

TRAFFIC ENGINEERING STUDY FOR  
**PROPOSED WHITE ROCK TRAIL  
ELEMENTARY SCHOOL**

DALLAS, TEXAS

DeShazo Project No. 16112

Prepared for:

**Corgan**

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Prepared by:

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September 6, 2016



Traffic Engineering Study for  
**Proposed White Rock Trail Elementary School**

~ DeShazo Project No. 16112 ~

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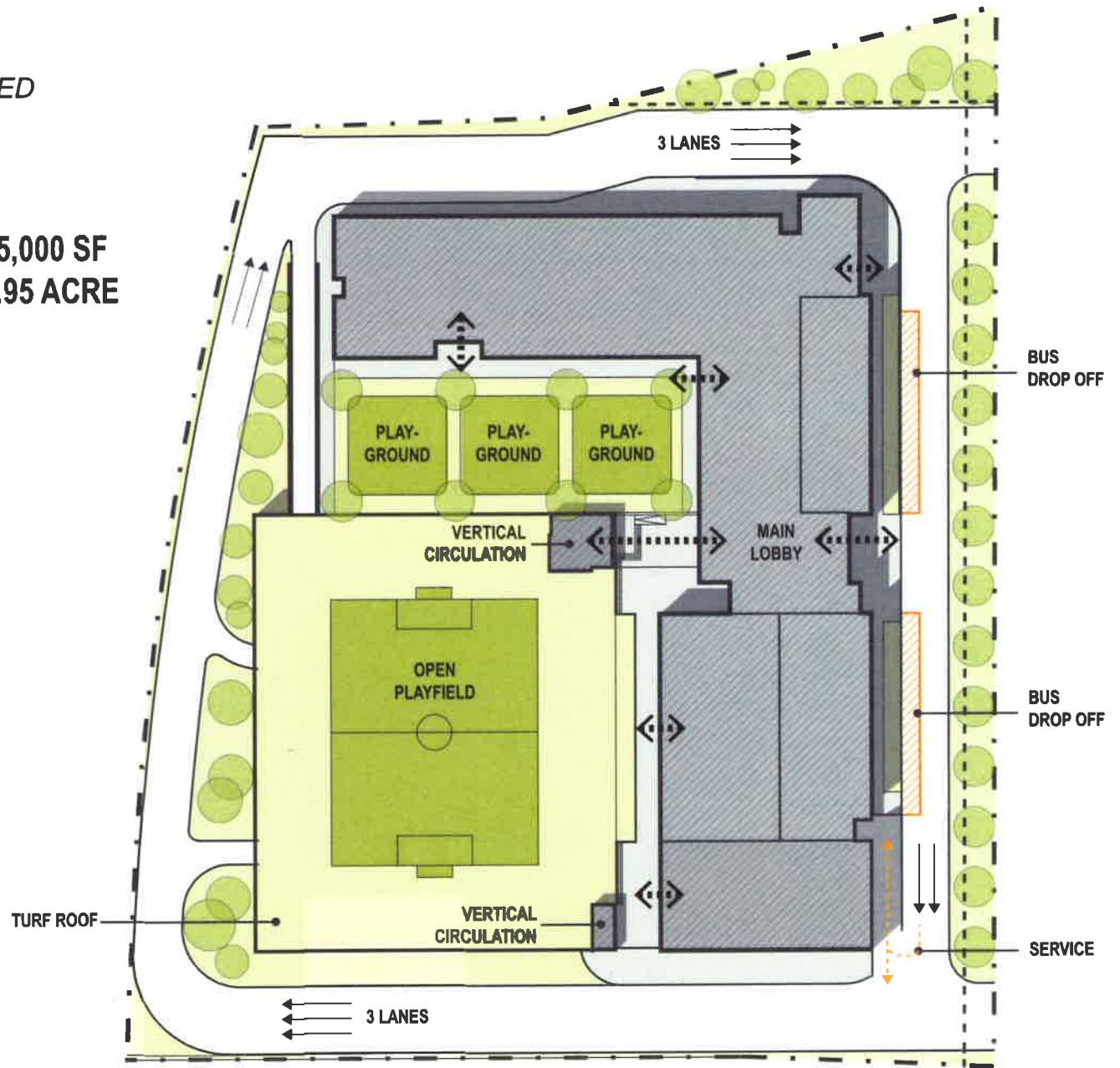
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# SITE PLAN

NO ZONING CHANGE REQUIRED

GREEN SPACE = Approx. 85,000 SF  
TOTAL PLAY AREA = Approx. 1.95 ACRE

PARKING # = 240 ~ 260  
LANE QUE = 230 ~ 250  
STACK SPACE #



## ***Technical Memorandum***

**To:** Steve Hulsey — Corgan  
**CC:** Richardson Independent School District  
**From:** David Nevarez, P.E. — DeShazo Group, Inc.  
**Date:** September 6, 2016  
**Re:** Traffic Engineering Study for Proposed RISD Elementary School in Dallas, Texas  
*DeShazo Project Number 16112; Case Number <CaseNumber>*

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### **INTRODUCTION**

DeShazo Group, Inc. (DeShazo) is an engineering consulting firm based in Dallas, Texas providing licensed engineers skilled in the field of traffic/transportation engineering. The services of DeShazo were retained by Corgan on behalf of the Richardson Independent School District (RISD or the District) to provide a requisite traffic engineering study for a proposed elementary school.

The proposed school campus is located at 9601 White Rock Trail in Dallas, Texas. The subject site is currently developed but vacant and zoned Neighborhood Office [NO(A)] District. A study of the anticipated traffic conditions is required in order to gain entitlements for a proposed school site plan. If approved, completion and implementation of the proposed site and any operational modifications are anticipated by the start of the 2018-2019 school year with a maximum enrollment of 650 students in Pre-Kindergarten through Grade 6. A student attendance boundary zone for the school has not been defined at the time of this study; it is assumed that the proposed school will host a portion of students from existing schools in the district—primarily RISD White Rock Elementary. The proposed school site plan is attached as reference to this report.

#### ***Purpose***

As part of the approval process, submittal of a traffic study to the City of Dallas is required as record of the preferred strategies to be used by the school to ensure overall traffic safety and efficiency. Findings and recommendations presented in this study are intended to provide information to the public and the governing agency regarding potential transportation improvements that may be warranted. But, also, this study is intended to provide a credible basis upon which the governing agency may determine whether some actions may be required as a condition of the site plan approval.

This study outlines a Traffic Management Plan (TMP) of the anticipated school traffic conditions on site. Observations of existing adjacent traffic conditions are also included to determine if any improvements to the adjacent transportation system are needed to maintain a satisfactory level of service, an acceptable level of safety, and appropriate access for the proposed school. By consent of this plan, the school agrees to be held self-accountable for the enforcement of the on-site strategies presented herein until and unless the City of Dallas deems further measures are necessary. This analysis, however, is a site-specific investigation of traffic conditions in a localized area and is not a substitute for area-wide or regional transportation planning.

## TRAFFIC MANAGEMENT PLAN

A school TMP is important to safely achieve an optimum level of traffic flow and circulation during peak traffic periods associated with student drop-off and pick-up. By properly managing the vehicular traffic generated during the critical periods, the safety and efficiency of other modes of travel—including walking and bicycle traffic—will inherently improve and the operational impact on the public street system should also be minimized. This plan, however should not be considered a comprehensive set of instructions to ensure adequate safety; however; it is a tool to facilitate a safer and more efficient environment.

### *RISD Elementary School Operational Characteristics*

DeShazo, in coordination with the school district, visited existing RISD elementary schools to evaluate aspects such as passenger loading and unloading and vehicle queuing. Field observations indicate that arrival of vehicles during the morning drop-off period is notably more sporadic than any traffic generated during the afternoon pickup period. These characteristics are consistent with DeShazo’s observations of traffic at public schools in the area. **Table 1** summarizes the known operational characteristics at two existing RISD schools.

