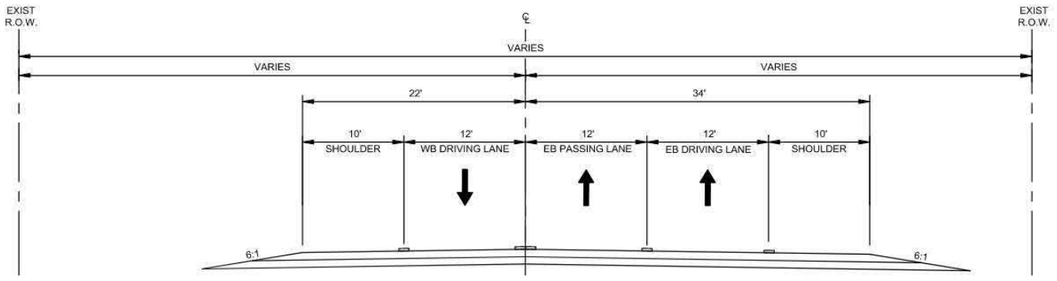


Exhibit 4-50.E. NM 128 Typical Sections MP 50.5 to MP 59.9



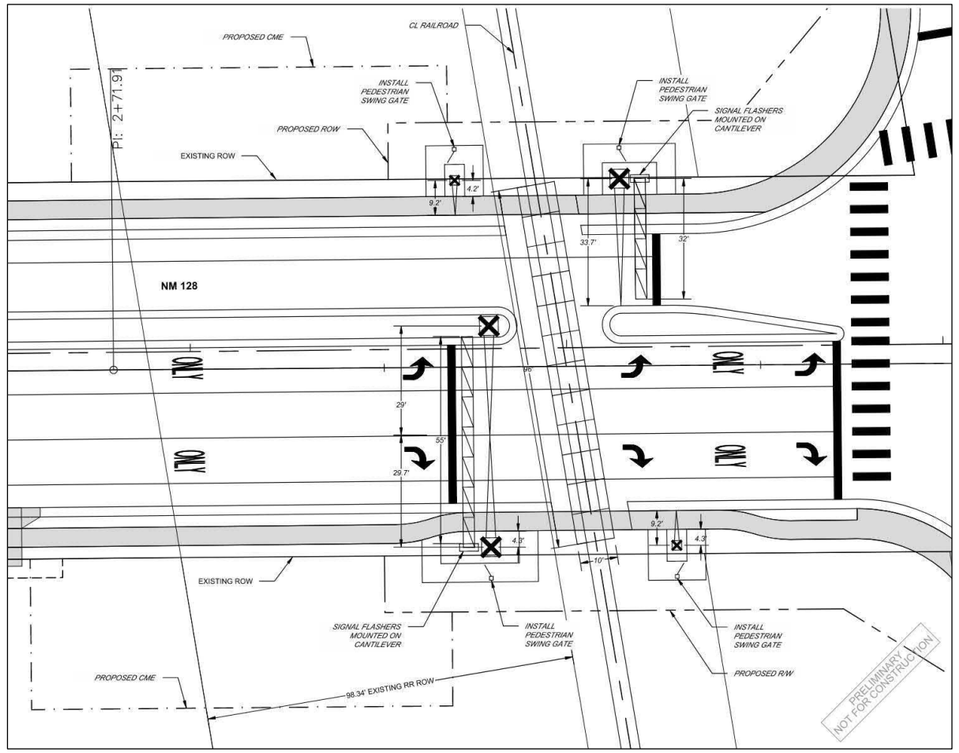


Railroad Crossings

The Build Alternative for NM 128 includes one railroad crossing operated by the TX-NM Railroad. This crossing is located immediately west of the NM 128/NM 18 intersection in Jal (see **Exhibit 4-53**). The design concept for this crossing was developed in collaboration with the TX-NM Railroad and following the requirements of AREMA and AASHTO. Key design features of this crossing include:

- The crossing will include advance signage, signals, flashers, and gates. The width of the roadway at this location will necessitate dual gates (i.e., one gate installed in the median and a second gate installed along the outside edge of the highway for each direction of travel).
- Warning flashers will be installed on signal masts using cantilever structures. Overhead structures will not be used because of the frequency of over-sized trucks using NM 31 and NM 128.

Exhibit 4-53. NM 128 Railroad Crossing Layout at NM 18



Access Management along NM 128

Access management changes are proposed as part of the improvements to NM 128. These changes include the addition of left-turn and right-turn speed change lanes at key intersections, median opening controls for the four-lane segments, providing U-turns as part of the median controls, turnout design for large vehicles (**Exhibit 4-45**), and realignment of minor roads to eliminate offset intersections with NM 128.

Exhibit 4-52.A. Typical Conventional Unsignalized Intersection Layout with Speed Change Lanes along NM 128

Exhibit 4-52.B. Typical Unsignalized High-T Layout for 3-Legged Intersections along NM 128

Exhibit 4-52.C. Typical Roundabout Layout for 3-Legged Intersections along NM 128

Exhibit 4-54 lists the priority access changes along NM 128. For the four-lane segments with managed median openings, U-turns will be provided at intervals no greater than four miles in either direction. Refer to the NM 128 ECD Plans for U-turn and loon design details. The proposed realignment of minor roads will involve work outside of NMDOT right-of-way which will require coordination with local agencies and/or property owners to implement the needed realignments. Speed change lanes are addressed in a separate section of this chapter.

NM 128 Proposed Drainage Conditions

A Draft Final Drainage Report was prepared for NM 128 which provides an assessment of existing drainage conditions in the corridor, identifies deficient drainage structures, and recommends improvements that are needed to comply with NMDOT drainage design requirements. The report is provided in the *electronic appendices*. Preliminary recommendations are summarized below to address cross drainage culverts, bridges and storm drain needs. Outlet protection, embankment protection, ditch design (outside of the Jal area), and erosion and sediment control will be designed by the Design/Build (DB) contractor and will be included in the final drainage report.

Cross Drainage Culverts

The analysis showed that majority of the existing culverts operate under inlet control conditions and are hydraulically adequate. Forty-five (45) of the existing 122 crossing culverts pipes (CP) within the project are hydraulically inadequate and do not meet the drainage design criteria for existing culverts. A complete listing of proposed crossing culvert improvements is provided in **Exhibit 4-55**. For the crossings where the existing drainage criteria was not met, alternative structure sizes were proposed.

- A design variance for the 25-year storm is recommended for DS-103 due to the downstream floodplain.
- Rather than overtopping NM 128, overflow from DS-23 routes west to DS-22. To analyze the flow for the two structures, a single crossing was used in HY-8 to model both culverts. It is recommended to model these crossings in SRH-2D before final design.
- DS-10-14 and DS-18-19 act more as equalizer pipes for two of the salt lakes that NM 128 crosses rather than crossing structures. These two salt lakes were measured using quad map contours and compared to the runoff volume generated by the 100-year storm to check if the lakes have sufficient storage capacity.

For existing pipes to remain and those that will be replaced, standard NMDOT end treatments are proposed. The end treatments would consist of concrete blankets when the end of culvert is located within the roadway clear zone. Safety bars would be added for the larger diameter structures. When the end of the culvert pipe is outside the clear zone, end sections would be installed.

Culvert Outlet Protection

Field inspection of the project revealed scour at the outlets of several of the existing culverts. Soil type and high runoff velocities may be the potential cause. After the selection of the preferred alternative and for final design, outlet protection should be designed where outlet channels have steep slopes or where erosion has occurred in the past. Outlet protection will primarily consist of placed riprap or wire-enclosed riprap, depending on site conditions and material availability.

Ditches and Turnout Structures

With the widening of the roadway, ditches will be regraded parallel to NM 128 to provide for roadway and pavement subgrade drainage, and in instances where the roadway is in a cut section, for offsite flows. The typical ditch in cut sections of the roadway has a 6:1 and 3:1 side slopes and a minimum depth of 1’ below the pavement subgrade. New ditches will be analyzed and designed as part of the enhanced concept design plan development.

With the widening of the roadway, it is anticipated that all turnout culverts will be replaced. Preliminary analysis reveals that the existing turnout culverts are hydraulically adequate. It is expected that replacement turnout structures will be the same size as the existing 24” and bigger culverts; this will need to be further investigated during final design. Eighteen-inch (18”) turnout structures are recommended to be replaced with 24” culverts if sufficient cover is available.

Two median ditch typical sections are proposed from MP 0 to Jal. The first typical section is a V-ditch with 6:1 side slopes from MP 0 to MP 11. The second typical section is a flat bottom ditch with 10:1 side slopes with an 8’ bottom width from MP 12 to Jal. While these ditches typically have capacity, median drop inlets should be placed at approximately half mile intervals at the nearest crossing culvert.

Jal Storm Drain

With the addition of curb and gutter from County Road 6A to Schooley Road in the Jal area, storm drain is required to limit roadway spread to the shoulder. The widening of NM 128 through the Jal area will cause increased runoff to the crossings that exist within AE flood zones, so additional drainage infrastructure is required to not increase downstream flooding. The following lengths and sizes of pipe are recommended to drain NM 128 within the Jal area:

- 11,300 feet of 24” storm drain
- 1,200 feet of 30” storm drain
- 1,000 feet of 36” storm drain
- 100 feet of 42” storm drain

Outfalls for the storm drain are the existing crossings. Orifice plates with a 15” diameter opening are recommended to maintain existing flow rates to the outfalls. Flap gates are recommended at the outlet of all lateral pipes to the trunk line for storm drain that outlet to the regulated floodways.

It should be noted that the storm drain may not function during the peak of the 100-year storm due to the FEMA Floodplain maps’ base flood elevations being higher than the top of curb elevation. After the peak of the 100-year storm, the storm drain should function as designed.

NM 128 Major Structures

There is currently one major structure along NM 128 with a bridge number. Bridge No. 9438 is a CBC allowing flow from Antelope Draw to pass under NM 128 at MP 39.70. It is a three cell 10’ (span) x 8’ (rise) CBC on a 45 degree skew. This CBC will remain and is proposed to be extended and cleaned.

There are other drainage crossings that could be considered major structures due to an existing or proposed width greater than twenty feet including:

- DS-5 at MP 1.05: proposed 5-42” Culvert Pipes or Arch Pipe equivalent
- DS-28 at MP 9.14: existing 5-48" CPP and proposed to add 1-48” Culvert Pipe or Arch Pipe equivalent
- DS-63 at MP 33.07: existing 6-36" CMP which will be extended
- DS-80 at MP 43.23: existing 4-48" CMP and proposed to add 1-48” Culvert Pipe or Arch Pipe equivalent
- DS-91 at MP 47.49: proposed 8-42” Culvert Pipe or Arch Pipe equivalent
- DS-97 at MP 49.97: proposed 5-48” Culvert Pipe or Arch Pipe equivalent
- DS-105 at MP 52.45: existing 8-64” S x 43” R CMPA
- DS-107 at MP 53.11: proposed 7-42” S x 29” R CPA
- DS-109 at MP 53.55: proposed 5-49” S x33” R CPA
- DS-117 at MP 56.85: proposed 7-49” S x 33” R CPA
- DS-119 at MP 58.43: existing 8-64” S x 43” R CMPA

Exhibit 4-54. NM 128 Priority Access Changes and Potential Road Realignment and Connecting Tie-In Improvements Required due to Proposed Access Revisions

Location	Intersection / Turnout	Location Based On Existing M.P.	Side	Land Ownership	Affected Facility	Responsible Party	Proposed Access Changes
1	TO-20	10.620	LT.	BLM	Mills Ranch Rd.	Eddy County	Close Current Access. Realign Mills Ranch Road Connection to WIPP Rd.
2.1	TO-27	12.844	RT.	BLM	Twin Wells Rd.	Eddy County	Close Current Access. Realign Twin Wells Road to MP 13.03 RT.
2.2	TO-28	12.962	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Realign Unnamed O&G Road to MP 13.03 LT.
3.1	TO-29	13.792	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Realign Oil Field Access to MP 13.939 LT.
3.2	TO-31	14.012	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Build Tie-In Connection to New Access at MP 13.939 LT.
4.1	TO-32	14.323	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road (Option A).
4.2	TO-32	14.323	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road (Option B).
5	TO-40	16.466	RT.	BLM	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road.
6.1	TO-50	17.758	LT.	SLO & BLM	Red Rd.	Eddy County	Close Current Access. Realign Red Road across from Twin Wells Road at MP 17.665 LT.
6.2	TO-50	17.758	LT.	SLO & BLM	Unnamed O&G Road	Private	Realign Unnamed O&G Road Connection to Red Road.
7	TO-63	22.458	LT.	BLM	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road.
8	TO-72	23.583	LT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road at MP 23.620 LT.
9	TO-74	23.832	RT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road.
10	TO-84	26.992	RT.	SLO	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road.
11	TO-168	45.967	RT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road.
12	TO-173	46.925	LT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Realign across from Unnamed O&G Road at MP 46.871 RT.
13	TO-179	48.630	LT.	PRIVATE	Unnamed O&G Turnout	Private	Close Current Access. Build New Tie-In to Adjacent O&G Pad With Access at MP 48.433 LT.
14	TO-190	51.013	LT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Realign Oil Field Access across from Cr 6-A at MP 50.979 RT.
15	TO-201	51.801	RT.	PRIVATE	Continental Dr.	City of Jal	Close Jal Clinic Access Point #1. Improve Jal Clinic Access On Continental Drive.
16	VARIOUS	VARIOUS	LT./RT.	PRIVATE	NM 18	NMDOT	Evaluate Restricting Current Access In Close Proximity to The NM 128 / NM 18 Intersection
17.1	TO-276	53.216	RT.	PRIVATE	Kizzar Ln.	Private	Close Kizzar Ln. Access at NM 128. Improve Connection across from Schooley Rd. at MP 53.309 RT.
17.2	TO-277	53.309	RT.	PRIVATE	Unnamed Road	Private	Close Kizzar Ln. Access at NM 128. Improve Connection across from Schooley Rd. at MP 53.309 RT.
18.1	TO-287	54.251	RT.	PRIVATE	Unnamed Road	Private	Close Current Access. Build New Tie-In to Jay Bird Lane.
18.2	TO-288	54.257	RT.	PRIVATE	Unnamed Road	Private	Close Current Access. Realign Jay Bird Ln. across from Jal Airport Rd. at MP 54.276 RT.
19	TO-300	57.103	LT.	PRIVATE	Unnamed O&G Road	Private	Close Current Access. Build New Tie-In to Unnamed O&G Road at MP 57.354 LT.

