Report Prepared for
Tanner & White

Woodside Development
47th Place and Rainbow Boulevard
Westwood, Kansas

Olsson Associates
Project Number
010-2516
March 2011

OLSSON
ASSOCIATES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION & OBJECTIVE

This report studies traffic impacts regarding the construction of a mixed-used development located northeast and southeast of the 47th Place and Rainbow Road (Hwy 169) intersection in Westwood, Kansas. The approximate locations of the proposed improvements are shown on the vicinity map, ***Figure 1***. The City of Westwood, Kansas, the Unified Government of Kansas City, Kansas and Kansas Department of Transportation (KDOT) provided guidance on the scope for this project. ***Figure 2*** illustrates the site plan for the proposed mixed use development.

Parcel 1: Renovation of Existing Health Club and Tennis Courts
Parcel 2: Construction of Retail and Residential Units (south side of 47th Place)
Parcel 3: Construction of Retail and Residential Units (north side of 47th Place)
Parcel 4: Construction of an Office Building (NE corner of 47th Avenue & Rainbow)

The objective of this study is to evaluate the existing traffic, roadway conditions, and traffic impacts expected from the construction of the proposed improvements. The appropriate intersection geometrics and traffic control improvements necessary to accommodate the increased traffic on the study area roadways were identified and for the purpose of this study the following scenarios will be analyzed for the AM and PM peak periods for vehicular traffic operations:

- Existing conditions
- Existing conditions plus Parcels 1 & 3 only
- Existing conditions plus Parcels 1 & 3 plus Parcels 2 & 4 (full build-out)
- Future conditions (existing conditions plus full build-out plus background traffic growth on Rainbow Boulevard)

The study area intersections include the following:

- Rainbow Boulevard & 47th Avenue
- Rainbow Boulevard & 47th Place
- State Line Road & 47th Place
- Site Drives

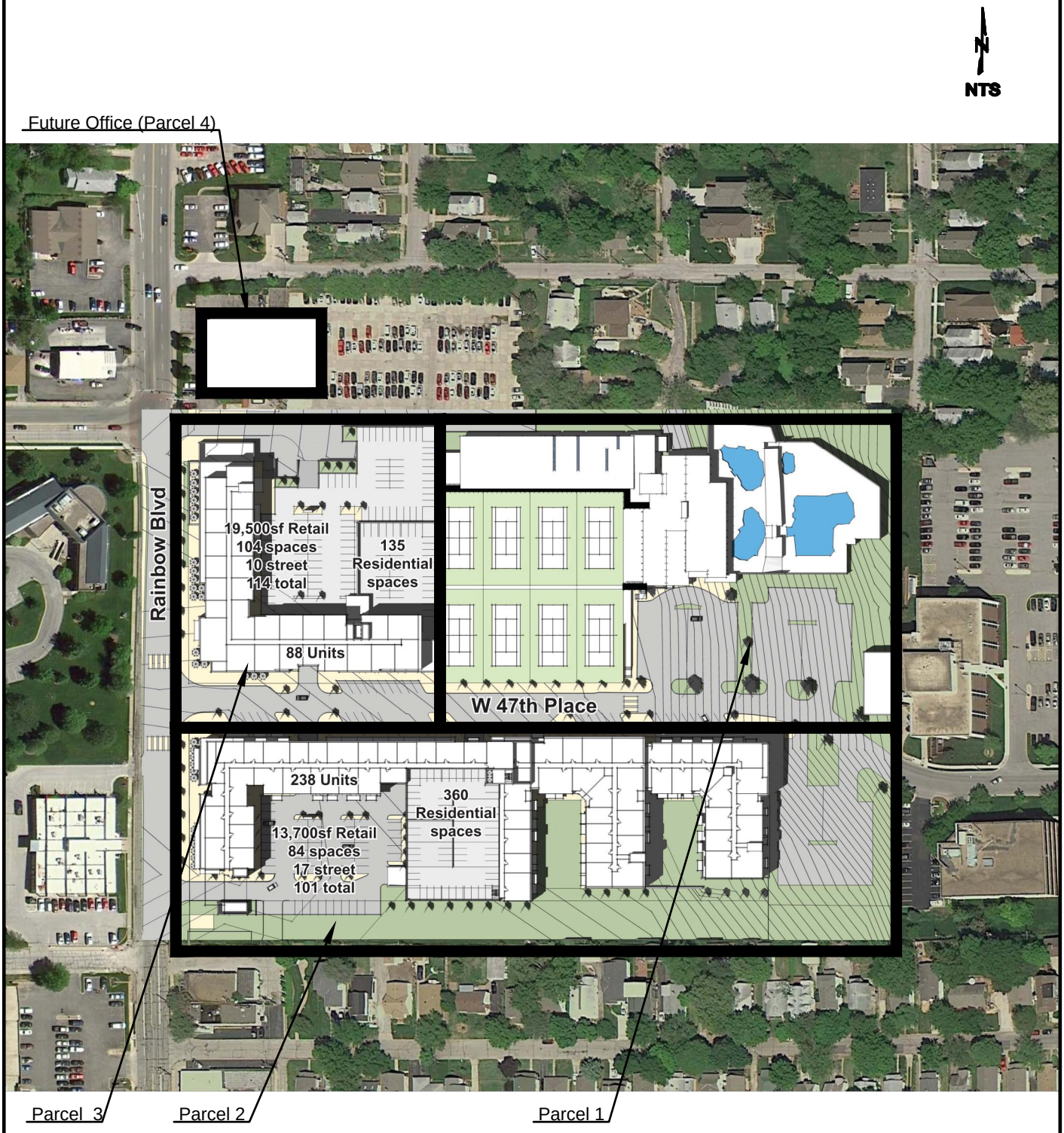
Jurisdictions to be involved with development and traffic impacts include:

- City of Westwood, Kansas
- City of Kansas City, Kansas (Unified Government)
- Kansas Department of Transportation (KDOT)

Woodside Development
Westwood, KS

OLSSON ASSOCIATES	Vicinity Map	FIGURE 1

Woodside Development
Westwood, KS



OLSSON ASSOCIATES	Site Plan	FIGURE 2

2.0 DESCRIPTION OF STUDY AREA

2.1 Proposed Development

Residential units, commercial retail space and an office building are proposed to be built on the site at full build-out. Renovations to an existing health and tennis club are also planned. See ***Figure 2*** for a further breakdown of proposed improvements by parcel numbers. The site is bound by 47th/46th Avenue to the north, State Line Road to the east, 47th Terrace to the south, and Rainbow Boulevard to the west.

Primary access is proposed via 47th Place from both the east and west. The development may also be accessed from the 47th Avenue and Rainbow Boulevard intersection. Additionally, Parcel 2 specifically may be accessed from Rainbow Boulevard, immediately north of 47th Terrace. The site plan for the future development is a preliminary plan and exact dimensions and arrangement may be modified.

2.2 Roadway and Intersection Characteristics

KDOT and Roadway Classifications

The KDOT Route Classification map was used to determine the classification of the roadway in the vicinity of the proposed site.

Rainbow Boulevard is currently an undivided four-lane north/south roadway with a posted speed limit of 35 mph. By KDOT route classification, it is classified as a type D route.

47th Avenue is an east/west arterial with a posted speed limit of 30 mph that intersects and ends (eastbound) at Rainbow Boulevard. The centerline of 47th Avenue serves as the dividing line between the Westwood, Kansas and Kansas City, Kansas (UG) jurisdictions.

Near this site, State Line Road acts as a north/south collector. It is a two lane undivided roadway with a posted speed limit of 30 mph. 47th Place is also a two lane undivided collector. It has a posted speed limit of 25 mph and many access locations between State Line Road and Rainbow Boulevard for the existing health and tennis club, businesses and their respective parking lots.

Intersection Characteristics

The T-intersection of Rainbow Boulevard and 47th Avenue is a signalized intersection owned by the city of Westwood. This signal is currently operating in an uncoordinated/actuated mode. Basic timing and phasing information was obtained from Kansas City Power & Light and used in modeling.

Rainbow Boulevard and 47th Place is an unsignalized T-intersection, stop-controlled for westbound traffic. The intersection is approximately 375 feet south of 47th Avenue.

The intersection of 47th Place and State Line Road is an unsignalized intersection. Stop control is provided for all directions of traffic. This intersection is approximately 1,300 feet east of Rainbow Boulevard and no separate turn lanes are provided in any direction.

Sight Distance

Sight distance was reviewed for the intersection of Rainbow Boulevard and 47th Place using guidance provided in the American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets". The posted speed limit along Rainbow Boulevard is 35 mph. Due to the vertical alignment of the roadway and an existing tree-line along the east side of Rainbow Boulevard sight distance is restricted for westbound traffic on 47th Place turning onto Rainbow Boulevard. Intersection sight distance is based on intersection control and turning type.

Case B represents intersections with stop control on the minor road. Case B1 is for the left-turn movement from the minor road (47th Place) onto an undivided roadway (Rainbow Boulevard). With a posted speed limit of 35 mph the sight distance for Case B1 should be a minimum of 415 feet. Case B2 is for the right-turn movement from the minor road (47th Place) onto an undivided roadway (Rainbow Boulevard). With a posted speed limit of 35 mph, the sight distance for Case B2 should be a minimum of 365 feet.

Based on measurements obtained during the field visit, sight distance for Case B1 exceeds 500 feet, thus Case B1 is met. Sight distance for Case B2 is 280 feet, less than the minimum requirement of 365 feet. As discussed above, the restricted sight distance can be attributed to the vertical grade of the roadway and an existing tree-line. ***Figure 4*** illustrates existing lane configurations, as well as sight distance measurements.

2.3 Area Transit

FutureTransit Improvements

Currently, no transit route operates on Rainbow Boulevard south of 47th Avenue. A map of current transit routes in the area can be found in the "KDOT ADT" section of the ***Appendix***. The Unified Government, the University of Kansas Medical Center, the Kansas City Area Transportation Authority and Johnson County Transit have recently been engaged in discussions centered around the development of a transit facility in the vicinity of 39th & Rainbow. This facility would provide an off-street convergence point for transit routes in the area, including KCATA route #39, #47 and #107, and JCT route 667E.

3.0 DATA COLLECTION

Olsson Associates collected AM and PM peak period traffic counts at the following intersections:

- Rainbow Blvd & 47th Avenue
- Rainbow Blvd & 47th Place
- State Line Road & 47th Place

Manual turning movement counts were collected on Tuesday, November 16, 2011 and Wednesday, November 17, 2011 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. Based on the count data collected, the AM peak hour is from 7:30 AM to 8:30 AM. The PM peak hour began at either 4:45 PM or 5:00 PM depending on the intersection. In addition to turning movement counts done by Olsson Associates, turning movement counts were completed for the existing parking lots on 47th Place by the Woodside Health Club. These were used in estimating and assigning internal traffic on 47th Place and are included in the appendix.

Field reviews of the site were conducted June 16, 2010 and Tuesday, November 16, 2010. Existing roadway and intersection characteristics were noted and traffic control at study intersections was documented.

Parking lot turning movement counts were taken by a Woodside Health Club employee (Chris Bell) from 5:00 PM to 7:00 PM on Tuesday February 15, 2011. These counts assisted in determining a realistic traffic volume entering and exiting the existing health/fitness club during the PM peak hour (5-6 PM) and patterns along 47th Place. Parking lot movements observed by the employee included direction for exiting vehicles, but not for those entering. Distribution for entering vehicles was assumed to be 55% from the west and 45% from the east to closely match proposed distribution.

Traffic and parking lot movement count sheets can be found in the ***Appendix.***

4.0 EXISTING TRAFFIC CONDITIONS

The analysis of existing conditions is based on the traffic counts for the study intersections. ***Section 2.2*** details roadway classification and characteristics for the existing network. Existing traffic volumes used for analysis are illustrated in ***Figure 3.*** The existing lane configurations and traffic control for intersections in the study area are illustrated in ***Figure 4.***

4.1 Signal Warrant Analysis

The Manual on Uniform Traffic Control Devices (MUTCD - 2009 Edition) provides eight signal warrants for evaluation of signalization at intersections. Typically, traffic signal warrants are based on a complete review of traffic information including volumes, pedestrians, accident experience, and traffic progression. The preliminary need for signalization at the study intersections was evaluated based on the Peak Hour Warrant (Warrant 3) contained in the MUTCD.

The existing unsignalized study intersections were evaluated for signalization. Based on Warrant 3, only the 47th Place & Rainbow Boulevard intersection satisfies the warrant criteria for signalization based on existing conditions during the PM peak period. Signal warrant analysis sheets are included in the ***Appendix.***

4.2 Capacity Analysis

Unsignalized capacity analyses were performed in accordance with Chapter 17 of the HCM using the Highway Capacity Software (HCS+), version T7F. For simplicity, the amount of delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. A letter grade between A and F is assigned, where LOS A represents the best operation. ***Table 1*** represents the LOS associated with intersection control delay, in seconds per vehicle (sec/veh), for signalized and unsignalized intersections.

Table 1: Intersection Level of Service Summary

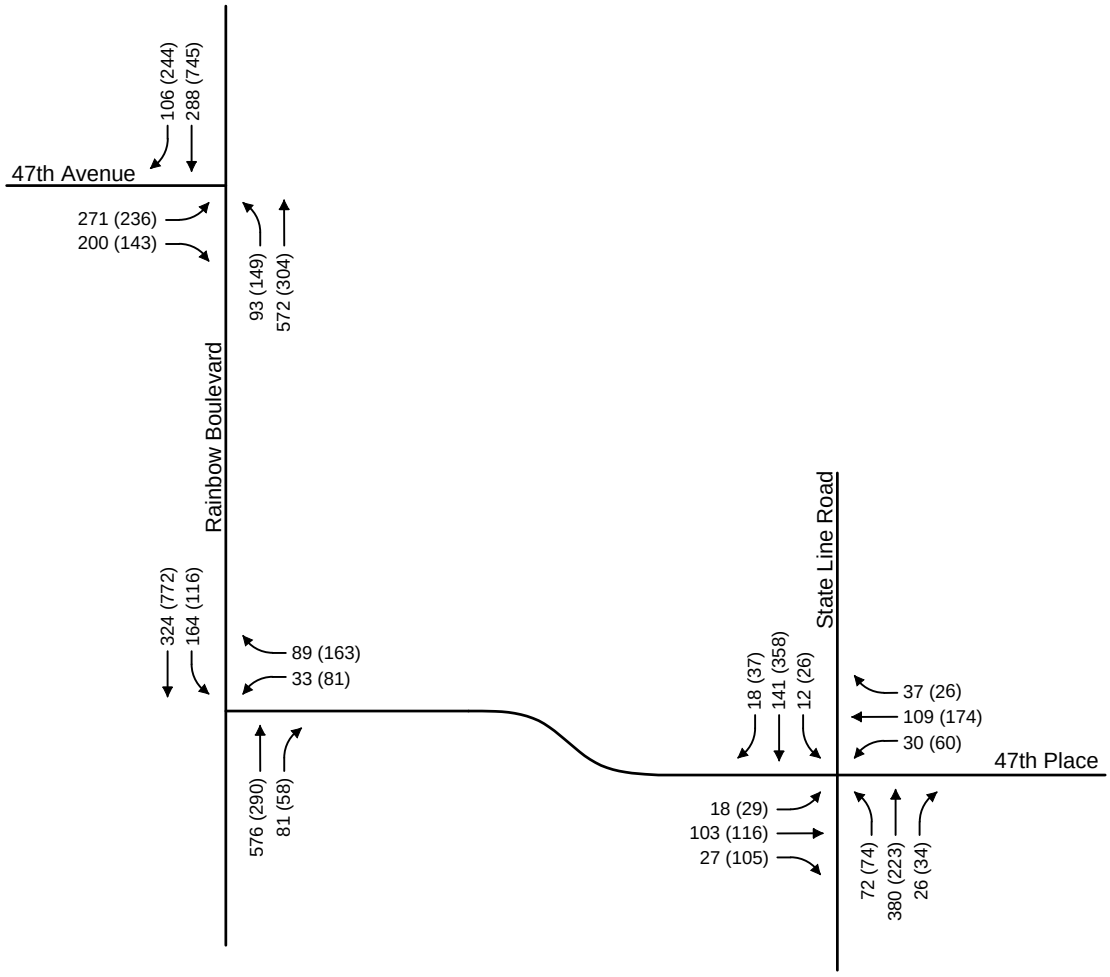
Level-of-Service Criteria		
Level of Service (LOS)	**Stop Control** Approach Delay sec/veh	**Signal Control** Control Delay sec/veh
A	≤ 10	≤ 10
B	>10 and ≤ 15	>10 and ≤ 20
C	>15 and ≤ 25	>20 and ≤ 35
D	>25 and ≤ 35	>35and ≤ 55
E	>35 and ≤ 50	>55 and ≤ 80
F	>50	>80

Capacity analysis was conducted for the study intersections. Currently, the signalized T-intersection at 47th Avenue and Rainbow Boulevard is expected to operate at LOS B or better during both AM and PM peak hour periods.

All movements at the unsignalized study intersections are expected to operate at LOS D or better during the AM and PM peak hour periods except for westbound left-turning movements during both peak periods (LOS F), northbound traffic at State Line Road in both peak periods (LOS E) and southbound traffic at State Line Road during the PM peak (LOS F).

Unsignalized side street movements can be expected to operate at a lower level of service during peak hour periods as higher major street movements and progression are accommodated. Based on field observations, operations appeared to be acceptable. In existing conditions, the LOS, queuing, and delay is not a significant concern for any intersections.

Figure 5 illustrates the existing level of service for individual movements at study intersections.



