

EVALUATION OF ALTERNATIVES REPORT NM 14/NM 536/FROST ROAD SANDIA PARK, NEW MEXICO

Prepared For:



Prepared By:



6100 Uptown Boulevard NE, Suite 700
Albuquerque, NM 87110

March 30, 2018



NM 14/NM 536/Frost Road Study

NMDOT Project: CN A301440

Evaluation of Alternatives Report

Phase I-A/B Evaluation of Alternatives

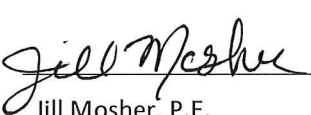


 4/9/18

Leslie Fortier, P.E. Date
NMDOT District Three Technical
Support Engineer

 4/11/18

Kenneth Murphy, P.E. Date
NMDOT District Three Engineer

 4/10/18

Jill Mosher, P.E. Date
NMDOT Assistant District Three
Engineer



TABLE OF CONTENTS	PAGE
1. BACKGROUND	1
1.1 Introduction	1
1.2 Project Area and Background	1
1.2.1 Transportation Network	1
1.2.2 Environmental Setting	1
1.2.3 Community Setting	1
1.3 Project Purpose and Need	2
1.4 Report Organization	2
1.5 Project Schedule	3
1.6 Project Team	3
2. AGENCY COORDINATION AND PUBLIC INVOLVEMENT	5
2.1 Introduction	5
2.2 Public Involvement	5
2.3 Agency Coordination	5
2.4 How Stakeholder Input was Used	6
3. EXISTING CONDITIONS	7
3.1 Introduction	7
3.2 Transportation System	7
3.2.1 Regional Roadway Network	7
3.2.2 Local Roadway Network	7
3.2.3 Access Spacing	8
3.2.4 Roadway Conditions	9
3.3 Geometry	9
3.3.1 Intersection Sight Distance	9
3.3.2 Horizontal Curves	11
3.3.3 Existing Vertical Geometry	12
3.4 Multimodal Facilities	12
3.4.1 Pedestrian Facilities	12
3.4.2 Bicycle Facilities	12
3.5 Pavement Condition	13
3.6 Traffic Operations	13
3.6.1 Traffic Counts	14
3.6.2 Intersection Operations Analysis	14
3.6.3 Traffic Signal Warrant Evaluation	15
3.6.4 Crash Analysis	16
3.7 Property Ownership and Right-of-Way	17
3.7.1 Property Ownership and Right-of-Way Research	17
3.7.2 Mapping and Surveying	17
3.8 Drainage Conditions	17
3.9 Utilities	18
3.10 Current and Future Transportation and Land Use Plans	18
3.10.1 2040 No Build Operational Analysis	18
3.11 Environmental Conditions	19
3.11.1 Community and Economic Resources	19
3.11.2 Natural Resources	22



3.11.3 Cultural Resources	23
3.11.4 Other Environmental Considerations	23
4. PROJECT ALTERNATIVES AND EVALUATION	25
4.1 Introduction.....	25
4.2 Alternatives Identification and Initial Screening Analysis	25
4.2.1 Assumptions and Design Criteria	25
4.2.2 Description of Alternatives	25
4.2.3 Evaluation Factors for the Initial Screening.....	26
4.3 Evaluation of Alternatives	28
4.3.1 No Build Alternative.....	28
4.3.2 Alternative 1A: Split Intersection.....	29
4.3.3 Alternative 1B: Split Intersection with High-T	33
4.3.4 Alternative 2: South Realignment.....	38
4.3.5 Alternative 3: North Realignment.....	42
4.3.6 Alternative 4: Roundabout Intersection	46
4.4 Summary of Screening Evaluation.....	51
5. CONCLUSIONS AND RECOMMENDATIONS	53

LIST OF FIGURES

PAGE

Figure 1-1: Recreational Setting.....	2
Figure 1-2: Vicinity Map and Intersection Limits	4
Figure 3-1: Intersection and Driveway Access Spacing.....	8
Figure 3-2: Departure Sight Triangles for Left Turn from Frost Road	10
Figure 3-3: Departure Sight Triangle for Right Turn from Frost Road	10
Figure 3-4: Departure Sight Triangles for Left Turn from NM 536	11
Figure 3-5: Departure Sight Triangle for Right Turn from NM 536.....	11
Figure 3-6: 2040 Long Range Bikeway System.....	13
Figure 3-7: Existing Traffic Volumes – Peak Hour Turning Movements.....	14
Figure 3-8: Vicinity Map and Block Groups.....	21
Figure 4-1: Alternative 1A – Split Intersection.....	30
Figure 4-2: Alternative 1B – Split Intersection with High T.....	35
Figure 4-3: Alternative 2 – South Realignment.....	39
Figure 4-4: Alternative 3 – North Realignment.....	43
Figure 4-5: Alternative 4 – Roundabout Intersection	47
Figure 4-6: Roundabout Crash Reduction Summary.....	49



LIST OF TABLES	PAGE
Table 3-1: Access Spacing Standards for Intersections and Driveways	8
Table 3-2: Existing Roadway Conditions	9
Table 3-3: LOS Thresholds for Intersections	15
Table 3-4: Existing AM and PM Peak-Hour Intersection Performance	15
Table 3-5: Crash Summary at the NM 14/NM536/Frost Road Intersection	16
Table 3-6: 2040 Existing Intersection Operations Summary.....	19
Table 3-7: Census Data Summary	20
Table 4-1: Intersection Operations Summary – Existing Volumes Split Intersection	30
Table 4-2: Intersection Operations Summary – 2040 Volumes Split Intersection (Unsignalized)	31
Table 4-3: Intersection Operations Summary – 2040 Volumes Split Intersection (Signalized)	31
Table 4-4: Intersection Operations Summary – Existing Volumes Split Intersection with High-T	34
Table 4-5: Intersection Operations Summary – 2040 Volumes Split Intersection with High-T	34
Table 4-6: Intersection Operations Summary – Existing Volumes South Realignment	38
Table 4-7: Intersection Operations Summary – 2040 Volumes South Realignment (Unsignalized)	39
Table 4-8: Intersection Operations Summary – 2040 Volumes South Realignment (Signalized)	40
Table 4-9: Intersection Operations Summary – Existing Volumes North Realignment	43
Table 4-10: Intersection Operations Summary – 2040 Volumes North Realignment (Unsignalized)	44
Table 4-11: Intersection Operations Summary – 2040 Volumes North Realignment (Signalized)	44
Table 4-12: Intersection Operations Summary – Existing Volumes Roundabout.....	48
Table 4-13: Intersection Operations Summary – 2040 Volumes Roundabout	48
Table 4-14: Alternative Matrix	52



LIST OF APPENDICES

Appendix A: Statewide Transportation Improvement Plan Project Summary
Appendix B: CN A301440 Project Team
Appendix C: CN A301440 Public Involvement Plan
Appendix D: Public Meeting Comment Summary
Appendix E: NM 14/Frost Road Traffic Count
Appendix F: Existing Traffic Operations Output Files
Appendix G: Existing Traffic Signal Warrant Worksheets
Appendix H: Intersection Crash History Summary
Appendix I: Property Ownership & Right-of-Way
Appendix J: Hydrologic Analysis and Drainage Patterns
Appendix K: Existing Drainage Infrastructure
Appendix L: Existing Utilities
Appendix M: 2040 Metropolitan Transportation Plan Model Output
Appendix N: 2040 FRATAR Worksheets
Appendix O: 2040 Existing Conditions Traffic Operations Output Files
Appendix P: 2040 Existing Conditions Traffic Signal Warrants Worksheets
Appendix Q: Split Intersection Traffic Operations Output Files
Appendix R: Split Intersection Traffic Signal Warrants Worksheets
Appendix S: Split Intersection with High-T Traffic Operations Output Files
Appendix T: Split Intersection with High-T Traffic Signal Warrants Worksheets
Appendix U: South and North Realignment Traffic Operations Output Files
Appendix V: South and North Realignment Traffic Signal Warrants Worksheets
Appendix W: Roundabout Intersection Traffic Operations Output Files
Appendix X: Alternative Construction Cost Summaries



Executive Summary

The NM 14/NM 536/Frost Road intersection (**Figure 1-2**) is a split intersection located within Bernalillo County, New Mexico in the East Mountains. NM 14 is a state highway that runs north-south through the Cibola National Forest and Sandia Mountain Wilderness Area in the Bernalillo, Sandoval, and Santa Fe Counties. NM 536 (Sandia Crest Road) is a state highway that runs east-west through the Cibola National Forest and Sandia Wilderness Area in Bernalillo County. Frost Road runs east-west through the eastern mountain communities in the Bernalillo and Santa Fe Counties in New Mexico. These three roadways are the most regionally significant thoroughfares and the intersection provides interconnectivity to numerous local communities including Cedar Crest, San Antonito, Sandia Park and Tijeras and recreational access to forest lands.

The purpose of the NM 14/NM 536/Frost Road project is to reduce congestion along the corridor, improve driver expectation, improve access spacing, and consider multi-modal opportunities. To develop alternatives to address the purpose and need established for this project, the efforts initiated as a part of the Phase I-A/B Evaluation of Alternatives include assessing intersection conditions, traffic capacity and operations, roadway geometry, safety, access management, pedestrian and bicycle facilities, drainage, environmental conditions, community and economic resources, and public feedback. In addition, input was gathered from local stakeholders and the public through a public meeting and additional outreach.

Analysis of the existing conditions identified the following issues within the corridor:

- Future operation capacity deficiencies
- Intersection does not meet driver expectation
- Lack of ADA and PROWAG compliance for pedestrian facilities
- Lack of adherence to NMDOT access management guidelines

As part of the Phase I-A/B, several alternatives were developed to address the defined purpose and need for the project. Aligned with the project purpose, alternatives were focused on improving capacity, safety and mobility for all modes of travel.

The following alternates were evaluated for this study:

- No Build
- Split Intersection
- Split Intersection with High-T
- South Realignment
- North Realignment
- Roundabout Intersection

Each of the build alternatives would improve safety, access spacing, and mobility issues within the corridor. Capacity analysis indicates that the Roundabout Alternative will operate at an acceptable level of service (LOS) under projected 2040 traffic demands without requiring a traffic signal.

Therefore, the following alternative is recommended to be further analyzed in greater detail during the *Phase I-C Environmental Documentation and Processing* stage of this project:

- Roundabout Intersection

In addition to the selected alternative, additional consideration should also include the following:



- Improved access management.
- Improved wayfinding for the intersections within the study area.
- Pedestrian facilities should be upgraded to be brought into compliance with the current PROWAG standards, which the NMDOT has adopted.

These additional considerations can be implemented as standalone projects or can be further evaluated with any of the recommended Build Alternatives during the *Phase I- C Environmental Documentation and Processing*.



1. BACKGROUND

1.1 Introduction

This report follows NMDOT's *Location Study Procedures* guidelines for *Phase I-A/B Evaluation of Alternatives* completed for the NM 14/NM 536/Frost Road intersection in Sandia Park, New Mexico. The Location Study Procedures provide guidance to NMDOT for project planning through the NEPA phase. The New Mexico Department of Transportation (NMDOT) is conducting the study to document existing and future deficiencies at the intersection, and to identify improvement strategies to address current and design-year (2040) transportation needs. The results of this study will provide guidance to plan and program improvements for the intersection with reasonable accuracy based on the best information available today.

1.2 Project Area and Background

1.2.1 Transportation Network

NM 14 is a New Mexico State Highway that provides access from Interstate 40 and serves the Cedar Crest, San Antonito, Sandia Park and Tijeras communities and is a National Scenic Byway that comprises most of the Turquoise Trail. Consequently, all north-south travel demand within Tijeras, Cedar Crest, and the unincorporated communities to the south and east of Santa Fe rely on NM 14 to travel to work, school, shopping, and services. NM 14 is classified as a minor arterial through the study area. NM 536 and Frost Road are both major collectors that provide regional access to tourist attractions as well as residential developments in the East Mountain area in addition to recreational uses including forest lands and the Sandia Peak Ski Area.

1.2.2 Environmental Setting

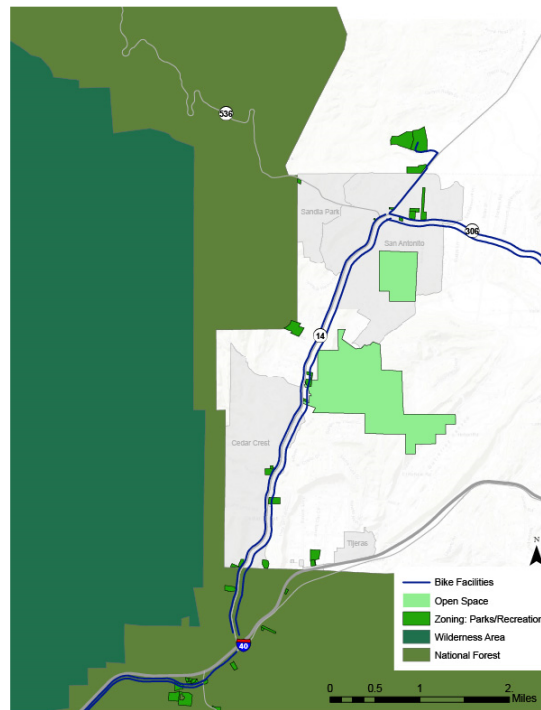
The project area is located on the east side of the Sandia Mountains. The adjacent setting consists of developed lands, to either side of which is mountainous habitat. There is not a designated critical habitat for threatened or endangered species within the project area, however there is a substantial amount of nesting habitat for birds. The National Wetland Inventory identified no known wetlands in the project area, although intermittent streams are located at the south and north ends of the project area.

1.2.3 Community Setting

The project area is located within Sandia Park, NM. The Census Designated Places (CDPs) and Block Groups (BGs) have a higher per capita income and lower unemployment and poverty rates compared to the State of New Mexico and Bernalillo County. The CDPs and BGs also have lower percentage of minorities and families below the poverty level compared to the State and County. Additionally, the CDPs and BGs have a lower number of people under the age of 18 and higher rates of people over the age of 65 compared to the State and County. See [Section 3.11 \(Environmental Conditions\)](#) for additional information.

As part of the community setting recreational activity centers were identified surrounding the project area. The east mountains provide many recreation areas including designated Open Space and National Forest Service Land. Access to these recreations areas are located off NM 14 and are important key recreational destinations within the project area. Some of the key recreation areas include Carlito Springs, Ojito De San Antonio Open Space, El Refugio Archery Range, John Milne/Gutierrez Canyon Open Space, San Antonito Open Space and Sandia Peak Ski Area.

Figure 1-1: Recreational Setting



1.3 Project Purpose and Need

Existing operational and access deficiencies have been identified at the NM 14/NM 536/Frost Road intersection (see [Figure 1-2](#)). The split arrangement of the intersection experiences high congestion on Frost Road approaching NM 14 due to the volume of left turn traffic from the minor road. Furthermore, expected future growth within the region will impact travel conditions at the intersection. The NM 14/NM 536/Frost Road intersection requires improvements to enhance operations and safety, and accommodate future increases in travel demand.

In addition, the intersection does not meet any conventional driver expectation for an intersection because of the split approaches to NM 536 and numerous access points along NM 14 for this intersection. Simplifying the intersection(s) would clarify driver decision making through the area and improve vehicular and pedestrian access.

Contributing factors to the needs at the intersection are discussed in subsequent chapters of this report.

1.4 Report Organization

Following this section:

- Section 2 (**Agency Coordination and Public Involvement**) summarizes the public involvement and agency coordination that have been conducted.
- Section 3 (**Existing Conditions**) describes the existing conditions that are the basis of need for the project and inform the selection of alternatives that meet the project purpose.
- Section 4 (**Project Alternatives and Evaluation**) discusses how the project alternatives were identified, and the evaluation process.



- Section 5 (**Conclusions and Recommendations**) summarizes the report, the alternative that is recommended, and the anticipated environmental documentation and approval process.

1.5 Project Schedule

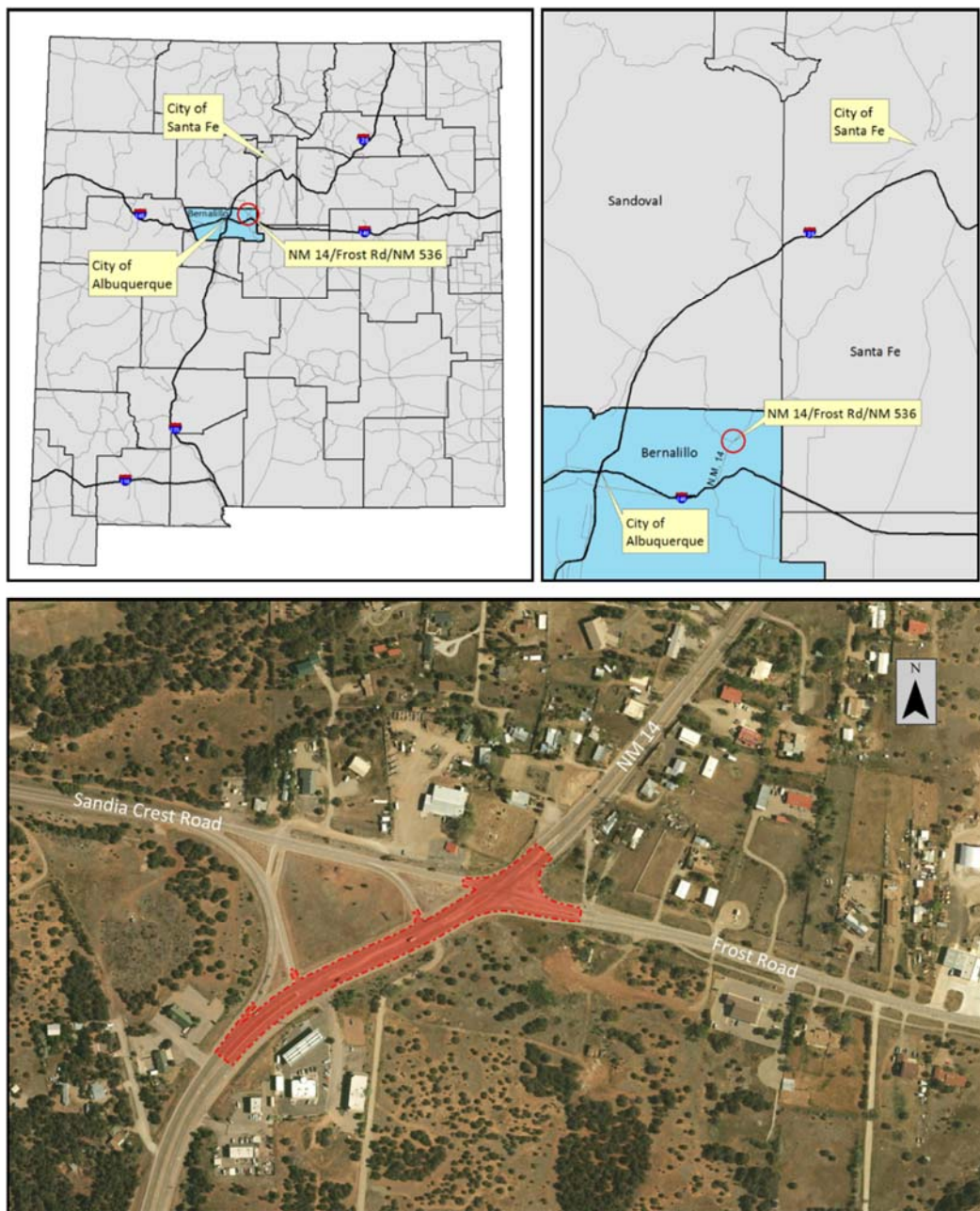
Funding for intersection improvements has been identified in the Statewide Transportation Improvement Program (STIP) for 2023. The project summary from the STIP is included in **Appendix A**.

1.6 Project Team

A list of agency and consultant staff who participated in the Project Team is included in **Appendix B**.



Figure 1-2: Vicinity Map and Intersection Limits





2. AGENCY COORDINATION AND PUBLIC INVOLVEMENT

2.1 Introduction

This chapter summarizes the public involvement and agency coordination efforts performed during the *Phase I-A/B: Evaluation of Alternatives Analysis* for the NM 14/NM 536/Frost Road Intersection Improvements Study. Public outreach was guided by the Public Involvement Plan (**Appendix C**) developed for this study in 2017. A summary of the public and agency outreach efforts is provided below.

2.2 Public Involvement

A Public Information Meeting was held at the Vista Grande Community Center on July 18, 2017. The purpose of the public information meeting was to present the existing conditions, project purpose and need, proposed project alternatives, and project schedule. A presentation detailing the above topics was given by the project team representatives, followed by a question and answer period. The meeting also involved time for the public to review display material and talk to the project team representatives. Below is a summary of the key issues expressed by the public at the meeting:

- Pedestrian and bicycle facilities: Interests in pedestrian and bicycle facilities along NM 14 and at the NM 14/NM536/Frost Road intersection.
- High-T Intersection: Interests in design and function of the High-T alternative.
- Project Schedule: Interest in project schedule for pavement rehabilitation, slope stabilization and intersection improvements.
- Gas Station: Concern about access and visibility from the Shell Gas Station.
- Drainage improvements: Interests in the improvements made to drainage and project schedule.
- Roundabout alternative: Concern about the roundabout alternative accommodating vehicles and confusion of the design.
- Slope stabilization improvements: Interests in the slope stabilization options and water diversion methods.

Meeting attendees were provided return-addressed comment forms for submission at the meeting or through the mail within the comment period. The following is a summary of the comments that were received after the meeting, during the comment period:

- Split Intersection: Support of the split intersection alternative.
- High-T Intersection: Opposition of the High-T alternative.
- North Realignment: Support for north realignment alternative.
- Roundabout: Both support and opposition for the roundabout alternative.
- Trail: Interest in making improvements to the trail.
- Lighted intersection: Interest in a lighted intersection at NM 14/NM 536/Frost Road and meeting dark skies policies.
- Reducing speed: Interest in reducing speed through residential and business areas.
- Gas station: Interest in better access and visibility to the Shell Gas Station.

A comprehensive summary of the comments received at the public meeting are included in **Appendix D**.

2.3 Agency Coordination

Coordination meetings were held with Bernalillo County, the Greater Albuquerque Bicycling Advisory Committee (GABAC), and the design team as indicated below. In addition, project team



meetings were also conducted amongst the consultant team. Agency coordination and project team meetings were held as follows:

- Kickoff Meeting, May 24, 2016
 - Coordination meeting with the NMDOT Project Team to discuss the four primary project tasks: Driveway Permitting, Mill and Overlay PS&E Projects, and Slope Stabilization Preliminary Design and NM 14/NM 536/Frost Road Phase I-A/B Study.
- Bernalillo County, March 23, 2017
 - Coordination meeting with the NMDOT Project Team and Bernalillo County to discuss the driveway permits along NM 14 for Bernalillo County.
- Outreach for Driveway Permits – East Mountain Library, May 3, 2017
 - Public outreach to solicit driveway permits along NM 14 and discuss the overall project.
- Outreach for Driveway Permits – Triangle Grocery, May 6, 2017
 - Public outreach to solicit driveway permits along NM 14 and discuss the overall project.
- GABAC Meeting, August 14, 2017
 - Coordination with GABAC to discuss the overall project will impact the corridor including the trail.

2.4 How Stakeholder Input was Used

Stakeholder input was a guiding factor for various elements of the project design and was used as a metric for evaluating alternatives. The following were the most common issues of concern:

- Intersection alternative that best serves the community and improves safety.
- Improvements to the trail and providing for pedestrian and bicycle facilities.
- Improve or maintain access to local businesses.
- Both support and opposition were expressed for the roundabout alternative.



3. EXISTING CONDITIONS

3.1 Introduction

This chapter summarizes parameters of the present state that were evaluated as part of this study in determining appropriate alternatives for the NM 14/NM 536/Frost Road intersection. An overview of the study area is provided in [Figure 1-2](#). Existing conditions that were analyzed include:

- Transportation System
- Geometry
- Multimodal Facilities
- Pavement Conditions
- Traffic Operations
- Property Ownership and Right-of-Way
- Conditions
- Existing Utilities
- Current and Future Transportation and Land Use Plans
- Environmental Conditions

3.2 Transportation System

3.2.1 Regional Roadway Network

NM 14 is a state highway that runs north-south along the eastside of the Sandia Mountains in the Bernalillo, Sandoval, and Santa Fe Counties. This National Scenic Byway, the Turquoise Trail, connects eastern mountain communities and Santa Fe, New Mexico. The southern terminus of NM 14 is NM 333 in the Village of Tijeras, NM. The northern terminus is US 85 in Santa Fe, NM. NM 14 is approximately 60-miles in length and intersects NM 536, NM 344, NM 599, NM 466, as well as the communities of Tijeras, Cedar Crest, Los Cerrillos, Sandia Park, and San Antonito.

NM 536 (Sandia Crest Road) is a state highway that runs east-west through the Cibola National Forest and Sandia Wilderness Area in Bernalillo County. This National Scenic Byway connects the Sandia Crest and Sandia Park in New Mexico. The western terminus of NM 536 is the Sandia Crest in the Cibola National Forest. The eastern terminus of NM 536 is NM 14 in Sandia Park, NM. NM 536 is approximately 14 miles in length and intersects NM165 and San Antonito community.

Frost Road is a county road that run east-west through the eastern mountain communities in the Bernalillo and Santa Fe Counties in New Mexico. This roadway connects several eastern mountain communities in New Mexico. The western terminus of Frost Road is NM 14 and the eastern terminus of Frost Road is NM 344 in Edgewood, NM. Frost Road is approximately 10 miles in length and intersects NM 14 and NM 344.

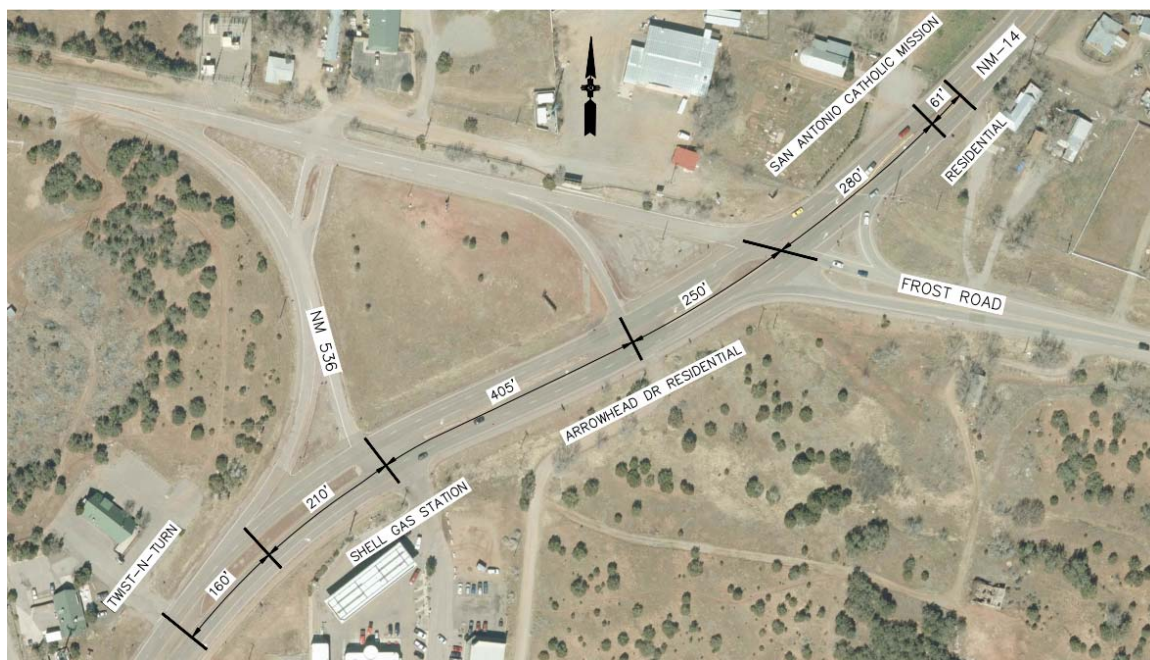
3.2.2 Local Roadway Network

The NM 14/NM 536/Frost Road intersection is a split intersection that intersects NM 536 to the west of NM-14 and Frost Road to the east. This split intersection utilizes channelized lanes intended for turning movements. The intersection configuration does not meet driver expectation of traffic patterns in the surrounding area. In addition to being spread over four (4) points, there is also access to multiple driveways within the intersection limits.



As shown in **Figure 3-1**, the eastbound right and left turn channels are separated by 210-feet and are located 655-feet south of Frost Road. Northbound left turn movements accessing NM 536 are 250-feet south of the NM 14/Frost Road intersection.

Figure 3-1: Intersection and Driveway Access Spacing



3.2.3 Access Spacing

The NMDOT *Statewide Access Management Manual* (SAMM) sets guidelines for access spacing along roadways. The following criteria, taken from SAMM, establishes desirable access spacing along a rural minor arterial (RMA) based upon the posted speed limit. The posted speed limit through the intersection is 45 mph.

Table 3-1: Access Spacing Standards for Intersections and Driveways

Access Category	Posted Speed (mph)	Intersection Spacing (feet)		Driveway Spacing (feet)		
		Signalized	Unsignalized	Non-Traversable Median		Traversable Median
				Full Access	Partial Access	
RMA	≤30 mph	1,760	660	660	200	200
	35 to 40 mph	2,640	660	660	325	325
	45 to 50 mph	2,640	1,320	1,320	450	450
	≥55 mph	5,280	2,640	2,640	725	725

The split intersection configuration at NM 14/NM 536/Frost Road includes four (4) unsignalized intersections that were evaluated for access spacing. The average spacing along NM 14 between these intersections is 285-feet which does not meet criteria established by the SAMM of 1,320-feet.

Within the study area, there is access to five (5) driveways. The average spacing between the driveways along the east side on NM 14 is 500-feet. The average spacing between driveways along the west side of NM 14 is 1,305-feet. The existing driveway spacing does meet relevant SAMM criteria of 450-feet (partial access) and 1,320 (full access).



3.2.4 Roadway Characteristics

The existing roadway characteristics of NM 14, NM 536, and Frost Road are summarized in **Table 3-2**. These roadway characteristics represent the conditions approaching the intersection.

Table 3-2: Existing Roadway Conditions

Description	NM 14	NM 536	Frost Road
Function Classification	Minor Arterial	Major Collector	Major Collector
Number of Travel Lanes	2 per direction, 1 shared TWLT lane	1 per direction	1 per direction
Width of Travel Lanes	11 feet	12 feet	14 – 20 feet
Posted Speed Limit	45 mph	45 mph	40 mph
Median Treatment	Raised	Undivided	Raised
Shoulder Width	2 feet	8 feet	Southside: 6 feet Northside: 2 feet
Sidewalk	West Side: 8 feet multiuse path East Side: none	None	None
Bicycle	West Side: 8 feet multiuse path East Side: none	None	None

3.3 Geometry

An evaluation of the existing geometry of the NM 14/NM 536/Frost Road intersection was performed based upon 2014 photogrammetry images provided by Bernalillo County. The criteria used were from the American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets, 6th Edition (*Green Book*) for a design speed of 45 mph.

3.3.1 Typical Section

South of the intersection, NM 14 is a five-lane section with two lanes in each direction and a center two-way left-turn lane. Through the intersection the left turn lane is channelized with raised medians and left-turn storage bays. North of the intersection, NM 14 transitions from the five-lane section to a three-lane section with one lane in each direction and a center two-way left-turn lane.

NM 536 is a two-lane roadway, however all the approaches to NM 14 are single lane approaches by direction.

Frost Road is a two-lane roadway with a lane in each direction. Near the intersection with NM 14, there is a raised median that separate the eastbound and westbound travel lanes and raised pork-chop style island that channelizes the westbound right-turn lane.

3.3.2 Intersection Sight Distance

As shown in the study area overview provided in **Figure 1-2**, the NM 14/NM 536/Frost Road intersection arrangement separates approaching eastbound/westbound movements on NM 536. Sight distance was analyzed to confirm that adequate sight distance is provided at the intersection. This allows drivers to perceive the presence of potentially conflicting vehicles and to provide stopped drivers with a sufficient view of the intersecting highway to decide when to enter the intersection. Sight triangles are a specified area along the approaches of an intersection that should be clear of obstructions that might block a driver's view of potentially conflicting vehicles as they look to enter the intersection.



Sight triangles were analyzed for an intersection with stop control on the minor road and are shown below. The design vehicle used for analysis was a passenger car per AASHTO. The required movements to be analyzed for this case include:

- Left turn from Frost Road (**Figure 3-2**)
- Right turn from Frost Road (**Figure 3-3**)
- Left turn from NM 536 (**Figure 3-4**)
- Right turn from NM 536 (**Figure 3-5**)

Clear sight triangles for left and right turns onto the major road (NM 14) will also provide more than adequate sight distance for minor-road (Frost Road/NM 536) vehicles to cross the major road. AASHTO recommends a sight distance of 220-feet for a speed of 45 mph.

Figure 3-2: Departure Sight Triangles for Left Turn from Frost Road

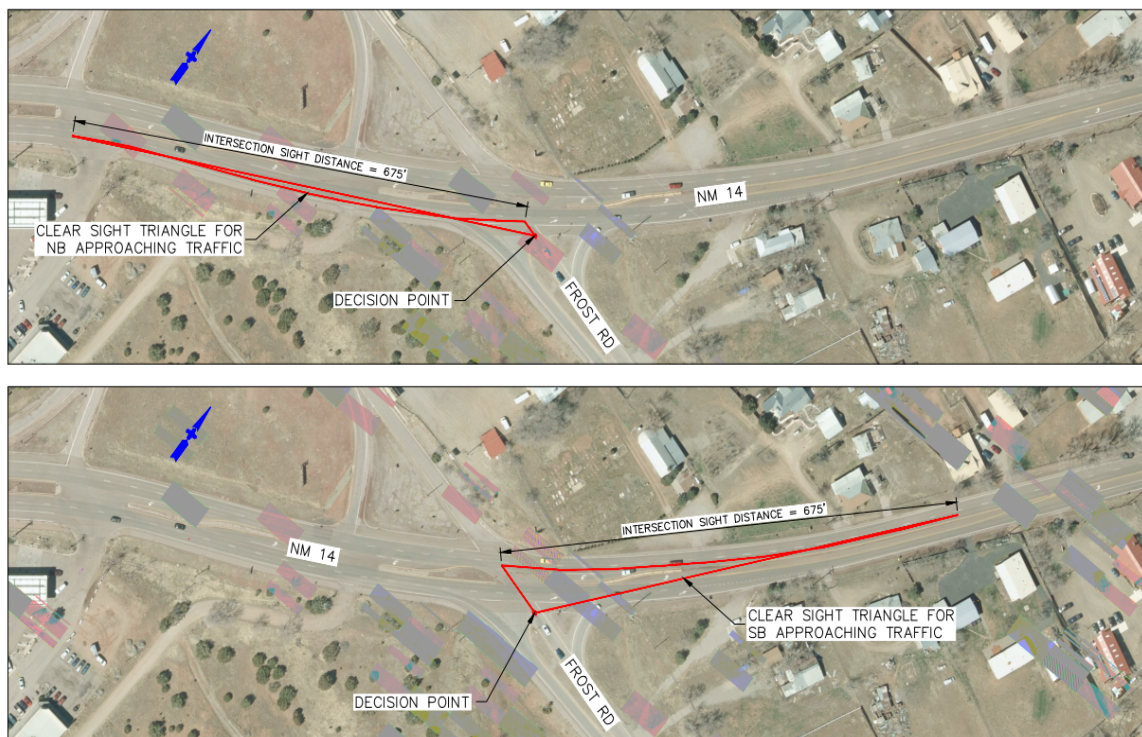
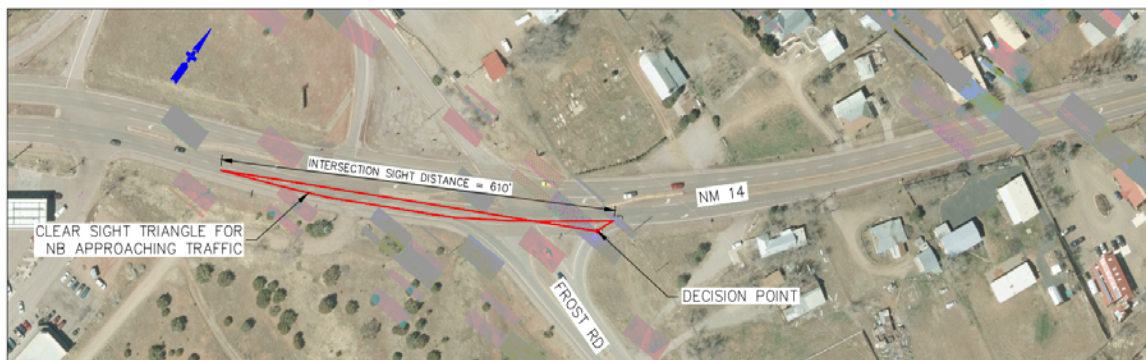


Figure 3-3: Departure Sight Triangle for Right Turn from Frost Road



As shown above, the clear sight triangles for movements from Frost Road do not have any obstructions and are adequate for intersection sight distance.

Figure 3-4: Departure Sight Triangles for Left Turn from NM 536

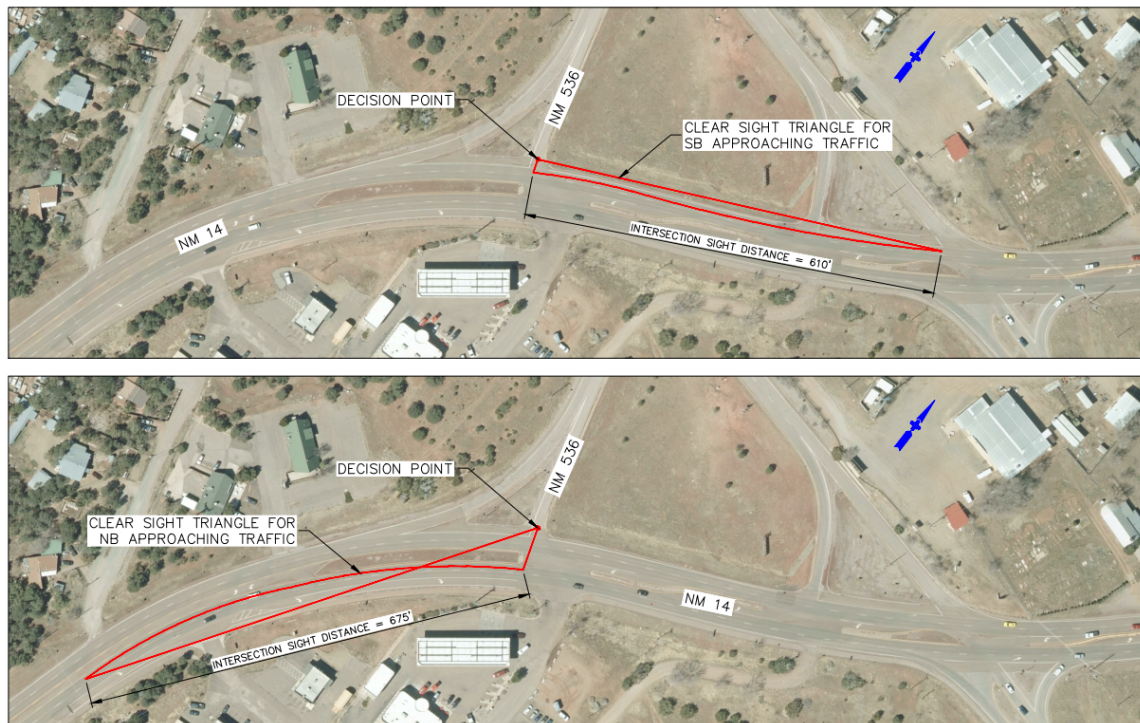
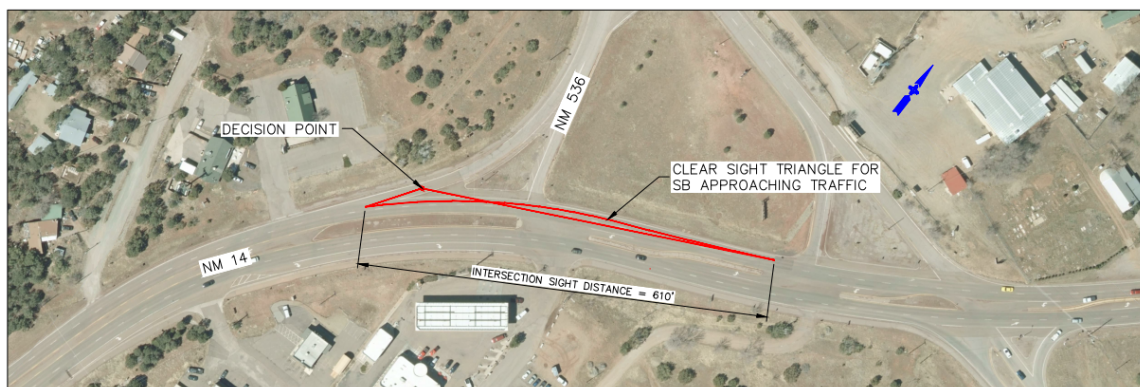


Figure 3-5: Departure Sight Triangle for Right Turn from NM 536



As shown above, the clear sight triangles for movements from NM 536 do not have any obstructions and are adequate for intersection sight distance.

3.3.3 Horizontal Curves

The horizontal curvature of NM 14 was evaluated based upon criteria identified in the *American Association of State Highway and Transportation Officials A Policy on Geometric Design of Highways and Streets (AASHTO Green Book)*. Based upon a review of as-builts for the intersection, the horizontal alignment of the study area consists of two large radius curves with tangent sections in between. Based upon field observations, NM 14 maintains a normal crown with no superelevation. The minimum curve radius for a roadway with a design speed of 45 mph is 5,930-feet (*AASHTO Green Book*, Equation 3-7) assuming a normal crown. Within the intersection limits, the two curves 955-feet and 1,800-feet do not meet the criteria for a design speed of 45 mph. Superelevation would be required for



the two horizontal curves: 3.6% (955-foot curve) and 3.0% (1,000-foot curve) to meet AASHTO standards.

3.3.4 Existing Vertical Geometry

The vertical curvature of NM 14 was evaluated based upon criteria identified in the *AASHTO Green Book*. Based upon a review of as-builts for the intersection, the vertical curves within the study area were reviewed for adequate stopping sight distance by comparing curve lengths and algebraic difference in grades to vertical curvature values (K values) with the design controls found in *AASHTO Green Book, Table 3-34* (Crest Curves). Within the study area, there is a vertical crest curve with a length of 500-feet, algebraic grade difference of approximately 6.4% and a corresponding K-value of 78 that is adequate for the 45-mph design speed (Design K-value = 61). Minimum and maximum roadway grade criteria are satisfied for the corridor as NM 14 maintains an average running grade of 3%.

3.4 Multimodal Facilities

3.4.1 Pedestrian Facilities

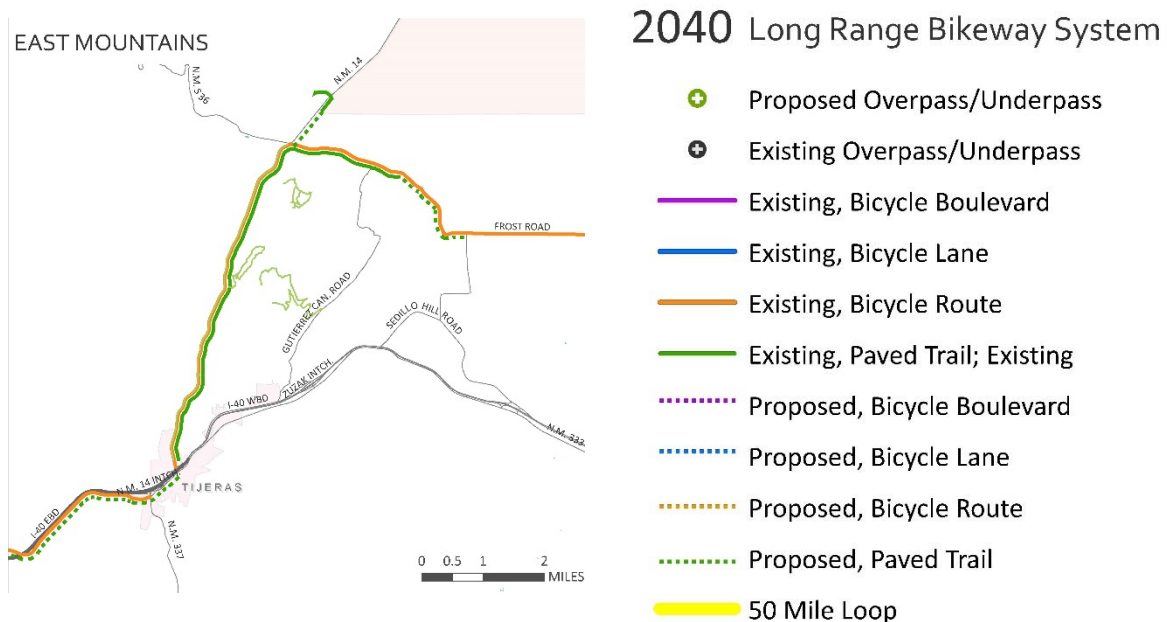
Pedestrian facilities within the study area were reviewed for general compliance with the American with Disabilities Act (ADA) and Public Rights-of-Way (PROWAG) guidelines. Existing facilities include an 8-foot wide paved trail on the east side of NM 14, extending from Matterhorn Drive to Frost Road. At Frost Road, the trail connects to and extends from NM 14 to the east on the south side of the roadway. There are no designated pedestrian access routes on the west side of NM 14, north of the intersection, or along NM 536. However, there are paved shoulders that pedestrians walk along on each approach to the intersection. In general, the cross slopes on the trail meet design criteria however, the ramp facilities on the trail do not meet slope requirement criteria at driveways and intersections.

3.4.2 Bicycle Facilities

Existing bicycle facilities in the study area were identified in the *2040 Long Range Bikeway System* (**Figure 3-6**) developed by the *Mid-Region Council of Governments of New Mexico* (MRCOG). The plan identifies the existing paved trail on the east side of NM 14 that extends to the south side of Frost Road. Within the study area, NM 14 and Frost Road are also identified as a bicycle route. The plan also identifies a proposed trail along the east side of NM 14 extending north of the intersection.

In addition, proposed bike facilities within the project area proposed bike facilities were identified in the Park, Recreation and Open Space Facilities Master Plan developed by Bernalillo County. The Master Plan identified new potential projects including new multiuse-trails within the east mountains. The NM 14 Powerline Trails would be located along powerline easements from Village of Tijeras to Sandia Park. The trails would provide connections and access points to Ojito de San Antonio Open Space, National Forest Trails, John Milne/Gutierrez Canyon Open Space and surrounding neighborhoods.

Figure 3-6: 2040 Long Range Bikeway System



Note: Image clipped from 2040 Long Range Bikeway System

3.5 Pavement Condition

The existing pavement condition within the study area was evaluated for material defects by visual inspection. Based upon as-builts, the NM 14 pavement section is comprised of the following pavement section:

- 5/8-inch of Open Graded Friction Course (OGFC)
- 2-1/2-inches of Type I Plant Mix Bituminous Pavement (PMBP)
- 3-inches of Asphalt Treated Base
- 4-inches of Subbase
- 6-inches of Lime Treated Base

In 2007, the intersection was milled and overlaid (NMDOT Project Number SP-3-07(332)). The project consisted of a 2-1/2-inch mill, 2-1/2-inches of SP-III (fine mix) and 5/8-inch of OGFC.

