



Intermodal Transportation

# NEW APPLICATION



0000152639

## ORIGINAL

RECEIVED

AZ CORP COMMISSION  
DOCKET CONTROL

February 24, 2014

Arizona Corporation Commission  
Office of Railroad Safety  
Attn: Chris Watson  
1200 W Washington Street  
Phoenix, AZ 85007

2014 FEB 27 PM 12:03

Jennifer Toth, State Engineer  
Robert Samour, Senior Deputy State Engineer, Operations  
Dallas Hammit, Senior Deputy State Engineer, Development

Arizona Corporation Commission  
**DOCKETED**

FEB 27 2014

DOCKETED BY	
-------------	--

RE: Application to upgrade existing railroad signals and surface  
Project: Realigned Home Alone Rd. railroad crossing in Bylas, Arizona  
Federal Project #STP-TE-HSIP-070-A(209)A  
ADOT TRACS #070 GH 294 H7637 01D  
Existing Home Alone Crossing AAR/DOT # 742-307K

RR-02634A-14-0065

Mr. Watson,

Please find enclosed the original and 13 copies of the application to allow Arizona Eastern Railroad (AZER) to furnish and install 3 gate and flasher units, a new crossing surface and constant warning circuitry on the realigned Home Alone Rd crossing. Also enclosed is an excerpt from Atwell Project H7637 01C, Stage III plans. I have also included pictures of both road approaches to this crossing for reference.

The existing Home Alone Rd. is an at-grade roadway, used for 2 way traffic, (1 thru westbound, and 1 thru eastbound lane), with passive protective devices (crossbucks). This crossing will be closed as part of this project.

Feel free to contact me if you have any questions.

Sincerely,

Jason Pike  
Railroad and Utility Coordinator  
Arizona Department of Transportation  
205 S. 17th Ave, Room 357 MD 618E  
Phoenix, AZ 85007  
Phone: 602-712-7149 jpike@azdot.gov



February 25, 2014

Arizona Corporation Commission  
Office of Railroad Safety  
Attn: Chris Watson  
1200 W Washington Street  
Phoenix, AZ 85007

RE: Application to upgrade existing railroad signals and surface  
Project: Realigned Home Alone Rd. in Bylas, Arizona  
Federal Project #STP-TE-HSIP-070-A(209)A  
ADOT TRACS #070 GH 294 H7637 01D  
Home Alone Crossing AAR/DOT # 742-307K

Mr. Watson,

This application is being submitted to allow the Arizona Eastern Railroad (AZER) to furnish and install 3 gate and flasher units, a new crossing surface and constant warning circuitry on the realigned Home Alone Rd crossing.

**1. Project Location and Description**

The project is located at the crossing of AZER and the newly realigned Home Alone Rd. south of US70 in Bylas, Arizona. This crossing consists of one mainline with daily usage for AZER.

The project consists of realigning Home Alone Rd. about 1000ft. north to line up (across US70) with the Health Center. This will result in a new railroad crossing at the realigned road and closing the crossing and demolishing the existing Home Alone Rd. AZER will install new gate and flasher units – 2 on the outside edge and 1 in the median and a new concrete crossing surface. ADOT will construct new civil improvements including roadway curb and gutter, medians and sidewalk on the south side from the existing US70 ROW to a 'T' intersection with the community road, striping, warning signs, and improving the road approaches, these civil improvements will help facilitate the necessary railroad safety improvements at the crossing.

The existing Home Alone Rd. is an at-grade roadway, used for 2 way traffic, (1 thru westbound, and 1 thru eastbound lane), with passive protective devices (crossbucks). This crossing will be closed as part of this project.

**2. Why the crossing is needed**

The new Home Alone road was included as part of the existing ADOT Highway project H7637 and the new railroad crossing was necessary at this location. The existing Home Alone Rd. crossing will be closed.

**3. Construction Phasing**

The railroad crossing is scheduled to be done prior to the road work. Once the utility, environmental, and right-of-way clearances are obtained, ADOT can apply for and receive FHWA Construction Authorization and authorize AZER to order their signal materials. Once an Opinion and Order is issued, AZER will do the track work and install signal equipment. The railroad improvements will be installed by AZER within 36 months of the receipt of an Opinion and Order from the ACC.

**4. Maintenance of the crossing**

AZER will be responsible for installing and maintaining the railroad surface and signal equipment. The San Carlos Apache Tribe will be responsible for maintaining the road approaches and sidewalks that are outside of both ADOT and AZER responsibility. ADOT will maintain the highway (US70) within the limits of their ROW.

**Project Funding**

100% of the funding will be provided thru the Federal Highway Administration thru their HSIP program.

Costs are as follows: US70 project budget is \$1,000,000+

Preliminary and Construction Engineering	\$10,000.00
AZER Furnish and Install Flashers and Gates and Constant Warning	\$350,000.00
Total Cost	\$360,000.00

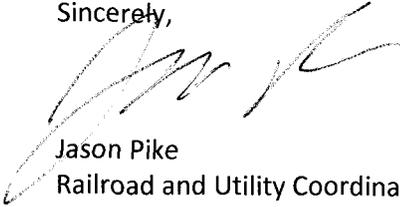
**5. Other information (based on typical Staff Data Requests):**

1. Provide Average Daily Traffic Counts for each of the locations.  
New Home Alone Traffic Counts are unavailable but existing Home Alone ADT provided.  
Existing Home Alone Rd.-2012 Traffic Count = 701 vehicles per day
2. Please describe the current Level of Service (LOS) at each intersection.  
New Home Alone LOS unavailable but existing Home Alone LOS provided.  
  
The SWTE 2010 Traffic Study indicates that the existing Home Alone Rd. has a current Level of Service(LOS) of A.
3. Provide any traffic studies done by the road authorities for each area.  
A Traffic Impact Analysis for a Master Planned Community in 2010 (south of the project-SWTE 2010 Traffic Study)

4. Provide the population of the City the crossing is located in.  
2010 census: 1,962 persons.
5. Provide what warning devices are currently installed at the crossing.  
New crossing
6. Provide distances in miles to the next public crossing on either side of the proposed project location. Are any of these grade separations?  
Centerpoint Rd (742 306D) is an at-grade crossing 0.5 mile to the south. Navajo Rd. (742 309Y) is an at-grade crossing 1.4 miles to the north of the proposed realigned location of Home Alone Rd.
7. How and why was grade separation not decided on at this time? Please provide any studies that were done to support these answers.  
Grade separation was not considered at this time due to the close proximity of US70.
8. If this crossing was grade separated, provide a cost estimate of the project.  
Estimate \$30,000,000++
9. Please describe what the surrounding areas are zoned for near this intersection. i.e. Are there going to be new housing developments, industrial parks etc.  
The areas adjacent to the Home Alone railroad crossing are residential.
10. Please supply the following: number of daily train movements through the crossing, speed of the trains, and the type of movements being made (i.e. thru freight or switching). Is this a passenger train route?  
Per AZER, there are a total of 2 train movements over the crossing per day, 0 switching movements and 0 daytime thru movements (2 trains run at night, one in each direction). The typical speed range over the crossings is 10mph and that is also the maximum Time Table speed.  
  
This is not a passenger train route.
11. Please provide the names and locations of all schools (elementary, junior high and high school) within the area of the crossing.  
Students in Bylas are served by schools in both Bylas and Fort Thomas.
  - Fort Thomas Elementary School (Grades KG-6)  
15560 W. Elementary School Rd., Fort Thomas, AZ
  - Fort Thomas High School (Grades 7-12)  
Highway 70, Fort Thomas, AZ 85536
  - Mount Turnbull Academy (Grades 9-12)  
Hwy. 70, Bylas, AZ 85530

12. Please provide school bus route information concerning the crossing, including the number of times a day a school bus crosses this crossing.  
No data is available for new crossing, but the intent of the ADOT project is to provide safer accessibility to both vehicles and pedestrians.
13. Please provide information about any hospitals in the area and whether the crossing is used extensively by emergency service vehicles.  
Bylas Health Center – 101 Medical Drive (east of US70, Approximate MP= 295).  
This crossing is on a major emergency service route for the health center.
14. Please provide total cost of the railroad improvements to each crossing.  
Cost described above.
15. Provide any information as to whether vehicles carrying hazardous materials utilize this crossing and the number of times a day they might cross it.  
No data - new crossing
16. Please provide the posted vehicular speed limit for the roadway.  
Expected to be – 25MPH (Residential area)
17. Do any buses (other than school buses) utilize the crossing, and how many times a day do they cross the crossing. Bus traffic varies depending on sporting events.  
No data - new crossing
18. Please indicate whether any spur lines have been removed within the last three years inside a 10 mile radius of any crossings covered in this application. Please include the reason for the removal, date of the removal and whether an at-grade crossing or crossings were removed in order to remove the spur line.  
None
19. Please fill in the attached FHWA Grade Separation Guidelines Table, (from FHWA's 2007 revised second edition Railroad Highway Grade-Crossing Handbook, page 151) with a yes or no answer as to whether each item applies. Also, please provide all information to support your answers of yes or no (i.e. vehicle delay numbers, any calculations that were performed to get the answers).
20. Based on the current single track configuration at the crossings specified by this application, please provide the current traffic blocking delay per train. Please indicate the time in which vehicular traffic is delayed (1) to allow the train to pass at a crossing and (2) due to trains stopped on the track for any purpose. The delay is measured from the point that the warning devices are activated at the crossing to the time after the train has cleared the crossing and the warning devices are reset.  
The delay at the crossing is really a function of the average length of the train and the average speed that is traveling. An example that a 7,000 foot train traveling 30 miles per hour would cause a traffic delay of approximately 3.5 minutes.

Sincerely,

A handwritten signature in black ink, appearing to read 'JP', is written over the word 'Sincerely,'.

Jason Pike  
Railroad and Utility Coordinator  
Arizona Department of Transportation  
205 S. 17th Ave, Room 357 MD 618E  
Phoenix, AZ 85007  
Phone: 602-712-7149 [jpik@azdot.gov](mailto:jpik@azdot.gov)

### FHWA - GRADE SEPARATION GUIDELINES

Highway-rail grade crossings should be considered for grade separation or otherwise eliminated across the railroad right of way whenever one or more of the following conditions exist:		Home Alone Rd
The highway is a part of the designated Interstate Highway System	Crossing Currently meets the criteria	N
The highway is otherwise designed to have full controlled access	Crossing meets the criteria by 2030	N
The posted highway speed equals or exceeds 70 mph	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
AADT exceeds 100,000 in urban areas or 50,000 in rural areas	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
Maximum authorized train speed exceeds 110 mph	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
An average of 150 or more trains per day or 300 million gross tons/year	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
Crossing exposure (trains/day x AADT) exceeds 1M in urban or 250k in rural; or passenger train crossing exposure exceeds 800k in urban or 200k in rural	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
Expected accident frequency for active devices with gates, as calculated by the US DOT Accident Prediction Formula including five-year accident history, exceeds 0.5	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N
Vehicle delay exceeds 40 vehicle hours per day	Crossing Currently meets the criteria	N
	Crossing meets the criteria by 2030	N



To US70 MP295



Bylas, AZ

US70 MP296

GRAMM

Sage-Gallup Indian Reservation

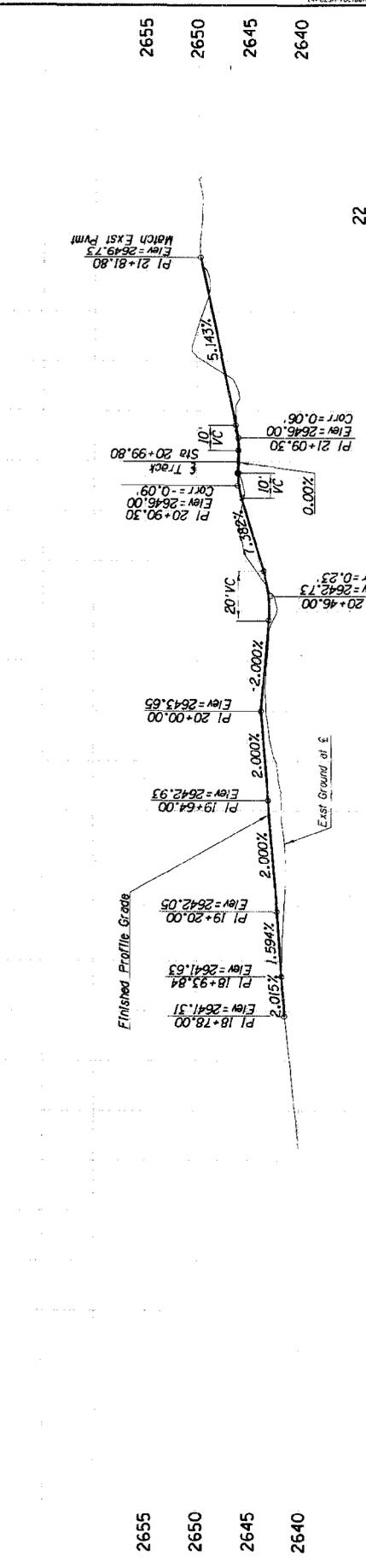
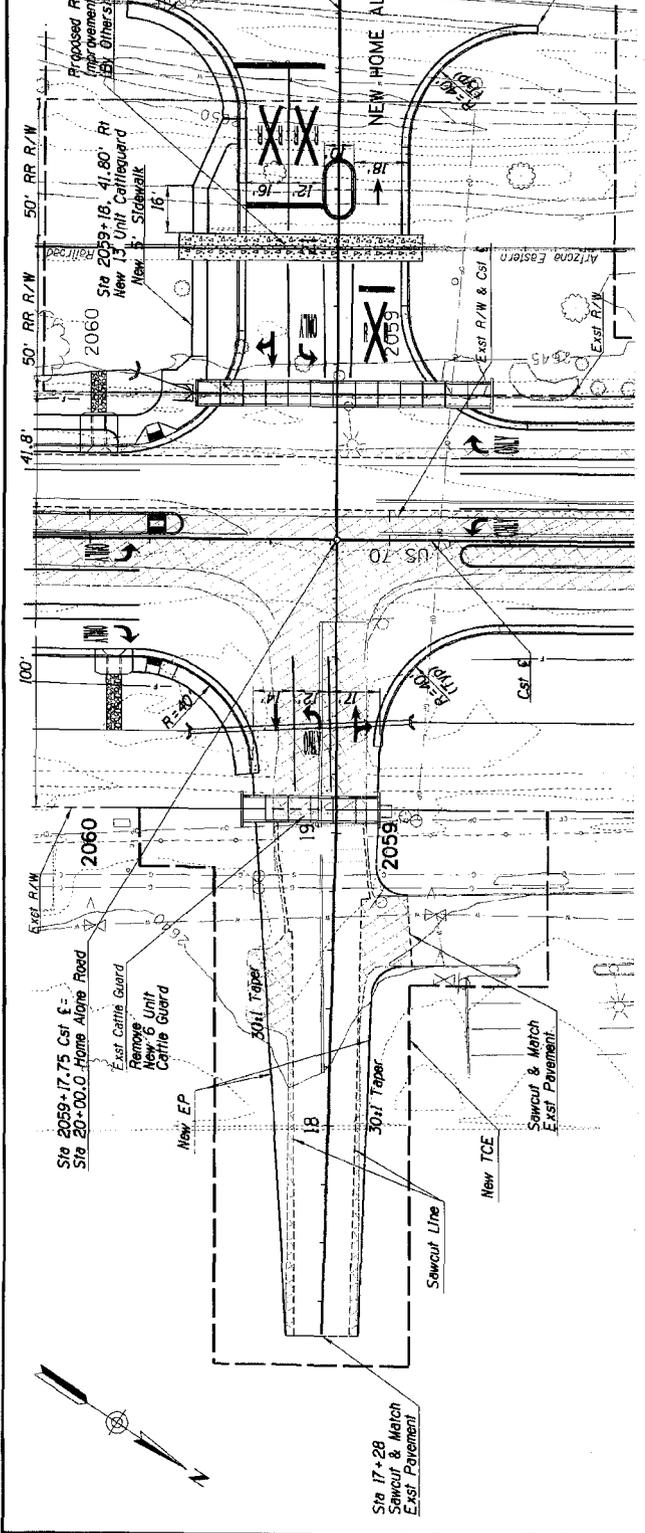
Switch Basemap

State of Arizona © 2013 Nokia

New re-aligned  
Home Alone Rd.  
New AZER  
crossing  
DOT#742-307K

Existing Home  
Alone Rd.  
AZER crossing  
DOT#742-307K  
Road and crossing  
to be closed

STATE	9	PROJECT NO.	010-A12091A	SHEET NO.	91	OF SHEETS	95
FED. ROAD DIST.		CONTRACT NO.	010 OH 294				



DATE	12/13	PREPARED BY	ATWELL
DATE	12/13	CHECKED BY	ATWELL
DATE	12/13	DESIGNED BY	ATWELL
DATE	12/13	IN CHARGE	ATWELL

ARIZONA DEPARTMENT OF TRANSPORTATION  
 INTRAMODAL TRANSPORTATION DIVISION  
 ROADWAY DESIGN SERVICES  
 NEW HOME ALONE ROAD  
 PLAN AND PROFILE SHEET  
 STA. 2059+17.75  
 GLOBE-LORDSBURG HIGHWAY (BYLAS, AZ)  
 TRACS NO. H7637 DIC  
 DTD-A12091A

DATE	12/13	PREPARED BY	ATWELL
DATE	12/13	CHECKED BY	ATWELL
DATE	12/13	DESIGNED BY	ATWELL
DATE	12/13	IN CHARGE	ATWELL

ARIZONA DEPARTMENT OF TRANSPORTATION  
 INTRAMODAL TRANSPORTATION DIVISION  
 ROADWAY DESIGN SERVICES  
 NEW HOME ALONE ROAD  
 PLAN AND PROFILE SHEET  
 STA. 2059+17.75  
 GLOBE-LORDSBURG HIGHWAY (BYLAS, AZ)  
 TRACS NO. H7637 DIC  
 DTD-A12091A

