Millwood Avenue Diversion Study

March 2012

SABRA, WANG & ASSOCIATES, INC.

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I. INTRODUCTION

Shenandoah University requested a Traffic Analysis be performed to study the impact of the proposed closure of Millwood Avenue between Apple Blossom Drive and East Jubal Early Drive in the City of Winchester, Virginia. The study area includes Millwood Avenue, Jubal Early Drive, Pleasant Valley Road, and Apple Blossom Drive, and the intersections along these roadways. The study area is shown in **Figure 1**. Improvements associated with the closure of Millwood include a new continuous right run lane from Jubal Early onto Apple Blossom Drive and a new traffic signal serving a new Apple Blossom Drive/University Drive intersection.

This report is divided into two sections: the first section presents the results of the evaluation of traffic operations under existing conditions for Year 2011. The second section presents the results of the future conditions for Year 2022. Year 2022 conditions were evaluated for "No-Build" conditions assuming that Millwood Avenue would not be closed, and for "Build" conditions assuming that Millwood Avenue will be closed.

II. EXISTING CONDITIONS

A. Study Area

The study focuses on the signalized and unsignalized intersections along Pleasant Valley Road, Jubal Early Drive and Millwood Avenue. The intersections included in the study are:

1. Pleasant Valley Road at Millwood Avenue
2. Apple Blossom Drive at Millwood Avenue Connector
3. Millwood Avenue at University Drive
4. Jubal Early Drive at Apple Blossom Drive
5. Jubal Early Drive at Millwood Avenue
6. Millwood Avenue at Frontage Road
7. Millwood Avenue at Lowry Drive
8. University Drive at Lowry Drive

FIGURE 1: Area Map

B. Existing Traffic Volumes

Twelve-hour turning movement counts were performed in November 2011 at the following intersections in the study area from 7:00 AM to 7:00 PM.

1. Pleasant Valley Road at Millwood Avenue
2. Apple Blossom Drive at Millwood Avenue
3. Millwood Avenue at University Drive / Apple Blossom Drive
4. Jubal Early Drive at Apple Blossom Drive
5. Jubal Early Drive at Millwood Avenue (Diverge)
6. Millwood Avenue at Frontage Road

AM and PM peak period (6:30 AM to 9:00 AM and 3:30 PM to 6:00 PM) turning movement counts were collected for the following intersections.

7. Millwood Avenue at Lowry Drive
8. University Drive at Lowry Drive

The following traffic trends are notable, which are based on the 2011 traffic count data.

- Jubal Early Drive carries approximately 1,600 vehicles per hour in the AM peak and 3,000 vehicles per hour in the PM peak hour between Frontage Road and Apple Blossom Drive.
- Westbound Jubal Early Drive traffic entering the City in the AM peak is split 50% towards Millwood Avenue and 50% towards Jubal Early Drive.
- The southbound left-turn movement from Apple Blossom Drive onto eastbound Jubal Early Drive is 42% of the total eastbound traffic going towards I-81 during the PM peak hour.
- Traffic volumes are generally heavier in the PM peak hour. Therefore, PM peak hour is the critical design hour for this study.

The AM and PM peak traffic patterns are shown in **Figures 2** and **3**. **Figures 4** and **5** show the AM and PM peak hour volumes, respectively. The 2011 turning movement counts are included as **Appendix A**.