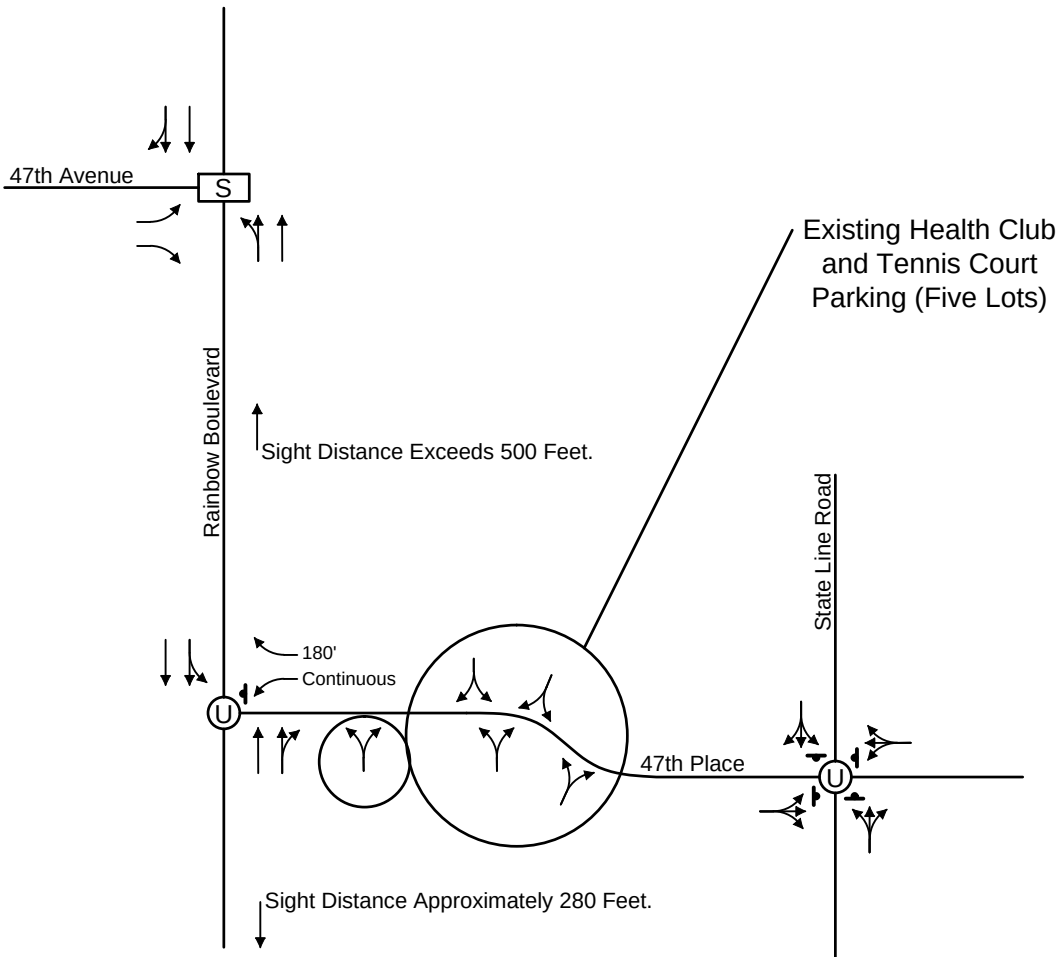
NOTE:
REFER TO APPENDIX FOR HEALTH CLUB PM PEAK HOUR PARKING LOT COUNTS (DONE BY OTHERS)

LEGEND
XX (XX) - AM (PM) Peak Hour Volumes

OLSSON ASSOCIATES

Existing Peak Hour Volumes

FIGURE 3



LEGEND

Ⓤ Unsignalized Intersection

Stop Sign

S Signalized Intersection Level of Service

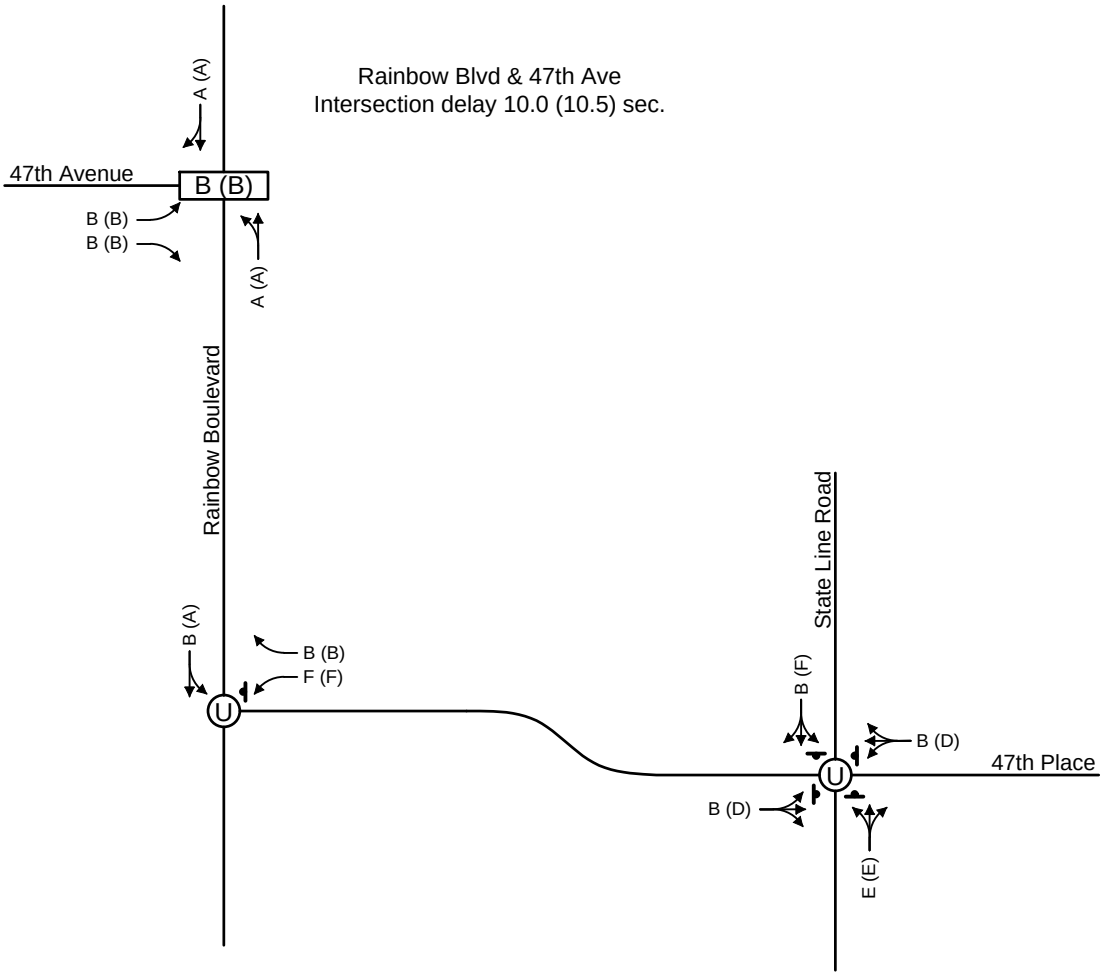
XX' Turn Bay Storage Length

OLSSON ASSOCIATES

Existing Lane Configurations & Traffic Control

FIGURE 4

N
NTS



LEGEND

Ⓤ	Unsignalized Intersection
	Stop Sign
X (X)	AM (PM) Level of Service
X (X)	AM (PM) Intersection Level of Service

NOTE:
REFER TO APPENDIX FOR HEALTH CLUB PM PEAK HOUR PARKING LOT COUNTS (DONE BY OTHERS)

OLSSON ASSOCIATES

Existing Level of Service

FIGURE 5

5.0 EXISTING CONDITIONS PLUS PARCELS 1 & 3

Proposed development in the first phase will include renovations to the existing health and tennis club as well as construct 19,500 square feet of new retail space and 88 residential units on the northeast corner at 47th Place and Rainbow Boulevard. Parcels 1 and 3 represent this phase of the project, respectively.

The existing Westwood Health and Tennis Club will undergo a reconstruction overhaul throughout the duration of the project. Renovations to the existing health club and tennis facilities may occur in this initial phase or in a later stage of the project. Scope of this work includes, but may not be limited to, reducing and centralizing the number of tennis courts from 18 to 8, renovating the existing health club building on the north side of 47th Place, as well as demolition of the existing structure on the south side of 47th Place.

Two new access drives are proposed in this phase, a retail drive located on 47th Place 175 feet east of Rainbow Boulevard and the north retail drive a connection at 47th Avenue and Rainbow Boulevard, making that intersection four-way. In addition to those drives, existing health and tennis club parking lot entrances will be consolidated into one lot & garage entrance approximately 675 feet east of Rainbow Boulevard. This parking garage will be below the proposed tennis courts. Angled parking may also be implemented on both sides of 47th Place. ***Figure 2*** depicts the March 8, 2011 proposed site plan.

5.1 Trip Generation and Distribution

Trip generation characteristics expected for the site are shown in **Table 2**. All phases of development are included in this table. These characteristics are based on trip generation data included in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (8th Edition). For trip generation determination the site was classified as Specialty Retail and Apartments. Trip generation was based on square footage of retail and number of residential units in the building.

The proposed residential units and retail space is expected to generate 1,521 daily trips on an average weekday. The development is expected to generate 66 trips during the AM peak period and 134 trips during the PM peak period.

The ITE Trip Generation Manual does not provide a rate or average for expected AM Peak Hour traffic volumes for the Specialty Retail land use. Often many specialty retail shops are not open during the morning peak hour, so to be conservative, for the AM Peak period, 27% of the expected PM peak hour traffic was used.

The existing health and fitness club is not expected to generate any additional trips after renovations and this is reflected in the report's trip generation tables.

Table 2: Trip Generation (Parcels 1 & 3 Only)

Daily Trip Generation - Woodside Development (All Parcels)

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Daily Trips	Trip Distribution Enter	Trip Distribution Exit	Daily Trips Enter	Daily Trips Exit	Parcel
492/897*	Health/Fitness Club	35,000	SF	-	-	-	-	-	-	1
814/1387	Specialty Retail Center	19,500	SF	Average	864	50%	50%	432	432	3
220/326	Apartment	88	Units	Equation	657	50%	50%	329	328	3
Total					**1,521**			**761**	**760**	

AM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Peak Hr Trips	Trip Distribution Enter	Trip Distribution Exit	AM Peak Hr Trips Enter	AM Peak Hr Trips Exit	Parcel
492/898**	Health/Fitness Club	35,000	SF	Average	0	45%	55%	0	0	1
814/1387^	Specialty Retail Center	19,500	SF	Equation	19	50%	50%	9	10	3
220/328	Apartment	88	Units	Equation	47	20%	80%	9	38	3
Total					**66**			**18**	**48**	

PM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Peak Hr Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hr Trips Enter	PM Peak Hr Trips Exit	Parcel
492/899**	Health/Fitness Club	35,000	SF	Equation	0	57%	43%	0	0	1
814/1388	Specialty Retail Center	19,500	SF	Equation	68	44%	56%	30	38	3
220/329	Apartment	88	Units	Equation	66	65%	35%	43	23	3
Total					**134**			**73**	**61**	

**No accurate estimates of daily trips for "Health/Fitness Club" Land Use in the ITE Manual.*

***Trips for "Health/Fitness Club" Land Use are already accounted for in the traffic counts. The Health/Fitness Club's cumulative square footage is decreasing and there will be a decrease in tennis courts from 18 to 8. No new trips are expected to be generated.*

^27% of PM Peak Hour trips used, no AM Peak Hour rates provided in ITE Manual.

A trip distribution was developed for the proposed site based on the distribution of the existing site volumes and conditions. The distribution for trips generated from the site is illustrated in ***Table 3***.

Table 3: Trip Distribution

Roadway	To	From
North (Rainbow Boulevard)	20%	20%
South (Rainbow Boulevard)	30%	30%
West (47th Avenue)	15%	15%
East (47th Place)	10%	10%
North (State Line Road)	10%	10%
South (State Line Road)	15%	15%

The AM and PM peak hour period trips for the first phase, following distribution and assignment to the roadway network, are illustrated in ***Figures 6 & 7***. Trips associated with the development were added to the existing traffic volumes. The resulting existing plus parcels 1 & 3 traffic volumes are illustrated in ***Figure 8***. The existing plus parcels 1 & 3 intersection geometrics and traffic control for the study area intersections are illustrated in ***Figure 9***.

5.2 Signal Warrant Analysis

Signal warrant analysis was completed as discussed in ***Section 4.1*** and warrant analysis sheets are included in the ***Appendix.*** All of the unsignalized study intersections were evaluated for signalization. Based on Warrant 3, none of the study intersections satisfy the peak hour warrant criteria for signalization based on existing plus parcels 1 & 3 only conditions except 47th Place & Rainbow Boulevard during the PM peak hour.

The intersection of 47th Place and Rainbow Boulevard is approximately 375 feet south of the signalized intersection of 47th Avenue and Rainbow Boulevard. With standard engineering practice, a greater distance between signalized intersections is usually preferred. However, sight distance to the south along Rainbow Boulevard is restricted, which is a safety concern for traffic along 47th Place as noted previously in ***Section 2.2***. Thus, it is recommended to signalize this intersection and coordinate with the signal to the north at 47th Avenue via interconnect.

For the purposes of this study, a 90-second cycle length was utilized for operation estimates. More in depth analysis will be required including the consideration of

operations and the coordination of adjacent signals along Rainbow Boulevard prior to implementation and final design.

Although not obtained at the time of our traffic counts, per City representatives the Woodside swimming pool serves as the City pool which creates significant pedestrian traffic in the summer months. The signal would provide an additional controlled crossing location for pedestrians at a location where there is limited sight distance and safety concerns.

5.3 Capacity Analysis

Methods of capacity analysis were discussed in ***Section 4.2.*** Despite the 47th Place & Rainbow Boulevard intersection meeting a signal warrant in this scenario, unsignalized capacity analysis was also completed for the intersection for comparison.

All movements at signalized intersections on Rainbow Boulevard (47th Place and 47th Avenue) are expected to operate at a LOS C or better during peak hours, with the exception of westbound movements at both intersections (LOS D). Operations may improve after completing additional, more in-depth timing analysis.

All movements at the unsignalized intersections are expected to operate at LOS D or better during the AM and PM peak hour periods with the exception of westbound left turn movements at an unsignalized 47th Place & Rainbow Boulevard intersection during both peaks (LOS F) when modeled as stop-controlled and the State Line Road & 47th Place intersection during the PM peak hour (LOS E).

As discussed in ***Section 4.2*****,** unsignalized side street movements can be expected to operate at a lower level of service during peak hour periods as higher major street movements are accommodated. Turning movements at the new access locations, as well as the consolidated health/fitness club entrance are expected to operate at a LOS C or better in both peak hours. ***Figure 10*** illustrates the existing plus parcels 1 & 3 level of service for the study area intersections.

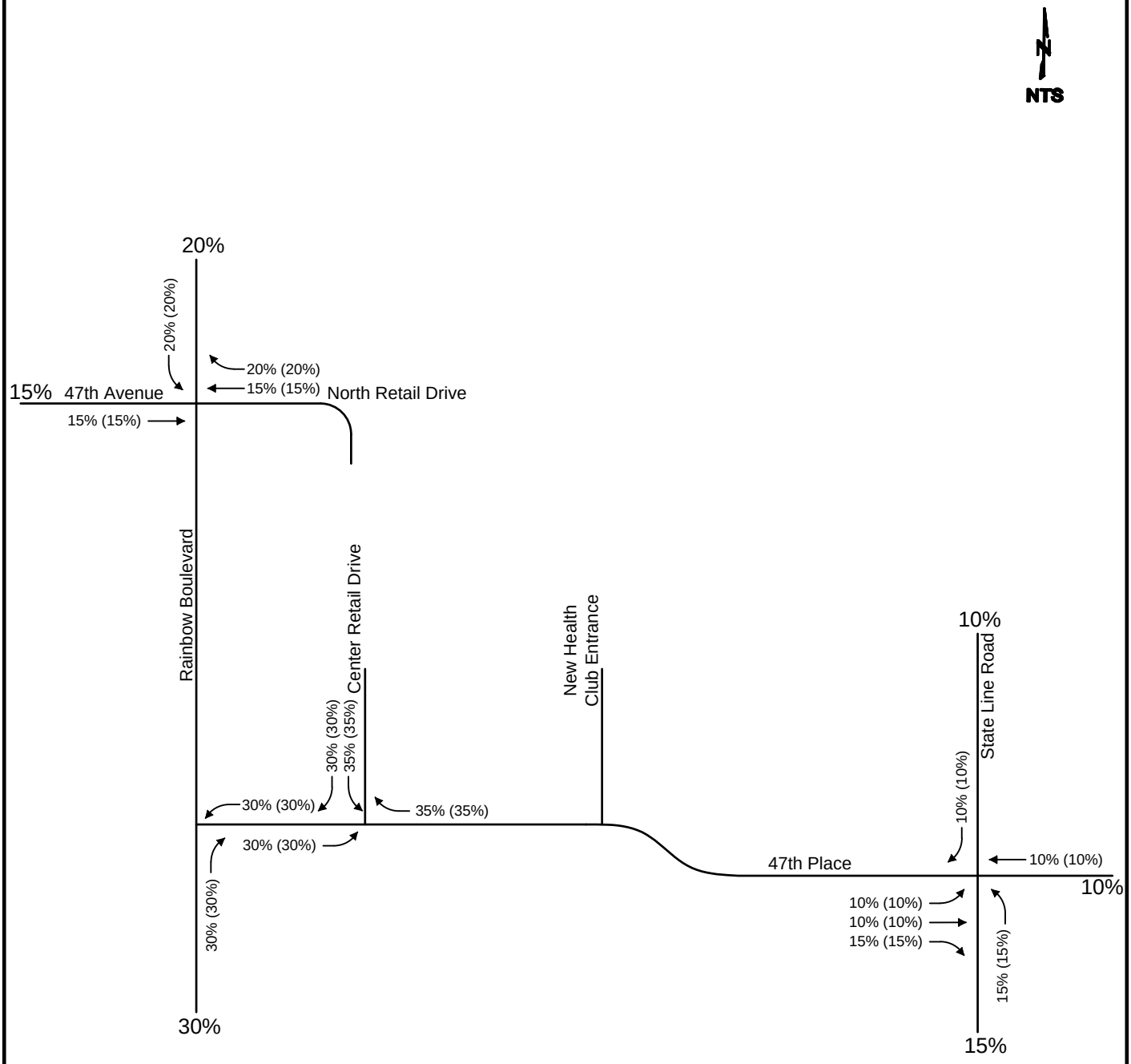
5.4 Site Circulation, Internal Capture & Lane Configurations

A proposed site plan was provided March 8, 2011. This plan illustrates the proposed improvements in all phases. As opposed to 47th Place potentially experiencing high volumes of pass-thru traffic in existing conditions, this particular development will benefit from consolidation of all health and fitness club parking. This mixed use development should cater to a more pedestrian-friendly environment. Angled parking should provide a narrowing effect and promote slower speeds. Improved aesthetics in this kind of redevelopment may potentially result in less pass-thru traffic on 47th Place from the Plaza area.

Internal trip capture between residential units and retail land uses was investigated for this site based on Chapter 7 in the 2004 version of ITE's Trip Generation Handbook. In calculations, internal trip capture was determined to be minimal (less than 12%) so for purposes of this study, internal trip capture was omitted.

47th Place should have separate westbound left and right turn lanes. To accommodate peak hour queuing, the westbound right turn lane should accommodate at least 3 vehicles (60 feet).

