Wal-Mart
US 16 / Sammis Trail / Moon Meadows
Traffic Impact Study

Rapid City, South Dakota

Prepared for

Wal-Mart Stores, Inc.

At the request of BFA, Inc.

This document originally issued and sealed by Jason L. Kjenstad, Registered Professional Engineer, Reg. 7905, on 12/29/05. This media should not be considered a certified document.

Prepared by
HDR Engineering, Inc.

DECEMBER 23RD 2005

ONE COMPANY
Many Solutions℠

Memo

To:	City of Rapid City Planning Staff (Vicki Fischer, Marcia Elkins, and John Less) & SDDOT (Monica Heller)		
From:	Jason Kjenstad-HDR	Project:	Wal*Mart Study – Rapid City, SD
CC:	Joe Feldmann, BFA		
Date:	12-23-2005	Job No:	20494

Traffic Impact Analysis 12-23-05

Study Objective

The objective of this traffic impact study is to determine if the US 16 / Moon Meadows / Sammis Trail intersection and proposed intersections can support the traffic generated by a proposed Wal*Mart Supercenter.

Executive Summary

A traffic impact analysis was performed for a new mixed-use development near US Highway 16 and Sammis Trail in Rapid City, SD. This mixed-use development includes a Wal*Mart, a hotel, 4 retail lots, and 300 single-family detached housing lots. A level of service (LOS) analysis was preformed for the intersection of US 16 and Sammis Trail, as well as four additional intersections within the development. The analysis revealed that a signal is warranted at the intersection of US 16 / Sammis Road / Moon Meadows Drive with dual left-turn lanes for the westbound and southbound approaches, as well as a free right-turn lane for the westbound approach. An additional signal is warranted at the intersection of Sammis Trail at the Main Access Road, along with exclusive left and right-turn lanes on the eastbound approach (assuming full site development). A signal at Sammis Trail/Main Access Road does not meet signal warrant criteria opening day therefore should not be installed until it is warranted. All other intersections operate at LOS C or better.

Based on the criteria that all proposed intersections must be mitigated to operate at LOS C or better, the US 16 / Moon Meadows / Sammis Trail access and proposed internal intersections with mitigation as recommended will provide acceptable operations. A connection to Catron Boulevard is not needed based on the LOS criteria established for this study.

Driveway locations as indicated on the figures are the recommended locations determined from this traffic analysis. It is recommended that Sammis Trail have limited access since it is classified as an arterial for the City of Rapid City.

The intersection of Sammis Trail / Rearage Road operates at an acceptable LOS and does not warrant a traffic signal.

It is recommended that either a continuous left-turn lane or left-turn lanes within a median section be provided at each intersection on the Rearage Road. As development increases north of this area, the turn lanes will provide additional safety and capacity.

Several types of signal control options were evaluated with the recommended lane geometry to determine if queuing along Sammis Trail would have a negative impact at the US 16 / Sammis Trail intersection and Sammis Trail / Main access road. Both protected only and permitted/protected left-turn phasing, along with actuated uncoordinated and actuated coordinated timing plans were evaluated using SimTRAFFIC simulation software. The simulation results revealed that protected phasing at US 16 / Moon Meadows / Sammis Trail allows for acceptable queues with no spill back into other intersections when actuated uncoordinated signals were used. Permitted/protected phasing was used at Sammis Trail / Main Access Road. SimTRAFFIC also verified the length of the recommended storage lanes were sufficient and that merging the southbound dual left-turn lanes on US 16 into a single left-turn lane at the Main Access Road into Wal*Mart would not negatively traffic operations; the analysis indicates that the spacing of 850 feet is sufficient. It is recommended the detector loops be placed according to the SDDOT recommended procedure or video detection be used to allow the signals to operate fully-actuated. During the construction of the Sammis Trail / Main Access Road intersection, signal conduit should be installed across the roadway in preparation for a future signal.

Background

The proposed development will be located at the southwest corner of the Commerford Ranch Development Park near US 16, Moon Meadows Drive and Sammis Trail. The land uses included in the proposal are shown in **Table 1**.

Table 1: Land Use Information

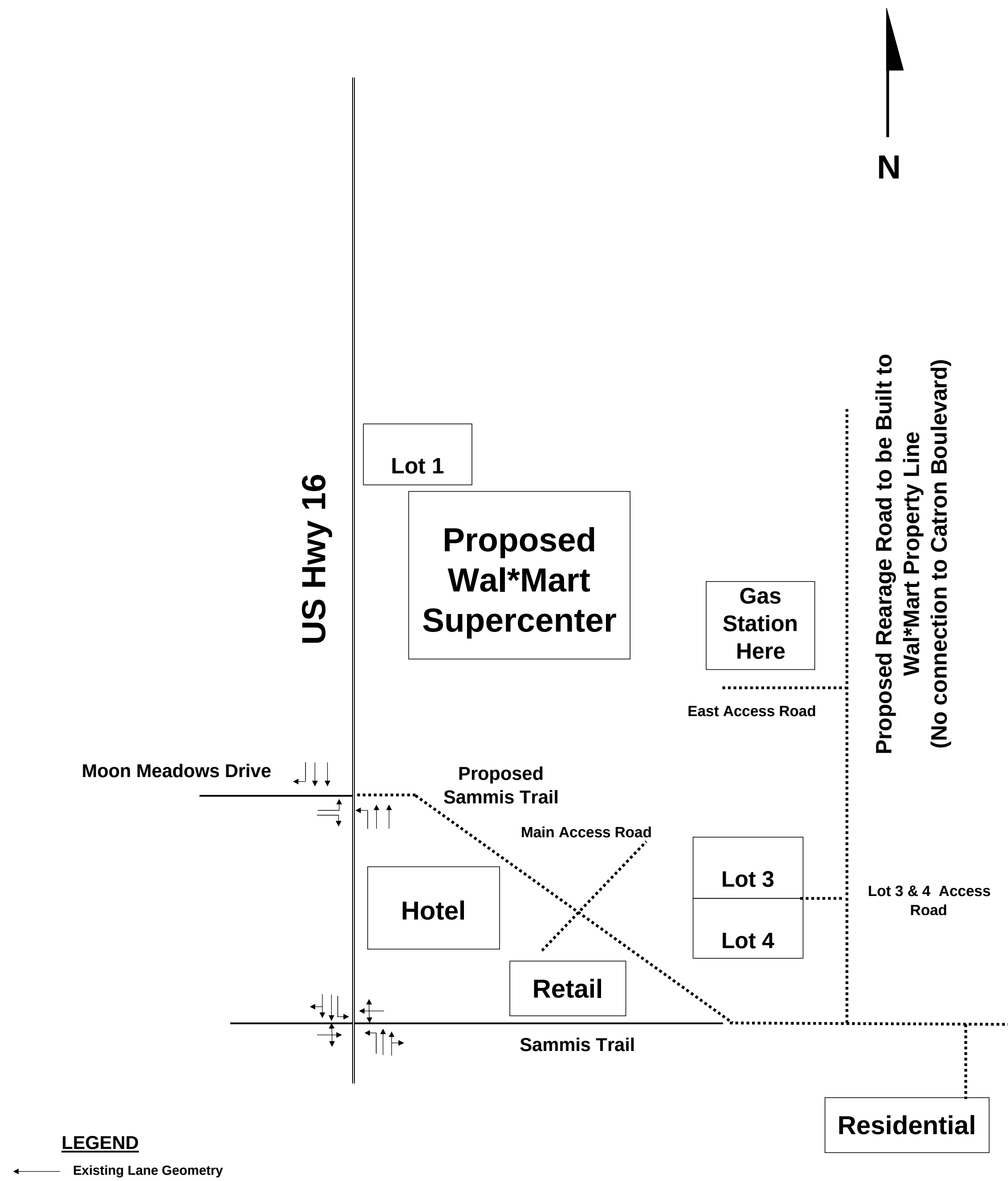
Land Use Type	Size
Wal*Mart (Discount Superstore)	203,000 sq.ft.
Lot 1 (Specialty Retail)	30,000 sq.ft.
Lot 3 (High Turnover Restaurant)	6,000 sq.ft.
Lot 4 (Specialty Retail)	50,000 sq. ft.
Hotel	150 rooms
Specialty Retail near Hotel	20,000 sq. ft.
Single Family Detached Housing	300 lots

The site plan includes realignment of a portion of Sammis Trail west of US 16 to connect with Moon Meadows Drive at US 16. The Wal*Mart and Lots 1,3, & 4 will be located north of Sammis Trail, while the hotel, specialty retail, and single family houses will be located south of Sammis Trail. The Wal*Mart and Lot 1 will have an access road (Main Access Road) located approximately 850-900 feet east of US 16. The access road will continue south across Sammis Trail to provide access to the hotel and retail, creating a four-legged intersection. Until the Hotel and retail area are developed, an interim connection from existing Sammis Trail will be required. The existing Sammis Trail shall connect to the proposed Sammis Trail at approximately a 90 degree angle. The location of the interim connection shall be a minimum of 200 feet north of the access road to Wal*Mart. This interim connection shall be removed as development begins on the south side of Sammis Trail.

The site plan includes a proposed Rearage Road to the north property line of the proposed Wal*Mart property where it will terminate and will run parallel to US 16. This road would provide access to Wal*Mart and lots along the eastern edge of the development. A driveway will be located approximately 400 feet north of the Rearage Road/Sammis Trail intersection to provide access to Lots 3 & 4. The exact driveway location shall meet City of Rapid City driveway spacing standards. One additional access road will also be constructed to provide direct access to the Rearage Road. The study area encompasses the US 16 / Moon Meadows Drive intersection, plus four additional intersections created by the development:

- US 16 / Moon Meadows Drive / Sammis Trail
- Sammis Trail / Main Access Road (proposed)
- Sammis Trail / Rearage Road (proposed)
- Rearage Trail / East Access Road (proposed)
- Rearage Road / Lot 3 & 4 access (proposed)

An illustration of the proposed development and study area is shown in **Figure 1**.



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Existing Lane Geometry

Figure 1

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Methodology

The main objective of the study was to determine the traffic impacts of the proposed mixed-use development located near the intersection of US 16 and Moon Meadows Drive/Sammis Trail in Rapid City, South Dakota. A traffic operations analysis of the surrounding roadway system and proposed roadways was performed to predict the quality of traffic operations in the area.

- Existing AM and PM peak hour turning movement counts were collected at the intersection of US 16 and Moon Meadows Drive (**Figure 2**). The existing counts were adjusted to represent summer "seasonal" volumes factors supplied by the SDDOT.

- The proposed development trips were estimated using the methodology of ITE Trip Generation, 7th Edition. The PM Peak Hour of Generator rate for the Wal*Mart store was adjusted based on recommendations in a SDDOT completed study "Verify Certain ITE Trip Generation Rate Applications in South Dakota".

- Some portion of the trips to the proposed development may be shared-use trips. An internal capture rate of 16% was agreed upon by City of Rapid City, the State of South Dakota, and HDR to be used in this study.

