

**JACOBS®**

# Fort Defiance Industrial Area Traffic Circulation Study

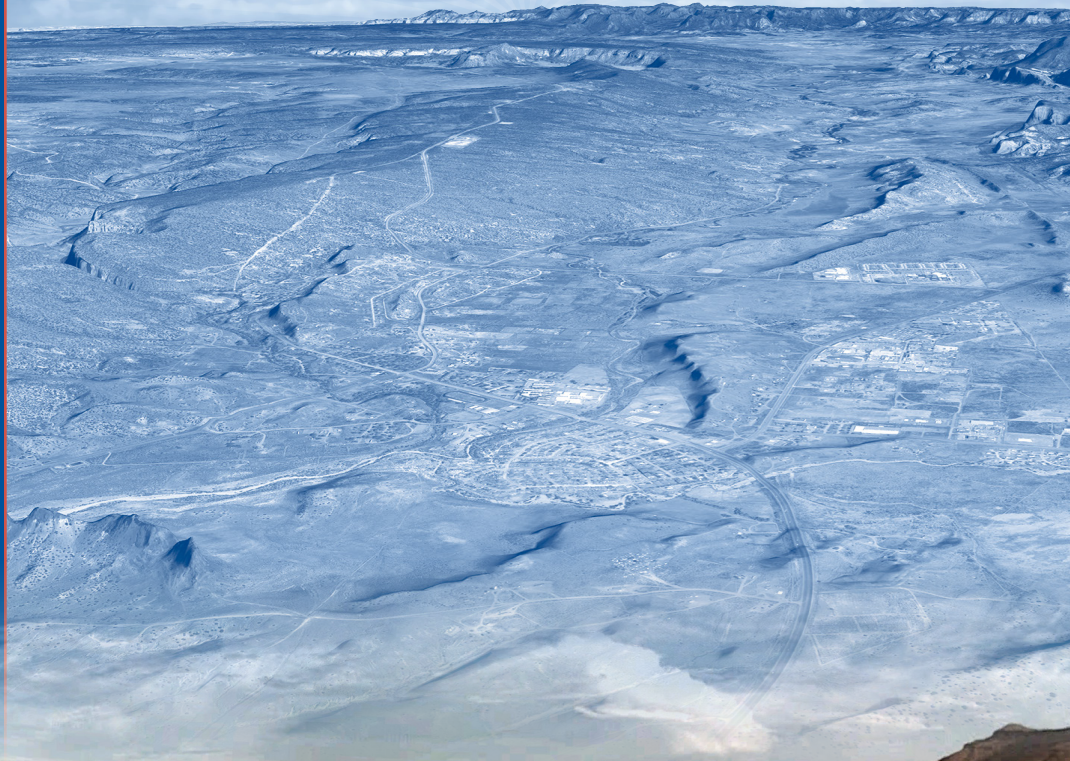
Task Assignment MPD 029-13

**Executive Summary**

March 14, 2014

**ADOT**

Arizona Department of Transportation







**THE NAVAJO NATION  
FORT DEFIANCE CHAPTER**

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FDC-2014-03-09-01

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*Navajo Nation Vice President*

**RESOLUTION OF THE FORT DEFIANCE CHAPTER**

**Supporting and Approving the Fort Defiance Industrial Area Traffic Circulation Study: MPD 029-13 Completed by Jacobs Engineering Group Inc. under the Planning Assistance for Rural Areas (PARA) Program Sponsored by the Arizona Department of Transportation (ADOT) Multimodal Planning Division.**

**WHEREAS:**

1. The Fort Defiance Community Chapter is a duly called chapter of the Navajo Nation pursuant to the Navajo Nation Code, Title II, Sections 4001 and 4006. Therefore it is authorized to address and take action on the needs and concerns of its people, and
2. The Fort Defiance Chapter has a vision of economic growth supported by commercial activity in a home to numerous governmental, social and educational facilities, including various residential subdivisions, and
3. Within the study area there are five (5) major roads that intersect and each has numerous safety deficiencies that become extremely hazardous to all modes of transportation, and
4. The traffic study is within the jurisdiction of the Bureau of Indian Affairs Right-of-Way whose regulations require and approved study prior to any improvements within their jurisdiction, and
5. Apache County District II served as the Local Public Agency in submitting the grant application to Arizona Department of Transportation Multimodal Planning Division on behalf of the Fort Defiance Community, and
6. The study analyzed and addressed planning of a broad range of multimodal transportation needs to promote safety and mobility, enhance economic vitality and improve community livability also future economic development, and
7. The study will become a major component in the pursuit of competitive funding to various entities detailing justification in the form of statistics for the various improvements.



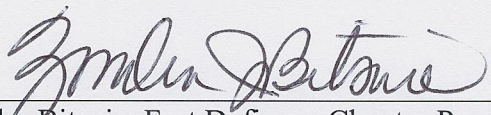
**NOW, THEREFORE, BE IT RESOLVED THAT,**

The Fort Defiance Community Chapter Hereby Supports and Approves the Fort Defiance Industrial Area Traffic Circulation Study: MPD 029-13 completed by Jacobs Engineering Group Inc. under the Planning Assistance for Rural Areas (PARA) Program as sponsored by the Arizona Department of Transportation (ADOT) Multimodal Planning Division.

**C E R T I F I C A T I O N**

I, hereby certify that the foregoing resolutions was considered at a duly called meeting of the Fort Defiance, Navajo Nation, Arizona at which a quorum was present at the same was passed with a vote of 63 in favor, 0 opposed, and 1 abstained on this 9th day of March, 2014.

Motion by: Katherine Arviso Second by: Eva Platero



Zondra Bitsuie, Fort Defiance Chapter President

# TABLE OF CONTENTS

	<u>Page</u>
STUDY PURPOSE AND NEED .....	1
STUDY PROCESS.....	2
TRANSPORTATION ISSUES SUMMARY .....	4
PLAN FOR IMPROVEMENTS .....	7
Roadway Improvement Recommendations .....	7
Pedestrian, Bicycle, and Trail Facility Recommendations.....	15
Transit Recommendations .....	15
Title VI Implications.....	18
Tribal Transportation Program Update Recommendations .....	20
IMPLEMENTATION AND FUNDING STRATEGIES .....	21
Funding Sources.....	21
Partnerships .....	22
Implementation Guidelines .....	23

## LIST OF TABLES

	<u>Page</u>
1: Short-Term Recommendations .....	8
2: Mid-Term Recommendations .....	13
3: Long-Term Recommendations .....	14
4: Recommended Transit Stop Locations.....	17
5: Recommended Project Impacts and Advantages on Title VI Populations.....	19

## LIST OF FIGURES

	<u>Page</u>
1: Study Process .....	2
2: Study Area .....	3
3: Roadway Issues Summary .....	5
4: Pedestrian, Bicycle, and Transit Summary of Issues.....	6
5: Recommended Pedestrian and Trail Facilities.....	16

# EXECUTIVE SUMMARY

## STUDY PURPOSE AND NEED

The Arizona Department of Transportation (ADOT), in coordination with Apache County District II and the Fort Defiance Chapter of the Navajo Nation, analyzed the traffic circulation conditions of Navajo Routes 7, 12, 54, 110, and 112 within the Fort Defiance Industrial Area which is designated as a major growth area on the Navajo Nation. The study was funded by the Federal Highway Administration's (FHWA) State Planning and Research Program and administered through ADOT's Multimodal Planning Division's Planning Assistance for Rural Areas (PARA) program. Through request from Apache County District II, the *Fort Defiance Industrial Area Traffic Circulation Study* was initiated to develop a planning strategy to improve the mobility and safety within the Fort Defiance Industrial Area. Figure 2 provides an illustration of the Fort Defiance Industrial Area and study roadways. While the study focuses mainly on Navajo Routes 7, 12, 54, 110, and 112, other key local streets were analyzed to optimize traffic circulation performance.

