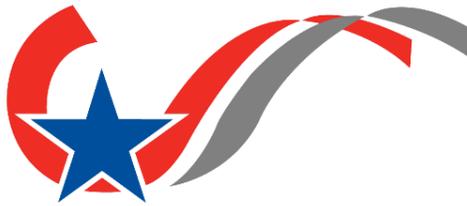


# Capstone Drive and Barron Road Realignment Preliminary Engineering Report

Prepared for



CITY OF COLLEGE STATION

July 2016



*Eric J. Ratzman* 7/6/2016

Information in this report is preliminary and intended for design development, not for construction.

## TABLE OF CONTENTS

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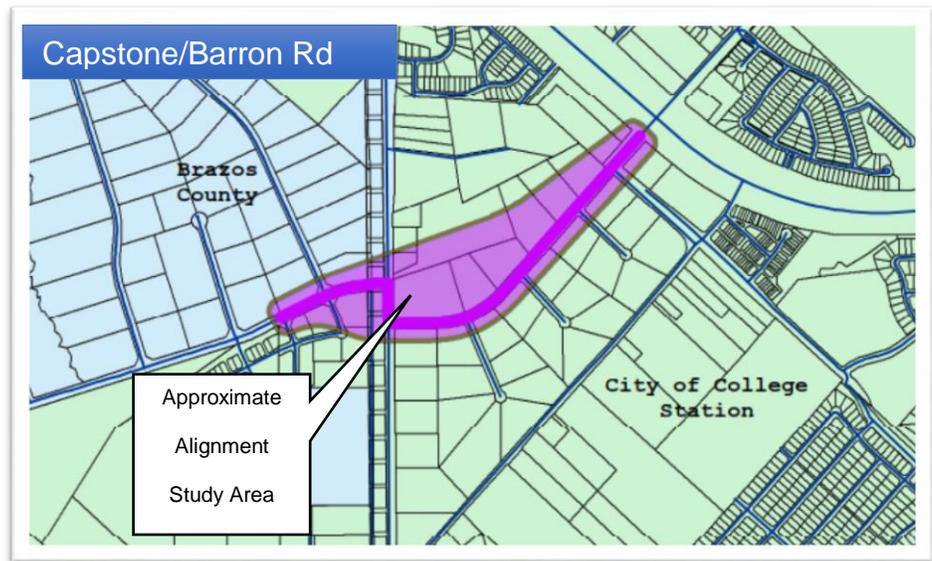
1. EXECUTIVE SUMMARY.....	1
2. INTRODUCTION.....	2
2.1 Purpose and Need.....	2
2.2 Project Corridor Description.....	4
3. EXISTING CORRIDOR CONDITIONS.....	4
3.1 Right-of-Way & Roadway.....	4
3.2 Railroad Crossing .....	5
3.3 Utilities .....	5
3.4 Drainage .....	5
3.5 Traffic & Signal Warrant Study.....	6
4. PROPOSED ROADWAY ALTERNATIVES.....	7
4.0 Design Analysis .....	7
4.1 Alternative 1.....	9
4.2 Alternative 2.....	10
4.3 Alternative 3.....	10
4.4 Alternative 4.....	11
4.5 Alternative 5.....	11
4.6 Alternative 6.....	12
5. PUBLIC INVOLVEMENT PROCESS .....	12

6. CONCLUSION .....	14
6.1 Evaluation of Alternatives .....	14
6.2 Recommendation.....	16
Appendix A Alternatives	
Appendix B Typical Sections	
Appendix C Traffic Study	
Appendix D Public Involvement Comments	
Appendix E Preliminary Cost Estimate	
Appendix F Evaluation Criteria	
Table 1 Crash Summary .....	6
Table 2 Evaluation Matrix.....	15
Table 3 Weighted Scoring of Alternatives .....	15

## 1. EXECUTIVE SUMMARY

Half Associates Inc. was selected by the City of College Station to provide professional services for the preliminary engineering and alignment study of Capstone Drive and Barron Road. This report evaluates roadway alternatives to align the intersection of Capstone Drive & Barron Road at Wellborn Road (FM 2154) into

one four way intersection while widening Barron Road to accommodate future



population growth. The objective of this study is to provide documented analysis and recommendations to aid the city of College Station in determining the most desirable alignment alternative to accommodate future traffic volumes in a safe and efficient manner, while remaining sensitive to the desires of the community, and being cost effective. A traffic study & warrant analysis was conducted to plan for a future traffic signal at the intersection of Wellborn Road. A primary goal of the study is to determine if Barron Road should be realigned to meet at the intersection of Capstone Drive & Wellborn Road or if Capstone Drive should

be realigned to meet at the intersection of Barron Road and Wellborn Road. The conclusion and recommended actions from this study are contained in Section 6.

## 2. INTRODUCTION

### **2.1 Purpose and Need**

Based previous population data, the city of College Station is expected to see a population growth of roughly 50% by 2030. In addition to that, College Station Independent School District recently opened Spring Creek Elementary School and is planning on opening two more schools to account for the expected future growth. As the population in the area grows it is appropriate and necessary to expand Barron Road to accommodate the future needs of the community.

As traffic on highways within the city increases, the connectivity to arterial roads becomes necessary to accommodate larger volumes of motorists. The widening of Barron Road was identified in the city's Master Thoroughfare plan as a target project that will improve both connectivity and mobility based on other improvements within the area. Though not intended to show an exact alignment (actual alignments may vary by as much as 1000 feet from the alignments shown), the Master Thoroughfare Plan (adopted in May 2009 and updated in December 2015) does show a realignment to connect Barron Road with Capstone Drive at a single intersection at Wellborn Road.

As presently constructed, the intersections are spaced approximately 350 feet apart. Their relatively close spacing is a critical issue that needs to be addressed in this project.

The TxDOT Roadway Design Manual specifies in table 3-3 that the minimum left turn deceleration lane length for vehicles traveling 55mph, coming to a complete stop, is 510 feet with a minimum storage length of 100 feet. To accommodate the simultaneous left turn movements in both directions, the two-way left-turn lane would require a total length of 1220 feet (significantly more than the existing 350 feet between intersections).

Drivers traveling west on Barron Road wanting to continue west on Capstone have to make a right turn onto Wellborn Road and then weave over to the left turn lane to Capstone Drive (waiting for breaks first in northbound traffic and then in the southbound traffic). A similar but opposite movement is needed when traveling east on Capstone Drive and the driver wants to continue east on Barron Road. Not only can these movements be dangerous but they also can result in delayed travel times.

The safety aspect could be improved by simply adding signals. However, analysis of signals spaced less than  $\frac{1}{4}$  of a mile apart have shown that they are inefficient, (per the TxDOT Access Management Manual page 1-8) the result would be reduced capacity and therefore increased delay time, even when the signals are synchronized. Aligning the intersections will much improve the traffic operation and capacity of the east/west movement, increasing mobility in the area.

By aligning the intersections of Capstone Drive and Barron Road at Wellborn Road, into a single signalized intersection, safety and efficiency are expected to improve substantially.

In addition to introducing a traffic signal at the intersection, medians and improved illumination along Barron Road will provide an added level of safety to all modes of transportation. Curb & Gutter along the edge of the roadway will provide protection to pedestrians who currently have no safe path along the roadway. Dedicated on-street bicycle lanes would improve bicyclist comfort and safety throughout the corridor. Refer to Appendix B for a detailed drawing of the typical sections proposed for the project.

## **2.2 Project Corridor Description**

The portion of Barron Road/Capstone Drive is approximately 4500 feet long from William D. Fitch Parkway (SH 40) to Apricot Glen (west of Wellborn Road) and located partially in Brazos County (west of the railroad) and the City of College Station (from the railroad to William D. Fitch Parkway). The Barron Road Corridor crosses Wellborn Road (FM 2154) which is part of the TxDOT Roadway System and is designated on the National Highway System (NHS) as a principal arterial. The Barron Road corridor consists of mainly rural zoning adjacent to the Right-of-Way and commercial zones along intersecting roads.

## **3. EXISTING CORRIDOR CONDITIONS**

### **3.1 Right-of-Way & Roadway**

Barron Road is currently constructed as a two-lane road with no shoulder. The plats provided by the city indicate that the existing right-of-way along Barron Road is 100 feet and 80 feet along Capstone Drive. Geotechnical services for pavement quality and subsurface investigations for this phase of the project but will be performed in the preliminary design phase. The intersections of both

Barron Road & Capstone Drive with Wellborn Road are stop controlled in the east and west directions, and are spaced approximately 350 feet apart.

### **3.2 Railroad Crossing**

There is a railroad crossing belonging to the Union Pacific Rail Road (U.P.R.R.) that crosses Capstone Drive immediately west of the intersection with Wellborn Road. This track is a mainline of the U.P.R.R. and has signals and gates for one lane in each direction of Capstone Drive at the existing crossing. For a replacing and potentially relocating the railroad crossing, approval must be obtained from the U.P.R.R.

### **3.3 Utilities**

There are utilities along the project corridor that may need to be relocated if the roadway is to be expanded. Utilities include a petroleum pipeline of an unknown diameter crossing Barron Road, and overhead power transmission lines on the southern border of Barron Road & along Wellborn Road. Existing utility plans have been provided by the City of College Station identifying the types and locations water and sewer lines. An 18 inch water main is located along Barron Road on the northern border which connects to 6 inch water lines on Buckingham Circle, Picadilly Circle, and Wimbledon Circle.

### **3.4 Drainage**

The total area of the study is approximately 52.5 acres. No portion of the site is show in the 100-year flood plain according to the Federal Emergency Management Agency (FEMA). According to the United States Geological Survey (USGS) topographic map, storm water travels northwest to southeast

across the Barron Road Section of the project, and the western portion of the project limits conveys storm water to Peach Creek. Visual inspection of the road identified two active storm water drains crossing underneath Barron Road and one crossing underneath Capstone Drive. These crossings will be evaluated in more detail during the design phase. It is presumed that these culverts would have to be constructed for any of the alignments so they do not substantially differ in cost or affect alternative analysis.

### **3.5 Traffic & Signal Warrant Study**

From the Transportation Chapter (amended December 2015) of the Comprehensive Plan, the existing traffic volumes on Barron Rd are in the 5,001-15,000 ADT range with an “Acceptable” level of service, but are projected to increase to the 15,001-25,000 ADT range by 2035 so the widening of Barron Rd (currently two lanes) to four lanes (classified as 4 lane minor arterial in the MTP) is needed to maintain an “Acceptable” level of service in 2035.

The existing traffic conditions at the intersection of Barron Road and Capstone Drive with Wellborn Road are described in a study prepared by Brown & Gay Engineers and are presented in Appendix C. The report details the traffic movements and determined that a traffic signal is warranted at this intersection.

The traffic signal meets warrant numbers 1, 2, and 9 in the 2019 calendar year and will require pre-emption due to the adjacent railroad crossing. **Table 1** summarizes a collision diagram that covers all reported crashes within the intersection over the past 3 years which can be found in Appendix C.

### **Table 1 Crash Summary**

	DATE	TIME	CONDITION	NOTES	SEVERITY
1	2/11/2013	6:20 PM	CLOUDY, WET, DARK, LIGHTED	FAILED TO YIELD ROW - TURNING LEFT	1
2	3/5/2013	4:25 PM	CLOUDY, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	3
3	10/4/2013	1:28 PM	CLEAR, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	2
4	2/16/2014	12:46 PM	CLOUDY, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	2
5	2/10/2015	1:25 PM	CLEAR, DRY, DAYLIGHT	SPEEDING, REAR END	1
6	2/12/2015	8:52 PM	CLOUDY, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	3
7	4/17/2015	11:17 PM	RAIN, WET, NOT LIGHTED	SPEEDING, HYROPLANED OFF ROAD TURNING RIGHT	1
8	4/24/2015	6:33 PM	CLOUDY, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	1
9	7/9/2015	6:31 PM	CLEAR, DRY, DAYLIGHT	UNSAFE LANE CHANGE	1
10	10/12/2015	5:48 PM	CLEAR, DRY, DAYLIGHT	FAILED TO YIELD ROW - TURNING LEFT	3
11	10/16/2015	10:25 PM	CLEAR, DRY, DARK, LIGHTED	FAILED TO YIELD ROW - TURNING LEFT	2
Severity is measured by the following: 1=No Injury, 2=Minor Injury, 3=Major Injury,4=Fatality					

#### 4. PROPOSED ROADWAY ALTERNATIVES

##### 4.0 Design Analysis

As part of the study process, a public meeting was held on March 23, 2016 to gather public input on the alternatives, and a second meeting was held on June 28, 2016 to report on the alternatives evaluated and our recommendations. The major issue with the existing intersections at Wellborn Road is that they are offset and un-signalized which leads to traffic hazards and inefficiencies. A primary goal of the study is to determine if Barron Road should be realigned to meet at the intersection of Capstone Drive & Wellborn Road or if Capstone Drive should be realigned to meet at the intersection of Barron Road and Wellborn Road. A

total of six alternatives have been evaluated for the realignment of Capstone Drive and Barron Road. These alternatives all propose aligning Capstone Drive, Barron Road, and Wellborn Road into a single signalized intersection. The signalization of the intersection provides an added level of safety for vehicles in every direction especially during peak traffic times. Further traffic signal analysis can be found in Appendix C.

The typical cross section of Barron Road from William D. Fitch Parkway to the railroad crossing near Wellborn Road is proposed to be a four (4) lane minor arterial street section with on-street bicycle facilities and sidewalks per the City of College Station Thoroughfare Plan (2015) in accordance with the Transportation Chapter of the Comprehensive Plan (2015).

Raised medians are shown in the cross section in accordance with the typical four lane minor arterial section. However, based on the fact that the current land use is mainly comprised of residential homesteads, a flush median may serve to be the more effective option as this would provide access to residential driveways. A number of residents expressed concern at the June 28, 2016 open house regarding a raised median-they expressed concern/disapproval of a raised median due to the restriction of access to driveways and the need to get horse trailers in/out of properties (trailers would not be able to make U-turns, required by a raised median). Further analysis will need to be conducted during the schematic phase to determine the most appropriate median design and location of median breaks (for raised medians).

There is an existing deceleration and dedicated right-turn lane for southbound Wellborn Road. This lane is proposed to remain in operation. There is not an existing deceleration and dedicated right turn lane for northbound Wellborn Road but one is proposed/recommended with this project if funding allows. Widening wellborn in order to provide dedicated left turn lanes is also proposed.

The existing at-grade railroad crossing will be replaced and potentially relocated based on the location of the alignment selected. The new railroad crossing will provide for four travel lanes plus turn lanes across the railroad allowing more vehicles through the intersection. The crossing will also be upgraded to meet the minimum safety requirements for a quiet zone. The section will then transition back into the existing rural collector section west of the railroad tracks.

Based on geotechnical bores and pavement design for an adjacent section of Barron Road, the proposed pavement section is anticipated to be a concrete pavement on a lime treated subgrade.

#### **4.1 Alternative 1**

Alternative 1 follows the existing alignment of Barron Road and realigns Capstone Drive on the west side of Wellborn Road to tie in at the existing location of the intersection of Barron Road and Wellborn Road. As presently constructed, the alignment of Barron Road has a curve with a radius of approximately 800 feet which is currently super elevated and will require super elevation in the final condition if not realigned using a larger radius (requiring additional right-of-way on the north side). It is the recommendation of the city to

keep the new roadway within the existing right-of-way so as to avoid having to acquire small slivers of right-of-way from multiple properties.

The alignment will intersect with Wellborn Road at a 90° crossing east of the U.P.R.R. tracks, which is better than options 3 and 5, which have a slight skew- The Texas Department of Transportation prefers a perpendicular crossing as opposed to a skewed crossing, as per page 3-48 in the TxDOT Roadway Design Manual, so TxDOT will require a 90° intersection (or as close to 90° as feasible) for a road crossing a principle arterial under their jurisdiction. The road will continue west of the railroad tracks on the new alignment and then transition into the existing rural collector section. The roadway then has a reverse curve with radii of 1000 feet so as not to require super elevation. The affected parcels west of Wellborn Road are as follows: 02, 03, 04, and 05.

#### **4.2 Alternative 2**

Alternative 2 is a variation of alternative 1 except that west of Wellborn Road, it is aligned straight and then ties back into the existing Capstone Drive alignment with a single horizontal curve with a 1000 foot radius. Though this alignment looks cleaner on paper than alternative 1, it adversely affects additional parcels and would require additional infrastructure costs to reconstruct the cul-de-sac at Treeline Drive. The affected parcels are as follows: 02, 03, 04, and 05.

#### **4.3 Alternative 3**

In alternative 3, the Barron Road is realigned to provide the shortest route to the intersection of Capstone Drive at Wellborn Road. This alternative will widen the road to coincide with the updated thoroughfare plan's minor arterial section. The

minor arterial section will continue past the railroad crossing and then transition back into the existing rural collector section. An issue with this alignment is that it crosses Wellborn Road and the railroad crossing at a slight skew, which is not a preferred result as per the TxDOT roadway design manual. This alignment requires right-of-way acquisition from and adversely affects the following parcels: 18, 19, 20, and 21 including full acquisition and removal of the home on parcel 19.

#### **4.4 Alternative 4**

Alternative 4 also realigns Barron Road, but is oriented further north to maximize the use of parcel number 22 for right-of-way based on that property owner's willingness to donate the right-of-way to the city. All curves on this alignment have a radius of 1000 feet so as to not require super elevation. The alignment will then transition into a perpendicular crossing with the railroad. The full four lane major arterial cross section with turn lanes will be constructed from the eastern section of the project and across the railroad tracks where, it will then transition back to the existing rural collector section. The Capstone Drive alignment will then transition into the existing section with a reverse curve with radii of 1000 feet. The affected parcels west of Wellborn Road will include parcel numbers 23, 26, and 29.

#### **4.5 Alternative 5**

Alternative 5 is a variation of alternative 4; it realigns Barron Road in an attempt to utilize as much of the donated right-of-way on Parcel number 22 but then tie into the at-grade railroad crossing at a slight skew equivalent to the skew at the

existing crossing which is estimated to be less than 10°. All of the curves in this alternative are 1000 feet and will not require super elevation. The alignment will then continue past the railroad crossing, tying into the existing alignment of Capstone Drive as to limit the amount of reconstruction and property acquisition west of Wellborn Road. The alignment will impact the following parcels: 17, 18, 19, 20, 21, 22, and 26.

#### **4.6 Alternative 6**

Alternative 6 follows the existing Barron Road alignment for a longer distance, in an effort to limit the number of affected properties. The alignment then transitions into a reverse curve with radii of 675 feet, requiring a super elevation of 6%, and ties into the at-grade railroad crossing. The alignment will then come to a perpendicular crossing with Wellborn Road and cross the railroad tracks. As in the other alternatives proposed, the road will be widened to accommodate the functional classification of minor arterial from the eastern portion of the project and past the railroad crossing. The section will then transition back into the existing rural collector section while maintaining the current Capstone Drive alignment. This alignment will impact on the following parcels: 19, 20, and 21.

### **5. PUBLIC INVOLVEMENT PROCESS**

A public open house was conducted at the Spring Creek Elementary cafeteria on Wednesday, March 23, 2016 and at the Wellborn Community Center on June 28, 2016 to inform the community about the planned project and to gather input and comments regarding which alignment would best serve the community.

Invitations were mailed to all properties within the project study area.

Written comments were received and city project manager offered to take comments via email or phone. A sign-in sheet was provided for attendees to add their name and email address, to indicate their attendance at the meeting and to get on the city's list of people to receive email updates as the project progresses.

In general, the community is in favor of a project to align the intersections and construct a traffic signal, but their support for the project depends entirely upon the location of the roadway alignments. Two property owners were in favor of realigning Barron Road along a northern alignment and one property owner offered to donate right-of-way to the city for the project, so these alignments were evaluated in the study. However, the large majority of attendees were highly opposed to the realignment of Barron Road.

Many of them acknowledged the need to widen the roadway for safety and anticipated increases in traffic volumes, but would only be in favor of a project along the existing alignment of Barron Road. At least one property owner said she expected to lose a narrow strip of frontage to serve as ROW along the existing alignment of Barron, but was adamantly opposed to a new alignment cutting through/across her property.

A concern of those residing along Barron Road is the limited access that comes from a raised median. If direct access to those properties is obstructed, the driver will need to either make a U-turn or change their route to properly access their property. Other property owners had concerns that ranged from maintaining driveway access to preservation of the large tree on the north side of Barron Road just east of Wellborn Road.

## 6. CONCLUSION

Traffic studies have shown an increasing trend in traffic accidents at the intersection of Capstone Drive and Wellborn Road and if left in the current configuration, with the increasing population, will only continue to increase. So leaving both roadways in their existing configuration, with two offset intersections at Wellborn Road, does not achieve the purpose and need of the project, so one of the six re-alignment alternatives should be advanced (the existing configuration was evaluated in our matrix and scored lower than all six alternatives).

A primary impact identified in this study is with respect to the community and affected land owners. Comments gathered from the public meeting have shown that there is support for the project and a strong desire by a large majority of citizens to keep the current alignment of Barron Road intact (see Appendix D for copies of the written public comments received).

### **6.1 Evaluation of Alternatives**

Six proposed alternatives, were evaluated using an evaluation matrix as shown in **Table 2**. The scoring is based on a rubric for each evaluation metric, which can be found in Appendix F.

**Table 2 Evaluation Matrix**

Evaluation Criteria		Existing**	Alignment Alternatives					
			1	2	3	4	5	6
A.	Improve Safety	--	++	++	++	++	++	++
B.	Improve Mobility	--	++	++	++	++	++	++
C.	Right of Way Impacts	++	+	0	--	-	-	--
D.	Public Comments	-	+	+	--	--	--	--
E.	Construction Cost	++	-	-	+	+	+	0
F.	Right of Way Cost*	++	++	++	--	--	+	0
G.	Long Term PVMT Maintenance	0	++	++	--	--	0	0

(-- Major Negative Effect, - Minor Negative Effect, 0 Neutral/No Effect, + Minor Positive Effect, ++ Major Positive Effect)

\* Right of Way Cost provided by the City of College Station

\*\* If roadways are rebuilt on existing alignment and offset intersections left in place

Numerical Scores were then applied to the evaluation matrix for the alternatives based on project goals and community priorities with the results of the scoring presented in **Table 3** below with higher scores indicating more favorable alternatives and lower scores indicating less favorable alternatives.

**Table 3 Weighted Scoring of Alternatives**

<u>CRITERIA</u>		<u>WEIGHTING</u>	<u>Scoring</u>						
			<u>ALTERNATIVES</u>						
			Existing	1	2	3	4	5	6
A.	Improve Safety	4	-8	8	8	8	8	8	8
B.	Improve Mobility	3	-6	6	6	6	6	6	6
C.	Right of Way Impacts	3	6	3	0	-6	-3	-3	-6
D.	Public Comments	3	-3	3	3	-6	-6	-6	-6
E.	Construction Cost	2	4	-2	-2	2	2	2	0
F.	Right of Way Cost	2	4	4	4	-4	-4	2	0
G.	Pavement Maintenance	1	0	2	2	-2	-2	0	0
<b>TOTAL:</b>			<b>-3</b>	<b>24</b>	<b>21</b>	<b>-2</b>	<b>1</b>	<b>9</b>	<b>2</b>

## **6.2 Recommendation**

Alternatives 1 & 2, are alignments that follow the existing Barron Road alignment from William D. Fitch Parkway to Wellborn Road and then realign Capstone Drive from the railroad to approximately 1400 feet west before tying back to the existing roadway. They are the highest scoring alternatives based on the multiple considerations evaluated in the evaluation matrix. Therefore, Halff recommends for the city to proceed with the project development of some form of either alternative alignment 1 or 2. The proposed four lanes increase mobility for future users and provides an enhanced level of service over the existing two lane road. The re-alignment into a signalized intersection along with a proposed median on Barron Road increases the safety for all users traveling through the corridor. The engineer's opinion of probable total project cost (construction, engineering, right-of-way acquisition, and utility relocation) is \$6,200,000.

The next step for improving the Barron Road/Capstone Drive corridor is to develop a roadway design schematic for the selected alternative. The city would like to begin construction of a project by 2018 note, the schedule of improvements is subject to outside agency reviews, approval, and the availability of funding. It is recommended allotting at least a year to coordinate approval from the Union Pacific Rail Road. The next phase in the project will require a more in depth analysis of drainage, environmental and utility impacts. Once an alignment is selected by the City of College Station, project development can continue with a schematic design to be prepared to begin the approval review process with TxDOT, U.P.R.R., and Brazos County.