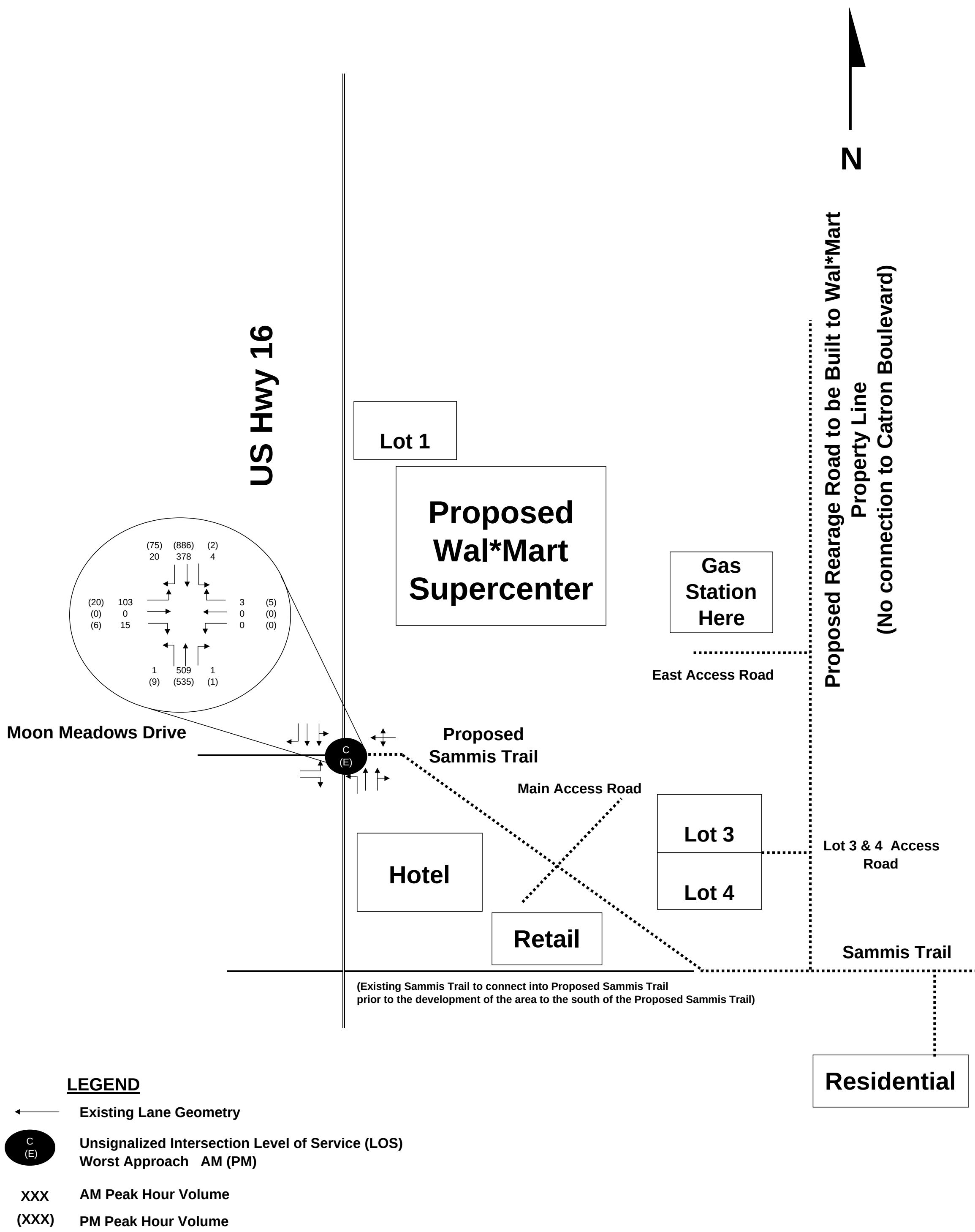
- The pre-development daily traffic volumes were used to determine the directional orientation of traffic. It was assumed the development would alter the directional orientation as shown in **Figure 3**.

- Capacity analyses were performed for the AM and PM peak hours. The following scenarios will be evaluated:

  - **Existing Conditions**
  - **2005 Build Condition** – Existing volumes added to the build volumes (proposed development trips).
  - **2020 Build Condition –** Existing volumes increased at a rate of 2% per year for 15 years added to the build volumes (proposed development trips).

- The impacts of the site-generated trips on the surrounding street network were determined using Synchro 6.1 and the methodologies summarized in the *Highway Capacity Manual*.

- Mitigation measures were identified to provide acceptable operations at the study area intersections.



Existing "Seasonal" Volumes and Levels of Service
(Combined Sammis Trail and Moon Meadows)

Figure 2

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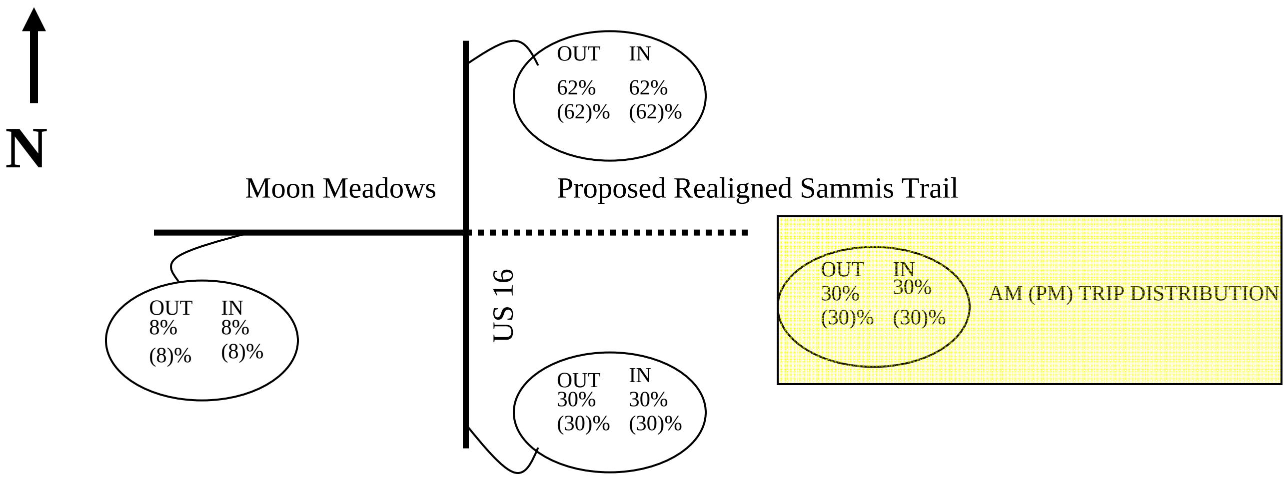
FIGURE 3: Distribution of Trips at US 16 / Sammis Trail (Represents approximately the existing distribution)



Trip Generation

ITE Trip Generation, 7th Edition was used to determine the number of expected trips generated by the development during the AM and PM peak hour. Due to the numerous buildings on the proposed site, separate land uses were used in the trip generation calculation. The trip generation rate for the Wal*Mart Superstore was adjusted to 5.00 for the PM Peak Hour of Generator based on a study completed by the South Dakota Department of Transportation.

Based on the high density of retail land uses located in a relatively small area, an internal capture rate of 16% was determined to be a conservative approach for estimating trips for this development. The trips internally captured were routed on the proposed roadways with exception of trips that were allowed to travel between land uses using internal roadways or parking lots.

The site-generated trip summary using this methodology is shown in **Table 2.**

Table 2

Development	Number	Unit	ITE Land Use	AM Peak Hour of Generator						PM Peak Hour of Generator					
				% Enter	% Exit	ITE Trip Rate	Total Trip Ends	Entering Trips	Exiting Trips	% Enter	% Exit	ITE Trip Rate	Total Trip Ends	Entering Trips	Exiting Trips
Wal*Mart	203000	sq ft	813	53%	47%	3.17	644	341	302	52%	48%	5.00	1015	528	487
Lot 1 (Specialty Retail)	30000	sq ft	814	48%	52%	6.84	205	98	107	56%	44%	5.02	151	84	66
Lot 3 (High Turnover Restaurant)	6000	sq ft	932	52%	48%	13.53	81	42	39	55%	45%	18.8	113	62	51
Lot 4 (Specialty Retail)	50000	sq ft	814	48%	52%	6.84	342	164	178	56%	44%	5.02	251	141	110
Hotel	150	Rooms	310	55%	45%	0.52	78	43	35	58%	42%	0.61	92	53	38
Specialty Retail	20000	sq ft	814	48%	52%	6.84	137	66	71	56%	44%	5.02	100	56	44
Houses (SF Detached)	300	lots	210	26%	74%	0.77	231	60	171	64%	36%	1.02	306	196	110
Subtotal							1718	815	903				2027	1120	907
Internal Trip Reduction - 16%							275	130	145				324	179	145
Total							1443	684	759				1703	941	762

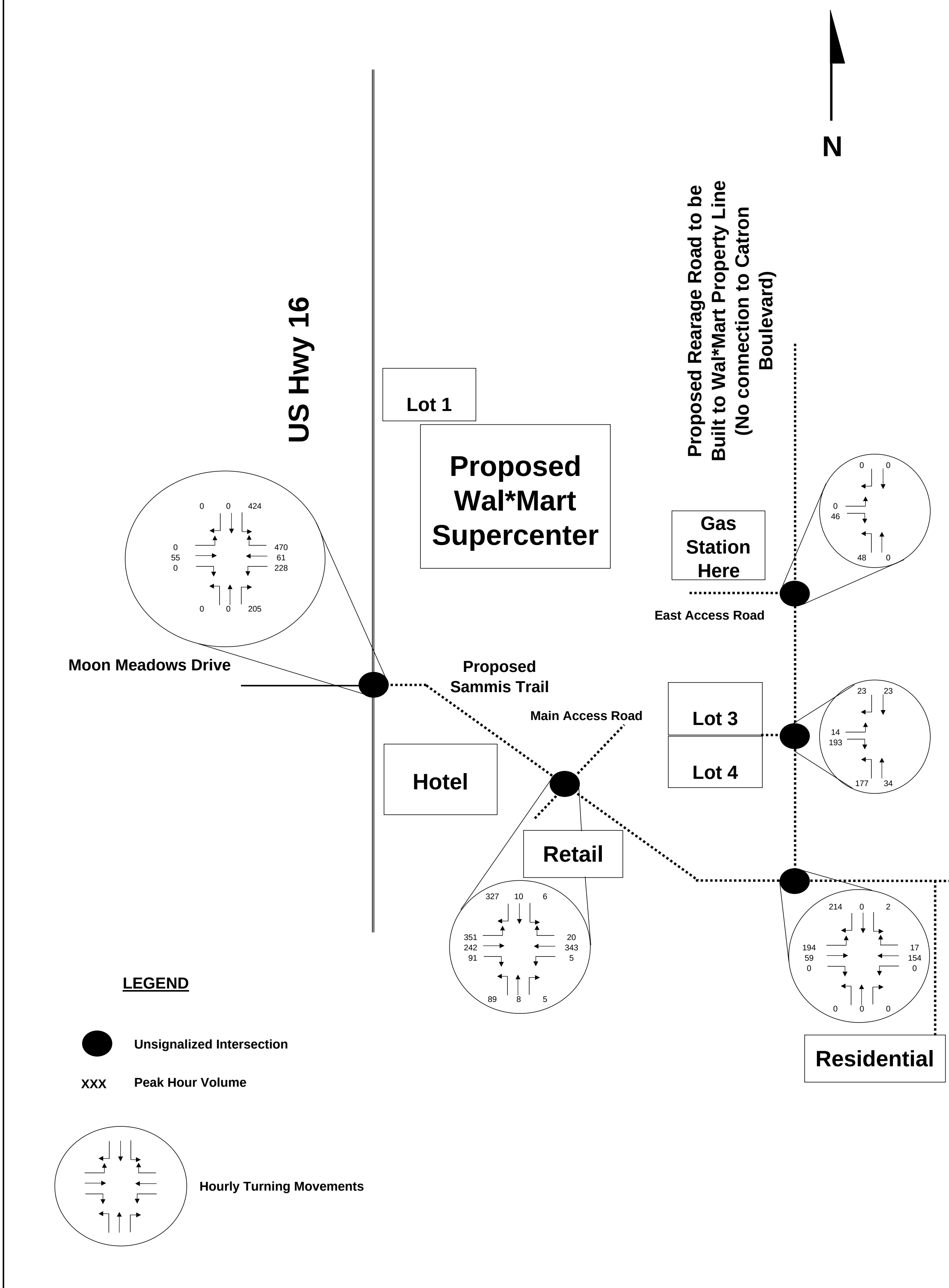
Note: The PM trip generation rate for Wal*Mart was determined by information provided in a Trip Generation Study conducted by the SDDOT called "Verify Certain ITE Trip Generation Rate Applications" in South Dakota.

Trip Distribution

The orientation of site-generated traffic is the most complex and subjective step in the process of any traffic impact analysis. There are a variety of methods available to estimate the likely orientation of traffic; however, no method can guarantee 100 percent accuracy (people are free to visit this site from any location using whichever route they choose). Therefore, it is important to provide the most reasonable possible analysis in combination with a procedure that is reasonably conservative such that an appropriate "factor of safety" is inherent to the results. Trips were distributed along each of the roadway segments and intersections using the directional orientation from Figure 3 and the layout of the proposed site. It is important to note that several assumptions were made including:

- 95% of trips entering and exiting Wal*Mart and Lot 1 were assigned via the Main Access Road. The remaining 5% were assigned to the Rearage Road based on the location of the Gas Station.
- All of the trips entering and exiting lot 3 & 4 occurred via the rearage road as no internal access to Wal*Mart exists.
- All of the trips entering and exiting the hotel and retail area south of Sammis Trail used the Main Access Road.
- All of the proposed trips entering and exiting the residential area used Sammis Trail to the east of the Rearage Road.