Where: BLM = Bureau of Land Management; SLO = State Land Office

Exhibit 4-55. Crossing Culvert Recommendations

Structure Number	Mile Post	STATION	Existing Structure	Skew[2]	Proposed Structure
DS-1	0.08	14+22	2-42" CPP	0	Extend and clean
DS-2	0.12	16+34	1-24" CPP	0	Extend and clean
DS-3	0.65	44+32	1-60" CPP	0	Extend and clean
DS-4	0.98	61+74	1-48" CPP	0	Extend and clean
DS-5	1.05	65+44	4-48" CPP	10	5-42” CP or Arch Pipe equivalent
DS-6	1.25	76+00	1-24" CPP	0	Extend and add 1-24” CP or Arch Pipe equivalent
DS-7	1.29	78+11	1-60" CPP	0	Extend and clean
DS-8	1.39	83+39	1-60" CPP	0	Extend and clean
DS-9	1.83	106+62	1-24" CPP	10	Extend and clean
DS-10-14	2.13	122+32	10-36" CPP	0	Extend and clean
DS-15	2.67	150+98	1-48" CPP	25	Extend and clean
DS-16	2.9	163+12	1-24"CPP	0	Extend and clean
DS-17	3.14	175+79	1-24"CPP	0	3-36” CP or Arch Pipe equivalent
DS-18-19	4.97	272+48	4-36" CPP	0	Extend and clean
DS-20	6.15	334+72	3-42" CPP	0	Extend and clean
DS-21	6.5	353+20	4-36" CPP	0	10-42” CP or Arch Pipe equivalent
DS-22-23[3]	6.72	364+82	1-8'S x 8'R CBC 4-48” CPP	0	Extend and clean
DS-24	7.31	395+97	1-36" CPP	45	1-30” CP or Arch Pipe equivalent
DS-25	7.85	424+48	1-36" CPP	0	5-48” CP or Arch Pipe equivalent
DS-26	8.73	470+94	1-30" CPP	0	Extend and clean
DS-27	9.02	486+26	1-48" CPP	0	Extend and clean
DS-28	9.14	492+59	5-48" CPP	0	Extend and add 1-48” CP or Arch Pipe equivalent
DS-29	9.62	517+94	2-36" CPP	30	Extend and clean
DS-30	9.81	527+97	2-36" CPP	0	Extend and add 2-36” CP or Arch Pipe equivalent
DS-31	10.61	570+21	3-30" CPP	0	4-42” CP or Arch Pipe equivalent
DS-32	10.88	584+46	2-36" CPP	40	5-42” CP or Arch Pipe equivalent
DS-33	11.36	609+81	1-24" CPP	0	Extend and add 1-24” CP or Arch Pipe equivalent
DS-34	11.77	631+46	1-24" CPP	30	Extend and add 1-24” CP or Arch Pipe equivalent

1. Headwater depths are existing conditions unless the structure is recommended to be upsized.
2. Proposed structures are recommended to remain at the same skew as existing.

Exhibit 4-55. Crossing Culvert Recommendations (Continued)

Structure Number	Mile Post	STATION	Existing Structure	Skew[2]	Proposed Structure
DS-35	12.06	646+77	6-24" CPP	0	5-36” CMP or Arch Pipe equivalent
DS-36	12.51	670+53	1-6'S x 6'R CBC	0	Extend and clean
DS-37	14.78	790+38	3-36" CMP	29	Extend and add 1-36” CP or Arch Pipe equivalent
DS-38	15.32	818+90	4-36" CMP	3	Extend and add 3-36” CP or Arch Pipe equivalent
DS-39	17.21	918+69	1-36" CMP	0	Extend and clean
DS-40	17.59	938+75	1-24” CMP	0	Extend and add 1-24” CP or Arch Pipe equivalent
DS-41	18.39	980+99	1-24” CMP	0	1-30” CP or Arch Pipe equivalent
DS-42	18.54	988+91	2-24" CMP	0	2-30” CP or Arch Pipe equivalent
DS-43	19.18	1022+70	2-36” CMP	26	Extend and clean
DS-44	20.15	1073+92	3-24” CMP	30	3-24” CPA
DS-45	21.27	1133+06	3-30" CMP	0	3-36” CP or Arch Pipe equivalent
DS-46	21.66	1153+65	2-36" CMP	3	Extend and clean
DS-47	22.01	1172+13	2-36" CMP	0	4-42” CP or Arch Pipe equivalent
DS-48-49	21.66	1153+89	5-36" CMP	0	Extend and clean
DS-50	23.24	1237+07	4-24" CMP	0	Extend and clean
DS-51	23.63	1257+66	2-36" CMP	0	Extend and clean
DS-52	23.84	1268+75	2-36" CMP	0	Extend and clean
DS-53-54	24.41	1298+90	14-36” CMP	0	Extend and clean
DS-55	26.81	1425+57	8-36” CMP	0	Extend and add 1-36” CP or Arch Pipe equivalent
DS-56	27.9	1483+12	2-42” CMP	0	Extend and add 1-42” CP or Arch Pipe equivalent
DS-57	28.96	1539+09	1-30” CMP	0	Extend and add 1-30” CP or Arch Pipe equivalent
DS-58	30.04	1596+11	5-36” CMP	0	Extend and clean
DS-59	30.24	1606+67	1-24” CMP	0	Extend and add 1-24” CP or Arch Pipe equivalent
DS-60	31.00	1646+80	2-42" CMP	0	Extend and clean
DS-61	31.04	1648+91	1-42" CMP	0	1-36” CP or Arch Pipe equivalent
DS-62	31.84	1691+15	5-24" CMP	0	5-36” CMP or Arch Pipe equivalent
DS-63	33.07	1756+10	6-36" CMP	0	Extend and clean

1. Headwater depths are existing conditions unless the structure is recommended to be upsized.
2. Proposed structures are recommended to remain at the same skew as existing.

Exhibit 4-55. Crossing Culvert Recommendations (Continued)

Structure Number	Mile Post	STATION	Existing Structure	Skew[2]	Proposed Structure
DS-64	33.38	1772+46	2-36" CMP	0	Extend and add 1-36” CP or Arch Pipe equivalent
DS-65	34.1	1810+48	5-36" CMP	0	Extend and clean
DS-66	36.48	1936+14	1-30" CMP	30	2-36” CMP or Arch Pipe equivalent
DS-67	36.76	1950+93	2-54" CMP	0	Extend and clean
DS-68	36.92	1959+38	1-36" CMP	30	2-30” CP or Arch Pipe equivalent
DS-69	38.28	2031+18	2-36" CMP	0	Extend and clean
DS-70	38.63	2049+66	3-24" CMP	0	Extend and clean
BR 9438 (DS-71)	39.74	2108+27	3-10'S x 8'R CBC	45	Extend and clean
DS-72	39.79	2110+91	2-42" CMP	40	Extend and clean
DS-73	40.19	2132+03	3-30" CMP	0	Extend and clean
DS-74	40.72	2160+02	2-36" CMP	0	Extend and clean
DS-75	41.21	2185+89	4-36" CMP	0	Extend and clean
DS-76	41.63	2208+06	3-30" CMP	0	Extend and clean
DS-77	41.82	2218+10	1-24" CMP	0	Extend and add 1-24” CP or Arch Pipe equivalent
DS-78	42.44	2250+83	3-54" CMP	20	Extend and add 1-54” CP or Arch Pipe equivalent
DS-79	42.8	2269+84	1-24" CMP	25	Extend and clean
DS-80	43.23	2292+54	4-48" CMP	0	Extend and add 1-48” CP or Arch Pipe equivalent
DS-81	43.32	2297+30	2-48" CMP	0	Extend and clean
DS-82	44.03	2334+78	3-30" CMP	0	3-24” CP or Arch Pipe equivalent
DS-83	44.23	2345+34	4-36" CMP	0	Extend and clean
DS-84	44.61	2365+41	3-24" CMP	20	Extend and clean
DS-85	44.91	2381+25	3-48" CMP	0	Extend and clean
DS-86	45.01	2386+53	1-24" CMP	0	Extend and clean
DS-87	45.31	2402+37	2-24" CMP	0	Extend and clean
DS-88	46.07	2442+50	4-48" CMP	18	Extend and clean
DS-89	46.24	2451+47	3-42" CMP	0	Extend and clean
DS-90	46.6	2470+48	2-48" CMP	0	Extend and clean
DS-91	47.49	2517+47	6-36" CMP	0	8-42” CP or Arch Pipe equivalent
DS-92	48.06	2547+57	2-12' Sx6' R CBCA	0	Extend and clean
DS-93	48.4	2565+52	4-24" CMP	0	Extend and clean

1. *Headwater depths are existing conditions unless the structure is recommended to be upsized.*
2. *Proposed structures are recommended to remain at the same skew as existing.*

Exhibit 4-55. Crossing Culvert Recommendations (Continued)

Structure Number	Mile Post	STATION	Existing Structure	Skew[2]	Proposed Structure
DS-94	48.46	2568+69	3-30" CMP	0	Extend and clean
DS-95	49.31	2613+57	3-36" CMP	0	7-48” CP or Arch Pipe equivalent
DS-96	49.39	2617+79	4-36" CMP	0	Extend and clean
DS-97	49.97	2648+42	2-42" CMP	16	5-48” CP or Arch Pipe equivalent
DS-98	50.39	2670+59	1-42" CMP	0	Extend and clean
DS-99	50.74	2689+07	2-49” S x 33” R CMP	16	Extend and clean
DS-100	51.02	2703+86	2-49” S x 33” R CMPA	15	Extend and clean
DS-101	51.28	2717+58	2-49” S x 33” R CMPA	44	Extend and clean
DS-102	51.96	2753+49	Scupper	0	Remove
DS-103	51.98	2754+54	3-42” S x 29” R CMPA	24	Extend and clean
DS-104	52.23	2767+74	2-77” S x 52” R CMP	45	Extend and clean
DS-105	52.45	2779+36	8-64” S x 43” R CMPA	0	Extend and clean
DS-106	52.68	2791+50	2-28” S x 20” R CMPA	0	Extend and clean
DS-107	53.11	2814+21	7-28” S x 20” R CMPA	0	7-42” S x 29” R CPA
DS-108	53.24	2821+07	2-28” S x 20” R CMPA	48	Extend and Clean
DS-109	53.55	2837+44	5-35” S x 24” R CMPA	0	5-49” S x 33” R CPA
DS-110	53.89	2855+39	3-28” S x 20” R CMPA	0	Extend and add 1-28” S x 20” R CPA
DS-111	54.03	2862+78	1-35” S x 24” R CMPA	0	3-49” S x33” R CPA
DS-112	54.63	2894+46	2-64” S x 43” R CMPA	0	Extend and add 3-64” S x 43” R CPA
DS-113	54.92	2909+78	2-24" CMP	0	3-24” CP or Arch Pipe equivalent
DS-114	55.08	2918+22	2-36" CMP	0	Extend and clean
DS-115	55.43	2936+70	3-42” S x 29” R CMPA	0	3-49” S x 33” R CPA
DS-116	56.19	2976+83	2-42” S x 29” R CMPA	0	Extend and clean
DS-117	56.85	3011+68	2-42” S x 29” R CMPA	0	7-49” S x 33” R CPA
DS-118	57.92	3068+18	1-24 CMP	0	Extend and add 2-24” CP or Arch Pipe equivalent
DS-119	58.43	3095+10	8-64” S x 43” R CMPA	3	Extend and clean
DS-120	58.82	3115+70	1-24" CMP	2	Extend and add 2-24” CP or Arch Pipe equivalent
DS-121	59.5	3151+60	1-24" CMP	0	Extend and add 3-24” CP or Arch Pipe equivalent
DS-122	59.5	3151+60	3-28” S x 20” R CMPA	0	4-42” S x 29” R CPA

1. *Headwater depths are existing conditions unless the structure is recommended to be upsized.*
2. *Proposed structures are recommended to remain at the same skew as existing.*

4.3.4 Evaluation Metrics and Findings

The proposed Build Alternatives for NM 31 and NM 128 were evaluated for their traffic operational and safety performance, right-of-way requirements, cost of construction, and constructability under traffic. In addition, the alternatives were assessed for their impacts on existing conditions within the project limits including utilities, geotechnical conditions, land use, communities, and environmental and cultural resources, and other pertinent factors. The findings of the evaluation are summarized in the following sections.

For this section of the report, the discussion is separated with the performance and impacts of NM 31 discussed in its entirety followed by a discussion of NM 128, with the exceptions of utilities and geotechnical considerations. Because these two aspects of the corridor are generally universal, they are discussed separately and have not been separated by corridor.

Utilities

Background

An extensive network of utilities exists along the project corridors. This is due primarily to the oil and gas activity in this portion of the Permian Basin. From the subsurface utility exploration (SUE) efforts for the project, one-hundred and nine (109) utility companies were identified that have utility facilities within the existing right-of-way throughout the limits of these corridors. Forty-five (45) were identified on NM 31 and sixty-four (64) on NM 128.

From previous projects in this area of New Mexico, utility coordination and challenges can have significant schedule and cost implications for NMDOT. A well-planned approach is needed to try and mitigate this risk.

Utility Investigation and Alternatives Analysis

The project team assessed the potential utility conflicts and impacts throughout both the NM 31 and NM 128 project corridors based on the two mainline four (4) lane alternatives, the flush and depressed median alternatives. The team did not find significant differences in utility impacts between the alternatives and, as such, the extent of utility impacts was not deemed to be a significant factor in the analysis of the alternatives.

The team did note that if a 4-lane depressed mainline alternative with a 60-foot wide median (from edge of driving lane to edge of driving lane) is selected, there may be opportunities to narrow the median in areas of significant utility conflicts to help mitigate schedule and cost impacts.

Design-Build Approach to Utility Coordination

The NMDOT proposes to advance the first phase of construction of the improvements in the NM 31 and NM 128 corridors using a Design-Build (DB) procurement method, due in part to the utility challenges. The DB method has proven to be beneficial in better positioning the owner in delivering projects with complex and challenging utility issues.

The coordination of utilities on a DB project differs from that of traditional design-bid-build projects in two major areas: contractors' roles and NMDOT's roles. Contractors have more roles and responsibilities with design-build projects than they do with traditional projects, and they have greater freedom and control to mitigate utility issues. The Design-Build Contractor must follow the provisions of the Master Utility Agreements (MUAs), individual agreements with utility owners (including utility-specific modifications to an MUA), and the project contract. They may also use innovative methods to coordinate work with utility owners. The Design-Builder Contractor's ability to coordinate utility concerns will influence the success of all parties involved. By mitigating risk and taking a proactive approach, NMDOT and the Design-Build Contractor can avoid unexpected utility issues, delays, and claims.

To better position NMDOT for success on this area, NMDOT developed a DB program level guidance document detailing their approach to utility coordination on October 5, 2020.

Fastlines/Lay Flat Lines

Fastlines or lay flat lines are temporary utility facilities placed by oil and gas midstream companies to move water back and forth from oil production sites to treatment sites. A significant number of them are placed in the NM 31 and NM 128 corridors. On previous NMDOT projects, their presence has led to significant contractor schedule and cost impacts.

While these temporary utility facilities are required to have a Temporary Utility Permit from NMDOT prior to their placement, at times they are placed without proper permitting. This increases the risk of a contractor encountering them in the field and making a claim for a changed condition.

To try and mitigate this risk, the project team issued a Utility Alert to the oil and gas industry on March 5, 2021 noting the following:

- The owner of any private facility (pipe) within NMDOT ROW is required to submit a permit request form to NMDOT.
- Once project construction starts, any private facility located within NMDOT ROW that is not permitted will be considered an encroachment by the NMDOT.
- NMDOT will authorize their Design-Build contractor to remove, adjust, relocate and/or shut-off (cap) any facility encroaching within NMDOT ROW.
- Upon NMDOT request, any permitted facility that is not timely relocated or moved out of the NMDOT ROW for project construction, if necessary, will also be subject to capping at the ROW line at the owner's expense.

During the SUE investigations for the initial DB project, every fastline encountered in the field was tagged with ownership information. The project team will send a specialized letter to each of the fastline owners prior to the start of construction. In addition, the DB proposing on the project will be required to visit the project site and inform NMDOT of any fastlines they encounter that are lacking ownership information.

Unclaimed Utilities

There is the potential in the project corridors that unclaimed, or utilities previously unidentified, could be encountered by the contractor. If the utility appears to be a remnant pipeline of previous oil and gas activity, it presents significant challenges to mitigate as there are only a handful of companies that are equipped to safely remove portions of these pipes since they may still be pressurized.

As a mitigation strategy, NMDOT will develop specialized contract specifications that address how these instances, if they occur, will be handled, including a roster of companies that have the experience and expertise to deal with any remnant oil and gas pipeline infrastructure.

Geotechnical Recommendations

A Preliminary Geotechnical Report and a Preliminary Foundation Report are planned to be prepared during subsequent project development efforts. These reports will describe the geologic and geotechnical site conditions of the project and alternate foundation systems for support of the bridges and retaining walls as well as discuss the hazards related to karst conditions encountered during field investigations.