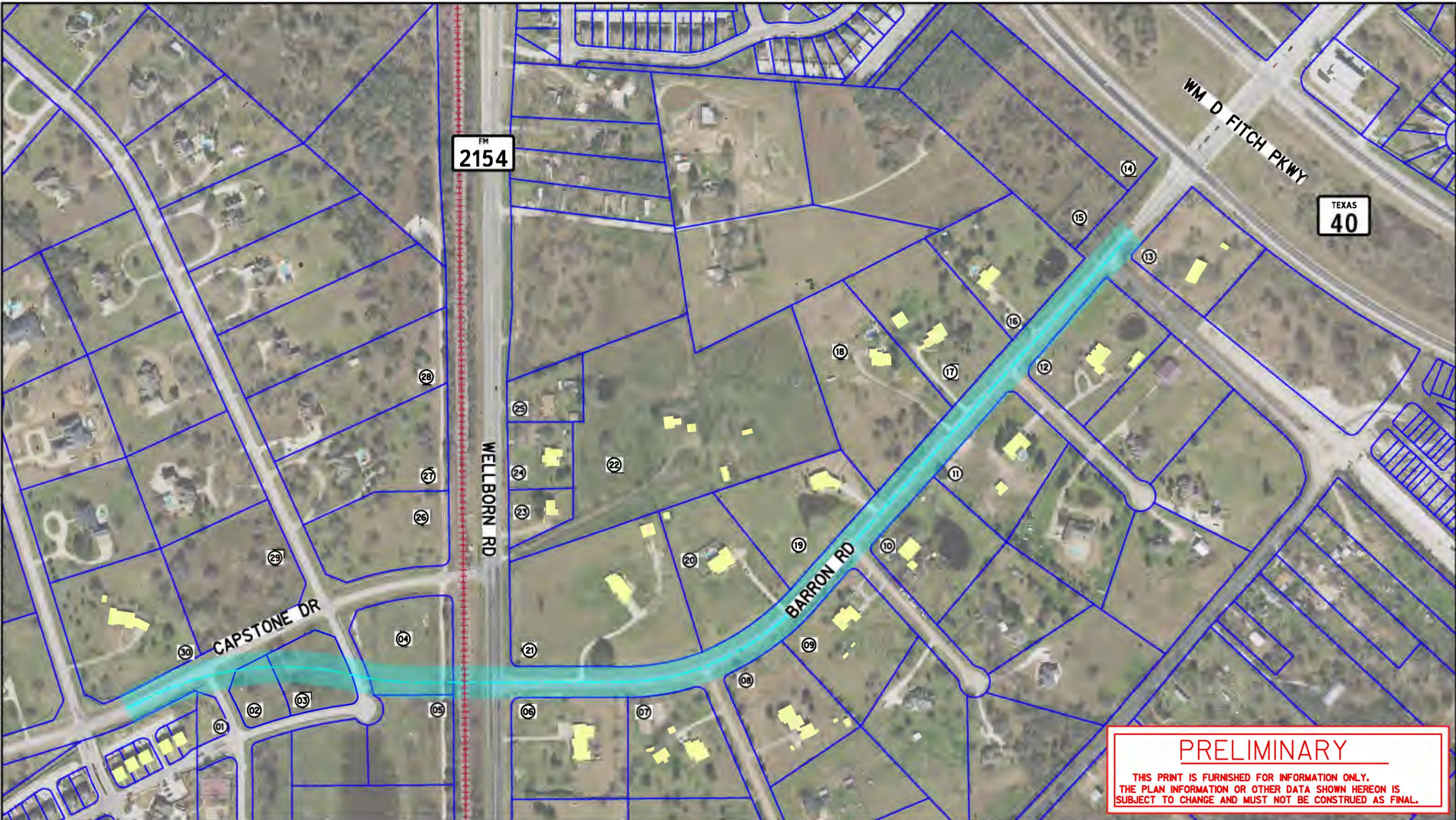
# Appendix A Alternatives

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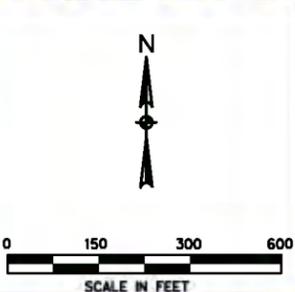
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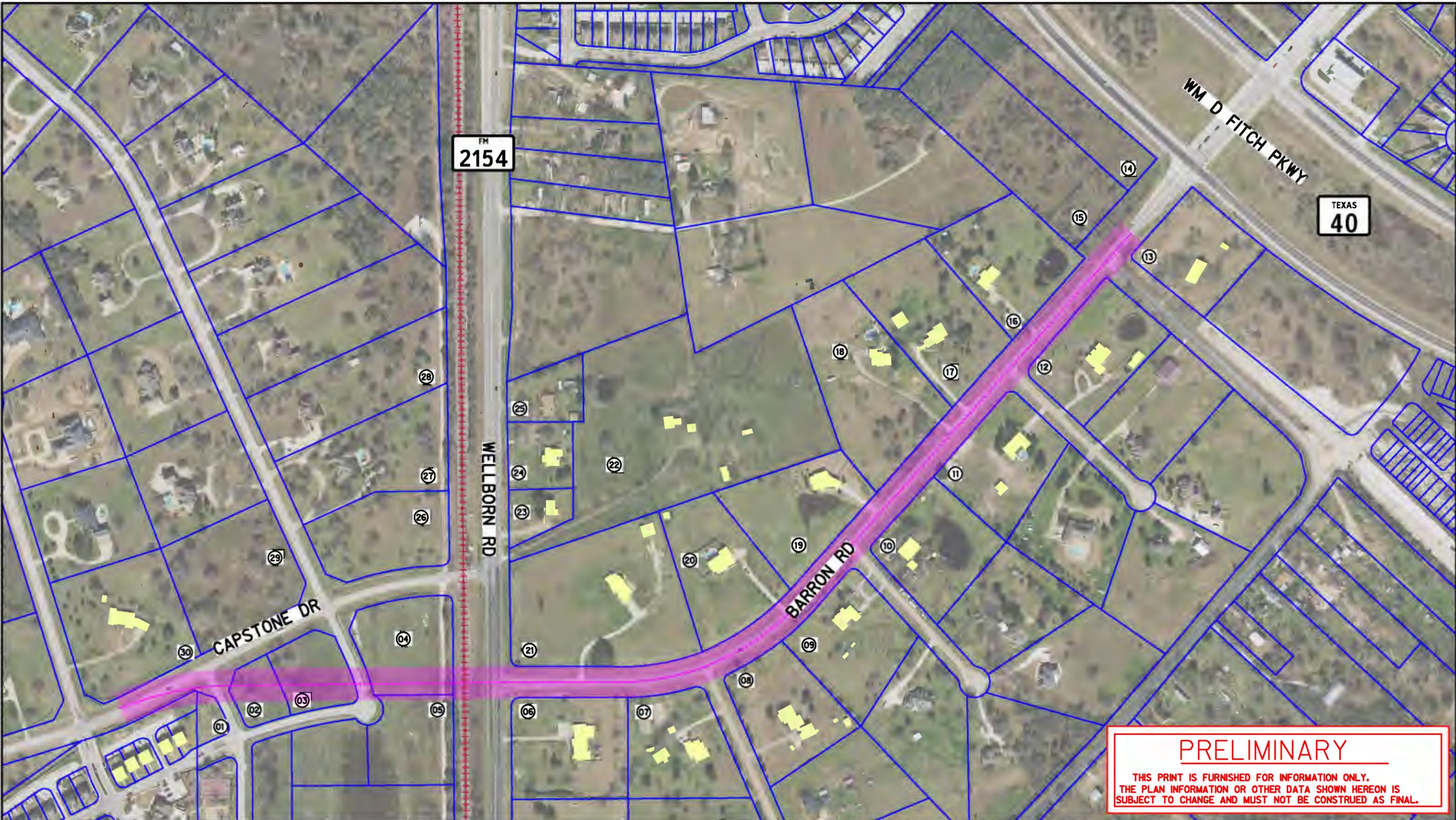


- LEGEND**
- EXISTING PROPERTY LINE
  - EXISTING R.O.W.
  - EXISTING STRUCTURE
  - ++++ U.P.R.R. LINE

# ALTERNATIVE 1

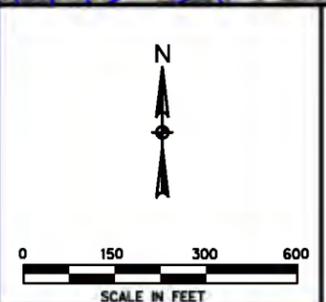


**BARRON RD / CAPSTONE DR**  
 From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
**ALTERNATIVES**



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**LEGEND**

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- EXISTING R.O.W.
- EXISTING STRUCTURE
- ++++ U.P.R.R. LINE

# ALTERNATIVE 2

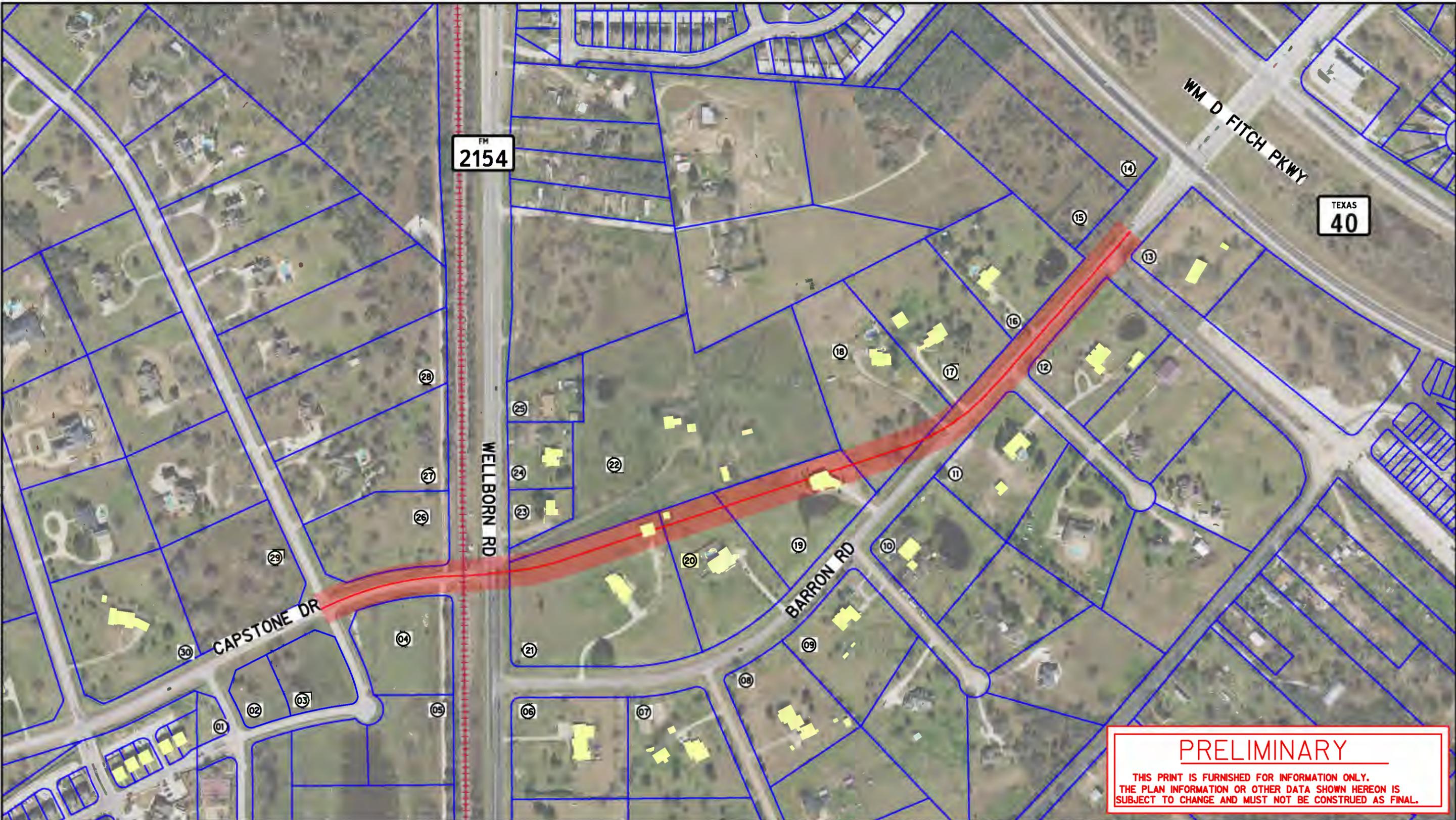


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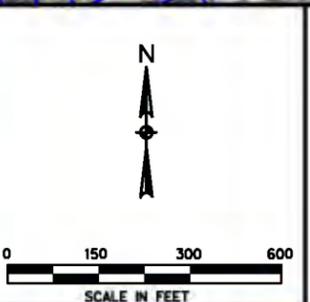
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**ALTERNATIVES**

SHEET 1/1
DATE: JULY 28, 2016



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- EXISTING STRUCTURE
- ++++ U.P.R.R. LINE

# ALTERNATIVE 3

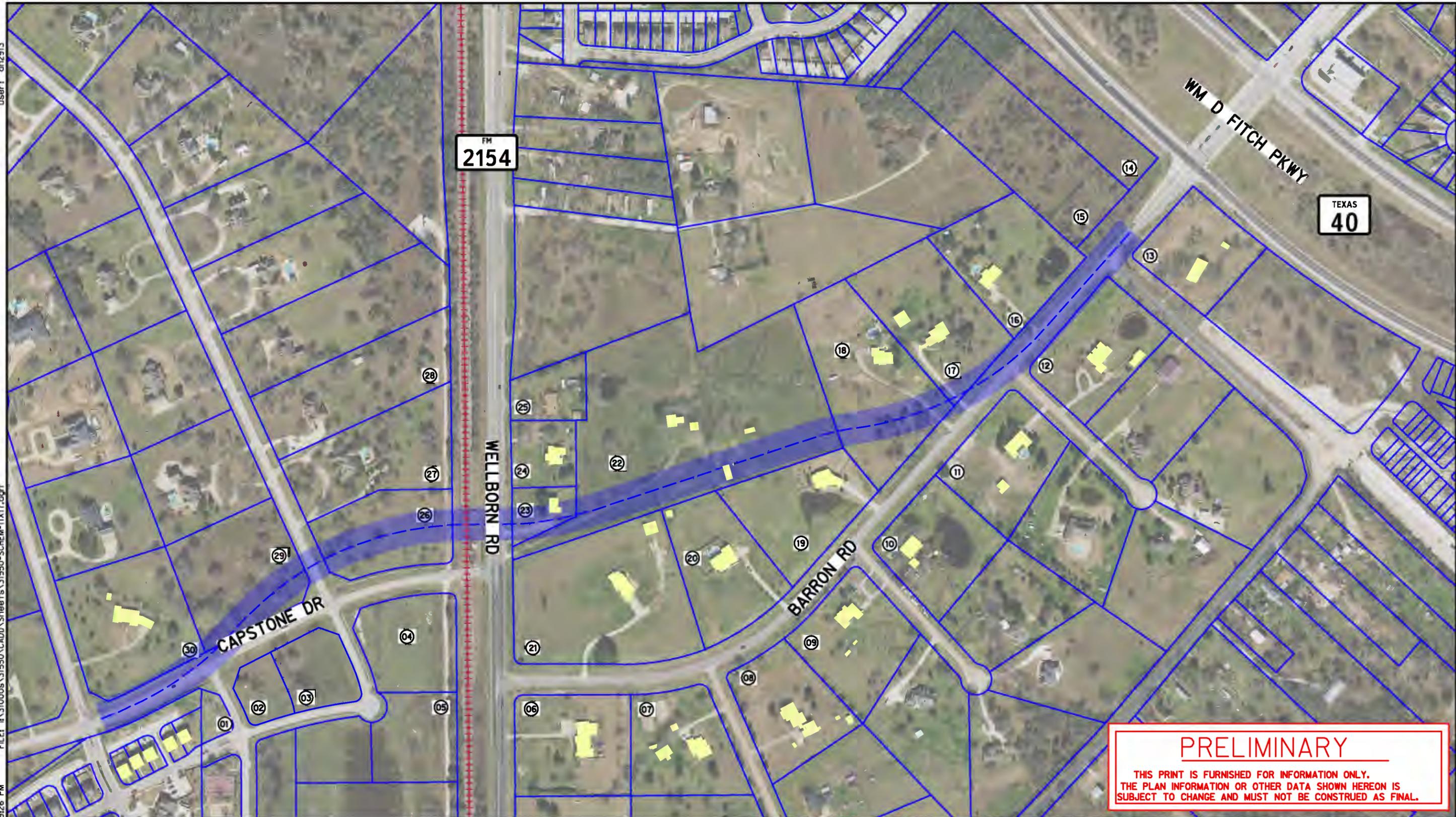


CITY OF COLLEGE STATION

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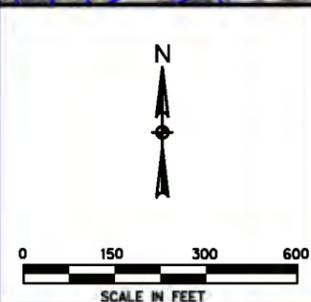
**BARRON RD / CAPSTONE DR**  
 From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
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SHEET 1/1
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**LEGEND**

- EXISTING PROPERTY LINE
- EXISTING R.O.W.
- EXISTING STRUCTURE
- ++++ U.P.R.R. LINE

# ALTERNATIVE 4

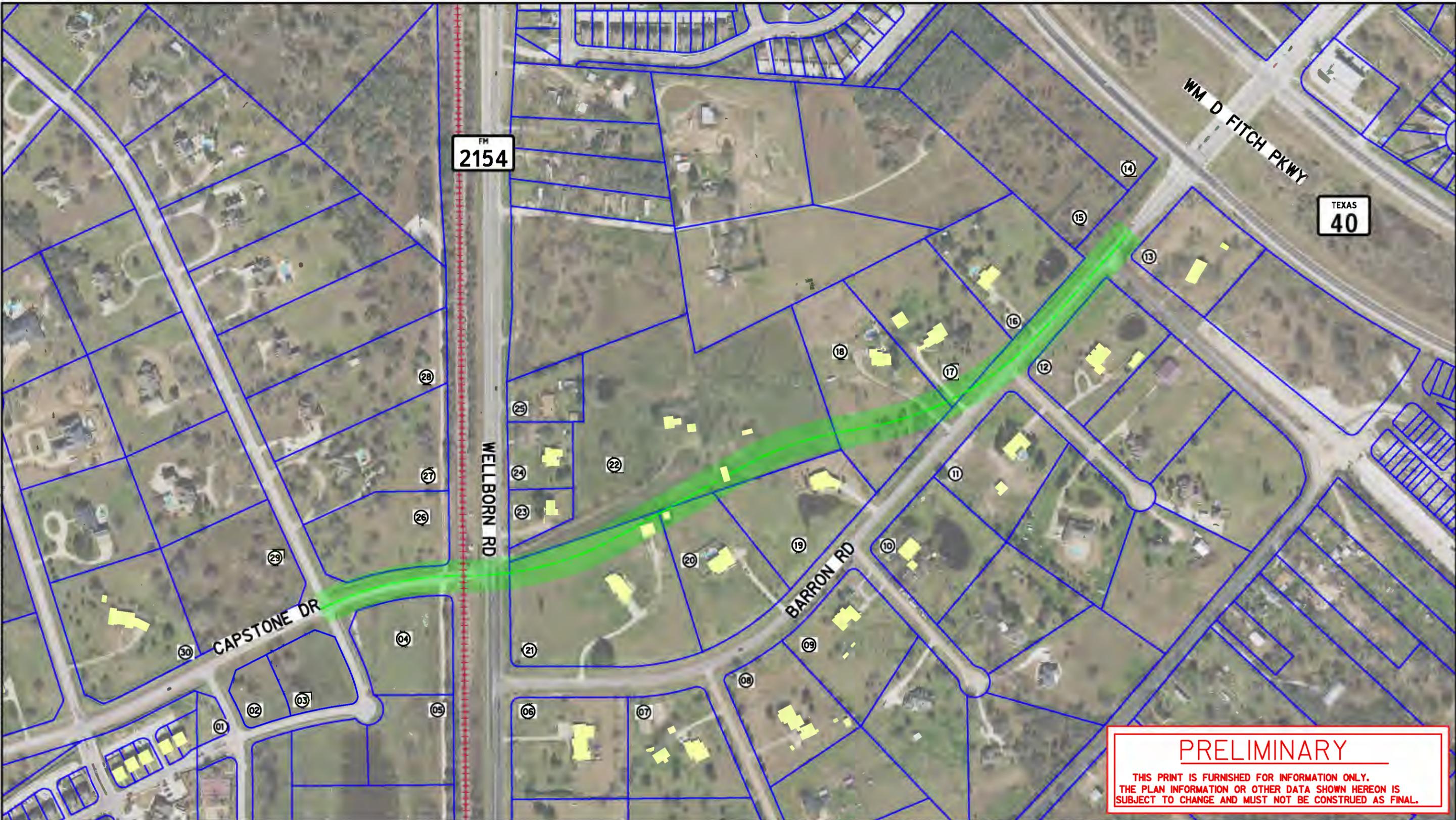


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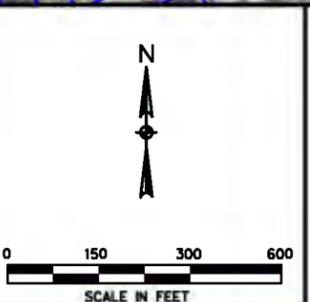
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**ALTERNATIVES**

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DATE: JULY 28, 2016



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**LEGEND**

- EXISTING PROPERTY LINE
- EXISTING R.O.W.
- EXISTING STRUCTURE
- ++++ U.P.R.R. LINE

# ALTERNATIVE 5

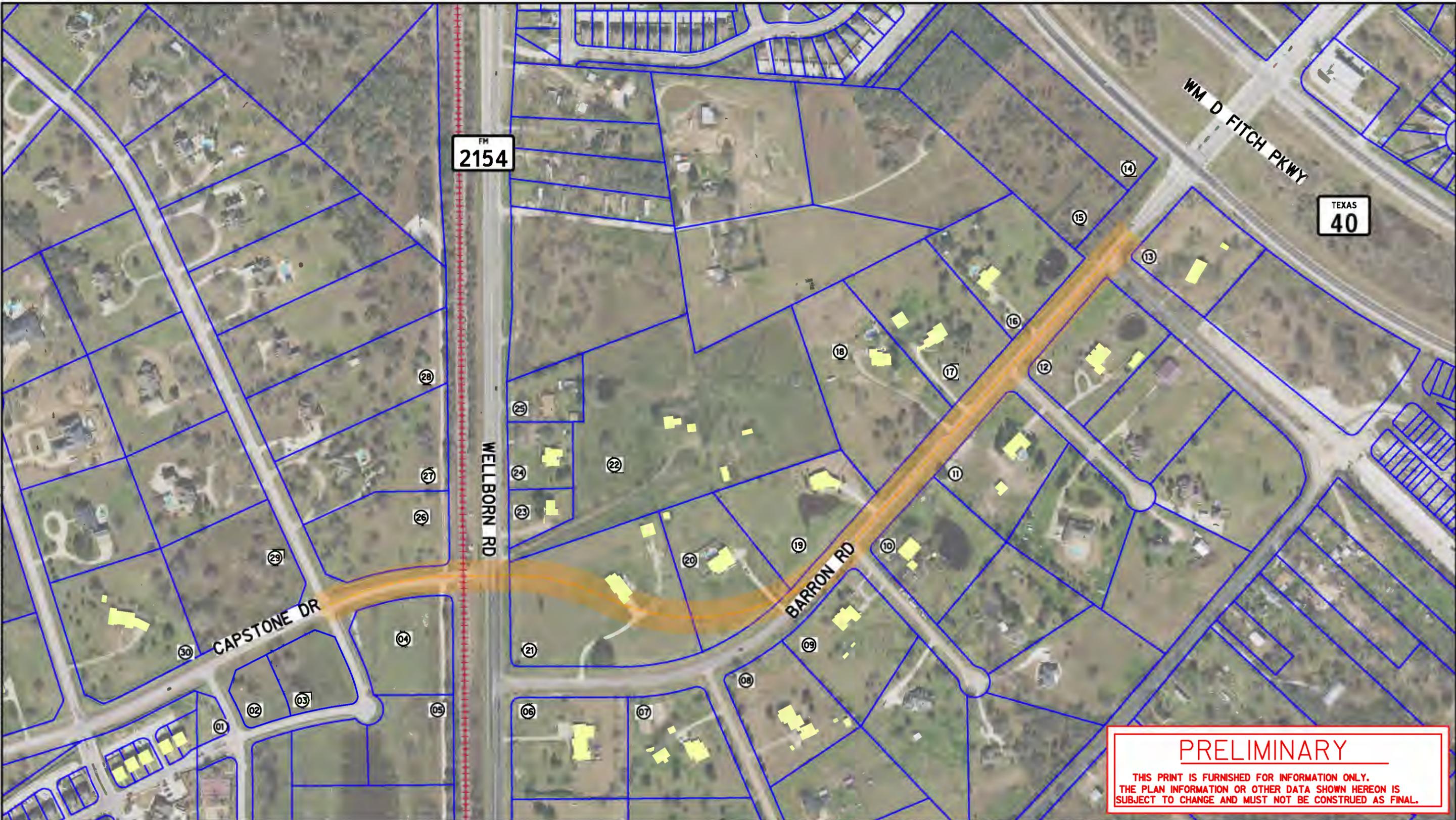


CITY OF COLLEGE STATION

HALFF  
TYPE FIRM #912

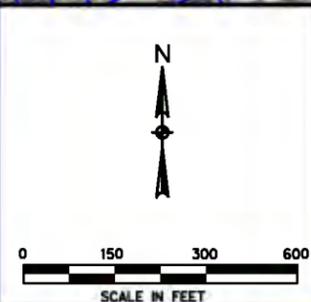
**BARRON RD / CAPSTONE DR**  
 From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
**ALTERNATIVES**

SHEET 1/1
DATE: JULY 28, 2016



**PRELIMINARY**

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- LEGEND**
- EXISTING PROPERTY LINE
  - EXISTING R.O.W.
  - EXISTING STRUCTURE
  - ++++ U.P.R.R. LINE

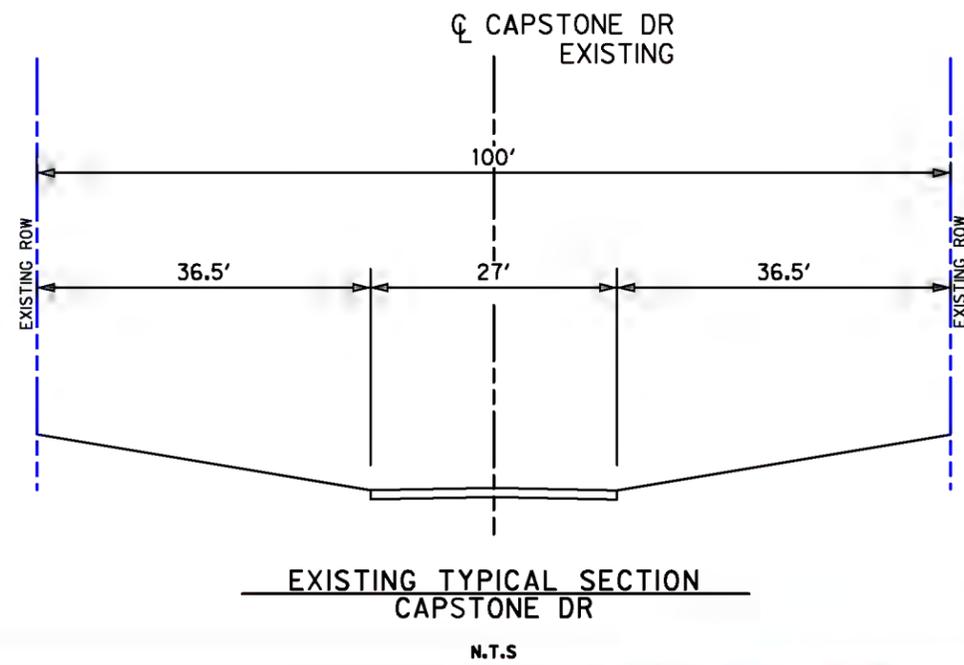
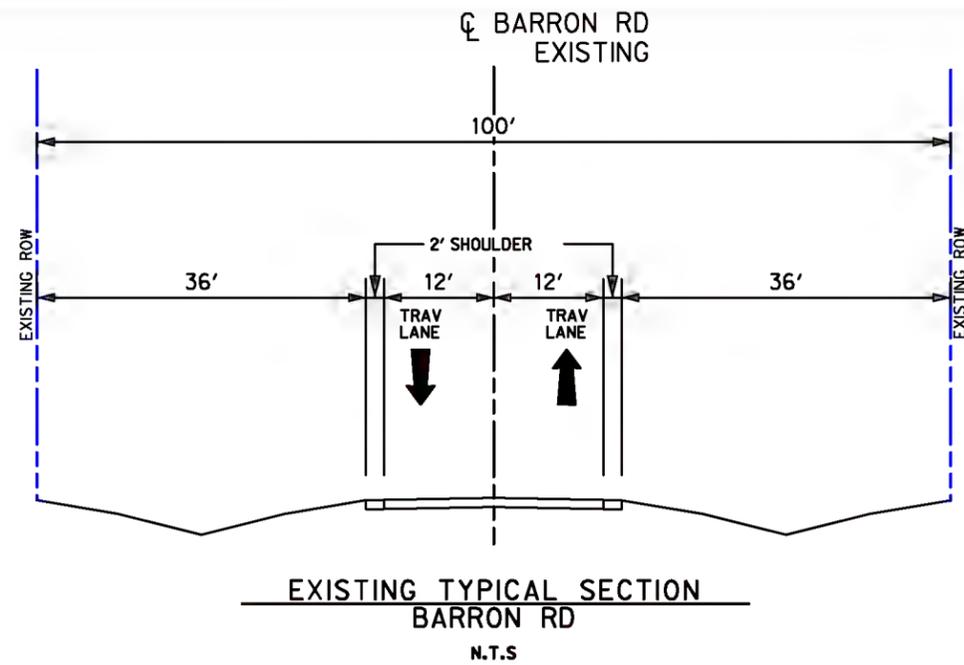
# ALTERNATIVE 6



**BARRON RD / CAPSTONE DR**  
From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
**ALTERNATIVES**

# Appendix B Typical Sections

DATE: 5/26/2016 TIME: 9:40:13 AM FILE: J:\31000\31000\31000\CADD\Sheets\21550-TYPICAL-SECTION-EXIST.cad

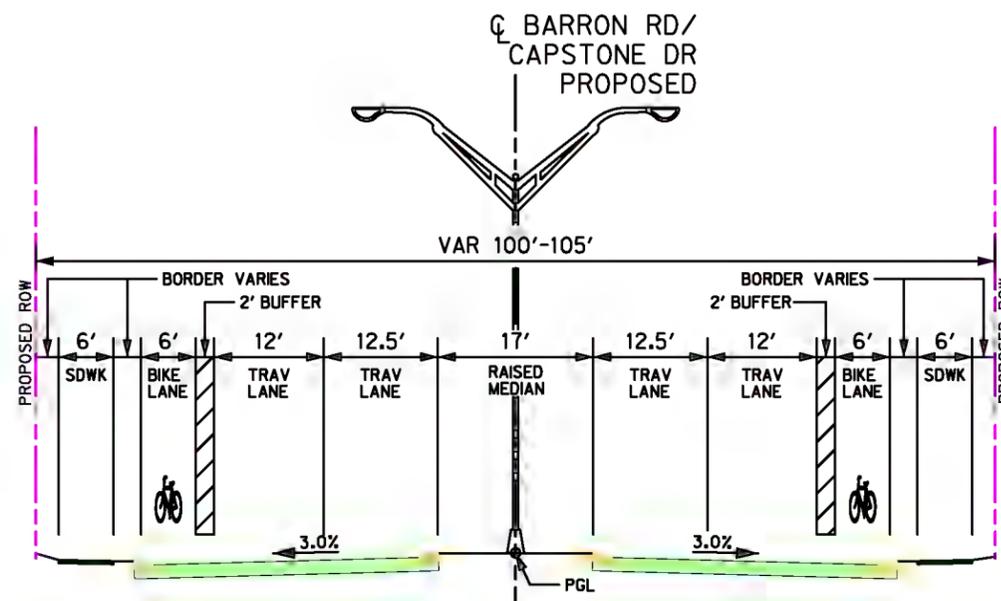


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BARRON RD / CAPSTONE DR  
From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
EXISTING TYPICAL SECTIONS



CONCEPTUAL MINOR ARTERIAL 4 LANE TYPICAL SECTION  
BARRON RD

N.T.S

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**BARRON RD / CAPSTONE DR**  
From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
**PROPOSED TYPICAL SECTIONS**

# Appendix C Traffic Study

**Traffic Engineering Study**  
**FM 2154**  
**AT CAPSTONE DRIVE AND**  
**BARRON RD**  
**College Station, Texas**



**Prepared for:**



**Prepared by:**

**Brown & Gay Engineers, Inc.**

**July 2016**

*Contract No. 16300247*



BROWN & GAY ENGINEERS, INC.  
TBPE FIRM REGISTRATION NO 1046



## Executive Summary

Brown & Gay Engineers, Inc. (BGE) performed a traffic engineering study and signal warrant analysis for the intersection of FM 2154 (Wellborn Road) at Capstone Drive and Barron Road in College Station, Texas.