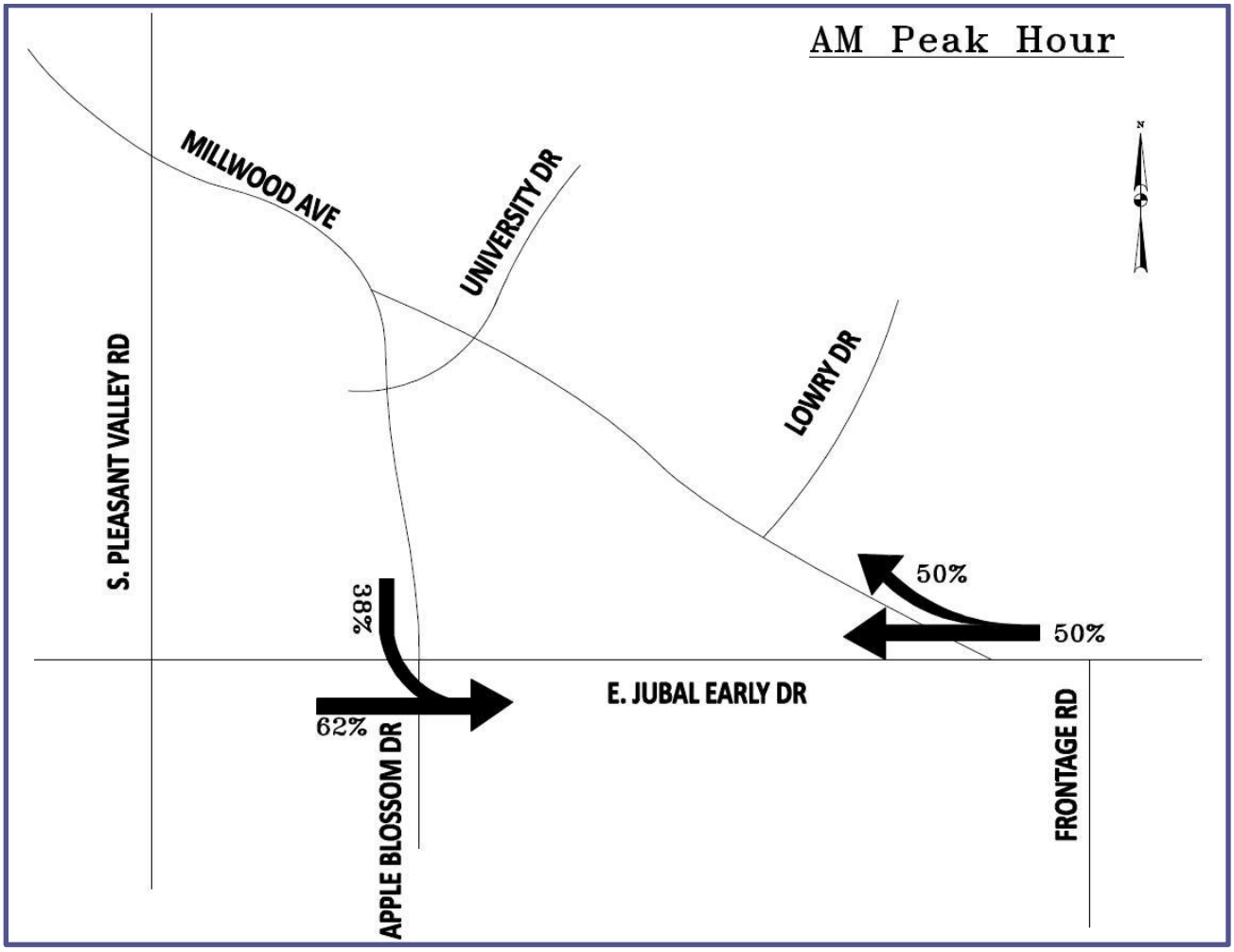

FIGURE 2: AM Peak Traffic Flows

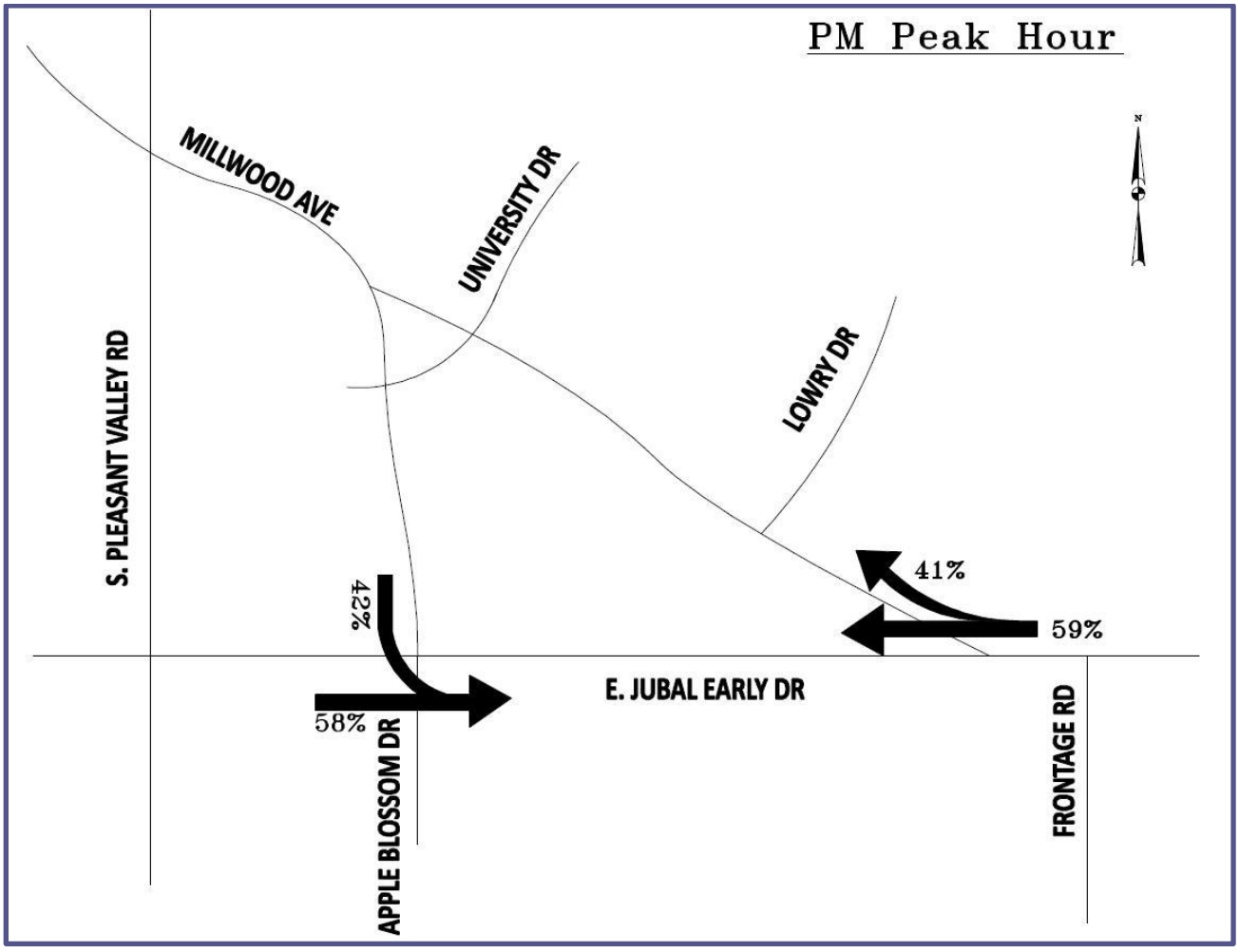

FIGURE 3: PM Peak Traffic Flows

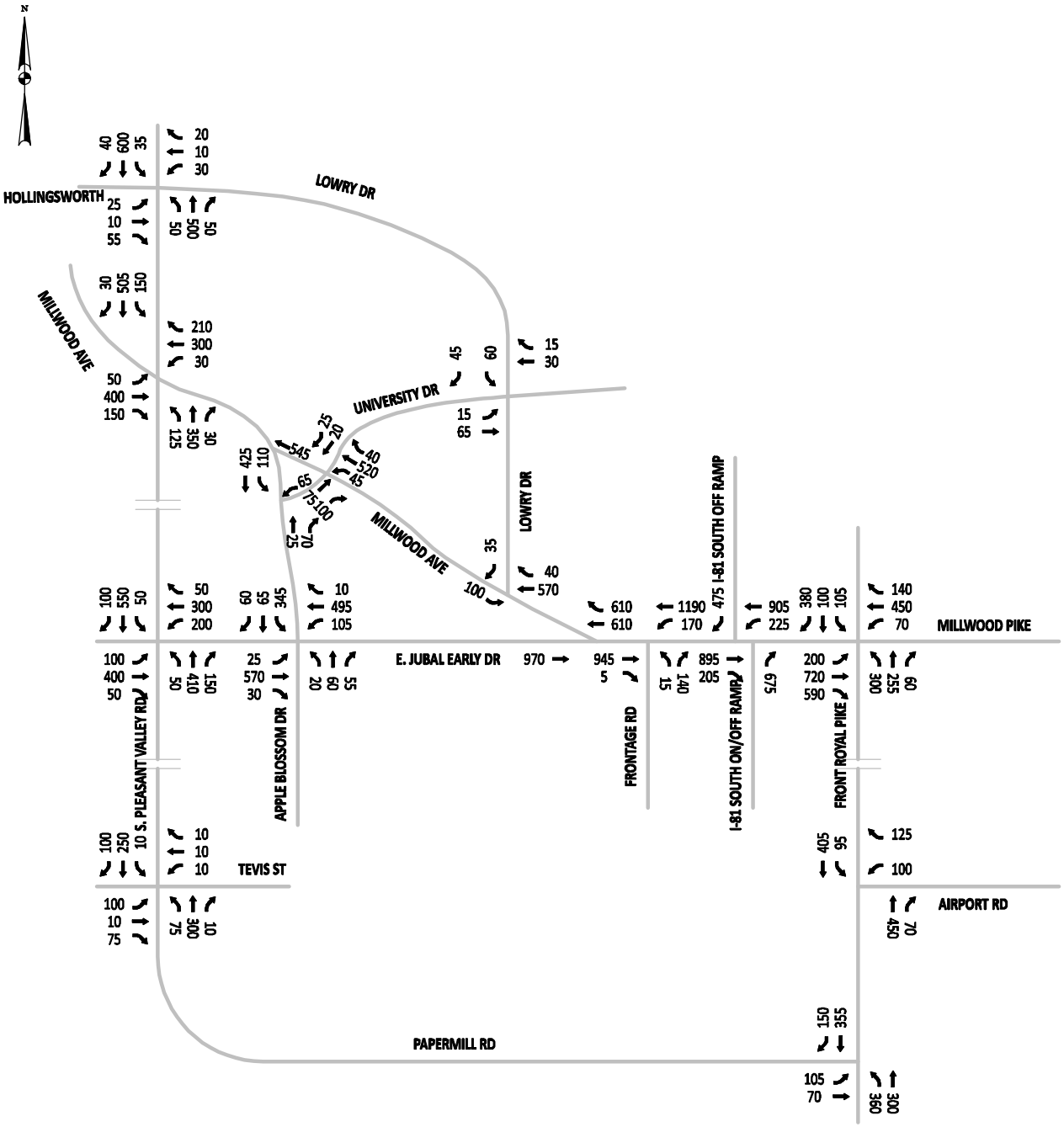

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FIGURE 4 - MILLWOOD AVENUE CORRIDOR STUDY
2011 AM VOLUMES

SCALE: N.T.S.