The need for this study stemmed directly from the desire of the Fort Defiance Chapter and Apache County District II to increase economic vitality, improve community livability, and enhance transportation conditions along the Area's major transportation routes. The project purpose is demonstrated with the following statement of need:

- **Address Safety and Operational Needs.** The current roadway network needs to be evaluated to identify solutions to improve safety and mobility, optimize traffic operations, and enhance overall streetscaping. Key issues that need to be addressed include:
  - Existing roadway and intersection design is not optimal, as commuter and truck traffic often causes congestion and unsafe conditions.
  - Roadways need to be upgraded to meet BIA design standards.
  - Roadways lack shoulders which limit vehicles from pulling over or yielding to emergency vehicles.
  - Vehicles travel at high speeds, particularly in school zones, causing unsafe driving and walking conditions.
  - The area has limited pedestrian walkways, crosswalks, and bicycle facilities.
- **Accommodate Planned Land Use and Future Growth.** Designated as one of the Navajo Nation's growth centers and industrial park areas, significant economic development activities will greatly increase truck and commuter congestion along study roadways and will require updated facilities to accommodate traffic and to promote multimodal transportation.
- **Provide Bicycle, Pedestrian, and Trail Connections Between Activity Centers.** Sidewalks and bike paths are limited and unsafe within numerous locations of the study area. Improvements are necessary to provide continuous and safe connections between business and activity centers for residents and for recreational purposes.



- Promote Economic Growth and Community Livability while Maintaining the Area's Character.** A plan for transportation investments that encourages economic growth needs to be developed along the study roadways where local business can thrive while maintaining the rural and historic nature of the Fort Defiance growth area. Transportation investments that provide transportation choices and connections at the local and regional level can strengthen local businesses, spur business growth and job creation, encourage activity among residents, and promote tourism.

This document outlines a phased improvement plan to address the most critical transportation needs of the study roadways in the Fort Defiance study area. Recommendations in this study will enable the Navajo Nation and the County to facilitate safer and more efficient infrastructure for the traveling public and guide the development along the study roadways. Study findings will also be used to update the Navajo Nation's Road Inventory Field Data System (RIFDS) and Tribal Transportation Improvement Program (TTIP) over the next 5-, 10-, and 20-year planning horizon periods.

### STUDY PROCESS

Development of a transportation plan consists of a comprehensive six phase process: data collection, analysis of existing and future conditions, stakeholder involvement, and analysis of improvement scenarios, recommendations, and public outreach. Throughout the process, the study team maintained consistent contact with the Technical Advisory Committee and stakeholders and conducted extensive public outreach efforts. Figure 1 illustrates the process utilized for this study.

*Working Paper 1: Existing and Future Conditions* inventoried and analyzed the existing and future conditions in the study area, including existing transportation system deficiencies, issues, and needs. The First Public Open House was conducted on August 7, 2013 to present existing and projected transportation conditions and issues. *Working Paper 2: Draft Transportation Improvement Plan* evaluated and identified improvement projects that addressed the needs and deficiencies identified in Working Paper 1. The Second Public Open House was conducted on January 8, 2014 to present the Draft Transportation Improvement Plan.

Figure 1. Study Process

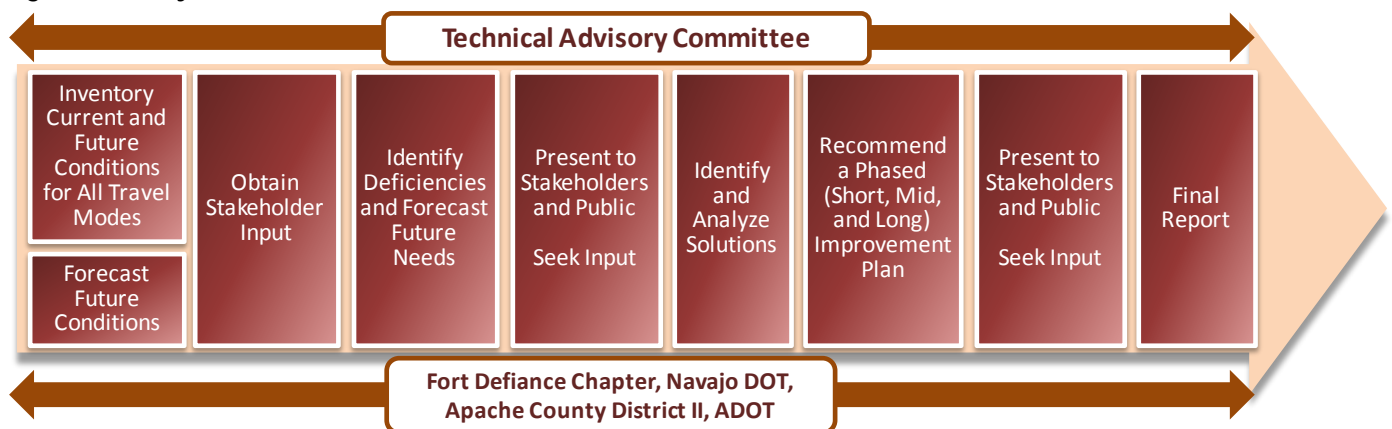
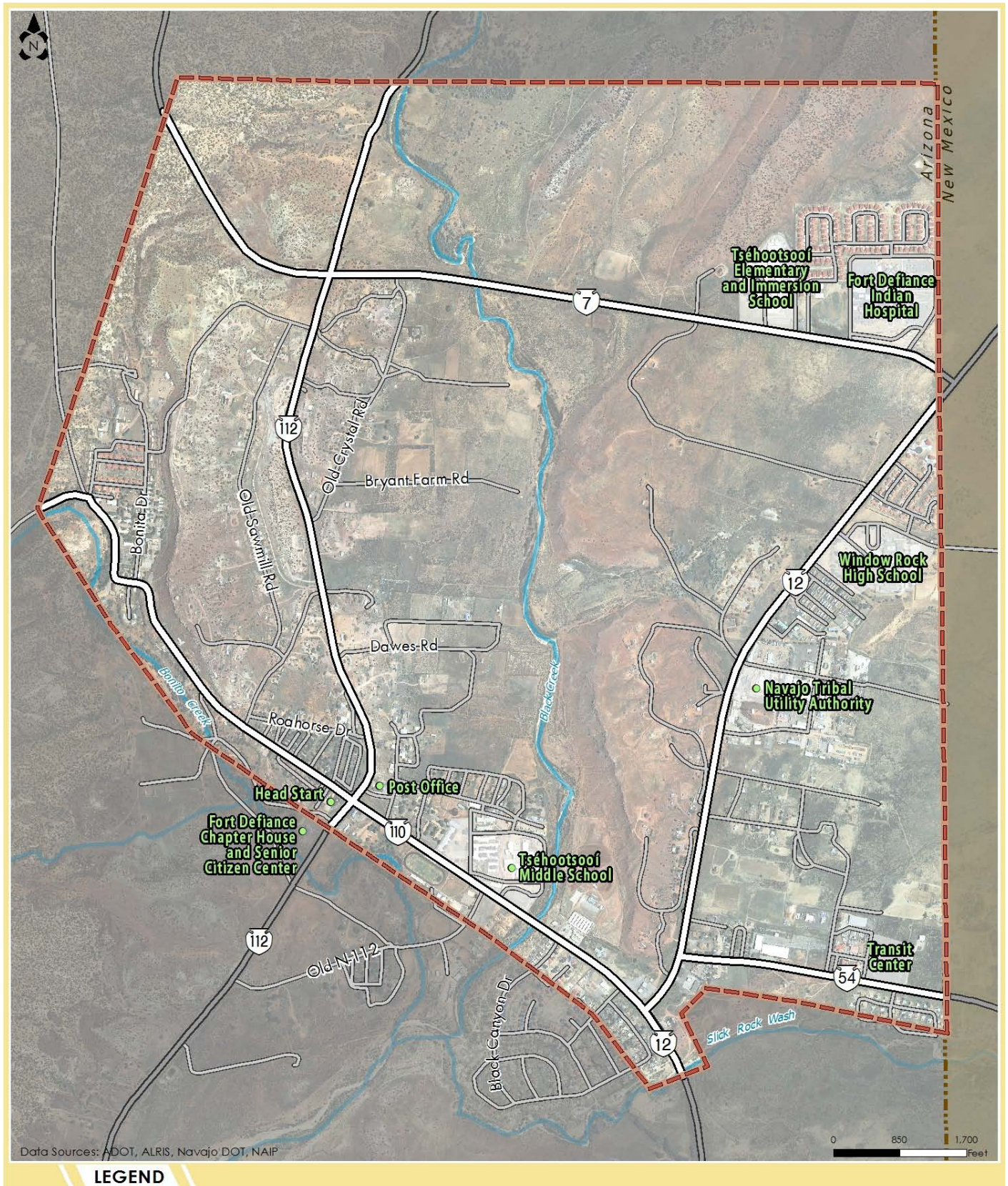







Figure 2. Study Area



**LEGEND**

-  Study Roadway
-  Streams and Washes
-  Study Area



## **TRANSPORTATION ISSUES SUMMARY**

Based on the inventory and analysis of existing conditions, transportation system deficiencies and issues were identified. These issues and deficiencies formed the basis for the development of the transportation improvement plan. Figure 3 is a summary of the major roadway issues in the study area and Figure 4 is a summary of issues for the transit, pedestrian, and bicycle modes. Key issues are listed below.