In 2017, a pavement core was acquired approximately 3,000-feet south of the intersection. The pavement core was comprised of the following pavement section”

- 7-inches of Asphalt Concrete
- 3.5-inches of Asphalt Base Course

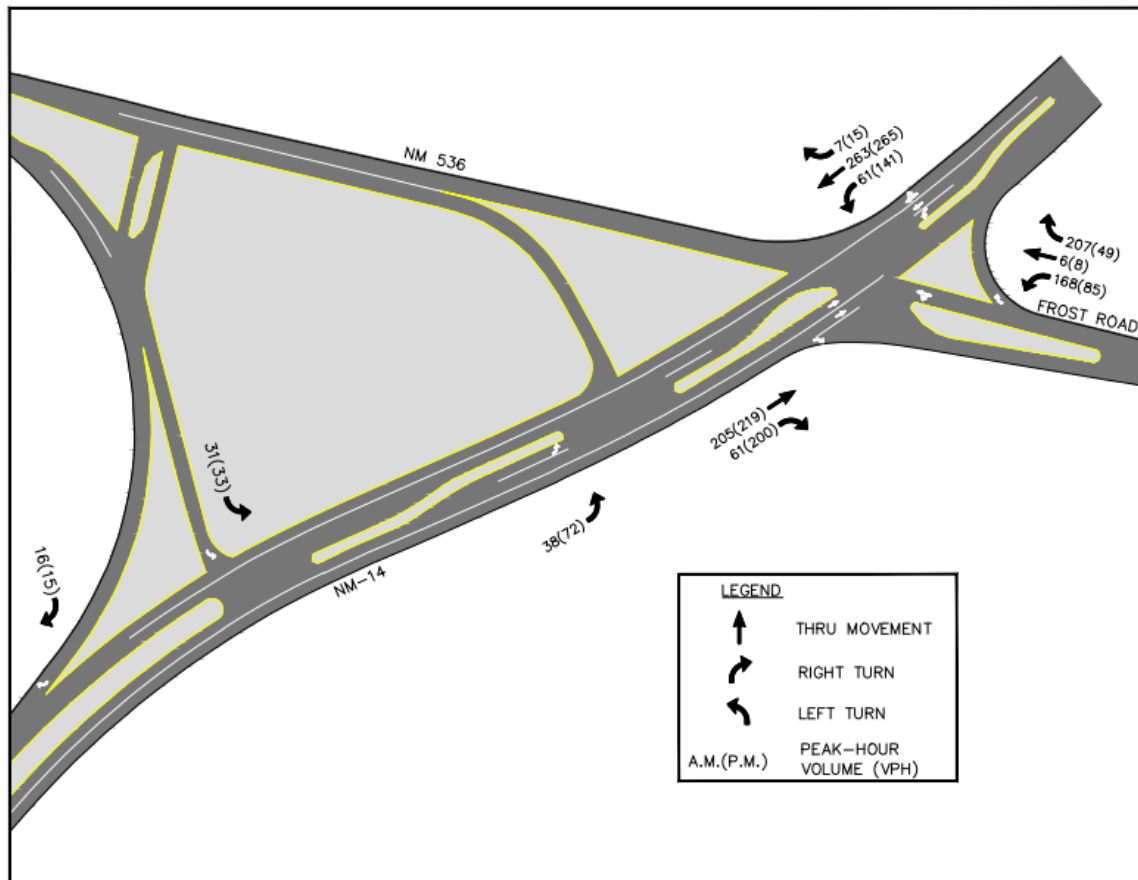
Based upon visual inspection, currently the southbound lanes have many shrinkage cracks that have been sealed; additional map cracks are propagating from the seals. The northbound lanes have several longitudinal cracks that have been sealed; additional map and longitudinal cracks are propagating from the seals. The NM 536 leg of the study area has several transverse, longitudinal, and shrinkage cracks. The Frost Road leg of the study area has several transverse and shrinkage cracks that have been sealed.

3.6 Traffic Operations

3.6.1 Traffic Counts

Existing intersection turning movement traffic volumes were collected in December 2015 including the AM, mid-day and PM Peak hours (9 total hours) for the NM 14/Frost Road intersection by the NMDOT. Additional supplemental peak hour data was collected by WSP in February 2017 to provide information for the NM 536 portion of the intersection. The AM and PM peak-hour traffic volumes (NMDOT count) used for analysis are shown in **Figure 3-7**. The traffic data used are included in **Appendix E**.

Figure 3-7: Existing Traffic Volumes – Peak Hour Turning Movements



3.6.2 Intersection Operations Analysis

Intersection capacity analyses were completed using the Highway Capacity Software. The NM 14/Frost Road and NM 14/NM 536 intersections are two-way stop controlled intersections.

The accepted measure of traffic operational performance is Level of Service (LOS), which is a term used to qualitatively describe roadway and intersection traffic operations based on a defined performance measure. Level of service is expressed as letters A to F, with LOS A representing the best operating conditions and LOS F the worst. For a rural corridor, LOS C or better traffic operations represents a desirable performance goal.

Table 3-3 summarizes the level of service criteria for unsignalized intersections, which is expressed in terms of control delay in seconds per vehicle (sec/veh). A volume-to-capacity



(V/C) ratio greater than 1.0 signifies LOS F whether other performance measures (e.g., delay) are estimated to be within acceptable thresholds.

Table 3-3: LOS Thresholds for Intersections

Level of Service	Definition	Unsignalized (sec/veh)
A	Most vehicles do not stop.	<10
B	Some vehicles stop.	>10 and <15
C	Significant numbers of vehicles stop.	>15 and <25
D	Many vehicles stop.	>25 and <35
E	Limit of acceptable delay.	>35 and <50
F	Unacceptable delay.	>50

The results of the existing conditions intersection analyses are summarized in **Table 3-4** and as shown in the table, the key movements at the intersection operate at an overall acceptable level of service based upon existing traffic volumes. The intersection output reports are provided in **Appendix F**.

Table 3-4: Existing AM and PM Peak-Hour Intersection Performance

Period	NM 14				NM 536				Frost Road			
	Northbound		Southbound		Eastbound				Westbound			
	Left Turn		Left Turn		Left Turn/Thru		Right Turn		Left Turn/Thru		Right Turn	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
AM Peak	8.4	A	7.8	A	14.1	B	9.9	A	19.5	C	10.2	B
PM Peak	8.3	A	8.1	A	14.3	B	9.6	A	23.1	C	9.2	A

3.6.3 Traffic Signal Warrant Evaluation

The *Manual on Uniform Traffic Control Devices* (MUTCD) establishes traffic signal warrants to determine whether installation of a traffic signal is justified at a particular location. The investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study and the potential to improve these conditions. The NM 14/Frost Road intersection was evaluated based upon the following traffic signal warrants:

- Warrant 1 (8-Hour)
- Warrant 2 (4-Hour)
- Warrant 3 (Peak Hour)
- Warrant 7 (Crash Experience)

The additional warrants identified in the MUTCD were not evaluated because they did not apply to the conditions at the intersection. If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph (the posted speed limit is 45 mph), the MUTCD allows for 70 percent of the threshold volumes to be utilized. Therefore, the 70% thresholds were utilized for the signal warrant analysis of this intersection.

The intersection does not meet the 8-Hour, and 4-Hour thresholds for traffic signalization. The AM Peak Hour threshold for the intersection is met, however if the right-turn volumes, where there are dedicated right-turn lanes, with free/yield conditions are removed from the approaches, the Peak Hour warrant is not met. Summary worksheets documenting the evaluation of the three volume warrants are included in **Appendix G**. In addition, the



intersection does not meet the crash experience warrant because there were not enough preventable crashes that occurred within the study period at the intersection.

3.6.4 Crash Analysis

A review of crash history of the NM 14/NM 536/Frost Road intersection was conducted to determine if crash patterns exist within the study area. Five (5) years of crash data were obtained from NMDOT for the analyses, including 2012-2016. The number, type, severity, crash rates, and other pertinent statistics were summarized. **Table 3-5** provides a crash history summary including number of crashes, type, and severity.

Table 3-5: Crash Summary at the NM 14/NM536/Frost Road Intersection

Category	2012		2013		2014		2015		2016		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Accident Type												
Fixed Object	0	0%	1	33%	1	50%	0	0%	1	100%	3	19%
Right Angle	0	0%	1	33%	0	0%	0	0%	0	0%	1	6%
Rear End	0	0%	0	0%	1	50%	1	14%	0	0%	2	13%
Left Turn	1	100%	1	33%	0	0%	1	14%	2	200%	5	31%
Roll Over	0	0%	0	0%	0	0%	1	14%	0	0%	1	6%
Other Vehicle	0	0%	0	0%	0	0%	4	57%	0	0%	4	25%
Total	1	100%	3	100%	2	100%	7	100%	3	100%	16	100%
Accident Severity												
Property Damage Only (PDO)	1	100%	1	33%	0	0%	4	57%	1	33%	7	44%
Injury/Non-Fatal	0	0%	2	66%	2	100%	3	43%	2	67%	9	56%
Total	1	100%	3	100%	2	100%	7	100%	3	100%	16	100%
Contributing Circumstance												
Following Too Close	0	0%	0	0%	1	50%	1	14%	0	0%	2	13%
Driver Inattention	0	0%	2	67%	0	0%	0	0%	2	67%	4	25%
Excess Speed/Too Fast for Conditions	0	0%	1	33%	1	50%	1	14%	0	0%	3	19%
Improper Driving	1	100%	0	0%	0	0%	4	57%	0	0%	5	31%
Alcohol	0	0%	0	0%	0	0%	1	14%	1	33%	2	13%
Total	1	100%	3	100%	2	100%	7	100%	3	100%	16	100%

It can be observed that the number of crashes at the intersection is relatively low for the five-year analysis period. Additional pertinent crash statistics are:

- The dominant type of crash was Fixed Object, Left Turn, and Other Vehicle representing 75% among all crash types.
- The percentage of PDO and Injury was 44% and 56%, respectively.
- The dominant contributing circumstances were Driver Inattention, Excessive Speed, and Improper Driving.

The number of crash occurrences at the intersection among the sample years was small and has limited statistical significance in comparison to statewide crash characteristics within the same years.

- Statewide injury crashes account for roughly 29% of total crashes. Crashes at the NM 14/NM 536/Frost Road intersection are greater (44%) for injury crashes.
- The prevalent top contributing factors statewide in 2014 included driver inattention, failure to yield right-of-way, and following too closely are comparable to the study area where driver inattention, excess speed, and improper driving contributed to most of the crashes.



A summary of the crashes and collision diagram for this intersection is provided in [Appendix H](#).

3.7 Property Ownership and Right-of-Way

Existing right-of-way and property ownership for the NM 14/NM 536/Frost Road intersection are shown in [Appendix I](#). The efforts used to establish conditions for the intersection are listed below.

3.7.1 Property Ownership and Right-of-Way Research

- Researched NMDOT records for existing right-of-way maps.
- Researched property ownership through GIS information.
- Investigated additional survey information from the New Mexico State Highway Department completed to re-establish right-of-way boundaries.

3.7.2 Mapping and Surveying

- Surveyed readily-apparent right-of-way and property monuments.
- Reconciled existing right-of-way mapping with monuments to produce approximate right-of-way limits and corridor alignment into right-of-way CADD base file.
- Input GIS parcel line work to illustrate property lines not immediately adjacent to right-of-way.
- Established project GPS control survey.
- Scaled ortho-photography and contour data to project GPS datum.
- Located readily-apparent right-of-way monuments.
- Located crossing drainage structures.

3.8 Drainage Conditions

Offsite drainage basins within the project area lie to the north and west of the intersection study area and flow in a southeasterly direction toward the project area main outfall, the Armijo Arroyo. Flows from onsite drainage basins are collected by curb inlets and are conveyed to the Armijo Arroyo via segments of storm drain as no complete storm drain system exists within NM 14. A drainage basin map and hydrologic analysis for the study area can be found in [Appendix J](#). The study area is well vegetated and erosion does not appear to be an issue.

Roadway drainage is collected by several existing curb drop inlets, and lateral pipes carry the runoff to the crossing culverts. In general, the spacing of the inlets is adequate and it meets the NMDOT design criteria. The existing inlet at the southern extent of the study area (eastside of NM 14) is a transverse drop inlet that currently extends to the edge of the existing lane. This inlet will be replaced with a series of Type I curb drop inlets with the mill and overlay project adjacent to the study area. A map of the existing drainage infrastructure for the study area is included in [Appendix K](#).

The existing curb drop inlet located on the on-ramp from NM 536 onto the NM 14 appears to be undersized and should be replaced with a Type III inlet. The runoff from Basins E and F gets to this inlet and the bypass flow crosses NM 14 super-elevated section just south of the ramp. The bypass flow from this inlet eventually makes it to the transvers drop inlet at the south side of the study area.

The existing drainage crossings within the study area range in size from 18" diameter to 30" diameter. A couple of 12" diameter culverts convey flows under private driveways. For the most part, the existing crossing culverts are in good condition and are adequately sized. To meet the NMDOT minimum culvert size criteria, it is suggested that the smaller than 24" diameter culverts



be replaced with larger ones. This should be evaluated during the design stage and all the existing drainage issues identified can be accommodated without difficulty in the design process.

3.9 Utilities

Subsurface Utility Engineering Level D (records research) and Level C (visible above ground utility features) were conducted within the study area. Utilities facilities within the study area were identified by general location and owner with more precise location level conducted when this project moves to the design phase. The approximate location of the utilities is shown in [Appendix L](#) for the study area. Known utilities owners and facility types within the study area includes the following:

- APS (Service Lines)
- Cedar Crest MDWC & SWA (Wastewater)
- Century Link (Telecommunications)
- Century Link (Network)
- Comcast (Cable TV)
- Entranosa Water & Waste water Association (Water / Wastewater)
- Forest Park Property Owner's Co-op Association (Water)
- NMDOT (ITS)
- NM Gas (Gas)
- Old Sandia Park Svc Co-Op (Water)
- Plateau Telecommunications (Telecommunications)
- PNM (Electric)
- Sierra Vista South Coop (Utilities)
- Sierra Vista Mutual Domestic Association (Transmission)

3.10 Current and Future Transportation and Land Use Plans

2040 data sets were developed as baseline forecasts for the study area. Forecasts were based on the *2040 Metropolitan Transportation Plan*, which includes the regional anticipated socioeconomic forecast, as well as any programmed roadway infrastructure projects. Output data from the *2040 Metropolitan Transportation Plan* are included in [Appendix M](#).

Land use plans, including the North Highway 14 Sector Development Plan, identified potential land use changes within the project area. The Sector Plan identified two main land use changes including a Design Overlay Zone (DOZ) and the creation of a commercial zone. The goal of the Design Overlay Zone is to promote physical elements that define the corridors unique character through design standards. The creation of the commercial zone would allow property owners within designated nodes and centers to apply for newly creates zones.

3.10.1 2040 No Build Operational Analysis

Intersection traffic volumes were developed utilizing the model output from the 2040 Metropolitan Transportation Plan Model developed by MRCOG, for accessing future traffic operations. Unsignalized intersection analysis methodologies were utilized using the 2016 Highway Capacity Software and the project peak-hour turning movement count data that were calculated using the FRATAR method ([Appendix N](#)). The average delay and LOS for each approach are shown in [Table 3-6](#). The intersection output reports are provided in [Appendix O](#).



Table 3-6: 2040 Existing Intersection Operations Summary

Period	NM 14				NM 536				Frost Road			
	Northbound		Southbound		Eastbound				Westbound			
	Left Turn		Left Turn		Left Turn/Thru		Right Turn		Left Turn/Thru		Right Turn	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
AM Peak	10.5	B	7.7	A	22.9	C	12.7	B	134.3	F	9.3	A
PM Peak	9.1	A	8.9	A	23.0	C	10.6	C	113.6	F	11.2	B

Notable operational conditions and observations for the 2040 No Build scenario include the following:

- The westbound shared left turn/thru lane does not operate at an acceptable level of service during both peak hours.

A Peak Hour signal warrant assessment was completed for the 2040 intersection volumes. The AM and PM Peak Hours both met the minimum threshold for the warrant when both the full volume and right-turn reduction scenarios were evaluated. Summary worksheets documenting the evaluation of the peak hour volume warrant are included in [Appendix P](#).

3.11 Environmental Conditions

Existing environmental conditions within the project area were assessed with the primary objective to identify conditions that warrant consideration as alternatives are being developed and evaluated. Existing conditions are identified based on review of existing data and records and are organized below into the categories of community and economic resources, natural resources, cultural resources, and other considerations.

3.11.1 Community and Economic Resources

Community facilities identified within and near the project area include schools, churches, and emergency response providers. Economic considerations include displacement of businesses, changes in access to businesses, or changes in employment. Demographic characteristics of the population were also identified within proximity of the project area. Finally, existing planning documents were assessed to ensure this project is consistent with all adopted plans and policies.

Nearby community facilities include the fire department and post office along Frost Road as well as the community center, church, and elementary and high school adjacent to the north end of the project. Local businesses in the area include the Shell Gas Station, a restaurant, mechanic shop, and an additional business along NM 14 just south of the NM 536/Frost Road intersection. Maintaining appropriate access to these businesses and facilities during and after construction will be a project goal.

Data from the US Census Bureau was reviewed to characterize the economic and demographic make-up of the area. The demographic research shows that all the Census Designated Places (CDPs) and Block Groups (BGs) in the study area have a higher per capita income and lower unemployment and poverty rates compared the State of New Mexico and Bernalillo County. Additional pertinent census data includes:

- CDPs and BGs in the project area have a slightly lower number of people under the age of 18 when compared to the State and County.
- CDPs and BGs in the project area have a higher number of people over 65, Tract 38.03 BG 2 having more than twice the State or County.

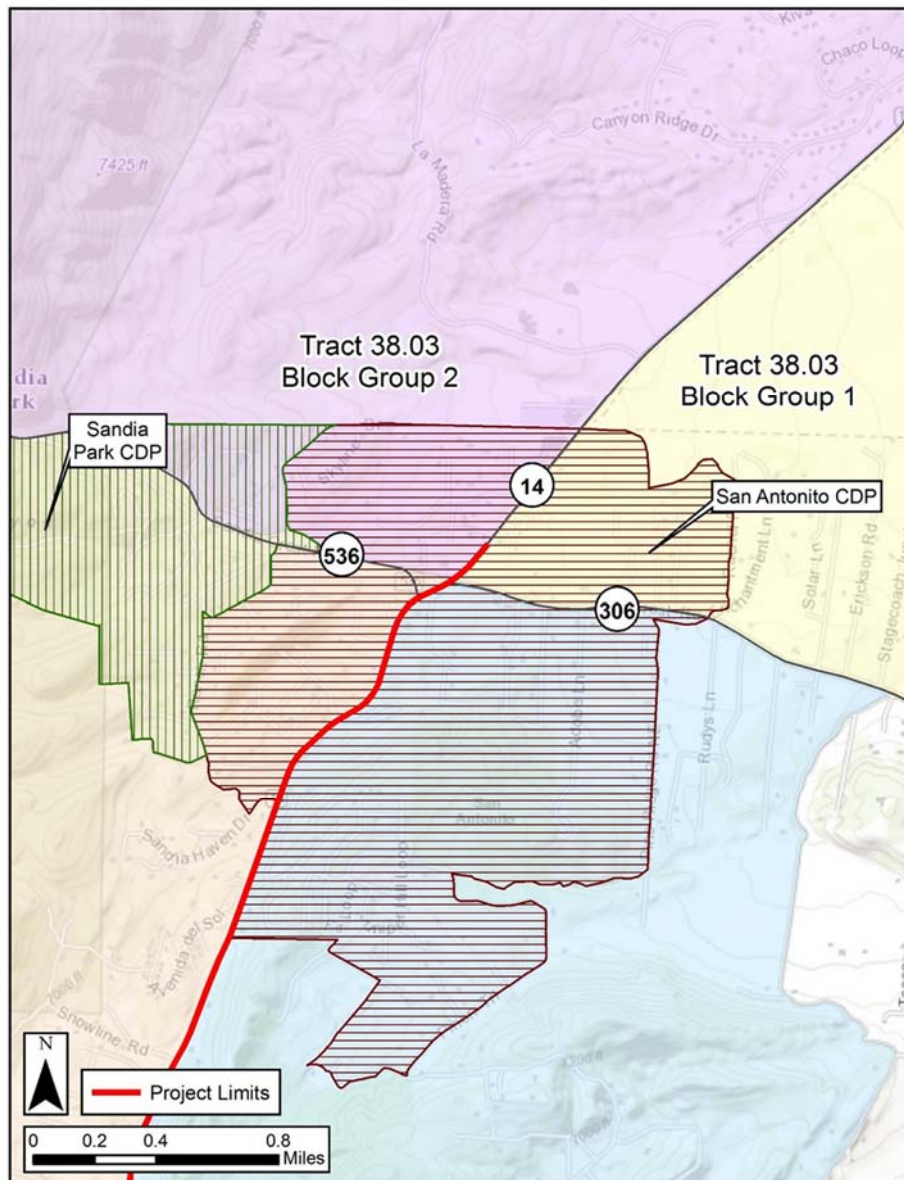


- CDPs and BGs in the project area generally have a lower percentage of minorities and families living below the poverty level when compared to the State or County.

Overall, the demographics indicate that minorities and low-income families would not be affected by the current project.



Figure 3-8: Vicinity Map and Block Groups





■ Table 3-7: Census Data Summary

	New Mexico	Bernalillo County	San Antonio CDP	Sandia Park CDP	Tract 38.03 BG 1	Tract 38.03 BG 2	Tract 38.04 BG 1	Tract 38.05 BG 1
Total Population	2,084,117	673,943	952	105	2,196	841	2,436	1,200
Income								
Unemployed	5.7%	5.5%	2.6%	0.0%	4.5%	1.6%	1.1%	2.4%
Per Capita Income	\$24,012	\$26,765	\$42,394	\$54,119	\$37,111	\$62,150	\$35,362	\$38,713
Households Below Poverty	19.1%	17.6%	4.8%	10.9%	5.0%	6.2%	0.3%	9.3%
Race								
Black or African American	2.1%	3.0%	0.0%	0.0%	0.5%	0.0%	1.5%	0.0%
American Indian & Alaska Native	9.1%	4.5%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
Asian	1.4%	2.3%	3.7%	0.0%	0.4%	0.0%	1.6%	0.0%
Some Other Race	10.9%	14.1%	6.6%	0.0%	0.4%	5.9%	1.6%	0.2%
Two or More Races	3.3%	4.2%	7.6%	0.0%	1.5%	3.3%	13.1%	1.7%
Ethnicity								
Non-Hispanic	52.6%	51.3%	84.1%	100.0%	82.9%	76.7%	74.5%	72.9%
Hispanic	47.4%	48.7%	15.9%	0.0%	17.1%	23.3%	25.5%	27.1%
Limited English Speaking Households	5.4%	4.6%	0.0%	0.0%	2.3%	2.2%	0.5%	0.0%
Age								
Under 18	24.3%	23.2%	22.4%	0.0%	17.6%	10.3%	21.8%	17.6%
Over 65	14.7%	13.6%	18.6%	14.3%	17.6%	31.7%	20.1%	15.6%

Adopted long-range planning documents for the area include the Futures 2040 Metropolitan Transportation Plan, and the Context-Sensitive Design Approach for Scenic Byways in New Mexico.

Pertinent elements of the Futures 2040 Metropolitan Transportation Plan include:

- A rural character should be preserved in undeveloped areas of Bernalillo County.
- In developing locations, growth should be balanced with the rural character.
- Development in the East Mountains should consider impacts to native wildlife habitat.

Pertinent elements of the Context-Sensitive Design Approach for Scenic Byways in New Mexico include:

- Gateway treatments at the NM 14/NM 536/Frost Road intersection
- Consideration of a roundabout at NM 14/NM 536/Frost Road intersection
- Stone facing for structures
- Corten guardrail
- Special signing, lighting, and vegetation
- Multi-modal facilities

Elements of these plans will be considered for implementation within the project limits, based on their feasibility and the project budget.

3.11.2 Natural Resources

The project area is located along NM 14 on the east side of the Sandia Mountains. Immediately adjacent to the roadway, much of the project setting consists of developed lands, to either side of which is mountainous habitat with a limestone bedrock covered in light red to dark brown silty soil. Vegetation includes Piñon, juniper, ponderosa pine, Gamble's oak, prickly pear, cholla, yucca, and grasses. Additionally, east/west-oriented intermittent drainages are located at the north and south ends of the project area.

Natural resource considerations for the project area include general wildlife habitat, endangered species, surface water, and floodplains. The US Fish and Wildlife Service's Information for Planning and Conservation (IPaC) website identified no designated critical



habitat for threatened or endangered species within the project area. There is however, a substantial amount of nesting habitat for birds protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. As such, impacts to wildlife and nesting bird habitat should be considered when evaluating alternatives.

Per the National Wetland Inventory there are no known wetlands within the project area, although intermittent streams are located at the south and north ends. Any roadway work within these drainages would likely require a permit under Section 404 of the Clean Water Act as administered by the Corps of Engineers. Additionally, the Federal Emergency Management Agency (FEMA) has identified no designated flood hazards within the project area.

3.11.3 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.

Review of the Archaeological Records Management Section (ARMS) database shows that within NM 14 the project area has been surveyed for cultural resources while NM 536 and Frost Road have not. Two archaeological sites are located near the west and north sides of the intersection and possibly extend into the project area. Additionally, the historic San Antonito Church and cemetery are located just north of the intersection, within the project area. The church and cemetery are listed on the National Register of Historic Places (NRHP).

These cultural resources may also qualify for protection under Section 4(f) of the Department of Transportation Act. This section states that Section 4(f) properties may not be used for transportation purposes unless there are no other feasible and prudent alternatives and all possible planning to minimize harm to the properties has been completed. Potential impacts to the archaeological sites, cemetery, and church should be avoided if possible.

3.11.4 Other Environmental Considerations

Additional environmental considerations include hazardous materials, air quality, and traffic noise. A preliminary investigation of hazardous materials using the Environmental Protection Agency (EPA) EnviroMapper database shows one location at the west end of the project area that currently reports to the EPA. Additional investigations, coordinated through the Environmental Geology Section, will likely be needed if ground disturbance from construction is deeper than 2 ft. or if right-of-way is required in this area.

While Bernalillo County has been under maintenance for carbon monoxide pollution since the 1990's, no violations of the National Ambient Air Quality Standards have occurred in several years. Further, the Albuquerque metropolitan area is the center of county-wide air quality concerns and the air quality within more rural portions of the county, such as along NM 14, is generally considered to be good.

Any significant adjustment to the roadway alignment could qualify as a Type I project under FHWA policy and would require analysis of traffic noise and abatement in accordance with 23 CFR 772-Procedures for Abatement of Highway Traffic Noise and Construction Noise. Several noise-sensitive receptors are located throughout the project area. Therefore, if noise impacts occur, mitigation would need to be considered and implemented if found to be prudent and feasible. This analysis will be conducted during the environmental



documentation phase of the project and is not anticipated to present a major challenge as the project advances.



4. PROJECT ALTERNATIVES AND EVALUATION

4.1 Introduction

The existing intersection configuration in addition to future predicted growth, driver confusion, lack of ADA/PROWAG compliant facilities, and access spacing deficiencies are the needs that can be addressed at the NM 14/NM 536/Frost Road intersection.

Potential project alternatives that meet the purpose and need were identified in a collaborative effort involving the NMDOT Project Team. The alternatives are being evaluated with an iterative screening process that follows the NMDOT *Location Study Procedures*. The process is intended to eliminate alternatives that do not meet the purpose and need or are otherwise not feasible and identify alternatives that best meet the defined purpose and need of the project. As the basis for the screening analysis, quantitative and qualitative criteria were developed to aid in the evaluation.

This section provides a detailed analysis of the No Build Alternative and five (5) Build Alternatives, based upon design criteria with input received from the agency coordination and public involvement process. The final step in the process will be proceeding with the preferred alternative through environmental clearance and into project design.

This section describes the criteria used to identify and evaluate the alternatives, the potential alternatives that were identified, and the results of the screening process.

4.2 Alternatives Identification and Initial Screening Analysis

4.2.1 Assumptions and Design Criteria

Various design criteria were used to lay out the project alternatives. The criteria came from the American Association of State Highway and Transportation Officials (AASHTO) *Policy on the Geometric Design of Highways and Streets* (2011) and discussions with the NMDOT Project Team. The design speed is 45 mph. The minimum horizontal centerline curve radius is 8,650 feet, assuming the roadway has a normal crown with 2 percent cross slopes.

4.2.2 Description of Alternatives

As stated in Section 1.3, the project is needed to address operational and access deficiencies as well as match driver expectation of the surrounding roadway network at the NM 14/NM 536/Frost Road intersection. Alternatives were identified by the Project Team, which included representatives of NMDOT and were refined with input from the Public through public outreach. A description of each alternative is provided below.

- No Build – Leave the existing intersection in place and continue to maintain it, without any changes.
- Alternative 1A (**Figure 4-1**) – Split Intersection: Split NM 14/NM 536/Frost Road into two separate intersections, NM 536 will intersect NM 14 south of Frost Road in conventional stop controlled intersections.
- Alternative 1B (**Figure 4-2**) – Split Intersection with High-T: Split NM 14/NM 536/Frost Road into two separate intersections, NM 536 will intersect NM 14 south of Frost Road. The NM 14/NM 536 intersection would be a conventional stop controlled intersection and NM 14/Frost Road would be a High-T intersection.



- Alternative 2 (**Figure 4-3**) – South Realignment: NM 536 and Frost Road would be aligned to intersect NM 14 to the south at a two-way stop controlled intersection.
- Alternative 3 (**Figure 4-4**) – North Realignment: NM 536 would realign to the north to intersect NM 14 at the Frost Road intersection at a two-way stop controlled intersection.
- Alternative 4 (**Figure 4-5**) – Roundabout: NM 536 and Frost Road would be realigned to intersect NM 14 at a single roundabout intersection.

The horizontal curve deficiency can be addressed through all of the Build Alternatives through the introduction of superelevation within the project area to NM 14.

4.2.3 Evaluation Factors for the Initial Screening

The first level screening is a high-level evaluation intended to select alternatives for further detailed analysis. The primary evaluation factors will be measured against the No Build scenario to complete a comparative evaluation and are described below.

Meets Purpose and Need

The alternatives will be evaluated in terms of how well they satisfy the project purpose and need. The criteria include:

- A new intersection layout that will accommodate traffic needs and match driver expectation of the surrounding roadway network.
- Design in accordance with appropriate NMDOT and design standards.
- Access for motor vehicles, bicycles, and pedestrians.
- Consistency with adopted transportation plans and policies.

Existing plans include the 2040 MTP, the STIP, and the New Mexico Department of Transportation Context-Sensitive Design Approach for Scenic Byways in New Mexico. Proposed projects along NM 14 adjacent to the study area include pavement rehabilitation between Mile Posts 0 and 6 and slope stabilization near Mile Post 3.5.

Traffic Operations

Intersection traffic operations can be qualitatively measured by the Level of Service (LOS) and volume-to-capacity (v/c) ratio. As discussed in **3.6 Traffic Operations**, the desirable performance goal is LOS C or better. This evaluation factor will compare the alternatives in terms of meeting existing and projected 2040 traffic demands identified in the 2040 MTP.

Safety

This evaluation factor will assess how well each alternative addresses roadway, pedestrian, and bicycle safety within the intersection. Potential new risks will also be identified.

Constructability

NM 14 is a minor arterial roadway, and NM 536 and Frost Road are both major collector roadways. Disruptions to the flow of traffic can cause lost productivity, wasted fuel, and inconvenience. NM 14, Frost Road, and NM 536 are the major roadways serving emergency responders such as medical, police, and fire personnel who rely on them to access locations on either side of the canyon. Traffic disruptions on NM 14, NM 536, or Frost Road could delay emergency response and increase risks for the community. Also, work zones are



hazardous for construction personnel and the public. The risks are generally proportional to the duration of construction. This evaluation factor will assess the impacts of construction related to movement along the NM 14, NM 536, and Frost Road corridors.

Right-of-Way Needs

Realignment of NM 536 and Frost Road was considered and would require acquisition of right-of-way. This evaluation factor will quantify the right-of-way needs of each alternative.

Driveway Access

Desirable access spacing is outlined in the NMDOT SAMM by roadway classification. Alternatives will be assessed with respect to location of access points (existing or relocated) and overall compliance with the SAMM along NM 14.

Multi-Modal Facilities

A desire to maintain and improve pedestrian and bicycle multi-modal facilities have been identified within the intersection limits. This factor will identify the impact of each alternative on these multi-modal facilities.

Seasonal Maintenance

Snowfall in the East Mountains requires seasonal maintenance during the winter months to keep the roadway traversable. This evaluation factor will assess the feasibility of completing the necessary seasonal maintenance of each alternative.

Cost

Major project costs include the construction cost for the roadway, infrastructure, and right-of-way acquisition. For the initial screening, preliminary costs are useful to provide order-of-magnitude comparisons of the alternative concepts. Costs were based upon NMDOT unit bid prices for major work categories for each alternative and were completed at a scoping level. It is anticipated that utility impacts will be minimal for each of the alternatives within the study area.

Environmental

Environmental impacts were considered in terms of:

- Impacts to wildlife and nesting bird habitat
- Consistency with adopted plans and policies
- Impacts to cultural resources and Section 4(f) properties

Habitat concerns are more pronounced on the south side of the road where the project area generally connects to more open and undeveloped space. The area on the north side of the intersection is more developed and fragmented. Therefore, potential habitat impacts were evaluated based on how the proposed alternative would affect the areas on the south side of the intersection.

The *Futures 2040 Metropolitan Transportation Plan* calls for compatibility with rural character and balancing areas of growth with rural character. *Context-Sensitive Design Approach for Scenic Byways in New Mexico* calls for a gateway treatment, various aesthetic treatments, and the consideration of a roundabout.



Cultural resources include two archaeological sites documented on the west side of the intersection as well as the historic church and cemetery. Only newly disturbed ground surface would potentially impact the archaeological sites; however, the church is listed on the NRHP and, while no physical impacts are anticipated, changing the intersection configuration could affect its historic setting. Therefore, alternatives were evaluated in terms of how much new disturbance would be anticipated in areas near the archaeological sites and how they would affect the setting near the church. The possibility of adverse effects under Section 106 of the National Historic Preservation Act or potential uses of the property under Section 4(f) would need to be further evaluated during the Phase IC documentation.

4.3 Evaluation of Alternatives

4.3.1 No Build Alternative

The No Build Alternative serves as a base condition in which the NM 14/NM 536/Frost Road intersection would remain as it is today with no improvements made to the intersection or within the project area.

Meets Purpose and Need

The No Build Alternative does not meet the project purpose and need statement. Without improvements, existing access deficiencies along NM 14 as well as operational deficiencies eastbound and westbound will be maintained. Additionally, pedestrian modes of travel will not be accommodated satisfactorily due to lack of ADA compliance on the existing multi-modal facility.

Traffic Operations

Without improvements, operational performance will continue to degrade over time as regional development occurs as identified in the previous section.

Safety

There will be no improvements and the status quo will be maintained. Though the overall crash rate is currently low, deficient criteria identified in the existing conditions assessment will not be addressed with the No Build Alternative.

Constructability

This alternative does not include new construction, all facilities are maintained on NM 14, NM 536, and Frost Road.

Right of Way Needs

There would be no right-of-way impacts with this alternative.

Driveway Access

Without improvement, the access spacing deficiencies will be maintained.

Multi-Modal Facilities

This alternative will not impact multi-modal facilities. Additionally, pedestrian modes of travel will not be accommodated satisfactorily due to lack of ADA compliance on the existing multi-modal facility.



Seasonal Maintenance

Snow removal will not be changed. The existing raised medians within the study area have been identified as an issue for the snow plows to work around.

Cost

With no construction costs, the cost of this alternative will be limited to maintenance costs of the existing facility.

Environmental

The No Build alternative would have no environmental impacts to habitat or cultural resources. The No Build alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan*, however, this alternative would not accommodate for scenic byway treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

4.3.2 Alternative 1A: Split Intersection

The Split Intersection alternative would modify the existing intersection with multiple NM 536 access points to a split condition where NM 536 would intersect NM 14 opposite to the Shell Gas Station gas station driveway creating a two-way stop controlled intersection. The four access points of NM 536 would be combined to one approach. Frost Road would maintain its alignment and intersect NM 14 at its current location. The intersection would now be a T-intersection with stop control maintained on Frost Road. There would be approximately 650-feet between the NM 536 and Frost Road intersections.

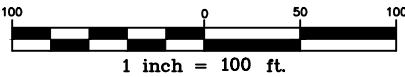
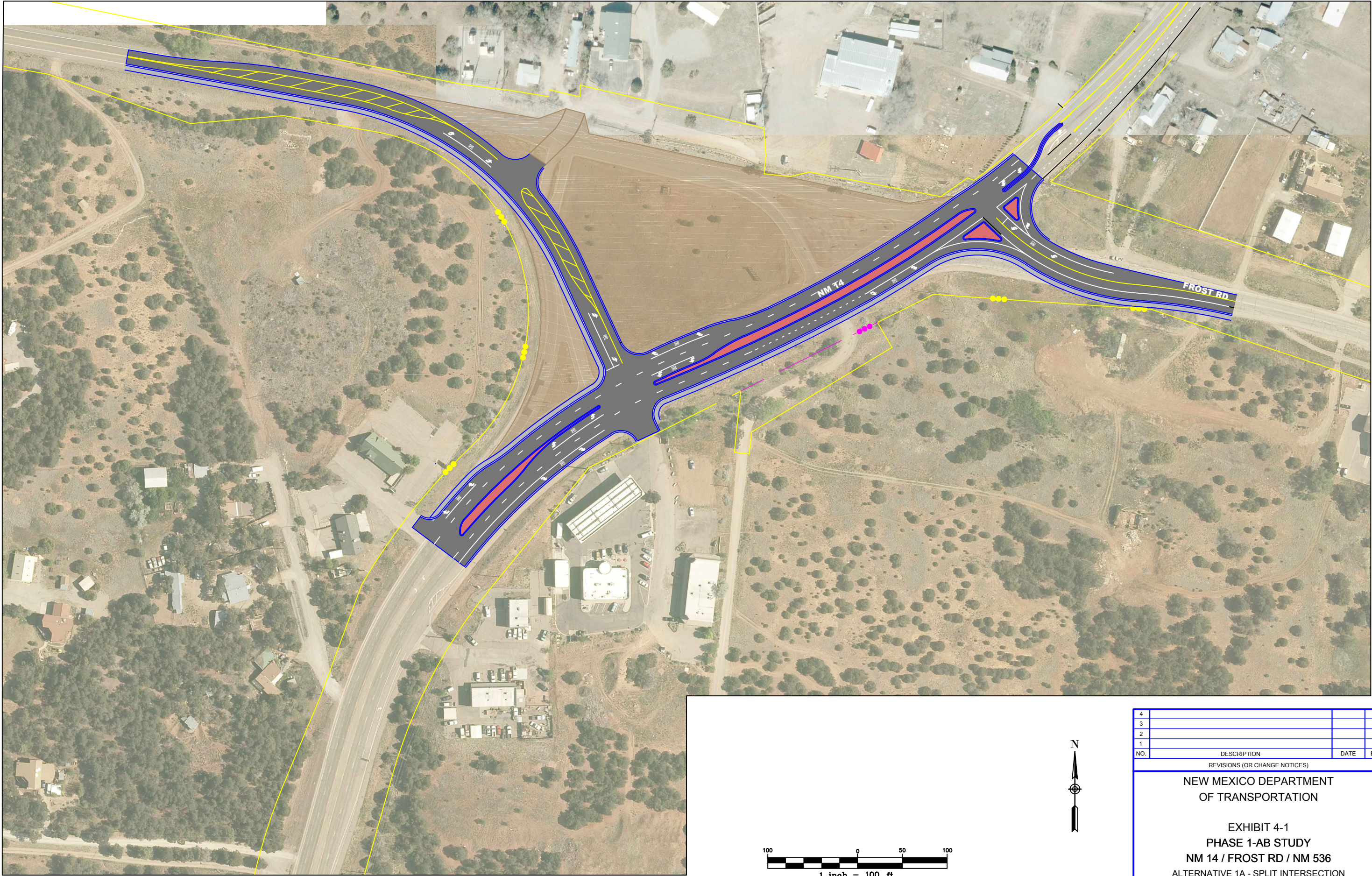
Meets Purpose and Need

The Split Intersection Alternative partially meets the project purpose and need statement. With the proposed intersection alternative:

- Traffic operations will be improved from the existing condition; however, the Frost Road approach will fail in the 2040 scenario.
- Driver expectation issues are addressed by clarifying the intersection decision making location.
- The spacing between intersections, though improved, will not meet the NMDOT SAMM criteria.
- Multi-modal facilities can be accommodated to meet current design standards.

Traffic Operations

Future travel demand necessitates change to achieve acceptable operations within the study area. Operational performance will continue to degrade over time as regional development occurs without improvements. The average delays and LOS for the intersections at NM 536 and Frost Road are shown in the table below for the Split Intersection alternative. The intersection output reports are provided in [Appendix Q](#).



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY
REVISIONS (OR CHANGE NOTICES)			
NEW MEXICO DEPARTMENT OF TRANSPORTATION			
EXHIBIT 4-1			
PHASE 1-AB STUDY			
NM 14 / FROST RD / NM 536			
ALTERNATIVE 1A - SPLIT INTERSECTION			



Table 4-1: Intersection Operations Summary – Existing Volumes Split Intersection

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536</i>						
Northbound Left	8.4	0.04	A	8.3	0.07	A
Southbound Left	7.8	0.02	A	8.3	0.02	A
Eastbound Left	18.2	0.06	C	20.3	0.06	C
Eastbound Thru/Right	10.8	0.06	B	11.2	0.07	B
Westbound Left/Thru/Right	13.1	0.10	B	19.8	0.20	C
<i>NM 14/Frost Road</i>						
Southbound Left	8.0	0.05	A	8.8	0.14	A
Westbound Left	17.6	0.40	C	21.1	0.31	C

Table 4-2: Intersection Operations Summary – 2040 Volumes Split Intersection (Unsignalized)

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536</i>						
Northbound Left	10.6	0.13	B	9.1	0.10	A
Southbound Left	7.6	0.02	A	8.2	0.03	A
Eastbound Left	38.9	0.09	E	43.2	0.41	E
Eastbound Thru/Right	16.3	0.24	C	13.6	0.17	B
Westbound Left/Thru/Right	31.6	0.29	D	22.9	0.25	C
<i>NM 14/Frost Road</i>						
Southbound Left	8.0	0.08	A	9.4	0.17	A
Westbound Left	93.7	1.05	F	81.0	0.85	F

Notable operational conditions and observations for the Split Intersection Alternative for the existing and 2040 scenarios include the following:

- All operations function at acceptable level of service during AM and PM peak hours in existing conditions.
- In 2040, there are failures for the eastbound and westbound movement at the NM 536/Frost Road intersection. Each of these movements are low volume.
- In 2040, the westbound left-turn movement at the NM 14/Frost Road intersection fails. Frost Road is a high-volume approach making this failure significant.

The NM 14/Frost Road intersection meets the Peak Hour signalization warrant (**Appendix R**) in 2040. A summary of the signalized operations of the NM 14/Frost Road intersection is shown below.

Table 4-3: Intersection Operations Summary – 2040 Volumes Split Intersection (Signalized)

Intersection	Northbound		Southbound		Westbound		Overall		
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	Max v/c Ratio	LOS
<i>NM 14/Frost Road</i>									
AM Peak	12.1	B	18.3	B	7.8	A	13.3	0.55	B
PM Peak	14.8	B	17.3	B	7.1	A	14.1	0.7	B



With a traffic signal, the NM 14/Frost Road intersection operates at an acceptable level of service for the 2040 scenario.

Safety

Safety benefits of this alternative include:

- Improved driver expectation for where decision points occur.
- Reduced number of conflict points for turning vehicles.

The Split Intersection alternative improves driver expectation by reducing the number of intersections. The existing intersection is spread over the length of approximately 865-feet with five intersection access points. By consolidating these points of access to two, driver will more clearly understand where to access NM 536 and where to access Frost Road. Alleviating driver confusion over where to access either roadway will improve safety through the corridor.

A second byproduct of reducing the number of intersections to two is that it reduces the number of conflict points from 39 with the existing configuration to 30 conflict points with the split intersection. Fewer conflict points should result in a safer intersection.

Constructability

The Split Intersection alternative would require construction that impacts all three roadways of the intersection

Improvements on NM 14 would largely be straight forward. It is anticipated that full reconstruction of the corridor would be completed to address the deteriorating pavement in the study area. Reconstruction of the medians would be needed to modify access. It is anticipated that these improvements can be made within the existing roadway prism through internal and external lane closures. Maintaining full access, though single lane in each direction, should be feasible during construction. Any drainage or pedestrian improvements could be made with simple lane closures to NM 14.

Improvements to NM 536 should be easily accommodated due to the multiple existing access points to NM 14 that currently exist. The new alignment for NM 536 could be constructed while detour traffic is moved to one of the other existing approaches of NM 536 that intersect NM 14.

Improvements to Frost Road would require widening and general reconstruction while maintaining the current roadway alignment. There is adequate width to maintain a single lane in each direction along Frost Road during construction though this will limit the capacity of Frost Road which already has capacity concerns during the peak periods.

Right of Way Needs

There would be no right-of-way impacts for this alternative.

Driveway Access

The Split Intersection alternative layout results in two unsignalized intersections: NM 14/NM 536 and NM 14/Frost Rd. The proposed spacing along NM 14 between the intersections is 655-feet which does not meet the criteria established by SAMM. However,



the number of intersections within the study area is reduced, resulting in an overall improved condition.

Multi-Modal Facilities

Existing multi-modal facilities will benefit from the proposed roadway improvements of this alternative. The improvements would result in a trail with an improved paved surface and compliance with ADA and PROWAG guidelines. In addition, bike lanes or widened shoulders could be added to NM 14 through the intersection to better accommodate the heavy bike traffic that currently utilizes the corridor.

Seasonal Maintenance

The Split Intersection alternative would largely maintain the status quo for the intersection with respect to snow removal. Raised medians along the corridor would remain however there would be a small benefit through the reduction in access points that would result in fewer points for the snow plows to have to negotiate and clear.

Cost

The estimated construction cost of the Split Intersection Alternative is \$2,700,000. It should be noted that the NM 14/Frost Road intersection will not need to be signalized currently, but will likely warrant signalization around 2027 (assuming linear growth). The cost of the construction of a traffic signal would be an additional \$250,000.

Environmental

The Split Intersection alternative would have minimal environmental impacts to habitat and cultural resources. The Split Intersection alternative would not disturb any habitat as this alternative is like the existing intersection configuration. The Split Intersection alternative would move Frost Road slightly closer to the church but would have no impact to cultural resources.