The data collected for this study included traffic counts during a 24-hour period, spot speed survey, crash data and field conditions data. A signal warrant analysis was performed in accordance with the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD). Volumes were projected for the opening year 2019 for the realignment of Barron Road to intersect Capstone Drive at a single intersection, a project that will eliminate the existing offset between the two intersections.

### **Conclusion**

- Under existing conditions, the Capstone Drive intersection meets Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume) and Warrant 9 (Intersection Near a Grade Crossing).
- Under existing conditions, the Barron Road intersection meets Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume).
- For future conditions and year 2019 projected volumes, the realigned intersection meets Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume) and Warrant 9 (Intersection Near a Grade Crossing)

### **Recommendations**

1. Install a traffic signal at the intersection once one of the two roadways has been realigned to form a single intersection. The traffic signal will require railroad preemption. Therefore, early coordination with the Union Pacific Railroad is desirable. Railroad preemption will add significant time and cost to the project.
2. Provide dedicated right-turn lanes on both approaches of FM 2154 at the realigned intersection.
3. Retain the dedicated left-turn lanes on FM 2154.

# Table of Contents

1.0 Introduction.....	1
2.0 Existing Conditions.....	3
2.1 FM 2154.....	3
2.2 Capstone Drive and Barron Road.....	3
2.3 Intersection Characteristics.....	3
2.4 Land Use.....	3
3.0 Traffic Data.....	9
3.1 Traffic Volumes.....	9
3.2 Spot Speed Study.....	12
3.3 Crash Experience.....	12
3.4 Sight Distance.....	12
4.0 Traffic Projections.....	14
5.0 Traffic Signal Warrant Analysis.....	17
6.0 Traffic Operation Analysis.....	18
7.0 Conclusion and Recommendations.....	19

**List of Figures**

Figure 1. Location Map..... 2  
 Figure 2. Existing Condition Diagram..... 4  
 Figure 3. Aerial Photograph..... 5  
 Figure 4. FM 2154, northbound at Capstone Drive ..... 6  
 Figure 5. FM 2154, southbound at Capstone Drive..... 6  
 Figure 6. Capstone Drive, eastbound approach ..... 7  
 Figure 7. Capstone Drive, westbound..... 7  
 Figure 8. Barron Road, eastbound ..... 8  
 Figure 9. Barron Road, westbound approach..... 8  
 Figure 10. Peak Hour Turning Movement Volumes ..... 11  
 Figure 11. Collision Diagram ..... 13  
 Figure 12. Peak Hour Turning Movement Volumes – 2019 Projected Volumes..... 16

**List of Tables**

Table 1. Volume Summary at Capstone Drive ..... 9  
 Table 2. Volume Summary at Barron Road..... 10  
 Table 3. Summary of Traffic Projections (year 2019)..... 15  
 Table 4. Summary of Signal Warrant Analysis ..... 17

**List of Appendices**

- Appendix A. Existing Traffic Volumes
- Appendix B. Spot Speed Data
- Appendix C. Traffic Signal Warrant Analysis Worksheets
- Appendix D. Barron Road/Capstone Drive Turn Lane Configuration
- Appendix E. U.S. DOT Crossing Inventory Form

## 1.0 Introduction

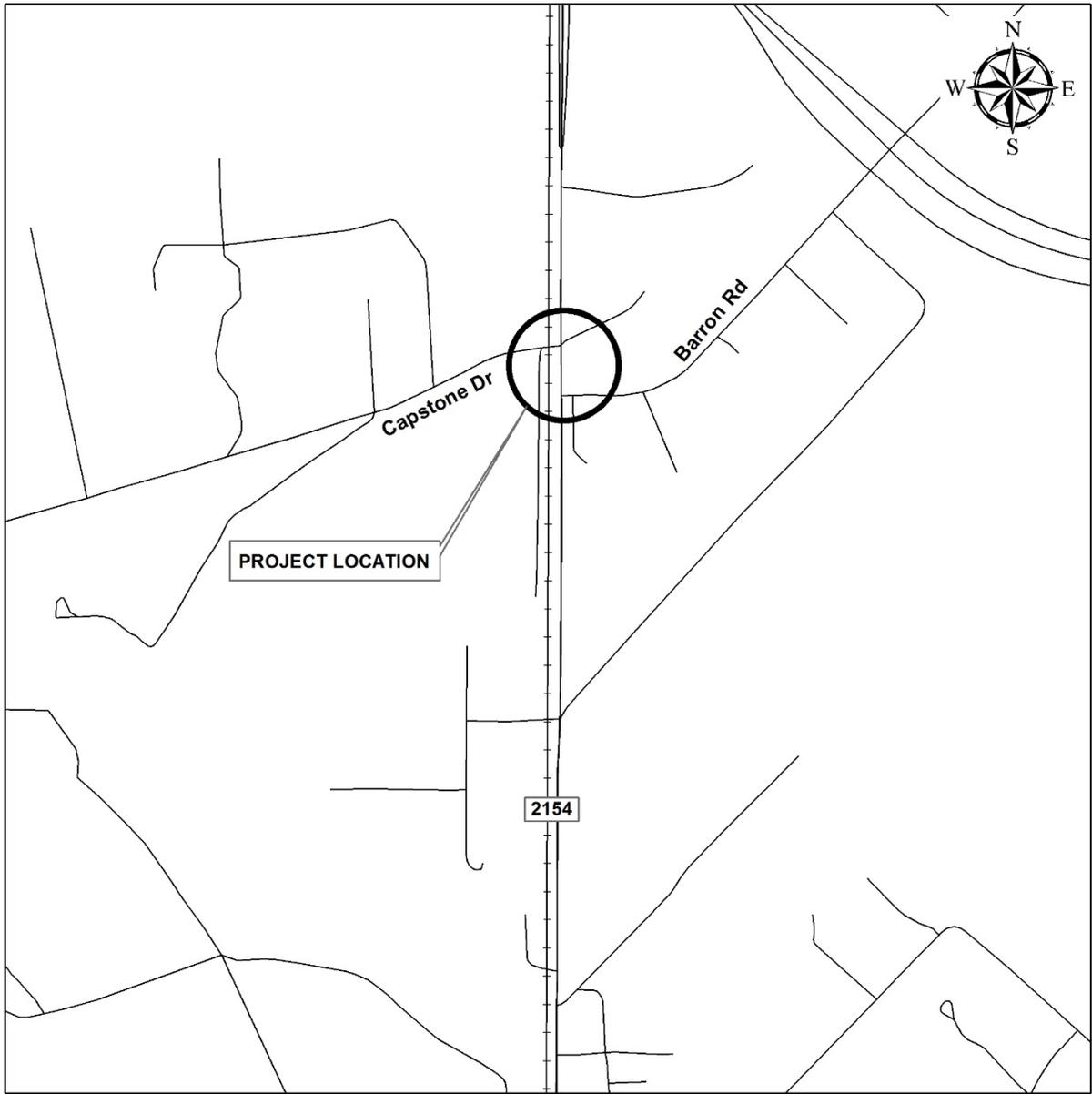
This report documents a traffic engineering study and traffic signal warrant analysis for the intersection of FM 2154 (Wellborn Road) at Capstone Drive and Barron Road, located in College Station, Texas. The intersection is an offset intersection located approximately 3,400 feet south of William D. Finch Parkway. FM 2154 is a minor north-south urban arterial that runs parallel to the west of SH 6, while Capstone Drive and Barron Road are minor local thoroughfares providing access from primarily residential neighborhoods to College Station High School and SH 6.

The study comprised the following tasks:

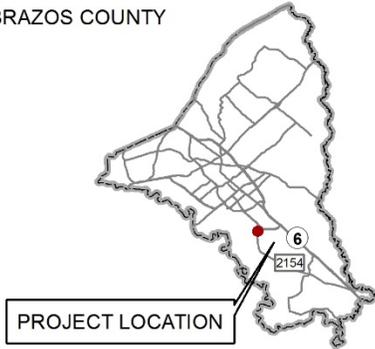
- Evaluation of existing roadway characteristics, including lane configuration, intersection geometry, and pavement markings.
- Evaluation of existing traffic characteristics, including turning movements, sight distance, traffic control, and crash data.
- Development of traffic projections for the future realigned intersection.
- Evaluation of a traffic signal warrant analysis for both existing and future conditions in accordance with the guidelines contained in Part 4, Chapter 4C of the 2011 *Texas Manual on Uniform Traffic Control Devices (TMUTCD)*
- Recommendation of potential improvements.

The study location is illustrated in **Figure 1**.

**Figure 1. Location Map**



BRAZOS COUNTY



## 2.0 Existing Conditions

### 2.1 FM 2154

FM 2154 is a two-lane rural highway with 6-foot shoulders, and open ditch drainage. There is a right and left turn lane provided at Capstone Drive, and a left turn lane for southbound traffic at Barron Road. The posted speed limit is 55 mph. A railroad track runs parallel to FM 2154 on the west side.

### 2.2 Capstone Drive and Barron Road

Capstone Drive is a two-lane local street with asphalt pavement, no shoulders, and open ditch drainage. The posted speed limit is 40 mph. The at-grade railroad crossing is located approximately 90 feet from the intersection.

Barron Road is a two-lane local street with asphalt pavement, no shoulders, and open ditch drainage. The posted speed limit is 45 mph.

### 2.3 Intersection Characteristics

Capstone Drive approaches from the west side of FM 2154 and Barron Road from the east to create a 360-foot offset intersection. The stop control is on Capstone Drive and Barron Road. There is a railroad crossing approximately 90 feet west of FM 2154, running parallel to FM 2154, with railroad signals and gates.

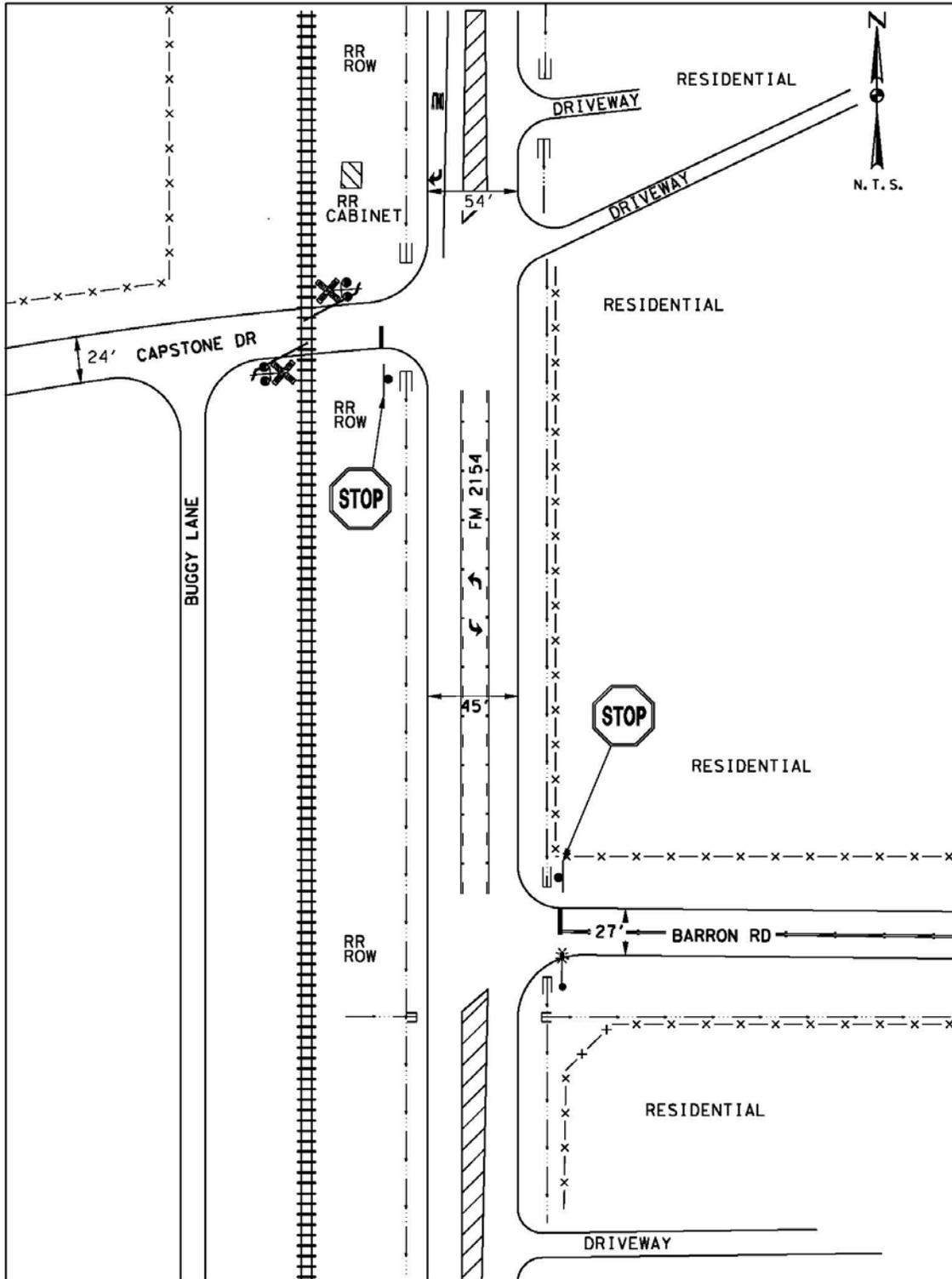
Intersection illumination is provided by a pole on the southeast corner of Barron Road. There is no illumination at the Capstone Drive intersection. The nearest signalized intersection is located approximately 1.5 miles north at the Rock Prairie Road intersection and none to the south.

### 2.4 Land Use

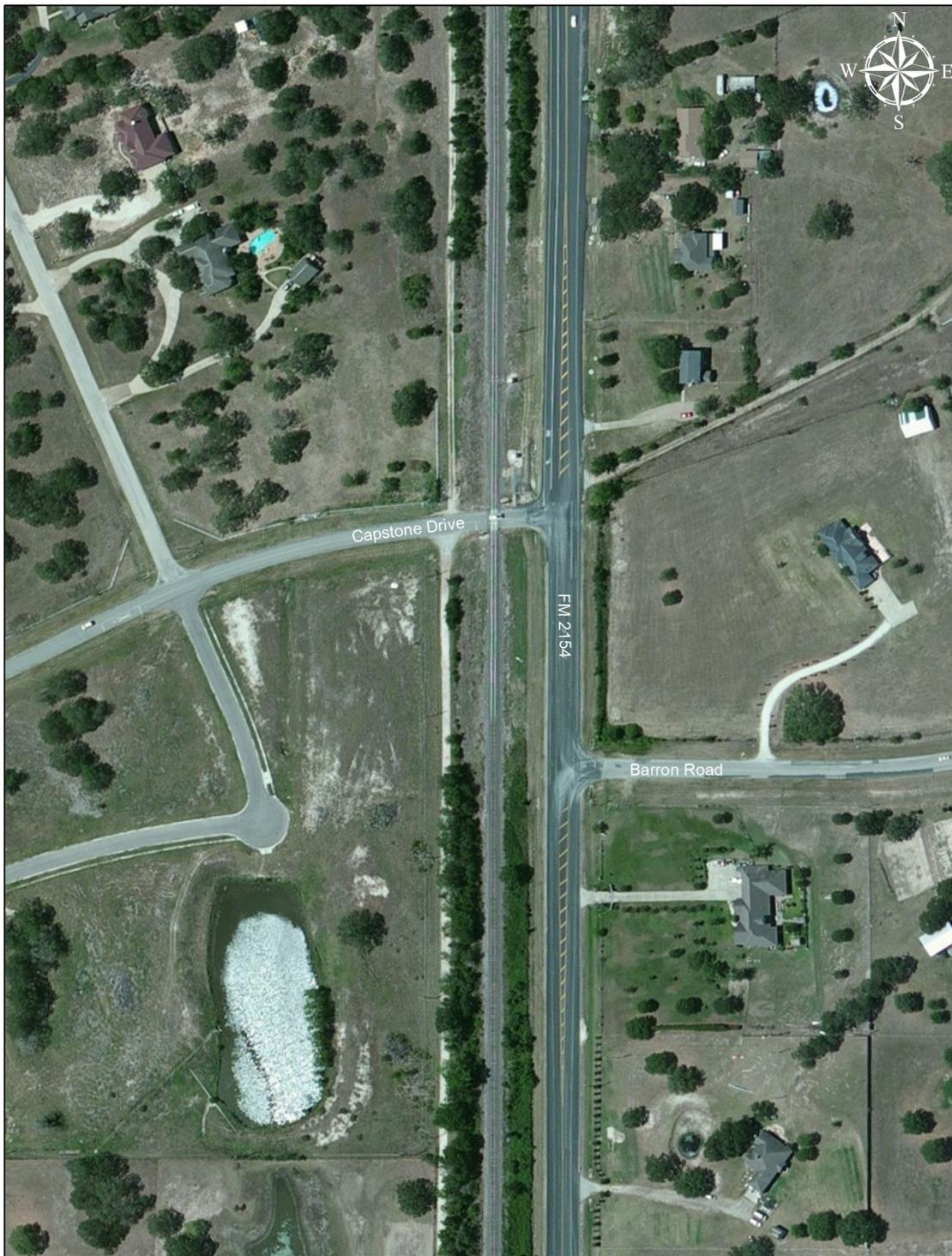
The area is primarily residential, large acre homesites, farms and horse ranches.

An existing conditions diagram of the study intersection is shown in **Figure 2**, and an aerial photograph is shown in **Figure 3**. **Figure 4** through **Figure 9** contain photographs of each intersection approach.

Figure 2. Existing Condition Diagram



**Figure 3. Aerial Photograph**



Source: ESRI, Digital Globe

**Figure 4. FM 2154, northbound at Capstone Drive**



**Figure 5. FM 2154, southbound at Capstone Drive**



**Figure 6. Capstone Drive, eastbound approach**



**Figure 7. Capstone Drive, westbound**



**Figure 8. Barron Road, eastbound**



**Figure 9. Barron Road, westbound approach**



## 3.0 Traffic Data

### 3.1 Traffic Volumes

Turning movement counts were recorded at the study intersection for 24-hours on Wednesday, March 2, 2016. The complete count data is included in **Appendix A**, and a summary of the data from 7 AM to 7 PM is presented in **Table 1** and **Table 2**. Peak hour turning movements are shown in **Figure 10**.

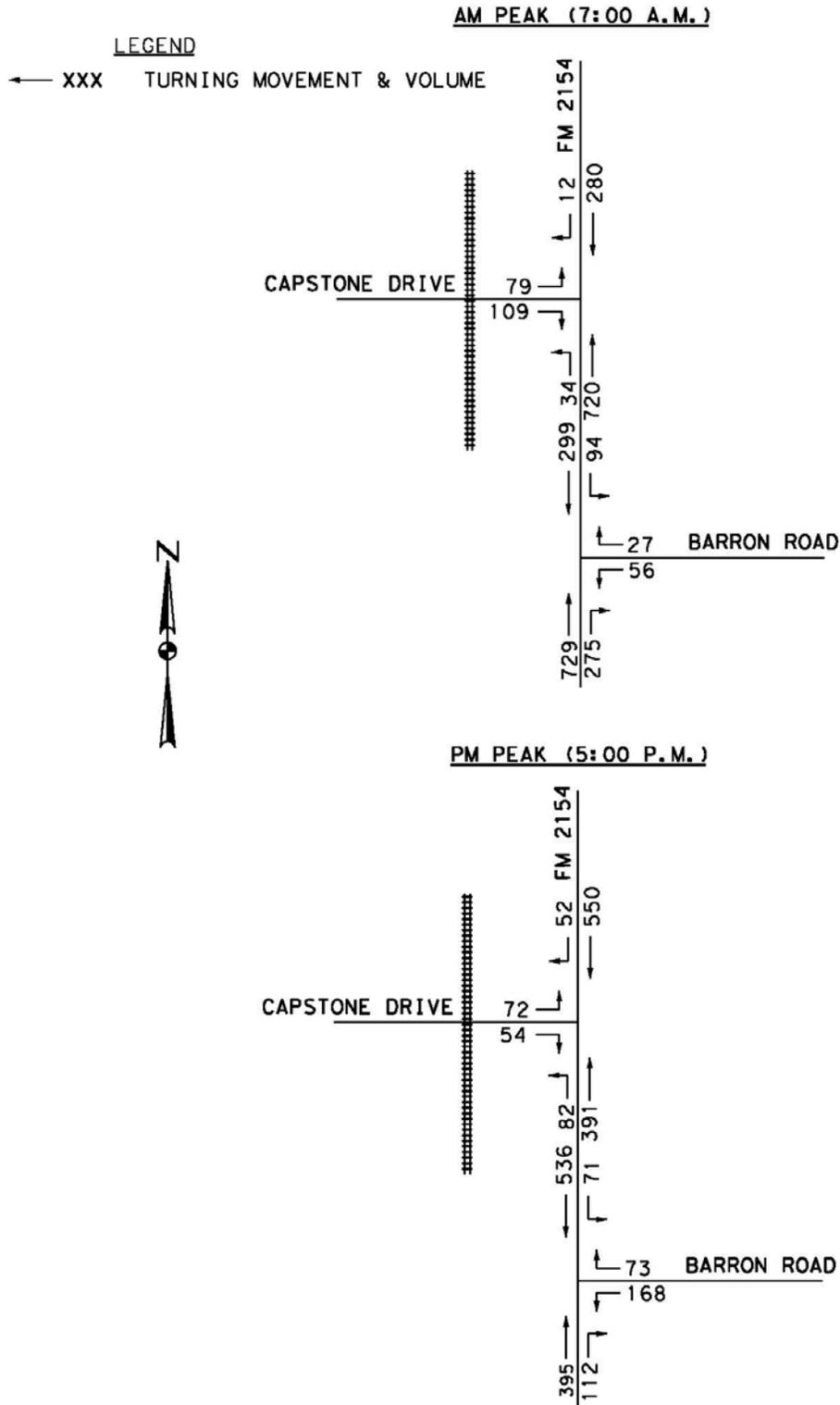
**Table 1. Volume Summary at Capstone Drive**

Time Period	Traffic Volumes (vph)					Rank
	FM 2154			Capstone Drive	Total Intersection Volume	
	SB	NB	Both Apps.	EB		
7:00-8:00 AM	292	754	1046	188	1234	1
8:00-9:00 AM	210	371	581	117	698	6
9:00-10:00 AM	186	283	469	97	566	11
10:00-11:00 AM	188	253	441	74	515	12
11:00-12:00 PM	234	284	518	99	617	10
12:00-1:00 PM	306	295	601	73	674	8
1:00-2:00 PM	283	298	581	91	672	9
2:00-3:00 PM	322	284	606	91	697	7
3:00-4:00 PM	326	402	728	115	843	5
4:00-5:00 PM	494	410	904	126	1030	3
5:00-6:00 PM	602	473	1075	114	1189	2
6:00-7:00 PM	415	363	778	82	860	4
<b>Total Volume</b>	<b>3858</b>	<b>4470</b>	<b>8328</b>	<b>1267</b>	<b>9595</b>	

**Table 2. Volume Summary at Barron Road**

Time Period	Traffic Volumes (vph)					Rank
	FM 2154			Barron Road	Total Intersection Volume	
	SB	NB	Both Apps.	EB		
7:00-8:00 AM	393	1004	1397	83	1480	1
8:00-9:00 AM	255	464	719	107	826	6
9:00-10:00 AM	214	319	533	76	609	11
10:00-11:00 AM	186	298	484	79	563	12
11:00-12:00 PM	263	327	590	80	670	10
12:00-1:00 PM	273	318	591	108	699	9
1:00-2:00 PM	274	315	589	135	724	8
2:00-3:00 PM	321	297	618	126	744	7
3:00-4:00 PM	335	454	789	133	922	5
4:00-5:00 PM	462	418	880	219	1099	3
5:00-6:00 PM	607	507	1114	241	1355	2
6:00-7:00 PM	421	377	798	201	999	4
<b>Total Volume</b>	<b>4004</b>	<b>5098</b>	<b>9102</b>	<b>1588</b>	<b>10690</b>	

**Figure 10. Peak Hour Turning Movement Volumes**



### 3.2 Spot Speed Study

A spot speed survey of vehicles traveling on FM 2154 was conducted on Tuesday, March 1, 2016, in the vicinity of the study intersection. The speed of 125 vehicles was measured in each direction with a radar gun. The data obtained in this spot speed study was used to determine the 85th percentile speed, the speed at which 85% of motorists drive at or below.

