Traffic Study

Walmart Supercenter

prepared for:

CARLSON
CONSULTING
ENGINEERS, INC.

California Avenue
and
S.E. 25th Street

Topeka, Kansas

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Project No.: P-1614

May 11, 2013

Traffic Impact Study
Prepared for the exclusive use of

Walmart Stores, Inc.

and

Carlson Consulting Engineers, Inc.

This Traffic Impact Study is prepared for the exclusive use of, Walmart Stores, Inc. and Carlson Consulting Engineers, Inc. and their respective successors and assigns.

Project No. P-1614
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EXECUTIVE SUMMARY

Peters & Associates Engineers, Inc., has conducted a traffic engineering study relating to a Walmart Supercenter proposed to be located on the east side of California Avenue and on the south side of S.E. 25th Street in Topeka, Kansas. The existing zoning of the site tracts are currently residential and commercial. Access to the proposed site will be provided by one access drive along California Avenue and one access drive along S.E. 25th Street. The primary focus of this report is to assess traffic operational characteristics of several nearby intersections and the access drive intersections proposed to serve the site so they provide acceptable operation. The commercial site is proposed to consist of a discount retail superstore and has provisions for one outlot as indicated on the project site plan.

Existing vehicle turning movement count data were gathered for the AM and PM peak hours for the following intersections (as requested by The City of Topeka) in the vicinity of the development (counts were made in April, 2013 while school was in session):

- California Avenue and S.E. 21st Street
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street (counts provided by the City of Topeka).

There are no intersection sight distance issues at the proposed access drive locations at California Avenue or at S.E. 25th Street.

Projected traffic volumes were calculated for full build-out of the proposed Walmart Supercenter and outlot development. The outlot land-use is not yet know, so it was assumed for completeness as a part of this study. These projected site-generated trips were added to the existing traffic volumes, which resulted in projected traffic volumes at initial completion of the proposed Walmart Supercenter site. Additionally, at the request of the City of Topeka, included in the projected traffic volumes at initial completion are projected traffic asso-

ciated with the nearby Dillon's expansion. Directional splits and proposed street assignments at the study intersections were made based on existing traffic volume gravity, transportation network, and regional use.

The City of Topeka provided a yearly growth rate of 0.5 percent per year to use to estimate 20-year future traffic volumes for the study intersections. The site-generated traffic volumes have been combined with the 20-year future horizon traffic volumes, which resulted in projected 20-year traffic volumes with full build-out of the proposed Walmart Supercenter site. Per the request of the City of Topeka, also included in the projected 20-year volumes are projected traffic associated with the nearby Dillon's expansion and projected traffic volumes associated with the re-development of a nearby vacant grocery store at the southwest corner of the intersection of California Avenue and S.E. 29th Street.

The Walmart Supercenter, once approvals are in place, is expected to be open in approximately one year.

Recommendations of this study are summarized as follows:

- It is recommended to construct Drive A at California Avenue to consist of an outbound right-turn lane, an outbound left-turn lane and an inbound receiving lane.

- It is recommended to construct Drive B at S.E. 25th Street to consist of an outbound right-turn lane, an outbound left-turn lane and an inbound receiving lane.

- It is recommended that California Avenue be widened to accommodate the addition of a southbound left-turn lane at Drive A.

- It is recommended that S.E. 25th Street be striped to accommodate a westbound left-turn lane at Drive B. Existing street width (approximately 40 feet) is adequate to accommodate the addition of a westbound left-turn lane.

- It is recommended that a fully-actuated traffic signal be installed at the intersection of California Avenue and Drive A coincident with the site development. This traffic signal should have provisions to be coordinated with the existing traffic signals along California Avenue.

- The recommended traffic signal at California Avenue and Drive A and the recommended roadway improvements to California Avenue and S.E. 25th Street must conform to City of Topeka design standards and will require approval by the City.

- The new access drives (Drives A and B) must conform to City of Topeka design standards and will require approval by the City.

INTRODUCTION

Peters & Associates Engineers, Inc., has conducted a traffic engineering study relating to a Walmart Supercenter proposed to be located on the east side of California Avenue and on the south side of S.E. 25th Street in Topeka, Kansas. The existing zoning of the site tracts are currently residential and commercial. Access to the proposed site will be provided by one access drive along California Avenue and one access drive along S.E. 25th Street. The primary focus of this report is to assess traffic operational characteristics of several nearby intersections and the access drive intersections proposed to serve the site so they provide acceptable operation. The commercial site is proposed to consist of a discount retail superstore and has provisions for one outlot as indicated on the project site plan (a reduced copy of the site plan is included in the Appendix for reference).

This is a report of methodology and findings relating to a traffic engineering study undertaken to:

- Evaluate existing traffic conditions in the vicinity of the site.

- Determine projected traffic volumes entering and exiting the proposed development at the nearby study intersections and the access drive intersections proposed to serve the site.

- Identify the effects on traffic operations for existing traffic in combination with site-generated traffic associated with the Walmart Supercenter development as proposed.

- Evaluate traffic operations for the following conditions:
  - Existing traffic conditions.
  - Projected traffic conditions at initial completion of the site development. (Includes projected traffic expected to be associated with the nearby Dillon's Expansion.)
  - Projected future 20-year traffic conditions with full build-out of the proposed development. (Includes

projected traffic expected to be associated with the nearby Dillon's Expansion and the re-development of a nearby vacant grocery store.)

- Projected no-build future 20-year traffic conditions without the proposed Walmart Supercenter development.

- Evaluate traffic operations for the nearby study intersections and the access drive intersections proposed to serve the site and make recommendations for improvements which may be necessary and appropriate for acceptable traffic operations for each of the projected traffic conditions.

In the following sections of this traffic study report are traffic data, study methods, findings and recommendations. The study is technical in nature. Analysis techniques employed are those most commonly used in the traffic engineering profession for traffic impact analysis. Certain data and calculations relative to traffic operational analysis are referenced in the report. Complete calculations and data are included in the Appendix of the report.

THE SITE

The location of the development is within the city limits of Topeka in Shawnee County, Kansas. The Walmart Supercenter development is proposed to be located on the east side of California Avenue and on the south side of S.E. 25th Street. The site is currently an undeveloped tract. The proposed development site location and vicinity are shown on Figures 1 and 2, which follow.

Access to the Walmart Supercenter site, as shown on the site plan, is proposed from one access drive (Drive A) intersecting California Avenue approximately 1,000 feet south of S.E. 25th Street and one access drive (Drive B) intersecting S.E. 25th Street approximately 950 feet east of California Avenue. Drives A and B are each proposed to be constructed to consist of an outbound right-turn lane, an outbound left-turn lane and an inbound receiving lane. Drive B will also be used as the primary truck drive.

The Topeka Metro is the area public transit system. Currently the Topeka Metro runs along the site frontage on California Avenue and along S.E. 25th Street. The nearest existing bus stops in the vicinity of the site are located on the southeast corner of California Avenue and S.E. 25th Street and another stop located along the south side of S.E. 25th Street approximately 250 feet east California Avenue.

Development of the proposed Walmart Supercenter site, as shown on the attached site plan, calls for the construction of a discount superstore, plus access drives and parking and has provisions for one outlot. As a part of t his development, sidewalks will be constructed along the site frontage to tie into the existing sidewalk system in the vicinity to accommodate the nearby pedestrians and bicyclists,

Figure 1 – Vicinity Map

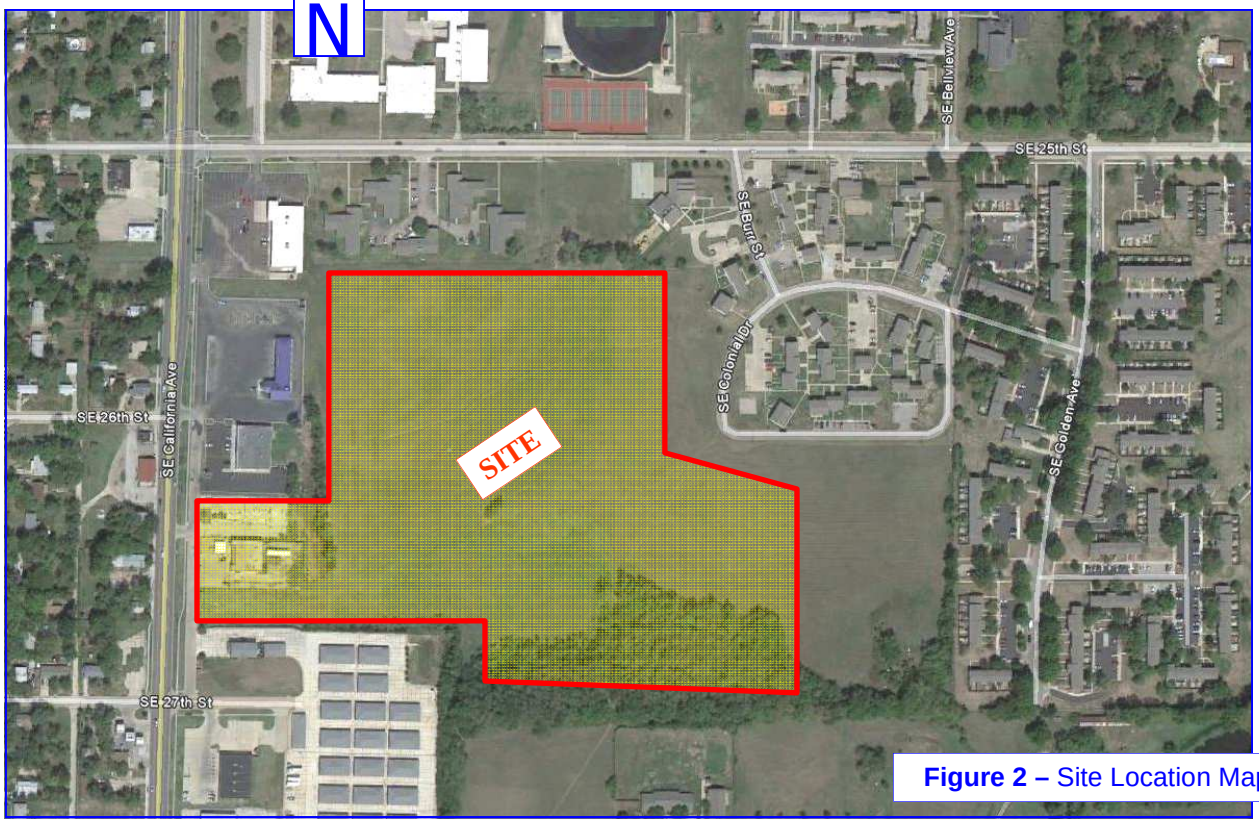


Figure 2 – Site Location Map

STREET SYSTEM

California Avenue, at the site, is a four-lane roadway consisting of two northbound lanes and two southbound lanes. At its intersections with S.E. 21st Street, S.E. 25th Street and S.E. 29th Street, California Avenue widens to accommodate the addition of northbound and southbound left-turn lanes at each of these locations. This roadway is constructed with curbs and gutters and there are sidewalks along both sides in the immediate vicinity of the site. The speed limit is 35 miles per hour in the vicinity. California Avenue is classified as a Principal Arterial on the City of Topeka Functional Classification Plan.

S.E. 25th Street, at the site, is an approximate 40-foot wide street with no pavement markings. At the westbound approach to California Avenue, S.E. 25th Street is striped to consist of a westbound left-turn lane, a westbound thru/right-turn lane and an eastbound receiving lane. This roadway is constructed with curbs and gutters and there are sidewalks along the south side of the street in the immediate vicinity of the site. The speed limit is 30 miles per hour in the vicinity. S.E. 25th Street is classified as a Collector on the City of Topeka Functional Classification Plan.

The following study intersections in the vicinity of the site are traffic signal controlled:

- California Avenue and S.E. 21st Street
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street .

There is an existing high school (Highland Park High School) located on the north side of S.E. 25th Street and on the east side of California Avenue. The east leg of the traffic signal controlled intersection of California Avenue and S.E. 24th Street is an access drive to the high school.

The following photos show the general layout of the aforementioned study intersections along California Avenue. Photos were taken at locations as indicated on the captions.

The Site

Looking north on California Avenue at the site.

S.E. 25th Street

Looking south on California Avenue toward S.E. 25th Street.

California Avenue

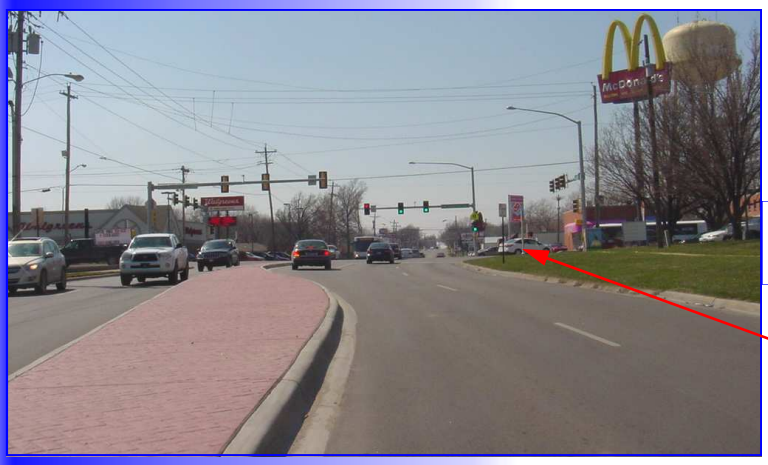
Looking west on S.E. 25th Street toward California Avenue.

S.E. 24th Street

Looking north on California Avenue Toward S.E. 24th Street.

Looking east on S.E. 24th Street toward California Avenue.

Looking north on California Avenue toward S.E. 29th Street.



Looking west on S.E. 29th Street toward California Avenue.

California Avenue

Looking north on California Avenue toward S.E. 21st Street.

EXISTING TRAFFIC CONDITIONS

Hourly, 24-hour traffic counts were made at the following location in the vicinity of the development by this consultant as a part of this study as follows:

Hourly, 24-hour traffic count data for these locations are summarized on Table 1 and Chart 1.

STREET	24-HOUR VOLUME	TABLE & CHART
California Avenue at the Site	17,932	Table 1/Chart 1

Traffic count data collected as a part of this study include weekday AM and PM peak hours vehicle turning movement counts at the following intersections:

- California Avenue and S.E. 21st Street. (Traffic volumes at California Avenue and S.E. 21st Street have been adjusted as shown on Figure 3, to account for the west leg of this intersection being under construction at the time of data collection. Adjustments were made by including counts on the west leg from previous traffic counts provided by the City.)
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street (PM peak hour counts only provided by the City of Topeka).

The peak hours vehicle turning movement count data at these intersections are summarized in the following peak hour turning movement Charts 2 thru 8 and are presented in more detail in the Appendix of this report.

The City of Topeka has required the PM peak hour to be analyzed as a part of this study. PM peak hour vehicle turning movement counts made as a part of this study are shown on Figure 3, "Existing Traffic Volumes - PM Peak Hour."

TIME	California Avenue at the Site		
	Northbound	Southbound	NB + SB
01:00 PM	506	539	1044
02:00 PM	556	547	1103
03:00 PM	577	803	1380
04:00 PM	629	834	1463
05:00 PM	659	820	1479
06:00 PM	558	637	1195
07:00 PM	480	534	1014
08:00 PM	459	451	910
09:00 PM	280	322	602
10:00 PM	215	204	420
11:00 PM	118	130	248
12:00 AM	56	57	112
01:00 AM	38	48	86
02:00 AM	36	53	89
03:00 AM	39	25	64
04:00 AM	54	19	73
05:00 AM	132	70	203
06:00 AM	306	180	487
07:00 AM	968	447	1415
08:00 AM	494	387	881
09:00 AM	405	369	774
10:00 AM	391	393	783
11:00 AM	464	534	997
12:00 PM	534	576	1110
24-Hour Total:	**8954**	**8978**	**17932**

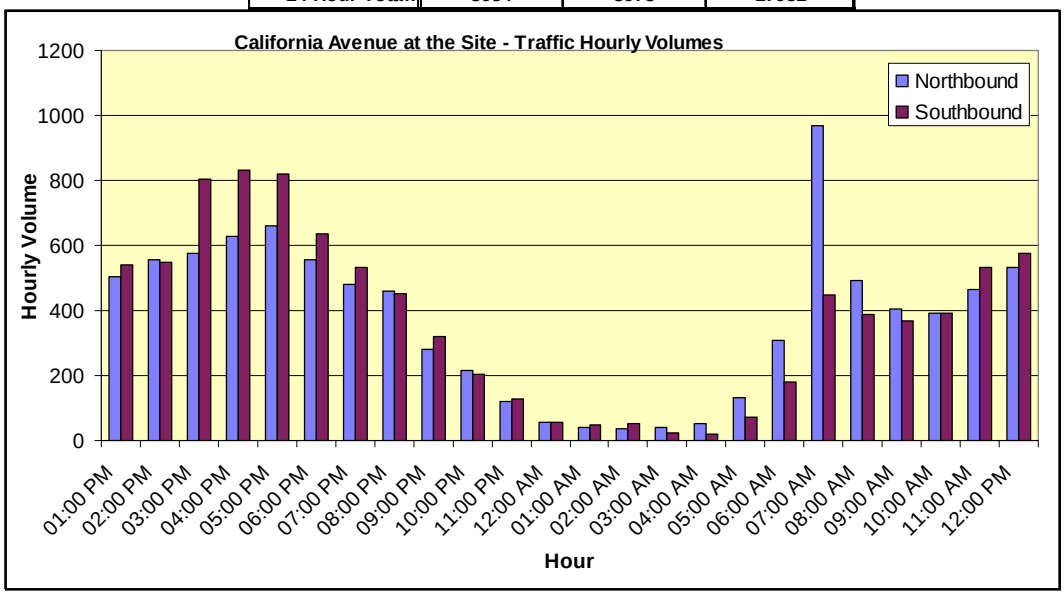


Table 1—Chart 1 24-Hour Traffic Counts
California Avenue at the Site

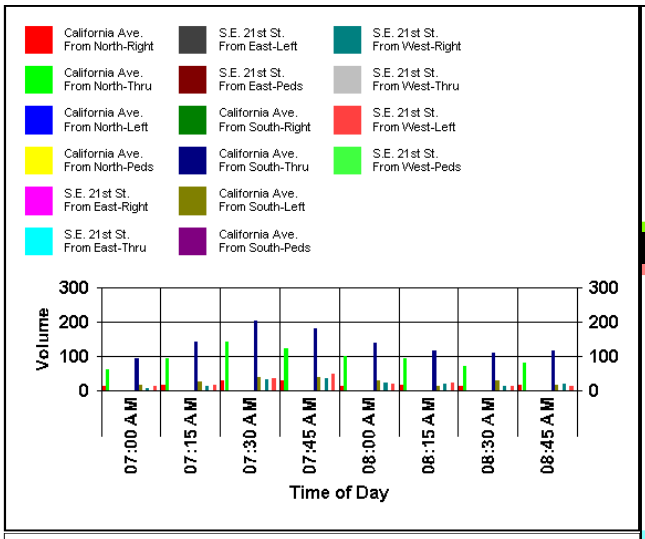


Chart 2
AM Peak Hours Turning Movement Count Data
S.E. 21st Street and California Avenue
(Un-adjusted for east leg construction closure)

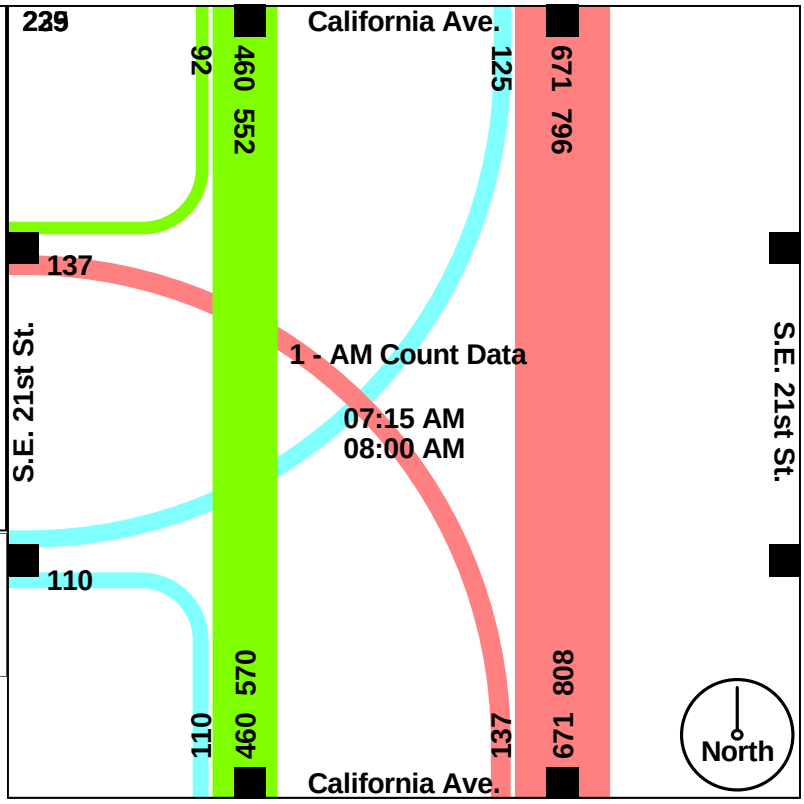
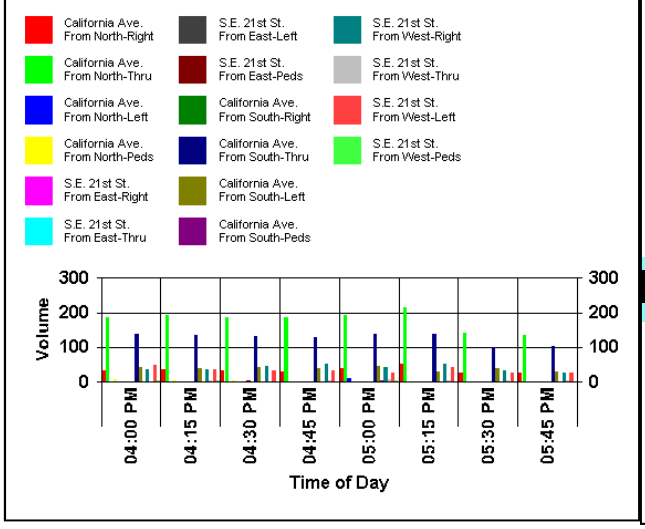
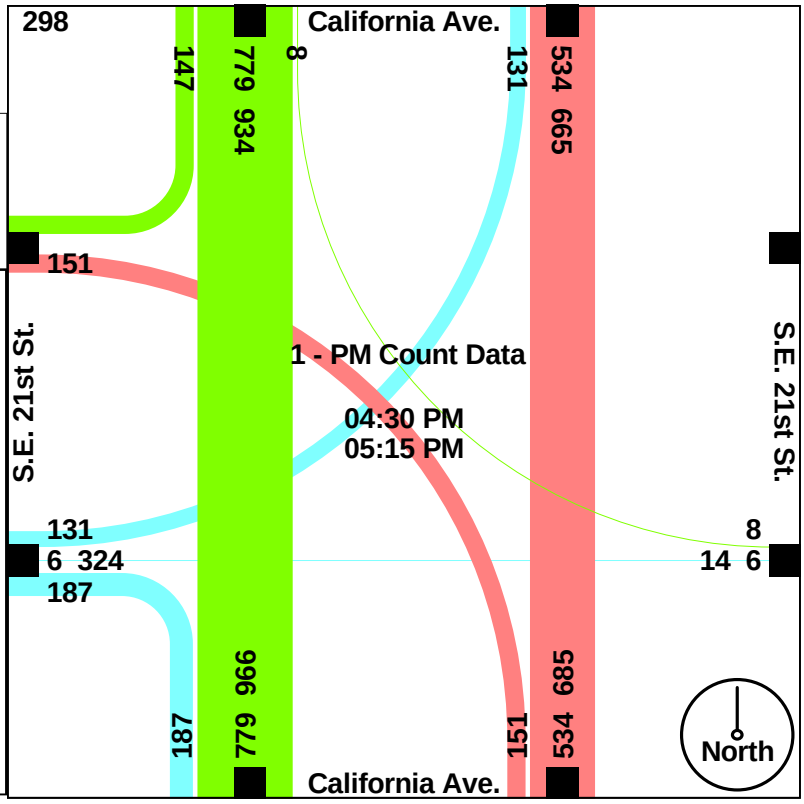


Chart 3
PM Peak Hours Turning Movement Count Data
S.E. 21st Street and California Avenue
(Un-adjusted for east leg construction closure)





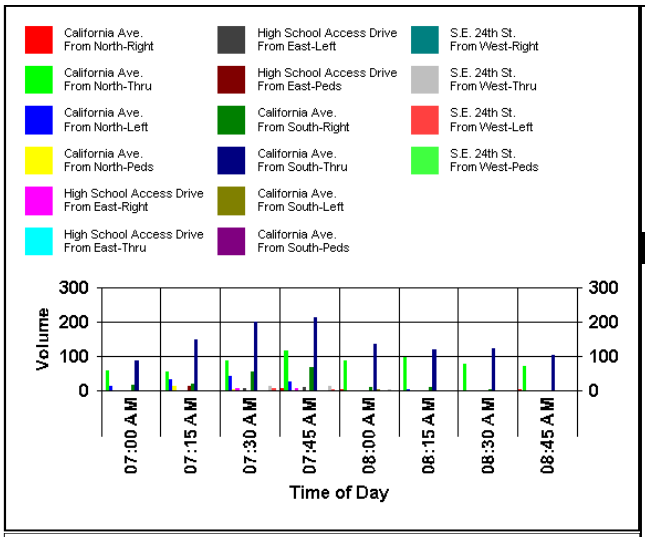


Chart 4
AM Peak Hours Turning Movement Count Data
S.E. 24th Street and California Avenue

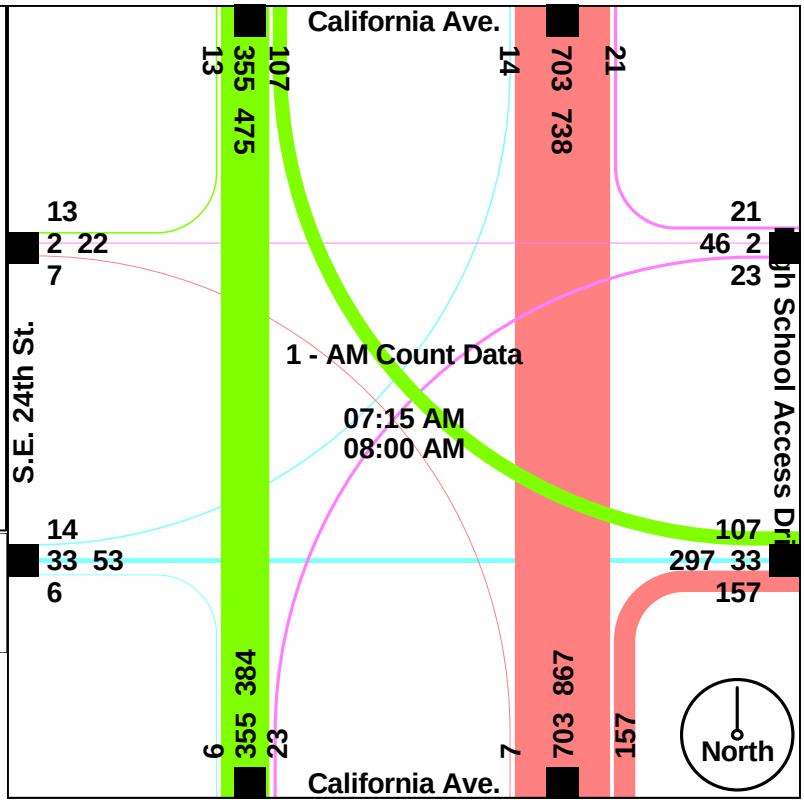
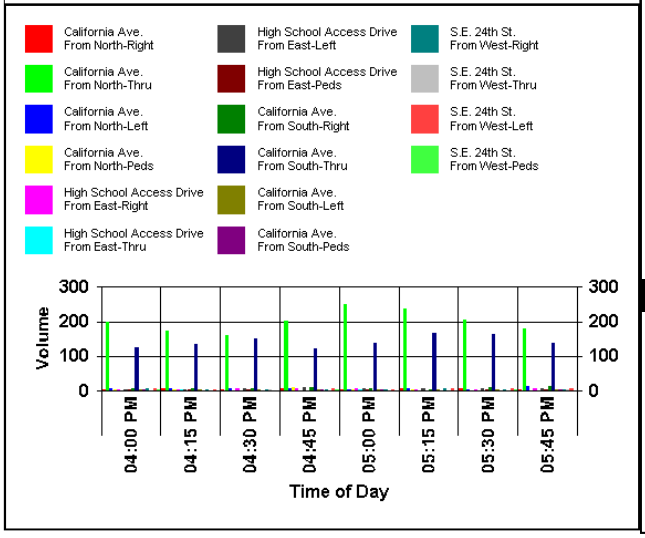
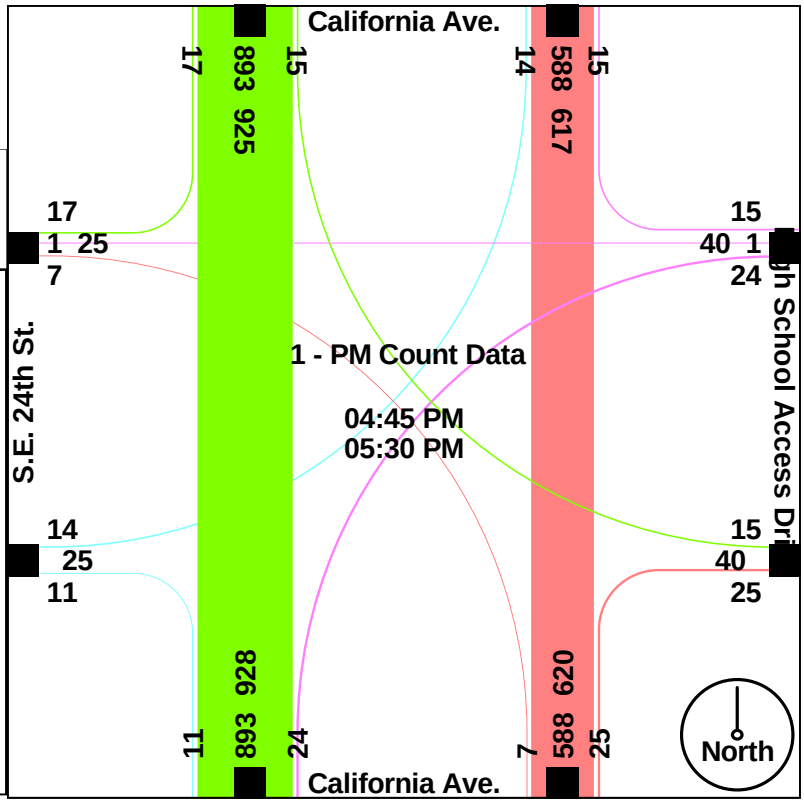