### **Safety and Congestion Issues:**

- N12/N110 intersection is a major gateway for regional travel entering/exiting Fort Defiance. The intersection lacks safe pedestrian crossing facilities, has driveways located close to intersection, no street lighting is present, and the westbound traffic light is difficult to see by motorists.
- N112/N110 intersection is an unsignalized intersection that experiences queue delays from motorists turning onto N12, lacks lighting and safe pedestrian crosswalks, and has sidewalks in fair to poor condition.
- Access management issues along N12 and N112.
- High number of crashes occurred at the N12/N110 intersection, N112/N110 intersection, and along N12 from N110 to N7.
- Roadways lack shoulders which limit vehicles from pulling over or yielding to emergency vehicles.
- Vehicles travel at high speeds, particularly in school zones, causing unsafe driving and walking conditions.
- No designated turn lanes or no lane striping at most minor intersections.
- Poor pavement conditions, as well as poor lane and shoulder striping.
- Existing roadway signs are covered in graffiti making visibility difficult.
- Missing cattle guards and fencing allow animals to enter right-of-way.

### **Pedestrian and Bicycle Issues:**

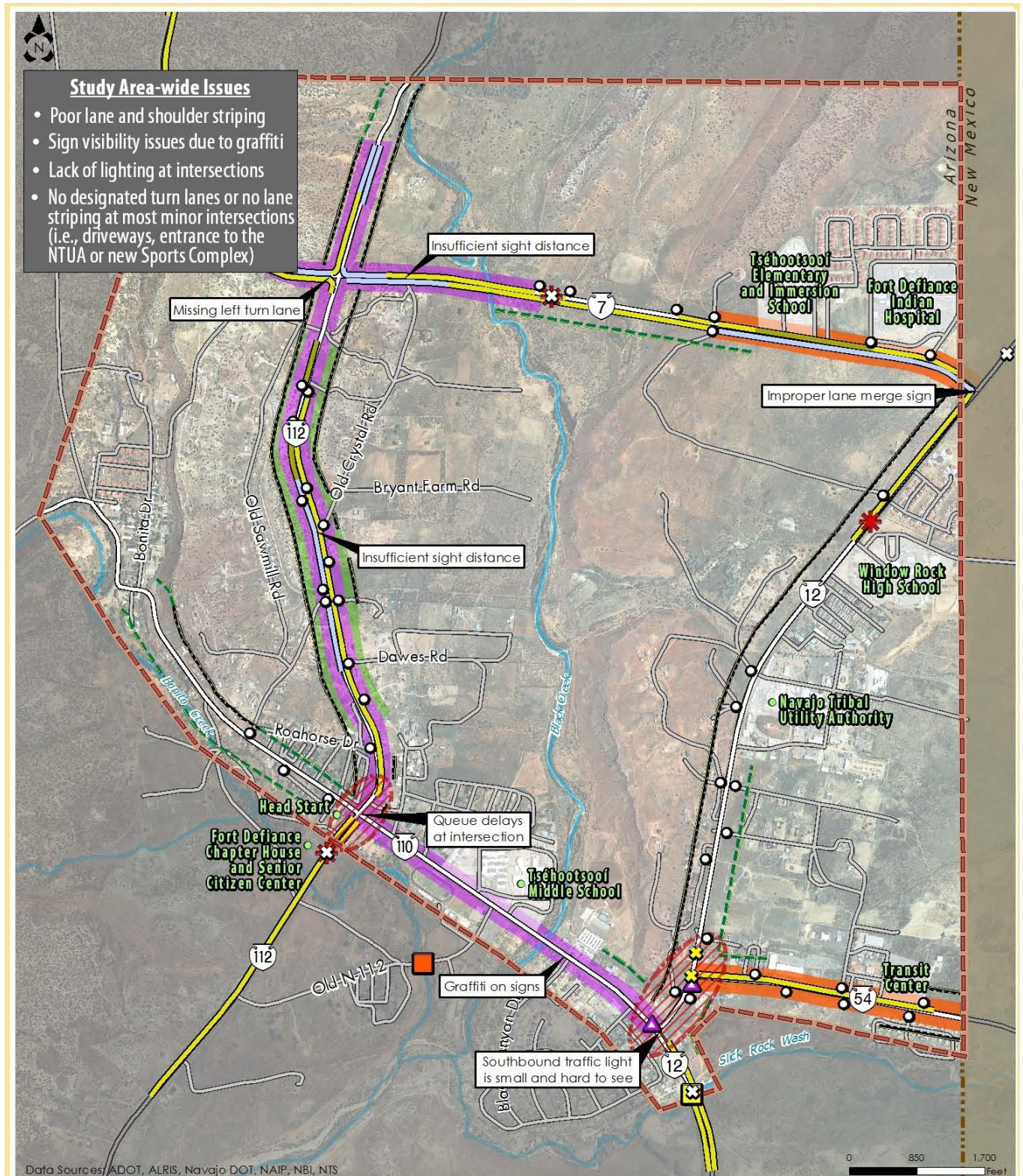
- The area has limited pedestrian walkways, street lighting, crosswalks, and bicycle facilities.
- Existing sidewalks are in fair to poor condition and have poor ADA ramps.

### **Transit Issues:**

- No designated bus shelters or pullouts.
- No local circulator bus route within Fort Defiance and to neighboring communities.



Figure 3. Roadway Issues Summary



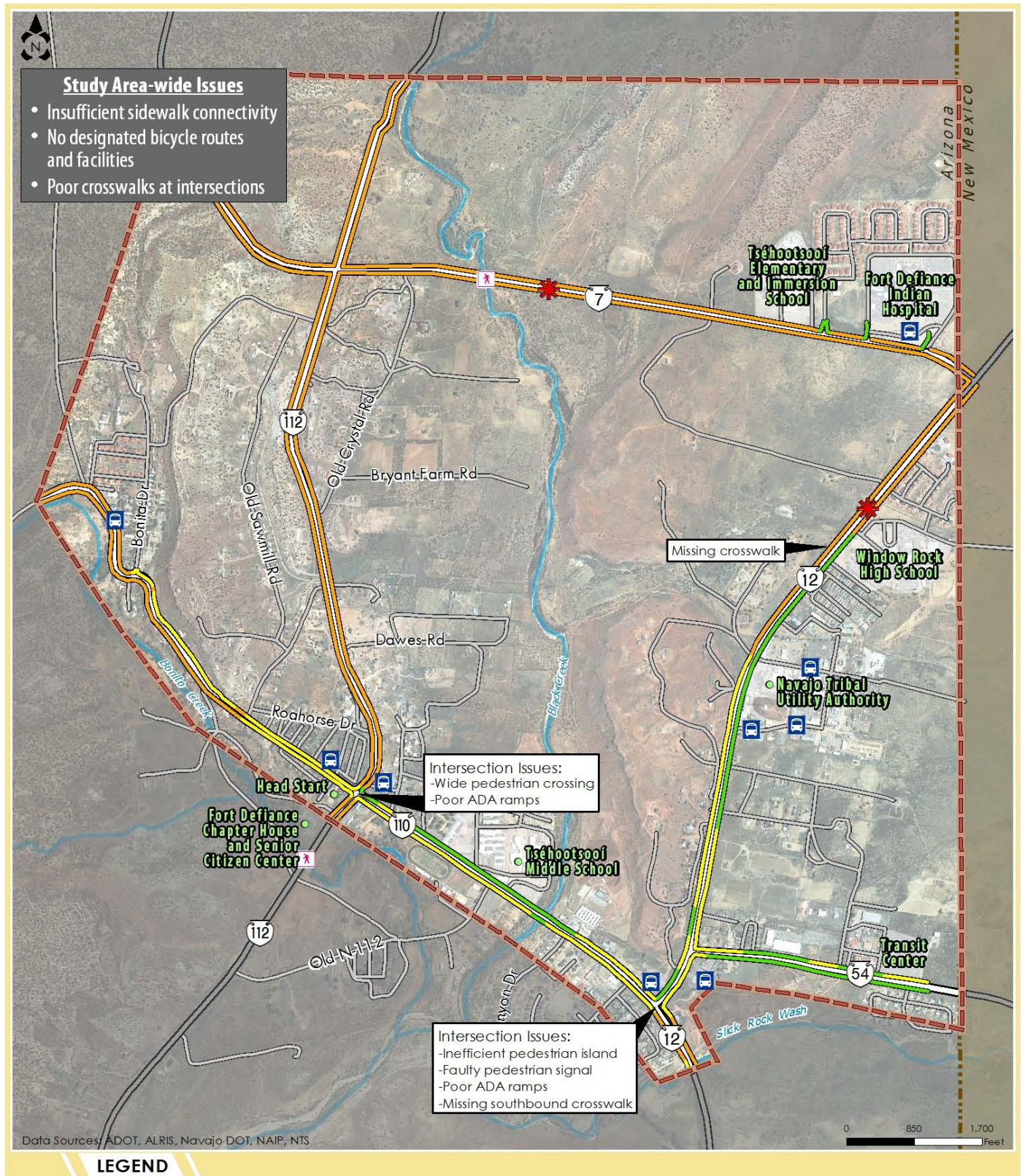
Data Sources: ADOT, ALRIS, Navajo DOT, NAIP, NBI, NTS