**Table 1. School Operational Characteristics (Existing)**

School	Grades	Schedule	Student Population	Mode of Transportation	Observed Max No. of Cars On Site*
Stults Road ES 8700 Stults Rd	Pre-K to 6 <sup>th</sup> Grade	8:00 AM to 3:00 PM	726 students	Bus/Shuttle/Van ≈25%	63 Vehicles (May 2016)
				Walking ≈15%	
				Private Auto ≈50%	
White Rock ES 9229 Chiswell Rd	Pre-K to 6 <sup>th</sup> Grade	8:00 AM to 3:00 PM	953 students	Bus/Shuttle/Van ≈5%	85 Vehicles (August 2016)
				Walking ≈15%	
				Private Auto ≈80%	

\*Includes all vehicles during the afternoon pick-up period in queue, standing and parked on and off-street. Less detailed site observations were also conducted during the morning drop-off period; however, the total number of vehicular accumulation on site was substantially smaller.

### *Anticipated School Operational Characteristics*

**Exhibit 1** presents an illustration of the recommended traffic management plan for the school. Based upon a review of the proposed site plan, a segregation of student drop-off/pick-up areas by grade is recommended to better facilitate school traffic. **Table 2** summarizes anticipated operational characteristics for the school.

**Table 2. Operational Characteristics (Proposed School)**

School	Student Group	Schedule	Student Population	Mode of Transportation	Projected Max No. of Cars On Site
Proposed Elementary School	Pre-K – Kinder	7:45 AM to 2:45 PM	150	Bus/Shuttle/Van ≈10%	17 Vehicles
				Private Auto ≈90%	
9601 White Rock Trail	1 <sup>st</sup> – 3 <sup>rd</sup> Grade	8:00 AM to 3:00 PM	250	Bus/Shuttle/Van ≈10%	29 Vehicles
				Walking ≈10%	
				Private Auto ≈70%	
	4 <sup>th</sup> – 6 <sup>th</sup> Grade	8:00 AM to 3:00 PM	250	School Bus ≈10%	22 Vehicles
				Walking ≈10%	
				Private Auto ≈70%	
<b>TOTALS:</b>			<b>650</b>		<b>68 vehicles</b>

### *Student Drop-Off/Pick-Up Operations*

The proposed site plan for the school provides two vehicular driveways on White Rock Trail at their existing location. The north driveway is approximately 120 feet away from Walnut Hill Lane (measured from curb to curb). The north driveway will limit vehicular ingress access to school buses/vans only during school peak hours. The south driveway is approximately 360 feet from the north driveway (also measured from curb to curb). During both morning drop-off and afternoon pick-up periods, parents will enter the school campus at the south driveway and proceed along their designated queue line toward students loading/unloading area. Traffic will circulate counterclockwise along a designated route. School buses will enter the site at the north driveway and proceed to the designated bus loading area at the east front of the school building. Buses will egress the school campus from the south driveway as well.

The school should implement a managed “Advance Passenger Identification System” during the afternoon pick-up period. At the beginning of each school term, parents will be issued hang tags with unique identification that pairs them with the corresponding student(s). During the afternoon pick-up period, hang-tags should be on display through the vehicle’s windshield while parents circulate through their prescribed route. School staff will be positioned at strategic locations ahead of the loading areas and relay the sequence of parent arrival back to the loading area via hand radio. Students will then be prepped for pick-up as parents approach their designated loading area. With the assistance of other school staff stationed at the loading area, several vehicles are loaded simultaneously from the left side (the driver’s side back seat) of the car. After loading, vehicles should be cleared by school staff to carefully exit the site along the designated route.

Carpool queue will be divided into three lanes—one for each student cohort presented in **Table 2**: 1) Pre-K and Kindergarten, 2) Grades 1 through 3, and 3) Grades 4 through 6. **Exhibit 1** presents the proposed traffic operations plan. This plan was designed with the intent of optimizing the on-site vehicular circulation and retention of vehicle queuing in a manner that promotes safety and operational efficiency.

### *On-Site Queuing*

#### Pre-K and Kindergarten:

- The proposed site plan provides 870 linear feet of on-site vehicular queuing or storage for up to 37 vehicles at 23.5 feet per vehicle for Pre-K and Kindergarten at 2:45 PM. This capacity is expected to accommodate the projected maximum queue of 17 vehicles and provide a surplus of 494 linear feet.

#### Grade 1 through 3:

- The proposed site plan provides 728 linear feet of on-site vehicular queuing or storage for up to 31 vehicles at 23.5 feet per vehicle for Grade 1 through 3 at 3:00 PM. This capacity is expected to accommodate a maximum queue of 29 vehicles and provide a surplus of 47 linear feet.

#### Grade 4 through 6:

- The proposed site plan provides 870 linear feet of on-site vehicular queuing or storage for up to 37 vehicles at 23.5 feet per vehicle for Grade 4 through 6 at 3:00 PM. This capacity is expected to accommodate a maximum queue of 22 vehicles and provide a surplus of 353 linear feet.

# TRAFFIC OPERATIONAL ANALYSIS

## Existing Traffic Observations

DeShazo conducted traffic counts and field observations during traditional school peak periods on Tuesday, August 23 and Wednesday, August 24, 2016. Detailed data sheets are provided in the Appendix. Our observations are summarized as follows:

- White Rock Trail is approximately 33 feet wide at the intersection of Walnut Hill Lane, providing three lanes of traffic (one southbound lane, one dedicated northbound left lane and one shared through-right lane). Roadway width reduces to two lanes around the subject site's south driveway.
- The traffic signal at Walnut Hill Lane and White Rock Trail currently operates in 120-second, two-phase cycles with approximately 45 and 35 seconds dedicated to north-south traffic in the morning and school afternoon periods, respectively.
- Northbound left approaching traffic experiences significant delays with up to 22 vehicles constantly in queue between 7:40 and 7:55 AM. Queue extends approximately 550 feet and blocks access to the subject site's south driveway. School afternoon peak conditions experience lower traffic demands.
- The site is immediately adjacent to a pedestrian walkway directly connecting to DART's White Rock Station. However, our observations do not include any evidence of high pedestrian traffic. Standard sidewalk amenities are also provided directly in front of the school site on both sides of White Rock Trail and along Walnut Hill Lane. Pedestrian push buttons are provided at all four crossing segments of the intersection.
- There is not significant delay for traffic approaching the west, east, or south-bound approach lanes during neither of the study's peak hours.

## School-Generated Traffic

Trip generation for the school was calculated using the Institute of Transportation Engineers (ITE) *Trip Generation* manual (9<sup>th</sup> Edition). **Table 3** summarizes anticipated operational characteristics for the proposed school assumed in this analysis. The appendix provides detailed information about these calculations.

**Table 3. Trip Generation Summary**

School Capacity	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
650 students	323	265	184	208

Assumptions included in this analysis:

- For this study, ITE Land Use 534 *Private School (K-8)* is considered to be a more representative land use to analyze public school traffic based on our field observations and data collection at numerous schools in the Dallas area.
- Approximately 60 percent of the traffic is anticipated to drive to/from Walnut Hill Lane.
- Approximately 25 percent of the calculated trip generation is currently attending school at White Rock Elementary School and therefore already part of the background traffic.

### Deceleration Lane Analysis

Projected right-turn volumes into the south driveway on White Rock Trail (a road operating at 20 MPH during school hours) exceed the City’s minimum guidelines for deceleration lanes as outlined in the City’s *Off-Street Parking and Driveways Handbook*. **Table 4** presents a summary of projected peak hour volumes and evaluation of the deceleration guidelines.

**Table 4. Deceleration Lane Analysis Summary**

Driveway	Hourly Entering Right-Turning Volume		Exceeds min vols? (>120 VPH)	Observed speeds >35 VPH?	Recommend Right-Turn Decel Lane?
	AM	PM			
South Driveway on White Rock Trail	210	120	Yes	No	<u>Yes</u>

Based on projected traffic derived in this study, right-turning volumes exceed the minimum guidelines for a deceleration lane. Consideration of *clear sight triangles* is also recommended in the design of all driveways.