MARCH 2012

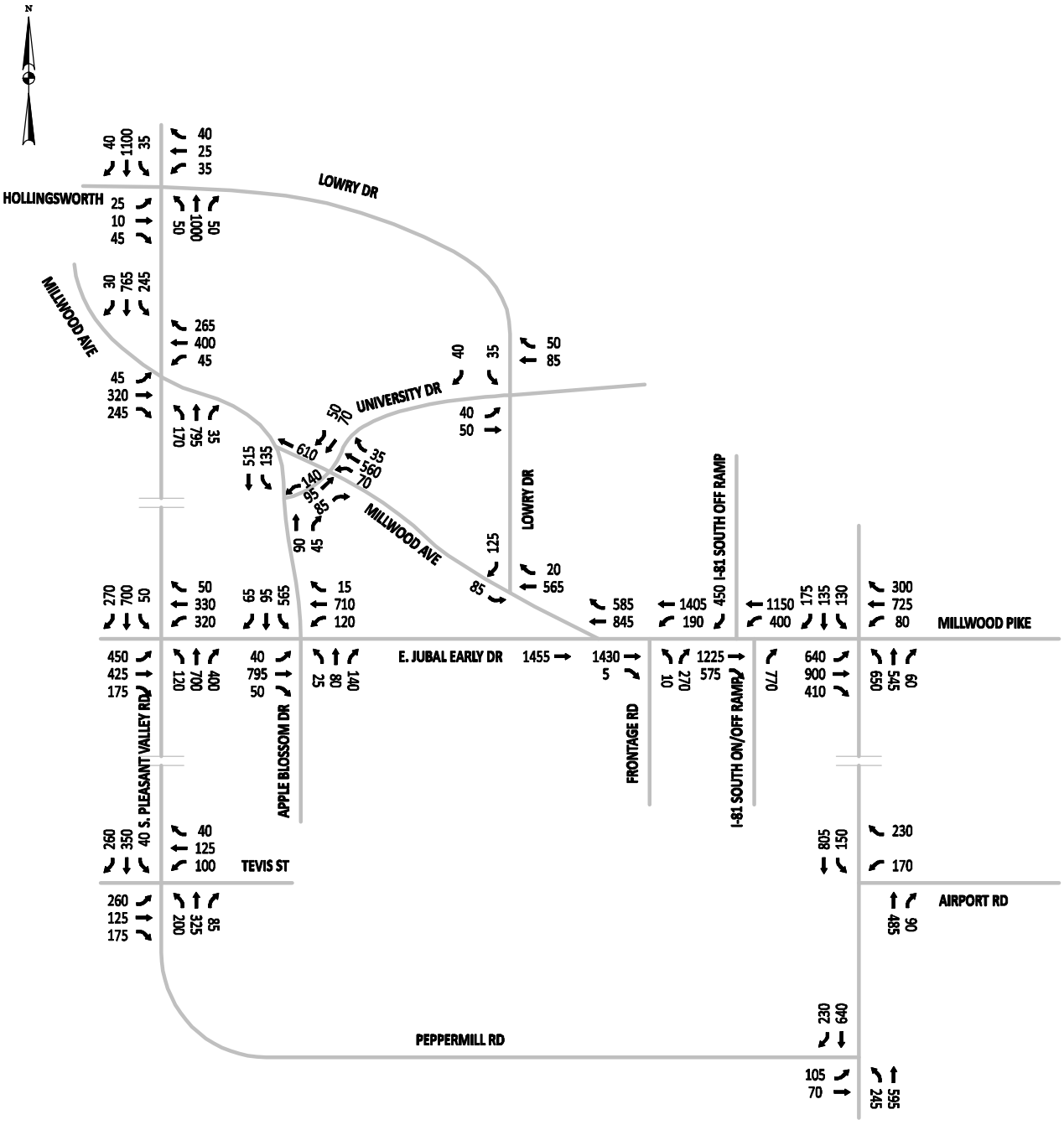

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FIGURE 5 - MILLWOOD AVENUE CORRIDOR STUDY
2011 PM VOLUMES

SCALE: N.T.S.

MARCH 2012

C. Existing Intersection Traffic Analysis

Two methods were utilized to analyze traffic operations. Both analysis methods are locally and nationally recognized and accepted methodologies.

1. *The National Academy of Sciences, Transportation Research Board's Highway Capacity Manual (HCM) as implemented in Trafficware Corporation's Synchro 7.0 software.* The HCM analysis methodology was used to evaluate intersection performance, which uses the concept "Level Of Service" (LOS) as its primary measure of intersection performance. LOS is a letter designation that corresponds to a certain range of roadway operating conditions. The LOS values range from A to F, with A indicating the best operating conditions and F indicating the worst, or a failing, operating conditions.
2. *Trafficware Corporation's microscopic simulation and animation software: SimTraffic.* The SimTraffic analysis methodology was used to evaluate the interaction among the individual intersections in the transportation network. The primary output used for SimTraffic is the visual animation of the transportation network.

Table 1 below summarizes the HCM capacity analyses for existing conditions during both the AM and PM peak periods. The HCM worksheets are included as **Appendix B**. The analysis shows that all intersections operate at an acceptable LOS (LOS E or better) based on the methodologies of the Highway Capacity Manual. SimTraffic was used to simulate existing traffic conditions. The simulation showed PM peak hour queues extending along Jubal Early Drive/Millwood Avenue from the traffic signal at Frontage Road / I-81 Ramps back to the Apple Blossom Drive intersection, and some localized congestion for the left turn from southbound Apple Blossom onto eastbound Jubal Early Drive. The simulation also showed queues extending along Millwood Avenue from the signal at Pleasant Valley Road. At times, these queues extended into the diverge point at Apple Blossom Drive. General observations of traffic congestion confirmed that the extent of queuing described in the simulation regularly occurs, and is consistent with the traffic analysis data shown in Table 1.

TABLE 1: Existing Conditions Traffic Analysis

Intersection / Approach	Level of Service AM (PM)	Average Delay (sec) AM (PM)	v/c Ratio AM (PM)
Pleasant Valley Road at Millwood Avenue			
EB Millwood	E (E)	69.4 (59.7)	0.90 (0.83)
WB Millwood	E (E)	68.2 (76.6)	0.69 (0.91)
NB Pleasant Valley	D (D)	41.7 (42.9)	0.24 (0.59)
SB Pleasant Valley	C (D)	20.8 (36.5)	0.32 (0.52)
Overall Intersection	***D (D)***	***47.9 (50.6)***	***0.55 (0.84)***

TABLE 1: Existing Conditions LOS Summary (Contd.)

Intersection / Approach	Level of Service AM (PM)	Average Delay (sec) AM (PM)	v/c Ratio AM (PM)
Jubal Early Drive at Apple Blossom Drive			
EB Jubal Early	D (D)	35.3 (47.9)	0.59 (0.97)
WB Jubal Early	B (C)	15.2 (26.1)	0.39 (0.65)
NB Apple Blossom	D (C)	36.1 (29.5)	0.51 (0.42)
SB Apple Blossom	D (E)	37.6 (75.6)	0.80 (1.04)
Overall Intersection	***C (D)***	***29.4 (46.7)***	***0.62 (0.87)***
Millwood Avenue at Frontage Road			
EB Millwood Ave	B (C)	18.0 (30.4)	0.60 (0.65)
WB Millwood Ave	A (A)	4.2 (2.9)	0.53 (0.50)
NB Frontage Rd	D (D)	36.4 (52.3)	0.16 (0.26)
SB Frontage Rd	D (D)	35.0 (48.9)	0.10 (0.08)
Overall Intersection	***B (B)***	***12.0 (19.3)***	***0.50 (0.54)***
Millwood Avenue at University Drive (Two-Way Stop)**			
NB University Dr	B (B)	10.6 (13.0)	0.23 (0.38)
SB University Dr	B (C)	13.8 (17.5)	0.07 (0.27)
Apple Blossom Drive at Millwood Avenue Connector (Two-Way Stop)**			
WB Millwood Ave Connector Left	B (C)	14.1 (19.6)	0.15 (0.36)
SB Apple Blossom Left	A (A)	1.6 (1.6)	0.08 (0.10)

*** - HCM MOEs are only reported for the stop controlled approaches; the mainline approaches are not controlled and have no delays (i.e., LOS A)*

III. YEAR 2022 CONDITIONS

Traffic volumes for Year 2022 conditions were generated based on approved-but-unbuilt development proposals, continued growth at Shenandoah University, and regional background growth. The background development assumptions and projected growth rates and supporting assumptions for the University are outlined in the ***Phase 2022 Development Conditions Executive Summary,*** which was reviewed and approved by the City of Winchester's Technical Review Committee (TRC), and is included as **Appendix C**.