Chart 5
PM Peak Hours Turning Movement Count Data
S.E. 24th Street and California Avenue





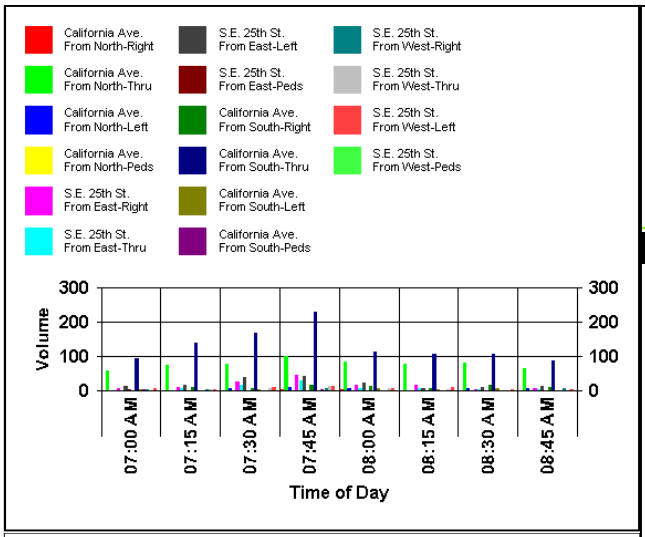


Chart 6
AM Peak Hours Turning Movement Count Data
S.E. 25th Street and California Avenue

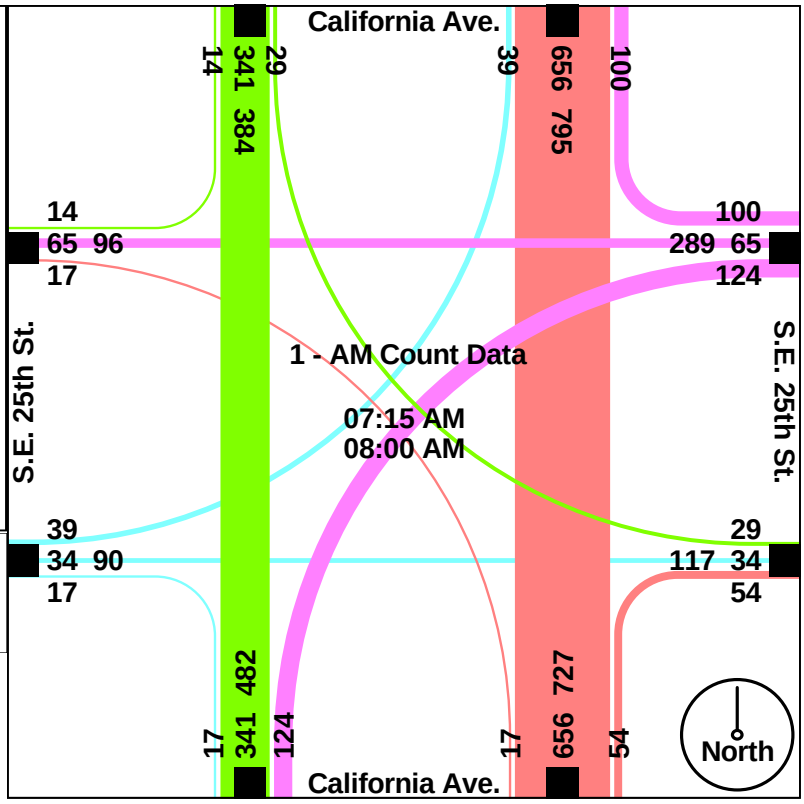
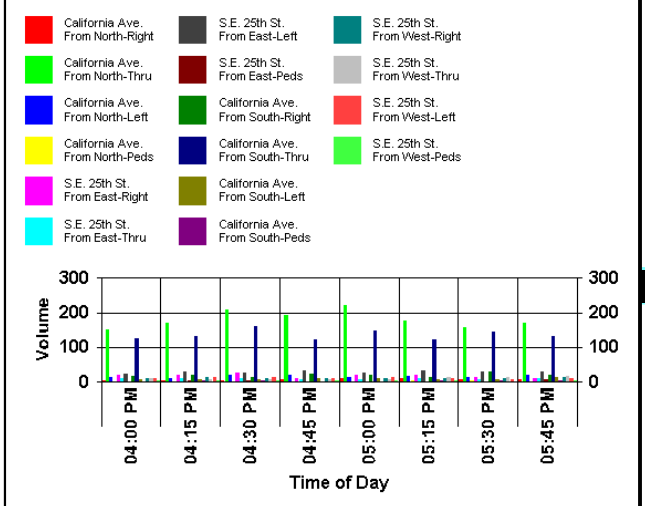
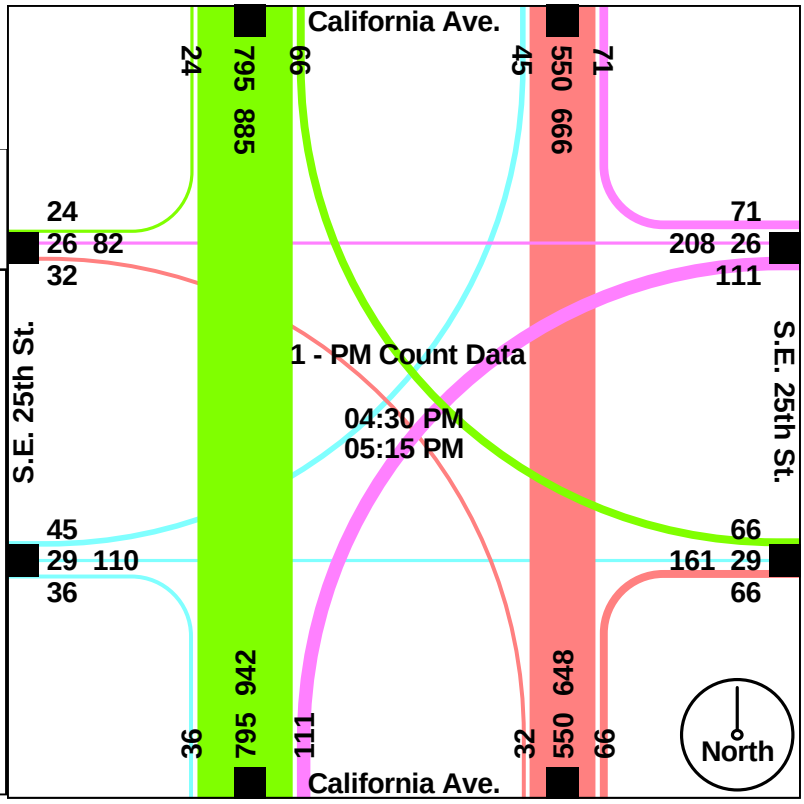


Chart 7
PM Peak Hours Turning Movement Count Data
S.E. 25th Street and California Avenue





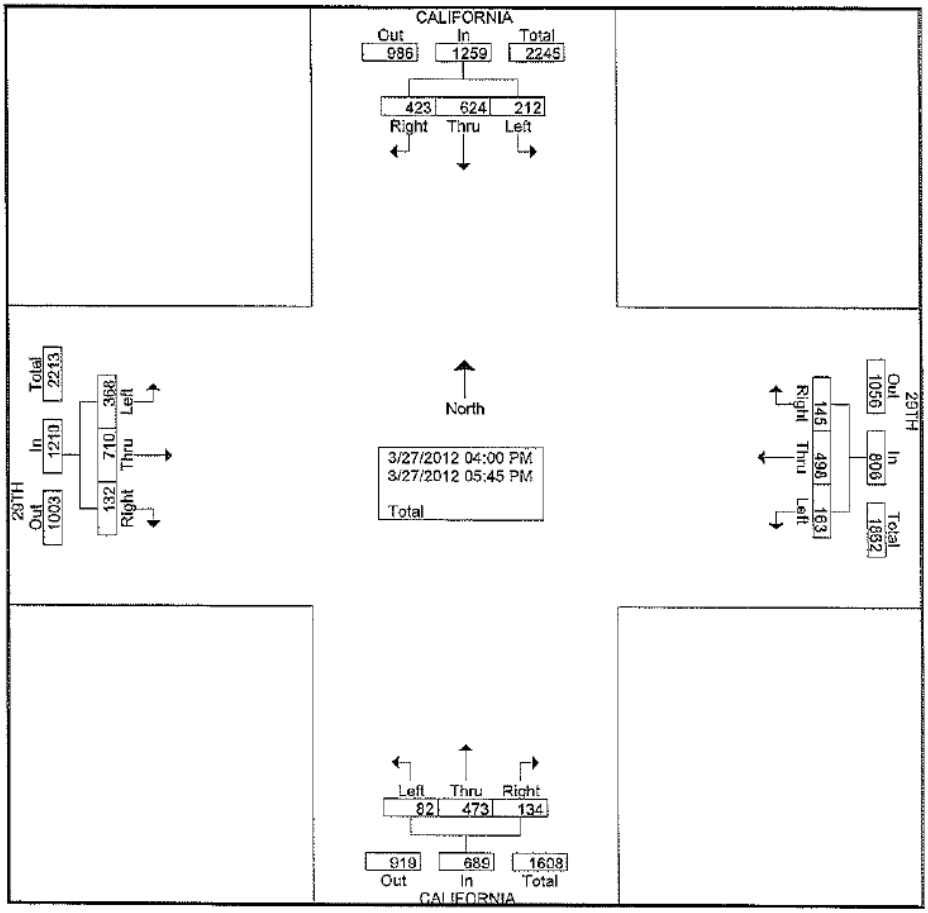


Chart 8
AM Peak Hours Turning Movement Count Data
S.E. 29 Street and California Avenue
(2-Hour Count Data Provided by the City)

TRIP GENERATION and SITE TRAFFIC PROJECTIONS

The Trip Generation, an Informational Report (8th Edition), 2008, published by the Institute of Transportation Engineers (ITE) and The Trip Generation Software (Version 6 by Microtrans), were utilized in calculating the magnitude of traffic volumes expected to be generated by the proposed land-uses of the Walmart Supercenter development. These are reliable sources for this information and are universally used in the traffic engineering profession.

Using the selected trip generation rates, calculations were made as a part of this study to provide a reliable estimate of traffic volumes that can be expected to be associated with the development as proposed. Applying the appropriate trip-generation rates to the land uses proposed for this development makes these calculations. The land use for the proposed outlot was assumed for completeness. Results of these calculations are summarized on Table 2, "Summary of Trip-Generation."

These calculations indicate that approximately 9,639 vehicle trips (combined in and out) per average weekday are projected to be generated by the proposed Walmart Supercenter and assumed outlot land uses on this site. Of this total, approximately 397 vehicle trips are estimated during the traffic conditions of the AM peak hour and approximately 812 vehicle trips are estimated during the traffic conditions of the PM peak hour.

TRACT	PROPOSED LAND USE	APPROXIMATE SIZE	ITE CODE	24-HOUR TWO-WAY WEEKDAY TRIPS	AM PEAK HOUR TRIPS		PM PEAK HOUR TRIPS	
					ENTER	EXIT	ENTER	EXIT
Walmart	Discount Superstore	155,288 Sq. Ft.	813	8,250	146	113	351	365
Outlot 1	*Assumed Fast-Food Restaurant	3,500 Sq. Ft.	934	1,389	70	68	50	46
			TOTALS:	**9,639**	**216**	**181**	**401**	**411**
			TOTAL ENTERING + EXITING		**397**		**812**	

**The volumes for the outlot land-use have been adjusted to reflect 20% internal trip capture.*

Table 2 – Summary of Trip-Generation

The data for the outlot land use has been adjusted for "internal trip capture" (i.e. multi-purpose trips within the site as opposed to new trips for each site land use).

These data have been adjusted for "pass-by" trips (i.e. that portion of the site-destined traffic likely to come from the existing adjacent street traffic stream). Table 3, "Trip-Generation Adjustments," lists the specific values used to adjust raw trip-generation data for "pass-by."

Retail commercial traffic, as will be associated with site, ordinarily contributes greater during the PM peak hour than the AM peak hour to the adjacent street traffic conditions during the on-street AM and PM peak traffic hours. Additionally, the City of Topeka has required this study to analyze the PM peak hour only. Accordingly, the PM peak traffic period of the adjacent streets is the traffic operating conditions which have warranted primary traffic analysis as a part of this study.

	Anchor: Walmart Supercenter 155,288 SF	Outparcel: Fas-Food Restaurant 3,500 SF	Development Totals
Parcel Number	1	2	Σ
Daily External Trips	8,599	1,213	**9,812**
% of External Trips	**87.64%**	**12.36%**	**100.00%**
% Pass-By Trips	17.20%	50.00%	21.25%
Net New Trips	7,120	607	**7,726**
% Net New Trips	**92.15%**	**7.85%**	**100.00%**

Table 3 – Trip-Generation Adjustments

TRAFFIC VOLUME ASSIGNMENTS

Once projected traffic was estimated for the site, directional distributions were made to reflect the percent of anticipated left and right-turns at the study intersections. Directional distribution percentages used in this study are shown on Figure 4, "Directional Distribution - Site Traffic." The directional distribution percentages for site traffic have been equated to percentage turns for each movement at the study intersections. These values are shown on:

- Figure 5, "Entering Traffic Percentage Turns"
- Figure 6, "Exiting Traffic Percentage Turns."

The site-generated traffic volumes shown on Figure 7, "Site-Generated Traffic Volumes - PM Peak Hour," result from applying the projected entering and exiting percentages shown on Figures 5 and 6 to the corresponding projected site-generated traffic volumes summarized on Table 2, "Summary of Trip-Generation."

The site-generated traffic volumes shown on Figure 7 and corresponding existing background traffic volumes shown on Figure 3 have been combined and the results are depicted on Figure 8, "Projected Traffic Volumes at initial Completion - PM Peak Hour." Additionally, at the request of the City of Topeka, projected traffic volumes associated with the nearby Dillon's expansion have been assumed and accounted for on traffic volumes depicted on Figure 8.

The City of Topeka provided a yearly growth rate of 0.5 percent per year to use to estimate 20-year future traffic volumes for the study intersections. The site-generated traffic volumes have been combined with the 20-year future horizon traffic volumes, which resulted in projected 20-year traffic volumes with full build-out of the proposed Walmart Supercenter site. Per the request of the City of Topeka, also included in the projected 20-year volumes are projected traffic associated with the nearby Dillon's expansion and projected traffic volumes associated with the re-development of a nearby vacant grocery store at the southwest corner of the

intersection of California Avenue and S.E. 29th Street. The results are depicted on Figure 9, "Full Build-Out Projected 20-Year Traffic Volumes - PM Peak Hour."

No-build projected 20-year traffic volumes are shown on Figure 10, "No-Build Projected 20-Year Traffic Volumes - PM Peak Hour."

Traffic volumes shown on Figures 3, 8, 9 and 10 are the values used in capacity and level of service calculations conducted as a part of this study. The effect of existing background traffic (i.e. the adjacent street non-site traffic which exists) and projected traffic associated with the site development as well as background growth, plus planned vicinity development by others has thus been accounted for in this analysis.

CAPACITY and LEVEL OF SERVICE

Generally, the "capacity" of a street is a measure of its ability to accommodate a certain magnitude of moving vehicles. It is a rate as opposed to a quantity, measured in terms of vehicles per hour. More specifically, street capacity refers to the maximum number of vehicles that a street element (e.g. an intersection) can be expected to accommodate in a given time period under the prevailing roadway and traffic conditions.

Traffic operational analysis for the study intersections were evaluated based on the methodologies outlined in the Highway Capacity Manual, 2010 Edition, published by the Transportation Research Board. The operating conditions at an intersection are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. LOS “A” represents the most desirable condition with free-flow movement of traffic with minimal delays. LOS “F” generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. The table below shows the upper limit of delay associated with each level of service for signalized and un-signalized intersections.

Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Un-Signalized
A	< 10 Seconds	< 10 Seconds
B	< 20 Seconds	< 15 Seconds
C	< 35 Seconds	< 25 Seconds
D	< 55 Seconds	< 35 Seconds
E	< 80 Seconds	< 50 Seconds
F	≥ 80 Seconds	≥ 50 Seconds

The LOS rating deemed acceptable varies by community, facility type and traffic control device. A LOS "D" is the desirable goal for movements at un-signalized intersections that must yield to other movements; however, a LOS "E" or "F" is often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location is deemed undesirable for signalization for other reasons. For signalized intersections, level of service and average delay relate to all vehicles using the intersection. LOS "D" is the typical desirable standard for signalized intersections. All study intersections were evaluated using the Synchro analysis software package based on Highway Capacity Manual methods. This computer program has been proven to be reliable when used to analyze capacity and levels of traffic service under various operating conditions. Detailed results for all capacity calculations are included in the Appendix. The adjacent street weekday PM peak traffic period was used for these calculations. Factors included in the analysis are as follows:

- Existing traffic volumes and patterns.
- Directional distribution of projected traffic volumes.
- Existing, planned and proposed intersection geometry (including elements such as turn lanes, curb radii, etc.).
- Existing background traffic volumes and projected site-generated volumes for projected traffic conditions.
- Background traffic growth.
- Traffic generated by developments by others.
- Existing or proposed traffic control.

The traffic signal data used in the capacity analysis for the traffic study reflects existing timings provided by the City of Topeka. Additionally, a peak hour factor of 0.92 has been used in the analysis of this study.

CAPACITY ANALYSIS

Level of Service Analysis Results

Existing Traffic Conditions

Capacity and level of service analysis was performed for existing traffic volumes, lane geometry and traffic control for the PM peak hour for the following study intersections:

- California Avenue and S.E. 21st Street*
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street.

**Traffic volumes at California Avenue and S.E. 21st Street have been adjusted to account for the west leg of this intersection being under construction at the time of data collection. Adjustments were made on the west leg of this intersection using City provided previous traffic counts at this intersection.*

As indicated in Table 4, "Level of Service Summary – Existing Traffic Conditions," all of the intersections currently operate at what calculates as an acceptable LOS "C" or better during the existing conditions of the PM peak hour at the study intersections. Additionally, all vehicle movements currently operate at what calculates as an acceptable LOS "D" or better for existing traffic conditions at the study intersections for the PM peak hour under existing traffic conditions.

Traffic volumes used for this analysis are shown on Figure 3, "Existing Traffic Volumes - PM Peak Hour."

EXISTING TRAFFIC CONDITIONS		Traffic Control	Eastbound Left-Turn	Eastbound Thru	Eastbound Right-Turn	Westbound Left-Turn	Westbound Thru	Westbound Right-Turn	Northbound Left-Turn	Northbound Thru	Northbound Right-Turn	Southbound Left-Turn	Southbound Thru	Southbound Right-Turn	Overall Intersection	Avg. Control Delay Seconds / Vehicle	Intersection Capacity Utilization (%)
INTERSECTION	PEAK HR		PEAK HOUR - LEVEL OF SERVICE														
California Avenue and S.E. 21st Street	PM	SIGNAL	D	C	C	D	C		D	B		D	C		C	27.4	65.3%
California Avenue and S.E. 24th Street	PM	SIGNAL	B			B			B	B		A	A		A	6.4	46.8%
California Avenue and S.E. 25th Street	PM	SIGNAL	C	B		C	B		A	A		A	A		B	10.9	49.7%
California Avenue and S.E. 29th Street	PM	SIGNAL	D	C		C	C		C	C		C	B		C	23.4	52.7%

Table 4 - Level of Service Summary - Existing Traffic Conditions

Projected Traffic Conditions at Initial Completion

Capacity and LOS analysis was performed for projected traffic conditions at initial completion of the site development for the PM peak hour for the following intersections:

- California Avenue and S.E. 21st Street
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street.
- California Avenue and Drive A
- S.E. 25th Street and Drive B.

Traffic volumes used for these projected traffic conditions are shown on Figure 8, "Projected Traffic Volumes at Initial Completion - PM Peak Hour." The operating conditions projected to exist at the study intersections are summarized in Table 5, "Level of Service Summary - Projected Traffic Conditions at Initial Completion." Additionally, projected traffic volumes associated with the nearby Dillon's expansion have been assumed and accounted for on traffic volumes depicted on Figure 8

As indicated in Table 5, all of the study intersections are expected to continue to operate at what calculates as an acceptable LOS "C" or better during the PM peak hour for these projected conditions at initial completion. Additionally, all vehicle movements are expected to operate at what calculates as LOS "D" or better for existing traffic conditions at the study intersections for the PM peak hour.

PROJECTED TRAFFIC CONDITIONS AT INITIAL COMPLETION		Traffic Control	Eastbound Left-Turn	Eastbound Thru	Eastbound Right-Turn	Westbound Left-Turn	Westbound Thru	Westbound Right-Turn	Northbound Left-Turn	Northbound Thru	Northbound Right-Turn	Southbound Left-Turn	Southbound Thru	Southbound Right-Turn	Overall Intersection	Avg. Control Delay Seconds / Vehicle	Intersection Capacity Utilization (%)
INTERSECTION	PEAK HR		PEAK HOUR - LEVEL OF SERVICE														
California Avenue and S.E. 21st Street	PM	SIGNAL	D	C	C	D	D		D	B		D	D		C	34.2	71.6%
California Avenue and S.E. 24th Street	PM	SIGNAL	D			D			A	A		A	A		A	5.0	72.2%
California Avenue and S.E. 25th Street	PM	SIGNAL	D	D		D	D		A	A		A	A		B	14.3	60.9%
California Avenue and S.E. 29th Street	PM	SIGNAL	D	C		C	C		D	C		D	B		C	25.5	69.8%
California Avenue and Drive A	PM	SIGNAL				C		B		A		A	A		A	6.0	47.7%
S.E. 25th Street and Drive B	PM	"STOP" SIGN		A		A	A		B		A				n/a	2.4	30.9%

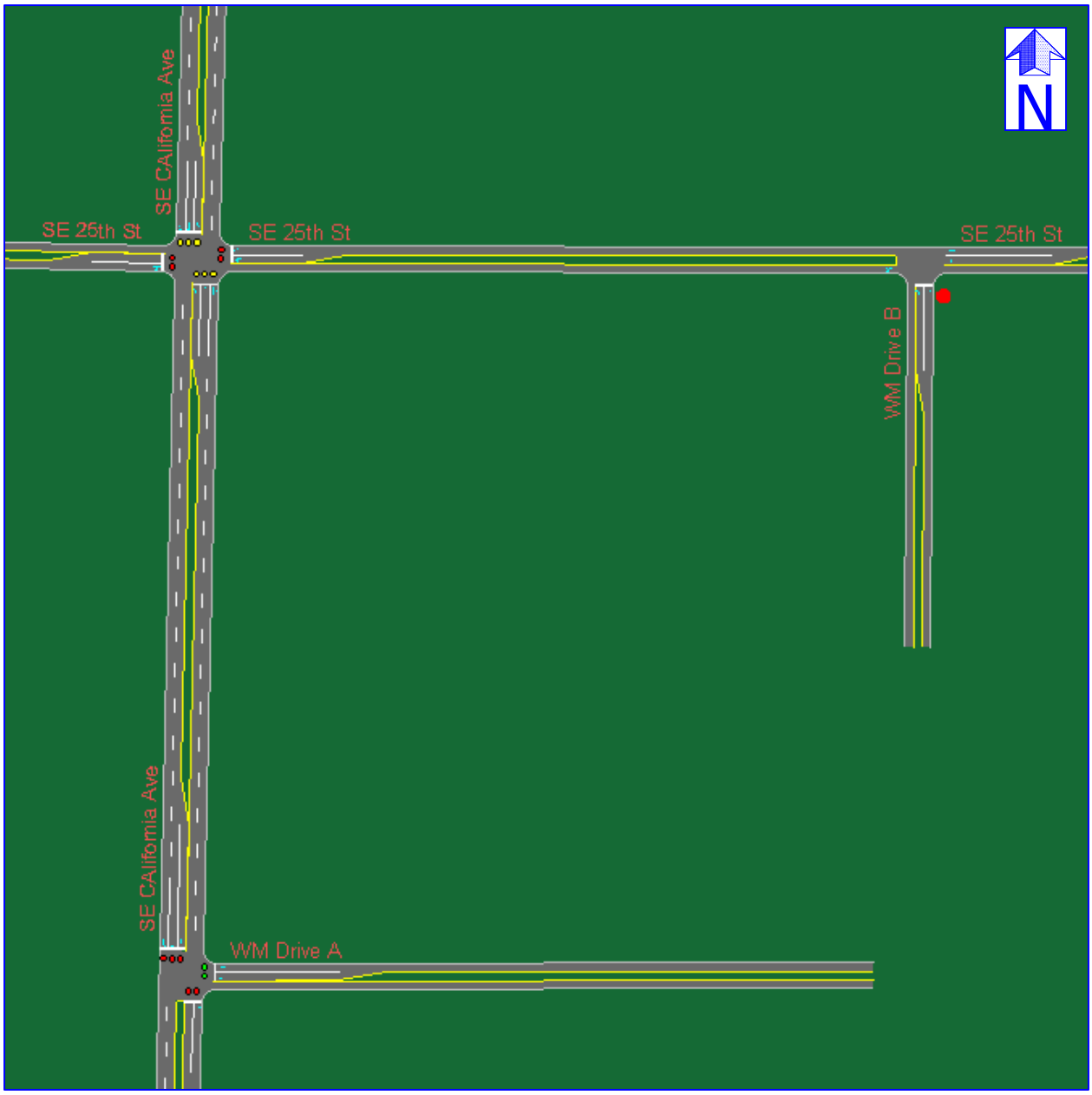
Table 5 - Level of Service Summary - Projected Traffic Conditions at Initial Completion

Projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for all of the study intersections.

For these projected traffic conditions, analysis was conducted with existing lane geometry and traffic control at the study intersections plus the following assumed (depicted schematically on the following page):

- California Avenue constructed to accommodate the addition of a southbound left-turn lane at Drive A.
- S.E. 25th Street striped to accommodate a westbound left-turn lane at Drive B.
- Drives A and B each constructed to consist of an outbound lane right-turn lane, an outbound left-turn lane and an inbound receiving lane.
- With traffic signal control at the intersection of California Avenue and Drive A.

The recommended widening on California Avenue and signal control at the intersection of California Avenue and Drive A would allow acceptable traffic operations and add safety and convenience for this intersection.



Projected Traffic Conditions Intersection and Roadway Geometry

Full Build-Out Projected 20-Year Traffic Conditions

Capacity and LOS analysis was performed for full build-out projected 20-year traffic conditions for the PM peak hour for the following study intersections:

- California Avenue and S.E. 21st Street
- California Avenue and S.E. 24th Street
- California Avenue and S.E. 25th Street
- California Avenue and S.E. 29th Street.
- California Avenue and Drive A
- S.E. 25th Street and Drive B.

Traffic volumes used for these projected traffic conditions are shown on Figure 9, "Full Build-Out Projected 20-Year Traffic Volumes - PM Peak Hour." The City of Topeka provided a yearly growth rate of 0.5 percent per year to use to estimate 20-year future traffic volumes for the study intersections. The site-generated traffic volumes have been combined with the 20-year future horizon traffic volumes, which resulted in projected 20-year traffic volumes with full build-out of the proposed Walmart Supercenter site. Per the request of the City of Topeka, also included in the projected 20-year volumes are projected traffic associated with the nearby Dillon's expansion and projected traffic volumes associated with the re-development of a nearby vacant grocery store at the southwest corner of the intersection of California Avenue and S.E. 29th Street. The operating conditions projected to exist at the study intersection are summarized in Table 6, "Level of Service Summary - Full Build-Out Projected 20-Year Traffic Conditions."

FULL BUILD-OUT PROJECTED 20-YEAR TRAFFIC CONDITIONS		Traffic Control	Eastbound Left-Turn	Eastbound Thru	Eastbound Right-Turn	Westbound Left-Turn	Westbound Thru	Westbound Right-Turn	Northbound Left-Turn	Northbound Thru	Northbound Right-Turn	Southbound Left-Turn	Southbound Thru	Southbound Right-Turn	Overall Intersection	Avg. Control Delay Seconds / Vehicle	Intersection Capacity Utilization (%)
INTERSECTION	PEAK HR		PEAK HOUR - LEVEL OF SERVICE														
California Avenue and S.E. 21st Street	PM	SIGNAL	D	D	D	D	D		D	B		D	D		**D**	41.8	77.2%
California Avenue and S.E. 24th Street	PM	SIGNAL	D			D			A	A		A	A		**A**	5.2	77.8%
California Avenue and S.E. 25th Street	PM	SIGNAL	D	D		D	D		A	A		B	A		**B**	15.3	64.6%
California Avenue and S.E. 29th Street	PM	SIGNAL	D	C		D	C		D	C		D	C		**C**	28.8	63.3%
California Avenue and Drive A	PM	SIGNAL				C		C		A		A	A		**A**	6.1	49.9%
S.E. 25th Street and Drive B	PM	"STOP" SIGN		A		A	A		B		A				**n/a**	2.3	30.9%

Table 6 - Level of Service Summary - Full Build-Out Projected 20-Year Traffic Conditions

As indicated in Table 6, for the these projected 20-year traffic conditions at the study intersections, intersection overall LOS are expected to continue to operate at what calculates as an acceptable LOS "D" and all vehicle movements at the study intersections are expected to continue to operate at what calculates as a LOS "D" or better for the PM peak hour.

Projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for all of the study intersections with the recommended improvements assumed (same improvements as previously stated in the projected traffic conditions at initial completion).

No-Build Projected 20-Year Traffic Conditions

Capacity and LOS analysis was performed for no-build projected 20-year traffic conditions (without the traffic volumes associated with the site development) to include City-provided growth rate of 0.5 percent per year for 20 years, plus, per the request of the City, projected traffic associated with the nearby Dillon's expansion and projected traffic volumes associated with the re-development of a nearby vacant grocery store at the southwest corner of the intersection of California Avenue and S.E. 29th Street for the PM peak hour for the study intersections.

Traffic volumes used for these projected traffic conditions are shown on Figure 10, "No-Build Projected 20-Year Traffic Volumes - PM Peak Hour." The operating conditions projected to exist at the study intersection are summarized in Table 7, "Level of Service Summary - No-Build Projected 20-Year Traffic Conditions." As indicated in Table 7, all of the study intersections overall LOS is projected to operate at what calculates as an acceptable LOS "C" or better during the PM peak hour and all vehicle movements for the projected 20-year traffic conditions at the study intersections are expected to operate at what calculates as LOS "D" or better for the PM peak hour.

Projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for all of the study intersections.

NO-BUILD PROJECTED 20-YEAR TRAFFIC CONDITIONS		Traffic Control	Eastbound Left-Turn	Eastbound Thru	Eastbound Right-Turn	Westbound Left-Turn	Westbound Thru	Westbound Right-Turn	Northbound Left-Turn	Northbound Thru	Northbound Right-Turn	Southbound Left-Turn	Southbound Thru	Southbound Right-Turn	Overall Intersection	Avg. Control Delay Seconds / Vehicle	Intersection Capacity Utilization (%)
INTERSECTION	PEAK HR		PEAK HOUR - LEVEL OF SERVICE														
California Avenue and S.E. 21st Street	PM	SIGNAL	D	D	C	D	D	D	B	D	D	C	34.0	71.1%	
California Avenue and S.E. 24th Street	PM	SIGNAL	D			D		A	A	A	A	A	4.9	51.8%	
California Avenue and S.E. 25th Street	PM	SIGNAL	D	D		D	D	A	A	A	A	B	12.7	53.2%	
California Avenue and S.E. 29th Street	PM	SIGNAL	D	C		D	C	D	C	D	B	C	26.4	67.8%	

Table 7 - Level of Service Summary - No-Build Projected 20-Year Traffic Conditions

TRAFFIC SIGNAL WARRANTS ANALYSIS

In evaluating the need for a traffic signal, certain established warrants must be examined by a comprehensive investigation of traffic conditions and physical characteristics of the location. The decision to install a traffic signal at a particular location must be evaluated quantitatively relative to these warrants. These warrants, as specified in the Manual on Uniform Traffic Control Devices (MUTCD), are described in detail in the appendix of this report. They are summarized as follows:

- **Warrant One: Eight-Hour Vehicular Volume**
- **Warrant Two: Four-Hour Vehicular Volume**
- **Warrant Three: Peak Hour**
- **Warrant Four: Pedestrian Volume**
- **Warrant Five: School Crossing**
- **Warrant Six: Coordinated Signal System**
- **Warrant Seven: Crash Experience**
- **Warrant Eight: Roadway Network**

Traffic signal warrants analysis was made for projected traffic volumes at initial completion of the development for the intersection of California Avenue and Drive A.

Based on volume criteria set out in the MUTCD, it was found that three traffic signal warrants are projected to be met for the intersection of California Avenue and Drive A at initial completion of the development of the Walmart Supercenter site as proposed. Volumes are projected to be sufficient at this intersection to satisfy Warrants 1, 2 and 3. Traffic signal control would be appropriate for this intersection to coincide with the development as proposed. The traffic signal warrants analysis results for this intersection are summarized in Table 8, “Traffic Signal Warrants Results - California Avenue and Drive A - Projected Traffic Conditions at Initial Completion of the Site.” Traffic signal warrants are expected to continue to be met with the additional 20-year background traffic growth included.

FINAL RESULTS: **Traffic Signal Warrants Analysis**

Projected Traffic Conditions

Major St.: California Avenue
Minor St.: Drive A

			Hour warrant was met:						
			VOLUME		COMB.			4 Hr.	Peak
			600	900	480		720		
			150	75	120		60		
	SUM	MAX.	Warrant Number						
HOUR	MAJOR	MINOR	1A	1B	1AB			2	3
7:00	1516	49	0	0	0	0	0	0	0
8:00	950	42	0	0	0	0	0	0	0
9:00	875	42	0	0	0	0	0	0	0
10:00	911	58	0	0	0	0	0	0	0
11:00	1220	60	0	0	0	0	1	0	0
12:00	1326	105	0	1	0	0	1	1	0
13:00	1345	111	0	1	0	0	1	1	0
14:00	1401	112	0	1	0	0	1	1	0
15:00	1608	104	0	1	0	0	1	1	0
16:00	1733	106	0	1	0	0	1	1	1
17:00	1936	127	0	1	1	1	1	1	1
18:00	1444	122	0	1	1	1	1	1	0
19:00	1257	127	0	1	1	1	1	1	0
20:00	1119	110	0	1	0	0	1	0	0
21:00	813	94	0	0	0	0	1	0	0
			0	9		3		8	2

This intersection SATISFIES the warrants for signalization as outlined in the "M.U.T.C.D."

Table 8
Traffic Signal Warrants Results
California Avenue and Drive A
Projected Traffic Conditions
at Initial Completion.

FINDINGS and RECOMMENDATIONS

Findings of this study are summarized as follows:

- For the development of the Walmart Supercenter site as proposed, approximately 9,639 vehicle trips (combined in and out) per average weekday are projected to be generated by the land uses land uses on this site. Of this total, approximately 397 vehicle trips are estimated during the traffic conditions of the AM peak hour and approximately 812 vehicle trips are estimated during the traffic conditions of the PM peak hour.

- Capacity and level of service analysis was performed for existing traffic volumes, lane geometry and traffic control for the PM peak hour for the study intersections. All of the intersections currently operate at what calculates as an acceptable LOS "C" or better during the existing conditions of the PM peak hour at the study intersections. Additionally, all vehicle movements currently operate at what calculates as an acceptable LOS "D" or better for existing traffic conditions at the study intersections for the PM peak hour under existing traffic conditions.

- Capacity and LOS analysis was performed for projected traffic conditions at initial completion of the site development for the PM peak hour for the study intersections. All of the study intersections are expected to continue to operate at what calculates as an acceptable LOS "C" or better during the PM peak hour for these projected conditions at initial completion with roadway and traffic signal improvements proposed. Additionally, all vehicle movements are expected to operate at what calculates as LOS "D" or better (most of which are projected to operate at LOS "C" of better) for existing traffic conditions at the study intersections for the PM peak hour. Projected average control delay (seconds per vehicle) and intersection capacity utilization are expected to be acceptable for all of the study intersections.

- Based on volume criteria set out in the MUTCD, it was found that three traffic signal warrants are projected to be met for the intersection of California Avenue and Drive A at initial completion of the development of the Walmart Supercenter site as proposed. Volumes are projected to be sufficient at this intersection to satisfy

Warrants 1, 2 and 3. Traffic signal control would be appropriate for this intersection to coincide with the development as proposed. Traffic signal warrants are expected to continue to be met with the additional 20-year background traffic growth included.

- The recommended widening on California Avenue and signal control at the intersection of California Avenue and Drive A would allow acceptable traffic operations and add safety and convenience for this intersection.

- Capacity and LOS analysis was performed for full build-out projected 20-year traffic conditions for the PM peak hour for the study intersections. For the projected 20-year traffic conditions at the study intersections, intersection overall LOS are expected to operate at what calculates as an acceptable LOS "D" and all vehicle movements at the study intersections are expected to continue to operate at what calculates as a LOS "D" or better for the PM peak hour. Additionally, projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for all of the study intersections with the recommended improvements assumed.

- Capacity and LOS analysis was performed for no-build projected 20-year traffic conditions (without the traffic volumes associated with the site development). All of the study intersections overall LOS is projected to operate at what calculates as an acceptable LOS "C" or better during the PM peak hour and all vehicle movements for the projected 20-year traffic conditions at the study intersections are expected to operate at what calculates as LOS "D" or better for the PM peak hour. Additionally, projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for all of the study intersections.

- It was found that there are no intersection sight distance issues at the proposed access drive locations at California Avenue or at S.E. 25th Street.

Recommendations of this study are summarized as follows:

- It is recommended to construct Drive A at California Avenue to consist of an outbound right-turn lane, an outbound left-turn lane and an inbound receiving lane.

- It is recommended to construct Drive B at S.E. 25th Street to consist of an outbound right-turn lane, an outbound left-turn lane and an inbound receiving lane.

- It is recommended that California Avenue be widened to accommodate the addition of a southbound left-turn lane at Drive A.

- It is recommended that S.E. 25th Street be striped to accommodate a westbound left-turn lane at Drive B. Existing street width (approximately 40 feet) is adequate to accommodate the addition of a westbound left-turn lane.

- It is recommended that a fully-actuated traffic signal be installed at the intersection of California Avenue and Drive A coincident with the site development. This traffic signal should have provisions to be coordinated with the existing traffic signals along California Avenue.

- The recommended traffic signal at California Avenue and Drive A and the recommended roadway improvements to California Avenue and S.E. 25th Street must conform to City of Topeka design standards and will require approval by the City.

- The new access drives (Drives A and B) must conform to City of Topeka design standards and will require approval by the City.

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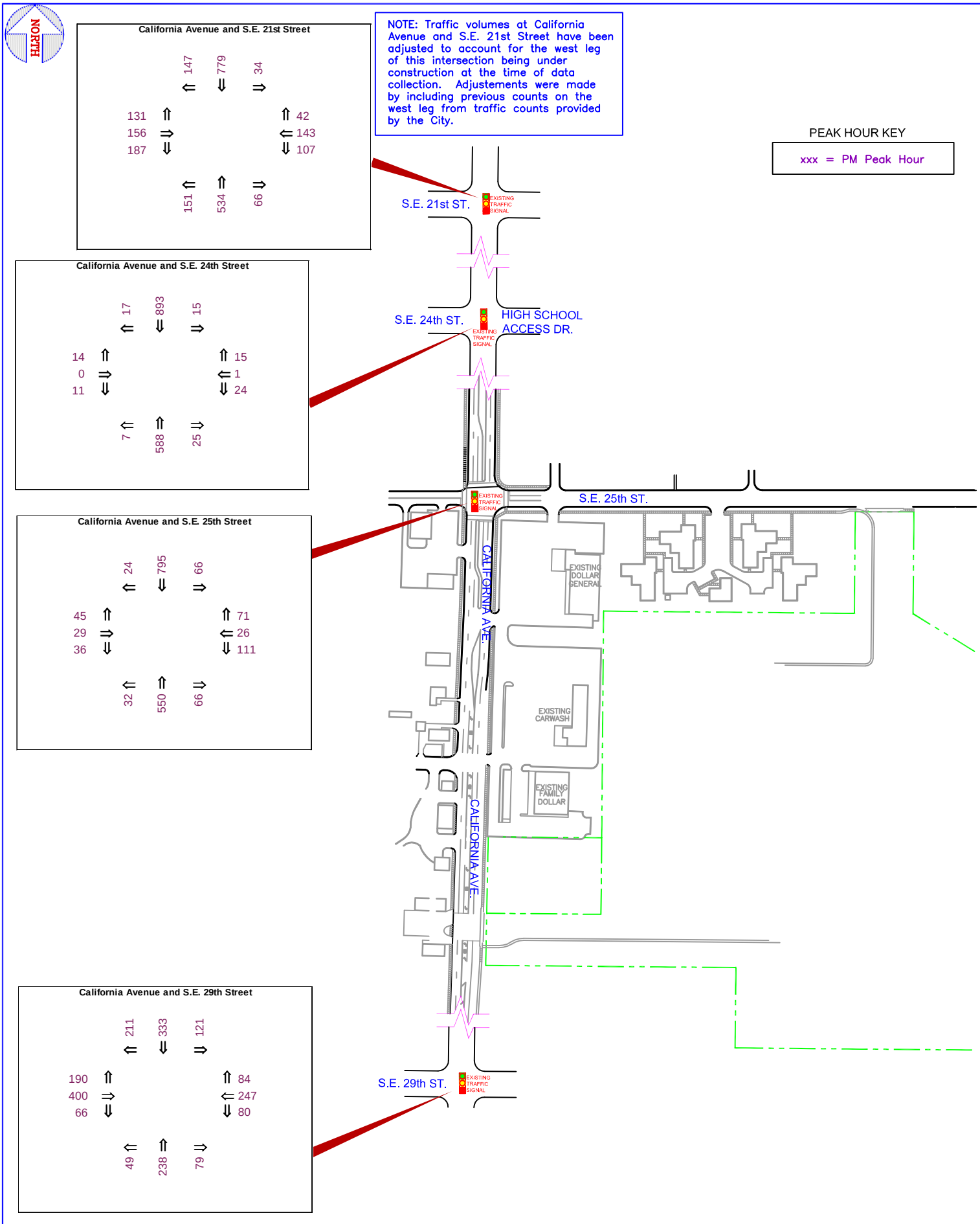
ENGINEERS, INC.

FIGURES



PROJECT No. P1614
DATE: 4-24-2013

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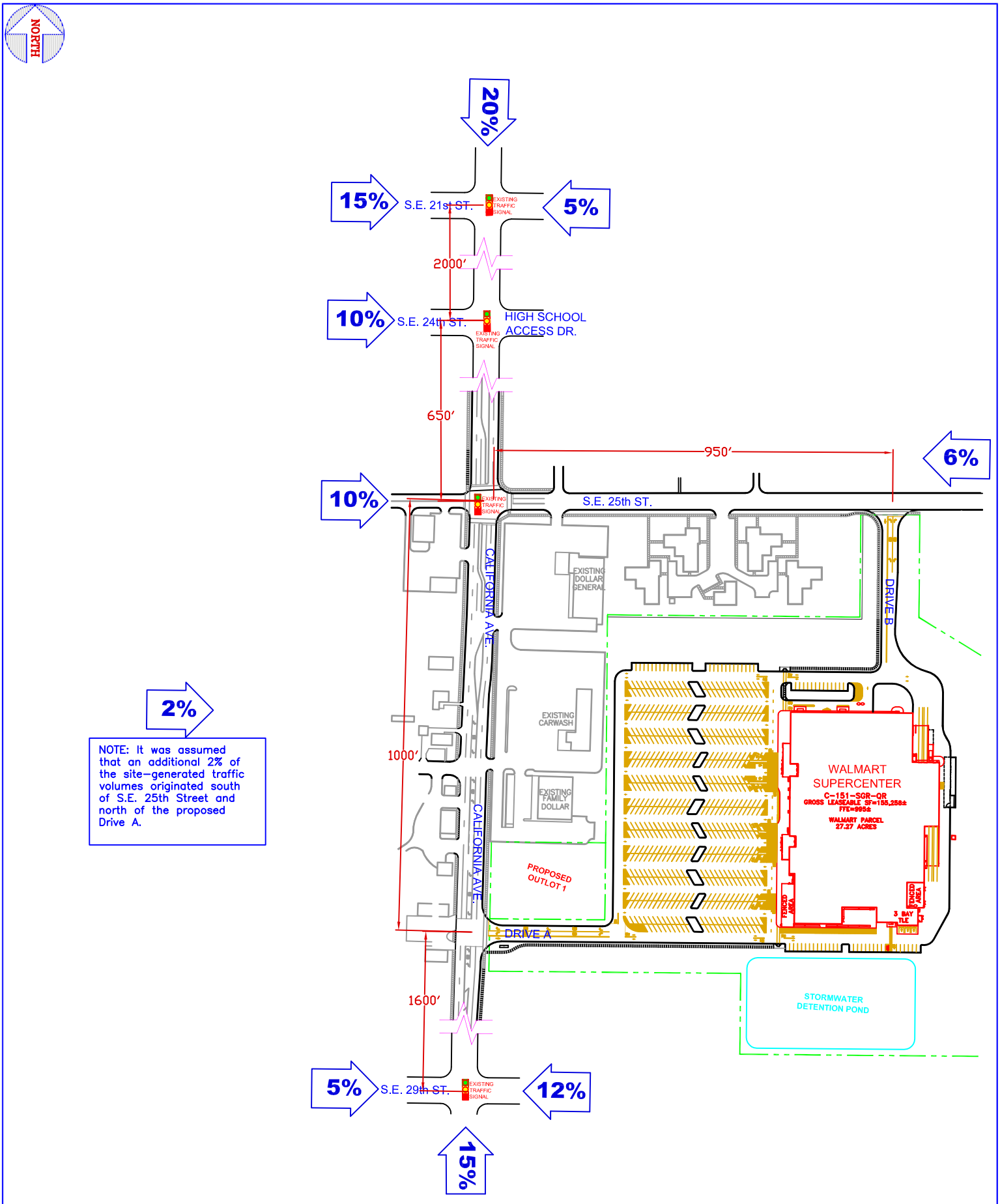
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

EXISTING
TRAFFIC VOLUMES
PM PEAK HOUR

FIGURE No.
3



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DATE: 4-24-2013

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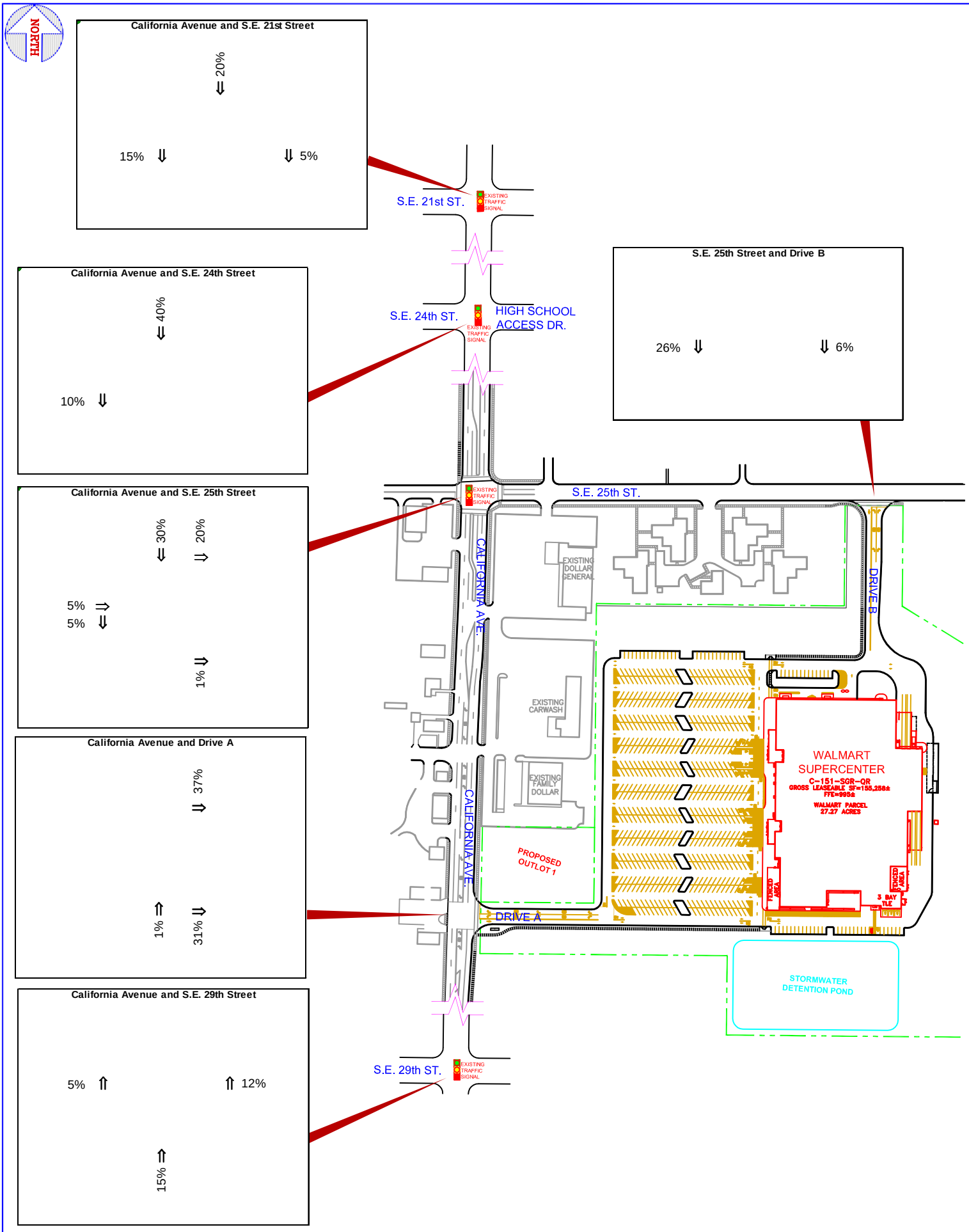
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

DIRECTIONAL DISTRIBUTION
SITE TRAFFIC

FIGURE No.
4



PROJECT No. P1614
DATE: 4-24-2013

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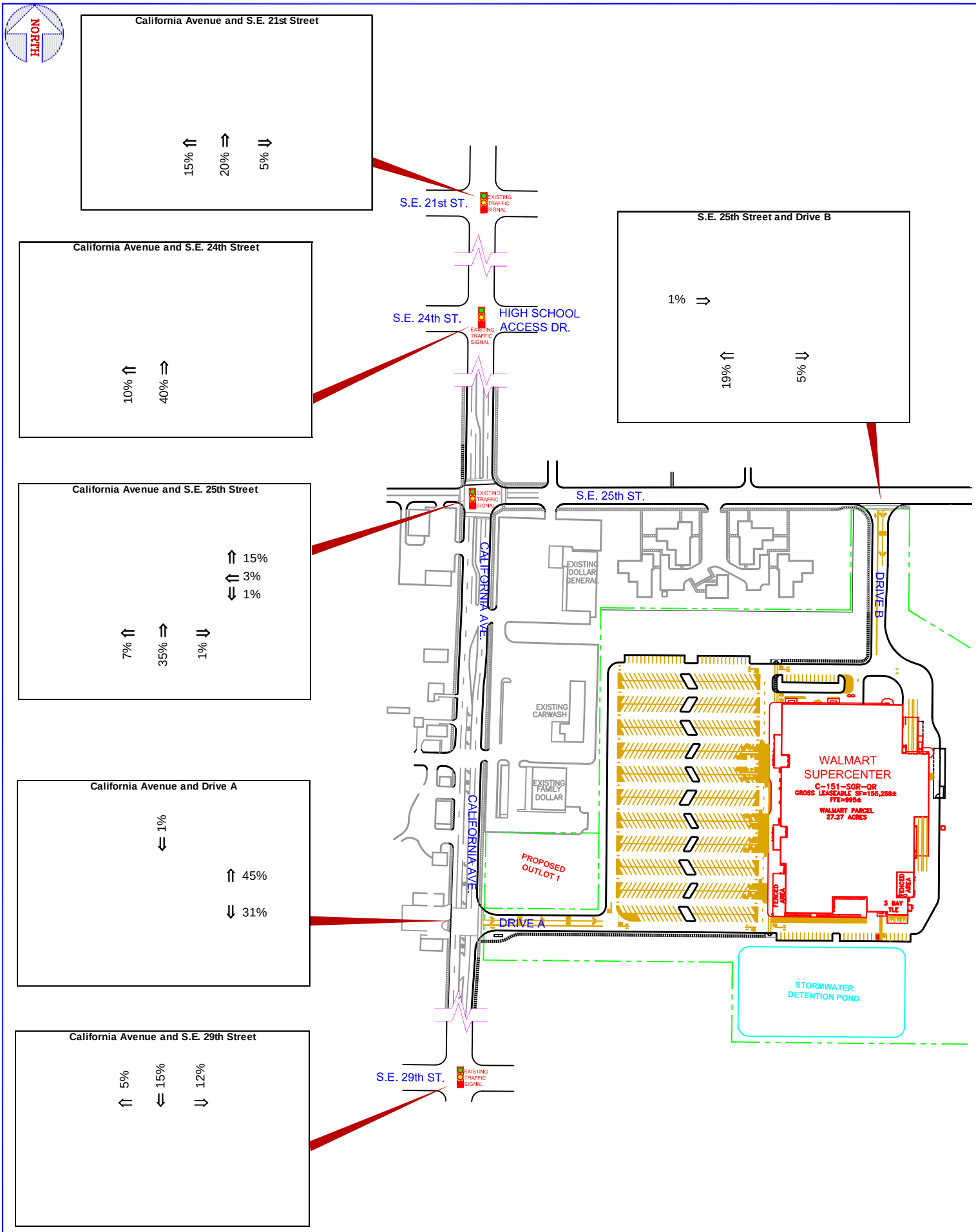
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

ENTERING TRAFFIC
PERCENTAGE TURNS

FIGURE No.
5



PROJECT No. P1614
DATE: 4-24-2013

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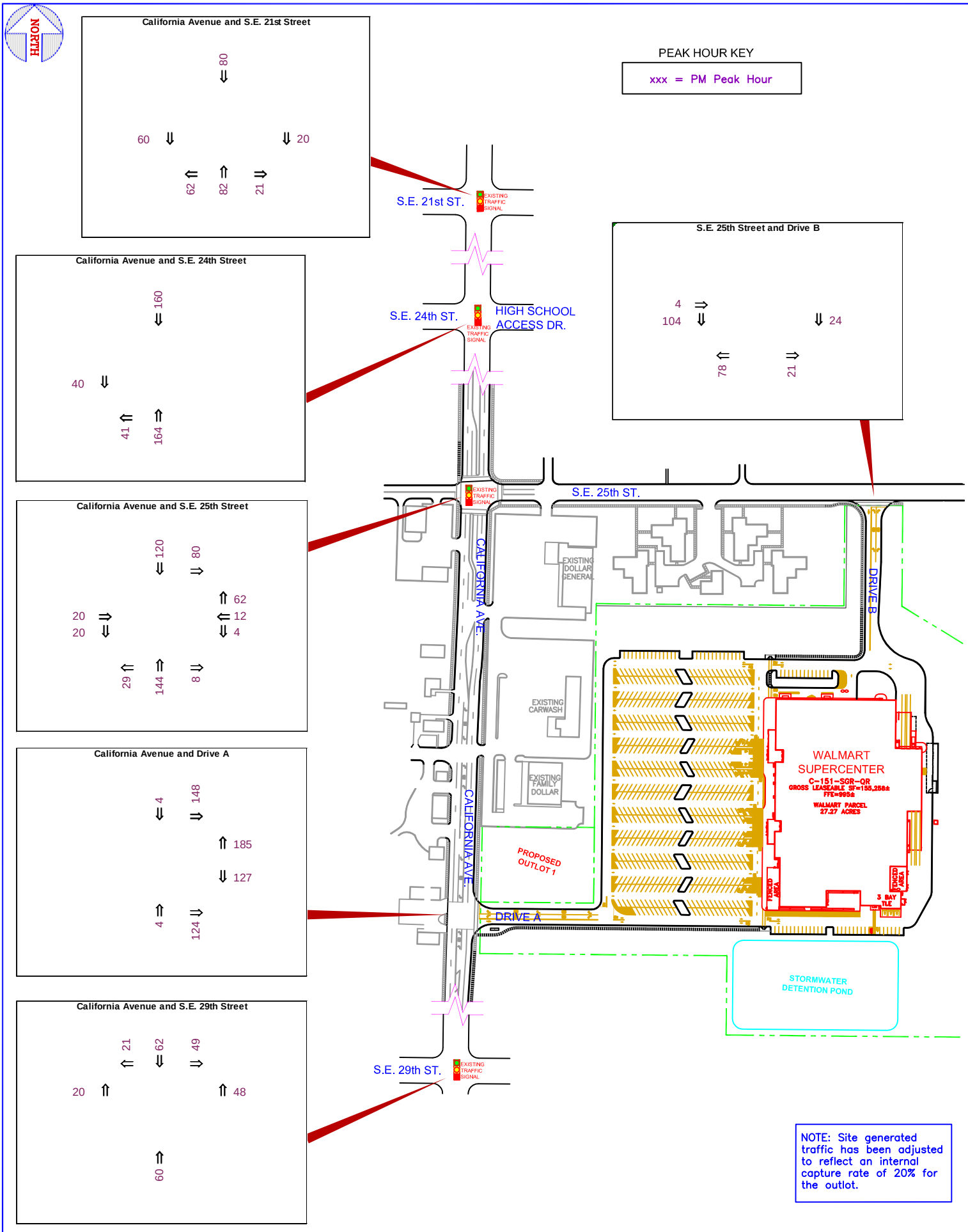
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

EXITING TRAFFIC
PERCENTAGE TURNS

FIGURE No.
6



NOTE: Site generated traffic has been adjusted to reflect an internal capture rate of 20% for the outlot.

