

Prepared For: City of Palm Coast

Prepared By: Sean L. Castello, P.E.

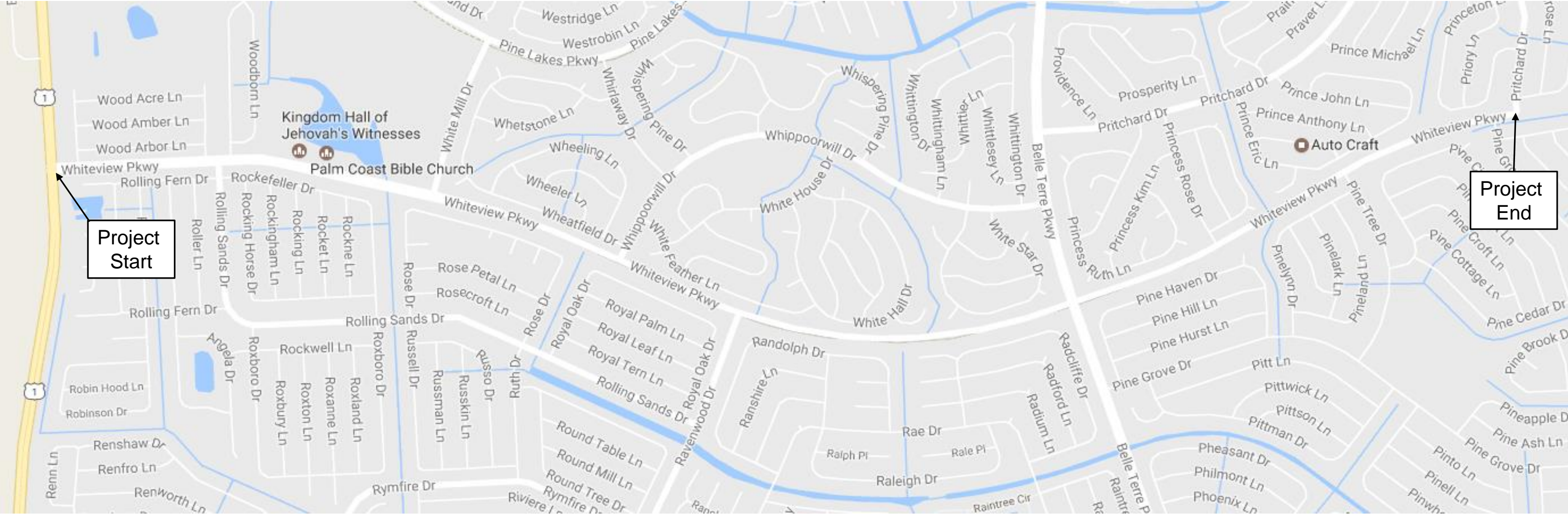
Date: 3/6/2017

Re: **Whiteview Parkway Corridor Study**

City Staff has been tasked with evaluating corridors throughout the City to improve traffic operation and safety for vehicles and pedestrians. In this study, staff is evaluating Whiteview Parkway from US 1 to Pritchard Drive to evaluate the potential for adding turn lanes, crosswalks, and sidewalks/paths. The purpose of this study is to determine corridor improvements based on projected future traffic volumes.

In addition, City Staff has begun analysis of completing the path along Whiteview Pkwy from US 1 to White Mill Drive. Due to Right of Way (ROW) restrictions along this segment, it's difficult to fit a path based on the existing roadway configuration. After a charrette with City Staff and a project consultant, reducing the roadway lanes from four (4) lanes to two (2) lanes became a preferred alternative to provide a safe and functional pedestrian facility. The viability of reducing the roadway from four (4) lanes to two (2) lanes is based on the projected future traffic that will be analyzed as part of this study.

Figure 1 illustrates the project limits.



Existing Condition

Whiteview Pkwy is classified as an urban arterial. The roadway is approximately 3.5 miles in length. Whiteview Pkwy is a four (4) lane divided roadway from US 1 to White Mill Drive and a two (2) lane undivided from White Mill Drive to Pritchard Drive. The speed limits along Whiteview Pkwy are as follows:

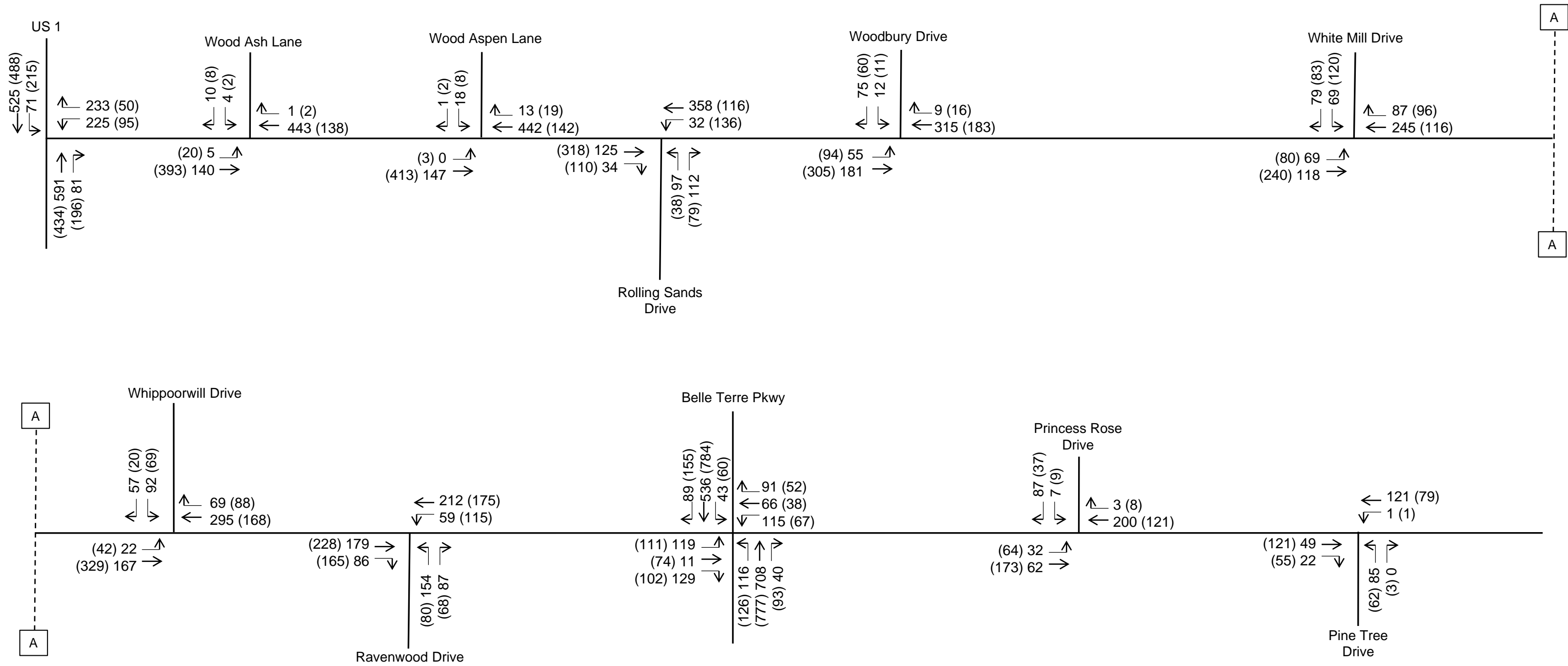
- Whiteview Pkwy from US 1 to White Mill Drive – 45 MPH
- Whiteview Pkwy from White Mill Drive to Belle Terre Pkwy – 50 MPH
- Whiteview Pkwy from Belle Terre Pkwy to Pritchard Drive – 40 MPH

As part of the existing and future conditions analysis for Whiteview Pkwy, general operating conditions on study area roadways were evaluated. Based on anticipated traffic impacts of the proposed improvements of Whiteview Pkwy, the following roadways and signalized intersections were included in this study:

Table 1: Intersections Traffic Counts

Intersection	Intersection Control	Date of Collection
Whiteview Pkwy at US 1	Signal	Sept 13, 2016
Whiteview Pkwy at Wood Ash Lane	Stop	Sept 13, 2016
Whiteview Pkwy at Wood Aspen Lane	Stop	Sept 14, 2016
Whiteview Pkwy at Rolling Sands Drive	Stop	Sept 14, 2016
Whiteview Pkwy at Woodbury Drive	Stop	Sept 15, 2016
Whiteview Pkwy at White Mill Drive	Stop	Sept 15, 2016
Whiteview Pkwy at Whippoorwill Drive	Stop	Sept 20, 2016
Whiteview Pkwy at Ravenswood Drive	Stop	Sept 20, 2016
Whiteview Pkwy at Belle Terre Boulevard	Signal	Sept 1, 2015
Whiteview Pkwy at Princess Rose Drive	Stop	Sept 21, 2016
Whiteview Pkwy at Pine Tree Drive	Stop	Sept 22, 2016

All traffic counts were conducted during the typical AM (7-9 AM) and PM (4-6 PM) peak hours on Tuesday, Wednesday and Thursday. A summary of the existing AM and PM peak hour traffic volumes are illustrated in **Figure 2**.