EXISTING HOME ALONE RD., SOUTH OF US70 IN BYLAS, AZ  
DOT# 742-307K, LOOKING EAST

RAILROAD  
CROSSING



W - 110-113015, N 33-122477, 780900m, 0.611KM, M244-400

EXISTING HOME ALONE RD., SOUTH OF US70 IN BYLAS, AZ  
DOT# 742-307K, LOOKING SOUTHEAST





## Table of Contents

<b>Executive Summary</b>	<b>3</b>
<b>Project Description</b>	<b>9</b>
<b>Study Methodology</b>	<b>9</b>
<b>Existing Conditions</b>	<b>10</b>
<b>Existing Traffic Data</b>	<b>16</b>
<b>Trip Generation</b>	<b>16</b>
<b>Trip Distribution &amp; Assignment</b>	<b>19</b>
<b>Access</b>	<b>24</b>
<b>Existing Traffic Operations</b>	<b>24</b>
<b>Future Traffic Operations Without Project</b>	<b>26</b>
<b>Future Traffic Operations With Project</b>	<b>32</b>
<b>Traffic Signal Warrant Analysis</b>	<b>39</b>
<b>Turn Lane Analysis</b>	<b>41</b>
<b>Mitigation</b>	<b>42</b>
<b>Crash Analysis</b>	<b>44</b>
<b>Vehicle Speed Review</b>	<b>46</b>
<b>Conclusion</b>	<b>47</b>



## Table of Figures

Figure EX 1 – Proposed Lane Configurations and Traffic Control – 2012	6
Figure EX 2 – Proposed Lane Configurations and Traffic Control – Fifth Year Projection	7
Figure EX 3 – Proposed Lane Configurations and Traffic Control – 15 <sup>th</sup> Year Projection	8
Figure 1 – Vicinity Map	11
Figure 2 – Conceptual Site Plan	12
Figure 3 – Existing Lane Configurations and Traffic Control	15
Figure 4 – Existing Weekday Peak Hour Traffic Volumes	18
Figure 5 – Weekday Peak Hour Trip Distribution	20
Figure 6 – Weekday Peak Hour Trip Assignment (2012)	21
Figure 7 – Weekday Peak Hour Trip Assignment (Fifth Year Projection)	22
Figure 8 – Weekday Peak Hour Trip Assignment (15 <sup>th</sup> Year Projection)	23
Figure 9 – 2012 Weekday Peak Hour Traffic Volumes Without Project	27
Figure 10 – Fifth Year Projection Weekday Peak Hour Traffic Volumes Without Project	28
Figure 11 – 15 <sup>th</sup> Year Projection Weekday Peak Hour Traffic Volumes Without Project	29
Figure 12 – 2012 Weekday Peak Hour Traffic Volumes With Project	33
Figure 13 – Fifth Year Projection Weekday Peak Hour Traffic Volumes With Project	34
Figure 14 – 15 <sup>th</sup> Year Projection Weekday Peak Hour Traffic Volumes With Project	35
Figure 15 – Crash Diagram	45
Figure 15b – Crash Diagram	46



## List of Tables

<b>Table 1 – Opening Year (2012) Weekday Project Site Generated Trips</b>	<b>17</b>
<b>Table 2 – Interim Year (Fifth Year Projection) Weekday Project Site Trips</b>	<b>19</b>
<b>Table 3 – Full Buildout (15<sup>th</sup> Year Projection) Weekday Project Site Trips</b>	<b>19</b>
<b>Table 4 – Level of Service Criteria – Signalized Intersections</b>	<b>24</b>
<b>Table 5 – Level of Service Criteria – Un-signalized Intersections</b>	<b>25</b>
<b>Table 6 – Existing Peak Hour Levels of Service</b>	<b>26</b>
<b>Table 7 – Opening Year (2012) Peak Hour Levels of Service Without Project</b>	<b>30</b>
<b>Table 8 – Interim Year (Fifth Year Projection) Peak Hour LOS Without Project</b>	<b>31</b>
<b>Table 9 – Full Buildout (15<sup>th</sup> Year Projection) Peak Hour LOS Without Project</b>	<b>32</b>
<b>Table 10 – Opening Year (2012) Peak Hour Levels of Service With Project</b>	<b>36</b>
<b>Table 11 – Interim Year (Fifth Year Projection) Peak Hour LOS With Project</b>	<b>37</b>
<b>Table 12 – Full Buildout (15<sup>th</sup> Year Projection) Peak Hour LOS With Project</b>	<b>38</b>
<b>Table 13 – Traffic Signal Warrant Analyses (US 70/Route 193)</b>	<b>40</b>
<b>Table 14 – Traffic Signal Warrant Analyses (US 70/Route 194)</b>	<b>40</b>
<b>Table 15 – Recommended Turn Lane Treatments With Project</b>	<b>41</b>
<b>Table 16 – Recommended Turn Lane Lengths – ADOT Roadways</b>	<b>42</b>
<b>Table 17 – 15<sup>th</sup> Year Projection Peak Hour LOS With Mitigations With Project</b>	<b>43</b>
<b>Table 18 – Reported Crashes 2005-2010</b>	<b>44</b>
<b>Table 19 – Existing Speed Data, US 70</b>	<b>47</b>

### **Appendix (Provided on CD)**

Traffic Counts  
Trip Generation Calculations  
Trip Distribution  
Traffic Growth Calculations  
Capacity Calculations  
Traffic Signal Warrant Analysis  
Turn Lane Analysis  
Crash Data  
Preliminary Roadway Cross Section



**TRAFFIC IMPACT ANALYSIS  
NEW BYLAS MASTER PLANNED COMMUNITY  
US 70/ROUTE 193 – BYLAS, ARIZONA**

**Executive Summary**

The San Carlos Apache Tribe is planning a new master planned mixed-use development on undeveloped property south of US 70 in Bylas, Arizona. The New Bylas Master Planned Community will include residential, educational, local commercial, service facilities, and faith-based land uses at full buildout. The conceptual land use plan also shows parks, cemetery, and orchard area that will accompany the development.

The project is expected to consist of three phases and corresponding level of development for each phase is listed below:

**Opening Year (2012)**

- 80 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing. The 80 units consist of 30 teacher housing units and 50 single-family homes.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.

**Interim Year (Fifth Year Projection)**

- 330 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.

**Full Buildout (15<sup>th</sup> Year Projection)**

- 1,715 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.

The purpose of this traffic study is to evaluate the current and future transportation system within the project study area surrounding the site without and with the project and analyze traffic operations at the existing intersections of US 70/Clinic West Driveway, US 70/Clinic East Driveway, US 70/Ocotillo Circle, US 70/Market West Driveway, US 70/Rainbow City Circle, US 70/Market East Driveway, and US 70/Route 194 along with the proposed access point located at US 70/Route 193.



**Existing and Future Traffic Data Without Project** - AM and PM weekday peak hour turning movement counts including pedestrian volumes were taken at several existing intersections within the study area of US 70 between Market West Driveway (Milepost 295) and Route 194 (Milepost 297). In addition, Weekday Twenty-four hour traffic and speed counts were taken at three locations along US 70 in the same area.

The existing study intersections currently operate at an adequate LOS B or better in the AM and PM weekday peak hours. All of the project intersections are expected to operate at an adequate LOS B or better for all movements during the AM and PM peak hours of the opening year (2012), interim year (Fifth Year Projection), and full build-out (15<sup>th</sup> Year Projection) without traffic from the project.

**Future Traffic Data With Project** - All of the study area intersections are anticipated to operate at acceptable LOS C or better for all movements during the AM and PM peak hours of the opening year (2012) and interim year (Fifth Year Projection) with traffic from the project.

At full build-out (15<sup>th</sup> Year Projections), several intersections are expected to operate at inadequate rural levels of service. These intersections include; US 70/ Rainbow City Circle, US 70/Clinic East Driveway, US 70/Ocotillo Circle, US 70/Route 193 and US 70/Route 194.

**Traffic Signal Warrant Analysis** - In order to determine if a traffic signal is warranted at the intersections of US 70/Route 193 and US 70/Route 194, a Traffic Signal Warrant study was completed. The intersections of US 70/Route 193 and US 70/Route 194 are predicted to meet traffic signal warrants 1 and 2 at full build-out, with the project.

**Crash Analysis** - Crash history data was obtained from ADOT along US 70 from milepost 294 to 297 between the months of January 2005 to January 2010. A total of three crashes were reported within the study area during this time period. Two vehicle crashes occurred in 2005 and 2008 that resulted in pedestrian fatalities. A rear end collision occurred in 2007 that resulted in an injury. The crashes in 2007 and 2008 were alcohol related.

**Mitigation** - Various mitigation measures at the non-performing intersections were analyzed to determine their effectiveness in improving intersection levels of service. Several intersection improvements are recommended in order to provide acceptable levels of service at full build-out.

**Recommendations** - Recommended improvements, by project phase and year are shown below:



### **Opening Year – 2012**

- Recommended improvements at US 70/Route 193:
  - The northbound approach should be stop controlled and provide a right-turn deceleration lane and an exclusive left-turn lane.
  - Provide eastbound right-turn deceleration lane.
  - Provide westbound left-turn lane.
- Recommended improvements at US 70/Route 194:
  - The un-named Access Road and Route 194 should align.
  - The northbound approach should be stop controlled and provide a right-turn deceleration lane and an exclusive left-turn lane
  - Provide right-turn deceleration lane on the eastbound approach.
  - Provide left-turn lane on the westbound approach.
- Proposed lane configurations and traffic control for the study area intersections in 2012 are shown in **EX 1**.

### **Interim Year – Fifth Year Projection**

- No additional roadway improvements are necessary in the interim year (Fifth Year Projection).
- The study area intersections should provide the lane configurations and traffic control as shown in **EX 2** for the interim year (Fifth Year Projection).

### **Full Buildout – 15<sup>th</sup> Year Projection**

At time of full build-out the following improvements should be in place:

- Recommended improvements at US 70/Route 193:
  - Install a traffic signal.
- Recommended improvements at US 70/Route 194:
  - Install a traffic signal.
  - Provide left-turn lane on the eastbound approach.
- Recommended improvements at US 70/Clinic East Driveway:
  - Provide exclusive left-turn lane on the southbound approach.
- Recommended improvements at US 70/Ocotillo Circle:
  - Provide exclusive northbound left-turn lane.
- Recommended improvements at US 70/Rainbow City Circle:
  - Provide exclusive left-turn lane on the northbound approach.
  - Provide exclusive left-turn lane on the southbound approach.
- Proposed lane configurations and traffic control for the study area intersections at full build-out (15<sup>th</sup> Year Projection) are shown in **EX 3**.



Figure EX 1 – Proposed Lane Configurations and Traffic Control –  
Opening Year (2012)

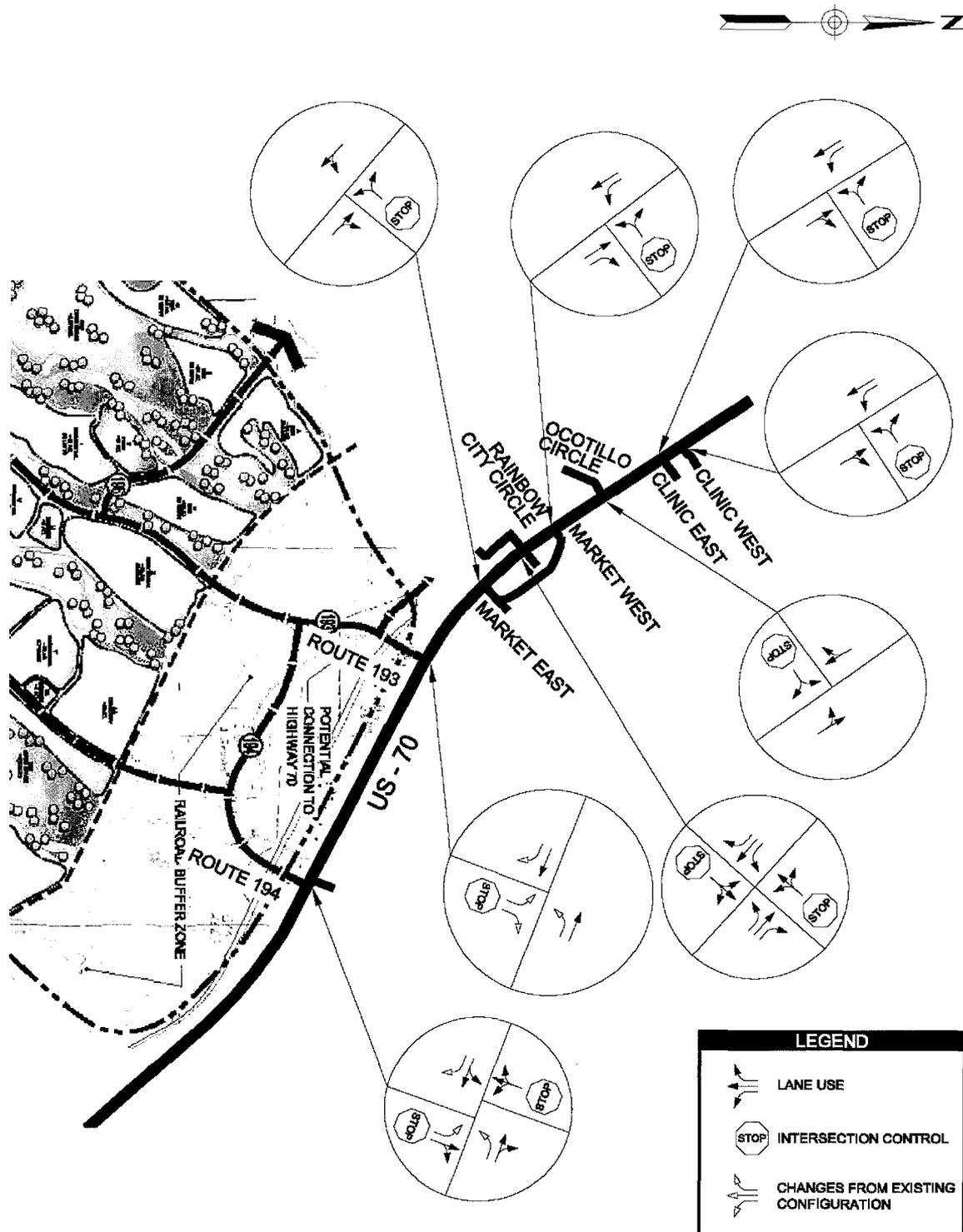




Figure EX 2 – Proposed Lane Configurations and Traffic Control –  
Fifth Year Projection

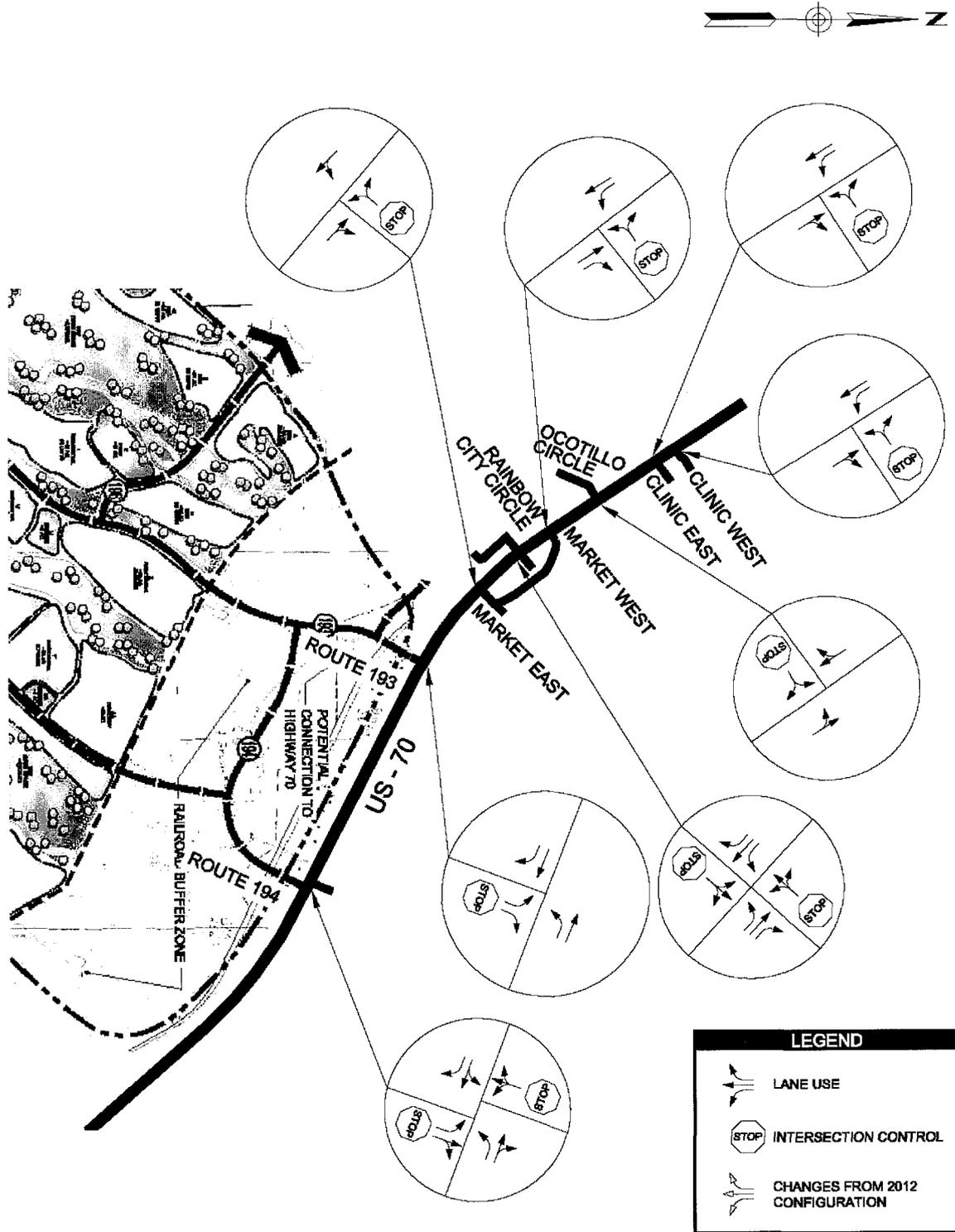
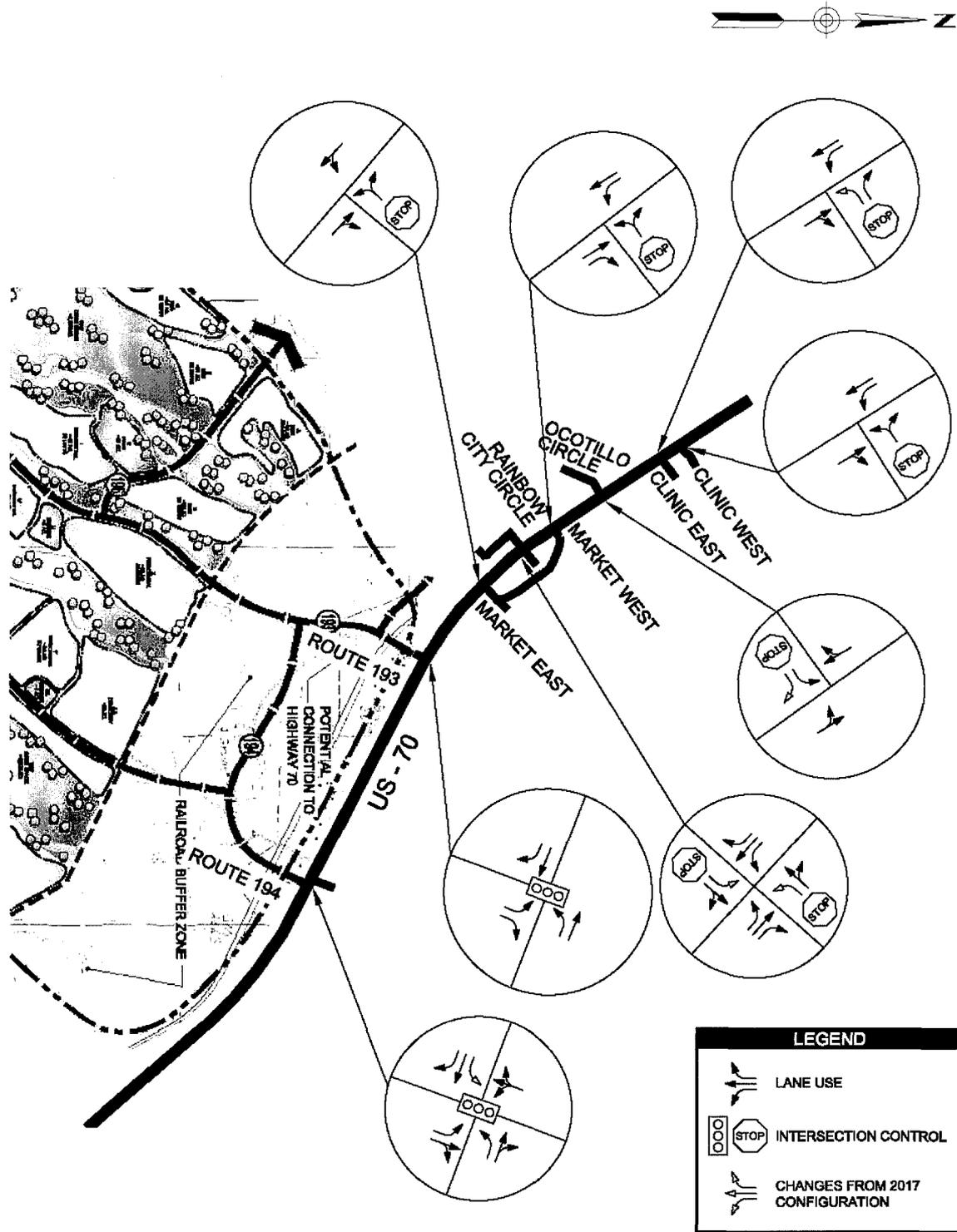