The spot speed study indicated that the 85th percentile speed was 55 mph in the northbound direction and 59 mph in the southbound direction. The posted speed limit is 55 mph. According to the TxDOT Procedures for Establishing Speed Zones manual, the posted speed limit should be within 5 mph of the 85th percentile speed. The complete speed survey data is included in **Appendix B**.

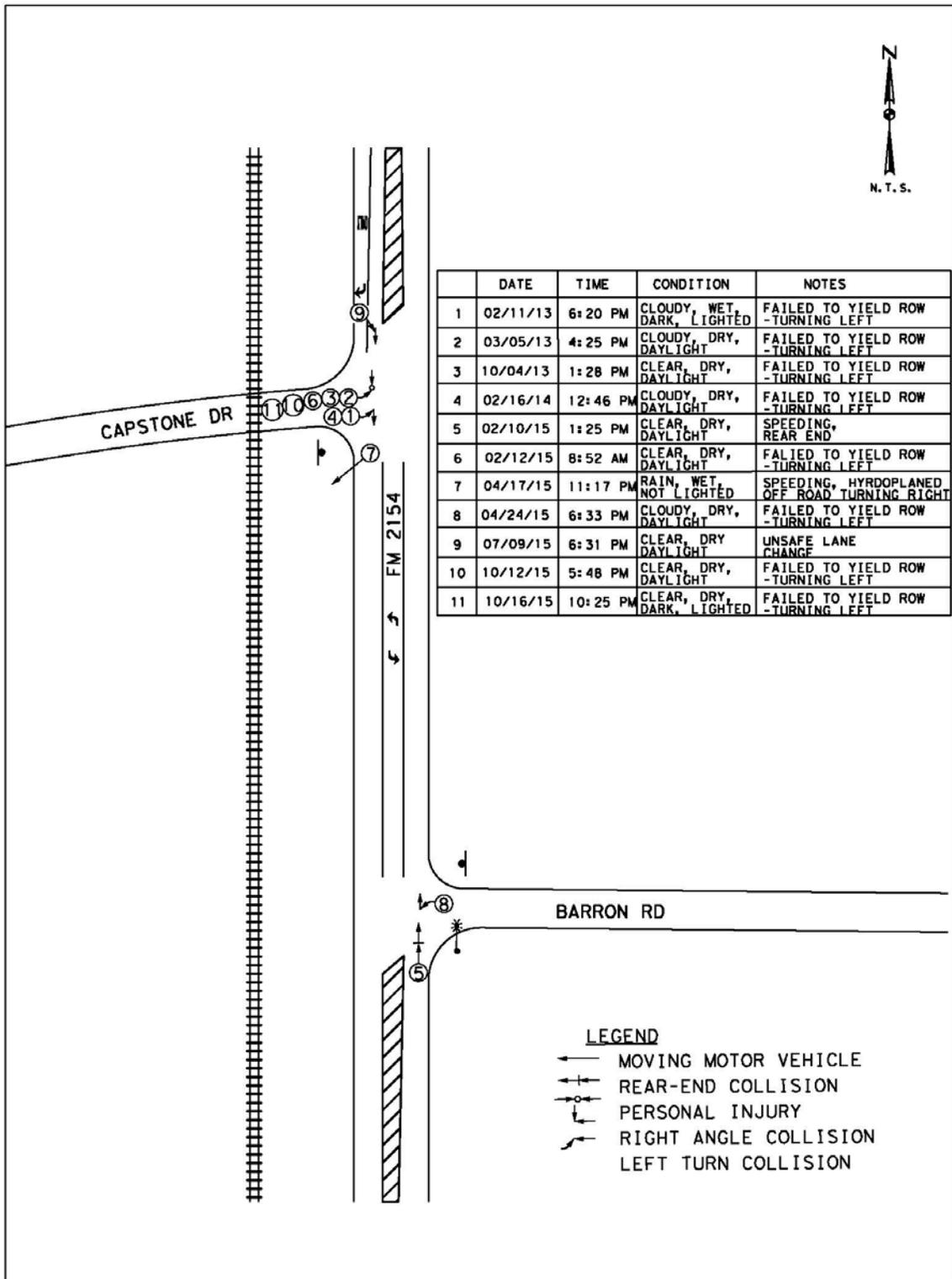
### 3.3 Crash Experience

Crash records were provided by the city of College Station covering the time period from 2013 to 2015. **Figure 11** illustrates the crashes in a Collision Diagram. Eleven accidents occurred during the thirty-six month period, two occurred at Barron Road and nine occurred at Capstone Drive. Seven of the nine accidents at Capstone Drive were left-hand turn accidents and five of those were with injury. The other two accidents were hydroplaning turning right and unsafe lane change. One accident occurred at Barron Road due to left-turn and the other was a rear-end collision. Neither of these accidents resulted in injury.

### 3.4 Sight Distance

Sight distance was checked on all approaches to the study intersection and was found to be adequate. There were no visual obstructions within the right of way at the time of inspection.

Figure 11. Collision Diagram



## 4.0 Traffic Projections

The following assumptions were made for the proposed realigned intersection of FM 2154 with Capstone Drive and Barron Road. A summary of the project traffic volumes can be found in **Table 3** and projected peak turning movements can be seen in **Figure 12**.

1. It was assumed that 70% of the existing westbound right-turn traffic from Barron Road was actually continuing westbound onto Capstone Drive (becoming thru-traffic at the realigned intersection) and the remaining 30% was going north on FM 2154.

2. Using this assumption for the westbound traffic onto Capstone Drive, it was assumed that same amount of traffic, in this case 63% of the right-hand turns on Capstone Drive, were continuing onto eastbound Barron Road and the remaining 37% were going south on FM 2154.

3. The resulting volumes at the intersection of FM 2154 at Capstone Drive and Barron Road were projected for the opening date of the realignment project. An annual average growth rate of 5% was used, based on information provided by the city. The opening date is 2019 so the values used were  $i=0.05$  and  $n=3$ .

$$F = P(1+i)^n$$

F – future count

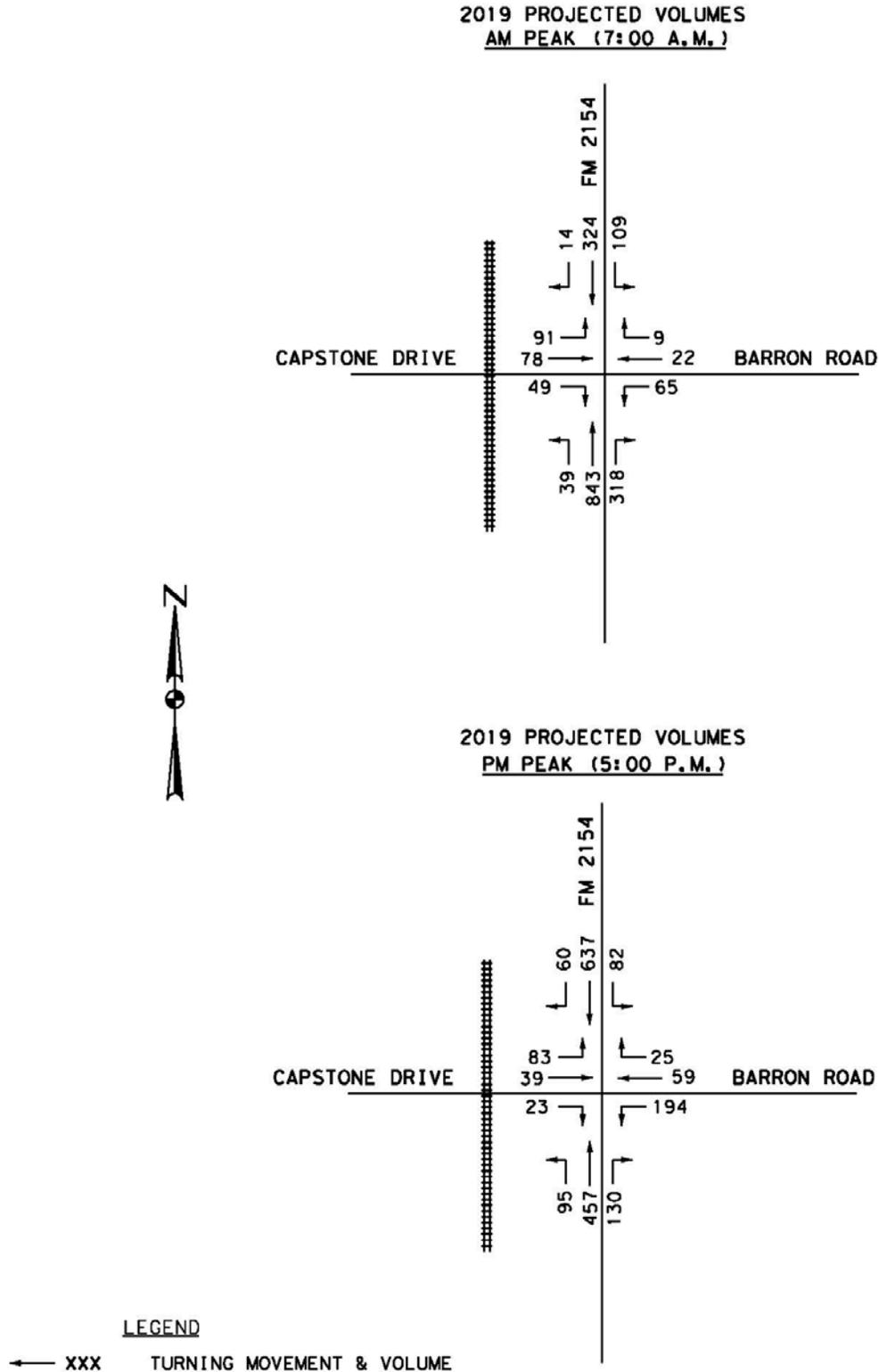
P – present count

n – number of years

**Table 3. Summary of Traffic Projections (year 2019)**

Time Period	Traffic Volumes (vph)						Rank
	FM 2154			Capstone Drive	Barron Road	Total Intersection Volume	
	NB	SB	Both Apps.	EB	WB		
7:00-8:00 AM	1162	338	1500	218	96	1814	1
8:00-9:00 AM	537	243	780	135	124	1039	6
9:00-10:00 AM	369	215	584	113	88	785	11
10:00-11:00 AM	345	218	563	86	92	741	12
11:00-12:00 PM	378	271	649	114	93	856	10
12:00-1:00 PM	368	354	722	85	124	931	9
1:00-2:00 PM	365	328	693	106	156	956	8
2:00-3:00 PM	344	373	717	106	145	958	7
3:00-4:00 PM	526	377	903	133	154	1190	5
4:00-5:00 PM	484	572	1056	110	253	1419	3
5:00-6:00 PM	587	697	1284	146	278	1708	2
6:00-7:00 PM	436	480	916	132	233	1281	4
<b>Total Volume</b>	<b>5901</b>	<b>4466</b>	<b>10367</b>	<b>1484</b>	<b>1836</b>	<b>13678</b>	

**Figure 12. Peak Hour Turning Movement Volumes – 2019 Projected Volumes**



## 5.0 Traffic Signal Warrant Analysis

The existing and proposed turning movement volumes at the intersection of FM 2154 and Capstone Drive and Barron Road were analyzed to determine if the conditions warranted the installation of a traffic signal. This analysis was performed in accordance to Part 4, Chapter 4C of the 2011 *Texas Manual on Uniform Traffic Control Devices* (TMUTCD) using rural warrant criteria since the speed limit is 55 mph.

**Table 4** contains a summary of the signal warrant analysis. The complete analysis is included in **Appendix B**.

**Table 4. Summary of Signal Warrant Analysis**

Signal Warrant	Satisfaction of Requirement		
	Existing Condition Barron	Existing Condition Capstone	Proposed Condition
1. 8 Hour Vehicular Volume	Yes	Yes	Yes
2. Four Hour Volumes	Yes	Yes	Yes
3. Peak Hour	N/A	N/A	N/A
4. Pedestrian Volumes	N/A	N/A	N/A
5. School Crossing	N/A	N/A	N/A
6. Coordinated Signal System	N/A	N/A	N/A
7. Crash Experience	No	No	N/A
8. Roadway Network	N/A	N/A	N/A
9. Intersection Near a Grade Crossing	N/A	Yes	Yes

The train activity on the at-grade railroad crossing was obtained from the U.S. Dot crossing inventory (**Appendix E**), which indicates 18 trains daily and a maximum timetable speed of 60 mph.

A traffic signal at this intersection will require railroad preemption. Early coordination with UPRR is recommended since railroad preemption will add significant time and cost to the project.

## 6.0 Traffic Operation Analysis

Capstone Drive and Barron Road in their existing conditions were observed as two separate intersections.

### **Capstone Drive**

The AM peak period occurred from 7:00 AM to 8:00 AM. The majority of the traffic on FM 2154 is through traffic, 280 southbound and 720 northbound vehicles, with 34 vehicles turning left and only 12 vehicles turning right. 79 vehicles heading east on Capstone Drive made left-hand turns with the remainder 109 turning right.

The PM peak period occurred from 5:00 PM to 6:00 PM, with 550 southbound vehicles and 391 northbound vehicles. 52 vehicles on FM 2154 traffic turned right and 82 made left-hand turns onto Capstone Drive. 72 eastbound vehicles turned left onto FM 2154 and 54 vehicles made right-hand turns.

The average throughout the 12-hour period was 7% of the total vehicles turned right onto Capstone Drive and 6% made left-hand turns. 6% of the vehicles made right-hand turns onto FM 2154 and 8% turned left. The remaining drove straight through on FM 2154.

### **Barron Road**

The AM peak period occurred from 7:00 AM to 8:00 AM. The majority of the traffic on FM 2154 is through traffic, 299 southbound and 729 northbound vehicles, with 94 vehicles turning left and 275 vehicles turning right. 56 vehicles heading west on Barron Road made left-hand turns with the remainder 27 turning right.

The PM peak period occurred from 5:00 PM to 6:00 PM, with 536 southbound vehicles and 395 northbound vehicles. 112 vehicles on FM 2154 traffic turned right and 71 made left-hand turns onto Barron Road. 168 westbound vehicles turned left onto FM 2154 and 73 vehicles made right-hand turns.

The average throughout the 12-hour period was 10% vehicles turned right onto Barron Road and 5% made left-hand turns. 5% of the vehicles made right-hand turns onto FM 2154 and 11% turned left. The remaining vehicles drove straight through on FM 2154.

### **2019 Realigned Intersection Configuration**

The realigned intersection will need to provide separate left-turn and right-turn lanes on FM 2154, as well as separate left-turn lanes on Barron Road and Capstone Drive, for the proposed traffic signal to operate efficiently.

## 7.0 Conclusion and Recommendations

This report summarizes a traffic engineering study and traffic signal warrant analysis for the intersection of FM 2154 and Capstone Drive and Barron Road.

### Conclusion

- The current posted speed on FM 2154, 55 mph, is within 4 mph of the of observed 85<sup>th</sup> percentile speed, so no changes are required to this speed limit.
- The existing Capstone Drive intersection meets Warrant 1(Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume) and Warrant 9 (Intersection Near a Grade Crossing).
- The existing Barron Road intersection meets Warrant 1(Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume).
- For future intersection geometry and projected volumes for year 2019, the intersection meets Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume) and Warrant 9 (Intersection Near a Grade Crossing). A diagram of the proposed intersection can be seen in **Appendix D**.

### Recommendations

Based on the projected volumes:

- A traffic signal is warranted and must include railroad preemption. The signal should be installed once one of the two roadways has been realigned to a single intersection
- Provide dedicated right-turn and left-turn lanes on FM 2154.

## **APPENDIX A**

### **Existing Traffic Volumes**



bg@cjhensch.com  
5215 Sycamore Ave

Pasadena, Texas, United States 77503  
281-487-5417 ijoskowicz@browngay.com

Count Name: FM 2154 at Barron Rd  
Site Code:  
Start Date: 03/02/2016  
Page No: 1

### Turning Movement Data

Start Time	FM 2154 Southbound					Barron Rd Westbound					FM 2154 Northbound					Int. Total
	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	
12:00 AM	1	10	0	0	11	0	1	0	0	1	4	1	0	0	5	17
12:15 AM	2	5	0	0	7	2	1	0	0	3	2	1	0	0	3	13
12:30 AM	0	3	0	0	3	0	2	0	0	2	5	1	0	0	6	11
12:45 AM	0	6	0	0	6	0	0	0	0	0	3	0	0	0	3	9
Hourly Total	3	24	0	0	27	2	4	0	0	6	14	3	0	0	17	50
1:00 AM	0	1	0	0	1	0	0	0	0	0	3	0	0	0	3	4
1:15 AM	0	2	0	0	2	4	0	0	0	4	2	1	0	0	3	9
1:30 AM	0	2	0	0	2	0	0	0	0	0	2	0	0	0	2	4
1:45 AM	0	1	0	0	1	1	0	0	0	1	1	0	0	0	1	3
Hourly Total	0	6	0	0	6	5	0	0	0	5	8	1	0	0	9	20
2:00 AM	1	3	0	0	4	1	1	0	0	2	0	0	0	0	0	6
2:15 AM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
2:30 AM	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
2:45 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2
Hourly Total	1	9	0	0	10	1	1	0	0	2	2	0	0	0	2	14
3:00 AM	1	1	0	0	2	0	0	0	0	0	1	0	0	0	1	3
3:15 AM	1	1	0	0	2	0	1	0	0	1	0	0	0	0	0	3
3:30 AM	0	2	0	0	2	1	0	0	0	1	3	0	0	0	3	6
3:45 AM	0	0	0	0	0	0	1	0	0	1	2	1	0	0	3	4
Hourly Total	2	4	0	0	6	1	2	0	0	3	6	1	0	0	7	16
4:00 AM	1	3	0	0	4	0	1	0	0	1	4	0	0	0	4	9
4:15 AM	0	3	0	0	3	0	0	0	0	0	2	4	0	0	6	9
4:30 AM	1	5	0	0	6	0	0	0	0	0	9	1	0	0	10	16
4:45 AM	0	4	0	0	4	3	0	0	0	3	16	3	0	0	19	26
Hourly Total	2	15	0	0	17	3	1	0	0	4	31	8	0	0	39	60
5:00 AM	0	3	0	0	3	0	0	0	0	0	6	3	0	0	9	12
5:15 AM	0	6	0	0	6	1	0	0	0	1	7	5	0	0	12	19
5:30 AM	2	10	0	0	12	1	0	0	0	1	22	2	0	0	24	37
5:45 AM	5	5	0	0	10	1	0	0	0	1	26	4	0	0	30	41
Hourly Total	7	24	0	0	31	3	0	0	0	3	61	14	0	0	75	109
6:00 AM	4	10	1	0	15	4	1	0	0	5	32	4	0	0	36	56
6:15 AM	6	21	0	0	27	3	0	0	0	3	33	16	0	0	49	79
6:30 AM	6	26	0	0	32	11	0	0	0	11	93	35	0	0	128	171
6:45 AM	14	40	0	0	54	15	3	0	0	18	76	33	0	0	109	181
Hourly Total	30	97	1	0	128	33	4	0	0	37	234	88	0	0	322	487
7:00 AM	17	62	0	0	79	10	7	0	0	17	99	40	0	0	139	235
7:15 AM	18	71	0	0	89	16	5	0	0	21	198	87	0	0	285	395
7:30 AM	25	78	0	0	103	16	3	0	0	19	226	76	0	0	302	424

7:45 AM	34	88	0	0	122	14	12	0	0	26	206	72	0	0	278	426
Hourly Total	94	299	0	0	393	56	27	0	0	83	729	275	0	0	1004	1480
8:00 AM	18	59	0	0	77	22	9	0	0	31	100	35	0	0	135	243
8:15 AM	11	50	0	0	61	20	4	0	0	24	73	35	0	0	108	193
8:30 AM	10	54	0	0	64	22	6	0	0	28	82	30	0	0	112	204
8:45 AM	12	41	0	0	53	19	5	0	0	24	88	21	0	0	109	186
Hourly Total	51	204	0	0	255	83	24	0	0	107	343	121	0	0	464	826
9:00 AM	9	43	0	0	52	20	5	0	0	25	75	16	0	0	91	168
9:15 AM	8	39	0	0	47	14	6	0	0	20	66	15	0	0	81	148
9:30 AM	18	40	0	0	58	13	3	0	0	16	59	14	0	0	73	147
9:45 AM	3	54	0	0	57	9	6	0	0	15	63	11	0	0	74	146
Hourly Total	38	176	0	0	214	56	20	0	0	76	263	56	0	0	319	609
10:00 AM	8	41	0	0	49	11	7	0	0	18	51	15	0	0	66	133
10:15 AM	8	37	0	0	45	17	6	0	0	23	54	18	0	0	72	140
10:30 AM	6	46	0	0	52	14	4	0	0	18	58	20	0	0	78	148
10:45 AM	4	36	0	0	40	14	6	0	0	20	70	12	0	0	82	142
Hourly Total	26	160	0	0	186	56	23	0	0	79	233	65	0	0	298	563
11:00 AM	9	48	0	0	57	13	12	0	0	25	62	15	0	0	77	159
11:15 AM	14	52	0	0	66	11	3	0	0	14	68	15	0	0	83	163
11:30 AM	13	50	0	0	63	14	5	0	0	19	62	18	0	0	80	162
11:45 AM	10	66	1	0	77	18	4	0	0	22	67	20	0	0	87	186
Hourly Total	46	216	1	0	263	56	24	0	0	80	259	68	0	0	327	670
12:00 PM	2	70	0	0	72	28	5	0	0	33	74	14	0	0	88	193
12:15 PM	4	56	0	0	60	20	13	0	0	33	56	8	0	0	64	157
12:30 PM	3	56	0	0	59	18	7	0	0	25	56	18	0	0	74	158
12:45 PM	15	67	0	0	82	12	5	0	0	17	73	19	0	0	92	191
Hourly Total	24	249	0	0	273	78	30	0	0	108	259	59	0	0	318	699
1:00 PM	6	61	0	0	67	20	16	0	0	36	59	20	0	0	79	182
1:15 PM	5	55	0	0	60	30	11	0	0	41	61	16	0	0	77	178
1:30 PM	8	61	0	0	69	17	11	0	0	28	63	9	0	0	72	169
1:45 PM	8	70	0	0	78	19	11	0	0	30	70	17	0	0	87	195
Hourly Total	27	247	0	0	274	86	49	0	0	135	253	62	0	0	315	724
2:00 PM	9	52	0	0	61	17	8	0	0	25	46	12	0	0	58	144
2:15 PM	10	62	0	0	72	20	7	0	0	27	70	15	0	0	85	184
2:30 PM	12	77	0	0	89	22	9	0	0	31	59	17	0	0	76	196
2:45 PM	12	87	0	0	99	25	18	0	0	43	68	10	0	0	78	220
Hourly Total	43	278	0	0	321	84	42	0	0	126	243	54	0	0	297	744
3:00 PM	10	68	0	0	78	20	11	0	0	31	95	12	0	0	107	216
3:15 PM	9	65	1	0	75	28	9	0	0	37	83	21	0	0	104	216
3:30 PM	11	50	0	0	61	14	10	0	0	24	92	35	0	0	127	212
3:45 PM	19	102	0	0	121	25	16	0	0	41	87	29	0	0	116	278
Hourly Total	49	285	1	0	335	87	46	0	0	133	357	97	0	0	454	922
4:00 PM	4	86	0	0	90	57	21	0	0	78	74	24	0	0	98	266
4:15 PM	15	110	1	0	126	33	20	0	0	53	81	16	0	0	97	276
4:30 PM	11	103	0	0	114	31	13	0	0	44	90	21	0	0	111	269
4:45 PM	15	117	0	0	132	33	11	0	0	44	95	17	0	0	112	288
Hourly Total	45	416	1	0	462	154	65	0	0	219	340	78	0	0	418	1099
5:00 PM	23	146	0	0	169	31	15	0	0	46	106	21	0	0	127	342
5:15 PM	14	130	0	0	144	42	18	0	0	60	114	32	0	0	146	350
5:30 PM	22	145	0	0	167	43	18	0	0	61	88	36	0	0	124	352
5:45 PM	12	115	0	0	127	52	22	0	0	74	87	23	0	0	110	311
Hourly Total	71	536	0	0	607	168	73	0	0	241	395	112	0	0	507	1355

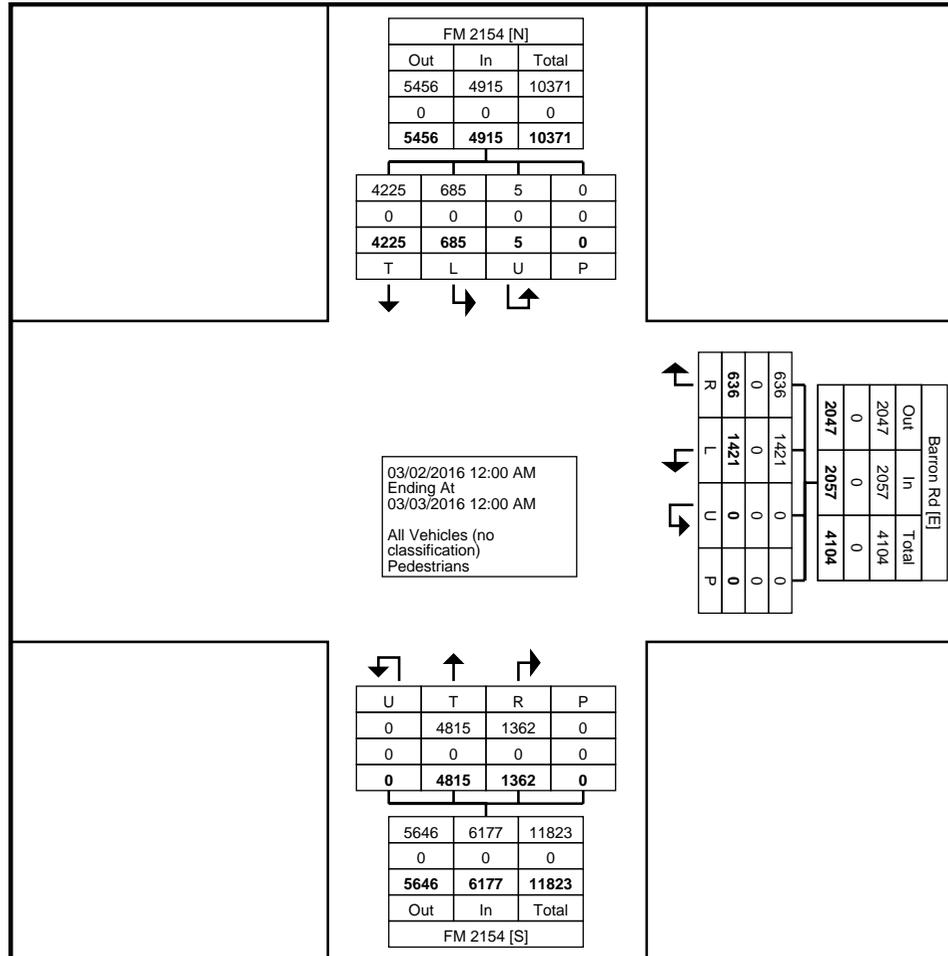




bg@cjhensch.com  
5215 Sycamore Ave

Pasadena, Texas, United States 77503  
281-487-5417 ijoskowicz@browngay.com

Count Name: FM 2154 at Barron Rd  
Site Code:  
Start Date: 03/02/2016  
Page No: 4