Legend
 XX (XX) – AM (PM)



**Whiteview Pkwy
 Technical Memorandum**

Existing (2016) Traffic Volumes

Figure 2

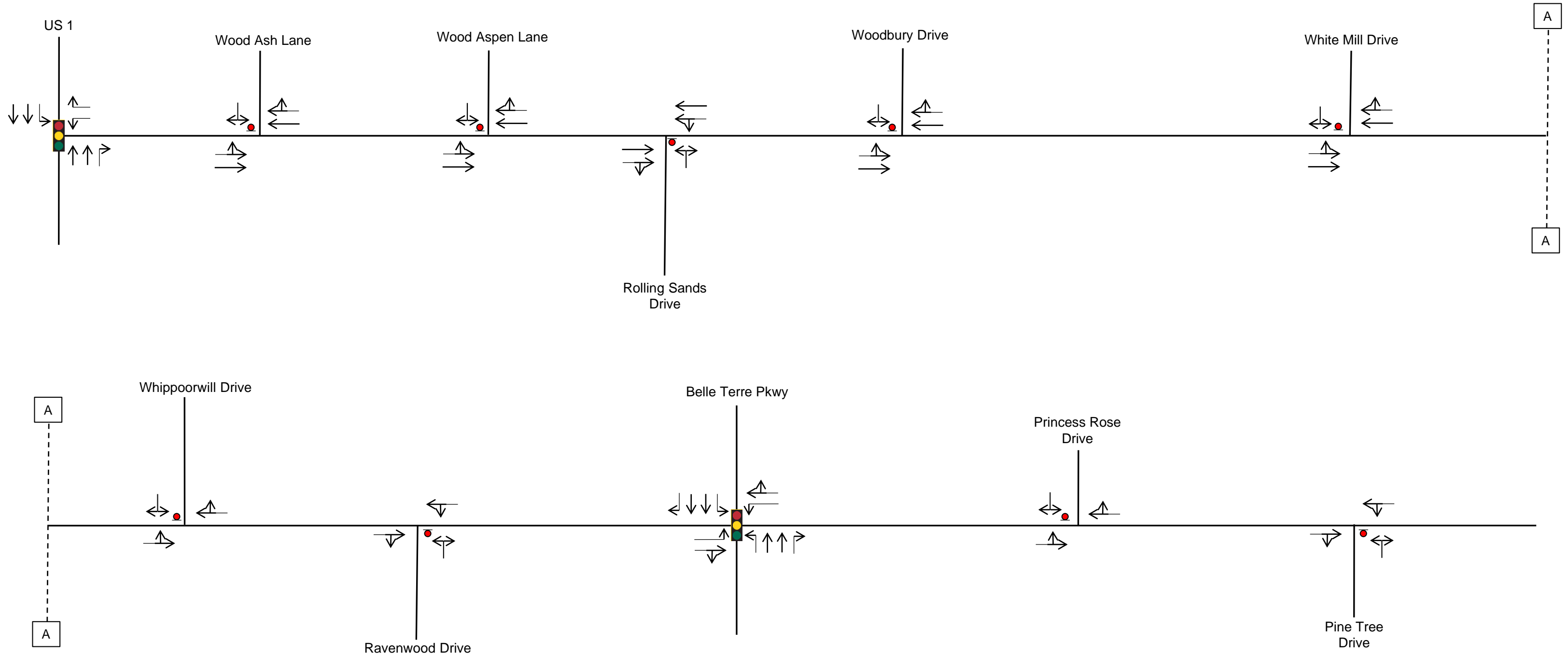
Existing Condition Intersection Analysis

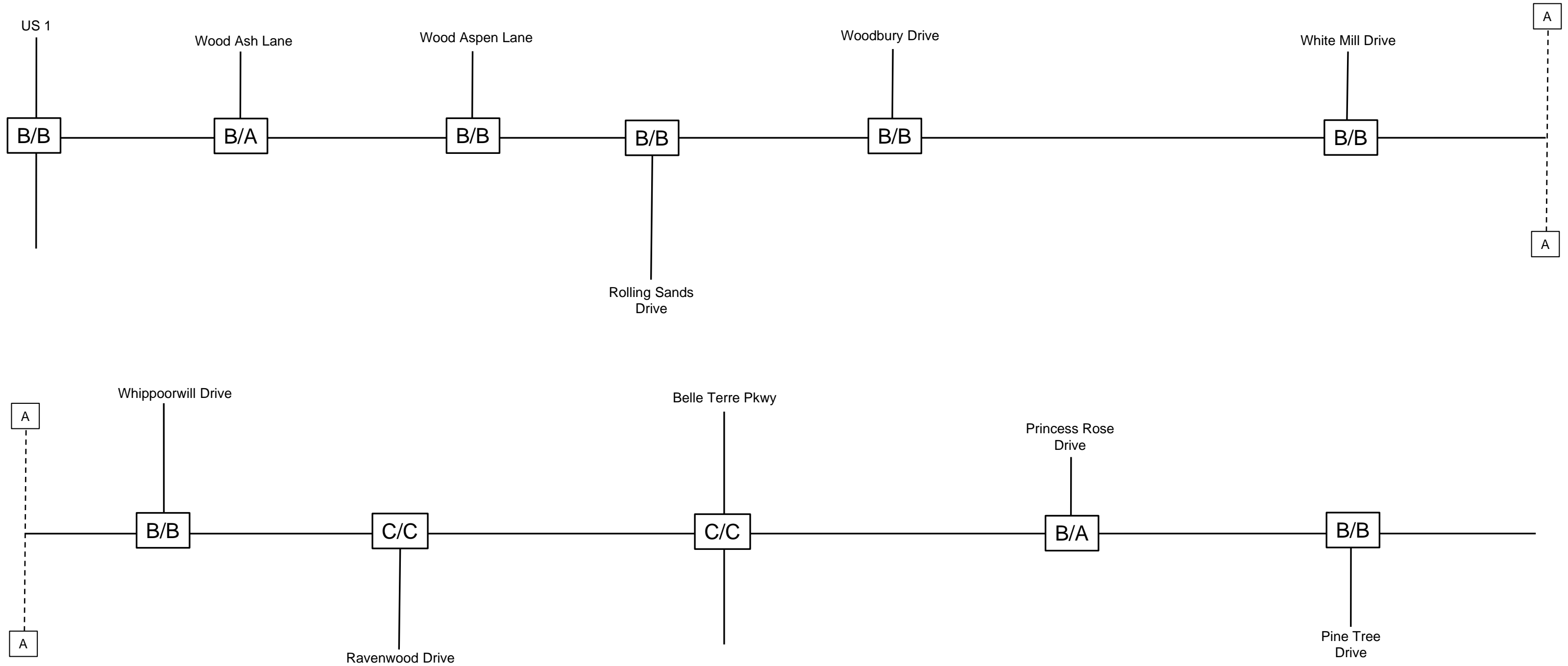
Table 2 summarizes the existing Level of Service based on the average delay for the approaches at signalized intersections and the stop controlled movements at unsignalized intersections based on the intersection geometry in **Figure 3**. Intersection operational analyses were performed for the AM and PM peak periods. **Figure 4** illustrates the Level of Service for the AM and PM peak periods under the existing condition. The SYNCHRO 7 intersection worksheets are included in **Appendix A**. As shown in **Tables 2**, and in **Figure 4**, all study intersections operate at Level of Service “D” or better.

Table 2: Existing (2016) Intersection Analysis

Intersection	Intersection Type	AM		PM	
		Delay	LOS	Delay	LOS
Whiteview Pkwy at US 1	Signal	15.2	B	11.7	B
Whiteview Pkwy at Wood Ash Ln	Stop	8.4/11.1*	A/B	7.5/9.3*	A/A
Whiteview Pkwy at Wood Aspen Ln	Stop	0.0/12.8*	A/B	7.6/10.7*	A/B
Whiteview Pkwy at Rolling Sands Dr	Stop	7.6/12.2*	A/B	8.8/14.7*	A/B
Whiteview Pkwy at Woodbury Dr	Stop	8.2/10.7*	A/B	7.8/10.0*	A/B
Whiteview Pkwy at Whitemill Dr	Stop	8.1/12.7*	A/B	7.9/14.3*	A/B
Whiteview Pkwy at Whippoorwill Dr	Stop	8.1/14.5*	A/B	7.9/14.7*	A/B
Whiteview Pkwy at Ravenwood Dr	Stop	8.0/19.3*	A/C	8.6/18.7*	A/C
Whiteview Pkwy at Belle Terre Pkwy	Signal	24.0	C	24.2	C
Whiteview Pkwy at Princess Rose Dr	Stop	7.8/10.3*	A/B	7.6/9.8*	A/A
Whiteview Pkwy at Pine Tree Dr	Stop	7.4/10.1*	A/B	7.7/11.0*	A/B

*Major/Minor approach Delay & LOS





Legend
 AM/PM – Level of Service



Crash Analysis

Crash data was analyzed along the corridor. From January 2014 to December 2016, there were a total of 60 crashes reported along the corridor. **Table 3** summarizes the types that occurred at each intersection over the 3 year period.

Table 3: Crash Summary by Intersection

Intersection	Crash Type							Total	Wet	Injury	Fatalities
	Rear End	Left Turn	Angle	Pedestrian	Animal	Sideswipe	Other				
Princess Rose Dr at Whiteview Pkwy	0	1	0	0	0	0	0	1	1	0	0
Belle Terre Pkwy at Whiteview Pkwy	14	1	2	0	1	1	2	21	3	9	0
Ravenwood Dr at Whiteview Pkwy	5	2	2	1	0	0	4	14	3	62	1
Rolling Sand Dr at Whiteview Pkwy	0	5	2	0	1	1	0	9	1	8	0
US 1 at Whiteview Pkwy	4	1	0	0	0	0	0	5	2	5	0
Whippoorwill Dr at Whiteview Pkwy	1	2	1	0	0	0	2	6	0	8	0
White Mill Dr at Whiteview Pkwy	1	1	0	0	0	1	0	3	1	1	0
Wood Aspen Ln at Whiteview Pkwy	0	0	1	0	0	0	0	1	0	1	0

Table 4 illustrates the types of crashes that have occurred over the 3 year period.

Table 4: Crash Summary by Year

Crash Type	2014	2015	2016
Rear End	5	14	6
Left Turn	3	4	6
Angle	1	4	3
Pedestrian	1	0	0
Animal	0	2	0
Sideswipe	0	2	1
Other	2	3	3
Total	12	29	19

The following observations can be made from the crash data.