Figure EX 3 – Proposed Lane Configurations and Traffic Control –  
15<sup>th</sup> Year Projection





## TRAFFIC IMPACT ANALYSIS NEW BYLAS MASTER PLANNED COMMUNITY US 70/ROUTE 193 – BYLAS, ARIZONA

### **Project Description**

The San Carlos Apache Tribe is planning a new master planned mixed-use development on undeveloped property south of US 70 in Bylas, Arizona. The vicinity of the project is shown in **Figure 1**. The proposed project site plan is located as shown in **Figure 2**. The New Bylas Master Planned Community will include residential, educational, local commercial, service facilities, and faith-based land uses at full buildout. The conceptual land use plan also shows parks, cemetery, and orchard area that will accompany the development. Key access points to the area will be from the existing intersection of US 70/Route 194 as well as the proposed intersection of US 70/Route 193.

The purpose of this traffic impact analysis is to:

- Evaluate the current and future transportation system within the area surrounding the proposed project site and along US 70 between Market West Driveway (Milepost 295) and Route 194 (Milepost 297)
- Estimate the traffic generation associated with the project and assign that traffic to the roadway system for the opening year (2012), interim year (Fifth Year Projection), and full build-out (15<sup>th</sup> Year Projection).
- Analyze traffic operations at the existing intersections of:
  - US 70/Clinic West Driveway
  - US 70/Clinic East Driveway
  - US 70/Ocotillo Circle
  - US 70/Market West Driveway
  - US 70/Rainbow City Circle
  - US 70/Market East Driveway
  - US 70/Route 194
- Analyze traffic operations at the new intersection of US and Route 193.

The author of this report is a registered professional engineer (civil) in the State of Arizona having specific expertise and experience in the preparation of traffic impact analyses.

### **Study Methodology**

In order to analyze and evaluate the potential traffic impacts of the proposed development, the following tasks were undertaken:

- Field observation of the proposed site and surrounding area was conducted to evaluate the existing physical and operational characteristics of the adjacent roadway network.



- Site traffic volumes generated by the proposed site were calculated using the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 8<sup>th</sup> Edition, 2003*.
- Trip distribution assignments were made and used to assign the site traffic to the site access point and the primary roadways within the project study limits.
- Capacity analyses were performed for the existing conditions and future conditions without and with the project based on an opening year of 2012, interim year (Fifth Year Projection), and full build-out (15<sup>th</sup> Year Projection).
- The intersections were analyzed using the methodology presented in the *2000 Highway Capacity Manual (HCM)*.
- Traffic Signal Warrant analysis at the proposed two access points to the project site.
- Crash analysis along US 70 between mileposts 294 to 297.

### **Existing Conditions**

The project site is located on undeveloped property south of US 70 in Bylas, Arizona. The study location includes the existing un-signalized intersections of US 70/Clinic West Driveway, US 70/Clinic East Driveway, US 70/Ocotillo Circle, US 70/Market West Driveway, US 70/Rainbow City Circle, US 70/Market East Driveway, and US 70/Route 194.

### **Roadways**

US 70, an Arizona Department of Transportation (ADOT) facility, is a two-lane undivided rural highway between Market West Driveway (MP 295) and Route 194 (MP 297) with a posted speed limit of 50 miles per hour (mph) within the Bylas Town Limits. US 70 is the primary route connecting the Globe, Bylas, and Safford areas with a posted speed limit of 65 mph west and east of Bylas. The roadway has pedestrian crossing warning signs (sign code# - W11A-2) within the project vicinity, and provides no curb or gutter facilities in the area. US 70 widens at major intersection approaches to provide right-turn and left-turn lanes, and has 6 foot paved shoulders on both sides of the road. Approximately 60 feet north of US 70 there is a paved pedestrian pathway that runs parallel to the highway within the project area.

The Bylas Health Clinic, located on the north side of US 70, provides two access driveways onto US 70, located on the west and east sides of the health center. The west access point, Health Clinic West Driveway, is a two-lane road that runs north from US 70 and loops around the Bylas Health Clinic to its parking lot. Health Clinic West Driveway is paved until it becomes a dirt road approximately 60 feet north of its intersection with US 70. The east access point, Health Clinic East, is a paved two-lane road that extends from US 70 into the Bylas Health Clinic. Both the East and West Health Clinic Driveways have a cattle guard approximately 60 feet north of their intersections with US70. Neither driveway provides curb, gutter, or sidewalk facilities.



Figure 1 – Vicinity Map

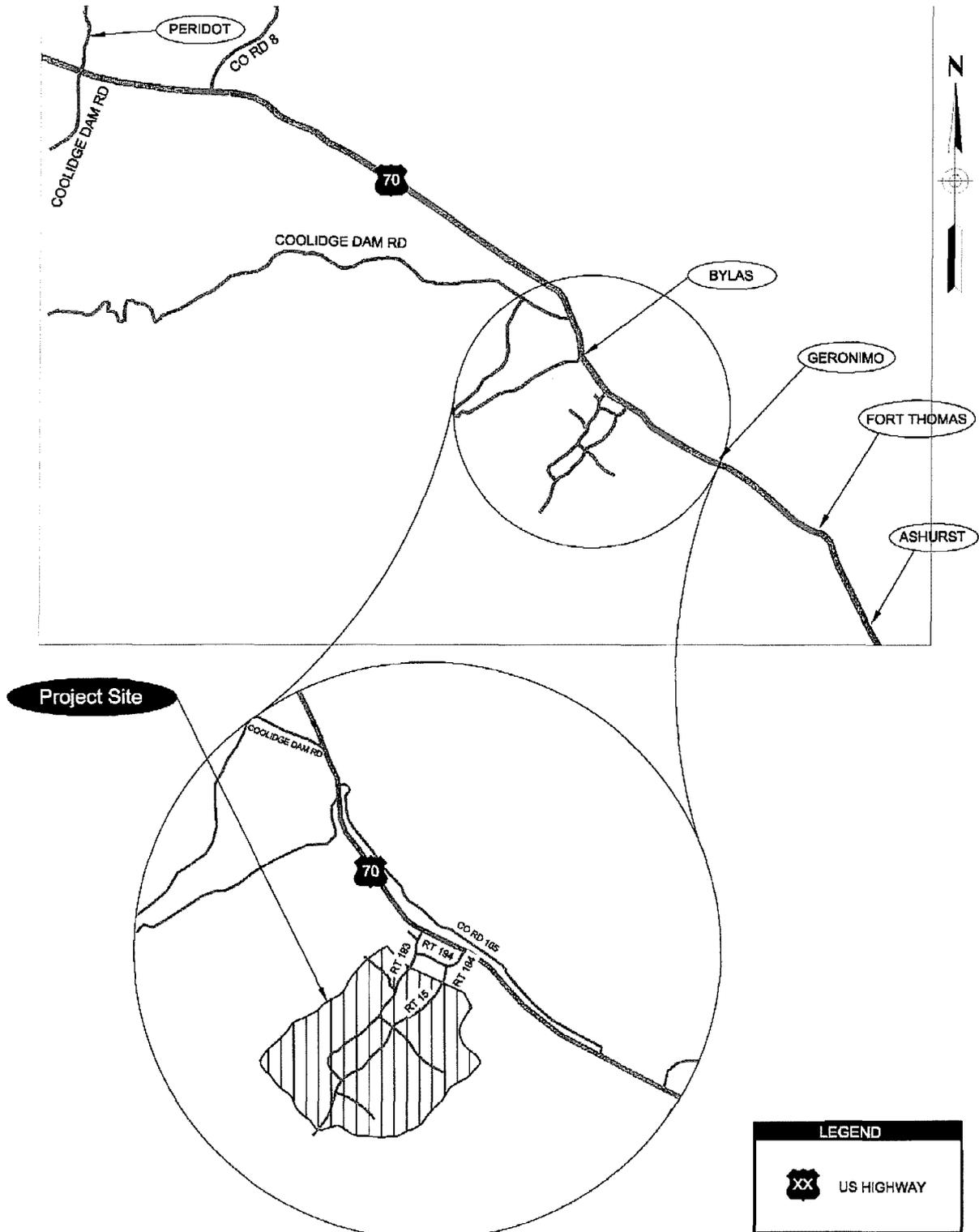




Figure 2 – Conceptual Site Plan





Ocotillo Circle Road is a paved, two lane road, with no posted speed limit. It has dirt shoulders with no curb, gutter, or sidewalk facilities on either side of it. Approximately 66 feet south of its intersection with US 70 is an un-gated railroad crossing. There is a cattle guard on Ocotillo Circle Road between the railroad crossing and US 70. Ocotillo Circle Road provides access to the residential area immediately south of US 70.

Mt. Turnbull Apache Market Center is located on the north side of US 70 and has two access driveways onto US 70, to the west and east side of it, Market Driveway West and East. Market Driveway West is a two-lane, paved, roadway that provides access into the Market Center from the west and to the residential area located northwest of the Market Center. Market Driveway East is a two-lane, paved road that provides access to the Market Center from the east, and to the residential homes east of the Market Center. Neither Access Driveways provide curb, gutter, or sidewalk facilities along their entire span.

Located in between Apache Market West Driveway and Apache Market East Driveway, Rainbow City Circle Road is a two lane paved road that provides access from US 70 south to the Rainbow City residential neighborhood. North of US 70, Rainbow City Circle becomes the third driveway into the Apache Market. There is a cattle guard on Rainbow City Circle Road approximately 10 feet south of US 70, and a gated railroad crossing approximately 66 feet south of US 70. There are no curb, gutter, or sidewalk facilities along Rainbow City Circle Road.

Route 194 is a narrow unmarked dirt road with no posted speed limit. It has no curb, gutter, or sidewalk facilities on either side of the road. Route 194 crosses under the railroad approximately 500 feet south of its intersection with US 70.

### **Intersections**

The intersection of US 70/Clinic West Driveway is an un-signalized “T” intersection with STOP control for the southbound approach, while the eastbound and westbound approaches are free flow. The eastbound approach offers a through lane and a left turn lane. The westbound approach has a single shared through/right turn lane, while the southbound approach offers a single shared left turn/right turn lane. There is overhead lighting on the south side of US 70 at this intersection.

The un-signalized “T” intersection of US 70/Clinic East Driveway is STOP sign controlled on the southbound approach while the east and west legs of the intersection remain free flow. The southbound approach offers a single left turn/right turn lane while the eastbound approach offers a single left turn lane and a through lane. The westbound approach offers a single shared through/right turn lane. Along the south side of US 70 is over head lighting, but no curb, gutter or sidewalk facilities at this intersection.

The existing intersection of US 70/Ocotillo Circle Road is a “T” intersection that is stop controlled on the northbound approach while eastbound and westbound traffic is free flow. The northbound approach has a single shared left turn/right turn lane while the eastbound and westbound approaches offer a single shared through/turn lane.



US 70/Market West Driveway is an un-signalized “T” intersection that is STOP sign controlled on the southbound approach while traffic on the east and west legs of the intersection are free flow. The southbound approach has a shared left turn/right turn lane. The east leg of the intersection has a single through lane and a right turn lane approximately 100 feet long. The west leg of the intersection offers a single through lane and a single left turn lane approximately 200 feet long.

The intersection of US 70/Rainbow City Circle Road is a four-leg intersection that is STOP sign controlled on the northbound and southbound approaches while eastbound and westbound traffic remains free flow. The northbound and southbound approaches both offer a single shared left turn/right turn lane. The eastbound approach offers a left turn lane, a through lane, and a right turn lane. The left turn lane provides approximately 225 feet of storage while the right turn lane offers approximately 110 feet of storage. The westbound approach has a single left turn lane, a through lane, and a right turn lane. The left turn has approximately 225 feet of storage while the right turn lane offers approximately 100 feet of storage.

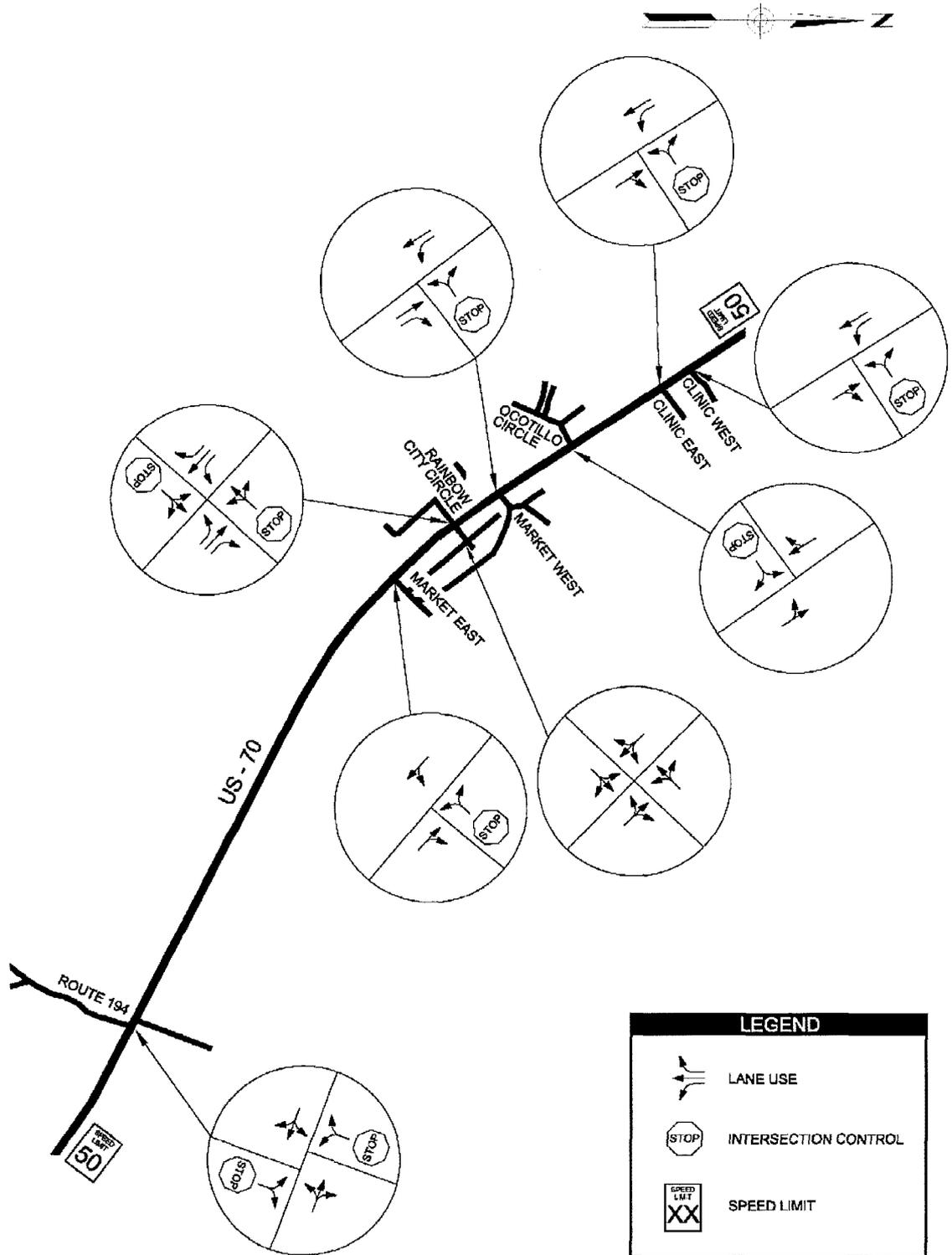
The un-signalized “T” intersection of US 70/Market East is an un-controlled intersection with no posted sign for the southbound approach which must yield to the busier US 70. There is existing guardrail on the north and south sides of the road on the east leg of the intersection along US 70 which may limit visibility for drivers turning south from Market East. The eastbound and westbound approaches both offer a single shared through/turn lane while the southbound approach offers a single shared left turn/right turn lane.