The site-generated trip distribution for the AM and PM peak hours are shown in **Figures 4** and **5**, respectively.



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Site Generated Traffic & Assignment (AM)

Figure 4

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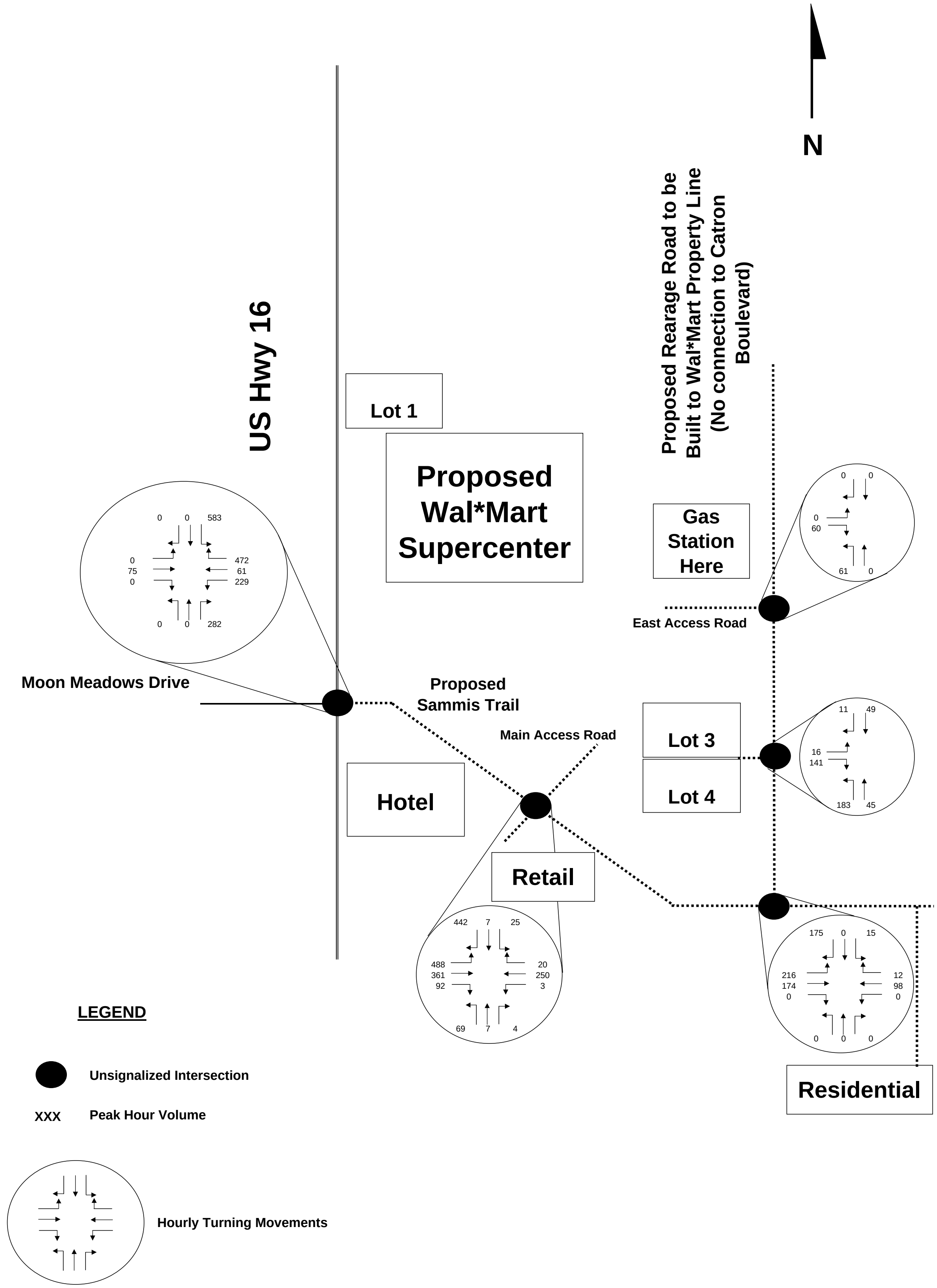

Site Generated Traffic & Assignment (PM)

Figure 5

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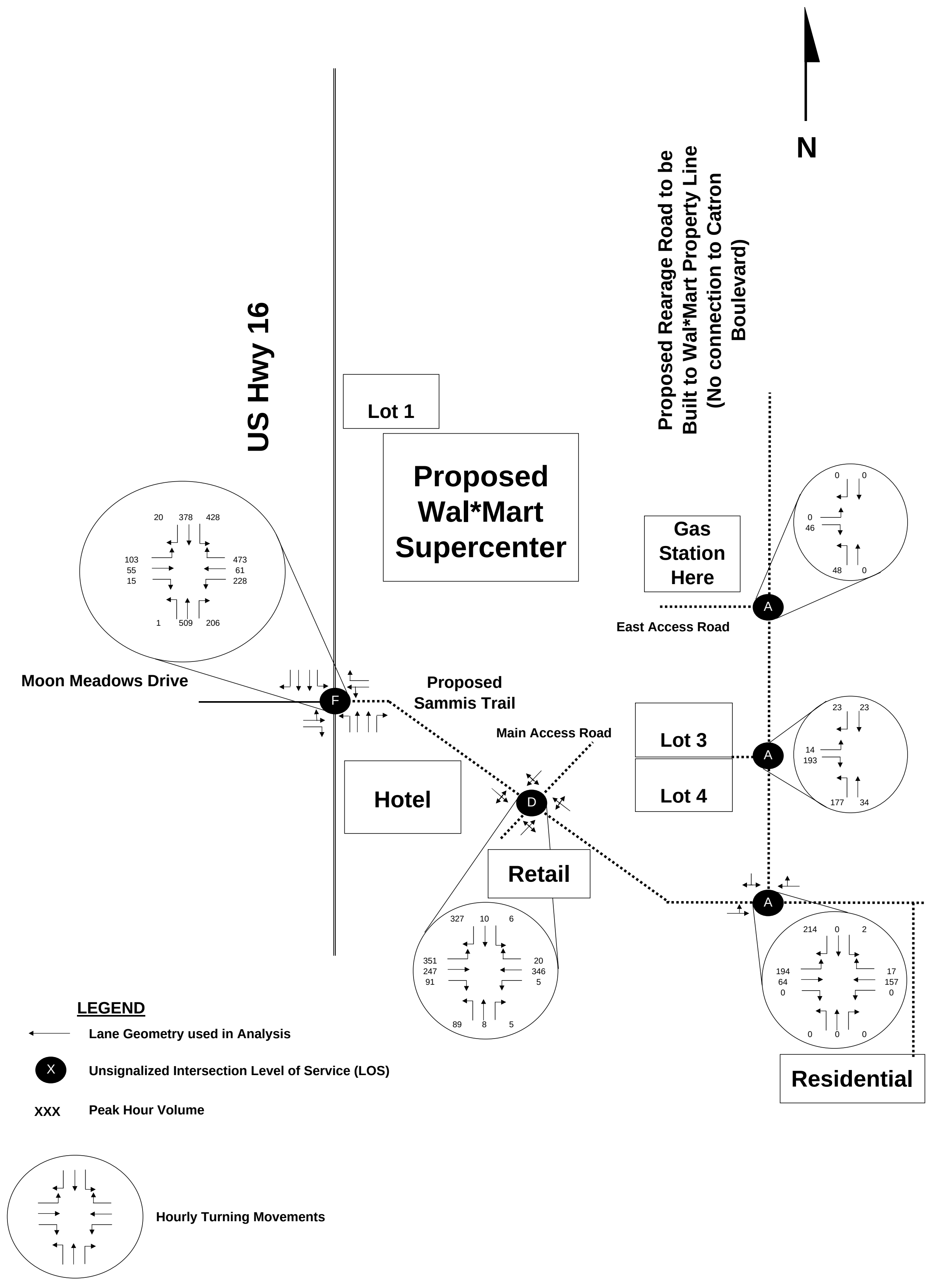
Post-Development Volume

The existing AM and PM peak hour traffic volumes from Figure 2 were combined with those from Figures 4 and 5, respectively, to determine the total volumes used in the level of service analysis. It is assumed due to the number of land uses estimated in this study that this area will take 5 to10 years to fully developed as only the Wal*Mart store is being proposed at this time. The LOS for each intersection is also documented and represents the unmitigated or baseline scenario. An assessment of the quality of traffic operations and mitigation measures are discussed in the next section. **Figures 6** and **7** documents the anticipated post-development turning movements and LOS for the AM and PM peak hours, respectively.



Post-Development Volume and Levels of Service (AM)

Figure 6

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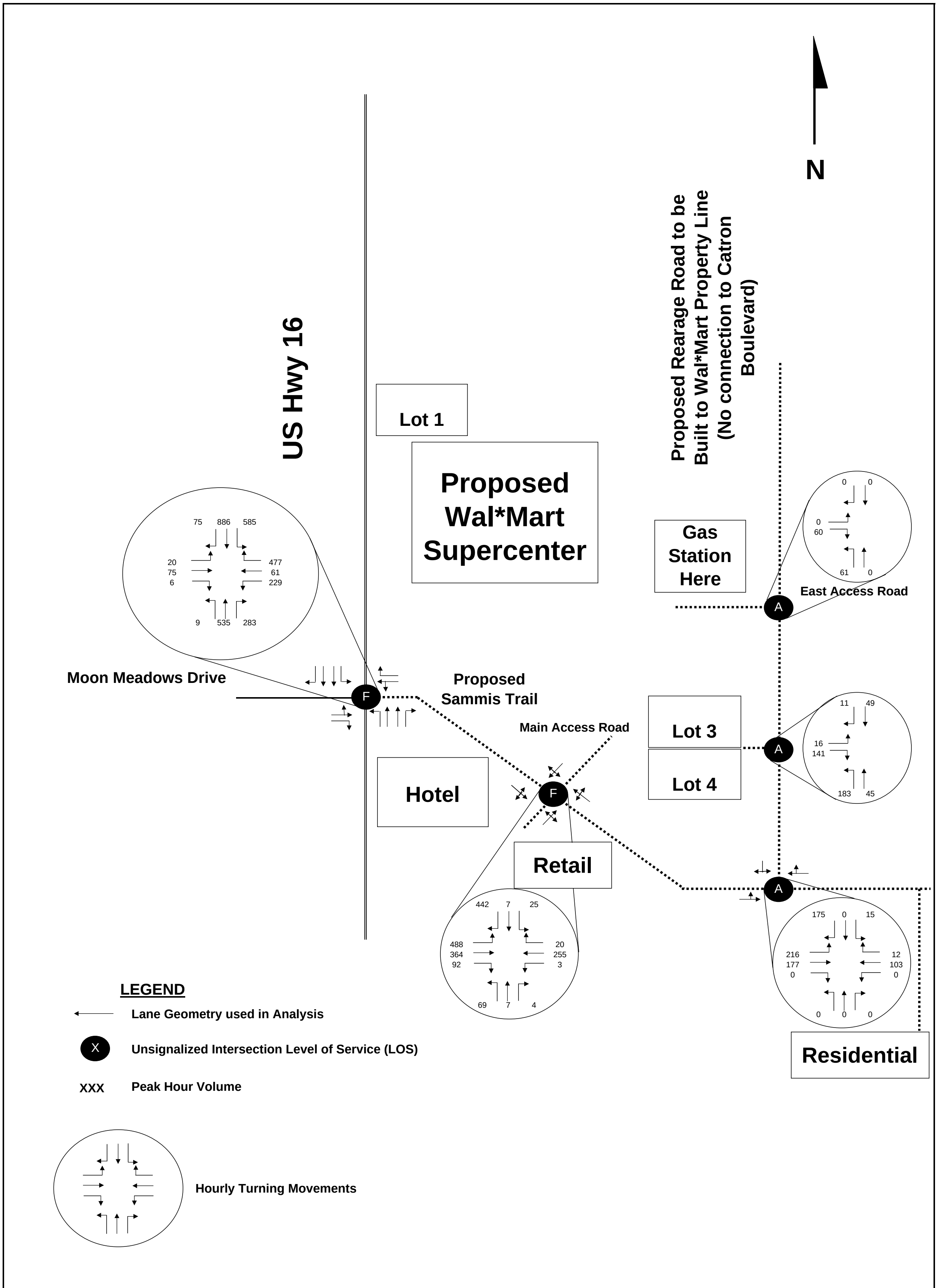