Subsurface investigation and laboratory testing will include:

- Bridge foundation borings for the new Pecos River bridge and a proposed overpass bridge at the NM 31-128 intersection, as needed.
- Subgrade borings along the outer limits of the Salt Lake areas along NM 128 where gypsum is anticipated.
- Localized areas along NM 31 and NM 128 that are anticipated to have cuts in excess of 10 feet.
- Areas of concern from previous seismic line testing where anomalies were encountered to aid in determining the extent of potential karst or sinkhole conditions.

Additional seismic line testing will be performed in locations found to be areas of concern for karst or sinkhole conditions. An initial research effort will be undertaken to aid in determining the exact location of this testing. This effort will discuss the hazards and risks of karst and sinkhole features and will try to mitigate these challenges during construction to the extent possible.

4.3.5 NM 31 Evaluation Findings

The following summarizes the evaluation of the proposed build Alternative for NM 31 and the NM 31/NM 128 intersection.

Traffic Operations

As discussed above in **Section 4.2.2**, Design-Year Traffic Analysis, the four-lane highway alternatives for NM 31 from US 285 to NM 128 and the enhanced two-lane highway for NM 31 from NM 128 to US 62 will provide acceptable levels of traffic performance (LOS C or better) for design-year conditions. For most of the minor road intersections with NM 31, conventional stop-sign control will provide acceptable traffic performance.

For the intersection of NM 31 with Refinery Road, both the roundabout configuration ad High-T intersection will provide acceptable traffic performance and acceptable delay. The roundabout will also accommodate a wide-range of traffic flows at acceptable operational levels, which may be a key consideration once the Carlsbad SE Relief Route is completed. The High-T is an improvement over the conventional intersection but requires constructing a new connection between the south leg of Refinery Road and Fishermans Lane to the southwest. While the High-T would provide acceptable traffic performance, the roundabout is the recommended intersection configuration.

At the NM 31/NM 128 intersection, both the roundabout and the High-T intersection configurations will provide acceptable traffic performance. Both configurations are based on the realignment of NM 31 and NM 128. Identification of the preferred alternative will need to consider other evaluation metrics.

Safety/ HSM Evaluation

NM 31 Future Conditions IHSDM Analysis and Results

The IHSDM predictive model produces unique segment predictions for changes in geometry and/or traffic volume along the analysis corridor. The future conditions IHSDM analyses for NM 31 includes 2041 No Build and Build scenarios. The 2041 No Build conditions serve as a baseline condition in which the NM 31 corridor would remain as it is today with no improvements within the project limits. The IHSDM analysis for the 2041 No Build scenario was based on the existing roadway alignments and the estimated 2041 ADT volumes and incorporated the 0.84 calibration factor as well as the project-specific crash distributions for segments and intersections (see **Chapter 3**).

The 2041 Build scenario incorporates the estimated future-year ADTs as well as geometry improvements including a rural four-lane divided (4D) collector with a 26-foot depressed median south of NM 128, and a rural two-lane undivided (2U) collector with passing lanes north of NM 128. The HSM default calibration factor of 1.0 and the HSM default crash distributions were utilized for the four-lane, divided (4D) section in future scenarios. The two-lane roadway with passing lanes was modeled using the same assumptions as the existing and 2041 No Build scenarios. Note that the Build scenario does not include any special improvements at the NM 128 and Refinery Road intersections with NM 31. The 2041 IHSDM evaluation is intended to compare the existing two-lane highway to a proposed divided, four-lane highway. For comparative purposes, the NM 31 corridor was divided into two roadway sections with distinct roadway geometries as shown in **Exhibit 4-56**.

Exhibit 4-56. Section Characteristics by Scenario for NM 31

Scenario	Section	Area Type	Functional Classification	Type of Alignment
2041 No Build	South of NM 128 (STA 3+24.198 to 406+47)	Rural	Collector	2-Lane Undivided (2U)
	North of NM 128 (STA 406+47 to 1195+29.136)	Rural	Collector	2-Lane Undivided (2U)
2041 Build	South of NM 128 (STA 3+24.198 to 406+47)	Rural	Collector	4-Lane Divided (4D)
	North of NM 128 (STA 406+47 to 1195+29.136)	Rural	Collector	2-Lane Undivided w/ Passing Lanes (2U)

Estimated Cost of Crashes

An estimate of the cost of crashes for the 2041 conditions was made using the economic evaluation module of the IHSDM based on the 2041 KABCO unit costs by severity level shown in **Exhibit 4-57**. To determine the crash unit costs for the 2041 analysis year, the HSM 2016 KABCO unit costs were increased by 2% per year. The IHSDM software determines the crash costs by multiplying the number of crashes of a given severity level by the unit cost for that severity level.

Exhibit 4-57. KABCO Unit Crash Costs (2041)

Severity Level	2041 Unit Crash Cost
Fatality (K)	$ 18,531,300.95
Disabling Injury (A)	$ 1,074,596.93
Evident Injury (B)	$ 325,660.29
Possible Injury (C)	$ 206,060.11
PDO (O)	$ 19,523.21

Analysis Results

Exhibit 4-58 summarizes the predicted crashes and severity results for the 2041 No Build and Build scenarios for the NM 31 corridor, and the estimated cost of the crashes by scenario is summarized in **Exhibit 4-59**. When comparing the average number of crashes per year for the existing and 2041 No Build two-lane highway scenarios, IHSDM predicts 49 more crashes in 2041.

Key findings for the NM 31 segment south of NM 128 include:

- A substantial reduction in PDO crashes (-17) is expected for the 2041 Build condition with only a slight reduction in FI crashes (-1). The predicted crashes are 60 for the No Build scenario and 42 for the Build scenario.

Exhibit 4-58. Future Year Conditions (2041) IHSDM Results for NM 31

Crashes		2041 No Build			2041 Build		
		South of NM 128	North of NM 128		South of NM 128	North of NM 128	
		Rural 2-Lane Undivided (2U)	Rural 2-Lane Undivided (2U)	Combined Corridor	Rural 4-Lane Divided (4D)	Rural 2-Lane Undivided w/ Passing Lanes (2U)	Combined Corridor
Calibration Factor		0.84	0.84		1.0	0.84	
Crash Distribution		Project Specific	Project Specific		HSM Default	Project Specific	
Predicted	Total	60	17	77	42	15	57
	FI	23	6	29	22	5	27
	PDO	37	11	48	20	10	30
	FI	38.3%	35.3%	37.7%	52.4%	33.3%	47.4%
	PDO	61.7%	64.7%	62.3%	47.6%	66.7%	52.6%

Exhibit 4-59. IHSDM Estimated Cost of Crashes by Scenario for NM 31

Scenario	Section	Site Types	Cost
Existing No Build	Entire Corridor		**$ 6,828,408.83**
2041 No Build	South of NM 128	Rural 2-Lane Undivided (2U)	$ 25,552,849.21
	North of NM 128	Rural 2-Lane Undivided (2U)	$ 6,454,359.06
	Combined Corridor		**$ 32,007,208.27**
2041 Build	South of NM 128	Rural 4-Lane Divided (4D)	$ 14,824,217.15
	North of NM 128	Rural 2-Lane Undivided w/ Passing Lanes (2U)	$ 5,390,225.62
	Combined Corridor		**$ 20,214,442.77**

- Because of the substantial reduction in PDO crashes for the Build scenario, the FI severity level is predicted to increase from 38% to 52%.
- The cost of crashes for the 2041 Build scenario is approximately $10.7M less than the cost of crashes for the 2041 No Build scenario.

Key findings for the NM 31 segment north of NM 128 include:

- The number of predicted crashes is similar for the 2041 No Build and Build scenarios with a two-crash reduction for the Build scenario.
- Based on the cost of crashes, the Build scenario with passing lanes is predicted to result in lower crash costs than the No Build scenario by approximately $1.1M.

Overall, the IHSDM crash prediction models indicate that the 2041 Build scenario can be expected to improve safety along the NM 31 corridor. Overall, the cost of crashes for the 2041 No Build scenario is greater than that of the 2041 Build scenario by approximately $11.8M, a 36.8% improvement.

The total number of predicted crashes along the corridor in the future year reduces from 77 crashes in the 2041 No Build scenario to 57 crashes with the proposed improvements in the 2041 Build scenario. The total number of FI crashes decreases slightly from 29 crashes in the 2041 No Build conditions to 27 crashes in the 2041 Build scenario.

The total number of predicted PDO crashes along the corridor decreases from 48 crashes in the 2041 No Build scenario to 30 in the 2041 Build scenario. That is a 26% decrease in total crashes, 7% decrease in FI crashes, and 38% decrease in PDO crashes.

Other Considerations – Barrier Use for the 4-Lane Flush Median Sections

As noted earlier in this chapter, the proposed Build Alternative for the segment of NM 31 from the BOP to Donaldson Farm Road (MP 3.25) will consist of a 4-Lane section with a 14-foot flush paved median. As proposed, the median would not include any type of positive barrier to prevent vehicles from crossing the median into opposing traffic lanes. Access into the median area would be controlled by double-yellow striping at the outside edges of the median and rumble strips adjacent to the striping. Openings in the striping would be provided at all locations where left-turns are allowed.

The concept described above is proposed because of the relatively high number of access points in this segment of NM 31, the proposed posted speed of 55 mph, and the presence of roadside development that prevents the use of a wider roadway section without the need to acquire houses, buildings and other structures. This typical section has been implemented on corridors throughout New Mexico including other highways in NMDOT District 2 and has resulted in significant safety improvements, as compared to the previously existing 2-lane highways.

Constructing a positive barrier in the median was considered. This barrier could consist of a concrete wall barrier (CWB) or a high-tension cable barrier. In either case, the resulting inside shoulder width would be narrowed to 6-feet, including a 2-foot shy distance from the barrier. High-tension cable barriers reduce deflection but some deflection into the opposing lane could still occur. According to the AASHTO Roadside Design Guide, deflection with high-tension cable barriers ranges from 6.6 feet to 9.2 feet, depending on the barrier design.

The primary advantage of a positive barrier is its potential to reduce head-on crashes. As discussed in **Chapter 3**, the predominant crash types experienced on the first few miles of NM 31 were rear-end and right-angle crashes, both of which are associated with intersection congestion and turning movements. A total of 28 of these crash types occurred from the BOP to Donaldson Farm Road. In contrast, the occurrence of head-on crashes was much less with four head-on crashes recorded for this segment of NM 31. While the number of head-on crashes is low, the severity of this crash type is typically higher than other crash types.

Disadvantages of a positive barrier include impacts to access, reduced shoulder area for mechanical breakdowns, and loss of the full median width for crash avoidance. As noted above, the segment of NM 31 from the BOP to Donaldson Farm Road has relatively frequent access points with an average of about 8 intersections per mile. While some of the access turnouts would be eliminated and/or consolidated with the proposed Build Alternative, access frequency will remain relatively high. Crash attenuators would be needed at barrier ends. In addition, crashes would still likely occur as a result of motorists hitting the barrier ends.

The usable shoulder area available with a CWB would be about 5-feet. This width is acceptable for rural arterials but it would preclude shoulder use for mechanical breakdowns and crash avoidance. Increasing the available inside shoulder width could be accomplished by using a 16-foot flush median, but cost of the overall roadway would increase. Based on the comparison of the advantages and disadvantages of median barrier use, the proposed Build Alternative does not include barriers. However, barriers could be installed at a later date if the need is demonstrated.

NM 31 Right-of-Way Requirements

Construction of the Build Alternative for NM 31 would require acquisition of approximately 95.2 acres of publicly- and privately-owned property for conversion to highway right-of-way over the total 22.6 mile project length. This amount includes approximately 65.2 acres for the segment from the BOP through the NM 31/NM 128 intersection and approximately 30 acres for the segment north of the intersection to the EOP at US 62. An additional 0.8 acre would require construction maintenance easements (CME) and 3.7 acres would require temporary construction permits (TCP).

The lands acquired include a mixture of private property (approximately 16.7 acres) and about 78.5 acres of land owned and/or managed by the Bureau of Land Management or New Mexico State Land Office. **Exhibit 4-60** summarizes the right-of-way acquisition by project segment and landowner.

Exhibit 4-60. Summary of Property Acquisition for NM 31

Segment and Milepost (MP)	Bureau of Land Management			State Land Office			Private Owners			Project Total		
	ROW	CME	TCP	ROW	CME	TCP	ROW	CME	TCP	ROW	CME	TCP
S1: MP 0.5 to 8.0	37.1	0.2	0.9	12.4	0.1	0	15.7	0	0.5	65.2	0.3	1.4
S2: MP 8.0 to 22.6	28.3	0.5	1.2	0.7	0	0.4	1.0	0	0.7	30.0	0.5	2.3
Project Totals	65.4	0.7	2.1	13.1	0.1	0.4	16.7	0	1.2	95.2	0.8	3.7

ROW = right-of-way; CME = construction maintenance easement; TCP = temporary construction permit

Acquisition of the properties shown in the above exhibit mostly involves narrow slivers of land adjacent to the existing highway right-of-way fences and would not impact the existing land use. Exceptions include:

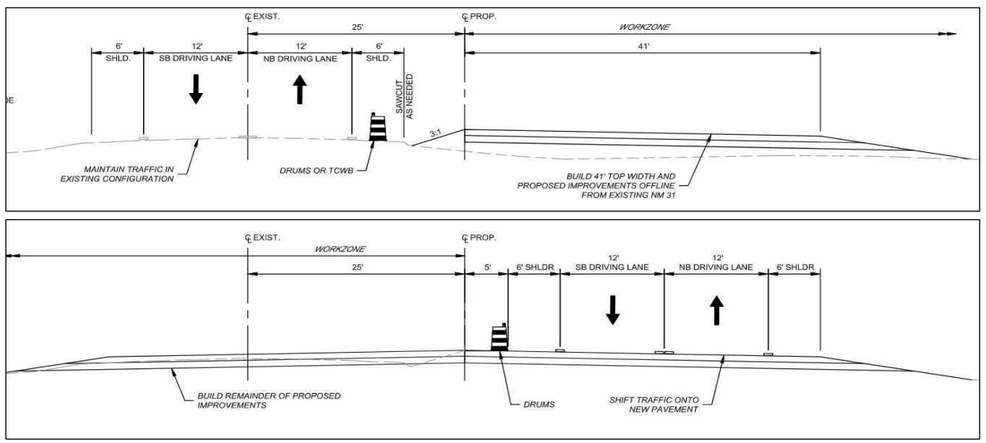
- The existing driveway serving the residential property along the north side on NM 31 at MP 2.4 would require reconstruction and slight realignment. This activity could result in the loss of one or more mature trees adjacent to the existing driveway.
- The loss of several small trees, grass lawn area, and an associated irrigation system at the residence located along the north side of the highway near MP 2.75. Approximately 25 feet of existing frontage would be acquired at this residence. The driveway of this residence would also be affected, Access to the residence would be via an existing local road parallel and immediately adjacent to the driveway. This change is proposed to eliminate back-to-back turn-outs onto NM 31.
- A small lateral irrigation canal that parallels the highway from MP 2.35 to MP 2.75 would be relocated to the inside edge of the new highway right-of-way. As discussed under the drainage section, this canal does not show signs of use within the last 10 years. The need to relocate and reconstruct this irrigation facility will be discussed with the affected landowner and the Carlsbad Irrigation District.