The existing intersection of US 70/Route 194 Road is an uncontrolled “T” intersection in which the northbound approach must yield while eastbound and westbound traffic is free flow. The northbound approach has a single shared left turn/right turn lane while the eastbound and westbound approaches offer a single shared through/turn lane. An unnamed access road is offset approximately 60 feet to the west of Route 194 on the north side of US 70. This road provides access to Route 105 which parallels on the north side of US 70 throughout all of Bylas. There is existing guardrail on both the north and south sides of US 70, west of Route 194 which may interfere with sight distance from Route 194.

Existing lane configurations and traffic control are shown in **Figure 3**.



Figure 3 – Existing Lane Configurations and Traffic Control





### **Existing Traffic Data**

In order to form a basis for analysis of the project impacts, weekday twenty-four (24) hour, weekday bi-directional traffic volume counts were taken in the area at the following locations in late January 2010:

- US 70, West of Clinic West Driveway
- US 70, East of Market East Driveway
- US 70, East of Route 194

Weekday AM and PM peak hour turning movement counts were also conducted at the following intersections:

- US 70/Clinic West Driveway
- US 70/Clinic East Driveway
- US 70/Ocotillo Circle
- US 70/Market West Drive
- US 70/Rainbow City Circle
- US 70/Market East Driveway
- US 70/Route 194

The weekday turning movement counts were conducted from 8:00 AM to 11:00 AM and 2:00 PM to 5:00 PM to coincide with the peak hours identified by the twenty-four counts and included pedestrian counts. The turning movement counts were conducted in February of 2010.

The existing weekday AM and PM peak hour traffic volumes, 24 hour traffic volumes and pedestrian crossing volumes are shown in **Figure 4**. The complete traffic volume and pedestrian count summaries can be found in the Appendix.

### **Trip Generation**

The New Bylas Master Planned Community will include local commercial, service facilities, park, cemetery, and faith-based land uses at full buildout. The trips by these uses are expected to be primarily contained within the proposed development and not onto the external roadway system. Only the 1,715 single family dwelling units and educational land uses were analyzed at full buildout due to the uncertainty of support land uses that the site will include at full buildout. A portion of the single-family dwelling unit trips will be captured internal to the site; however, all of the trips characterized by the single family homes were distributed to the external roadway network to provide for a conservative analysis. The Small Business Incubator Facility will offer new business opportunities for tribal members with coaching and motivation from teachers and professionals.

Trip generation for the project was developed utilizing nationally agreed upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 8<sup>th</sup> Edition*, 2008. So as to provide accurate analysis for the project, an opening phase, interim condition and ultimate condition of trip generation was estimated. The following land uses are projected for the site:



**Opening Year (2012)**

- 80 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing. The 80 units consist of 30 teacher housing units and 50 single-family homes.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.
- 

**Interim Year (Fifth Year Projection)**

- 330 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.

**Full Build-out (15<sup>th</sup> Year Projection)**

- 1,715 dwelling units based on ITE Land Use Code 210, Single-Family Detached Housing.
- 200 student elementary school based on ITE Land Use Code 520, Elementary School.
- Small Business Incubator Facility: 9,300 square feet of retail space based on ITE Land Use Code 814, Specialty Retail.

The result is the expected weekday trip generation for the New Bylas Master Planned Community Development as shown in **Tables 1, 2 and 3**. **Table 1** details the Opening Phase, **Table 2** estimates an Interim Phase and **Table 3** documents full project buildout. The complete trip generation calculations can be found in the Appendix.

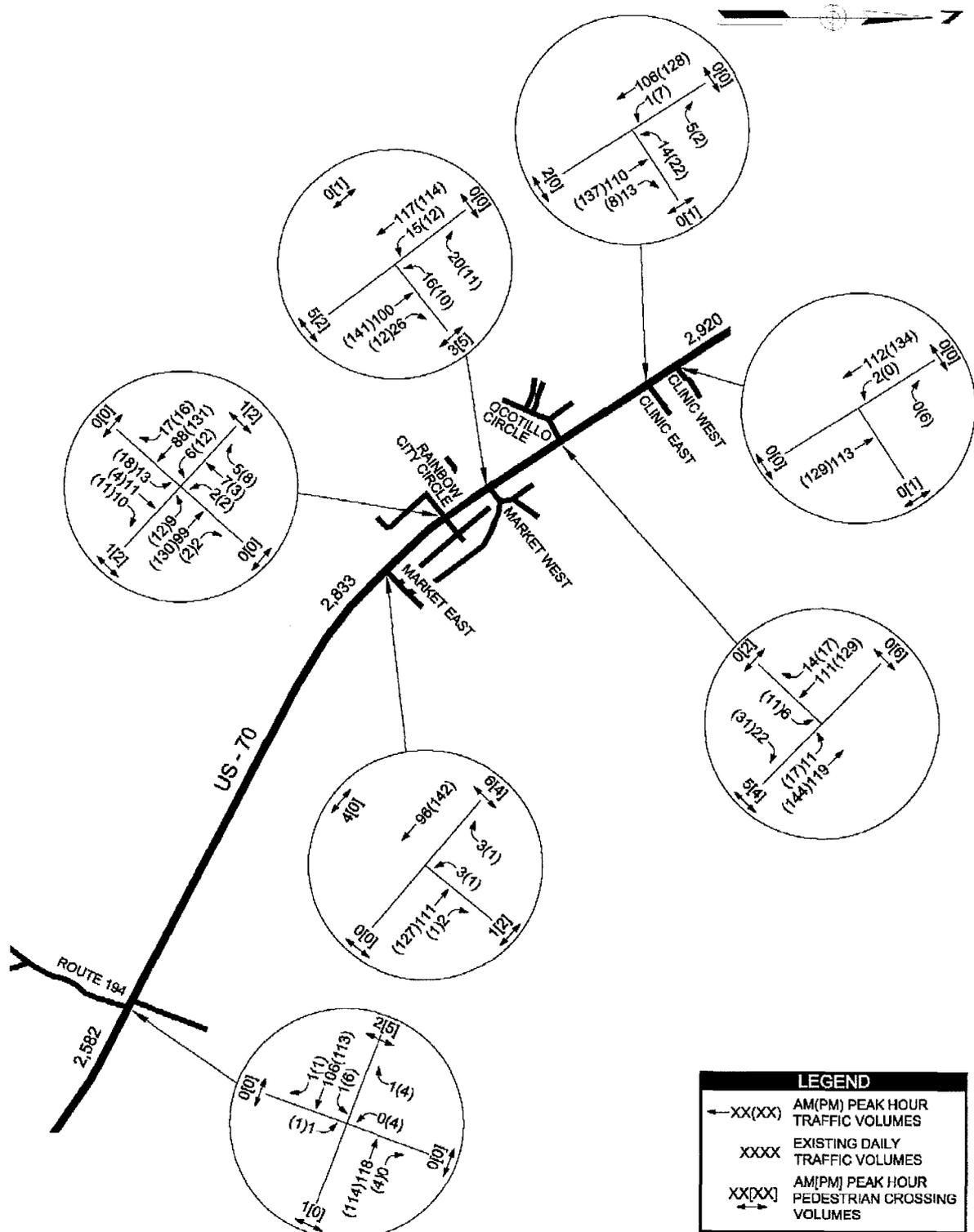
**Table 1 – Opening Year (2012) Weekday Project Site Generated Trips**

Time Period	Weekday Trips			
	Single-Family Detached Housing	Elementary School	Specialty Retail	Total
Average Daily, Inbound (vtpd)	383	129	206	718
Average Daily, Outbound (vtpd)	383	129	206	718
<b>Total Daily</b>	<b>766</b>	<b>258</b>	<b>412</b>	<b>1,436</b>
AM Peak Hour, Inbound (vtph)	15	50	31	96
AM Peak Hour, Outbound (vtph)	45	40	33	118
<b>Total AM Peak</b>	<b>60</b>	<b>90</b>	<b>64</b>	<b>214</b>
PM Peak Hour, Inbound (vtph)	51	15	11	77
PM Peak Hour, Outbound (vtph)	30	15	15	60
<b>Total PM Peak</b>	<b>81</b>	<b>30</b>	<b>26</b>	<b>137</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour



Figure 4 – Existing Weekday Peak Hour Traffic Volumes





**Table 2 – Interim Year (Fifth Year Projection) Weekday Project Site Trips**

Time Period	Weekday Trips			
	Single-Family Detached Housing	Elementary School	Specialty Retail	Total
Average Daily, Inbound (vtpd)	1,580	129	206	1,915
Average Daily, Outbound (vtpd)	1,580	129	206	1,915
<b>Total Daily</b>	<b>3,160</b>	<b>258</b>	<b>412</b>	<b>3,830</b>
AM Peak Hour, Inbound (vtph)	62	50	31	143
AM Peak Hour, Outbound (vtph)	186	40	33	259
<b>Total AM Peak</b>	<b>248</b>	<b>90</b>	<b>64</b>	<b>402</b>
PM Peak Hour, Inbound (vtph)	210	15	11	236
PM Peak Hour, Outbound (vtph)	124	15	15	154
<b>Total PM Peak</b>	<b>334</b>	<b>30</b>	<b>26</b>	<b>390</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour

**Table 3 – Full Buildout (15<sup>th</sup> Year Projection) Weekday Project Site Trips**

Time Period	Weekday Trips			
	Single-Family Detached Housing	Elementary School	Specialty Retail	Total
Average Daily, Inbound (vtpd)	8,207	129	206	8,542
Average Daily, Outbound (vtpd)	8,207	129	206	8,542
<b>Total Daily</b>	<b>16,414</b>	<b>258</b>	<b>412</b>	<b>17,084</b>
AM Peak Hour, Inbound (vtph)	322	50	31	402
AM Peak Hour, Outbound (vtph)	965	40	33	1,039
<b>Total AM Peak</b>	<b>1,287</b>	<b>90</b>	<b>64</b>	<b>1,441</b>
PM Peak Hour, Inbound (vtph)	1,092	15	11	1,118
PM Peak Hour, Outbound (vtph)	641	15	15	671
<b>Total PM Peak</b>	<b>1,733</b>	<b>30</b>	<b>26</b>	<b>1,789</b>

vtpd - vehicle trips per day, vtph - vehicle trips per hour

### Trip Distribution & Assignment

Trip distribution for the project was based on current volumes and traffic patterns near the site.

Additionally, a gravity model that obtained a weighted percentage of trips based on the population and distance from the nearby cities of Globe and Safford to the New Bylas Project was utilized to verify the general accuracy of the trip distribution. Globe and Safford are nearby accessible cities that will be potential commuting destinations for residents within the New Bylas Master Planned Community.

**Figure 5** shows the weekday trip distribution for the project as a percentage of net new primary trips in the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection). **Figures 6, 7 and 8** show the weekday traffic assignment for the project in the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection). Trip distribution calculations are shown in the appendix.



Figure 5 – Weekday Peak Hour Trip Distribution

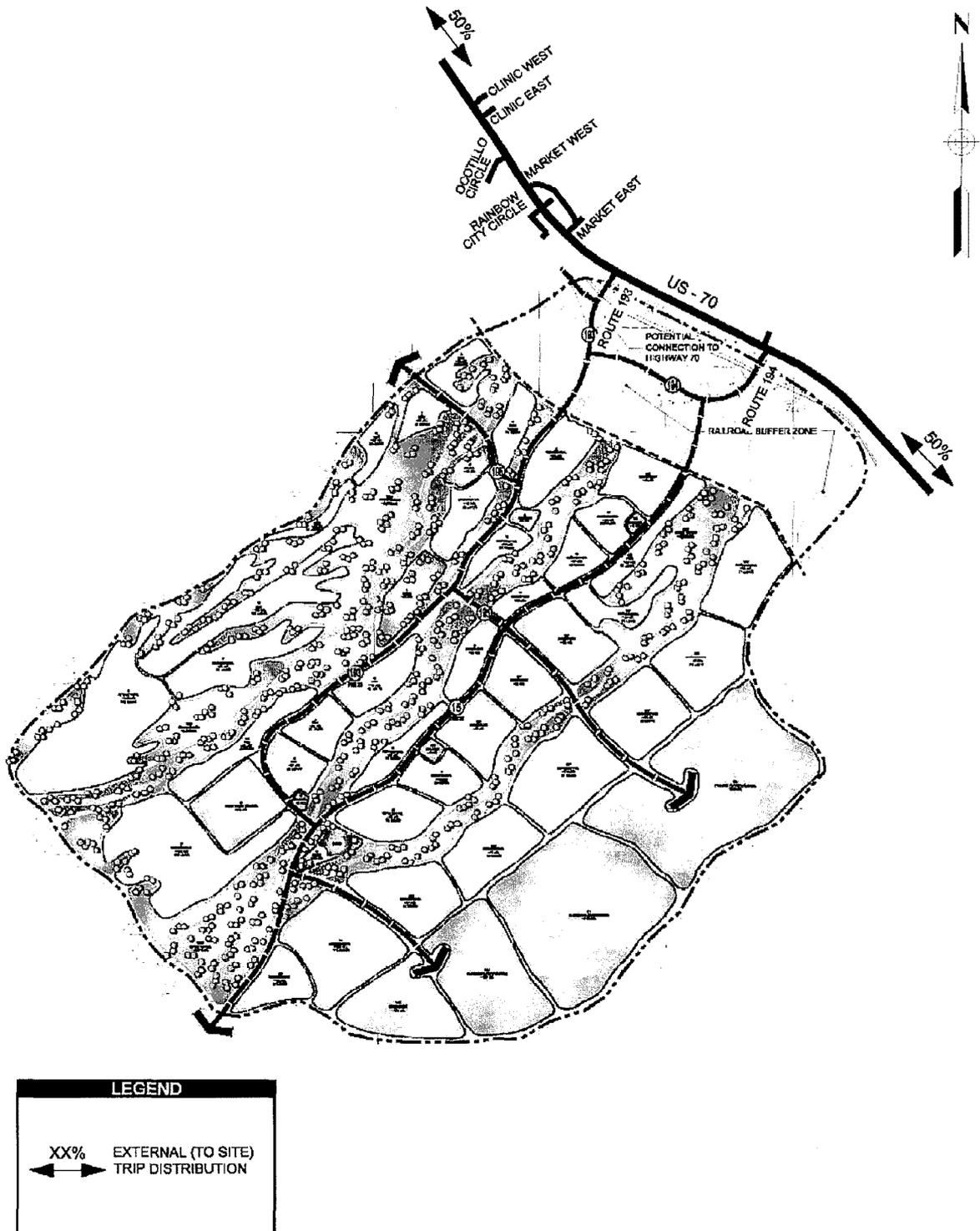






Figure 7 – Weekday Peak Hour Trip Assignment (Fifth Year Projection)

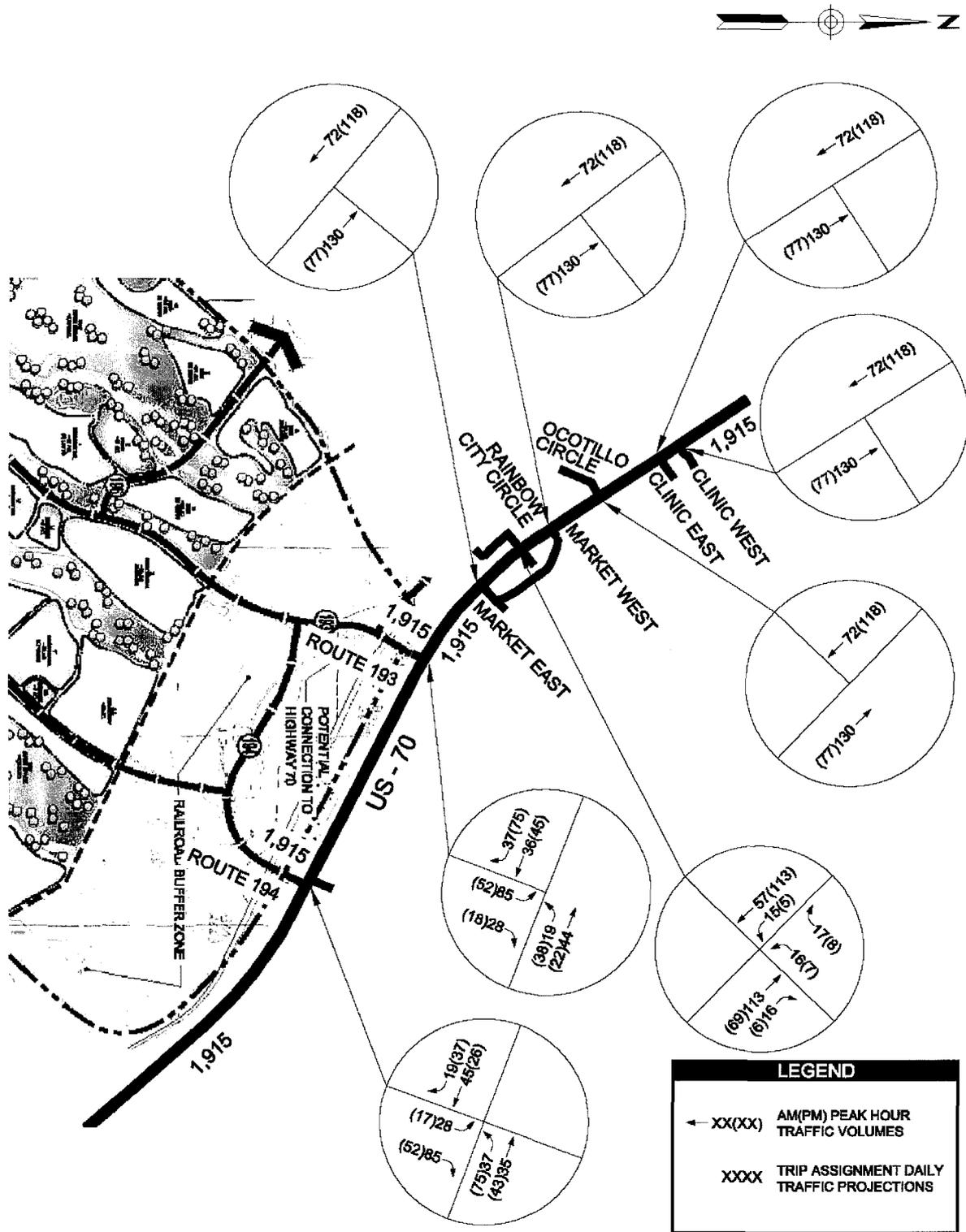
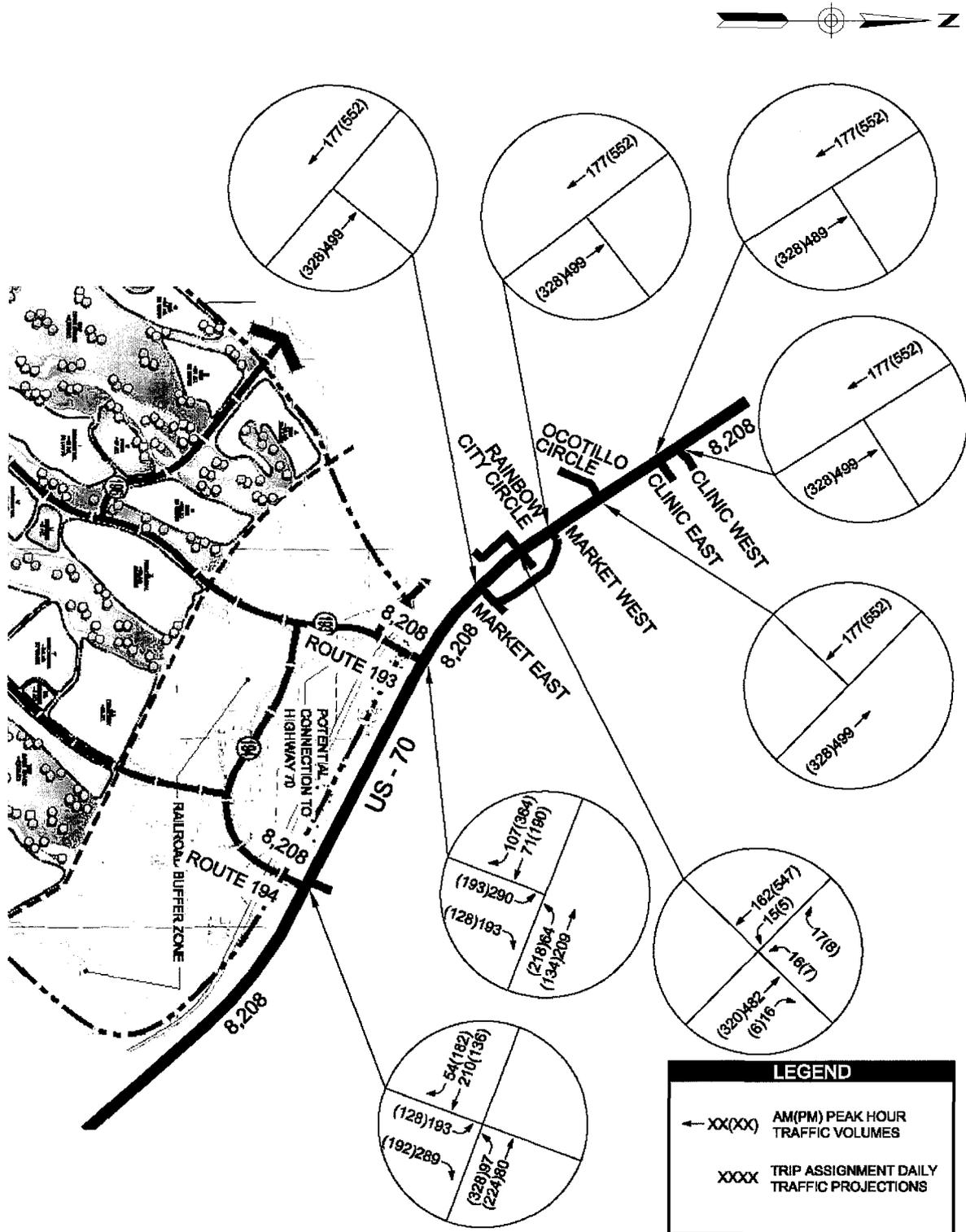