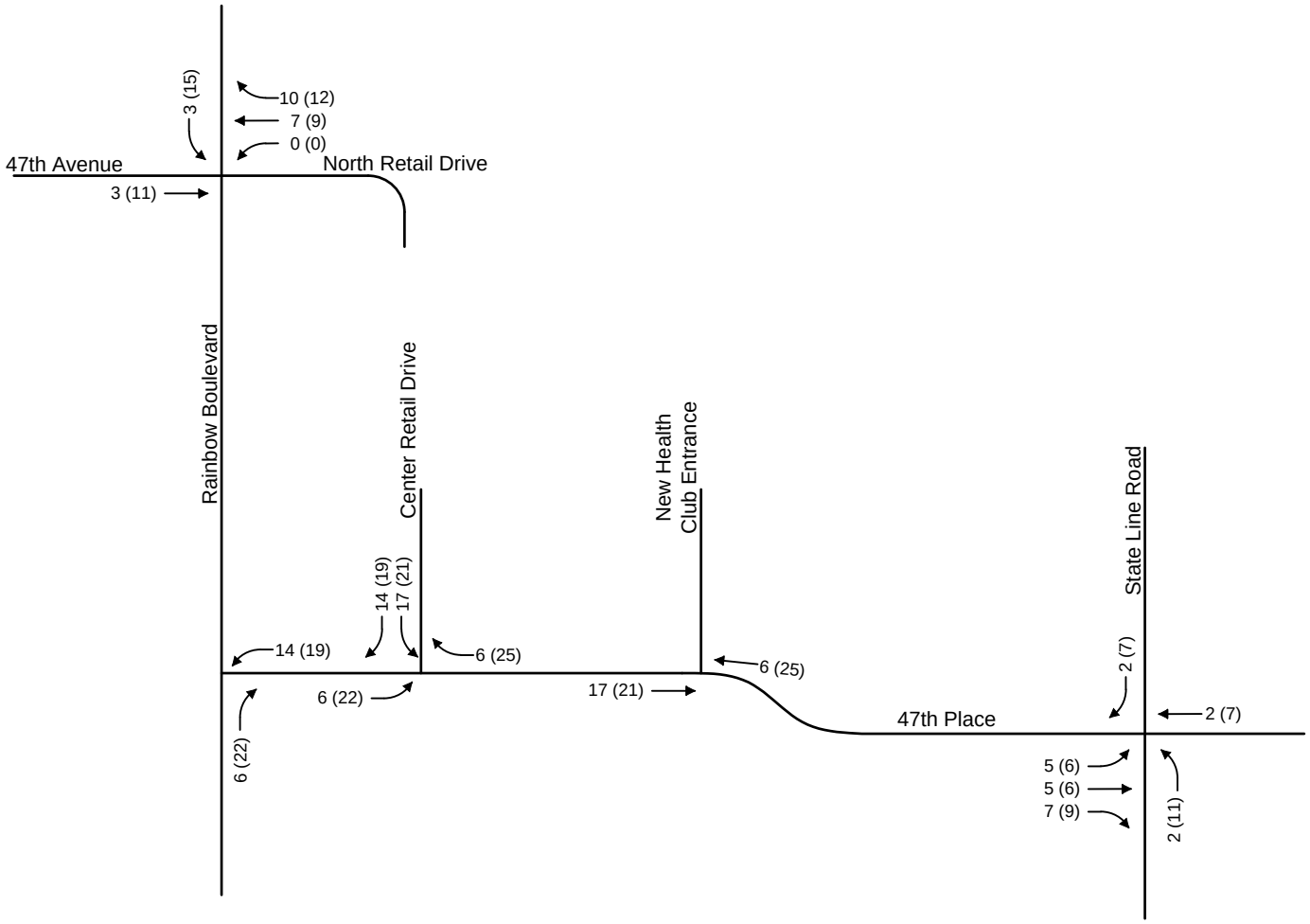
Since Rainbow Boulevard is recommended to be signalized at 47th Place, southbound lanes should be restriped to provide for a thru/left turn lane for vehicles turning onto 47th Place, similar to existing striping for northbound left turning vehicles at 47th Avenue. The same restriping should be done north of 47th Avenue for southbound vehicles turning left into the development.



LEGEND
XX (XX) - Residential Units (Retail) % Traffic Distribution

OLSSON ASSOCIATES	Trip Distribution % (Parcels 1 & 3 Only)	FIGURE 6

Woodside Development
Westwood, KS



NOTE:
AM & PM trips shown reflect both the Apartment and Specialty Retail specific Land Use expected trips.

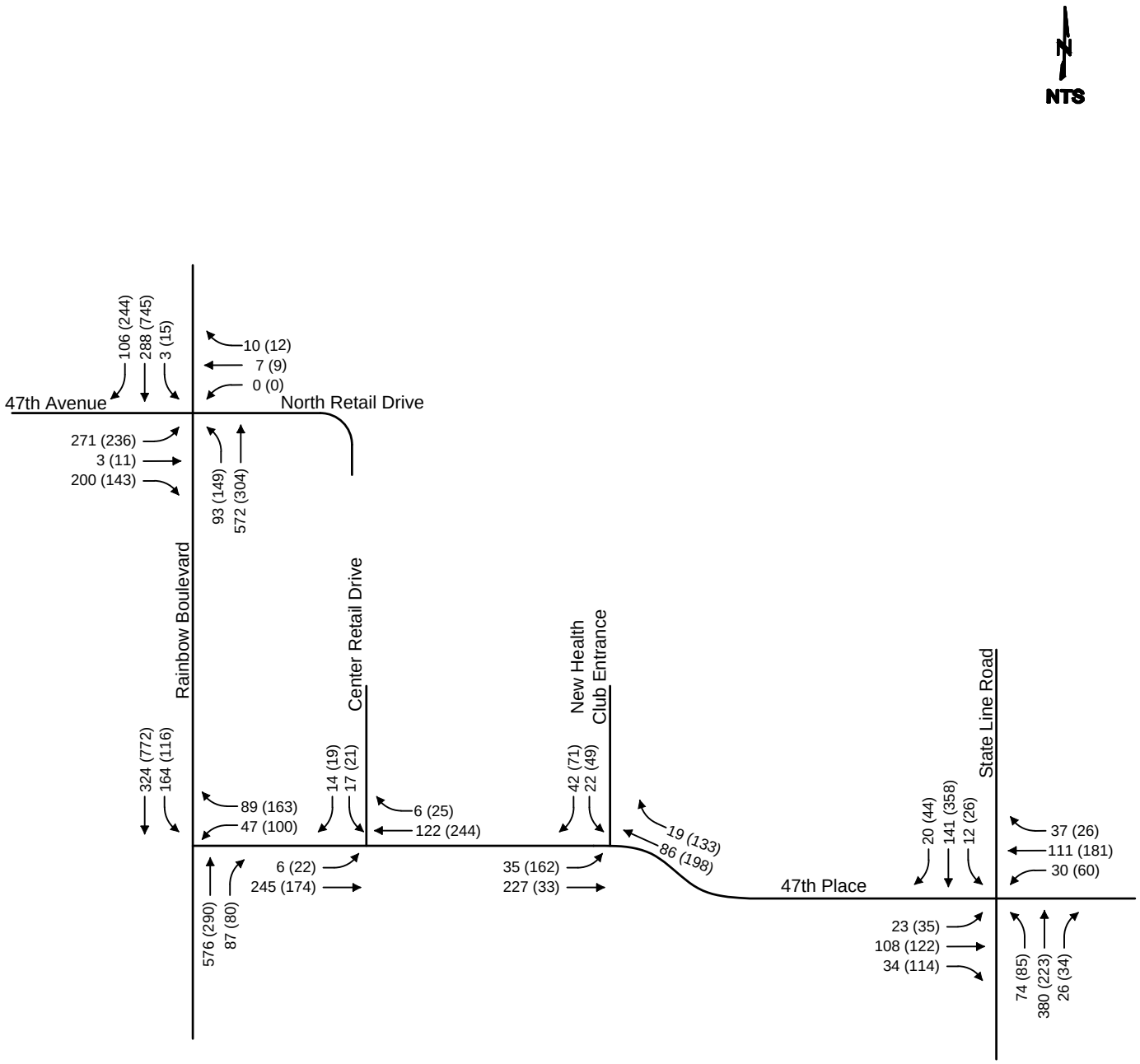
LEGEND
XX (XX) - AM (PM) Expected Peak Hour Trips Generated

OLSSON ASSOCIATES

Trip Distribution (Parcels 1 & 3 Only)

FIGURE 7

Woodside Development
Westwood, KS

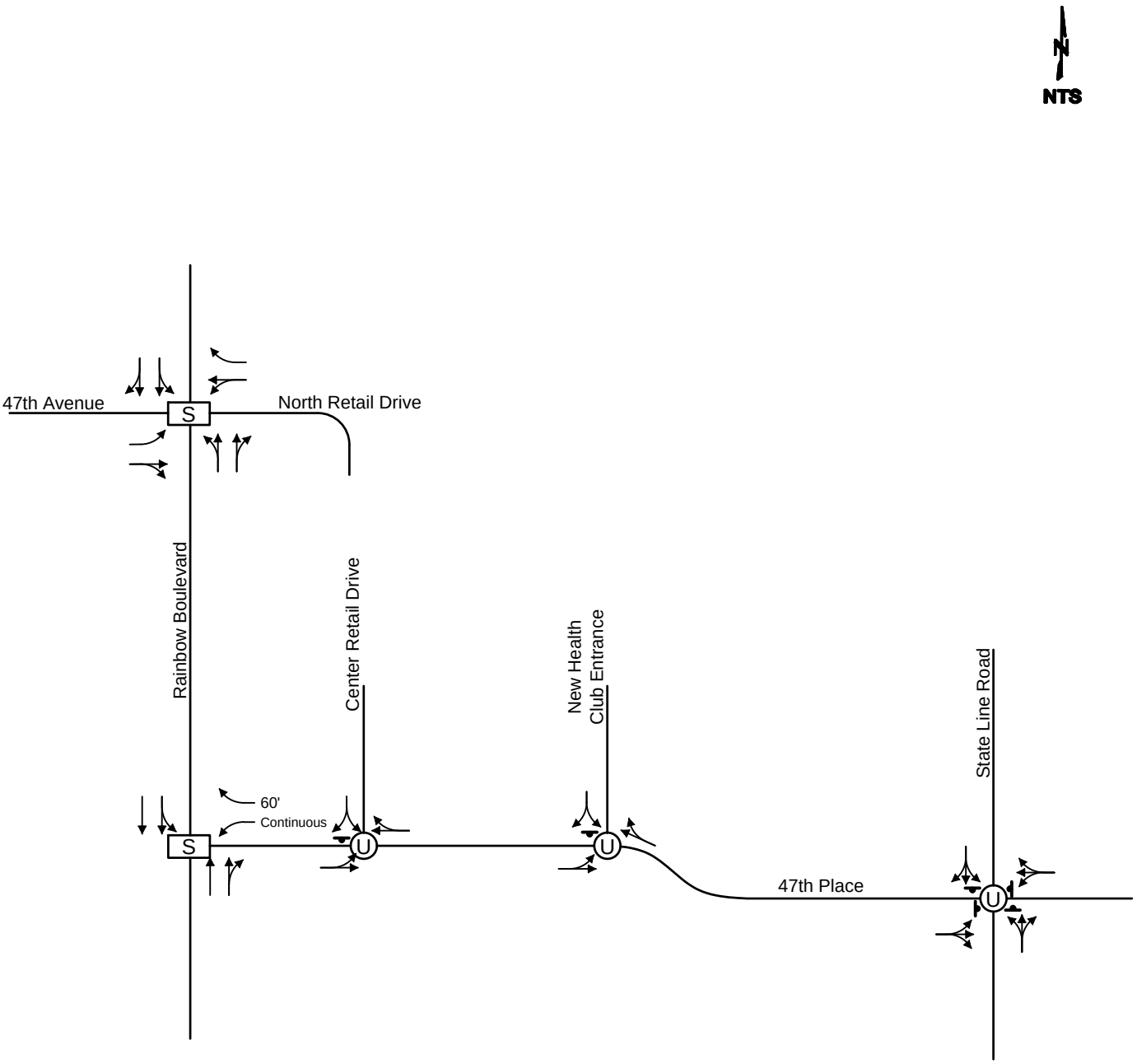


NOTE:
REFER TO APPENDIX FOR HEALTH CLUB PM PEAK HOUR PARKING LOT COUNTS (DONE BY OTHERS)

LEGEND
XX (XX) - AM (PM) Peak Hour Volumes

OLSSON ASSOCIATES	Existing + Development (Parcels 1 & 3 Only) Peak Hour Volumes	FIGURE 8

Woodside Development
Westwood, KS



LEGEND

Ⓤ Unsignalized Intersection

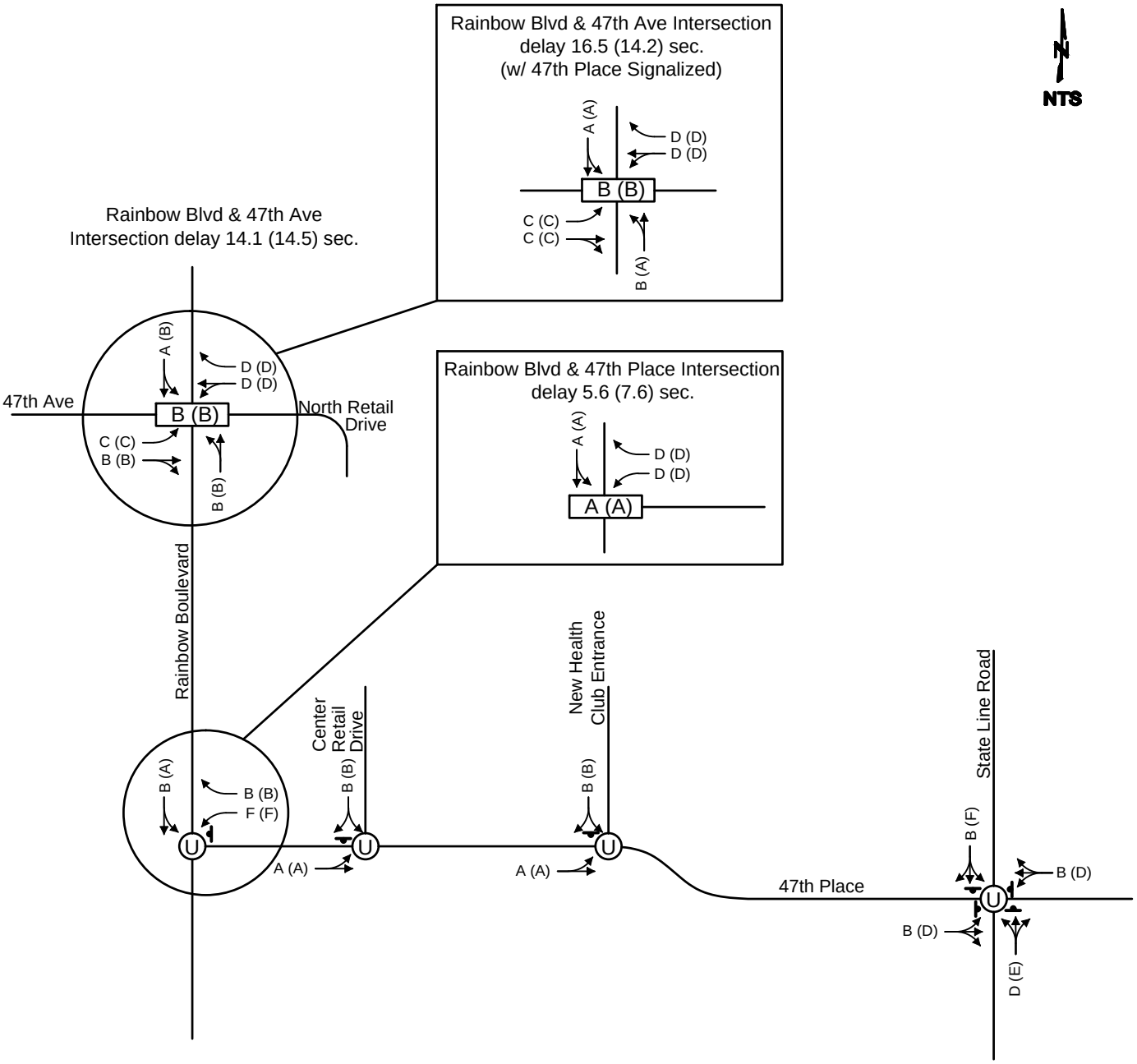
Stop Sign

[S] Signalized Intersection Level of Service

XX' Recommended Turn Bay Storage Length

OLSSON ASSOCIATES	Existing + Development (Parcels 1 & 3 Only) Lane Configurations & Traffic Control	FIGURE 9

Woodside Development
Westwood, KS



LEGEND

Ⓤ	Unsignalized Intersection
	Stop Sign
X (X)	AM (PM) Level of Service
X (X)	AM (PM) Intersection Level of Service

OLSSON ASSOCIATES	Existing + Development (Parcels 1 & 3 Only) Level of Service	FIGURE 10

6.0 EXISTING CONDITIONS PLUS ALL PARCELS (1-4)

In its second phase (Parcels 2 & 4) the development proposes an additional 13,700 square feet of retail space and 238 residential units on the southeast corner of 47th Place and Rainbow Boulevard. Retail and residential additions represent Parcel 2. A 50,000 square feet office building will also be constructed at the northwest corner of 47th Avenue and Rainbow Boulevard, north of Parcel 3. The office building characterizes Parcel 4. Tanner & White Properties is considering increasing retail area space by 2,000 square feet in Parcel 2 which is not currently included in the site plan, so for the purposes of this study that additional square footage is included in the analysis.

Three new access drives are proposed in this phase. One is located on 47th Place across from the center retail drive installed with Parcel 3 making that a 4-way intersection, a *south parking garage entrance* (for residential units) is located 160 feet east of that center retail drive, and a *south retail drive* provides access to Rainbow Boulevard about 250 feet south of 47th Place.
A 50,000 square feet office building (Parcel 4) to be built in this phase is proposed to have access to Rainbow Boulevard via 47th Avenue and thru-access to the south using center retail drive to 47th Place.

6.1 Trip Generation and Distribution

Trip generation characteristics expected for this phase of development are shown in **Table 4** below.