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Post-Development Volume and Levels of Service (PM)

Figure 7

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Analysis Description

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service provided by the street system. For this reason the concept of Levels of Service (LOS) was developed to correlate numerical traffic operational data to subjective descriptions of traffic performance at intersections. Each lane of traffic has delay associated with it and therefore a correlating LOS. The weighted average delay for each of these lanes of traffic for a signalized intersection is the intersection LOS. LOS categories range from LOS A (best) to F (worst) as shown in **Table 3.**

TABLE 3: Level of Service Description

Level of Service	SIGNALIZED Intersection Control Delay (sec)	UNSIGNALIZED Intersection Control Delay (sec)	Intersection LOS Description
A	≤ 10.0	≤ 10.0	Free flow, insignificant delays.
B	10.1-20.0	10.1-15.0	Stable operation, minimal delays.
C	20.1-35.0	15.1-25.0	Stable operation, acceptable delays.
D	35.1-55.0	25.1-35.0	Restricted flow, regular delays.
E	55.1-80.0	35.1-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80.0	> 50.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

Source: *Highway Capacity Manual*, Transportation Research Board, 2000

The intersection capacity analyses were completed using Synchro 6.1 software. Synchro replicates the analysis procedures defined in the *2000 Highway Capacity Manual*. This manual provides procedures for the analysis of both signalized and unsignalized intersections. It should be noted that stop-controlled intersections are analyzed by identifying the amount of delay at each approach that conflict with other intersection movements (i.e. all movements except the free flow through lanes), thus approach level of service is reported for unsignalized intersections.

LOS C has generally been established as the standard for planning of transportation facilities for peak hour traffic conditions. For this study, LOS “C” for the overall intersection was used as the minimum standard.

A review of the analyses for each volume scenario is provided in the following sections, with summaries of the LOS analyses. Summary LOS output reports of the analysis are included in the appendix and may be referenced to review signal timings and phasing as presented in this study.

Unmitigated Conditions Analysis

Capacity analysis was performed using the existing AM and PM peak hour traffic volumes adjusted where necessary to represent peak summer volumes on the existing and proposed roadway network. In general, the surrounding roadways on the eastern edge of the site are characterized by low levels of traffic with acceptable levels of service based on the lane geometry shown in **Figures 6 and 7**. The US 16 / Sammis Trail / Moon Meadows and Sammis Trail / Main Access Road intersections are characterized by near or over capacity conditions. In this study, it was assumed that the intersection of Sammis Trail / Main Access Road and Sammis Trail / Rearage Road were operated as all-way stop controlled, while the remaining intersections were two-way stop controlled (with US 16 and Rearage Road uncontrolled). A summary of the intersection LOS for the existing conditions is documented in **Table 4.**

TABLE 4: Unmitigated Condition Intersection Level-of-Service

Intersection	Traffic Control	AM Peak Hour LOS	Avg Delay per Vehicle (sec)	PM Peak Hour LOS	Avg Delay per Vehicle (sec)
U.S. 16 / Sammis Trail	Two-Way	F	NA[2]	F	NA[2]
Sammis Trail / Main access road	Four-Way Stop	D[1]	32.2	F[3]	64.1
Sammis Trail / Rearage Road	All-Way Stop	A	8.2	A	8.6
Rearage Road / Lot 3 & 4	Two-Way	A	9.9	A	10.0
Rearage Road / East Access	Two-Way	A	8.5	A	8.5

Source: HDR Engineering, Inc. using Synchro 6.1 (HCM Methodology)
Note: 1. Worst Approach at LOS F (54.3 sec/veh), overall intersection at LOS D or 32.2 sec/veh
Note: 2. Overcapacity conditions
Note: 3. Worst Approach at LOS F (108.2 sec/veh), overall intersection at LOS F or 64.1 sec/veh

The LOS reported for four-way intersections represents overall intersection delay, whereas the delay for unsignalized two-way stop controlled intersections are reported as the "worst approach." This is to account for the potential of vehicles waiting on the minor approaches for unreasonable amounts of time where mainline through vehicles have no delay. Two-way stop controlled intersections having minor approaches operating at LOS D, E, or F do not necessarily require mitigation; however additional minor street approach lanes and investigation of signal warrants may be appropriate.

Mitigation

There are two main areas that will likely require mitigation as a result of the development:

- US Highway 16 / Moon Meadows / Sammis Trail
- Sammis Trail / Wal*Mart Main access road

U.S. Highway 16 / Sammis Trail

As documented in **Figure 6 and 7**, the intersection of US 16 / Sammis Trail is expected to operate at deficient levels after the site is developed. To mitigate this condition, installation of an 8-phase traffic signal with protected left-turn phasing for the northbound and southbound directions and protected left-turns for the eastbound and westbound approaches is the most appropriate measure. A Synchro analysis revealed that this measure improved the level of service to LOS B. Due to the large volume of left-turning traffic from southbound US 16 to Sammis Trail, installation of an additional left-turn lane along southbound US 16 has significant potential to reduce delay. The southbound left-turn lanes shall be designed to allow the left-turns to run protected only without the requirement of split phasing due to lane geometrics. The large volume of left-turning traffic from Sammis Trail onto southbound US 16 also warrants an additional left-turn lane. The westbound left-turn lanes shall be designed to allow the left-turns to run protected only without the requirement of split phasing due to lane geometrics. Finally, the volume of right-turning traffic from Sammis Trail onto northbound US 16 should be given a separate lane to make free right-turns. The free right-turn lane should be long enough (preferably at least 600 feet) to allow traffic to merge onto US 16.

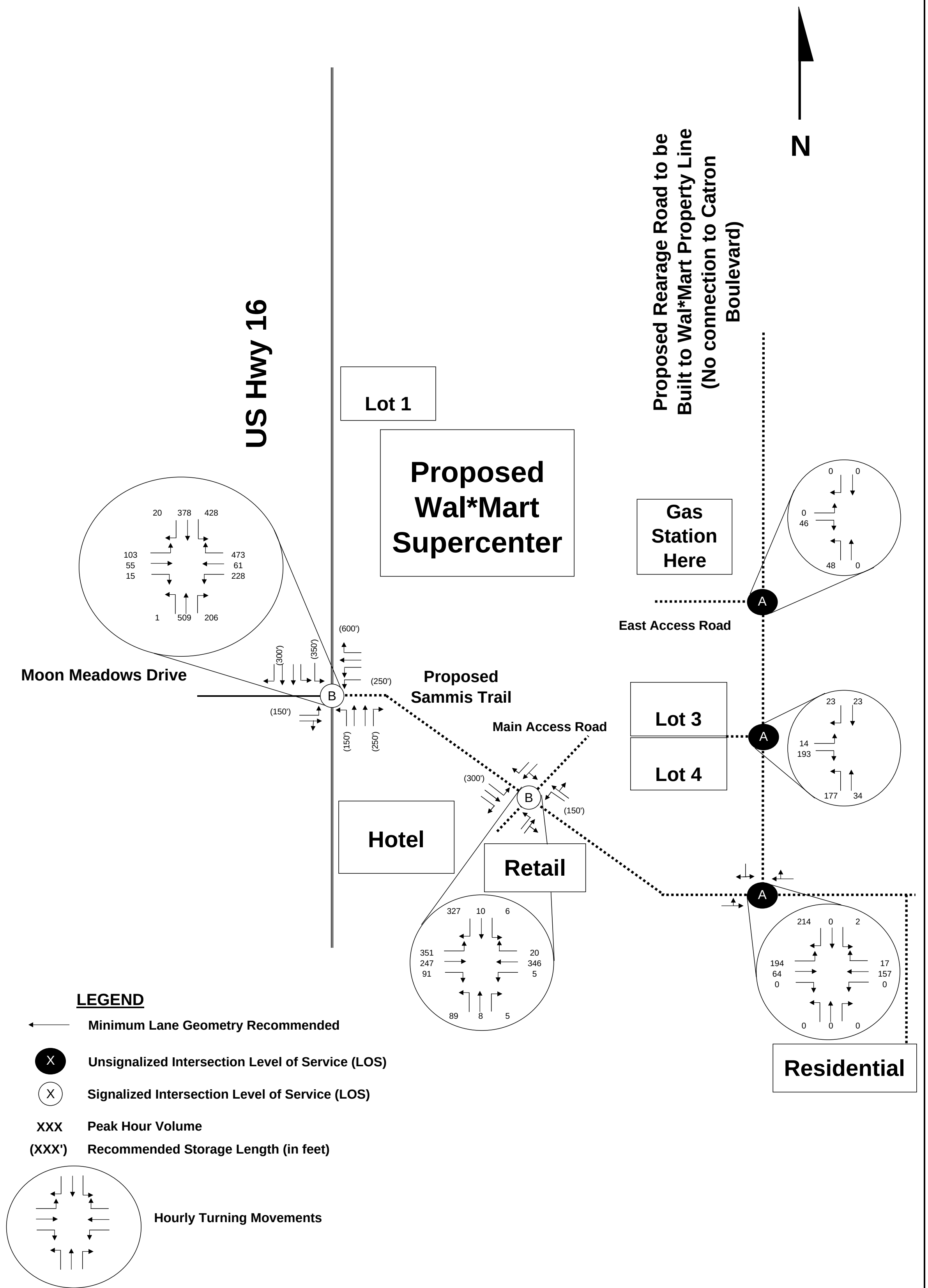
Sammis Trail / Main Access Road

As documented in **Figure 6 and 7**, the intersection of Sammis Trail / Main Access Road is expected to operate at deficient levels after the site is developed. To mitigate this condition, the intersection shall be signalized and the proposed lane geometry shall consist of an exclusive left-turn lane along the eastbound approach from Sammis Trail and a right-turn lane to improve intersection operations, especially in reducing queue lengths. Installation of a 5-phase traffic signal (with permitted-protected left turns for eastbound left-turning traffic) improved PM peak hour operations from LOS F to LOS B.

Summary of Capacity Improvements

Summaries of the mitigated LOS and turning movements are documented in **Figures 8 and 9**, and **Table 5** for the AM and PM peak hours. The following improvements were made:

- Installation of an 8-phase traffic signal at US Highway 16 / Sammis Trail.
- Installation of an additional southbound left-turn lane along US Highway 16 at Sammis Trail.
- Installation of a free-right turn lane along westbound Sammis Trail at US Highway 16.
- Installation of an additional left-turn lane along westbound Sammis Trail at US Highway 16.
- Installation of a 600 foot free-right turn acceleration lane along northbound US Highway 16.
- Installation of a 5-phase traffic signal at Sammis Trail / Main Access Road.
- Installation of a left-turn lane along eastbound Sammis Trail at the Main Access Road.
- Installation of a right-turn lane along eastbound Sammis Trail at the Main access road.