**LEGEND**

- |  |   |  |                                  |  |                                 |  |                    |
|--|---|--|----------------------------------|--|---------------------------------|--|--------------------|
|  | Fatal Crash                             |  | Driveway Close to Intersection   |  | Broken/Intermittent Fencing     |  | Study Roadway      |
|  | Animal Collision along Unfenced Roadway |  | Missing Cattle Guard             |  | Lack of Fencing                 |  | Streams and Washes |
|  | Other Animal Collision                  |  | High Crash Corridor/Intersection |  | No Shoulder                     |  | Study Area         |
|  | Functionally Obsolete Bridge            |  | Roadside Vegetation              |  | Poor Shoulder Surface Condition |  |                    |
|  | Structurally Deficient Bridge           |  | Poor Pavement Conditions         |  | Faded Shoulder Striping         |  |                    |
|  |   |  | Moderate Traffic Congestion      |  |                                 |  |                    |



Figure 4. Pedestrian, Bicycle, and Transit Summary of Issues





## PLAN FOR IMPROVEMENTS

This section presents the Plan for Improvements for the Fort Defiance Industrial Area for the short-, mid-, and long-term planning horizons. This transportation plan is the result of the deficiency analysis from Working Paper 1, Working Paper 2, stakeholder input, and Public Open House input. Together these projects will strengthen Fort Defiance's existing roadway network; provide a network of pedestrian, bicycle, and transit facilities; support economic development; and improve safety and operations.

### Roadway Improvement Recommendations

#### Short-Term (2018) Improvements

Short-term phase projects are recommended to be completed as the study area reaches year 2018. Table 1 presents a comprehensive list of the transportation recommendations for this phase, as well as the project number\*, location, description, and estimated costs for each project.

#### Mid-Term (2023) Improvements

Mid-term phase projects are recommended to be completed as the study area reaches year 2023. Table 2 presents a comprehensive list of the transportation recommendations for this phase, as well as the project number\*, location, location, description, and estimated costs for each project.

#### Long-Term (2033) Improvements

Long-term phase projects are recommended to be completed as the study area reaches year 2033. Table 3 presents a comprehensive list of the transportation recommendations for this phase, as well as the project number\*, location, location, description, and estimated costs for each project.

*\* Each project is assigned a unique project number that can be used to track project progress. Planning level cost estimates were developed based on typical per-mile/per-foot construction costs. They were not derived using detailed material and labor appraisals. These cost estimates are expressed in 2013 dollars and should be regarded as preliminary planning estimates. Actual costs for projects could vary at the time of implementation based on the extent of right-of-way acquisition, environmental, and utility relocation impacts. Unless otherwise noted, the recommended projects are not yet funded.*



Table 1. Short-Term Recommendations

ID	Project Location and Description	Cost
ST-1	<p><b>N7: N12 Intersection to Tséhootsooí Elementary School</b>            Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.41 mi)</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (0.41 mi)</li> <li>• Install Lighting</li> <li>• Add 8" Wide, Unpaved Shoulders</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Install Cattle Guards (2)</li> <li>• Construct Asphalt Share Use Path – Westbound (0.41 mi)</li> </ul>	\$173,650
ST -2	<p><b>N7: Tséhootsooí Elementary School to N112 Intersection</b>            Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (1.14 mi)</li> <li>• Pavement Preservation – Structural Overlay (1.14 mi)</li> <li>• Replace Signage</li> <li>• Install Lighting</li> <li>• Add 8" Wide, Unpaved Shoulders</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Repair Fencing (0.60 mi)</li> <li>• Install Cattle Guards (2)</li> </ul>	\$904,660
ST -3	<p><b>N7: N112 Intersection to Western Study Boundary</b>            Upgrade corridor to improve roadway safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.61 mi)</li> <li>• Pavement Preservation – Structural Overlay</li> <li>• Add 8" Wide, Unpaved Shoulders</li> </ul>	\$405,650
ST-4	<p><b>N12: Southern Study Boundary to N110 Intersection</b>            Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.18 mi)</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (0.18 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Repair Fencing (0.18 mi)</li> <li>• Construct Concrete Shared Use Path – Northbound</li> <li>• Construct Concrete Shared Use Path – Southbound</li> </ul>	\$140,000
ST -5	<p><b>N12: N110 Intersection to N54 Intersection</b>            Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.16 mi)</li> <li>• Remove Roadside Vegetation</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (0.16 mi)</li> <li>• Replace Signage</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Repair Fencing (0.14 mi)</li> <li>• Install Cattle Guards (2)</li> <li>• Construct Concrete Shared Use Path – Northbound</li> <li>• Construct Concrete Shared Use Path – Southbound</li> </ul>	\$134,560

Table 1. Short-Term Roadway Recommendations (Continued)

ID	Project Location and Description	Cost
ST -6	<p><b>N12: N54 Intersection to Window Rock High School</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (1.12 mi)</li> <li>• Remove Roadside Vegetation</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (1.12 mi)</li> <li>• Replace Signage</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Repair Fencing (0.51 mi)</li> <li>• Install New Fencing (0.61 mi)</li> <li>• Install Cattle Guards (7)</li> <li>• Construct Extra-Wide Asphalt Shared Use Path – Northbound</li> </ul>	\$494,220
ST -7	<p><b>N12: Window Rock High School to N7 Intersection</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.47 mi)</li> <li>• Remove Roadside Vegetation</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (0.47 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Install Cattle Guard (1)</li> <li>• Install New Fencing (0.47 mi)</li> <li>• Construct Extra-Wide Asphalt Shared Use Path – Northbound</li> </ul>	\$195,690
ST -8	<p><b>N54: Eastern Study Boundary to N12 Intersection</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.66 mi)</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (0.66 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Install New Fencing (0.40 mi)</li> <li>• Install Cattle Guards (6)</li> </ul>	\$136,300
ST -9	<p><b>N110: N12 Intersection to Tséhootsooi Middle School</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.54 mi)</li> <li>• Pavement Preservation – Structural Overlay (0.54 mi)</li> <li>• Replace Signage</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Construct Concrete Shared Use Path – Westbound</li> <li>• Construct Concrete Shared Use Path – Eastbound</li> </ul>	\$803,360