This section of the report is categorized into the following sub-sections:

A. Background Developments
B. Regional Traffic Growth
C. Shenandoah University Growth
D. Total Traffic Growth – Year 2011 to Year 2022
E. Year 2022 No-Build Conditions
F. Year 2022 Build Conditions

A. Background Developments

The approved-but-unbuilt developments assumed to be constructed by year 2020 are:

- Russell 150 (Single Family Attached Residential, Retail and Office spaces) and
- Willow Run (Single Family Detached and Attached Residential Units).

The *Institute of Transportation Engineers (ITE), Trip Generation Manual, 8th Edition* was used to calculate the trips generated from these developments (i.e., new traffic volumes that would be added onto the area roadways). Trips were distributed through the study area based on the approved Traffic Impact Analyses (TIA) performed for these two developments. The trip generation and trip distribution for each background development for AM and PM peak hours are shown in **Appendix E**. **Table 2** details the background developments and the trips generated by these developments for the year 2022 traffic volume forecasts.

TABLE 2: Background Developments

Location	Development Type	Trips Generated					
		AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
Russell 150							
Between I-81 and Front Royal Pike south of Millwood Pike	118 Single Family Attached	9	43	**52**	42	20	**62**
	110,000 SF Retail Space	67	43	**110**	201	209	**410**
	40,000 SF Office Space	55	7	**62**	10	50	**60**
Willow Run							
East of Route 37 north of Cedar Creek Grade	182 Single Family Detached	34	103	**137**	116	68	**184**
	136 Single Family Attached	10	50	**60**	47	24	**71**

A condition of the Russell 150 development is the construction of a bridge over I-81 connecting Tevis Street at Pleasant Valley Road to Airport Road east of I-81. The proposed flyover bridge would divert some traffic currently using Jubal Early Drive to the new roadway. **Table 3** (on page 10) shows the traffic volumes that would be diverted as a result of the proposed Tevis Street flyover.

B. Regional Traffic Growth

Regional traffic growth accounts for increases in traffic volumes due to development that occurs outside of the study area, but generates traffic that travels through the study area. The impact of regional traffic growth was estimated by increasing existing traffic volumes in the study area by 1% per year (compounded annually) for 10 years until year 2022. The 1% background growth rate was calculated based on the historical traffic growth in the area.

In order to determine the historical growth rate, traffic volumes collected in 2007 were compared to the traffic volumes collected for this study in November 2011. The 5-year comparison shows a decrease in traffic volumes of approximately 3% on Jubal Early Drive between the I-81 Ramps and Pleasant Valley Drive. In order to make a conservative assumption (i.e. project more traffic in the area that is reasonably expected); a growth rate of 1% per year was utilized. **Appendix E** shows the increase in traffic volumes due to the background growth in the study area for AM and PM peaks.

C. Shenandoah University Growth

The University evaluated historical growth in enrollment and staff, and projections high school class sizes over the next 10 years to forecast growth in undergraduate and graduate enrollment, and increases in faculty and staff positions**.** The ***Phase 2022 Development Conditions Executive Summary*** calculated a 2% growth rate in University related traffic over the next 10 years. Traffic growth forecasts and trip distributions for University related traffic for AM and PM peaks is shown in **Appendix F**.

D. Total Traffic Growth – Year 2011 to Year 2022

Year 2022 traffic volumes were obtained by summing the existing traffic volumes, background development and growth traffic volumes, and additional traffic volumes generated by Shenandoah University. The Year 2022 volumes for AM and PM peak are shown in **Figures 7** and **8** (on pages 14 and 15)**.**

Table 3 summarizes the additional trips added to the study area at one point in the transportation network (on Millwood Avenue west of Frontage Road) to illustrate the extent of the projected increases in traffic volumes in 2022. Also, **Figure 6** graphically illustrates the increase in traffic volumes at key traffic movements in the study area.

TABLE 3: Increase in Traffic Volumes for Year 2022

INCREASE IN VEHICULAR TRAFFIC: 2011 to 2022 AM Peak (PM Peak)		
Development	**Trips Added to Jubal Early Drive / Millwood Ave at Frontage Road**	
	Eastbound	**Westbound**
Russell 150	20 (38)	14 (42)
Tevis St Flyover	-33 (-67)	-56 (-100)
Willow Run	23 (14)	9 (33)
General Growth	102 (167)	115 (137)
SU Growth	14 (29)	31 (34)
NET GROWTH	**126 (180)**	**113 (146)**