The Split Intersection alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan* and would accommodate several scenic byway design treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

4.3.3 Alternative 1B: Split Intersection with High-T

The Split Intersection alternative with High-T alternative is like the Split Intersection Alternative (Alternative 1A) and would modify the existing intersection with multiple NM 536 access points to a split condition where NM 536 would intersect NM 14 adjacent to the intersection creating a two-way stop controlled intersection. The four access points of NM 536 would be combined to one approach. However, Frost Road would maintain its alignment and intersect NM 14 at its current location but in a High-T configuration. The intersection would also narrow southbound through traffic to a single lane (outside lane) north of the intersection while maintaining the inside lane as an exclusive left-turn lane for traffic turning from Frost Road. This configuration allows for traffic turning from Frost Road to only identify gaps in northbound through and southbound left-turning traffic to negotiate the intersection. This should allow for improved operations because traffic is less restrictive. The NM 14/Frost Road intersection would remain stop controlled at the Frost



Road approach. There would be approximately 650-feet between the NM 536 and Frost Road intersections

Meets Purpose and Need

The Split Intersection Alternative with High-T partially meets the project purpose and need statement. With the proposed intersection alternative:

- Traffic operations will be improved from the existing and 2040 conditions.
- Driver expectation issues are addressed by clarifying the intersection decision making location
- The spacing between intersections, though improved, will not meet the NMDOT SAMM criteria
- Multi-modal facilities can be accommodated to meet current design standards.

Traffic Operations

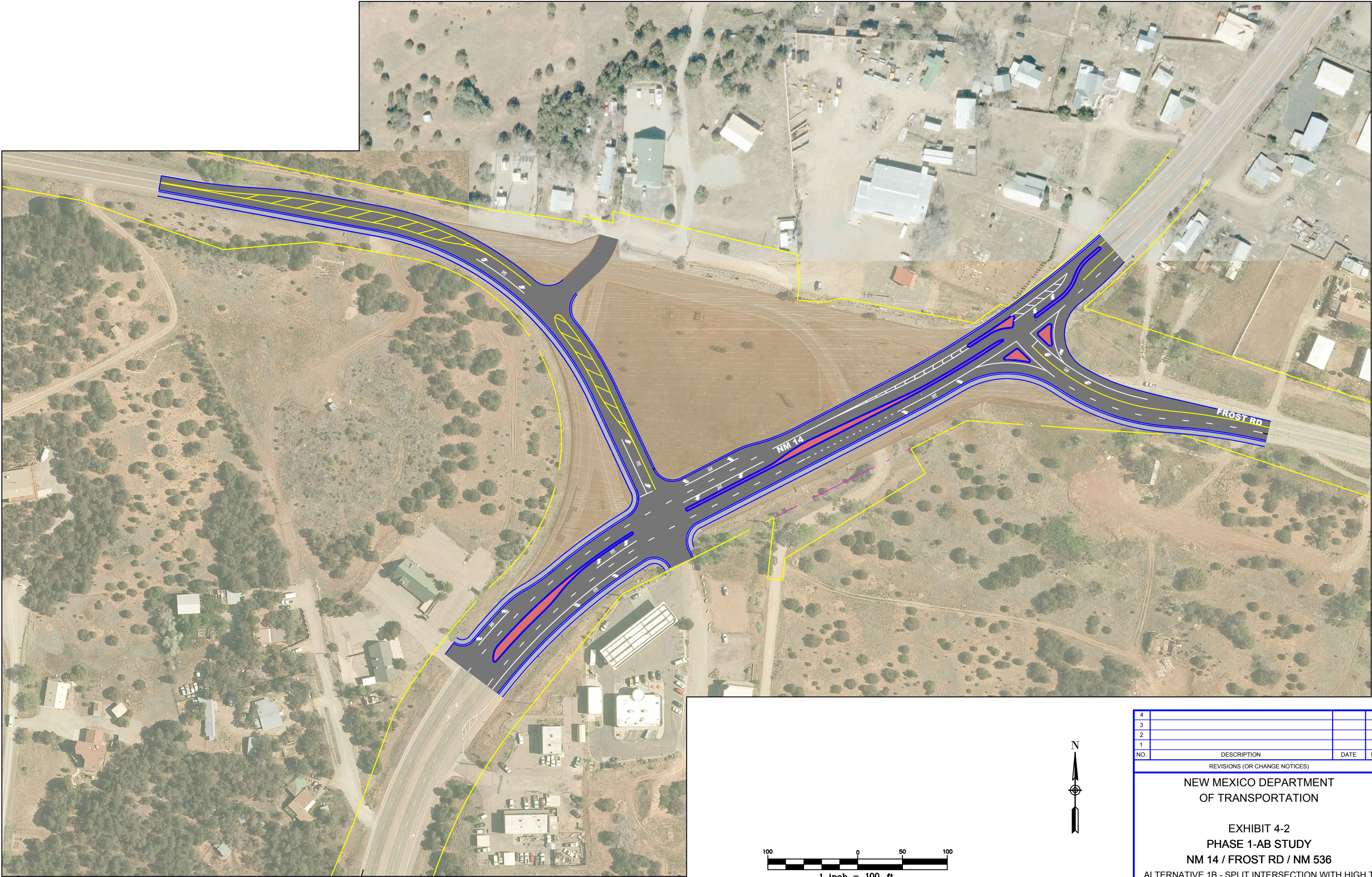
Future travel demand necessitates change to achieve acceptable operations within the study area. Operational performance will continue to degrade over time as regional development occurs without improvements. The average delays and LOS for the split intersections at NM 536 and Frost Road are shown in the table below for the Split Intersection with High-T alternative. The intersection output reports are provided in [Appendix S](#).

Table 4-4: Intersection Operations Summary – Existing Volumes Split Intersection with High-T

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536</i>						
Northbound Left	8.4	0.04	A	8.3	0.07	A
Southbound Left	7.8	0.02	A	8.3	0.02	A
Eastbound Left	18.2	0.06	C	20.3	0.06	C
Eastbound Thru/Right	10.8	0.06	B	11.2	0.07	B
Westbound Left/Thru/Right	13.1	0.10	B	19.8	0.20	C
<i>NM 14/Frost Road</i>						
Southbound Left	8.0	0.05	A	8.8	0.14	A
Westbound Left	13.5	0.31	B	15.9	0.23	C

Table 4-5: Intersection Operations Summary – 2040 Volumes Split Intersection with High-T

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536</i>						
Northbound Left	10.6	0.13	B	9.1	0.10	A
Southbound Left	7.6	0.02	A	8.2	0.03	A
Eastbound Left	38.9	0.09	E	43.2	0.41	E
Eastbound Thru/Right	16.3	0.24	C	13.6	0.17	B
Westbound Left/Thru/Right	31.6	0.29	D	22.9	0.25	C
<i>NM 14/Frost Road</i>						
Southbound Left	8.0	0.08	A	9.4	0.17	A
Westbound Left	23.0	0.68	C	30.7	0.55	D



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY

REVISIONS (OR CHANGE NOTICES)

NEW MEXICO DEPARTMENT
OF TRANSPORTATION

EXHIBIT 4-2
PHASE 1-AB STUDY
NM 14 / FROST RD / NM 536
ALTERNATIVE 1B - SPLIT INTERSECTION WITH HIGH T



Notable operational conditions and observations for the Split Intersection with High-T alternative for the existing and 2040 scenarios include the following:

- All operations function at acceptable level of service during AM and PM peak hours in existing conditions.
- In 2040, there are failures for the eastbound and westbound movement at the NM 14 and NM 536 intersection approaches. Each of these movements are low volume.
- In 2040, the westbound left-turn movement at the NM 14/Frost Road intersection fails in the PM Peak hour. Frost Road is a high-volume approach making this failure significant.

The NM 14/Frost Road intersection does not meet the Peak Hour signalization warrant (**Appendix T**) as a High-T intersection and therefore was not evaluated as such.

Safety

Safety benefits of this alternative include:

- Improved driver expectation for where decision points occur.
- Reduced number of conflict points for turning vehicles.

The Split Intersection with High-T alternative improves driver expectation by reducing the number of intersections. The existing intersection is spread over the length of approximately 865-feet with five intersection access points. By consolidating these points of access to two, driver will more clearly understand where to access NM 536 and where to access Frost Road. Alleviating driver confusion over where to access either roadway will improve safety through the corridor.

A second byproduct of reducing the number of intersections to two is that it reduces the number of conflict points from 39 with the existing configuration to 28 conflict points with the split intersection with one of the intersections being a High-T. Fewer conflict points should result in a safer intersection.

One limitation of the High-T intersection will be the need for a weave movement southbound between Frost Road and NM 536. This weave is the result of the exclusive protected westbound to southbound left-turn lane. The weave will occur when traffic southbound on NM 14 weaves to the inside lane to turn into the Shell Gas Station development at the NM 536 intersection or traffic from Frost Road seeks to get to the outside lane on NM 14 to turn onto NM 536. The SAMM recommends an acceleration length of 380-feet for a posted speed limit of 45mph. That would leave 485-feet of weave distance for this movement that also would necessitate deceleration that the SAMM recommends at 400-feet. That leaves approximately 85-feet for queuing and decision making along southbound NM 14 based on SAMM criteria.

Constructability

The Split Intersection with High-T alternative would require construction that impacts all three roadways of the intersection like Alternative 1A.

Improvements on NM 14 would largely be straight forward. It is anticipated that full reconstruction of the corridor would be completed to address the deteriorating pavement in the study area. Reconstruction of the medians would be needed to modify access. It is anticipated that these improvements can be made within the existing roadway prism



through internal and external lane closures. Maintaining full access, though single lane in each direction, should be feasible during construction, though special consideration would need to be made during the construction of the central portion of the NM 14/Frost Road intersection due to the High-T configuration. Any drainage or pedestrian improvements could be made with simple lane closures to NM 14.

Improvements to NM 536 should be easily accommodated due to the multiple existing access points to NM 14 that currently exist. The new alignment for NM 536 could be constructed while detour traffic is moved to one of the other existing approaches of NM 536 that intersect NM 14.

Improvements to Frost Road would require widening and general reconstruction while maintaining the current roadway alignment. There is adequate width to maintain a single lane in each direction along Frost Road during construction though this will limit the capacity of Frost Road which already has capacity concerns during the peak periods.

Right of Way Needs

There would be no right-of-way impacts with this alternative.

Driveway Access

The Split Intersection with High-T alternative layout results in two unsignalized intersections: NM 14/NM 536 and NM 14/Frost Rd. The proposed spacing along NM 14 between the intersections is 655-feet which does not meet the criteria established by SAMM. However, the number of intersections within the study area is reduced, resulting in an overall improved condition.

Multi-Modal Facilities

Existing multi-modal facilities will benefit from the proposed roadway improvements of this alternative. The improvements would result in a multi-use trail with an improved paved surface and compliance with ADA and PROWAG guidelines. In addition, bike lanes or widened shoulders could be added to NM 14 through the intersection to better accommodate the heavy bike traffic that currently utilize the corridor.

Seasonal Maintenance

The Split Intersection with High-T alternative would largely maintain the status quo for the intersection with respect to snow removal. Raised medians along the corridor would remain however there would be a small benefit through the reduction in access points that would result in fewer points for the snow plows to have to negotiate and clear. However, it is anticipated that the High-T configuration at the NM 14/Frost Road intersection would require additional consideration.

Cost

The estimated construction cost of the Split Intersection Alternative with High-T is \$2,600,000.

Environmental

The Split Intersection with High-T alternative would have minimal environmental impacts to habitat and cultural resources. The Split Intersection with High-T alternative would not



disturb any habitat as this alternative is like the existing intersection configuration. The alternative would move Frost Road slightly closer to the church but would have no impact to cultural resources.

The alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan* and would accommodate several scenic byway design treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

4.3.4 Alternative 2: South Realignment

The South Realignment alternative would combine the western NM 536 approach to the eastern Frost Road approach to intersect NM 14 at one intersection. Frost Road would be realigned to the south approximately 250-feet south of the existing NM 14/Frost Road intersection. Sandia Crest Road would be realigned to the alignment near the north-to-west approach.

Meets Purpose and Need

The South Realignment Alternative partially meets the project purpose and need statement. With the proposed intersection alternative:

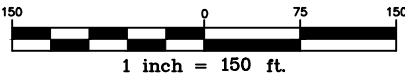
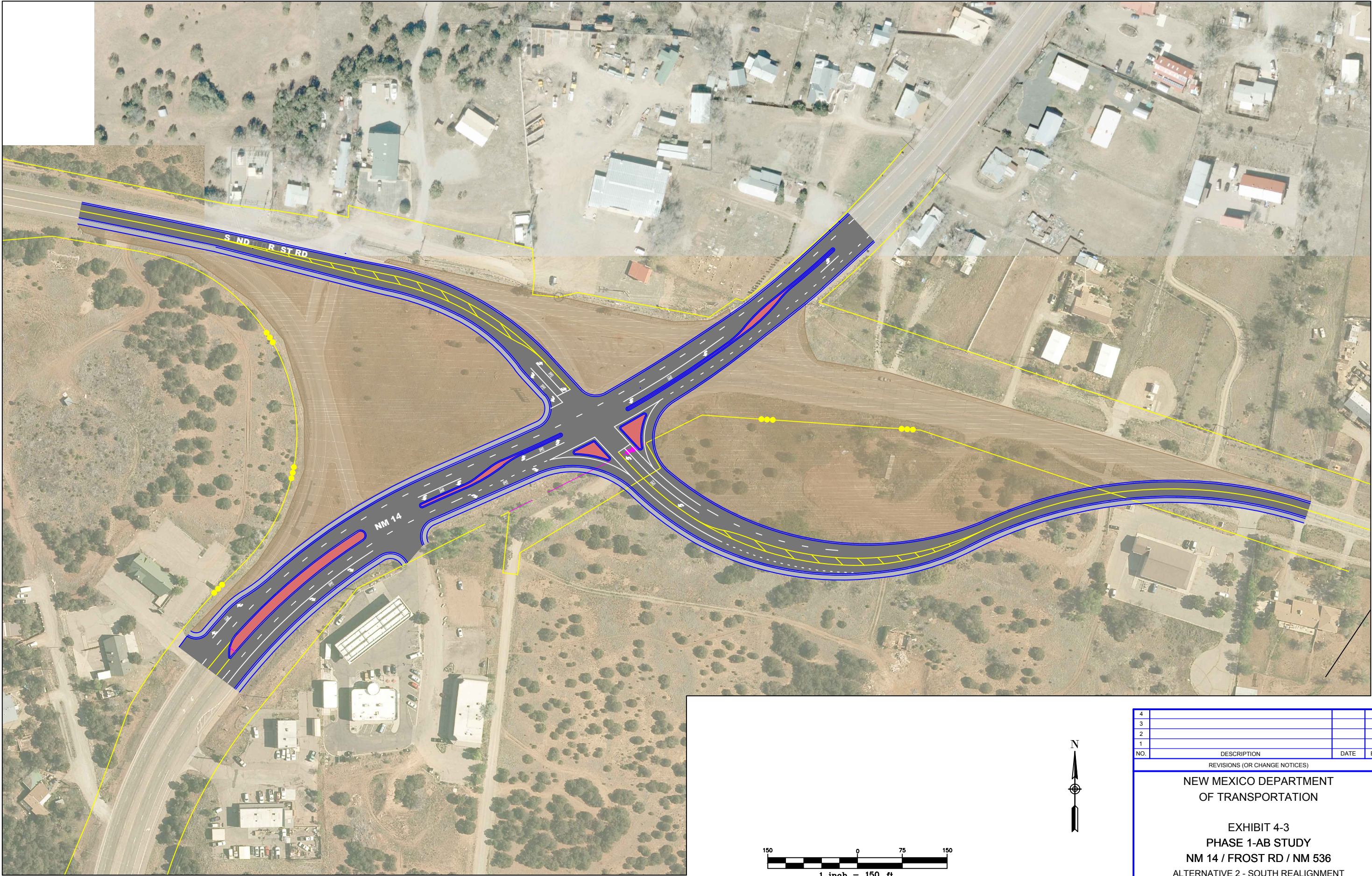
- Traffic operations will not be improved from the existing and 2040 conditions, unless a traffic signal were implemented.
- Driver expectation issues are addressed by clarifying the intersection decision making location
- The spacing between intersections, would meet the NMDOT SAMM criteria
- Multi-modal facilities can be accommodated to meet current design standards.

Traffic Operation

Future travel demand necessitates change to achieve acceptable operations within the study area. Operational performance will continue to degrade over time as regional development occurs without improvements. The average delays and LOS for the combined intersection are shown in the table below for the South Alignment alternative. The intersection output reports are provided in [Appendix U](#).

Table 4-6: Intersection Operations Summary – Existing Volumes South Realignment

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
NM 14/NM 536/Frost Road						
Northbound Left	7.9	0.03	A	8.1	0.06	A
Southbound Left	8.0	0.05	A	8.8	0.14	A
Eastbound Left	24.3	0.08	C	31.6	0.11	D
Eastbound Thru	17.8	0.04	C	31.7	0.08	D
Eastbound Right	9.3	0.04	A	9.3	0.04	A
Westbound Left	26.7	0.53	D	38.7	0.47	E
Westbound Thru	11.6	0.29	B	12.2	0.07	B



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY
REVISIONS (OR CHANGE NOTICES)			
NEW MEXICO DEPARTMENT OF TRANSPORTATION			
EXHIBIT 4-3 PHASE 1-AB STUDY NM 14 / FROST RD / NM 536 ALTERNATIVE 2 - SOUTH REALIGNMENT			



Table 4-7: Intersection Operations Summary – 2040 Volumes South Realignment (Unsignalized)

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536/Frost Road</i>						
Northbound Left	8.9	0.10	A	8.6	0.09	A
Southbound Left	8.0	0.08	A	9.4	0.17	A
Eastbound Left	40.0	0.10	E	429.1	1.43	F
Eastbound Thru	29.7	0.07	D	55.0	0.13	F
Eastbound Right	10.6	0.12	B	10.2	0.09	B
Westbound Left	489.5	1.96	F	420.4	1.66	F
Westbound Thru	12.8	0.14	B	16.8	0.34	C

Notable operational conditions and observations for the South Alignment Alternative for the existing and 2040 scenarios include the following:

- There are operational deficiencies in the AM and PM Peak Hour for the existing condition for the eastbound and westbound movements. The Frost Road volumes are significant.
- There are operational deficiencies in the AM and PM Peak Hour for the 2040 condition for the eastbound and westbound movements. The Frost Road volumes are high volume and the delay is significant. The NM 536 volumes are low but the delay is significant.

The combined intersection meets the Peak Hour signalization warrant ([Appendix V](#)). A summary of the signalized operations of the combined intersection is shown below.

Table 4-8: Intersection Operations Summary – 2040 Volumes South Realignment (Signalized)

Intersection	Northbound		Southbound		Eastbound		Westbound		Overall		
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	Max v/c Ratio	LOS
<i>NM 14/NM536/Frost Road</i>											
AM Peak	16.2	B	18.1	B	3.4	A	9.0	A	13.8	0.56	B
PM Peak	1.1	B	16.1	B	7.9	A	7.6	A	13.0	0.7	B

With a traffic signal, the combined intersection operates at an acceptable level of service for the 2040 scenario.

Safety

Safety benefits of this alternative include:

- Improved driver expectation for where decision points occur.
- Reduced number of conflict points for turning vehicles.

The South Alignment alternative improves driver expectation by reducing the number of intersections. The existing intersection is spread over the length of approximately 865-feet with five intersection access points. By consolidating these points of access to two (the combined intersection and the Shell Gas Station development entrance), driver will more clearly understand where to access NM 536 and Frost Road. Alleviating driver confusion over where to access either roadway will improve safety through the corridor.



A second byproduct of reducing the number of intersections to two is that it reduces the number of conflict points from 39 with the existing configuration to 33 conflict points with the combined intersection.

Constructability

The South Realignment would require construction that impacts all three roadways.

Improvements on NM 14 would largely be straight forward. It is anticipated that full reconstruction of the corridor would be completed to address the deteriorating pavement in the study area. Reconstruction of the medians would be needed to modify access. It is anticipated that these improvements can be made within the existing roadway prism through internal and external lane closures. Maintaining full access, though single lane in each direction, should be feasible during construction. Any drainage or pedestrian improvements could be made with simple lane closures to NM 14.

Improvements to NM 536 should be easily accommodated due to the multiple existing access points to NM 14 that currently exist. The new alignment for NM 536 could be constructed while detour traffic is moved to one of the other existing approaches of NM 536 that intersect NM 14.

Improvements to Frost Road should be accommodated maintaining the existing alignment of Frost Road while constructing the new alignment. The construction of the new approach could largely be accomplished off-line of existing roadway operations. It is anticipated that construction of the new roadway will require up to 15-feet of fill that will be sloped at 3:1 from the shoulders to the existing ground along the new alignment.

Right of Way Needs

There would be a need to acquire right-of-way with the South Alignment alternative. The alternative would result in impacting 3 private parcels and the acquisition of 5-acres of property.

Driveway Access

The South Alignment alternative layout results in two unsignalized intersections: NM 14/Shell Gas Station development and NM 14/NM 536/Frost Road. The proposed spacing along NM 14 between the two intersections is 400-feet which does not meet the criteria established by SAMM. However, the number of intersections within the study area is reduced, resulting in an overall improved condition.

Multi-Modal Facilities

Existing multi-modal facilities will benefit from the proposed roadway improvements of this alternative. The improvements would result in a trail with an improved paved surface and compliance with ADA and PROWAG guidelines. In addition, bike lanes or widened shoulders could be added to NM 14 through the intersection to better accommodate the heavy bike traffic that currently utilize the corridor.

Seasonal Maintenance

The South Alignment alternative would largely maintain the status quo for the intersection with respect to snow removal. Raised medians along the corridor would remain however



there would be a benefit through the reduction in access points that would result in fewer points for the snow plows to have to negotiate and clear.

Cost

The estimated construction cost of the South Alignment Alternative is \$4,100,000.

Environmental

The South Realignment alternative would have some environmental impacts to habitat and cultural resources. The South Realignment alternative would reclaim 4.5 acres of habitat on the west side of the intersection and would impact 6.8 acres of habitat along the new Frost Road alignment. The South Realignment alternative would move the intersection further from the church.

The South Realignment alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan* and would accommodate several scenic byway design treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

4.3.5 Alternative 3: North Realignment

The North Realignment alternative would combine the western NM 536 approach to the eastern Frost Road approach to intersect NM 14 at one intersection. NM 536 would be realigned to the north to intersect the NM 14/Frost Road intersection.

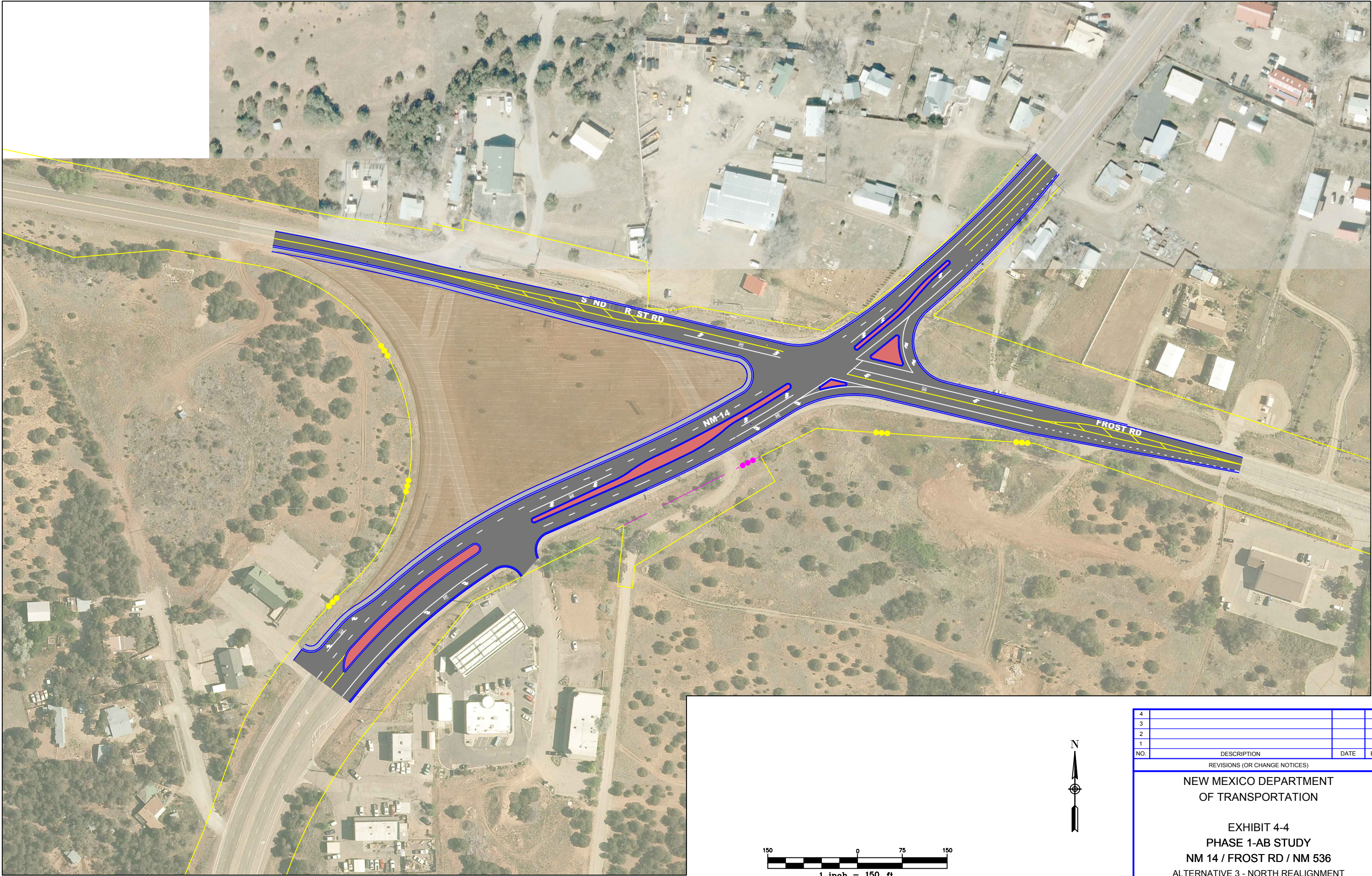
Meets Purpose and Need

The North Realignment Alternative partially meets the project purpose and need statement. With the proposed intersection alternative:

- Traffic operations will not be improved from the existing and 2040 conditions, unless a traffic signal were implemented.
- Driver expectation issues are addressed by clarifying the intersection decision making location
- The spacing between intersections, though improved, will not meet the NMDOT SAMM criteria
- Multi-modal facilities can be accommodated to meet current design standards.

Traffic Operations

Future travel demand necessitates change to achieve acceptable operations within the study area. Operational performance will continue to degrade over time as regional development occurs without improvements. The average delays and LOS for the combined intersection are shown in the table below for the North Alignment alternative. The intersection output reports are provided in [Appendix U](#).



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY

REVISIONS (OR CHANGE NOTICES)			
NEW MEXICO DEPARTMENT OF TRANSPORTATION			
EXHIBIT 4-4			
PHASE 1-AB STUDY			
NM 14 / FROST RD / NM 536			
ALTERNATIVE 3 - NORTH REALIGNMENT			



Table 4-9: Intersection Operations Summary – Existing Volumes North Realignment

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536/Frost Road</i>						
Northbound Left	7.9	0.03	A	8.1	0.06	A
Southbound Left	8.0	0.05	A	8.8	0.14	A
Eastbound Left	24.3	0.08	C	31.6	0.11	D
Eastbound Thru	17.8	0.04	C	31.7	0.08	D
Eastbound Right	9.3	0.04	A	9.3	0.04	A
Westbound Left	26.7	0.53	D	38.7	0.47	E
Westbound Thru	11.6	0.29	B	12.2	0.07	B

Table 4-10: Intersection Operations Summary – 2040 Volumes North Realignment (Unsignalized)

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (sec/veh)	v/c Ratio	LOS	Delay (sec/veh)	v/c Ratio	LOS
<i>NM 14/NM 536/Frost Road</i>						
Northbound Left	8.9	0.10	A	8.6	0.09	A
Southbound Left	8.0	0.08	A	9.4	0.17	A
Eastbound Left	40.0	0.10	E	429.1	1.43	F
Eastbound Thru	29.7	0.07	D	55.0	0.13	F
Eastbound Right	10.6	0.12	B	10.2	0.09	B
Westbound Left	489.5	1.96	F	420.4	1.66	F
Westbound Thru	12.8	0.14	B	16.8	0.34	C

Notable operational conditions and observations for the North Alignment Alternative for the existing and 2040 scenarios include the following:

- There are operational deficiencies in the AM and PM Peak Hour for the existing condition for the eastbound and westbound movements. The Frost Road volumes are significant.
- There are operational deficiencies in the AM and PM Peak Hour for the 2040 condition for the eastbound and westbound movements. The Frost Road volumes are high volume and the delay is significant. The NM 536 volumes are low but the delay is significant.

The combined intersection meets the Peak Hour signalization warrant (**Appendix V**). A summary of the signalized operations of the combined intersection is shown below.

Table 4-11: Intersection Operations Summary – 2040 Volumes North Realignment (Signalized)

Intersection	Northbound		Southbound		Eastbound		Westbound		Overall		
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	Max v/c Ratio	LOS
<i>NM 14/NM536/Frost Road</i>											
AM Peak	16.2	B	18.1	B	3.4	A	9.0	A	13.8	0.56	B
PM Peak	1.1	B	16.1	B	7.9	A	7.6	A	13.0	0.7	B

With a traffic signal, the combined intersection operates at an acceptable level of service for the 2040 scenario.

Safety



Safety benefits of this alternative include:

- Improved driver expectation for where decision points occur.
- Reduced number of conflict points for turning vehicles.

The North Alignment alternative improves driver expectation by reducing the number of intersections. The existing intersection is spread over the length of approximately 865-feet with five intersection access points. By consolidating these points of access to two (the combined intersection and the Shell Gas Station development entrance), driver will more clearly understand where to access NM 536 and Frost Road. Alleviating driver confusion over where to access either roadway will improve safety through the corridor.

A second byproduct of reducing the number of intersections to two is that it reduces the number of conflict points from 39 with the existing configuration to 33 conflict points with the combined intersection.

Special consideration will need to be given to the NM 536 approach to the intersection. Sight distance will be limited for southbound traffic coming around the horizontal curve in addition to the guardrail and chain link fence obstructions in the northwest quadrant of the intersection. The approach can be moved slightly to the south to better accommodate visibility for vehicles.

Constructability

The North Realignment would require construction that impacts all three roadways.

Improvements on NM 14 would largely be straight forward. It is anticipated that full reconstruction of the corridor would be completed to address the deteriorating pavement in the study area. Reconstruction of the medians would be needed to modify access. It is anticipated that these improvements can be made within the existing roadway prism through internal and external lane closures. Maintaining full access, though single lane in each direction, should be feasible during construction. Any drainage or pedestrian improvements could be made with simple lane closures to NM 14.

Improvements to NM 536 should be easily accommodated due to the multiple existing access points to NM 14 that currently exist. The new alignment for NM 536 could be constructed while detour traffic is moved to one of the other existing approaches of NM 536 that intersect NM 14.

Improvements to Frost Road would require widening and general reconstruction while maintaining the current roadway alignment. There is adequate width to maintain a single lane in each direction along Frost Road during construction though this will limit the capacity of Frost Road which already has capacity concerns during the peak periods.

Right of Way Needs

There would be no right-of-way impacts with this alternative.

Driveway Access

The North Alignment alternative layout results in two unsignalized intersections: NM 14/Shell Gas Station development and NM 14/NM 536/Frost Road. The proposed spacing along NM 14 between the intersections is 655-feet which does not meet the criteria



established by SAMM. However, the number of intersections within the study area is reduced, resulting in an overall improved condition.

Multi-Modal Facilities

Existing multi-modal facilities will benefit from the proposed roadway improvements of this alternative. The improvements would result in a trail with an improved paved surface and compliance with ADA and PROWAG guidelines. In addition, bike lanes or widened shoulders could be added to NM 14 through the intersection to better accommodate the heavy bike traffic that currently utilize the corridor.

Seasonal Maintenance

The North Alignment alternative would largely maintain the status quo for the intersection with respect to snow removal. Raised medians along the corridor would remain however there would be a small benefit through the reduction in access points that would result in fewer points for the snow plows to have to negotiate and clear.

Cost

The estimated construction cost of the North Alignment Alternative is \$3,100,000.

Environmental

The North Realignment alternative would have no environmental impacts to habitat and cultural resources. The North Realignment alternative would reclaim 4.9 acres of habitat on the west side of the intersection. The North Realignment alternative is the closest to the existing intersection and would have no impact on the church.

The North Realignment alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan* and would accommodate several scenic byway design treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

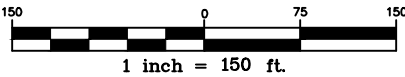
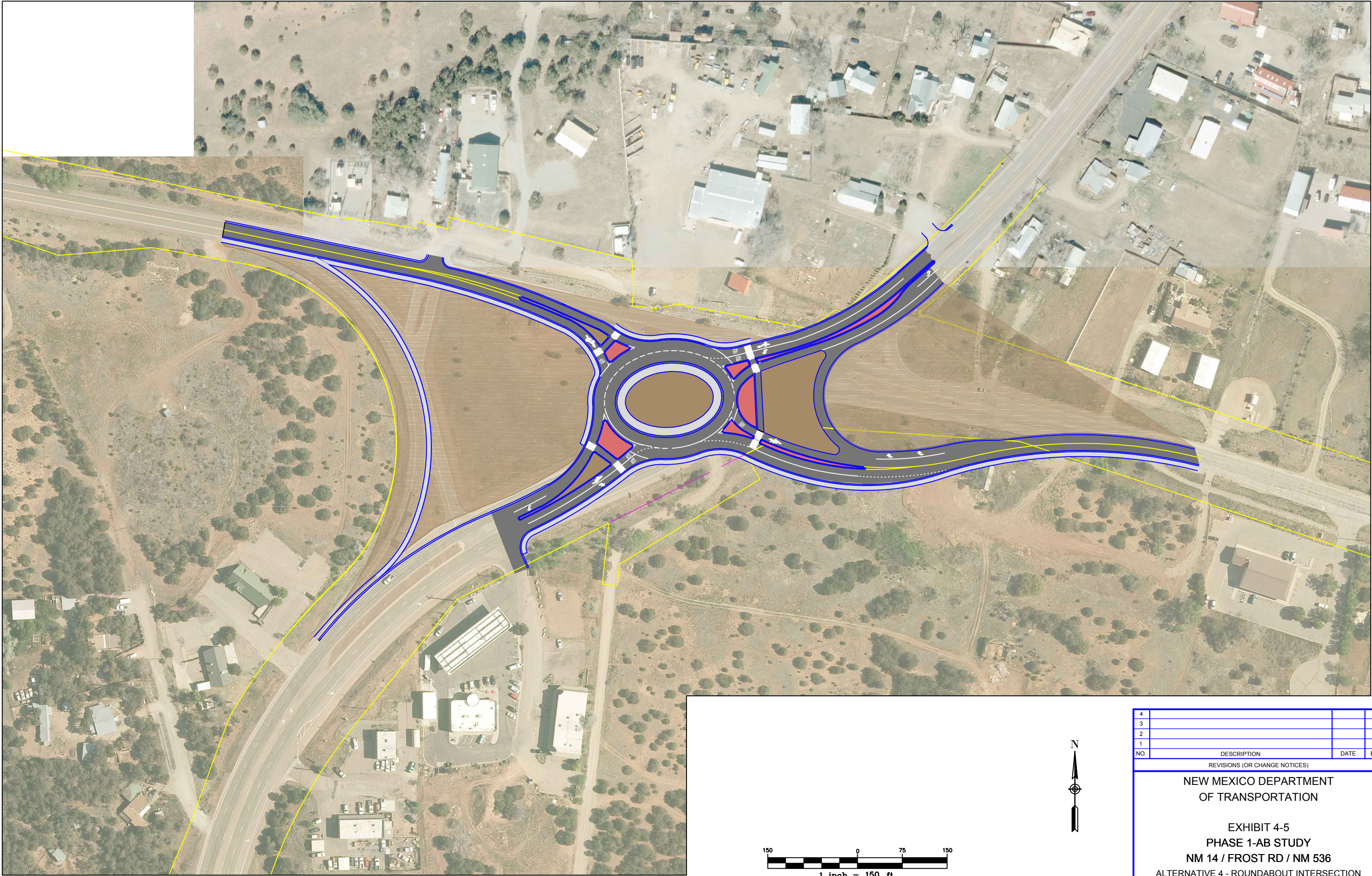
4.3.6 Alternative 4: Roundabout Intersection

The Roundabout Intersection alternative would combine the western NM 536 approach to the eastern Frost Road approach in a roundabout intersection. Both NM 536 and Frost Road would be realigned to accommodate the new intersection configuration

Meets Purpose and Need

The Roundabout Alternative partially meets the project purpose and need statement. With the proposed intersection alternative:

- Traffic operations will be improved from the existing and 2040 conditions.
- Driver expectation issues are addressed by clarifying the intersection decision making location
- The spacing between intersections, though improved, will not meet the NMDOT SAMM criteria
- Multi-modal facilities can be accommodated to meet current design standards.



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY

REVISIONS (OR CHANGE NOTICES)

NEW MEXICO DEPARTMENT
OF TRANSPORTATION

EXHIBIT 4-5
PHASE 1-AB STUDY
NM 14 / FROST RD / NM 536
ALTERNATIVE 4 - ROUNDABOUT INTERSECTION



Traffic Operations

Future travel demand necessitates change to achieve acceptable operations within the study area. Operational performance will continue to degrade over time as regional development occurs without improvements. The average delays and LOS for the roundabout intersection are shown in the table below for the Roundabout alternative. The intersection output reports are provided in [Appendix W](#).

Table 4-12: Intersection Operations Summary – Existing Volumes Roundabout

Intersection	Northbound		Southbound		Eastbound		Westbound		Overall	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
NM 14/NM 536/Frost Road										
AM Peak	7.1	A	3.8	A	6.1	A	8.1	A	5.9	A
PM Peak	10.5	B	6.5	A	13.7	B	11.3	B	11.7	B

Table 4-13: Intersection Operations Summary – 2040 Volumes Roundabout

Intersection	Northbound		Southbound		Eastbound		Westbound		Overall	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
NM 14/NM 536/Frost Road										
AM Peak	8.9	A	6.3	A	4.7	A	12.7	B	8.6	A
PM Peak	7.6	A	3.7	A	9.3	A	7.3	A	7.4	A

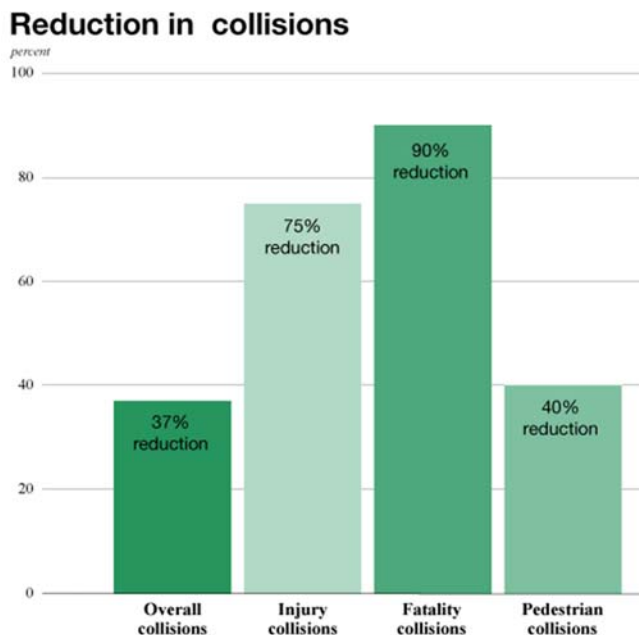
With a roundabout, the combined intersection operates at an acceptable level of service for the existing and 2040 scenario

Safety

Studies have shown that roundabouts are safer than traditional stop sign or signal-controlled intersections. Roundabouts reduced injury crashes by 75 percent at intersections where stop signs or signals were previously used for traffic control, according to a study by the Insurance Institute for Highway Safety (IIHS). Studies by the IIHS and Federal Highway Administration have shown that roundabouts achieve reductions in collisions as summarized in the following figure.



Figure 4-6: Roundabout Crash Reduction Summary



Source: Federal Highway Administration and Insurance Institute for Highway Safety (FHWA and IIHS)

There are several reasons why roundabouts help reduce the likelihood and severity of collisions:

- **Low travel speeds** – Drivers must slow down and yield to traffic before entering a roundabout. Speeds in the roundabout are typically between 15 and 20 miles per hour. The few collisions that occur in roundabouts are typically minor and cause few injuries since they occur at such low speeds.
- **No light to beat** – Roundabouts are designed to promote a continuous, circular flow of traffic. Drivers need only yield to traffic before entering a roundabout; if there is no traffic in the roundabout, drivers are not required to stop. Because traffic is constantly flowing through the intersection, drivers don't have the incentive to speed up to try and "beat the light," like they might at a traditional intersection.
- **One-way travel** – Roads entering a roundabout are gently curved to direct drivers into the intersection and help them travel counterclockwise around the roundabout. The curved roads and one-way travel around the roundabout eliminate the possibility for T-bone and head-on collisions.

The Roundabout Intersection alternative improves driver expectation by reducing the number of intersections. The existing intersection is spread over the length of approximately 865-feet with five intersection access points. By consolidating these points of access to two (the roundabout intersection and the Shell Gas Station development entrance), driver will more clearly understand where to access NM 536 and Frost Road. Alleviating driver confusion over where to access either roadway will improve safety through the corridor.

A second byproduct of reducing the number of intersections to two is that it reduces the number of conflict points from 39 with the existing configuration to 28 conflict points with the roundabout intersection.



Constructability

The Roundabout Intersection would require the most significant reconstruction of the study area impacting all three roadways. The roundabout will need to be constructed along the existing NM 14 alignment.

During construction the bulk of the roundabout can be constructed to the west of the existing NM 14 alignment while maintaining the two eastern lanes of NM 14. During construction, NM 14 would need to be reduced to one lane in each direction on these lanes as the roundabout is constructed to the west. Once the western portion of the roundabout is complete, NM 14 traffic can be moved to the western side of the roundabout (single lane in each direction) while the eastern side is completed.

Improvements to NM 536 should be accommodated with temporary widening of the east-to-south leg of NM 536. The leg would need to be widened to accommodate two-way traffic and would operate for the duration of construction. The new NM 536 leg of the roundabout could be constructed offline not impacting operations of the temporary two-lane NM 536 to the south.

Improvements to Frost Road should be accommodated maintaining the existing alignment of Frost Road while constructing the new alignment into the intersection. The existing NM 14/Frost Road intersection is largely north of the new roundabout. Frost Road could intersect the eastern two-legs of NM 14 during construction maintaining operations of the intersection. The new Frost Road leg of the roundabout could be constructed offline not impacting operations of the existing two-lane Frost Road to the north.

Right of Way Needs

There would be a need to acquire right-of-way with the Roundabout Intersection alternative. The alternative would result in impacting 2 private parcels and the acquisition of 1.2-acres of property.

Driveway Access

The Roundabout alternative layout results in two unsignalized intersections: NM 14/Shell Gas Station development and NM 14/NM 536/Frost Road roundabout. The proposed spacing along NM 14 between the two intersections is 350-feet which does not meet the criteria established by SAMM. However, the number of intersections within the study area is reduced, resulting in an overall improved condition.

Multi-Modal Facilities

Existing multi-modal facilities will benefit from the proposed roadway improvements of this alternative. The improvements would result in a trail with an improved paved surface and compliance with ADA and PROWAG guidelines. In addition, the roundabout is designed to accommodate bicycle traffic both within the roundabout as well as around it. Widened shoulders through the rest of the study area could be added to NM 14 to better accommodate the heavy bike traffic that currently utilize the corridor.

Seasonal Maintenance

A number of communities in snowy areas have installed roundabouts, including Howard, Wisconsin; Montpelier, Vermont; and Vail, Colorado. Maintenance crews from these



communities have indicated that while there is some initial adjustment in procedures for snowplow crews, roundabouts generally present no major problems for snow removal. For example, one truck will start on the truck apron and plow around the roundabout to the outside, while another truck will plow each entry and exit, pushing the snow to the outside. Roundabouts make it easier to turn snowplows as well.

Cost

The estimated construction cost of the Roundabout Alternative is \$2,900,000.

Environmental

The Roundabout Intersection alternative would have some environmental impacts to habitat and cultural resources. The Roundabout Intersection alternative would reclaim 4.5 acres of habitat on the west side of the intersection and impact 2.1 acres of habitat on the new Frost Road alignment. The alternative would be the most substantial change to the current condition and impact the geographical context of the church.

The Roundabout Intersection alternative would be consistent with maintaining the rural character of the area in accordance with the *Futures 2040 Metropolitan Transportation Plan* and would accommodate several scenic byway design treatments in accordance with *Context-Sensitive Design Approach for Scenic Byways in New Mexico*.

4.4 Summary of Screening Evaluation

The findings of the analysis are summarized in the matrix in the following table. Findings were color coded to indicate the practicality and feasibility of the alternatives relative to the evaluation factors.