### Clearance Distance to Intersection

Spacing between main cross-streets and driveways should be adequate to avoid driveway-conflict areas that would interfere with the efficient operation of adjacent intersections, as stated in the City’s *Off-Street Parking and Driveways Handbook*. **Table 5** presents an evaluation of intersection clearance for the south driveway.

**Table 5. Intersection Clearance from Driveway**

Driveway	Desirable Distance	Measured Distance	Meets Min. Distance?
South Driveway on White Rock Trail	50’	100’	<u>Yes</u>

### Intersection Sight Distance

Sight distance is the metric used to describe the ability of a motorist to physically see, via a direct line of sight, objects and/or other vehicles to a degree sufficient to allow safe and efficient use a roadway. Sight distance is a function of the roadway’s geometric characteristics and observed speeds. For this study, DeShazo compiled topographic data from Google Earth Pro. The analysis revealed that the proposed south driveway meets vertical sight distances, have sufficient light of sight and do not warrant any mitigation. *Clear sight triangles* should be further examined in the design phase of the development. A summary of the evaluation of the sight distance at driveways is presented in **Table 6**.

**Table 6. Intersection Sight Distance Analysis Summary**

Driveway	Intersection Sight Distance for Passenger Cars				Vertical sight distance (Topographic Data)	Meets Intersection Sight (Min.) Distance?
	Design Speed	Crossing Lanes	Median Divided?	Design* Distance		
South Driveway on White Rock Trail	20 MPH	1	No	225 ft	>500 ft	<u>YES</u>

\*Case B1 Analysis per AASHTO’s A Policy on Geometric Design of Highways and Streets



### Intersection Operational Analysis

Traffic operational analysis is measured in one-hour periods during peak conditions. Level-of-Service (LOS) conditions are determined based upon calculated seconds of average delay per vehicle. Intersection capacity analysis for the intersection of Walnut Hill Lane and White Rock Trail was performed using the *Synchro™ 9* software package. **Table 7** provides a summary of the peak period intersection operational conditions under the analysis conditions presented previously. Detailed software output is provided in **Appendix**.

**Table 7. Peak Hour Intersection Capacity Analysis**  
(Walnut Hill at White Rock Trail)

Analysis Parameter	EXISTING		BUILDOUT		MITIGATION ALTERNATIVE #1		MITIGATION ALTERNATIVE #2	
	AM	PM	AM	PM	AM	PM	AM	PM
<u>SIGNAL PARAMETERS</u>								
Cycle Length	120 secs		120 secs		120 secs		120 secs	
Phases:	Permitted (all)		Permitted (all)		Permitted (all)		NBL Protected	
<i>E-W time</i>	<i>75 sec</i>	<i>85 sec</i>	<i>75 sec</i>	<i>85 sec</i>	<i>55 sec</i>	<i>70 sec</i>	<i>63 sec</i>	<i>70 sec</i>
<i>N-S time</i>	<i>45 sec</i>	<i>35 sec</i>	<i>45 sec</i>	<i>35 sec</i>	<i>65 sec</i>	<i>50 sec</i>	<i>57 sec</i>	<i>50 sec</i>
<i>NBL time</i>	--	--	--	--	--	--	<i>22 sec</i>	<i>27 sec</i>
<u>LEVEL-OF-SERVICE</u>								
Overall Delay (sec)	E (62)	B (16)	F (>100)	C (26)	D (51)	C (21)	D (38)	C (21)
NB Delay (sec)	F (>100)	E (59)	F (>100)	F (>100)	F (>100)	D (42)	E (64)	D (36)
NB Queue ( <i>95<sup>th</sup> pctl</i> )	470'	180'	>600'	250'	460'	210'	405'	195'

Traffic signal operational parameters used in this analysis were based upon actual, existing settings observed at the time of traffic data collection. Findings indicate that improvements to the signal timing settings would improve existing conditions and mitigate the impact resulting from the proposed school traffic.

## SUMMARY OF FINDINGS AND RECOMMENDATIONS

This TMP is to be used by proposed elementary school to provide safe and efficient transportation of students, staff, and faculty to and from the site. The Plan was developed with the intent of optimizing safety and efficiency and the goal of accommodating vehicular traffic generated by the school at peak traffic periods within the site. Details of the TMP shall be reviewed by the school on a regular basis to confirm its effectiveness. The following findings and recommendations are based upon buildout conditions with a maximum enrollment of 650 students. It should be noted that the merit of any recommended mitigation measures may warrant re-evaluation should the site develop into a higher density development.

### Recommendations to the City of Dallas

*NOTE: Recommendations for public improvements presented in this report reflect the opinion of DeShazo based solely upon a technical analysis and professional judgment and are not intended to define, imply, or allocate funding sources nor required improvements.*

- Implementation of Mitigation Alternative #1: Optimize traffic signal timings at the intersection of Walnut Hill Lane and White Rock Trail to extend allocated N-S time and reduce the northbound queue.
- Alternatively, provide an additional signal head for northbound left-turn traffic and optimize timing settings for a protected left-turn phase at the intersection of Walnut Hill Lane and White Rock Trail.
- Restripe and maintain pedestrian crosswalks at the intersection of Walnut Hill Lane and White Rock Trail.

### *Recommendations to Facilitate Queue Operations*

Queue pick-up participation is a challenge that schools face constantly. Despite the anticipated practices and operational characteristics at the proposed school, full cooperation of all school staff members, students and parents is crucial for the success of the systematic operations. Proper training of school staff on the duties and expectations pertaining to this plan is recommended. Sufficient communications at the beginning of each school term (and otherwise, as needed) with students and parents on their duties and expectations is also recommended.

It should also be the goal of school officials to encourage active modes of transportation, including walking, carpooling, and bicycle riding. DeShazo recommends the consideration of the following actions to optimize school traffic operations:

- Implementation of an “Advance Passenger Identification System” to expedite queue operations. As described on page 3 (*Student Drop-Off/Pick-Up Operations* section of this report), this system uses hangtags displayed through the windshield of arriving vehicles to identify arriving vehicles with the name(s) of corresponding student(s).
- School should create a traffic management team among interested staff and/or PTA members to coordinate and evaluate traffic queue operations. This team should investigate resources and incentives that encourage parents to walk or ride bikes to school as well as propagate the responsibility of parents to abide by a traffic management plan, as proposed in this report and revised as needed. This group should also monitor and review traffic conditions on a regular basis to confirm the effectiveness of the TMP. As needed, the group should conduct meetings with school officials to address any deficiencies or problems concerning this traffic management plan.
- The school should distribute reminders on a regular basis for motorists to obey speed limits on neighborhood streets and school zones. (This task could be delegated to the traffic management team.)