Maintenance of Traffic along NM 31

Maintenance of traffic (MOT) refers to the construction sequencing and temporary traffic control and detouring required to reconstruct a highway while minimizing disruption of existing traffic flow. MOT for NM 31 will require various approaches depending on the specific improvements to be constructed along the NM 31 corridor. The MOT concept for NM 31 generally involves maintaining traffic on existing pavement while constructing improvements offline as much as possible. Notable exceptions are the suggested closure and detour of NM 31 for installation of the new railroad crossings at MP 3 and MP 4, and locations that require a flagger or temporary signal for construction of high fill areas and/or large drainage structures. The MOT phases for NM 31 are described in more detail below:

- Segment 1 (BOP to MP 8.0, see **Exhibit 4-61**): The 4-lane flush and divided depressed median typical sections in this segment can be constructed in two major phases. In the first, two-way traffic is maintained on the existing pavement while half of the new roadway is constructed offline. Due to the offset between proposed and existing centerlines and the width of pavement that can be built in the first phase, both lanes of traffic can be shifted onto the new pavement in the second phase while the remainder of the pavement is constructed.

Exhibit 4-61. Typical Sections of Major MOT Phases for NM 31, BOP to MP 8.0



- Segment 2 (MP 8.0 to MP 22.6, see **Exhibit 4-62**): The Enhanced 2-lane typical section is anticipated to be completed in three phases. Traffic is maintained on the existing pavement while a portion of the new roadway is constructed offline in the first phase. Due to the narrower pavement width, only one lane of traffic can be shifted onto the new pavement; the second phase of construction would build the middle portion of the new pavement, with one lane of traffic on either side of the work zone. Finally, the traffic is shifted fully onto the new pavement and the remainder of the improvements is constructed in the third phase. Certain locations in Segment 2 are expected to require one-lane/two-way operation under a flagger or temporary signal. These locations are at high fill areas and some drainage structure crossings.
- Railroad crossings (see **Exhibit 4-63**): Construction of the new railroad crossings at MP 3 and MP 4 is anticipated to require short-term closures of NM 31 for installation of the new crossings and railroad signals. Though both lanes of traffic could be switched onto new pavement after the first phase as described above, the signal configuration would not permit this as there would be no gate for southbound traffic. The suggested construction sequence is as follows:
- Phase 1: Build half of new roadway (southbound lanes at MP 3 or northbound lanes at MP 4) and install new crossing panels and signals.
- Phase 2: Close NM 31 and detour traffic; Refinery Road may be a viable detour. Install new crossing panels and signals across old roadway and activate new signal system.
- Phase 3A: Provide one lane of traffic each on new and existing pavement under new signals. Reconstruct half of existing NM 31 pavement.
- Phase 3B: Move traffic onto new pavement built in Phase 3A and reconstruct remainder of existing pavement on NM 31.

Exhibit 4-62. Typical Sections of Major MOT Phases for NM 31, MP 8.0 to MP 22.6

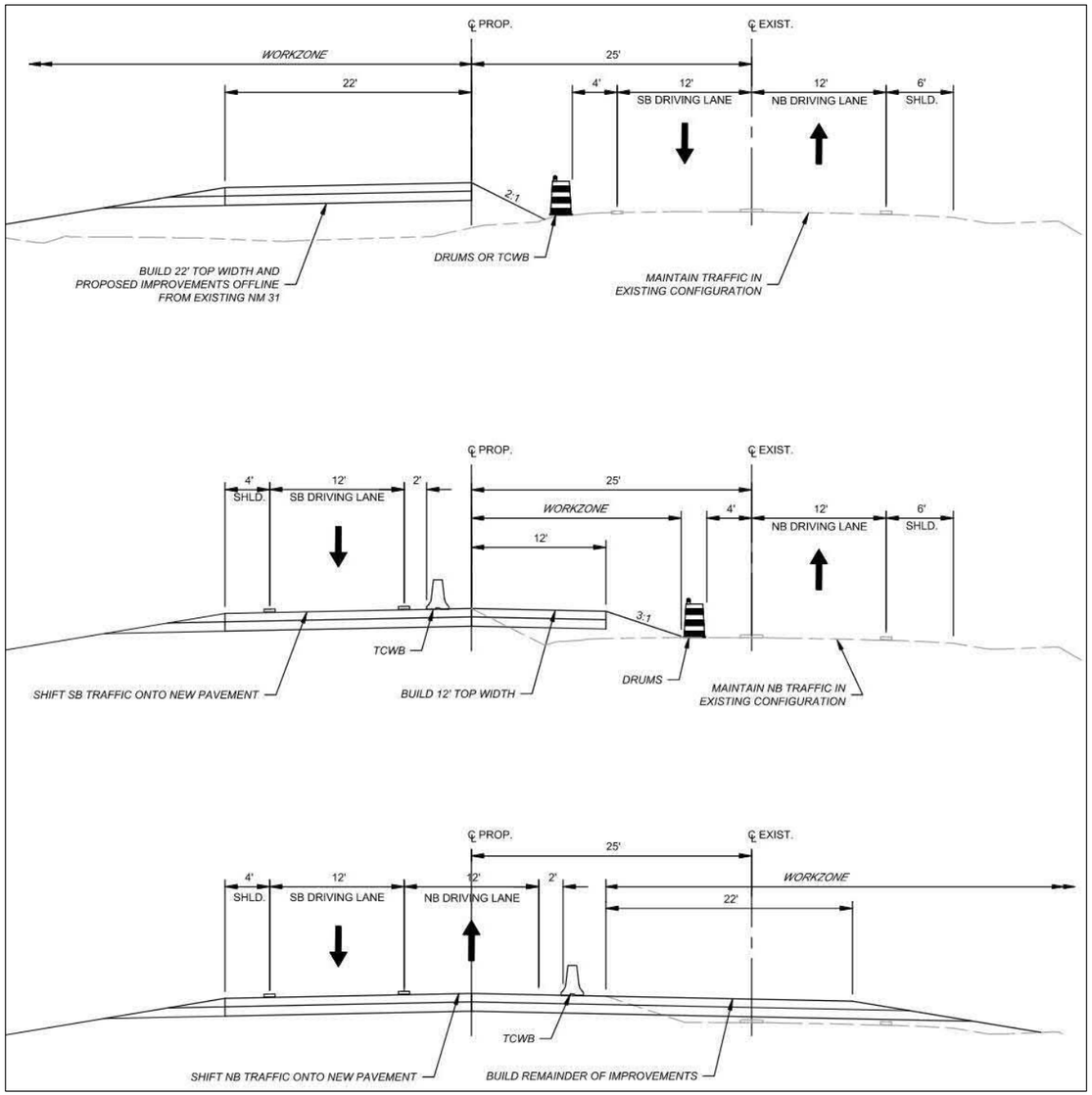
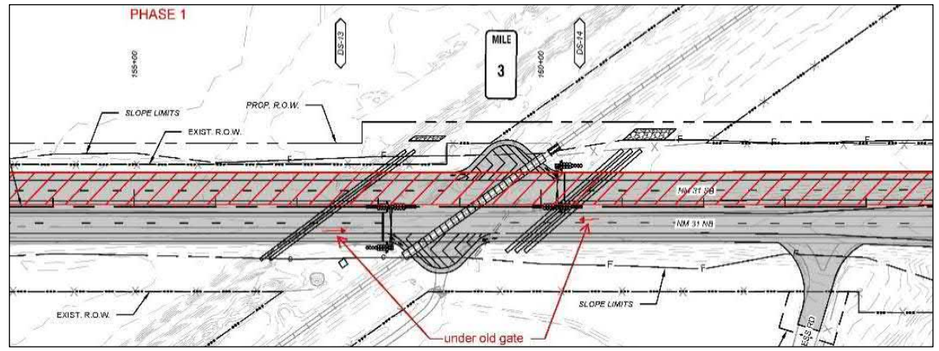
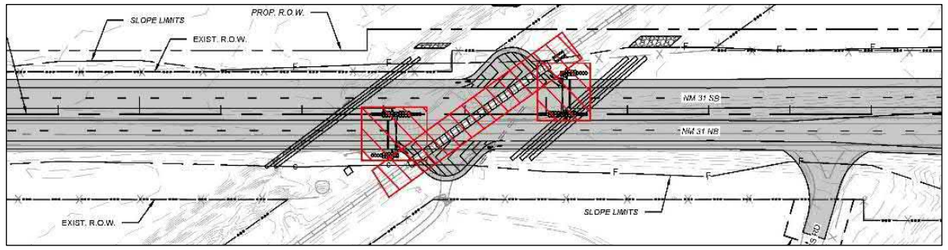


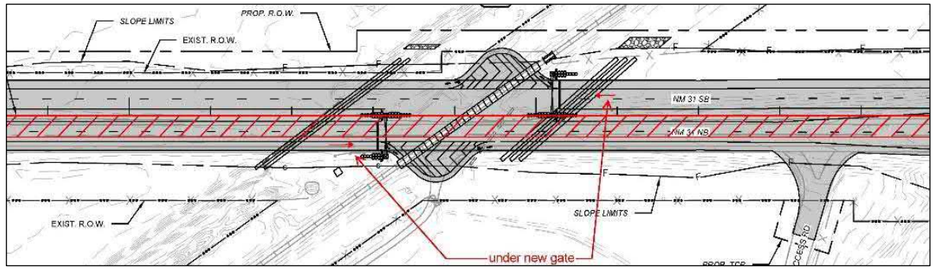
Exhibit 4-63. MOT Phases for RR Crossing Construction



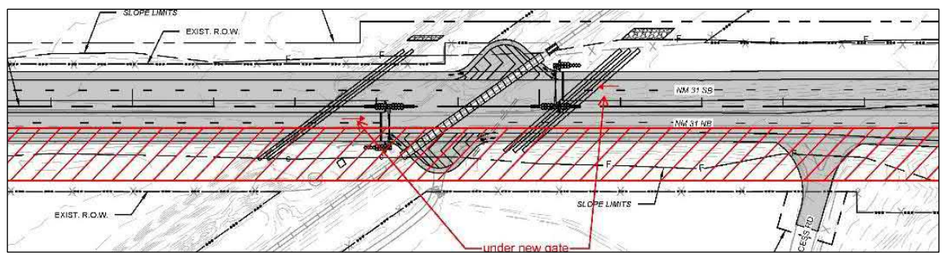
Phase 1



Phase 2



Phase 3



Phase 4

Estimated Construction Costs for NM 31 Improvements

The major cost items and total cost to construct the proposed Build Alternative for NM 31 are summarized in **Exhibit 4-64** below.

Exhibit 4-64. Estimated Construction Costs for NM 31

Description	Segment 1: MP 0.5 to MP 8.0	Segment 2: MP 8.0 to EOP at US 62
Roadway Elements (includes lighting and RR Crossings)	$ 64,450,484	$ 66,636,570
Drainage	$ 4,970,700	$ 8,732,500
Bridges	$ 10,360,420	0
Major Item Subtotal	$ 79,781,604	$ 75,369,070
Contingency and Cost escalation (6%)	$ 4,786,896	$ 4,522,144
Construction Subtotal	$ 84,568,500	$ 79,891,214
Engineering (8% of construction subtotal)	$ 6,765,480	$ 6,391,297
Construction Management (10%)	$ 8,456,850	$ 7,989,121
Construction Total	$ 99,790,830	$ 94,271,633
NMGRT (rate effective July 1, 2022)	$ 5,821,099	$ 5,499,147
Project Total	**$ 105,611,929**	**$ 99,770,780**

The major item subtotal shown in **Exhibit 4-64** includes 45% to account for various other cost items such as mobilization, MOT, survey, signing and striping, etc. The costs of right-of-way and utility relocations are not included. While right-of-way is not expected to be a major expense because of the relatively small amount of private property to be acquired, utility relocation costs could be substantial.

The cost shown above would be lower if either or both of the intersection options at Refinery Road and NM 31/128 were implemented in place of the roundabout intersections included as part of the base Build Alternative. For the NM 31/Refinery Road intersection, costs are approximately $2.7M less if a High-T configuration is used instead of the roundabout. Likewise, the cost at the NM 31/NM 128 intersection would be about $2.5M less for a High-T intersection compared to a roundabout (note that these costs do not include E & C and NMGRT). The difference is primarily due to the added costs of by-passes and the cost of concrete pavement used for a roundabout intersection versus asphalt pavement used for other intersection types.

While not part of the proposed Build Alternative, a grade-separated crossing of the BNSF railroad at NM 31/NM 128 was evaluated. Assuming a bridge span of approximately 110 feet, a grade separation at this railroad crossing would add approximately $6.5M to $7.0M to the construction total.

NM 31 Environmental and Cultural Impacts

This section summarizes the potential environmental impacts of the portion of NM 31 between the BOP and US 62 based on our understanding of the existing conditions and anticipated preliminary effects of the Build Alternative. Only those topics that are germane to the project are included below. A detailed analysis of the preferred alternative and associated effects as a result of the project will be performed during Phase IC.

No Build Alternative

Under the No Build Alternative there would be no improvements and existing conditions would remain the same. Although the No Build Alternative would not result in any impacts to the natural environment, choosing the '*do nothing*' alternative would have a negative impact to the human environment. This alternative also would not meet the project purpose and need. The remainder of this section focuses on the proposed improvement alternatives.

Communities and Land Use

As described in **Chapter 3** and earlier in this Chapter, the portion of NM 31 between the BOP and the Pecos River is developed with a mix of agricultural farmlands and associated residences, industrial properties used for oil field equipment storage, and several active oil wells that include pump jacks and other equipment associated with oil extraction. East of this segment, roadside development is limited to occasional oil wells, tank batteries, and larger industrial sites located away from the highway. Alternative 1 will acquire small amounts of property from some of these residential and industrial properties and convert this land into highway right-of-way. While some frontage will be lost, no residential or business relocations are expected and overall land use would not be impacted. Other community impacts identified with NM 31 Alternative 1 include:

- A small lateral irrigation ditch serving a property at MP 2.75 will require relocation. This ditch is currently within the highway right-of-way and can be relocated and constructed within the new highway right-of-way. However, review of previous aerial imagery indicates this ditch has not been in operation since 2008 and the Carlsbad Irrigation District does not have current records for this facility. The need for this ditch and impacts to the owner's water rights if it is not replaced will be researched with the property owner prior to project construction.
- Several residential driveways would require reconstruction to achieve an appropriate landing and grade at the top of the driveways. These modifications would be constructed using a temporary construction permit and would not result in the loss of additional property.
- Several billboards may require relocation including two north of the highway near MP 3.2 and one west of the highway near the NM 31/NM 128 intersection. The relocation of these billboards will be coordinated with the property / billboard owners.
- Bus service operated by the Loving School District operates on NM 31 with student pick-up along the highway in front of student homes. Because the locations with students change over time, specific bus stops cannot be planned as part of the project. However, with the additional travel lane, much wider shoulders, and 6:1 roadside slopes, student boarding and alighting is improved as compared to the existing condition. Coordination with the Loving School District will continue through project design and construction and will explore additional needs to ensure student safety.
- In general, access to communities such as Loving and Carlsbad, community services such as emergency responders, social services, and access to local residences and businesses will be maintained. As such, impacts to communities and land use are not anticipated for either of the NM 31 study segments or intersection options.

Noise

Based on ambient noise measurements obtained for this study (see **Chapter 3**), traffic noise at the residences near MP 0.8, MP 2.4, MP 2.75, and MP 3.1 are expected to approach or exceed FHWA noise abatement criteria under design-year traffic flows. Data collected near the residences at MP 0.8 and MP 2.75 found existing traffic noise levels of 67.9 dBA and 68.5 dBA, respectively, during the afternoon peak hour. Because overall traffic is projected to increase, design-year traffic noise is expected to exceed FHWA and NMDOT noise abatement criteria.

State and federal noise policy stipulates that when traffic noise impacts occur, noise abatement must be considered and implemented if found to be feasible and reasonable. Typically, noise abatement measures include construction of noise wall barriers. Based on site conditions along NM 31, it is expected that noise abatement in the form of noise walls would not meet NMDOT feasibility and reasonableness criteria.