PROJECT No. P1614
DATE: 4-24-2013

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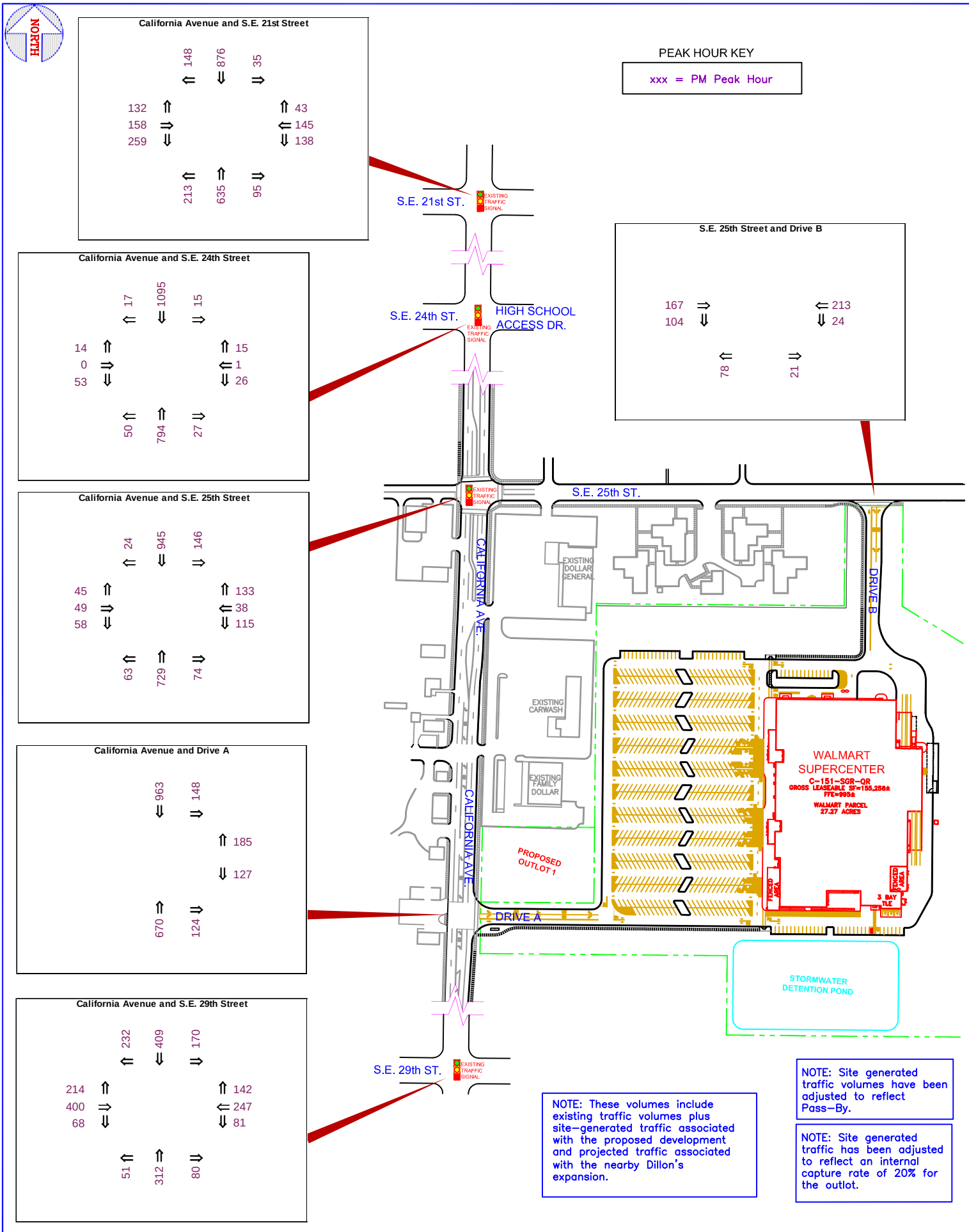
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

SITE-GENERATED
TRAFFIC VOLUMES
PM PEAK HOUR

FIGURE No.
7



PROJECT No. P1614
DATE: 4-24-2013

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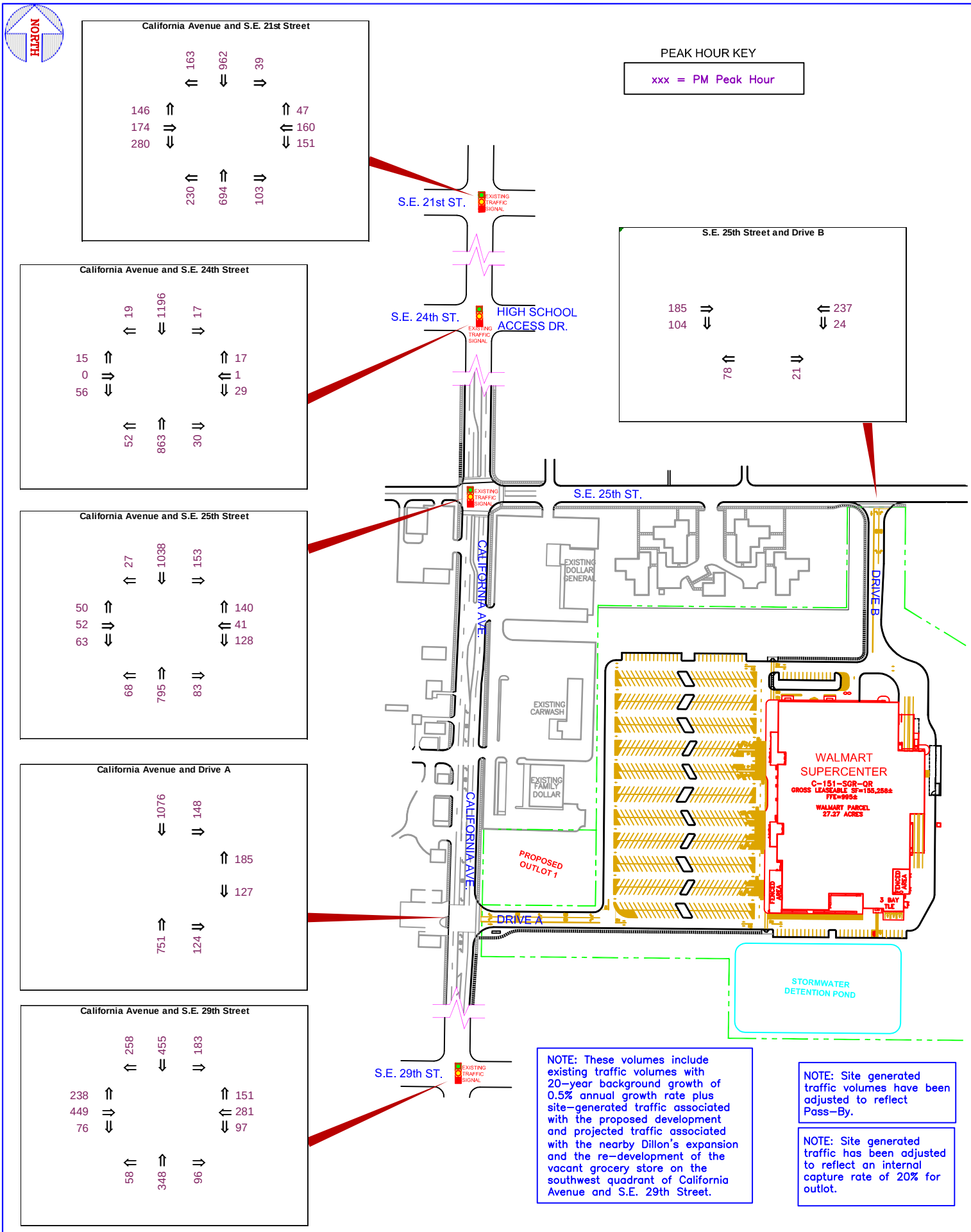
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

PROJECTED TRAFFIC VOLUMES
AT INITIAL COMPLETION
PM PEAK HOUR

FIGURE No.
8



NOTE: These volumes include existing traffic volumes with 20-year background growth of 0.5% annual growth rate plus site-generated traffic associated with the proposed development and projected traffic associated with the nearby Dillon's expansion and the re-development of the vacant grocery store on the southwest quadrant of California Avenue and S.E. 29th Street.

NOTE: Site generated traffic volumes have been adjusted to reflect Pass-By.

NOTE: Site generated traffic has been adjusted to reflect an internal capture rate of 20% for outlot.

PROJECT No. P1614
DATE: 4-24-2013

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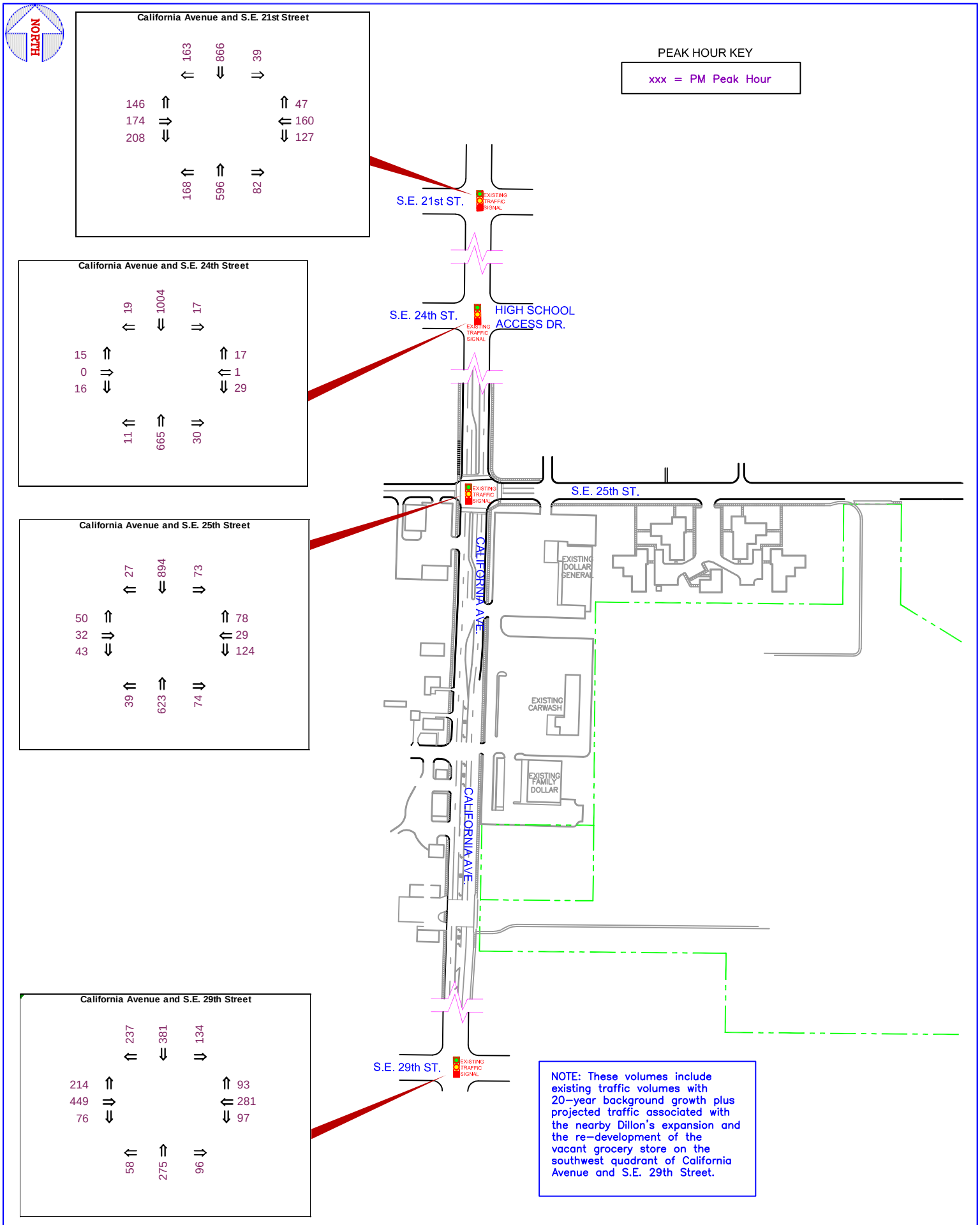
WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

FULL BUILD-OUT PROJECTED 20-YEAR
TRAFFIC VOLUMES
PM PEAK HOUR

FIGURE No.
9



PROJECT No. P1614
DATE: 4-24-2013

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WALMART SUPERCENTER

CALIFORNIA AVENUE AND
S.E. 25TH STREET
TOPEKA, KANSAS

NO-BUILD PROJECTED 20-YEAR
TRAFFIC VOLUMES
PM PEAK HOUR

FIGURE No.
10

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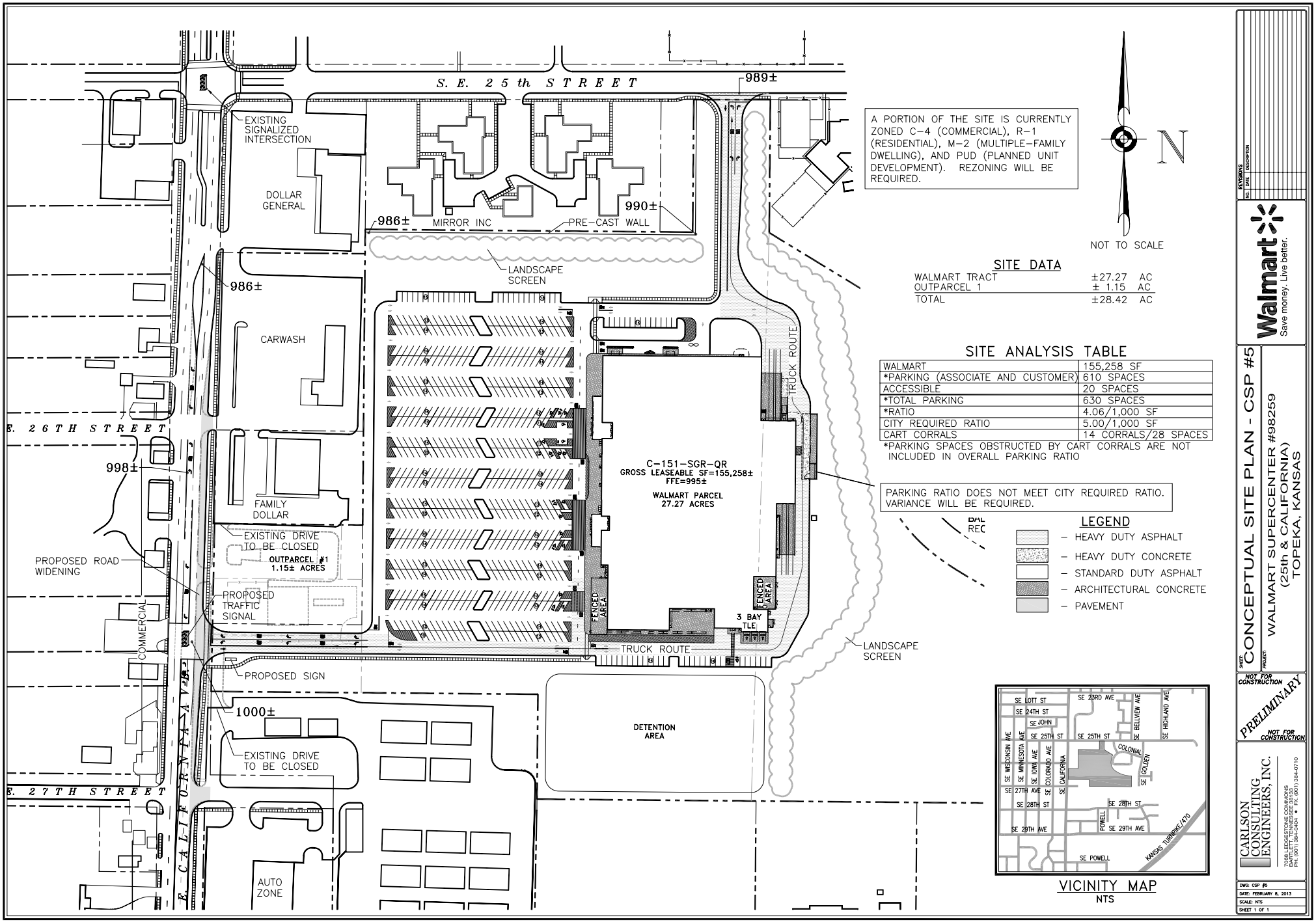
APPENDIX

Site Plan



REVISIONS
NO. DATE DESCRIPTION

Walmart
Save money. Live better.

SHEET: CONCEPTUAL SITE PLAN - CSP #5
PROJECT: WALMART SUPERCENTER #98259
(25th & CALIFORNIA)
TOPEKA, KANSAS

NOT FOR CONSTRUCTION
PRELIMINARY
NOT FOR CONSTRUCTION

CARLSON CONSULTING ENGINEERS, INC.
7088 LEDGESTONE COMMONS
BONNER SPRINGS, KANSAS 66012
PH: (913) 384-0404 • FX: (913) 384-0710

DWG: CSP #5
DATE: FEBRUARY 8, 2013
SCALE: NTS
SHEET 1 OF 1

PETERS & ASSOCIATES
ENGINEERS, INC.

Trip-Generation Data

Topeka, KS

P1614

TRACT	PROPOSED LAND USE	APPROXIMATE SIZE	ITE CODE	24-HOUR TWO-WAY WEEKDAY TRIPS	AM PEAK HOUR TRIPS ENTER	AM PEAK HOUR TRIPS EXIT	PM PEAK HOUR TRIPS ENTER	PM PEAK HOUR TRIPS EXIT
Walmart	Discount Superstore	155,288 Sq. Ft.	813	8,250	146	113	351	365
Outlot 1	*Assumed Fast-Food Restaurant	3,500 Sq. Ft.	934	1,389	70	68	50	46
			TOTALS:	**9,639**	**216**	**181**	**401**	**411**
			TOTAL ENTERING + EXITING		**397**		**812**	

**The volumes for the outlot land-use have been adjusted to reflect 20% internal trip capture.*

P1614 - WMSC Site - Topeka KS
Summary of Multi-Use Trip Generation
Average Weekday Driveway Volumes
April 25, 2013

Land Use	Size	24 Hour Two-Way Volume	AM Pk Hour Enter	AM Pk Hour Exit	PM Pk Hour Enter	PM Pk Hour Exit
Free-Standing Discount Superstore	155.288 Th.Sq.Ft. GFA	8250	146	113	351	365
Fast-Food Restaurant with Drive-Thru	3.5 Th.Sq.Ft. GFA	1736	88	85	62	57
Total Driveway Volume		9986	234	198	413	422
Total Peak Hour Pass-By Trips			43	42	129	131
Total Peak Hour Vol. Added to Adjacent Streets			191	156	284	291

Note: A zero indicates no data available.

TRIP GENERATION BY MICROTRANS

Walmart Supercenter Traffic Data Sheet

Topeka, KS
Walmart Supercenter
City of Topeka, Shawnee County, Kansas

Transportation Consultant:	Peters & Assoc. Engineers, Inc
Contact Name:	
Phone / Mobile:	
Date Completed:	4/25/2013

A. Existing Conditions

Roadways in Area

A	Road Name	California Avenue
	Lanes	4
	Daily Volume	17,932 (2-way)
	Count year	2013
	Count source	P & A
	Count location	at the Site
B	Road Name	
	Lanes	
	Daily Volume	(2-way)
	Count year	
	Count source	
	Count location	
C	Road Name	
	Lanes	
	Daily Volume	(2-way)
	Count year	
	Count source	
	Count location	
D	Road Name	
	Lanes	
	Daily Volume	(2-way)
	Count year	
	Count source	
	Count location	

B. Development Traffic

Trips Generated

	Anchor: Walmart Supercenter 155,288 SF	Outparcel: Fas-Food Restaurant 3,500 SF	Outparcel:	Outparcel:	Outparcel:	Outparcel:	Development Totals
Parcel Number	1	2	3	4	5	6	Σ
Daily External Trips	8,599	1,213					**9,812**
% of External Trips	**87.64%**	**12.36%**					**100.00%**
% Pass-By Trips	17.20%	50.00%					21.25%
Net New Trips	7,120	607					**7,726**
% Net New Trips	**92.15%**	**7.85%**					**100.00%**

Trip Distribution (Columns need not sum to 100%)

	Roadway	1	2	3	4	5	6
Percent of Trips	A	90.00%	90.00%				
	B						
	C						
	D						
	Σ	90.00%	90.00%				

Trip Assignment (Volumes)

	Roadway	1	2	3	4	5	6	Σ
Number of Trips	A	6,408	546					6,954
	B							
	C							
	D							0

C. Background Traffic

Growth Information

Expected Project Buildout Year		2014
A	Name	California Avenue
	Annual Growth	0.50%
	Source	City Provided
	Years to Buildout	1
	Total Growth	0.50%
B	Name	
	Annual Growth	
	Source	
	Years to Buildout	2014
	Total Growth	
C	Name	
	Annual Growth	
	Source	
	Years to Buildout	2014
	Total Growth	
D	Name	0
	Annual Growth	
	Source	
	Years to Buildout	2014
	Total Growth	

D. Impact Summary

New Trip Impact Percentage by Roadway by Parcel

	Roadway	1	2	3	4	5	6	Σ
Impact Percent	A	92.15%	7.85%					100.00%
	B							
	C							
	D							

E. Summary of Roadway Volumes

	Roadway	Existing Volume	Non-Project Volume	Project Volume (Site Difference)	**Total Volume**
A	California Avenue	17,932	18,022	6,954	**24,975**
B					
C					
D					

PETERS & ASSOCIATES
ENGINEERS, INC.

Vehicle Turning Movement Count Data

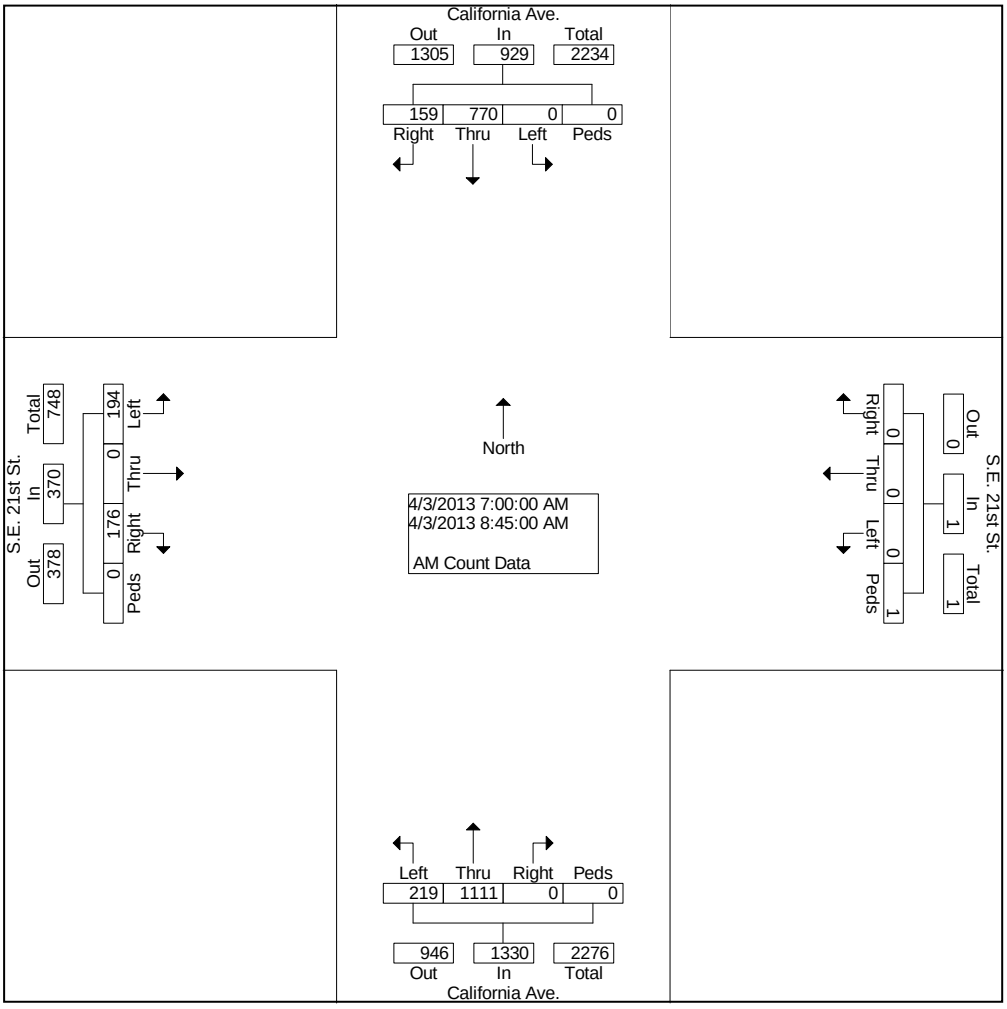
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 21st Street
Topeka, KS
P-1614

File Name : AM-21st
Site Code : 00000000
Start Date : 04/03/2013
Page No : 1

Groups Printed- AM Count Data

	California Ave. From North					S.E. 21st St. From East					California Ave. From South					S.E. 21st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	16	62	0	0	78	0	0	0	0	0	0	95	19	0	114	8	0	15	0	23	215
07:15 AM	17	94	0	0	111	0	0	0	0	0	0	142	26	0	168	16	0	17	0	33	312
07:30 AM	29	142	0	0	171	0	0	0	0	0	0	205	41	0	246	33	0	37	0	70	487
07:45 AM	31	123	0	0	154	0	0	0	0	0	0	183	41	0	224	36	0	49	0	85	463
Total	93	421	0	0	514	0	0	0	0	0	0	625	127	0	752	93	0	118	0	211	1477
08:00 AM	15	101	0	0	116	0	0	0	0	0	0	141	29	0	170	25	0	22	0	47	333
08:15 AM	17	94	0	0	111	0	0	0	0	0	0	116	14	0	130	22	0	24	0	46	287
08:30 AM	15	72	0	0	87	0	0	0	0	0	0	112	31	0	143	16	0	15	0	31	261
08:45 AM	19	82	0	0	101	0	0	0	1	1	0	117	18	0	135	20	0	15	0	35	272
Total	66	349	0	0	415	0	0	0	1	1	0	486	92	0	578	83	0	76	0	159	1153
Grand Total	159	770	0	0	929	0	0	0	1	1	0	1111	219	0	1330	176	0	194	0	370	2630
Apprch %	17.1	82.9	0.0	0.0		0.0	0.0	0.0	100.0		0.0	83.5	16.5	0.0		47.6	0.0	52.4	0.0		
Total %	6.0	29.3	0.0	0.0	35.3	0.0	0.0	0.0	0.0	0.0	0.0	42.2	8.3	0.0	50.6	6.7	0.0	7.4	0.0	14.1	

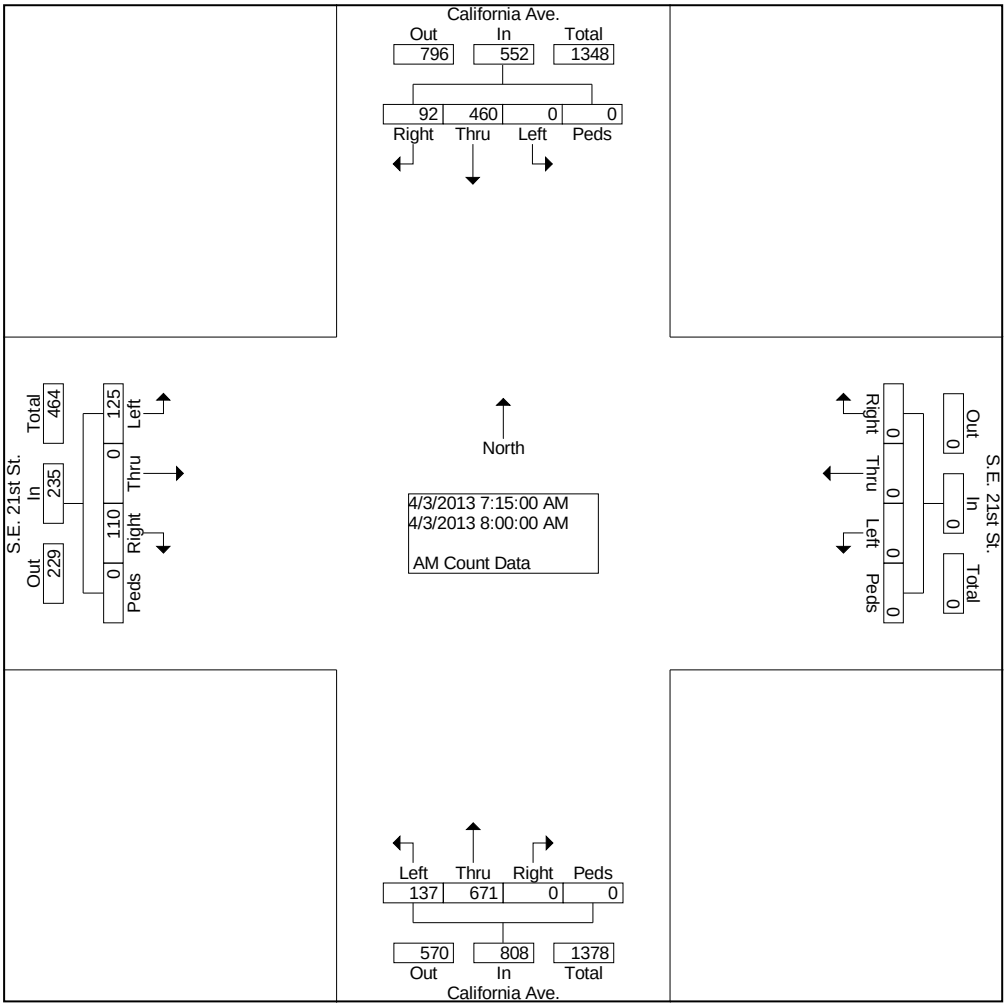


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 21st Street
Topeka, KS
P-1614