- 60 crashes have occurred along the corridor.
- 21 crashes occurred at the intersection of Belle Terre Pkwy and Whiteview Pkwy with the majority being rear end collisions. The improvements for this intersection are already spelled out in the Belle Terre Blvd/Pkwy Corridor Study.
- 14 crashes have occurred at the intersection of Ravenwood Drive and Whiteview Pkwy. This was also the intersection where the most injuries have occurred and there was 1 fatality.
- Rolling Sands Drive at Whiteview Pkwy had the most number of left turning, angle and sideswipe collisions (8).
- The majority of collisions (25) are rear end collisions while the second most are left turn collisions (13).

Crash Analysis

The development of traffic projections for Whiteview Pkwy requires the examination of historical traffic growth, proposed development within the corridor vicinity, and a basic understanding of the traffic circulation patterns and characteristics of the corridor. In arriving at the volume forecasts for Whiteview Pkwy, various growth rates were examined. Due to the lack of available data, it was determined that the use of population data for trends analysis and growth rates determined by the Belle Terre Blvd/Pkwy Intersection Analysis Report (2016).

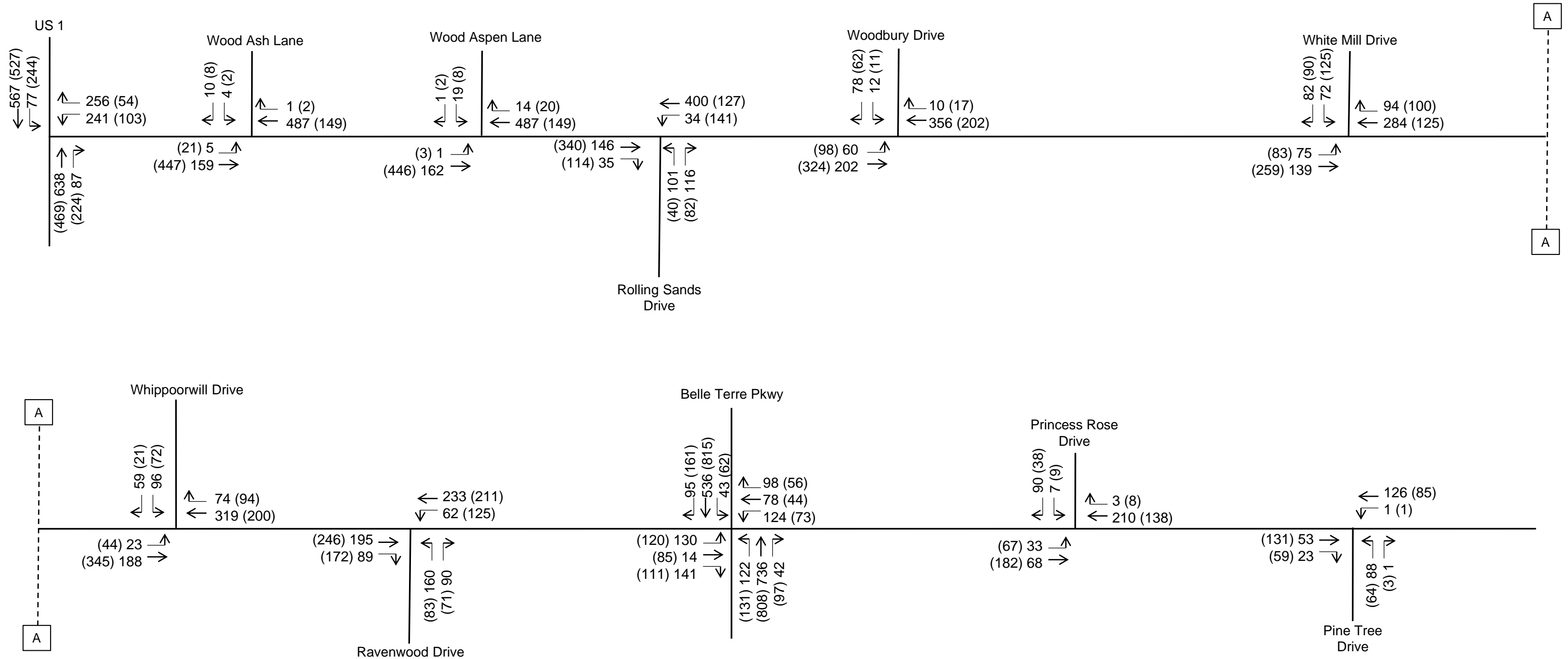
A Trends Analysis was performed based on population data collected from the US census bureau. The analysis provided the following information in **Table 5**. The trend analysis output spreadsheets are available in **Appendix B**.

Table 5: Trends Analysis

Analysis Area	R²	Growth Rate
Palm Coast	91.89%	1.08%
Flagler County	90.91%	0.92%
Average		1.00%

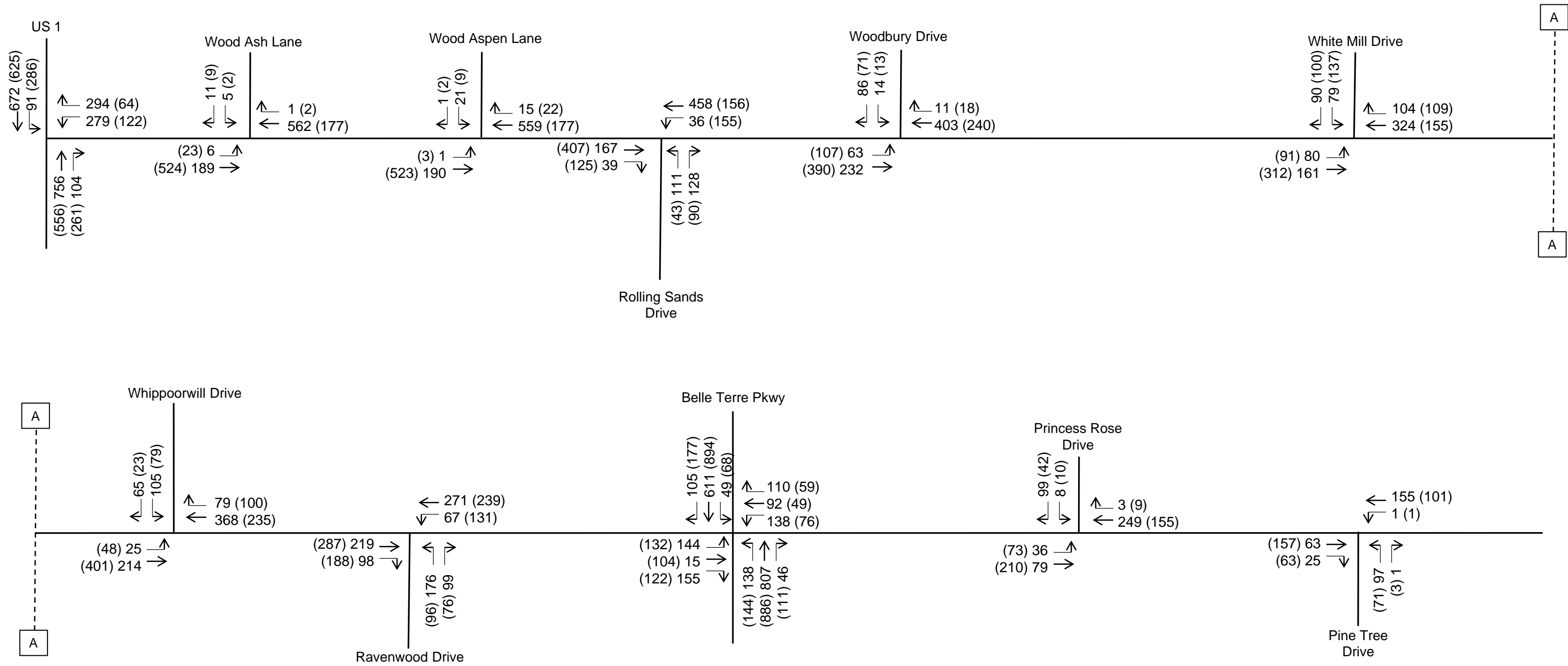
With an R² greater than 75%, an average growth rate of 1.0% was calculated. The growth rate was applied to the existing traffic volumes entering and exiting neighborhood streets. For all other traffic along the corridor and the side streets, a 2.0% growth rate was applied to account for background coming from other roadways such as US 1 and Belle Terre Pkwy.

Figures 5, 6 and 7 illustrates the Opening Year (2020), Mid-design (2030) and Design Year (2040). These volumes will be utilized to analyze the No Build and Build Conditions.



Legend
XX (XX) – AM (PM)