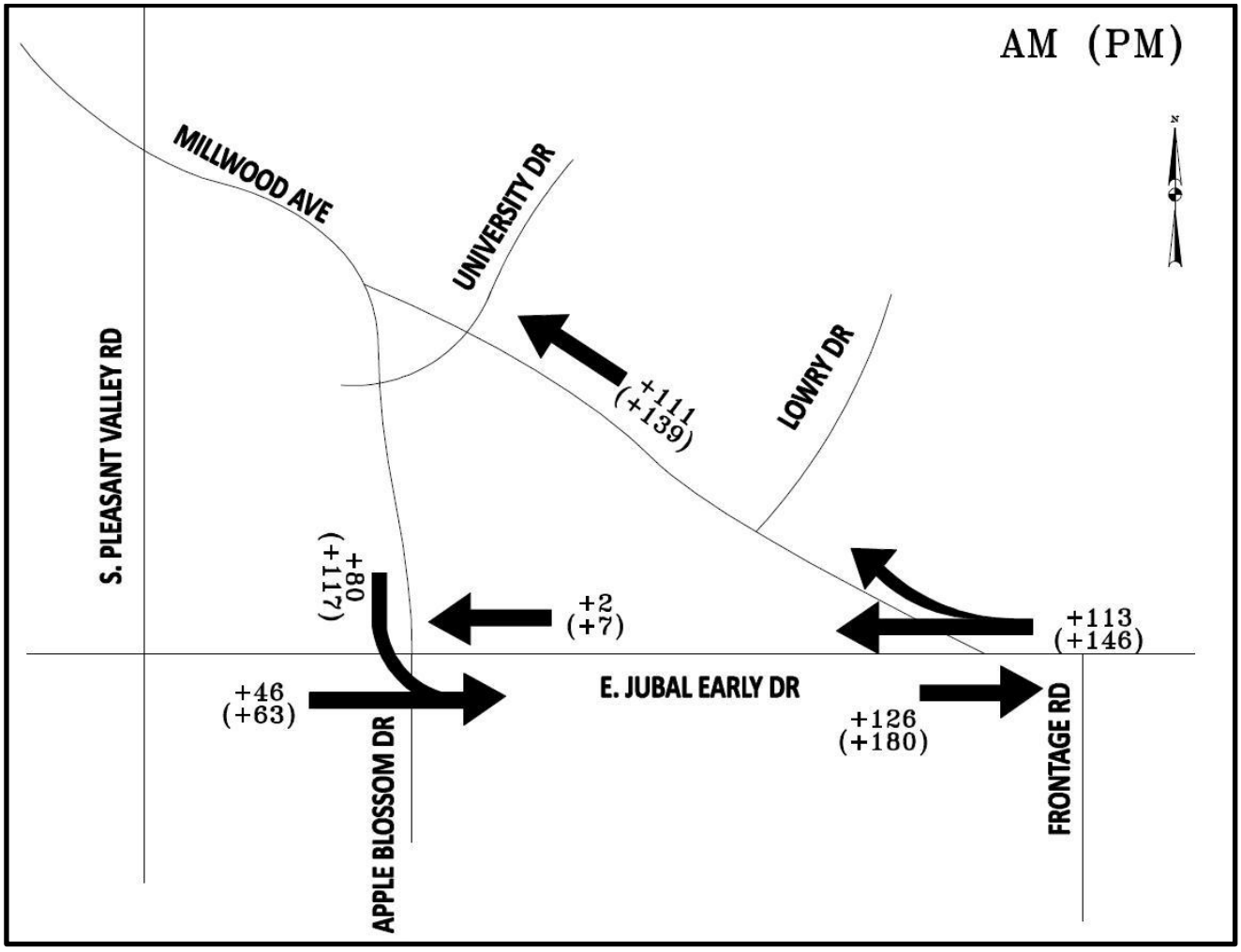

FIGURE 6: 2022 Net Growth for AM and PM Peak Traffic

E. Year 2022 No-Build Conditions

Year 2022 No-Build conditions assume that Millwood Avenue would remain and no improvements, except for basic maintenance would be performed on area roadways.

Synchro HCM Analysis

Table 4 summarizes the *Synchro* HCM analysis performed under year 2022 no-build traffic conditions. The analysis shows that the study intersections are expected to continue to operate at acceptable LOS E or better in the AM peak hour. The peak hour delays in 2022 AM and PM peak hours are expected to increase in general due to the increase in traffic volumes.

The delays on southbound University Drive at Millwood Avenue are expected to nearly double due to the increase in traffic volumes along both roadways, and due to the fact that University Drive is "Stop" controlled. With the increase in traffic volumes along Millwood Avenue, traffic exiting University Drive will find fewer gaps in Millwood Avenue traffic and will wait at the STOP sign longer in order to turn onto Millwood Avenue.

In addition, the analysis showed that the southbound approach on Apple Blossom Drive at Jubal Early Drive would operate at LOS F in the 2022 PM peak hour (note the overall intersection is still projected to operate at LOS E). This rating is due to the heavy southbound left turning movement towards I-81. **Appendix I** contains the *Synchro* HCM worksheets.

SimTraffic Analysis

SimTraffic simulations confirmed the results of the Synchro HCM analysis – traffic congestion increases over the next 10 years most notably on eastbound Jubal Early Drive between Frontage Road and Pleasant Valley Road. The congestion along southbound Apple Blossom Drive and westbound Millwood Avenue would also increase. A snapshot of the SimTraffic simulation for PM peak hour is shown in **Figure 9.**

TABLE 4: Year 2022 No-Build LOS Summary

Intersection / Approach	Level of Service AM (PM)	Average Delay (sec) AM (PM)	v/c Ratio AM (PM)
Pleasant Valley Road at Millwood Avenue			
EB Millwood	E (E)	67.5 (60.1)	0.93 (0.89)
WB Millwood	D (E)	53.7 (69.9)	0.72 (0.88)
NB Pleasant Valley	D (E)	45.5 (67.8)	0.32 (0.92)
SB Pleasant Valley	C (D)	25.6 (52.9)	0.40 (0.66)
Overall Intersection	***D (E)***	***46.8 (62.1)***	***0.65 (0.89)***
Jubal Early Drive at Apple Blossom Drive			
EB Jubal Early	B (D)	14.2 (53.3)	0.60 (1.00)
WB Jubal Early	B (C)	14.3 (31.5)	0.38 (0.71)
NB Apple Blossom	D (D)	39.9 (37.7)	0.64 (0.64)
SB Apple Blossom	C (E)	31.2 (55.7)	0.24 (0.95)
Overall Intersection	***C (D)***	***20.1 (45.9)***	***0.61 (0.92)***
Millwood Avenue at Frontage Road			
EB Millwood Ave	C (C)	25.0 (28.6)	0.76 (0.70)
WB Millwood Ave	A (A)	5.2 (2.9)	0.62 (0.53)
NB Frontage Rd	C (D)	31.0 (52.7)	0.15 (0.29)
SB Frontage Rd	C (D)	29.8 (48.9)	0.05 (0.08)
Overall Intersection	***B (B)***	***15.1 (19.1)***	***0.57 (0.58)***
Millwood Avenue at University Drive (Two-Way Stop)**			
NB University Dr	B (C)	12.8 (23.8)	0.43 (0.67)
SB University Dr	C (E)	18.9 (35.2)	0.39 (0.72)
Apple Blossom Drive at Millwood Connector (Two-Way Stop)**			
WB Millwood Connector Left	C (F)	17.3 (59.3)	0.22 (0.82)
SB Apple Blossom Left	A (A)	1.8 (1.9)	0.11 (0.14)

*** - HCM MOEs are only reported for the stop controlled approaches; the mainline approaches are not not controlled and have no delays (i.e., LOS A)*