File Name : AM-21st
Site Code : 00000000
Start Date : 04/03/2013
Page No : 2

	California Ave. From North					S.E. 21st St. From East					California Ave. From South					S.E. 21st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	92	460	0	0	552	0	0	0	0	0	0	671	137	0	808	110	0	125	0	235	1595
Percent	16.7	83.3	0.0	0.0		0.0	0.0	0.0	0.0		0.0	83.0	17.0	0.0		46.8	0.0	53.2	0.0		
07:30 Volume	29	142	0	0	171	0	0	0	0	0	0	205	41	0	246	33	0	37	0	70	487
Peak Factor																					0.819
High Int.	07:30 AM					6:45:00 AM					07:30 AM					07:45 AM					
Volume	29	142	0	0	171	0	0	0	0	0	0	205	41	0	246	36	0	49	0	85	
Peak Factor					0.807										0.821					0.691	



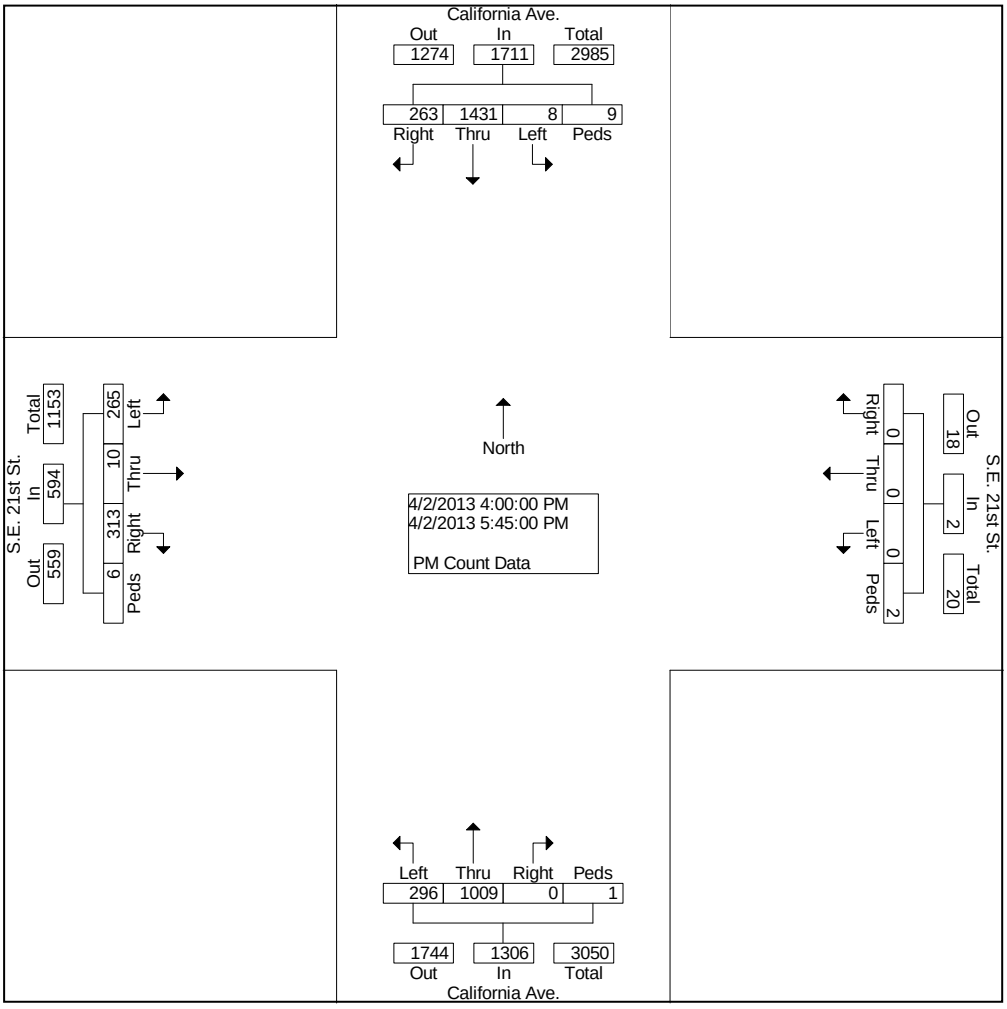
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 21st Street
Topeka, KS
P-1614

File Name : PM-21st
Site Code : 00000000
Start Date : 04/02/2013
Page No : 1

Groups Printed- PM Count Data

	California Ave. From North					S.E. 21st St. From East					California Ave. From South					S.E. 21st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	32	187	0	7	226	0	0	0	0	0	0	138	40	0	178	36	0	48	2	86	490
04:15 PM	33	192	0	1	226	0	0	0	0	0	0	134	39	0	173	35	1	36	3	75	474
04:30 PM	32	185	0	1	218	0	0	0	2	2	0	132	42	0	174	43	0	32	0	75	469
04:45 PM	29	185	0	0	214	0	0	0	0	0	0	127	39	0	166	51	1	32	0	84	464
Total	126	749	0	9	884	0	0	0	2	2	0	531	160	0	691	165	2	148	5	320	1897
05:00 PM	37	193	8	0	238	0	0	0	0	0	0	138	43	1	182	41	4	26	1	72	492
05:15 PM	49	216	0	0	265	0	0	0	0	0	0	137	27	0	164	52	1	41	0	94	523
05:30 PM	25	140	0	0	165	0	0	0	0	0	0	100	39	0	139	30	2	24	0	56	360
05:45 PM	26	133	0	0	159	0	0	0	0	0	0	103	27	0	130	25	1	26	0	52	341
Total	137	682	8	0	827	0	0	0	0	0	0	478	136	1	615	148	8	117	1	274	1716
Grand Total	263	1431	8	9	1711	0	0	0	2	2	0	1009	296	1	1306	313	10	265	6	594	3613
Apprch %	15.4	83.6	0.5	0.5		0.0	0.0	0.0	100.0		0.0	77.3	22.7	0.1		52.7	1.7	44.6	1.0		
Total %	7.3	39.6	0.2	0.2	47.4	0.0	0.0	0.0	0.1	0.1	0.0	27.9	8.2	0.0	36.1	8.7	0.3	7.3	0.2	16.4	

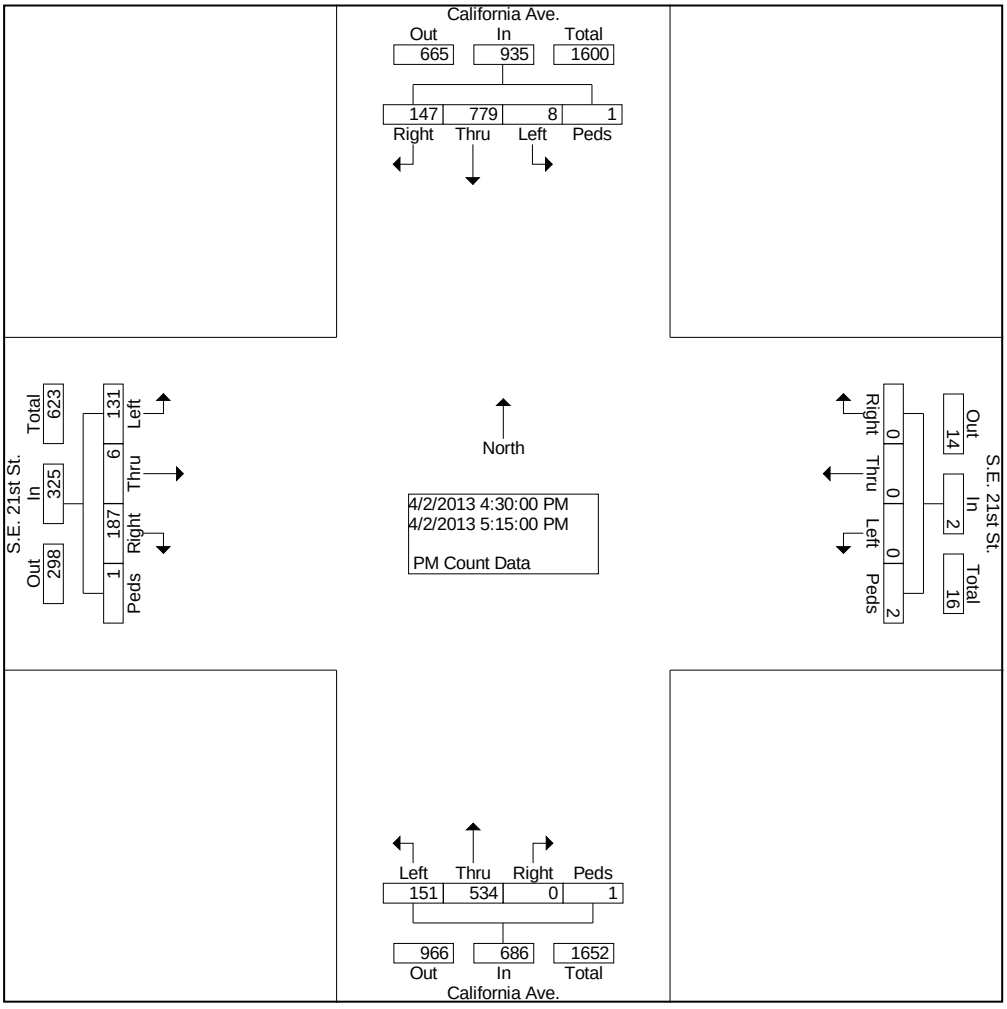


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 21st Street
Topeka, KS
P-1614

File Name : PM-21st
Site Code : 00000000
Start Date : 04/02/2013
Page No : 2

	California Ave. From North					S.E. 21st St. From East					California Ave. From South					S.E. 21st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	04:30 PM																				
Volume	147	779	8	1	935	0	0	0	2	2	0	534	151	1	686	187	6	131	1	325	1948
Percent	15.7	83.3	0.9	0.1		0.0	0.0	0.0	100.0		0.0	77.8	22.0	0.1		57.5	1.8	40.3	0.3		
05:15 Volume	49	216	0	0	265	0	0	0	0	0	0	137	27	0	164	52	1	41	0	94	523
Peak Factor																					0.931
High Int.	05:15 PM					04:30 PM					05:00 PM					05:15 PM					
Volume	49	216	0	0	265	0	0	0	2	2	0	138	43	1	182	52	1	41	0	94	
Peak Factor					0.882					0.250					0.942					0.864	



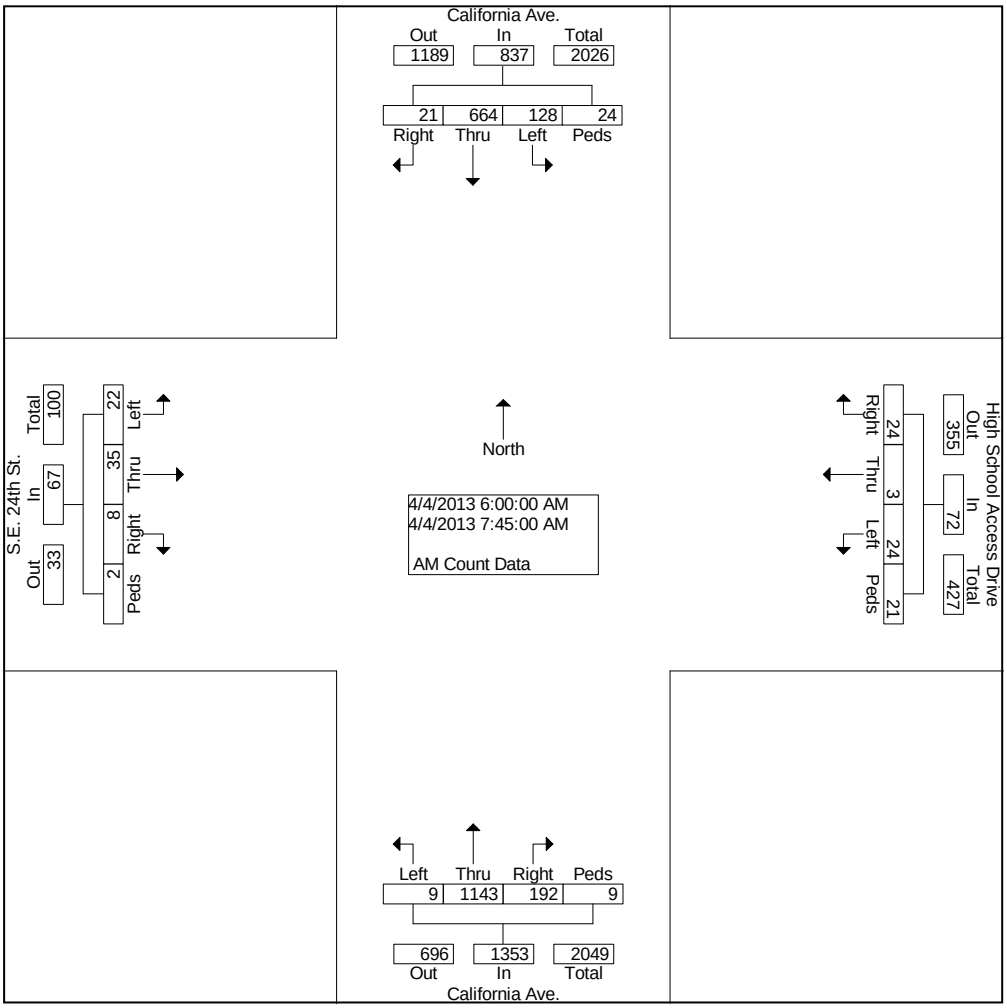
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 24th Street
Topeka, KS
P-1614

File Name : AM-24th
Site Code : 00000000
Start Date : 04/04/2013
Page No : 1

Groups Printed- AM Count Data

	California Ave. From North					High School Access Drive From East					California Ave. From South					S.E. 24th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:00 AM	0	59	14	0	73	2	0	0	0	2	17	90	0	2	109	1	2	2	0	5	189
06:15 AM	1	57	33	16	107	3	0	2	16	21	21	150	1	2	174	1	3	2	0	6	308
06:30 AM	1	89	45	4	139	7	1	8	0	16	55	202	0	2	259	1	13	8	0	22	436
06:45 AM	7	119	26	3	155	9	1	11	2	23	69	214	2	3	288	3	13	4	0	20	486
Total	9	324	118	23	474	21	2	21	18	62	162	656	3	9	830	6	31	16	0	53	1419
07:00 AM	4	90	3	0	97	2	0	2	0	4	12	137	4	0	153	1	4	0	0	5	259
07:15 AM	3	98	5	0	106	1	1	0	0	2	11	120	1	0	132	0	0	3	2	5	245
07:30 AM	1	79	0	0	80	0	0	1	2	3	4	124	1	0	129	0	0	3	0	3	215
07:45 AM	4	73	2	1	80	0	0	0	1	1	3	106	0	0	109	1	0	0	0	1	191
Total	12	340	10	1	363	3	1	3	3	10	30	487	6	0	523	2	4	6	2	14	910
Grand Total	21	664	128	24	837	24	3	24	21	72	192	1143	9	9	1353	8	35	22	2	67	2329
Apprch %	2.5	79.3	15.3	2.9		33.3	4.2	33.3	29.2		14.2	84.5	0.7	0.7		11.9	52.2	32.8	3.0		
Total %	0.9	28.5	5.5	1.0	35.9	1.0	0.1	1.0	0.9	3.1	8.2	49.1	0.4	0.4	58.1	0.3	1.5	0.9	0.1	2.9	

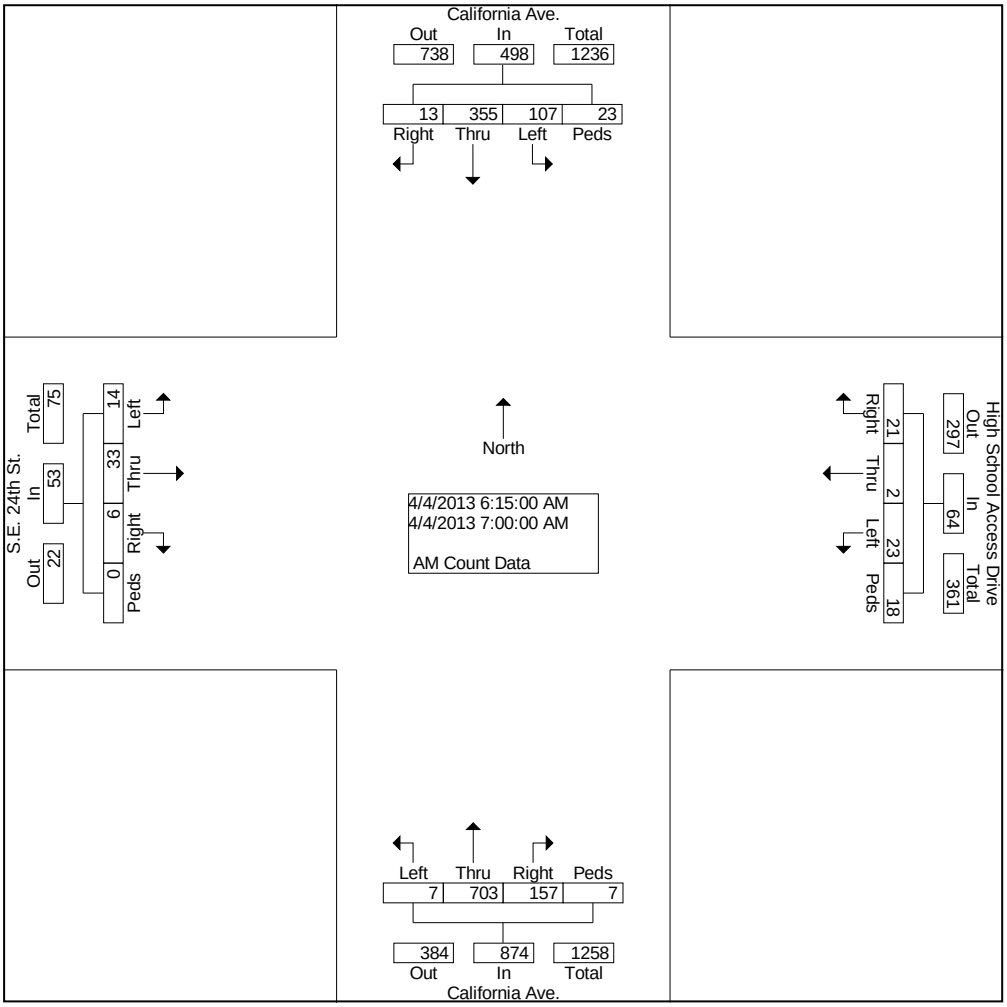


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 24th Street
Topeka, KS
P-1614

File Name : AM-24th
Site Code : 00000000
Start Date : 04/04/2013
Page No : 2

	California Ave. From North					High School Access Drive From East					California Ave. From South					S.E. 24th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 06:00 AM to 07:45 AM - Peak 1 of 1																					
Intersection	06:15 AM																				
Volume	13	355	107	23	498	21	2	23	18	64	157	703	7	7	874	6	33	14	0	53	1489
Percent	2.6	71.3	21.5	4.6		32.8	3.1	35.9	28.1		18.0	80.4	0.8	0.8		11.3	62.3	26.4	0.0		
06:45 Volume	7	119	26	3	155	9	1	11	2	23	69	214	2	3	288	3	13	4	0	20	486
Peak Factor																					0.766
High Int.	06:45 AM					06:45 AM					06:45 AM					06:30 AM					
Volume	7	119	26	3	155	9	1	11	2	23	69	214	2	3	288	1	13	8	0	22	
Peak Factor					0.803					0.696					0.759					0.602	



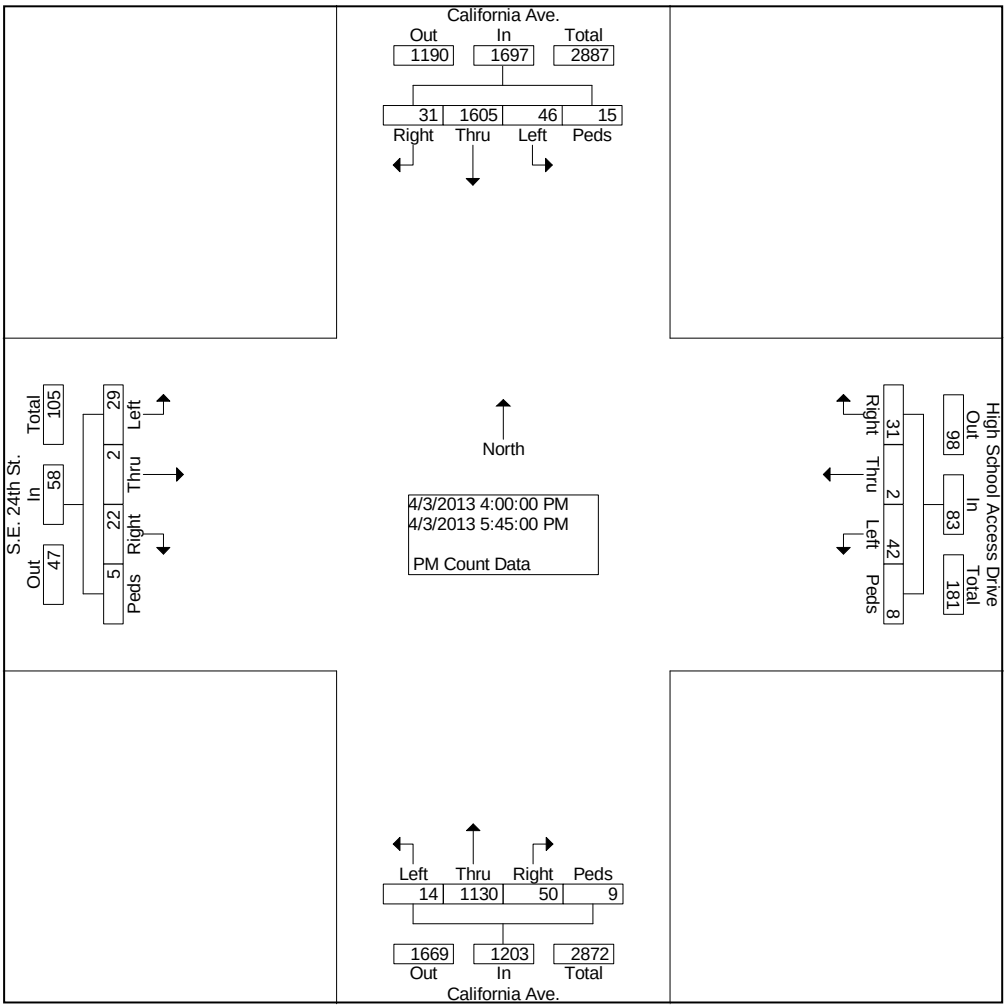
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 24th Street
Topeka, KS
P-1614

File Name : PM-24th
Site Code : 00000000
Start Date : 04/03/2013
Page No : 1

Groups Printed- PM Count Data

	California Ave. From North					High School Access Drive From East					California Ave. From South					S.E. 24th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	2	199	6	1	208	2	0	3	1	6	6	123	1	2	132	4	0	6	3	13	359
04:15 PM	7	174	6	1	188	3	1	3	1	8	4	133	2	0	139	1	0	3	0	4	339
04:30 PM	3	161	6	0	170	7	0	7	2	16	4	149	1	0	154	3	1	0	0	4	344
04:45 PM	5	201	4	9	219	7	0	10	0	17	8	122	1	3	134	2	0	4	1	7	377
Total	17	735	22	11	785	19	1	23	4	47	22	527	5	5	559	10	1	13	4	28	1419
05:00 PM	1	250	1	2	254	5	1	4	1	11	6	138	1	1	146	2	0	2	0	4	415
05:15 PM	4	237	7	2	250	1	0	5	0	6	3	166	3	0	172	4	0	4	0	8	436
05:30 PM	7	205	3	0	215	2	0	5	1	8	8	162	2	0	172	3	0	4	1	8	403
05:45 PM	2	178	13	0	193	4	0	5	2	11	11	137	3	3	154	3	1	6	0	10	368
Total	14	870	24	4	912	12	1	19	4	36	28	603	9	4	644	12	1	16	1	30	1622
Grand Total	31	1605	46	15	1697	31	2	42	8	83	50	1130	14	9	1203	22	2	29	5	58	3041
Apprch %	1.8	94.6	2.7	0.9		37.3	2.4	50.6	9.6		4.2	93.9	1.2	0.7		37.9	3.4	50.0	8.6		
Total %	1.0	52.8	1.5	0.5	55.8	1.0	0.1	1.4	0.3	2.7	1.6	37.2	0.5	0.3	39.6	0.7	0.1	1.0	0.2	1.9	

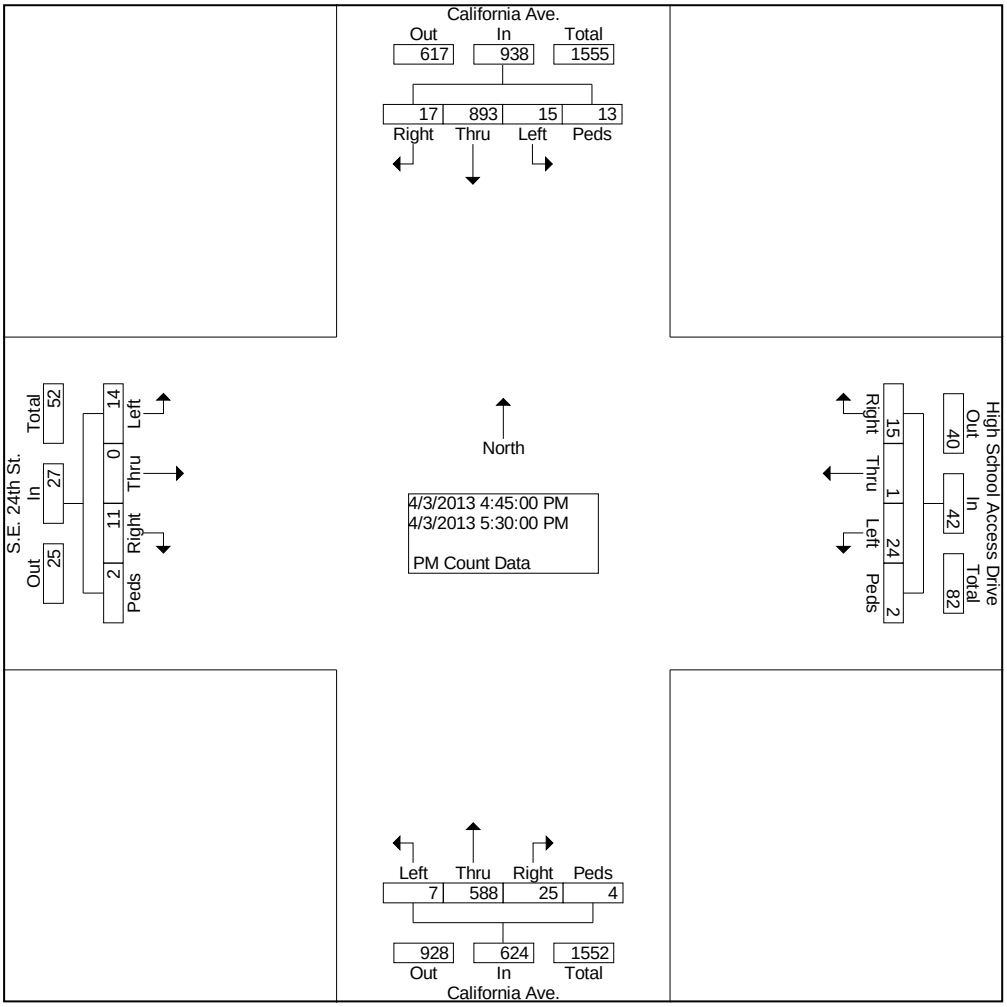


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 24th Street
Topeka, KS
P-1614

File Name : PM-24th
Site Code : 00000000
Start Date : 04/03/2013
Page No : 2

	California Ave. From North					High School Access Drive From East					California Ave. From South					S.E. 24th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	04:45 PM																				
Volume	17	893	15	13	938	15	1	24	2	42	25	588	7	4	624	11	0	14	2	27	1631
Percent	1.8	95.2	1.6	1.4		35.7	2.4	57.1	4.8		4.0	94.2	1.1	0.6		40.7	0.0	51.9	7.4		
05:15 Volume	4	237	7	2	250	1	0	5	0	6	3	166	3	0	172	4	0	4	0	8	436
Peak Factor																					0.935
High Int.	05:00 PM					04:45 PM					05:15 PM					05:15 PM					
Volume	1	250	1	2	254	7	0	10	0	17	3	166	3	0	172	4	0	4	0	8	
Peak Factor					0.923					0.618					0.907					0.844	