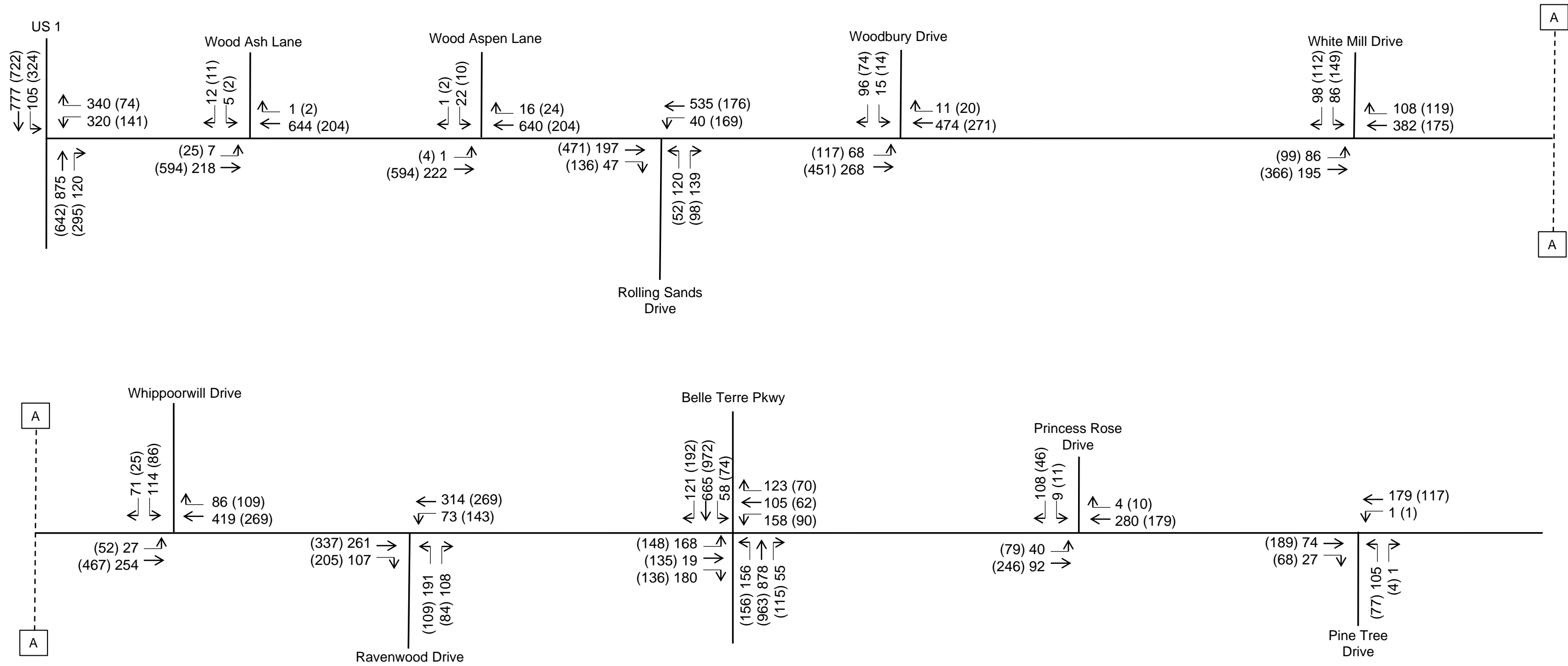
Legend
 XX (XX) – AM (PM)



**Whiteview Pkwy
 Technical Memorandum**

**Mid-Design Year (2030)
 Traffic Volumes**

Figure 6



**Whiteview Pkwy
Technical Memorandum**

**Design Year (2040)
Traffic Volumes**

Figure 7

Future Traffic Analysis

This section presents the results of the operational analyses for the future conditions (2020, 2030 and 2040). All conditions were analyzed using the most current adopted procedures as outlined in the Transportation Research Board's Special Report 209 - Highway Capacity Manual (HCM). Signalized and unsignalized intersection analyses were conducted using the SYNCHRO 9 software package. The HCS outputs from SYNCHRO 9 were presented as the results for this analysis.

No Build Scenario

The No-Build geometry for Whiteview Pkwy is consistent with the existing roadway condition. **Figure 8** shows the No-Build geometry utilized for the Level of Service analysis for the opening, mid-design and design years. Signal timings were optimized to achieve the best level of service possible.

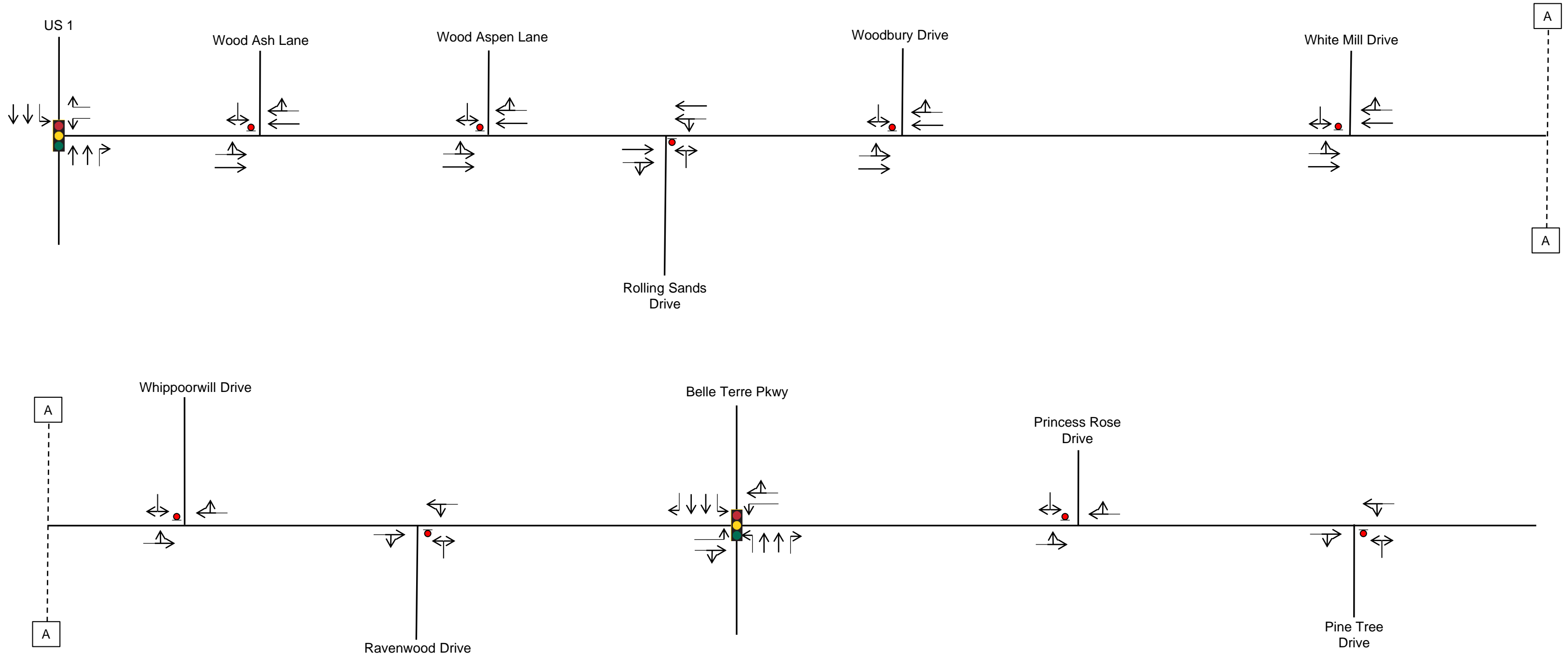
Intersection Analysis

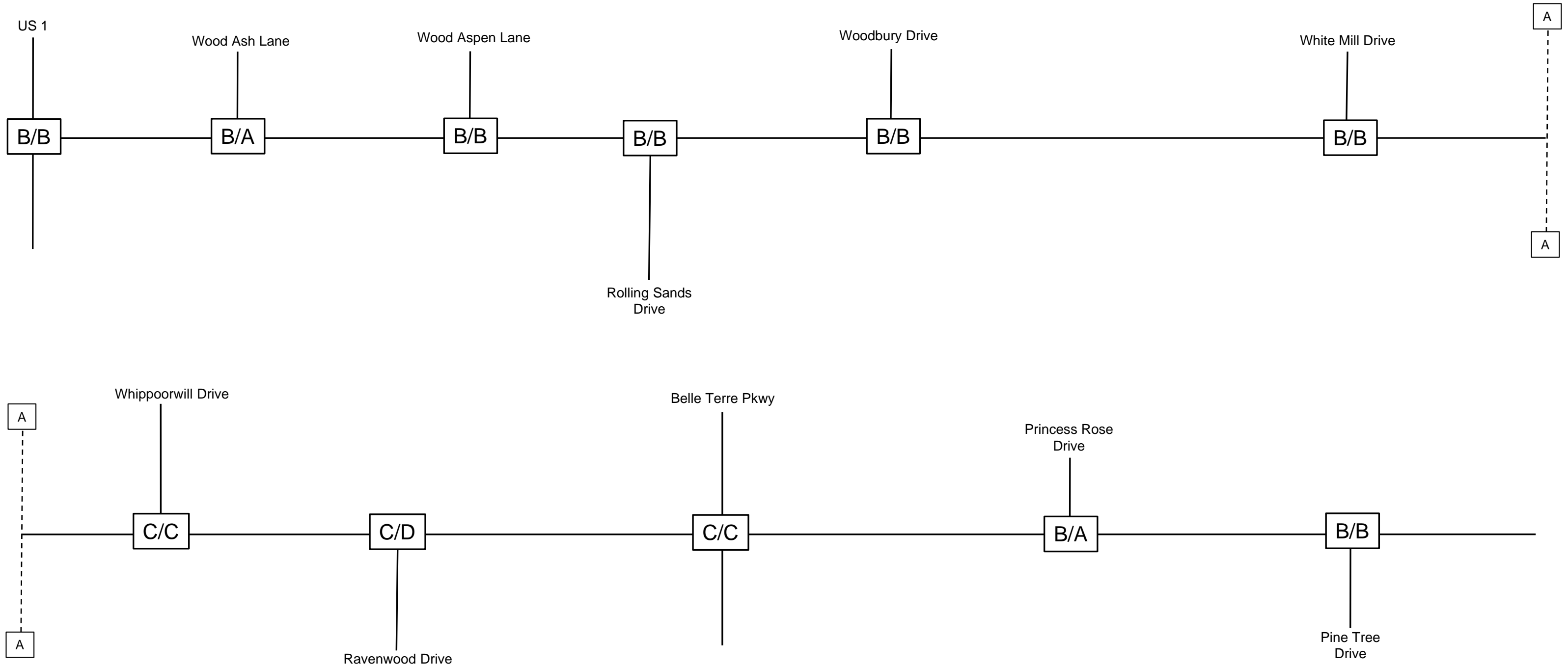
Table 6 summarizes the No-Build Level of Service based on the average delay for the approaches at signalized intersections and the major/minor stop controlled movements at unsignalized intersections. **Figures 9, 10 and 11** illustrate the Level of Service for the AM and PM peak periods for the future No Build intersection conditions. The SYNCHRO 7 intersection worksheets for signalized intersections are included in **Appendix C**.