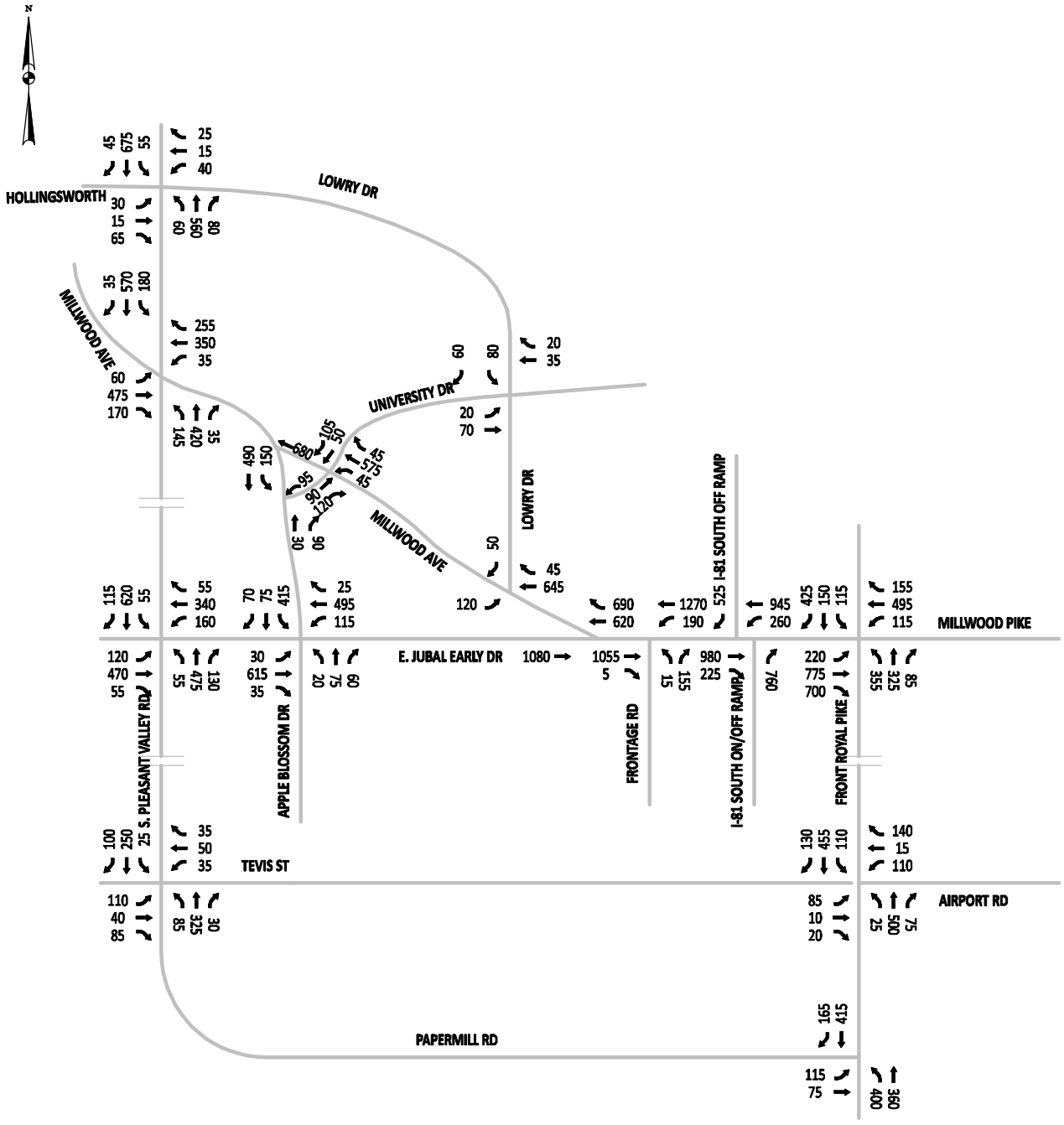

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FIGURE 7 - MILLWOOD AVENUE CORRIDOR STUDY
YEAR 2022 NO-BUILD VOLUMES - AM PEAK

SCALE: N.T.S.

MARCH 2012

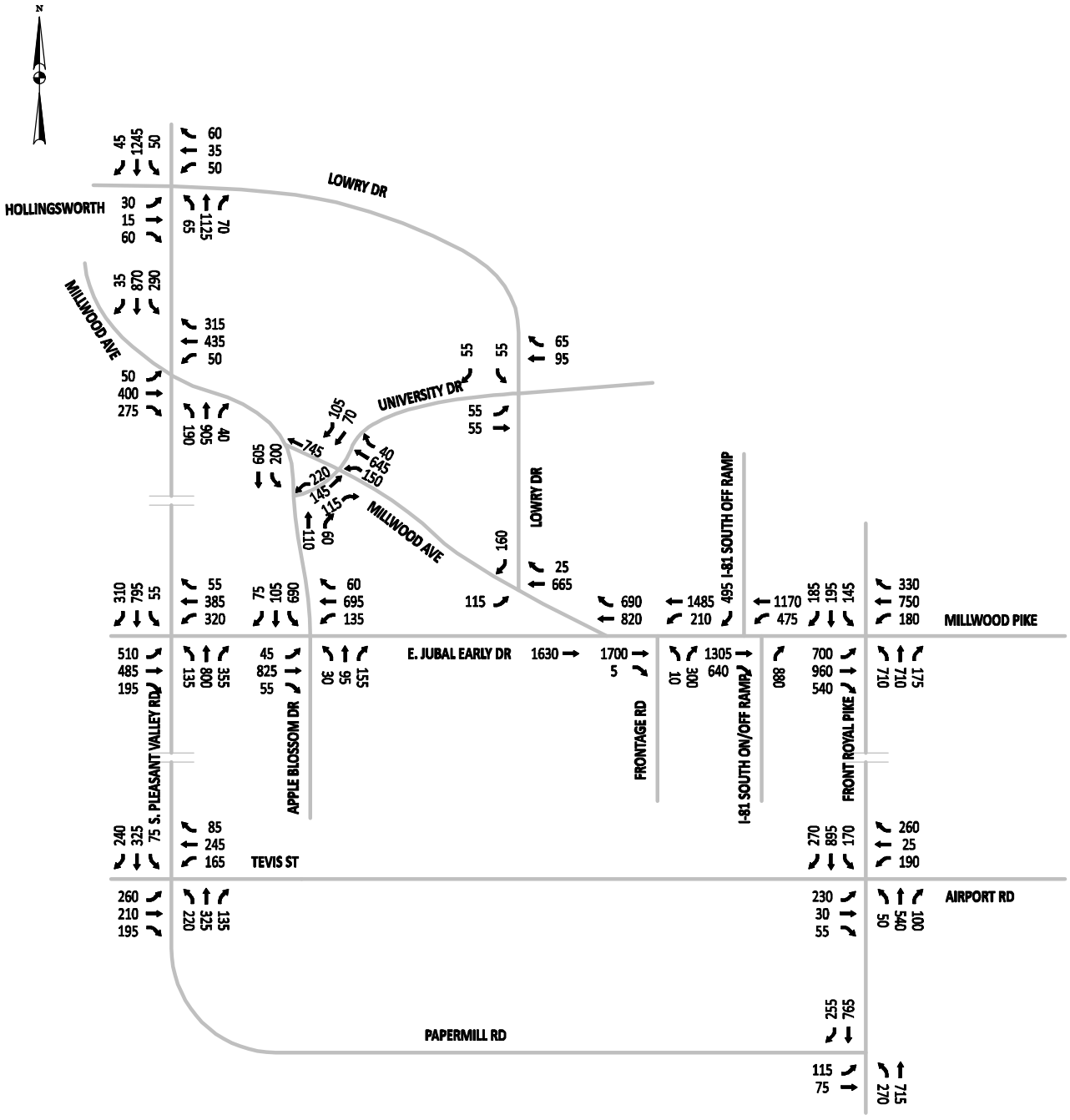

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FIGURE 8 -MILLWOOD AVENUE CORRIDOR STUDY
YEAR 2022 NO-BUILD VOLUMES - PM PEAK

SCALE: N.T.S.

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FIGURE 9: Year 2022 No-Build PM SimTraffic Snapshot

F. Year 2022 Build Conditions

Year 2022 Build conditions include the closure of Millwood Avenue between Jubal Early Drive and Apple Blossom Drive. Traffic currently using Millwood Avenue would be diverted to Jubal Early Drive and would make a right-turn onto Apple Blossom Drive to access Millwood Avenue. University Drive would be realigned to create a signalized intersection with Apple Blossom Drive. The realignment of the intersection would eliminate the awkward triangular geometry of multiple intersections. The installation of the traffic signal would provide safer conditions for pedestrians to cross Apple Blossom Drive. The following geometric conditions were assumed for the build scenario.

- Remove Millwood Avenue between Jubal Early Drive and Apple Blossom Drive.

- Add a continuous free flow right-turn lane from westbound Jubal early Drive onto northbound Apple Blossom Drive.
- Remove the multiple intersections and realign University Drive for a four legged intersection with Apple Blossom Drive.
- Signalize the Apple Blossom Drive at University Drive intersection.
- Provide separate turn lanes on northbound and southbound Apple Blossom Drive at University Drive.
- Provide crosswalks and pedestrian signals at the intersection.

The redistributed 2022 traffic volumes for AM and PM peaks are shown in **Figure 10** and **11** (on page 18 and 19). The intersection information for Millwood Avenue /Apple Blossom Drive at University Drive is included in **Appendix H**.

***Synchro* Analysis**

Table 5 summarizes the HCM analysis performed under year 2022 Build conditions. The realignment of University Drive and the installation of a traffic signal at University Drive at Apple Blossom Drive reduces the delays that are expected to occur for University Drive when compared to the No-Build scenario. Additionally, note that the intersection of Jubal Early Drive at Apple Blossom Drive is expected to operate adequately under the Build conditions. The *Synchro* HCM worksheets are included as **Appendix I**.