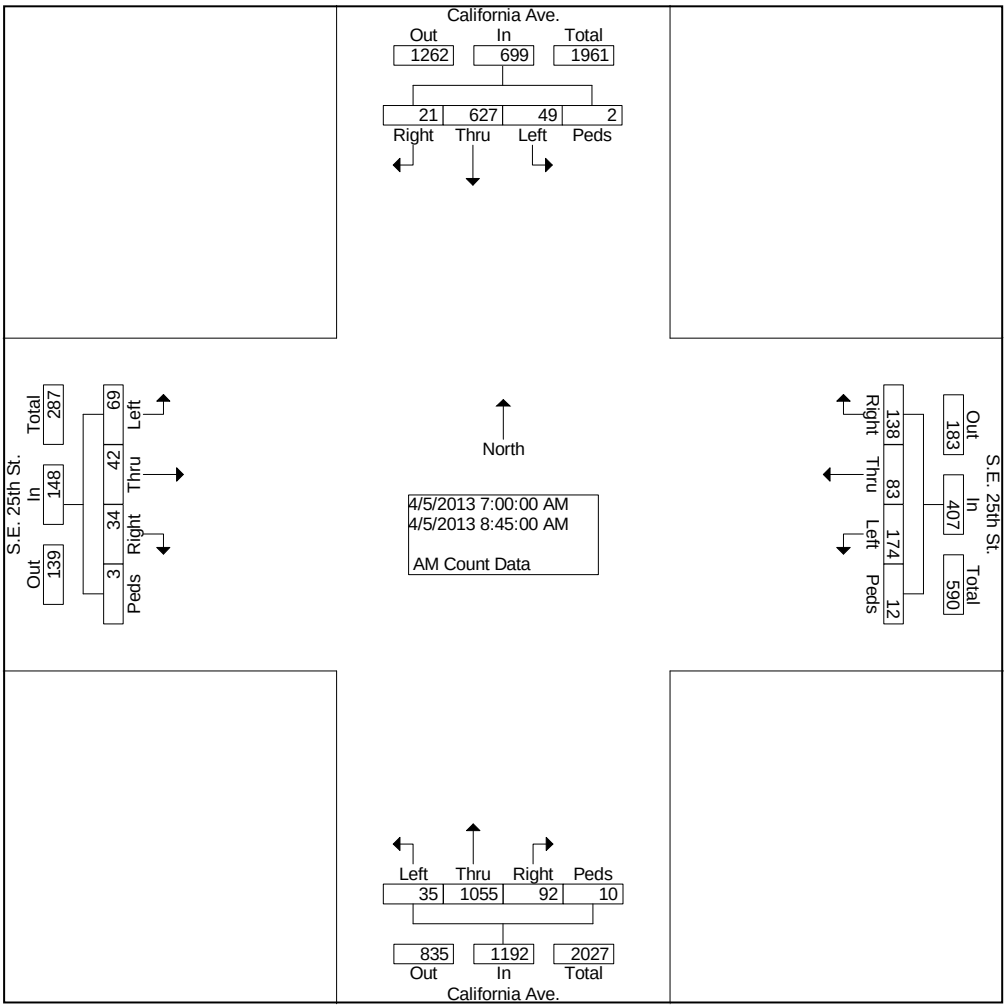
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 25th Street
Topeka, KS
P-1614

File Name : AM-25th
Site Code : 00000000
Start Date : 04/05/2013
Page No : 1

Groups Printed- AM Count Data

	California Ave. From North					S.E. 25th St. From East					California Ave. From South					S.E. 25th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	1	60	2	0	63	7	2	16	4	29	1	96	4	5	106	6	2	9	0	17	215
07:15 AM	3	77	3	2	85	10	9	17	0	36	12	141	3	0	156	6	5	5	0	16	293
07:30 AM	1	79	7	0	87	26	18	39	0	83	9	170	4	0	183	2	9	12	0	23	376
07:45 AM	6	101	11	0	118	46	29	44	2	121	17	230	2	4	253	7	13	15	2	37	529
Total	11	317	23	2	353	89	58	116	6	269	39	637	13	9	698	21	29	41	2	93	1413
08:00 AM	4	84	8	0	96	18	9	24	1	52	16	115	8	1	140	2	7	7	1	17	305
08:15 AM	3	78	2	0	83	17	7	7	3	34	9	107	4	0	120	1	4	11	0	16	253
08:30 AM	1	82	9	0	92	6	5	11	0	22	17	107	8	0	132	3	1	6	0	10	256
08:45 AM	2	66	7	0	75	8	4	16	2	30	11	89	2	0	102	7	1	4	0	12	219
Total	10	310	26	0	346	49	25	58	6	138	53	418	22	1	494	13	13	28	1	55	1033
Grand Total	21	627	49	2	699	138	83	174	12	407	92	1055	35	10	1192	34	42	69	3	148	2446
Apprch %	3.0	89.7	7.0	0.3		33.9	20.4	42.8	2.9		7.7	88.5	2.9	0.8		23.0	28.4	46.6	2.0		
Total %	0.9	25.6	2.0	0.1	28.6	5.6	3.4	7.1	0.5	16.6	3.8	43.1	1.4	0.4	48.7	1.4	1.7	2.8	0.1	6.1	

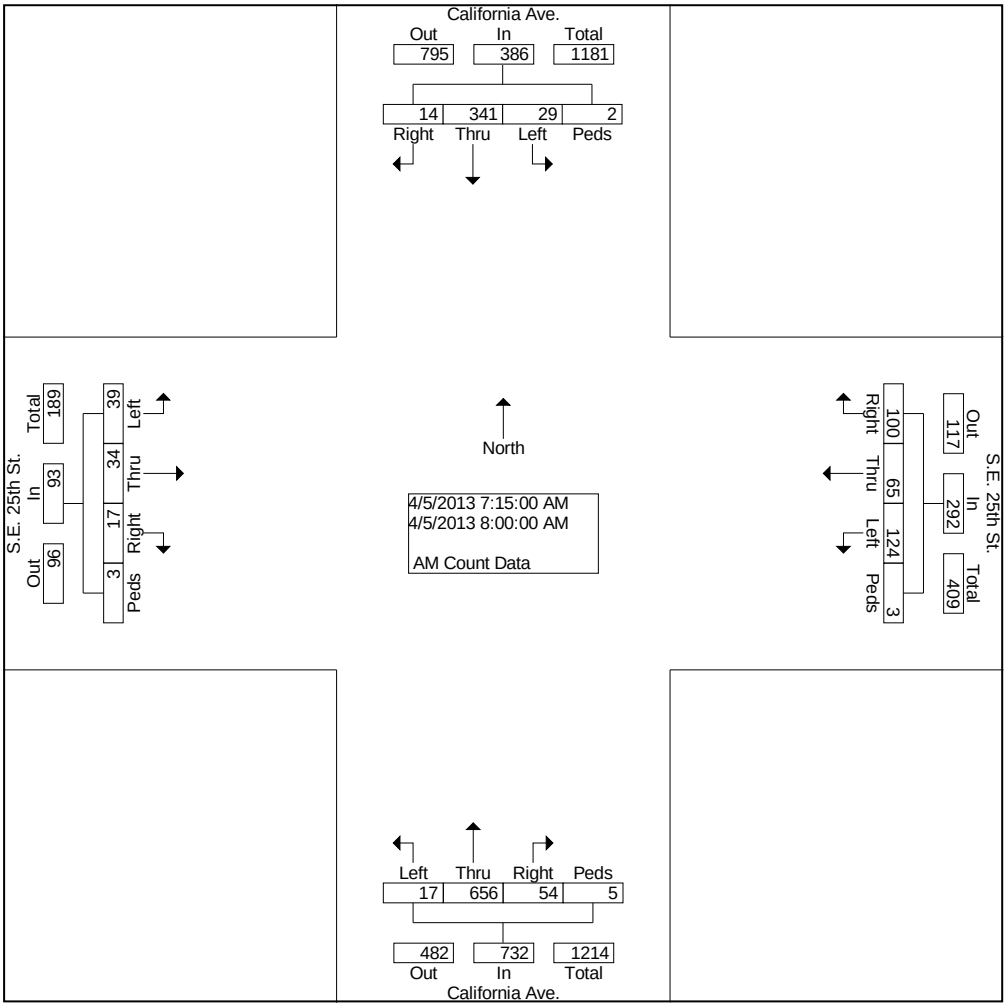


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

AM Hour Turning Movement Count Data
California Avenue and S.E. 25th Street
Topeka, KS
P-1614

File Name : AM-25th
Site Code : 00000000
Start Date : 04/05/2013
Page No : 2

	California Ave. From North					S.E. 25th St. From East					California Ave. From South					S.E. 25th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	14	341	29	2	386	100	65	124	3	292	54	656	17	5	732	17	34	39	3	93	1503
Percent	3.6	88.3	7.5	0.5		34.2	22.3	42.5	1.0		7.4	89.6	2.3	0.7		18.3	36.6	41.9	3.2		
07:45 Volume	6	101	11	0	118	46	29	44	2	121	17	230	2	4	253	7	13	15	2	37	529
Peak Factor																					0.710
High Int.	07:45 AM					07:45 AM					07:45 AM					07:45 AM					
Volume	6	101	11	0	118	46	29	44	2	121	17	230	2	4	253	7	13	15	2	37	
Peak Factor					0.818					0.603					0.723					0.628	



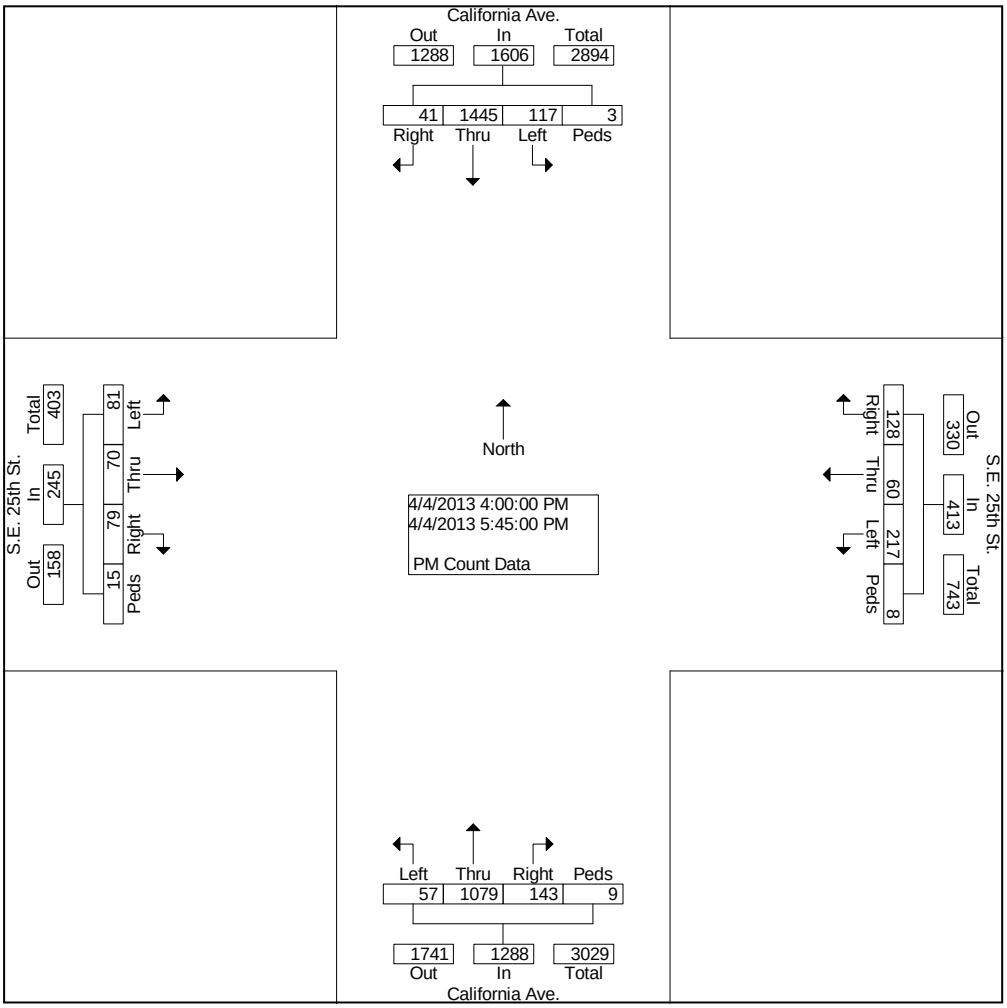
Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 25th Street
Topeka, KS
P-1614

File Name : PM-25th
Site Code : 00000000
Start Date : 04/04/2013
Page No : 1

Groups Printed- PM Count Data

	California Ave. From North					S.E. 25th St. From East					California Ave. From South					S.E. 25th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	3	151	13	0	167	17	10	22	0	49	15	123	4	0	142	8	9	9	2	28	386
04:15 PM	2	171	8	0	181	17	8	27	1	53	17	132	4	3	156	13	7	12	1	33	423
04:30 PM	3	207	20	0	230	24	8	25	3	60	13	160	5	1	179	8	7	13	3	31	500
04:45 PM	4	193	17	0	214	10	5	31	0	46	21	121	10	0	152	10	4	10	1	25	437
Total	12	722	58	0	792	68	31	105	4	208	66	536	23	4	629	39	27	44	7	117	1746
05:00 PM	9	220	13	0	242	18	4	25	0	47	19	148	10	0	177	9	7	12	2	30	496
05:15 PM	8	175	16	2	201	19	9	30	0	58	13	121	7	1	142	9	11	10	3	33	434
05:30 PM	6	158	11	1	176	13	7	28	0	48	28	143	6	3	180	10	11	7	0	28	432
05:45 PM	6	170	19	0	195	10	9	29	4	52	17	131	11	1	160	12	14	8	3	37	444
Total	29	723	59	3	814	60	29	112	4	205	77	543	34	5	659	40	43	37	8	128	1806
Grand Total	41	1445	117	3	1606	128	60	217	8	413	143	1079	57	9	1288	79	70	81	15	245	3552
Apprch %	2.6	90.0	7.3	0.2		31.0	14.5	52.5	1.9		11.1	83.8	4.4	0.7		32.2	28.6	33.1	6.1		
Total %	1.2	40.7	3.3	0.1	45.2	3.6	1.7	6.1	0.2	11.6	4.0	30.4	1.6	0.3	36.3	2.2	2.0	2.3	0.4	6.9	

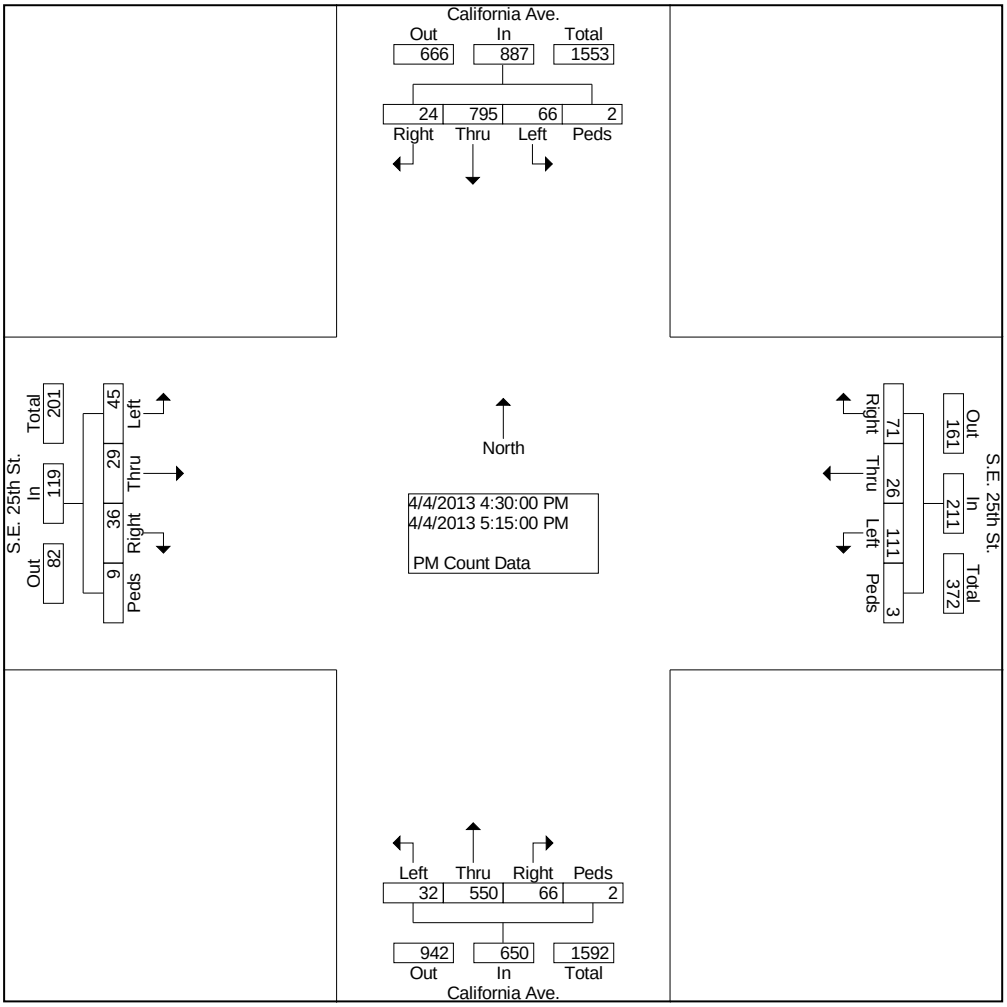


Peters & Associates Engineers, Inc.
Peak Hours Turning Movement Count Data

PM Hour Turning Movement Count Data
California Avenue and S.E. 25th Street
Topeka, KS
P-1614

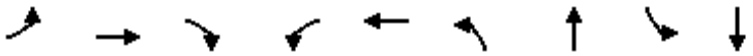
File Name : PM-25th
Site Code : 00000000
Start Date : 04/04/2013
Page No : 2

	California Ave. From North					S.E. 25th St. From East					California Ave. From South					S.E. 25th St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	04:30 PM																				
Volume	24	795	66	2	887	71	26	111	3	211	66	550	32	2	650	36	29	45	9	119	1867
Percent	2.7	89.6	7.4	0.2		33.6	12.3	52.6	1.4		10.2	84.6	4.9	0.3		30.3	24.4	37.8	7.6		
04:30 Volume	3	207	20	0	230	24	8	25	3	60	13	160	5	1	179	8	7	13	3	31	500
Peak Factor																					0.934
High Int.	05:00 PM					04:30 PM					04:30 PM					05:15 PM					
Volume	9	220	13	0	242	24	8	25	3	60	13	160	5	1	179	9	11	10	3	33	
Peak Factor					0.916					0.879					0.908					0.902	



PETERS & ASSOCIATES
ENGINEERS, INC.

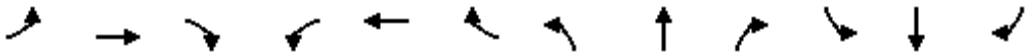
Capacity & Level of Service Calculations



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	142	170	203	116	201	164	652	37	1007
v/c Ratio	0.62	0.43	0.41	0.57	0.54	0.70	0.40	0.24	0.80
Control Delay	48.8	33.1	7.1	49.3	34.9	55.4	18.5	42.7	30.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	33.1	7.1	49.3	34.9	55.4	18.5	42.7	30.0
Queue Length 50th (ft)	74	83	0	61	95	89	131	20	252
Queue Length 95th (ft)	144	142	52	124	163	#205	214	51	#381
Internal Link Dist (ft)		1790			2330		1951		1270
Turn Bay Length (ft)	175			175		175		100	
Base Capacity (vph)	279	645	681	239	601	255	1644	229	1374
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.26	0.30	0.49	0.33	0.64	0.40	0.16	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1799		1770	3481		1770	3455	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1770	1799		1770	3481		1770	3455	
Volume (vph)	131	156	187	107	143	42	151	534	66	34	779	147
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)	142	170	203	116	155	46	164	580	72	37	847	160
RTOR Reduction (vph)	0	0	161	0	12	0	0	8	0	0	14	0
Lane Group Flow (vph)	142	170	42	116	189	0	164	644	0	37	993	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4									
Actuated Green, G (s)	8.7	15.0	15.0	7.6	13.9		10.6	35.4		4.4	29.2	
Effective Green, g (s)	8.7	17.0	17.0	7.6	15.9		10.6	37.1		4.4	30.9	
Actuated g/C Ratio	0.11	0.21	0.21	0.09	0.19		0.13	0.45		0.05	0.38	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0		4.0	5.7		4.0	5.7	
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)	188	386	328	164	348		229	1573		95	1300	
v/s Ratio Prot	c0.08	0.09		0.07	c0.11		c0.09	0.19		0.02	c0.29	
v/s Ratio Perm			0.03									
v/c Ratio	0.76	0.44	0.13	0.71	0.54		0.72	0.41		0.39	0.76	
Uniform Delay, d1	35.7	28.4	26.5	36.2	29.8		34.3	15.1		37.6	22.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.8	0.8	0.2	13.0	1.7		10.2	0.2		2.6	2.7	
Delay (s)	51.4	29.2	26.7	49.2	31.6		44.5	15.3		40.2	25.1	
Level of Service	D	C	C	D	C		D	B		D	C	
Approach Delay (s)		34.3			38.0			21.2			25.7	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	82.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

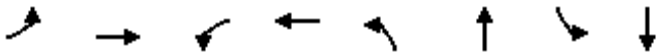
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	27	43	674	1005
v/c Ratio	0.09	0.15	0.53	0.41
Control Delay	13.6	14.0	11.4	3.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.6	14.0	11.4	3.7
Queue Length 50th (ft)	3	6	64	47
Queue Length 95th (ft)	20	28	110	87
Internal Link Dist (ft)	1091	369	590	1951
Turn Bay Length (ft)				
Base Capacity (vph)	593	587	2132	2792
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.05	0.07	0.32	0.36

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			1.00			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.94			0.95			0.99			1.00	
Flt Protected		0.97			0.97			1.00			1.00	
Satd. Flow (prot)		1693			1708			3512			3524	
Flt Permitted		0.80			0.80			0.94			0.95	
Satd. Flow (perm)		1398			1406			3300			3357	
Volume (vph)	14	0	11	24	1	15	7	588	25	15	893	17
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)	15	0	12	26	1	16	8	639	27	16	971	18
RTOR Reduction (vph)	0	11	0	0	14	0	0	4	0	0	1	0
Lane Group Flow (vph)	0	16	0	0	29	0	0	670	0	0	1004	0
Confl. Peds. (#/hr)	2		2	2		2	4		4	13		13
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			4			6		5	2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		3.6			3.6			13.8			26.5	
Effective Green, g (s)		4.6			4.6			14.8			27.5	
Actuated g/C Ratio		0.11			0.11			0.37			0.69	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		160			161			1218			2338	
v/s Ratio Prot											c0.09	
v/s Ratio Perm		0.01			c0.02			c0.20			0.20	
v/c Ratio		0.10			0.18			0.55			0.43	
Uniform Delay, d1		15.9			16.0			10.0			2.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.5			0.5			0.1	
Delay (s)		16.2			16.6			10.5			2.9	
Level of Service		B			B			B			A	
Approach Delay (s)		16.2			16.6			10.5			2.9	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	40.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



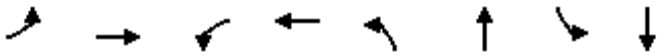
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	49	71	121	105	35	670	72	890
v/c Ratio	0.16	0.16	0.38	0.23	0.12	0.37	0.17	0.45
Control Delay	17.4	10.3	19.4	8.2	7.2	11.2	6.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	10.3	19.4	8.2	7.2	11.2	6.6	10.3
Queue Length 50th (ft)	10	6	26	6	4	74	8	63
Queue Length 95th (ft)	39	36	80	40	15	141	26	194
Internal Link Dist (ft)		1234		2016		920		590
Turn Bay Length (ft)	100		100		100		100	
Base Capacity (vph)	588	801	610	799	407	2078	499	2184
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.09	0.20	0.13	0.09	0.32	0.14	0.41

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.89		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1760	1692		1766	1641		1769	3474		1769	3521	
Flt Permitted	0.69	1.00		0.71	1.00		0.28	1.00		0.33	1.00	
Satd. Flow (perm)	1277	1692		1321	1641		525	3474		617	3521	
Volume (vph)	45	29	36	111	26	71	32	550	66	66	795	24
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)	49	32	39	121	28	77	35	598	72	72	864	26
RTOR Reduction (vph)	0	30	0	0	60	0	0	7	0	0	1	0
Lane Group Flow (vph)	49	41	0	121	45	0	35	663	0	72	889	0
Confl. Peds. (#/hr)	9		9	3		3	2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)	10.9	10.9		10.9	10.9		33.8	31.2		38.2	33.4	
Effective Green, g (s)	13.9	13.9		13.9	13.9		34.8	32.2		39.2	34.4	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.55	0.51		0.62	0.55	
Clearance Time (s)	7.0	7.0		7.0	7.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	282	374		292	363		342	1778		472	1926	
v/s Ratio Prot		0.02			0.03		0.00	0.19		c0.01	c0.25	
v/s Ratio Perm	0.04			c0.09			0.05			0.08		
v/c Ratio	0.17	0.11		0.41	0.12		0.10	0.37		0.15	0.46	
Uniform Delay, d1	19.8	19.6		21.0	19.6		6.5	9.3		4.9	8.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.1		1.0	0.2		0.1	0.1		0.2	0.2	
Delay (s)	20.1	19.7		22.0	19.8		6.7	9.4		5.1	8.8	
Level of Service	C	B		C	B		A	A		A	A	
Approach Delay (s)		19.9			20.9			9.3			8.5	
Approach LOS		B			C			A			A	

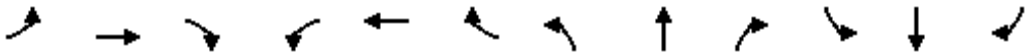
Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



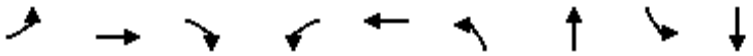
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	207	507	87	359	53	345	132	591
v/c Ratio	0.61	0.49	0.37	0.43	0.26	0.40	0.48	0.52
Control Delay	37.1	23.7	37.9	26.0	38.7	25.1	37.8	20.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.1	23.7	37.9	26.0	38.7	25.1	37.8	20.2
Queue Length 50th (ft)	80	91	34	63	21	60	51	92
Queue Length 95th (ft)	191	186	99	143	70	134	136	194
Internal Link Dist (ft)		1320		2050		1413		1561
Turn Bay Length (ft)	100		65		60		90	
Base Capacity (vph)	661	1657	456	1301	386	1284	546	1575
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.31	0.19	0.28	0.14	0.27	0.24	0.38

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.96		1.00	0.96		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3464		1770	3405		1770	3407		1770	3334	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3464		1770	3405		1770	3407		1770	3334	
Volume (vph)	190	400	66	80	247	84	49	238	79	121	333	211
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)	207	435	72	87	268	91	53	259	86	132	362	229
RTOR Reduction (vph)	0	11	0	0	26	0	0	25	0	0	77	0
Lane Group Flow (vph)	207	496	0	87	333	0	53	320	0	132	514	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	10.7	16.7		7.0	13.0		4.4	14.2		8.4	18.2	
Effective Green, g (s)	10.7	19.1		7.0	15.4		4.4	16.6		8.4	20.6	
Actuated g/C Ratio	0.16	0.28		0.10	0.23		0.07	0.25		0.13	0.31	
Clearance Time (s)	4.0	6.4		4.0	6.4		4.0	6.4		4.0	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	282	986		185	781		116	843		222	1024	
v/s Ratio Prot	c0.12	c0.14		0.05	0.10		0.03	0.09		c0.07	c0.15	
v/s Ratio Perm												
v/c Ratio	0.73	0.50		0.47	0.43		0.46	0.38		0.59	0.50	
Uniform Delay, d1	26.8	20.0		28.3	22.1		30.2	21.0		27.7	19.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.5	0.4		1.9	0.4		2.8	0.3		4.2	0.4	
Delay (s)	36.3	20.4		30.2	22.5		33.0	21.3		32.0	19.4	
Level of Service	D	C		C	C		C	C		C	B	
Approach Delay (s)		25.1			24.0			22.8			21.7	
Approach LOS		C			C			C			C	

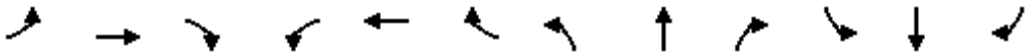
Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	67.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	143	172	282	150	205	232	793	38	1113
v/c Ratio	0.70	0.50	0.54	0.72	0.59	0.78	0.47	0.27	0.91
Control Delay	58.6	37.9	8.1	60.5	38.4	56.4	18.7	45.3	40.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.6	37.9	8.1	60.5	38.4	56.4	18.7	45.3	40.9
Queue Length 50th (ft)	80	90	0	84	101	128	165	21	317
Queue Length 95th (ft)	#178	151	63	#189	170	#261	262	54	#507
Internal Link Dist (ft)		1790			2330		1951		1270
Turn Bay Length (ft)	175			175		175		100	
Base Capacity (vph)	218	546	663	218	538	315	1683	202	1223
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.32	0.43	0.69	0.38	0.74	0.47	0.19	0.91

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1799		1770	3470		1770	3462	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1770	1799		1770	3470		1770	3462	
Volume (vph)	132	158	259	138	145	43	213	635	95	35	876	148
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)	143	172	282	150	158	47	232	690	103	38	952	161
RTOR Reduction (vph)	0	0	231	0	11	0	0	9	0	0	12	0
Lane Group Flow (vph)	143	172	51	150	194	0	232	784	0	38	1101	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4									
Actuated Green, G (s)	10.3	14.5	14.5	10.4	14.6		16.7	41.3		4.9	29.5	
Effective Green, g (s)	10.3	16.5	16.5	10.4	16.6		16.7	43.0		4.9	31.2	
Actuated g/C Ratio	0.11	0.18	0.18	0.11	0.18		0.18	0.47		0.05	0.34	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0		4.0	5.7		4.0	5.7	
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)	201	339	288	203	329		326	1643		96	1190	
v/s Ratio Prot	0.08	0.09		c0.08	c0.11		c0.13	0.23		0.02	c0.32	
v/s Ratio Perm			0.03									
v/c Ratio	0.71	0.51	0.18	0.74	0.59		0.71	0.48		0.40	0.92	
Uniform Delay, d1	38.8	33.5	31.4	38.9	34.0		34.8	16.3		41.5	28.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.3	1.2	0.3	13.1	2.7		7.2	0.2		2.7	12.0	
Delay (s)	50.1	34.7	31.7	52.0	36.7		41.9	16.5		44.2	40.7	
Level of Service	D	C	C	D	D		D	B		D	D	
Approach Delay (s)		37.0			43.1			22.2			40.8	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	34.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