Table 6: No Build Intersection Level of Service

Intersection	Intersection Type	2020				2030				2040			
		AM		PM		AM		PM		AM		PM	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Whiteview Pkwy at US 1	Signal	15.7	B	11.8	B	17.5	B	12.8	B	21.0	C	14.1	B
Whiteview Pkwy at Wood Ash Ln	Stop	8.4/11.0	A/B	7.6/9.4	A/A	8.7/11.8	A/B	7.6/9.5	A/A	9.0/12.5	A/B	7.7/9.6	A/A
Whiteview Pkwy at Wood Aspen Ln	Stop	8.5/13.6	A/B	7.6/10.9	A/B	8.7/14.9	A/B	7.6/11.6	A/B	9.0/16.7	A/C	7.7/12.3	A/B
Whiteview Pkwy at Rolling Sands Dr	Stop	7.7/12.9	A/B	8.8/14.9	A/B	7.7/14.2	A/B	9.2/19.1	A/C	7.8/16.4	A/C	9.7/23.0	A/C
Whiteview Pkwy at Woodbury Dr	Stop	8.2/10.8	A/B	7.9/10.2	A/B	8.4/11.3	A/B	8.0/10.8	A/B	8.7/12.1	A/B	8.2/11.3	A/B
Whiteview Pkwy at Whitmill Dr	Stop	8.3/14.0	A/B	7.9/14.9	A/B	8.5/15.6	A/C	8.0/17.8	A/C	8.7/18.5	A/C	8.1/21.8	A/C
Whiteview Pkwy at Whippoorwill Dr	Stop	8.2/15.4	A/C	8.0/15.8	A/C	8.4/17.8	A/C	8.1/18.5	A/C	8.6/21.9	A/C	8.2/22.8	A/C
Whiteview Pkwy at Ravenwood Dr	Stop	8.0/19.5	A/C	8.7/25.2	A/D	8.1/25.3	A/D	8.9/26.0	A/D	8.6/40.1	A/E	9.2/41.6	A/E
Whiteview Pkwy at Belle Terre Pkwy	Signal	24.0	C	25.7	C	25.4	C	27.4	C	27.5	C	30.1	C
Whiteview Pkwy at Princess Rose Dr	Stop	7.7/10.2	A/B	7.6/9.9	A/A	7.8/10.6	A/B	7.7/10.2	A/B	7.9/11.1	A/B	7.8/10.5	A/B
Whiteview Pkwy at Pine Tree Dr	Stop	7.4/10.2	A/B	7.7/11.2	A/B	7.4/10.6	A/B	7.7/10.9	A/B	7.4/11.0	A/B	7.8/11.4	A/B

The results of the analysis shows that all intersections will operate at an acceptable level of service except for the intersection of Whiteview Pkwy at Ravenwood Drive which experiences failure in the minor approach.





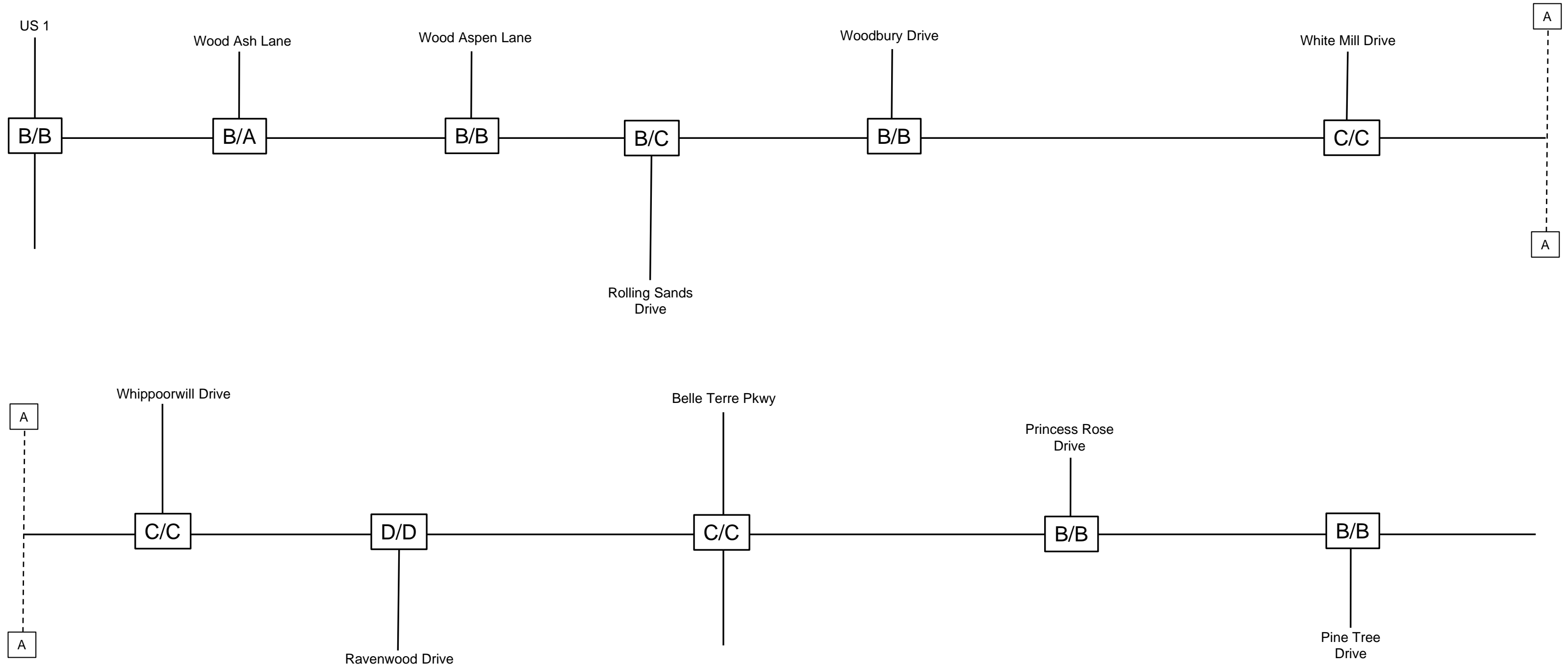
Legend
AM/PM – Level of Service



**Whiteview Pkwy
Technical Memorandum**

**Opening Year (2020) - No Build
Level Of Service**

Figure 9



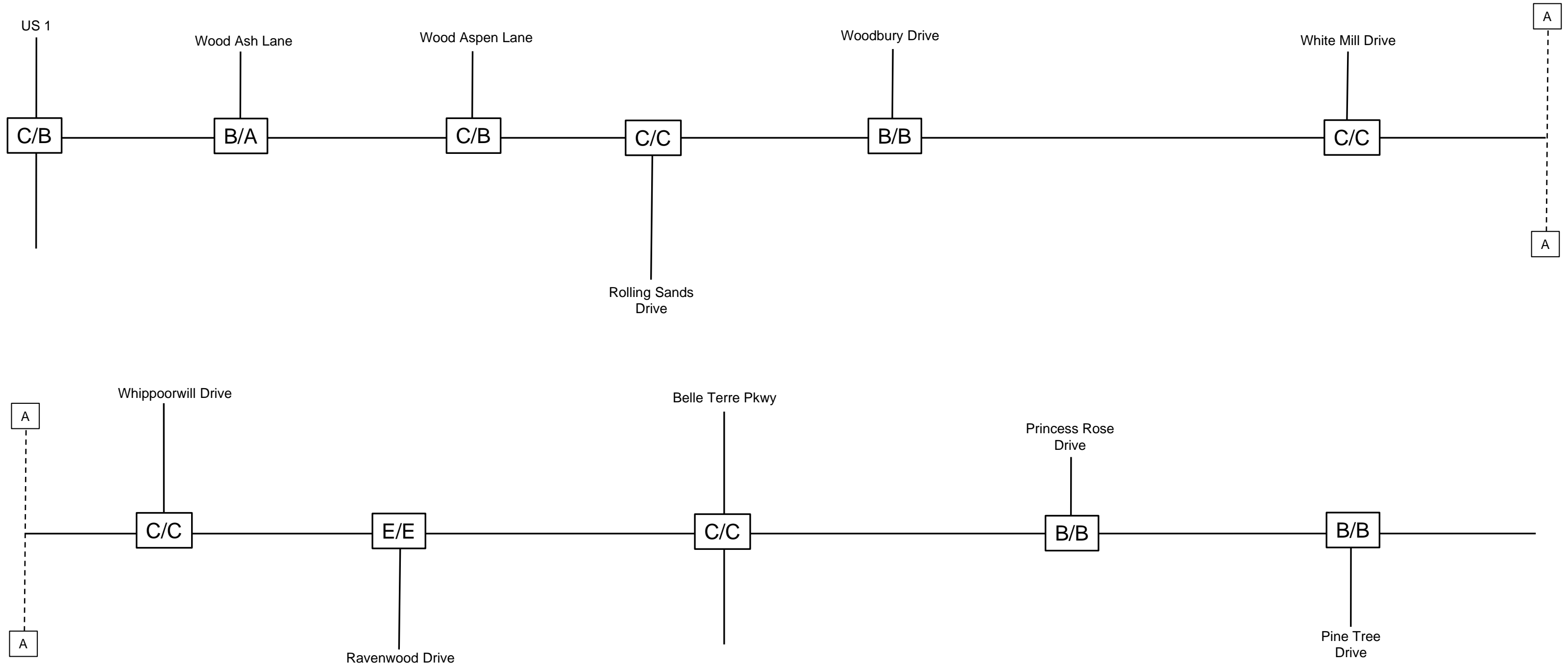
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AM/PM – Level of Service



**Whiteview Pkwy
Technical Memorandum**

**Mid-Design Year (2030) - No Build
Level Of Service**

**Figure
10**



Legend
AM/PM – Level of Service



Build Scenario

The Build geometry for Whiteview Pkwy is consistent with much of the existing roadway condition except for the four (4) lane segment reduced to a two (2) lane segment. **Figure 12** shows the Build geometry utilized for the Level of Service analysis for the opening, mid-design and design years. Signal timings were optimized to achieve the best level of service possible.