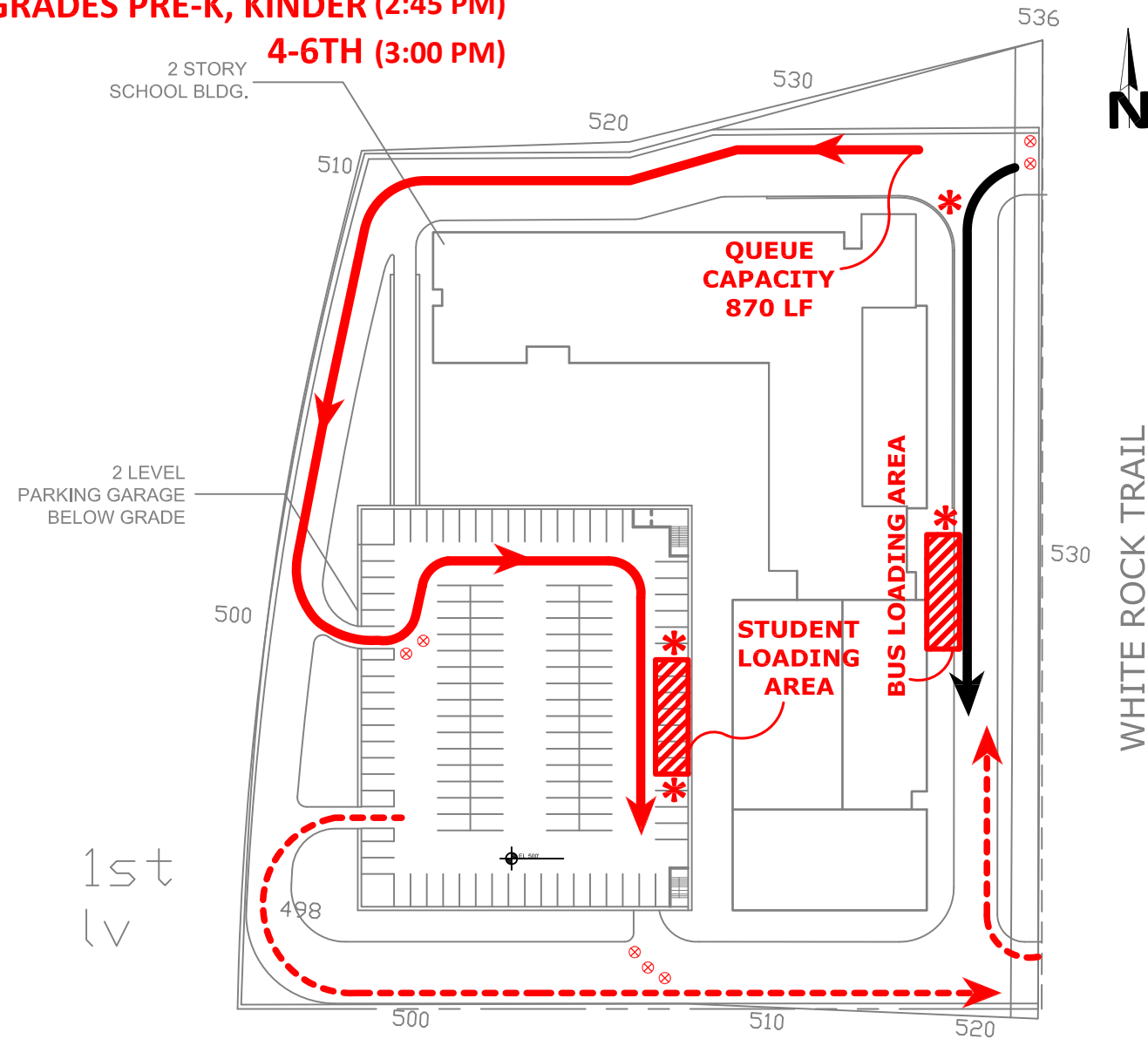
### *General Recommendations*

The following recommendations area also provided to school officials for the management of vehicular traffic generated by the school during peak conditions:

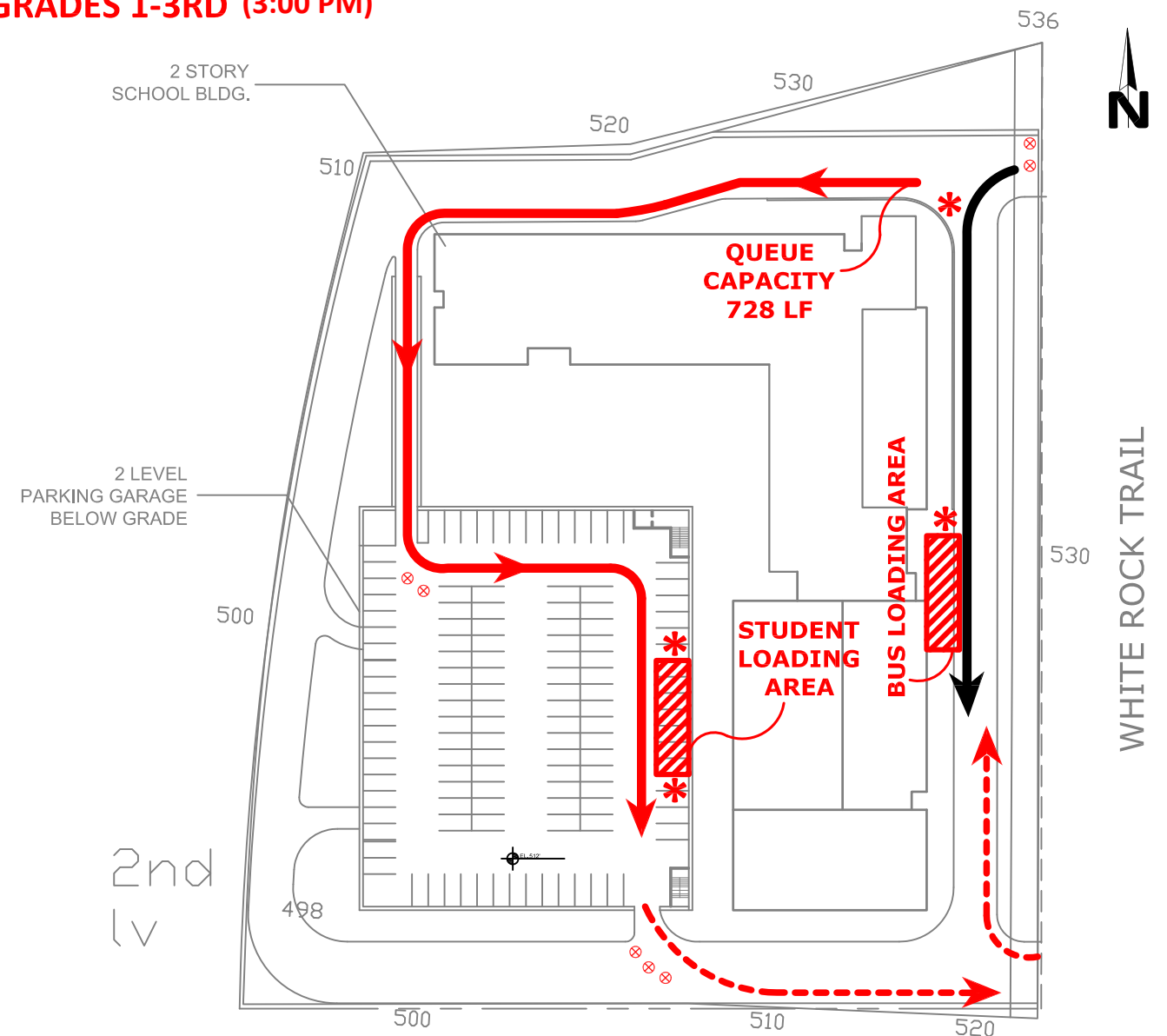
- Passenger loading (or unloading) within the public right-of-way should be avoided at all times.
- Vehicular access to the site should be limited to the south driveway during peak hours.
- An appropriate number of school staff shall be assigned to fulfill the duties of student supervision, traffic control and other related duties as generally depicted in **Exhibit 1**.
- Staff participating in student drop-off/pick-up operations should, in lieu of simple hand gestures, procure the use of reversible hand-paddle signs with messages for STOP and SLOW. Optional additional equipment used by staff include whistles (for audible warnings), and fluorescent vest and flashlights (for visual warning) in order to gain the attention of motorists.
- The plan includes recommended configuration of temporary traffic control devices (such as traffic cones, etc.) that shall be installed on a daily basis when typical traffic conditions are expected. An appropriate number of school staff shall be assigned to fulfill the duties of student supervision, traffic control, and other related duties as generally depicted on the plan.

**END OF MEMO**

**GRADES PRE-K, KINDER (2:45 PM)**  
**4-6TH (3:00 PM)**



**GRADES 1-3RD (3:00 PM)**



NOTE : Traffic cones at north driveway to be removed for Buses/Vans only.

NOTE : Traffic cones at north driveway to be removed for Buses/Vans only.