**Table 1. Short-Term Roadway Recommendations (Continued)**

ID	Project Location and Description	Cost
ST -10	<p><b>N110: Tséhootsooi Middle School to N112 Intersection</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.34 mi)</li> <li>• Pavement Preservation – Structural Overlay (0.34 mi)</li> <li>• Replace Signage</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Construct Concrete Shared Use Path – Westbound</li> <li>• Construct Concrete Shared Use Path – Eastbound</li> </ul>	\$506,060
ST -11	<p><b>N110: N112 Intersection to Western Study Boundary</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (1.17 mi)</li> <li>• Pavement Preservation – Minor Rehabilitation (Chip Seal) (1.17 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Add Unpaved Shoulders</li> <li>• Repair Existing Fencing (1.08 mi)</li> </ul>	\$275,650
ST -12	<p><b>N112: Southern Study Boundary to Old Crystal Road</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.81 mi)</li> <li>• Remove Roadside Vegetation</li> <li>• Replace Signage</li> <li>• Pavement Preservation – Structural Overlay (0.81 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Add Unpaved Shoulders</li> <li>• Install New Fencing (0.91 mi)</li> <li>• Install Cattle Guards (7)</li> <li>• Construct Narrow Asphalt Shared Use Path – Southbound</li> </ul>	\$824,760
ST -13	<p><b>N112: Old Crystal Road to N7 Intersection</b>                      Upgrade corridor to improve roadway and pedestrian safety conditions</p> <ul style="list-style-type: none"> <li>• Roadway Striping (0.62 mi)</li> <li>• Remove Roadside Vegetation</li> <li>• Replace Signage</li> <li>• Pavement Preservation – Structural Overlay (0.62 mi)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Add Unpaved Shoulders</li> <li>• Install New Fencing (1.2 mi)</li> <li>• Install Cattle Guards (9)</li> <li>• Construct Narrow Asphalt Share Use Path – Southbound</li> </ul>	\$676,240

Table 1. Short-Term Roadway Recommendations (Continued)

ID	Project Location and Description	Cost
ST -14	<b>N112: N7 Intersection to Northern Study Boundary</b> Restripe roadway to improve roadway safety conditions	\$1,750
ST -15	<b>N112/N7 Intersection</b> Upgrade intersection to include: <ul style="list-style-type: none"> <li>• Pavement Restriping of Travel Lanes and to Include Pedestrian Crosswalks</li> <li>• Add Turn Lanes on N112 - Northbound and Southbound</li> <li>• Add Left Turn Lane on N7 - Westbound</li> </ul>	\$5,000
ST -16	<b>N12/N110 Intersection</b> Repair cross slope to improve drainage; remove barrier along intersection; and upgrade intersection to include: <i>Option 1 (No Roundabout):</i> Upgrade traffic signal; install raised medians on N12 and N110; reconfigure pedestrian island; construct shared use path; install pedestrian crosswalks and pedestrian crossing signals; convert entrance to Conoco Gas Station to a right-in only; pavement restriping to include exclusive turn lanes. <i>Option 2 (Roundabout):</i> Reconfigure intersection to include a roundabout; pedestrian crosswalks and sidewalks incorporated into design	Option1: \$600,000  Option 2: \$1,050,000
ST -17	<b>N112/N110 Intersection</b> Repair cross slope to improve drainage and upgrade intersection to include: <i>Option 1 (No Roundabout):</i> Restripe the intersection to include turn-lanes on N112; install traffic signal; pedestrian crosswalks and sidewalks incorporated into design <i>Option 2 (Roundabout):</i> Reconfigure intersection to include a roundabout; pedestrian crosswalks and sidewalks incorporated into design	Option1: \$600,000  Option 2: \$1,050,000
ST -18	<b>Black Canyon Drive/N110 Intersection</b> Widen Cross-street to Add Turn Lanes and Cross-walks	\$300,000
ST -19	<b>NTUA/N12 Intersection</b> Widen Cross-street to Add Turn Lanes and Cross-walks	\$300,000
ST -20	<b>Tséhootsooi Middle School/N110 Intersection</b> Upgrade intersection to include traffic calming measure: <i>Option 1:</i> Chicane raised medians. Enhancement to the chicane will need to be made in the mid-term phase to include the HAWK pedestrian beacon <i>Option 2:</i> Install flashing speed signs <i>Option 3:</i> Install rumble strips <i>Option 4:</i> Install speed limit pavement markings <i>Option 5:</i> Install speed hump or speed table	Option 1: \$100,000  Option 2: \$80,000  Option 3: \$4,500  Option 4: \$1,500  Option 5: \$10,000



**Table 1. Short-Term Roadway Recommendations (Continued)**

ID	Project Location and Description	Cost
ST -21	<p><b>Window Rock High School/N12 Intersection</b>            Upgrade intersection to include traffic calming measure:  <i>Option 1:</i> Chicane raised medians. Enhancement to the chicane will need to be made in the mid-term phase to include the HAWK pedestrian beacon  <i>Option 2:</i> Install flashing speed signs  <i>Option 3:</i> Install rumble strips  <i>Option 4:</i> Install speed limit pavement markings  <i>Option 5:</i> Install speed hump or speed table</p>	Option 1: \$100,000 Option 2: \$80,000 Option 3: \$4,500 Option 4: \$1,500 Option 5: \$10,000
ST -22	<p><b>Tséhootsooi Elementary School/N7 Intersection</b>            Upgrade intersection to include traffic calming measure:  <i>Option 1:</i> Chicane raised medians. Enhancement to the chicane will need to be made in the mid-term phase to include the HAWK pedestrian beacon  <i>Option 2:</i> Install flashing speed signs  <i>Option 3:</i> Install rumble strips  <i>Option 4:</i> Install speed limit pavement markings  <i>Option 5:</i> Install speed hump or speed table</p>	Option 1: \$100,000 Option 2: \$80,000 Option 3: \$4,500 Option 4: \$1,500 Option 5: \$10,000
ST -23	<p><b>Entrance to Town - Southbound N12</b>            Upgrade roadway to include traffic calming measures:  <i>Option 1:</i> Install flashing speed signs  <i>Option 2:</i> Install rumble strips  <i>Option 3:</i> Install speed limit pavement markings  <i>Option 4:</i> Install speed hump or speed table</p>	Option 1: \$80,000 Option 2: \$4,500 Option 3: \$1,500 Option 4: \$10,000
ST -24	<p><b>Entrance to Town - Northbound N12</b>            Upgrade roadway to include traffic calming measures:  <i>Option 1:</i> Install flashing speed signs  <i>Option 2:</i> Install rumble strips  <i>Option 3:</i> Install speed limit pavement markings  <i>Option 4:</i> Install speed hump or speed table</p>	Option 1: \$80,000 Option 2: \$4,500 Option 3: \$1,500 Option 4: \$10,000
ST -25	<p><b>Entrance to Town - Northbound N112</b>            Upgrade roadway to include traffic calming measures:  <i>Option 1:</i> Install flashing speed signs  <i>Option 2:</i> Install rumble strips  <i>Option 3:</i> Install speed limit pavement markings  <i>Option 4:</i> Install speed hump or speed table</p>	Option 1: \$80,000 Option 2: \$4,500 Option 3: \$1,500 Option 4: \$10,000
ST -26	<p><b>Entrance to Window Rock High School Sports Stadium</b>            Create alternative route entering/exiting the Stadium:  <i>Option 1a:</i> Extend Window Rock High School Road south for 0.14 miles to entrance currently in construction  <i>Option 1b:</i> Extend Window Rock High School Road south for 0.25 miles  <i>Option 2:</i> Extend Industrial Area roadway to the Stadium (0.23 miles)</p>	Option 1a: \$126,000 Option 1b: \$225,000 Option 2: \$207,000

Table 2. Mid-Term Recommendations

ID	Project Location and Description	Cost
MT-1	<b>N7: N12 Intersection to Tséhootsooí Elementary School</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Narrow Asphalt Shared Use Path – Eastbound (0.41 mi)</li> </ul>	\$82,000
MT-2	<b>N7: Tséhootsooí Elementary School to N112 Intersection</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Narrow Asphalt Shared Use Path – Eastbound (1.14 mi)</li> <li>• Replace Bridge: Add Pedestrian Walkway</li> </ul>	\$685,200
MT-3	<b>N7: N112 Intersection to Western Study Boundary</b> Upgrade corridor to improve roadway safety conditions <ul style="list-style-type: none"> <li>• Repair Existing Fencing</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> </ul>	\$75,450
MT-4	<b>N12: Southern Study Boundary to N110 Intersection</b> Replace structurally deficient bridge	\$480,000
MT-5	<b>N12: N54 Intersection to Window Rock High School</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Extra-Wide Asphalt Shared Use Path – Southbound (1.12 mi)</li> </ul>	\$252,000
MT-6	<b>N12: Window Rock High School to N7 Intersection</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Extra-Wide Asphalt Shared Use Path – Southbound (0.47 mi)</li> </ul>	\$105,750
MT-7	<b>N110: N112 Intersection to Western Study Boundary</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Narrow Asphalt Shared Use Path – Westbound (1.17 mi)</li> </ul>	\$351,000
MT-8	<b>N112: Southern Study Boundary to Old Crystal Road</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Narrow Asphalt Shared Use Path – Westbound (0.81 mi)</li> </ul>	\$145,800
MT-9	<b>N112: Old Crystal Road to N7 Intersection</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>• Construct Narrow Asphalt Share Use Path – Northbound (0.62 mi)</li> </ul>	\$111,600
MT-10	<b>N112: N7 Intersection to Northern Study Boundary</b> Upgrade corridor to improve roadway safety conditions <ul style="list-style-type: none"> <li>• Pavement Preservation – Structural Overlay (0.35 mi)</li> <li>• Install New Fencing</li> <li>• Install Cattle Guards (4)</li> <li>• Install Lighting</li> <li>• Add 4" Wide Landscape Buffer</li> <li>• Add Unpaved Shoulders</li> </ul>	\$313,150