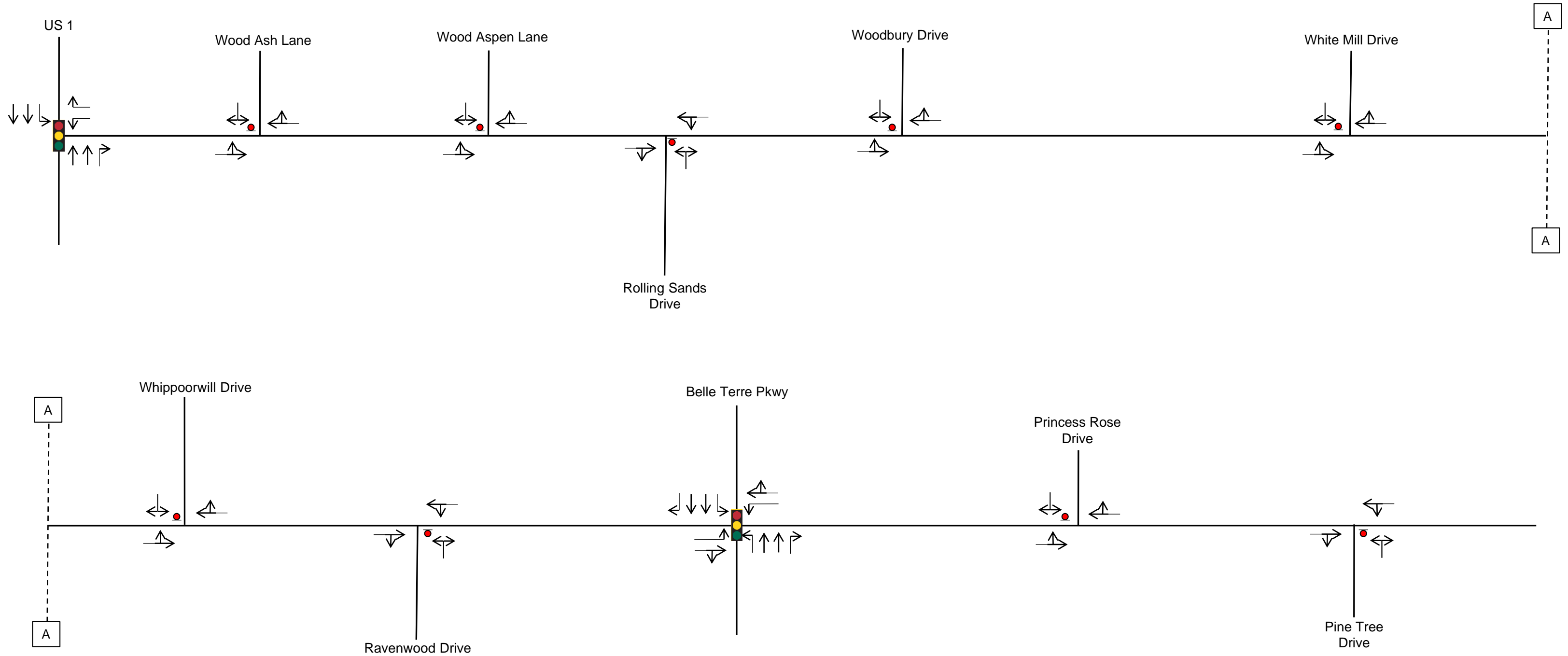
Intersection Analysis

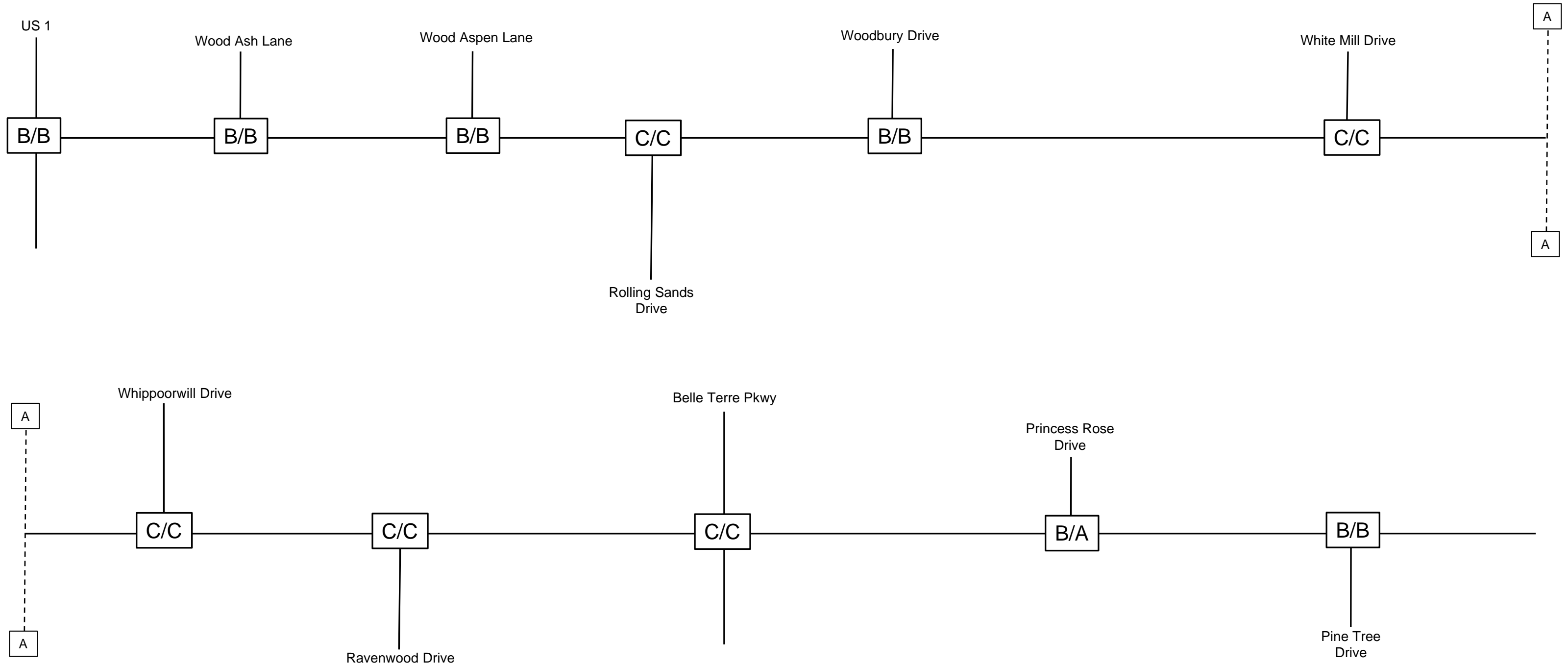
Table 7 summarizes the Build Level of Service based on the average delay for the approaches at signalized intersections and the major/minor stop controlled movements at unsignalized intersections. **Figure 12** illustrates the geometries utilized for this analysis while **Figures 13, 14 and 15** illustrate the Level of Service for the AM and PM peak periods for the future Build intersection conditions. The SYNCHRO 7 intersection worksheets for signalized intersections are included in **Appendix D**.

Table 7: Build Intersection Level of Service

Intersection	Intersection Type	2020				2030				2040			
		AM		PM		AM		PM		AM		PM	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Whiteview Pkwy at US 1	Signal	15.7	B	11.8	B	17.5	B	12.8	B	21.0	C	14.1	B
Whiteview Pkwy at Wood Ash Ln	Stop	8.4/12.3	A/B	7.6/10.1	A/B	8.7/13.4	A/B	7.6/10.4	A/B	9.0/14.6	A/B	7.7/10.6	A/B
Whiteview Pkwy at Wood Aspen Ln	Stop	8.4/14.1	A/B	7.6/13.5	A/B	8.7/15.7	A/C	7.6/13.8	A/B	9.0/17.7	A/C	7.7/15.3	A/C
Whiteview Pkwy at Rolling Sands Dr	Stop	7.7/15.4	A/C	8.8/16.1	A/C	7.7/18.1	A/C	9.2/19.6	A/C	7.8/23.9	A/C	9.7/26.7	A/D
Whiteview Pkwy at Woodbury Dr	Stop	8.2/12.1	A/B	7.9/11.0	A/B	8.4/13.0	A/B	8.0/11.9	A/B	8.6/14.5	A/B	8.2/12.9	A/B
Whiteview Pkwy at Whitmill Dr	Stop	8.3/15.1	A/C	7.9/16.8	A/C	8.5/17.2	A/C	8.0/21.6	A/C	8.7/21.3	A/C	8.1/29.9	A/D
Whiteview Pkwy at Whippoorwill Dr	Stop	8.2/15.4	A/C	8.0/15.8	A/C	8.4/17.8	A/C	8.1/18.5	A/C	8.6/21.9	A/C	8.2/22.8	A/C
Whiteview Pkwy at Ravenwood Dr	Stop	8.0/19.5	A/C	8.7/21.9	A/C	8.1/25.3	A/D	8.9/26.0	A/D	8.3/40.1	A/E	9.2/57.3	A/F
Whiteview Pkwy at Belle Terre Pkwy	Signal	24.0	C	25.7	C	25.4	C	27.4	C	27.5	C	30.1	C
Whiteview Pkwy at Princess Rose Dr	Stop	7.7/10.2	A/B	7.6/9.9	A/A	7.8/10.6	A/B	7.7/10.2	A/B	7.9/11.0	A/B	7.8/10.5	A/B
Whiteview Pkwy at Pine Tree Dr	Stop	7.4/10.2	A/B	7.7/11.2	A/B	7.4/10.6	A/B	7.7/10.9	A/B	7.4/11.0	A/B	7.8/11.4	A/B