Mitigated Post-Development Volume and Levels of Service (AM)

Figure 8

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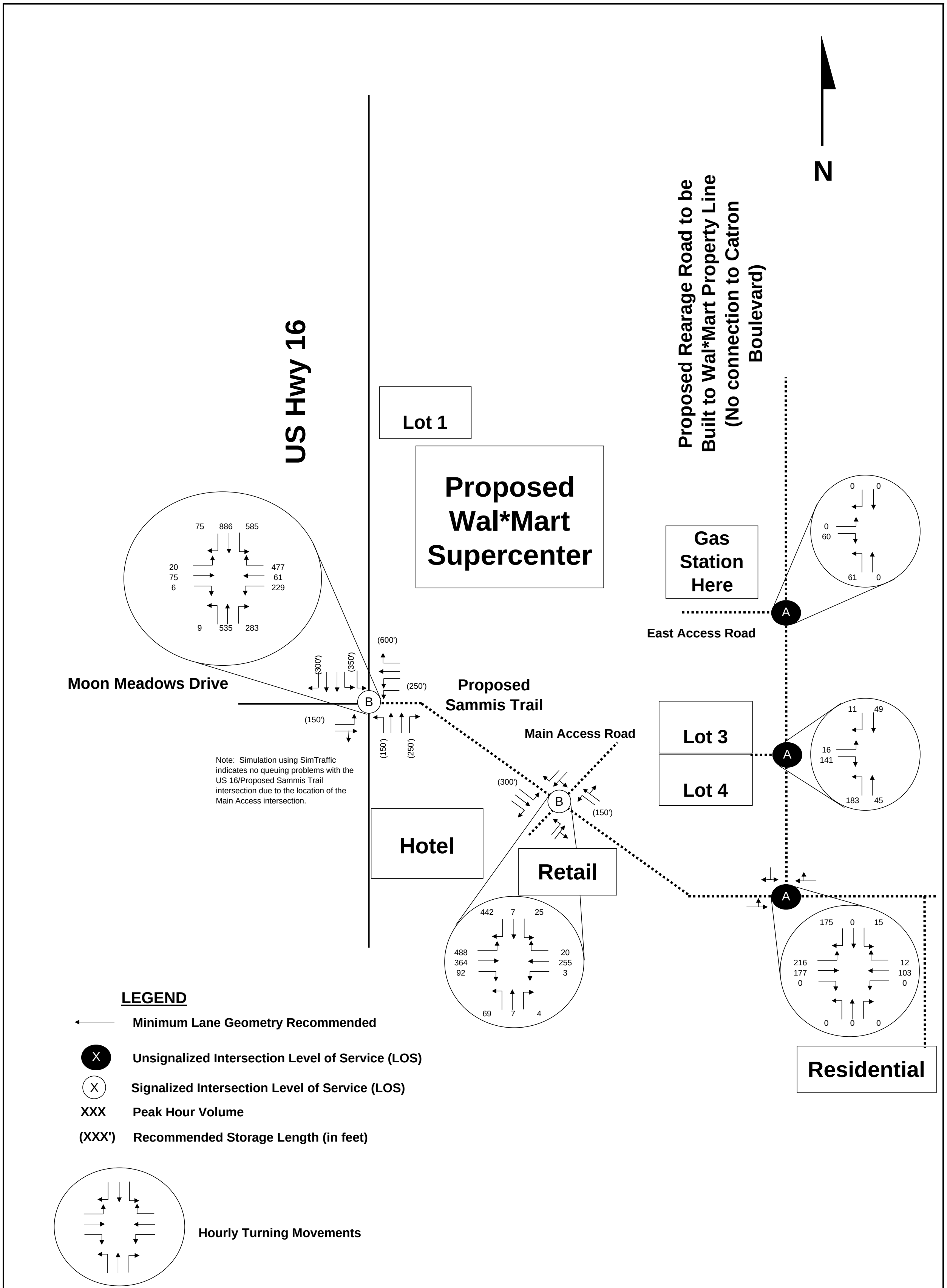

Mitigated Post-Development Volume and Levels of Service (PM)

Figure 9

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TABLE 5: Mitigated Intersection Level-of-Service

Intersection	Traffic Control	AM Peak Hour LOS	Avg Delay per Vehicle (sec)	PM Peak Hour LOS	Avg Delay per Vehicle (sec)
US 16 / Sammis Trail / Moon Meadows	Signal	B	15.6	B	19.0
Sammis Trail / Wal*Mart Main access road	Signal	B	17.3	B	12.3
Sammis Trail / Rearage Road	All-Way Stop	A	8.2	A	8.6
Rearage Road / Lot 3 & 4	Two-Way	A	9.9	A	10.0
Rearage Road / East Access	Two-Way	A	8.5	A	8.5

Source: HDR Engineering, Inc. using Synchro 6.1 (HCM Methodology)

Future Build (2020) Conditions Analysis

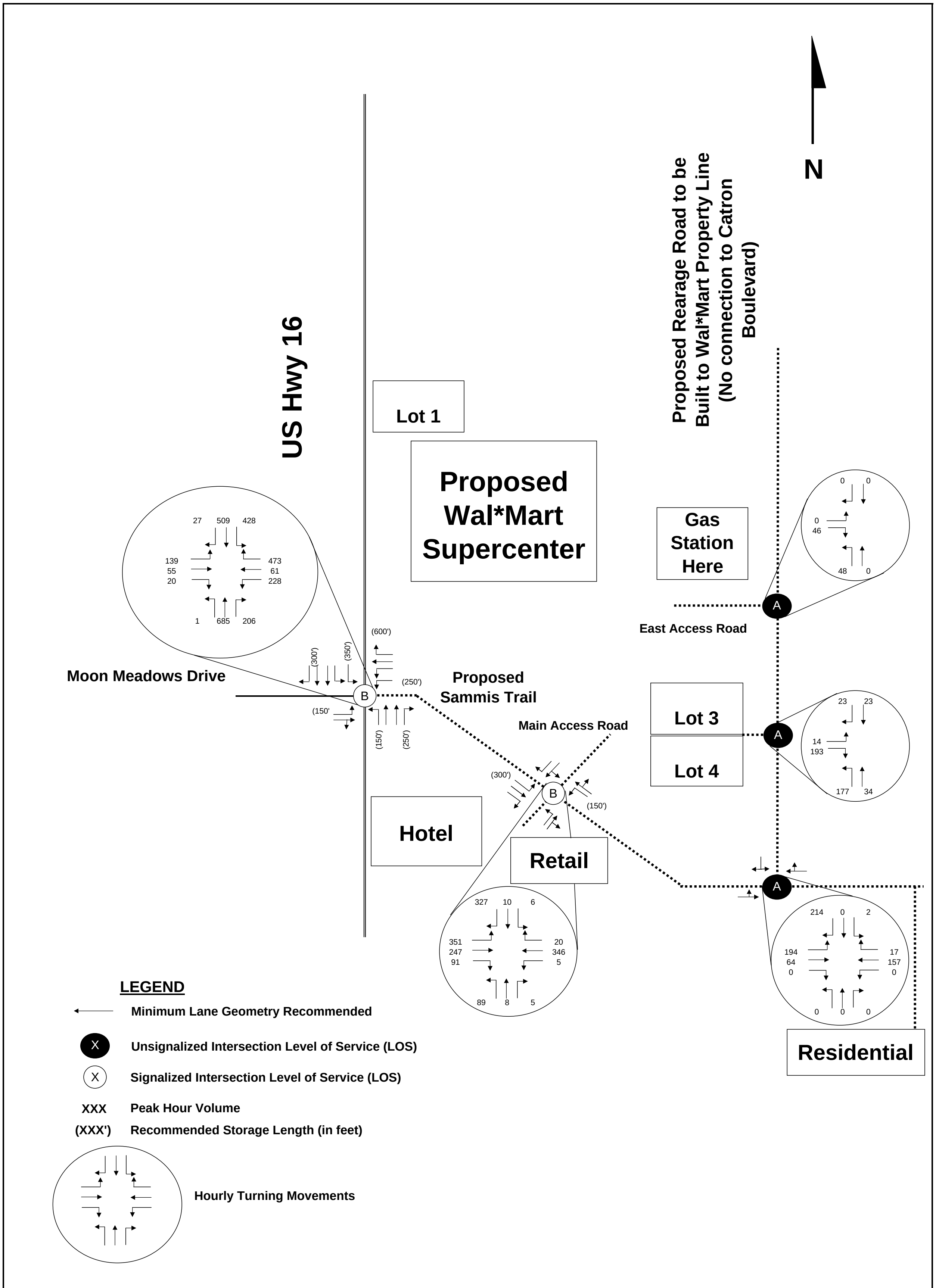
Based on growth trends in the study area, future build (2020) volumes were developed by growing the existing traffic volumes by 2.0 percent per year for 15 years and adding them to the trips generated by the proposed mixed-use development. The growth rate was based on historical count information gathered by the SDDOT. The 2020 build traffic volumes and LOS (AM) are shown in **Figure 10**. The 2020 build traffic volumes and LOS (PM) are shown in **Figure 11**.

The capacity analysis was performed using future build (2020) AM and PM peak hour traffic volumes to determine if the geometric improvements recommended would serve this area in the future. It was determined through an operational analysis that the study intersections would operate at an acceptable LOS in 2020 with no further geometric improvements. A summary of the intersection LOS for the existing conditions is documented in **Table 6.**

TABLE 6: Future Build (2020) Intersection Level-of-Service

Intersection	Traffic Control	AM Peak Hour LOS	Avg Delay per Vehicle (sec)	PM Peak Hour LOS	Avg Delay per Vehicle (sec)
US 16 / Sammis Trail / Moon Meadows	Signal	B	19.6	C	23.1
Sammis Trail / Wal*Mart Main access road	Signal	B	17.4	B	12.3
Sammis Trail / Rearage Road	All-Way Stop	A	8.2	A	8.6
Rearage Road / Lot 3 & 4	Two-Way	A	9.9	A	10.0
Rearage Road / East Access	Two-Way	A	8.5	A	8.5

Source: HDR Engineering, Inc. using Synchro 6.1 (HCM Methodology)



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Future Build (2020) Volumes and Levels of Service (AM)

Figure 10

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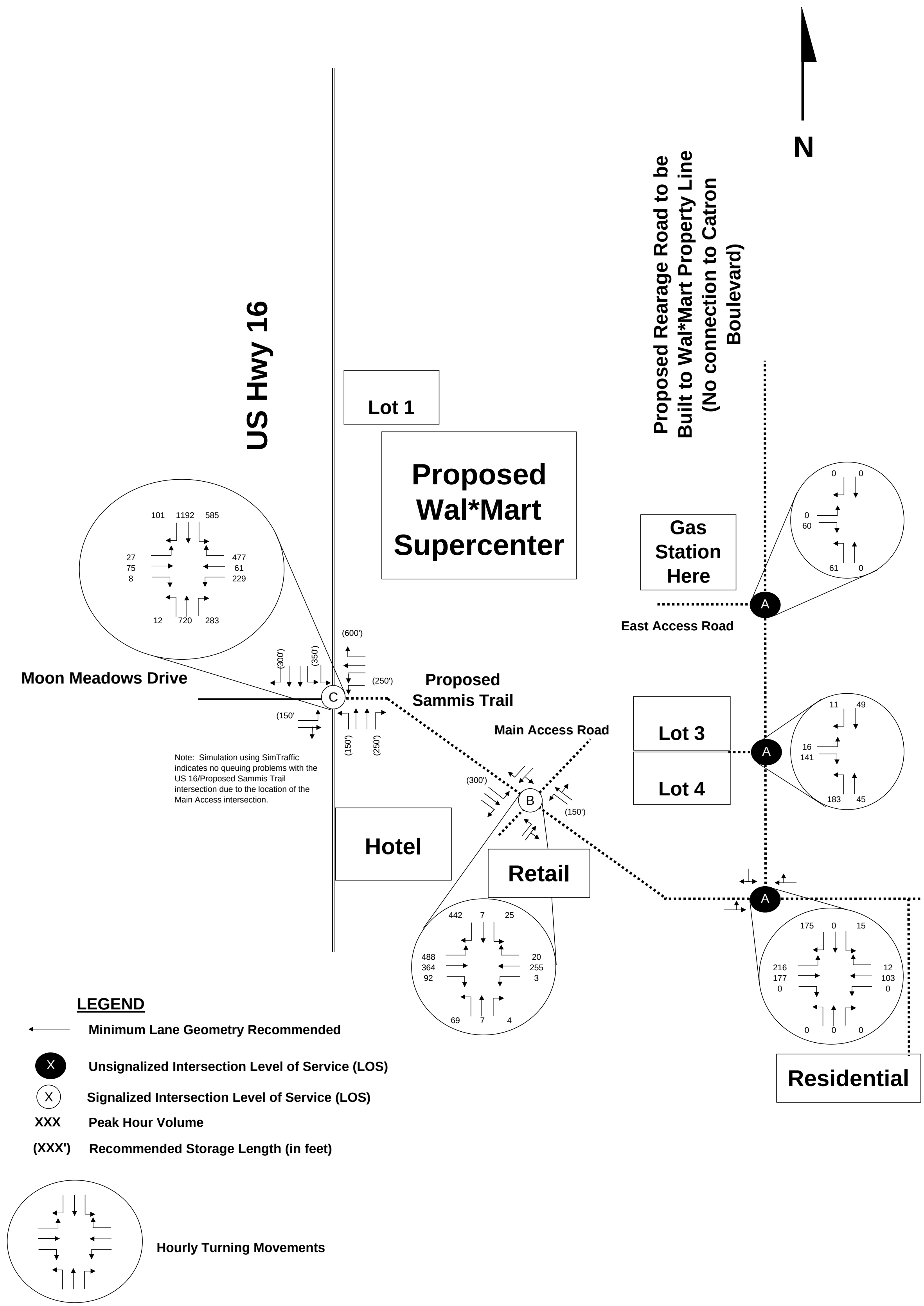