***SimTraffic* Analysis**

SimTraffic simulations were also performed for both the AM and PM peak hours. The simulation analysis confirmed the results of the Synchro HCM analyses. University Drive would operate more efficiently with the new signalized intersection at Apple Blossom Drive. The free flow right turn from westbound Jubal Early Drive would operate freely, without queues or long delays. In the simulation, weaving maneuvers along Apple Blossom Drive between Jubal Early Drive and Pleasant Valley Road are observed to be made efficiently. Comparing the simulation analyses between 2022 Build and No-Build, the weaving maneuvers under the Build conditions appear to improve due to:

1. The longer distance in order to complete the maneuver (the No-Build condition has about ½ the distance of the Build condition); and
2. Queues from Pleasant Valley Road (in the Build condition) to not extend into the free flow right turn, whereas in the No-Build condition, these queues extend into the merge area from Millwood Avenue.

It should be noted that the cycle failures described previously in the No-Build scenario for southbound Apple Blossom Drive left-turns at Jubal Early Drive are expected to remain in the Build scenario. This should be expected since this failure is caused by intersection that will operate the same under both the Build and No-Build conditions. A snapshot of the SimTraffic simulation for PM peak hour is shown in **Figure 12.**

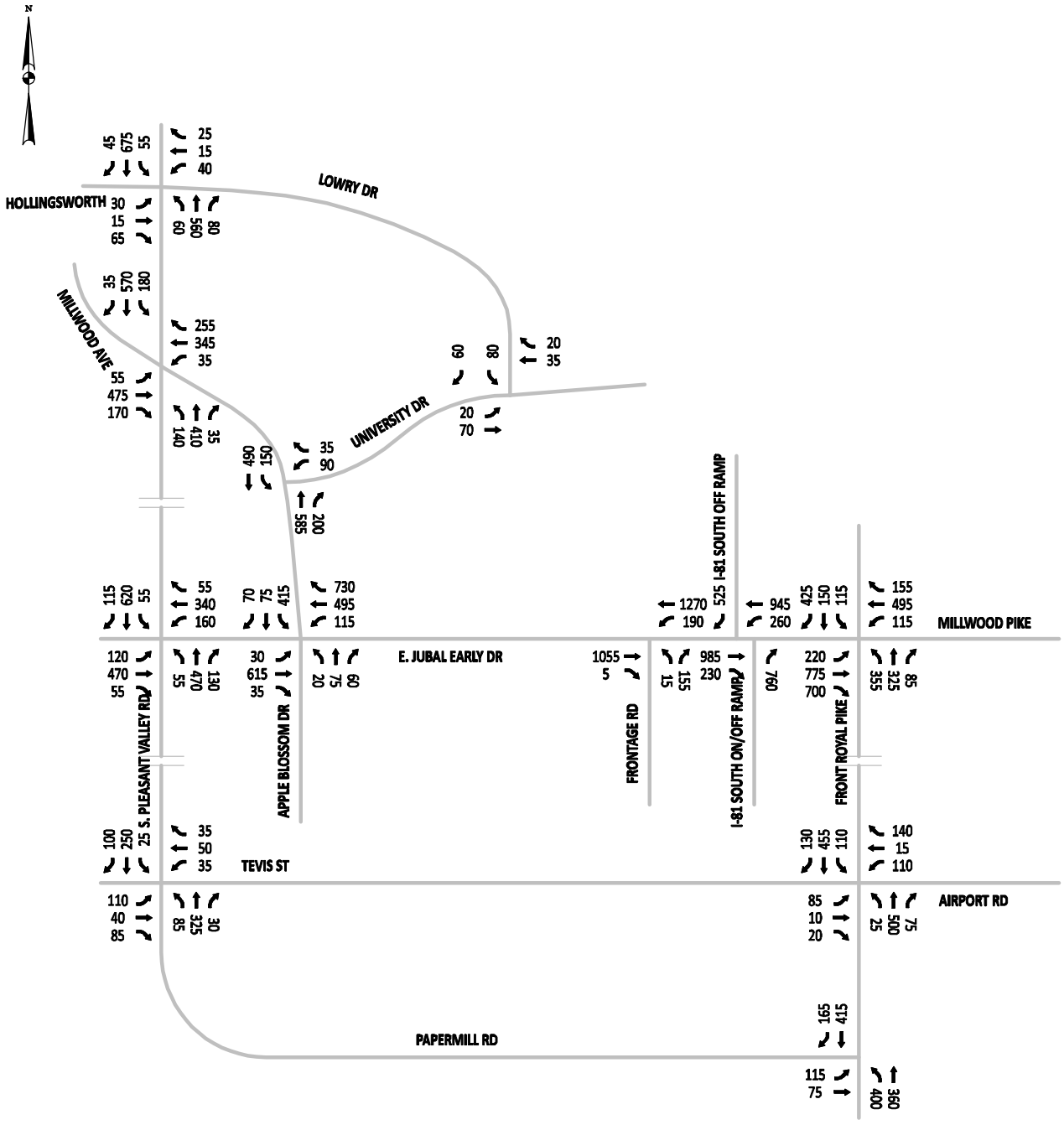

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FIGURE 10 - MILLWOOD AVENUE CORRIDOR STUDY
YEAR 2022 BUILD VOLUMES - AM PEAK

SCALE: N.T.S.