Table 2. Mid-Term Roadway Recommendations (Continued)

ID	Project Location and Description	Cost
MT -11	<b>Tséhootsooi Middle School/N110 Intersection</b> Upgrade chicane installed during the short-term phase o include a HAWK pedestrian beacon	\$100,000
MT -12	<b>Window Rock High School/N12 Intersection</b> Upgrade chicane installed during the short-term phase o include a HAWK pedestrian beacon	\$100,000
MT -13	<b>Tséhootsooi Elementary School/N7 Intersection</b> Upgrade chicane installed during the short-term phase o include a HAWK pedestrian beacon	\$100,000
MT -14	<b>Multi-Use Trail</b> Construct a multi-use path to increase pedestrian and bicyclist mobility, encourage recreation activities; and to ultimately connect with neighboring communities <ul style="list-style-type: none"> <li>Develop multi-use trail from Black Creek from the Southern Study Boundary to Window Rock High School</li> </ul>	\$160,000

Table 3. Long-Term Recommendations

ID	Project Location and Description	Cost
LT-1	<b>N7: Tséhootsooi Elementary School to N112 Intersection</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>Construct Narrow Asphalt Shared Use Path – Eastbound (0.60 mi)</li> </ul>	\$205,200
LT-2	<b>N7: N112 Intersection to Western Study Boundary</b> Upgrade corridor to provide safe access for pedestrians and bicyclists <ul style="list-style-type: none"> <li>Construct Narrow Asphalt Shared Use Path – Eastbound (0.61 mi)</li> <li>Construct Narrow Asphalt Shared Use Path – Westbound (0.61 mi)</li> </ul>	\$219,600
LT-3	<b>N110: N112 Intersection to Western Study Boundary</b> Upgrade corridor to provide safe access for pedestrians and bicyclists and improve roadway conditions <ul style="list-style-type: none"> <li>Pave 0.2 Miles of Unpaved Roadway</li> <li>Construct Concrete Shared Use Path – Westbound (1.17 mi)</li> </ul>	\$468,000
LT-4	<b>N112: N7 Intersection to Northern Study Boundary</b> Upgrade corridor to provide safe access for pedestrians and bicyclists and improve roadway conditions <ul style="list-style-type: none"> <li>Construct Narrow Asphalt Shared Use Path – Eastbound (0.50 mi)</li> <li>Construct Narrow Asphalt Shared Use Path – Westbound (0.50 mi)</li> <li>Pave 0.15 Miles of Unpaved Roadway</li> </ul>	\$300,000
LT-5	<b>Multi-Use Trail</b> Construct a multi-use path to increase pedestrian and bicyclist mobility, encourage recreation activities; and to ultimately connect with neighboring communities <ul style="list-style-type: none"> <li>Develop multi-use trail along remaining portion of Black Creek within the Study Area</li> </ul>	\$250,000

## **Pedestrian, Bicycle, and Trail Facility Recommendations**

The Fort Defiance study area's existing sidewalks, bike lanes, and trails were reviewed in relation to:

- The location of activity centers such as schools, large retail establishments, libraries, hospitals, recreation activity centers,
- Proposed developments; and
- Existing roadway alignments.

Analyzing the study area's existing pedestrian and bicycle facilities helped to identify locations that would benefit from these amenities and that would be closely integrated with the area's roadway system. Figure 5 provides an illustration of recommended pedestrian, bicycle and trail facilities.

## **Transit Recommendations**

The identification of transit projects were based on input from the Navajo Transit System staff, the TAC, stakeholders, public input and a review of the Navajo Transit System Five-Year Plan and previous planning studies.

### **Short-Term (2018) Transit Recommendations**

- Conduct a transit ridership survey to determine the need for local transit service and to identify potential new stop locations.
- If warranted by the transit ridership survey, redesign existing transit routes to add an additional transit stop at the Window Rock High School.
- Install shelters at bus stop locations to provide safety for waiting passengers and to encourage transit ridership.
- Per the *2009 Navajo Transit System Five-Year Implementation Plan*, establish a circulator bus route between St. Michaels, Window Rock, and the Fort Defiance study area.

### **Mid-Term (2023) Transit Recommendations**

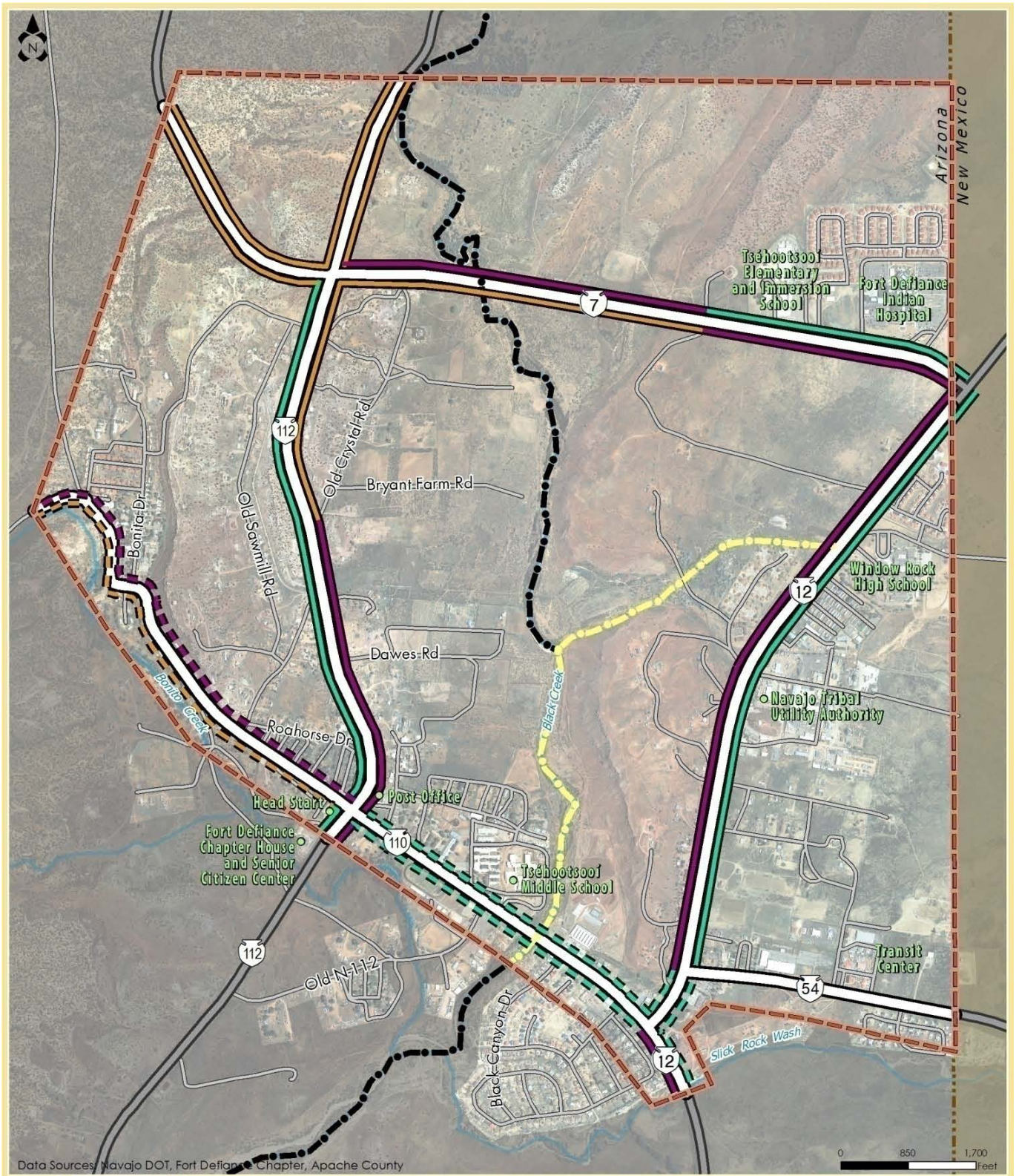
- Establish a Local Circulator that operates daily between 8am – 5pm and connects government and activity centers within Fort Defiance.