Figure 8 – Weekday Peak Hour Trip Assignment (15<sup>th</sup> Year Projection)





### Access

Access to the site will be provided by two intersections on US 70. Route 193 is a new collector facility that will provide access to the New Bylas Master Planned Community along US 70. Route 193 will be located approximately 1,300 feet southeast of the Market East Driveway. Route 194 is an existing narrow dirt roadway located approximately 5,700 feet southeast of the Market East Driveway that will provide access to the New Bylas Master Planned Community.

One lane approaches on the south legs of the intersections of US 70/Route 193 and US 70/Route 194 should operate acceptably during the opening year in 2012. Ultimately, the northbound approach of the intersection of US 70/Route 193 should provide a separate left-turn lane and right-turn lane. An un-named access road is offset approximately 60 feet to the west of Route 194 on the north side of US 70. It is recommended that the un-named Access Road be relocated to align with Route 194. Ultimately, the northbound approach of the intersection of US 70 and Route 194 should provide a left-turn lane and a shared right-turn/through lane.

Sight distance at the access points and internal intersections should be verified during the design process.

### Existing Traffic Operations

Analysis of current intersection operations was conducted for the weekday AM and PM peak hours using the nationally accepted methodology set forth in the *Highway Capacity Manual*, Transportation Research Board, 2000. The computer software HCS (Highway Capacity Software) was utilized to calculate the levels of service for individual movements, approaches, and for the intersections as a whole.

Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. Level of service is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS C is considered adequate operation at signalized and un-signalized intersections per ADOT guidelines for rural areas.

At signalized intersections, level of service is calculated for each movement and then is summed in a weighted fashion to yield the LOS for the approach and for the intersection as a whole. The criteria for level of service at signalized intersections are shown in **Table 4**.

**Table 4 - Level of Service Criteria – Signalized Intersections**

<b>Level-of-Service</b>	<b>Average Total Delay</b>
A	≤ 10.0 seconds
B	> 10.0 and ≤ 20.0 seconds/vehicle
C	> 20.0 and ≤ 35.0 seconds/vehicle
D	> 35.0 and ≤ 55.0 seconds/vehicle
E	> 55.0 and ≤ 80.0 seconds/vehicle
F	> 80.0 seconds per vehicle



In calculating the levels of service, assumed signal phasing and timing data was used. Other assumptions included:

- Cycle length – 90 seconds
- Lane widths – 12 feet
- Approach grade – 0%
- Right turn on red – 20%

At un-signalized intersections, level of service is calculated for those movements which must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. The criteria for level of service at un-signalized intersections are shown below in **Table 5**.

**Table 5 – Level of Service Criteria – Un-signalized Intersections**

<b>Level-of-Service</b>	<b>Delay</b>
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle
F	> 50 seconds per vehicle

Existing levels of service were calculated for the project intersections within the study area. The results of this analysis are shown in **Table 6**. Complete capacity calculations are included in the Appendix.

As shown in **Table 6**, the existing study intersections currently operate at an adequate LOS B or better in the AM and PM weekday peak hours.



**Table 6 – Existing Peak Hour Levels of Service**

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>				
<b>US 70 and Clinic West Driveway</b>				
Southbound Left/Right	A	0.0	A	9.1
Eastbound Left	A	7.5	A	7.5
<b>US 70 and Clinic East Driveway</b>				
Southbound Left/Right	A	9.9	B	10.8
Eastbound Left	A	7.5	A	7.6
<b>US 70 and Ocotillo Circle</b>				
Northbound Left/Right	A	9.3	A	9.8
Westbound Left/Through	A	7.5	A	7.6
<b>US 70 and Market West Driveway</b>				
Southbound Left/Right	A	9.6	A	9.8
Eastbound Left	A	7.5	A	7.5
<b>US 70 and Rainbow City Circle</b>				
Northbound Left/Through/Right	B	10.2	B	10.9
Southbound Left/Through/Right	B	10.1	A	9.9
Eastbound Left	A	7.4	A	7.5
Westbound Left	A	7.5	A	7.6
<b>US 70 and Market East Driveway</b>				
Southbound Left/Right	A	9.4	A	9.6
Eastbound Left/Through	A	7.4	A	7.5
<b>US 70 and Route 194</b>				
Northbound Left/Through	B	10.2	B	10.2
Southbound Left/Through	A	8.9	A	9.6
Eastbound Left/Through/Right	A	7.5	A	7.4
Westbound Left/Through/Right	A	7.4	A	7.4

Delay - seconds per vehicle

### **Future Traffic Operations Without Project**

In order to assess the impacts of the project on future traffic operations, traffic projections were made for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection).

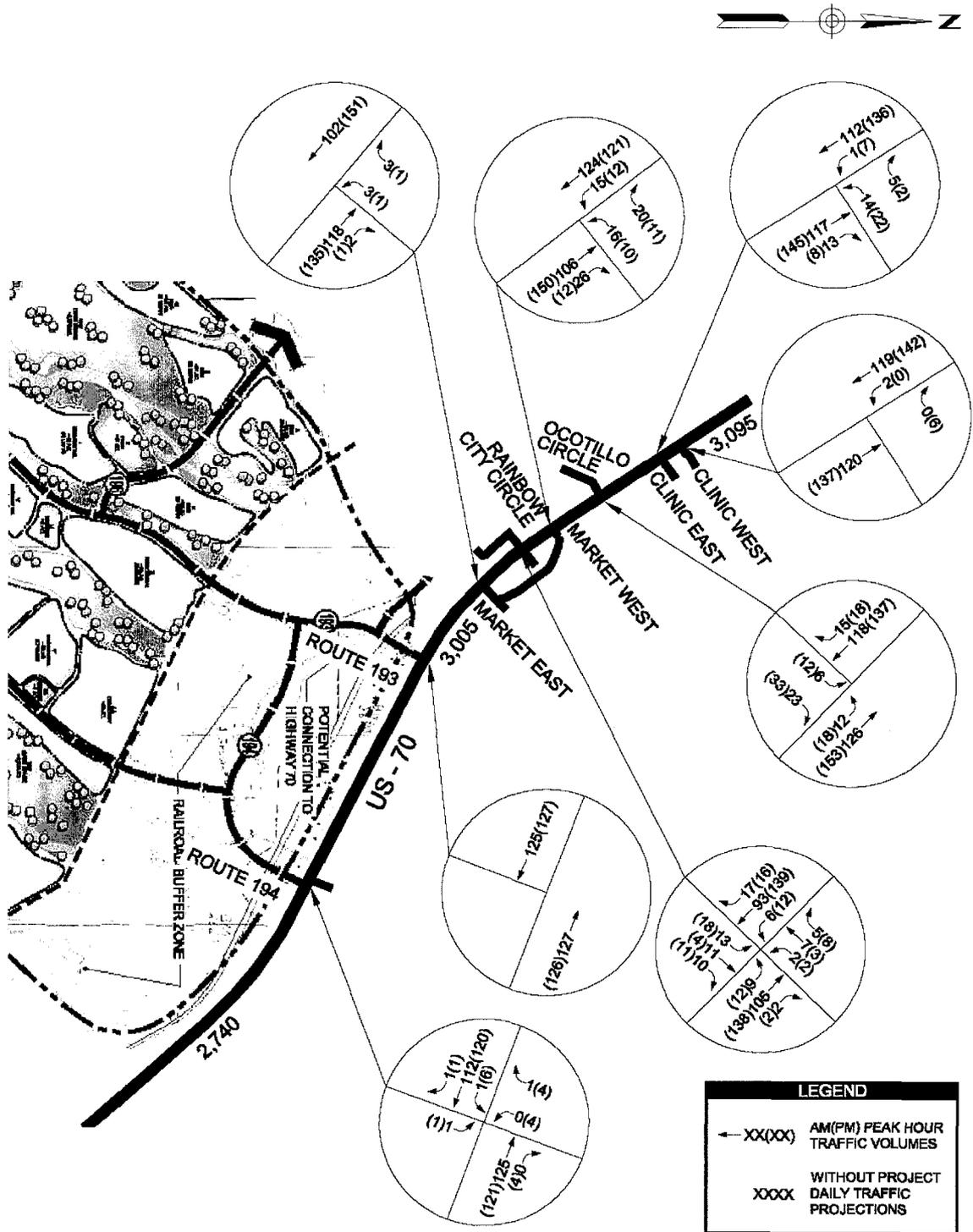
Several factors were analyzed to determine a growth rate for traffic in this area:

- Analysis of historic traffic count data was obtained from ADOT's Transportation Planning Division (TPD). Counts on US 70 have declined over the past two years.
- ADOT State Highway System – 20 year forecasts were obtained from ADOT's TPD website. The average annual growth rate predicted on US 70 in this area is 1.67%
- The Graham County Small Area Transportation Study prepared in August of 2008 by PB uses a 2.3% annual growth rate to grow traffic between 2005 and 2030.

In order to make a conservative estimate, a three percent growth rate was used to estimate traffic growth in the project area without the project. Growth rate calculation data is shown in the Appendix. Using the compounded yearly traffic growth rate, opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection), weekday peak hour traffic volumes without the project were estimated as shown in **Figures 9, 10, and 11.**



Figure 9 – Opening Year (2012) Weekday Peak Hour Traffic Volumes Without Project





**Figure 10 – Fifth Year Projection Weekday Peak Hour Traffic Volumes Without Project**

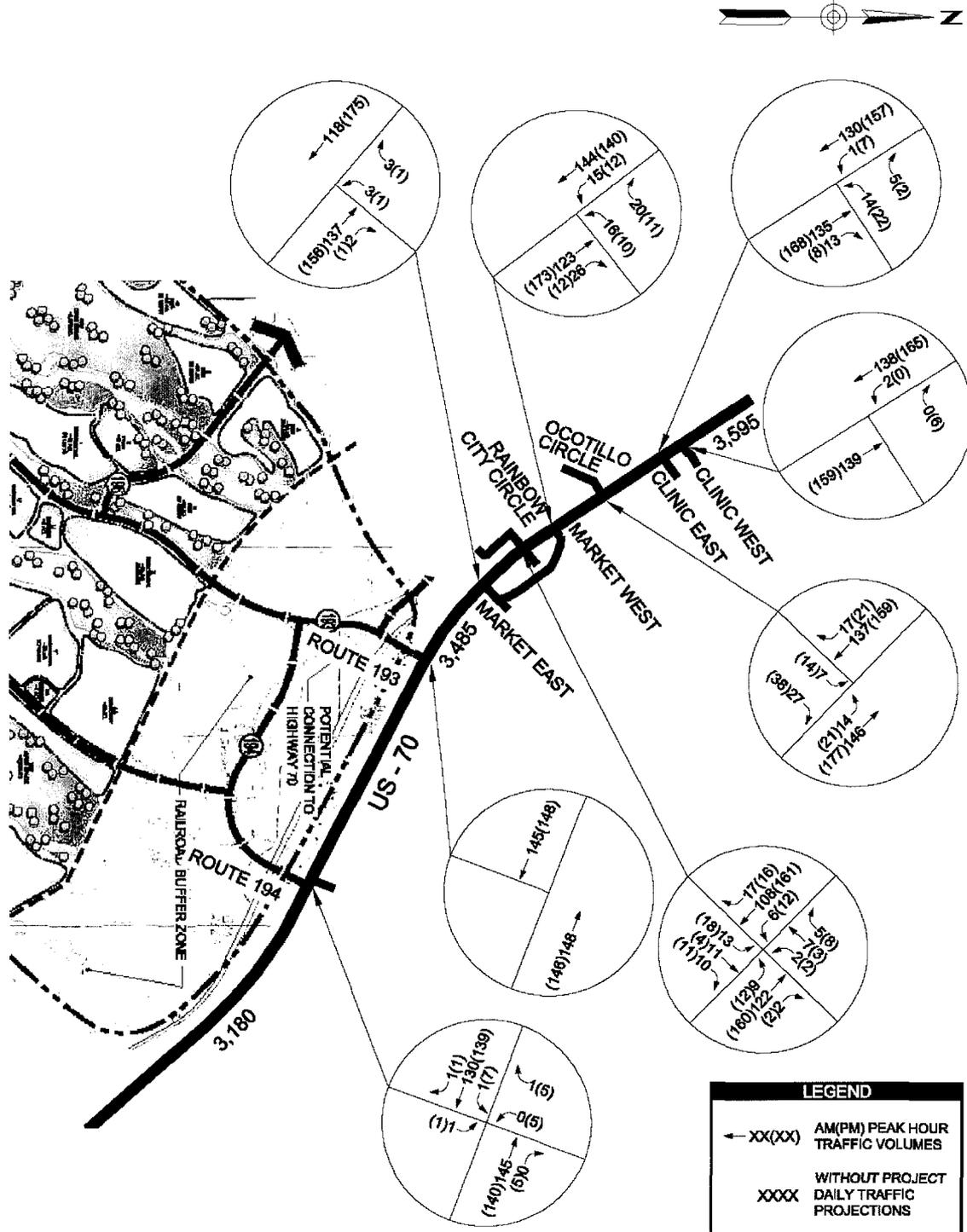
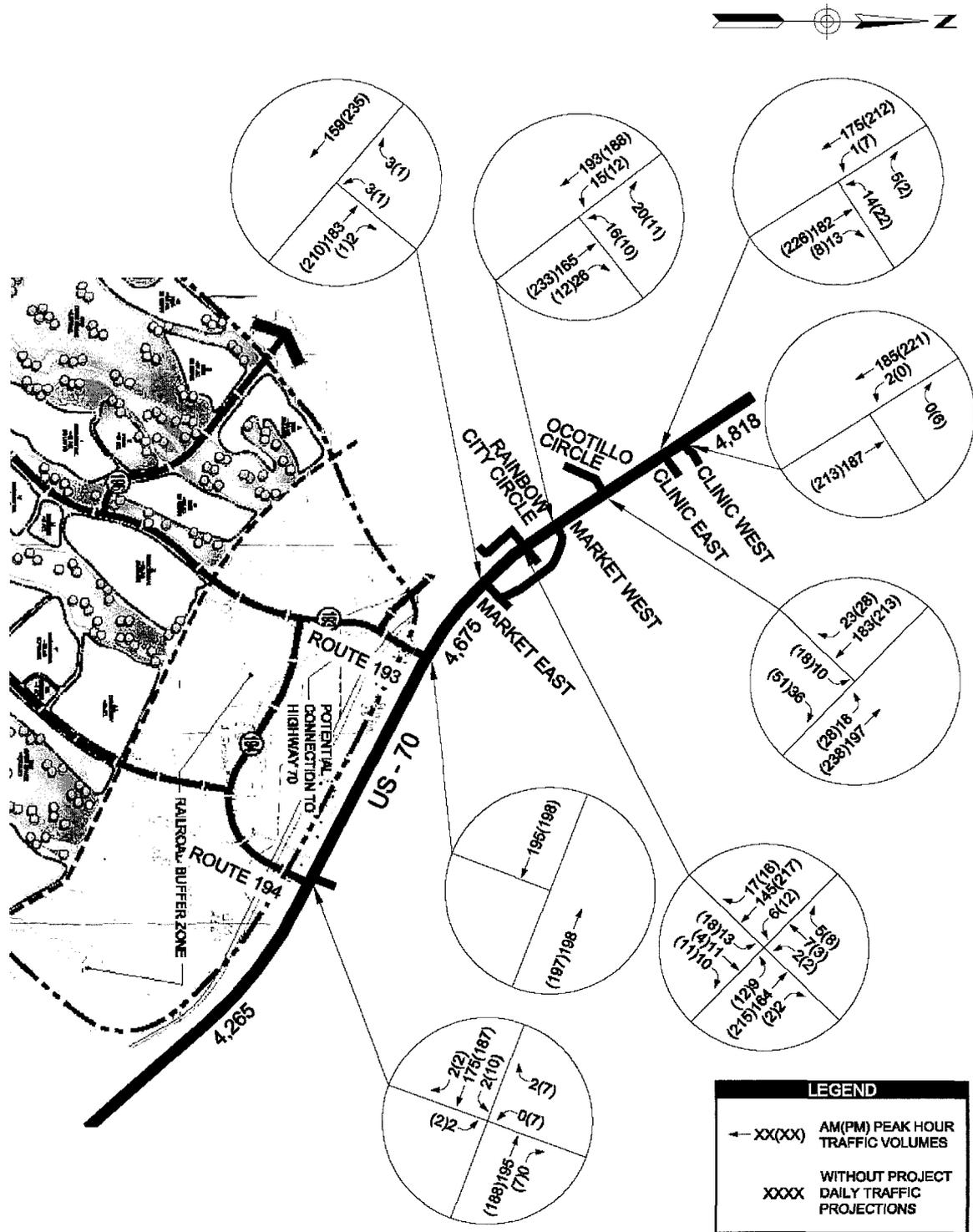




Figure 11 – 15<sup>th</sup> Year Projection Weekday Peak Hour Traffic Volumes Without Project





As with the current volumes, levels of service were calculated for each of the intersections in the study area for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection) without the project. Levels of service for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection) without the project are shown in **Tables 7, 8, and 9**. Complete capacity calculations are included in the Appendix.