Table 4: Trip Generation (Entire Project)

Daily Trip Generation - Woodside Development (All Parcels)

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Daily Trips	Trip Distribution Enter	Trip Distribution Exit	Daily Trips Enter	Daily Trips Exit	Parcel
492/897*	Health/Fitness Club	35,000	SF	-	-	-	-	-	-	1
814/1387	Specialty Retail Center	15,700	SF	Average	696	50%	50%	348	348	2
220/326	Apartment	238	Units	Equation	1,566	50%	50%	783	783	2
814/1387	Specialty Retail Center	19,500	SF	Average	864	50%	50%	432	432	3
220/326	Apartment	88	Units	Equation	657	50%	50%	329	328	3
710/1203	General Office Bldg	50,000	SF	Equation	782	50%	50%	391	391	4
Total					**4,565**			**2,283**	**2,282**	

AM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	AM Peak Hr Trips	Trip Distribution Enter	Trip Distribution Exit	AM Peak Hr Trips Enter	AM Peak Hr Trips Exit	Parcel
492/898**	Health/Fitness Club	35,000	SF	Average	0	45%	55%	0	0	1
814/1387^	Specialty Retail Center	15,700	SF	Equation	16	50%	50%	8	8	2
220/328	Apartment	238	Units	Equation	120	20%	80%	24	96	2
814/1387^	Specialty Retail Center	19,500	SF	Equation	19	50%	50%	9	10	3
220/328	Apartment	88	Units	Equation	47	20%	80%	9	38	3
710/1204	General Office Bldg	50,000	SF	Equation	108	88%	12%	95	13	4
Total					**310**			**145**	**165**	

PM Peak Hour Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	PM Peak Hr Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hr Trips Enter	PM Peak Hr Trips Exit	Parcel
492/899**	Health/Fitness Club	35,000	SF	Equation	0	57%	43%	0	0	1
814/1388	Specialty Retail Center	15,700	SF	Equation	59	44%	56%	26	33	2
220/329	Apartment	238	Units	Equation	149	65%	35%	97	52	2

814/1388	Specialty Retail Center	19,500	SF	Equation	68	44%	56%	30	38	3
220/329	Apartment	88	Units	Equation	66	65%	35%	43	23	3
710/1205	General Office Bldg	50,000	SF	Equation	135	17%	83%	23	112	4
Total					**477**			**219**	**258**	

**No accurate estimates of daily trips for "Health/Fitness Club" Land Use in the ITE Manual.*

***Trips for "Health/Fitness Club" Land Use are already accounted for in the traffic counts. The Health/Fitness Club's cumulative square footage is decreasing and there will be a decrease in tennis courts from 18 to 8. No new trips are expected to be generated.*

^27% of PM Peak Hour trips used, no AM Peak Hour rates provided in ITE Manual.

The additional residential units and retail space and office building are expected to generate 3,044 daily trips on an average weekday. Combined, the residential units, retail and office building are expected to generate 244 trips during the AM peak period and 343 trips during the PM peak period.

Trip distribution for this phase remained the same as previously illustrated in ***Table 3***. ***Figures 11-15*** show expected trip generations, peak hour volumes, lane configurations and level of service for Parcels 2 and 4 in addition to Parcels 1 & 3 being complete.

6.2 Signal Warrant Analysis

Signal warrant analysis was completed as discussed in ***Section 4.1*** and warrant analysis sheets are included in the ***Appendix***. Based on signal warrant 3, none of the study intersections satisfy the peak hour warrant criteria for signalization based on existing plus parcels 1-4 conditions except 47th Place & State Line Road during the PM peak hour. Despite satisfying the peak hour warrant criteria for signalization in the PM peak hour, it is not recommended to signalize this intersection based solely on a one hour warrant. Delays, moderate queuing and lower levels of service can be expected during peak hour periods for four-way stop controlled intersections.

The 47th Place and Rainbow Boulevard intersection again met signal warrant during the PM peak hour, but for purposes of this study it was analyzed as both signalized and stop controlled. Upon construction of Parcels 2 and 4, signal timings at 47th Place and 47th Avenue on Rainbow Boulevard should be re-evaluated and readjusted as necessary for current traffic volumes.

6.3 Capacity Analysis

Capacity analysis was examined as in ***Section 5.3***. All movements at signalized intersections on Rainbow Boulevard (47th Place and 47th Avenue) are expected to operate at a LOS C or better during peak hours, with the exception of westbound

movements at both intersections (LOS D). Operations may improve after completing additional, more in-depth timing analysis.

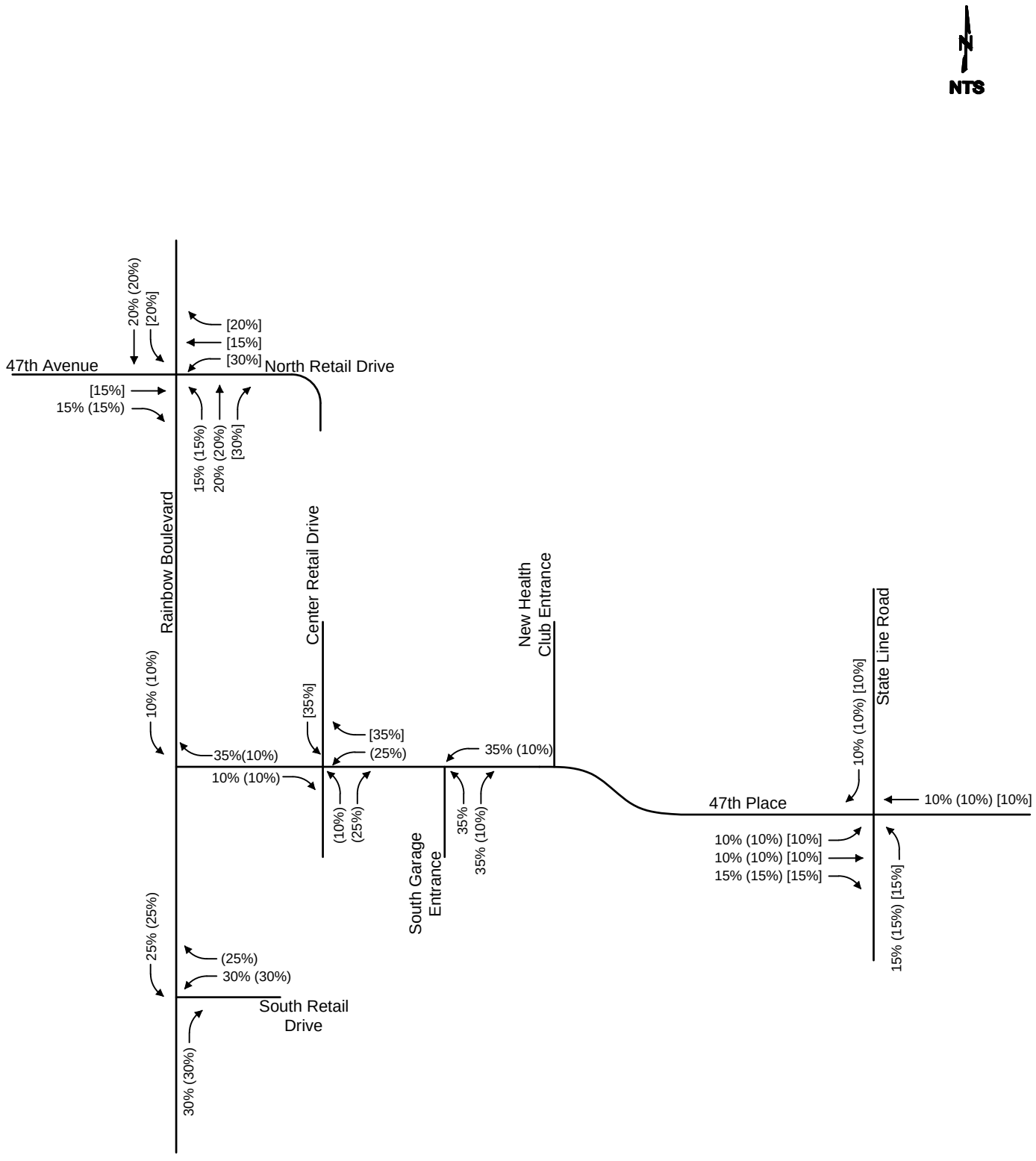
All movements at the study intersections are expected to operate at LOS D or better during the AM and PM peak hour periods with the exception of the 47th Place & State Line Road intersection during the PM peak (LOS F) and 47th Place and Rainbow Boulevard during both peak hours when analyzed as stop-controlled. ***Figure 15*** illustrates the existing plus all parcels (1-4) scenario's level of service for the study area intersections.

In the March 8th, 2011 site plan, the proposed south retail drive with access to Rainbow Boulevard south of 47th Place is currently staggered from 47th Terrace to the west. Moving the new south retail drive entrance further south approximately 80 feet to align with 47th Terrace to the west will eliminate staggered access points and would reduce driver confusion, while increasing safety.

Rainbow Boulevard will be classified as a "D" route and the new south retail drive should be built as a Type 6 Access per the KDOT Corridor Management Policy. Per the policy, high volume access spacing along a "D" route is 195 feet for a Type 6 Access. The south retail drive appears to meet all KDOT's Corridor Management criteria for access spacing and geometrics as a Type 6 access if it is located directly across from 47th Terrace. Additionally, a right turn lane does not appear to be warranted based on the low volume of expected northbound right turning vehicles according to the corridor policy.

6.4 Site Circulation, Internal Capture & Lane Configurations

As in ***Section 5.4***, internal trip capture between residential units, retail and general office building land uses was investigated for this site based on Chapter 7 in the 2004 version of ITE's Trip Generation Handbook. In calculations, internal trip capture was again determined to be minimal (less than 10%), so in study scenario internal trip capture was omitted.



LEGEND

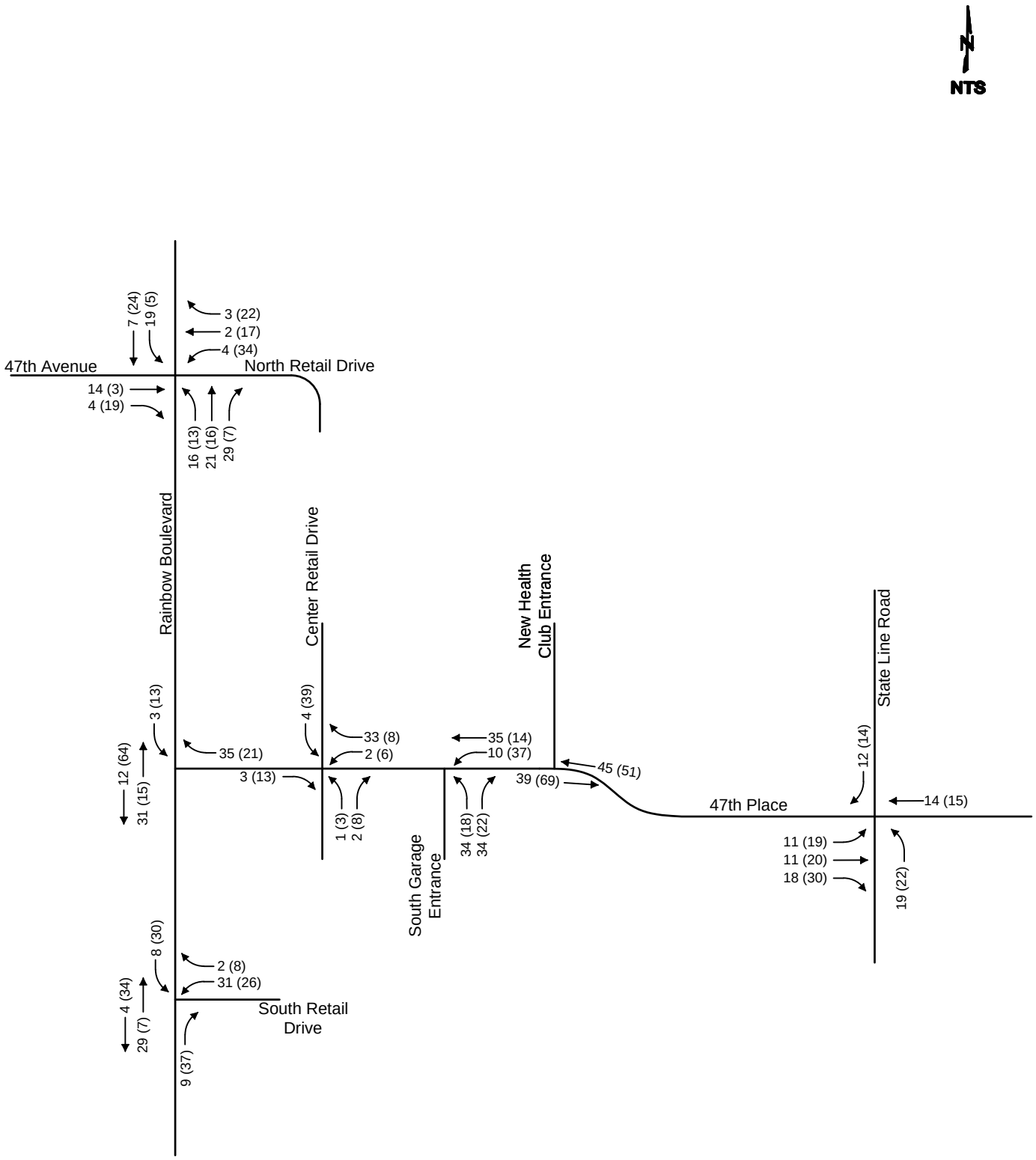
XX (XX) [XX] - Residential Units (Retail) [Office Building] % Traffic Distribution

OLSSON ASSOCIATES

Trip Distribution % (Parcels 2 & 4)

FIGURE 11

Woodside Development
Westwood, KS



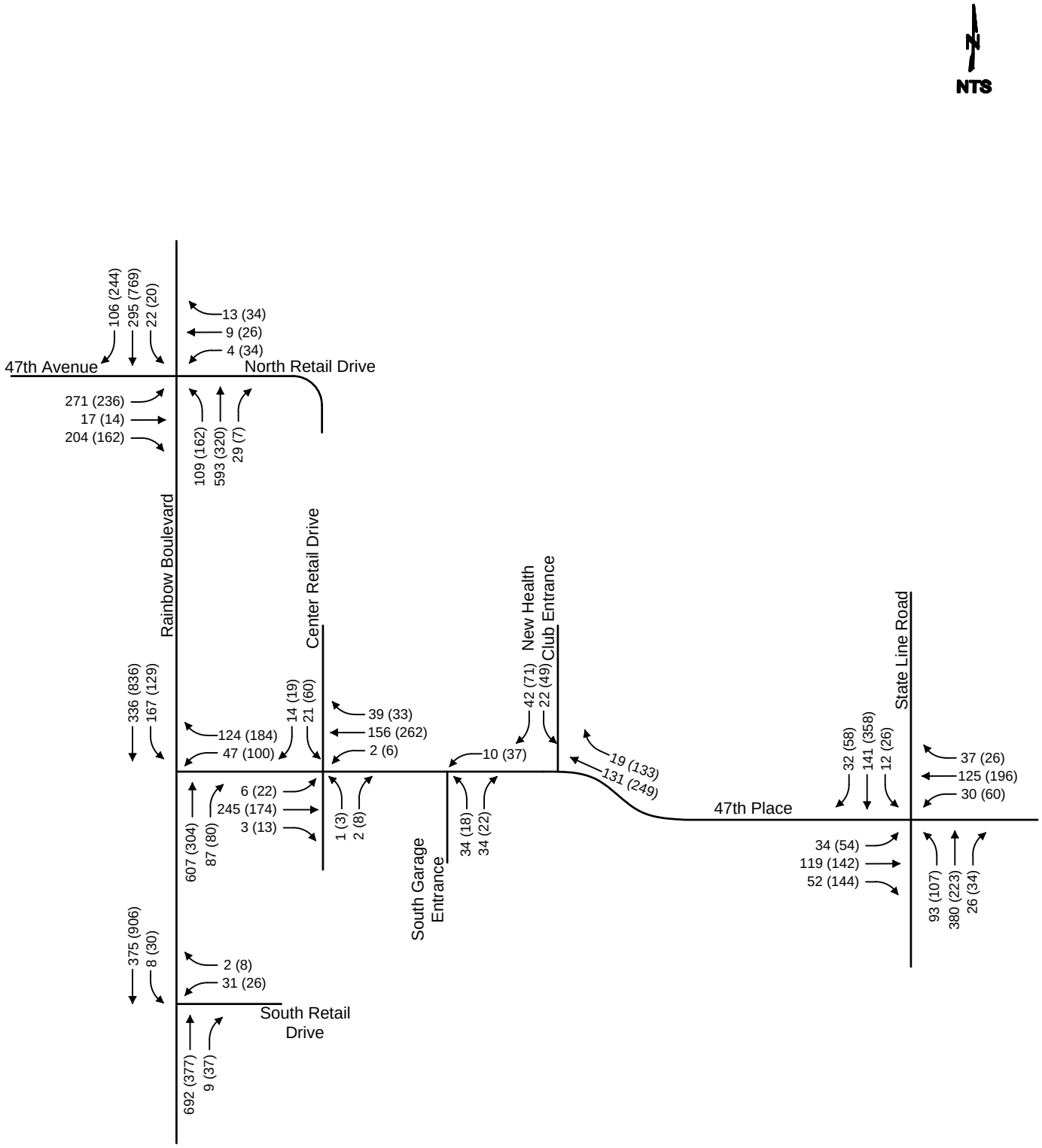
NOTE:
AM & PM trips shown reflect combined Apartment, Specialty Retail and Office Building specific Land Use expected trips.