### **Long-Term (2033) Transit Recommendations**

- Install bus pullouts and advance signage at the pullouts to reduce delays and to lower the potential for rear-end collisions with motor vehicles. Table 4 provides a summary of existing transit stop locations in which the existing right-of-way and roadway conditions support the installation of bus pullouts.



Figure 5. Recommended Pedestrian and Trail Facilities



Data Sources: Navajo DOT, Fort Defiance Chapter, Apache County

0 850 1,700 Feet

**LEGEND**

- |                                |                                 |                           |                    |
|--------------------------------|---------------------------------|---------------------------|--------------------|
| <b>Asphalt Shared Use Path</b> | <b>Concrete Shared Use Path</b> | <b>Multi-Use Trail</b>    | Study Roadway      |
| Short-Term                     | Short-Term                      | Mid-Term Multi-Use Trail  | Streams and Washes |
| Mid-Term                       | Mid-Term                        | Long-Term Multi-Use Trail | Study Area         |
| Long-Term                      | Long-Term                       |                           |                    |



Table 4. Recommended Transit Stop Locations

Bus Stop	Considerations	Recommended Bus Location*
Conoco Gas Station	<ul style="list-style-type: none"> <li>• 150 FT ROW, four-lane roadway</li> <li>• Intersection operations may be impacted by near-side or far-side bus stops</li> <li>• Existing driveways may cause conflicts for near-side, far-side, and bus pullouts</li> </ul>	Bus pullout can be accommodated west of the Conoco Gas Station on N110.
7-2-11	<ul style="list-style-type: none"> <li>• 150 FT ROW, four-lane roadway</li> <li>• Near-side and far-side bus stops may cause conflicts and visibility issues for motor vehicles</li> </ul>	Bus pullout can be accommodated south of 7-2-11 on N12.
Transit Center	<ul style="list-style-type: none"> <li>• Existing transit center provides ample space for buses to enter the facility and to pick-up passengers</li> </ul>	Not applicable
NTUA	<ul style="list-style-type: none"> <li>• Existing stop is located on small two-lane street</li> </ul>	If warranted, an additional bus pullout can be accommodated on N12, south of the NTUA
Water Development	<ul style="list-style-type: none"> <li>• Existing stop is located on small two-lane street</li> </ul>	If warranted, an additional bus pullout can be accommodated on N12, south of the NTUA
Facilities Maintenance Building	<ul style="list-style-type: none"> <li>• Existing stop is located on small two-lane street</li> </ul>	If warranted, an additional bus pullout can be accommodated on N12, south of the NTUA
Fort Defiance Indian Hospital	<ul style="list-style-type: none"> <li>• Existing stop is located at the entrance of the Fort Defiance Indian Hospital</li> </ul>	A centralized bus pullout can be installed along N7 to service both the hospital and neighboring residential area
Old PHS Building	<ul style="list-style-type: none"> <li>• 150 FT ROW, four-lane roadway</li> <li>• Existing roadway conditions limits bus' available space to turn around</li> </ul>	Bus pullout cannot be accommodated at the stop
Old Firehouse Building	<ul style="list-style-type: none"> <li>• 100 FT ROW, two-lane roadway</li> </ul>	Bus pullout can be accommodated north of the firehouse building on N110
Post Office	<ul style="list-style-type: none"> <li>• 100 FT ROW, two-lane roadway</li> </ul>	Bus pullout can be accommodated north of the Post Office driveway on N112
Window Rock High School	<ul style="list-style-type: none"> <li>• 200 FT ROW, four-lane roadway</li> <li>• Can provide a centralized bus stop for the school and adjacent residential areas</li> </ul>	Bus pullout can be accommodated a north of the High School on N12

\*Recommendations are based on existing ROW and roadway characteristics, a detailed site suitability study will need to be conducted to identify the exact location that can support a bus pullout or transit stop. Factors such as sidewalk and right-of-way space, topography, land use compatibility, safety, and operation should be considered during this analysis.



## Title VI Implications

To ensure that the recommended projects provide a fair distribution of benefits and burdens to all residents, an analysis of potential impacts on protected populations was conducted. Since the study is located within the Navajo Reservation, the entire study area has a high percentage of Title VI populations. It is anticipated, however, that recommended transportation improvement projects will only have negative impacts during construction periods. Ultimately, this plan's recommendations will provide protected populations with enhanced, safer multimodal transportation. Table 5 provides an overview of potential impacts and benefits of recommended improvements on Title VI population.

Throughout the course of the study, efforts were made to including meaningful participation by all residents through stakeholder and public outreach. A two-phase public involvement process including two public meetings in which protected populations were invited to voice their opinion on the needs of the community and comment on recommended improvements. As recommended projects are implemented, it is vital that on-going outreach efforts to protected populations continue. Furthermore, consideration should be given during project development and construction to minimize or mitigate adverse impacts to minority business owners, the mobility needs of the protected populations, and residential parcels of protected populations.

Table 5. Recommended Project Impacts and Advantages on Title VI Populations

Project Type	Project Number	Project Description	Impacted Populations	Disproportionate/ Adverse Impacts	Benefits of Recommended Improvement
Roadway Deficiencies	ST: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 MT: 3, 4, 10 LT: 3, 4	Pavement preservation, pavement rehabilitation, roadway striping, install shoulders, add landscape buffer; widen street, bridge replacement.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints to access businesses, residential areas, and activity centers during construction. Increased noise during construction.	Improved overall safety and efficiency of roadway network. Improved road conditions and emergency response time. Improved pedestrian safety. Reduction in crashes and crash severity.
Roadside Safety Enhancements	ST: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 MT: 3, 10	Install cattle guards, repair fencing, remove vegetation.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints and increased noise during construction.	Improved overall safety and efficiency of roadway network. Reduction in crashes and crash severity.
Intersection Traffic Control	ST: 14, 15, 16, 17, 18, 19	Install traffic signals, enhance existing traffic signal, add turn lanes, reconfigure intersection to roundabout.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints and increased noise during construction.	Improved overall safety and efficiency of roadway network. Improved road conditions and emergency response time. Improved pedestrian safety. Reduction in crashes and crash severity. Relieve traffic congestion.
Pedestrian Mobility	ST: 1, 4, 5, 6, 7, 9, 10, 12, 13, 18, 19 MT: 1, 2, 5, 6, 7, 8, 9 LT: 1, 2, 3, 4, 5	Install shared-use paths, sidewalks, pedestrian crosswalks, bike lanes, and multi-use trails.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints and increased noise during construction.	Improved pedestrian, bicycle, and roadway safety. Promote safe mobility and exercise. Provide alternative means of transportation.
School Zone and Community Gateway Safety Improvements	ST: 20, 21, 22, 23, 24, 25, 26 MT: 11, 12, 13, 14	Install traffic calming devices such as chicane median, HAWK Pedestrian Beacon, and rumble strips.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints and increased noise during construction.	Improved pedestrian, bicycle, and roadway safety. Reduction in crashes and crash severity.
Alternative Routes	ST: 26	Construct alternative route to access Window Rock High School Sports Stadium	Minority, low-income, age 65 and older, and disabled populations	Temporary constraints and increased noise during construction.	Relieve traffic congestion.
Transit		Install bus shelters, establish circulator bus routes, and install bus pullouts.	Minority, low-income, age 65 and older, and disabled populations.	Temporary constraints to access activity centers during construction. Increased traffic noise and traffic volume. Decreased air quality.	Improved local and regional transit connectivity. Provide alternative means of transportation. Improved pedestrian safety. Improved overall efficiency of roadway network. Relieve traffic congestion.



## **Tribal Transportation Program Update Recommendations**

The National Tribal Transportation Facility Inventory (NTTFI) is a comprehensive national inventory of all tribal transportation facilities that are eligible for TTP funding by tribe, reservation, BIA agency and region, Congressional district, State, and county. This inventory is utilized as the basis to identify a tribe's transportation system, determine the transportation needs of a tribe, and serves as a basis for apportioning federal funds. The inventory includes specific facility information, such as classification, route/bridge number, current and projected traffic volumes, pavement conditions etc, and is utilized for the ongoing review of facility conditions.