- ↑ - an advantage relative to the other alternatives
- ⬆ - an advantage relative to the other alternatives with minor issues
- ↓ - an issue that could be unfavorable relative to other alternatives and would need to be evaluated further
- ↓ - negative finding that indicates the alternative would need to be further evaluated

Table 4-14: Alternative Matrix

Evaluation Criteria	No Build	Alternative 1		Alternative 2	Alternative 3	Alternative 4
Criteria		Split Intersection	Split Intersection with High T	South Realignment	North Realignment	Roundabout
Consistency with Purpose and Need	↓ • Does not meet Purpose and Need	↑ • Meets Purpose and Need to some degree	↑ • Meets Purpose and Need to some degree	↑ • Meets Purpose and Need to some degree	↑ • Meets Purpose and Need to some degree	↑ • Meets Purpose and Need to some degree
Traffic Impacts During Construction	↑ • Maintenance of existing facility	↓ • Lane closures and mobile operations for NM 14 and Frost Road • Frost Road capacity will be limited • Utilization of corridors proposed to be closed on NM 536	↓ • Lane closures and mobile operations for NM 14 and Frost Road • Frost Road capacity will be limited • Utilization of corridors proposed to be closed on NM 536	↓ • Lane closures and mobile operations for NM 14 • Utilization of corridors proposed to be closed on NM 536 • New approach on Frost Road can be built off-line	↓ • Lane closures and mobile operations for NM 14 and Frost Road • Frost Road capacity will be limited • Utilization of corridors proposed to be closed on NM 536	↓ • Significant roadway reconstruction required • Lane closures and mobile operations for NM 14 • Temporary widening required for NM 536 • New approach on Frost Road can be built off-line
Right-of-Way	↑ • No right-of-way needs	↑ • No right-of-way needs	↑ • No right-of-way needs	↓ • Require 5 acres of right-of-way • Impacts to 3 private parcels	↑ • No right-of-way needs	↓ • Require 1.2 acres of right-of-way • Impacts to 2 private parcels
Traffic Operations	↓ • Overall acceptable operations, but failures on NM 536 and Frost Road	↑ • Improved traffic flow/operations • Overall acceptable operations in existing conditions • Failures on NM 536 and Frost Road in 2040 conditions • Signal is warranted for future volumes	↑ • Improved traffic flow/operations • Overall acceptable operations in existing conditions • Failures on NM 536 and Frost Road in 2040 conditions	↑ • Operation deficiencies in existing and 2040 conditions • Signal is warranted for current and future volumes	↑ • Operation deficiencies in existing and 2040 conditions • Signal is warranted for current and future volumes	↑ • Overall acceptable operations in existing and 2040 conditions
Cost	↑ • No construction cost, just maintenance of infrastructure	↓ • \$ 2,700,000	↓ • \$ 2,600,000	↓ • \$ 4,100,000	↓ • \$ 3,100,00	↓ • \$ 2,900,000
Environmental: Plans	↓ • Consistent w/ Rural Character • No Byway treatments	↑ • Consistent w/ Rural Character • Accommodates several Byway treatments	↑ • Consistent w/ Rural Character • Accommodates several Byway treatments	↑ • Consistent w/ Rural Character • Accommodates several Byway treatments	↑ • Consistent w/ Rural Character • Accommodates several Byway treatments	↑ • Balances Growth w/ Rural Character • Accommodates <u>all</u> Byway treatments
Habitat	• No change to existing	↑ • Minimal change from existing	↑ • Minimal change from existing	↓ • Reclaim 4.5 acres on west side of intersection • Impacts 6.8 acres along new Frost Road alignment	↑ • Reclaim 4.9 acres on west side of intersection	↑ • Reclaim 4.5 acres on west side of intersection • Impact 2.1 acres on new Frost Road alignment
Cultural/4(f)	↑ • No change to existing	↓ • Moves Frost Rd. closer to the church	↓ • Moves Frost Rd. closer to the church	↑ • Moves intersection further from church	↑ • Closest to existing condition	↓ • Substantial change from existing condition
Drainage and Floodplains	↓ • Will not address minor drainage deficiencies	↑ • Will accommodate needed drainage improvements	↑ • Will accommodate needed drainage improvements	↑ • Will accommodate needed drainage improvements	↑ • Will accommodate needed drainage improvements	↑ • Will accommodate needed drainage improvements
Utilities	↑ • No impact	↓ • Minor utility impacts anticipated	↓ • Minor utility impacts anticipated	↓ • Minor utility impacts anticipated	↓ • Minor utility impacts anticipated	↓ • Minor utility impacts anticipated
Traffic and Safety	↓ • No improvements to safety	↑ • Improved driver expectation • Reduced conflict points	↑ • Improved driver expectation • Reduced conflict points • Short weaving distance	↑ • Improved driver expectation • Fewer conflict points	↑ • Improved driver expectation • Fewer conflict points	↑ • Fewer conflict points • Improved driver expectation • Historically results in significant reduction of collisions • Lowered travel speeds • One-way travel
Multi-Modal Facilities	↓ • No impact to multi-modal facilities	↑ • Improved pavement surface for multi-use trail • Compliance with ADA and PROWAG guidelines • Bicycle route accommodations can be added				
Driveway/Business Access	↓ • <u>All</u> access maintained but it doesn't meet SAMM	↑ • <u>All</u> access maintained on NM 14 but doesn't meet SAMM • Reduced number of intersections • Driveway access required to be reestablished on NM 536 and Frost Road	↑ • <u>All</u> access maintained on NM 14 but doesn't meet SAMM • Reduced number of intersections • Driveway access required to be reestablished on NM 536 and Frost Road	↑ • <u>All</u> access maintained on NM 14 but doesn't meet SAMM • Reduced number of intersections • Driveway access required to be reestablished on NM 536 and Frost Road	↑ • <u>All</u> access is maintained but it doesn't meet SAMM • Reduced number of intersections	↑ • Significant impacts to access • Driveways required to be reestablished on all corridors • Resulting intersections do not meet SAMM • Reduced number of intersections
Seasonal Maintenance	↓ • No improvements, median makes snow removal difficult	↓ • Raised medians still utilized • Reduced points for snow plows to negotiate/clear	↓ • Raised medians still utilized • Reduced points for snow plows to negotiate/clear • High-T layout may cause additional maintenance concerns	↓ • Raised medians still utilized • Reduced points for snow plows to negotiate/clear	↓ • Raised medians still utilized • Reduced points for snow plows to negotiate/clear	↓ • Maintenance crews indicate no major problems, though there are still raised medians
Public and Stakeholder Support	↓ • Opposition on current intersection • Support on intersection improvements	↑ • Support for intersection improvements				
		↑ • Both support and opposition this alternative				



5. CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

This chapter summarizes the conclusions identified in this study and provides recommendations for the *Phase I-C Environmental Documentation and Processing*. The findings of this initial evaluation will be used to identify the types of improvements recommended for the next phase as well as those eliminated from further consideration.

CONCLUSIONS

The NM 14/NM 536/Frost Road intersection is expected to experience regional growth within the next 20 years. The highest priority for the corridor is to provide and maintain relatively smooth traffic flow at the intersection. Secondly, accommodating vehicular and multi-modal access must also be managed to support existing and future development. Access management improvements are needed including clarification of access points and improvement in access spacing to better comply with NMDOT guidelines. The successful development of improvements to address these issues will result in improved safety conditions within the corridor.

Improvements are needed to the corridor to address the following:

- Future operation capacity deficiencies
- Intersection does not meet driver expectation
- Lack of ADA and PROWAG compliance for pedestrian facilities
- Lack of adherence to NMDOT access management guidelines

This study reviewed existing conditions, constraints, and public input to develop a series of alternatives that would attempt to address the project purposes and needs. It is a challenge to balance the needs between accommodating future traffic demands and the desire for the local communities to maintain their identity.

RECOMMENDATIONS

Based on the completed analysis and public outreach conducted for the *Phase I-A/B Evaluation of Alternatives*, an understanding of the issues and constraints at the NM 14/NM 536/Frost Road intersection has been developed. Alternative improvement scenarios were conceptually designed to provide a basis for evaluating the merits, feasibility and impacts as well as to demonstrate the challenges in revamping the NM 14/NM 536/Frost Road intersection. The findings of the evaluations reveal improvement types deserving further evaluation as well as those that should be eliminated.

Alternatives Eliminated from Further Consideration

The following concepts were eliminated from further consideration based on the Phase I-A/B evaluations and discussions at Study Team meetings held for this project:

- *Alternative 1A: Split Intersection* – the intersection configuration would not fully address future congestion issues with considering signalization at NM 14/Frost Road which does not meet the desired context of the community.
- *Alternative 1B: Split Intersection with High-T Intersection* – the intersection improves operations but creates a configuration that includes a weave segment that may not be adequate for southbound traffic.



- *Alternative 2: South Realignment* – the intersection configuration would not fully address future congestion issues with considering signalization at the combined intersection which does not meet the desired context of the community.
- *Alternative 3: North Realignment* – the intersection configuration would not fully address future congestion issues with considering signalization at the combined intersection which does not meet the desired context of the community.

Recommended Alternatives for Phase I-C Environmental Documentation and Processing

The following alternatives are recommended to proceed to the Phase 1-C stage of the project:

- No Build Alternative
- Alternative 4: Roundabout Intersection

As discussed in previous portions of the report, any improvements should also be accompanied by the following:

- Improved access management.
- Improved wayfinding for the intersections within the study area.
- Pedestrian facilities should be upgraded to be brought into compliance with the current PROWAG standards, which the NMDOT has adopted.

These additional considerations can be implemented as standalone projects or can be further evaluated with any of the recommended Build Alternatives during the *Phase I-C Environmental Documentation and Processing*.



Appendices



Appendix A: Statewide Transportation Improvement Plan Project Summary



New Mexico Department of Transportation Statewide Transportation Improvement Plan FFY 2018 - 2023 Amendment 0



PREPARED IN COOPERATION WITH
US DEPARTMENT OF TRANSPORTATION FEDERAL
HIGHWAY ADMINISTRATION FEDERAL TRANSIT
ADMINISTRATION FEDERAL AVIATION
ADMINISTRATION

APPROVED BY
NMDOT/FHWA/FTA
As of September 29, 2017

ONE DOT
Working Better Together

**NEW MEXICO DEPARTMENT OF TRANSPORTATION
STATEWIDE TRANSPORTATION IMPROVEMENT PROGRAM**

CN: A301441 **Plan:** 20182023-WRK-0 **MPO/RPO:** MID-REGION MPO - ID: 99.10 **NMDOT Dist.:** 3 **County:** Bernalillo **Municipality:** Unincorporated Area
Fed/State ID: A301441 **Demo IDs:** **Lead Agency:** **OverSight:** Delegated/State Administrated
RT: NM0014 **Project Location:** NM 14 SLOPE EROSION MITIGATION - FROM NEW TIP DEV. TO NEW TIP DEV **Beg/End Mpst:** 3.500 - 4.200 **Length:** 0.700
Category: Reconstruction- No Added Capacity **PDE:** NMDOT UNASSIGNED PDE **Production Date:**
Project Scope: SLOPE EROSION MITIGATION AND OTHER APPURTENANCES A S NEEDED. **Est. Letting:** 10/01/2022
Proj. Phases: Y Environ. Document Y Prel. Engr. Y Design _ Right-of-way Y Construction _ Other **FHWA Work Zone Type:** Routine
Remarks:
R-17-03.

PROGRAMMED FUNDS								
FUND SOURCE	IMP TYP	2018	2019	2020	2021	2022	2023	TOTALS
State Match		\$0	\$0	\$0	\$0	\$368,662	\$0	\$368,662
STP Flex	04	\$0	\$0	\$0	\$0	\$344,332	\$0	\$344,332
STP Rural Areas With 5k & Under	04	\$0	\$0	\$0	\$0	\$1,819,026	\$0	\$1,819,026
TOTALS:		\$0	\$0	\$0	\$0	\$2,532,020	\$0	\$2,532,020

CN: A301442 **Plan:** 20182023-WRK-0 **MPO/RPO:** MID-REGION MPO - ID: 99.20 **NMDOT Dist.:** 3 **County:** Bernalillo **Municipality:** Unincorporated Area
Fed/State ID: A301442 **Demo IDs:** **Lead Agency:** DISTRICT 3 **OverSight:** Delegated/State Administrated
RT: NM0014 **Project Location:** NM14/NM 536/FROST RD INTERSECTION IMPROVEMENTS - NM 14 / NM 536 / FROST RD INTERSECTION **Beg/End Mpst:** 5.500 - 6.100 **Length:** 0.850
Secondary Location: Route: NM0536 Length: .25 Beg/End Mpst: .000 - .250 **PDE:** NMDOT UNASSIGNED PDE **Production Date:**
Category: Safety **Est. Proj. Cost:** \$2,129,010
Project Scope: INTERSECTION IMPROVEMENTS WITH POSSIBLE RECONFIGURATION TO INCREASE SAFETY AND DECREASE CONFUSION AT INTERSECTION. **Est. Letting:** 03/01/2023
Proj. Phases: Y Environ. Document Y Prel. Engr. Y Design _ Right-of-way Y Construction _ Other **FHWA Work Zone Type:** Regionally Significant
Remarks:
R-17-03.

PROGRAMMED FUNDS								
FUND SOURCE	IMP TYP	2018	2019	2020	2021	2022	2023	TOTALS
State Match		\$0	\$0	\$0	\$0	\$0	\$309,984	\$309,984
STP Rural Areas With 5k & Under	21	\$0	\$0	\$0	\$0	\$0	\$1,819,026	\$1,819,026
TOTALS:		\$0	\$0	\$0	\$0	\$0	\$2,129,010	\$2,129,010



Appendix B: CN A301440 Project Team



Project Team

Leslie Fortier, NMDOT Project Manager
Timothy Brown, NMDOT
Tim Chavez, NMDOT
Gwyneth Duncan, NMDOT
Todd Dunlap, NMDOT
Robert Fine, NMDOT
Abraham Flores, NMDOT
Naomi Gaede, NMDOT
Justin Gibson, NMDOT
Margaret Haynes, NMDOT
Thomas Kratochvil, NMDOT
Sandra Kruzich, NMDOT
Rhonda Lopez, NMDOT
Mary Lovato, NMDOT
Barry Lytle, NMDOT
Jeffrey Mann, NMDOT
Michelle Mann, NMDOT
Jill Mosher, NMDOT
Kenneth Murphy, NMDOT
Patsy Najar, NMDOT

Ronald Noedel, NMDOT
Johnny Perea, NMDOT
Nancy Perea, NMDOT
Ramon Quintana, NMDOT
Charles Remkes, NMDOT
Marc Romer, NMDOT
Blake Roxlau, NMDOT
David Salazar, NMDOT
Dean Serna, NMDOT
Timothy Trujillo, NMDOT

Richard Meadows, Bernalillo County

Marilyn Valdez, FHWA

Paul Steffin, WSP
Danny Sims, WSP
Summer Apodaca, WSP
Dominic Chavez, WSP
Allison Shinn, WSP



Appendix C: CN A301440 Public Involvement Plan

CONTEXT SENSITIVE PUBLIC INVOLVEMENT PLAN

NM 14 FROM I-40 TO NM 536/FROST ROAD

BERNALILLO COUNTY, NM

Project Number: A301440

Control Number: A301440

Prepared for:



Prepared by:



January, 2017

TABLE OF CONTENTS

Table of Contents 2

Introduction 1

Collaboration with the Community 3

Project Background Context 4

 Environmental 4

 Historic 4

 Land Use..... 5

 Transportation..... 5

 Community 6

 Demographics 6

 Community Resources 9

 Planning Documents 9

 Visual 10

 Economic 10

 Public Health..... 12

Modal Considerations and Connectivity 12

 Motorized vehicles 12

 Transit..... 13

 Pedestrian and Bicycle 13

Opportunities to Express Local Values..... 13

Scale the Solution to the Problem 13

The Design Approach 14

 Identifying Stakeholders and the Interested Public 14

 Communication Strategy..... 15

INTRODUCTION

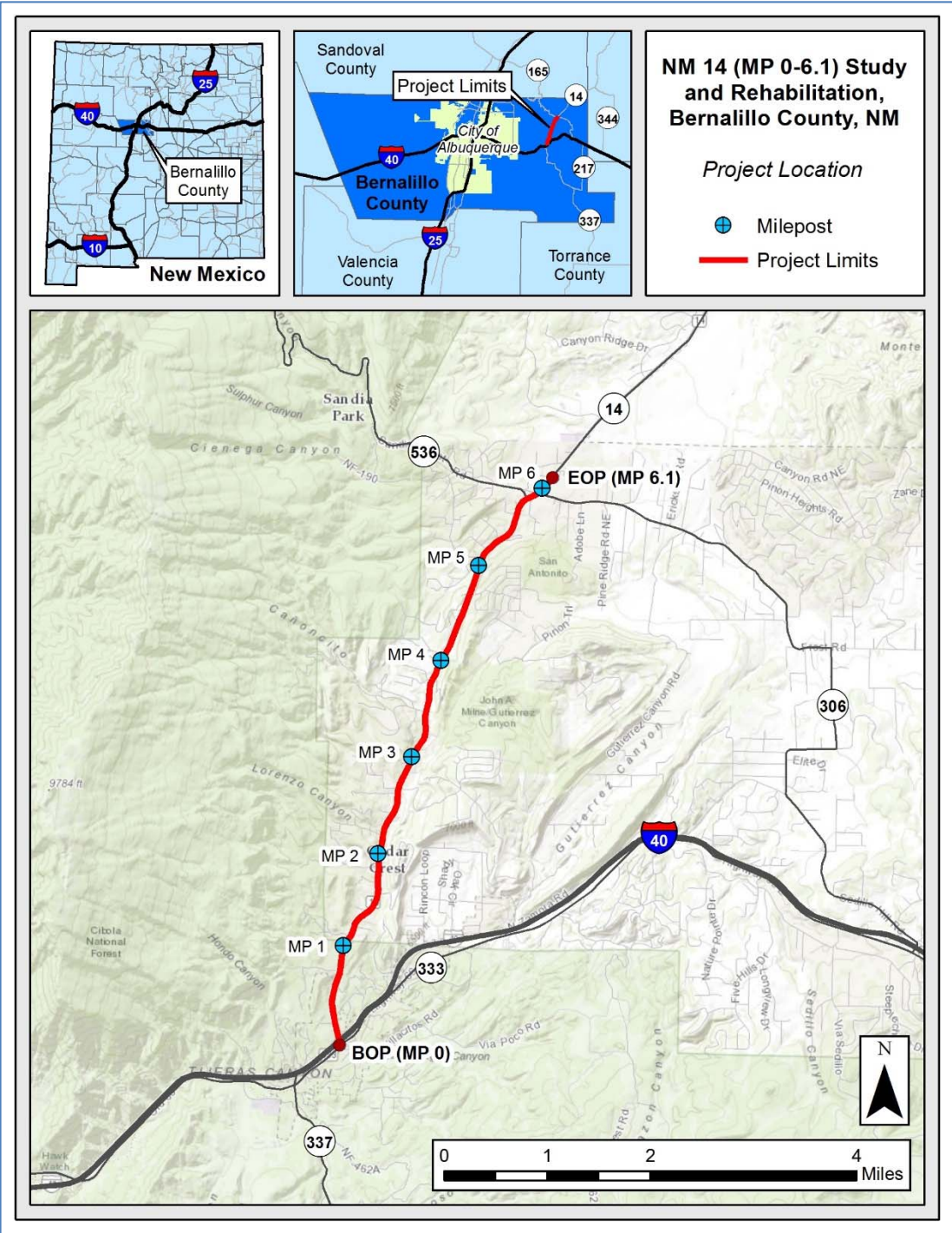
This document is the Context Sensitive Public Involvement Plan (CSPIP) for the New Mexico 14 Project (Project and Control Number A301440). The project, cooperatively sponsored by the Federal Highway Administration (FHWA) and the New Mexico Department of Transportation (NMDOT), is located in Bernalillo County, New Mexico between the intersection with Interstate 40 and NM 536/Frost Road (Milepost 0-6.1) (*Figure 1*).

NM 14 is a minor rural arterial that connects several communities including Tijeras, Cedar Crest, San Antonito, and Sandia Park. Collectively, these and other communities on the east side of the Sandia Mountains are known as the East Mountains. The roadway serves commuters accessing jobs, schools, and services in the Albuquerque, Santa Fe, and Moriarty areas. NM 14 is also traveled by tourists, bicyclists, skiers, hikers, and visitors destined to the recreation areas in the Sandia Mountains and tourist spots along the Turquoise Trail National Scenic Byway. The highway also provides access to several community businesses and services.

The roadway is in need of maintenance and improvements in order to continue to serve these transportation needs. The proposed project would include pavement rehabilitation, evaluation of access to the highway, Americans with Disabilities Act (ADA) and Public Right-of-Way Accessibility Guidelines (PROWAG) improvements, slope stabilization, and intersection improvements. Project CN A301440 addresses each of these issues to varying levels of design and construction as indicated below.

- **Roadway design**—The rehabilitation effort will be limited to the existing roadway prism and will match the current typical section. Preliminary design, final design, and construction are planned for this aspect of CN A301440.
 - **ADA/PROWAG** improvements will be implemented as part of the rehabilitation. The need for improvements is anticipated where curb cuts intersect pedestrian and bicycle facilities.
 - **Access** to the highway will also be addressed with this effort. The rehabilitation project will bring the access into compliance with current standards to the maximum extent possible.
 - **Multiple Phases** will be used to complete the rehabilitation. Phase I will extend from milepost (MP) 0 to MP 2 and Phase II will extend from MP 2 to MP 6.1.

Figure 1: Project Location



- **Slope Stabilization**—Erosion in the area between MP 3.0 and MP 4.2 undermines the right-of-way fence and washes sediment onto the multi-use path and roadway. Preliminary design for mitigation measures will be developed as part of CN A301440. Final design and construction will be scheduled at a later date.
- **NM 14/NM 536/Frost Road Intersection**—The current design of the intersection is atypical and has separate access points for each movement from NM 14 onto NM 536, NM 536 onto NM 14, and Frost Road to NM 536. An alternatives analysis, consisting of a combined Phase A/B study consistent with the NMDOT Location Study Procedures, will be conducted as part of CN A301440. Preliminary design, final design, and construction will be scheduled at a later date

The appropriate level of public participation for each of these elements would vary between basic notification/awareness of the project to more involved stakeholder collaboration. This CSPIP identifies the goals for collaboration with the community, outlines the context for the project area, and describes proposed outreach strategies.

COLLABORATION WITH THE COMMUNITY

The overall engagement goal for the NM 14 Project is to achieve stakeholder participation that results in a safe transportation facility, uses resources efficiently, is consistent with the surrounding environment, and addresses local community and social issues. Given the differing levels of development and implementation for the individual project elements, various levels of stakeholder input will be needed to achieve these engagement goals.

- The **rehabilitation** of the roadway and associated **ADA/PROWAG** improvements do not require an evaluation of alternatives or present opportunities to express local values. Therefore, stakeholder engagement will include informing the public of the project, its construction schedule, and duration.
- Addressing **access** in the corridor will require consultation and involvement with stakeholders to ensure support for the project and any modifications to the current access.
- The need for **erosion control** is readily apparent and the mitigation options are limited to retaining walls. Consequently, consultation with stakeholders will be undertaken to ensure the aesthetics of the mitigation are contextually appropriate.

- The **NM 14/NM 536/Frost Road Intersection** will be evaluated to determine a preferred alternative. As such, public *involvement* will ensure that stakeholder concerns and aspirations are directly reflected in the development and evaluation of alternatives.

Methods for achieving these varying levels of engagement are described below in the Design Approach section of this document.

PROJECT BACKGROUND CONTEXT

This section provides a general context for the area. It covers such topics as the environment, history, land use, transportation, demographics, visual concerns, economic factors, and public health of the area.

ENVIRONMENTAL

NM 14 runs north/south along the east side of the Sandia Mountains. Immediately adjacent to the roadway, much of the project setting consists of developed lands which include commercial and residential uses. To either side of the developed NM 14 strip, and in undeveloped portions of the corridor, is mountainous habitat with a limestone bedrock covered in light red to dark brown silty soil. Vegetation includes piñon, juniper, ponderosa pine, Gamble's oak, prickly pear, cholla, yucca, and grasses. The east/west-oriented Tijeras Canyon is located at the south end of the project area and various smaller canyons and arroyos cross the highway throughout the project area.

According to the US Fish and Wildlife Service's Information for Planning and Conservation (IPaC) website, there is no designated critical habitat for threatened or endangered species within the project area. There are also no known wetlands within the project area. There is however, a substantial amount of nesting habitat for birds protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

HISTORIC

With access to springs, creeks, and other mountain resources, Tijeras Canyon and the east side of the Sandias along the NM 14 corridor was heavily populated by prehistoric Pueblo peoples. The height of prehistoric population occurred between AD 1300 and 1450. This period was marked by a large pueblo near the current Village of Tijeras and smaller pueblo settlements to the north along what is now NM 14. Tijeras Pueblo was abandoned by 1425 while smaller settlements near Cedar Crest were inhabited intermittently until the 1600s. Paa-ko Pueblo, located north of the project area between San Antonito and the Cerrillos Hills, was also occupied during this period (Cordell 1980).

Throughout the 17th and 18th centuries, the area was often used as a campground for bands of Apache who were raiding the Pueblos and Spanish settlements to the west in Albuquerque. In 1763, Tomas Veles Cachupin, the New Mexico Governor, authorized a land grant in Tijeras Canyon for a group called San Miguel de Carnue. The community was regularly attacked by Apaches and was abandon and later destroyed in 1771. Apache activity continued to hinder the development of permanent settlements in the area until 1818 when the Governor awarded two new settlements. One was at the original San Miguel de Carnue site and the other was located to the northeast, within the current project area, just south of present day Cedar Crest (Baxter 1977; Quintana and Kayser 1980).

After New Mexico became part of the United States, courts re-evaluated land grant holdings and the Carnue Land Grant was officially recognized but within a much smaller area. Only the private holdings of the grant, not the communal lands, were recognized. This reduced the land grand from 90,000 acres down to 2,000 acres, centered on the current Village of Carnuel to the south and west of the current project area (Villages of Tijeras and Carnuel 2007).

As the land grant boundaries were being decided in court, small villages began to emerge along the NM 14 project area, including Tijeras, Hobbies, San Antonio, Cedar Crest, Cañoncito, San Antonito, and Sandia Park. These settlements provided opportunities for mining, logging, ranching, and catering to the needs of tuberculosis patients. The National Forest assumed management of much of the area around NM 14 in 1908 and today the only incorporated community is the Village of Tijeras (Smith 2006).

LAND USE

Surrounded by open space managed by City of Albuquerque and the Cibola National Forest, the area is popular with people who enjoy a rural lifestyle but want access to population centers such as Albuquerque and Santa Fe. As a result, consistent growth in the past several years has increased the commercial and industrial uses along and near NM 14 within the project area, although residential land use, areas of undeveloped land, and a rural character still persist.

TRANSPORTATION

The current typical section for NM 14 is a four-lane highway with a two-way center left turn lane. Lanes are 11 feet wide and the two-way left-turn lane is approximately 14 feet wide. There are narrow 2-foot shoulders in each direction at the south end of the corridor with shoulders widening up to 4 feet at the north end. Curb and gutter is present on both sides of the road and there is a multi-use path at the back of the curb along the east side. This typical section remains constant through the project limits

with the exception of the NM 14/NM 536/Frost Road intersection. Pavement throughout the project limits is weathered and exhibits cracking. The existing curb and gutter is also aging and damaged, and in many areas is cracked longitudinally.

There are drop inlets built into the curb throughout the project limits. While the drop inlets are still serve their drainage function, they are weathered and rusted and separating from the curb and gutter. This is especially evident between MP 5 and MP 6, where drop inlets extend out into the travel lanes. In these areas, the grates are also separating from their frames.

Throughout the project limits, there are many driveways and turnouts, with most properties having separate access onto NM 14. Most of these access points are unpermitted based on NMDOT research.

Between approximately MP 3.5 and MP 4.2, the road cuts into the eastern slope. The resulting slope is steep and erodes onto the multi-use path and roadway each time it rains. This erosion has undermined the right-of-way fence and caused maintenance issues in the area.

The NM 14/NM 536/Frost Road intersection is located near MP 6.0. This intersection has an unconventional layout and is the source several complaints from roadway travelers and local residents.

COMMUNITY

The East Mountain communities found in the project area are described below in terms of demographic characteristics, community resources, and various planning documents.

Demographics

Community demographics, such as a high percentage of minority or economically distressed populations, could require special outreach methods. As such, data from the US Census Bureau were reviewed to characterize the economic and demographic make-up of the area (*Table 1*). The project area either runs through or is adjacent to the Village of Tijeras; the Census Designated Places (CDP) of Cedar Crest, Sandia Park, and San Antonito; and five different block groups (BG) (*Figure 2*).

Figure 2: Census Block Group Map

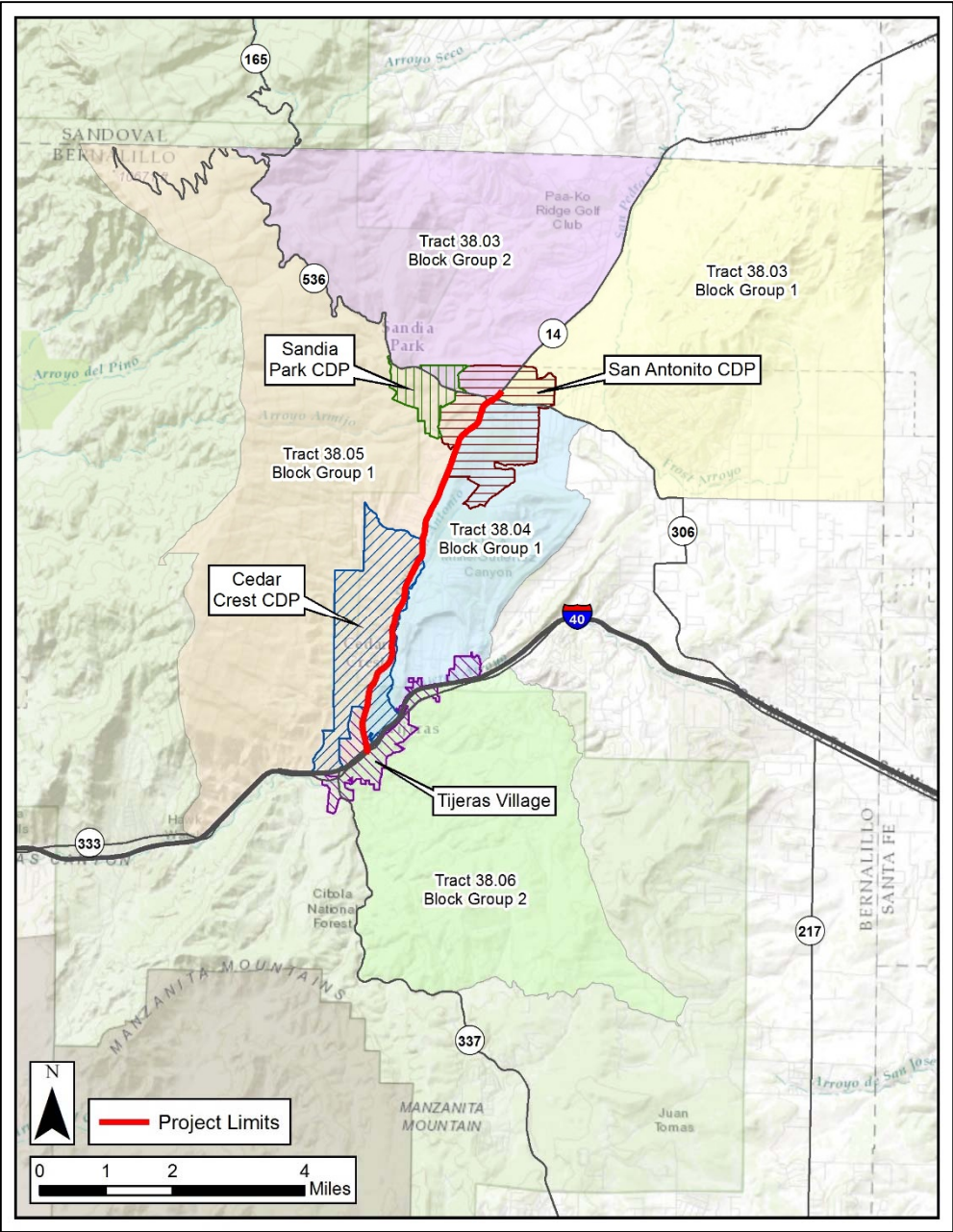


Table 1: Census Block Group Data

	New Mexico	Bernalillo County	Tijeras Village	Cedar Crest CDP	San Antonio CDP	Sandia Park CDP	Tract 38.03 BG 1	Tract 38.03 BG 2	Tract 38.04 BG 1	Tract 38.05 BG 1	Tract 38.06 BG 2
Total Population	2,084,117	673,943	530	919	952	105	2,196	841	2,426	1,200	561
Income											
Unemployed	5.7%	5.5%	4.8%	2.2%	2.6%	0.0%	4.5%	1.6%	1.1%	2.4%	0.0%
Per Capita Income	\$24,012	\$26,765	\$36,054	\$30,058	\$42,394	\$54,119	\$37,111	\$62,150	\$35,362	\$38,713	\$32,852
Households Below Poverty	19.1%	17.6%	5.9%	5.7%	4.8%	10.5%	5.0%	6.2%	0.3%	9.3%	6.4%
Race											
Black or African American	2.1%	3.0%	0.8%	0.0%	0.0%	0.0%	0.5%	0.0%	1.5%	0.0%	0.0%
American Indian & Alaska Native	9.1%	4.5%	0.8%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	0.0%
Asian	1.4%	2.3%	0.8%	0.0%	3.7%	0.0%	0.4%	0.0%	1.6%	0.0%	0.0%
Some Other Race	10.9%	14.1%	6.0%	0.4%	6.6%	0.0%	0.4%	5.9%	1.6%	0.2%	4.3%
Two or More Races	3.3%	4.2%	1.3%	2.6%	7.6%	0.0%	1.5%	3.3%	13.1%	1.7%	6.8%
Ethnicity											
Non-Hispanic	52.6%	51.3%	44.7%	50.9%	84.1%	100.0%	82.9%	76.7%	74.5%	72.9%	80.6%
Hispanic	47.4%	48.7%	55.3%	49.1%	15.9%	0.0%	17.1%	23.3%	25.5%	27.1%	19.4%
Limited English Speaking Households	5.4%	4.6%	3.0%	0.0%	0.0%	0.0%	2.3%	2.2%	0.5%	0.0%	0.0%
Age											
Under 18	24.3%	23.2%	16.4%	16.8%	22.4%	0.0%	17.6%	10.3%	21.8%	17.6%	6.2%
Over 65	14.7%	13.6%	8.9%	12.9%	18.6%	14.3%	17.6%	31.7%	20.1%	15.6%	29.1%

When compared to New Mexico State and Bernalillo County, all of the CDPs and BGs in the study area have a higher per capita income and lower unemployment and poverty rates. All of the CDPs and BGs also have lower percentages of Native Americans and African Americans when compared to the state and county percentages. Two BGs (Track 38.05 BG 1 and Track 38.06 BG 2) and the San Antonito CDP have relatively high percentages of people from two or more races and the San Antonito CDP also has a relatively high percentage of Asians. Additionally both the Village of Tijeras and the Cedar Crest CDP have slightly higher amounts of people with a Hispanic ethnicity when compared to the state and county while the remaining CDPs and BGs in the study area have significantly lower percentages.

All of the CDPs and BGs have a slightly lower number of people under the age of 18 when compared to the state and county numbers. Tijeras and Cedar Crest also have a lower number of people over the age 65 while the remaining CDPs and BGs have a higher number of people over 65 with Tract 38.03 BG 2 having more than twice the state or county numbers. Overall, the demographics do not indicate the need for special outreach strategies to support the current project.

Community Resources

Several community services such as schools, emergency response providers, and medical facilities are located at either end of the project corridor and people must use NM 14 for access to these services. A sheriff's department and Village of Tijeras offices are located along NM 333 and 337 at the south end of the study area, along with a library, community center, and elementary and middle schools. Similarly, the East Mountain High School and the Bernalillo County Fire Department are located adjacent to NM 14 at the north end of the corridor. Additionally, a medical facility and several churches are located along NM 14 within the project area.

NM 14 is also a vital evacuation route for the area in case of wildfires or other natural disasters. Additionally, NM 14 provides East Mountain communities with access to I-40 and to the larger communities to the east, west, and north such as Albuquerque, Moriarty, and Santa Fe.

Planning Documents

The project area is part of the Albuquerque Metropolitan Planning Area (AMPA) and is guided by the long and short-term planning documents for that area. The AMPA long-range plan is the *Futures 2040 Metropolitan Transportation Plan*. Projects within the AMPA need to be consistent with this plan. While the plan does not mention NM 14 or the communities within the project area specifically, it does contain the following pertinent information:

- A rural character should be preserved in undeveloped areas of Bernalillo County.
- In developing locations, growth should be balanced with the rural character.
- Wildlife/vehicle incidents are concentrated in the East Mountains and Tijeras Canyon.
- Development in the East Mountains should consider impacts to native wildlife habitat.

The current project is consistent with the long-range plan and is listed in the short-range Transportation Improvement Program (TIP) for Fiscal years 2018 and 2019.

The project area is also part of the Turquoise Trail National Scenic Byway. The document entitled *A Context-Sensitive Design Approach for Scenic Byways in New Mexico* provides specific recommendations for the Turquoise Trail and defines the portion of the trail that includes the project area as the “Cedar Crest Character Area”. The specific considerations called for in this plan include possible gateway treatments at I-40 and the NM 14/NM 536/Frost Road intersection; consideration of a roundabout at NM 14/NM 536/Frost Road intersection; stone facing for structures; corten guardrail; special signing, lighting, and vegetation; and multi-modal facilitates.

Although the villages of Carnuel and Tijeras have a joint planning document titled *Tijeras Canyon/Carnuel Plan 2007*, the plan does not cover the current project area and there is no mention of NM 14 in the document.

VISUAL

The project area itself has a relatively high visual quality due to the natural mountainous environment. As such, aesthetics of the retaining walls could be important and the project may provide an opportunity for gateway treatments at the NM 14/NM 526/Frost Road intersection. Various views of the project area are provided in *Figure 3* on the next page.

ECONOMIC

The economic context for the study area involves commuters, commercial development, and tourism. A large percentage of workers in the East Mountains commute to Albuquerque or Santa Fe for employment and their commuting route involves NM 14. Congestion during construction is likely to be a primary concern for commuters.

Figure 3: Visual Quality



In addition to heavy commuter traffic, NM 14 is used by residents to access employment, shopping, services, and government offices within the project area. NM 14 is the primary commercial corridor in the area with several commercial developments on either side of the highway.

PUBLIC HEALTH

A holistic approach to public health includes elements such as air quality, active transportation, safety, and access to emergency and medical care. While Bernalillo County has been under maintenance for carbon monoxide pollution since the 1990s, no violations of the National Ambient Air Quality Standards have occurred in several years. Further, the Albuquerque metropolitan area is the center of county-wide air quality concerns and the air quality within more rural portions of the county, such as along NM 14, is generally considered to be good.

Active transportation includes pedestrian and bicycle opportunities. The project area has been designated by the Mid-Region Council of Governments (MRCOG) as a bicycle route and the project area includes 2-to-4-foot shoulders and a recreational trail along the east side of the road for active transportation opportunities.

An additional component of public health is safety and access to emergency and medical services. The full or partial closure of NM 14 during construction could significantly increase emergency response and travel times. Emergency response in the area is dependent on NM 14 as it is the only north/south access through the corridor. Because there are currently no hospitals or trauma centers within the project area, patient transport to the regional trauma centers in Albuquerque (approximately 17 miles west of the project area) ultimately requires travel on NM 14. The police, fire, and emergency medical responders in the area depend on NM 14 for rapid response.

MODAL CONSIDERATIONS AND CONNECTIVITY

Modal considerations for the NM 14 project area include motor vehicles, transit, pedestrian, and bicycles. Characteristics of these modes within the study area are described below.

MOTORIZED VEHICLES

The project area is generally automobile oriented and NM 14 provides the main north/south access along the east side of the Sandia Mountains between Tijeras, Cedar Crest, Sandia Park, and San Antonito. Communities along this corridor do not have an apparent center but rather have developed in a linear fashion adjacent to the highway.

TRANSIT

Although fixed route service does not exist in the area, the project area is part of the Rio Metro Transit service area. Only on-demand para-transit is provided for customers who qualify. The closest fixed-route transit service to the project area is the NMDOT Park and Ride Turquoise Route that runs along I-40, south of the project area, between Moriarty and Albuquerque.

PEDESTRIAN AND BICYCLE

The NMDOT Bicycle Guideline map indicates the majority of the project area has >4-foot shoulders and is designated by MRCOG as a bicycle route. Additionally, although sidewalks are not present, a paved pedestrian/bicycle trail runs through the project area parallel to the east side of the roadway.

OPPORTUNITIES TO EXPRESS LOCAL VALUES

The NM 14 Project has the potential for gateway and/or place-making features consistent with *A Context-Sensitive Design Approach for Scenic Byways in New Mexico*. While the roadway rehabilitation will be limited to the existing roadway prism and does not offer aesthetic opportunities, several other elements would be conducive to aesthetic enhancements. Corten material will be considered for any required guardrail, aesthetic designs will be developed for retaining walls, and gateway treatments will be considered for the NM 14/NM 536/Frost Road intersection. Public input will be sought for all aesthetic considerations within the project area.

SCALE THE SOLUTION TO THE PROBLEM

The project involves rehabilitating the roadway, developing preliminary plans for erosion control, and conducting an alternatives analysis for the NM 14/NM 536/Frost Road intersection. The project team will develop improvements that will not result in unforeseen costs to area property owners or municipalities or require repairs to adjoining properties or infrastructure. In addition, aesthetic treatments that are to be considered shall fully consider stakeholder expectations; however they must also keep the project within the NMDOT's budget.

The State Transportation Improvement Program (STIP) and TIP currently show a project budget of \$1,000,000 in federal fiscal year (FY) 2016, with \$2,526,154 programmed in FY 2018, and \$2,526,154 in FY 2019. However, this could change as an implementation and funding plan is established during the project development process.

THE DESIGN APPROACH

The NM 14 Project will be developed by a multi-disciplinary team of highway engineers, structural and drainage specialists, traffic engineers, transportation planners, and environmental and cultural resource specialists. The organization of the project team is such that the issues identified by the resource specialists do not react to the ideas and concepts developed by the engineers; rather, these issues are identified early and are used proactively by the engineers to develop concepts. In addition, improvement concepts will be discussed among all project team members to ensure critical issues are not overlooked. This process is consistent with the latest version of the NMDOT Location Study Procedures, which will be followed throughout the project development process.

IDENTIFYING STAKEHOLDERS AND THE INTERESTED PUBLIC

Based on the nature of the project and the context provided above, stakeholders for the NM 14 Project can be divided into three categories:

- 1) Those directly impacted by the project because they are located within the project area, travel consistently through and within the corridor, and have a vested interest in project decisions;
- 2) Those indirectly impacted by the project because they may use NM 14 as part of their travel routes or because of their special interest in the project and the project area; and
- 3) Agencies with jurisdictional authority over the infrastructure and/or land use within the project area

These categories are further defined below.

Directly Impacted Stakeholders:

- Business owners
- Other landowners
- Residents
- Commuters
- Bicyclists and pedestrians
- Police, fire, and emergency response providers
- Schools
- Local utilities

Indirectly Affected Stakeholders:

- The East Mountain Chamber of Commerce
- General public
- Turquoise Trail Association
- Tourists

- Elected officials
- Community/neighborhood groups
- Bicycle advocacy groups

Agencies and Governmental Entities:

- COE – Albuquerque Office
- Mid-Region Council Of Governments (MRCOG)
- New Mexico Environment Department (NMED)
- New Mexico Office of Cultural Affairs, State Historic Preservation Officer (SHPO)
- Federal Highway Administration (FHWA)
- Village of Tijeras
- Bernalillo County
- US Fish and Wildlife Service (USFWS)
- New Mexico Department of Game and Fish

COMMUNICATION STRATEGY

The expected concerns from these groups include access to businesses and property, congestion during construction, aesthetic treatments for the retaining walls, the layout of the NM 14/NM 536/Frost Road intersection, and possible gateway treatments at the intersection. Additional concerns may also be identified during the outreach process.

As discussed earlier in this document, the need to improve and maintain the highway is composed of several different elements that vary in the appropriate level of stakeholder engagement. The design options and opportunity to express local values are limited for both the rehabilitation of the roadway and the associated ADA/PROWAG improvements. As such, engagement will consist of informing stakeholders of the project, its construction schedule, and duration. This will be achieved through:

- Notification letters to area residents informing them of the project will be sent early in the design process.
- A public meeting that provides an update on the project design, schedule, and duration will be presented later in the design process.
- Press releases at regular intervals during construction will provide continued updates on the project status.

Addressing access in the corridor will require consultation and involvement with stakeholders to ensure support for the project and any modifications to the current access. This will be achieved through:

- Notification letters sent to area residents and businesses as described above.
- Individual and small-group follow-up meetings to discuss specific access situations and concerns.
- A public meeting, held later in the project development process, to update affected property owners and the general public on the status of access modifications.

The need for erosion control is readily apparent and the primary mitigation technique would involve retaining walls. As such, consultation with stakeholders concerning wall aesthetics will be undertaken to ensure the mitigation is contextually appropriate. This will be achieved through:

- A public meeting that would be held once the basic design and aesthetic concepts have been developed.

The NM 14/NM 536/Frost Road Intersection will be evaluated to determine a preferred alternative for improvements. This will be achieved through a combined Phase A/B study consistent with the NMDOT Location Study Procedures. Public involvement efforts for this aspect of the project will ensure that stakeholder concerns and aspirations are directly reflected in the development and evaluation of alternatives. This will be achieved through:

- A public meeting that presents the purpose and need for the project, the initial set of alternatives that were developed, and the preliminary engineering and environmental analysis of those alternatives. The concerns and input from this meeting would be incorporated into NMDOT's final decision on a preferred alternative.

A single public meeting is anticipated to address the issues of notification for the rehabilitation/PROWAG elements, an update of the proposed access adjustments, input into the aesthetic considerations for retaining walls, and input into the alternatives analysis for the NM 14/NM 536/Frost Road intersection. If unresolved issues persist after the public meeting, additional outreach will be scheduled during the environmental clearance (Phase C) or preliminary design (Phase D). Additional information on outreach efforts is provided below.

Agency coordination:

- Coordination with identified agencies will begin with letters informing each agency of the project and asking for their input on issues of interest to them.
- Unless agencies request follow-up meetings, supplemental coordination with agencies such as the COE, USFWS, or SHPO will occur as needed after appropriate resource studies have been completed. This will allow the agencies to issue permits or concur with findings during the initial consultation rather than having to request supplemental information.

Notice of public involvement meetings will be achieved through the following:

- Meeting notices sent via mail and email to businesses within and in the vicinity of the project area and to other identified stakeholders
- Meeting notices posted at community gathering locations within the project area
- Advertisements in the local newspapers

All public involvement meetings will utilize the following as needed:

- Sign-in sheets to collect attendee contact information
- Display boards which are easy to read and informative
- PowerPoint presentations which are informative and easy to understand
- Flip charts to record comments and issues
- Handouts including 8-1/2" x 11" copies of the display boards or presentation
- Return-addressed comment forms
- Information on how to submit comments and how to contact the project team

Post-meeting information will be distributed to meeting attendees through the following:

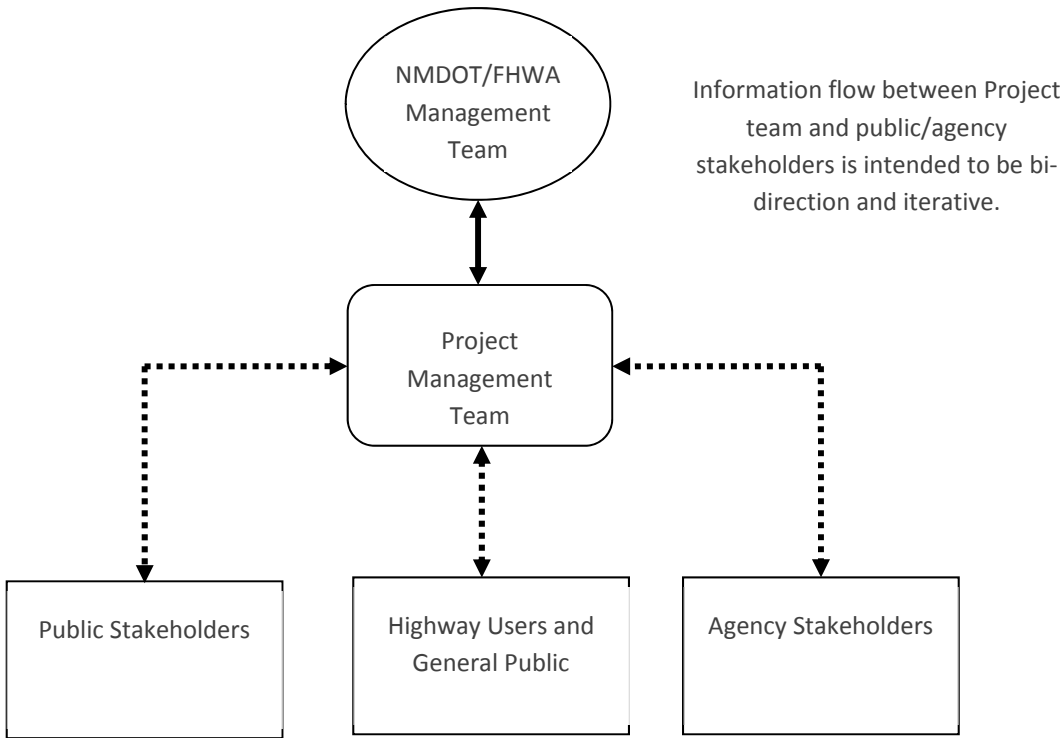
- Project updates will be emailed to those included on the project contact list throughout the project process, as necessary.

All of the above elements will be used in project decisions. While comprehensive input will be sought, the NMDOT, in collaboration with FHWA, will have responsibility for making final decisions. **Figure 4** on the following page illustrates the general process by which project decisions will be made.