Turning Movement Data Plot

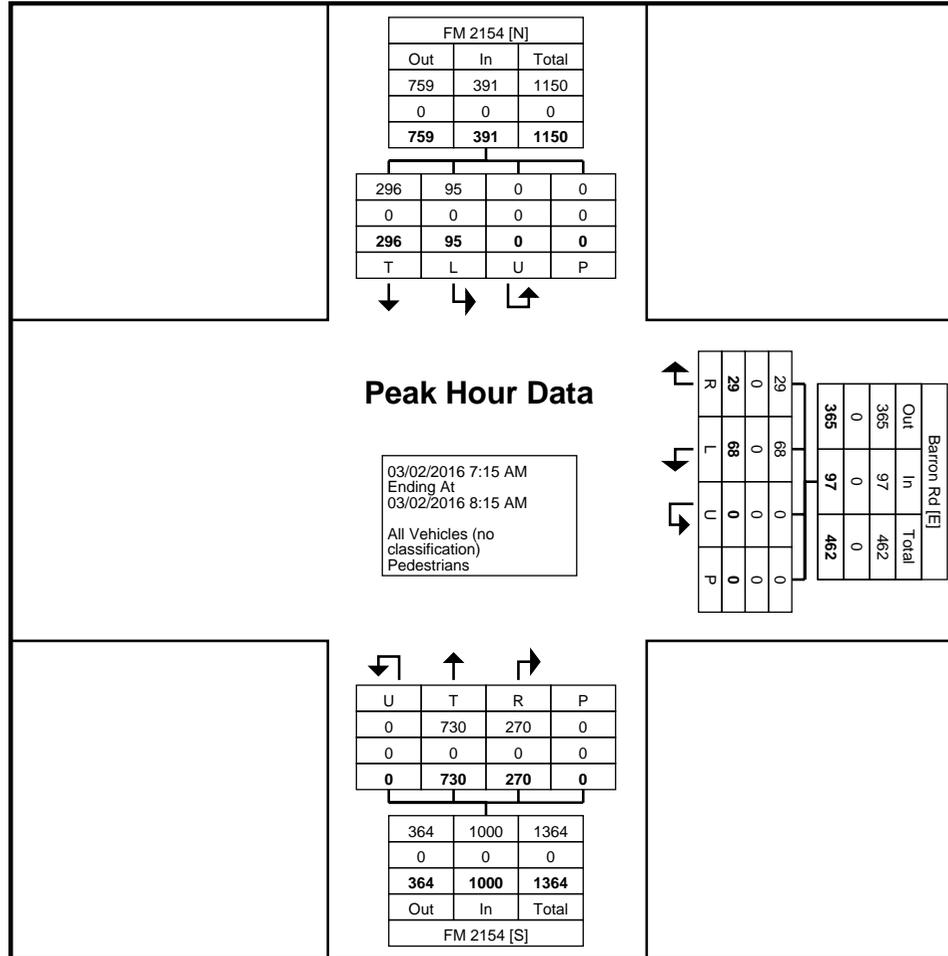




bg@cjhensch.com  
5215 Sycamore Ave

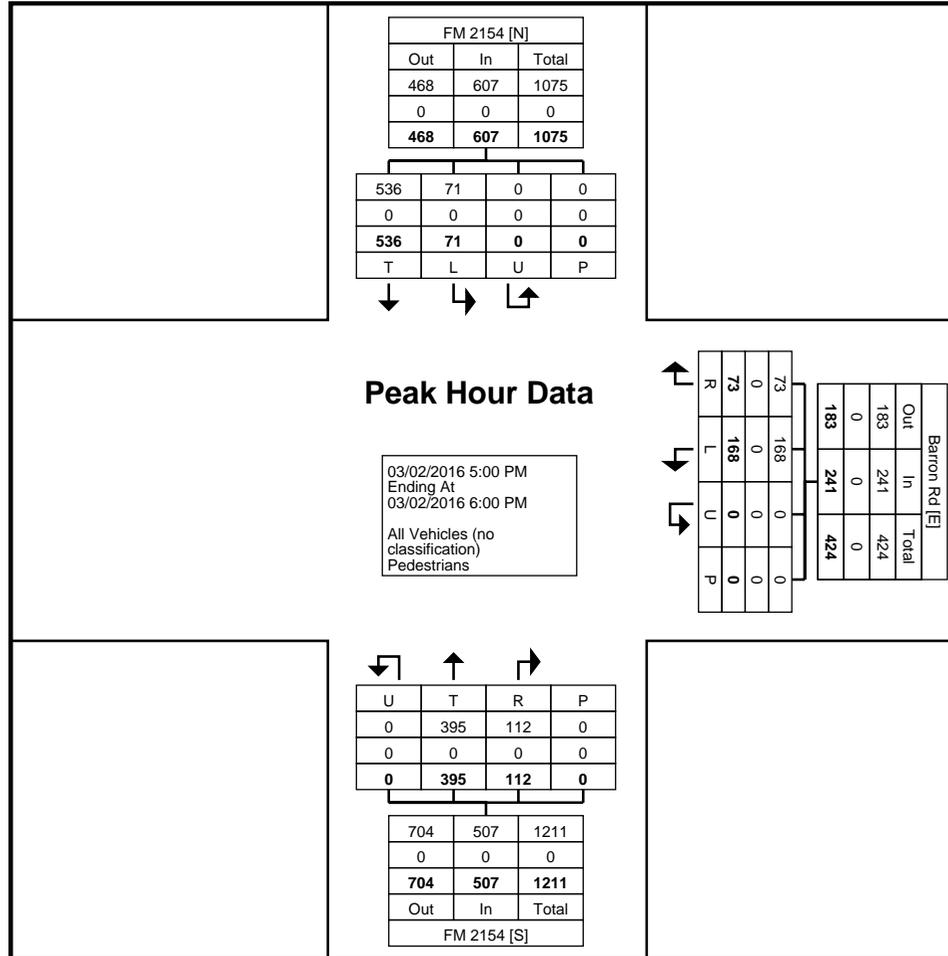
Pasadena, Texas, United States 77503  
281-487-5417 ijoskowicz@browngay.com

Count Name: FM 2154 at Barron Rd  
Site Code:  
Start Date: 03/02/2016  
Page No: 6



Turning Movement Peak Hour Data Plot (7:15 AM)





Turning Movement Peak Hour Data Plot (5:00 PM)



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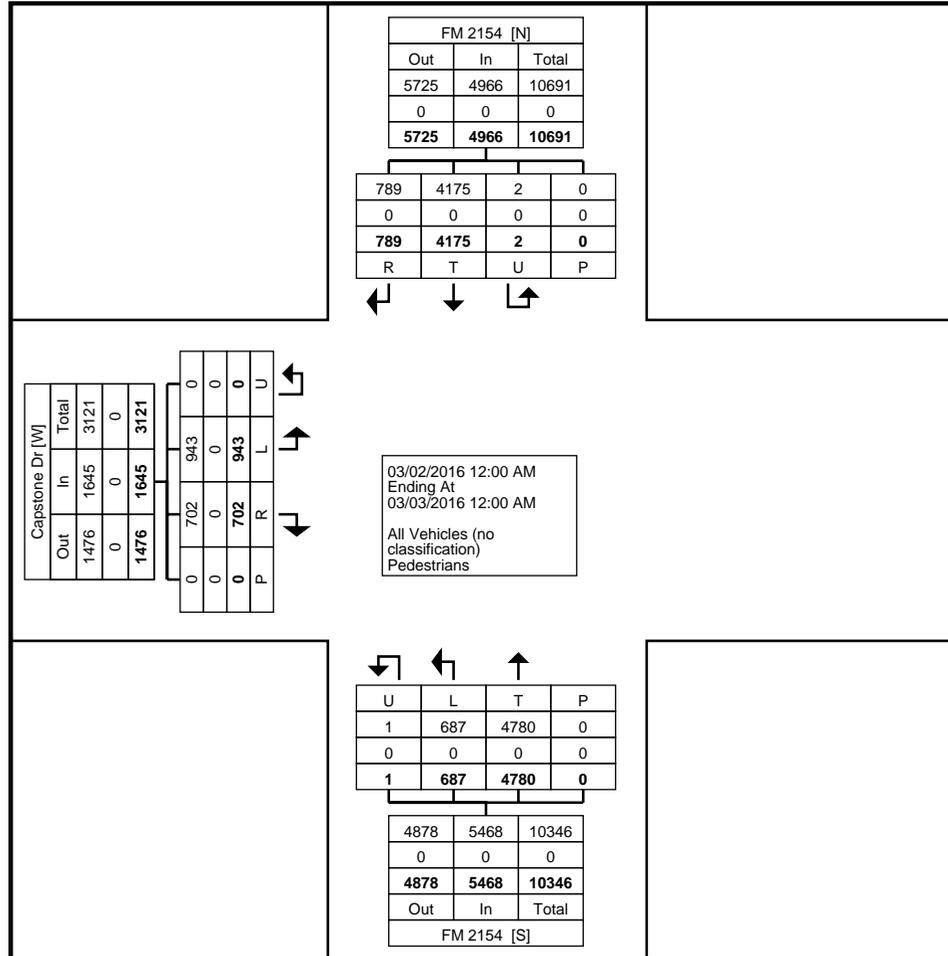
Count Name: FM 2154 at Capstone Dr  
Site Code:  
Start Date: 03/02/2016  
Page No: 1

### Turning Movement Data

Start Time	FM 2154 Southbound					FM 2154 Northbound					Capstone Dr Eastbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
12:00 AM	8	5	0	0	13	2	2	0	0	4	0	1	0	0	1	18
12:15 AM	8	7	0	0	15	0	3	0	0	3	2	2	0	0	4	22
12:30 AM	3	6	0	0	9	2	5	0	0	7	0	0	0	0	0	16
12:45 AM	6	2	0	0	8	0	3	0	0	3	2	0	0	0	2	13
Hourly Total	25	20	0	0	45	4	13	0	0	17	4	3	0	0	7	69
1:00 AM	2	2	0	0	4	0	2	0	0	2	1	0	0	0	1	7
1:15 AM	2	1	0	0	3	0	2	0	0	2	2	0	0	0	2	7
1:30 AM	2	2	0	0	4	1	1	0	0	2	2	0	0	0	2	8
1:45 AM	1	2	0	0	3	0	1	0	0	1	0	0	0	0	0	4
Hourly Total	7	7	0	0	14	1	6	0	0	7	5	0	0	0	5	26
2:00 AM	4	0	0	0	4	1	0	0	0	1	0	0	0	0	0	5
2:15 AM	2	1	0	0	3	0	0	0	0	0	1	0	0	0	1	4
2:30 AM	4	3	1	0	8	0	0	0	0	0	1	0	0	0	1	9
2:45 AM	1	0	0	0	1	0	2	0	0	2	2	0	0	0	2	5
Hourly Total	11	4	1	0	16	1	2	0	0	3	4	0	0	0	4	23
3:00 AM	2	2	0	0	4	0	0	0	0	0	1	1	0	0	2	6
3:15 AM	1	0	0	0	1	1	2	0	0	3	0	1	0	0	1	5
3:30 AM	1	0	0	0	1	0	3	0	0	3	1	0	0	0	1	5
3:45 AM	2	0	0	0	2	1	2	0	0	3	1	0	0	0	1	6
Hourly Total	6	2	0	0	8	2	7	0	0	9	3	2	0	0	5	22
4:00 AM	2	2	0	0	4	0	5	0	0	5	0	0	0	0	0	9
4:15 AM	3	0	0	0	3	0	2	0	0	2	0	1	0	0	1	6
4:30 AM	4	0	0	0	4	0	8	0	0	8	2	2	0	0	4	16
4:45 AM	4	0	0	0	4	0	15	0	0	15	3	0	0	0	3	22
Hourly Total	13	2	0	0	15	0	30	0	0	30	5	3	0	0	8	53
5:00 AM	1	1	0	0	2	0	8	0	0	8	1	2	0	0	3	13
5:15 AM	5	1	0	0	6	0	7	0	0	7	0	1	0	0	1	14
5:30 AM	8	2	0	0	10	0	20	0	0	20	4	3	0	0	7	37
5:45 AM	7	0	0	0	7	0	26	0	0	26	3	3	0	0	6	39
Hourly Total	21	4	0	0	25	0	61	0	0	61	8	9	0	0	17	103
6:00 AM	9	2	0	0	11	0	38	0	0	38	1	6	0	0	7	56
6:15 AM	20	1	0	0	21	0	33	0	0	33	4	6	0	0	10	64
6:30 AM	27	2	0	0	29	1	91	0	0	92	3	5	0	0	8	129
6:45 AM	37	5	0	0	42	0	78	0	0	78	6	17	0	0	23	143
Hourly Total	93	10	0	0	103	1	240	0	0	241	14	34	0	0	48	392
7:00 AM	53	2	0	0	55	6	101	0	0	107	15	23	0	0	38	200
7:15 AM	62	3	0	0	65	7	188	0	0	195	24	31	0	0	55	315
7:30 AM	71	6	0	0	77	5	225	0	0	230	21	28	0	0	49	356

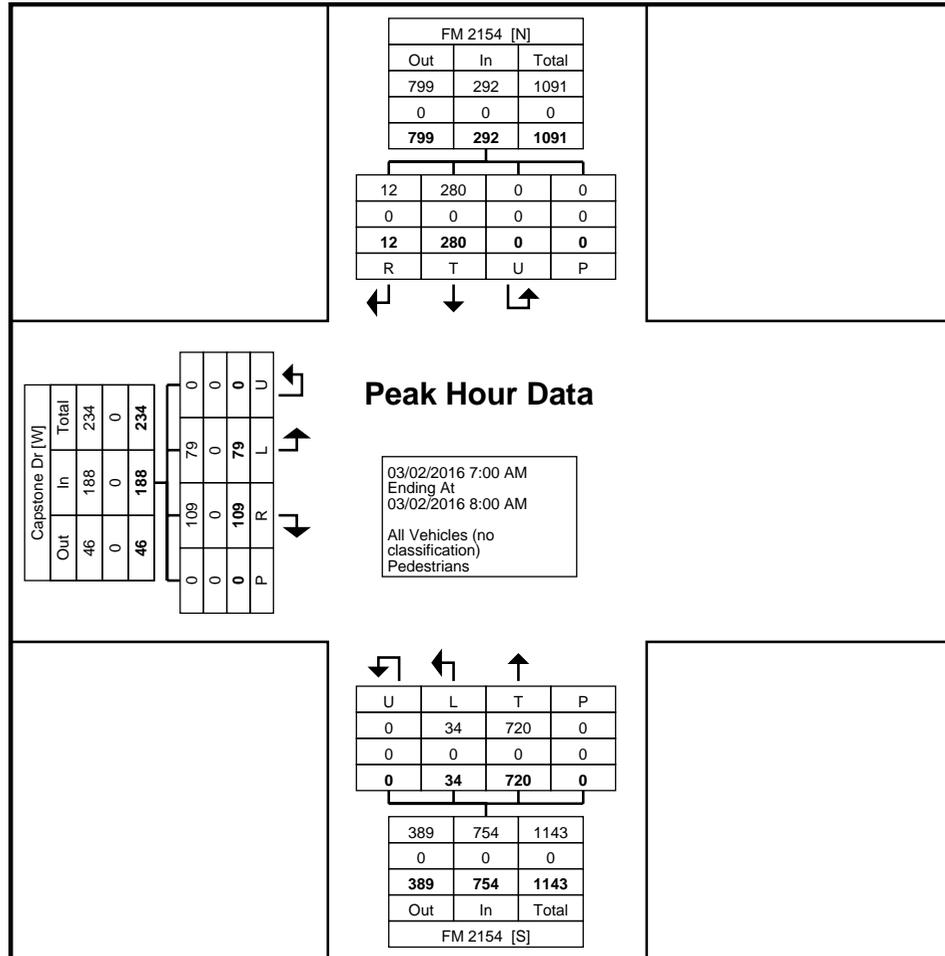
7:45 AM	94	1	0	0	95	16	206	0	0	222	19	27	0	0	46	363
Hourly Total	280	12	0	0	292	34	720	0	0	754	79	109	0	0	188	1234
8:00 AM	55	4	0	0	59	12	96	0	0	108	14	17	0	0	31	198
8:15 AM	45	4	0	0	49	6	74	0	0	80	19	17	0	0	36	165
8:30 AM	54	6	0	0	60	4	83	0	0	87	20	11	0	0	31	178
8:45 AM	40	2	0	0	42	7	88	1	0	96	7	12	0	0	19	157
Hourly Total	194	16	0	0	210	29	341	1	0	371	60	57	0	0	117	698
9:00 AM	35	4	0	0	39	5	74	0	0	79	13	9	0	0	22	140
9:15 AM	41	4	0	0	45	4	67	0	0	71	12	10	0	0	22	138
9:30 AM	36	7	0	0	43	4	61	0	0	65	13	19	0	0	32	140
9:45 AM	52	7	0	0	59	7	61	0	0	68	17	4	0	0	21	148
Hourly Total	164	22	0	0	186	20	263	0	0	283	55	42	0	0	97	566
10:00 AM	43	3	0	0	46	7	50	0	0	57	20	11	0	0	31	134
10:15 AM	36	12	0	0	48	6	51	0	0	57	9	7	0	0	16	121
10:30 AM	46	7	0	0	53	5	60	0	0	65	7	5	0	0	12	130
10:45 AM	35	6	0	0	41	6	68	0	0	74	10	5	0	0	15	130
Hourly Total	160	28	0	0	188	24	229	0	0	253	46	28	0	0	74	515
11:00 AM	45	8	0	0	53	14	57	0	0	71	11	7	0	0	18	142
11:15 AM	51	6	0	0	57	2	69	0	0	71	16	14	0	0	30	158
11:30 AM	47	7	0	0	54	7	62	0	0	69	14	14	0	0	28	151
11:45 AM	63	7	0	0	70	9	64	0	0	73	12	11	0	0	23	166
Hourly Total	206	28	0	0	234	32	252	0	0	284	53	46	0	0	99	617
12:00 PM	71	8	0	0	79	12	67	0	0	79	11	1	0	0	12	170
12:15 PM	59	9	0	0	68	9	65	0	0	74	13	2	0	0	15	157
12:30 PM	54	16	0	0	70	6	53	0	0	59	16	6	0	0	22	151
12:45 PM	69	20	0	0	89	10	73	0	0	83	10	14	0	0	24	196
Hourly Total	253	53	0	0	306	37	258	0	0	295	50	23	0	0	73	674
1:00 PM	60	6	0	0	66	16	57	0	0	73	16	8	0	0	24	163
1:15 PM	56	9	0	0	65	11	63	0	0	74	13	7	0	0	20	159
1:30 PM	55	19	0	0	74	9	61	0	0	70	16	11	0	0	27	171
1:45 PM	66	12	0	0	78	13	68	0	0	81	10	10	0	0	20	179
Hourly Total	237	46	0	0	283	49	249	0	0	298	55	36	0	0	91	672
2:00 PM	56	9	1	0	66	11	44	0	0	55	12	10	0	0	22	143
2:15 PM	62	11	0	0	73	6	68	0	0	74	8	11	0	0	19	166
2:30 PM	74	10	0	0	84	12	56	0	0	68	12	14	0	0	26	178
2:45 PM	83	16	0	0	99	17	70	0	0	87	11	13	0	0	24	210
Hourly Total	275	46	1	0	322	46	238	0	0	284	43	48	0	0	91	697
3:00 PM	64	13	0	0	77	16	86	0	0	102	13	14	0	0	27	206
3:15 PM	66	17	0	0	83	14	82	0	0	96	14	14	0	0	28	207
3:30 PM	48	10	0	0	58	11	94	0	0	105	14	9	0	0	23	186
3:45 PM	96	12	0	0	108	17	82	0	0	99	19	18	0	0	37	244
Hourly Total	274	52	0	0	326	58	344	0	0	402	60	55	0	0	115	843
4:00 PM	87	13	0	0	100	21	75	0	0	96	11	5	0	0	16	212
4:15 PM	112	25	0	0	137	19	82	0	0	101	10	13	0	0	23	261
4:30 PM	103	17	0	0	120	15	92	0	0	107	15	9	0	0	24	251
4:45 PM	121	16	0	0	137	14	92	0	0	106	19	13	0	0	32	275
Hourly Total	423	71	0	0	494	69	341	0	0	410	55	40	0	0	95	999
5:00 PM	140	10	0	0	150	17	110	0	0	127	19	17	0	0	36	313
5:15 PM	147	16	0	0	163	21	107	0	0	128	21	8	0	0	29	320
5:30 PM	150	11	0	0	161	19	91	0	0	110	14	17	0	0	31	302
5:45 PM	113	15	0	0	128	25	83	0	0	108	18	12	0	0	30	266
Hourly Total	550	52	0	0	602	82	391	0	0	473	72	54	0	0	126	1201





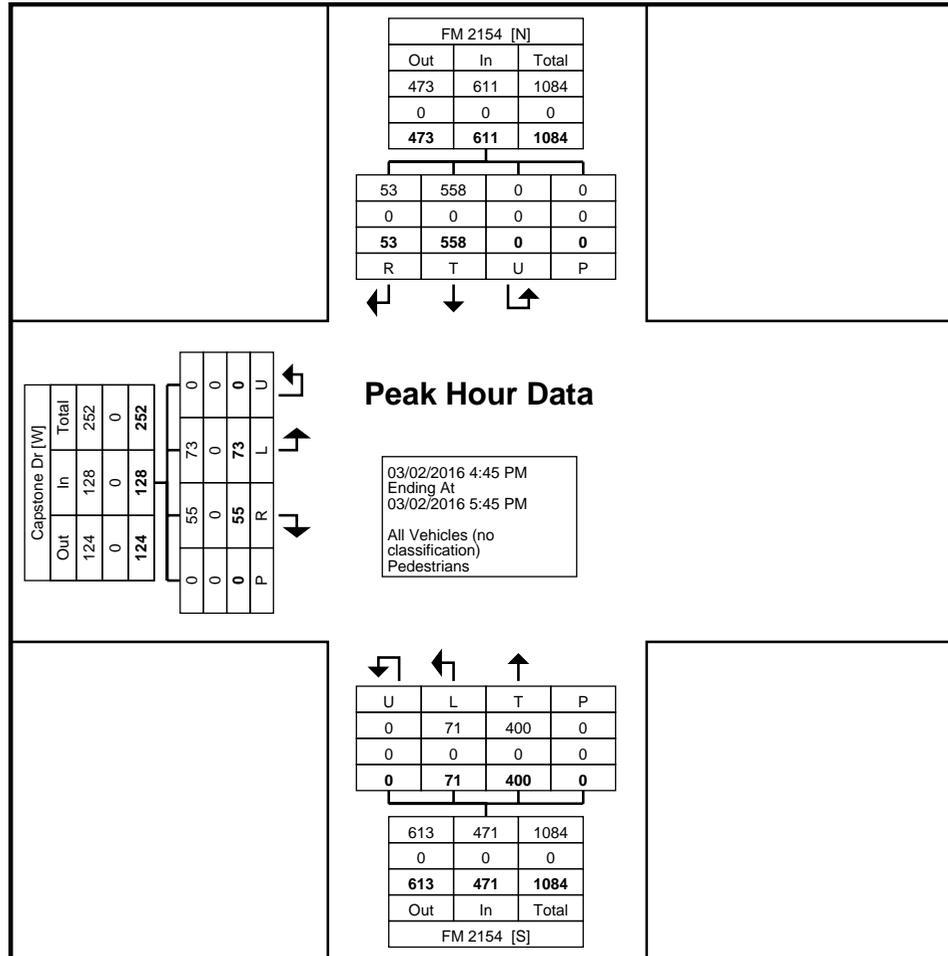
Turning Movement Data Plot





Turning Movement Peak Hour Data Plot (7:00 AM)





Turning Movement Peak Hour Data Plot (4:45 PM)

## **APPENDIX B**

### **Spot Speed Data**

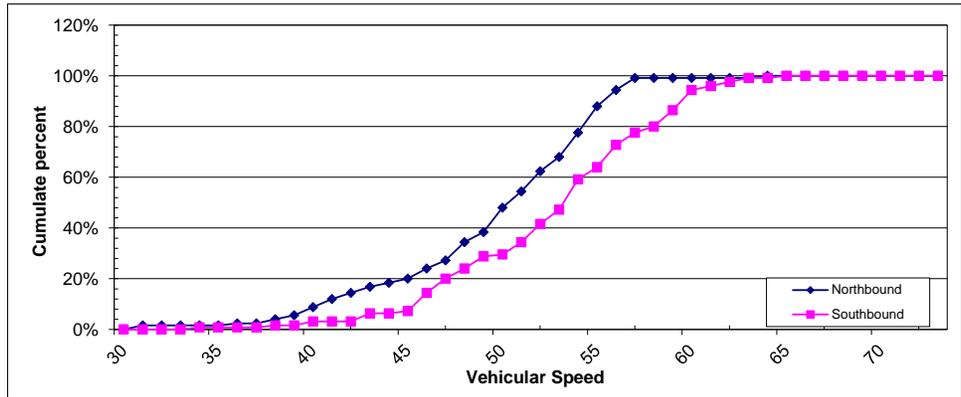
## Spot Speed Study FM 2154 in the vicinity of Capstone Dr

Northbound 85% speed is: **55 MPH**  
Southbound 85% speed is: **59 MPH**

Date: 3/1/2016  
Posted Speed: 55 MPH

Begin Time: 9:30 AM  
End Time: 11:30 AM

Speed	Northbound	Southbound
30	0	0
31	2	0
32	0	0
33	0	0
34	0	1
35	0	0
36	1	0
37	0	0
38	2	1
39	2	0
40	4	2
41	4	0
42	3	0
43	3	4
44	2	0
45	2	1
46	5	9
47	4	7
48	9	5
49	5	6
50	12	1
51	8	6
52	10	9
53	7	7
54	12	15
55	13	6
56	8	11
57	6	6
58	0	3
59	0	8
60	0	10
61	0	2
62	0	2
63	0	2
64	1	0
65	0	1
66	0	0
67	0	0
68	0	0
69	0	0
70	0	0
71	0	0
72	0	0
73	0	0
74	0	0
75	0	0
<b>Total:</b>	<b>125</b>	<b>125</b>



Northbound					Southbound						
Cumulative			Cumulative		Cumulative			Cumulative			
Total of Vehicles Surveyed	Percent of Vehicles Surveyed		Total of Vehicles Surveyed	Percent of Vehicles Surveyed	Total of Vehicles Surveyed	Percent of Vehicles Surveyed		Total of Vehicles Surveyed	Percent of Vehicles Surveyed		
30	0	0%	53	85	68%	30	0	0%	53	59	47.20%
31	2	2%	54	97	78%	31	0	0%	54	74	59.20%
32	2	2%	55	110	88%	32	0	0%	55	80	64.00%
33	2	2%	56	118	94%	33	0	0%	56	91	72.80%
34	2	2%	57	124	99%	34	1	1%	57	97	77.60%
35	2	2%	58	124	99%	35	1	1%	58	100	80.00%
36	3	2%	59	124	99%	36	1	1%	59	108	86.40%
37	3	2%	60	124	99%	37	1	1%	60	118	94.40%
38	5	4%	61	124	99%	38	2	2%	61	120	96.00%
39	7	6%	62	124	99%	39	2	2%	62	122	97.60%
40	11	9%	63	124	99%	40	4	3%	63	124	99.20%
41	15	12%	64	125	100%	41	4	3%	64	124	99.20%
42	18	14%	65	125	100%	42	4	3%	65	125	100.00%
43	21	17%	66	125	100%	43	8	6%	66	125	100.00%
44	23	18%	67	125	100%	44	8	6%	67	125	100.00%
45	25	20%	68	125	100%	45	9	7%	68	125	100.00%
46	30	24%	69	125	100%	46	18	14%	69	125	100.00%
47	34	27%	70	125	100%	47	25	20%	70	125	100.00%
48	43	34%	71	125	100%	48	30	24%	71	125	100.00%
49	48	38%	72	125	100%	49	36	29%	72	125	100.00%
50	60	48%	73	125	100%	50	37	30%	73	125	100.00%
51	68	54%	74	125	100%	51	43	34%	74	125	100.00%
52	78	62%	75	125	100%	52	52	42%	75	125	100.00%

**APPENDIX C**

**Traffic Signal Warrant Analysis Worksheets**



Form Revised 2/27/2012

# Traffic Survey — Count Analysis

## 2011 TMUTCD Warrants

County: Brazos District: Bryan  
 City: College Station Population: \_\_\_\_\_ Survey Date: 03/02/2016

	Name	Control	Section	85% Speed
Major	FM 2154 Wellborn Road			55 MPH
Minor	Barron Road			

**Eight Highest Hours:** Include the same 8 hours for the Major and Minor St. volumes.

Time Ends	Major St. - Both App.		Minor St. - Hi. Vol. App.		Comments: Meets Warrant #1 and #2 under existing conditions.
	Veh. Total	Ped. Total	Veh. Total	Ped. Total	
8:00 AM	1,397		83		
6:00 PM	1,114		241		
5:00 PM	880		219		
7:00 PM	798		201		
4:00 PM	789		133		
9:00 AM	719		107		
3:00 PM	618		126		
2:00 PM	589		135		

### Warrant 1. Eight Hour Vehicular Volume

Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition A.  
 - *or* -  
 Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition B.  
 - *or* -  
 Yes  No Meets 80%<sup>d</sup> of Conditions A and B.  
 - *or* -  
 Yes  No Meets 56%<sup>d</sup> of Conditions A and B (and major-street speed exceeds 40 mph or population less than 10,000).