MARCH 2012

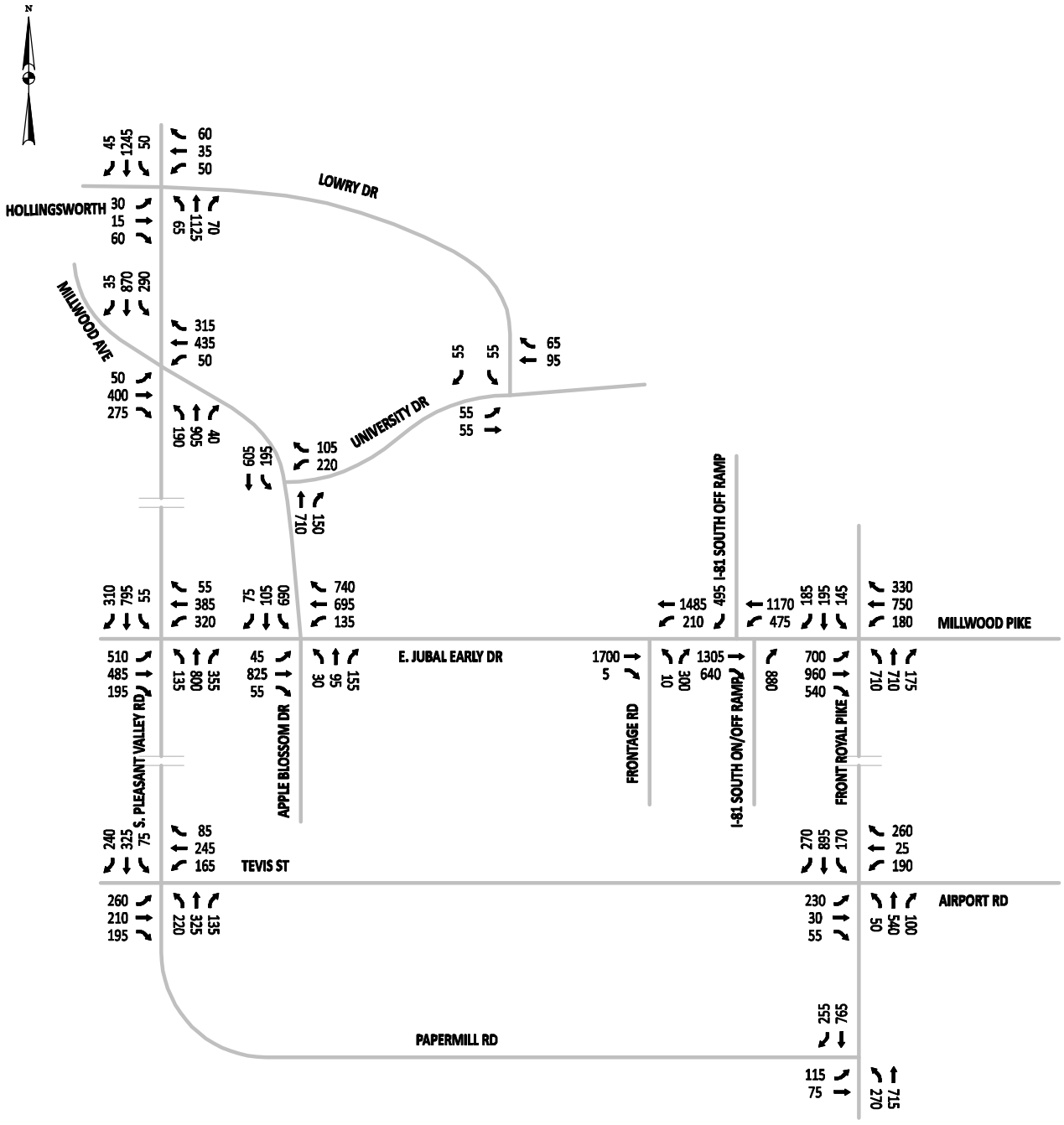

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FIGURE 11 - MILLWOOD AVENUE CORRIDOR STUDY
YEAR 2022 BUILD VOLUMES - PM PEAK

SCALE: N.T.S.

MARCH 2012

TABLE 5: Year 2022 Build Conditions LOS Summary

Intersection / Approach	Level of Service AM (PM)	Average Delay (sec) AM (PM)	v/c Ratio AM (PM)
Pleasant Valley Road at Millwood Avenue[1]			
EB Millwood	E (E)	66.5 (60.9)	0.92 (0.90)
WB Millwood	D (E)	48.6 (55.0)	0.71 (0.88)
NB Pleasant Valley	D (E)	45.9 (66.7)	0.30 (0.90)
SB Pleasant Valley	C (D)	25.3 (54.8)	0.40 (0.66)
Overall Intersection	***D (E)***	***45.3 (59.7)***	***0.64 (0.92)***
Jubal Early Drive at Apple Blossom Drive[2]			
EB Jubal Early	B (D)	13.6 (49.6)	0.59 (1.00)
WB Jubal Early	A (B)	6.0 (15.3)	0.35 (0.62)
NB Apple Blossom	D (D)	38.1 (38.0)	0.60 (0.65)
SB Apple Blossom	C (D)	31.9 (53.5)	0.24 (0.94)
Overall Intersection	***B (C)***	***14.4 (34.1)***	***0.64 (0.87)***
Millwood Avenue at Frontage Road			
EB Millwood Avenue	C (C)	31.9 (28.9)	0.76 (0.70)
WB Millwood Avenue	A (A)	4.2 (2.9)	0.62 (0.53)
NB Frontage Rd	C (D)	31.0 (52.7)	0.15 (0.29)
SB Frontage Rd	C (D)	29.8 (48.9)	0.05 (0.08)
Overall Intersection	***B (B)***	***17.4 (19.2)***	***0.57 (0.58)***
Apple Blossom Drive at University Drive *(New Traffic Signal)*			
NB Apple Blossom	B (B)	11.1 (15.5)	0.27 (0.49)
SB Apple Blossom	A (B)	2.9 (10.9)	0.23 (0.34)
EB Driveway	C (C)	31.8 (24.3)	0.07 (0.05)
WB University	C (D)	34.2 (36.9)	0.06 (0.10)
Overall Intersection	***B (B)***	***10.2 (17.6)***	***0.31 (0.61)***

1. No significant change from No-Build conditions. Minor differences in LOS, Delays and v/c-ratios are attributed to minor differences in the signal timing plans between the Build and No-Build conditions.
2. Operations improve on the WB approach compared to the No-Build because the heavy WB free right has 0 seconds delay. When the delay calculations are performed, the 0 seconds is averaged with the through and left movement delays . Therefore the overall approach delay decreases.

FIGURE 12: Year 2022 Build Conditions PM SimTraffic Snapshot

SimTraffic simulations were used to compare the expected increases in westbound travel time between Frontage Road at Jubal Early Drive to Pleasant Valley Road at Millwood Avenue. The simulations were performed for multiple runs and the average travel times are reported. The travel times from Frontage Road through Pleasant Valley Road are summarized in **Table 6** below. The SimTraffic reports are included as **Appendix J**. The travel time from Frontage Road through the Pleasant Valley Road signal is dictated by the signal timing at Pleasant Valley Road at Millwood Avenue signal. It should be noted that the traffic signal coordination plans would provide for better progression along the corridor. As a result, the

travel time analysis in **Table 6** identifies a minor increase in delays when comparing the 2022 Build vs. 2022 No-Build conditions.

TABLE 6: Summary of Westbound Travel Times

Westbound Travel Times (Seconds)					
AM Peak			PM Peak		
No-Build 2022	Build 2022	Difference	No-Build 2022	Build 2022	Difference
110	115	+5	95	111	+16

IV. SUMMARY

The following is a summary of findings based on the analysis and observations presented in the report:

1. Under *existing conditions*, all intersections operate at a level of service "D" or better based on the methodologies of the Highway Capacity Manual.
2. Two background developments were noted in the study area, projecting a total of 420 new vehicles trips in the study area in the AM peak hour and 790 new vehicle trips in the PM peak hour.
3. The Shenandoah University would generate a total of 140 and 190 vehicle trips during the AM and PM peak hours, respectively.
4. Under *2022 No-Build* conditions all intersection would operate at LOS E or better, except for the southbound approach of Apple Blossom Drive that would operate at LOS F during the PM peak hour.
5. Under *2022 No-Build* conditions the delays for University Drive are expected to double during the PM peak hour.
6. Under *2022 Build* conditions the addition of the new traffic signal at Apple Blossom Drive / Millwood Avenue at University Drive is expected to reduce the delays for University Drive.
7. The congestion on eastbound Jubal Early Drive is expected to remain the same in *2022 Build* and *No-Build* conditions due to the traffic queuing from the Frontage Road / I-81 Ramps intersection.

The summary of advantages of the *Build* conditions over *No-Build* conditions is described in **Table 7**.

TABLE 7: Summary of Advantages and Disadvantages

	2022 Build Conditions	2022 No-Build Conditions
Advantages	• Eliminates the diverge of westbound Millwood Avenue between Jubal Early Drive and University Drive thus eliminating the awkward geometry of multiple intersections at Apple Blossom Drive /Millwood Avenue at University Drive scenario that currently exits. • The addition of a signalized intersection at Apple Blossom Drive and University Drive would create safer conditions for vehicular and pedestrian traffic to and from University Drive. • Improves pedestrian safety • Reduces delays for University Drive traffic exiting the University at Millwood Avenue. • Fewer weaving conflicts along Millwood Avenue because of the distance between Jubal Early Drive and Pleasant Valley Road, especially when Millwood Avenue backs-up in the No-Build condition beyond the split. • The removal of Millwood Avenue would remove several curb cuts thus improving the pedestrian safety by reducing potential pedestrian and vehicular conflicts. • Provides for more sustainable solutions by improving travel conditions to all modes of transportation and pedestrian traffic	• No Construction costs • No action required

	2022 Build Conditions	2022 No-Build Conditions
Disadvantages	• Construction costs • Westbound Millwood Avenue queues may extend into the new intersection at times. • Increase in travel time for westbound Jubal Early Drive traffic headed towards downtown Winchester.	• No operational improvements • Unsafe maneuvers for traffic entering or exiting University Drive. • Queues from adjacent intersections extend into University Drive thus blocking the exiting traffic. • Continued problems with weaving traffic on Millwood Avenue.

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