LEGEND
XX (XX) - AM (PM) Expected Peak Hour Trips Generated

OLSSON ASSOCIATES

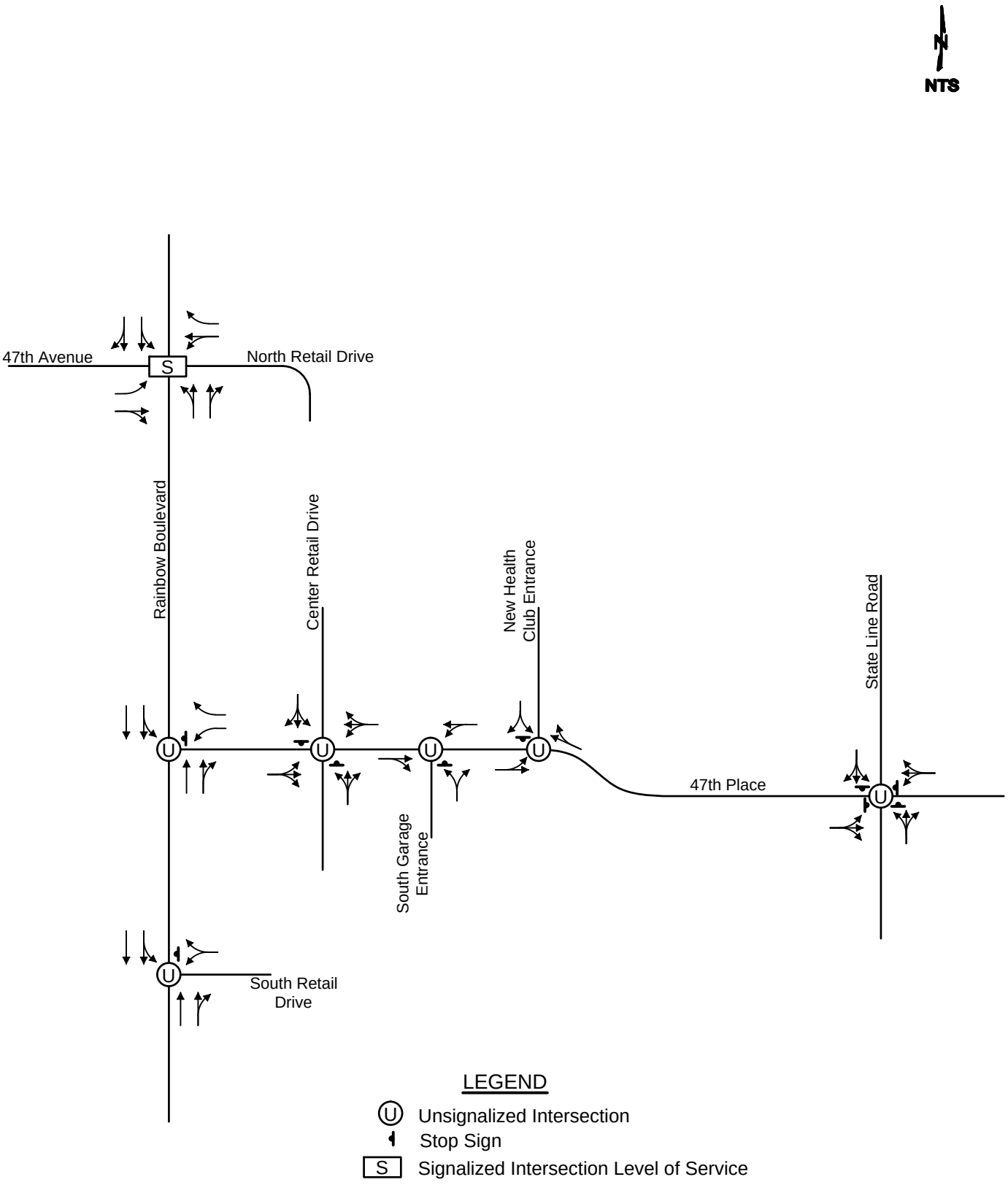
Trip Distribution (Parcels 2 & 4 Only)

FIGURE 12



LEGEND
XX (XX) - AM (PM) Peak Hour Volumes

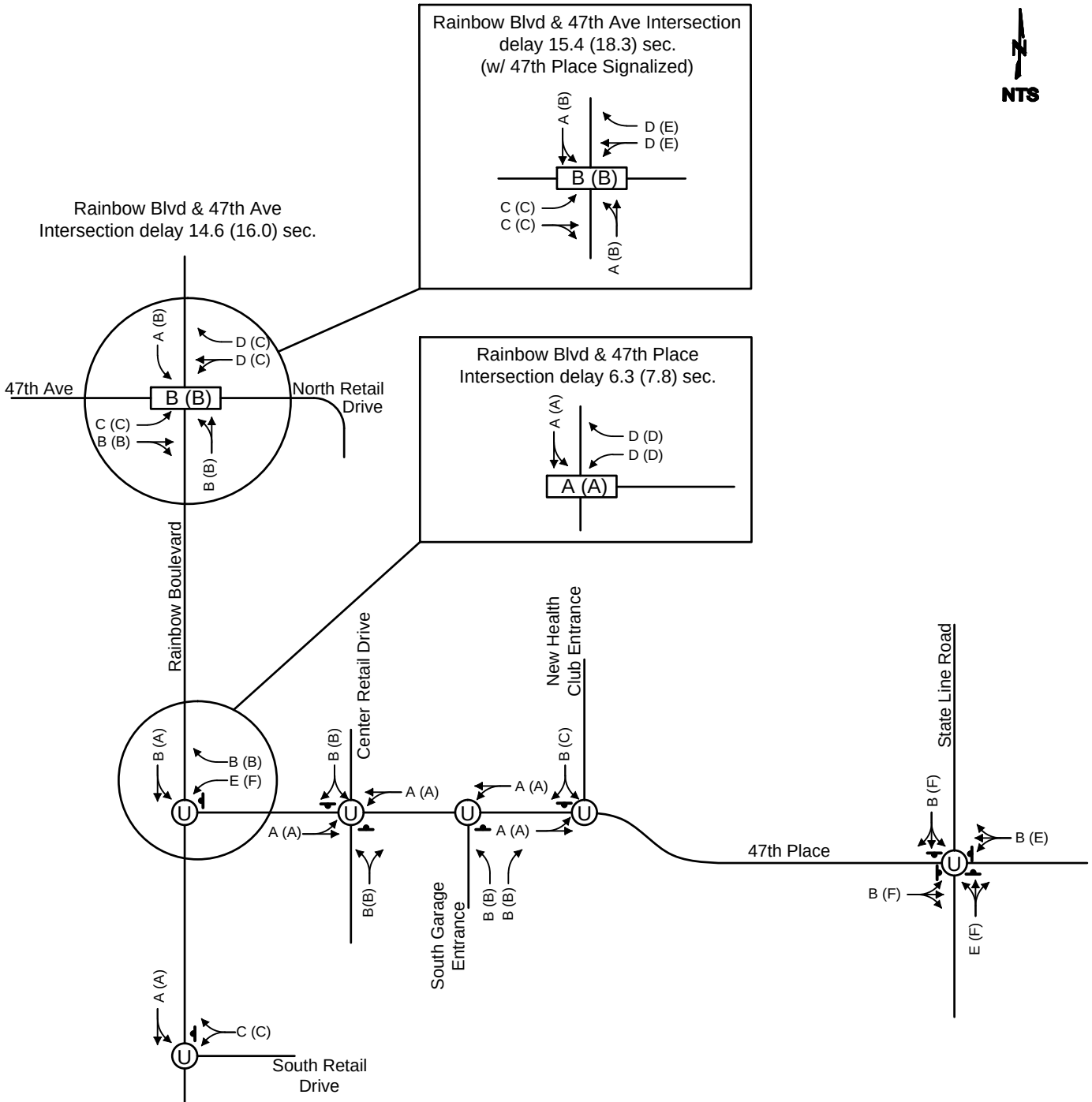
OLSSON ASSOCIATES	Existing + Development (All Parcels 1-4) Peak Hour Volumes	FIGURE 13



OLSSON ASSOCIATES

Existing + Development (All Parcels 1-4)
Lane Configurations & Traffic Control

FIGURE
14



OLSSON ASSOCIATES	Existing + Development (All Parcels 1-4) Level of Service	FIGURE 15

7.0 FUTURE CONDITIONS PLUS ALL PARCELS (1-4)

This scenario considers operations of the future roadway network. At the request of the Kansas Department of Transportation, the future scenario represents thru-traffic volumes in 2030 on Rainbow Boulevard. These estimated northbound and southbound volumes in the year 2030 account for a 1% annual increase in traffic.

It should be noted that interpolation of average daily traffic volumes (ADT) posted on KDOT's website actually indicate a net decrease in traffic on Rainbow Road near 47th Avenue in each of the past four years. These volumes and traffic percentage decrease calculations are included in the ***Appendix***.

7.1 Future Background Trip Operations

Signal warrants and traffic operations of the roadway network considering the future background traffic volumes were reviewed. This provides for a comparison of operations to determine improvements required based on estimated traffic growth or improvements associated with the additional traffic to the east and west of the development.

It is recommended to observe operations of the roadway network and re-evaluate future operations based on actual volumes. Traffic growth (or decline) may occur at lower or higher levels than anticipated which will impact potential improvements.

7.2 Signal Warrant Analysis

Signal warrant analysis was completed as discussed in ***Section 4.1.*** The intersection of 47th Place with Rainbow Boulevard is expected to meet the warrant for signalization in both the AM and PM peak hours based on a 1% annual growth of traffic volumes on Rainbow Boulevard. In previous phases of development, this intersection appeared to warrant a signal in only the PM peak period. In the future, signal timings should be evaluated and adjusted accordingly for optimal performance based on actual traffic volumes.

Volumes are the same as analyzed in the previous scenario at the intersection of State Line Road and 47th Place and is expected to still meet the warrant for signalization based on the PM peak hour traffic volume estimations. Prior to planning for any signalization along the State Line corridor it would be recommended to complete analysis in the future scenario based on actual volumes. Background traffic growth may be lower or higher than anticipated which may skew the results of the signal warrant analysis. Signal warrant analysis sheets are included in the ***Appendix.***

7.3 Capacity Analysis

All movements at signalized intersections on Rainbow Boulevard (47th Place and 47th Avenue) are expected to operate at a LOS C or better during peak hours, with the exception of westbound movements at both 47th Place (LOS D) and 47th Avenue (LOS E). Operations may improve after completing more in-depth timing analysis and signal coordination for actual traffic volumes.

Unsignalized capacity analysis was completed as discussed in ***Section 4.2.*** All individual movements at study intersections are expected to operate at LOS D or better with the exception of all movements at the State Line Road and 47th Place intersection as in the previous scenario.

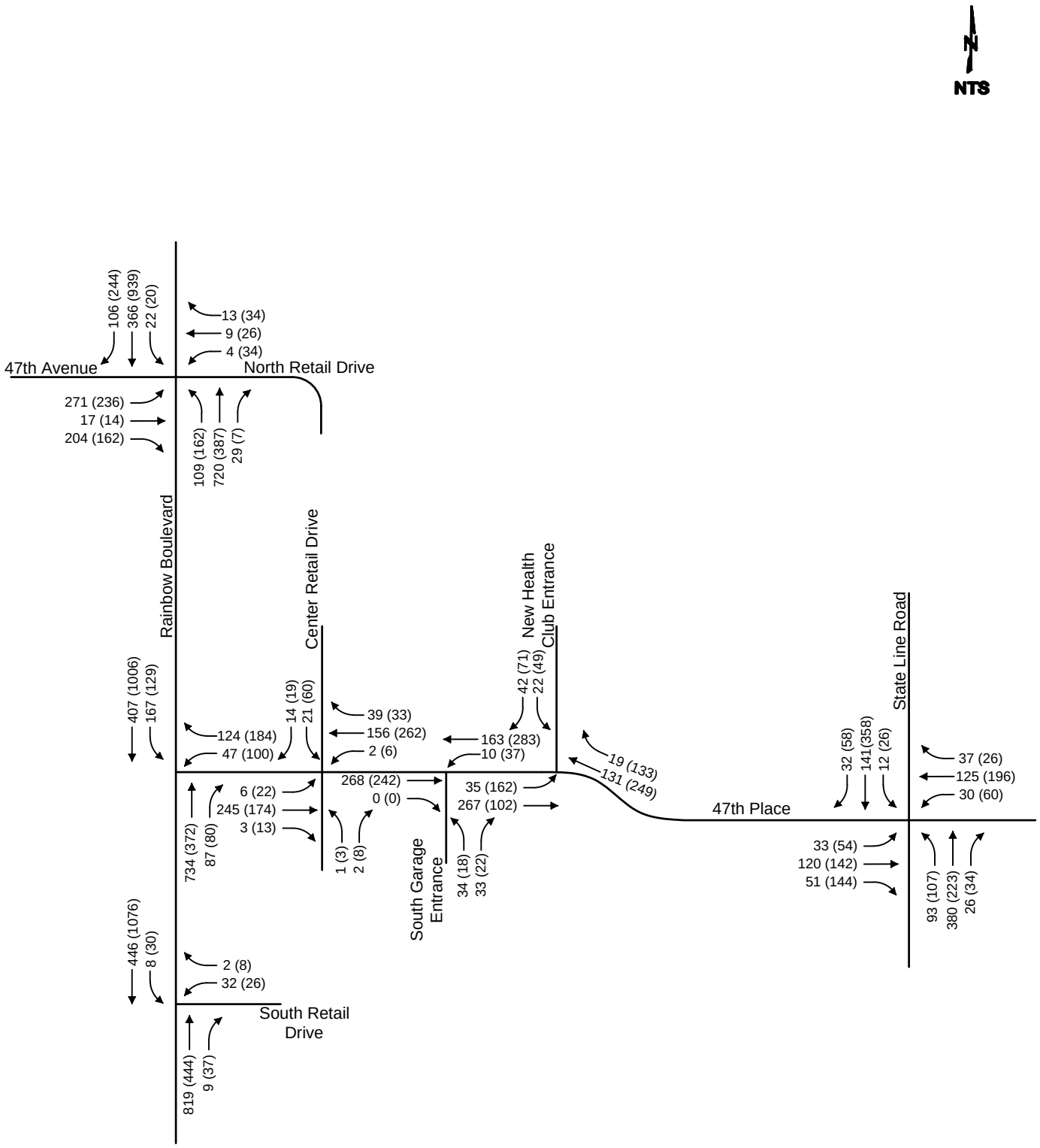
All movements at the State Line intersection are expected to operate at a LOS F except westbound traffic which may operate at a LOS E. While these levels of service may seem poor, unsignalized street movements can be expected to operate at a lower level of service during peak hour periods as higher major street movements and progression are accommodated. ***Figure 18*** illustrates the existing plus future conditions level of service for the study area intersections.

7.4 Site Circulation, Internal Capture & Lane Configurations

No major roadway geometry changes are recommended for future conditions based on estimated traffic growth discussed earlier.

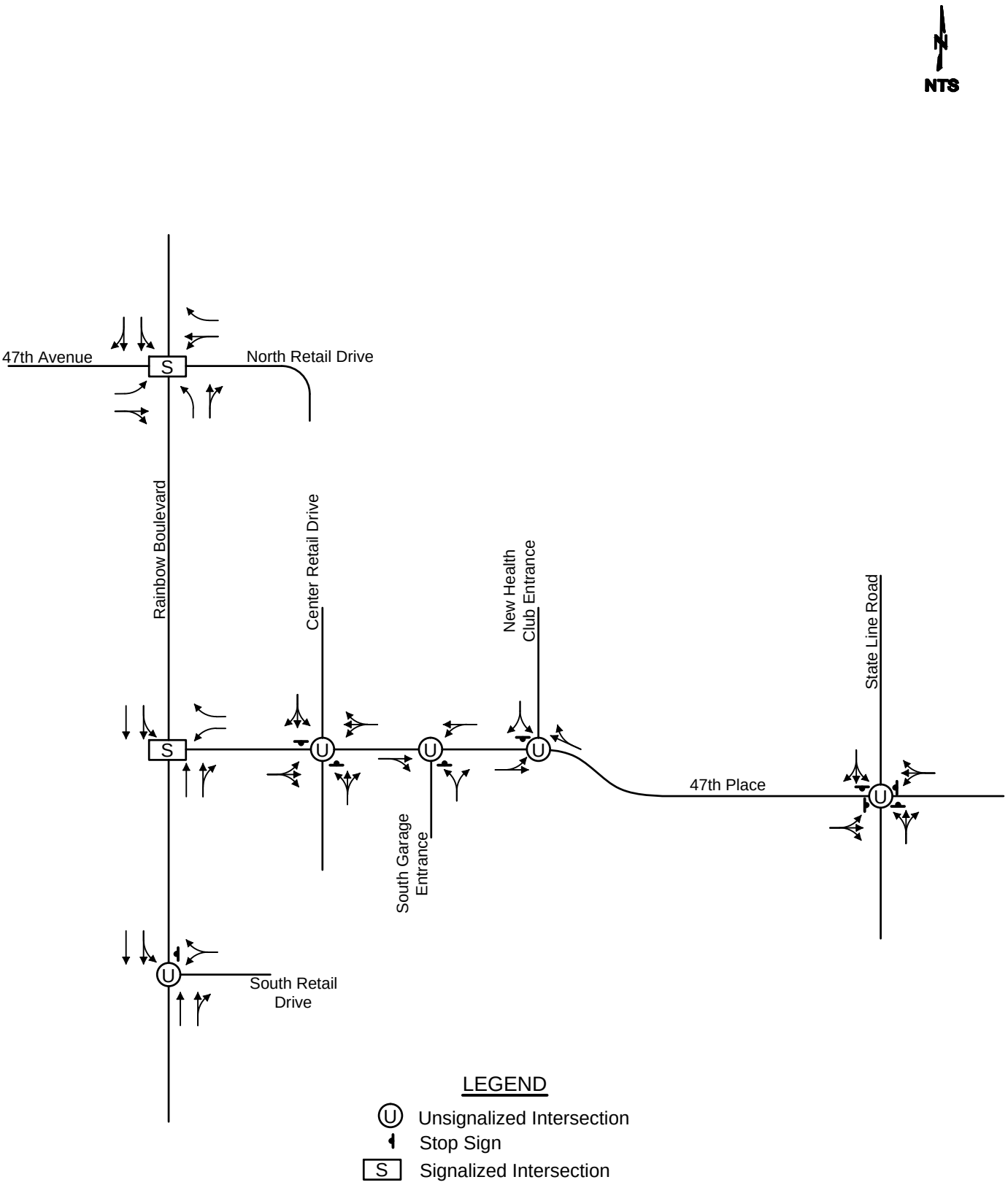
In the future conditions scenario, Roadway Using volumes as shown in ***Figure 16***, In 2030, it is recommended for Rainbow Boulevard to remain as a 4 lane undivided roadway (but incorporate suggestions mentioned in ***Sections 5 & 6***). Further analysis of Rainbow Boulevard operations is recommended in the future, as volumes will differ from estimations shown in this study.

Internal trip capture between residential units and retail land uses was not investigated for a future conditions scenario as no additional land uses were being introduced to the area. For purposes of this study, internal trip capture in future conditions (year 2030) was omitted.