### Condition A - Minimum Vehicle Volume

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	500	400	350	280	589	150	120	105	84	83
2 or more	1	600	480	420	336		150	120	105	84	
2 or more	2 or more	600	480	420	336		200	160	140	112	
1	2 or more	500	400	350	280		200	160	140	112	

### Condition B - Interruption of Continuous Traffic

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	750	600	525	420	589	75	60	53	42	83
2 or more	1	900	720	630	504		75	60	53	42	
2 or more	2 or more	900	720	630	504		100	80	70	56	
1	2 or more	750	600	525	420		100	80	70	56	

<sup>a</sup>Basic minimum hourly volume.

<sup>b</sup>Used for combination of Conditions A and B after adequate trial of other remedial measures.

<sup>c</sup>May be used when the major-street speed exceeds 40 mph or in a community with a population of less than 10,000.

<sup>d</sup>May be used for combination of Conditions A and B after adequate trial of other remedial measures when major street exceeds 40 mph or in an isolated community with a population of less than 10,000.

**Warrant 2. Four Hour Volumes (70% Factor)**

<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Meets each of 4 Highest Hours (Warrant 2 — see Figure 1).
---	---

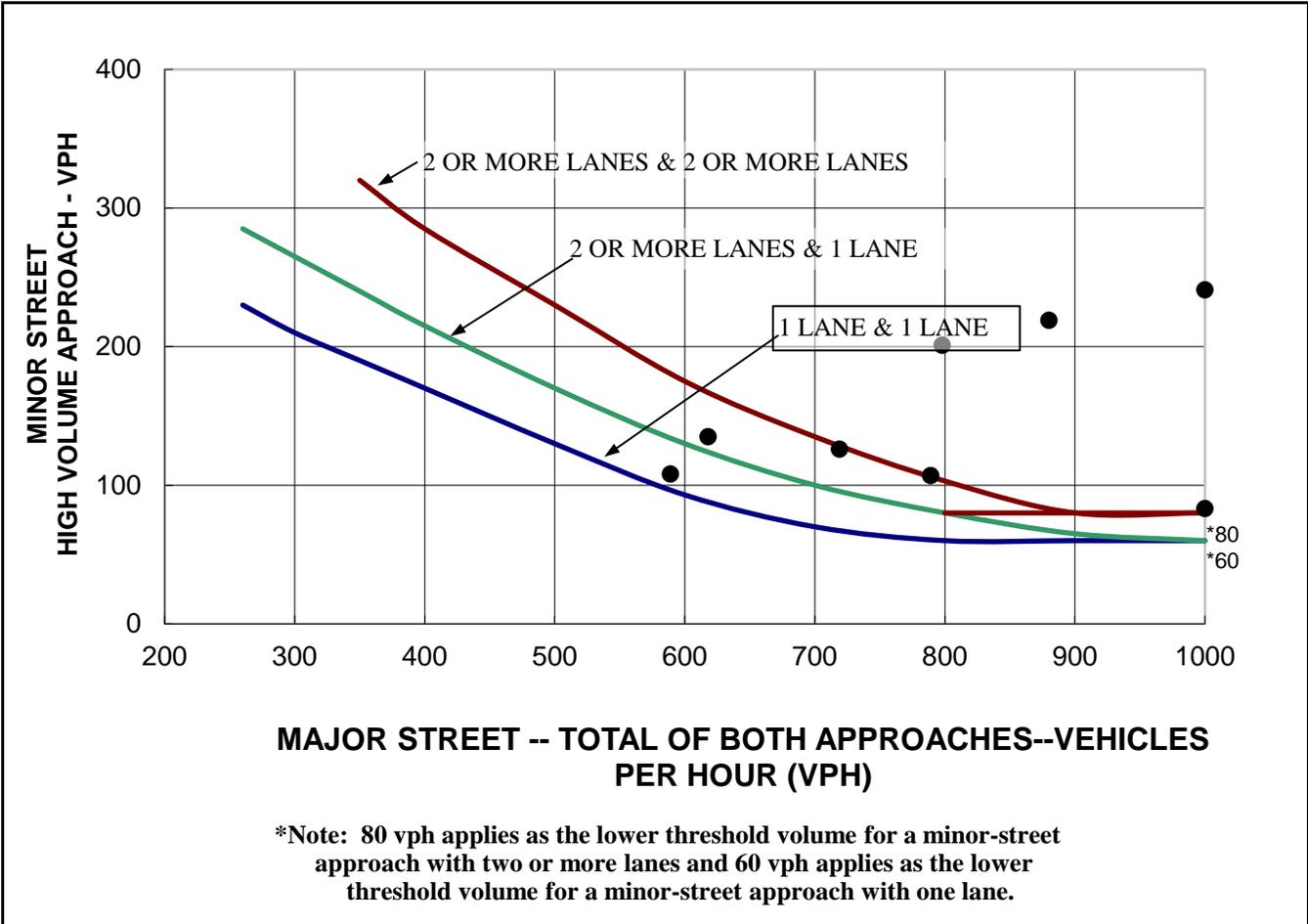


Figure 1. Four-hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 2.)

**Warrant 3. Peak Hour (70% Factor)**

<input type="checkbox"/> Yes <input type="checkbox"/> No  <p style="text-align: center; font-size: 1.5em;"><b>N/A</b></p>	Are all of the following conditions true for any four consecutive 15 minute periods?  1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds 4 vehicle-hours for a one-lane approach and 5 vehicle-hours for a two-lane approach, <i>and</i>  2. The volume of the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, <i>and</i>  3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four (or more) approaches.
– <i>or</i> –	
<input type="checkbox"/> Yes <input type="checkbox"/> No	Meets one High Hour (Warrant 3 — see Figure 2).

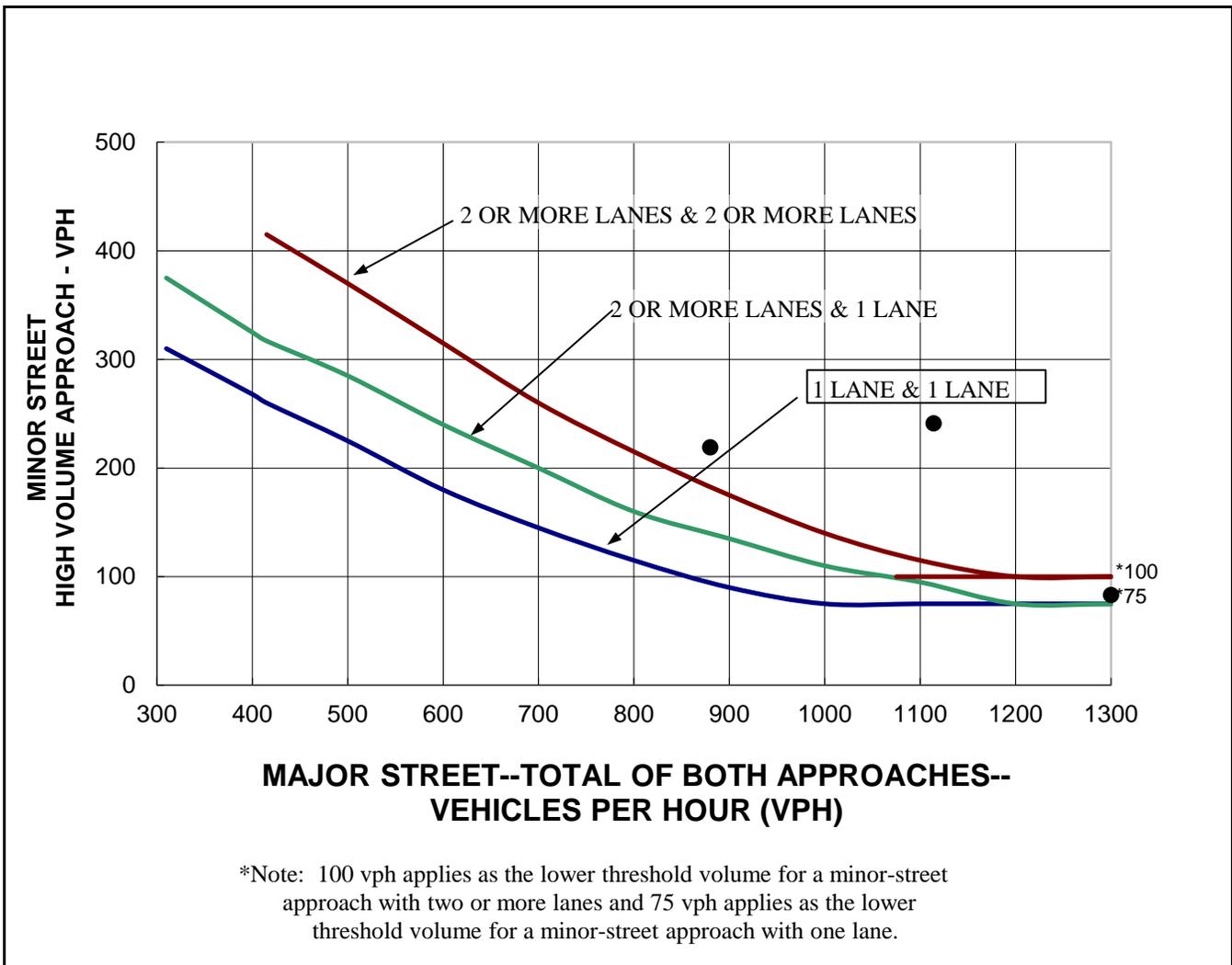


Figure 2. Peak hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 3.)

**Warrant 5. School Crossing**

<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>N/A</b>	Is the number of adequate gaps in traffic stream during the period when the children are using the crossing less than the number of minutes in the same period? – <i>and</i> –
<input type="checkbox"/> Yes <input type="checkbox"/> No		Is there a minimum of 20 students during the highest crossing hour? – <i>and</i> –
<input type="checkbox"/> Yes <input type="checkbox"/> No		Is the nearest signal located more than 300 feet away? (This warrant may be applied, if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic.)

**Warrant 6. Coordinated Signal System**

<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>N/A</b>	On a one-way street or a street with traffic predominantly in one direction, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur? – <i>or</i> –
<input type="checkbox"/> Yes <input type="checkbox"/> No		On a two-way street, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur and would the proposed and adjacent traffic control signal provide a progressive operation?

**Warrant 7. Crash Experience**

<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Is one of the following conditions met?:
	<ul style="list-style-type: none"> <li>◆ 80% of Condition A or Condition B in Warrant 1</li> <li>◆ 56% of Condition A or B in Warrant 1 (major-street speed exceeding 40 mph or population less than 10,000)</li> <li>◆ 80 % or more of Warrant 4 met?</li> </ul> – <i>and</i> –
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Have there been 5 or more reportable crashes susceptible to correction by a traffic signal within a 12 month period?

**Warrant 8. Roadway Network**

<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Is the total existing, or immediately projected, entering volume on all approaches greater than 1000 vehicles for each of any 5 hours of a Saturday and/or Sunday. – <i>or</i> –
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Is the total existing, or immediately projected, entering volume greater than 1000 vehicles for the peak hour of a typical weekday, and do the 5 year projected traffic volumes meet one or more of Warrants 1, 2, and 3 during an average weekday?

Check applicable characteristics of each route:

Major Street	Minor Street	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It is part of street or highway system that serves as the principal roadway network for through traffic flow.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	It includes rural or suburban highways outside, entering, or traversing a city.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

**Remarks:**



Form Revised 2/27/2012

# Traffic Survey — Count Analysis

## 2011 TMUTCD Warrants

County: Brazos District: Bryan  
 City: College Station Population: \_\_\_\_\_ Survey Date: 03/02/2016

		Name	Control	Section	85% Speed
Major	FM 2154	Wellborn Road			55 MPH
Minor		Capstone Drive			

**Eight Highest Hours:** Include the same 8 hours for the Major and Minor St. volumes.

Time Ends	Major St. - Both App.		Minor St. - Hi. Vol. App.	
	Veh. Total	Ped. Total	Veh. Total	Ped. Total
8:00 AM	1,046		188	
6:00 PM	1,075		126	
5:00 PM	904		95	
7:00 PM	778		114	
4:00 PM	728		115	
9:00 AM	581		117	
3:00 PM	606		91	
1:00 PM	601		73	

Comments: Meets Warrant #1, #2, and #9 under existing conditions.

### Warrant 1. Eight Hour Vehicular Volume

Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition A.  
 - *or* -  
 Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition B.  
 - *or* -  
 Yes  No Meets 80%<sup>d</sup> of Conditions A and B.  
 - *or* -  
 Yes  No Meets 56%<sup>d</sup> of Conditions A and B (and major-street speed exceeds 40 mph or population less than 10,000).

### Condition A - Minimum Vehicle Volume

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	500	400	350	280	581	150	120	105	84	73
2 or more	1	600	480	420	336		150	120	105	84	
2 or more	2 or more	600	480	420	336		200	160	140	112	
1	2 or more	500	400	350	280		200	160	140	112	

### Condition B - Interruption of Continuous Traffic

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	750	600	525	420	581	75	60	53	42	73
2 or more	1	900	720	630	504		75	60	53	42	
2 or more	2 or more	900	720	630	504		100	80	70	56	
1	2 or more	750	600	525	420		100	80	70	56	

<sup>a</sup>Basic minimum hourly volume.

<sup>b</sup>Used for combination of Conditions A and B after adequate trial of other remedial measures.

<sup>c</sup>May be used when the major-street speed exceeds 40 mph or in a community with a population of less than 10,000.

<sup>d</sup>May be used for combination of Conditions A and B after adequate trial of other remedial measures when major street exceeds 40 mph or in an isolated community with a population of less than 10,000.

**Warrant 2. Four Hour Volumes (70% Factor)**

<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Meets each of 4 Highest Hours (Warrant 2 — see Figure 1).
---	---

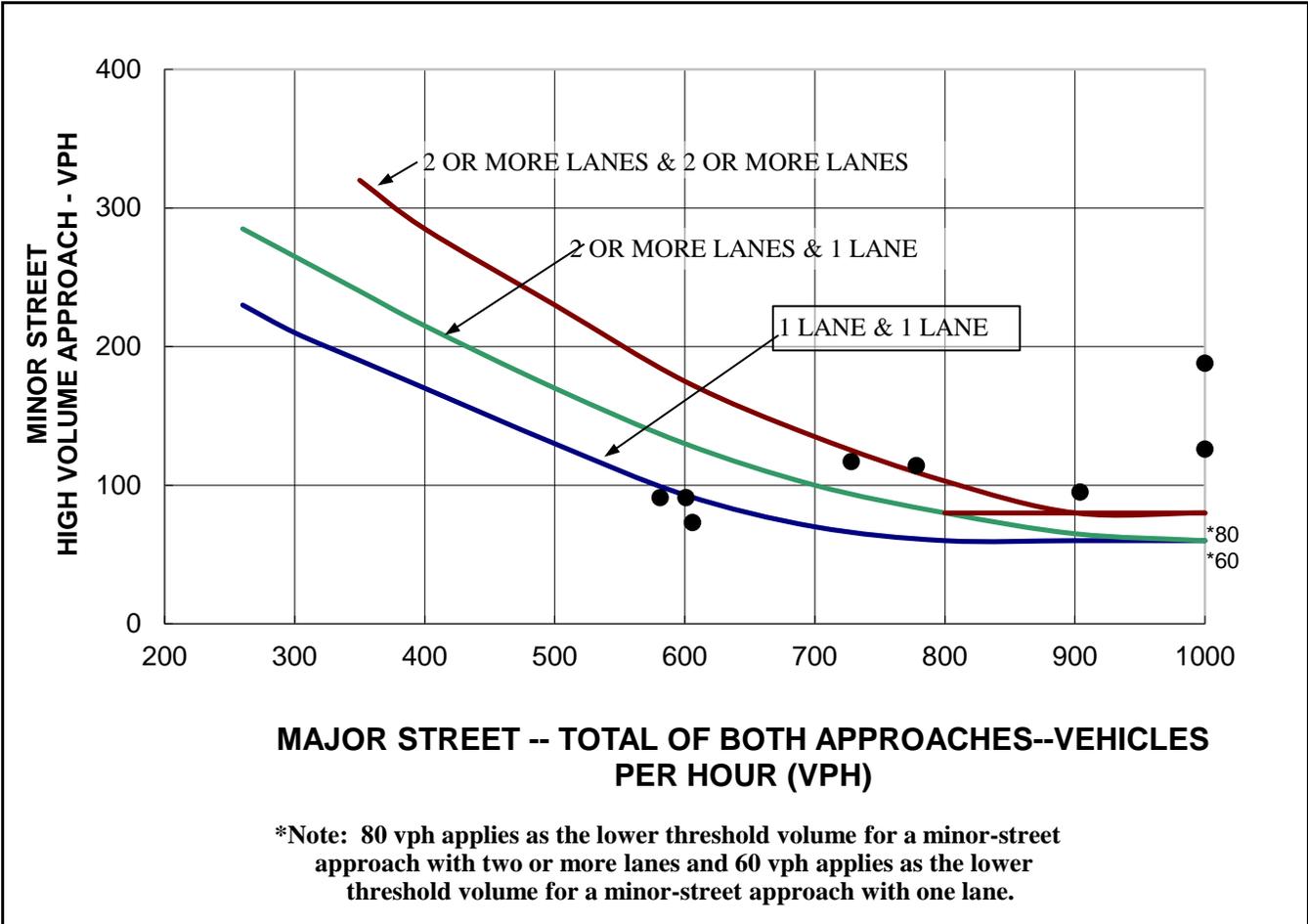


Figure 1. Four-hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 2.)

**Warrant 3. Peak Hour (70% Factor)**

<input type="checkbox"/> Yes <input type="checkbox"/> No  <p style="text-align: center; font-size: 1.5em;"><b>N/A</b></p>	Are all of the following conditions true for any four consecutive 15 minute periods?  1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds 4 vehicle-hours for a one-lane approach and 5 vehicle-hours for a two-lane approach, <i>and</i>  2. The volume of the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, <i>and</i>  3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four (or more) approaches.
- <i>or</i> -	
<input type="checkbox"/> Yes <input type="checkbox"/> No	Meets one High Hour (Warrant 3 — see Figure 2). <b>N/A</b>

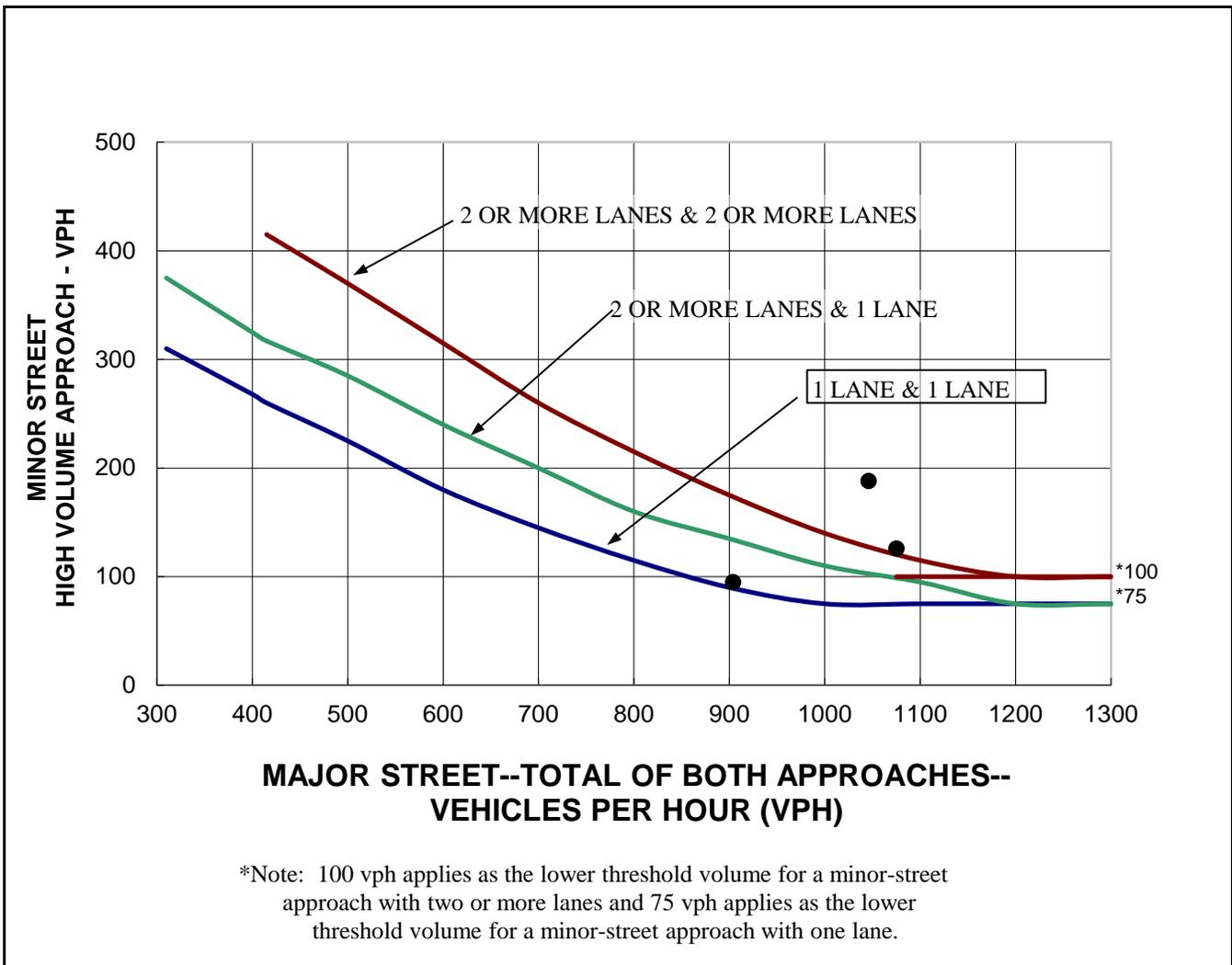


Figure 2. Peak hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 3.)

**Warrant 5. School Crossing**

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Is the number of adequate gaps in traffic stream during the period when the children are using the crossing less than the number of minutes in the same period? - <i>and</i> -
<b>N/A</b>				
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Is there a minimum of 20 students during the highest crossing hour? - <i>and</i> -
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Is the nearest signal located more than 300 feet away? (This warrant may be applied, if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic.)

**Warrant 6. Coordinated Signal System**

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	On a one-way street or a street with traffic predominantly in one direction, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur? - <i>or</i> -
<b>N/A</b>				
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	On a two-way street, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur and would the proposed and adjacent traffic control signal provide a progressive operation?

**Warrant 7. Crash Experience**

<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	Is one of the following conditions met?: <ul style="list-style-type: none"> <li>◆ 80% of Condition A or Condition B in Warrant 1</li> <li>◆ 56% of Condition A or B in Warrant 1 (major-street speed exceeding 40 mph or population less than 10,000)</li> <li>◆ 80 % or more of Warrant 4 met?</li> </ul> - <i>and</i> -
<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No	Have there been 5 or more reportable crashes susceptible to correction by a traffic signal within a 12 month period?

**Warrant 8. Roadway Network**

<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No	Is the total existing, or immediately projected, entering volume on all approaches greater than 1000 vehicles for each of any 5 hours of a Saturday and/or Sunday. - <i>or</i> -
<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No	Is the total existing, or immediately projected, entering volume greater than 1000 vehicles for the peak hour of a typical weekday, and do the 5 year projected traffic volumes meet one or more of Warrants 1, 2, and 3 during an average weekday?

Check applicable characteristics of each route:

<u>Major Street</u>	<u>Minor Street</u>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It is part of street or highway system that serves as the principal roadway network for through traffic flow.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	It includes rural or suburban highways outside, entering, or traversing a city.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

**Remarks:**

**Warrant 9. Intersection Near a Grade Crossing (One Approach Lane at the Track Crossing)**

Yes  No Meets one High Hour (Warrant 9 — see Figure 5).