The resolution of any disputes will focus on strategies which avoid any one group from dominating public meetings and intimidating others. Effort will be made to obtain different perspectives and the rationale for each view. Decisions will be made in the

open, will be transparent to all stakeholders, and will include explanations on how decisions were reached.

Figure 4: Decision Process



REFERENCES CITED

Baxter, John

- 1977 Holy Child Church. *National Register of Historic Places Inventory—Nomination Form*. Ms. on file at State of New Mexico Office of Cultural Affairs, Historic Preservation Division, Santa Fe.

Cordell, Linda S.

- 1980 *Tijeras Canyon: Analysis of the Past*. Maxwell Museum of Anthropology Publication Series, general editors J. J. Brody and Mari Lyn Salvador. University of New Mexico Press, Albuquerque.

Quintana, Frances Leon, and David Kayser

- 1980 The Development of Tijeras Canyon Hispanic Communities. In *Tijeras Canyon: Analysis of the Past*. Maxwell Museum of Anthropology Publication Series, general editors J. J. Brody and Mari Lyn Salvador. University of New Mexico Press, Albuquerque.

Smith, Mike

- 2006 *Towns of the Sandia Mountains*. Arcadia Publishing, Mount Pleasant, South Carolina.

Villages of Tijeras and Carnuel

- 2007 *Tijeras Canyon/Carnuel Plan*. Ms. on file with Bernalillo County, Albuquerque, New Mexico.



Appendix D: Public Meeting Comment Summary

NM 14

Study and Rehabilitation

From I-40 to NM 536/Frost Road

Milepost 0 to 6.1

Public Involvement Meeting Summary

Meeting No. 1 – July 18th, 2017

Introduction

The NMDOT held the first public information meeting for the NM 14 Study and Rehabilitation Project on **Tuesday, July 18th, 2017 at 6:30pm**. The meeting was held at the Vista Grande Community Center, 15 La Madera Rd, New Mexico. This document summarizes the organization of the meeting and comments received.

In addition to providing the public with the opportunity to provide comments and ask questions about the project, the purpose of the meeting was to present the:

- Existing conditions
- Project purpose and need
- Proposed Project Description Including
 - NM 14 pavement Rehabilitation
 - NM 14 Slope Stabilization
 - NM 14/Frost Road/NM 536 Intersection Improvement
- Project Schedule

Overview

Notification of the public meeting occurred through the following methods (copies of the original documents are in Appendix A.):

- A newspaper advertisement was published in the Mountain View Telegraph on Thursday, July 6th, 2017.
- Meeting announcements were:
 - *Mailed to 336 owners and residences within the project area.*
 - *Emailed to stakeholders in the area*
- Notices were posted at local libraries, post offices and the Triangle Grocery

Seventy-six (76) people signed in at the registration table. Fifteen (15) representatives from the project team including NMDOT and the consultant team were also present.

The meeting format included a presentation by project team representatives followed by a question and answer period. Additionally, display materials were available for review and project team representatives were available to provide information and answer questions. A copy of the presentation is attached in Appendix B. All meeting attendees were provided a return-addressed comment form. A copy of the comment form is attached in Appendix B.

Comments

Comments about the project were compiled using several methods:

- Flip charts: written notes of all verbal questions and comments made at the meeting were recorded by a project team member or by the public on flip charts displayed throughout the meeting room.
- Displays: written notes of questions and comments made by the public were recorded on display boards that were placed throughout the meeting room.
- Comment forms: forms were distributed to all attendees and return-addressed to be either left in a comment box at the meeting or mailed to the Project Team.
- Email or phone: contact information for project team members was provided during the presentation and on the comment form for future comments.

The comment forms list August 18th, 2017 as the requested deadline for comments; however, due to the long development period for the project, it was stated at the meeting that comments will be accepted throughout the project development process and incorporated or addressed as appropriate. Questions from the audience are presented below. Answers from the project team members are shown in *italics* below.

Questions and Comments Recorded on Flip-Charts and Displays:

- Where will PowerPoint be available?
 - *PowerPoint will be available online for download*
- How will the project, not at the intersection, better accommodate road and recreational biking?
 - *This is beyond the scope of the project*
- How does the High T alternative work?
 - *In a high-T intersection, one lane of traffic on NM 14 is free-flowing. For the free-flowing through lanes, access into and out of Frost Road is provided via a turn lanes separated from the through lanes via a raised median. The second southbound travel lane on the inside of the road is exclusive to left-turning traffic from Frost Road. Therefore, left-turning traffic from Frost Road only is interacting with northbound traffic and the southbound left-turn lane to travel through the intersection making finding a gap in traffic easier*
- How many crashes have occurred at the intersection, per the crash study?
 - *A total of 6 crashes were reported between 2012-2014*
- Will there be any modifications to the gas station?
 - *No, this is beyond the scope of this project*
- How will the dead wood be maintained on NM 14?
 - *Maintenance will begin in the South section of the corridor*
 - *North section of corridor has already been completed*
 - *Safety issues will always be addressed right away*

- What is the schedule for improvements to NM 14?
 - *Pavement Rehabilitation*
 - *Phase 1: 2018*
 - *Phase 2: 2018/2019*
 - *Phase 3: 2020/2021*
 - *Slope Stabilization: 2022*
 - *Intersection: 2023*
- Will NMDOT be making any improvements to Columbine Lane, especially when considering safety for school children and winter maintenance?
 - *Improvements will only be made within the NMDOT right-of-way*
- What improvements will be made to drainage?
 - *Curb and gutter*
 - *Clean out culvert pipes*
- How will traffic be accommodated during construction?
 - *Two lanes, one traveling in each direction, will always be open*
- What does resurfacing do for the highway?
 - *It will extend the life of the highway*
 - *Prevents immediate need for reconstruction of the highway*
- How long will construction for pavement rehabilitation be?
 - *Typically, construction for pavement resurfacing occurs during March to September*
- How will this project encourage children to walk and bike more frequently, especially to school?
 - *The project team will consider this comment*
- How will public input be taken into consideration for the intersection alternatives?
 - *Public input will be taken through comment forms*
 - *Comments will be taken at any time but decisions on the alternatives will be made after August 18th*
- What are the current and future levels of service for the intersection?
 - *Detailed analysis has been completed for the intersection alternatives and will be summarized in the final study. The information was not presented in this meeting because the intent was to provide a general overview of each alternative*
- What will happen to the old road if the intersection is redone?
 - *The existing roadway will be removed and returned to a more natural state*
 - *Natural vegetation will be planted*
- If a roundabout is built will it accommodate trucks and emergency vehicles?
 - *Yes, the roundabout will be designed to accommodate all vehicles that will be using the roundabout*
- Future congestion projections, where do these numbers come from?
 - *Mid Region Council of Government's regional model for 2040*
- Is a larger roundabout being considered?
 - *No, the roundabout diameter has been designed to accommodate existing and future traffic per design guidance*

- A roundabout would cause confusion among drivers and is dangerous because cement trucks and other heavy truck mix with commuter traffic at this intersection. A roundabout would not be safe.
 - *Thank you for your comment, it will be considered as part of the evaluation of alternatives*
- Will the gas station access be modified with a roundabout?
 - *No, access will not be affected*
- For slope stabilization solutions where will the water go?
 - *Looked at four conceptual options: drain pipe, concrete slope paving, concrete slope paving & corrugated metal pipe, and earth berm. Still evaluating options to address drainage*
- Are driveway permits new?
 - *They have been around for 30 years*
 - *NMDOT is trying to develop permits for access locations that pre-date the permit requirements*
- Will changes to the intersection affect getting cars out for emergency evacuation?
 - *No, all alternatives will accommodate emergency evacuations*
- Which intersection alternative will best serve pedestrians and bicyclists?
 - *All alternatives will accommodate pedestrians and bicyclists*
- Did WSP use computer simulations for the intersection considerations?
 - *Yes, WSP did use computer simulations*
- Are stop signs being considered along NM 14?
 - *No, stop signs would not improve operations along NM 14*
- Will there be more public meetings on this project?
 - *Yes, as the project moves along more public meetings will follow*
- What are the costs for the intersection alternatives?
 - *The costs are being developed and will be a part of the final study for the project*
- If curb and gutter are going to be replaced, will bikes lanes be widened?
 - *No, this is beyond the scope of this project*
- Does this project consider the 4,000-home subdivision planned north of Frost Road?
 - *Yes, the future traffic volumes were derived from the Mid Region Council of Government's 2040 regional model which considers regional growth and development*
- Is there sufficient data to support the alternatives/options that are proposed for this project?
 - *Pavement rehabilitation, slope stabilization and intersection alternatives were carefully considered by the project team based on current and future data*
- Will school children be a priority for this project?
 - *Walkability is an evaluation criteria for the intersection project. Each of the build alternatives will include pedestrian facilities that meet current standards*
- Could a sidewalk, access route for school busses, or a park & ride for school busses be implemented within and north of the study area to accommodate school children?
 - *No, this is beyond the scope of the current project*

Written Comments

Meeting attendees were provided return-addressed comment forms for submission at the meeting or through the mail within the comment period. Eight (8) completed comment forms were received by the project team during the comment period. Residents expressed the following concerns:

- Support for the roundabout alternative (6 comments)
- Opposition to the roundabout alternative (2 comments)
- Improvements are needed for the multi-use path
- Recommendation to designate right and left turns lanes on and off NM 14 and Frost Road
- Support for a traffic light at the NM 14/NM 536/Frost Road
- Support for Alternative 2 (1 comment)
- Curb and gutter improvements should be made at the same height of pavement
- Sight distance from shell station needs improvement
- Preserve the scenic byway sign
- Prior to project construction, lower the speed limit and enforce the speed limit

Additional Comments

Additional comment submissions were received during and after the meeting. Eighteen (18) comments were received by email by the project team during the comment period. Residents expressed the following concerns:

- School zone signs with flashers are needed in front of San Antonito Elementary School
- Slope stabilization solutions might cause damage to the curbs, consider doing slope stabilization before pavement rehabilitation
- Consider a design for the intersection that would minimize deceleration, acceleration and direction changes to ensure safety
- If lighting is installed at the intersection, it needs to conform to the dark skies ordinances
- Does the lighting along NM 14 meet the dark skies ordinances?
- Replace the ravine at MP 1 with a culvert to collect water runoff
- Reduce speeds to 30-35 mph through residential and business areas
- Is a noise study being conducted for this project?
- Slope stabilization should be done immediately and pavement rehabilitation should follow (2 comments)
- Intersection Alternative 3, could a light be installed at the intersection?
- Could NMDOT assist Bernalillo County to coordinate more efficient evacuation plans, especially rerouting traffic to I-40?
- Opposition to the roundabout alternative (2 comment)
- Opposition to “T” configuration
- Support for roundabout (3 comments)
- Support for a traffic signal
- Several requests for the meeting presentation to be made publicly available
- Support for Alternative 3 (1 comment)
- Support for Alternative 1 (1 comment)

Appendix A

Advertisements

[FULL APPENDIX PROVIDED IN ACUTAL SUMMARY
PROVIDED UNDER SEPERATE COVER]

Appendix B

Presentation

[FULL APPENDIX PROVIDED IN ACUTAL SUMMARY
PROVIDED UNDER SEPERATE COVER]

Appendix C

Sign-in Sheet and
Comments Received

[FULL APPENDIX PROVIDED IN ACUTAL SUMMARY
PROVIDED UNDER SEPERATE COVER]



Appendix E: NM 14/Frost Road Traffic Count



NMDOT - District 3 Traffic

File Name : TMC_12~1

Site Code : 00000001

Start Date : 12/3/2015

Page No : 2

Groups Printed- Unshifted

	NM 14 From North					NM 536/Frost Rd From East					NM 14 From South					NM 536/Frost Rd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	3	30	5	0	38	16	2	23	0	41	42	61	0	0	103	0	0	0	0	0	182
03:15 PM	2	37	9	0	48	43	1	24	0	68	35	75	0	0	110	0	0	0	0	0	226
03:30 PM	9	120	70	0	199	20	3	17	0	40	41	64	0	0	105	0	0	0	0	0	344
03:45 PM	2	60	38	0	100	14	2	26	0	42	55	45	0	0	100	0	0	0	0	0	242
Total	16	247	122	0	385	93	8	90	0	191	173	245	0	0	418	0	0	0	0	0	994
04:00 PM	1	45	15	0	61	8	1	23	0	32	56	52	0	0	108	0	0	0	0	0	201
04:15 PM	3	40	18	0	61	7	2	19	0	28	48	58	0	0	106	0	0	0	0	0	195
04:30 PM	0	39	19	0	58	14	1	26	0	41	48	58	0	0	106	0	0	0	0	0	205
04:45 PM	3	36	13	0	52	12	5	18	0	35	45	63	0	0	108	0	0	0	0	0	195
Total	7	160	65	0	232	41	9	86	0	136	197	231	0	0	428	0	0	0	0	0	796
05:00 PM	1	36	25	0	62	8	0	21	0	29	57	60	0	0	117	0	0	0	0	0	208
05:15 PM	0	33	20	0	53	5	2	22	0	29	60	65	0	0	125	0	0	0	0	0	207
05:30 PM	0	19	16	0	35	8	2	22	0	32	52	56	0	0	108	0	0	0	0	0	175
05:45 PM	0	25	13	0	38	8	0	23	0	31	48	55	1	0	104	0	0	0	0	0	173
Total	1	113	74	0	188	29	4	88	0	121	217	236	1	0	454	0	0	0	0	0	763
Grand Total	47	1512	434	0	1993	531	48	1119	0	1698	1017	1382	1	0	2400	0	0	0	0	0	6091
Apprch %	2.4	75.9	21.8	0		31.3	2.8	65.9	0		42.4	57.6	0	0		0	0	0	0		
Total %	0.8	24.8	7.1	0	32.7	8.7	0.8	18.4	0	27.9	16.7	22.7	0	0	39.4	0	0	0	0	0	



Appendix F: Existing Traffic Operations Output Files

Intersection

Int Delay, s/veh 0.7

Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		↑↑	↑↑		↑	↑
Traffic Vol, veh/h	0	305	431	0	16	31
Future Vol, veh/h	0	305	431	0	16	31
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	332	468	0	17	34

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	634	234
Stage 1	-	-	-	-	468	-
Stage 2	-	-	-	-	166	-
Critical Hdwy	-	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	0	-	-	0	411	768
Stage 1	0	-	-	0	597	-
Stage 2	0	-	-	0	846	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	411	768
Mov Cap-2 Maneuver	-	-	-	-	411	-
Stage 1	-	-	-	-	597	-
Stage 2	-	-	-	-	846	-

Approach	NB	SB	SE
HCM Control Delay, s	0	0	11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBT	SELn1	SELn2	SBT
Capacity (veh/h)	-	411	768	-
HCM Lane V/C Ratio	-	0.042	0.044	-
HCM Control Delay (s)	-	14.1	9.9	-
HCM Lane LOS	-	B	A	-
HCM 95th %tile Q(veh)	-	0.1	0.1	-

Intersection

Int Delay, s/veh 5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↖	↗		↖	↗	↖	↖	↖
Traffic Vol, veh/h	0	0	0	168	6	207	0	205	61	61	263	7
Future Vol, veh/h	0	0	0	168	6	207	0	205	61	61	263	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	0	-	-	0	100	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	183	7	225	0	223	66	66	286	8

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	499	649	111	-	0	0	223	0	0
Stage 1	223	223	-	-	-	-	-	-	-
Stage 2	276	426	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.54	6.94	-	-	-	4.14	-	-
Critical Hdwy Stg 1	5.84	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	-	-	-	2.22	-	-
Pot Cap-1 Maneuver	501	387	921	0	-	-	1343	-	-
Stage 1	793	718	-	0	-	-	-	-	-
Stage 2	746	584	-	0	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	476	0	921	-	-	-	1343	-	-
Mov Cap-2 Maneuver	476	0	-	-	-	-	-	-	-
Stage 1	793	0	-	-	-	-	-	-	-
Stage 2	709	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.5	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	476	921	1343	-	-
HCM Lane V/C Ratio	-	-	0.397	0.244	0.049	-	-
HCM Control Delay (s)	-	-	17.5	10.2	7.8	-	-
HCM Lane LOS	-	-	C	B	A	-	-
HCM 95th %tile Q(veh)	-	-	1.9	1	0.2	-	-

Intersection

Int Delay, s/veh 0.6

Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		↑↑	↑↑		↑	↑
Traffic Vol, veh/h	0	490	350	0	15	33
Future Vol, veh/h	0	490	350	0	15	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	533	380	0	16	36

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	646	190
Stage 1	-	-	-	-	380	-
Stage 2	-	-	-	-	266	-
Critical Hdwy	-	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	0	-	-	0	404	820
Stage 1	0	-	-	0	661	-
Stage 2	0	-	-	0	754	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	404	820
Mov Cap-2 Maneuver	-	-	-	-	404	-
Stage 1	-	-	-	-	661	-
Stage 2	-	-	-	-	754	-

Approach	NB	SB	SE
HCM Control Delay, s	0	0	11.1
HCM LOS			B

Minor Lane/Major Mvmt	NBT	SELn1	SELn2	SBT
Capacity (veh/h)	-	404	820	-
HCM Lane V/C Ratio	-	0.04	0.044	-
HCM Control Delay (s)	-	14.3	9.6	-
HCM Lane LOS	-	B	A	-
HCM 95th %tile Q(veh)	-	0.1	0.1	-

Intersection

Int Delay, s/veh 3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕	↕		↕	↕	↕	↕	↕
Traffic Vol, veh/h	0	0	0	85	8	49	0	219	200	141	265	15
Future Vol, veh/h	0	0	0	85	8	49	0	219	200	141	265	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	0	-	-	0	100	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	92	9	53	0	238	217	153	288	16

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	689	849	119	-	0	0	238	0	0
Stage 1	238	238	-	-	-	-	-	-	-
Stage 2	451	611	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	-	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	-	-	-	2.22	-	-
Pot Cap-1 Maneuver	332	296	910	0	-	-	1326	-	-
Stage 1	744	707	-	0	-	-	-	-	-
Stage 2	557	482	-	0	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	303	262	910	-	-	-	1326	-	-
Mov Cap-2 Maneuver	303	262	-	-	-	-	-	-	-
Stage 1	744	707	-	-	-	-	-	-	-
Stage 2	493	426	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.3	0	2.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	299	910	1326	-	-
HCM Lane V/C Ratio	-	-	0.338	0.059	0.116	-	-
HCM Control Delay (s)	-	-	23.1	9.2	8.1	-	-
HCM Lane LOS	-	-	C	A	A	-	-
HCM 95th %tile Q(veh)	-	-	1.4	0.2	0.4	-	-



Appendix G: Existing Traffic Signal Warrant Worksheets

EIGHT-HOUR VEHICULAR VOLUME SIGNAL WARRANT ANALYSIS

Condition A - Minimum Vehicular Volume					
Time Period	Vehicles per Hour on Major Street	Threshold	Vehicles per Hour on High-Volume Minor Street Approach	Threshold	Condition Met
15:00 - 16:00	803	420	191	140	Met
8:00 - 9:00	644	420	329	140	Met
16:00 - 17:00	660	420	136	140	Not Met
17:00 - 18:00	647	420	121	140	Not Met
7:00 - 8:00	399	420	335	140	Not Met
12:00 - 13:00	391	420	153	140	Not Met
13:00 - 14:00	369	420	132	140	Not Met
11:00 - 12:00	335	420	133	140	Not Met

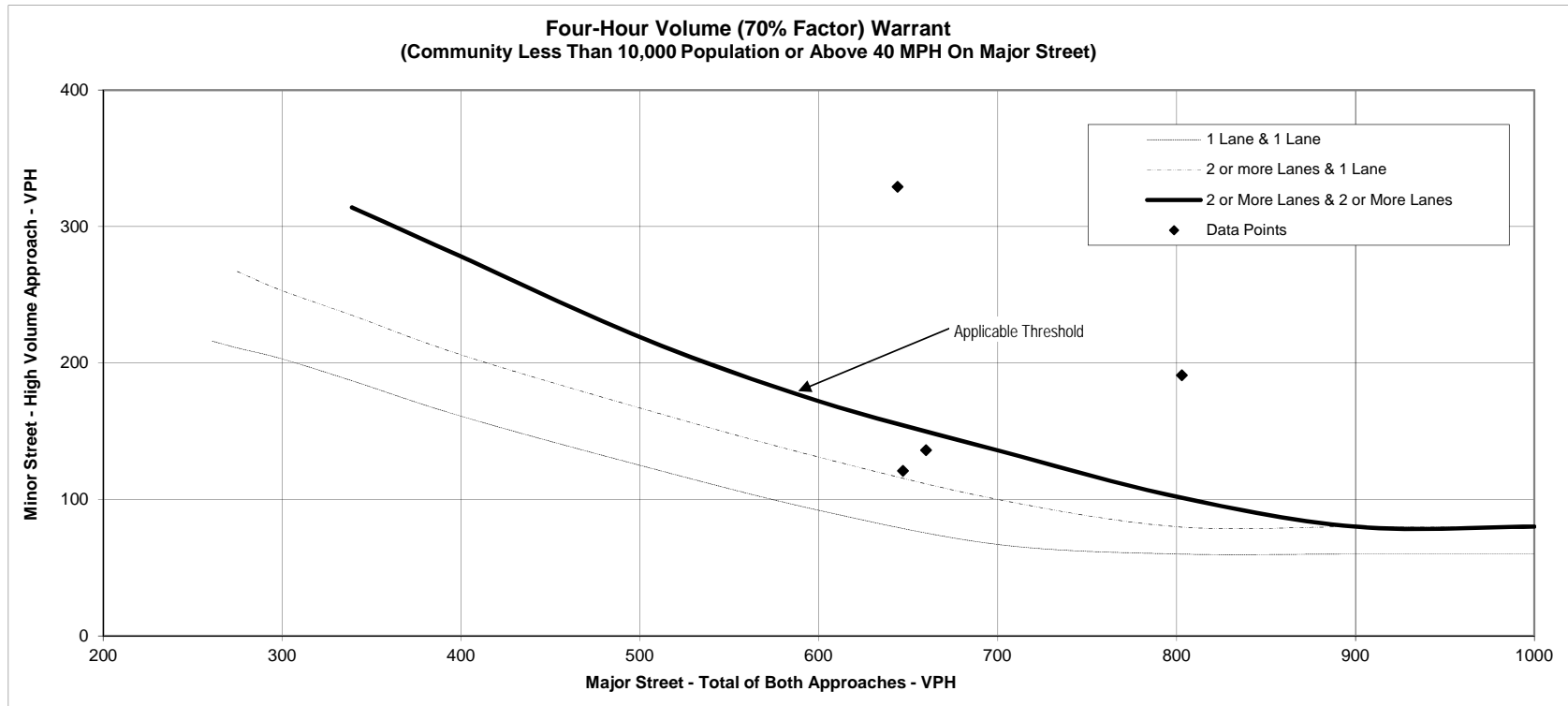
Condition B - Interruption of Continuous Traffic					
Time Period	Vehicles per Hour on Major Street	Threshold	Vehicles per Hour on High-Volume Minor Street Approach	Threshold	Condition Met
15:00 - 16:00	803	630	191	70	Met
8:00 - 9:00	644	630	329	70	Met
16:00 - 17:00	660	630	136	70	Met
17:00 - 18:00	647	630	121	70	Met
7:00 - 8:00	399	630	335	70	Not Met
12:00 - 13:00	391	630	153	70	Not Met
13:00 - 14:00	369	630	132	70	Not Met
11:00 - 12:00	335	630	133	70	Not Met

Combination Condition A and Condition B							
Time Period	Vehicles per Hour on Major Street	Threshold		Vehicles per Hour on High-Volume Minor	Threshold		Condition Met
		A	B		A	B	
15:00 - 16:00	803	336	504	191	112	56	Met
8:00 - 9:00	644	336	504	329	112	56	Met
16:00 - 17:00	660	336	504	136	112	56	Met
17:00 - 18:00	647	336	504	121	112	56	Met
7:00 - 8:00	399	336	504	335	112	56	Not Met
12:00 - 13:00	391	336	504	153	112	56	Not Met
13:00 - 14:00	369	336	504	132	112	56	Not Met
11:00 - 12:00	335	336	504	133	112	56	Not Met

FOUR-HOUR VEHICULAR VOLUME (70% FACTOR) SIGNAL WARRANT ANALYSIS

Scenario: Existing Conditions
 Intersection: NM 14/NM 536/Frost Road
 Approach Type: 2 or More Lanes & 2 or More Lanes
 Major Street (Name): NM 14
 Major Street (Orientation): North-South
 Minor Street (Name): Frost Road
 Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 2?
15:00 - 16:00	0	191	191	418	385	803	Yes
8:00 - 9:00	0	329	329	258	386	644	Yes
16:00 - 17:00	0	136	136	428	232	660	No
17:00 - 18:00	0	121	121	453	194	647	No

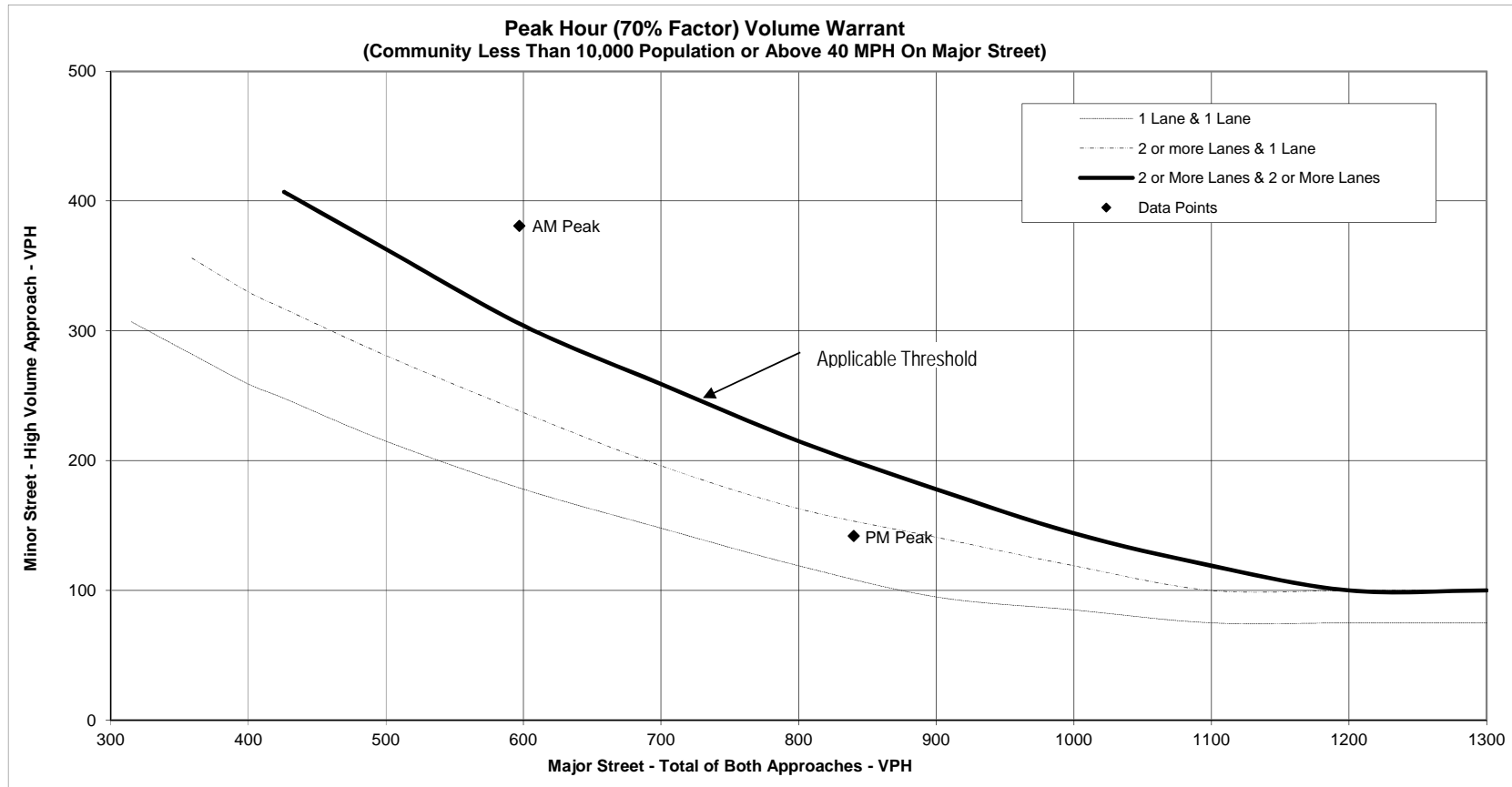


Note: 115 vph applies as the lower threshold for minor street approach with 2 or more lanes and 80 vph as the threshold for a minor street approach with one lane.

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: Existing Conditions
 Intersection: NM 14/NM 536/Frost Road
 Approach Type: 2 or More Lanes & 2 or More Lanes
 Major Street (Name): NM 14
 Major Street (Orientation): North-South
 Minor Street (Name): Frost Road
 Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak	0	381	381	266	331	597	Yes
PM Peak	0	142	142	419	421	840	No



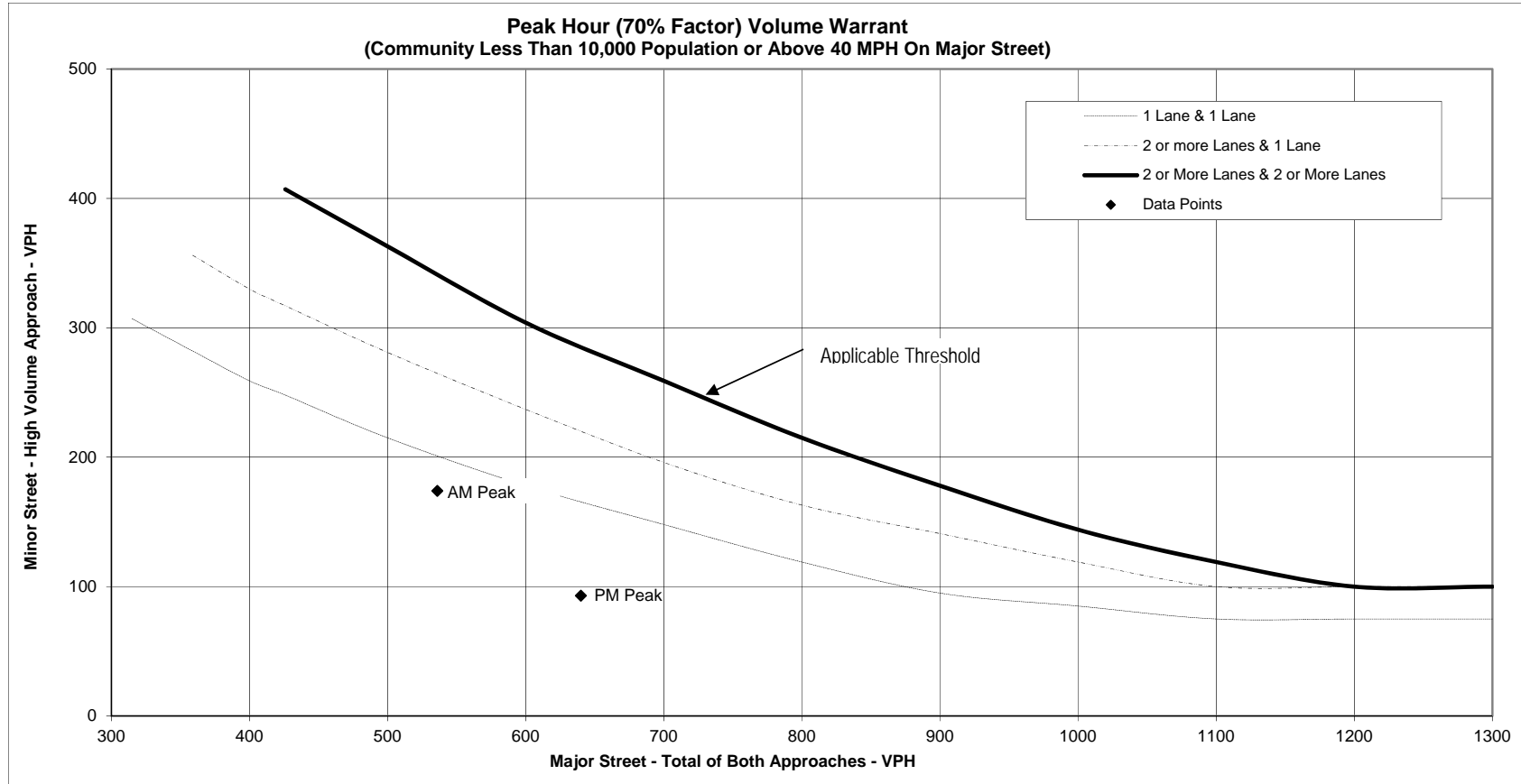
Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

FREE RIGHT TURN MOVEMENTS REMOVED

Scenario: Existing Conditions
 Intersection: NM 14/NM 536/Frost Road
 Approach Type: 2 or More Lanes & 2 or More Lanes
 Major Street (Name): NM 14
 Major Street (Orientation): North-South
 Minor Street (Name): Frost Road
 Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak	0	381	174	205	331	536	Yes
PM Peak	0	142	93	219	421	640	No



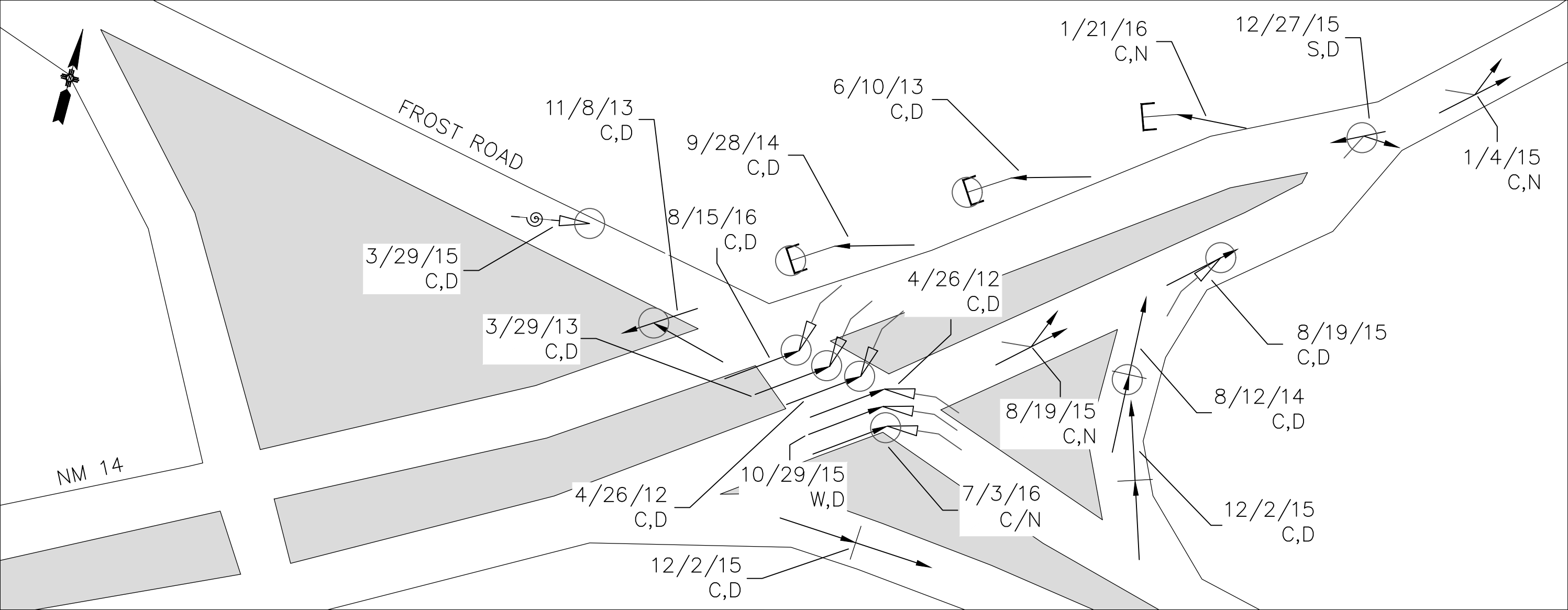
Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane



Appendix H: Intersection Crash History Summary

CRASH REPORT NUMBER	CRASH DATE	YEAR OF CRASH	MONTH OF CRASH	TIME OF CRASH	DAY OF WEEK	PRIMARY STREET	SECONDARY STREET	CRASH SEVERITY	CRASH CLASSIFICATION	CRASH ANALYSIS	HIGHEST CONTRIBUTING FACTOR IN CRASH	ALCOHOL INVOLVEMENT	LIGHTING	WEATHER
40007334	4/26/2012	2012	April	17:15	Thursday	HWY NORTH 14	FROST RD	Property Damage Only Crash	Other Vehicle	Intersection - Both Going Straight/Entering At Angle	Other Improper Driving	Not Involved	Daylight	Wind
10398757	3/29/2013	2013	March	6:44	Friday	NORTH HIGHWAY 14	FROST	Property Damage Only Crash	Other Vehicle	Intersection - From Opposite Direction/One Left Turn	Driver Inattention	Not Involved	Dawn	Clear
10399297	6/10/2013	2013	June	14:30	Monday	NORTH HIGHWAY 14		Injury Crash	Fixed Object	Fixed Object - Barbed Wire Fence	Excessive Speed	Not Involved	Daylight	Left Blank
30091996	11/8/2013	2013	November	8:20	Friday	FROST ROAD	NORTH HWY 14	Injury Crash	Vehicle on Other Road	Invalid Code	Driver Inattention	Not Involved	Daylight	Clear
10402901	8/12/2014	2014	August	7:59	Tuesday	N HWY 14	FROST RD	Injury Crash	Other Vehicle	Intersection - Both Turn Right/Entering At Angle	Following Too Closely	Not Involved	Daylight	Clear
10403312	9/28/2014	2014	September	14:10	Sunday	N HWY 14	SANDIA CREST RD	Injury Crash	Fixed Object	Fixed Object - Median Raised Or Curb	Excessive Speed	Not Involved	Daylight	Clear
10404241	1/4/2015	2015	January	17:20	Sunday	HIGHWAY N-14	FROST RD	Property Damage Only Crash	Other Vehicle	Other Vehicle - From Same Direction/Both Going Straight	Speed Too Fast for Conditions	Not Involved	ark-Not Lighted	Clear
10404937	3/29/2015	2015	March	17:56	Sunday	NM 536	HWY N - 14	Injury Crash	Overturn/Rollover	Overturn/Rollover - Left Side of Road	Alcohol/Drug Involved	Involved	Daylight	Clear
23253689	8/19/2015	2015	August	21:45	Wednesday	NM 14	NEAR FROST RD	Property Damage Only Crash	Other Vehicle	Other Vehicle - From Same Direction/Sideswipe Collision	Improper Overtaking	Not Involved	ark-Not Lighted	Clear
30148091	8/19/2015	2015	August	7:47	Wednesday	N HWY 14	FROST RD	Injury Crash	Other Vehicle	Other Vehicle - One Right Turn/Entering At Angle	Failed to Yield Right of Way	Not Involved	Daylight	Clear
30162347	10/29/2015	2015	October	16:30	Thursday	176 NORTH 14 HIGHWAY	NEW MEXICO 536	Property Damage Only Crash	Other Vehicle	Other Vehicle - One Left Turn/Entering At Angle	Failed to Yield Right of Way	Not Involved	Daylight	Raining
30162654	12/2/2015	2015	December	8:50	Wednesday	FROST ROAD	N?14	Property Damage Only Crash	Other Vehicle	Other Vehicle - From Same Direction/Both Turn Right	Failed to Yield Right of Way	Not Involved	Daylight	Clear
30162892	12/27/2015	2015	December	14:07	Sunday	HIGHWAY NORTH 14	SANDIA CREST RD	Injury Crash	Other Vehicle	Other Vehicle - From Opposite Direction	Failed to Yield Right of Way	Not Involved	Daylight	Snowing
30177163	1/21/2016	2016	January	22:10	Thursday	N HIGHWAY 14	SANDIA CREST RD	Property Damage Only Crash	Fixed Object	Fixed Object - Utility or Telephone Pole	Driver Inattention	Not Involved	ark-Not Lighted	Clear
710304580	8/15/2016	2016	August	18:15	Monday	NM 14	SANDIA CREST RD	Injury Crash	Other Vehicle	Other Vehicle - One Left Turn/Entering At Angle	Failed to Yield Right of Way	Not Involved	Daylight	Clear
710305297	7/3/2016	2016	July	20:57	Sunday	FROST RD	NORTH HIGHWAY 14	Injury Crash	Other Vehicle	Other Vehicle - One Left Turn/Entering At Angle	Driver Inattention	Not Involved	ark-Not Lighted	Clear

TIME PERIOD: 4/26/12 – 8/15/16

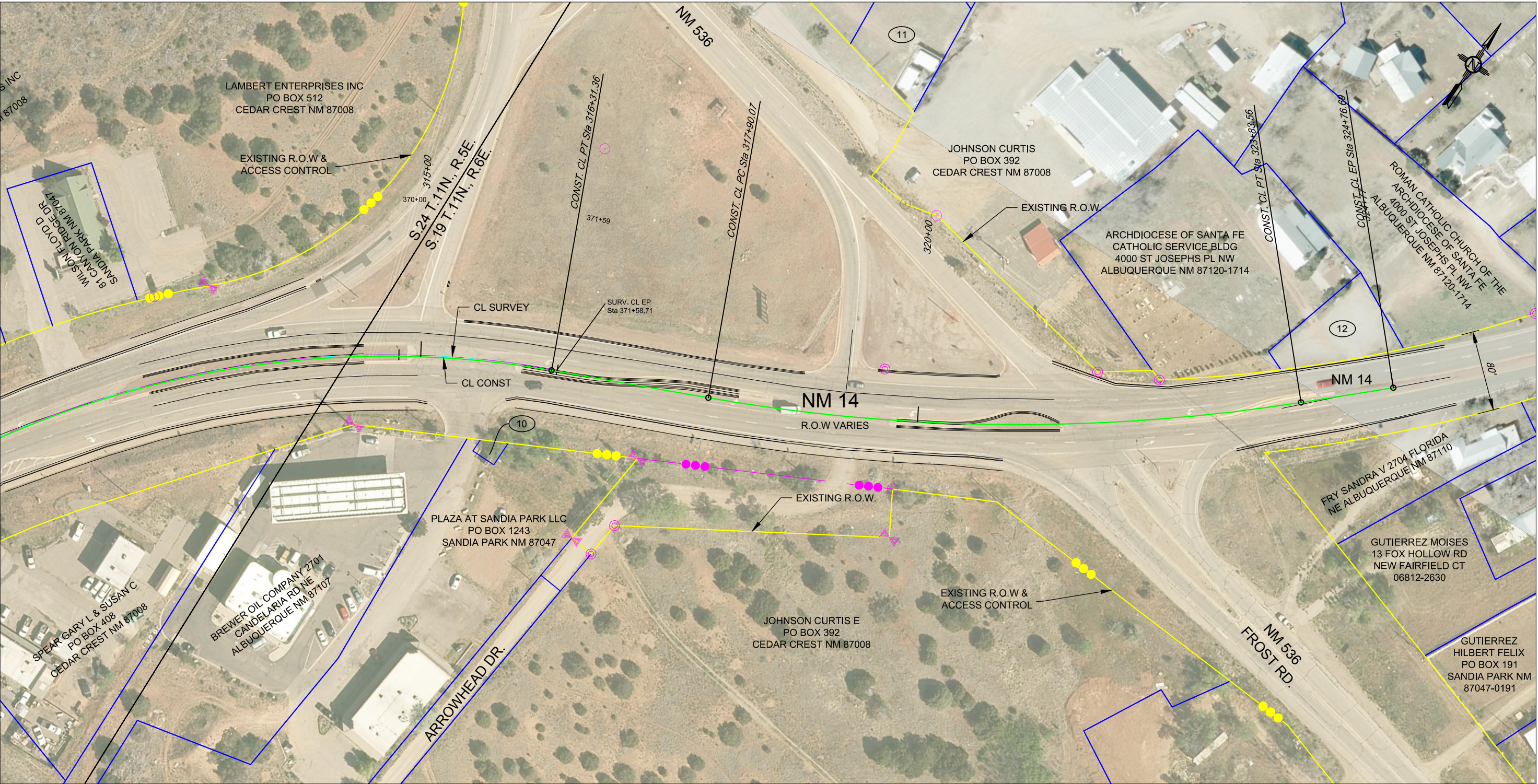


KEY TO COLLISION DIAGRAM SYMBOLS

VEHICLE MOVEMENTS		ACCIDENT TYPES		ROAD SURFACE		LIGHTING	
	STRAIGHT		REAR END	C	CLEAR	D	DAYLIGHT
	RIGHT TURN		HEAD ON	W	WET	N	DARK, NO STREET LIGHTS
	LEFT TURN		ANGLE	S	SNOW, ICY	L	DARK, WITH STREET LIGHTS
	BACKING		SIDESWIPE, OPPOSITE DIRECTION	O	OTHER		
	ERRATIC		SIDESWIPE, SAME DIRECTION				
	OUT OF CONTROL		FIXED OBJECT COLLISION				
	PARKED		INJURY				
	ROLL OVER						



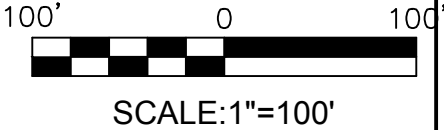
Appendix I: Property Ownership & Right-of-Way



NO.	OWNER	ADDRESS
10	INGLE G D	PO BOX 2087, ALBUQUERQUE, NM 87103
11	JACOB SETH A & MYRA K MURPHY JACOB	PO BOX 1283 SANDIA PARK NM 87047
12	ROMAN CATH CH ARCH OF SANTA FE CATHOLIC SERVICE BLDG	4000 ST JOSEPHS PL NW ALBUQUERQUE NM 87120-8717

LEGEND

- DENOTES FND. R/W T-RAIL
- DENOTES FND. PROPERTY CORNER
- DENOTES EXISTING ACCESS CONTROL LINE



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY

REVISIONS (OR CHANGE NOTICES)