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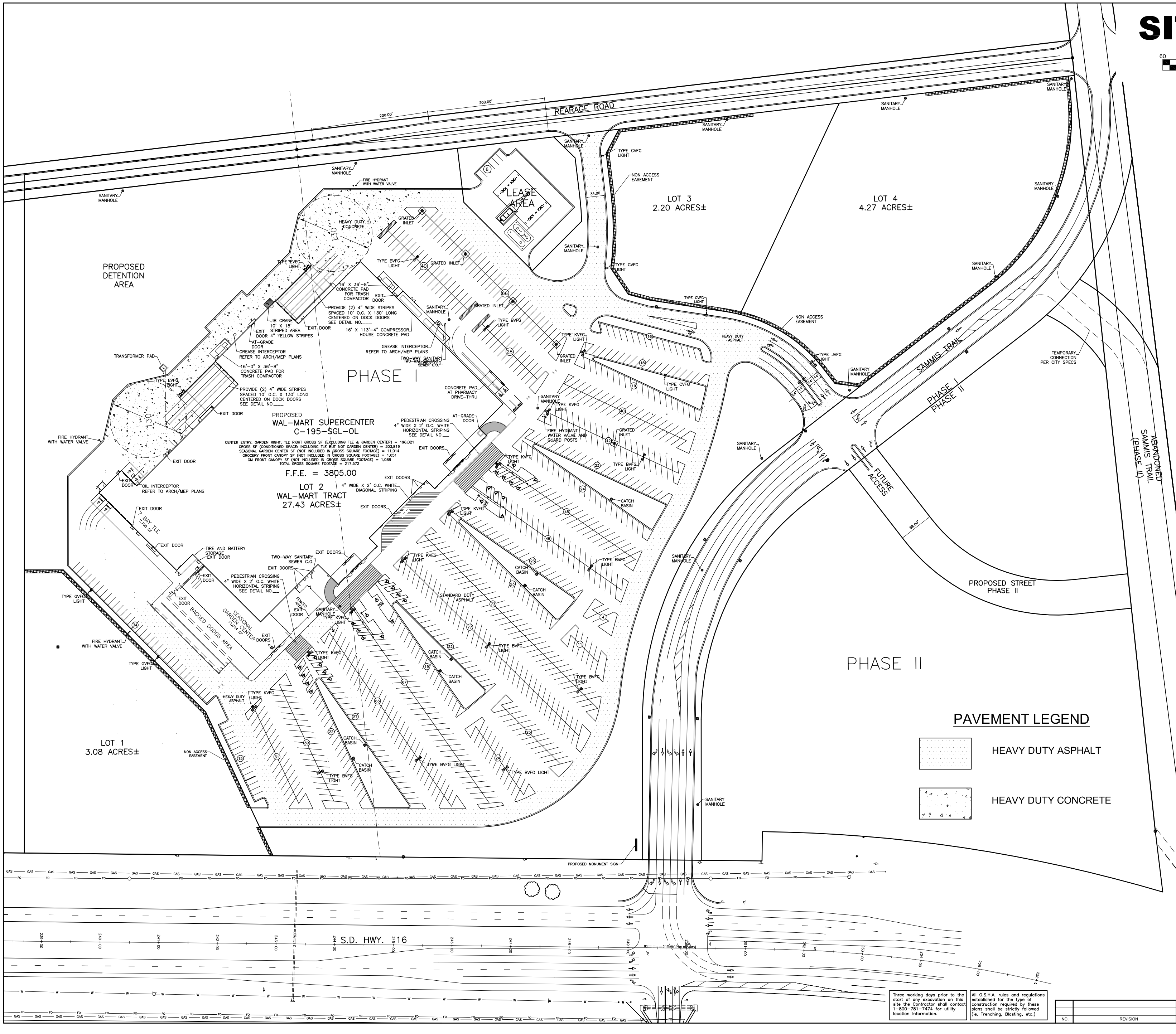
Future Build (2020) Volume and Levels of Service (PM)

Figure 11	December 2005

APPENDIX

1.) Current Site Plan
2.) Synchro Print-outs

SITE PLAN



60 0 60 180

SITE NOTES:

1. The Contractor is specifically cautioned that the location and/or elevation of existing utilities as shown on these plans is based on records of the various utility companies and, where possible, measurements taken in the field. The information is not to be relied on as being exact or complete. The Contractor must call the appropriate utility company to request exact field location of utilities. It shall be the responsibility of the Contractor to relocate all existing utilities which conflict with the proposed improvements shown on plans.

2. North derived from bearing of record for the _______ line of ________ as per ________________________________, dated _______, 20__. (______________)

3. Contractor shall verify elevation of temporary benchmarks based on the elevation of the primary benchmark, prior to the start of construction. Contractor shall notify engineer if elevations differ from those shown on these plans.

(Note source of primary benchmark)

Primary Benchmark – (Describe benchmark)

Temporary Benchmark No. 1 – (Describe benchmark)

Temporary Benchmark No. 2 – (Describe benchmark)

4. This site is designated as Zone "____" – _____________, as per Federal Emergency Management Agency National Flood Insurance Rate Map, Community Panel No. ___________, dated ______________, 20___.

5. All trenches under paved areas shall be backfilled with granular material and compacted to meet compaction requirements for the parking lot. Granular material shall be placed and compacted to a level equal to the trench depth at the time of the utility installations.

6. All unsurfaced areas are to receive six inches of topsoil. Contractor to seed, mulch, fertilize and maintain all areas outside of paved areas that were disturbed during construction until an acceptable stand of grass is established. Contractor shall be responsible to take whatever means necessary to establish permanent soil stabilization.

7. Contractor to contact telephone, electric, gas, and water companies to have underground utilities located on this site and adjacent to this site prior to doing any excavating.

8. Contractor shall refer to architectural plans for exact locations and dimensions of vestibules, exit porches, ramps, truck docks, precise building dimensions, exact building utility entrance locations, and exact number and location of downspouts.

9. The contractor is responsible for keeping storm water run-off and sedimentation under control during construction.

10. All survey monuments disturbed during construction shall be replaced by a surveyor licensed in the state, in which this project is located, at the contractors expense.

11. The sitework for this project shall meet or exceed the "Wal-Mart Standard Sitework Specifications."

12. Note to Lighting Contractor: All floodlights mounted on parking lot light poles for purposes of illuminating the face of the building, as well as any parking lot light poles utilized for lighting the truckwell areas, shall be separately circuited for the purpose of security lighting.

13. Parking Ratio – _______ spaces = ______/1000 sq.ft. Based on _________S.F. Parking required _________
_______ spaces for the disabled   Number of Associate Parking _________

14. The Contractor shall verify and/or perform all necessary inspections and/or certifications required by codes and/or utility companies prior to the announced building possession date and the final connections of utility services. All fees shall be paid by the Contractor.

15. All new parking lot lighting poles and fixtures with lamps and paint will be provided by Wal-Mart and installed by the electrical contractor. The electrical contractor shall provide Wal-Mart a one-year warranty certificate. All incurred costs for receiving, storage, liability, and warranty labor shall be included in the installation and contract price. Refer to architectural plans for site lighting conduit routing.

16. Aisle signs shall begin with the number one at the _______ aisle and increase numerically to _______ at the _______ aisle.

17. All associate parking shall be striped with white paint, end islands to be painted yellow. ____________ associate spaces are provided. See plans for location.

18. All dimensions and radii are to the back of curb, unless otherwise shown.

19. Contractor shall be responsible for all removals of and/or relocations, including but not limited to, utilities, storm drainage, signs, traffic signals and poles, etc as required. All work shall be done in accordance with governing authorities specifications and shall be approved by such. All costs shall be included in base bid.

20. The height of the light poles concrete base is critical (see detail).

21. All lane striping, stop bars and arrows installed at entrance drives shall be thermoplastic.

SITE PLAN LEGEND

DESCRIPTION	PROPOSED	EXISTING
AERIAL ELECTRIC	—AE—	—AE—
UTILITY POLE		
GUARD POST	GP	GP
SANITARY MANHOLE		
CATCH BASIN		
JUNCTION BOX		
FLARED END SECTION		
CLEANOUT		
GRATED INLET		
GUARD RAIL		
CHAINLINK FENCE		
BARBWIRE FENCE	—X—X—X—	—X—X—X—
WATER VALVE		
FIRE HYDRANT		
EASEMENT		
PROPERTY LINE		
NON ACCESS EASEMENT		

PARKING RATIO:
1013 SPACES = 4.99 SPACES/1000 SQ. FT.

PAVEMENT LEGEND

HEAVY DUTY ASPHALT

HEAVY DUTY CONCRETE

Three working days prior to the start of any excavation on this site the Contractor shall contact 1-800-781-7474 for utility location information.

All O.S.H.A. rules and regulations established for the type of construction required by these plans shall be strictly followed (ie. Trenching, Blasting, etc.)

NO.	REVISION	BY	DATE	APP'D

PRELIMINARY DRAWING

FOR REVIEW PURPOSES ONLY
NOT TO BE USED FOR CONSTRUCTION

SITE PLAN
WAL-MART SUPERCENTER #3872-00
RAPID CITY SOUTH, PENNINGTON CO., SD

E-Mail: mail@bfaeng.com Telephone: (636) 239-4751
BUESCHER FRANKENBERG ASSOCIATES, INC.
consultants & engineers
103a ELM STREET WASHINGTON, MISSOURI 63090

DWN. BY K.C.V.	DATE 12/9/05	PROJ. NO. 04-2771
CHK'D	SCALE	DWG. NO.
APP'D		

\\Server1\E-drive\Projects\2771 Rapid City South WM\2771 city site sumital plans\2771 site sumital 12-9-05.dwg\2771 Site submital 12-9-05.dwg
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HCM Unsignalized Intersection Capacity Analysis
6: Sammis Trail & Wal*Mart Main Access Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	351	247	91	5	346	20	89	8	5	6	10	327
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	382	268	99	5	376	22	97	9	5	7	11	355

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	749	403	111	373
Volume Left (vph)	382	5	97	7
Volume Right (vph)	99	22	5	355
Hadj (s)	0.1	0.0	0.2	-0.5
Departure Headway (s)	6.5	6.9	8.1	6.6
Degree Utilization, x	1.35	0.78	0.25	0.68
Capacity (veh/h)	564	493	395	537
Control Delay (s)	54.3	14.9	11.8	12.8
Approach Delay (s)	54.3	14.9	11.8	12.8
Approach LOS	F	B	B	B

Intersection Summary			
Delay	32.2		
HCM Level of Service	D		
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	103	55	15	228	61	473	1	509	206	428	378	20
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	112	60	16	248	66	514	1	553	224	465	411	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2167	2121	205	1738	1918	277	433			777		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2167	2121	205	1738	1918	277	433			777		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	98	0	0	29	100			44		
cM capacity (veh/h)	0	22	801	0	29	721	1123			835		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	172	16	314	514	1	277	277	224	465	205	205	22
Volume Left	112	0	248	0	1	0	0	0	465	0	0	0
Volume Right	0	16	0	514	0	0	0	224	0	0	0	22
cSH	0	801	0	721	1123	1700	1700	1700	835	1700	1700	1700
Volume to Capacity	Err	0.02	Err	0.71	0.00	0.16	0.16	0.13	0.56	0.12	0.12	0.01
Queue Length (ft)	Err	2	Err	151	0	0	0	0	88	0	0	0
Control Delay (s)	Err	9.6	Err	21.4	8.2	0.0	0.0	0.0	14.6	0.0	0.0	0.0
Lane LOS	F	A	F	C	A				B			
Approach Delay (s)	Err		Err		0.0				7.6			
Approach LOS	F		F									