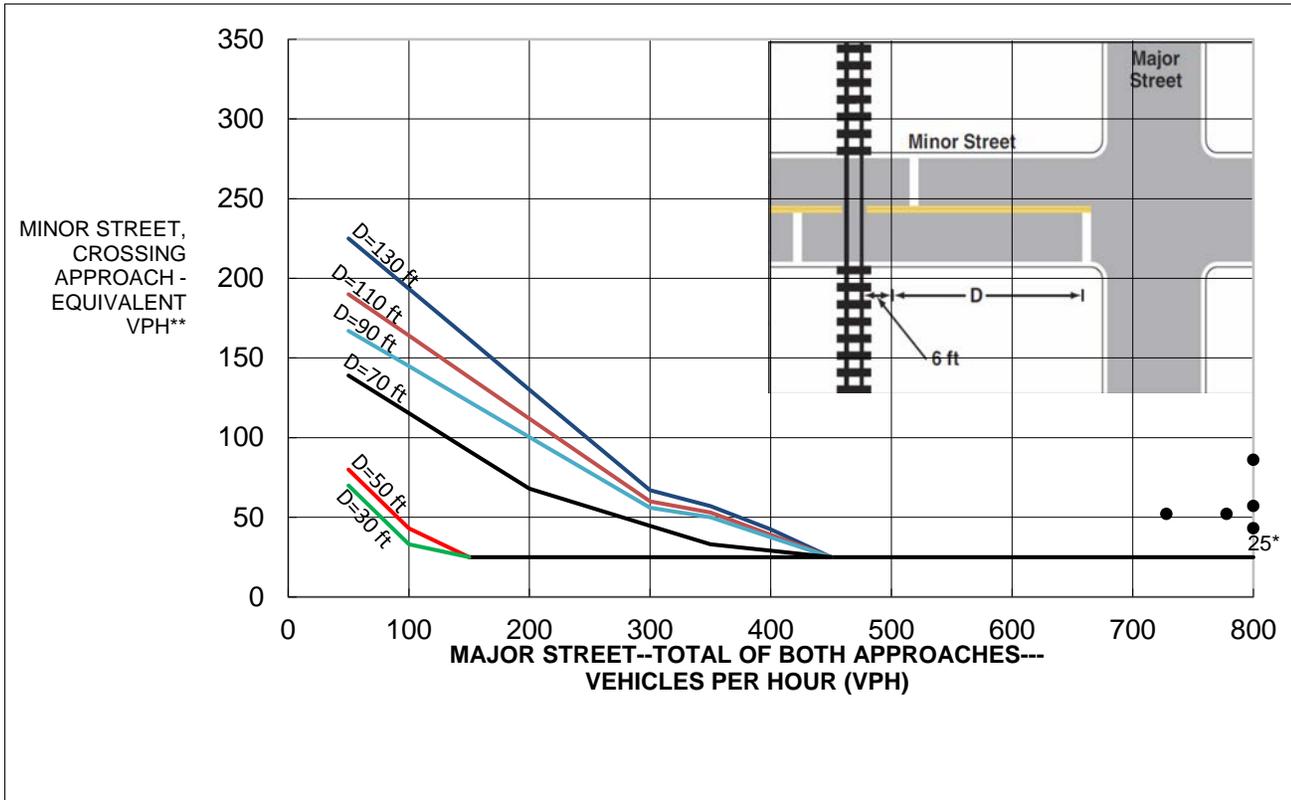


Figure 5. Railroad Grade Crossing (One Approach Lane at the Track Crossing).  
 (Warrant 9.)

\*25 vph applies as the lower threshold volume  
 \*\* VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate



Form Revised 2/27/2012

# Traffic Survey — Count Analysis

## 2011 TMUTCD Warrants

County: Brazos District: Bryan

City: College Station Population: \_\_\_\_\_ Survey Date: \_\_\_\_\_

	Name	Control	Section	85% Speed
Major	FM 2154 Wellborn Road			55 MPH
Minor	Capstone Dr/Barron Rd			

**Eight Highest Hours:** Include the same 8 hours for the Major and Minor St. volumes.

Time Ends	Major St. - Both App.		Minor St. - Hi. Vol. App.		Comments
	Veh. Total	Ped. Total	Veh. Total	Ped. Total	
8:00 AM	1,500		218		Comments: Meets Warrants #1, #2 and #9, for year 2019 projected traffic volumes, and Barron Road realigned to intersect Capstone Drive. The traffic signal will need railroad preemption.
6:00 PM	1,284		278		
5:00 PM	1,056		253		
7:00 PM	916		233		
4:00 PM	903		154		
9:00 AM	780		135		
3:00 PM	717		145		
2:00 PM	693		156		

### Warrant 1. Eight Hour Vehicular Volume

Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition A.  
- *or* -

Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) *or* 100%<sup>a</sup> (regardless of speed) of Condition B.  
- *or* -

Yes  No Meets 80%<sup>d</sup> of Conditions A and B.  
- *or* -

Yes  No Meets 56%<sup>d</sup> of Conditions A and B (and major-street speed exceeds 40 mph or population less than 10,000).

### Condition A - Minimum Vehicle Volume

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	500	400	350	280	<b>138.6%</b>	150	120	105	84	<b>67.5%</b>
2 or more	1	600	480	420	336		150	120	105	84	
2 or more	2 or more	600	480	420	336		200	160	140	112	
1	2 or more	500	400	350	280	693	200	160	140	112	135

### Condition B - Interruption of Continuous Traffic

Number of Lanes		Vehicles per hour on Major St (Total of Both Approaches)				Vehicles per hour on higher-volume Minor St approach (One Direction Only)					
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	750	600	525	420	<b>92.4%</b>	75	60	53	42	<b>135.0%</b>
2 or more	1	900	720	630	504		75	60	53	42	
2 or more	2 or more	900	720	630	504		100	80	70	56	
1	2 or more	750	600	525	420	693	100	80	70	56	135

<sup>a</sup>Basic minimum hourly volume.

<sup>b</sup>Used for combination of Conditions A and B after adequate trial of other remedial measures.

<sup>c</sup>May be used when the major-street speed exceeds 40 mph or in a community with a population of less than 10,000.

<sup>d</sup>May be used for combination of Conditions A and B after adequate trial of other remedial measures when major street exceeds 40 mph or in an isolated community with a population of less than 10,000.

**Warrant 2. Four Hour Volumes (70% Factor)**

<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Meets each of 4 Highest Hours (Warrant 2 — see Figure 1).
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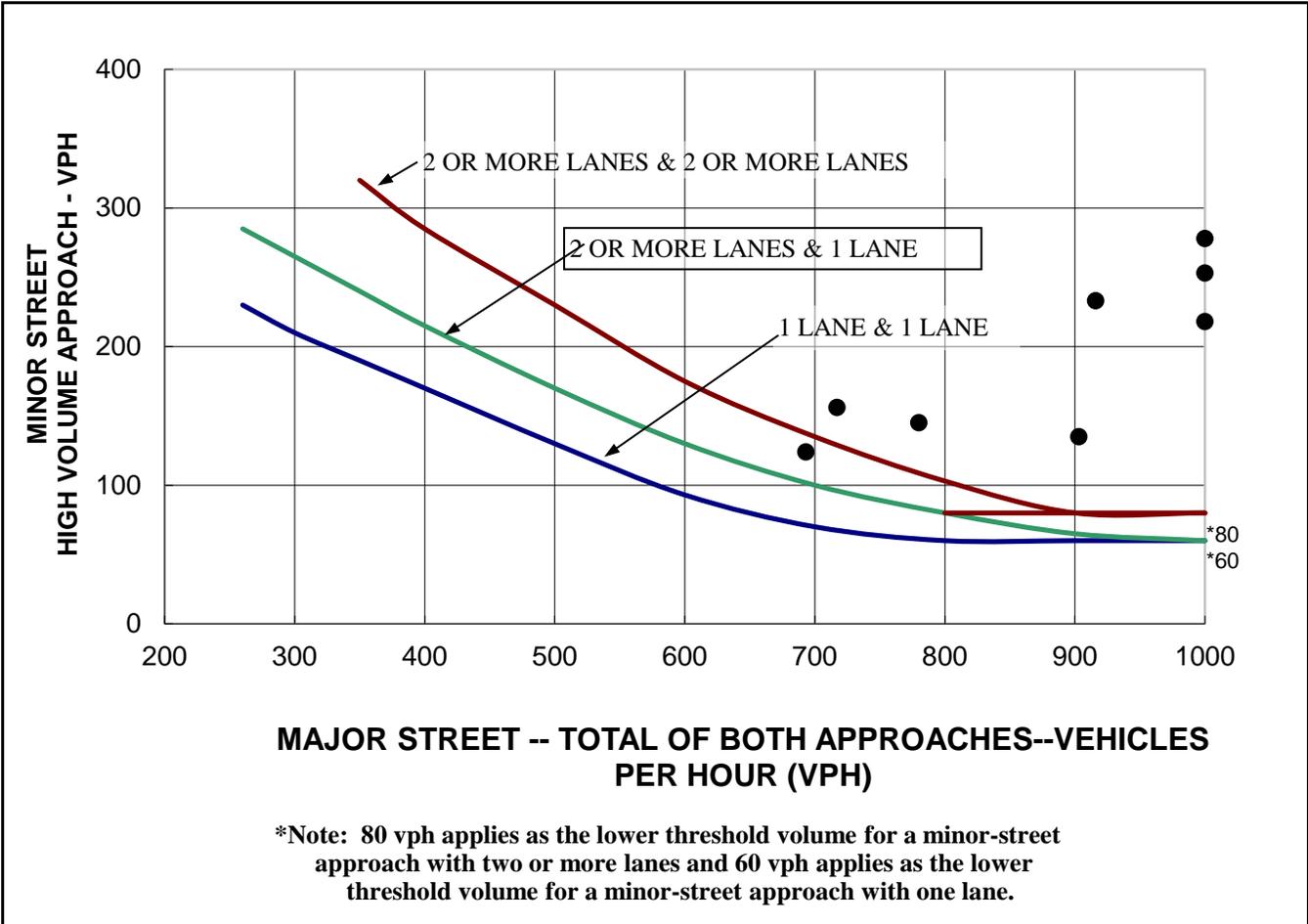


Figure 1. Four-hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 2.)

**Warrant 3. Peak Hour (70% Factor)**

<input type="checkbox"/> Yes <input type="checkbox"/> No  <p style="text-align: center; font-size: 1.5em;"><b>N/A</b></p>	Are all of the following conditions true for any four consecutive 15 minute periods?  1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds 4 vehicle-hours for a one-lane approach and 5 vehicle-hours for a two-lane approach, <i>and</i>  2. The volume of the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, <i>and</i>  3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four (or more) approaches.
- <i>or</i> -	
<input type="checkbox"/> Yes <input type="checkbox"/> No	Meets one High Hour (Warrant 3 — see Figure 2). <b>N/A</b>

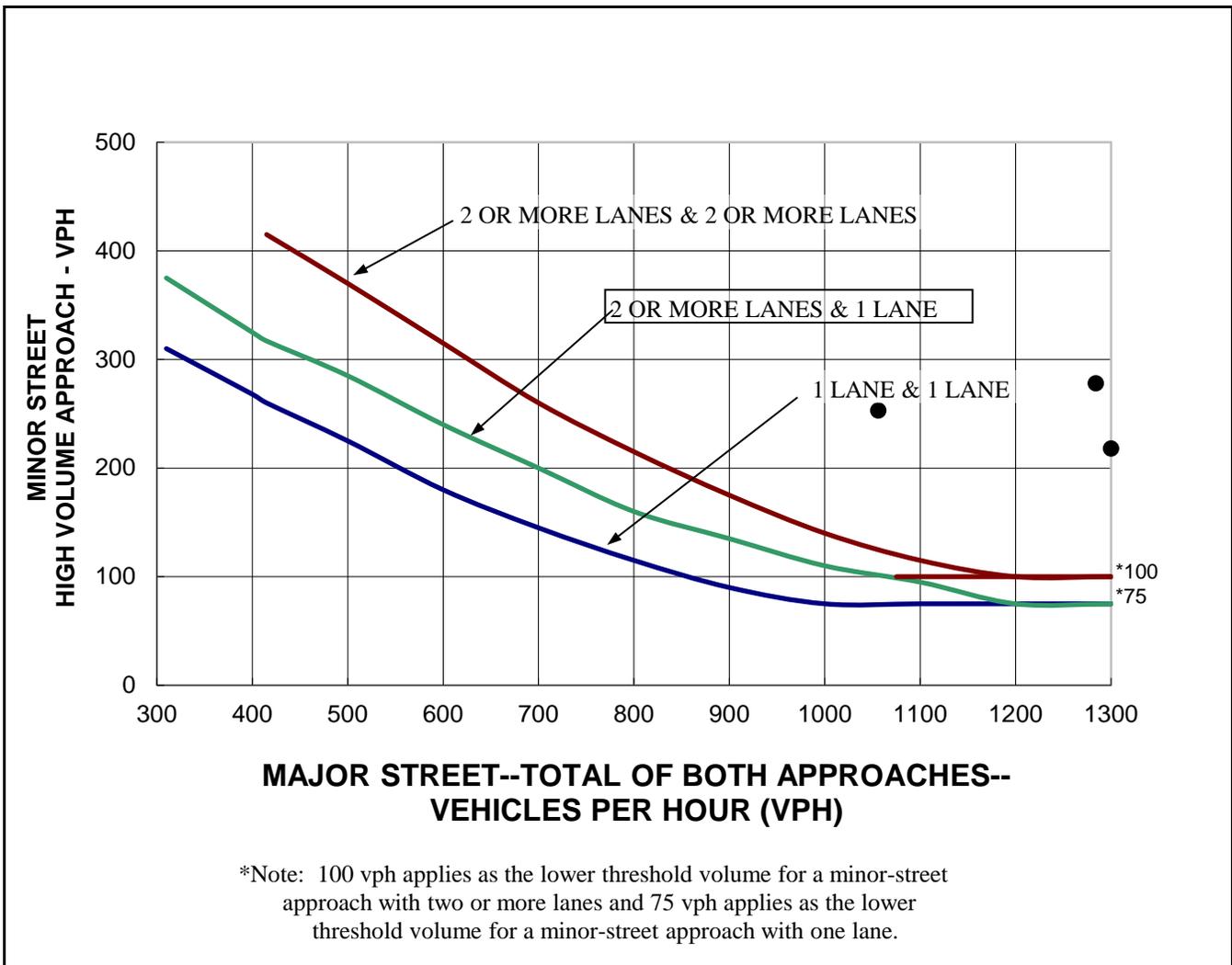


Figure 2. Peak hour volume warrant (community less than 10,000 population or above 40 MPH on major street). (Warrant 3.)

**Warrant 5. School Crossing**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is the number of adequate gaps in traffic stream during the period when the children are using the crossing less than the number of minutes in the same period? - <i>and</i> -
<b>N/A</b>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is there a minimum of 20 students during the highest crossing hour? - <i>and</i> -
<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is the nearest signal located more than 300 feet away? (This warrant may be applied, if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic.)

**Warrant 6. Coordinated Signal System**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	On a one-way street or a street with traffic predominantly in one direction, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur? - <i>or</i> -
<b>N/A</b>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	On a two-way street, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur and would the proposed and adjacent traffic control signal provide a progressive operation?

**Warrant 7. Crash Experience**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is one of the following conditions met?: <ul style="list-style-type: none"> <li>◆ 80% of Condition A or Condition B in Warrant 1</li> <li>◆ 56% of Condition A or B in Warrant 1 (major-street speed exceeding 40 mph or population less than 10,000)</li> <li>◆ 80 % or more of Warrant 4 met?</li> </ul> - <i>and</i> -
<b>N/A</b>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	Have there been 5 or more reportable crashes susceptible to correction by a traffic signal within a 12 month period?

**Warrant 8. Roadway Network**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is the total existing, or immediately projected, entering volume on all approaches greater than 1000 vehicles for each of any 5 hours of a Saturday and/or Sunday. - <i>or</i> -
<b>N/A</b>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is the total existing, or immediately projected, entering volume greater than 1000 vehicles for the peak hour of a typical weekday, and do the 5 year projected traffic volumes meet one or more of Warrants 1, 2, and 3 during an average weekday?

Check applicable characteristics of each route:

<u>Major Street</u>	<u>Minor Street</u>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It is part of street or highway system that serves as the principal roadway network for through traffic flow.
<input type="checkbox"/>	<input type="checkbox"/>	It includes rural or suburban highways outside, entering, or traversing a city.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

**Remarks:**

**Warrant 9. Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)**

<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	Meets one High Hour (Warrant 9 — see Figure 5).
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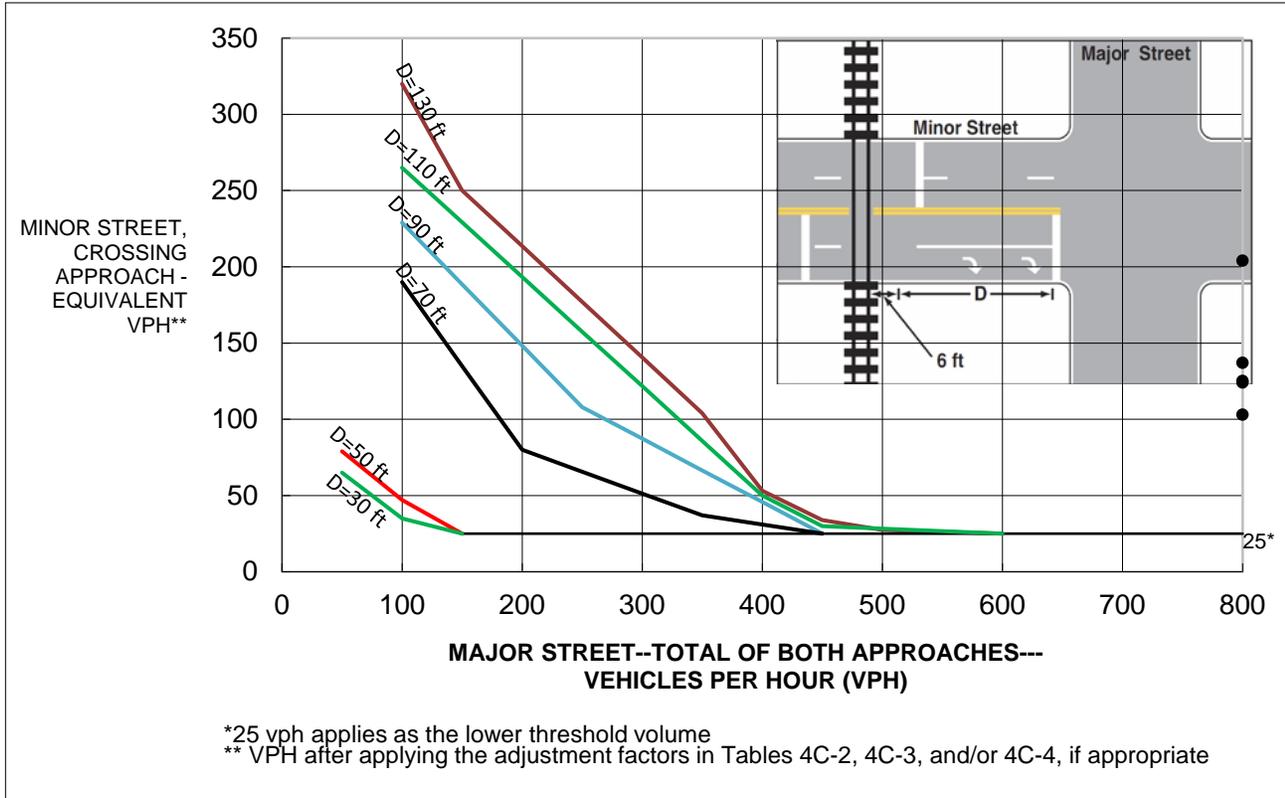
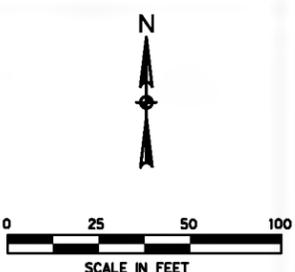
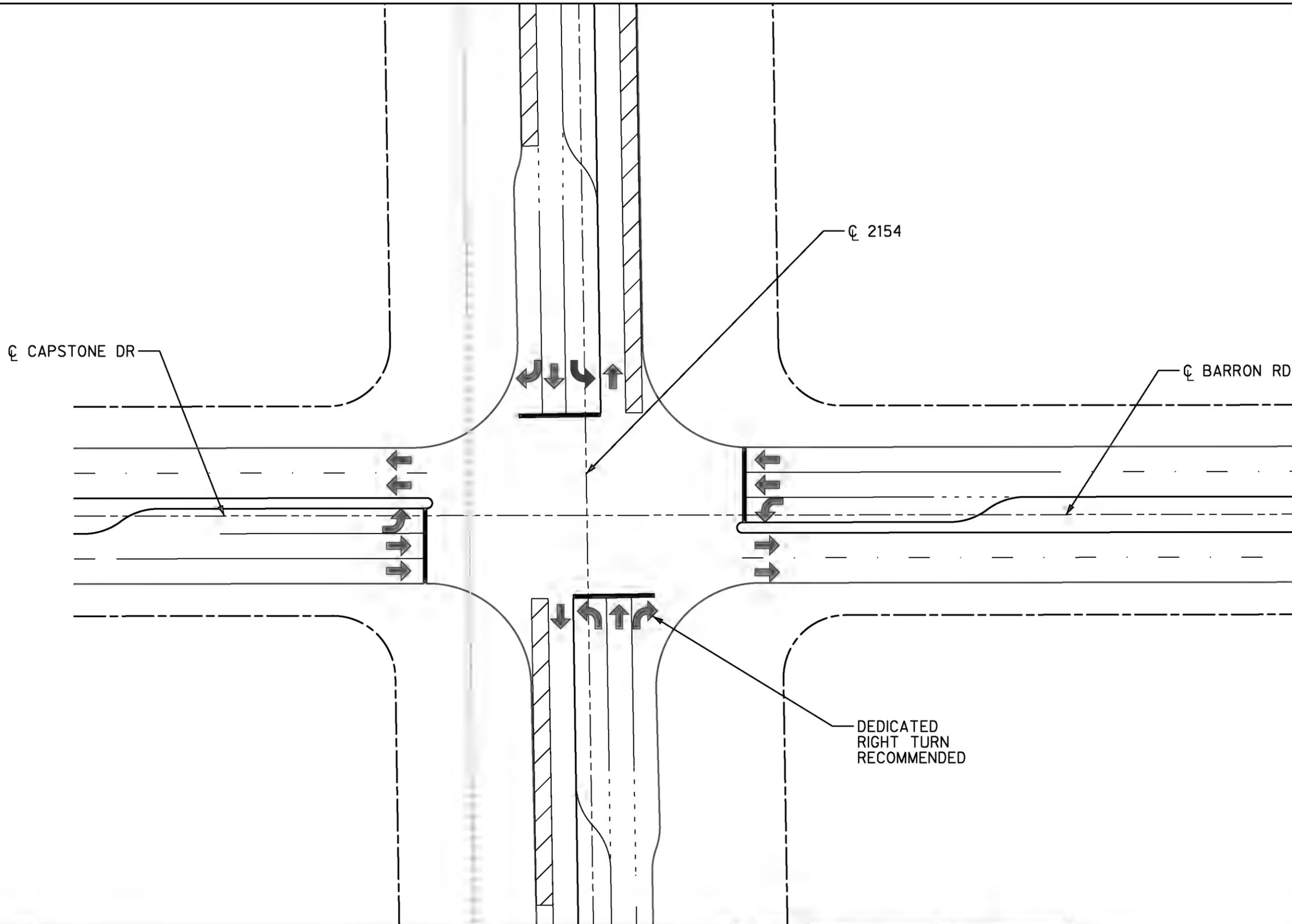


Figure 5. Railroad Grade Crossing (Two or More Approach Lanes at the Track Crossing).  
 (Warrant 9.)

**APPENDIX D**

**Barron Road/Capstone Drive Turn Lane Configuration**

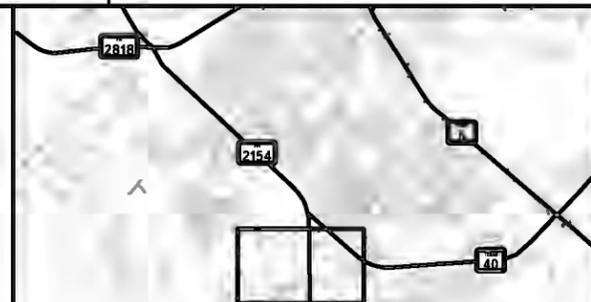


**LEGEND**

---	R.O.W.
---	PROPOSED LANE
---	PROPOSED MEDIAN
---	SHOULDER
+++	U.P.R.R. LINE

**PRELIMINARY**

THIS PRINT IS FURNISHED FOR INFORMATION ONLY.  
THE PLAN INFORMATION OR OTHER DATA SHOWN HEREON IS  
SUBJECT TO CHANGE AND MUST NOT BE CONSTRUED AS FINAL.



**BARRON RD / CAPSTONE DR**  
From Wellborn Rd (FM 2154) to Wm. Fitch Pkwy (SH 40)  
**TURN LANE CONFIGURATION**

**APPENDIX E**

**U.S. DOT Crossing Inventory Form**

# U. S. DOT CROSSING INVENTORY FORM

**DEPARTMENT OF TRANSPORTATION**  
FEDERAL RAILROAD ADMINISTRATION

OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For Private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.K. are required unless otherwise noted. An asterisk \* denotes an optional field.