Ambient noise levels would temporarily increase during construction. Provisions requiring the contractor to make every reasonable effort to minimize construction noise at noise-sensitive locations through measures such as work-hour controls (e.g., nighttime/daytime) and maintenance of muffler systems may be considered as the project development advances.

Natural Resources

The Pecos River, located in Segment 1, is the only perennial waterway in the study area. Wetlands are also located adjacent to the shores of the Pecos River. The proposed bridge is offset to the south in order to avoid impacts to the wetlands and the USACE will be consulted as needed for any fill that might be required within the ordinary high-water mark of the Pecos River. Based on the current regulatory interpretation, any ephemeral waterways along NM 31 would meet the current criteria of Waters of the U.S. (WOTUS) and fall under jurisdictional oversight by the USACE for Clean Water Act 404 permit authorization. Preliminary engineering will further inform the potential impacts (permanent and temporary) and permitting needs to potentially jurisdictional waters.

As mentioned in **Chapter 3**, there is no critical habitat for threatened and endangered species within the study area. However, the portions of the right-of-way beyond the current roadway shoulders do provide some general habitat for reptiles, small mammals, and birds. Based on the difference between the existing roadway prism and the build alternative, Segment 1 would impact approximately 53 acres of this habitat. This amount would be virtually the same regardless of the intersection options selected at Refinery Road and NM 128. The build alternative in Segment 2 would impact approximately 24 acres of wildlife habitat. The affected habitat is generally consistent with the habitat outside of the highway right-of-way and is part of a much larger ecoregion representative of the arid grasslands and shrublands typical of the Chihuahuan Basins and Playas and Chihuahuan Desert Grasslands ecoregions. While some individual animals and plants within the project construction footprint will be killed or displaced, impacts to the broader plant and animal community are not anticipated as a result of project implementation.

A Biological Evaluation will be prepared in Phase IC to support the identification of potential impacts to natural resources and associated permitting needs.

Cultural Resources

As described earlier in **Chapter 3**, cultural resources identified in the study area include 11 archaeological sites and 10 historic properties that are eligible for listing on the NRHP, and one historic property with an "undetermined" eligibility status. The build alternative would impact five of these archaeological sites (LA 129214, 171850, 171884, PMX-7, and PMX-8) in Segment 1 if the roundabout option is implemented at the NM 128 intersection. If the High T intersection is chosen at the NM 128 intersection, then four archaeological sites would be impacted (PMX-7 would not be impacted under this option). There would be no difference regardless of the intersection option chosen for Refinery Road. The build alternative in Segment 2 would impact four archaeological sites (LA 16218, 16219, 162620, and PMX-2). A testing and data recovery plan would need to be developed during Phase IC, in consultation with the SHPO, the State Land Office, and BLM to mitigate the impacts to these resources. The remaining eligible archaeological sites (LA 55021 and 162617) are located outside of the construction slope limits and likely can be avoided by the project.

Segment 1 will cross or intersect with eight historic properties eligible for listing on the NRHP. These include at-grade crossings of historic railroad track alignments (HCPI 32260 and 40243) and irrigation canals (HCPI 38939, 40244, 40428, 47996, 47997, and PMX-1). There is no difference in the number of historic properties affected regardless of the option selected for the NM 31 intersections at NM 128 and Refinery Road. Segment 2 will cross or intersect one NRHP-eligible historic property, an at-grade crossing of a historic railroad track alignment (HCPI 31513). In addition, two properties, a railroad crossing (HCPI 49686) and the historic alignment of the NM 31 highway (HCPI 38948), manifest in both segments 1 and 2. Typically, the areas or length of the historic properties impacted by roadway crossing and widening projects is not sufficient to warrant an adverse effect determination for these resources. Additionally, the portions of the properties that are impacted by the project are composed of modern replacement materials and do not contribute the properties' eligibility to the NRHP. As such, the project will likely have a "no adverse effect" to these historic properties, although a formal determination will be made by NMDOT and concurred with by SHPO during Phase IC of the project.

Section 4(f) Properties

The eligible historic properties are also considered under Section 4(f) of the Transportation Act. However, since a "no adverse effect" determination is anticipated, there would be no official "use" under Section 4(f). The archaeological sites mentioned above are not considered 4(f) properties as their significance is based solely on their ability to provide additional research opportunities rather than their potential for preservation and interpretation in place.

Environmental Clearance Level of Effort

During Phase IC a National Environmental Policy Act (NEPA)-compliant document and associated analysis will be prepared to meet the requirements of 23 CFR Part 771, FHWA Technical Advisory T6640.8A, the current NMDOT Location Study Procedures, and other applicable guidelines and regulations. The NEPA analysis will be supported by research and environmental resource investigations performed during Phase I-A/B and Phase IC to document pertinent environmental conditions within the project limits. Based on an initial review of potential impacts to the human and natural environment during Phase I-A/B and input from agencies to date, it is anticipated that the appropriate level of effort for environmental clearance and NEPA compliance would be a Categorical Exclusion (CE) document.

The NMDOT has applied federal funding to this project, which makes FHWA the lead federal agency for meeting all requirements of NEPA. Under the stewardship and oversight agreement between the FHWA and NMDOT, the NMDOT assumes the authority of the FHWA for project responsibilities. The BLM and SLO have land management responsibilities within and adjacent to the corridor. These agencies have roles as participating agencies and have not been invited to serve as cooperating agencies to carrying out the NEPA process. Acquiring right-of-way from both agencies will be needed as part of the Build Alternative.

4.3.6 NM 128 Evaluation Findings

The following summarizes the evaluation of the proposed improvements for NM 128.

Traffic Operations

As discussed above in **Section 4.2.2**, Design-Year Traffic Analysis, the four-lane highway alternatives for NM 128 from NM 31 to Jal and the enhanced two-lane highway for NM 128 east of Jal will provide acceptable levels of traffic performance (LOS C or better) for design-year conditions. For most of the minor road intersections with NM 128, conventional unsignalized intersections will provide acceptable traffic performance.

Within Jal, the 4-Lane Alternative, which is a three-lane section with a second eastbound lane from 4th Street to NM 18 where it drops as a right-turn lane, will provide acceptable traffic performance. Traffic signals at NM 18 and at 3rd Street will provide substantial improvement over the existing all-way stop control at these intersections.

Three intersections along NM 128 are proposed for alternative intersection configurations to provide acceptable traffic performance because unacceptable delays are expected for a conventional unsignalized intersection. These include WIPP Road, Buck Jackson Road and Orla Road. For each of these intersections, a High-T would provide acceptable operational performance with stop-sign control, and a roundabout would provide acceptable operations under a wide range of traffic volume conditions. Identification of the preferred alternative will need to consider other evaluation metrics.

Safety/HSM Evaluation

NM 128 Future Conditions IHSDM Analysis and Results

The IHSDM predictive model produces unique segment predictions for changes in geometry and/or traffic volume along the analysis corridor. The future conditions IHSDM analyses for NM 128 includes 2041 No Build and Build scenarios. The 2041 No Build conditions serve as a baseline condition in which the NM 128 corridor would remain as it is today with no improvements within the project limits. The IHSDM analysis for the 2041 No Build scenario was based on the existing roadway alignments and the estimated 2041 ADT volumes, and incorporated the 0.84 calibration factor as well as the project-specific crash distributions for segments and intersections used for the existing conditions evaluation (see **Chapter 3**).

The 2041 Build scenario incorporates the estimated future-year ADTs as well as geometry improvements including a rural four-lane divided (4D) collector with a 60-foot median from NM 31 to west of Jal, a two-lane highway (2U) with a TWLTL through Jal, and a rural two-lane undivided (2U) collector with passing lanes east of Jal to the state line. In Jal, two signalized intersections were included at NM 18 and at 3rd Street. The HSM default calibration factor of 1.0 and the HSM default crash distributions were utilized for the four-lane, divided (4D) section in future scenarios. The two-lane roadway with passing lanes was modeled using the same assumptions as the existing and 2041 No Build scenarios. The 2041 IHSDM evaluation is intended to compare the existing two-lane highway to a proposed divided, four-lane highway.

To allow comparisons between the No Build and Build scenarios, the NM 128 corridor was divided into three roadway sections with distinct roadway geometries shown in **Exhibit 4-65**.

Exhibit 4-65. Section Characteristics by Scenario for NM 128

Scenario	Section	Area Type	Functional Classification	Type of Alignment
2041 No Build	West of Jal (St. 10+00 to 2733+32.023)	Rural	Collector	2-Lane Undivided (2U)
	Jal City Limits (St. 2733+32.023 to 2842+60)	Rural	Collector	2-Lane Undivided w/ TWLTL (2U)
	East of Jal (St. 2842+60 to 3197+91.575)	Rural	Collector	2-Lane Undivided (2U)
2041 Build	West of Jal (St. 10+00 to 2733+32.023)	Rural	Collector	4-Lane Divided (4D)
	Jal City Limits (St. 2733+32.023 to 2842+60)	Rural	Collector	2-Lane Undivided w/ TWLTL (2U)
	East of Jal (St. 2842+60 to 3197+91.575)	Rural	Collector	2-Lane Undivided w/ Passing Lanes (2U)

Estimated Cost of Crashes

An estimate of the cost of crashes for the 2041 conditions was made using the economic evaluation module of the IHSDM based on the 2041 KABCO unit costs by severity level shown in **Exhibit 4-58**. The IHSDM software determines the crash costs by multiplying the number of crashes of a given severity level by the unit cost for that severity level.

Analysis Results

Exhibit 4-66 summarizes the predicted crashes and severity results for the 2041 No Build and Build scenarios for the NM 128 corridor, and the estimated cost of the crashes by scenario is summarized in **Exhibit 4-67**. Note that for the 2041 No Build scenario, IHSDM predicts 3.2 fatal crashes compared to the average 3.8 fatal crashes that occurred for existing conditions. For 2041 Build, IHSDM predicts 2.9 fatal crashes. In addition, comparing the number of crashes for the existing and 2041 No Build two-lane highway scenarios, IHSDM predicts 138 more crashes in 2041.

Exhibit 4-66. Future Year Conditions (2041) IHSDM Results for NM 128

Crashes		2041 No Build				2041 Build			
		West of Jal	Jal City Limits	East of Jal	Combined Corridor	West of Jal	Jal City Limits	East of Jal	Combined Corridor
		Rural 2-Lane Undivided (2U)	Rural 2-Lane Undivided w/ TWLTL (2U)	Rural 2-Lane Undivided (2U)		Rural 4-Lane Divided (4D)	Rural 2-Lane Undivided w/ TWLTL (2U) + Signalized Intersections at 3rd St and NM 18	Rural 2-Lane Undivided w/ Passing Lanes (2U)	
Calibration Factor		0.84	0.84	0.84		1.0	0.84	0.84	
Crash Distribution		Project Specific	Project Specific	Project Specific		HSM Default	Project Specific	Project Specific	
Predicted	Total	158	55	16	229	136	54	13	203
	FI	53	24	6	83	68	20	5	93
	PDO	105	31	10	146	68	34	8	110
	FI	33.5%	43.6%	37.5%	36.2%	50.0%	37.0%	38.5%	45.8%
	PDO	66.5%	56.4%	62.5%	63.8%	50.0%	63.0%	61.5%	54.2%

Exhibit 4-67. IHSDM Estimated Cost of Crashes by Scenario for NM 128

Scenario	Section	Site Types	Cost
Existing No Build	Entire Corridor		**$ 17,644,258.30**
2041 No Build	West of Jal	Rural 2-Lane Undivided (2U)	$ 59,855,342.14
	Jal City Limits	Rural 2-Lane Undivided w/ TWLTL (2U)	$ 25,798,973.70
	East of Jal	Rural 2-Lane Undivided (2U)	$ 6,610,855.14
	Combined Corridor		**$ 92,265,170.98**
2041 Build	West of Jal	Rural 4-Lane Divided (4D)	$ 68,011,894.79
	Jal City Limits	Rural 2-Lane Undivided w/ TWLTL (2U)	$ 19,133,936.64
	East of Jal	Rural 2-Lane Undivided w/ Passing Lanes (2U)	$ 4,228,486.25
	Combined Corridor		**$ 91,374,317.68**

Key findings for the 51.5-mile segment of NM 128 west of Jal include:

- A substantial decrease in PDO crashes (-37) is expected for the 2041 Build condition whereas FI crashes increase (+15).
- Because of the substantial reduction in PDO crashes for the Build scenario, the FI severity level is predicted to increase from 33.5% to 50%.
- The cost of crashes for the 2041 Build scenario is approximately $8.2M more than the cost of crashes for the 2041 No Build scenario. This is attributed to the increase in FI crashes.

Key findings for the NM 128 segment within the Jal city limits include:

- The number of predicted crashes is similar for the 2041 No Build and Build scenarios with a one-crash reduction for the Build scenario.
- With traffic signal control added at NM 18 and 3rd Street, the FI crashes decreased (-4) but PDO crashes increased (+3).
- Based on the cost of crashes, the Build scenario within Jal is predicted to result in lower crash costs than the No Build scenario by approximately $6.7M.

Key findings for the NM 128 segment east of Jal include:

- The number of predicted crashes is similar for the 2041 No Build and Build scenarios with a three-crash reduction for the Build scenario.
- Based on the cost of crashes, the Build scenario with passing lanes is predicted to result in lower crash costs than the No Build scenario by approximately $2.4M.

The IHSDM crash prediction models indicate that the 2041 Build scenario can be expected to improve safety along the NM 128 corridor by a modest amount. Overall, the cost of crashes for the 2041 No Build scenario is greater than that of the 2041 Build scenario by approximately $900,000, a 1.0% improvement.

The total number of predicted crashes decreases from 229 crashes in the 2041 No Build scenario to 203 crashes with the proposed improvements in the 2041 Build scenario. The total number of FI crashes increases from 83 crashes in the 2041 No Build conditions to 93 crashes in the 2041 Build scenario. The number of fatal crashes decreases by 0.3 for the Build scenario. The total number of predicted PDO crashes along the corridor decreases from 146 crashes in the 2041 No Build scenario to 110 in the 2041 Build scenario. That is an 11% decrease in total crashes, 12% increase in FI crashes, and 25% decrease in PDO crashes. While the overall number of crashes goes down, including fatal crashes, the increase in injury crashes goes up which offsets the benefits of the overall crash reduction.

NM 128 Right-of-Way Requirements

Exhibit 4-68 summarizes the acreage of land impacted by the proposed improvements along NM 128 including ROW acquisitions, TCPs and CMEs. The impacted land primarily involves undeveloped areas along NM 128. However, there are proximity and/or physical impacts at the following locations:

- NM 128 @ 3rd Street: northwest corner residential property, fencing/yard impacts
- NM 128 @ 3rd Street: southeast corner auto repair garage, driveway reduction
- NM 128 @ NM 18: northwest corner commercial property, accessibility impacts may render business inoperable

Exhibit 4-68. NM 128 Proposed Right-of-Way Summary by Segment in Acres

Project Segment	Approximate Milepost Range	Bureau of Land			State Land Office			Private Owners			Project Total		
		ROW	TCP	CME	ROW	TCP	CME	ROW	TCP	CME	ROW	TCP	CME
Segment 1	MP 0.5 TO 11.8	49.9	2.1	4.6	12.1	0.4	3.1	0	0.0	0.0	62	2.5	7.7
Segment 2	MP 11.8 TO 28.8	25.9	2.2	6.5	9.5	1.2	0	3.9	1.3	0.2	39.3	4.7	6.7
Segment 3	MP 28.8 TO 38.8	0	0.2	0	0	0.1	0	2.3	2.1	0.1	2.3	2.4	0.1
Segment 4	MP 38.8 TO 50.7	0.3	0.3	0.3	1.6	0.4	1.3	21.1	2.8	2.0	23	3.5	3.6
Segment 5	MP 50.7 TO 53.9	0	0	0	0	0	0	2.4	5.6	1.3	2.4	5.6	1.3
Segment 6	MP 53.9 TO 59.9	0	0	0	0	0	0	29.5	2.7	0.3	29.5	2.7	0.3
	Project Totals	76.1	4.8	11.4	23.2	2.1	4.4	59.2	14.5	3.9	158.5	21.4	19.7

Where: ROW = right-of-way; TCP = temporary construction permit; CME = construction maintenance easement

Maintenance of Traffic along NM 128

Maintenance of traffic during construction will utilize different approaches depending on the type of improvements recommended along the NM 128 corridor. For the purposes of this evaluation, the corridor has been separated into three main segments which are discussed below.