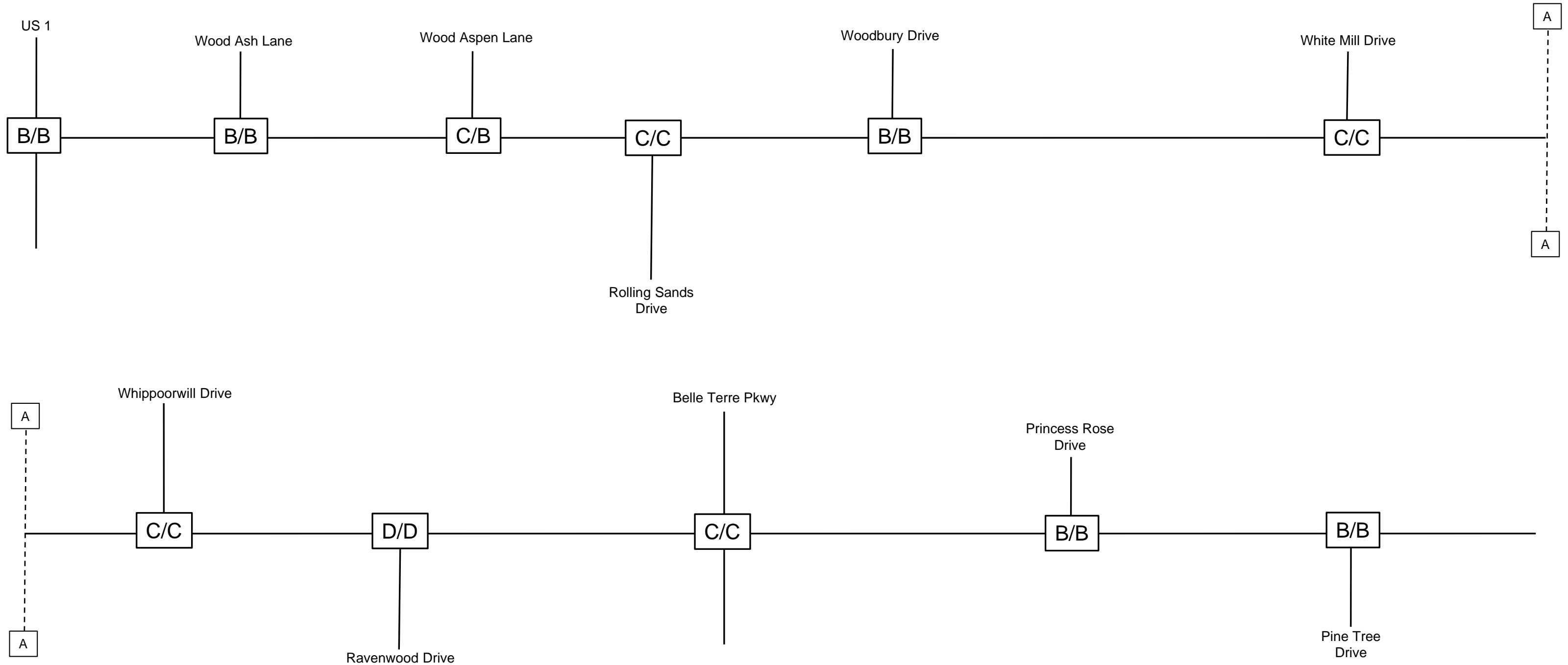
The results of the analysis shows that all intersections will operate at an acceptable level of service except for the intersection of Whiteview Pkwy at Ravenwood Drive which experiences failure in the minor approach.





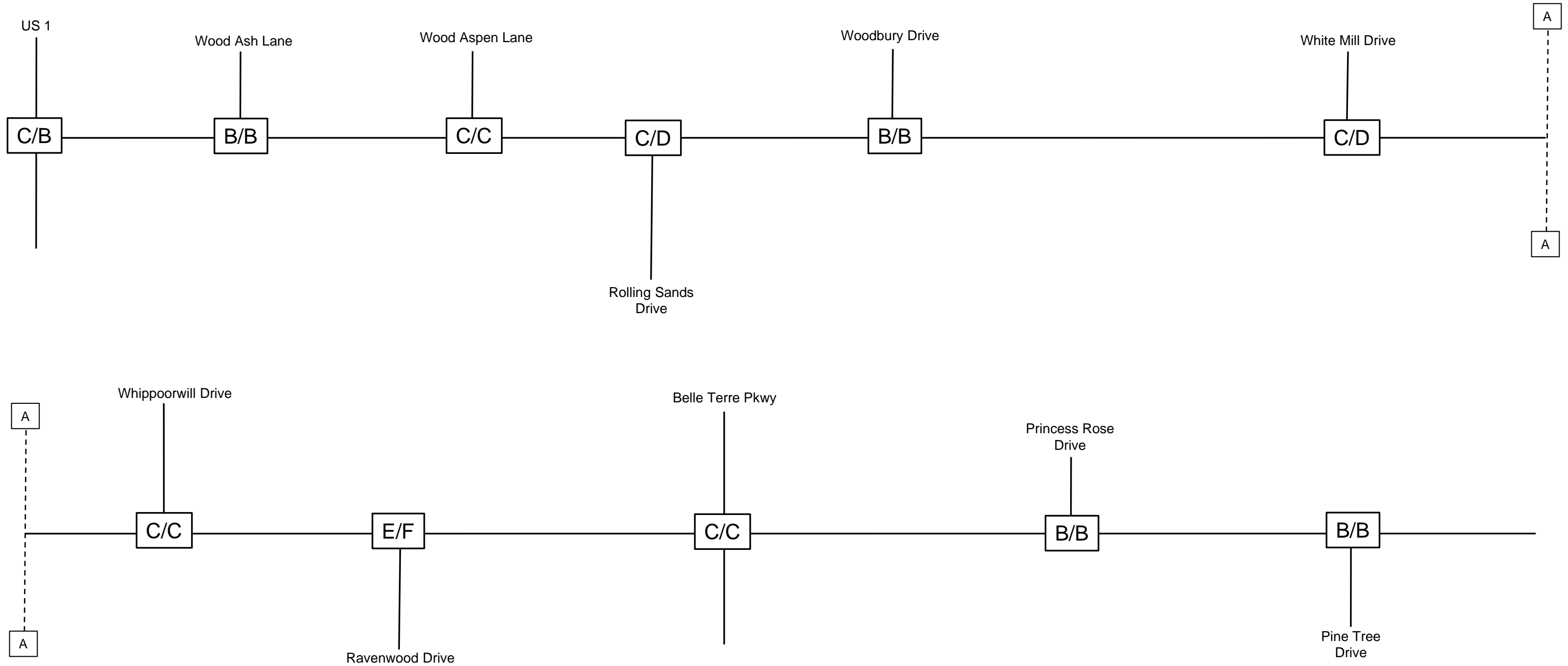
Legend
AM/PM – Level of Service





Legend
AM/PM – Level of Service





Legend
AM/PM – Level of Service



**Whiteview Pkwy
Technical Memorandum**

**Design Year (2040) - Build
Level Of Service**

Figure 15

Build Scenario with Improvements

In addition to the build scenario, city staff evaluated further improvements, such as turn lanes, which would improve safety and operations along the corridor. The roadway geometry does not change for Whiteview Pkwy from the Build Condition except for the addition of turn lanes where they are needed. **Figure 16** shows the improved Build Condition geometry utilized for the Level of Service analysis for the design (2040) year only. Signal timings were optimized to achieve the best level of service possible.

Intersection Analysis

Table 8 summarizes the Build Level of Service based on the average delay for the approaches at signalized intersections and the major/minor stop controlled movements at unsignalized intersections. **Figure 16** illustrates the geometries utilized for this analysis. The following improvements are illustrated below:

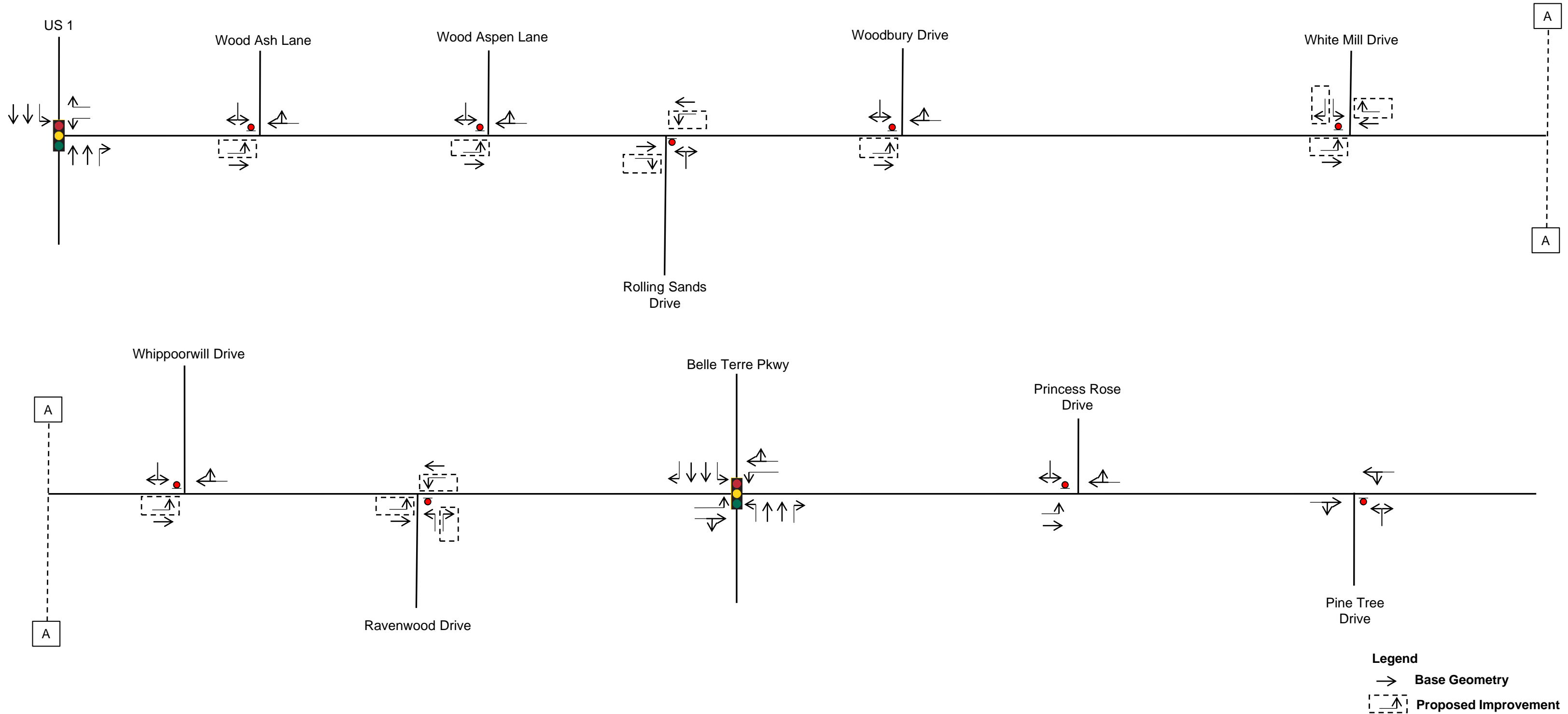
- Whiteview Pkwy at Wood Ash Lane
 - EB Left Turn Lane
- Whiteview Pkwy at Wood Aspen Lane
 - EB Left Turn Lane
- Whiteview Pkwy at Rolling Sands Drive
 - WB Left Turn Lane
 - EB Right Turn Lane
- Whiteview Pkwy at Woodbury Lane
 - EB Left Turn Lane
- Whiteview Pkwy at White Mill Drive
 - EB Left Turn Lane
 - WB Right Turn Lane
 - SB Right Turn Lane
- Whiteview Pkwy at Whippoorwill Drive
 - EB Left Turn Lane
- Whiteview Pkwy at Ravenwood Drive
 - WB Left Turn Lane
 - EB Right Turn Lane
 - NB Right Turn Lane
- Whiteview Pkwy at Princess Rose Drive
 - EB Left Turn Lane