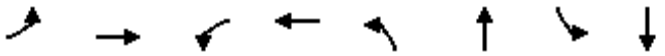
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	73	45	946	1224
v/c Ratio	0.41	0.34	0.45	0.42
Control Delay	24.1	40.9	3.6	2.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	24.1	40.9	3.6	2.4
Queue Length 50th (ft)	10	20	43	71
Queue Length 95th (ft)	54	55	64	116
Internal Link Dist (ft)	1091	369	590	1951
Turn Bay Length (ft)				
Base Capacity (vph)	441	387	2103	2902
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.12	0.45	0.42

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.89			0.95			1.00			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1625			1708			3509			3525	
Flt Permitted		0.94			0.69			0.79			0.94	
Satd. Flow (perm)		1542			1209			2789			3314	
Volume (vph)	14	0	53	26	1	15	50	794	27	15	1095	17
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)	15	0	58	28	1	16	54	863	29	16	1190	18
RTOR Reduction (vph)	0	54	0	0	15	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	19	0	0	30	0	0	945	0	0	1224	0
Confl. Peds. (#/hr)	2		2	2		2	4		4	13		13
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			4			6		5	2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		6.6			6.6			81.4			93.4	
Effective Green, g (s)		7.6			7.6			82.4			94.4	
Actuated g/C Ratio		0.07			0.07			0.75			0.86	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		107			84			2089			2859	
v/s Ratio Prot											c0.03	
v/s Ratio Perm		0.01			c0.02			c0.34			0.34	
v/c Ratio		0.18			0.36			0.45			0.43	
Uniform Delay, d1		48.3			48.9			5.2			1.7	
Progression Factor		1.00			1.00			0.53			1.00	
Incremental Delay, d2		0.8			2.6			0.7			0.1	
Delay (s)		49.1			51.5			3.4			1.9	
Level of Service		D			D			A			A	
Approach Delay (s)		49.1			51.5			3.4			1.9	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



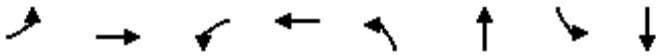
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	49	117	125	186	68	872	159	1053
v/c Ratio	0.28	0.35	0.60	0.47	0.23	0.39	0.49	0.44
Control Delay	41.8	22.6	53.3	14.4	5.8	9.1	11.9	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	22.6	53.3	14.4	5.8	9.1	11.9	8.3
Queue Length 50th (ft)	31	36	83	25	8	135	24	123
Queue Length 95th (ft)	63	82	135	83	18	223	61	184
Internal Link Dist (ft)		1234		967		920		590
Turn Bay Length (ft)	100		100		100		100	
Base Capacity (vph)	339	592	401	629	415	2256	502	2404
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.20	0.31	0.30	0.16	0.39	0.32	0.44

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.88		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1756	1688		1764	1625		1769	3483		1769	3524	
Flt Permitted	0.42	1.00		0.60	1.00		0.24	1.00		0.27	1.00	
Satd. Flow (perm)	771	1688		1107	1625		443	3483		505	3524	
Volume (vph)	45	49	59	115	38	133	63	729	74	146	945	24
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)	49	53	64	125	41	145	68	792	80	159	1027	26
RTOR Reduction (vph)	0	49	0	0	120	0	0	4	0	0	1	0
Lane Group Flow (vph)	49	68	0	125	66	0	68	868	0	159	1052	0
Confl. Peds. (#/hr)	9		9	3		3	2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)	15.7	15.7		15.7	15.7		75.2	70.1		81.4	73.2	
Effective Green, g (s)	18.7	18.7		18.7	18.7		76.2	71.1		82.4	74.2	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.69	0.65		0.75	0.67	
Clearance Time (s)	7.0	7.0		7.0	7.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	131	287		188	276		368	2251		473	2377	
v/s Ratio Prot		0.04			0.04		0.01	0.25		c0.03	c0.30	
v/s Ratio Perm	0.06			c0.11			0.12			0.23		
v/c Ratio	0.37	0.24		0.66	0.24		0.18	0.39		0.34	0.44	
Uniform Delay, d1	40.5	39.5		42.7	39.5		5.8	9.2		4.8	8.3	
Progression Factor	1.00	1.00		1.00	1.00		0.90	0.86		1.66	0.84	
Incremental Delay, d2	1.8	0.4		8.6	0.4		0.2	0.5		0.4	0.6	
Delay (s)	42.3	39.9		51.3	39.9		5.5	8.4		8.3	7.5	
Level of Service	D	D		D	D		A	A		A	A	
Approach Delay (s)		40.6			44.5			8.2			7.6	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

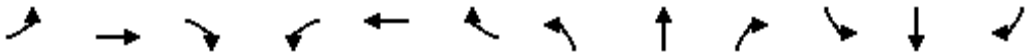
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	233	509	88	422	55	426	185	697
v/c Ratio	0.77	0.48	0.44	0.53	0.37	0.51	0.73	0.54
Control Delay	47.8	22.1	37.7	18.7	40.5	23.1	49.0	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	22.1	37.7	18.7	40.5	23.1	49.0	16.9
Queue Length 50th (ft)	93	92	34	54	22	73	74	102
Queue Length 95th (ft)	#241	151	87	102	62	126	#202	175
Internal Link Dist (ft)		1320		2050		1413		1561
Turn Bay Length (ft)	100		65		60		90	
Base Capacity (vph)	318	1180	228	1033	150	1049	266	1360
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.43	0.39	0.41	0.37	0.41	0.70	0.51

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	0.97		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3462		1770	3345		1770	3431		1770	3347	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3462		1770	3345		1770	3431		1770	3347	
Volume (vph)	214	400	68	81	247	142	51	312	80	170	409	232
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)	233	435	74	88	268	154	55	339	87	185	445	252
RTOR Reduction (vph)	0	17	0	0	108	0	0	29	0	0	95	0
Lane Group Flow (vph)	233	492	0	88	314	0	55	397	0	185	602	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	11.6	17.7		6.4	12.5		3.3	15.2		9.7	21.6	
Effective Green, g (s)	11.6	20.1		6.4	14.9		3.3	17.6		9.7	24.0	
Actuated g/C Ratio	0.17	0.29		0.09	0.21		0.05	0.25		0.14	0.34	
Clearance Time (s)	4.0	6.4		4.0	6.4		4.0	6.4		4.0	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	294	997		162	714		84	865		246	1151	
v/s Ratio Prot	c0.13	c0.14		0.05	0.09		0.03	0.12		c0.10	c0.18	
v/s Ratio Perm												
v/c Ratio	0.79	0.49		0.54	0.44		0.65	0.46		0.75	0.52	
Uniform Delay, d1	27.9	20.6		30.3	23.8		32.7	22.1		28.9	18.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.6	0.4		3.7	0.4		16.9	0.4		12.2	0.4	
Delay (s)	41.5	21.0		34.0	24.3		49.6	22.5		41.1	18.8	
Level of Service	D	C		C	C		D	C		D	B	
Approach Delay (s)		27.5			25.9			25.6			23.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	69.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	138	201	863	161	1047
v/c Ratio	0.45	0.46	0.36	0.44	0.43
Control Delay	24.5	7.1	4.3	6.8	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	7.1	4.3	6.8	3.3
Queue Length 50th (ft)	41	0	43	15	49
Queue Length 95th (ft)	77	41	88	37	80
Internal Link Dist (ft)	886		1561		920
Turn Bay Length (ft)				175	
Base Capacity (vph)	515	603	2380	362	2416
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.33	0.36	0.44	0.43

Intersection Summary

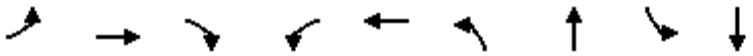
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3456		1770	3539
Flt Permitted	0.95	1.00	1.00		0.31	1.00
Satd. Flow (perm)	1770	1583	3456		580	3539
Volume (vph)	127	185	670	124	148	963
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	201	728	135	161	1047
RTOR Reduction (vph)	0	166	20	0	0	0
Lane Group Flow (vph)	138	35	843	0	161	1047
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.5	9.5	37.5		37.5	37.5
Effective Green, g (s)	9.5	9.5	37.5		37.5	37.5
Actuated g/C Ratio	0.17	0.17	0.68		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	306	273	2356		395	2413
v/s Ratio Prot	c0.08		0.24			c0.30
v/s Ratio Perm		0.02			0.28	
v/c Ratio	0.45	0.13	0.36		0.41	0.43
Uniform Delay, d1	20.4	19.2	3.7		3.9	4.0
Progression Factor	1.00	1.00	1.00		0.62	0.63
Incremental Delay, d2	1.1	0.2	0.4		2.8	0.5
Delay (s)	21.5	19.5	4.1		5.2	3.0
Level of Service	C	B	A		A	A
Approach Delay (s)	20.3		4.1			3.3
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	167	104	24	213	78	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	182	113	26	232	85	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	1047					
pX, platoon unblocked						
vC, conflicting volume			295		522	238
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			295		522	238
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		83	97
cM capacity (veh/h)			1267		505	801

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	295	26	232	85	23
Volume Left	0	26	0	85	0
Volume Right	113	0	0	0	23
cSH	1700	1267	1700	505	801
Volume to Capacity	0.17	0.02	0.14	0.17	0.03
Queue Length 95th (ft)	0	2	0	15	2
Control Delay (s)	0.0	7.9	0.0	13.6	9.6
Lane LOS		A		B	A
Approach Delay (s)	0.0	0.8		12.7	
Approach LOS				B	

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	159	189	304	164	225	250	866	42	1223
v/c Ratio	0.70	0.55	0.56	0.70	0.64	0.88	0.51	0.31	0.97
Control Delay	59.7	43.6	8.5	58.7	44.3	73.7	21.4	52.1	51.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.7	43.6	8.5	58.7	44.3	73.7	21.4	52.1	51.6
Queue Length 50th (ft)	99	112	0	102	128	161	213	26	407
Queue Length 95th (ft)	#190	184	69	183	206	#338	328	63	#636
Internal Link Dist (ft)		1790			2330		1951		1270
Turn Bay Length (ft)	175			175		175		100	
Base Capacity (vph)	260	502	649	276	508	284	1701	182	1262
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.38	0.47	0.59	0.44	0.88	0.51	0.23	0.97

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1799		1770	3471		1770	3462	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1770	1799		1770	3471		1770	3462	
Volume (vph)	146	174	280	151	160	47	230	694	103	39	962	163
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)	159	189	304	164	174	51	250	754	112	42	1046	177
RTOR Reduction (vph)	0	0	249	0	11	0	0	8	0	0	11	0
Lane Group Flow (vph)	159	189	55	164	214	0	250	858	0	42	1212	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4									
Actuated Green, G (s)	12.9	16.5	16.5	13.3	16.9		17.8	47.1		5.2	34.5	
Effective Green, g (s)	12.9	18.5	18.5	13.3	18.9		17.8	48.8		5.2	36.2	
Actuated g/C Ratio	0.13	0.18	0.18	0.13	0.19		0.17	0.48		0.05	0.36	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0		4.0	5.7		4.0	5.7	
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)	224	339	288	231	334		309	1664		90	1231	
v/s Ratio Prot	0.09	0.10		c0.09	c0.12		c0.14	0.25		0.02	c0.35	
v/s Ratio Perm			0.03									
v/c Ratio	0.71	0.56	0.19	0.71	0.64		0.81	0.52		0.47	0.98	
Uniform Delay, d1	42.7	37.9	35.3	42.4	38.3		40.4	18.3		47.0	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.9	2.0	0.3	9.6	4.2		14.4	0.3		3.8	21.8	
Delay (s)	52.5	39.9	35.6	52.0	42.5		54.7	18.6		50.7	54.3	
Level of Service	D	D	D	D	D		D	B		D	D	
Approach Delay (s)		41.0			46.5			26.7			54.2	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	101.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

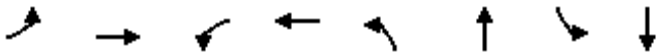
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	77	51	1028	1339
v/c Ratio	0.42	0.38	0.50	0.46
Control Delay	23.5	41.4	4.0	2.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.5	41.4	4.0	2.7
Queue Length 50th (ft)	11	22	45	84
Queue Length 95th (ft)	56	60	69	138
Internal Link Dist (ft)	1091	369	590	1951
Turn Bay Length (ft)				
Base Capacity (vph)	443	385	2045	2881
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.13	0.50	0.46

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.89			0.95			1.00			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1626			1708			3508			3525	
Flt Permitted		0.93			0.67			0.77			0.94	
Satd. Flow (perm)		1533			1174			2724			3300	
Volume (vph)	15	0	56	29	1	17	52	863	30	17	1196	19
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)	16	0	61	32	1	18	57	938	33	18	1300	21
RTOR Reduction (vph)	0	57	0	0	17	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	20	0	0	34	0	0	1027	0	0	1339	0
Confl. Peds. (#/hr)	2		2	2		2	4		4	13		13
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			4			6		5	2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		6.9			6.9			81.1			93.1	
Effective Green, g (s)		7.9			7.9			82.1			94.1	
Actuated g/C Ratio		0.07			0.07			0.75			0.86	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		110			84			2033			2839	
v/s Ratio Prot											c0.03	
v/s Ratio Perm		0.01			c0.03			c0.38			0.37	
v/c Ratio		0.19			0.41			0.51			0.47	
Uniform Delay, d1		48.0			48.8			5.7			1.9	
Progression Factor		1.00			1.00			0.52			1.00	
Incremental Delay, d2		0.8			3.2			0.8			0.1	
Delay (s)		48.8			52.0			3.8			2.1	
Level of Service		D			D			A			A	
Approach Delay (s)		48.8			52.0			3.8			2.1	
Approach LOS		D			D			A			A	

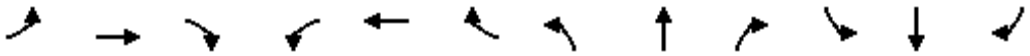
Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	125	139	197	74	954	166	1157
v/c Ratio	0.29	0.35	0.63	0.47	0.30	0.44	0.56	0.49
Control Delay	40.8	22.9	53.5	13.9	8.1	11.0	19.7	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.8	22.9	53.5	13.9	8.1	11.0	19.7	9.6
Queue Length 50th (ft)	33	41	92	27	9	163	27	144
Queue Length 95th (ft)	66	87	147	85	20	271	100	267
Internal Link Dist (ft)		1234		927		920		590
Turn Bay Length (ft)	100		100		100		100	
Base Capacity (vph)	329	591	394	635	362	2178	464	2353
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.21	0.35	0.31	0.20	0.44	0.36	0.49

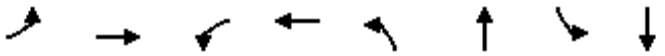
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.88		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1756	1689		1764	1627		1769	3481		1769	3524	
Flt Permitted	0.41	1.00		0.59	1.00		0.21	1.00		0.23	1.00	
Satd. Flow (perm)	761	1689		1087	1627		382	3481		437	3524	
Volume (vph)	50	52	63	128	41	140	68	795	83	153	1038	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)	54	57	68	139	45	152	74	864	90	166	1128	29
RTOR Reduction (vph)	0	47	0	0	124	0	0	4	0	0	1	0
Lane Group Flow (vph)	54	78	0	139	73	0	74	950	0	166	1156	0
Confl. Peds. (#/hr)	9		9	3		3	2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)	17.1	17.1		17.1	17.1		73.0	67.7		80.8	71.6	
Effective Green, g (s)	20.1	20.1		20.1	20.1		74.0	68.7		81.8	72.6	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.67	0.62		0.74	0.66	
Clearance Time (s)	7.0	7.0		7.0	7.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	139	309		199	297		324	2174		436	2326	
v/s Ratio Prot		0.05			0.04		0.01	0.27		c0.03	c0.33	
v/s Ratio Perm	0.07			c0.13			0.14			0.25		
v/c Ratio	0.39	0.25		0.70	0.25		0.23	0.44		0.38	0.50	
Uniform Delay, d1	39.5	38.5		42.1	38.5		6.8	10.7		5.6	9.5	
Progression Factor	1.00	1.00		1.00	1.00		0.95	0.87		2.03	0.84	
Incremental Delay, d2	1.8	0.4		10.2	0.4		0.3	0.6		0.5	0.7	
Delay (s)	41.3	38.9		52.3	38.9		6.8	9.9		11.9	8.7	
Level of Service	D	D		D	D		A	A		B	A	
Approach Delay (s)		39.7			44.4			9.7			9.1	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	259	571	105	469	63	482	199	775
v/c Ratio	0.78	0.52	0.54	0.60	0.36	0.57	0.75	0.62
Control Delay	49.8	24.3	45.3	25.1	41.2	26.8	53.3	22.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.8	24.3	45.3	25.1	41.2	26.8	53.3	22.0
Queue Length 50th (ft)	125	125	51	87	30	102	99	153
Queue Length 95th (ft)	#258	182	106	138	70	157	#220	238
Internal Link Dist (ft)		1320		2050		1413		1561
Turn Bay Length (ft)	100		65		60		90	
Base Capacity (vph)	371	1202	226	944	218	1006	284	1257
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.48	0.46	0.50	0.29	0.48	0.70	0.62

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	0.97		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3462		1770	3354		1770	3425		1770	3347	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3462		1770	3354		1770	3425		1770	3347	
Volume (vph)	238	449	76	97	281	151	58	348	96	183	455	258
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)	259	488	83	105	305	164	63	378	104	199	495	280
RTOR Reduction (vph)	0	16	0	0	84	0	0	29	0	0	84	0
Lane Group Flow (vph)	259	555	0	105	385	0	63	453	0	199	691	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	14.1	21.4		7.1	14.4		5.0	17.6		11.3	23.9	
Effective Green, g (s)	14.1	23.8		7.1	16.8		5.0	20.0		11.3	26.3	
Actuated g/C Ratio	0.18	0.30		0.09	0.21		0.06	0.26		0.14	0.34	
Clearance Time (s)	4.0	6.4		4.0	6.4		4.0	6.4		4.0	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	319	1054		161	721		113	876		256	1126	
v/s Ratio Prot	c0.15	c0.16		0.06	0.11		0.04	0.13		c0.11	c0.21	
v/s Ratio Perm												
v/c Ratio	0.81	0.53		0.65	0.53		0.56	0.52		0.78	0.61	
Uniform Delay, d1	30.8	22.5		34.4	27.2		35.5	25.0		32.2	21.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.5	0.5		9.1	0.8		5.8	0.5		13.8	1.0	
Delay (s)	45.3	23.0		43.5	28.0		41.4	25.5		46.0	22.7	
Level of Service	D	C		D	C		D	C		D	C	
Approach Delay (s)		30.0			30.8			27.3			27.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	138	201	951	161	1170
v/c Ratio	0.45	0.49	0.40	0.51	0.48
Control Delay	24.5	10.1	4.6	9.7	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	10.1	4.6	9.7	3.6
Queue Length 50th (ft)	41	11	50	15	57
Queue Length 95th (ft)	77	53	101	68	115
Internal Link Dist (ft)	886		1561		920
Turn Bay Length (ft)				175	
Base Capacity (vph)	515	576	2382	318	2416
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.35	0.40	0.51	0.48

Intersection Summary

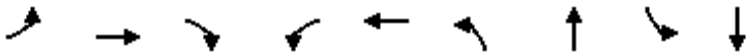
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3464		1770	3539
Flt Permitted	0.95	1.00	1.00		0.28	1.00
Satd. Flow (perm)	1770	1583	3464		520	3539
Volume (vph)	127	185	751	124	148	1076
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	201	816	135	161	1170
RTOR Reduction (vph)	0	135	18	0	0	0
Lane Group Flow (vph)	138	66	934	0	161	1170
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.5	9.5	37.5		37.5	37.5
Effective Green, g (s)	9.5	9.5	37.5		37.5	37.5
Actuated g/C Ratio	0.17	0.17	0.68		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	306	273	2362		355	2413
v/s Ratio Prot	c0.08		0.27			c0.33
v/s Ratio Perm		0.04			0.31	
v/c Ratio	0.45	0.24	0.40		0.45	0.48
Uniform Delay, d1	20.4	19.6	3.8		4.0	4.2
Progression Factor	1.00	1.00	1.00		0.82	0.64
Incremental Delay, d2	1.1	0.5	0.5		3.6	0.6
Delay (s)	21.5	20.1	4.3		6.9	3.3
Level of Service	C	C	A		A	A
Approach Delay (s)	20.7		4.3			3.7
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	6.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	185	104	24	237	78	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	201	113	26	258	85	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			314		567	258
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			314		567	258
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		82	97
cM capacity (veh/h)			1246		474	781

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	314	26	258	85	23
Volume Left	0	26	0	85	0
Volume Right	113	0	0	0	23
cSH	1700	1246	1700	474	781
Volume to Capacity	0.18	0.02	0.15	0.18	0.03
Queue Length 95th (ft)	0	2	0	16	2
Control Delay (s)	0.0	8.0	0.0	14.2	9.7
Lane LOS		A		B	A
Approach Delay (s)	0.0	0.7		13.3	
Approach LOS				B	

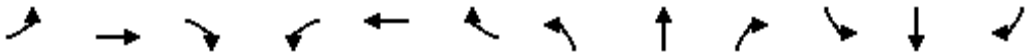
Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	159	189	226	138	225	183	737	42	1118
v/c Ratio	0.69	0.52	0.46	0.62	0.64	0.73	0.44	0.31	0.86
Control Delay	58.6	41.5	8.0	54.9	43.5	59.5	20.3	51.7	37.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	58.6	41.5	8.0	54.9	43.5	59.5	20.3	51.7	37.9
Queue Length 50th (ft)	99	110	0	86	128	113	172	26	354
Queue Length 95th (ft)	#190	184	61	156	206	#220	270	63	#550
Internal Link Dist (ft)		1790			2330		1951		1270
Turn Bay Length (ft)	175			175		175		100	
Base Capacity (vph)	267	517	603	281	518	285	1679	186	1300
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.37	0.37	0.49	0.43	0.64	0.44	0.23	0.86

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1799		1770	3475		1770	3455	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1770	1799		1770	3475		1770	3455	
Volume (vph)	146	174	208	127	160	47	168	596	82	39	866	163
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)	159	189	226	138	174	51	183	648	89	42	941	177
RTOR Reduction (vph)	0	0	183	0	11	0	0	8	0	0	13	0
Lane Group Flow (vph)	159	189	43	138	214	0	183	729	0	42	1105	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4									
Actuated Green, G (s)	12.7	17.1	17.1	12.2	16.6		15.7	45.3		5.1	34.7	
Effective Green, g (s)	12.7	19.1	19.1	12.2	18.6		15.7	47.0		5.1	36.4	
Actuated g/C Ratio	0.13	0.19	0.19	0.12	0.19		0.16	0.47		0.05	0.37	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0		4.0	5.7		4.0	5.7	
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)	226	358	304	217	337		280	1643		91	1265	
v/s Ratio Prot	c0.09	0.10		0.08	c0.12		c0.10	0.21		0.02	c0.32	
v/s Ratio Perm			0.03									
v/c Ratio	0.70	0.53	0.14	0.64	0.64		0.65	0.44		0.46	0.87	
Uniform Delay, d1	41.5	36.1	33.4	41.5	37.3		39.3	17.5		45.8	29.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.5	1.4	0.2	6.0	3.9		5.4	0.2		3.7	7.0	
Delay (s)	51.1	37.5	33.6	47.5	41.2		44.7	17.7		49.5	36.3	
Level of Service	D	D	C	D	D		D	B		D	D	
Approach Delay (s)		39.7			43.6			23.0			36.8	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	34.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	99.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

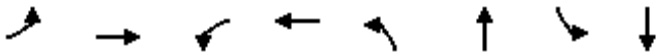
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	33	51	768	1130
v/c Ratio	0.24	0.37	0.31	0.39
Control Delay	32.1	41.2	4.8	2.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	32.1	41.2	4.8	2.3
Queue Length 50th (ft)	11	22	64	64
Queue Length 95th (ft)	41	60	106	106
Internal Link Dist (ft)	1091	369	590	1951
Turn Bay Length (ft)				
Base Capacity (vph)	404	392	2472	2888
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.08	0.13	0.31	0.39

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.99			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.93			0.95			0.99			1.00	
Flt Protected		0.98			0.97			1.00			1.00	
Satd. Flow (prot)		1677			1707			3508			3522	
Flt Permitted		0.86			0.86			0.93			0.94	
Satd. Flow (perm)		1477			1507			3272			3310	
Volume (vph)	15	0	16	29	1	17	11	665	30	17	1004	19
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)	16	0	17	32	1	18	12	723	33	18	1091	21
RTOR Reduction (vph)	0	16	0	0	17	0	0	2	0	0	1	0
Lane Group Flow (vph)	0	17	0	0	34	0	0	766	0	0	1129	0
Confl. Peds. (#/hr)	2		2	2		2	4		4	13		13
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			4			6		5	2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		6.8			6.8			81.2			93.2	
Effective Green, g (s)		7.8			7.8			82.2			94.2	
Actuated g/C Ratio		0.07			0.07			0.75			0.86	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		105			107			2445			2850	
v/s Ratio Prot											c0.03	
v/s Ratio Perm		0.01			c0.02			0.23			c0.31	
v/c Ratio		0.16			0.32			0.31			0.40	
Uniform Delay, d1		48.0			48.6			4.6			1.7	
Progression Factor		1.00			1.00			0.94			1.00	
Incremental Delay, d2		0.7			1.7			0.3			0.1	
Delay (s)		48.8			50.3			4.6			1.8	
Level of Service		D			D			A			A	
Approach Delay (s)		48.8			50.3			4.6			1.8	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	4.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	82	135	117	42	757	79	1001
v/c Ratio	0.26	0.25	0.61	0.33	0.13	0.32	0.22	0.41
Control Delay	40.7	20.0	52.8	15.3	4.5	7.2	5.2	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.7	20.0	52.8	15.3	4.5	7.2	5.2	7.5
Queue Length 50th (ft)	34	21	89	19	5	91	10	164
Queue Length 95th (ft)	66	60	144	65	m12	174	20	255
Internal Link Dist (ft)		1234		2016		920		590
Turn Bay Length (ft)	100		100		100		100	
Base Capacity (vph)	399	581	428	594	440	2367	555	2469
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.14	0.32	0.20	0.10	0.32	0.14	0.41

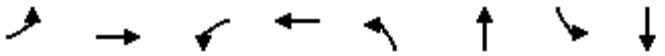
Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.89		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1753	1680		1764	1641		1769	3474		1769	3521	
Flt Permitted	0.60	1.00		0.69	1.00		0.25	1.00		0.33	1.00	
Satd. Flow (perm)	1102	1680		1282	1641		470	3474		609	3521	
Volume (vph)	50	32	43	124	29	78	39	623	74	73	894	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)	54	35	47	135	32	85	42	677	80	79	972	29
RTOR Reduction (vph)	0	39	0	0	70	0	0	4	0	0	1	0
Lane Group Flow (vph)	54	43	0	135	47	0	42	753	0	79	1000	0
Confl. Peds. (#/hr)	9		9	3		3	2		2	2		2
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)	15.8	15.8		15.8	15.8		76.7	73.0		79.7	74.5	
Effective Green, g (s)	18.8	18.8		18.8	18.8		77.7	74.0		80.7	75.5	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.71	0.67		0.73	0.69	
Clearance Time (s)	7.0	7.0		7.0	7.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	188	287		219	280		376	2337		502	2417	
v/s Ratio Prot		0.03			0.03		0.00	0.22		c0.01	c0.28	
v/s Ratio Perm	0.05			c0.11			0.08			0.11		
v/c Ratio	0.29	0.15		0.62	0.17		0.11	0.32		0.16	0.41	
Uniform Delay, d1	39.8	38.8		42.3	38.9		5.2	7.5		4.4	7.6	
Progression Factor	1.00	1.00		1.00	1.00		0.84	0.83		0.89	0.85	
Incremental Delay, d2	0.8	0.2		5.1	0.3		0.1	0.3		0.1	0.5	
Delay (s)	40.6	39.0		47.3	39.2		4.5	6.6		4.1	6.9	
Level of Service	D	D		D	D		A	A		A	A	
Approach Delay (s)		39.7			43.6			6.5			6.7	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

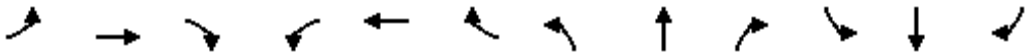
c Critical Lane Group



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	233	571	105	406	63	403	146	672
v/c Ratio	0.70	0.54	0.47	0.47	0.31	0.42	0.61	0.57
Control Delay	42.6	23.6	40.9	24.8	38.3	21.3	46.6	19.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.6	23.6	40.9	24.8	38.3	21.3	46.6	19.3
Queue Length 50th (ft)	101	115	47	79	28	72	66	112
Queue Length 95th (ft)	#223	182	106	133	70	121	#168	187
Internal Link Dist (ft)		1320		2050		1413		1561
Turn Bay Length (ft)	100		65		60		90	
Base Capacity (vph)	412	1334	270	1093	261	1251	272	1350
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.43	0.39	0.37	0.24	0.32	0.54	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.96		1.00	0.96		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3462		1770	3407		1770	3402		1770	3335	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3462		1770	3407		1770	3402		1770	3335	
Volume (vph)	214	449	76	97	281	93	58	275	96	134	381	237
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)	233	488	83	105	305	101	63	299	104	146	414	258
RTOR Reduction (vph)	0	16	0	0	37	0	0	41	0	0	107	0
Lane Group Flow (vph)	233	555	0	105	369	0	63	362	0	146	565	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	10.3	17.3		6.5	13.5		4.5	16.3		6.9	18.7	
Effective Green, g (s)	10.3	19.7		6.5	15.9		4.5	18.7		6.9	21.1	
Actuated g/C Ratio	0.15	0.29		0.10	0.23		0.07	0.28		0.10	0.31	
Clearance Time (s)	4.0	6.4		4.0	6.4		4.0	6.4		4.0	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	269	1006		170	799		117	938		180	1038	
v/s Ratio Prot	c0.13	c0.16		0.06	0.11		0.04	0.11		c0.08	c0.17	
v/s Ratio Perm												
v/c Ratio	0.87	0.55		0.62	0.46		0.54	0.39		0.81	0.54	
Uniform Delay, d1	28.1	20.3		29.5	22.3		30.6	19.9		29.8	19.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.0	0.7		6.5	0.4		4.7	0.3		23.4	0.6	
Delay (s)	52.1	21.0		36.0	22.7		35.3	20.2		53.2	20.0	
Level of Service	D	C		D	C		D	C		D	B	
Approach Delay (s)		30.0			25.4			22.2			25.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	67.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	138	201	951	161	1170
v/c Ratio	0.45	0.49	0.40	0.51	0.48
Control Delay	24.5	10.1	4.6	11.4	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	10.1	4.6	11.4	4.9
Queue Length 50th (ft)	41	11	50	49	184
Queue Length 95th (ft)	77	53	101	107	96
Internal Link Dist (ft)	886		1561		920
Turn Bay Length (ft)				175	
Base Capacity (vph)	515	576	2382	318	2416
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.35	0.40	0.51	0.48

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3464		1770	3539
Flt Permitted	0.95	1.00	1.00		0.28	1.00
Satd. Flow (perm)	1770	1583	3464		520	3539
Volume (vph)	127	185	751	124	148	1076
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	201	816	135	161	1170
RTOR Reduction (vph)	0	135	18	0	0	0
Lane Group Flow (vph)	138	66	934	0	161	1170
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.5	9.5	37.5		37.5	37.5
Effective Green, g (s)	9.5	9.5	37.5		37.5	37.5
Actuated g/C Ratio	0.17	0.17	0.68		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	306	273	2362		355	2413
v/s Ratio Prot	c0.08		0.27			c0.33
v/s Ratio Perm		0.04			0.31	
v/c Ratio	0.45	0.24	0.40		0.45	0.48
Uniform Delay, d1	20.4	19.6	3.8		4.0	4.2
Progression Factor	1.00	1.00	1.00		1.05	0.93
Incremental Delay, d2	1.1	0.5	0.5		3.9	0.7
Delay (s)	21.5	20.1	4.3		8.1	4.5
Level of Service	C	C	A		A	A
Approach Delay (s)	20.7		4.3			5.0
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

PETERS & ASSOCIATES
ENGINEERS, INC.