BOP to Jal

Within this 50-plus mile segment of the corridor, recommended improvements consist of a 4-Lane depressed median typical section. A significant benefit of this alternative is the relative ease of construction, which would involve building a new 2-lane facility parallel to the existing 2-lane roadway. A general sequence of construction consists of (see **Exhibit 4.69.A** through **Exhibit 4.69.D**):

- Phase I: Maintain traffic on existing lanes, while the new parallel facility is constructed.
- Phase II: Shift one or both lanes of traffic onto the new pavement (See Options 1 and 2), while completing improvements of the existing roadway.

Within Jal

The recommended alternative within this segment is a 3-Lane typical section, similar to existing, but wider. This is the most challenging portion of the corridor to construct due to narrow right-of-way, high density of intersections and driveways, and utilities. Maintenance of traffic plans must also consider pedestrian movements. The proposed centerline alignment is offset 6 feet north of existing to facilitate traffic control within the urban area. However, due to constraints, it is not possible to maintain the existing center turn lane during construction. Coordination with the City of Jal and extensive public outreach efforts prior to, and during construction, are critical to a successful project. A proposed sequence of construction follows (see **Exhibit 4.70.A** through **Exhibit 4.70.C**):

- Phase I: Shift traffic (one lane each direction) to the southernmost portion of existing pavement, while building a portion of new improvements to the north.
- Phase II: Shift the westbound lane onto new pavement built in Phase I. Eastbound traffic is maintained in same configuration as Phase I. Continuing to build new improvements in the center. This would be the most difficult and constrained phase of construction.
- Phase III: Shift the eastbound lane to the north, while completing all remaining improvements to the south.

Exhibit 4-69.A. NM 128 MOT Typical Section – Four Lane Construction

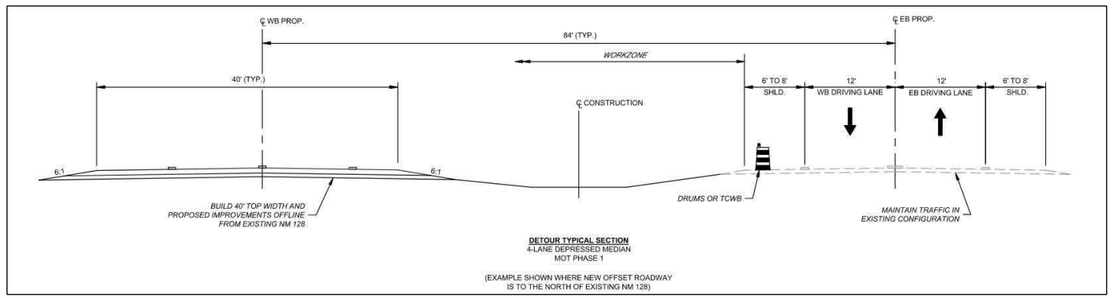


Exhibit 4-69.B. NM 128 MOT Typical Section – Four Lane Construction

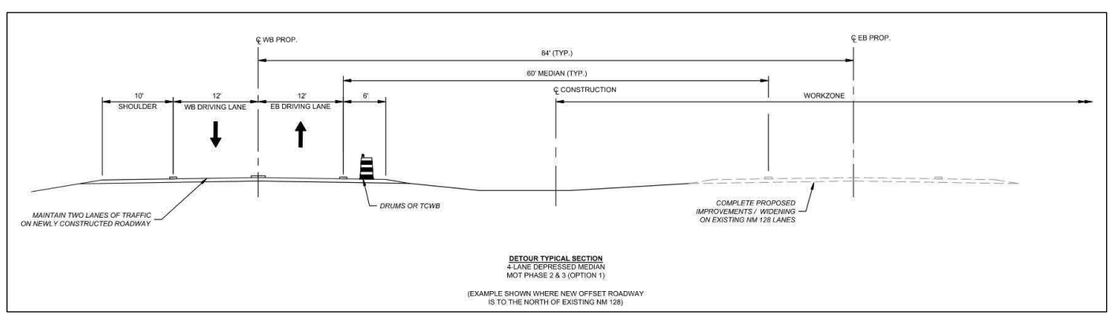


Exhibit 4-69.C. NM 128 MOT Typical Section – Four Lane Construction

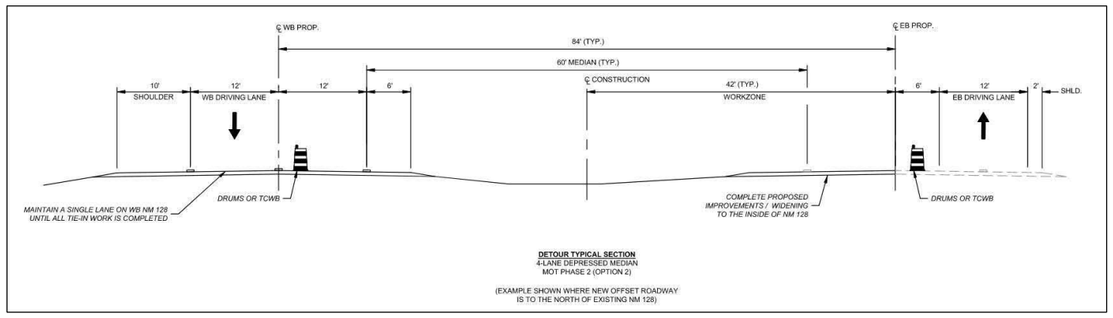


Exhibit 4-69.D. NM 128 MOT Typical Section – Four Lane Construction

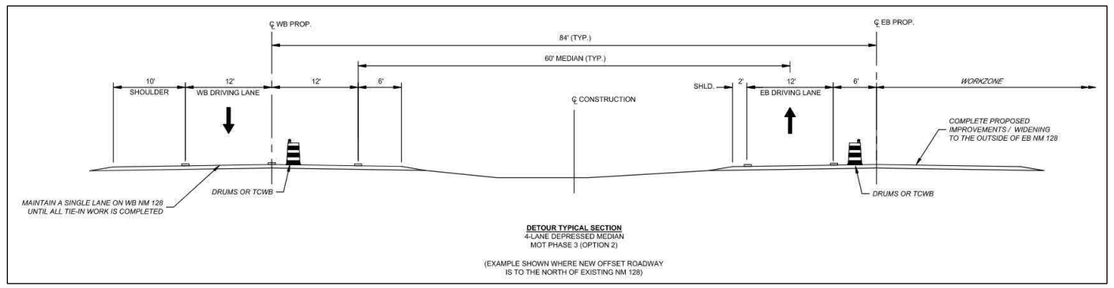


Exhibit 4-70.A. NM 128 MOT Typical Section – Jal Three Lane Construction

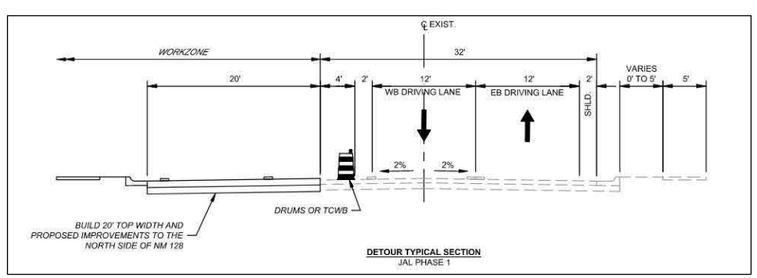


Exhibit 4-70.B. NM 128 MOT Typical Section – Jal Three Lane Construction

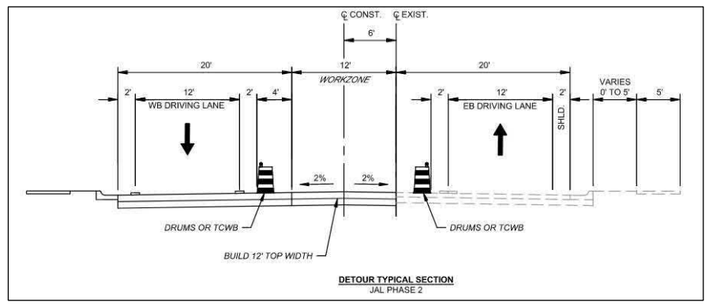
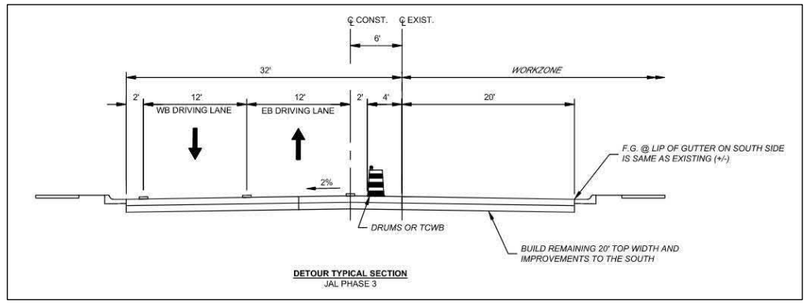


Exhibit 4-70.C. NM 128 MOT Typical Section – Jal Three Lane Construction



East of Jal

The recommended alternative from of Schooley Road at the east end of Jal to the EOP is an enhanced two-lane. The proposed typical section includes auxiliary lanes at major intersections and one passing lane in each direction of travel. Full Depth Reclamation (FDR) of the existing driving lanes is anticipated. As with recent FDR projects completed on the corridor, utilization of one-lane, two-way traffic with flagger operations can be expected during certain operations. A proposed sequence of construction consists of (see **Exhibit 4.71.A** through **Exhibit 4.71.D**):

- Phase I: Shift traffic (one lane each direction) to one side of the existing pavement section and shoulder. Build new widening and improvements to the opposite side. Utilize one-lane, two-way traffic operations with flaggers to complete the pavement width required to setup for Phase II.
- Phase II: Shift traffic (one lane each direction) onto new pavement build in Phase I. Continue building new widening and improvements. Utilize one-lane, two-way traffic operations with flaggers as needed to complete proposed improvements.

Exhibit 4-71.A. NM 128 MOT Typical Section – Enhanced Two-Lane Construction

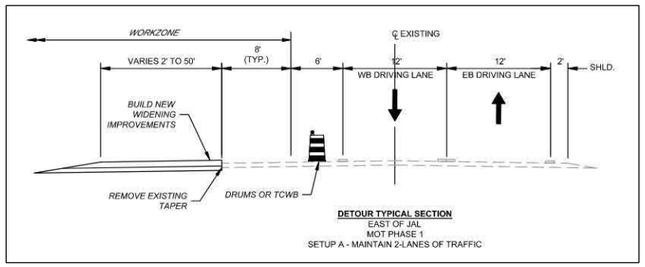


Exhibit 4-71.B. NM 128 MOT Typical Section – Enhanced Two-Lane Construction

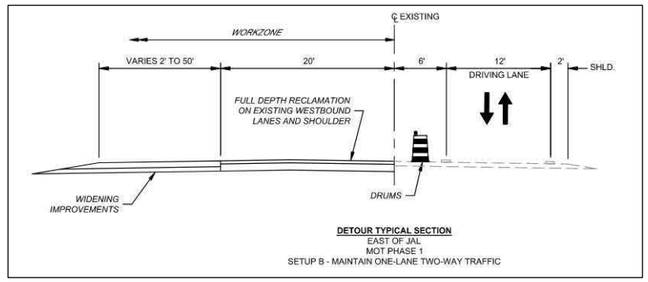


Exhibit 4-71.C. NM 128 MOT Typical Section – Enhanced Two-Lane Construction

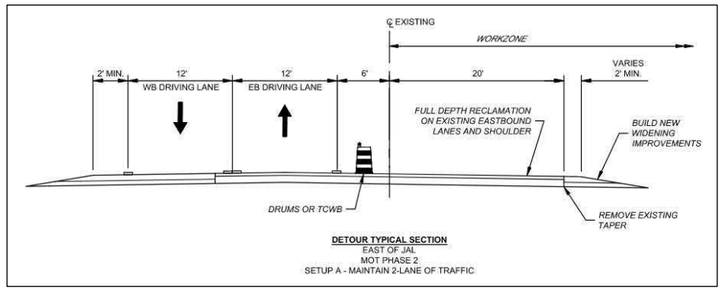
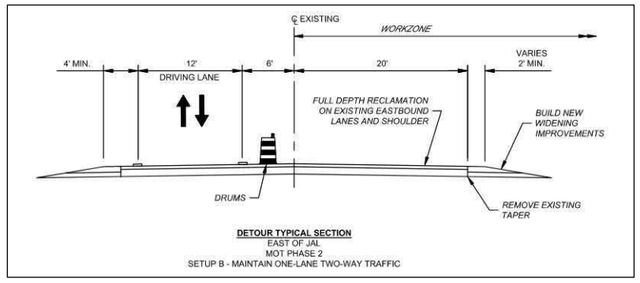


Exhibit 4-71.D. NM 128 MOT Typical Section – Enhanced Two-Lane Construction



Estimated Construction Costs for NM 128 Improvements

The major cost items and total cost to construct the proposed Build Alternative for NM 128 are summarized in **Exhibit 4-72**. The major item subtotal shown in **Exhibit 4-72** includes 45% to account for various other cost items such as mobilization, MOT, survey, signing and striping, etc. The costs of right-of-way and utility relocations are not included. While right-of-way is not expected to be a major expense because of the relatively small amount of private property to be acquired, utility relocation costs could be substantial.

Exhibit 4-72. Estimated Construction Costs for NM 128

Description	Segment 1: MP 0.5 to 11.8	Segment 2: MP 11.8 to 28.8	Segment 3: MP 28.8 to 38.8	Segment 4: MP 38.8 to 50.7	Segment 5: MP 50.7 to 53.9	Segment 6: MP 53.9 to 59.9
Roadway Elements (includes lighting and RR Crossings)	$61,645,417	$71,348,346	$55,033,493	$64,811,340	$20,075,941	$18,602,290
Drainage	$5,406,590	$4,506,215	$2,112,040	$5,743,535	$8,792,770	$838,320
Bridges	0	0	0	0	0	0
Major Items Subtotal	$67,052,007	$75,854,561	$57,145,533	$70,554,875	$28,868,711	$19,440,610
Contingency and Cost Escalation (6%)	$4,023,120	$4,551,274	$3,428,732	$4,233,292	$1,732,123	$1,166,437
Construction Subtotal	$71,075,127	$80,405,835	$60,574,265	$74,788,167	$30,600,834	$20,607,047
Engineering (8% of construction subtotal, 4% used in Segment 5)	$5,686,010	$6,432,467	$4,845,941	$5,983,053	$1,224,033	$1,648,564
Construction Management (10%)	$7,107,513	$8,040,583	$6,057,426	$7,478,817	$3,060,083	$2,060,705
Construction Total	$83,868,650	$94,878,885	$71,477,633	$88,250,037	$34,884,951	$24,316,316
NMGRT (rates effective July 1, 2022)	$4,892,310	$5,317,155	$3,841,923	$4,743,440	$2,213,014	$1,307,002
Project Totals	**$88,760,960**	**$100,196,040**	**$75,319,555**	**$92,993,477**	**$37,097,965**	**$25,623,318**

NM 128 Environmental and Cultural Impacts

This section summarizes the potential environmental impacts of the portion of NM 128 through the City of Jal based on our understanding of the existing conditions and anticipated preliminary effects of the Build Alternative. Only those topics that are germane to the project are included below. A detailed analysis of the preferred alternative and associated effects as a result of the project will be performed during Phase IC.