<b>A. Revision Date</b> (MM/DD/YYYY) 02 / 25 / 2016	<b>B. Reporting Agency</b> <input checked="" type="checkbox"/> Railroad <input type="checkbox"/> Transit <input type="checkbox"/> State <input type="checkbox"/> Other	<b>C. Reason for Update (Select only one)</b> <input checked="" type="checkbox"/> Change in Data <input type="checkbox"/> Re-Open <input type="checkbox"/> New Crossing <input type="checkbox"/> Date Change Only <input type="checkbox"/> Closed <input type="checkbox"/> Change in Primary Operating RR <input type="checkbox"/> No Train Traffic <input type="checkbox"/> Quiet Zone Update <input type="checkbox"/> Admin. Correction	<b>D. DOT Crossing Inventory Number</b> 743223T
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## Part I: Location and Classification Information

<b>1. Primary Operating Railroad</b> Union Pacific Railroad Company [UP]		<b>2. State</b> TEXAS		<b>3. County</b> BRAZOS	
<b>4. City / Municipality</b> <input type="checkbox"/> In <input checked="" type="checkbox"/> Near COLLEGE STATION		<b>5. Street/Road Name &amp; Block Number</b> CAPSTONE CR 208 (Street/Road Name)   * (Block Number)		<b>6. Highway Type &amp; No.</b> CO 0208	
<b>7. Do Other Railroads Operate a Separate Track at Crossing?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR			<b>8. Do Other Railroads Operate Over Your Track at Crossing?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR		
<b>9. Railroad Division or Region</b> <input type="checkbox"/> None HOUSTON		<b>10. Railroad Subdivision or District</b> <input type="checkbox"/> None Navasota		<b>11. Branch or Line Name</b> <input checked="" type="checkbox"/> None	
<b>12. RR Milepost</b> 0068.080 (prefix)   (nnnn.nnn)   (suffix)		<b>13. Line Segment</b> *		<b>14. Nearest RR Timetable Station</b> *	
<b>15. Parent RR (if applicable)</b> <input checked="" type="checkbox"/> N/A		<b>16. Crossing Owner (if applicable)</b> <input checked="" type="checkbox"/> N/A		<b>17. Crossing Type</b> <input checked="" type="checkbox"/> Public <input type="checkbox"/> Private	
<b>18. Crossing Purpose</b> <input checked="" type="checkbox"/> Highway <input type="checkbox"/> Pathway, Ped. <input type="checkbox"/> Station, Ped.		<b>19. Crossing Position</b> <input checked="" type="checkbox"/> At Grade <input type="checkbox"/> RR Under <input type="checkbox"/> RR Over		<b>20. Public Access (if Private Crossing)</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
<b>21. Type of Train</b> <input checked="" type="checkbox"/> Freight <input type="checkbox"/> Intercity Passenger <input type="checkbox"/> Commuter		<input type="checkbox"/> Transit <input type="checkbox"/> Shared Use Transit <input type="checkbox"/> Tourist/Other		<b>22. Average Passenger Train Count Per Day</b> <input type="checkbox"/> Less Than One Per Day <input type="checkbox"/> Number Per Day 0	
<b>23. Type of Land Use</b> <input type="checkbox"/> Open Space <input type="checkbox"/> Farm <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Institutional <input type="checkbox"/> Recreational <input type="checkbox"/> RR Yard					
<b>24. Is there an Adjacent Crossing with a Separate Number?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Provide Crossing Number			<b>25. Quiet Zone (FRA provided)</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> 24 Hr <input type="checkbox"/> Partial <input type="checkbox"/> Chicago Excused Date Established		
<b>26. HSR Corridor ID</b> <input checked="" type="checkbox"/> N/A		<b>27. Latitude in decimal degrees</b> (WGS84 std: nn.nnnnnnn) 30.5510668		<b>28. Longitude in decimal degrees</b> (WGS84 std: -nnn.nnnnnnn) -96.3015426	
<b>29. Lat/Long Source</b> <input checked="" type="checkbox"/> Actual <input type="checkbox"/> Estimated		<b>30.A. Railroad Use *</b>			
<b>30.B. Railroad Use *</b>		<b>31.A. State Use *</b>			
<b>30.C. Railroad Use *</b>		<b>31.B. State Use *</b>			
<b>30.D. Railroad Use *</b>		<b>31.C. State Use *</b>			
<b>30.E. Railroad Use *</b>		<b>31.D. State Use *</b>			
<b>32.A. Narrative (Railroad Use) *</b>			<b>32.B. Narrative (State Use) *</b>		
<b>33. Emergency Notification Telephone No. (posted)</b> 800-848-8715		<b>34. Railroad Contact (Telephone No.)</b> 402-544-3721		<b>35. State Contact (Telephone No.)</b> 512-486-5052	

## Part II: Railroad Information

<b>1. Estimated Number of Daily Train Movements</b>				
<b>1.A. Total Day Thru Trains (6 AM to 6 PM)</b> 9	<b>1.B. Total Night Thru Trains (6 PM to 6 AM)</b> 9	<b>1.C. Total Switching Trains</b> 0	<b>1.D. Total Transit Trains</b> 0	<b>1.E. Check if Less Than One Movement Per Day</b> <input type="checkbox"/> How many trains per week? _____
<b>2. Year of Train Count Data (YYYY)</b> 2016		<b>3. Speed of Train at Crossing</b> 3.A. Maximum Timetable Speed (mph) 60 3.B. Typical Speed Range Over Crossing (mph) From 30 to 60		
<b>4. Type and Count of Tracks</b> Main 1 Siding 0 Yard 0 Transit 0 Industry 0				
<b>5. Train Detection (Main Track only)</b> <input type="checkbox"/> Constant Warning Time <input type="checkbox"/> Motion Detection <input type="checkbox"/> AFO <input type="checkbox"/> PTC <input type="checkbox"/> DC <input checked="" type="checkbox"/> Other <input type="checkbox"/> None				
<b>6. Is Track Signaled?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		<b>7.A. Event Recorder</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<b>7.B. Remote Health Monitoring</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

# U. S. DOT CROSSING INVENTORY FORM

A. Revision Date (MM/DD/YYYY) 02/25/2016		PAGE 2		D. Crossing Inventory Number (7 char.) 7432231	
<b>Part III: Highway or Pathway Traffic Control Device Information</b>					
1. Are there Signs or Signals? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		2. Types of Passive Traffic Control Devices associated with the Crossing			
2.A. Crossbuck Assemblies (count) 0		2.B. STOP Signs (R1-1) (count) 0	2.C. YIELD Signs (R1-2) (count)	2.D. Advance Warning Signs (Check all that apply; include count) <input type="checkbox"/> None <input checked="" type="checkbox"/> W10-1 _____ <input type="checkbox"/> W10-3 _____ <input type="checkbox"/> W10-11 _____ <input type="checkbox"/> W10-2 _____ <input type="checkbox"/> W10-4 _____ <input type="checkbox"/> W10-12 _____	
2.E. Low Ground Clearance Sign (W10-5) <input type="checkbox"/> Yes (count 0) <input checked="" type="checkbox"/> No		2.F. Pavement Markings <input checked="" type="checkbox"/> Stop Lines <input type="checkbox"/> Dynamic Envelope <input checked="" type="checkbox"/> RR Xing Symbols <input type="checkbox"/> None		2.G. Channelization Devices/Medians <input type="checkbox"/> All Approaches <input type="checkbox"/> Median <input type="checkbox"/> One Approach <input type="checkbox"/> None	2.H. EXEMPT Sign (R15-3) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2.I. ENS Sign (I-13) Displayed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		2.J. Other MUTCD Signs <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Specify Type _____ Count 2 Specify Type _____ Count 0 Specify Type _____ Count _____		2.K. Private Crossing Signs (if private) <input type="checkbox"/> Yes <input type="checkbox"/> No	2.L. LED Enhanced Signs (List types)
<b>3. Types of Train Activated Warning Devices at the Grade Crossing (specify count of each device for all that apply)</b>					
3.A. Gate Arms (count) Roadway 2 Pedestrian _____	3.B. Gate Configuration <input type="checkbox"/> 2 Quad <input type="checkbox"/> Full (Barrier) Resistance <input type="checkbox"/> 3 Quad <input type="checkbox"/> Median Gates	3.C. Cantilevered (or Bridged) Flashing Light Structures (count) Over Traffic Lane 0 <input type="checkbox"/> Incandescent Not Over Traffic Lane 0 <input type="checkbox"/> LED		3.D. Mast Mounted Flashing Lights (count of masts) 0 <input type="checkbox"/> Incandescent <input type="checkbox"/> LED <input type="checkbox"/> Back Lights Included <input type="checkbox"/> Side Lights Included	3.E. Total Count of Flashing Light Pairs 0
3.F. Installation Date of Current Active Warning Devices: (MM/YYYY) ____/____/____ <input checked="" type="checkbox"/> Not Required		3.G. Wayside Horn <input type="checkbox"/> Yes <input type="checkbox"/> No Installed on (MM/YYYY) ____/____/____		3.H. Highway Traffic Signals Controlling Crossing <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	3.I. Bells (count) 2
3.J. Non-Train Active Warning <input type="checkbox"/> Flagging/Flagman <input type="checkbox"/> Manually Operated Signals <input type="checkbox"/> Watchman <input type="checkbox"/> Floodlighting <input type="checkbox"/> None				3.K. Other Flashing Lights or Warning Devices Count 0 Specify type _____	
4.A. Does nearby Hwy Intersection have Traffic Signals? <input type="checkbox"/> Yes <input type="checkbox"/> No	4.B. Hwy Traffic Signal Interconnection <input type="checkbox"/> Not Interconnected <input type="checkbox"/> For Traffic Signals <input type="checkbox"/> For Warning Signs	4.C. Hwy Traffic Signal Preemption <input type="checkbox"/> Simultaneous <input type="checkbox"/> Advance	5. Highway Traffic Pre-Signals <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Storage Distance * _____ Stop Line Distance * _____	6. Highway Monitoring Devices (Check all that apply) <input type="checkbox"/> Yes - Photo/Video Recording <input type="checkbox"/> Yes - Vehicle Presence Detection <input type="checkbox"/> None	
<b>Part IV: Physical Characteristics</b>					
1. Traffic Lanes Crossing Railroad Number of Lanes 2 <input type="checkbox"/> One-way Traffic <input type="checkbox"/> Two-way Traffic <input type="checkbox"/> Divided Traffic		2. Is Roadway/Pathway Paved? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	3. Does Track Run Down a Street? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	4. Is Crossing Illuminated? (Street lights within approx. 50 feet from nearest rail) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
5. Crossing Surface (on Main Track, multiple types allowed) Installation Date * (MM/YYYY) ____/____/____ Width * _____ Length * _____ <input type="checkbox"/> 1 Timber <input type="checkbox"/> 2 Asphalt <input type="checkbox"/> 3 Asphalt and Timber <input checked="" type="checkbox"/> 4 Concrete <input type="checkbox"/> 5 Concrete and Rubber <input type="checkbox"/> 6 Rubber <input type="checkbox"/> 7 Metal <input type="checkbox"/> 8 Unconsolidated <input type="checkbox"/> 9 Composite <input type="checkbox"/> 10 Other (specify) _____					
6. Intersecting Roadway within 500 feet? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Approximate Distance (feet) _____			7. Smallest Crossing Angle <input type="checkbox"/> 0° - 29° <input type="checkbox"/> 30° - 59° <input checked="" type="checkbox"/> 60° - 90°		8. Is Commercial Power Available? * <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Part V: Public Highway Information</b>					
1. Highway System <input type="checkbox"/> (01) Interstate Highway System <input type="checkbox"/> (02) Other Nat Hwy System (NHS) <input type="checkbox"/> (03) Federal AID, Not NHS <input checked="" type="checkbox"/> (08) Non-Federal Aid		2. Functional Classification of Road at Crossing <input type="checkbox"/> (0) Rural <input checked="" type="checkbox"/> (1) Urban <input type="checkbox"/> (1) Interstate <input checked="" type="checkbox"/> (5) Major Collector <input type="checkbox"/> (2) Other Freeways and Expressways <input type="checkbox"/> (3) Other Principal Arterial <input type="checkbox"/> (6) Minor Collector <input type="checkbox"/> (4) Minor Arterial <input type="checkbox"/> (7) Local		3. Is Crossing on State Highway System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	4. Highway Speed Limit 30 _____ MPH <input checked="" type="checkbox"/> Posted <input type="checkbox"/> Statutory
5. Linear Referencing System (LRS Route ID) *					
6. LRS Milepost *					
7. Annual Average Daily Traffic (AADT) Year 2013 AADT 2860		8. Estimated Percent Trucks 03 _____ %	9. Regularly Used by School Buses? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Average Number per Day 0 _____		10. Emergency Services Route <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Submission Information - This information is used for administrative purposes and is not available on the public website.</b>					
Submitted by _____ Organization _____ Phone _____ Date _____					
Public reporting burden for this information collection is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. According to the Paperwork Reduction Act of 1995, a federal agency may not conduct or sponsor, and a person is not required to, nor shall a person be subject to a penalty for failure to comply with, a collection of information unless it displays a currently valid OMB control number. The valid OMB control number for information collection is 2130-0017. Send comments regarding this burden estimate or any other aspect of this collection, including for reducing this burden to: Information Collection Officer, Federal Railroad Administration, 1200 New Jersey Ave. SE, MS-25 Washington, DC 20590.					

## Appendix D Public Involvement Comments

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: Marian Pichoda & Tim & Patrice Boyd (son's daughter)  
Telephone Number: Patrice (832-260-5862) (832-655-6084) Tim  
Email: ~~dp~~ dpboyd005@gmail.com

### Comments:

We can support either of the two  
options discussed. However we are very  
concerned about driveway access off  
Fm 2154 to 14181 Fm 2154 residence.  
The drive is very close to the current  
Barron Rd. intersection and may become  
unsafe to enter when going South on  
Fm 2154 do to this proximity. This  
does bias us toward moving Barron  
North vs. moving Capstone South.

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: H. Wayne Smith

Telephone Number: 979-422-9206

Email: hwsmith486@hotmail.com

### Comments:

While safety, connectivity, and reduction of congestion  
are high priorities, these can be met without significant  
impact to private property. The discussions with the railroad to  
vet the option of moving the crossing South must be  
fully disclosed to ensure this priority is met, and there is  
no deference to Union Pacific over private citizens.

Preferred, least intrusive route is clearly to move Capstone crossing  
South.

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: Guy + Dayne Foster  
Telephone Number: 979-690-3100  
Email: starstables@msn.com

### Comments:

move Capstone to meet with Barron. Only unimproved land would have to be acquired. Widen Welborn Rd to allow turn lanes. Barron Rd will need to be widened, but please allow several cut throughs for the 3 streets. And it needs to be wide enough for all the U-turns that will be happening.

To align Barron to Capstone is absurd. It affects many homeowners and would be much more expensive to build a redundant road (Barron plus a parallel road)

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: BENE SAUSAGE

Telephone Number: 979 255 0102

Email: J3SAUSAGE@yahoo.com

### Comments:

Barron should stay  
where it is. Move  
Capstone south to align  
with Barron.

"Do not move Barron  
Rd"

James Smith 764-3690  
jsmith@cs.tx.gov

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: JOE GUERRA

Telephone Number: 979 - 200 - 0495

Email: JOEGUERRAJR@SBCGLOBAL.NET

### Comments:

UTILIZING AN "S" CURVE FOR  
THE REALIGNMENT OF CAPSTONE  
IS A BETTER OPTION, FOR SEVERAL  
REASONS. LESS PROPERTY OWNERS  
TO BUY ROW FROM, LESS  
ROADWAY TO BUILD, AND  
LESS PAVEMENT TO MAINTAIN.

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name:

Laura Rychetsky

Telephone Number:

690-96610

Email:

laurarychetsky@gmail.com

### Comments:

I am for widening Barron Road and moving Capstone crossing to coincide with Barron. However, I would strongly fight to save the largest oak tree in the area that is close to the proposed intersection. I live across the street and would gladly sell part of my land to widen the road on my side to save that tree.

# Barron & Capstone Realignment

## Public Meeting Comment Sheet

Name: Fiona Lockhart (Meyer)

Telephone Number: 979-204-4303

Email: ftm3150@gmail.com

### Comments:

I would be strongly opposed to the movement of Barron Rd to meet with Capstone and prefer the option of moving Capstone to meet Barron Rd.

I purchased my land in 2009 with the understanding that eventually Barron Rd would be widened. I did not think there would be a possibility of losing a large portion of my land to a complete realignment. I believed that cutting through between homes by moving Barron would disturb more homes than just taking the larger portion to widen the current structure of Barron Rd.

I also believe that moving Capstone to meet Barron would help traffic coming from the "townhomes" and utilize the shorter distance while pulling away from the homes on the North side of Capstone. <sup>traffic</sup>

Prefer moving Capstone to meet Barron Rd.

Also believe moving the intersection farther South on Wellborn will be safer due to visibility of ~~the~~ top of hill, etc.

If Barron Rd is realigned both myself and my 3 neighbors with driveways on Barron Rd to the South will all lose portions of their property. These large lots are some of only a handful of homes that allow for any type of Ag still in the city limits (grandfathered in). If Barron Rd is realigned it will significantly reduce the use of my land as I currently have it with horses on site. I purchased this home with the intention of improving ~~it~~ it and living long term here. I hope it remains this way.

## James Smith

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**From:** Tracie Thomas Keller <traciethomaskeller@yahoo.com>  
**Sent:** Thursday, March 24, 2016 12:44 PM  
**To:** James Smith  
**Subject:** Barron / Capstone realignment

Mr. Smith,

We were at the meeting last night regarding Barron / Capstone realignment project. We live in Willow Run Subdivision and personally feel that we would all benefit with Capstone being moved south and realigned with Barron.

Please add us to your email list to receive additional information regarding this project.

Thank you for your time,  
Tracie Keller

Sent from my iPhone

## James Smith

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**From:** Cody Hall <cody@brazosmovingandstorage.com>  
**Sent:** Wednesday, February 24, 2016 2:21 PM  
**To:** James Smith  
**Subject:** Barron Road Realignment  
**Attachments:** WellbornBarron Property.pdf

Hello James,

It was nice speaking with you! Please keep me updated with the Barron Road realignment project. Per our conversation, I'm willing to discuss gifting the land for the road right-of-way.

Attached is an aerial of my property. Please don't hesitate to contact me with any questions or concerns. Thanks

Property:  
14097 FM 2154  
C/S, TX 77845

Legal:  
A005401, R STEVENSON (ICL), TRACT 70, 10.087 ACRES

Sincerely,

***Cody Hall***  
***President***

**Brazos Moving & Storage**  
17535 State Hwy 6 S.  
College Station, TX 77845  
979-776-1800  
979-324-3336 CELL  
979-776-1818 FAX  
[cody@brazosmovingandstorage.com](mailto:cody@brazosmovingandstorage.com)  
[www.brazosmovingandstorage.com](http://www.brazosmovingandstorage.com)  
TxDot 006411408C / USDOT 1845240 / MC668387

## Appendix E Preliminary Cost Estimate

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS  
BARRON RD & CAPSTONE DR REALIGNMENT  
ALTERNATIVE 1**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3300	LF	\$ 1,000	\$ 3,300,000
1.02	Turn Lane Widening on Wellborn Rd	1000	SY	\$ 84.00	\$ 84,000
				Contingencies 20%	\$ 677,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	R345651	9904	SF	\$ 3.00	\$ 29,712
2.02	R345652	1	EA	\$ 134,883.54	\$ 134,884
2.03	R345654	2594	SF	\$ 2.00	\$ 5,187
2.04	R345655	26336	SF	\$ 2.00	\$ 52,671
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 4,061,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 223,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 610,000</b>
<b>TOTAL COST ALTERNATIVE 1</b>					<b>\$ 6,200,000</b>

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS**  
**BARRON RD & CAPSTONE DR REALIGNMENT**  
**ALTERNATIVE 2**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3300	LF	\$ 1,000	\$ 3,300,000
1.02	Turn Lane Widening on Wellborn Rd	1000	SY	\$ 84.00	\$ 84,000
Contingencies 20%					\$ 677,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	R345648	2214	SF	\$ 1.50	\$ 3,321
2.02	R345651	1	EA	\$ 90,626.58	\$ 90,627
2.03	R345652	25143	SF	\$ 2.50	\$ 62,857
2.04	R345654	5428	SF	\$ 2.00	\$ 10,856
2.05	R345655	22300	SF	\$ 2.00	\$ 44,600
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 4,061,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 213,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 610,000</b>
<b>TOTAL COST ALTERNATIVE 2</b>					<b>\$ 6,200,000</b>

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS**  
**BARRON RD & CAPSTONE DR REALIGNMENT**  
**ALTERNATIVE 3**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3100	LF	\$ 1,000	\$ 3,100,000
1.02	Turn Lane Widening on Wellborn Rd	700	SY	\$ 84.00	\$ 59,000
Contingencies 20%					\$ 632,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	Metal Building	2	EA	\$ 20,000.00	\$ 40,000
2.02	Sheds	1	EA	\$ 1,000.00	\$ 1,000
2.03	R103028	4029	SF	\$ 1.26	\$ 5,088
2.04	R13924 (Donation by Owner)*	1	EA	\$ -	\$ -
2.05	R93493	52446	SF	\$ 0.92	\$ 48,159
2.06	R93493 Significant Acquisition Charge	30%	EA	\$ 498,290.00	\$ 149,487
2.07	R93495	21931	SF	\$ 1.15	\$ 25,174
2.08	R93495 Significant Acquisition Charge	30%	EA	\$ 527,720.00	\$ 158,316
2.09	R93496	1	EA	\$ 519,580.00	\$ 519,580
2.10	R93497	26713	SF	\$ 0.98	\$ 26,063
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 3,791,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 973,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 569,000</b>
<b>TOTAL COST ALTERNATIVE 3</b>					<b>\$ 6,600,000</b>

\* The property owner contacted the city to express his willingness to donate right-of-way for the project.

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS  
BARRON RD & CAPSTONE DR REALIGNMENT  
ALTERNATIVE 4**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3000	LF	\$ 1,000	\$ 3,000,000
1.02	Turn Lane Widening on Wellborn Rd	700	SY	\$ 84.00	\$ 59,000
Contingencies 20%					\$ 612,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	R103028	1	EA	\$ 136,875.00	\$ 136,875.00
2.02	R103078	1	EA	\$ 549,450.00	\$ 549,450.00
2.03	R103079	5523	SF	\$ 1.09	\$ 6,023.03
2.04	R13924 (Donation by Owner)*	1	EA	\$ -	\$ -
2.05	R13927	1	EA	\$ 273,795.80	\$ 273,795.80
2.06	R93497	38859	SF	\$ 0.98	\$ 37,912.92
2.07	R93497 Significant Acquisition Charge	10%	EA	\$ 374,352.50	\$ 37,435.25
2.08	R93499	10127	SF	\$ 1.03	\$ 10,462.11
2.09	R93499 Significant Acquisition Charge	10%	EA	\$ 363,095.00	\$ 36,310
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 3,671,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 1,089,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 551,000</b>
<b>TOTAL COST ALTERNATIVE 4</b>					<b>\$ 6,600,000</b>

\* The property owner contacted the city to express his willingness to donate right-of-way for the project.

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS**  
**BARRON RD & CAPSTONE DR REALIGNMENT**  
**ALTERNATIVE 5**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3100	LF	\$ 1,000	\$ 3,100,000
1.02	Turn Lane Widening on Wellborn Rd	700	SY	\$ 84.00	\$ 59,000
Contingencies 20%					\$ 632,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	R13924 (Donation by Owner)*	1	EA	\$ -	\$ -
2.02	R93493	47673	SF	\$ 0.92	\$ 43,777
2.03	R93493 Significant Acquisition Charge	30%	EA	\$ 498,290.00	\$ 149,487
2.04	R93495	8530	SF	\$ 1.15	\$ 9,791
2.05	R93495 Significant Acquisition Charge	10%	EA	\$ 527,720.00	\$ 52,772
2.06	R93496	1973	SF	\$ 1.15	\$ 2,265.15
2.07	R93497	38857	SF	\$ 0.98	\$ 37,911
2.08	R93497 Significant Acquisition Charge	10%	EA	\$ 374,352.50	\$ 37,435
2.09	R93499	10246	SF	\$ 1.03	\$ 10,585
2.10	R93499 Significant Acquisition Charge	10%	EA	\$ 363,095.00	\$ 36,310
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 3,791,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 381,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 569,000</b>
<b>TOTAL COST ALTERNATIVE 5</b>					<b>\$ 6,000,000</b>

\* The property owner contacted the city to express his willingness to donate right-of-way for the project.

**PRELIMINARY ESTIMATE OF PROBABLE PROJECT COSTS  
BARRON RD & CAPSTONE DR REALIGNMENT  
ALTERNATIVE 6**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL COST
<b>CONSTRUCTION</b>					
1.01	4 Lane Minor Arterial	3200	LF	\$ 1,000	\$ 3,200,000
1.02	Turn Lane Widening on Wellborn Rd	700	SY	\$ 84.00	\$ 59,000
Contingencies 20%					\$ 652,000
<b>RIGHT OF WAY ACQUISITION</b>					
2.01	R93495	33917	SF	\$ 1.15	\$ 38,932
2.02	R93496	8473	SF	\$ 1.15	\$ 9,726
2.03	R93493	1	EA	\$ 498,290.00	\$ 498,290
2.04	R103028	4029	SF	\$ 1.26	\$ 5,088
<b>COST SUMMARY</b>					
<b>Construction &amp; Utilities</b>					<b>\$ 3,911,000</b>
<b>At-Grade Railroad Crossing</b>					<b>\$ 1,000,000</b>
<b>Traffic Signal</b>					<b>\$ 250,000</b>
<b>Right-of-Way</b>					<b>\$ 553,000</b>
<b>Engineering &amp; Soft Costs (15%)</b>					<b>\$ 587,000</b>
<b>TOTAL COST ALTERNATIVE 6</b>					<b>\$ 6,400,000</b>

## Appendix F Evaluation Criteria

<b>RUBRIC (A)</b>		
SAFETY IS GREATLY IMPROVED	++	2
SAFETY IS SLIGHTLY IMPROVED	+	1
SAFETY IS NOT AFFECTED	0	0
SAFETY IS REDUCED	-	-1
SAFETY IS GREATLY REDUCED	--	-2

<b>RUBRIC (B)</b>		
MOBILITY IS GREATLY IMPROVED	++	2
MOBILITY IS SLIGHTLY IMPROVED	+	1
MOBILITY IS NOT AFFECTED	0	0
MOBILITY IS SLIGHTLY REDUCED	-	-1
MOBILITY IS GREATLY REDUCED	--	-2

<b>RUBRIC (C)</b>		
FEWEST NUMBER OF PROPERTIES ADVERSELY IMPACTED	++	2
ADVERSELY IMPACTS A FEWER NUMBER OF PROPERTIES THAT ARE BENEFITED	+	1
LITTLE IMPACT OR EQUAL NUMBER OF PROPERTIES ADVERSELY AFFECTED	0	0
ADVERSE IMPACTS FOR MORE PROPERTIES THAN BENEFITED	-	-1
ADVERSELY IMPACTS MULTIPLE PROPERTIES AND/OR REQUIRES ACQUISITION/DEED OF HOMESTEAD	--	-2

<b>RUBRIC (D)</b>		
PREFERRED BY A LARGE MAJORITY OF RESPONDENTS	++	2
PREFERRED BY A FEW RESPONDENTS	+	1
EVEN NUMBER FOR/AGAINST	0	0
OBJECTED TO BY A FEW RESPONDENTS	-	-1
OBJECTED TO BY THE MAJORITY OF RESPONDENTS	--	-2

<b>RUBRIC (E)</b>		
5% LESS THAN AVERAGE COST	++	2
1-5% LESS THAN AVERAGE COST	+	1
WITHIN 1 % OF AVERAGE COST	0	0
1-5% MORE THAN AVERAGE COST	-	-1
5% MORE THAN AVERAGE COST	--	-2

<b>RUBRIC (F)</b>		
50% LESS THAN AVERAGE COST	++	2
20-50% LESS THAN AVERAGE COST	+	1
WITHIN 20% AVERAGE COST	0	0
20-50% MORE THAN AVERAGE COST	-	-1
50% MORE THAN AVERAGE COST	--	-2

<b>RUBRIC (G)</b>		
10% LESS THAN AVERAGE LENGTH	++	2
2-10% OF AVERAGE LENGTH	+	1
WITHIN 2% OF AVERAGE LENGTH	0	0
2-10% MORE THAN AVERAGE LENGTH	-	-1
10% GREATER THAN AVERAGE LENGTH	--	-2