**Table 7 – Opening Year (2012) Peak Hour Levels of Service Without Project**

Intersection	2012 Without Project			
	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>				
<b>US 70 and Clinic West Driveway</b>				
Southbound Left/Right	A	0.0	A	9.1
Eastbound Left	A	7.5	A	7.5
<b>US 70 and Clinic East Driveway</b>				
Southbound Left/Right	A	9.9	B	10.7
Eastbound Left	A	7.5	A	7.6
<b>US 70 and Ocotillo Circle</b>				
Northbound Left/Right	A	9.4	A	9.9
Westbound Left/Through	A	7.5	A	7.6
<b>US 70 and Market West Driveway</b>				
Southbound Left/Right	A	9.7	A	10.0
Eastbound Left	A	7.5	A	7.6
<b>US 70 and Rainbow City Circle</b>				
Northbound Left/Through/Right	B	10.3	B	11.1
Southbound Left/Through/Right	B	10.2	B	10.1
Eastbound Left	A	7.5	A	7.5
Westbound Left	A	7.5	A	7.6
<b>US 70 and Market East Driveway</b>				
Southbound Left/Right	A	9.4	A	9.7
Eastbound Left/Through	A	7.5	A	7.5
<b>US 70 and Route 194</b>				
Northbound Left	B	10.4	B	10.6
Northbound Right/Through	A	0.0	A	0.0
Southbound Left/Through/Right	A	9.0	A	9.8
Eastbound Left/Through/Right	A	7.5	A	7.5
Westbound Left/Through/Right	A	7.5	A	7.5

Delay - seconds per vehicle

As shown in **Table 7**, all of the project intersections are predicted to operate at an adequate LOS B or better for all movements in the AM and PM peak hours of 2012 without traffic from the project.



**Table 8 – Interim Year (Fifth Year Projection) Peak Hour LOS Without Project**

Intersection	2017 Without Project			
	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>				
<b>US 70 and Clinic West Driveway</b>				
Southbound Left/Right	A	0.0	A	9.3
Eastbound Left	A	7.5	A	7.6
<b>US 70 and Clinic East Driveway</b>				
Southbound Left/Right	B	10.2	B	11.1
Eastbound Left	A	7.5	A	7.6
<b>US 70 and Ocotillo Circle</b>				
Northbound Left/Right	A	9.7	B	10.3
Westbound Left/Through	A	7.6	A	7.7
<b>US 70 and Market West Driveway</b>				
Southbound Left/Right	A	9.9	B	10.2
Eastbound Left	A	7.6	A	7.7
<b>US 70 and Rainbow City Circle</b>				
Northbound Left/Through/Right	B	10.6	B	11.5
Southbound Left/Through/Right	B	10.5	B	10.4
Eastbound Left	A	7.5	A	7.6
Westbound Left	A	7.5	A	7.6
<b>US 70 and Market East Driveway</b>				
Southbound Left/Right	A	9.7	A	10.0
Eastbound Left/Through	A	7.5	A	7.6
<b>US 70 and Route 194</b>				
Northbound Left	B	10.7	B	11.0
Northbound Right/Through	A	0.0	A	0.0
Southbound Left/Through/Right	A	9.1	B	10.1
Eastbound Left/Through/Right	A	7.5	A	7.5
Westbound Left/Through/Right	A	7.5	A	7.5

Delay - seconds per vehicle

As shown in **Table 8**, all of the project intersections are predicted to operate at an adequate LOS B or better for all movements in the AM and PM peak hours of the interim year (Fifth Year Projection) without traffic from the project.



**Table 9 – Full Buildout (15<sup>th</sup> Year Projection) Peak Hour LOS Without Project**

Intersection	2027 Without Project			
	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>				
<b>US 70 and Clinic West Driveway</b>				
Southbound Left/Right	A	0.0	A	9.6
Eastbound Left	A	7.6	A	7.7
<b>US 70 and Clinic East Driveway</b>				
Southbound Left/Right	B	10.9	B	12.3
Eastbound Left	A	7.7	A	7.8
<b>US 70 and Ocotillo Circle</b>				
Northbound Left/Right	B	10.1	B	11.3
Westbound Left/Through	A	7.7	A	7.9
<b>US 70 and Market West Driveway</b>				
Southbound Left/Right	B	10.5	B	11.0
Eastbound Left	A	7.7	A	7.8
<b>US 70 and Rainbow City Circle</b>				
Northbound Left/Through/Right	B	11.3	B	12.8
Southbound Left/Through/Right	B	11.1	B	11.2
Eastbound Left	A	7.6	A	7.8
Westbound Left	A	7.6	A	7.8
<b>US 70 and Market East Driveway</b>				
Southbound Left/Right	B	10.2	B	10.8
Eastbound Left/Through	A	7.6	A	7.7
<b>US 70 and Route 194</b>				
Northbound Left	B	11.8	B	12.3
Northbound Right/Through	A	0.0	A	0.0
Southbound Left/Through/Right	A	9.4	B	10.9
Eastbound Left/Through/Right	A	7.7	A	7.7
Westbound Left/Through/Right	A	7.6	A	7.6

Delay - seconds per vehicle

As shown in **Table 9**, all of the project intersections are predicted to operate at an adequate LOS B or better for all movements in the AM and PM peak hours of the full buildout year (15<sup>th</sup> Year Projection) without traffic from the project.

### **Future Traffic Operations With Project**

In order to assess the impacts of the project on future traffic operations, levels of service were calculated for each project intersection for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection) with the project. Weekday peak hour traffic volumes for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection) without the project were combined with the estimated trips generated by the project to yield peak hour traffic volumes with the project as shown in **Figures 12, 13, and 14**.



Figure 12 – Opening Year (2012) Weekday Peak Hour Traffic Volumes With Project

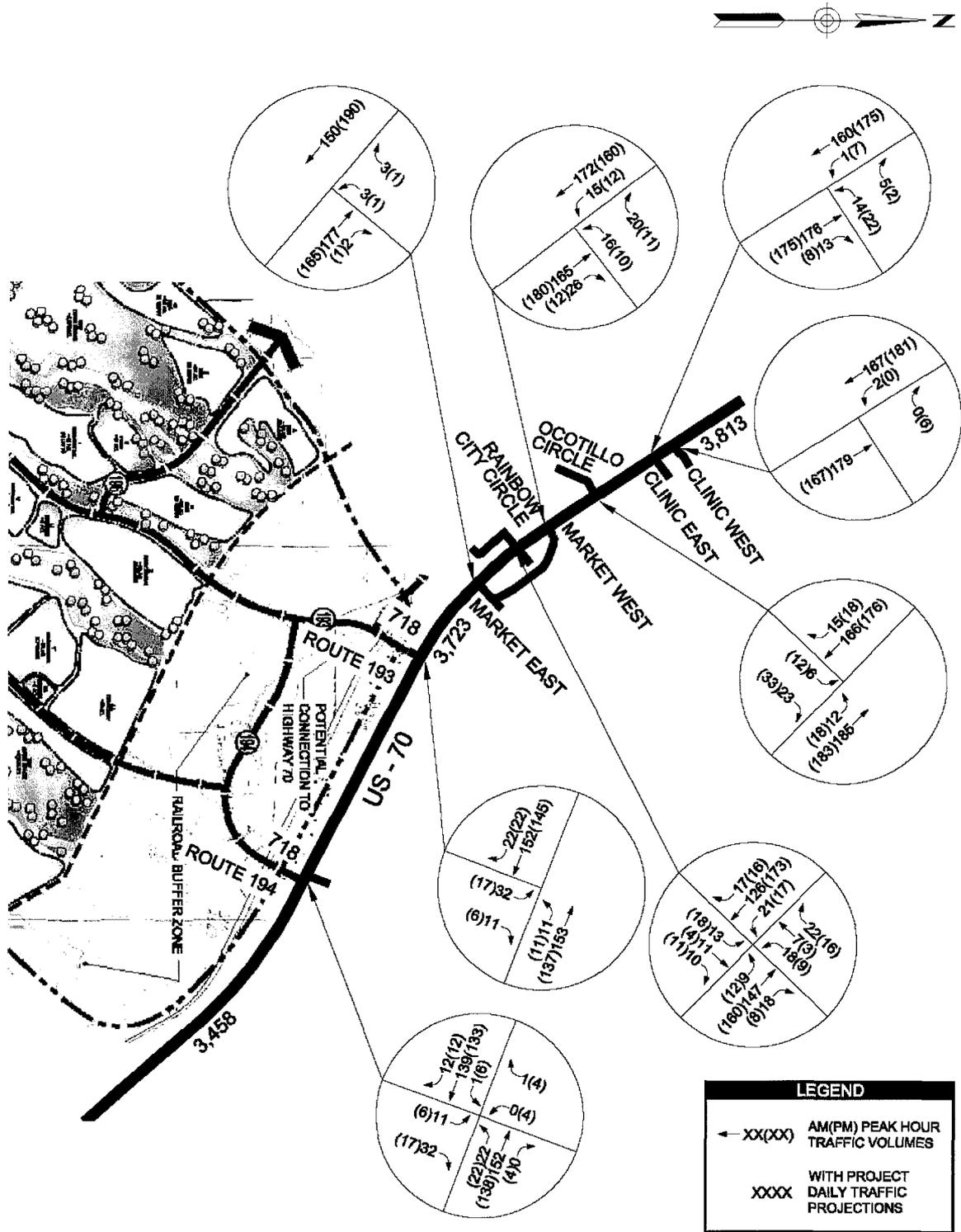




Figure 13 – Fifth Year Projection Weekday Peak Hour Traffic Volumes With Project

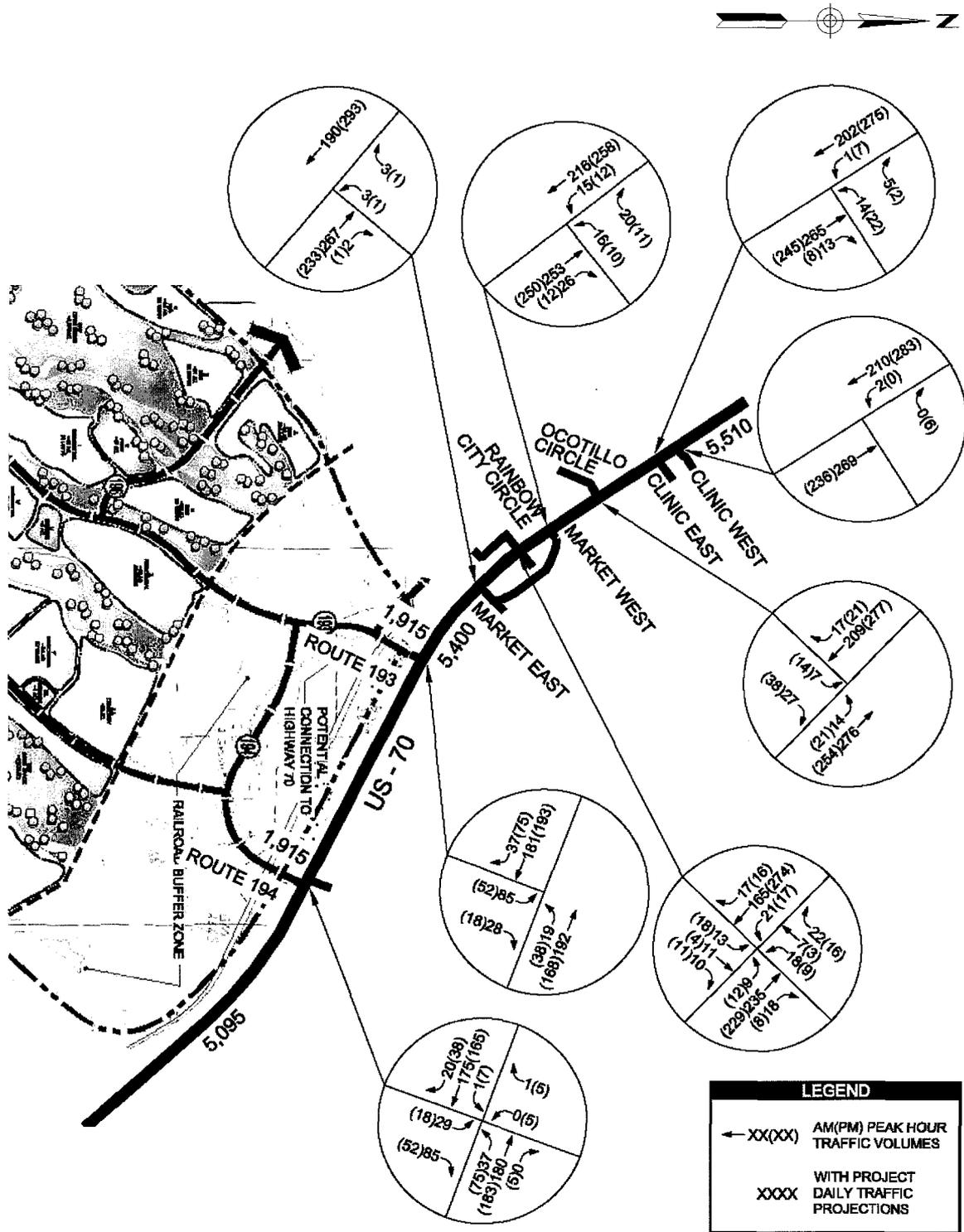
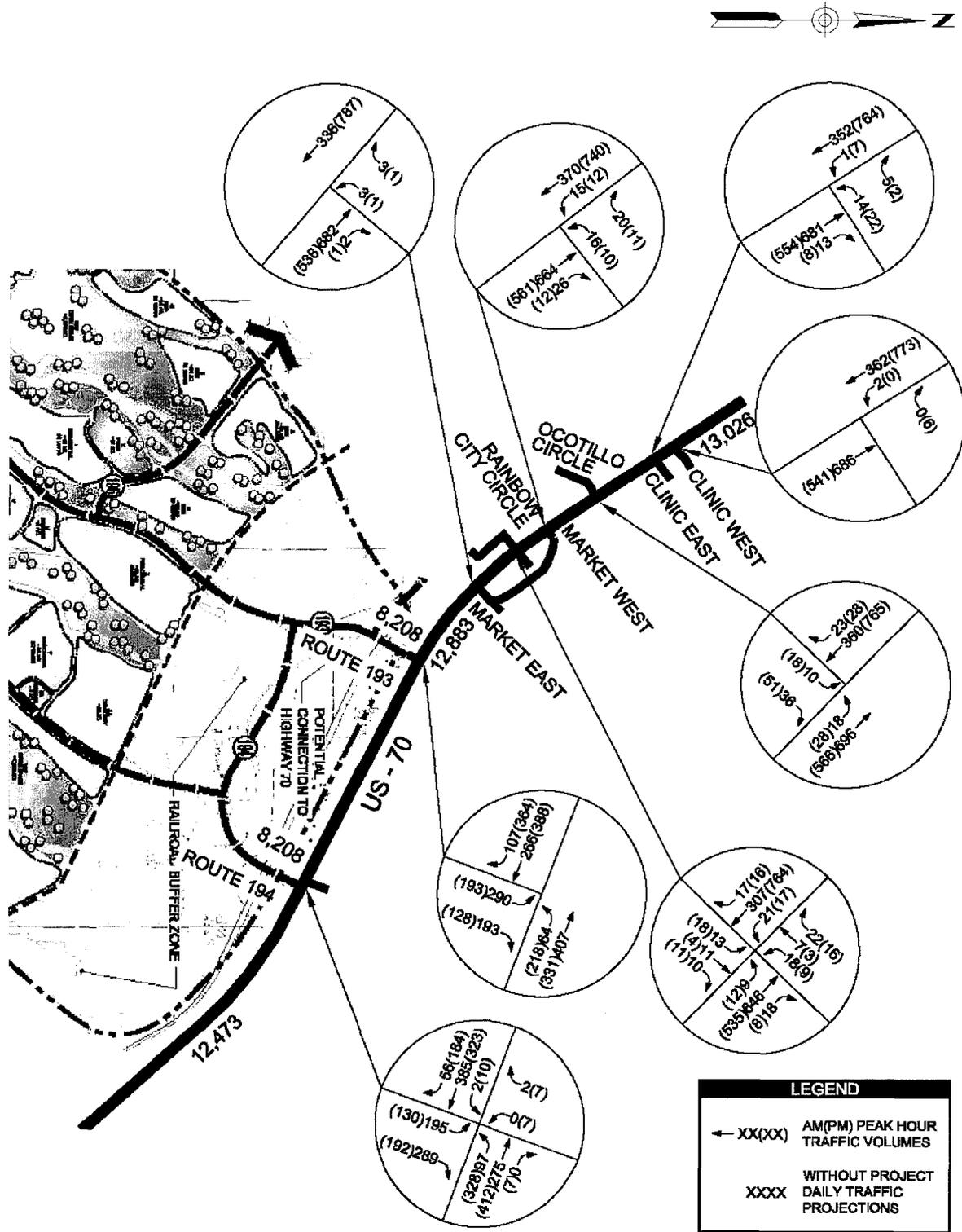




Figure 14 – 15<sup>th</sup> Year Projection Weekday Peak Hour Traffic Volumes With Project





Weekday intersection levels of service for the opening year (2012), interim year (Fifth Year Projection), and full buildout (15<sup>th</sup> Year Projection) with the project were then calculated as shown in Tables 10, 11, and 12. Complete capacity calculations are included in the Appendix.