NEW MEXICO DEPARTMENT
OF TRANSPORTATION

NM 14
EXISTING RIGHT-OF-WAY AND
PROPERTY OWNERSHIP









Appendix J: Hydrologic Analysis and Drainage Patterns



Legend

-  Existing Inlet
-  Existing Crossing
-  Flow Direction
-  Basin Boundary

0 125 250 500 750 1,000 Feet



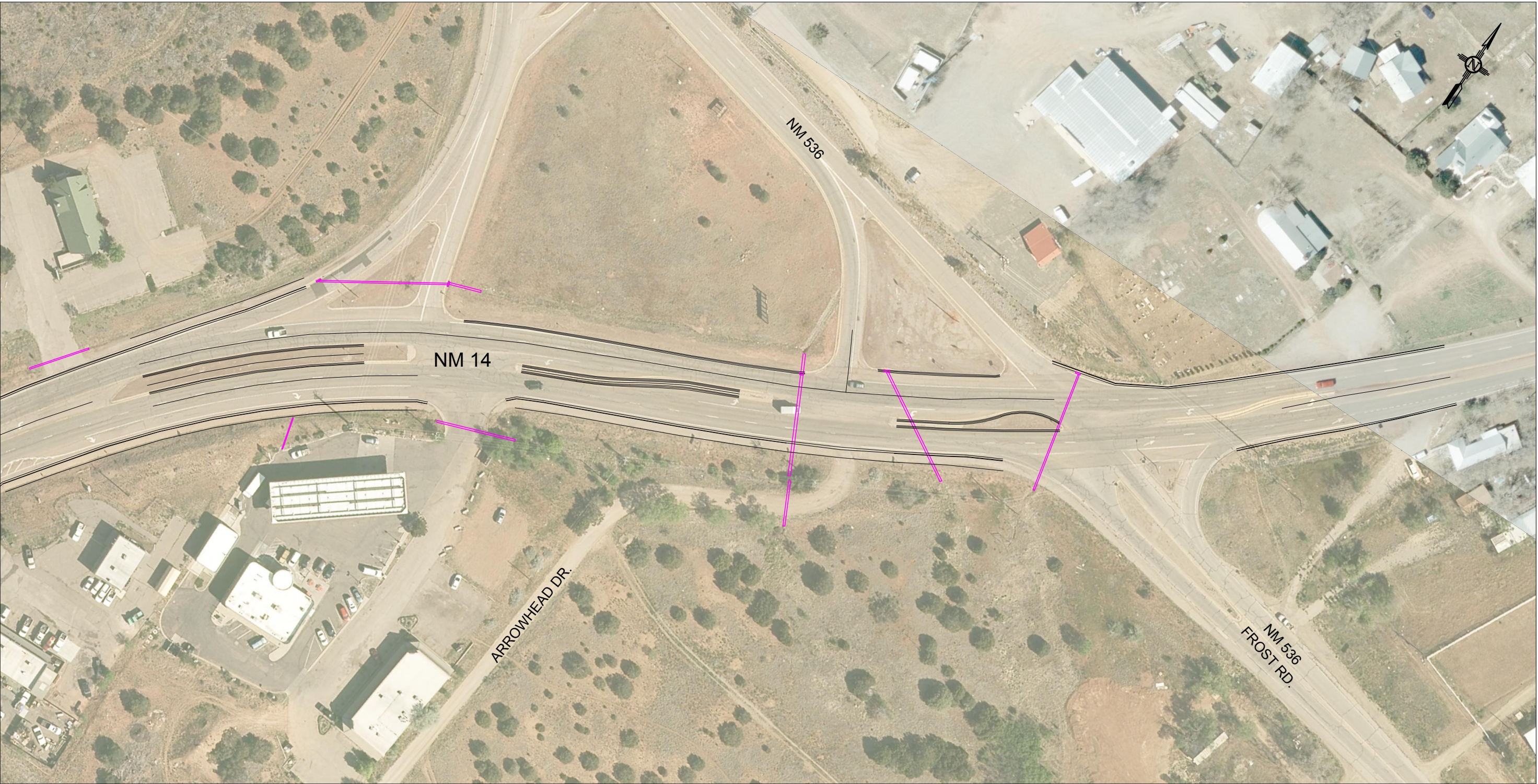
**NM 14 Study Rehabilitation Project
Phase II
Drainage Patterns**

Hydrologic Ananlysis (NM 14 Study Rehabilitation Project - Phase II)

Basin ID	Basin Area (acres)	C	Intensity (50yr, 10min) (In/hr)	Existing Peak Discharge 50-yr (cfs)	Intensity (100yr, 10min) (In/hr)	Existing Peak Discharge 100-yr (cfs)
A	1.81	0.95	5.18	8.90	5.84	10.03
B	5.35	0.70	5.18	19.40	5.84	21.87
C	1.14	0.95	5.18	5.60	5.84	6.32
D	1.81	0.95	5.18	8.90	5.84	10.03
E	6.87	0.70	5.18	24.91	5.84	28.09
F	0.75	0.90	5.18	3.50	5.84	3.95
G	0.62	0.90	5.18	2.88	5.84	3.24
H	2.13	0.70	5.18	7.72	5.84	8.71
I	0.32	0.90	5.18	1.49	5.84	1.68
J	1.85	0.85	5.18	8.15	5.84	9.19

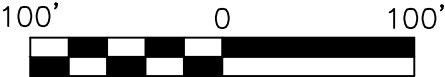


Appendix K: Existing Drainage Infrastructure



LEGEND

- PIPE
- INLET



SCALE: 1" = 100'

4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY

REVISIONS (OR CHANGE NOTICES)

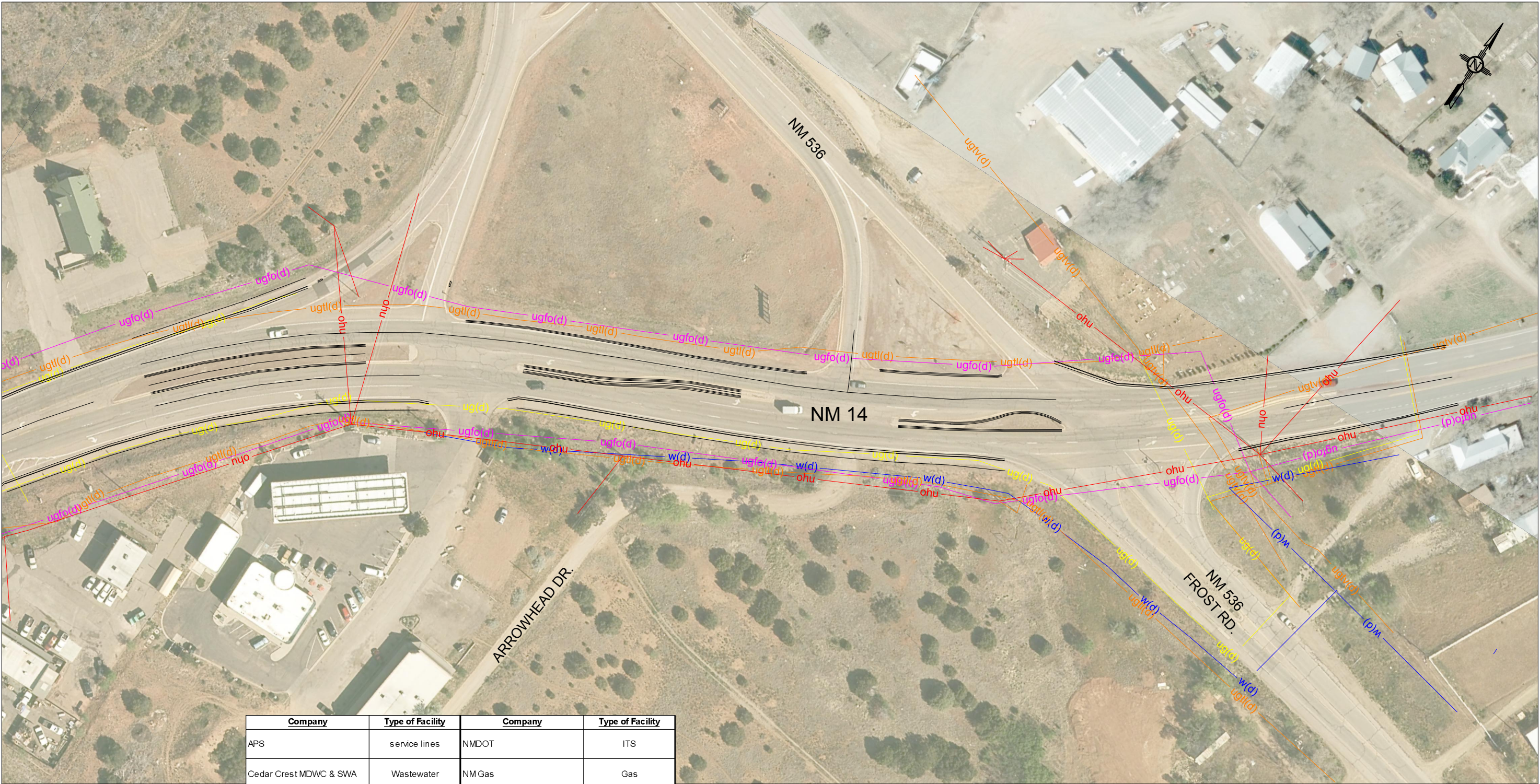
NEW MEXICO DEPARTMENT
OF TRANSPORTATION

NM 14
EXISTING DRAINAGE STRUCTURES





Appendix L: Existing Utilities



Company	Type of Facility	Company	Type of Facility
APS	service lines	NMDOT	ITS
Cedar Crest MDWC & SWA	Wastewater	NM Gas	Gas
CenturyLink	Telecommunications	Old Sandia Park Svc Co-Op	Water
CenturyLink	Network	Plateau Telecommunications	Telecommunications
Comcast	Cable TV	PNM - East Mountains	Electric
Entranosa Water & Waste water Association	Water / Wastewater	PNM	Electric
Forest Park Property Owner's Co-op Assoc.	Water	Sierra Vista South Coop	Utilities
		Sierra Vista Mutual Domestic Assoc.	Transmission

LEGEND

- ugtl(d)

TELEPHONE
- ugfo(d)

FIBER OPTIC
- ugtv(d)

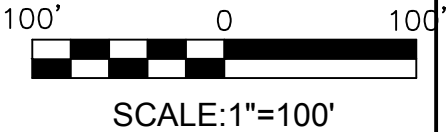
CATV
- ohe

OH ELECTRIC
- w(d)

WATER
- ug(d)

GAS
- ohu

OVERHEAD UTILITY



4			
3			
2			
1			
NO.	DESCRIPTION	DATE	BY
REVISIONS (OR CHANGE NOTICES)			
NEW MEXICO DEPARTMENT OF TRANSPORTATION			
NM 14 EXISTING UTILITY			



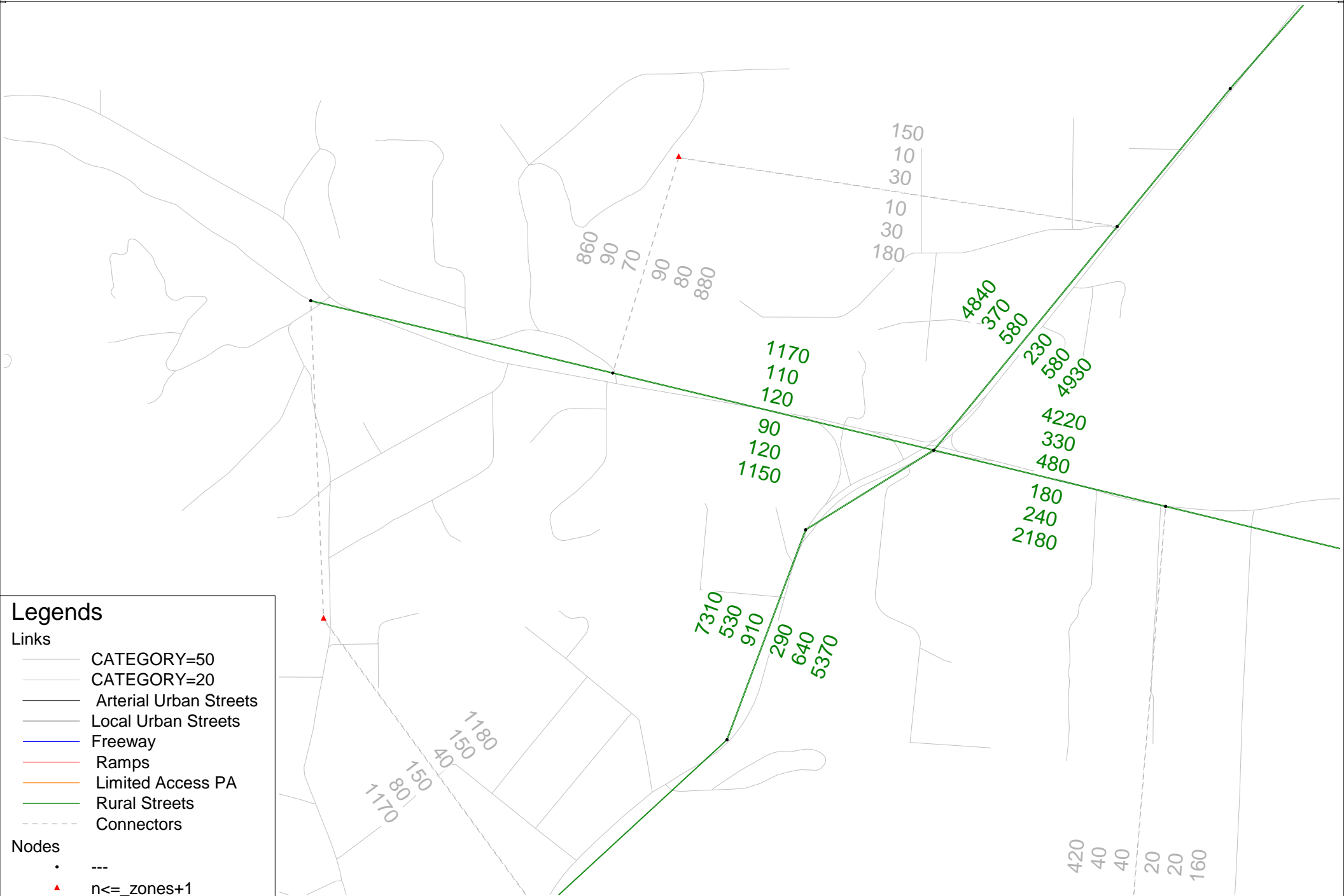


Appendix M: 2040 Metropolitan Transportation Plan Model Output

2040 MTP Dataset - Raw Model Output

AM, PM Pk Hour, and Daily volumes (AM is closest to link)

model network in solid lines, DASZ-TAZ centroid connectors (loadings) in dashed lines

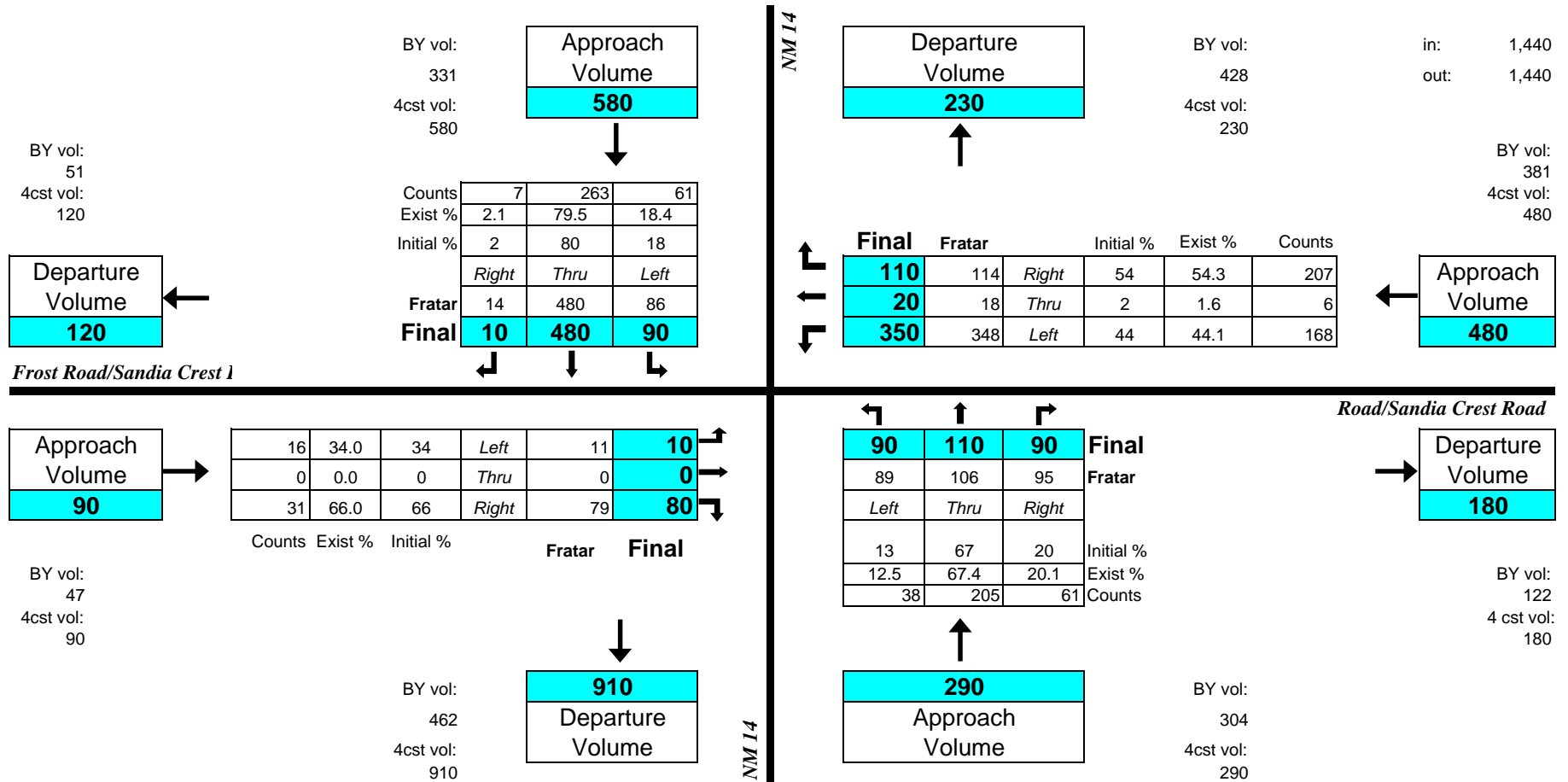




Appendix N: 2040 FRATAR Worksheets

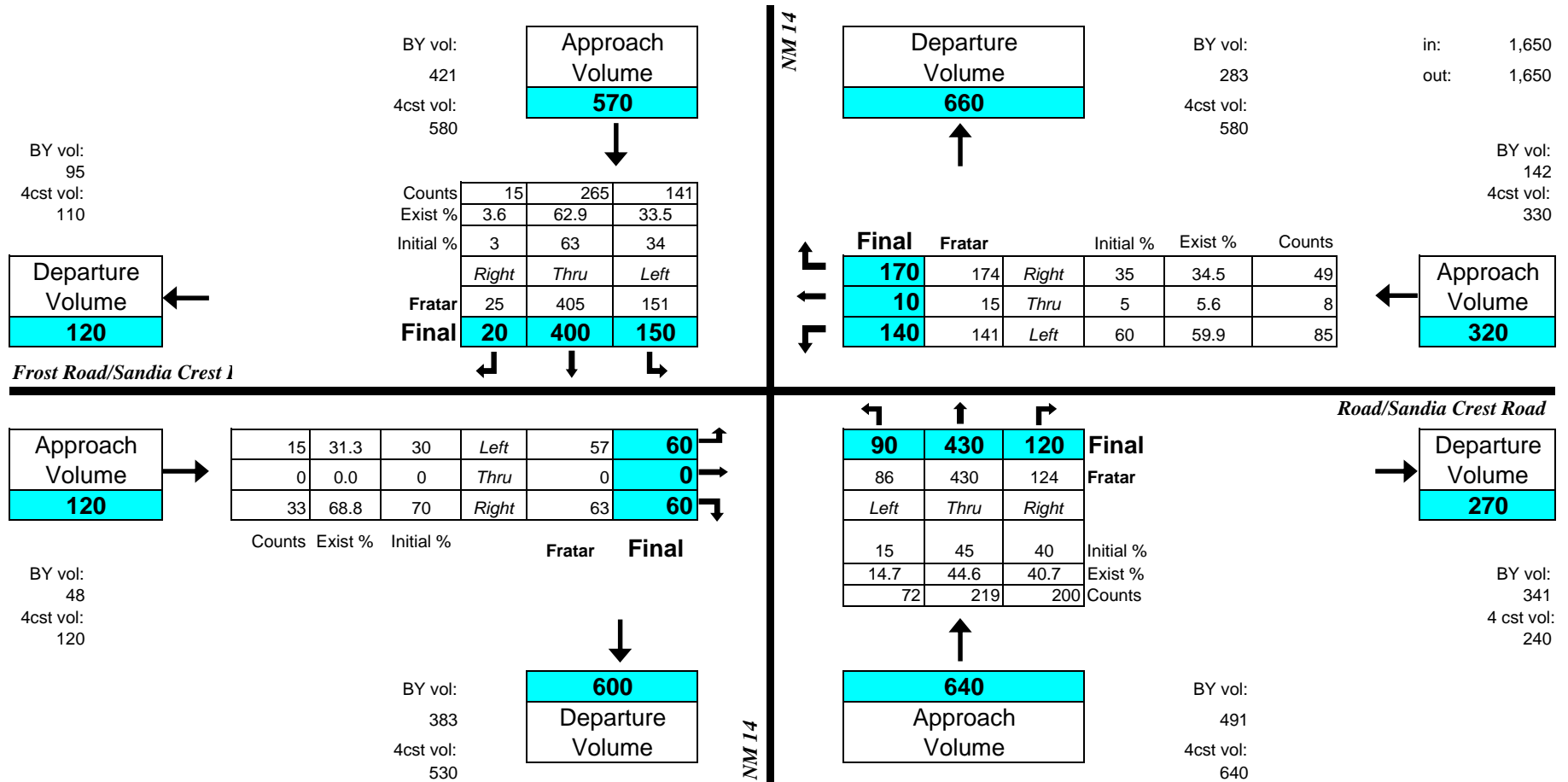
FORECASTED
Volumes are in
blue

Peak-Hour Turning Movement Worksheet	
Peak Period (AM or PM):	AM Peak Hour
North/South Leg:	NM 14
East/West leg:	Frost Road/Sandia Crest Road
SCENARIO:	2040 MTP



FORECASTED
Volumes are in
blue

Peak-Hour Turning Movement Worksheet	
Peak Period (AM or PM):	PM Peak Hour
North/South Leg:	NM 14
East/West leg:	Frost Road/Sandia Crest Road
SCENARIO:	2040 MTP





Appendix O: 2040 Existing Conditions Traffic Operations Output Files

Intersection

Int Delay, s/veh 1

Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		↑↑	↑↑		↑	↑
Traffic Vol, veh/h	0	330	830	0	10	80
Future Vol, veh/h	0	330	830	0	10	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	359	902	0	11	87

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	1081	451
Stage 1	-	-	-	-	902	-
Stage 2	-	-	-	-	179	-
Critical Hdwy	-	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	0	-	-	0	212	556
Stage 1	0	-	-	0	356	-
Stage 2	0	-	-	0	834	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	212	556
Mov Cap-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	356	-
Stage 2	-	-	-	-	834	-

Approach	NB	SB	SE
HCM Control Delay, s	0	0	13.8
HCM LOS			B

Minor Lane/Major Mvmt	NBT	SELn1	SELn2	SBT
Capacity (veh/h)	-	212	556	-
HCM Lane V/C Ratio	-	0.051	0.156	-
HCM Control Delay (s)	-	22.9	12.7	-
HCM Lane LOS	-	C	B	-
HCM 95th %tile Q(veh)	-	0.2	0.6	-

Intersection

Int Delay, s/veh 39.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕	↕		↕	↕	↕	↕	↕
Traffic Vol, veh/h	0	0	0	350	20	110	0	150	90	90	480	10
Future Vol, veh/h	0	0	0	350	20	110	0	150	90	90	480	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	0	-	-	0	100	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	380	22	120	0	163	98	98	522	11

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	620	891	82	-	0	0	163	0	0
Stage 1	163	163	-	-	-	-	-	-	-
Stage 2	457	728	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	-	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	-	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 372	280	961	0	-	-	1413	-	-
Stage 1	823	762	-	0	-	-	-	-	-
Stage 2	553	427	-	0	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	~ 352	261	961	-	-	-	1413	-	-
Mov Cap-2 Maneuver	~ 352	261	-	-	-	-	-	-	-
Stage 1	823	762	-	-	-	-	-	-	-
Stage 2	515	397	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	106.7	0	1.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	345	961	1413	-	-
HCM Lane V/C Ratio	-	-	1.166	0.124	0.069	-	-
HCM Control Delay (s)	-	-	135.6	9.3	7.7	-	-
HCM Lane LOS	-	-	F	A	A	-	-
HCM 95th %tile Q(veh)	-	-	16.4	0.4	0.2	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 1.6

Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		↑↑	↑↑		↑	↑
Traffic Vol, veh/h	0	640	540	0	60	60
Future Vol, veh/h	0	640	540	0	60	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	696	587	0	65	65

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	935	293
Stage 1	-	-	-	-	587	-
Stage 2	-	-	-	-	348	-
Critical Hdwy	-	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	0	-	-	0	264	703
Stage 1	0	-	-	0	519	-
Stage 2	0	-	-	0	686	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	264	703
Mov Cap-2 Maneuver	-	-	-	-	264	-
Stage 1	-	-	-	-	519	-
Stage 2	-	-	-	-	686	-

Approach	NB	SB	SE
HCM Control Delay, s	0	0	16.9
HCM LOS			C

Minor Lane/Major Mvmt	NBT	SELn1	SELn2	SBT
Capacity (veh/h)	-	264	703	-
HCM Lane V/C Ratio	-	0.247	0.093	-
HCM Control Delay (s)	-	23.1	10.6	-
HCM Lane LOS	-	C	B	-
HCM 95th %tile Q(veh)	-	0.9	0.3	-

Intersection

Int Delay, s/veh 14

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔	↔		↕	↕	↕	↕	↕
Traffic Vol, veh/h	0	0	0	140	10	170	0	430	120	150	400	20
Future Vol, veh/h	0	0	0	140	10	170	0	430	120	150	400	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Yield	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	0	-	-	0	100	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	152	11	185	0	467	130	163	435	22

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	1010	1250	234	-	0	0	467	0	0
Stage 1	467	467	-	-	-	-	-	-	-
Stage 2	543	783	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	-	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	-	-	-	2.22	-	-
Pot Cap-1 Maneuver	194	172	768	0	-	-	1091	-	-
Stage 1	545	560	-	0	-	-	-	-	-
Stage 2	492	403	-	0	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	172	146	768	-	-	-	1091	-	-
Mov Cap-2 Maneuver	172	146	-	-	-	-	-	-	-
Stage 1	545	560	-	-	-	-	-	-	-
Stage 2	418	343	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	58.9	0	2.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	170	768	1091	-	-
HCM Lane V/C Ratio	-	-	0.959	0.241	0.149	-	-
HCM Control Delay (s)	-	-	113	11.2	8.9	-	-
HCM Lane LOS	-	-	F	B	A	-	-
HCM 95th %tile Q(veh)	-	-	7.4	0.9	0.5	-	-



Appendix P: 2040 Existing Conditions Traffic Signal Warrants Worksheets

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: 2040 Metropolitan Transportation Plan

Intersection: NM 14/NM 536/Frost Road

Approach Type: 2 or More Lanes & 2 or More Lanes

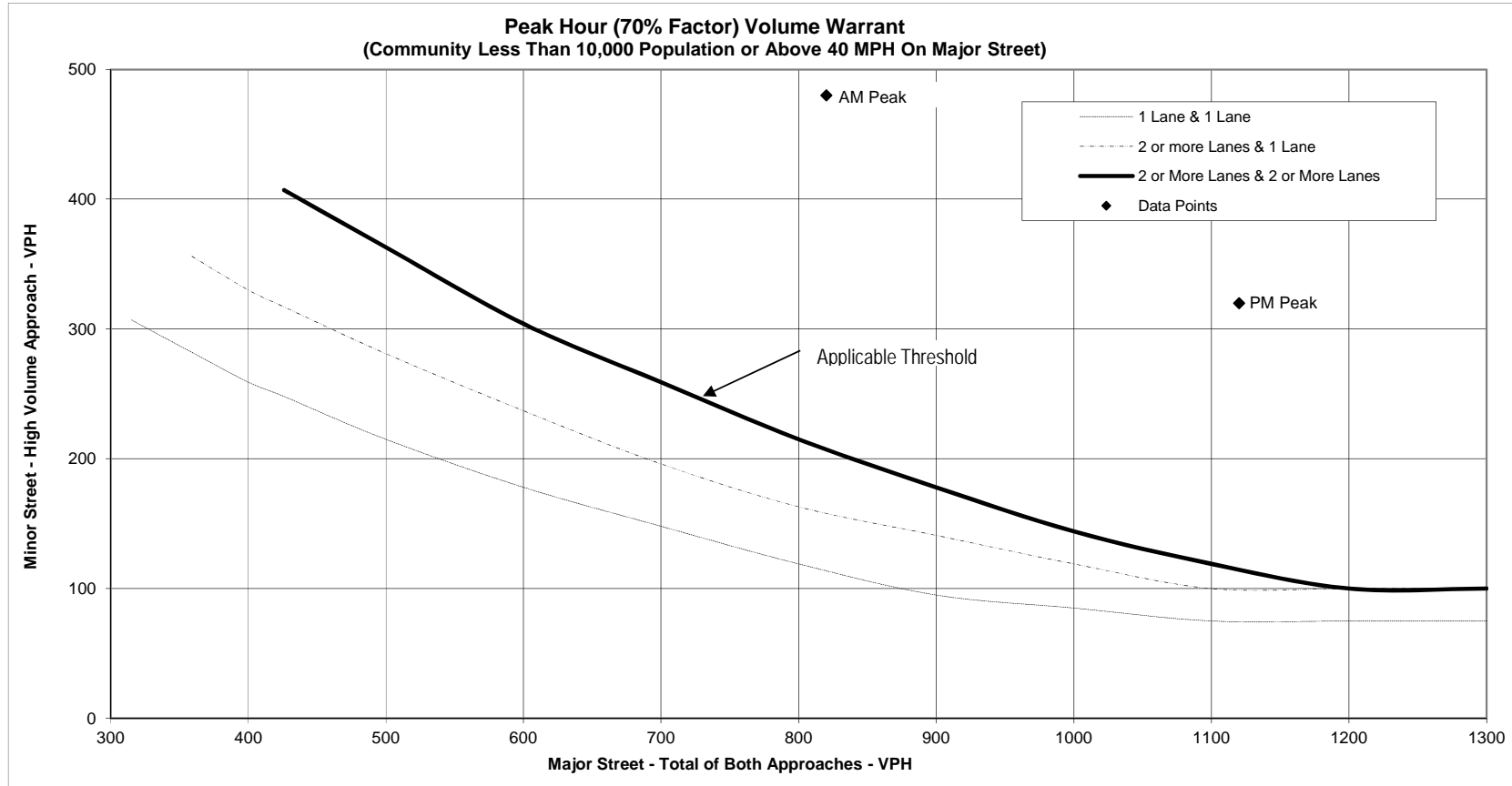
Major Street (Name): NM 14

Major Street (Orientation): North-South

Minor Street (Name): Frost Road

Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak	0	480	480	240	580	820	Yes
PM Peak	0	320	320	550	570	1,120	Yes



Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: 2040 Metropolitan Transportation Plan

Intersection: NM 14/NM 536/Frost Road

Approach Type: 2 or More Lanes & 2 or More Lanes

Major Street (Name): NM 14

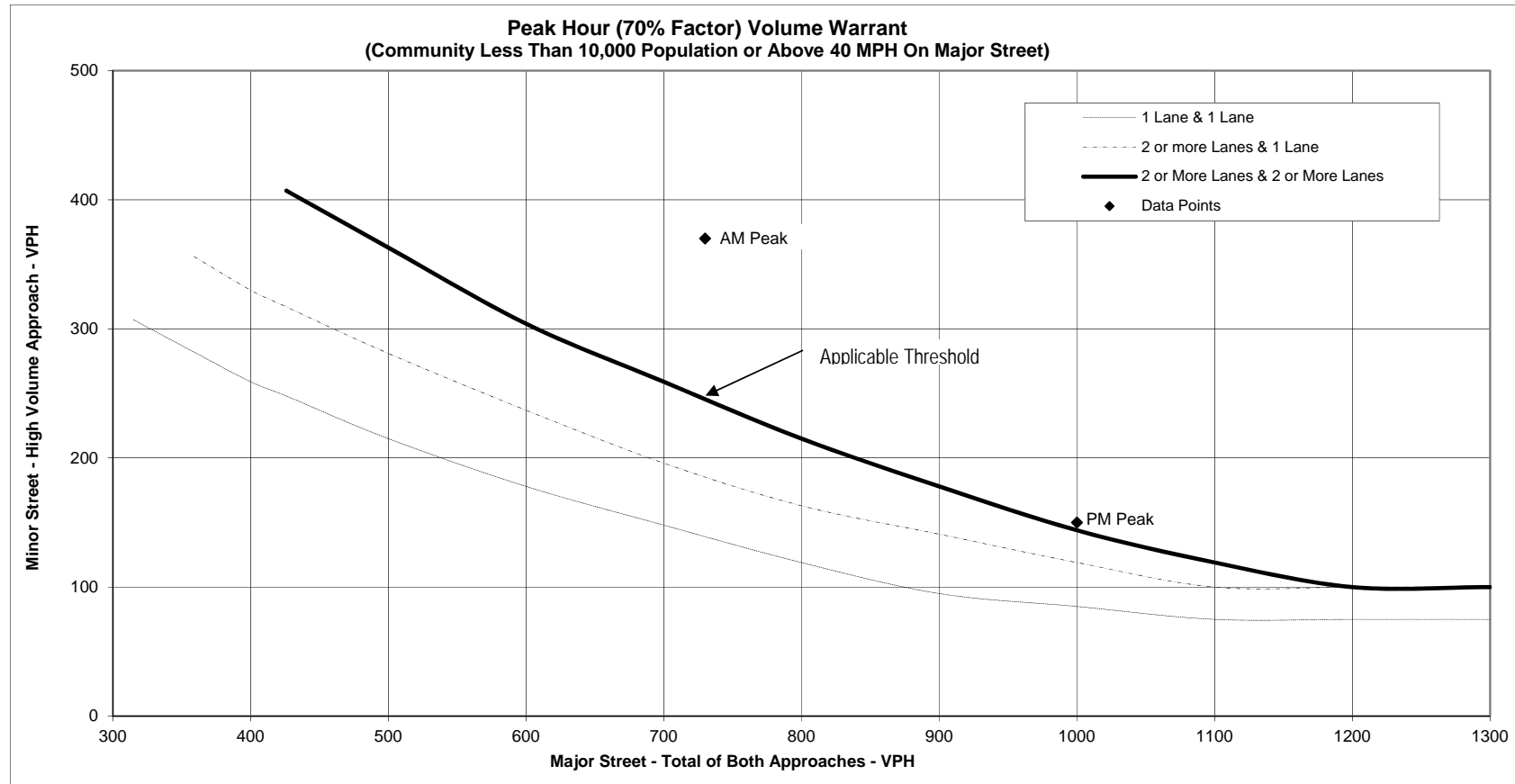
Major Street (Orientation): North-South

Minor Street (Name): Frost Road

Minor Street (Orientation): East-West

FREE RIGHT TURN MOVEMENTS REMOVED

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak	0	370	370	150	580	730	Yes
PM Peak	0	150	150	430	570	1,000	Yes












Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane









Appendix Q: Split Intersection Traffic Operations Output Files

**EXISTING
(2017)
OPERATIONS SUMMARIES**

Intersection												
Int Delay, s/veh	2.1											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	16	4	31	21	1	25	38	225	22	22	409	13
Future Vol, veh/h	16	4	31	21	1	25	38	225	22	22	409	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	200	-	0	150	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	4	34	23	1	27	41	245	24	24	445	14
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	697	819	222	599	819	122	445	0	0	245	0	0
Stage 1	492	492	-	327	327	-	-	-	-	-	-	-
Stage 2	205	327	-	272	492	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	328	309	782	385	309	906	1112	-	-	1318	-	-
Stage 1	527	546	-	660	646	-	-	-	-	-	-	-
Stage 2	778	646	-	711	546	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	304	292	782	349	292	906	1112	-	-	1318	-	-
Mov Cap-2 Maneuver	304	292	-	349	292	-	-	-	-	-	-	-
Stage 1	508	536	-	636	622	-	-	-	-	-	-	-
Stage 2	726	622	-	663	536	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	12.9			12.8			1.1			0.4		
HCM LOS	B			B								
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR				
Capacity (veh/h)	1112	-	-	515	304	656	1318	-	-			
HCM Lane V/C Ratio	0.037	-	-	0.099	0.057	0.058	0.018	-	-			
HCM Control Delay (s)	8.4	-	-	12.8	17.6	10.8	7.8	-	-			
HCM Lane LOS	A	-	-	B	C	B	A	-	-			
HCM 95th %tile Q(veh)	0.1	-	-	0.3	0.2	0.2	0.1	-	-			

Intersection










Int Delay, s/veh 4.4







Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	174	207	205	61	61	270
Future Vol, veh/h	174	207	205	61	61	270
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	200	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	189	225	223	66	66	293

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	502	-	0	0	223	0
Stage 1	223	-	-	-	-	-
Stage 2	279	-	-	-	-	-
Critical Hdwy	6.63	-	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	-	-	2.219	-
Pot Cap-1 Maneuver	514	0	-	-	1344	-
Stage 1	813	0	-	-	-	-
Stage 2	744	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	489	-	-	-	1344	-
Mov Cap-2 Maneuver	489	-	-	-	-	-
Stage 1	813	-	-	-	-	-
Stage 2	707	-	-	-	-	-

Approach	NW		NE		SW
HCM Control Delay, s	16.9		0		1.4
HCM LOS	C				

Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT
Capacity (veh/h)	-	- 489	- 1344	-
HCM Lane V/C Ratio	-	- 0.387	- 0.049	-
HCM Control Delay (s)	-	- 16.9	0 7.8	-
HCM Lane LOS	-	- C	A A	-
HCM 95th %tile Q(veh)	-	- 1.8	- 0.2	-










Intersection															
Int Delay, s/veh	2.6														
Movement	SEL	SET	SER		NWL	NWT	NWR		NEL	NET	NER		SWL	SWT	SWR
Lane Configurations															
Traffic Vol, veh/h	15	5	33		33	3	19		72	385	31		21	329	23
Future Vol, veh/h	15	5	33		33	3	19		72	385	31		21	329	23
Conflicting Peds, #/hr	0	0	0		0	0	0		0	0	0		0	0	0
Sign Control	Stop	Stop	Stop		Stop	Stop	Stop		Free	Free	Free		Free	Free	Free
RT Channelized	-	-	None		-	-	None		-	-	None		-	-	None
Storage Length	0	-	-		-	-	-		200	-	0		150	-	200
Veh in Median Storage, #	-	0	-		-	0	-		-	0	-		-	0	-
Grade, %	-	0	-		-	0	-		-	0	-		-	0	-
Peak Hour Factor	92	92	92		92	92	92		92	92	92		92	92	92
Heavy Vehicles, %	2	2	2		2	2	2		2	2	2		2	2	2
Mvmt Flow	16	5	36		36	3	21		78	418	34		23	358	25
Major/Minor	Minor2			Minor1			Major1			Major2					
Conflicting Flow All	770	978	179		802	978	209		358	0	0		418	0	0
Stage 1	403	403	-		575	575	-		-	-	-		-	-	-
Stage 2	367	575	-		227	403	-		-	-	-		-	-	-
Critical Hdwy	7.54	6.54	6.94		7.54	6.54	6.94		4.14	-	-		4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Critical Hdwy Stg 2	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Follow-up Hdwy	3.52	4.02	3.32		3.52	4.02	3.32		2.22	-	-		2.22	-	-
Pot Cap-1 Maneuver	290	249	833		275	249	797		1197	-	-		1138	-	-
Stage 1	595	598	-		470	501	-		-	-	-		-	-	-
Stage 2	625	501	-		755	598	-		-	-	-		-	-	-
Platoon blocked, %										-	-			-	-
Mov Cap-1 Maneuver	261	228	833		242	228	797		1197	-	-		1138	-	-
Mov Cap-2 Maneuver	261	228	-		242	228	-		-	-	-		-	-	-
Stage 1	556	586	-		439	468	-		-	-	-		-	-	-
Stage 2	565	468	-		701	586	-		-	-	-		-	-	-
Approach	SE			NW			NE			SW					
HCM Control Delay, s	13.7			19			1.2			0.5					
HCM LOS	B			C											
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR							
Capacity (veh/h)	1197	-	-	317	261	617	1138	-	-						
HCM Lane V/C Ratio	0.065	-	-	0.189	0.062	0.067	0.02	-	-						
HCM Control Delay (s)	8.2	-	-	19	19.7	11.3	8.2	-	-						
HCM Lane LOS	A	-	-	C	C	B	A	-	-						
HCM 95th %tile Q(veh)	0.2	-	-	0.7	0.2	0.2	0.1	-	-						

Intersection						
Int Delay, s/veh	3.2					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	93	49	219	200	141	280
Future Vol, veh/h	93	49	219	200	141	280
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	200	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	101	53	238	217	153	304
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	697	-	0	0	238	0
Stage 1	238	-	-	-	-	-
Stage 2	459	-	-	-	-	-
Critical Hdwy	6.63	-	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	-	-	2.219	-
Pot Cap-1 Maneuver	391	0	-	-	1327	-
Stage 1	801	0	-	-	-	-
Stage 2	604	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	346	-	-	-	1327	-
Mov Cap-2 Maneuver	346	-	-	-	-	-
Stage 1	801	-	-	-	-	-
Stage 2	534	-	-	-	-	-
Approach	NW	NE		SW		
HCM Control Delay, s	19.6	0		2.7		
HCM LOS	C					
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT		
Capacity (veh/h)	-	- 346	-	1327		
HCM Lane V/C Ratio	-	- 0.292	-	0.115		
HCM Control Delay (s)	-	- 19.6	0	8.1		
HCM Lane LOS	-	- C	A	A		
HCM 95th %tile Q(veh)	-	- 1.2	-	0.4		

2040 MTP
OPERATIONS SUMMARIES

Intersection

Int Delay, s/veh 3.4

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	10	10	80	35	5	10	90	130	25	20	820	30
Future Vol, veh/h	10	10	80	35	5	10	90	130	25	20	820	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	200	-	0	150	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	87	38	5	11	98	141	27	22	891	33







Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1204	1272	446	832	1272	71	891	0	0	141	0	0
Stage 1	935	935	-	337	337	-	-	-	-	-	-	-
Stage 2	269	337	-	495	935	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	140	166	560	262	166	977	757	-	-	1440	-	-
Stage 1	285	342	-	651	640	-	-	-	-	-	-	-
Stage 2	713	640	-	525	342	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	120	142	560	186	142	977	757	-	-	1440	-	-
Mov Cap-2 Maneuver	120	142	-	186	142	-	-	-	-	-	-	-
Stage 1	248	337	-	567	557	-	-	-	-	-	-	-
Stage 2	608	557	-	423	337	-	-	-	-	-	-	-













Approach	SE	NW	NE	SW
HCM Control Delay, s	18.3	27.5	3.8	0.2
HCM LOS	C	D		










Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR	
Capacity (veh/h)	757	-	-	214	120	422	1440	-	-
HCM Lane V/C Ratio	0.129	-	-	0.254	0.091	0.232	0.015	-	-
HCM Control Delay (s)	10.5	-	-	27.5	38	16.1	7.5	-	-
HCM Lane LOS	B	-	-	D	E	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	1	0.3	0.9	0	-	-

NM 14/Frost Road (Unsignalized)
Alternative 1A - Split Intersection

2040 MTP - AM Peak
11/20/2017

Intersection								
Int Delay, s/veh	25.2							
Movement	NWL	NWR	NET	NER	SWL	SWT		
Lane Configurations								
Traffic Vol, veh/h	370	110	150	90	90	500		
Future Vol, veh/h	370	110	150	90	90	500		
Conflicting Peds, #/hr	0	0	0	0	0	0		
Sign Control	Stop	Stop	Free	Free	Free	Free		
RT Channelized	-	Free	-	None	-	None		
Storage Length	0	0	-	0	200	-		
Veh in Median Storage, #	0	-	0	-	-	0		
Grade, %	0	-	0	-	-	0		
Peak Hour Factor	92	92	92	92	92	92		
Heavy Vehicles, %	2	2	2	2	2	2		
Mvmt Flow	402	120	163	98	98	543		
Major/Minor	Minor1		Major1		Major2			
Conflicting Flow All	630	-	0	0	163	0		
Stage 1	163	-	-	-	-	-		
Stage 2	467	-	-	-	-	-		
Critical Hdwy	6.63	-	-	-	4.13	-		
Critical Hdwy Stg 1	5.43	-	-	-	-	-		
Critical Hdwy Stg 2	5.83	-	-	-	-	-		
Follow-up Hdwy	3.519	-	-	-	2.219	-		
Pot Cap-1 Maneuver	429	0	-	-	1414	-		
Stage 1	865	0	-	-	-	-		
Stage 2	598	0	-	-	-	-		
Platoon blocked, %			-	-		-		
Mov Cap-1 Maneuver	~ 399	-	-	-	1414	-		
Mov Cap-2 Maneuver	~ 399	-	-	-	-	-		
Stage 1	865	-	-	-	-	-		
Stage 2	557	-	-	-	-	-		
Approach	NW		NE		SW			
HCM Control Delay, s	79.8		0		1.2			
HCM LOS	F							
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT				
Capacity (veh/h)	-	- 399	-	1414	-			
HCM Lane V/C Ratio	-	- 1.008	-	0.069	-			
HCM Control Delay (s)	-	- 79.8	0	7.7	-			
HCM Lane LOS	-	- F	A	A	-			
HCM 95th %tile Q(veh)	-	- 12.5	-	0.2	-			
Notes								
~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon								

								
Movement	NWL	NWR	NET	NER	SWL	SWT		
Lane Configurations								
Traffic Volume (veh/h)	370	110	150	90	90	500		
Future Volume (veh/h)	370	110	150	90	90	500		
Number	5	12	4	14	3	8		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	402	0	163	98	98	543		
Adj No. of Lanes	1	1	1	1	1	2		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	997	890	496	422	355	942		
Arrive On Green	0.56	0.00	0.27	0.27	0.27	0.27		
Sat Flow, veh/h	1774	1583	1863	1583	1114	3632		
Grp Volume(v), veh/h	402	0	163	98	98	543		
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1114	1770		
Q Serve(g_s), s	6.7	0.0	3.7	2.5	4.1	7.0		
Cycle Q Clear(g_c), s	6.7	0.0	3.7	2.5	7.8	7.0		
Prop In Lane	1.00	1.00		1.00	1.00			
Lane Grp Cap(c), veh/h	997	890	496	422	355	942		
V/C Ratio(X)	0.40	0.00	0.33	0.23	0.28	0.58		
Avail Cap(c_a), veh/h	997	890	763	649	515	1450		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	6.5	0.0	15.5	15.1	18.6	16.7		
Incr Delay (d2), s/veh	1.2	0.0	0.4	0.3	0.4	0.6		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.6	0.0	2.0	1.1	1.3	3.5		
LnGrp Delay(d),s/veh	7.7	0.0	15.9	15.3	19.0	17.2		
LnGrp LOS	A		B	B	B	B		
Approach Vol, veh/h	402		261			641		
Approach Delay, s/veh	7.7		15.7			17.5		
Approach LOS	A		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		34.0		18.5				18.5
Change Period (Y+Rc), s		4.5		4.5				4.5
Max Green Setting (Gmax), s		29.5		21.5				21.5
Max Q Clear Time (g_c+I1), s		8.7		5.7				9.8
Green Ext Time (p_c), s		1.2		4.9				4.2
Intersection Summary								
HCM 2010 Ctrl Delay			14.1					
HCM 2010 LOS			B					