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
18: Sammis Trail & Rearage Road

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	194	64	157	17	2	214
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	211	70	171	18	2	233

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	280	189	235
Volume Left (vph)	211	0	2
Volume Right (vph)	0	18	233
Hadj (s)	0.2	0.0	-0.6
Departure Headway (s)	4.8	4.6	4.4
Degree Utilization, x	0.38	0.24	0.29
Capacity (veh/h)	712	586	778
Control Delay (s)	8.5	8.0	7.9
Approach Delay (s)	8.5	8.0	7.9
Approach LOS	A	A	A

Intersection Summary			
Delay	8.2		
HCM Level of Service	A		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	14	193	177	34	23	23
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	210	192	37	25	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	459	38	50			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459	38	50			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	80	88			
cM capacity (veh/h)	491	1035	1557			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	225	229	50
Volume Left	15	192	0
Volume Right	210	0	25
cSH	962	1557	1700
Volume to Capacity	0.23	0.12	0.03
Queue Length (ft)	23	11	0
Control Delay (s)	9.9	6.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.9	6.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	46	48	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	50	52	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	104	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	104	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	95	97			
cM capacity (veh/h)	865	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	52	0
Volume Left	0	52	0
Volume Right	50	0	0
cSH	1085	1623	1700
Volume to Capacity	0.05	0.03	0.00
Queue Length (ft)	4	2	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	488	364	92	3	255	20	69	7	4	25	7	442
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	530	396	100	3	277	22	75	8	4	27	8	480

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	1026	302	87	515
Volume Left (vph)	530	3	75	27
Volume Right (vph)	100	22	4	480
Hadj (s)	0.1	0.0	0.2	-0.5
Departure Headway (s)	6.5	6.2	8.0	6.1
Degree Utilization, x	1.85	0.52	0.19	0.88
Capacity (veh/h)	562	495	406	580
Control Delay (s)	108.2	10.9	11.5	16.4
Approach Delay (s)	108.2	10.9	11.5	16.4
Approach LOS	F	B	B	C

Intersection Summary			
Delay	64.1		
HCM Level of Service	F		
Intersection Capacity Utilization	114.9%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	20	75	6	229	61	477	9	535	283	585	886	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	82	7	249	66	518	10	582	308	636	963	82
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	3097	3143	482	2402	2917	291	1045			889		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	3097	3143	482	2402	2917	291	1045			889		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	99	0	0	27	99			16		
cM capacity (veh/h)	0	2	531	0	2	706	662			758		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	103	7	315	518	10	291	291	308	636	482	482	82
Volume Left	22	0	249	0	10	0	0	0	636	0	0	0
Volume Right	0	7	0	518	0	0	0	308	0	0	0	82
cSH	0	531	0	706	662	1700	1700	1700	758	1700	1700	1700
Volume to Capacity	Err	0.01	Err	0.73	0.01	0.17	0.17	0.18	0.84	0.28	0.28	0.05
Queue Length (ft)	Err	1	Err	163	1	0	0	0	240	0	0	0
Control Delay (s)	Err	11.9	Err	22.9	10.5	0.0	0.0	0.0	29.3	0.0	0.0	0.0
Lane LOS	F	B	F	C	B				D			
Approach Delay (s)	Err		Err		0.1				11.1			
Approach LOS	F		F									

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	216	177	103	12	15	175
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	235	192	112	13	16	190

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	427	125	207
Volume Left (vph)	235	0	16
Volume Right (vph)	0	13	190
Hadj (s)	0.1	0.0	-0.5
Departure Headway (s)	4.7	4.6	4.6
Degree Utilization, x	0.55	0.16	0.27
Capacity (veh/h)	746	570	726
Control Delay (s)	9.1	7.9	8.1
Approach Delay (s)	9.1	7.9	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	8.6		
HCM Level of Service	A		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	16	141	183	45	49	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	153	199	49	53	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	506	59	65			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	506	59	65			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	85	87			
cM capacity (veh/h)	458	1006	1537			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	171	248	65
Volume Left	17	199	0
Volume Right	153	0	12
cSH	897	1537	1700
Volume to Capacity	0.19	0.13	0.04
Queue Length (ft)	17	11	0
Control Delay (s)	10.0	6.4	0.0
Lane LOS	A	A	
Approach Delay (s)	10.0	6.4	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	60	61	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	65	66	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	133	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	133	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	94	96			
cM capacity (veh/h)	826	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	65	66	0
Volume Left	0	66	0
Volume Right	65	0	0
cSH	1085	1623	1700
Volume to Capacity	0.06	0.04	0.00
Queue Length (ft)	5	3	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	14.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	1.00
Satd. Flow (prot)	1676	1765	1500	1676	1750		1676	1670			1731	1500
Flt Permitted	0.22	1.00	1.00	0.59	1.00		0.75	1.00			0.94	1.00
Satd. Flow (perm)	383	1765	1500	1049	1750		1316	1670			1662	1500
Volume (vph)	351	247	91	5	346	20	89	8	5	6	10	327
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	382	268	99	5	376	22	97	9	5	7	11	355
RTOR Reduction (vph)	0	0	44	0	4	0	0	4	0	0	0	249
Lane Group Flow (vph)	382	268	55	5	394	0	97	10	0	0	18	106
Turn Type	pm+pt		Perm	Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	29.8	29.8	29.8	14.8	14.8		16.0	16.0			16.0	16.0
Effective Green, g (s)	29.8	29.8	29.8	14.8	14.8		16.0	16.0			16.0	16.0
Actuated g/C Ratio	0.55	0.55	0.55	0.28	0.28		0.30	0.30			0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	477	978	831	289	481		391	497			494	446
v/s Ratio Prot	c0.16	0.15			0.23			0.01				
v/s Ratio Perm	c0.28		0.07	0.00			0.07				0.01	0.24
v/c Ratio	0.80	0.27	0.07	0.02	0.82		0.25	0.02			0.04	0.24
Uniform Delay, d1	8.9	6.3	5.6	14.2	18.3		14.3	13.4			13.4	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	9.3	0.2	0.0	0.0	10.5		1.5	0.1			0.1	1.2
Delay (s)	18.2	6.5	5.6	14.2	28.8		15.8	13.4			13.6	15.5
Level of Service	B	A	A	B	C		B	B			B	B
Approach Delay (s)		12.3			28.6			15.5			15.4	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	53.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1676	1709		3252	1765	1500	1676	3353	1500	3252	3353	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1676	1709		3252	1765	1500	1676	3353	1500	3252	3353	1500
Volume (vph)	103	55	15	228	61	473	1	509	206	428	378	20
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	60	16	248	66	514	1	553	224	465	411	22
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	198	0	0	11
Lane Group Flow (vph)	112	61	0	248	66	514	1	553	26	465	411	11
Turn Type	Prot			Prot		Free	Prot		Over	Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases						Free						6
Actuated Green, G (s)	5.8	4.5		6.3	5.0	53.4	0.7	12.7	6.3	13.9	25.9	25.9
Effective Green, g (s)	5.8	4.5		6.3	5.0	53.4	0.7	12.7	6.3	13.9	25.9	25.9
Actuated g/C Ratio	0.11	0.08		0.12	0.09	1.00	0.01	0.24	0.12	0.26	0.49	0.49
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	182	144		384	165	1500	22	797	177	846	1626	728
v/s Ratio Prot	0.07	0.04		0.08	0.04		0.00	c0.16	c0.15	c0.14	0.12	
v/s Ratio Perm						0.34						0.01
v/c Ratio	0.62	0.43		0.65	0.40	0.34	0.05	0.69	0.15	0.55	0.25	0.01
Uniform Delay, d1	22.7	23.2		22.5	22.8	0.0	26.0	18.6	21.1	17.0	8.1	7.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	2.0		3.7	1.6	0.6	0.9	2.6	0.4	0.7	0.1	0.0
Delay (s)	28.8	25.2		26.2	24.4	0.6	26.9	21.2	21.5	17.8	8.2	7.1
Level of Service	C	C		C	C	A	C	C	C	B	A	A
Approach Delay (s)		27.4			10.2			21.3			13.1	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	53.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	194	64	157	17	2	214
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	211	70	171	18	2	233

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	280	189	235
Volume Left (vph)	211	0	2
Volume Right (vph)	0	18	233
Hadj (s)	0.2	0.0	-0.6
Departure Headway (s)	4.8	4.6	4.4
Degree Utilization, x	0.38	0.24	0.29
Capacity (veh/h)	712	586	778
Control Delay (s)	8.5	8.0	7.9
Approach Delay (s)	8.5	8.0	7.9
Approach LOS	A	A	A

Intersection Summary			
Delay	8.2		
HCM Level of Service	A		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	14	193	177	34	23	23
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	210	192	37	25	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	459	38	50			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459	38	50			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	80	88			
cM capacity (veh/h)	491	1035	1557			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	225	229	50
Volume Left	15	192	0
Volume Right	210	0	25
cSH	962	1557	1700
Volume to Capacity	0.23	0.12	0.03
Queue Length (ft)	23	11	0
Control Delay (s)	9.9	6.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.9	6.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	46	48	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	50	52	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	104	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	104	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	95	97			
cM capacity (veh/h)	865	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	52	0
Volume Left	0	52	0
Volume Right	50	0	0
cSH	1085	1623	1700
Volume to Capacity	0.05	0.03	0.00
Queue Length (ft)	4	2	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
6: Sammis Trail & Wal*Mart Main Access Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	1.00
Satd. Flow (prot)	1676	1765	1500	1676	1745		1676	1676			1699	1500
Flt Permitted	0.32	1.00	1.00	0.53	1.00		0.73	1.00			0.81	1.00
Satd. Flow (perm)	571	1765	1500	933	1745		1296	1676			1434	1500
Volume (vph)	488	364	92	3	255	20	69	7	4	25	7	442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	530	396	100	3	277	22	75	8	4	27	8	480
RTOR Reduction (vph)	0	0	35	0	4	0	0	3	0	0	0	391
Lane Group Flow (vph)	530	396	65	3	295	0	75	9	0	0	35	89
Turn Type	pm+pt		Perm	Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	31.8	31.8	31.8	12.5	12.5		9.1	9.1			9.1	9.1
Effective Green, g (s)	31.8	31.8	31.8	12.5	12.5		9.1	9.1			9.1	9.1
Actuated g/C Ratio	0.65	0.65	0.65	0.26	0.26		0.19	0.19			0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	717	1148	975	238	446		241	312			267	279
v/s Ratio Prot	c0.23	0.22			0.17			0.01				
v/s Ratio Perm	c0.25		0.07	0.00			0.06				0.02	0.32
v/c Ratio	0.74	0.34	0.07	0.01	0.66		0.31	0.03			0.13	0.32
Uniform Delay, d1	5.5	3.9	3.1	13.6	16.3		17.2	16.3			16.6	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	4.0	0.2	0.0	0.0	3.6		0.7	0.0			0.2	0.7
Delay (s)	9.5	4.0	3.2	13.6	19.9		17.9	16.3			16.8	17.9
Level of Service	A	A	A	B	B		B	B			B	B
Approach Delay (s)		6.8			19.9			17.7			17.8	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1676	1744		3252	1765	1500	1676	3353	1500	3252	3353	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1676	1744		3252	1765	1500	1676	3353	1500	3252	3353	1500
Volume (vph)	20	75	6	229	61	477	9	535	283	585	886	75
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	82	7	249	66	518	10	582	308	636	963	82
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	194	0	0	48
Lane Group Flow (vph)	22	85	0	249	66	518	10	582	114	636	963	34
Turn Type	Prot			Prot		Free	Prot		pt+ov	Prot		Perm
Protected Phases	7	4		3	8		5	2	2 3	1	6	
Permitted Phases						Free						6
Actuated Green, G (s)	1.3	8.4		7.5	14.6	64.8	6.3	16.4	23.9	16.5	26.6	26.6
Effective Green, g (s)	1.3	8.4		7.5	14.6	64.8	6.3	16.4	23.9	16.5	26.6	26.6
Actuated g/C Ratio	0.02	0.13		0.12	0.23	1.00	0.10	0.25	0.37	0.25	0.41	0.41
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	34	226		376	398	1500	163	849	553	828	1376	616
v/s Ratio Prot	0.01	0.05		c0.08	0.04		0.01	c0.17	0.21	0.20	c0.29	
v/s Ratio Perm						0.35						0.05
v/c Ratio	0.65	0.37		0.66	0.17	0.35	0.06	0.69	0.21	0.77	0.70	0.05
Uniform Delay, d1	31.5	25.8		27.4	20.2	0.0	26.6	21.9	14.0	22.4	15.8	11.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	35.3	1.0		4.3	0.2	0.6	0.2	2.3	0.2	4.3	1.6	0.0
Delay (s)	66.8	26.8		31.8	20.4	0.6	26.7	24.2	14.2	26.7	17.4	11.6
Level of Service	E	C		C	C	A	C	C	B	C	B	B
Approach Delay (s)		34.8			11.5			20.8			20.6	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	64.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	216	177	103	12	15	175
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	235	192	112	13	16	190