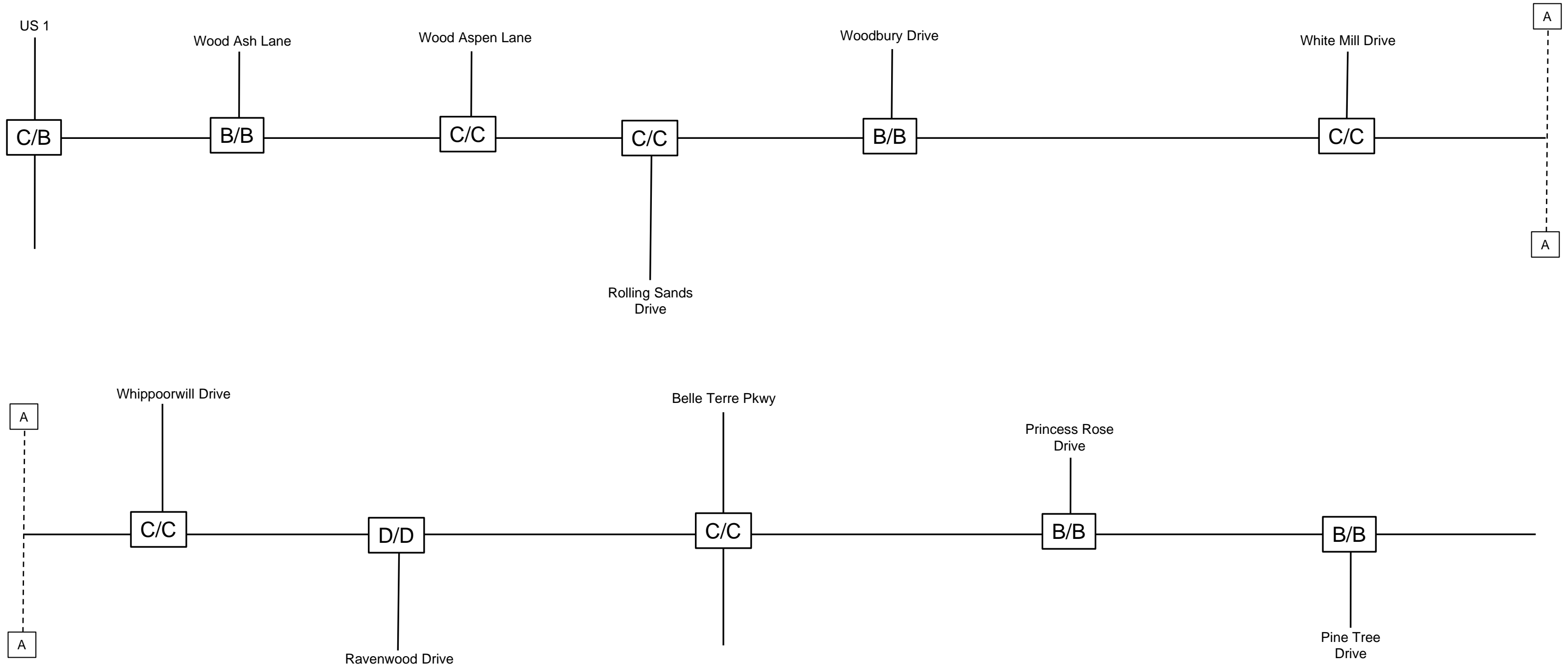
Figure 17 illustrates the Level of Service for the AM and PM peak periods for the improved Build intersection conditions. The SYNCHRO 7 intersection worksheets for signalized intersections are included in **Appendix E**.

Table 8: Improved Build Intersection LOS

Intersection	Intersection Type	2040			
		AM		PM	
		Delay	LOS	Delay	LOS
Whiteview Pkwy at US 1	Signal	21.0	C	14.1	B
Whiteview Pkwy at Wood Ash Ln	Stop	9.0/14.6	A/B	7.7/10.6	A/B
Whiteview Pkwy at Wood Aspen Ln	Stop	9.0/17.7	A/C	7.7/15.3	A/C
Whiteview Pkwy at Rolling Sands Dr	Stop	7.7/22.0	A/C	9.0/22.3	A/C
Whiteview Pkwy at Woodbury Dr	Stop	8.6/14.4	A/B	8.2/12.7	A/B
Whiteview Pkwy at Whitemill Dr	Stop	8.4/19.8	A/C	7.8/24.4	A/C
Whiteview Pkwy at Whippoorwill Dr	Stop	8.3/23.3	A/C	8.2/22.3	A/C
Whiteview Pkwy at Ravenwood Dr	Stop	8.0/27.7	A/D	8.4/29.8	A/D
Whiteview Pkwy at Belle Terre Pkwy	Signal	27.5	C	30.1	C
Whiteview Pkwy at Princess Rose Dr	Stop	7.9/11.0	A/B	7.8/10.5	A/B
Whiteview Pkwy at Pine Tree Dr	Stop	7.4/11.0	A/B	7.8/11.4	A/B

In the approved build conditions, the five intersections highlighted in **Table 8** showed a decrease in delay with the additions of turn lanes. These improvements will also improve safety throughout the corridor and reduce the need for traffic signals.





Legend
AM/PM – Level of Service



**Whiteview Pkwy
Technical Memorandum**

**Design Year (2040) – Build Condition with
Improvements Level Of Service**

Figure 17

Storage Length Calculations

As part of this study, staff evaluated the turn lane lengths required for the proposed improvements. **Table 9** illustrates the proposed lengths.

Table 9: Proposed Turn Lane Lengths

Intersection	Proposed Turn Lane	Total Turn Lane Length (ft)
Whiteview Pkwy at Wood Ash Ln	EB Left Turn Lane	245
Whiteview Pkwy at Wood Aspen Ln	EB Left Turn Lane	245
Whiteview Pkwy at Rolling Sands Dr	WB Left Turn Lane	245
	EB Right Turn Lane	245
Whiteview Pkwy at Woodbury Dr	EB Left Turn Lane	245
Whiteview Pkwy at Whitemill Dr	EB Left Turn Lane	245
	WB Right Turn Lane	285
	SB Right Turn Lane	245
Whiteview Pkwy at Whippoorwill Dr	EB Left Turn Lane	340
Whiteview Pkwy at Ravenwood Dr	WB Left Turn Lane	340
	EB Right Turn Lane	340
	NB Right Turn Lane	255
Whiteview Pkwy at Princess Rose Dr	EB Left Turn Lane	255

Conclusion & Recommendation

The study corridor of Whiteview Pkwy from US 1 to Pritchard Drive is currently classified an urban other principal arterial. Annual growth rates were developed to forecast the future demand for the future traffic conditions of Whiteview Pkwy.

Based on the traffic forecasts developed for this Technical Memorandum, an analysis was conducted to evaluate the existing and future operational conditions of the No-Build, Build and Build condition with improvements. This analysis indicated the performance of the Whiteview Pkwy study intersections through the design year (2040). The analysis showed that the Whiteview Pkwy corridor in its existing, No Build and Build configurations would be able to accommodate traffic through the design year (2040) except at the intersection of Whiteview Pkwy at Ravenwood Drive. The Build Condition improvement condition provides a considerable improvement in LOS and safety for all analysis years and provides an extension to the path from White Mill Drive to US 1.

From the evaluation of the operating conditions for the No-Build and Build Conditions, it is recommended that the intersection improvements shown in **Figure 16** be provided with the recommended storage lengths in **Table 9**.

Based on the analysis information provided within this study, City Staff recommends the Build Condition with improvements is implemented along Whiteview Pkwy. This condition provides better traffic operations and safety in the Design Year (2040) then the No Build and Build condition. In addition, the ability to build a path along the roadway will improve pedestrian and bicycle mobility and creating a better quality of life for residents who live in neighborhoods along the corridor.