Intersection												
Int Delay, s/veh	4.7											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	60	10	65	25	5	30	90	340	25	30	510	40
Future Vol, veh/h	60	10	65	25	5	30	90	340	25	30	510	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	200	-	0	150	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	11	71	27	5	33	98	370	27	33	554	43
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1003	1185	277	913	1185	185	554	0	0	370	0	0
Stage 1	620	620	-	565	565	-	-	-	-	-	-	-
Stage 2	383	565	-	348	620	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	196	188	720	228	188	826	1012	-	-	1185	-	-
Stage 1	442	478	-	477	506	-	-	-	-	-	-	-
Stage 2	611	506	-	641	478	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	166	165	720	177	165	826	1012	-	-	1185	-	-
Mov Cap-2 Maneuver	166	165	-	177	165	-	-	-	-	-	-	-
Stage 1	399	465	-	431	457	-	-	-	-	-	-	-
Stage 2	524	457	-	549	465	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	25.4			21.1			1.8			0.4		
HCM LOS	D			C								
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR				
Capacity (veh/h)	1012	-	-	289	166	497	1185	-	-			
HCM Lane V/C Ratio	0.097	-	-	0.226	0.393	0.164	0.028	-	-			
HCM Control Delay (s)	8.9	-	-	21.1	40.1	13.7	8.1	-	-			
HCM Lane LOS	A	-	-	C	E	B	A	-	-			
HCM 95th %tile Q(veh)	0.3	-	-	0.8	1.7	0.6	0.1	-	-			

NM 14/Frost Road (Unsignalized)
Alternative 1A - Split Intersection

2040 MTP - PM Peak
11/20/2017

Intersection













Int Delay, s/veh 8.7

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	150	170	430	120	150	430
Future Vol, veh/h	150	170	430	120	150	430
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	200	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	163	185	467	130	163	467

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1027	-	0	0	467	0
Stage 1	467	-	-	-	-	-
Stage 2	560	-	-	-	-	-
Critical Hdwy	6.63	-	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	-	-	2.219	-
Pot Cap-1 Maneuver	245	0	-	-	1093	-
Stage 1	630	0	-	-	-	-
Stage 2	536	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	208	-	-	-	1093	-
Mov Cap-2 Maneuver	208	-	-	-	-	-
Stage 1	630	-	-	-	-	-
Stage 2	456	-	-	-	-	-

Approach	NW		NE		SW
HCM Control Delay, s	65.7		0		2.3
HCM LOS	F				

Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT
Capacity (veh/h)	-	- 208	- 1093	-
HCM Lane V/C Ratio	-	- 0.784	- 0.149	-
HCM Control Delay (s)	-	- 65.7	0 8.9	-
HCM Lane LOS	-	- F	A A	-
HCM 95th %tile Q(veh)	-	- 5.5	- 0.5	-

								
Movement	NWL	NWR	NET	NER	SWL	SWT		
Lane Configurations								
Traffic Volume (veh/h)	150	170	430	120	150	430		
Future Volume (veh/h)	150	170	430	120	150	430		
Number	5	12	4	14	3	8		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	163	0	467	130	163	467		
Adj No. of Lanes	1	1	1	1	1	2		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	670	598	865	736	360	1644		
Arrive On Green	0.38	0.00	0.46	0.46	0.46	0.46		
Sat Flow, veh/h	1774	1583	1863	1583	818	3632		
Grp Volume(v), veh/h	163	0	467	130	163	467		
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	818	1770		
Q Serve(g_s), s	3.6	0.0	10.2	2.7	10.1	4.6		
Cycle Q Clear(g_c), s	3.6	0.0	10.2	2.7	20.3	4.6		
Prop In Lane	1.00	1.00		1.00	1.00			
Lane Grp Cap(c), veh/h	670	598	865	736	360	1644		
V/C Ratio(X)	0.24	0.00	0.54	0.18	0.45	0.28		
Avail Cap(c_a), veh/h	670	598	965	820	403	1833		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	12.2	0.0	10.9	8.9	18.2	9.4		
Incr Delay (d2), s/veh	0.9	0.0	0.5	0.1	0.9	0.1		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	1.9	0.0	5.3	1.2	2.4	2.2		
LnGrp Delay(d),s/veh	13.0	0.0	11.4	9.0	19.1	9.5		
LnGrp LOS	B		B	A	B	A		
Approach Vol, veh/h	163		597			630		
Approach Delay, s/veh	13.0		10.9			12.0		
Approach LOS	B		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		26.0		31.0				31.0
Change Period (Y+Rc), s		4.5		4.5				4.5
Max Green Setting (Gmax), s		21.5		29.5				29.5
Max Q Clear Time (g_c+I1), s		5.6		12.2				22.3
Green Ext Time (p_c), s		0.4		7.3				4.1
Intersection Summary								
HCM 2010 Ctrl Delay			11.6					
HCM 2010 LOS			B					

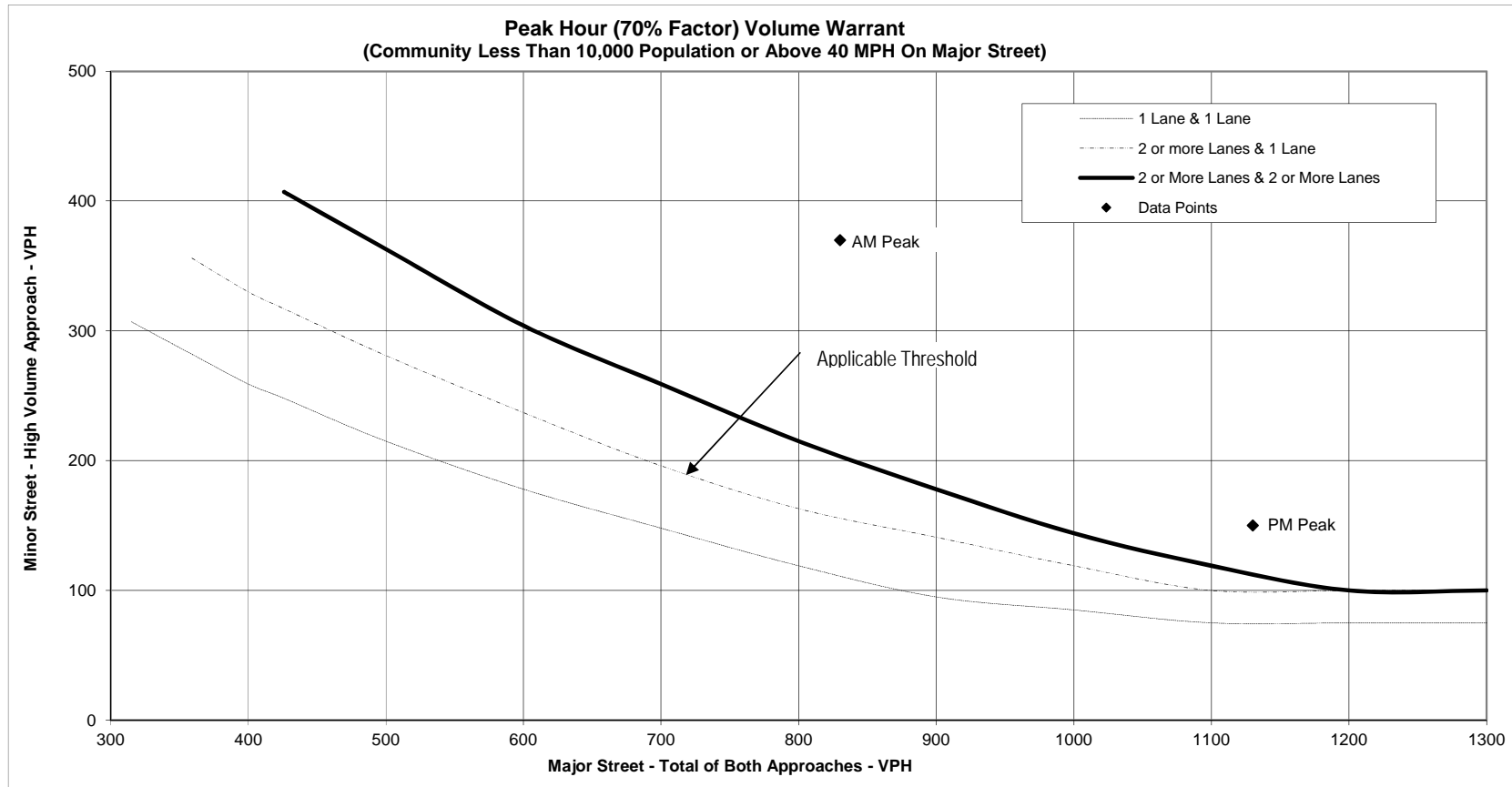


Appendix R: Split Intersection Traffic Signal Warrants Worksheets

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: 2040 / Split Intersection (Alternative 1A)
 Intersection: NM 14 / Frost Road
 Approach Type: 2 or More Lanes & 1 Lane
 Major Street (Name): NM 14
 Major Street (Orientation): North-South
 Minor Street (Name): Frost Road
 Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak		370	370	240	590	830	Yes
PM Peak		150	150	550	580	1,130	Yes


















Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane


















Appendix S: Split Intersection with High-T Traffic Operations Output Files

**EXISTING
(2017)
OPERATIONS SUMMARIES**

Intersection															
Int Delay, s/veh	2.1														
Movement	SEL	SET	SER		NWL	NWT	NWR		NEL	NET	NER		SWL	SWT	SWR
Lane Configurations															
Traffic Vol, veh/h	16	4	31		21	1	25		38	225	22		22	409	13
Future Vol, veh/h	16	4	31		21	1	25		38	225	22		22	409	13
Conflicting Peds, #/hr	0	0	0		0	0	0		0	0	0		0	0	0
Sign Control	Stop	Stop	Stop		Stop	Stop	Stop		Free	Free	Free		Free	Free	Free
RT Channelized	-	-	None		-	-	None		-	-	None		-	-	None
Storage Length	0	-	-		-	-	-		200	-	0		150	-	200
Veh in Median Storage, #	-	0	-		-	0	-		-	0	-		-	0	-
Grade, %	-	0	-		-	0	-		-	0	-		-	0	-
Peak Hour Factor	92	92	92		92	92	92		92	92	92		92	92	92
Heavy Vehicles, %	2	2	2		2	2	2		2	2	2		2	2	2
Mvmt Flow	17	4	34		23	1	27		41	245	24		24	445	14
Major/Minor	Minor2			Minor1			Major1			Major2					
Conflicting Flow All	697	819	222		599	819	122		445	0	0		245	0	0
Stage 1	492	492	-		327	327	-		-	-	-		-	-	-
Stage 2	205	327	-		272	492	-		-	-	-		-	-	-
Critical Hdwy	7.54	6.54	6.94		7.54	6.54	6.94		4.14	-	-		4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Critical Hdwy Stg 2	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Follow-up Hdwy	3.52	4.02	3.32		3.52	4.02	3.32		2.22	-	-		2.22	-	-
Pot Cap-1 Maneuver	328	309	782		385	309	906		1112	-	-		1318	-	-
Stage 1	527	546	-		660	646	-		-	-	-		-	-	-
Stage 2	778	646	-		711	546	-		-	-	-		-	-	-
Platoon blocked, %										-	-			-	-
Mov Cap-1 Maneuver	304	292	782		349	292	906		1112	-	-		1318	-	-
Mov Cap-2 Maneuver	304	292	-		349	292	-		-	-	-		-	-	-
Stage 1	508	536	-		636	622	-		-	-	-		-	-	-
Stage 2	726	622	-		663	536	-		-	-	-		-	-	-
Approach	SE			NW			NE			SW					
HCM Control Delay, s	12.9			12.8			1.1			0.4					
HCM LOS	B			B											
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR							
Capacity (veh/h)	1112	-	-	515	304	656	1318	-	-						
HCM Lane V/C Ratio	0.037	-	-	0.099	0.057	0.058	0.018	-	-						
HCM Control Delay (s)	8.4	-	-	12.8	17.6	10.8	7.8	-	-						
HCM Lane LOS	A	-	-	B	C	B	A	-	-						
HCM 95th %tile Q(veh)	0.1	-	-	0.3	0.2	0.2	0.1	-	-						

Intersection						
Int Delay, s/veh	5.9					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	174	207	205	61	61	0
Future Vol, veh/h	174	207	205	61	61	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	189	225	223	66	66	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	356	-	0	0	223	0
Stage 1	223	-	-	-	-	-
Stage 2	133	-	-	-	-	-
Critical Hdwy	7.12	-	-	-	4.12	-
Critical Hdwy Stg 1	6.12	-	-	-	-	-
Critical Hdwy Stg 2	6.12	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.218	-
Pot Cap-1 Maneuver	599	0	-	-	1346	-
Stage 1	780	0	-	-	-	-
Stage 2	870	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	577	-	-	-	1346	-
Mov Cap-2 Maneuver	577	-	-	-	-	-
Stage 1	780	-	-	-	-	-
Stage 2	827	-	-	-	-	-
Approach	NW	NE		SW		
HCM Control Delay, s	14.3	0		7.8		
HCM LOS	B					
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT		
Capacity (veh/h)	-	- 577	- 1346	-		
HCM Lane V/C Ratio	-	- 0.328	- 0.049	-		
HCM Control Delay (s)	-	- 14.3	0 7.8	-		
HCM Lane LOS	-	- B	A A	-		
HCM 95th %tile Q(veh)	-	- 1.4	- 0.2	-		










Intersection															
Int Delay, s/veh	2.6														
Movement	SEL	SET	SER		NWL	NWT	NWR		NEL	NET	NER		SWL	SWT	SWR
Lane Configurations															
Traffic Vol, veh/h	15	5	33		33	3	19		72	385	31		21	329	23
Future Vol, veh/h	15	5	33		33	3	19		72	385	31		21	329	23
Conflicting Peds, #/hr	0	0	0		0	0	0		0	0	0		0	0	0
Sign Control	Stop	Stop	Stop		Stop	Stop	Stop		Free	Free	Free		Free	Free	Free
RT Channelized	-	-	None		-	-	None		-	-	None		-	-	None
Storage Length	0	-	-		-	-	-		200	-	0		150	-	200
Veh in Median Storage, #	-	0	-		-	0	-		-	0	-		-	0	-
Grade, %	-	0	-		-	0	-		-	0	-		-	0	-
Peak Hour Factor	92	92	92		92	92	92		92	92	92		92	92	92
Heavy Vehicles, %	2	2	2		2	2	2		2	2	2		2	2	2
Mvmt Flow	16	5	36		36	3	21		78	418	34		23	358	25
Major/Minor	Minor2			Minor1			Major1			Major2					
Conflicting Flow All	770	978	179		802	978	209		358	0	0		418	0	0
Stage 1	403	403	-		575	575	-		-	-	-		-	-	-
Stage 2	367	575	-		227	403	-		-	-	-		-	-	-
Critical Hdwy	7.54	6.54	6.94		7.54	6.54	6.94		4.14	-	-		4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Critical Hdwy Stg 2	6.54	5.54	-		6.54	5.54	-		-	-	-		-	-	-
Follow-up Hdwy	3.52	4.02	3.32		3.52	4.02	3.32		2.22	-	-		2.22	-	-
Pot Cap-1 Maneuver	290	249	833		275	249	797		1197	-	-		1138	-	-
Stage 1	595	598	-		470	501	-		-	-	-		-	-	-
Stage 2	625	501	-		755	598	-		-	-	-		-	-	-
Platoon blocked, %										-	-			-	-
Mov Cap-1 Maneuver	261	228	833		242	228	797		1197	-	-		1138	-	-
Mov Cap-2 Maneuver	261	228	-		242	228	-		-	-	-		-	-	-
Stage 1	556	586	-		439	468	-		-	-	-		-	-	-
Stage 2	565	468	-		701	586	-		-	-	-		-	-	-
Approach	SE			NW			NE			SW					
HCM Control Delay, s	13.7			19			1.2			0.5					
HCM LOS	B			C											
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR							
Capacity (veh/h)	1197	-	-	317	261	617	1138	-	-						
HCM Lane V/C Ratio	0.065	-	-	0.189	0.062	0.067	0.02	-	-						
HCM Control Delay (s)	8.2	-	-	19	19.7	11.3	8.2	-	-						
HCM Lane LOS	A	-	-	C	C	B	A	-	-						
HCM 95th %tile Q(veh)	0.2	-	-	0.7	0.2	0.2	0.1	-	-						

Intersection						
Int Delay, s/veh	4					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	93	49	219	200	141	0
Future Vol, veh/h	93	49	219	200	141	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	101	53	238	217	153	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	545	-	0	0	238	0
Stage 1	238	-	-	-	-	-
Stage 2	307	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.218	-
Pot Cap-1 Maneuver	499	0	-	-	1329	-
Stage 1	802	0	-	-	-	-
Stage 2	746	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	442	-	-	-	1329	-
Mov Cap-2 Maneuver	442	-	-	-	-	-
Stage 1	802	-	-	-	-	-
Stage 2	660	-	-	-	-	-
Approach	NW	NE		SW		
HCM Control Delay, s	15.5	0		8.1		
HCM LOS	C					
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT		
Capacity (veh/h)	-	- 442	- 1329	-		
HCM Lane V/C Ratio	-	- 0.229	- 0.115	-		
HCM Control Delay (s)	-	- 15.5	0 8.1	-		
HCM Lane LOS	-	- C	A A	-		
HCM 95th %tile Q(veh)	-	- 0.9	- 0.4	-		

2040 MTP
OPERATIONS SUMMARIES

Intersection







Int Delay, s/veh 3.4

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	10	10	80	35	5	10	90	130	25	20	820	30
Future Vol, veh/h	10	10	80	35	5	10	90	130	25	20	820	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	200	-	0	150	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	87	38	5	11	98	141	27	22	891	33

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1204	1272	446	832	1272	71	891	0	0	141	0	0
Stage 1	935	935	-	337	337	-	-	-	-	-	-	-
Stage 2	269	337	-	495	935	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	140	166	560	262	166	977	757	-	-	1440	-	-
Stage 1	285	342	-	651	640	-	-	-	-	-	-	-
Stage 2	713	640	-	525	342	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	120	142	560	186	142	977	757	-	-	1440	-	-
Mov Cap-2 Maneuver	120	142	-	186	142	-	-	-	-	-	-	-
Stage 1	248	337	-	567	557	-	-	-	-	-	-	-
Stage 2	608	557	-	423	337	-	-	-	-	-	-	-










Approach	SE	NW	NE	SW
HCM Control Delay, s	18.3	27.5	3.8	0.2
HCM LOS	C	D		

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR	
Capacity (veh/h)	757	-	-	214	120	422	1440	-	-
HCM Lane V/C Ratio	0.129	-	-	0.254	0.091	0.232	0.015	-	-
HCM Control Delay (s)	10.5	-	-	27.5	38	16.1	7.5	-	-
HCM Lane LOS	B	-	-	D	E	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	1	0.3	0.9	0	-	-

Intersection						
Int Delay, s/veh	13					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	370	110	150	90	90	0
Future Vol, veh/h	370	110	150	90	90	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	402	120	163	98	98	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	359	-	0	0	163	0
Stage 1	163	-	-	-	-	-
Stage 2	196	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.218	-
Pot Cap-1 Maneuver	640	0	-	-	1416	-
Stage 1	866	0	-	-	-	-
Stage 2	837	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	596	-	-	-	1416	-
Mov Cap-2 Maneuver	596	-	-	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	779	-	-	-	-	-
Approach	NW	NE		SW		
HCM Control Delay, s	22.7	0		7.7		
HCM LOS	C					
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT		
Capacity (veh/h)	-	- 596	-	1416	-	
HCM Lane V/C Ratio	-	- 0.675	-	0.069	-	
HCM Control Delay (s)	-	- 22.7	0	7.7	-	
HCM Lane LOS	-	- C	A	A	-	
HCM 95th %tile Q(veh)	-	- 5.1	-	0.2	-	

Intersection

Int Delay, s/veh 4.7

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	60	10	65	25	5	30	90	340	25	30	510	40
Future Vol, veh/h	60	10	65	25	5	30	90	340	25	30	510	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	200	-	0	150	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	11	71	27	5	33	98	370	27	33	554	43

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1003	1185	277	913	1185	185	554	0	0	370	0	0
Stage 1	620	620	-	565	565	-	-	-	-	-	-	-
Stage 2	383	565	-	348	620	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	196	188	720	228	188	826	1012	-	-	1185	-	-
Stage 1	442	478	-	477	506	-	-	-	-	-	-	-
Stage 2	611	506	-	641	478	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	166	165	720	177	165	826	1012	-	-	1185	-	-
Mov Cap-2 Maneuver	166	165	-	177	165	-	-	-	-	-	-	-
Stage 1	399	465	-	431	457	-	-	-	-	-	-	-
Stage 2	524	457	-	549	465	-	-	-	-	-	-	-







Approach	SE	NW	NE	SW
HCM Control Delay, s	25.4	21.1	1.8	0.4
HCM LOS	D	C		

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	SELn1	SELn2	SWL	SWT	SWR
Capacity (veh/h)	1012	-	-	289	166	497	1185	-
HCM Lane V/C Ratio	0.097	-	-	0.226	0.393	0.164	0.028	-
HCM Control Delay (s)	8.9	-	-	21.1	40.1	13.7	8.1	-
HCM Lane LOS	A	-	-	C	E	B	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0.8	1.7	0.6	0.1	-

NM 14/Frost Road
Alternative 1B - Split Intersection with High-T

2040 MTP - PM Peak

11/20/2017

Intersection						
Int Delay, s/veh	6.8					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	150	170	430	120	150	0
Future Vol, veh/h	150	170	430	120	150	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	0	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	163	185	467	130	163	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	793	-	0	0	467	0
Stage 1	467	-	-	-	-	-
Stage 2	326	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	2.218	-
Pot Cap-1 Maneuver	358	0	-	-	1094	-
Stage 1	631	0	-	-	-	-
Stage 2	731	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	305	-	-	-	1094	-
Mov Cap-2 Maneuver	305	-	-	-	-	-
Stage 1	631	-	-	-	-	-
Stage 2	622	-	-	-	-	-
Approach	NW	NE		SW		
HCM Control Delay, s	29.6	0		8.9		
HCM LOS	D					
Minor Lane/Major Mvmt	NET	NERNWLn1NWLn2	SWL	SWT		
Capacity (veh/h)	-	- 305	- 1094	-		
HCM Lane V/C Ratio	-	- 0.535	- 0.149	-		
HCM Control Delay (s)	-	- 29.6	0 8.9	-		
HCM Lane LOS	-	- D	A A	-		
HCM 95th %tile Q(veh)	-	- 3	- 0.5	-		



Appendix T: Split Intersection with High-T Traffic Signal Warrants Worksheets

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: 2040 / Split Intersection (Alternative 1B)

Intersection: NM 14 / Frost Road

Approach Type: 1 Lane & 1 Lane

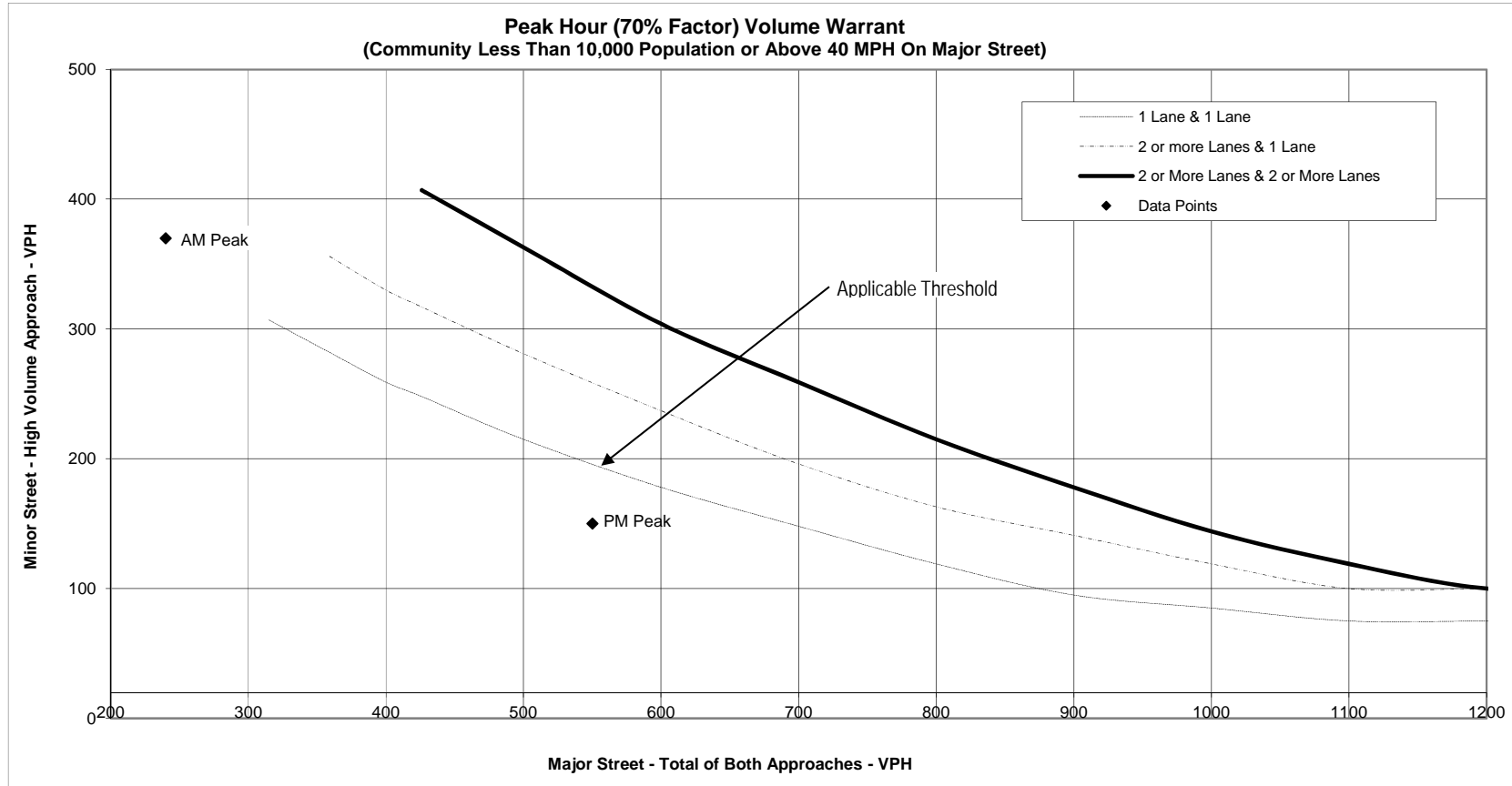
Major Street (Name): NM 14

Major Street (Orientation): North-South

Minor Street (Name): Frost Road

Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak		370	370	240		240	No
PM Peak		150	150	550		550	No



Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane















Appendix U: South and North Realignment Traffic Operations Output Files

**EXISTING
(2017)
OPERATIONS SUMMARIES**

Intersection













Int Delay, s/veh 6.7

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	16	10	31	168	6	207	38	205	61	61	263	7
Future Vol, veh/h	16	10	31	168	6	207	38	205	61	61	263	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	11	34	183	7	225	41	223	66	66	286	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	731	727	147	586	731	-	293	0	0	223	0	0
Stage 1	422	422	-	305	305	-	-	-	-	-	-	-
Stage 2	309	305	-	281	426	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	323	350	874	408	348	0	1267	-	-	1344	-	-
Stage 1	581	587	-	704	662	0	-	-	-	-	-	-
Stage 2	700	662	-	703	585	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	299	322	874	359	320	-	1267	-	-	1344	-	-
Mov Cap-2 Maneuver	299	322	-	359	320	-	-	-	-	-	-	-
Stage 1	562	558	-	681	641	-	-	-	-	-	-	-
Stage 2	670	641	-	630	556	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	13	24.7	1	1.4
HCM LOS	B	C		













Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1267	-	-	359	320	-	299	322	874	1344	-	-
HCM Lane V/C Ratio	0.033	-	-	0.509	0.02	-	0.058	0.034	0.039	0.049	-	-
HCM Control Delay (s)	7.9	-	-	25	16.5	0	17.8	16.6	9.3	7.8	-	-
HCM Lane LOS	A	-	-	D	C	A	C	C	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.8	0.1	-	0.2	0.1	0.1	0.2	-	-

Intersection															
Int Delay, s/veh	5.4														
Movement	SEL	SET	SER		NWL	NWT	NWR		NEL	NET	NER		SWL	SWT	SWR
Lane Configurations														 	
Traffic Vol, veh/h	15	10	33		85	8	49		72	219	200		141	265	15
Future Vol, veh/h	15	10	33		85	8	49		72	219	200		141	265	15
Conflicting Peds, #/hr	0	0	0		0	0	0		0	0	0		0	0	0
Sign Control	Stop	Stop	Stop		Stop	Stop	Stop		Free	Free	Free		Free	Free	Free
RT Channelized	-	-	Yield		-	-	Free		-	-	None		-	-	None
Storage Length	200	-	0		200	-	200		200	-	0		200	-	-
Veh in Median Storage, #	-	0	-		-	0	-		-	0	-		-	0	-
Grade, %	-	0	-		-	0	-		-	0	-		-	0	-
Peak Hour Factor	92	92	92		92	92	92		92	92	92		92	92	92
Heavy Vehicles, %	2	2	2		2	2	2		2	2	2		2	2	2
Mvmt Flow	16	11	36		92	9	53		78	238	217		153	288	16
Major/Minor	Minor2			Minor1			Major1			Major2					
Conflicting Flow All	1002	998	152		851	1006	-		304	0	0		238	0	0
Stage 1	603	603	-		395	395	-		-	-	-		-	-	-
Stage 2	399	395	-		456	611	-		-	-	-		-	-	-
Critical Hdwy	7.33	6.53	6.93		7.33	6.53	-		4.13	-	-		4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-		6.13	5.53	-		-	-	-		-	-	-
Critical Hdwy Stg 2	6.13	5.53	-		6.53	5.53	-		-	-	-		-	-	-
Follow-up Hdwy	3.519	4.019	3.319		3.519	4.019	-		2.219	-	-		2.219	-	-
Pot Cap-1 Maneuver	209	243	868		266	240	0		1255	-	-		1327	-	-
Stage 1	454	487	-		629	604	0		-	-	-		-	-	-
Stage 2	626	604	-		554	483	0		-	-	-		-	-	-
Platoon blocked, %										-	-			-	-
Mov Cap-1 Maneuver	176	202	868		213	199	-		1255	-	-		1327	-	-
Mov Cap-2 Maneuver	176	202	-		213	199	-		-	-	-		-	-	-
Stage 1	426	431	-		590	566	-		-	-	-		-	-	-
Stage 2	578	566	-		458	427	-		-	-	-		-	-	-
Approach	SE			NW			NE			SW					
HCM Control Delay, s	16.5			33.4			1.2			2.7					
HCM LOS	C			D											
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR				
Capacity (veh/h)	1255	-	-	213	199	-	176	202	868	1327	-	-			
HCM Lane V/C Ratio	0.062	-	-	0.434	0.044	-	0.093	0.054	0.041	0.115	-	-			
HCM Control Delay (s)	8.1	-	-	34.3	23.9	0	27.5	23.8	9.3	8.1	-	-			
HCM Lane LOS	A	-	-	D	C	A	D	C	A	A	-	-			
HCM 95th %tile Q(veh)	0.2	-	-	2	0.1	-	0.3	0.2	0.1	0.4	-	-			

2040 MTP
OPERATIONS SUMMARIES

NM 14/NM 536/Frost Road (Unsignalized)
Alternative 2 - South Realignment

























2040 MTP - AM Peak
11/20/2017

Intersection												
Int Delay, s/veh	111.9											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	10	10	80	350	20	110	90	150	90	90	480	20
Future Vol, veh/h	10	10	80	350	20	110	90	150	90	90	480	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	87	380	22	120	98	163	98	98	522	22
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1098	1087	272	821	1098	-	543	0	0	163	0	0
Stage 1	728	728	-	359	359	-	-	-	-	-	-	-
Stage 2	370	359	-	462	739	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	178	215	726	~ 280	212	0	1024	-	-	1414	-	-
Stage 1	382	428	-	658	626	0	-	-	-	-	-	-
Stage 2	649	626	-	550	423	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	142	181	726	~ 207	178	-	1024	-	-	1414	-	-
Mov Cap-2 Maneuver	142	181	-	~ 207	178	-	-	-	-	-	-	-
Stage 1	345	398	-	595	566	-	-	-	-	-	-	-
Stage 2	564	566	-	438	394	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	14.3			\$ 412.3			2.4			1.2		
HCM LOS	B			F								
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1024	-	-	207	178	-	142	181	726	1414	-	-
HCM Lane V/C Ratio	0.096	-	-	1.838	0.122	-	0.077	0.06	0.12	0.069	-	-
HCM Control Delay (s)	8.9	-	-	\$ 434.3	28	0	32.4	26.2	10.6	7.7	-	-
HCM Lane LOS	A	-	-	F	D	A	D	D	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	27	0.4	-	0.2	0.2	0.4	0.2	-	-
Notes												
-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon												

NM 14/NM 536/Frost Road (Signalized)
Alternative 2 - South Realignment

2040 MTP - AM Peak













11/20/2017

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	10	10	80	350	20	110	90	150	90	90	480	20
Future Volume (veh/h)	10	10	80	350	20	110	90	150	90	90	480	20
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	11	11	0	380	22	0	98	163	98	98	522	22
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	845	976	830	856	976	830	295	589	501	407	1094	46
Arrive On Green	0.52	0.52	0.00	0.52	0.52	0.00	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	1384	1863	1583	1398	1863	1583	859	1863	1583	1114	3461	146
Grp Volume(v), veh/h	11	11	0	380	22	0	98	163	98	98	267	277
Grp Sat Flow(s),veh/h/ln	1384	1863	1583	1398	1863	1583	859	1863	1583	1114	1770	1837
Q Serve(g_s), s	0.2	0.2	0.0	10.1	0.3	0.0	5.8	3.7	2.5	4.1	6.8	6.8
Cycle Q Clear(g_c), s	0.5	0.2	0.0	10.2	0.3	0.0	12.7	3.7	2.5	7.8	6.8	6.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	845	976	830	856	976	830	295	589	501	407	560	581
V/C Ratio(X)	0.01	0.01	0.00	0.44	0.02	0.00	0.33	0.28	0.20	0.24	0.48	0.48
Avail Cap(c_a), veh/h	845	976	830	856	976	830	351	711	605	480	676	702
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.6	6.4	0.0	8.9	6.5	0.0	20.6	14.4	14.0	17.3	15.5	15.5
Incr Delay (d2), s/veh	0.0	0.0	0.0	1.7	0.0	0.0	0.7	0.3	0.2	0.3	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.0	4.2	0.2	0.0	1.4	1.9	1.1	1.3	3.4	3.6
LnGrp Delay(d),s/veh	6.6	6.4	0.0	10.5	6.5	0.0	21.3	14.7	14.2	17.6	16.1	16.1
LnGrp LOS	A	A		B	A		C	B	B	B	B	B
Approach Vol, veh/h		22			402			359			642	
Approach Delay, s/veh		6.5			10.3			16.4			16.4	
Approach LOS		A			B			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		34.0		22.3		34.0		22.3				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		29.5		21.5		29.5		21.5				
Max Q Clear Time (g_c+I1), s		12.2		14.7		2.5		9.8				
Green Ext Time (p_c), s		1.3		3.1		1.4		4.4				
Intersection Summary												
HCM 2010 Ctrl Delay				14.5								
HCM 2010 LOS				B								

NM 14/NM 536/Frost Road (Unsignalized)
Alternative 2 - South Realignment

2040 MTP - PM Peak

























11/20/2017

Intersection												
Int Delay, s/veh	40.5											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	60	10	65	140	10	170	90	430	120	150	405	25
Future Vol, veh/h	60	10	65	140	10	170	90	430	120	150	405	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	11	71	152	11	185	98	467	130	163	440	27
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1448	1443	234	1215	1456	-	467	0	0	467	0	0
Stage 1	780	780	-	663	663	-	-	-	-	-	-	-
Stage 2	668	663	-	552	793	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	100	132	769	~ 147	129	0	1093	-	-	1093	-	-
Stage 1	355	405	-	450	458	0	-	-	-	-	-	-
Stage 2	447	458	-	486	399	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	76	102	769	~ 102	100	-	1093	-	-	1093	-	-
Mov Cap-2 Maneuver	76	102	-	~ 102	100	-	-	-	-	-	-	-
Stage 1	323	345	-	410	417	-	-	-	-	-	-	-
Stage 2	396	417	-	364	339	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	79.1			\$ 320.9			1.2			2.3		
HCM LOS	F			F								
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR
Capacity (veh/h)	1093	-	-	102	100	-	76	102	769	1093	-	-
HCM Lane V/C Ratio	0.09	-	-	1.492	0.109	-	0.858	0.107	0.092	0.149	-	-
HCM Control Delay (s)	8.6	-	-	\$ 340.6	45.3	0	159.4	44.5	10.2	8.9	-	-
HCM Lane LOS	A	-	-	F	E	A	F	E	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	11.3	0.4	-	4.3	0.3	0.3	0.5	-	-
Notes												
-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon												













NM 14/NM 536/Frost Road (Signalized)
Alternative 2 - South Realignment













2040 MTP - PM Peak

11/20/2017

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	60	10	65	140	10	170	90	430	120	150	405	25
Future Volume (veh/h)	60	10	65	140	10	170	90	430	120	150	405	25
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	65	11	0	152	11	0	98	467	130	163	440	27
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	647	701	596	647	701	596	482	868	737	361	1578	97
Arrive On Green	0.38	0.38	0.00	0.38	0.38	0.00	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1398	1863	1583	1398	1863	1583	922	1863	1583	818	3388	207
Grp Volume(v), veh/h	65	11	0	152	11	0	98	467	130	163	229	238
Grp Sat Flow(s),veh/h/ln	1398	1863	1583	1398	1863	1583	922	1863	1583	818	1770	1826
Q Serve(g_s), s	1.7	0.2	0.0	4.4	0.2	0.0	4.2	10.2	2.7	10.1	4.5	4.6
Cycle Q Clear(g_c), s	2.0	0.2	0.0	4.6	0.2	0.0	8.7	10.2	2.7	20.3	4.5	4.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.11
Lane Grp Cap(c), veh/h	647	701	596	647	701	596	482	868	737	361	824	851
V/C Ratio(X)	0.10	0.02	0.00	0.23	0.02	0.00	0.20	0.54	0.18	0.45	0.28	0.28
Avail Cap(c_a), veh/h	647	701	596	647	701	596	529	963	818	402	914	944
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.8	11.2	0.0	12.6	11.2	0.0	12.0	10.9	8.9	18.1	9.4	9.4
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.9	0.0	0.0	0.2	0.5	0.1	0.9	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.1	0.0	1.8	0.1	0.0	1.1	5.3	1.2	2.4	2.2	2.3
LnGrp Delay(d),s/veh	12.1	11.2	0.0	13.4	11.2	0.0	12.3	11.4	9.0	19.0	9.5	9.5
LnGrp LOS	B	B		B	B		B	B	A	B	A	A
Approach Vol, veh/h		76			163			695			630	
Approach Delay, s/veh		12.0			13.3			11.1			12.0	
Approach LOS		B			B			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		26.0		31.1		26.0		31.1				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		21.5		29.5		21.5		29.5				
Max Q Clear Time (g_c+I1), s		6.6		12.2		4.0		22.3				
Green Ext Time (p_c), s		0.6		7.6		0.6		4.3				
Intersection Summary												
HCM 2010 Ctrl Delay				11.7								
HCM 2010 LOS				B								

**EXISTING
(2017)
OPERATIONS SUMMARIES**

Intersection												
Int Delay, s/veh	6.7											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	16	10	31	168	6	207	38	205	61	61	263	7
Future Vol, veh/h	16	10	31	168	6	207	38	205	61	61	263	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	11	34	183	7	225	41	223	66	66	286	8
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	731	727	147	586	731	-	293	0	0	223	0	0
Stage 1	422	422	-	305	305	-	-	-	-	-	-	-
Stage 2	309	305	-	281	426	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	323	350	874	408	348	0	1267	-	-	1344	-	-
Stage 1	581	587	-	704	662	0	-	-	-	-	-	-
Stage 2	700	662	-	703	585	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	299	322	874	359	320	-	1267	-	-	1344	-	-
Mov Cap-2 Maneuver	299	322	-	359	320	-	-	-	-	-	-	-
Stage 1	562	558	-	681	641	-	-	-	-	-	-	-
Stage 2	670	641	-	630	556	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	13			24.7			1			1.4		
HCM LOS	B			C								
Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1267	-	-	359	320	-	299	322	874	1344	-	-
HCM Lane V/C Ratio	0.033	-	-	0.509	0.02	-	0.058	0.034	0.039	0.049	-	-
HCM Control Delay (s)	7.9	-	-	25	16.5	0	17.8	16.6	9.3	7.8	-	-
HCM Lane LOS	A	-	-	D	C	A	C	C	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.8	0.1	-	0.2	0.1	0.1	0.2	-	-













Intersection												
Int Delay, s/veh	5.4											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	15	10	33	85	8	49	72	219	200	141	265	15
Future Vol, veh/h	15	10	33	85	8	49	72	219	200	141	265	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	11	36	92	9	53	78	238	217	153	288	16
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1002	998	152	851	1006	-	304	0	0	238	0	0
Stage 1	603	603	-	395	395	-	-	-	-	-	-	-
Stage 2	399	395	-	456	611	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	209	243	868	266	240	0	1255	-	-	1327	-	-
Stage 1	454	487	-	629	604	0	-	-	-	-	-	-
Stage 2	626	604	-	554	483	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	176	202	868	213	199	-	1255	-	-	1327	-	-
Mov Cap-2 Maneuver	176	202	-	213	199	-	-	-	-	-	-	-
Stage 1	426	431	-	590	566	-	-	-	-	-	-	-
Stage 2	578	566	-	458	427	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	16.5			33.4			1.2			2.7		
HCM LOS	C			D								
Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR
Capacity (veh/h)	1255	-	-	213	199	-	176	202	868	1327	-	-
HCM Lane V/C Ratio	0.062	-	-	0.434	0.044	-	0.093	0.054	0.041	0.115	-	-
HCM Control Delay (s)	8.1	-	-	34.3	23.9	0	27.5	23.8	9.3	8.1	-	-
HCM Lane LOS	A	-	-	D	C	A	D	C	A	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	2	0.1	-	0.3	0.2	0.1	0.4	-	-

2040 MTP
OPERATIONS SUMMARIES

NM 14/NM 536/Frost Road (Unsignalized)
Alternative 3 - North Realignment

2040 MTP - AM Peak

























11/20/2017

Intersection												
Int Delay, s/veh	111.9											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	10	10	80	350	20	110	90	150	90	90	480	20
Future Vol, veh/h	10	10	80	350	20	110	90	150	90	90	480	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	87	380	22	120	98	163	98	98	522	22
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1098	1087	272	821	1098	-	543	0	0	163	0	0
Stage 1	728	728	-	359	359	-	-	-	-	-	-	-
Stage 2	370	359	-	462	739	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	178	215	726	~ 280	212	0	1024	-	-	1414	-	-
Stage 1	382	428	-	658	626	0	-	-	-	-	-	-
Stage 2	649	626	-	550	423	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	142	181	726	~ 207	178	-	1024	-	-	1414	-	-
Mov Cap-2 Maneuver	142	181	-	~ 207	178	-	-	-	-	-	-	-
Stage 1	345	398	-	595	566	-	-	-	-	-	-	-
Stage 2	564	566	-	438	394	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	14.3			\$ 412.3			2.4			1.2		
HCM LOS	B			F								
Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR
Capacity (veh/h)	1024	-	-	207	178	-	142	181	726	1414	-	-
HCM Lane V/C Ratio	0.096	-	-	1.838	0.122	-	0.077	0.06	0.12	0.069	-	-
HCM Control Delay (s)	8.9	-	-	\$ 434.3	28	0	32.4	26.2	10.6	7.7	-	-
HCM Lane LOS	A	-	-	F	D	A	D	D	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	27	0.4	-	0.2	0.2	0.4	0.2	-	-
Notes												
-: Volume exceeds capacity	\$: Delay exceeds 300s			+: Computation Not Defined			*: All major volume in platoon					

NM 14/NM 536/Frost Road (Signalized)
Alternative 3 - North Realignment

2040 MTP - AM Peak













11/20/2017

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	10	10	80	350	20	110	90	150	90	90	480	20
Future Volume (veh/h)	10	10	80	350	20	110	90	150	90	90	480	20
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	11	11	0	380	22	0	98	163	98	98	522	22
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	845	976	830	856	976	830	295	589	501	407	1094	46
Arrive On Green	0.52	0.52	0.00	0.52	0.52	0.00	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	1384	1863	1583	1398	1863	1583	859	1863	1583	1114	3461	146
Grp Volume(v), veh/h	11	11	0	380	22	0	98	163	98	98	267	277
Grp Sat Flow(s),veh/h/ln	1384	1863	1583	1398	1863	1583	859	1863	1583	1114	1770	1837
Q Serve(g_s), s	0.2	0.2	0.0	10.1	0.3	0.0	5.8	3.7	2.5	4.1	6.8	6.8
Cycle Q Clear(g_c), s	0.5	0.2	0.0	10.2	0.3	0.0	12.7	3.7	2.5	7.8	6.8	6.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.08
Lane Grp Cap(c), veh/h	845	976	830	856	976	830	295	589	501	407	560	581
V/C Ratio(X)	0.01	0.01	0.00	0.44	0.02	0.00	0.33	0.28	0.20	0.24	0.48	0.48
Avail Cap(c_a), veh/h	845	976	830	856	976	830	351	711	605	480	676	702
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.6	6.4	0.0	8.9	6.5	0.0	20.6	14.4	14.0	17.3	15.5	15.5
Incr Delay (d2), s/veh	0.0	0.0	0.0	1.7	0.0	0.0	0.7	0.3	0.2	0.3	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.0	4.2	0.2	0.0	1.4	1.9	1.1	1.3	3.4	3.6
LnGrp Delay(d),s/veh	6.6	6.4	0.0	10.5	6.5	0.0	21.3	14.7	14.2	17.6	16.1	16.1
LnGrp LOS	A	A		B	A		C	B	B	B	B	B
Approach Vol, veh/h		22			402			359			642	
Approach Delay, s/veh		6.5			10.3			16.4			16.4	
Approach LOS		A			B			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		34.0		22.3		34.0		22.3				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		29.5		21.5		29.5		21.5				
Max Q Clear Time (g_c+I1), s		12.2		14.7		2.5		9.8				
Green Ext Time (p_c), s		1.3		3.1		1.4		4.4				
Intersection Summary												
HCM 2010 Ctrl Delay				14.5								
HCM 2010 LOS				B								

NM 14/NM 536/Frost Road (Unsignalized)
Alternative 3 - North Realignment

2040 MTP - PM Peak

























11/20/2017

Intersection												
Int Delay, s/veh	40.5											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	60	10	65	140	10	170	90	430	120	150	405	25
Future Vol, veh/h	60	10	65	140	10	170	90	430	120	150	405	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Free	-	-	None	-	-	None
Storage Length	200	-	0	200	-	200	200	-	0	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	11	71	152	11	185	98	467	130	163	440	27
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1448	1443	234	1215	1456	-	467	0	0	467	0	0
Stage 1	780	780	-	663	663	-	-	-	-	-	-	-
Stage 2	668	663	-	552	793	-	-	-	-	-	-	-
Critical Hdwy	7.33	6.53	6.93	7.33	6.53	-	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.53	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.519	4.019	3.319	3.519	4.019	-	2.219	-	-	2.219	-	-
Pot Cap-1 Maneuver	100	132	769	~ 147	129	0	1093	-	-	1093	-	-
Stage 1	355	405	-	450	458	0	-	-	-	-	-	-
Stage 2	447	458	-	486	399	0	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	76	102	769	~ 102	100	-	1093	-	-	1093	-	-
Mov Cap-2 Maneuver	76	102	-	~ 102	100	-	-	-	-	-	-	-
Stage 1	323	345	-	410	417	-	-	-	-	-	-	-
Stage 2	396	417	-	364	339	-	-	-	-	-	-	-
Approach	SE			NW			NE			SW		
HCM Control Delay, s	79.1			\$ 320.9			1.2			2.3		
HCM LOS	F			F								
Minor Lane/Major Mvmt	NEL	NET	NER	NWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR
Capacity (veh/h)	1093	-	-	102	100	-	76	102	769	1093	-	-
HCM Lane V/C Ratio	0.09	-	-	1.492	0.109	-	0.858	0.107	0.092	0.149	-	-
HCM Control Delay (s)	8.6	-	-	\$ 340.6	45.3	0	159.4	44.5	10.2	8.9	-	-
HCM Lane LOS	A	-	-	F	E	A	F	E	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	11.3	0.4	-	4.3	0.3	0.3	0.5	-	-
Notes												
-: Volume exceeds capacity	\$: Delay exceeds 300s			+: Computation Not Defined			*: All major volume in platoon					