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	427	125	207
Volume Left (vph)	235	0	16
Volume Right (vph)	0	13	190
Hadj (s)	0.1	0.0	-0.5
Departure Headway (s)	4.7	4.6	4.6
Degree Utilization, x	0.55	0.16	0.27
Capacity (veh/h)	746	570	726
Control Delay (s)	9.1	7.9	8.1
Approach Delay (s)	9.1	7.9	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	8.6		
HCM Level of Service	A		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	16	141	183	45	49	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	153	199	49	53	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	506	59	65			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	506	59	65			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	85	87			
cM capacity (veh/h)	458	1006	1537			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	171	248	65
Volume Left	17	199	0
Volume Right	153	0	12
cSH	897	1537	1700
Volume to Capacity	0.19	0.13	0.04
Queue Length (ft)	17	11	0
Control Delay (s)	10.0	6.4	0.0
Lane LOS	A	A	
Approach Delay (s)	10.0	6.4	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	60	61	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	65	66	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	133	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	133	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	94	96			
cM capacity (veh/h)	826	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	65	66	0
Volume Left	0	66	0
Volume Right	65	0	0
cSH	1085	1623	1700
Volume to Capacity	0.06	0.04	0.00
Queue Length (ft)	5	3	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	14.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	1.00
Satd. Flow (prot)	1676	1765	1500	1676	1750		1676	1670			1731	1500
Flt Permitted	0.32	1.00	1.00	0.58	1.00		0.75	1.00			0.94	1.00
Satd. Flow (perm)	568	1765	1500	1023	1750		1316	1670			1664	1500
Volume (vph)	351	247	91	5	346	20	89	8	5	6	10	327
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	382	268	99	5	376	22	97	9	5	7	11	355
RTOR Reduction (vph)	0	0	43	0	4	0	0	4	0	0	0	249
Lane Group Flow (vph)	382	268	56	5	394	0	97	10	0	0	18	106
Turn Type	pm+pt		Perm	Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	32.2	32.2	32.2	15.9	15.9		17.1	17.1			17.1	17.1
Effective Green, g (s)	32.2	32.2	32.2	15.9	15.9		17.1	17.1			17.1	17.1
Actuated g/C Ratio	0.56	0.56	0.56	0.28	0.28		0.30	0.30			0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	557	992	843	284	486		393	498			497	448
v/s Ratio Prot	c0.15	0.15			c0.23			0.01				
v/s Ratio Perm	0.24		0.07	0.00			0.07				0.01	0.24
v/c Ratio	0.69	0.27	0.07	0.02	0.81		0.25	0.02			0.04	0.24
Uniform Delay, d1	13.6	6.5	5.7	15.0	19.3		15.2	14.2			14.3	15.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	3.5	0.1	0.0	0.0	9.9		1.5	0.1			0.1	1.2
Delay (s)	17.1	6.6	5.7	15.1	29.2		16.7	14.3			14.4	16.4
Level of Service	B	A	A	B	C		B	B			B	B
Approach Delay (s)		11.9			29.1			16.4			16.3	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1676	1694		3252	1765	1500	1676	3353	1500	3252	3353	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1676	1694		3252	1765	1500	1676	3353	1500	3252	3353	1500
Volume (vph)	139	55	20	228	61	473	1	685	206	428	509	27
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	151	60	22	248	66	514	1	745	224	465	553	29
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	196	0	0	14
Lane Group Flow (vph)	151	62	0	248	66	514	1	745	28	465	553	15
Turn Type	Prot			Prot		Free	Prot		Over	Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases						Free						6
Actuated Green, G (s)	6.1	5.2		7.4	6.5	59.2	0.7	15.8	7.4	14.8	29.9	29.9
Effective Green, g (s)	6.1	5.2		7.4	6.5	59.2	0.7	15.8	7.4	14.8	29.9	29.9
Actuated g/C Ratio	0.10	0.09		0.12	0.11	1.00	0.01	0.27	0.12	0.25	0.51	0.51
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	173	149		407	194	1500	20	895	188	813	1693	758
v/s Ratio Prot	0.09	0.05		0.08	0.04		0.00	c0.22	c0.15	c0.14	0.16	
v/s Ratio Perm						0.34						0.02
v/c Ratio	0.87	0.42		0.61	0.34	0.34	0.05	0.83	0.15	0.57	0.33	0.02
Uniform Delay, d1	26.2	25.6		24.5	24.4	0.0	28.9	20.5	23.1	19.4	8.7	7.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	35.1	1.9		2.6	1.0	0.6	1.0	6.7	0.4	1.0	0.1	0.0
Delay (s)	61.2	27.4		27.1	25.4	0.6	30.0	27.1	23.5	20.4	8.8	7.3
Level of Service	E	C		C	C	A	C	C	C	C	A	A
Approach Delay (s)		49.3			10.5			26.3			13.9	
Approach LOS		D			B			C			B	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	59.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	194	64	157	17	2	214
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	211	70	171	18	2	233

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	280	189	235
Volume Left (vph)	211	0	2
Volume Right (vph)	0	18	233
Hadj (s)	0.2	0.0	-0.6
Departure Headway (s)	4.8	4.6	4.4
Degree Utilization, x	0.38	0.24	0.29
Capacity (veh/h)	712	586	778
Control Delay (s)	8.5	8.0	7.9
Approach Delay (s)	8.5	8.0	7.9
Approach LOS	A	A	A

Intersection Summary			
Delay	8.2		
HCM Level of Service	A		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	14	193	177	34	23	23
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	210	192	37	25	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	459	38	50			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459	38	50			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	80	88			
cM capacity (veh/h)	491	1035	1557			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	225	229	50
Volume Left	15	192	0
Volume Right	210	0	25
cSH	962	1557	1700
Volume to Capacity	0.23	0.12	0.03
Queue Length (ft)	23	11	0
Control Delay (s)	9.9	6.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.9	6.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	46	48	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	50	52	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	104	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	104	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	95	97			
cM capacity (veh/h)	865	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	52	0
Volume Left	0	52	0
Volume Right	50	0	0
cSH	1085	1623	1700
Volume to Capacity	0.05	0.03	0.00
Queue Length (ft)	4	2	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.95			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	1.00
Satd. Flow (prot)	1676	1765	1500	1676	1745		1676	1676			1699	1500
Flt Permitted	0.32	1.00	1.00	0.53	1.00		0.73	1.00			0.81	1.00
Satd. Flow (perm)	571	1765	1500	933	1745		1296	1676			1434	1500
Volume (vph)	488	364	92	3	255	20	69	7	4	25	7	442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	530	396	100	3	277	22	75	8	4	27	8	480
RTOR Reduction (vph)	0	0	35	0	4	0	0	3	0	0	0	391
Lane Group Flow (vph)	530	396	65	3	295	0	75	9	0	0	35	89
Turn Type	pm+pt		Perm	Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	31.8	31.8	31.8	12.5	12.5		9.1	9.1			9.1	9.1
Effective Green, g (s)	31.8	31.8	31.8	12.5	12.5		9.1	9.1			9.1	9.1
Actuated g/C Ratio	0.65	0.65	0.65	0.26	0.26		0.19	0.19			0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	717	1148	975	238	446		241	312			267	279
v/s Ratio Prot	c0.23	0.22			0.17			0.01				
v/s Ratio Perm	c0.25		0.07	0.00			0.06				0.02	0.32
v/c Ratio	0.74	0.34	0.07	0.01	0.66		0.31	0.03			0.13	0.32
Uniform Delay, d1	5.5	3.9	3.1	13.6	16.3		17.2	16.3			16.6	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	4.0	0.2	0.0	0.0	3.6		0.7	0.0			0.2	0.7
Delay (s)	9.5	4.0	3.2	13.6	19.9		17.9	16.3			16.8	17.9
Level of Service	A	A	A	B	B		B	B			B	B
Approach Delay (s)		6.8			19.9			17.7			17.8	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1676	1739		3252	1765	1500	1676	3353	1500	3252	3353	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1676	1739		3252	1765	1500	1676	3353	1500	3252	3353	1500
Volume (vph)	27	75	8	229	61	477	12	720	283	585	1192	101
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	82	9	249	66	518	13	783	308	636	1296	110
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	278	0	0	56
Lane Group Flow (vph)	29	87	0	249	66	518	13	783	30	636	1296	54
Turn Type	Prot			Prot		Free	Prot		Over	Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases						Free						6
Actuated Green, G (s)	2.1	9.1		7.3	14.3	75.6	6.4	21.9	7.3	21.3	36.8	36.8
Effective Green, g (s)	2.1	9.1		7.3	14.3	75.6	6.4	21.9	7.3	21.3	36.8	36.8
Actuated g/C Ratio	0.03	0.12		0.10	0.19	1.00	0.08	0.29	0.10	0.28	0.49	0.49
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	47	209		314	334	1500	142	971	145	916	1632	730
v/s Ratio Prot	0.02	0.05		0.08	0.04		0.01	c0.23	c0.21	0.20	c0.39	
v/s Ratio Perm						0.35						0.07
v/c Ratio	0.62	0.41		0.79	0.20	0.35	0.09	0.81	0.21	0.69	0.79	0.07
Uniform Delay, d1	36.4	30.8		33.4	25.8	0.0	31.9	24.9	31.5	24.2	16.2	10.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.7	1.3		12.9	0.3	0.6	0.3	5.0	0.7	2.3	2.8	0.0
Delay (s)	58.1	32.1		46.3	26.1	0.6	32.2	29.9	32.2	26.5	19.0	10.4
Level of Service	E	C		D	C	A	C	C	C	C	B	B
Approach Delay (s)		38.4			16.3			30.5			20.9	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	216	177	103	12	15	175
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	235	192	112	13	16	190

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	427	125	207
Volume Left (vph)	235	0	16
Volume Right (vph)	0	13	190
Hadj (s)	0.1	0.0	-0.5
Departure Headway (s)	4.7	4.6	4.6
Degree Utilization, x	0.55	0.16	0.27
Capacity (veh/h)	746	570	726
Control Delay (s)	9.1	7.9	8.1
Approach Delay (s)	9.1	7.9	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	8.6		
HCM Level of Service	A		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	16	141	183	45	49	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	153	199	49	53	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	506	59	65			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	506	59	65			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	85	87			
cM capacity (veh/h)	458	1006	1537			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	171	248	65
Volume Left	17	199	0
Volume Right	153	0	12
cSH	897	1537	1700
Volume to Capacity	0.19	0.13	0.04
Queue Length (ft)	17	11	0
Control Delay (s)	10.0	6.4	0.0
Lane LOS	A	A	
Approach Delay (s)	10.0	6.4	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	60	61	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	65	66	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	133	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	133	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	94	96			
cM capacity (veh/h)	826	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	65	66	0
Volume Left	0	66	0
Volume Right	65	0	0
cSH	1085	1623	1700
Volume to Capacity	0.06	0.04	0.00
Queue Length (ft)	5	3	0
Control Delay (s)	8.5	7.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	7.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	14.2%	ICU Level of Service	A
Analysis Period (min)	15		