Traffic Signal Warrants Results

Traffic Signal Warrants Analysis

INTERSECTION CONFIGURATION

CITY: **Topeka**
CO.: **Shawnee**
HWY.,Mjr.: **California Avenue**
ST.,Minor: **Drive A**
Projected Traffic Conditions

No. Lanes — Major: 2 Minor: 1
Accidents > 5/yr? (Y or N) N
Speed =>40, or Pop. < 10 K N
Factor out "RTs" (Y or N)?: YES
Major: NB N SB N
Minor: EB N WB Y

April 25, 2013 Study peformed b RMT

Required Vol. for Warrant:

Warrant	major	minor
1A	600	150
1B	900	75
1AB (80% 1 & 2)	480	120
	720	60
2 (4 Hr.)	(see formula)	
3 (Peak Hr.)	" "	
Adj. Factor:	1	

MAJOR ST. (direction) Direction: NB SB

ENDING TIME	NB Existing + Proj	NB man.	NB Factor 100% results	SB Existing + Proj	SB man.	SB Factor 100% results	RESULTS SUM
7:00	1014		1014	502		502	1516
8:00	525		525	424		424	950
9:00	451		451	423		423	875
10:00	449		449	462		462	911
11:00	565		565	655		655	1220
12:00	633		633	693		693	1326
13:00	643		643	702		702	1345
14:00	692		692	709		709	1401
15:00	681		681	926		926	1608
16:00	752		752	981		981	1733
17:00	829		829	1107		1107	1936
18:00	672		672	773		773	1444
19:00	591		591	666		666	1257
20:00	554		554	564		564	1119
21:00	377		377	436		436	813

MINOR ST. (direction) EB WB

EB Existing + Proj	EB man.	EB Factor: 100% results	WB Existing + Proj	WB man.	WB Factor: 100% results	Minor vol. for 4Hr. War.	Minor vol. for Peak Hr. War.
0		0	49		49	80	144
0		0	42		42	156	312
0		0	42		42	179	342
0		0	58		58	168	327
0		0	60		60	96	219
0		0	105		105	82	189
0		0	111		111	80	184
0		0	112		112	80	170
0		0	104		104	80	126
0		0	106		106	80	106
0		0	127		127	80	100
0		0	122		122	80	159
0		0	127		127	91	208
0		0	110		110	114	251
0		0	94		94	200	368

* Note: Manual value is used if available.
Results have been factored for machine count error.

Traffic Signal Warrants Analysis

CITY: **Topeka**
CO.: **Shawnee**
HWY.,Mjr.: **California Avenue**
ST.,Minor: **Drive A**
Projected Traffic Conditions

FINAL RESULTS:
Projected Traffic Conditions
Major St.: California Avenue
Minor St.: Drive A

HOUR	SUM MAJOR	MAX. MINOR	Hour warrant was met: VOLUME 1A	VOLUME 1B	COMB. 1AB	4 Hr. 2	Peak 3
			600	900	480 720		
			150	75	120 60		
			Warrant Number				
7:00	1516	49	0	0	0 0 0	0	0
8:00	950	42	0	0	0 0 0	0	0
9:00	875	42	0	0	0 0 0	0	0
10:00	911	58	0	0	0 0 0	0	0
11:00	1220	60	0	0	0 0 1	0	0
12:00	1326	105	0	1	0 0 1	1	0
13:00	1345	111	0	1	0 0 1	1	0
14:00	1401	112	0	1	0 0 1	1	0
15:00	1608	104	0	1	0 0 1	1	0
16:00	1733	106	0	1	0 0 1	1	1
17:00	1936	127	0	1	1 1 1	1	1
18:00	1444	122	0	1	1 1 1	1	0
19:00	1257	127	0	1	1 1 1	1	0
20:00	1119	110	0	1	0 0 1	0	0
21:00	813	94	0	0	0 0 1	0	0
			0	9	3	8	2

This intersection SATISFIES the warrants for signalization as outlined in the "M.U.T.C.D."

CHAPTER 4C. TRAFFIC CONTROL SIGNAL NEEDS STUDIES

Section 4C.01 Studies and Factors for Justifying Traffic Control Signals

Standard:

01 **An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.**

02 **The investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants:**

Warrant 1, Eight-Hour Vehicular Volume
Warrant 2, Four-Hour Vehicular Volume
Warrant 3, Peak Hour
Warrant 4, Pedestrian Volume
Warrant 5, School Crossing
Warrant 6, Coordinated Signal System
Warrant 7, Crash Experience
Warrant 8, Roadway Network
Warrant 9, Intersection Near a Grade Crossing

03 **The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.**

Support:

04 Sections 8C.09 and 8C.10 contain information regarding the use of traffic control signals instead of gates and/or flashing-light signals at highway-rail grade crossings and highway-light rail transit grade crossings, respectively.

Guidance:

05 *A traffic control signal should not be installed unless one or more of the factors described in this Chapter are met.*

06 *A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.*

07 *A traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.*

08 *The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants listed in Paragraph 2.*

09 *Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics should dictate whether an approach is considered as one lane or two lanes. For example, for an approach with one lane for through and right-turning traffic plus a left-turn lane, if engineering judgment indicates that it should be considered a one-lane approach because the traffic using the left-turn lane is minor, the total traffic volume approaching the intersection should be applied against the signal warrants as a one-lane approach. The approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.*

10 *Similar engineering judgment and rationale should be applied to a street approach with one through/left-turn lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.*

11 *At a location that is under development or construction and where it is not possible to obtain a traffic count that would represent future traffic conditions, hourly volumes should be estimated as part of an engineering study for comparison with traffic signal warrants. Except for locations where the engineering study uses the satisfaction of Warrant 8 to justify a signal, a traffic control signal installed under projected conditions should have an engineering study done within 1 year of putting the signal into stop-and-go operation to determine if the signal is justified. If not justified, the signal should be taken out of stop-and-go operation or removed.*

12 *For signal warrant analysis, a location with a wide median, even if the median width is greater than 30 feet, should be considered as one intersection.*

Option:

13 At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the "minor-street" volume and the corresponding single direction of opposing traffic on the major street as the "major-street" volume.

14 For signal warrants requiring conditions to be present for a certain number of hours in order to be satisfied, any four sequential 15-minute periods may be considered as 1 hour if the separate 1-hour periods used in the warrant analysis do not overlap each other and both the major-street volume and the minor-street volume are for the same specific one-hour periods.

15 For signal warrant analysis, bicyclists may be counted as either vehicles or pedestrians.

Support:

16 When performing a signal warrant analysis, bicyclists riding in the street with other vehicular traffic are usually counted as vehicles and bicyclists who are clearly using pedestrian facilities are usually counted as pedestrians.

Option:

17 Engineering study data may include the following:

A. The number of vehicles entering the intersection in each hour from each approach during 12 hours of an average day. It is desirable that the hours selected contain the greatest percentage of the 24-hour traffic volume.
B. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, public-transit vehicles, and, in some locations, bicycles), during each 15-minute period of the 2 hours in the morning and 2 hours in the afternoon during which total traffic entering the intersection is greatest.
C. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in Item B and during hours of highest pedestrian volume. Where young, elderly, and/or persons with physical or visual disabilities need special consideration, the pedestrians and their crossing times may be classified by general observation.
D. Information about nearby facilities and activity centers that serve the young, elderly, and/or persons with disabilities, including requests from persons with disabilities for accessible crossing improvements at the location under study. These persons might not be adequately reflected in the pedestrian volume count if the absence of a signal restrains their mobility.
E. The posted or statutory speed limit or the 85th-percentile speed on the uncontrolled approaches to the location.
F. A condition diagram showing details of the physical layout, including such features as intersection geometrics, channelization, grades, sight-distance restrictions, transit stops and routes, parking conditions, pavement markings, roadway lighting, driveways, nearby railroad crossings, distance to nearest traffic control signals, utility poles and fixtures, and adjacent land use.
G. A collision diagram showing crash experience by type, location, direction of movement, severity, weather, time of day, date, and day of week for at least 1 year.

18 The following data, which are desirable for a more precise understanding of the operation of the intersection, may be obtained during the periods described in Item B of Paragraph 17:

A. Vehicle-hours of stopped time delay determined separately for each approach.
B. The number and distribution of acceptable gaps in vehicular traffic on the major street for entrance from the minor street.
C. The posted or statutory speed limit or the 85th-percentile speed on controlled approaches at a point near to the intersection but unaffected by the control.
D. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or Sunday.
E. Queue length on stop-controlled approaches.

Section 4C.02 Warrant 1, Eight-Hour Vehicular Volume

Support:

01 The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

02 The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

03 It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

Standard:

04 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Option:

05 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

Guidance:

06 *The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.*

Standard:

07 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and

B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

[a] Basic minimum hourly volume

[b] Used for combination of Conditions A and B after adequate trial of other remedial measures

[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

[d] May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

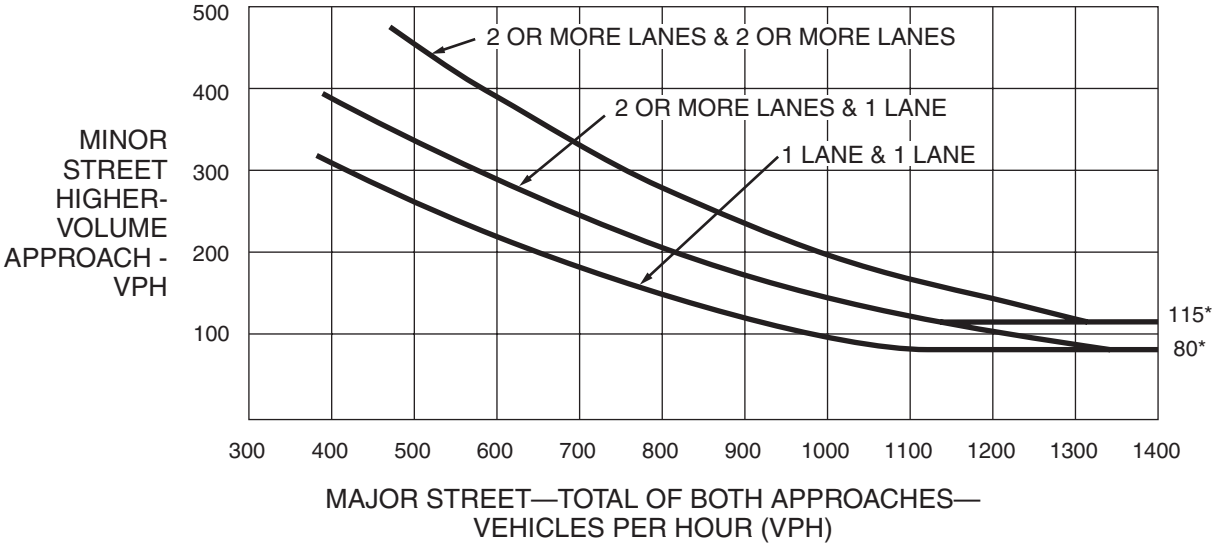
04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

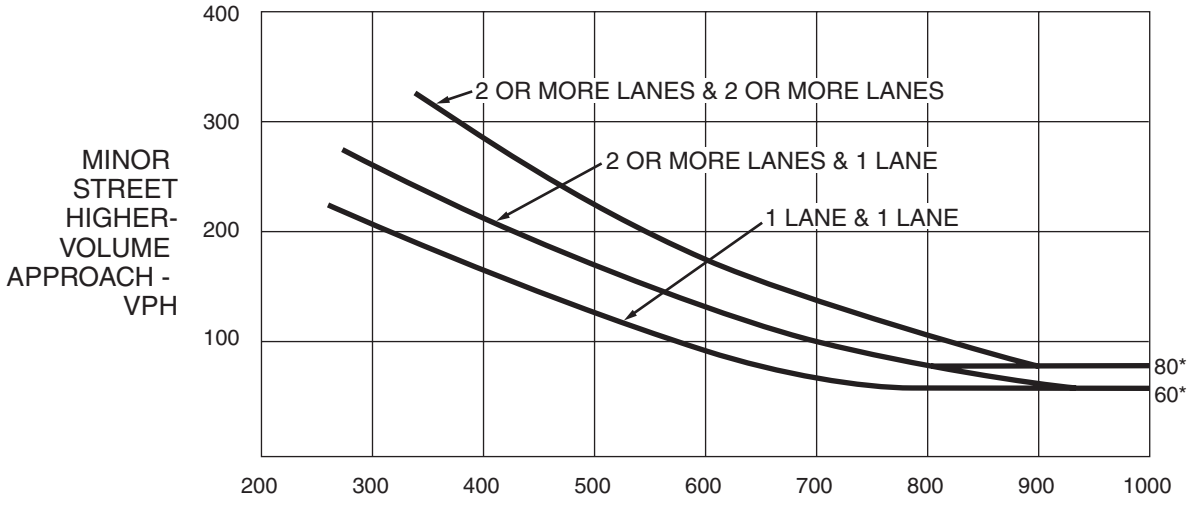
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

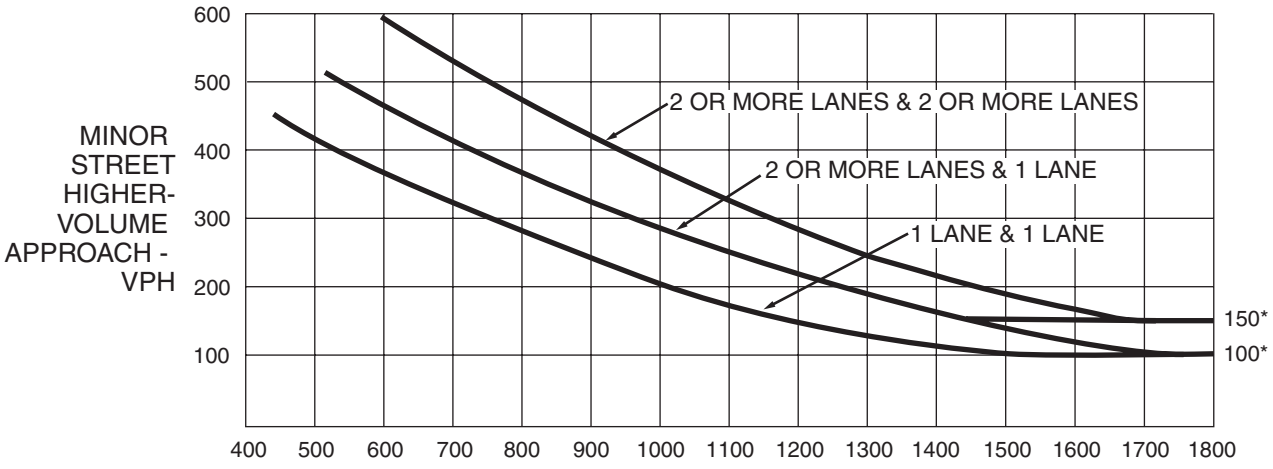
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

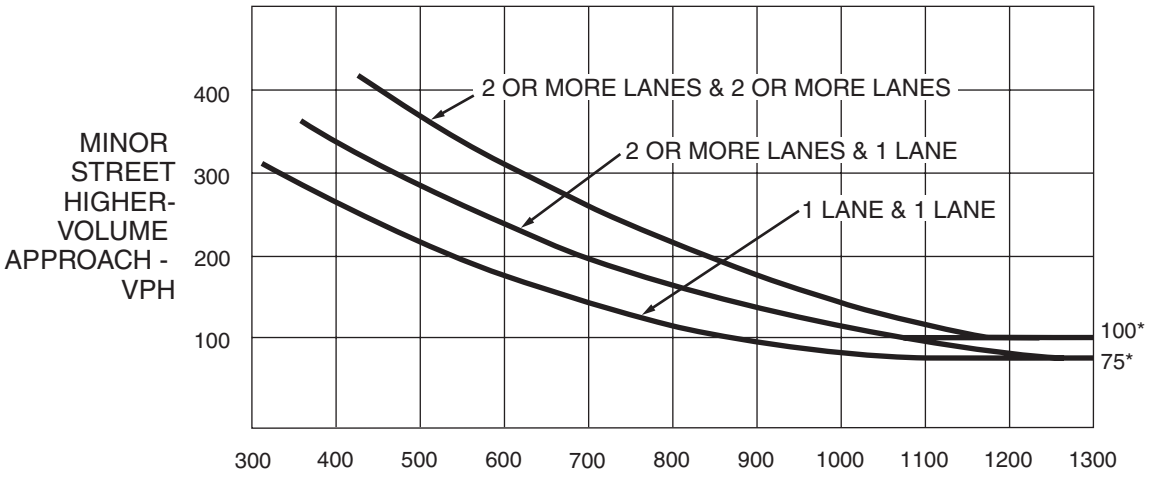
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

- **A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or**
- **B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

- *A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*
- *B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*
- *C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

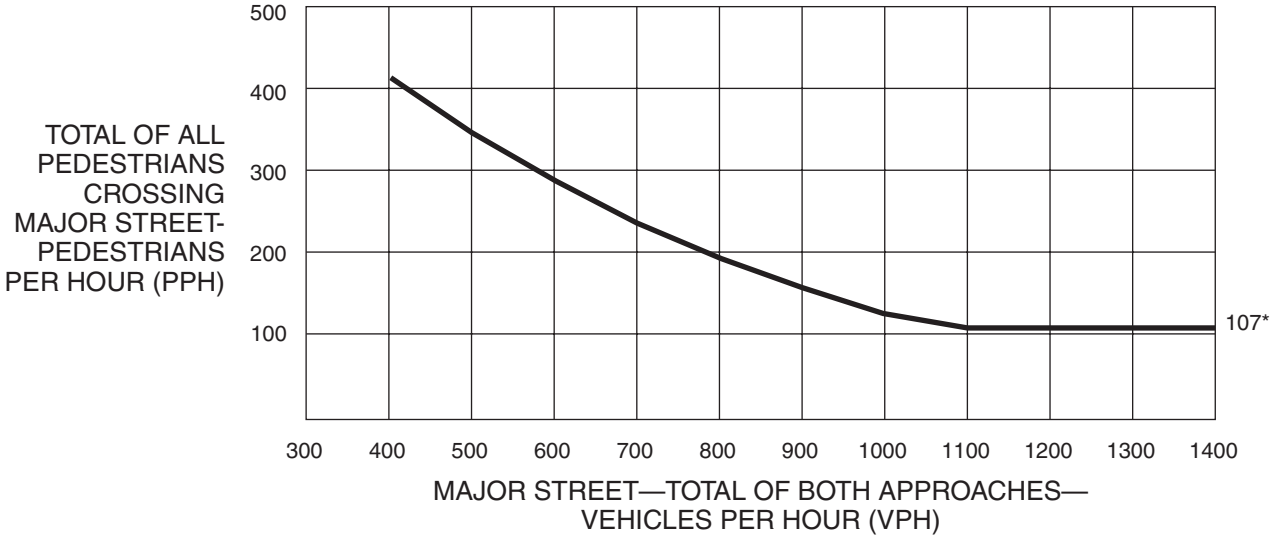
Support:

01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word “schoolchildren” includes elementary through high school students.

Standard:

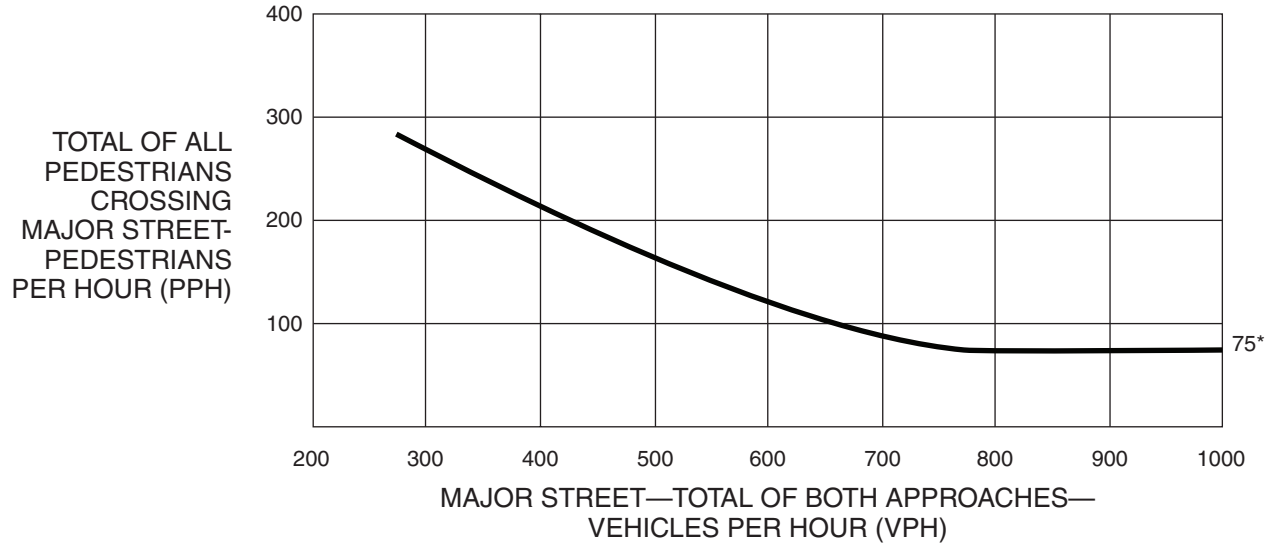
02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.**

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume



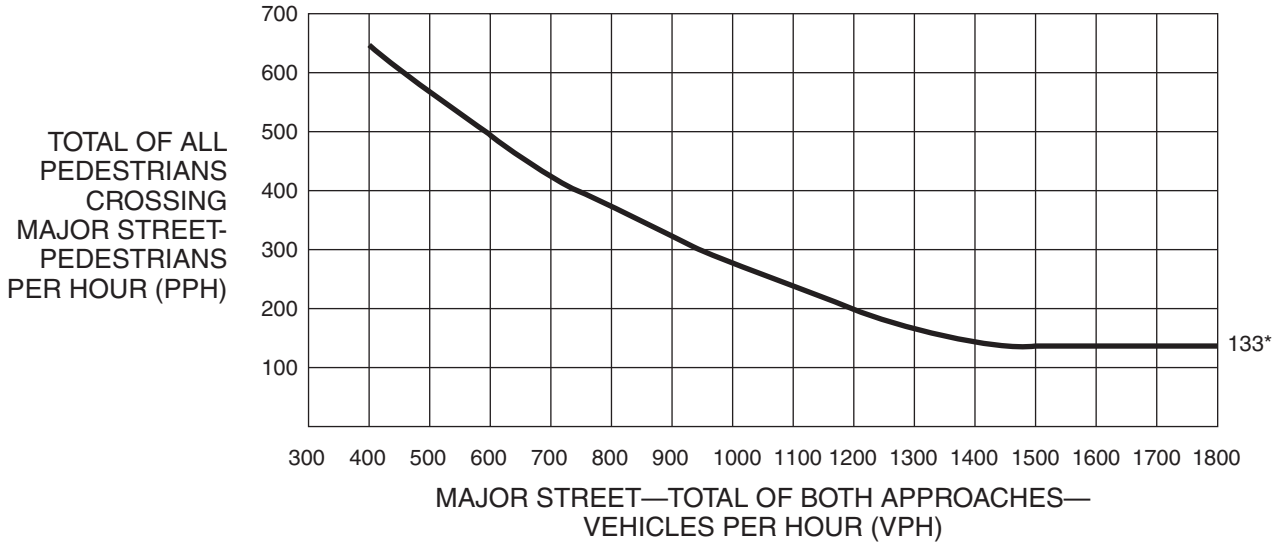
*Note: 107 pph applies as the lower threshold volume.

Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



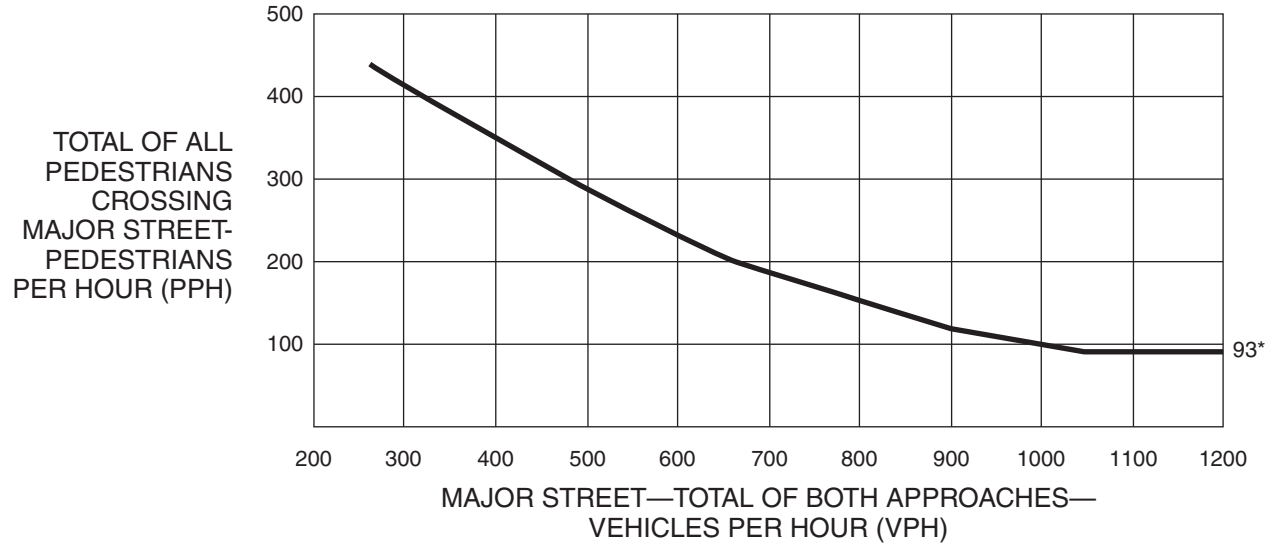
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

03 **Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.**

04 **The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

Guidance:

05 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Section 4C.07 Warrant 6, Coordinated Signal System

Support:

01 Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:**

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

Guidance:

03 *The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

Section 4C.08 Warrant 7, Crash Experience

Support:

01 The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:**

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.09 Warrant 8, Roadway Network

Support:

01 Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:**

- **A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or**
- **B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).**

03 **A major route as used in this signal warrant shall have at least one of the following characteristics:**

- **A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.**
- **B. It includes rural or suburban highways outside, entering, or traversing a city.**
- **C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.**

Section 4C.10 Warrant 9, Intersection Near a Grade Crossing

Support:

01 The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Guidance:

02 *This signal warrant should be applied only after adequate consideration has been given to other alternatives or after a trial of an alternative has failed to alleviate the safety concerns associated with the grade crossing. Among the alternatives that should be considered or tried are:*

- *A. Providing additional pavement that would enable vehicles to clear the track or that would provide space for an evasive maneuver, or*
- *B. Reassigning the stop controls at the intersection to make the approach across the track a non-stopping approach.*

Standard:

03 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:**

- **A. A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and**
- **B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of approach lanes over the track and the distance D, which is the clear storage distance as defined in Section 1A.13.**

Guidance:

04 *The following considerations apply when plotting the traffic volume data on Figure 4C-9 or 4C-10:*

- *A. Figure 4C-9 should be used if there is only one lane approaching the intersection at the track crossing location and Figure 4C-10 should be used if there are two or more lanes approaching the intersection at the track crossing location.*

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