**Queuing Summary**

Student Group	Student Enrollment	Schedule	Traveling Modes	Vehicular Traffic Demand		
				Queue	Queue	Queue
PreK, Kinder	150 Students	7:45 AM-2:45 PM	Pick Up: 90% Van: 10%	Provided: 870 LF (37 cars)	Required: 400 LF (17 cars)	Surplus: 470 LF (20 cars)
Grades 1st-3rd	250 Students	8:00 AM-3:00 PM	Pick Up: 70% Bus/Van: 15% Walk: 15%	Provided: 729 LF (31 cars)	Required: 682 LF (29 cars)	Surplus: 47 LF (2 cars)
Grades 4th-6th	250 Students	8:00 AM-3:00 PM	Pick Up: 70% Bus/Van: 15% Walk: 15%	Provided: 870 LF (37 cars)	Required: 517 LF (22 cars)	Surplus: 353 LF (15 cars)

**Legend**

- \* - School Staff
- [Hatched Box] - Loading Area
- [Red Arrow] - Provided Queue
- [Red X] - Traffic Cones
- [Red Dashed Arrow] - Entry/Exit Route
- [Black Arrow] - Bus Route

The purpose of this Traffic Management Plan (TMP) is to evaluate traffic operations that promote safety and efficient vehicle circulation. This TMP was developed to prevent queuing of drop-off/pick-up related vehicles within the city rights-of-way. The school administration should adhere to this TMP. Any deficiency due to spillover of queuing into undesignated areas of the city rights-of-way, including roadway travel lanes, should be corrected by the school immediately.

I, David Nevarez, P.E. #106200, certify that the results of the queuing analysis—upon complete enforcement of this Traffic Management Plan—indicate that no queuing of vehicles will extend into City of Dallas rights-of-way as a result of internal queuing constraints during the study peak hours of school operation.

\*Vehicular queue calculated at 23.5 feet/car based on field observations.

## ***Appendix***

1. Traffic Counts Data
2. Peak Hour Traffic Volumes Exhibit
3. Intersection Traffic Simulation Output

**Intersection Traffic Movements** DeShazo Group, Inc.

Location: **Walnut Hill Ln at White Rock Trail**  
 City/State: **Dallas**  
 Day/Date: **Tuesday, August 23, 2016**  
 Project-ID #: **16112-01**  
 Data Source: **CJ Hensch**  
 Data Collector(s): **Camera**  
 Weather Conditions: **Mild/Normal Conditions**  
 Traffic Control: **Signalized**

Time of Count		Northbound on White Rock Trail				Southbound on White Rock Trail				Eastbound on Walnut Hill Ln				Westbound on Walnut Hill Ln			
Begin	End	Peds	L	T	R	Peds	L	T	R	Peds	L	T	R	Peds	L	T	R
7:00 AM	7:15 AM	0	37	3	9	1	1	5	11	0	7	72	22	0	7	264	4
7:15 AM	7:30 AM	1	51	5	2	0	1	13	17	0	2	81	47	0	7	324	6
7:30 AM	7:45 AM	0	68	5	12	1	1	31	23	0	7	101	76	0	5	392	10
7:45 AM	8:00 AM	2	115	27	19	2	2	10	16	1	6	83	40	0	9	478	11
8:00 AM	8:15 AM	0	67	16	5	0	4	9	28	0	16	98	11	0	5	454	12
8:15 AM	8:30 AM	0	47	13	9	0	10	10	42	0	16	98	17	0	8	367	21
8:30 AM	8:45 AM	0	40	17	4	0	6	11	28	1	9	87	21	0	6	313	14
8:45 AM	9:00 AM	0	30	12	5	0	10	13	12	0	19	104	18	0	6	276	7
<i>Intersection PHV:</i>			297	61	45		17	60	109		45	380	144		27	1,691	54
<i>PHF:</i>			0.65	0.56	0.59		0.43	0.48	0.65		0.70	0.94	0.47		0.75	0.88	0.64

*Intersection Peak Hour: 7:30 AM - 8:30 AM*

*Intersection PHF: 0.90*

<b>Study Area PHV:</b>	<b>297</b>	<b>61</b>	<b>45</b>	<b>17</b>	<b>60</b>	<b>109</b>	<b>45</b>	<b>380</b>	<b>144</b>	<b>27</b>	<b>1,691</b>	<b>54</b>
<b>PHF:</b>	<b>0.65</b>	<b>0.56</b>	<b>0.59</b>	<b>0.43</b>	<b>0.48</b>	<b>0.65</b>	<b>0.70</b>	<b>0.94</b>	<b>0.47</b>	<b>0.75</b>	<b>0.88</b>	<b>0.64</b>

**Study Peak Hour: 7:30 AM - 8:30 AM**

**Study Area PHF: 0.90**

2:00 PM	2:15 PM	0	19	3	5	1	4	5	9	0	8	191	40	0	4	107	1
2:15 PM	2:30 PM	1	13	5	5	0	7	5	11	1	5	168	42	1	5	107	1
2:30 PM	2:45 PM	1	19	3	10	0	5	15	4	0	4	217	81	1	9	116	4
2:45 PM	3:00 PM	0	31	3	9	0	2	10	3	0	6	200	75	2	12	92	4
3:00 PM	3:15 PM	1	68	22	27	0	2	3	6	1	10	263	44	3	6	126	2
3:15 PM	3:30 PM	1	42	14	9	0	2	7	5	0	13	246	39	6	4	143	5
3:30 PM	3:45 PM	0	34	5	6	0	4	6	3	0	14	272	38	0	9	144	4
3:45 PM	4:00 PM	1	22	6	3	0	4	3	4	0	12	306	36	0	2	145	10
<i>Intersection PHV:</i>			166	47	45		12	19	18		49	1,087	157		21	558	21
<i>PHF:</i>			0.61	0.53	0.42		0.75	0.68	0.75		0.88	0.89	0.89		0.58	0.96	0.53

*Intersection Peak Hour: 3:00 PM - 4:00 PM*

*Intersection PHF: 0.95*

<b>Study Area PHV:</b>	<b>166</b>	<b>47</b>	<b>45</b>	<b>12</b>	<b>19</b>	<b>18</b>	<b>49</b>	<b>1,087</b>	<b>157</b>	<b>21</b>	<b>558</b>	<b>21</b>
<b>PHF:</b>	<b>0.61</b>	<b>0.53</b>	<b>0.42</b>	<b>0.75</b>	<b>0.68</b>	<b>0.75</b>	<b>0.88</b>	<b>0.89</b>	<b>0.89</b>	<b>0.58</b>	<b>0.96</b>	<b>0.53</b>

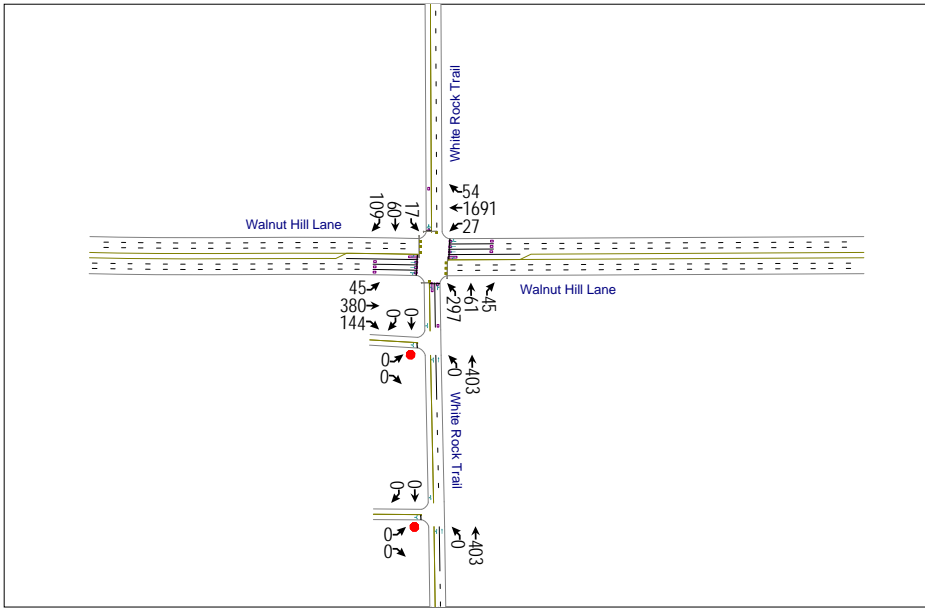
**Study Peak Hour: 3:00 PM - 4:00 PM**

**Study Area PHF: 0.95**

Observations:

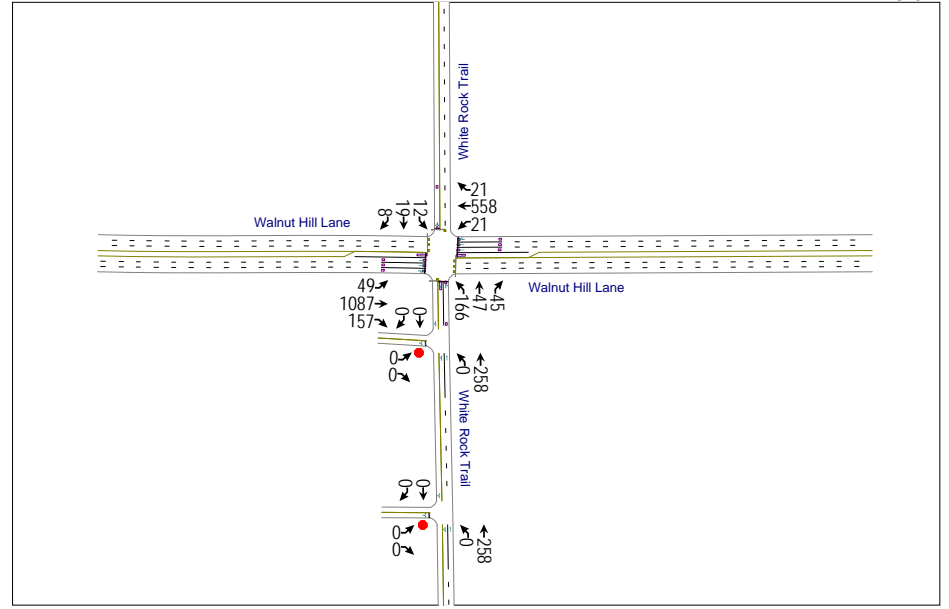


APPENDIX A1 Existing AM Peak Hour Traffic Volumes

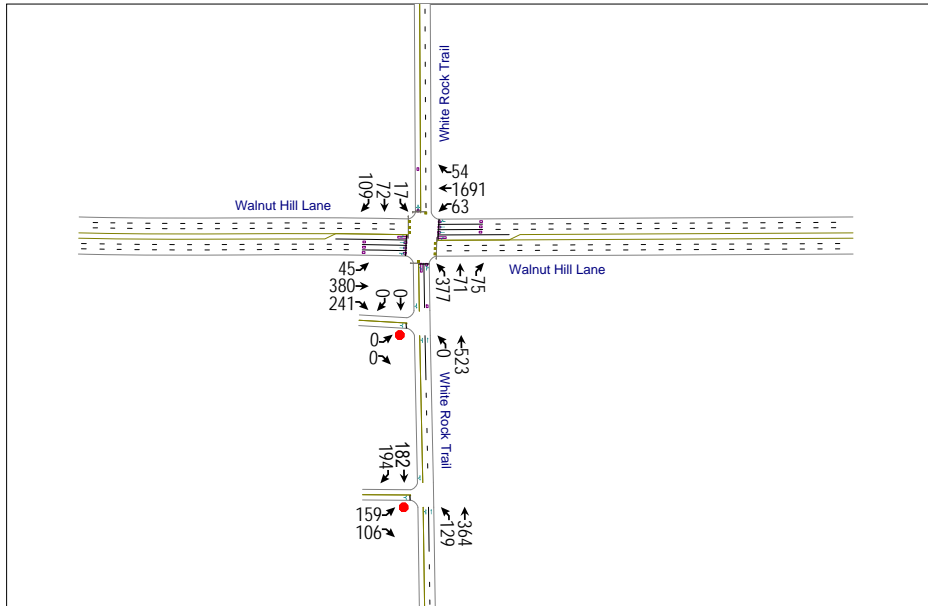


APPENDIX A2 Existing PM Peak Hour Traffic Volumes

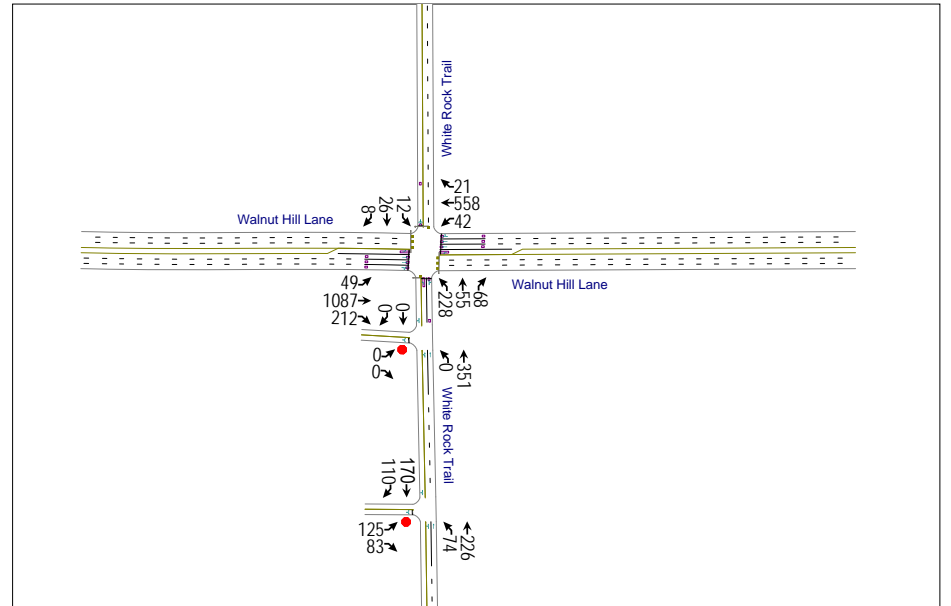
Not to Scale  
▲ North



APPENDIX A3 Buildout AM Peak Hour Traffic Volumes



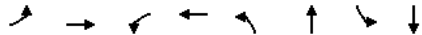
APPENDIX A4 Buildout PM Peak Hour Traffic Volumes



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Existing AM.syn

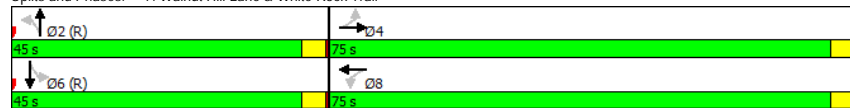


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔↔↔	↔	↔↔↔	↔	↔	↔	↔↔
Traffic Volume (vph)	45	380	27	1691	297	61	17	60
Future Volume (vph)	45	380	27	1691	297	61	17	60
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	75.0	75.0	75.0	75.0	45.0	45.0	45.0	45.0
Total Split (%)	62.5%	62.5%	62.5%	62.5%	37.5%	37.5%	37.5%	37.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	71.0	71.0	71.0	71.0	41.0	41.0	41.0	41.0
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.34	0.34	0.34	0.34
v/c Ratio	1.05	0.24	0.09	0.67	1.73	0.30	0.59	0.59
Control Delay	160.8	6.9	11.4	17.9	372.2	25.3	36.2	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	160.8	6.9	11.4	17.9	372.2	25.3	36.2	36.2
LOS	F	A	B	B	F	C	D	D
Approach Delay		19.7		17.8		272.2		36.2
Approach LOS		B		B		F		D

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 45  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.73  
 Intersection Signal Delay: 62.9 Intersection LOS: E  
 Intersection Capacity Utilization 74.6% ICU Level of Service D  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Existing AM.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	64	710	36	2006	457	185	333
v/c Ratio	1.05	0.24	0.09	0.67	1.73	0.30	0.59
Control Delay	160.8	6.9	11.4	17.9	372.2	25.3	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	160.8	6.9	11.4	17.9	372.2	25.3	36.2
Queue Length 50th (ft)	-54	51	11	361	-523	85	203
Queue Length 95th (ft)	#104	71	23	397	#468	77	134
Internal Link Dist (ft)		1069		1445		1813	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	61	2928	383	2994	264	617	569
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.24	0.09	0.67	1.73	0.30	0.59