NM 14/NM 536/Frost Road (Signalized)
Alternative 3 - North Realignment

2040 MTP - PM Peak

11/20/2017

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	60	10	65	140	10	170	90	430	120	150	405	25
Future Volume (veh/h)	60	10	65	140	10	170	90	430	120	150	405	25
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	65	11	0	152	11	0	98	467	130	163	440	27
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	647	701	596	647	701	596	482	868	737	361	1578	97
Arrive On Green	0.38	0.38	0.00	0.38	0.38	0.00	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1398	1863	1583	1398	1863	1583	922	1863	1583	818	3388	207
Grp Volume(v), veh/h	65	11	0	152	11	0	98	467	130	163	229	238
Grp Sat Flow(s),veh/h/ln	1398	1863	1583	1398	1863	1583	922	1863	1583	818	1770	1826
Q Serve(g_s), s	1.7	0.2	0.0	4.4	0.2	0.0	4.2	10.2	2.7	10.1	4.5	4.6
Cycle Q Clear(g_c), s	2.0	0.2	0.0	4.6	0.2	0.0	8.7	10.2	2.7	20.3	4.5	4.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.11
Lane Grp Cap(c), veh/h	647	701	596	647	701	596	482	868	737	361	824	851
V/C Ratio(X)	0.10	0.02	0.00	0.23	0.02	0.00	0.20	0.54	0.18	0.45	0.28	0.28
Avail Cap(c_a), veh/h	647	701	596	647	701	596	529	963	818	402	914	944
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.8	11.2	0.0	12.6	11.2	0.0	12.0	10.9	8.9	18.1	9.4	9.4
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.9	0.0	0.0	0.2	0.5	0.1	0.9	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.1	0.0	1.8	0.1	0.0	1.1	5.3	1.2	2.4	2.2	2.3
LnGrp Delay(d),s/veh	12.1	11.2	0.0	13.4	11.2	0.0	12.3	11.4	9.0	19.0	9.5	9.5
LnGrp LOS	B	B		B	B		B	B	A	B	A	A
Approach Vol, veh/h		76			163			695			630	
Approach Delay, s/veh		12.0			13.3			11.1			12.0	
Approach LOS		B			B			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		26.0		31.1		26.0		31.1				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		21.5		29.5		21.5		29.5				
Max Q Clear Time (g_c+I1), s		6.6		12.2		4.0		22.3				
Green Ext Time (p_c), s		0.6		7.6		0.6		4.3				
Intersection Summary												
HCM 2010 Ctrl Delay			11.7									
HCM 2010 LOS			B									



Appendix V: South and North Realignment Traffic Signal Warrants Worksheets

PEAK HOUR (70% FACTOR) VOLUME SIGNAL WARRANT ANALYSIS

Scenario: 2040 / Combined Intersection (Alternative 2 and 3)

Intersection: NM 14 / Frost Road

Approach Type: 2 or More Lanes & 2 or More Lanes

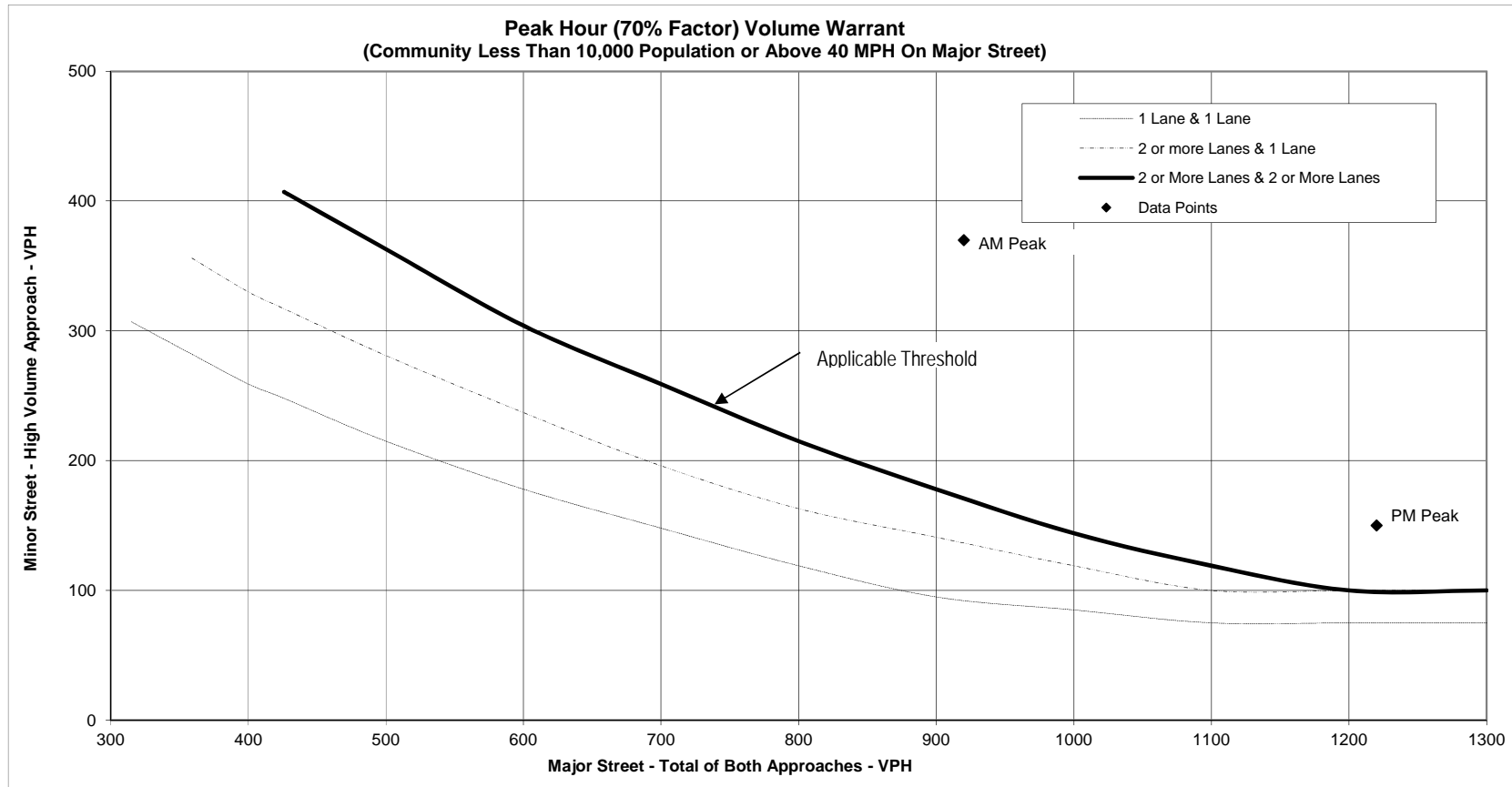
Major Street (Name): NM 14

Major Street (Orientation): North-South

Minor Street (Name): NM 536 / Frost Road

Minor Street (Orientation): East-West

Time Period	Minor Street Approach Volume			Major Street Approach Volume			Satisfies
	EB	WB	High Vol Approach	NB	SB	NB+SB	Warrant 3?
AM Peak	100	370	370	330	590	920	Yes
PM Peak	135	150	150	640	580	1,220	Yes



Note: 100 VPH applies as the lower threshold for minor street approach with 2 or more lanes & 75 VPH as the threshold for a minor street approach with one lane



Appendix W: Roundabout Intersection Traffic Operations Output Files

HCS7 Roundabouts Report

General Information

Analyst	S. Apodaca
Agency or Co.	WSP
Date Performed	5/31/2017
Analysis Year	2017
Time Period	2017 - AM Peak Hour
Project Description	

Site Information

Intersection	NM 14/Frost Road/NM 536
E/W Street Name	Frost Road/NM 536
N/S Street Name	NM 14
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.59
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	1	0	1	1	0
Lane Assignment	LTR				LT				LT				L			
Volume (V), veh/h	0	16	10	31	0	168	6	207	0	38	205	61	0	61	263	7
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{pc}), pc/h	0	28	17	54	0	293	10	361	0	66	358	106	0	106	459	12
Right-Turn Bypass	None				Non-Yielding				None				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.9763		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)		2.5352			2.6087		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		99			303	361	424	106		106	471	
Entry Volume veh/h		96			294	350	412	103		103	457	
Circulating Flow (v_c), pc/h	858			452			151			369		
Exiting Flow (v_{ex}), pc/h	229			88			386			806		
Capacity (C_{pc}), pc/h		685			870		1175	1249		961	1038	
Capacity (c), veh/h		665			845		1141	1213		933	1007	
v/c Ratio (x)		0.14			0.35		0.36	0.08		0.11	0.45	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		7.1			8.3	0.0	6.7	3.7		4.9	8.8	
Lane LOS		A			A	A	A	A		A	A	
95% Queue, veh		0.5			1.6		1.7	0.3		0.4	2.4	
Approach Delay, s/veh	7.1			3.8			6.1			8.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh LOS	5.9						A					

HCS7 Roundabouts Report

General Information

Analyst	S. Apodaca
Agency or Co.	WSP
Date Performed	5/31/2017
Analysis Year	2017
Time Period	2017 - PM Peak Hour
Project Description	

Site Information

Intersection	NM 14/Frost Road/NM 536
E/W Street Name	Frost Road/NM 536
N/S Street Name	NM14
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.44
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	1	0	1	1	0
Lane Assignment	LTR				LT				LT				L			
Volume (V), veh/h	0	15	10	33	0	85	8	49	0	72	219	200	0	141	265	15
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{pc}), pc/h	0	35	23	77	0	199	19	115	0	169	513	468	0	330	620	35
Right-Turn Bypass	None				Non-Yielding				None				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.9763		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)		2.5352			2.6087		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		135			218	115	682	468		330	655	
Entry Volume veh/h		131			212	112	662	454		320	636	
Circulating Flow (v_c), pc/h	1149			717			388			387		
Exiting Flow (v_{ex}), pc/h	821			223			548			896		
Capacity (C_{pc}), pc/h		535			664		945	1021		946	1022	
Capacity (c), veh/h		519			645		917	991		918	992	
v/c Ratio (x)		0.25			0.33		0.72	0.46		0.35	0.64	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		10.5			9.9	0.0	17.0	9.0		7.8	13.1	
Lane LOS		B			A	A	C	A		A	B	
95% Queue, veh		1.0			1.4		6.5	2.4		1.6	4.8	
Approach Delay, s/veh	10.5			6.5			13.7			11.3		
Approach LOS	B			A			B			B		
Intersection Delay, s/veh LOS	11.7						B					

HCS7 Roundabouts Report

General Information

Analyst	S. Apodaca
Agency or Co.	WSP
Date Performed	5/31/2017
Analysis Year	2040
Time Period	2040 MTP - AM Peak Hour
Project Description	

Site Information

Intersection	NM 14/Frost Road/NM 536
E/W Street Name	Frost Road/NM 536
N/S Street Name	NM 14
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.90
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	1	0	1	1	0
Lane Assignment	LTR				LT				LT				L			
Volume (V), veh/h	0	10	10	80	0	350	20	110	0	90	150	90	0	90	480	20
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{pc}), pc/h	0	11	11	92	0	401	23	126	0	103	172	103	0	103	549	23
Right-Turn Bypass	None				Non-Yielding				None				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.9763		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)		2.5352			2.6087		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		114			424	126	275	103		103	572	
Entry Volume veh/h		111			412	122	267	100		100	555	
Circulating Flow (v_c), pc/h	1053			286			125			527		
Exiting Flow (v_{ex}), pc/h	217			149			183			1042		
Capacity (C_{pc}), pc/h		580			1031		1203	1277		831	907	
Capacity (c), veh/h		563			1001		1168	1240		807	881	
v/c Ratio (x)		0.20			0.41		0.23	0.08		0.12	0.63	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.9			8.1	0.0	5.1	3.6		5.7	13.9	
Lane LOS		A			A	A	A	A		A	B	
95% Queue, veh		0.7			2.0		0.9	0.3		0.4	4.6	
Approach Delay, s/veh	8.9			6.3			4.7			12.7		
Approach LOS	A			A			A			B		
Intersection Delay, s/veh LOS	8.6						A					

HCS7 Roundabouts Report

General Information

Analyst	S. Apodaca
Agency or Co.	WSP
Date Performed	5/31/2017
Analysis Year	2040
Time Period	2040 MTP - PM Peak Hour
Project Description	

Site Information

Intersection	NM 14/Frost Road/NM 536
E/W Street Name	Frost Road/NM 536
N/S Street Name	NM 14
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.90
Jurisdiction	

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	1	0	1	1	0
Lane Assignment	LTR				LT				LT				L			
Volume (V), veh/h	0	60	10	65	0	140	10	170	0	90	430	120	0	150	405	25
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{pc}), pc/h	0	69	11	74	0	160	11	195	0	103	492	137	0	172	464	29
Right-Turn Bypass	None				Non-Yielding				None				None			
Conflicting Lanes	2				1				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.9763		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)		2.5352			2.6087		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		154			171	195	595	137		172	493	
Entry Volume veh/h		150			166	189	578	133		167	479	
Circulating Flow (v_c), pc/h	796			664			252			274		
Exiting Flow (v_{ex}), pc/h	320			143			561			698		
Capacity (C_{pc}), pc/h		722			701		1071	1146		1049	1125	
Capacity (c), veh/h		701			681		1039	1113		1019	1092	
v/c Ratio (x)		0.21			0.24		0.56	0.12		0.16	0.44	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		7.6			8.2	0.0	10.5	4.3		5.0	8.0	
Lane LOS		A			A	A	B	A		A	A	
95% Queue, veh		0.8			1.0		3.5	0.4		0.6	2.3	
Approach Delay, s/veh	7.6			3.8			9.3			7.3		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh LOS	7.4						A					



Appendix X: Alternative Construction Cost Summaries

ALTERNATIVE 1A:
SPLIT INTERSECTION

Estimate of Probable Cost

NM 14 REHABILITATION ALTERNATIVES COST ANALYSIS PN A301443 CN A301443 ALTERNATIVES COST ANALYSIS NOVEMBER 20, 2017

COST SUMMARY Alt. 1A - SPLIT INTERSECTION

TYPE OF CONSTRUCTION	CONSTRUCTION COST TOTAL	E&C 30%	TOTAL ESTIMATED COST
ROADWAY	\$1,474,432.80	\$442,329.84	\$1,916,762.64
CONSTRUCTION SIGNING	\$86,000.00	\$25,800.00	\$111,800.00
PERMANENT SIGNING AND STRIPING	\$57,863.90	\$17,359.17	\$75,223.07
CONSTRUCTION ENGINEERING	\$236,000.00	\$70,800.00	\$306,800.00
SIGNALS/ITS	\$45,000.00	\$13,500.00	\$58,500.00
SUBTOTAL	\$1,899,296.70	\$569,789.01	\$2,469,085.71
NM GROSS RECEIPTS TAX (7.50%)			\$185,181.43
TOTAL			\$2,654,300.00

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

ROADWAY Alt. 1A - Split Intersection

Item #	Description	Unit	Unit Cost	Estimate	Cost
201000	CLEARING AND GRUBBING	L.S.	\$23,000.00	L.S.	\$23,000.00
203000	UNCLASSIFIED EXCAVATION	CU.YD.	\$8.50	1,000	\$8,500.00
203100	BORROW	CU.YD.	\$9.50	2,500	\$23,750.00
203211	UNSTABLE SUBGRADE STABILIZATION	SQ.YD.	\$10.00	500	\$5,000.00
207000	SUBGRADE PREPARATION	SQ.YD.	\$1.50	15,743	\$23,614.50
303000	BASE COURSE	TON	\$14.00	3,455	\$48,370.00
403701	OPEN GRADED FRICTION COURSE COMPLETE	TON	\$110.00	547	\$60,129.51
407000	ASPHALT MATERIAL FOR TACK COAT	TON	\$575.00	10	\$6,034.82
408100	PRIME COAT MATERIAL	TON	\$480.00	7.9	\$3,778.32
417000	MISCELLANEOUS PAVING	SQ.YD.	\$30.00	2,195	\$65,860.00
424004	WMA SP IV COMPLETE	TON	\$75.00	6,161	\$462,040.65
	DRAINAGE SYSTEM	L.S.	\$150,000.00	L.S.	\$150,000.00
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	\$34,500.00	L.S.	\$125,000.00
608004	CONCRETE SIDEWALK 4"	SQ.YD.	\$40.00	50	\$2,000.00
609318	CONCRETE SLOPED CURB AND GUTTER 6" X 18"	LIN.FT.	\$20.00	2,459	\$49,180.00
609430	CONCRETE VERTICAL CURB AND GUTTER TYPE B 6" X 30"	LIN.FT.	\$25.00	4,127	\$103,175.00
613000	CLEANING CULVERTS AND DRAINAGE STRUCTURES	L.S.	\$23,000.00	L.S.	\$15,000.00
621000	MOBILIZATION	L.S.	\$280,000.00	L.S.	\$280,000.00
	SEEDING	ACRE	\$5,000.00	4	\$20,000.00
	ROADWAY COST SUBTOTAL				\$1,474,432.80

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION SIGNING Alt. 1A - Split Intersection

Item #	Description	Unit	Unit Cost	Estimate	Cost
702610	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	\$7,500.00	4	\$30,000.00
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	L.S.	\$46,000.00	L.S.	\$46,000.00
702811	TRAFFIC CONTROL DEVICES FOR PEDESTRIANS AND BICYCLISTS	L.S.	\$10,000.00	L.S.	\$10,000.00
CONSTRUCTION SIGNING COST SUBTOTAL					\$86,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

PERMANENT SIGNING AND STRIPING Alt 1A - Split Intersection

Item #	Description	Unit	Unit Cost	Estimate	Cost
701000	PANEL SIGNS	SQ.FT.	\$20.00	0	\$0.00
701010	EXTRUDED PANEL SIGNS	SQ.FT.	\$25.00	0	\$0.00
701100	STEEL POST AND BASE POST FOR ALUMINUM PANEL SIGNS	LIN.FT.	\$12.00	0	\$0.00
701108	STEEL I-BEAM POST TYPE S4X7.7	LIN.FT.	\$28.00	0	\$0.00
703003	OBJECT MARKER TYPE 3	EACH	\$125.00	0	\$0.00
703110	ROAD DELINEATOR TYPE HAZARD	EACH	\$40.00	0	\$0.00
704000	RETROREFLECTORIZED PAINTED MARKINGS 4"	LIN.FT.	\$5.47	9,043	\$49,463.90
704767	RETRO PTN'D PVMT MARK RIGHT ARROW	EACH	\$250.00	9	\$2,250.00
704768	RETRO PTN'D PVMT MARK LEFT ARROW	EACH	\$250.00	12	\$3,000.00
704770	RETRO PTN'D PVMT MARK WORD (ONLY)	EACH	\$350.00	9	\$3,150.00
704776	RETRO PTN'D PVMT MARK WORD (YEILD)	EACH	\$350.00	0	\$0.00
70477X	RETRO PTN'D PVMT MARK RIGHT/LEFT/THRU ARROW (ROUNDAE	EACH	\$500.00	0	\$0.00
PERMANENT SIGNING AND STRIPING COST SUBTOTAL					\$57,863.90

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION ENGINEERING Alt. 1A - Split Intersection

Item #	Description	Unit	Unit Cost	Estimate	Cost
618000	TRAFFIC CONTROL MANAGEMENT	L.S.	\$46,000.00	L.S.	\$75,000.00
618012	PUBLIC AWARENESS	DAY	\$250.00	0	\$0.00
622002	FIELD LABORATORY, TYPE II	EACH	\$20,000.00	0	\$20,000.00
622110	SUPPLEMENTAL HOT-MIX ASPHALT FIELD LABORATORY	EACH	\$26,000.00	0	\$26,000.00
702850	LAW ENFORCEMENT IN CONSTRUCTION ZONE	ALOW	\$23,000.00	ALOW	\$15,000.00
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	L.S.	\$46,000.00	L.S.	\$75,000.00
802000	POST CONSTRUCTION PLANS	L.S.	\$23,000.00	L.S.	\$25,000.00
CONSTRUCTION ENGINEERING COST SUBTOTAL					\$236,000.00

Signals/ITS Alt. 1A - Split Intersection

[illegible]

ALTERNATIVE 1B:
SPLIT INTERSECTION WITH HIGH-T

Estimate of Probable Cost

**NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017**

COST SUMMARY Alt. 1B - SPLIT INTERSECTION WITH HIGH-T

TYPE OF CONSTRUCTION	CONSTRUCTION COST TOTAL	E&C 30%	TOTAL ESTIMATED COST
ROADWAY	\$1,478,356.64	\$443,506.99	\$1,921,863.64
CONSTRUCTION SIGNING	\$86,000.00	\$25,800.00	\$111,800.00
PERMANENT SIGNING AND STRIPING	\$39,331.50	\$11,799.45	\$51,130.95
CONSTRUCTION ENGINEERING	\$236,000.00	\$70,800.00	\$306,800.00
SIGNALS/ITS	\$20,000.00	\$6,000.00	\$26,000.00
SUBTOTAL	\$1,859,688.14	\$557,906.44	\$2,417,594.58
NM GROSS RECEIPTS TAX (7.50%)			\$181,319.59
TOTAL			\$2,599,000.00

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

ROADWAY Alt. 1B - Split Intersection with High-T

Item #	Description	Unit	Unit Cost	Estimate	Cost
201000	CLEARING AND GRUBBING	L.S.	\$23,000.00	L.S.	\$23,000.00
203000	UNCLASSIFIED EXCAVATION	CU.YD.	\$8.50	1,000	\$8,500.00
203100	BORROW	CU.YD.	\$9.50	2,500	\$23,750.00
203211	UNSTABLE SUBGRADE STABILIZATION	SQ.YD.	\$10.00	500	\$5,000.00
207000	SUBGRADE PREPARATION	SQ.YD.	\$1.50	15,653	\$23,480.00
303000	BASE COURSE	TON	\$14.00	3,435	\$48,090.00
403701	OPEN GRADED FRICTION COURSE COMPLETE	TON	\$110.00	544	\$59,787.04
407000	ASPHALT MATERIAL FOR TACK COAT	TON	\$575.00	10	\$6,000.44
408100	PRIME COAT MATERIAL	TON	\$480.00	7.8	\$3,756.80
417000	MISCELLANEOUS PAVING	SQ.YD.	\$30.00	2,538	\$76,143.33
424004	WMA SP IV COMPLETE	TON	\$75.00	6,125	\$459,409.03
	DRAINAGE SYSTEM	L.S.	\$150,000.00	L.S.	\$150,000.00
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	\$34,500.00	L.S.	\$125,000.00
608004	CONCRETE SIDEWALK 4"	SQ.YD.	\$40.00	50	\$2,000.00
609318	CONCRETE SLOPED CURB AND GUTTER 6" X 18"	LIN.FT.	\$20.00	4,337	\$86,740.00
609430	CONCRETE VERTICAL CURB AND GUTTER TYPE B 6" X 30"	LIN.FT.	\$25.00	4,108	\$102,700.00
613000	CLEANING CULVERTS AND DRAINAGE STRUCTURES	L.S.	\$23,000.00	L.S.	\$15,000.00
621000	MOBILIZATION	L.S.	\$230,000.00	L.S.	\$240,000.00
	SEEDING	ACRE	\$5,000.00	4	\$20,000.00
	ROADWAY COST SUBTOTAL				\$1,478,356.64

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION SIGNING Alt. 1B - Split Intersection with High-T

Item #	Description	Unit	Unit Cost	Estimate	Cost
702610	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	\$7,500.00	4	\$30,000.00
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	L.S.	\$46,000.00	L.S.	\$46,000.00
702811	TRAFFIC CONTROL DEVICES FOR PEDESTRIANS AND BICYCLISTS	L.S.	\$10,000.00	L.S.	\$10,000.00
CONSTRUCTION SIGNING COST SUBTOTAL					\$86,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

PERMANENT SIGNING AND STRIPING Alt 1B - Split Intersection with High-T

Item #	Description	Unit	Unit Cost	Estimate	Cost
701000	PANEL SIGNS	SQ.FT.	\$20.00	0	\$0.00
701010	EXTRUDED PANEL SIGNS	SQ.FT.	\$25.00	0	\$0.00
701100	STEEL POST AND BASE POST FOR ALUMINUM PANEL SIGNS	LIN.FT.	\$12.00	0	\$0.00
701108	STEEL I-BEAM POST TYPE S4X7.7	LIN.FT.	\$28.00	0	\$0.00
703003	OBJECT MARKER TYPE 3	EACH	\$125.00	0	\$0.00
703110	ROAD DELINEATOR TYPE HAZARD	EACH	\$40.00	0	\$0.00
704000	RETROREFLECTORIZED PAINTED MARKINGS 4"	LIN.FT.	\$5.47	5,499	\$30,081.50
704767	RETRO PTN'D PVMT MARK RIGHT ARROW	EACH	\$250.00	11	\$2,750.00
704768	RETRO PTN'D PVMT MARK LEFT ARROW	EACH	\$250.00	12	\$3,000.00
704770	RETRO PTN'D PVMT MARK WORD (ONLY)	EACH	\$350.00	10	\$3,500.00
704776	RETRO PTN'D PVMT MARK WORD (YEILD)	EACH	\$350.00	0	\$0.00
70477x	RETRO PTN'D PVMT MARK RIGHT/LEFT/THRU ARROW (ROUNDAE	EACH	\$500.00	0	\$0.00
PERMANENT SIGNING AND STRIPING COST SUBTOTAL					\$39,331.50

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION ENGINEERING Alt. 1B - Split Intersection with High-T

Item #	Description	Unit	Unit Cost	Estimate	Cost
618000	TRAFFIC CONTROL MANAGEMENT	L.S.	\$46,000.00	L.S.	\$75,000.00
618012	PUBLIC AWARENESS	DAY	\$250.00	0	\$0.00
622002	FIELD LABORATORY, TYPE II	EACH	\$20,000.00	0	\$20,000.00
622110	SUPPLEMENTAL HOT-MIX ASPHALT FIELD LABORATORY	EACH	\$26,000.00	0	\$26,000.00
702850	LAW ENFORCEMENT IN CONSTRUCTION ZONE	ALOW	\$23,000.00	ALOW	\$15,000.00
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	L.S.	\$46,000.00	L.S.	\$75,000.00
802000	POST CONSTRUCTION PLANS	L.S.	\$23,000.00	L.S.	\$25,000.00
CONSTRUCTION ENGINEERING COST SUBTOTAL					\$236,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

Signal/ITS Alt. 1B - Split Intersection with High-T

Item #	Description	Unit	Unit Cost	Estimate	Cost
709030	RIGID ELECTRICAL CONDUIT 3" (DIA.)	LIN.FT.	\$12.00	0	\$0.00
750000	INTELLIGENT TRANSPORATION SYSTEM	L.S.	\$20,000.00	L.S.	\$20,000.00
750060	ITS PULLBOX (33"X24"X24")	EACH	\$700.00	0	\$0.00
750080	ITS MANHOLE (48"X48"X48")	EACH	\$3,100.00	0	\$0.00
ITS COST SUBTOTAL					\$20,000.00

ALTERNATIVE 2:
SOUTH ALIGNMENT

Estimate of Probable Cost

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

COST SUMMARY Alt. 2 - SOUTH REALIGNMENT

TYPE OF CONSTRUCTION	CONSTRUCTION COST TOTAL	E&C 30%	TOTAL ESTIMATED COST
ROADWAY	\$2,197,310.80	\$659,193.24	\$2,856,504.03
CONSTRUCTION SIGNING	\$86,000.00	\$25,800.00	\$111,800.00
PERMANENT SIGNING AND STRIPING	\$56,811.22	\$17,043.37	\$73,854.59
CONSTRUCTION ENGINEERING	\$236,000.00	\$70,800.00	\$306,800.00
SIGNALS/ITS	\$270,000.00	\$81,000.00	\$351,000.00
SUBTOTAL	\$2,846,122.02	\$853,836.60	\$3,699,958.62
RIGHT-OF-WAY			\$100,000.00
NM GROSS RECEIPTS TAX (7.50%)			\$277,496.90
TOTAL			\$4,077,500.00

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

ROADWAY Alt. 2 - South Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
201000	CLEARING AND GRUBBING	L.S.	\$23,000.00	L.S.	\$23,000.00
203000	UNCLASSIFIED EXCAVATION	CU.YD.	\$8.50	2,000	\$17,000.00
203100	BORROW	CU.YD.	\$9.50	50,000	\$475,000.00
203211	UNSTABLE SUBGRADE STABILIZATION	SQ.YD.	\$10.00	500	\$5,000.00
207000	SUBGRADE PREPARATION	SQ.YD.	\$1.50	18,520	\$27,780.33
303000	BASE COURSE	TON	\$14.00	4,065	\$56,910.00
403701	OPEN GRADED FRICTION COURSE COMPLETE	TON	\$110.00	643	\$70,736.96
407000	ASPHALT MATERIAL FOR TACK COAT	TON	\$575.00	12	\$7,099.42
408100	PRIME COAT MATERIAL	TON	\$480.00	9.3	\$4,444.85
417000	MISCELLANEOUS PAVING	SQ.YD.	\$30.00	3,160	\$94,790.00
424004	WMA SP IV COMPLETE	TON	\$75.00	7,247	\$543,549.23
	DRAINAGE SYSTEM	L.S.	\$150,000.00	L.S.	\$150,000.00
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	\$34,500.00	L.S.	\$125,000.00
608004	CONCRETE SIDEWALK 4"	SQ.YD.	\$40.00	80	\$3,200.00
609318	CONCRETE SLOPED CURB AND GUTTER 6" X 18"	LIN.FT.	\$20.00	2,395	\$47,900.00
609430	CONCRETE VERTICAL CURB AND GUTTER TYPE B 6" X 30"	LIN.FT.	\$25.00	6,736	\$168,400.00
613000	CLEANING CULVERTS AND DRAINAGE STRUCTURES	L.S.	\$23,000.00	L.S.	\$15,000.00
621000	MOBILIZATION	L.S.	\$230,000.00	L.S.	\$320,000.00
	SEEDING	ACRE	\$5,000.00	8.5	\$42,500.00
	ROADWAY COST SUBTOTAL				\$2,197,310.80

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION SIGNING Alt. 2 - South Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
702610	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	\$7,500.00	4	\$30,000.00
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	L.S.	\$46,000.00	L.S.	\$46,000.00
702811	TRAFFIC CONTROL DEVICES FOR PEDESTRIANS AND BICYCLISTS	L.S.	\$10,000.00	L.S.	\$10,000.00
CONSTRUCTION SIGNING COST SUBTOTAL					\$86,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

PERMANENT SIGNING AND STRIPING Alt 2 - South Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
701000	PANEL SIGNS	SQ.FT.	\$20.00	0	\$0.00
701010	EXTRUDED PANEL SIGNS	SQ.FT.	\$25.00	0	\$0.00
701100	STEEL POST AND BASE POST FOR ALUMINUM PANEL SIGNS	LIN.FT.	\$12.00	0	\$0.00
701108	STEEL I-BEAM POST TYPE S4X7.7	LIN.FT.	\$28.00	0	\$0.00
703003	OBJECT MARKER TYPE 3	EACH	\$125.00	0	\$0.00
703110	ROAD DELINEATOR TYPE HAZARD	EACH	\$40.00	0	\$0.00
704000	RETROREFLECTORIZED PAINTED MARKINGS 4"	LIN.FT.	\$5.47	9,033	\$49,411.22
704767	RETRO PTN'D PVMT MARK RIGHT ARROW	EACH	\$250.00	6	\$1,500.00
704768	RETRO PTN'D PVMT MARK LEFT ARROW	EACH	\$250.00	11	\$2,750.00
704770	RETRO PTN'D PVMT MARK WORD (ONLY)	EACH	\$350.00	9	\$3,150.00
704776	RETRO PTN'D PVMT MARK WORD (YEILD)	EACH	\$350.00	0	\$0.00
70477X	RETRO PTN'D PVMT MARK RIGHT/LEFT/THRU ARROW (ROUNDAE	EACH	\$500.00	0	\$0.00
PERMANENT SIGNING AND STRIPING COST SUBTOTAL					\$56,811.22

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION ENGINEERING Alt. 2 - South Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
618000	TRAFFIC CONTROL MANAGEMENT	L.S.	\$46,000.00	L.S.	\$75,000.00
618012	PUBLIC AWARENESS	DAY	\$250.00	0	\$0.00
622002	FIELD LABORATORY, TYPE II	EACH	\$20,000.00	0	\$20,000.00
622110	SUPPLEMENTAL HOT-MIX ASPHALT FIELD LABORATORY	EACH	\$26,000.00	0	\$26,000.00
702850	LAW ENFORCEMENT IN CONSTRUCTION ZONE	ALOW	\$23,000.00	ALOW	\$15,000.00
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	L.S.	\$46,000.00	L.S.	\$75,000.00
802000	POST CONSTRUCTION PLANS	L.S.	\$23,000.00	L.S.	\$25,000.00
CONSTRUCTION ENGINEERING COST SUBTOTAL					\$236,000.00

Signal/ITS Alt. 2 - South Realignment

[illegible]

ALTERNATIVE 3:
NORTH ALIGNMENT

Estimate of Probable Cost

NM 14 REHABILITATION ALTERNATIVES COST ANALYSIS PN A301443 CN A301443 ALTERNATIVES COST ANALYSIS NOVEMBER 20, 2017

COST SUMMARY Alt. 3 - NORTH REALIGNMENT

TYPE OF CONSTRUCTION	CONSTRUCTION COST TOTAL	E&C 30%	TOTAL ESTIMATED COST
ROADWAY	\$1,532,167.26	\$459,650.18	\$1,991,817.44
CONSTRUCTION SIGNING	\$86,000.00	\$25,800.00	\$111,800.00
PERMANENT SIGNING AND STRIPING	\$50,842.53	\$15,252.76	\$66,095.29
CONSTRUCTION ENGINEERING	\$236,000.00	\$70,800.00	\$306,800.00
SIGNALS/ITS	\$270,000.00	\$81,000.00	\$351,000.00
SUBTOTAL	\$2,175,009.79	\$652,502.94	\$2,827,512.73
NM GROSS RECEIPTS TAX (7.50%)			\$212,063.45
TOTAL			\$3,039,600.00

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

ROADWAY Alt. 3 - North Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
201000	CLEARING AND GRUBBING	L.S.	\$23,000.00	L.S.	\$23,000.00
203000	UNCLASSIFIED EXCAVATION	CU.YD.	\$8.50	2,000	\$17,000.00
203100	BORROW	CU.YD.	\$9.50	2,500	\$23,750.00
203211	UNSTABLE SUBGRADE STABILIZATION	SQ.YD.	\$10.00	800	\$8,000.00
207000	SUBGRADE PREPARATION	SQ.YD.	\$1.50	16,916	\$25,374.17
303000	BASE COURSE	TON	\$14.00	3,715	\$52,010.00
403701	OPEN GRADED FRICTION COURSE COMPLETE	TON	\$110.00	587	\$64,610.15
407000	ASPHALT MATERIAL FOR TACK COAT	TON	\$575.00	11	\$6,484.51
408100	PRIME COAT MATERIAL	TON	\$480.00	8.5	\$4,059.87
417000	MISCELLANEOUS PAVING	SQ.YD.	\$30.00	1,532	\$45,963.33
424004	WMA SP IV COMPLETE	TON	\$75.00	6,620	\$496,470.24
	DRAINAGE SYSTEM	L.S.	\$150,000.00	L.S.	\$150,000.00
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	\$34,500.00	L.S.	\$125,000.00
608004	CONCRETE SIDEWALK 4"	SQ.YD.	\$40.00	80	\$3,200.00
609318	CONCRETE SLOPED CURB AND GUTTER 6" X 18"	LIN.FT.	\$20.00	2,306	\$46,120.00
609430	CONCRETE VERTICAL CURB AND GUTTER TYPE B 6" X 30"	LIN.FT.	\$25.00	5,045	\$126,125.00
613000	CLEANING CULVERTS AND DRAINAGE STRUCTURES	L.S.	\$23,000.00	L.S.	\$15,000.00
621000	MOBILIZATION	L.S.	\$230,000.00	L.S.	\$280,000.00
	SEEDING	ACRE	\$5,000.00	4	\$20,000.00
	ROADWAY COST SUBTOTAL				\$1,532,167.26

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION SIGNING Alt. 3 - North Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
702610	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	\$7,500.00	4	\$30,000.00
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	L.S.	\$46,000.00	L.S.	\$46,000.00
702811	TRAFFIC CONTROL DEVICES FOR PEDESTRIANS AND BICYCLISTS	L.S.	\$10,000.00	L.S.	\$10,000.00
CONSTRUCTION SIGNING COST SUBTOTAL					\$86,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

PERMANENT SIGNING AND STRIPING Alt 3 - North Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
701000	PANEL SIGNS	SQ.FT.	\$20.00	0	\$0.00
701010	EXTRUDED PANEL SIGNS	SQ.FT.	\$25.00	0	\$0.00
701100	STEEL POST AND BASE POST FOR ALUMINUM PANEL SIGNS	LIN.FT.	\$12.00	0	\$0.00
701108	STEEL I-BEAM POST TYPE S4X7.7	LIN.FT.	\$28.00	0	\$0.00
703003	OBJECT MARKER TYPE 3	EACH	\$125.00	0	\$0.00
703110	ROAD DELINEATOR TYPE HAZARD	EACH	\$40.00	0	\$0.00
704000	RETROREFLECTORIZED PAINTED MARKINGS 4"	LIN.FT.	\$5.47	8,043	\$43,992.53
704767	RETRO PTN'D PVMT MARK RIGHT ARROW	EACH	\$250.00	8	\$2,000.00
704768	RETRO PTN'D PVMT MARK LEFT ARROW	EACH	\$250.00	11	\$2,750.00
704770	RETRO PTN'D PVMT MARK WORD (ONLY)	EACH	\$350.00	6	\$2,100.00
704776	RETRO PTN'D PVMT MARK WORD (YEILD)	EACH	\$350.00	0	\$0.00
70477x	RETRO PTN'D PVMT MARK RIGHT/LEFT/THRU ARROW (ROUNDAE	EACH	\$500.00	0	\$0.00
PERMANENT SIGNING AND STRIPING COST SUBTOTAL					\$50,842.53

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION ENGINEERING Alt. 3 - North Realignment

Item #	Description	Unit	Unit Cost	Estimate	Cost
618000	TRAFFIC CONTROL MANAGEMENT	L.S.	\$46,000.00	L.S.	\$75,000.00
618012	PUBLIC AWARENESS	DAY	\$250.00	0	\$0.00
622002	FIELD LABORATORY, TYPE II	EACH	\$20,000.00	0	\$20,000.00
622110	SUPPLEMENTAL HOT-MIX ASPHALT FIELD LABORATORY	EACH	\$26,000.00	0	\$26,000.00
702850	LAW ENFORCEMENT IN CONSTRUCTION ZONE	ALOW	\$23,000.00	ALOW	\$15,000.00
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	L.S.	\$46,000.00	L.S.	\$75,000.00
802000	POST CONSTRUCTION PLANS	L.S.	\$23,000.00	L.S.	\$25,000.00
CONSTRUCTION ENGINEERING COST SUBTOTAL					\$236,000.00

Signal/ITS Alt. 3 - North Realignment

Signal/ITS Alt. 3 - North Realignment

ALTERNATIVE 4:
ROUNDAABOUT

Estimate of Probable Cost

**NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017**

COST SUMMARY Alt. 4 - ROUNDABOUT

TYPE OF CONSTRUCTION	CONSTRUCTION COST TOTAL	E&C 30%	TOTAL ESTIMATED COST
ROADWAY	\$1,652,234.45	\$495,670.34	\$2,147,904.79
CONSTRUCTION SIGNING	\$86,000.00	\$25,800.00	\$111,800.00
PERMANENT SIGNING AND STRIPING	\$36,014.40	\$10,804.32	\$46,818.72
CONSTRUCTION ENGINEERING	\$236,000.00	\$70,800.00	\$306,800.00
SIGNALS/ITS	\$20,000.00	\$6,000.00	\$26,000.00
SUBTOTAL	\$2,030,248.86	\$609,074.66	\$2,639,323.51
RIGHT-OF-WAY			\$25,000.00
NM GROSS RECEIPTS TAX (7.50%)			\$197,949.26
TOTAL			\$2,862,300.00

NM 14 REHABILITATION
ALTERNATIVES COST ANALYSIS
PN A301443
CN A301443
ALTERNATIVES COST ANALYSIS
NOVEMBER 20, 2017

ROADWAY Alt. 4 - Roundabout

Item #	Description	Unit	Unit Cost	Estimate	Cost
201000	CLEARING AND GRUBBING	L.S.	\$30,000.00	L.S.	\$30,000.00
203000	UNCLASSIFIED EXCAVATION	CU.YD.	\$8.50	3,000	\$25,500.00
203100	BORROW	CU.YD.	\$9.50	15,000	\$142,500.00
203211	UNSTABLE SUBGRADE STABILIZATION	SQ.YD.	\$10.00	1,000	\$10,000.00
207000	SUBGRADE PREPARATION	SQ.YD.	\$1.50	14,875	\$22,312.12
303000	BASE COURSE	TON	\$14.00	3,263	\$45,682.00
403701	OPEN GRADED FRICTION COURSE COMPLETE	TON	\$110.00	516	\$56,813.26
407000	ASPHALT MATERIAL FOR TACK COAT	TON	\$575.00	10	\$5,701.99
408100	PRIME COAT MATERIAL	TON	\$480.00	7.4	\$3,569.94
417000	MISCELLANEOUS PAVING	SQ.YD.	\$30.00	3,070	\$92,104.00
424004	WMA SP IV COMPLETE	TON	\$75.00	5,821	\$436,558.25
451080	CONCRETE PAVEMENT-8"	SQ.YD.	\$50.00	731	\$36,548.90
	DRAINAGE SYSTEM	L.S.	\$150,000.00	L.S.	\$150,000.00
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	\$125,000.00	L.S.	\$125,000.00
608004	CONCRETE SIDEWALK 4"	SQ.YD.	\$40.00	500	\$20,000.00
609330	CONCRETE SLOPED CURB AND GUTTER 6" X 30"	LIN.FT.	\$22.00	2,602	\$57,244.00
609430	CONCRETE VERTICAL CURB AND GUTTER TYPE B 6" X 30"	LIN.FT.	\$25.00	4,808	\$120,200.00
613000	CLEANING CULVERTS AND DRAINAGE STRUCTURES	L.S.	\$15,000.00	L.S.	\$15,000.00
621000	MOBILIZATION	L.S.	\$230,000.00	L.S.	\$230,000.00
	SEEDING	ACRE	\$5,000.00	5.5	\$27,500.00
	ROADWAY COST SUBTOTAL				\$1,652,234.45

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION SIGNING Alt. 4

Item #	Description	Unit	Unit Cost	Estimate	Cost
702610	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	\$7,500.00	4	\$30,000.00
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	L.S.	\$46,000.00	L.S.	\$46,000.00
702811	TRAFFIC CONTROL DEVICES FOR PEDESTRIANS AND BICYCLISTS	L.S.	\$10,000.00	L.S.	\$10,000.00
CONSTRUCTION SIGNING COST SUBTOTAL					\$86,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

PERMANENT SIGNING AND STRIPING Alt 4

Item #	Description	Unit	Unit Cost	Estimate	Cost
701000	PANEL SIGNS	SQ.FT.	\$20.00	0	\$0.00
701010	EXTRUDED PANEL SIGNS	SQ.FT.	\$25.00	0	\$0.00
701100	STEEL POST AND BASE POST FOR ALUMINUM PANEL SIGNS	LIN.FT.	\$12.00	0	\$0.00
701108	STEEL I-BEAM POST TYPE S4X7.7	LIN.FT.	\$28.00	0	\$0.00
703003	OBJECT MARKER TYPE 3	EACH	\$125.00	0	\$0.00
703110	ROAD DELINEATOR TYPE HAZARD	EACH	\$40.00	0	\$0.00
704000	RETROREFLECTORIZED PAINTED MARKINGS 4"	LIN.FT.	\$5.47	5,560	\$30,414.40
704767	RETRO PTN'D PVMT MARK RIGHT ARROW	EACH	\$250.00	3	\$750.00
704768	RETRO PTN'D PVMT MARK LEFT ARROW	EACH	\$250.00	3	\$750.00
704770	RETRO PTN'D PVMT MARK WORD (ONLY)	EACH	\$350.00	0	\$0.00
704776	RETRO PTN'D PVMT MARK WORD (YEILD)	EACH	\$350.00	6	\$2,100.00
70477x	RETRO PTN'D PVMT MARK RIGHT/LEFT/THRU ARROW (ROUNDAE	EACH	\$500.00	4	\$2,000.00
PERMANENT SIGNING AND STRIPING COST SUBTOTAL					\$36,014.40

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

CONSTRUCTION ENGINEERING Alt. 4

Item #	Description	Unit	Unit Cost	Estimate	Cost
618000	TRAFFIC CONTROL MANAGEMENT	L.S.	\$46,000.00	L.S.	\$75,000.00
618012	PUBLIC AWARENESS	DAY	\$250.00	0	\$0.00
622002	FIELD LABORATORY, TYPE II	EACH	\$20,000.00	0	\$20,000.00
622110	SUPPLEMENTAL HOT-MIX ASPHALT FIELD LABORATORY	EACH	\$26,000.00	0	\$26,000.00
702850	LAW ENFORCEMENT IN CONSTRUCTION ZONE	ALOW	\$23,000.00	ALOW	\$15,000.00
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	L.S.	\$46,000.00	L.S.	\$75,000.00
802000	POST CONSTRUCTION PLANS	L.S.	\$23,000.00	L.S.	\$25,000.00
CONSTRUCTION ENGINEERING COST SUBTOTAL					\$236,000.00

NM 14 REHABILITATION
 ALTERNATIVES COST ANALYSIS
 PN A301443
 CN A301443
 ALTERNATIVES COST ANALYSIS
 NOVEMBER 20, 2017

Signal/ITS Alt. 4 - Roundabout

Item #	Description	Unit	Unit Cost	Estimate	Cost
709030	RIGID ELECTRICAL CONDUIT 3" (DIA.)	LIN.FT.	\$12.00	0	\$0.00
750000	INTELLIGENT TRANSPORTATION SYSTEM	L.S.	\$20,000.00	L.S.	\$20,000.00
750060	ITS PULLBOX (33"X24"X24")	EACH	\$700.00	0	\$0.00
750080	ITS MANHOLE (48"X48"X48")	EACH	\$3,100.00	0	\$0.00
ITS COST SUBTOTAL					\$20,000.00

wsp