LEGEND
XX (XX) - AM (PM) Peak Hour Volumes

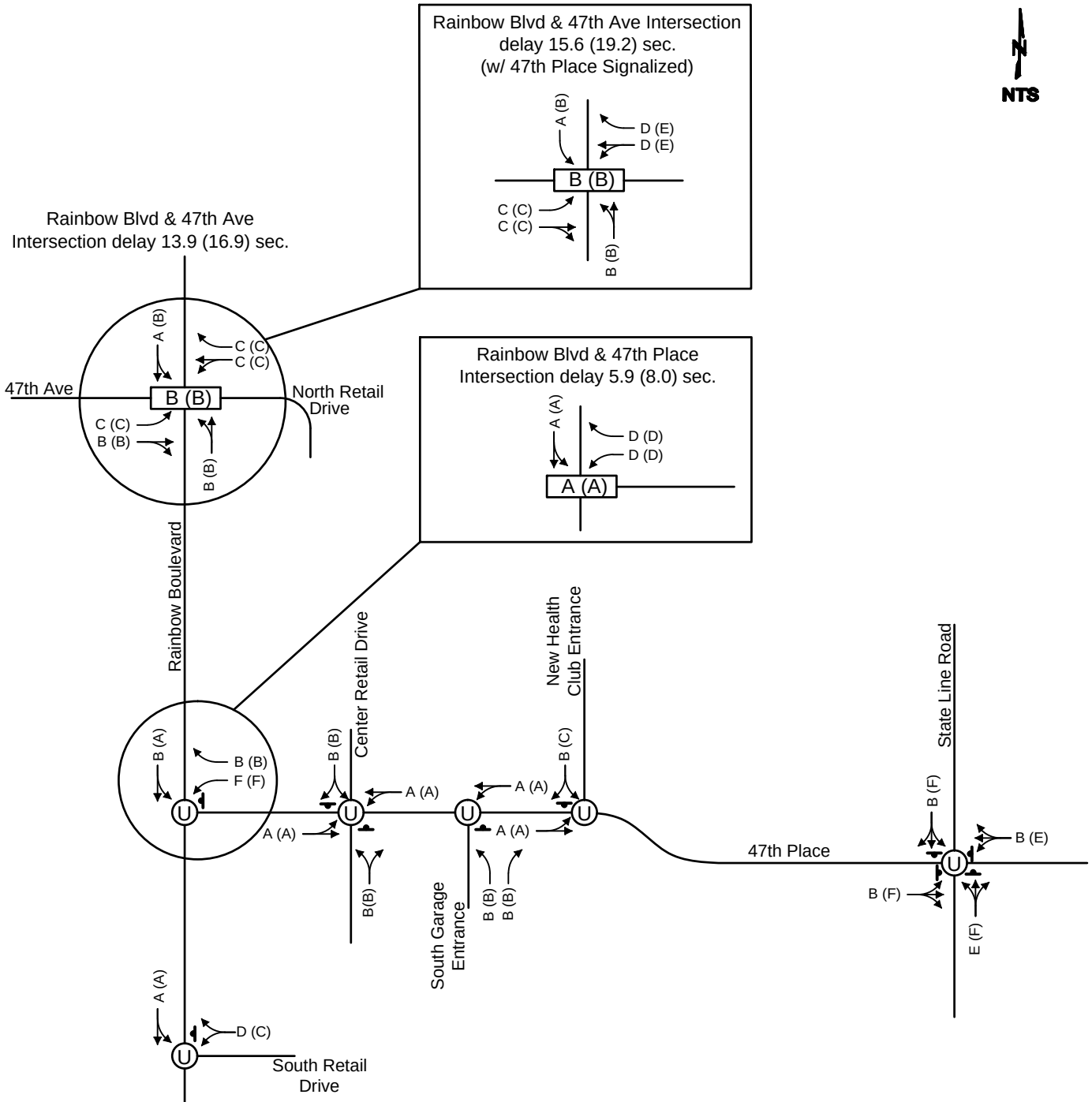
OLSSON ASSOCIATES	Future (Parcels 1-4 - 2030) Peak Hour Volumes	FIGURE 16



OLSSON ASSOCIATES

Future (Parcels 1-4 - 2030)
Lane Configurations & Traffic Control

FIGURE
17



OLSSON ASSOCIATES

Future (Parcels 1-4 - 2030)
Level of Service

FIGURE
18

8.0 RECOMMENDATIONS & CONCLUSIONS

This study considered the impact of the construction of a mixed-used development and health club renovation on the surrounding roadway network near Rainbow Boulevard and 47th Place in Westwood, Kansas. Considering the existing conditions, proposed development, and future traffic volumes, analysis was completed to determine the expected operations of the area. Based on KDOT's Corridor Management Policy, the results of the capacity analyses and field observations, the following conclusions and recommendations are made for the study area:

RECOMMENDATIONS FOR EXISTING CONDITIONS

- Roadway improvements are not recommended for the existing condition scenario. Based on a review of the existing conditions, intersections in the area are operating at acceptable levels of service.

RECOMMENDATIONS FOR EXISTING PLUS PARCELS 1 & 3 (NORTH RETAIL/RESIDENTIAL AND HEALTH/FITNESS CLUB RENOVATION)

- Based on a review of the expected operations of the area with the addition of trips associated with the proposed development, it is recommended to signalize the 47th Place and Rainbow Boulevard T-intersection. The intersection is expected to meet the peak hour warrant for signalization. Although traffic operations in terms of delay and LOS are acceptable as unsignalized there is limited sight distance at the intersection thus a signal would be expected to provide both adequate operations and improve safety.
- The new signal at 47th Place should be timed to coordinate with the existing signal at 47th Avenue which will require installing interconnect between the two.
- Separate right and left turn lanes should remain for westbound traffic on 47th Place with the right turn lane having at least 60 feet of storage.
- Restripe the inside southbound lane north of 47th Avenue on Rainbow Boulevard to provide a shared thru/left turn lane for vehicles entering the development.
- Restripe the inside southbound lane south of 47th Avenue on Rainbow Boulevard to provide a shared thru/left turn lane for vehicles entering the development via 47th Place.
- Provide separate shared thru/left and right turn lanes for proposed 47th Avenue access.

RECOMMENDATIONS FOR EXISTING PLUS ALL PARCELS (1-4) (SOUTH RETAIL AND RESIDENTIAL UNITS & OFFICE BUILDING)

- Signal timings on Rainbow Boulevard should be evaluated and adjusted to best accommodate new retail, residential and office building traffic volumes introduced with development of Parcels 2 & 4.

- If lined up with 47th Terrace to the west, new access to Rainbow Boulevard (the south retail drive) appears to meet access spacing requirements set forth in the KDOT Corridor Management Policy for a Route 'D' classification (195 feet center-to-center).

RECOMMENDATIONS FOR FUTURE YEAR CONDITIONS (2030)

- No roadway or geometric improvements are recommended for future year conditions.
- Signal timings should be adjusted as necessary along Rainbow Boulevard to best accommodate actual traffic volumes and patterns.

APPENDIX:

- Supplemental Information
  - Traffic Volumes
  - Parking Lot Volumes (By Others)
  - Development Schematic Plans (By Others)
  - KDOT ADT Calculations

- Existing
  - Signal Warrant Analysis
  - Capacity Analysis Reports

- Existing Plus Parcels 1 & 3
  - Signal Warrant Analysis
  - Capacity Analysis Reports

- Existing Plus All Parcels (1-4)
  - Signal Warrant Analysis
  - Capacity Analysis Reports

- Future Conditions 2030 Plus All Parcels (1-4)
  - Signal Warrant Analysis
  - Capacity Analysis Reports

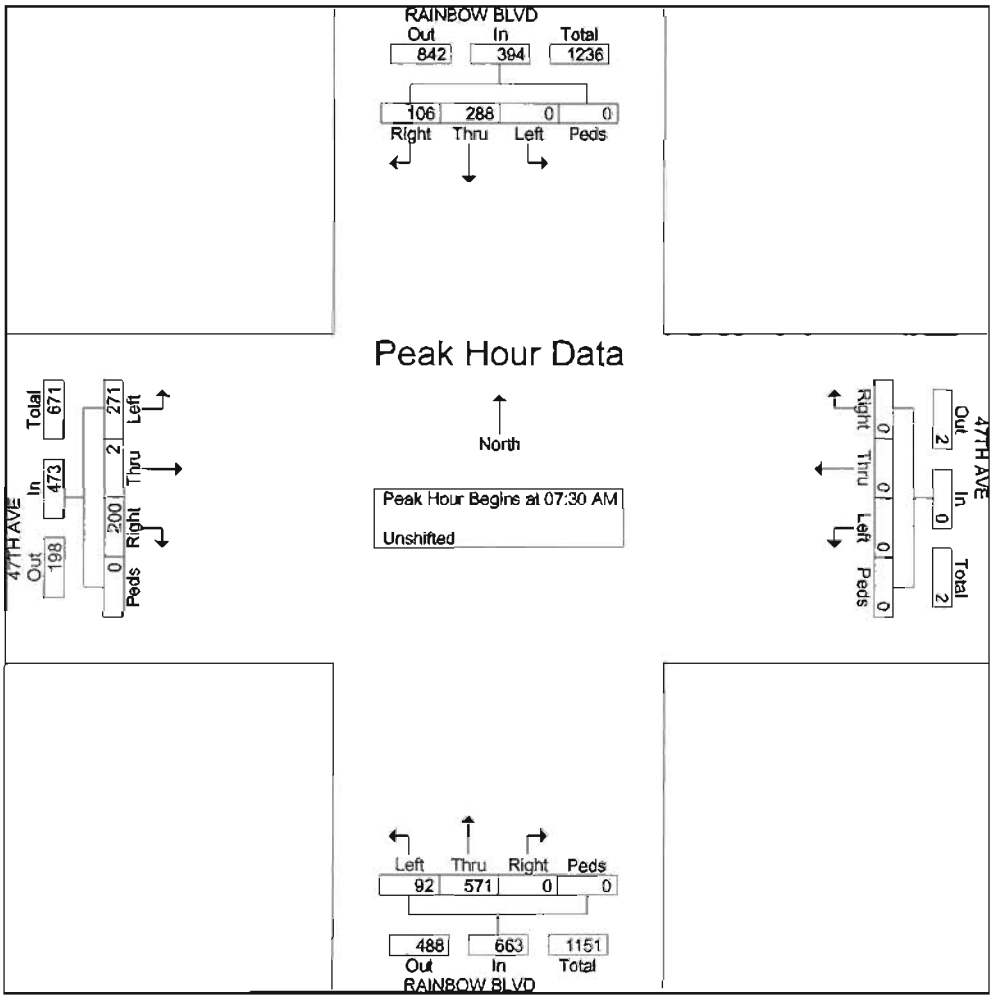
Traffic Volumes

Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

RAINBOW BLVD
47TH AVE
AM

File Name : Rainbow Blvd & 47th Ave AM
Site Code : 00000000
Start Date : 11/16/2010
Page No : 3

	RAINBOW BLVD From North					47TH AVE From East					RAINBOW BLVD From South					47TH AVE 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 Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	24	65	0	0	89	0	0	0	0	0	0	143	24	0	167	51	0	66	0	117	373
07:45 AM	28	**83**	0	0	111	0	0	0	0	0	0	**160**	**25**	0	**185**	**60**	**2**	66	0	**128**	**424**
08:00 AM	**29**	57	0	0	86	0	0	0	0	0	0	156	24	0	180	44	0	**80**	0	124	390
08:15 AM	25	83	0	0	108	0	0	0	0	0	0	112	19	0	131	45	0	59	0	104	343
Total Volume	106	288	0	0	394	0	0	0	0	0	0	571	92	0	663	200	2	271	0	473	1530
% App. Total	26.9	73.1	0	0		0	0	0	0		0	86.1	13.9	0		42.3	0.4	57.3	0		
PHF	.914	.867	.000	.000	.887	.000	.000	.000	.000	.000	.000	.892	.920	.000	.896	.833	.250	.847	.000	.924	.902

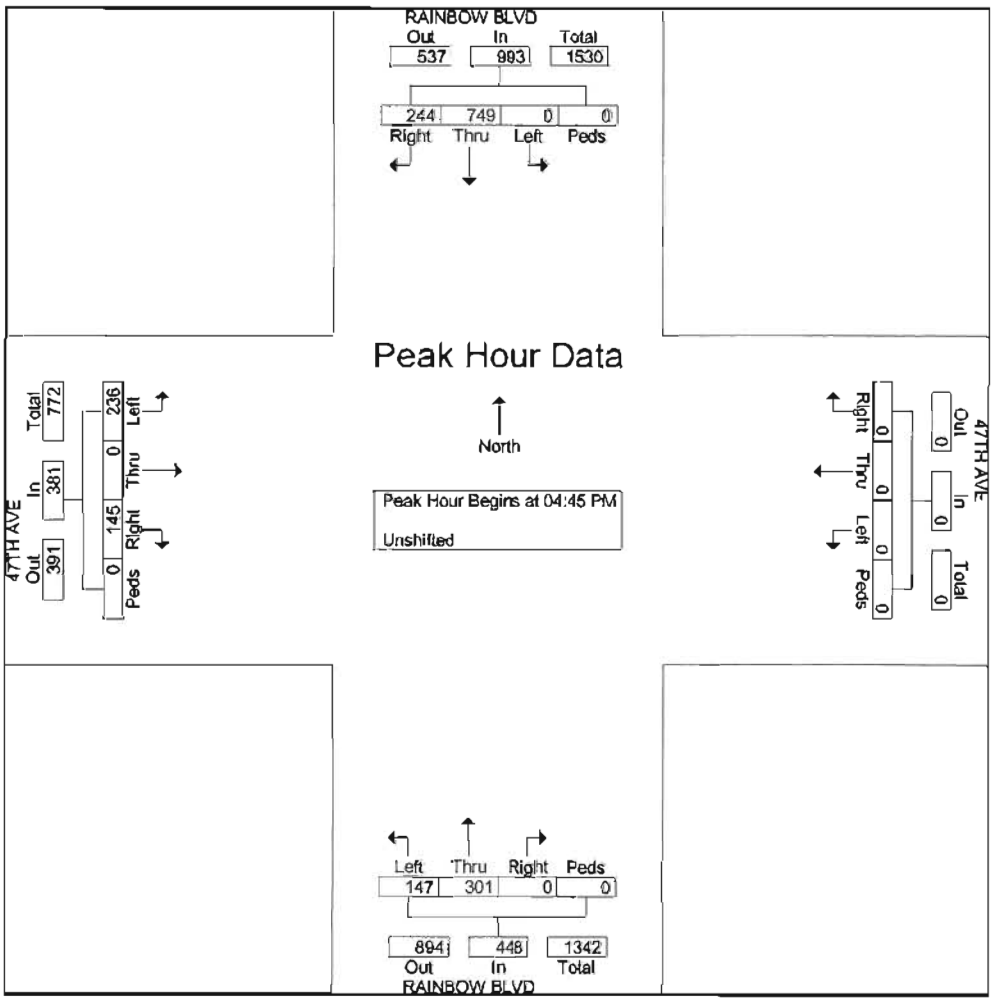


Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

RAINBOW BLVD
47TH AVE
PM

File Name : Rainbow Blvd & 47th Ave PM
Site Code : 00000000
Start Date : 11/16/2010
Page No : 3

	RAINBOW BLVD From North					47TH AVE From East					RAINBOW BLVD From South					47TH AVE 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 Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	59	154	0	0	213	0	0	0	0	0	0	57	35	0	92	35	0	66	0	101	406
05:00 PM	56	183	0	0	239	0	0	0	0	0	0	81	43	0	124	34	0	59	0	93	456
05:15 PM	72	217	0	0	289	0	0	0	0	0	0	83	29	0	112	43	0	59	0	102	503
05:30 PM	57	195	0	0	252	0	0	0	0	0	0	80	40	0	120	33	0	52	0	85	457
Total Volume	244	749	0	0	993	0	0	0	0	0	0	301	147	0	448	145	0	236	0	381	1822
% App. Total	24.6	75.4	0	0		0	0	0	0		0	67.2	32.8	0		38.1	0	61.9	0		
PHF	.847	.863	.000	.000	.859	.000	.000	.000	.000	.000	.000	.907	.855	.000	.903	.843	.000	.894	.000	.934	.906

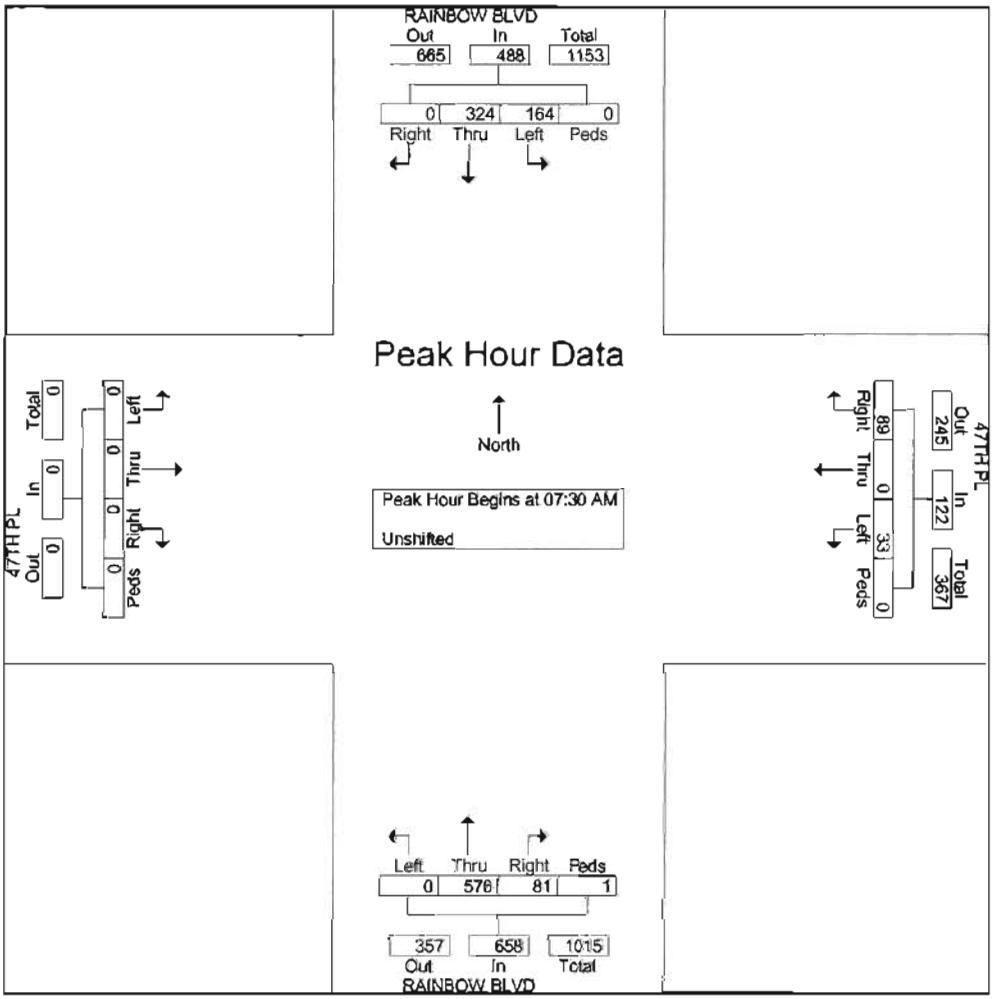


Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

RAINBOW BLVD
47TH PL
AM

File Name : Rainbow Blvd & 47th Pl AM
Site Code : 00000000
Start Date : 11/16/2010
Page No : 3

	RAINBOW BLVD From North					47TH PL From East					RAINBOW BLVD From South					47TH PL 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 Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	69	50	0	119	20	0	11	0	31	16	151	0	1	168	0	0	0	0	0	318
07:45 AM	0	97	44	0	141	26	0	6	0	32	18	161	0	0	179	0	0	0	0	0	352
08:00 AM	0	71	35	0	106	21	0	10	0	31	21	161	0	0	182	0	0	0	0	0	319
08:15 AM	0	87	35	0	122	22	0	6	0	28	26	103	0	0	129	0	0	0	0	0	279
Total Volume	0	324	164	0	488	89	0	33	0	122	81	576	0	1	658	0	0	0	0	0	1268
% App. Total	0	66.4	33.6	0		73	0	27	0		12.3	87.5	0	0.2		0	0	0	0		
PHF	.000	.835	.820	.000	.865	.856	.000	.750	.000	.953	.779	.894	.000	.250	.904	.000	.000	.000	.000	.000	.901