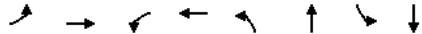
Intersection Summary

- Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Existing PM.syn

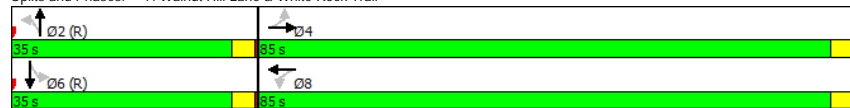


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Traffic Volume (vph)	49	1087	21	558	166	47	12	19
Future Volume (vph)	49	1087	21	558	166	47	12	19
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	85.0	85.0	85.0	85.0	35.0	35.0	35.0	35.0
Total Split (%)	70.8%	70.8%	70.8%	70.8%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	81.0	81.0	81.0	81.0	31.0	31.0	31.0	31.0
Actuated g/C Ratio	0.68	0.68	0.68	0.68	0.26	0.26	0.26	0.26
v/c Ratio	0.11	0.41	0.18	0.18	0.79	0.41	0.16	0.16
Control Delay	7.6	8.9	10.0	7.1	59.0	30.3	25.4	25.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	8.9	10.0	7.1	59.0	30.3	25.4	25.4
LOS	A	A	A	A	E	C	C	C
Approach Delay		8.8		7.3		47.0		25.4
Approach LOS		A		A		D		C

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 40  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 15.6      Intersection LOS: B  
 Intersection Capacity Utilization 53.7%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Existing PM.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	56	1397	36	621	272	196	68
v/c Ratio	0.11	0.41	0.18	0.18	0.79	0.41	0.16
Control Delay	7.6	8.9	10.0	7.1	59.0	30.3	25.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	8.9	10.0	7.1	59.0	30.3	25.4
Queue Length 50th (ft)	14	156	9	57	197	93	27
Queue Length 95th (ft)	29	180	15	72	183	76	45
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	499	3383	195	3404	345	478	437
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.41	0.18	0.18	0.79	0.41	0.16

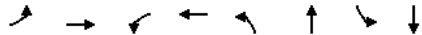
Intersection Summary



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out AM.syn

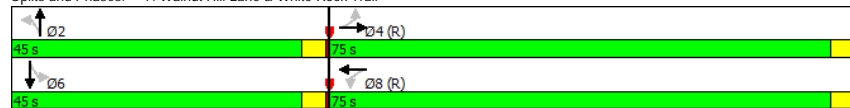


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔↔	↔	↔↔	↔	↔	↔	↔
Traffic Volume (vph)	45	380	63	1691	377	71	17	72
Future Volume (vph)	45	380	63	1691	377	71	17	72
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	75.0	75.0	75.0	75.0	45.0	45.0	45.0	45.0
Total Split (%)	62.5%	62.5%	62.5%	62.5%	37.5%	37.5%	37.5%	37.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	71.0	71.0	71.0	71.0	41.0	41.0	41.0	41.0
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.34	0.34	0.34	0.34
v/c Ratio	1.05	0.31	0.28	0.67	2.32	0.41	0.63	0.63
Control Delay	160.8	5.8	15.2	17.9	628.4	26.8	37.7	37.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	160.8	5.8	15.2	17.9	628.4	26.8	37.7	37.7
LOS	F	A	B	B	F	C	D	D
Approach Delay		15.9		17.8		445.2		37.7
Approach LOS		B		B		F		D

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 45 (38%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green  
 Natural Cycle: 40  
 Control Type: Pretimed  
 Maximum v/c Ratio: 2.32  
 Intersection Signal Delay: 102.7  
 Intersection LOS: F  
 Intersection Capacity Utilization 82.8%  
 ICU Level of Service E  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out AM.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	64	917	84	2006	580	254	358
v/c Ratio	1.05	0.31	0.28	0.67	2.32	0.41	0.63
Control Delay	160.8	5.8	15.2	17.9	628.4	26.8	37.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	160.8	5.8	15.2	17.9	628.4	26.8	37.7
Queue Length 50th (ft)	-54	53	30	361	-733	121	223
Queue Length 95th (ft)	#104	76	50	397	#633	101	143
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	61	2948	296	2994	250	618	569
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.31	0.28	0.67	2.32	0.41	0.63

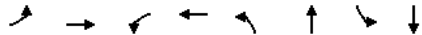
Intersection Summary

- Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out PM.syn

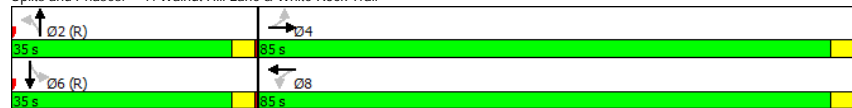


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↕↕↕	↔	↕↕↕	↔	↕	↔	↕↕
Traffic Volume (vph)	49	1087	42	558	228	55	12	26
Future Volume (vph)	49	1087	42	558	228	55	12	26
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	85.0	85.0	85.0	85.0	35.0	35.0	35.0	35.0
Total Split (%)	70.8%	70.8%	70.8%	70.8%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	81.0	81.0	81.0	81.0	31.0	31.0	31.0	31.0
Actuated g/C Ratio	0.68	0.68	0.68	0.68	0.26	0.26	0.26	0.26
v/c Ratio	0.11	0.43	0.40	0.18	1.12	0.55	0.18	0.18
Control Delay	7.6	8.9	16.9	7.1	125.9	33.9	27.9	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	8.9	16.9	7.1	125.9	33.9	27.9	27.9
LOS	A	A	B	A	F	C	C	C
Approach Delay		8.8		8.1		87.7		27.9
Approach LOS		A		A		F		C

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 40  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.12  
 Intersection Signal Delay: 26.4 Intersection LOS: C  
 Intersection Capacity Utilization 58.4% ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out PM.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	56	1459	72	621	374	266	78
v/c Ratio	0.11	0.43	0.40	0.18	1.12	0.55	0.18
Control Delay	7.6	8.9	16.9	7.1	125.9	33.9	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.6	8.9	16.9	7.1	125.9	33.9	27.9
Queue Length 50th (ft)	14	163	23	57	-333	136	36
Queue Length 95th (ft)	29	187	29	72	259	100	54
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	499	3374	179	3404	335	484	436
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.43	0.40	0.18	1.12	0.55	0.18

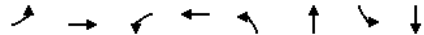
Intersection Summary

- Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.

White Rock Trail ES TMP

7: Walnut Hill Lane

AM - Optimized.syn

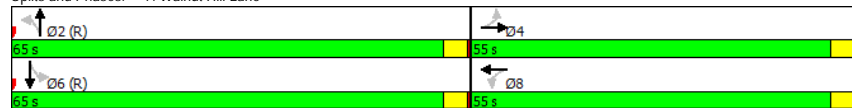


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↘	↗↗↗	↘	↗↗↗	↘	↗	↘	↗↗
Traffic Volume (vph)	45	380	63	1691	377	71	17	72
Future Volume (vph)	45	380	63	1691	377	71	17	72
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	55.0	55.0	55.0	55.0	65.0	65.0	65.0	65.0
Total Split (%)	45.8%	45.8%	45.8%	45.8%	54.2%	54.2%	54.2%	54.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	51.0	51.0	51.0	51.0	61.0	61.0	61.0	61.0
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.51	0.51	0.51	0.51
v/c Ratio	1.05	0.42	0.46	0.93	1.26	0.28	0.43	0.43
Control Delay	167.9	15.3	35.1	42.0	161.3	13.5	20.4	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	167.9	15.3	35.1	42.0	161.3	13.5	20.4	20.4
LOS	F	B	D	D	F	B	C	C
Approach Delay		25.3		41.7		116.3		20.4
Approach LOS		C		D		F		C

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 40  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.26  
 Intersection Signal Delay: 50.7 Intersection LOS: D  
 Intersection Capacity Utilization 82.8% ICU Level of Service E  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane



White Rock Trail ES TMP

7: Walnut Hill Lane

AM - Optimized.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	64	917	84	2006	580	254	358
v/c Ratio	1.05	0.42	0.46	0.93	1.26	0.28	0.43
Control Delay	167.9	15.3	35.1	42.0	161.3	13.5	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	167.9	15.3	35.1	42.0	161.3	13.5	20.4
Queue Length 50th (ft)	-54	109	46	531	-563	80	168
Queue Length 95th (ft)	#104	146	77	583	#463	66	109
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	61	2172	181	2152	461	905	836
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.42	0.46	0.93	1.26	0.28	0.43

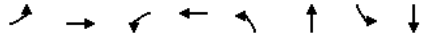
Intersection Summary

- Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

PM - Optimized.syn

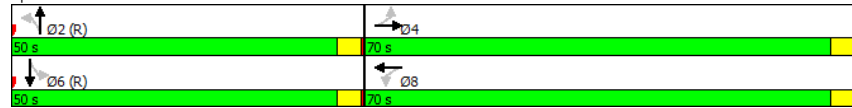


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↘	↗↗↗	↘	↗↗↗	↘	↗	↗	↗↗
Traffic Volume (vph)	49	1087	42	558	228	55	12	26
Future Volume (vph)	49	1087	42	558	228	55	12	26
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	70.0	70.0	70.0	70.0	50.0	50.0	50.0	50.0
Total Split (%)	58.3%	58.3%	58.3%	58.3%	41.7%	41.7%	41.7%	41.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	66.0	66.0	66.0	66.0	46.0	46.0	46.0	46.0
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.38	0.38	0.38	0.38
v/c Ratio	0.14	0.53	0.59	0.22	0.73	0.39	0.12	0.12
Control Delay	14.5	17.3	41.1	13.8	41.6	22.8	18.0	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.5	17.3	41.1	13.8	41.6	22.8	18.0	18.0
LOS	B	B	D	B	D	C	B	B
Approach Delay		17.2		16.6		33.8		18.0
Approach LOS		B		B		C		B

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 40  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.73  
 Intersection Signal Delay: 20.7 Intersection LOS: C  
 Intersection Capacity Utilization 58.4% ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

PM - Optimized.syn



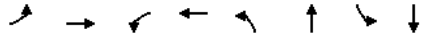
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	56	1459	72	621	374	266	78
v/c Ratio	0.14	0.53	0.59	0.22	0.73	0.39	0.12
Control Delay	14.5	17.3	41.1	13.8	41.6	22.8	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.5	17.3	41.1	13.8	41.6	22.8	18.0
Queue Length 50th (ft)	20	241	35	84	245	115	27
Queue Length 95th (ft)	42	278	46	107	210	86	42
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	391	2753	123	2775	512	683	645
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.53	0.59	0.22	0.73	0.39	0.12

Intersection Summary

White Rock Trail ES TMP

7: Walnut Hill Lane

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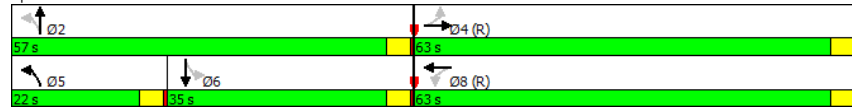


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↘	↗↗↗	↘	↗↗↗	↘	↗	↗	↗↗
Traffic Volume (vph)	45	380	63	1691	377	71	17	72
Future Volume (vph)	45	380	63	1691	377	71	17	72
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases		4		8	5	2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	5	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	63.0	63.0	63.0	63.0	22.0	57.0	35.0	35.0
Total Split (%)	52.5%	52.5%	52.5%	52.5%	18.3%	47.5%	29.2%	29.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead		Lag	Lag
Lead-Lag Optimize?					Yes		Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	59.0	59.0	59.0	59.0	53.0	53.0	31.0	31.0
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.44	0.44	0.26	0.26
v/c Ratio	1.03	0.37	0.37	0.81	1.14	0.32	0.82	0.82
Control Delay	159.3	11.0	25.0	28.8	114.4	18.2	55.8	55.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	159.3	11.0	25.0	28.8	114.4	18.2	55.8	55.8
LOS	F	B	C	C	F	B	E	E
Approach Delay		20.7		28.6		80.7		55.8
Approach LOS		C		C		F		E

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 20 (17%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green  
 Natural Cycle: 75  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.14  
 Intersection Signal Delay: 38.2  
 Intersection LOS: D  
 Intersection Capacity Utilization 82.8%  
 ICU Level of Service E  
 Analysis Period (min) 15

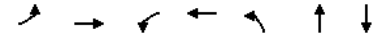
Splits and Phases: 7: Walnut Hill Lane



White Rock Trail ES TMP

7: Walnut Hill Lane

Build Out AM- Optimized - 2.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	64	917	84	2006	471	254	358
v/c Ratio	1.03	0.37	0.37	0.81	1.14	0.32	0.82
Control Delay	159.3	11.0	25.0	28.8	114.4	18.2	55.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	159.3	11.0	25.0	28.8	114.4	18.2	55.8
Queue Length 50th (ft)	-52	86	39	463	-300	97	247
Queue Length 95th (ft)	#103	118	66	509	#405	80	157
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	62	2482	227	2489	414	791	437
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.03	0.37	0.37	0.81	1.14	0.32	0.82

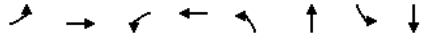
Intersection Summary

- Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out PM- Optimized - 2.syn

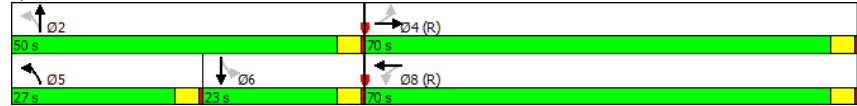


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↘	↗	↘	↗	↘	↗	↘	↗
Traffic Volume (vph)	49	1087	42	558	228	55	12	26
Future Volume (vph)	49	1087	42	558	228	55	12	26
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases		4		8		5		2
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	5	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	70.0	70.0	70.0	70.0	27.0	50.0	23.0	23.0
Total Split (%)	58.3%	58.3%	58.3%	58.3%	22.5%	41.7%	19.2%	19.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead		Lag	Lag
Lead-Lag Optimize?					Yes		Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effect Green (s)	66.0	66.0	66.0	66.0	46.0	46.0	19.0	19.0
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.38	0.38	0.16	0.16
v/c Ratio	0.14	0.53	0.59	0.22	0.69	0.39	0.29	0.29
Control Delay	14.5	17.3	41.1	13.8	36.8	22.8	38.5	38.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.5	17.3	41.1	13.8	36.8	22.8	38.5	38.5
LOS	B	B	D	B	D	C	D	D
Approach Delay		17.2		16.6		31.0		38.5
Approach LOS		B		B		C		D

Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 23 (19%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.69  
 Intersection Signal Delay: 20.6      Intersection LOS: C  
 Intersection Capacity Utilization 58.4%      ICU Level of Service B  
 Analysis Period (min) 15

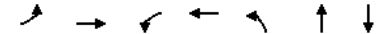
Splits and Phases: 7: Walnut Hill Lane & White Rock Trail



White Rock Trail ES TMP

7: Walnut Hill Lane & White Rock Trail

Build Out PM- Optimized - 2.syn



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	56	1459	72	621	374	266	78
v/c Ratio	0.14	0.53	0.59	0.22	0.69	0.39	0.29
Control Delay	14.5	17.3	41.1	13.8	36.8	22.8	38.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.5	17.3	41.1	13.8	36.8	22.8	38.5
Queue Length 50th (ft)	20	241	35	84	224	115	43
Queue Length 95th (ft)	42	278	46	107	195	86	64
Internal Link Dist (ft)		1069		1445		917	508
Turn Bay Length (ft)	160		150		400		
Base Capacity (vph)	391	2753	123	2775	541	683	269
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.53	0.59	0.22	0.69	0.39	0.29

Intersection Summary