No Build Alternative

Under the No Build Alternative there would be no improvements and existing conditions would remain the same. Although the No Build Alternative would not result in any impacts to the natural environment, choosing the *'do nothing'* alternative would have a negative impact to the human environment. This alternative also would not meet the project purpose and need. The remainder of this section focuses on the proposed improvement alternatives.

Communities and Land Use

As described in **Chapter 3** and earlier in this Chapter, the portion of NM 128 through the City of Jal is developed with residential housing and businesses serving the extraction industries and local community. NM 128 provides a connection to the Texas border east of Jal. West of Jal roadside development is sparse with oil wells, tank batteries, and larger industrial sites such as the WIPP facility and Mosaic Potash Mine. The Build Alternative will acquire small amounts of property from some of these residential and industrial properties and convert this land into highway right-of-way. While some frontage will be lost, no residential or business relocations are expected, and overall land use would not be impacted.

Other community impacts identified with the NM 128 Build Alternative include:

- Bus service provided by the Jal School District operates along NM 128. Students may be picked-up along the highway near their homes. Because the locations with students change over time, specific bus stops cannot be planned as part of the project. Coordination with the Jal School District will continue through project design and construction and will explore additional needs to ensure student safety.
- In general, access to communities such as Jal, community services such as emergency responders, social services, and access to local residences and businesses will be maintained. As such, impacts to communities and land use are not anticipated.

Noise

As described in **Chapter 3**, the proposed roadway improvements through Jal are not considered a Type 1 project and NMDOT/FHWA has determined that a noise study is not warranted.

Natural Resources

The portion of the NM 128 corridor near the intersection with NM 31 is situated in the Nash Draw watershed, which is a closed basin with no connection to the Pecos River watershed. The system of natural saline playa lakes, springs, and seeps present in the area east of the NM 31 and NM 128 intersection would not fall under USACE jurisdiction. East of the WIPP Road, the NM 128 corridor traverses across an open drainage basin that drains towards Texas. Based on the current regulatory interpretation, any ephemeral waterways along NM 128 and outside of the Nash Draw watershed would meet the current criteria of WOTUS and fall under jurisdictional oversight by the USACE for Clean Water Act 404 permit authorization. Preliminary engineering will further inform the potential impacts (permanent and temporary) and permitting needs to potentially jurisdictional waters.

As mentioned in **Chapter 3**, there is no critical habitat for threatened and endangered species within the study area. During the field investigation, two Scheer's beehive cactus, a BLM CFO special status plant species, was found in the existing ROW. NMDOT will consult with BLM as part of the environmental documentation phase. Portions of the right-of-way beyond the current roadway shoulders do provide some general habitat for reptiles, small mammals, and birds. Based on the difference between the existing roadway prism and the build alternative, approximately 163 total acres of habitat would be impacted. The affected habitat is generally consistent with the habitat outside of the highway right-of-way and is part of a much larger ecoregion. While some individual animals and plants within the project construction footprint will be killed or displaced, impacts to the broader plant and animal community are not anticipated as a result of project implementation.

A Biological Evaluation will be prepared in Phase IC to support the identification of potential impacts to natural resources and associated permitting needs.

Cultural Resources

As described earlier in **Chapter 3**, cultural resources identified in the NM 128 study area include archaeological sites and historic properties. The Build Alternative would impact five archaeological sites eligible for listing on the NRHP (LA 129214, 171850, 171884, PMX-7, and PMX-8) in Segment 1 if the roundabout option is implemented at the NM 31-128 intersection. If the High-T intersection is chosen at the NM 31-128 intersection, then four archaeological sites would be impacted (PMX-7 would not be impacted under this option). No additional archaeological sites eligible for listing on the NRHP have been identified within the NM 128 study area. Historic properties are present within the City of Jal; however, none are eligible resources. A testing and data recovery plan will be developed during Phase IC and implemented, in consultation with the SHPO, the State Land Office, and BLM to mitigate the impacts to these resources prior to construction.

A Cultural Resources Investigation Report will be prepared to support NMDOT's NRHP Section 106 consultation in Phase IC.

Section 4(f) Properties

The archaeological sites mentioned above are not considered 4(f) properties as their significance is based solely on their ability to provide additional research opportunities rather than their potential for preservation and interpretation in place.

Environmental Clearance Level of Effort

During Phase IC a National Environmental Policy Act (NEPA)-compliant document and associated analysis will be prepared to meet the requirements of 23 CFR Part 771, FHWA Technical Advisory T6640.8A, the current NMDOT Location Study Procedures, and other applicable guidelines and regulations. The NEPA analysis will be supported by research and environmental resource investigations performed during Phase I-A/B and Phase IC to document pertinent environmental conditions within the project limits. Based on an initial review of potential impacts to the human and natural environment during Phase I-A/B and input from agencies to date, it is anticipated that the appropriate level of effort for environmental clearance and NEPA compliance would be a Categorical Exclusion (CE) document.

The NMDOT has applied federal funding to this project, which makes FHWA the lead federal agency for meeting all requirements of NEPA. Under the stewardship and oversight agreement between the FHWA and NMDOT, the NMDOT assumes the authority of the FHWA for project responsibilities. The BLM and SLO have land management responsibilities within and adjacent to the corridor. These agencies have roles as participating agencies and have not been invited to serve as cooperating agencies to carrying out the NEPA process. Acquiring right-of-way from both agencies will be needed as part of the Build Alternative.

5.0 Summary and Recommendations

This chapter provides an overview of the Phase I-A/B Study completed for the NM 31 and NM 128 Corridors. The overview includes: (1) a summary of the project purpose and need; (2) description of the preferred alternative recommended by the NMDOT Project Team based on the analysis and public and stakeholder input; (3) preliminary cost estimates; (4) preliminary right-of-way needs; (5) a potential phasing plan; and (7) the next steps to be taken by the NMDOT to begin project implementation.

5.1 Project Overview and Purpose and Need

The Phase I-A/B study for the NM 31 and NM 128 corridors was conducted following the procedures of the NMDOT *Location Study Procedures*, FHWA's Environmental Impact and Related Procedures (23 CFR 771), Federal transportation planning rules, and various other state and federal procedures and guidelines. The proposed project includes NM 31 from MP 0.5 east of the intersection of US 285 to the terminus of NM 31 at its junction with US 62 at MP 22.6 (22.1 miles), and NM 128 from its junction with NM 31 (MP 0) east to its terminus at the New Mexico/Texas state line at MP 59.9 (59.9 miles). The total project length is approximately 82.0 miles.

NM 31 currently exists as a 2-lane collector highway. The highway corridor is predominantly rural in its setting with land use a mixture of small farms and scattered residential and industrial developments for the first four miles of the corridor. After crossing the Pecos River around MP 3.5, land use transitions to a mixture of range land, oil wells, and large industrial facilities serving the salt and potash mining industry. Traffic volumes are moderate and vary from an average daily traffic volume (ADT) of about 7,900 to 10,900 from the beginning of project (BOP) to the intersection of NM 31/NM 128, to approximately 3,200 ADT between NM 128 and the end of project (EOP) at US 62. Trucks make up a substantial percentage of traffic flows with 10% to 30% of peak hour traffic comprised of trucks.

NM 128 is also a 2-lane collector highway and traverses open range lands and expansive oil fields except for the segment through Jal, generally between MP 51 and MP 53. Traffic volumes are moderate and vary from an ADT of about 8,200 to 10,400 from the BOP to Jal, to approximately 6,200 ADT between Jal and the EOP at the Texas state line. Like NM 31, trucks make up a substantial percentage of traffic flows with estimates of 15% to 45% of peak hour traffic comprised of trucks.

Both NM 31 and NM 128 have needs associated with poor infrastructure condition, poor traffic operations, and user safety. Major problems with the existing highways are summarized below.

- The pavement condition is very poor for all of NM 31 and most of NM 128. Likewise, drainage structures and other roadway infrastructure are in poor condition and in need of rehabilitation or replacement.
- Analyses indicate all the mainline segments of NM 31 south of NM 128 currently operate at level of service (LOS) C or D, depending on location, in either or both AM and PM peak periods. Similarly, the mainline segments of NM 128 also operate at LOS C for one or both peak periods. The NMDOT State Access Management Manual (SAMM) establishes LOS of B or better for rural, two-lane highways.
- In addition to mainline congestion, significant delays occur at several intersections along NM 31 and NM 128. Delays occur primarily on intersecting side roads but also affect through traffic. Locations that do not meet SAMM criteria for NM 31 include the intersections at Refinery Road and NM 128. Locations along NM 128 with excessive delay include intersections at NM 31, WIPP Road, Buck Jackson Road, Orla Road, 3rd Street, and NM 18. Several of these intersections currently operate at LOS D, E, or F. The intersection of NM 31/NM 128 is particularly problematic for the northbound-to-eastbound movement in the mornings and the westbound-to-southbound in the evening.
- Crash data for the years 2014 to 2019 were reviewed for both NM 31 and NM 128. During this period, a total of 174 crashes were reported for NM 31 including 58 that resulted in injuries or fatalities. The predominant crash types were rear-end, overturn, and head-on crashes. Several NM 31 intersections had crash rates higher than the corridor average including NM 128, Donaldson Farm Road, Kelly Road, Fishermans Lane, and Refinery Road. The crash rate for the NM 31/128 intersection was 4.5 times as high as the corridor average.

Example of Westbound Traffic Queue in the PM Period at the NM 31/NM 128 Intersection

- A total of 548 crashes were reported for NM 128 including 146 that resulted in injuries or fatalities. Predominant crash types were similar to NM 31 and included rear-end crashes, right-angle crashes, and head-on crashes along with various other crash types. Several intersections had crash rates well above the corridor average including Orla Road, Red Road/Twin Wells East, Battle Axe Road, Delaware Basin Road, Brininstool/Diamond Road, and Schooley Road.
- The crash types and rates for both NM 31 and NM 128 are indicative of conflicts associated with passing maneuvers, turning conflicts, and narrow shoulders. Speed differential is also a contributing factor. Larger trucks, especially those associated with oil field development (drilling) and equipment transport, often travel in platoons and at slower speeds than other traffic. This condition results in a substantial amount of passing maneuvers when a vehicle attempts to pass numerous other vehicles. Because passing lanes are not available, passing occurs in the opposite direction driving lane, resulting in potential for severe conflicts.

The traffic and safety problems with the existing facilities are expected to worsen as traffic volumes increase on NM 31 and NM 128. Per the University of New Mexico Geospatial and Population Studies, the 2020 population of Eddy County was 59,179 and Lea County was 72,618. The 2040 population for Eddy County and Lea County is projected to increase to 68,435 and 86,405, respectively, over the next 20 years.

5.2 Public Involvement

The Phase I-A/B study included involvement of the public and specific stakeholder groups and coordination with various government agencies. The process for public outreach was guided by the NMDOT and the project-specific Context Sensitive Solutions Public Involvement Plan (PIP) prepared at the project onset.

Specific public involvement and stakeholder coordination efforts for the study phase included:

- Two rounds of public meetings. The first round of meetings occurred August 30, 2021, and September 14, 2021. This series of meetings included an initial virtual meeting that covered both the NM 31 and NM 128 corridors. The second virtual meeting focused on improvements through the City of Jal. Both meetings were held using a virtual platform that included a presentation followed by a comment period.
- A second round of public meetings was held in May 2022 and included a meeting May 3 and a meeting May 24. The approach to these two meetings followed the same as conducted for the first round of meetings in 2021.

- Various outreach meetings were held throughout the study phase with local and county governments, industry groups, land management agencies, resource management agencies, individual property owners, and other stakeholders with interests in the corridors.

Input from public involvement activities was used to guide the NMDOT Project Team in the identification of needs and potential alternatives for the mainline and major intersections, and the evaluation of alternatives.

5.3 Preferred Alternative Overview

The evaluation of alternatives performed for the Phase I-A/B study considered four mainline alternatives for the rural portions of the highway, three alternatives of the urban segment through the City of Jal, and four alternatives for major intersections. The mainline rural alternatives considered included:

- An **Enhanced 2-Lane** configuration that would reconstruct NM 31 and NM 128 as a 2-lane section with auxiliary lanes at major intersections and passing lanes at regular intervals — about every 5 to 8 miles depending on location within each corridor. Auxiliary lanes would include speed change lanes and turn lanes, as needed based on traffic volumes and SAMM criteria.
- A **Super 2-Lane** configuration that would reconstruct NM 31 and NM 128 to have continuous alternating passing lanes every 2 to 3 miles. Auxiliary lanes would be provided at major intersections.
- A **4-Lane Divided Highway** with a 14-foot paved median signed and striped to limit median use to intersections only. Auxiliary lanes would be provided at major intersections.
- **A 4-Lane Divided Highway with a 38-foot to a 60-foot depressed median**. Median cross-overs and auxiliary lanes would be provided at major intersections.

In addition to the rural alternatives, the following urban alternatives were considered for NM 128 through the City of Jal:

- A **3-lane section** consisting of a single driving lane for westbound and eastbound traffic and a continuous 14-foot center turn lane to accommodate left-turns onto side streets and driveways.
- A **4-lane section** with two driving lanes in each travel direction. Left-turns would occur from the inside driving lane.
- A **5-lane section** with two driving lanes in each travel direction and a continuous 14-foot center turn lane to accommodate left turns onto side streets and driveways.

The four intersection configurations considered include:

- A **Two-way stop controlled** (TWSC) intersection with stop signs used on the minor road approaches to the main highway.
- A **High-T intersection** with stop-sign control for the side street and channelization provided on the mainline to separate the minor road left-turn movement from the far-side through movement on the major road. Consideration of this concept was limited to three-legged intersections or four way intersections where one leg could be eliminated.
- **Restricted Crossing U-Turn Intersections** (RCUT) that prohibit left-turn and through movements from minor road approaches. The prohibited movements are required to turn right onto the major road and then make a U-turn maneuver at a one-way median opening 400 to 2,000 feet downstream of the intersection, depending on the posted speed of the major roadway.
- **Roundabout (RAB) intersections** consisting of a circular intersection controlled by yield signs on each approach leg. RAB intersections were sized to accommodate large trucks that are common within the oil fields.

The above alternatives were first evaluated using an iterative screening process followed by a detailed evaluation of the Alternatives not eliminated by the screening process. The detailed evaluation considered traffic and safety performance, implementation costs, right-of-way needs, impacts to utilities, natural, cultural, and community resources, compatibility with industrial operations, and other similar factors. Input from the public, elected officials, businesses, and major industry was also considered.

5.3.1 Preferred Alternative: NM 31

Typical Sections and Intersection Configurations

Based on the detailed evaluation and public input, the preferred alternative recommended for NM 31 consists of various mainline typical sections and intersection treatments. **Exhibit 5-1** and **Exhibit 5-2** provide a summary of the recommended mainline typical sections and intersection improvements for each major segment of the corridor. Detailed plan and profile drawings for NM 31 are included in the *electronic appendices*.

The variation in right-of-way shown in **Exhibit 5-1** is due primarily to intersections, roadside drainage, and other occasional features that require wider right-of-way in some areas. The first number in the Right-of-Way column is the prevailing right-of-way width.