**Table 10 – Opening Year (2012) Peak Hour Levels of Service With Project**

Intersection	2012 Without Project				2012 With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>								
<b>US 70 and Clinic West Driveway</b>								
Southbound Left/Right	A	0.0	A	9.1	A	0.0	A	9.3
Eastbound Left	A	7.5	A	7.5	A	7.6	A	7.6
<b>US 70 and Clinic East Driveway</b>								
Southbound Left/Right	A	9.9	B	10.7	B	10.7	B	11.3
Eastbound Left	A	7.5	A	7.6	A	7.7	A	7.6
<b>US 70 and Ocotillo Circle</b>								
Northbound Left/Right	A	9.4	A	9.9	A	9.9	B	10.3
Westbound Left/Through	A	7.5	A	7.6	A	7.7	A	7.7
<b>US 70 and Market West Driveway</b>								
Southbound Left/Right	A	9.7	A	10.0	B	10.4	B	10.4
Eastbound Left	A	7.5	A	7.6	A	7.7	A	7.7
<b>US 70 and Rainbow City Circle</b>								
Northbound Left/Through/Right	B	10.3	B	11.1	B	11.5	B	11.9
Southbound Left/Through/Right	B	10.2	B	10.1	B	11.1	B	10.8
Eastbound Left	A	7.5	A	7.5	A	7.6	A	7.6
Westbound Left	A	7.5	A	7.6	A	7.6	A	7.7
<b>US 70 and Market East Driveway</b>								
Southbound Left/Right	A	9.4	A	9.7	B	10.1	B	10.1
Eastbound Left/Through	A	7.5	A	7.5	A	7.6	A	7.6
<b>US 70 and Route 193</b>								
Northbound Left	N.A.	N.A.	N.A.	N.A.	B	11.3	B	10.9
Northbound Right	N.A.	N.A.	N.A.	N.A.	A	9.3	A	9.2
Westbound Left/Through	N.A.	N.A.	N.A.	N.A.	A	7.6	A	7.6
<b>US 70 and Route 194</b>								
Northbound Left	B	10.4	B	10.6	B	11.6	B	11.5
Northbound Right/Through	A	0.0	A	0.0	A	9.3	A	9.1
Southbound Left/Through/Right	A	9.0	A	9.8	A	9.1	B	10.4
Eastbound Left/Through/Right	A	7.5	A	7.5	A	7.6	A	7.5
Westbound Left/Through/Right	A	7.5	A	7.5	A	7.6	A	7.6

Delay - seconds per vehicle

**Opening Year 2012**

As shown in Table 10, the additional traffic generated by the project is not anticipated to greatly affect any of the study intersections in the opening year (2012). The project intersections are predicted to operate at an adequate LOS B or better for all movements in the AM and PM peak hours of 2012 with traffic from the project.



**Table 11 – Interim Year (Fifth Year Projection) Peak Hour LOS With Project**

Intersection	2017 Without Project				2017 With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>								
<b>US 70 and Clinic West Driveway</b>								
Southbound Left/Right	A	0.0	A	9.3	A	0.0	A	9.7
Eastbound Left	A	7.5	A	7.6	A	7.9	A	7.8
<b>US 70 and Clinic East Driveway</b>								
Southbound Left/Right	B	10.2	B	11.1	B	12.0	B	13.3
Eastbound Left	A	7.5	A	7.6	A	7.9	A	7.8
<b>US 70 and Ocotillo Circle</b>								
Northbound Left/Right	A	9.7	B	10.3	B	10.6	B	11.7
Westbound Left/Through	A	7.6	A	7.7	A	7.8	A	8.0
<b>US 70 and Market West Driveway</b>								
Southbound Left/Right	A	9.9	B	10.2	B	11.5	B	11.7
Eastbound Left	A	7.6	A	7.7	A	7.9	A	7.9
<b>US 70 and Rainbow City Circle</b>								
Northbound Left/Through/Right	B	10.6	B	11.5	B	12.9	B	14.2
Southbound Left/Through/Right	B	10.5	B	10.4	B	12.5	B	12.3
Eastbound Left	A	7.5	A	7.6	A	7.9	A	7.8
Westbound Left	A	7.5	A	7.6	A	7.6	A	8.0
<b>US 70 and Market East Driveway</b>								
Southbound Left/Right	A	9.7	A	10.0	B	11.1	B	11.3
Eastbound Left/Through	A	7.5	A	7.6	A	7.9	A	7.8
<b>US 70 and Route 193</b>								
Northbound Left	N.A.	N.A.	N.A.	N.A.	B	13.5	B	13.1
Northbound Right	N.A.	N.A.	N.A.	N.A.	A	9.6	A	9.6
Westbound Left/Through	N.A.	N.A.	N.A.	N.A.	A	7.8	A	7.8
<b>US 70 and Route 194</b>								
Northbound Left	B	10.7	B	11.0	B	13.5	C	15.3
Northbound Right/Through	A	0.0	A	0.0	A	9.9	A	9.7
Southbound Left/Through/Right	A	9.1	B	10.1	A	9.3	B	12.8
Eastbound Left/Through/Right	A	7.5	A	7.5	A	7.6	A	7.7
Westbound Left/Through/Right	A	7.5	A	7.5	A	7.8	A	7.9

Delay - seconds per vehicle

**Interim Year (Fifth Year Projection)**

As shown in **Table 11**, the additional traffic generated by the project is not anticipated to greatly affect any of the study intersections in interim year (Fifth Year Projection). The project intersections are predicted to operate at an adequate LOS B or better for all movements in the AM and PM peak hours of the interim year (Fifth Year Projection) with traffic from the project.



**Table 12 – Full Buildout (15<sup>th</sup> Year Projection) Peak Hour LOS With Project**

Intersection	2027 Without Project				2027 With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
<b>Unsignalized Intersections</b>								
<b>US 70 and Clinic West Driveway</b>								
Southbound Left/Right	A	0.0	A	9.6	A	0.0	B	12.2
Eastbound Left	A	7.6	A	7.7	A	9.2	A	8.7
<b>US 70 and Clinic East Driveway</b>								
Southbound Left/Right	B	10.9	B	12.3	C	20.8	D	34.9
Eastbound Left	A	7.7	A	7.8	A	9.2	A	8.7
<b>US 70 and Ocotillo Circle</b>								
Northbound Left/Right	B	10.1	B	11.3	B	14.5	D	27.3
Westbound Left/Through	A	7.7	A	7.9	A	8.2	A	9.8
<b>US 70 and Market West Driveway</b>								
Southbound Left/Right	B	10.5	B	11.0	C	19.3	C	23.1
Eastbound Left	A	7.7	A	7.8	A	9.3	A	8.8
<b>US 70 and Rainbow City Circle</b>								
Northbound Left/Through/Right	B	11.3	B	12.8	C	24.3	E	45.1
Southbound Left/Through/Right	B	11.1	B	11.2	C	24.2	D	29.6
Eastbound Left	A	7.6	A	7.8	A	9.2	A	8.7
Westbound Left	A	7.6	A	7.8	A	8.0	A	9.7
<b>US 70 and Market East Driveway</b>								
Southbound Left/Right	B	10.2	B	10.8	C	17.6	C	21.4
Eastbound Left/Through	A	7.6	A	7.7	A	9.2	A	8.6
<b>US 70 and Route 193</b>								
Northbound Left	N.A.	N.A.	N.A.	N.A.	F	>120	F	>120
Northbound Right	N.A.	N.A.	N.A.	N.A.	B	12.5	C	15.5
Westbound Left/Through	N.A.	N.A.	N.A.	N.A.	A	8.3	B	11.4
<b>US 70 and Route 194</b>								
Northbound Left	B	11.8	B	12.3	F	>120	F	>120
Northbound Right/Through	A	0.0	A	0.0	C	17.4	B	14.1
Southbound Left/Through/Right	A	9.4	B	10.9	A	9.9	F	102.9
Eastbound Left/Through/Right	A	7.7	A	7.7	A	7.8	A	8.3
Westbound Left/Through/Right	A	7.6	A	7.6	A	8.7	B	10.5

Delay - seconds per vehicle

**Full Buildout (15<sup>th</sup> Year Projection)**

As displayed in **Table 12**, the additional traffic generated by the project is anticipated to change the operation of five study area intersections from adequate levels of service to inadequate levels of services at full buildout (15<sup>th</sup> Year Projection).

The northbound and southbound shared left-turn/through/right-turn movements at the intersection of US 70 and Rainbow City Circle are anticipated to operate at an inadequate LOS E and D during the weekday PM peak hour at full build-out with the project, respectively.



The northbound shared left-turn/right-turn movements at the intersection of US 70 and Clinic East Driveway is anticipated to operate at an inadequate LOS D in the weekday PM peak hour at full build-out (15<sup>th</sup> Year Projection) with the project. Additionally, the southbound shared left-turn/right-turn movements at the intersection of US 70 and Ocotillo Circle is expected to operate at an inadequate LOS D in the weekday PM peak hour at full build-out (15<sup>th</sup> Year Projection) with the project.

The northbound approaches to the intersections of US 70/Route 193 and US 70/Route 194 are anticipated to operate at unacceptable levels of service during the peak hours at full build-out (15<sup>th</sup> Year Projection) with the project. The southbound approach to the intersection of US 70 and Route 194 is expected to operate at an inadequate LOS during the PM peak hour at full build-out (15<sup>th</sup> Year Projection) with the project.

The delay in all circumstances mentioned above is caused by high through traffic volumes on US 70 which limits the available gaps for left turning traffic from the minor stop controlled approaches as well as only providing one lane approaches on the minor streets.

### **Traffic Signal Warrant Analysis**

In order to determine if a traffic signal is warranted at the intersections of US 70/Route 193 and US 70/Route 194, a Traffic Signal Warrant study was completed. The intersection was studied with traffic from the project site at full build-out (15<sup>th</sup> Year Projection).

Several assumptions were made regarding the distribution of traffic throughout the day for new site traffic. For site generated traffic, it was assumed that 80% of the daily traffic was spread throughout the twelve busiest hours of the day from 6AM to 6 PM and the remaining 20% was evenly distributed throughout the twelve least busy hours of the day.

These factors were used to determine the approach volumes for each leg of the study intersection. Base average daily traffic volumes were calculated based on the trip generation for the site as previously shown in **Table 3**.

The *Manual on Uniform Traffic Control Devices (MUTCD)*, Federal Highway Administration, 2003, lists 8 warrants that are used to determine if a traffic signal should be considered for installation at an intersection. A traffic signal is warranted if one or more of the warrants are satisfied. Warrants #1 (Eight Hour Volume) and #2 (Four Hour Vehicular Volume) were used to evaluate the need to signalize the intersection. Based on existing conditions, availability of information, and applicability, the remaining warrants (#3, #4, #5, #6, #7, and #8) do not apply to the given conditions.

Warrant #1 (Eight Hour Volume) is satisfied when for at least eight (8) hours of an average day, specific traffic volume levels are met for both the major and minor streets (Condition A – Minimum Vehicular Volume). The MUTCD states these volumes



depending on the vehicles per hour (vph) combined for both approaches of the major street, and for the highest volume approach on the minor street. The values vary depending on the number of approach lanes.

Warrant #1 also applies to operating conditions where the major street traffic levels are sufficiently high that traffic entering or crossing from a minor street suffers excessive delay (Condition B – Interruption of Continuous Traffic). Once again, the warrant is satisfied when for each of any of the same eight (8) hours of an average day, specific traffic volume levels are met for both the major and minor streets.

Warrant #2 (Four Hour Volume) is met when, for any four hours of the average day on both the major and minor streets, the hourly approach volumes are above the plotted curve contained in the MUTCD (see Appendix).

**Tables 13 and 14** show the results of the warrant analyses. The Appendix contains a complete set of each of the warrant analyses.

As shown in **Tables 13 and 14**, the intersections of US 70/Route 193 and US 70/Route 194 both meet traffic signal warrants 1 and 2 at full build-out (15<sup>th</sup> Year Projection) with the project.

Regardless, it is important to mention that traffic signals should not be installed because one or more of the warrants are satisfied. The MUTCD warrants reflect only the lowest minimum levels on which traffic engineers agree. It also states that, “The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.”

**Table 13 – Traffic Signal Warrant Analyses (US 70/Route 193)**

Year	Warrant Number								
	1		2	3	4	5	6	7	8
	Condition A	Condition B							
2027 With project	Yes	Yes	Yes	*	*	*	*	*	*
Hours Met	23	12	12	*	*	*	*	*	*

\* Warrant Not Evaluated

**Table 14 – Traffic Signal Warrant Analyses (US 70/Route 194)**

Year	Warrant Number								
	1		2	3	4	5	6	7	8
	Condition A	Condition B							
2027 With project	Yes	Yes	Yes	*	*	*	*	*	*
Hours Met	23	12	12	*	*	*	*	*	*

\* Warrant Not Evaluated



### Turn Lane Analysis

A key element of this study is to determine if right and left turn lanes, on the major streets, are required at the project site intersections. *Institute of Transportation Engineers Traffic Engineering Handbook* provides guidelines for the installation of right and left-turn lanes on roadways. The figures from the *ITE Traffic Engineering Handbook, 5th Edition* are provided in the Appendix. The figures compare the through volumes on the major road against the turn lane volumes from the major road to determine if a specific turn lane is warranted.

Based on the opening year (2012) PM peak hour traffic volumes with the project, **Table 15** was developed.

**Table 15 – Recommended Turn Lane Treatments With Project**

Intersection	Turn Treatments Warranted?	Direction	Turn Treatment Analyzed
US 70 / Route 193	Yes	NB	Left Turn Lane
US 70 / Route 193	Yes	EB	Right Turn Lane
US 70 / Route 193	Yes	WB	Left Turn Lane
US 70 / Route 194	Yes	NB	Left Turn Lane
US 70 / Route 194	Yes	EB	Right Turn Lane
US 70 / Route 194	Yes	WB	Left Turn Lane

Another key element of this study is to determine storage lengths for the left and right turn lanes associated with the project. The queue storage requirements for the area roadways were calculated using the following methods as recommended in *A Policy of Geometric Design of Highways and Streets* (AASHTO, 2001).

For un-signalized intersections, storage for vehicles likely to arrive in an average two-minute period within the peak hour should be provided.

$$\begin{aligned} \text{Vehicles per 2 min. period} &= (\text{vehicles/hour}) \div (30 \text{ periods/hour}) \\ \text{Storage length} &= \text{vehicles per 2 min. period} \times 25 \text{ feet} \end{aligned}$$

For the signalized intersections in the study area the turn lane storage was calculated as follows assuming random arrivals:

$$\begin{aligned} \text{Vehicles/cycle} &= 2 \times (\text{vehicles/hour}) / \text{cycles/hour} \\ \text{Storage length} &= \text{vehicles/cycle} \times 25 \text{ feet} \end{aligned}$$

Once the queue length is determined, auxiliary lane gap and turn lane lengths can be determined using *ADOT Traffic Engineering Policies, Guidelines, and Procedures Section 430 Turn Lane Design*.



According to ADOT policies a right turn lane should be designed with two distances: the gap length and storage length. The storage length is comprised of braking distance and queue length. A speed limit of 50 mph was utilized for calculating the braking and taper distances required along US 70. A speed limit of 35 mph was assumed to be designated on Route 193 and Route 194 after development of the New Bylas Master Planned Community.

Based on the full build-out (15<sup>th</sup> Year Projection) AM and PM peak hour traffic volumes with the project, the storage lengths were found for the warranted right and left turn lanes serving the project site. The computed value is typically rounded up to the nearest 25 feet.

**Table 16** shows the calculated queue length for the turn lanes recommended with the project including braking distance and gap lengths per criteria set forth by ADOT. Complete storage length calculations can be found in the Appendix.

**Table 16 – Recommended Turn Lane Lengths – ADOT Roadways**

Intersection	Queue	Braking Distance	Gap	Total Length	Taper
<b>US 70 / Route 193</b>					
Northbound Left Turn Lane	375	115	60	550	300
Eastbound Right Turn Lane	475	245	90	810	300
Westbound Left Turn Lane	275	245	90	610	300
<b>US 70 / Route 194</b>					
Northbound Left Turn Lane	250	115	60	425	300
Eastbound Right Turn Lane	250	245	90	585	300
Westbound Left Turn Lane	425	245	90	760	300

All Lengths in Feet and Desirable Braking Distance Calculated.

A preliminary roadway cross section for US 70 at Route 193 and Route 194 showing the left, through, and right turn lanes has been included in the Appendix.

### **Mitigation**

Five of the study area intersections are predicted to operate at an inadequate level of service at full buildout (15<sup>th</sup> Year Projection) with the project. However, it is possible to propose mitigation measures, or improvements for these intersections that will help them operate more efficiently at full buildout, with the project. Proposed mitigation strategies for the project intersections are discussed below.

Proposed mitigation strategies and the corresponding levels of service are presented in **Table 17** for the intersections of US 70/Clinic East Driveway, US 70/Ocotillo Circle, US 70/Rainbow City Circle, US 70/Route 193, and US 70/Route 194 for the peak hour at full build-out (15<sup>th</sup> Year Projection) with the project. Complete capacity calculations are included in the Appendix.