In order to obtain funding and accurately report the status of the tribe's transportation system, the current NTTFI for the Fort Defiance Chapter was reviewed against field review conditions and GIS analysis to identify necessary corrections and updates.

### **Mileage Corrections**

Utilizing GIS software, existing NTTFI routes and sections were analyzed to determine section mileage. Within the study area, the following two roadway sections need to be updated to reflect accurate conditions:

- Route 07, Section 140: Length decreased by 0.1 mile
- Route 07, Section 150: Length increased by 0.1 mile

### **Existing Traffic Volumes**

Traffic counts were obtained as part of the Fort Defiance Industrial Area Traffic Circulation Study. One of the major criteria in determining the functional classification of a roadway is the number of vehicles that utilize the road every day. In order for appropriate decisions and improvement recommendations to be made, traffic count data was gathered in May 2013 at 12 locations along the study roadways shown in Appendix E. Existing ADT and ADT Year corrections to the NTTFI are made to the following roadways:

- Route 0110: Sections 010, 030, 035, 040, 043, 046, and 050
- Route 0112: Sections 050, 060, 063, 066, and 070
- Route 012: Sections 150, 160, 165, 170, and 180
- Route 07; Sections 115, 120, 140, and 150

### **Recommended New Route to the NTTFI**

Based on analysis of current and future conditions, it is recommended that the following roadways be added to the inventory:

- The Window Rock High School Sports Stadium will generate increased vehicle and pedestrian traffic in the area. As the recommended Window Rock High School Sports Stadium roadways are developed, consideration should be given for the inclusion in the inventory. The Window Rock High School Sport Stadium is a major activity center in the community that will generate substantial vehicle and pedestrian traffic to the area. Inclusion to the NTTFI will ensure appropriate funding and the maintenance of the roadway.

## IMPLEMENTATION AND FUNDING STRATEGIES

### Funding Sources

The successful implementation of the *Fort Defiance Industrial Area Traffic Circulation Study* is contingent upon the availability of funding for design and construction of the improvement projects. Primary funding sources for the area include Federal programs, BIA, ADOT, and other regional government agencies. Passed in July 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) reauthorized surface transportation programs through fiscal year 2014. The program was enacted to create a streamlined, performance-based, and multimodal program to address the many challenges facing the Nation's transportation system. Key tribal related elements under the new MAP-21 Program include:

- The new Tribal Transportation Program (TTP) provides \$450 million annually with the ultimate goal to provide safe and adequate transportation and public road access to and within Indian reservations and Indian lands. While generally following the former Indian Reservation Roads program, the TTP also includes new standards that a certain percentage of funds should be allocated for tribal bridge and tribal safety projects. In accordance with MAP-21, Tribes may utilize up to 25% of their TTP funds or \$500,000, whichever is greater, for eligible and approved maintenance activities.
- Tribal High Priority Projects Program (THPP) is a special funding pool that may be utilized for tribes or governmental subdivisions whose annual allocation is insufficient to complete its highest priority project; or for emergency/disasters on any TTP facilities. MAP-21 authorizes \$30 million per year from the General Fund (subject to appropriation) for this new program.
- MAP-21 provides federal funding for public transit assistance through the Tribal Transit Program (TTP). The TTP is a set-aside from the Formula Grants for Rural Areas program and consists of a \$25 million formula program and a \$5 million discretionary grant program.

Additional funding sources include:

- *Navajo Nation Fuel Excise Tax Revenue* generates, on average, approximately \$13 million each year. Projects completed with this funding are identified and included in the Navajo DOT Transportation Improvement Program (TIP).
- Navajo DOT can also partner with Apache County District II to establish an IGA. If the county elects to enter into IGAs then some funds could be dedicated to specific projects through cooperative partnership.
- Several counties in the state have instituted a ½ cent sales tax dedicated to transportation improvement projects. Counties have the ability to use these funds for planning, design and construction.

In addition to these Federal and local programs, there are a multitude of funding opportunities available through ADOT, regional government agencies, and private entities. A comprehensive matrix of potential funding sources that the Fort Defiance Chapter can apply for and to implement the Plan for Improvements is presented in the *Fort Defiance Industrial Area Traffic Circulation Study Final Report*. In addition, the following resources also provide more information related to funding sources.



## Local Public Agency Projects Manual for Federal-aid Funded Projects

The ADOT Local Public Agency Projects Manual provides information and guidance to assist local public agencies (i.e., counties, cities, towns and tribal governments) with projects funded through the Federal Highway Administration's (FHWA) Federal-Aid Highway Program (FAHP), from planning to final acceptance. The manual outlines the ADOT and FHWA policies and procedures when developing, delivering, and administering transportation projects. The Manual is available at the following website link:

<http://www.azdot.gov/business/programs-and-partnerships/LocalPublicAgency/lpa-projects-manual>

Additionally, another available tool is the Federal-aid Essentials. It is web based and can be accessed at:

<http://www.fhwa.dot.gov/federal-aidessentials/index.cfm>

## Arizona Tribal Transportation Website Funding Resources Links

The Arizona Tribal Transportation website is hosted by ADOT and is designed as a central location for state-tribal transportation related partnerships, projects, activities, groups, links, and other related information. The website contains a listing of transportation related funding resources which can be found at the following link:

<http://www.aztribaltransportation.com/aztt/links.asp>

## Partnerships

With the support of the ADOT Tribal Strategic Partnering Team, the Navajo Nation re-established a partnership between with the Navajo DOT, ADOT, BIA, FHWA, Hopi Tribe, Coconino County, Navajo County, and Apache County. The mission of the partnership is to foster and maintain working relationships in order to construct, operate, improve, and maintain a safe transportation system for the traveling public. The Navajo DOT Partnership Steering Committee identified the main goals of the partnership as focusing on aspects of the approval process, agreements, emergency response, training and education, funding resources, and route standards for the following subgoals:

- Subgoal#1: High Volume Routes/Region
- Subgoal#2: School Bus Routes/Region
- Subgoal#3: Low Volume Routes/Region
- Subgoal#4: Community Routes

As part of this partnership, a steering committee comprised of agency officials host meetings to discuss and plan for roadway improvement projects, emergency response, intergovernmental agreements, and to improve general communication and data sharing among agencies. Information generated on the above topics by this partnership could assist the Fort Defiance Chapter and Apache County District II with plan implementation. Access to the partnership information is available at the following link:

<http://www.aztribaltransportation.com/NNP/index.asp>.

In addition, the Fort Defiance Chapter and Apache County District II should work to build on the stakeholder partnership efforts initiated through this study planning process. It is recommended that project-specific partnerships be continued with the Navajo DOT, BIA Fort Defiance Agency and other agency stakeholders in order to garner support and available joint financial commitment to implement the study project recommendations. A guide on the basics of transportation partnering is available on the ADOT website at the following link: <http://www.azdot.gov/business/programs-and-partnerships/partnering>.

### **Implementation Guidelines**

Implementation of the recommended Improvement Plan to enhance the safety and mobility along roadways within Fort Defiance requires active participation from local citizens, private entities, and local, County, and State government officials. The following actions are recommended to successfully implement the Plan for Improvements developed as part of this study.

- The Fort Defiance Chapter Council needs to formally approve this plan in order to initiate the process of requesting project inclusion in the Navajo Nation TIP and to subsequently receive Federal Lands Highway Program funds or other MAP-21 funds
- Incorporate high priority improvement projects in the State Transportation Improvement Program (STIP). In order to receive any federal funding, transportation improvement projects must be included in the State TIP.
- Work with Apache County, ADOT, and BIA to confirm existing ROW widths and identify areas where additional ROW is required. It is important that as existing roads are reconstructed that right-of-way descriptions are prepared as part of the design surveys. If needed, purchase required ROW from property owners.
- Traffic calming devices should be considered in the design of new roads serving housing, governmental facilities, or commercial developments.
- Solicit grants for bicycle and pedestrian improvements to add bicycle lanes, enhance connections to existing facilities, and to construct new facilities in deficient locations.
- Develop policies and procedures to promote alternative modes of transportation.
- Further research and apply for funding for each project identified in the Plan for Improvements.