Exhibit 5-1. NM 31 Recommended Typical Sections

Roadway Milepost	Travel Lanes	Median Type / Width	Shoulder Width	Right-of-Way
BOP to MP 3.25	4, 12-foot lanes	14 ft. flush paved	10 ft. outside	175 ft. to 235 ft.
MP 3.25 to MP 4.0	4, 12-foot lanes	Transition from 14 ft. flush to 38 ft. depressed	10 ft outside 6 ft. inside	200 ft. to 290 ft.
MP 4.0 to MP 7.0	4, 12-foot lanes	38 ft. depressed	10 ft outside 6 ft. inside	225 ft. to 250 ft.
MP 7.0 to MP 7.6 NM 31/128 Intersection, South Leg	4, 12-foot lanes	38 ft. depressed*	10 ft. outside	250 ft.
MP 7.6 to MP 8.0 NM 31/128 Intersection, North Leg	2, 12-foot lanes	None*	10 ft. outside	185 ft.
MP 8.0 to EOP at MP 22.6	2, 12-foot lanes 2 NB Pass Lanes 2 SB Pass Lanes	None	10 ft. outside	175 ft. to 235 ft.

** Typical, median width varies at roundabout*

Cost Estimates for NM 31

The estimated cost to construct the NM 31 preferred alternative is summarized in **Exhibit 5-3**. Costs include mainline reconstruction, intersection improvements, drainage, railroad crossings, a new 2-lane bridge over the Pecos River, rehabilitation of the existing bridge, cost escalation, engineering and construction management, and New Mexico Gross Receipts tax. The estimate assumes a 45% multiplier applied to major cost categories (i.e., roadway, bridges, and drainage) to cover the miscellaneous items and for contingency purposes. The sum cost for Segments 1 and 2 is approximately $205.4M, not including cost of right-of-way.

Exhibit 5-2. NM 31 Recommended Intersection Configurations

Milepost	Intersection and Side of Highway	Intersection Configuration and Auxiliary Lanes
0.7	RIO Transload Facility (Right)	Stop-sign with left-turn and right-turn deceleration lanes
1.2	Carter Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
2.2	Nymeyer Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
3.2	Donaldson Farm Road (Left/Right)	TWSC with left-turn and right-turn deceleration lanes
4.4	Centurion Main Access (Right)	Stop-sign with left-turn and right-turn deceleration lanes
4.9	Fishermans Lane (Right)	Stop-sign with left-turn and right-turn deceleration lanes
5.3	Refinery Road	Roundabout with By-pass Lanes
6.5	USC Lake Plant Access (Right)	Stop-sign with left-turn and right-turn deceleration lanes
7.6	NM 128	Roundabout with By-pass Lanes
13.0	Ruger Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
13.6	Mosaic Potash Access Rd. #1 (Right)	Stop-sign with right-turn deceleration lane
14.1	Mosaic Potash Access Rd. #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.3	USC Access #1 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.3	USC Access #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
14.8	Cimarron Road (Right)	Stop-sign with left-turn and right-turn deceleration lanes
19.5	Intrepid Potash Access #1 (Right)	Stop-sign with right-turn deceleration lane
19.7	Intrepid Potash Access #2 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
19.8	Intrepid Potash Access #3 (Right)	Stop-sign with left-turn and right-turn deceleration lanes
21.4	Power Grid Facility (Left)	Stop-sign with right-turn deceleration lane
22.6	US 62/180 (NM 31 minor leg)	Stop-sign on NM 31; left-turn and right-turn deceleration lanes on US 62/180

Exhibit 5-3. Estimated Construction Costs for NM 31

Description	Segment 1: MP 0.5 to MP 8.0	Segment 2: MP 8.0 to EOP at US 62
Roadway Elements (includes lighting and RR Crossings)	$ 64,450,484	$ 66,636,570
Drainage	$ 4,970,700	$ 8,732,500
Bridges	$ 10,360,420	0
Major Item Subtotal	$ 79,781,604	$ 75,369,070
Cost escalation (6%)	$ 4,786,896	$ 4,522,144
Construction Subtotal	$ 84,568,500	$ 79,891,214
Engineering (8% of construction subtotal)	$ 6,765,480	$ 6,391,297
Construction Management (10%)	$ 8,456,850	$ 7,989,121
Construction Total	$ 99,790,830	$ 94,271,633
NMGRT (rate effective July 1, 2022)	$ 5,821,099	$ 5,499,147
Project Total	**$ 105,611,929**	**$ 99,770,780**

Right-of-Way Needs for NM 31

The preferred alternative for NM 31 will require acquisition of approximately 95 acres of property to accommodate the proposed roadway, drainage, and intersection improvements. The property to be acquired consists of a mixture of public lands under the jurisdiction of the Bureau of Land Management (65.4 acres) and New Mexico State Land office (13.1 acres) and private property (16.7 acres) from various owners. **Exhibit 5-4** provides a summary of right-of-way needs for each major segment and landowner.

Exhibit 5-4. NM 31 Right-of-Way Acquisition Summary

Segment and Milepost (MP)	Bureau of Land Management			State Land Office			Private Owners			Project Total		
	ROW	CME	TCP	ROW	CME	TCP	ROW	CME	TCP	ROW	CME	TCP
MP 0.5 to 8.0	37.1	0.2	0.9	12.4	0.1	0	15.7	0	0.5	65.2	0.3	1.4
MP 8.0 to 22.6	28.3	0.5	1.2	0.7	0	0.4	1.0	0	0.7	30.0	0.5	2.3
Totals	65.4	0.7	2.1	13.1	0.1	0.4	16.7	0	1.2	95.2	0.8	3.7

ROW = right-of-way; CME = construction maintenance easement; TCP = temporary construction permit

5.3.2 Preferred Alternative: NM 128

Typical Sections and Intersection Configurations

Based on the detailed evaluation and public input, the preferred alternative recommended for NM 128 consists of four typical sections and three major intersection types. **Exhibit 5-5** and **Exhibit 5-6** provide a summary of the recommended mainline typical sections and intersection improvements for each major segment of the corridor. Detailed plan and profile drawings for NM 128 are included in the *electronic appendices*.

Cost Estimates for NM 128

The estimated cost to construct the NM 128 preferred alternative is summarized in **Exhibit 5-7** on page 5-5. Costs include mainline reconstruction, intersection improvements, drainage, railroad crossings, cost escalation, engineering and construction management, and New Mexico Gross Receipts tax. The estimate assumes a 45% multiplier applied to major cost categories (i.e., roadway and drainage) to cover the miscellaneous items and for contingency purposes. Cost of right-of-way is not included. The sum cost for all six segments on NM 128 is approximately $420.0M, not including cost of right-of-way.

Right-of-Way Needs for NM 128

The preferred alternative for NM 128 will require acquisition of approximately 159 acres of property to accommodate the proposed roadway, drainage, and intersection improvements. The property to be acquired consists of a mixture of public lands under the jurisdiction of the Bureau of Land Management (76.1 acres) and New Mexico State Land office (23.2 acres) and private property (59.2 acres) from various owners. **Exhibit 5-8** provides a summary of right-of-way needs for each major segment and landowner.

Exhibit 5-5. NM 128 Recommended Typical Sections

Segment	Roadway Milepost	Travel Lanes	Median	Shoulders	Other Elements
NM 128 from BOP to MP 50.5	MP 0.5 to MP 6.4	4, 12-ft. lanes	38-ft. Depressed	10-ft	Auxiliary Lanes at major intersections
	MP 6.4 to MP 50.5	4, 12-ft. lanes	60-ft. Depressed	10-ft	Auxiliary Lanes at major intersections
NM 128 in the City of Jal	MP 50.5 to MP 53.5	2, 13-ft. lanes	14-ft. flush TWLTL	6-ft	Additional 12-ft. eastbound lane from 4th St. to NM 18, 5-ft. sidewalks on both sides
NM 128 from MP 53.5 to EOP at MP 59.9	MP 53.5 to MP 59.9	2, 12-ft. lanes	None	10-ft	1 Passing Lane in both directions

Exhibit 5-6. NM 128 Recommended Intersection Configurations

NM 128 Intersection	Intersection Improvements
	Base Alternative
BOP to Jal	
WIPP Road	High-T (Typ. **Exhibit 4-52.B**)
Red Road / Twin Wells Road	TWSC with left-turn and right-turn deceleration lanes
Buck Jackson Road	High-T (Typ. **Exhibit 4-52.B**)
Orla Road	High-T (Typ. **Exhibit 4-52.B**)
Delaware Basin Road	Stop-sign with left-turn and right-turn deceleration lanes
Battle Axe Road	Stop-sign with left-turn and right-turn deceleration lanes
Within Jal	
3rd Street	Signalized Intersection with left-turn lanes and a second eastbound lane
NM 18	Signalized Intersection with left-turn lanes and an eastbound right-turn lane
East of Jal	
Schooley Road	TWSC with left-turn and right-turn deceleration lanes
Willis Road	TWSC with left-turn and right-turn deceleration lanes

Exhibit 5-8. NM 128 Right-of-Way Acquisition Summary

Project Segment	Approximate Milepost Range	Bureau of Land			State Land Office			Private Owners			Project Total		
		ROW	TCP	CME	ROW	TCP	CME	ROW	TCP	CME	ROW	TCP	CME
Segment 1	MP 0.5 TO 11.8	49.9	2.1	4.6	12.1	0.4	3.1	0	0.0	0.0	62	2.5	7.7
Segment 2	MP 11.8 TO 28.8	25.9	2.2	6.5	9.5	1.2	0	3.9	1.3	0.2	39.3	4.7	6.7
Segment 3	MP 28.8 TO 38.8	0	0.2	0	0	0.1	0	2.3	2.1	0.1	2.3	2.4	0.1
Segment 4	MP 38.8 TO 50.7	0.3	0.3	0.3	1.6	0.4	1.3	21.1	2.8	2.0	23	3.5	3.6
Segment 5	MP 50.7 TO 53.9	0	0	0	0	0	0	2.4	5.6	1.3	2.4	5.6	1.3
Segment 6	MP 53.9 TO 59.9	0	0	0	0	0	0	29.5	2.7	0.3	29.5	2.7	0.3
Project Total		76.1	4.8	11.4	23.2	2.1	4.4	59.2	14.5	3.9	158.5	21.4	19.7

ROW = right-of-way; CME = construction maintenance easement; TCP = temporary construction permit

5.4 Project Phasing and Implementation

The proposed improvements to NM 31 and NM 128 will be implemented in phases, depending on funding amounts and availability. Two projects are currently planned for start of construction in late 2023 including the segment of NM 31 from the BOP to milepost 8.0 and the segment of NM 128 from MP 50.7 to 53.9 in Jal. If funding is available, the segment of NM 128 from MP 0.5 to MP 11.8 will also be advanced for start of construction in 2023. The NMDOT intends to implement these three projects using a Design-Build (D-B) procurement method. The D-B process has been initiated and will result in a request for proposals in late 2022 or early 2023.

Improvements in several spot locations may also be advanced as part of the design-build projects, depending on funding availability. These locations include areas of higher risk due to turning traffic and include the segment of NM 31 between MP 13.7 and 14.8 where primary access to the Mosaic and United Salt Corporation results in high turning volumes, NM 31 from MP 18.9 to MP 20.3 where access to the Intrepid facility exists, and the segment of NM 128 between Buck Jackson Road and Orla Road (MP 18.7 to MP 23.9). These three locations have a high volume of large commercial trucks turning from and onto NM 31 and NM 128.

Implementation of the remaining phases of NM 31 and NM 128 have not yet been determined and could be advanced using design-build, design-bid-build, or other procurement method. These segments include NM 31 north of the NM 31/NM 128 intersection to US 62 (MP 8.0 to MP 22.6), NM 128 from WIPP Road to the west side of Jal (MP 11.8 to MP 50.7), and NM 128 east of Jal to the New Mexico/Texas state line (MP 53.9 to MP 59.9).

5.5 Next Steps

Several activities will occur in 2022 to begin the implementation of the priority segments of NM 31 and NM 128. These steps include:

- Preparation of right-of-way maps to enable the acquisition of properties needed to implement the proposed improvements. This effort is underway and is based on the Enhanced Conceptual Design Plans prepared for both corridors.
- Completion of NEPA investigations, NEPA documents for the priority projects, and associated supporting investigations for cultural resources, natural resources, and community impacts. Separate NEPA documents will be prepared for NM 31 and NM 128. The anticipated level of effort is a Categorical Exclusion (CE). The Categorical Exclusions for each corridor will be completed by November 2022.
- Consultation and coordination with the New Mexico Historic Preservation Division, New Mexico State Land Office, Bureau of Land Management, and other land management and resource management agencies will be completed as part of the environmental document review and approvals.
- Right-of-way acquisition will commence after the NEPA documents have been approved.
- Design of the railroad crossings on NM 31 at MP 4.0 and MP 5.0 and on NM 128 at MP 0.05 and at the NM 128/NM 18 intersection are underway. Design of these crossings will be completed by the NMDOT project team outside of the design-build process and will be provided to the selected contractor team for construction of the adjacent highway segments. Construction of the track and associated signals and crossing arms will be by the railroad owner.

Exhibit 5-7. Estimated Construction Costs for NM 128

Description	Segment 1: MP 0.5 to 11.8	Segment 2: MP 11.8 to 28.8	Segment 3: MP 28.8 to 38.8	Segment 4: MP 38.8 to 50.7	Segment 5: MP 50.7 to 53.9	Segment 6: MP 53.9 to 59.9
Roadway Elements (includes lighting and RR Crossings)	$61,645,417	$71,348,346	$55,033,493	$64,811,340	$20,075,941	$18,602,290
Drainage	$5,406,590	$4,506,215	$2,112,040	$5,743,535	$8,792,770	$838,320
Bridges	0	0	0	0	0	0
Major Items Subtotal	$67,052,007	$75,854,561	$57,145,533	$70,554,875	$28,868,711	$19,440,610
Contingency and Cost Escalation (6%)	$4,023,120	$4,551,274	$3,428,732	$4,233,292	$1,732,123	$1,166,437
Construction Subtotal	$71,075,127	$80,405,835	$60,574,265	$74,788,167	$30,600,834	$20,607,047
Engineering (8% of construction subtotal, 4% used in Segment 5)	$5,686,010	$6,432,467	$4,845,941	$5,983,053	$1,224,033	$1,648,564
Construction Management (10%)	$7,107,513	$8,040,583	$6,057,426	$7,478,817	$3,060,083	$2,060,705
Construction Total	$83,868,650	$94,878,885	$71,477,633	$88,250,037	$34,884,951	$24,316,316
NMGRT (rates effective July 1, 2022)	$4,892,310	$5,317,155	$3,841,923	$4,743,440	$2,213,014	$1,307,002
Project Totals	**$88,760,960**	**$100,196,040**	**$75,319,555**	**$92,993,477**	**$37,097,965**	**$25,623,318**

APPENDICES

The following information is supplemental to the NM 31/NM 128 Phase I-A/B Alignment Study report and was used as part of the investigations and analyses. This information is available from the NMDOT in electronic format.

List of Supplemental Materials

- Context Sensitive Solutions Public Involvement Plan
- Research by TransGlobal Services of the Oil and Gas Industry in the Permian Basin
- Materials from the Public and Stakeholder Involvement Process
- Existing Conditions Traffic Information and Analysis Output Reports
- Highway Safety Manual (HCM) Analysis Reports (Existing and Future) and Crash Data Information
- Bridge Inspection Reports for Major Structures
- Draft Final Drainage Reports
- Geotechnical Engineering Documents
- Property Ownership Maps
- Utility Investigation Plans
- Design-Year Traffic Information and Analysis Output Reports
- Traffic Signal Warrant Study Reports
- Enhanced Conceptual Design Plans

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