**Table 17 – 15<sup>th</sup> Year Projection Peak Hour LOS With Mitigations With Project**

Intersection	Improvement	2027 With Project							
		2027 Without Mitigation				2027 With Mitigation			
		AM Peak		PM Peak		AM Peak		PM Peak	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
US 70 and Clinic East Driveway Southbound Left Southbound Right Eastbound Left	Exclusive SB Left-turn Lane	**	**	**	**	C	15.9	C	19.3
		C*	20.8*	D*	34.9*	B	13.9	B	12.3
		A	9.2	A	8.7	A	9.2	A	8.7
US 70 and Ocotillo Circle Northbound Left Northbound Right Westbound Left/Through	Exclusive NB Left-turn Lane	**	**	**	**	C	16.6	C	20.3
		B*	14.5*	D*	27.3*	B	11.0	C	17.0
		A	8.2	A	9.8	A	8.2	A	9.8
US 70 and Rainbow City Circle Northbound Left Northbound Through/Right Southbound Left Southbound Through/Right Eastbound Left Westbound Left	Exclusive NB Left-turn Lane	**	**	**	**	C	19.3	C	23.6
		C*	24.3*	E*	45.1*	C	18.1	C	21.2
		**	**	**	**	0	18.3	0	23.4
		C*	24.2*	C*	29.6*	C	16.7	C	16.4
		A	9.2	A	8.7	A	9.2	A	8.7
		A	8.0	A	9.7	A	8.0	A	9.7
US 70 and Route 193 Northbound Left Northbound Right Eastbound Through Eastbound Right Westbound Left Westbound Through	Signalized Intersection Exclusive EB Right-turn Lane Exclusive WB Left-turn Lane Exclusive NB Left-turn Lane	F*	>120*	F*	>120*	C	23.5	C	24.6
		B	12.5	C	15.5	C	21.7	C	24.8
		A*	8.3*	B*	11.4*	B	19.1	B	18.5
		**	**	**	**	B	16.8	B	19.8
		**	**	**	**	B	14.9	B	19.7
		**	**	**	**	B	12.3	A	8.2
US 70 and Route 194 Northbound Left Northbound Through/Right Southbound Left/Through/Right Eastbound Left Eastbound Through Eastbound Right Westbound Left Westbound Through/Right	Signalized Intersection Exclusive EB Right-turn Lane Exclusive EB Left-turn Lane Exclusive WB Left-turn Lane Exclusive NB Left-turn Lane	F*	>120*	F*	>120*	C	24.6	C	26.7
		C	17.4	B	14.1	C	27.2	C	28.3
		A	9.9	F	102.9	B	18.7	C	22.5
		A*	7.8*	A*	8.3*	B	13.9	B	11.5
		**	**	**	**	C	20.1	B	15.0
		**	**	**	**	B	14.7	B	13.6
		A*	8.7*	B*	10.5*	B	18.4	C	20.3
		**	**	**	**	A	9.7	A	8.5

Delay - seconds per vehicle

\*Utilize without mitigation lane configurations

\*\*Not applicable

As shown in **Table 17**, all of the project intersections requiring mitigations are expected to operate at an adequate LOS C or better for all movements in the AM and PM peak hours at full build-out (15<sup>th</sup> Year Projection) with traffic from the project.

The intersections of US 70/Route 193 and US 70/Route 194 are expected to require traffic signal control to operate adequately at full build-out (15<sup>th</sup> Year Projection), with traffic from the project. The following intersection improvements would provide acceptable levels of service at full build-out (15<sup>th</sup> Year Projection):

- Exclusive left-turn lane at the southbound approach of US 70/Clinic East Driveway;
- Exclusive left-turn lane at the northbound approach of US 70/Ocotillo Circle;
- Exclusive left-turn lane at the northbound and southbound approaches of US 70/Rainbow City Circle;
- Exclusive left-turn lane at the northbound approach of US 70/Route 193;
- Right-turn deceleration lane at the eastbound approach of US 70/Route 193;
- Exclusive left-turn lane at the westbound approach of US 70/Route 193;



- Exclusive left-turn lane at the northbound approach of US 70/Route 194;
- Right-turn deceleration lane at the eastbound approach of US 70/Route 194; and
- Exclusive left-turn lane at the westbound approach of US 70/Route 194.

### Crash Analysis

Crash history data was obtained from ADOT for study area segments of US 70 from milepost 294 to 297. Supplied crash data is from January 2005 to January 2010. A total of three crashes were reported within the study area during this time period.

Two vehicle crashes occurred in 2005 and 2008 that resulted in pedestrian fatalities, respectively. A rear end collision occurred in 2007 resulted in an injury. The crashes in 2007 and 2008 were alcohol related. **Table 18** shows the injury severity, collision type, and vehicle violations for each crash report within the project study area segment along US 70. Crash data is included in the Appendix.

**Table 18 – Reported Crashes 2005-2010**

Year	Injury Severity				Collision Type					Vehicle 1 Violation				Total	
	Fatalities	Injuries	Property Damage Only	Unknown	Single Vehicle	Rear End	Sideswipe	Angle	Other	Inattention	Speed Too Fast	Evasive Act	Other		Unknown
2005	1	-	-	-	1	-	-	-	-	-	-	-	1	-	1
2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2007	-	1	-	-	-	1	-	-	-	-	1	-	-	-	1
2008	1	-	-	-	1	-	-	-	-	-	-	-	1	-	1
2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	2	1	-	-	2	1	-	-	-	-	1	-	2	-	3

According to the *Road Safety Assessment US 70, MP 294 to 298*, completed by ADOT in September of 2009, a total of 19 crashes were reported to ADOT between mileposts 294 and 298 along US 70 from January 1, 1999 to December 31, 2008. The *Road Safety Assessment US 70, MP 294 to 298* also noted that the San Carlos Police Department (SCPD) indicated that 46 crashes occurred in a five year span from 2004 to 2008 on this section of US 70 so it seems that most crashes in Bylas are not being reported to ADOT. A crash diagram is shown in **Figure 15**.



Figure 15 – Crash Diagram

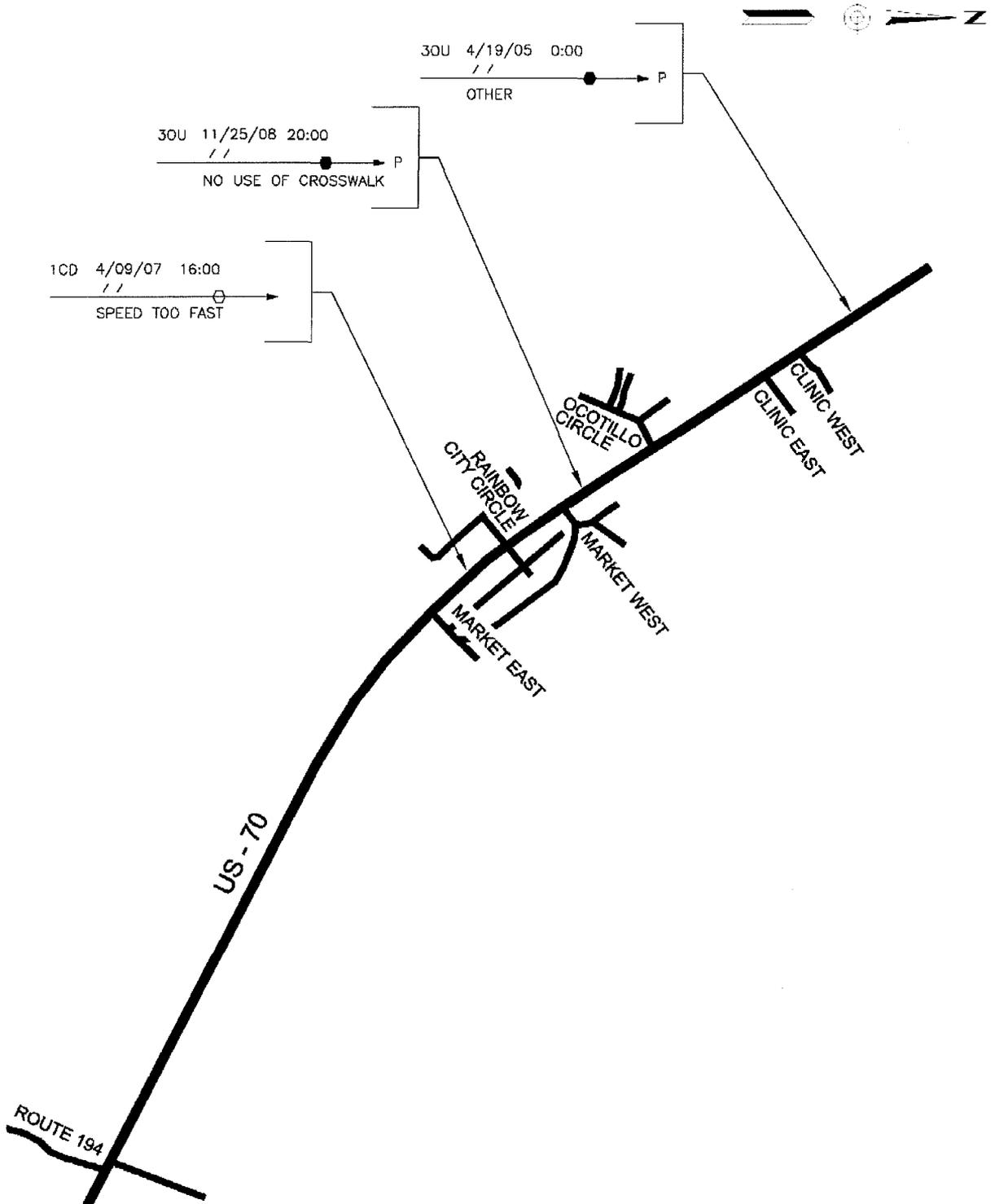
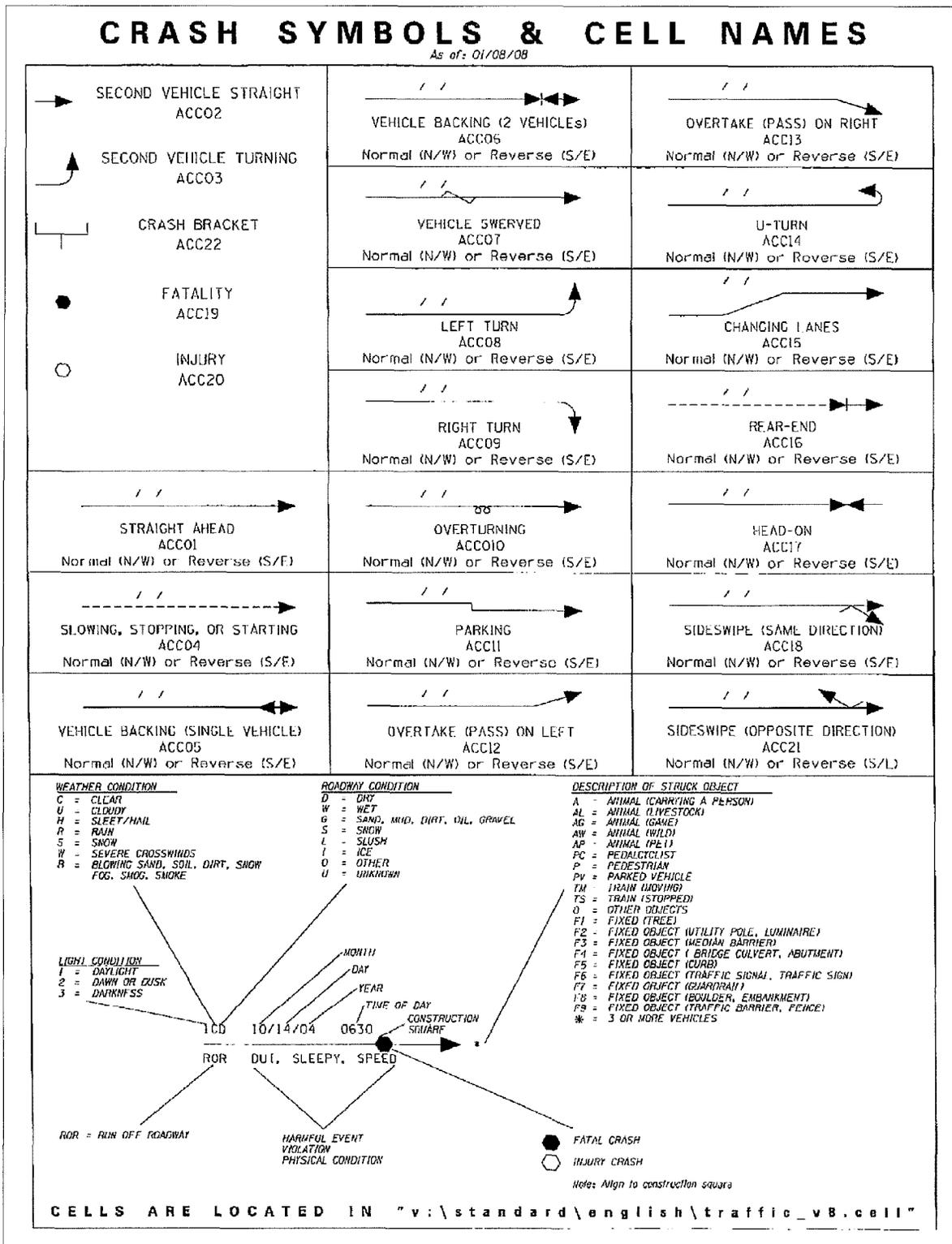




Figure 15b – Crash Diagram





## Vehicle Speed Review

A vehicle speed study was conducted along with the traffic counts for US 70 to determine how fast motorists were driving in the area. The speed counts were conducted in January of 2010. The posted speed limit along US-70 within the project area is 50 mph. As shown in **Table 19**, the speed studies revealed that motorists typically drive at speeds that average 50 to 53 MPH in the area.

**Table 19 – Existing Speed Data, US 70**

<b>Location</b>	<b>Average Speed (mph)</b>	<b>% over 50 mph</b>	<b>% over 55 mph</b>	<b>% over 60 mph</b>
<b>US 70, West of Clinic West Driveway</b>				
Eastbound (speed limit = 50 mph)	50.1	54.3	17.9	4.4
Westbound (speed limit = 50 mph)	53.3	74.6	39	14.1
Total	51.7	64.5	28.5	9.3
<b>US 70, East of Market East &amp; West of Route 194</b>				
Eastbound (speed limit = 50 mph)	53.5	75.1	37.7	14.5
Westbound (speed limit = 50 mph)	53.2	75.7	36	13.2
Total	53.4	75.4	36.9	13.9
<b>US 70, East of Route 194</b>				
Eastbound (speed limit = 50 mph)	53.9	77.8	42.8	17.3
Westbound (speed limit = 50 mph)	52.6	67.7	32.5	15
Total	53.3	72.8	37.7	16.2

mph - miles per hour

Traffic on US 70, west of Clinic West Driveway appears to be adhering to the posted speed limit with an average speed less than two mph over the posted speed limit and less than 10% of motorists exceed the speed limit by more than 10 mph.

East of Market East Driveway, vehicle speeds increase to more than three mph on average over the posted speed limit. Approximately 15% of the motorists east of Market East Driveway are exceeding the speed limit by more than 10 mph. Speeds may be higher on US 70, east of Market East Driveway because the street is clear of sight and other obstructions, and has minimal developments along this section, making drivers feel safer.

## Conclusion

When fully completed, the proposed project will generate an additional 16,826 vehicle trips per day (VTPD) on weekdays to the adjacent street system from the new development.

All of the study area intersections are anticipated to operate at adequate LOS C or better during the AM and PM peak hours in the opening year (2012), interim year (Fifth Year Projection), and full build-out (15<sup>th</sup> Year Projection) with the addition of site generated trips.



The addition of site-generated trips is predicted to affect five of the study intersections at full build-out (15<sup>th</sup> Year Projection). These intersections include; US 70/ Rainbow City Circle, US 70/Clinic East Driveway, US 70/Ocotillo Circle, US 70/Route 193 and US 70/Route 194.

The delay at these intersections is predicted to be caused by high through traffic volumes on US 70 which limit the available gaps for left turning traffic from the minor stop controlled approaches as well as only providing one lane approaches on the minor streets.

In order to determine if a traffic signal is warranted at the intersections of US 70/Route 193 and US 70/Route 194, a Traffic Signal Warrant study was completed. The intersections of US 70/Route 193 and US 70/Route 194 both meet traffic signal warrants 1 and 2 at full buildout (15<sup>th</sup> Year Projection), with the project.

Crash history data was obtained from ADOT along US 70 from milepost 294 to 297 between the months of January 2005 to January 2010. A total of three crashes were reported within the study area during this time period. Two vehicle crashes occurred in 2005 and 2008 that resulted in pedestrian fatalities, respectively. A rear end collision occurred in 2007 resulted in an injury. The crashes in 2007 and 2008 were alcohol related.

Various mitigation measures at the non-performing intersections were analyzed to determine their effectiveness in improving intersection levels of service. Several intersection improvements are recommended in order to provide acceptable levels of service at full buildout (15<sup>th</sup> Year Projection).

Recommended improvements, by project phase and year are shown below:

#### **Opening Year – 2012**

- Recommended improvements at US 70/Route 193:
  - The northbound approach should be stop controlled and provide a right-turn deceleration lane and an exclusive left-turn lane.
  - Provide eastbound right-turn deceleration lane.
  - Provide westbound left-turn lane.
- Recommended improvements at US 70/Route 194:
  - The un-named Access Road should be relocated to align with Route 194.
  - The northbound approach should be stop controlled and provide a right-turn deceleration lane and an exclusive left-turn lane
  - Provide right-turn deceleration lane on the eastbound approach.
  - Provide left-turn lane on the westbound approach.
- The study area intersections are recommended to provide the lane configurations and traffic control as shown in **EX 1**.



### **Interim Year – Fifth Year Projection**

- No additional roadway improvements are necessary in the interim year (5<sup>th</sup> Year Projection).
- The study area intersections should provide the lane configurations and traffic control as shown in **EX 2**.

### **Full Buildout – 15<sup>th</sup> Year Projection**

At time of project buildout the following improvements should be in place:

- Recommended improvements at US 70/Route 193:
  - Install a traffic signal.
- Recommended improvements at US 70/Route 194:
  - Install a traffic signal.
  - Provide left-turn lane on the eastbound approach.
- Recommended improvements at US 70/Clinic East Driveway:
  - Provide exclusive left-turn lane on the southbound approach.
- Recommended improvements at US 70/Ocotillo Circle:
  - Provide exclusive northbound left-turn lane.
- Recommended improvements at US 70/Rainbow City Circle:
  - Provide exclusive left-turn lane on the northbound approach.
  - Provide exclusive left-turn lane on the southbound approach
- The study area intersections should provide the lane configurations and traffic control as shown in **EX 3**:



**TRAFFIC IMPACT ANALYSIS  
NEW BYLAS – PLANNED AREA DEVELOPMENT  
US 70/ROUTE 193 – BYLAS, ARIZONA**

**APPENDIX (Provided on CD)**

**Traffic Counts**

**Trip Generation Calculations**

**Trip Distribution**

**Traffic Growth Calculations**

**Capacity Calculations**

**Traffic Signal Warrant Analysis**

**Turn Lane Analysis**

**Crash Data**

**Roadway Cross Section**