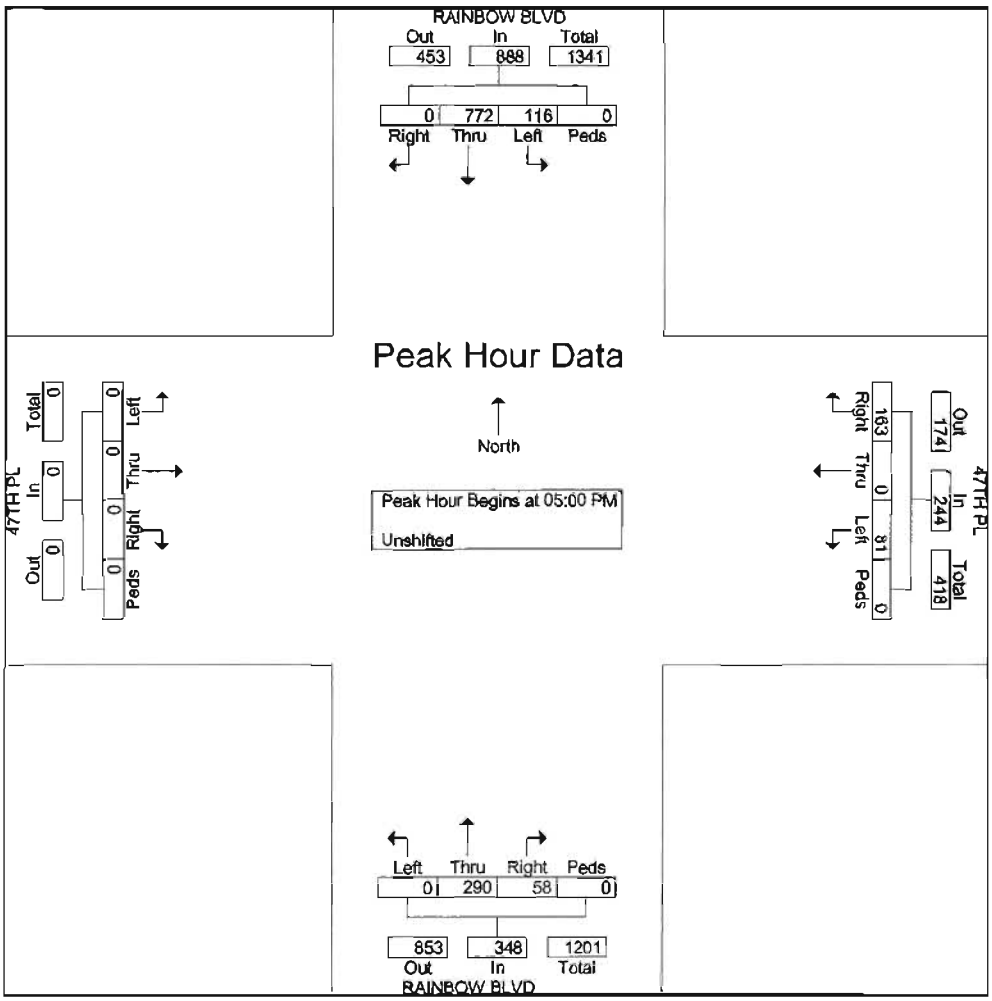


Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

RAINBOW BLVD
47TH PL
PM

File Name : Rainbow Blvd & 47th Pl PM
Site Code : 00000000
Start Date : 11/16/2010
Page No : 3

	RAINBOW BLVD From North					47TH PL From East					RAINBOW BLVD From South					47TH PL 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 Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	214	18	0	232	53	0	31	0	84	11	89	0	0	100	0	0	0	0	0	416
05:15 PM	0	218	36	0	254	33	0	14	0	47	11	70	0	0	81	0	0	0	0	0	382
05:30 PM	0	190	26	0	216	48	0	16	0	64	15	74	0	0	89	0	0	0	0	0	369
05:45 PM	0	150	36	0	186	29	0	20	0	49	21	57	0	0	78	0	0	0	0	0	313
Total Volume	0	772	116	0	888	163	0	81	0	244	58	290	0	0	348	0	0	0	0	0	1480
% App. Total	0	86.9	13.1	0		66.8	0	33.2	0		16.7	83.3	0	0		0	0	0	0		
PHF	.000	.885	.806	.000	.874	.769	.000	.653	.000	.726	.690	.815	.000	.000	.870	.000	.000	.000	.000	.000	.889

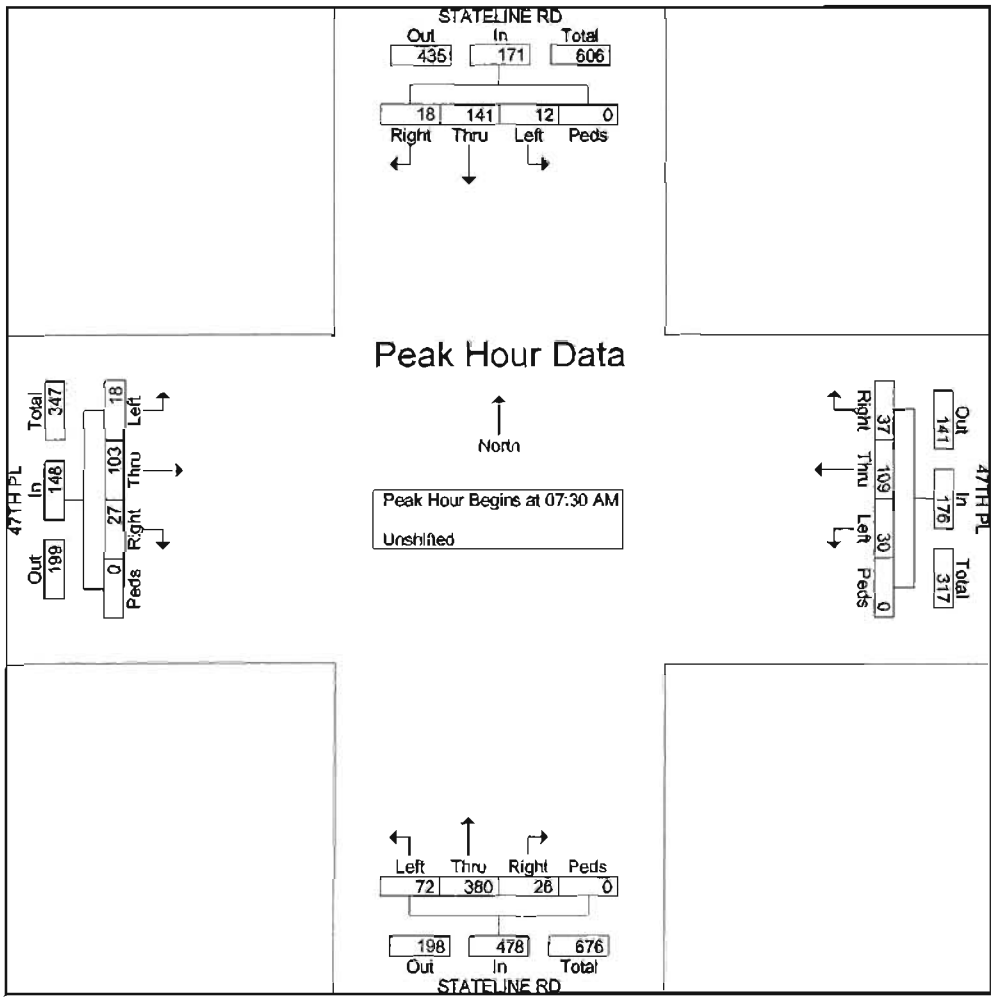


Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

STATELINE RD
47TH PL
AM

File Name : Stateline Rd & 47th Pl AM
Site Code : 00000000
Start Date : 11/17/2010
Page No : 3

	STATELINE RD From North					47TH PL From East					STATELINE RD From South					47TH PL 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 Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	2	33	2	0	37	8	22	6	0	36	2	98	13	0	113	9	18	2	0	29	215
07:45 AM	3	42	6	0	51	9	21	6	0	36	6	84	14	0	104	8	31	7	0	46	237
08:00 AM	3	35	2	0	40	8	28	12	0	48	8	97	19	0	124	4	26	2	0	32	244
08:15 AM	10	31	2	0	43	12	38	6	0	56	10	101	26	0	137	6	28	7	0	41	277
Total Volume	18	141	12	0	171	37	109	30	0	176	26	380	72	0	478	27	103	18	0	148	973
% App. Total	10.5	82.5	7	0		21	61.9	17	0		5.4	79.5	15.1	0		18.2	69.6	12.2	0		
PHF	.450	.839	.500	.000	.838	.771	.717	.625	.000	.786	.650	.941	.692	.000	.872	.750	.831	.643	.000	.804	.878

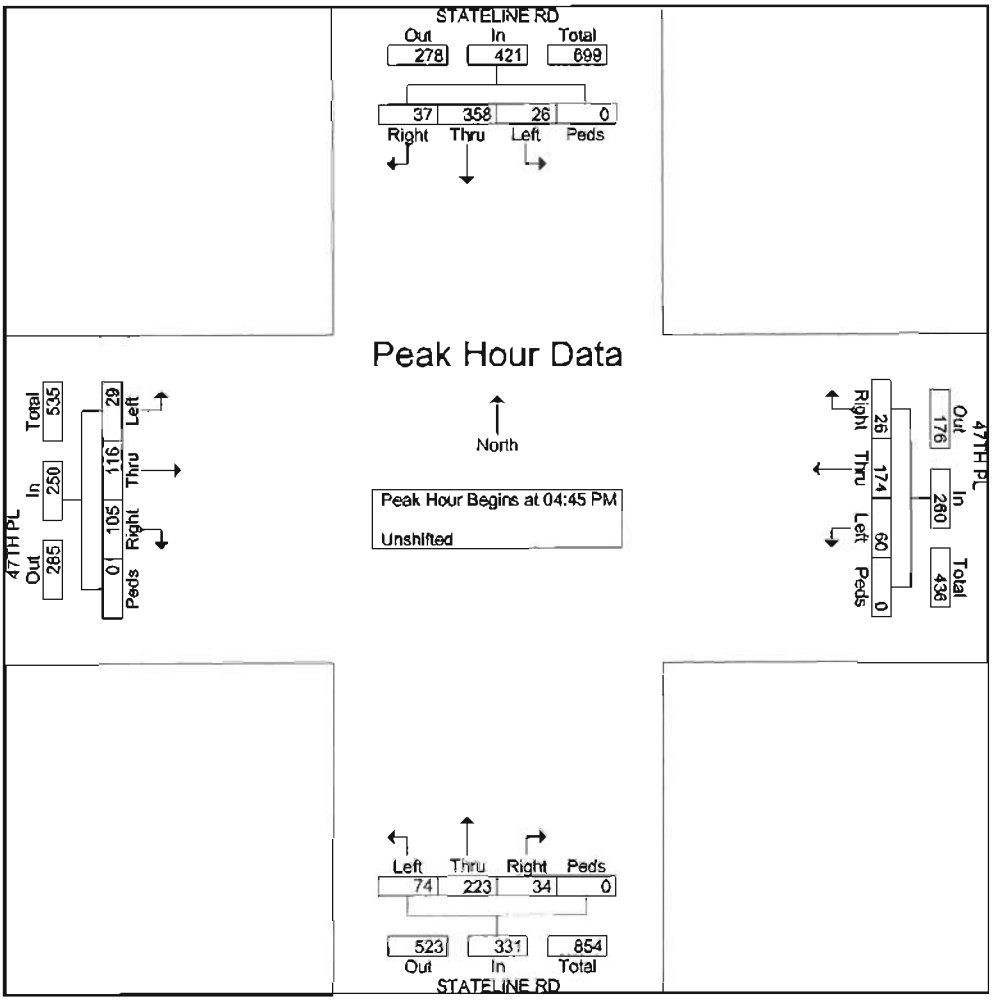


Olsson Associates
7301 West 133rd Street, Suite 200
Overland Park, KS 66213

STATELINE RD
47TH PL
PM

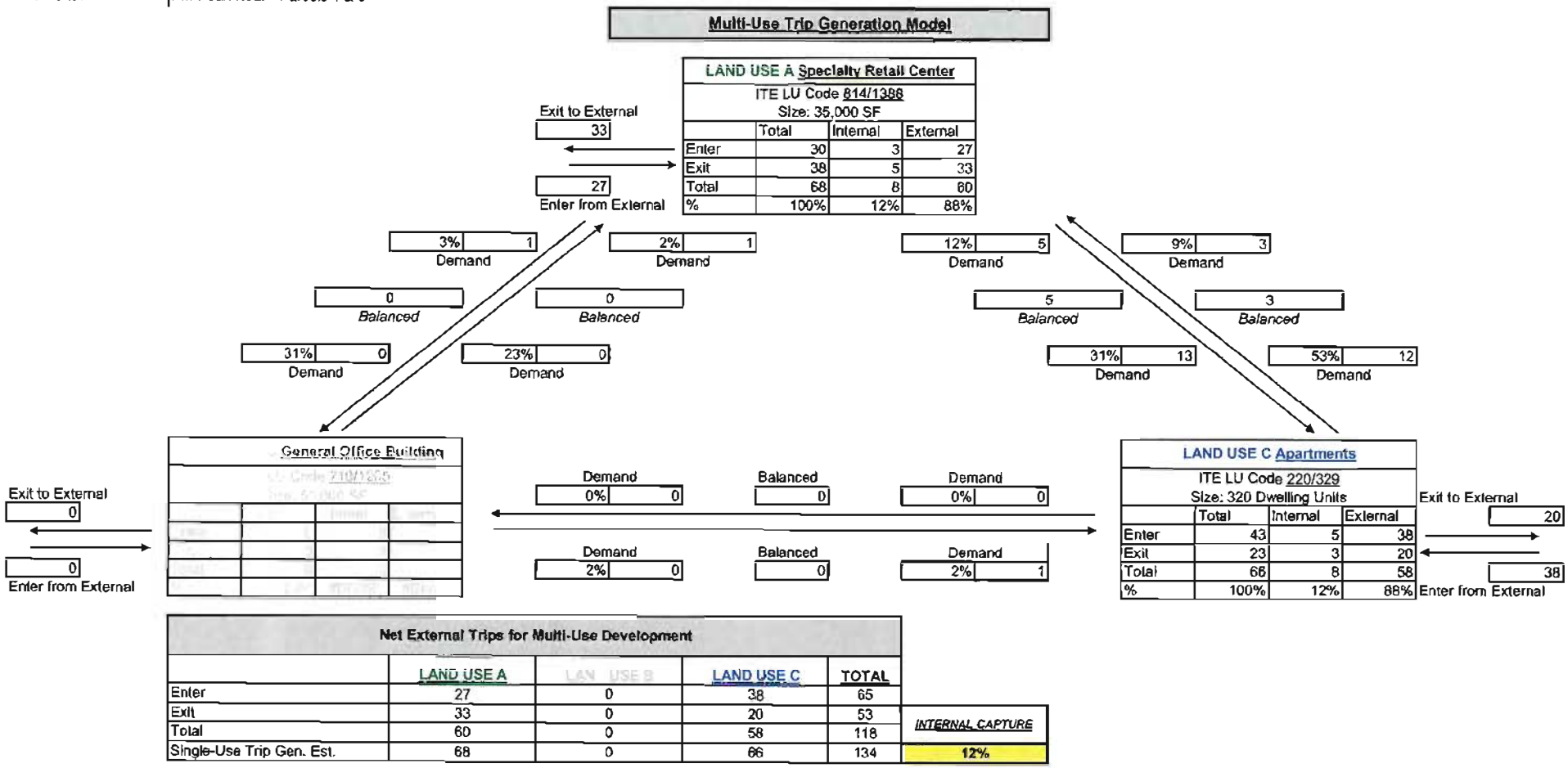
File Name : Statline Rd & 47th Pl PM
Site Code : 00000000
Start Date : 11/17/2010
Page No : 3

	STATELINE RD From North					47TH PL From East					STATELINE RD From South					47TH PL 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 Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	9	86	8	0	103	6	40	18	0	64	9	70	11	0	90	15	23	3	0	41	298
05:00 PM	9	103	6	0	118	7	42	19	0	68	8	48	21	0	77	26	39	11	0	76	339
05:15 PM	10	100	6	0	116	6	54	14	0	74	6	57	27	0	90	29	24	11	0	64	344
05:30 PM	9	69	6	0	84	7	38	9	0	54	11	48	15	0	74	35	30	4	0	69	281
Total Volume	37	358	26	0	421	26	174	60	0	260	34	223	74	0	331	105	116	29	0	250	1262
% App. Total	8.8	85	6.2	0		10	66.9	23.1	0		10.3	67.4	22.4	0		42	46.4	11.6	0		
PHF	.925	.869	.813	.000	.892	.929	.806	.789	000	.878	.773	.796	.685	.000	.919	.750	.744	.659	.000	.822	.917



Analyst:	BHL
Date:	3/14/2011
Name of Development:	Woodside
Time Period.	PM Peak Hour - Parcels 1 & 3

Multi-Use Trip Generation Model

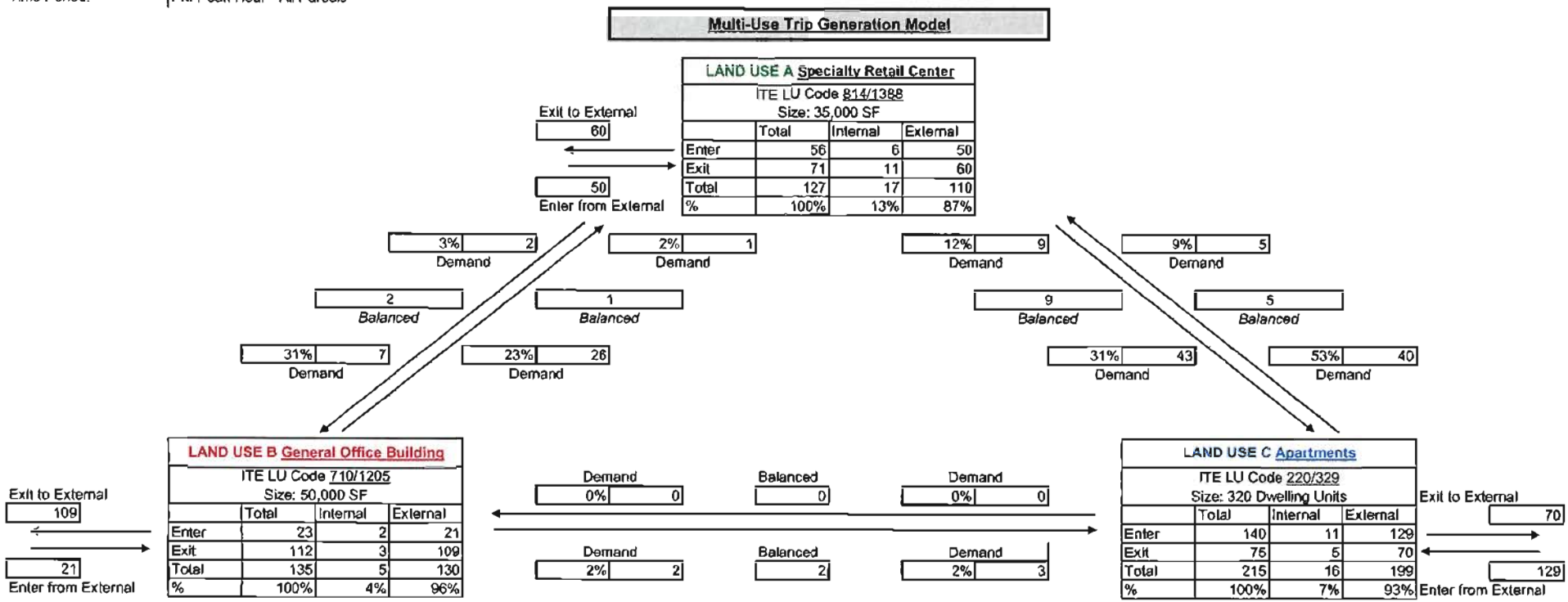


Net External Trips for Multi-Use Development

	LAND USE A	LAND USE B	LAND USE C	TOTAL	
Enter	27	0	38	65	
Exit	33	0	20	53	*INTERNAL CAPTURE*
Total	60	0	58	118	
Single-Use Trip Gen. Est.	68	0	66	134	12%

Analyst:	BHL
Date:	3/14/2011
Name of Development:	Woodside
Time Period:	PM Peak Hour - All Parcels

Multi-Use Trip Generation Model



Net External Trips for Multi-Use Development

	LAND USE A	LAND USE B	LAND USE C	TOTAL
Enter	50	21	129	200
Exit	60	109	70	239
Total	110	130	199	439
Single-Use Trip Gen. Est.	127	135	215	477

INTERNAL CAPTURE
8%

Parking Lot Volumes (By Others)

Upper Clubhouse

Tues

North West

Upper

LOT	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45
TOTAL at start 41 — Incoming	10	5	10	12	5	10	14	14
Outgoing Eastbound	6	1	7	4	6	6	8	5
Outgoing Westbound	7	3	2	3	1	4	1	4

NORTH EAST 5-7 LOWER LOWER

Lower Clubhouse

LOT	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7
TOTAL at START Incoming 45	9	10	10	6	5	10	7		
Outgoing Eastbound	2	5	9	1	5	1	4	1	
Outgoing Westbound	4	3	3	4	1	4	2	6	

South
WEST

& EAST

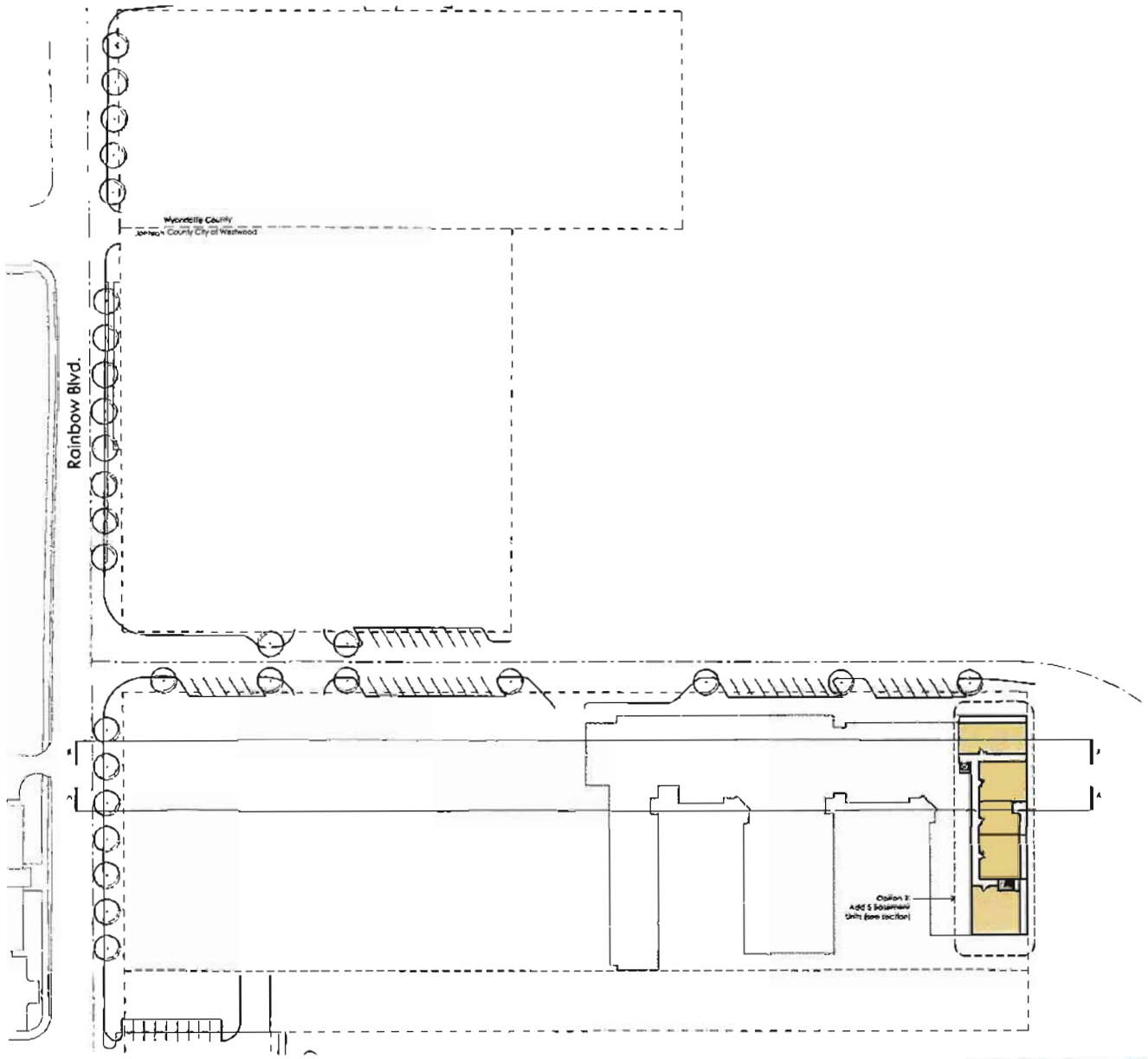
& WEST

	LOT	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45
7:00 TOTAL 47	Incoming Total	30	29	35	49	64	58	59	63
			How many cars left from						
			5:00 - 5:15	5:15 - 5:30	5:30 - 5:45	5:43 - 6:00	6:00 - 6:15	6:15 - 6:30	6:30 - 6:45	6:43 - 7:00
Outgoing	Eastbound		2	0	0	8	5	1	0	8
Outgoing	Westbound		4	0	4	4	3	0	5	14

South
Ent

LOT		5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45
Total 38	Incoming	10	16	25	29	5	7	10	7
Outgoing A	Eastbound	2	2	4	16	6	7	10	15
Outgoing R	Westbound	1	0	2	7	3	3	6	9

Development Schematic (By Others)

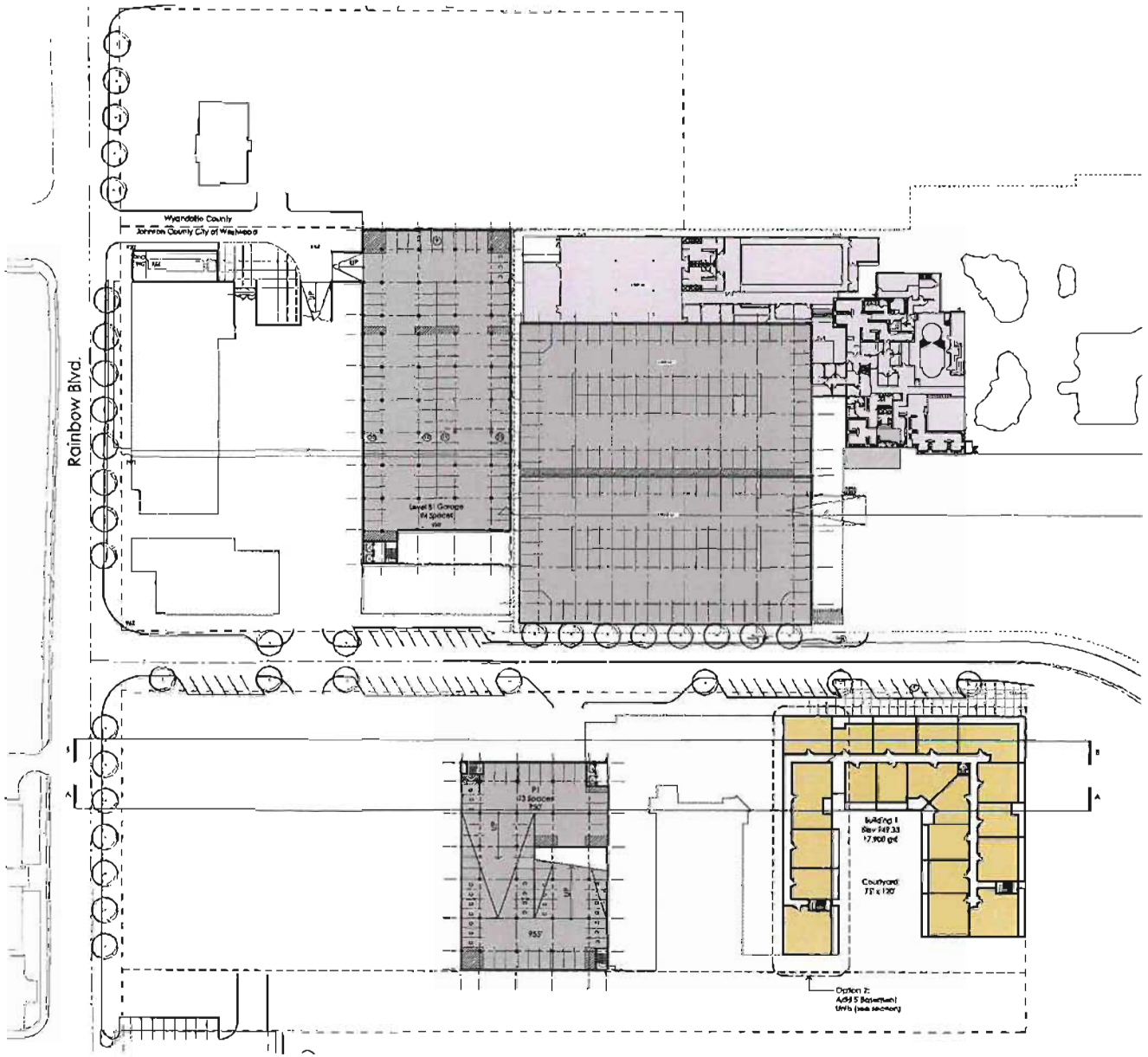


N

Level B Plan
Elev 938.66

Scale: 1" = 40'-0"

0 20 40 80

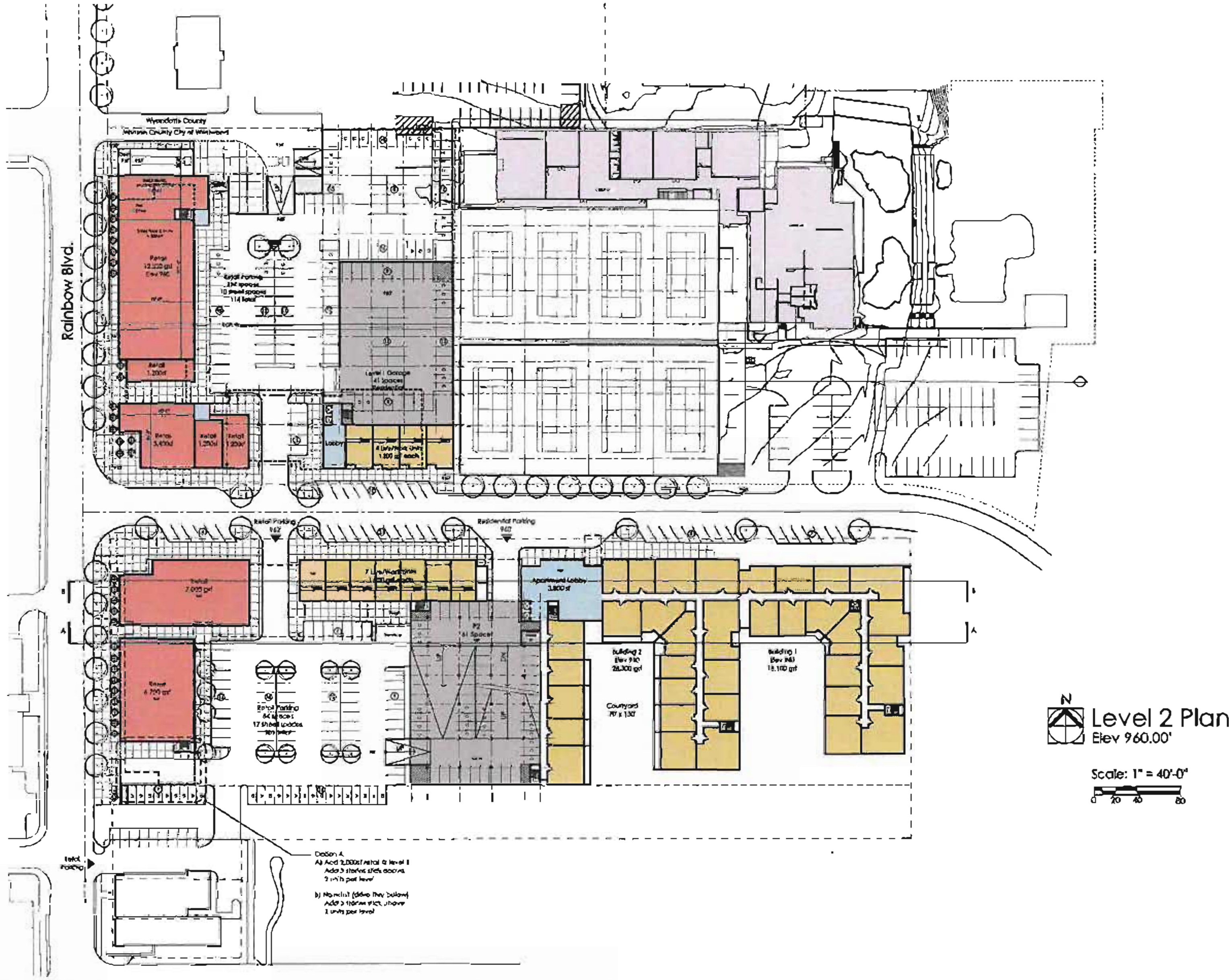


N

Level 1 Plan
Elev 949.33

Scale: 1" = 40'-0"

0 20 40 80



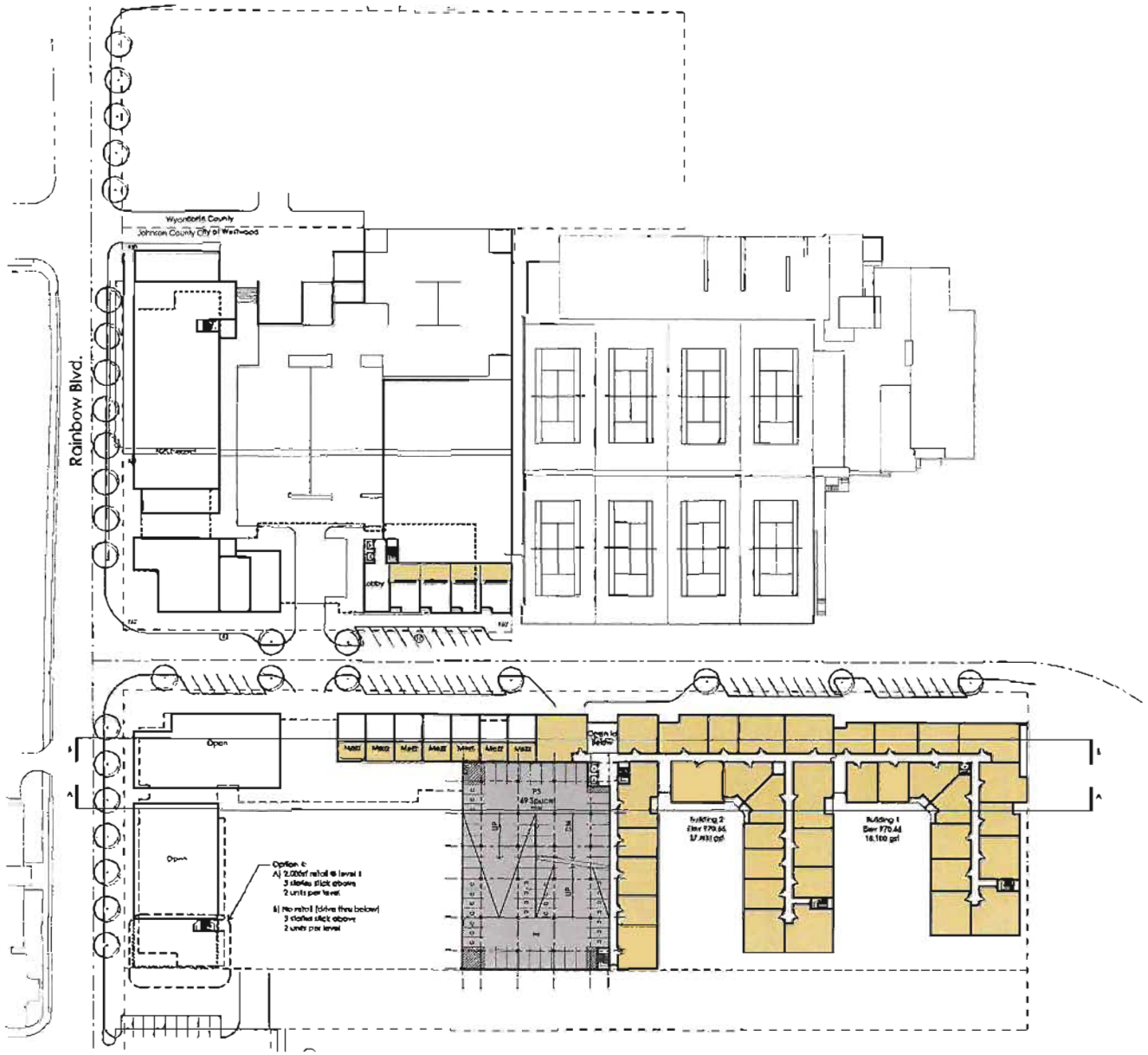
Shears Adkins Rockmore
Hufft Projects

TANNER & WHITE

Woodside Village

Concept Plan
8 March 2011

A3



N

Level 3 Plan
Elev 970.66

Scale: 1" = 40'-0"

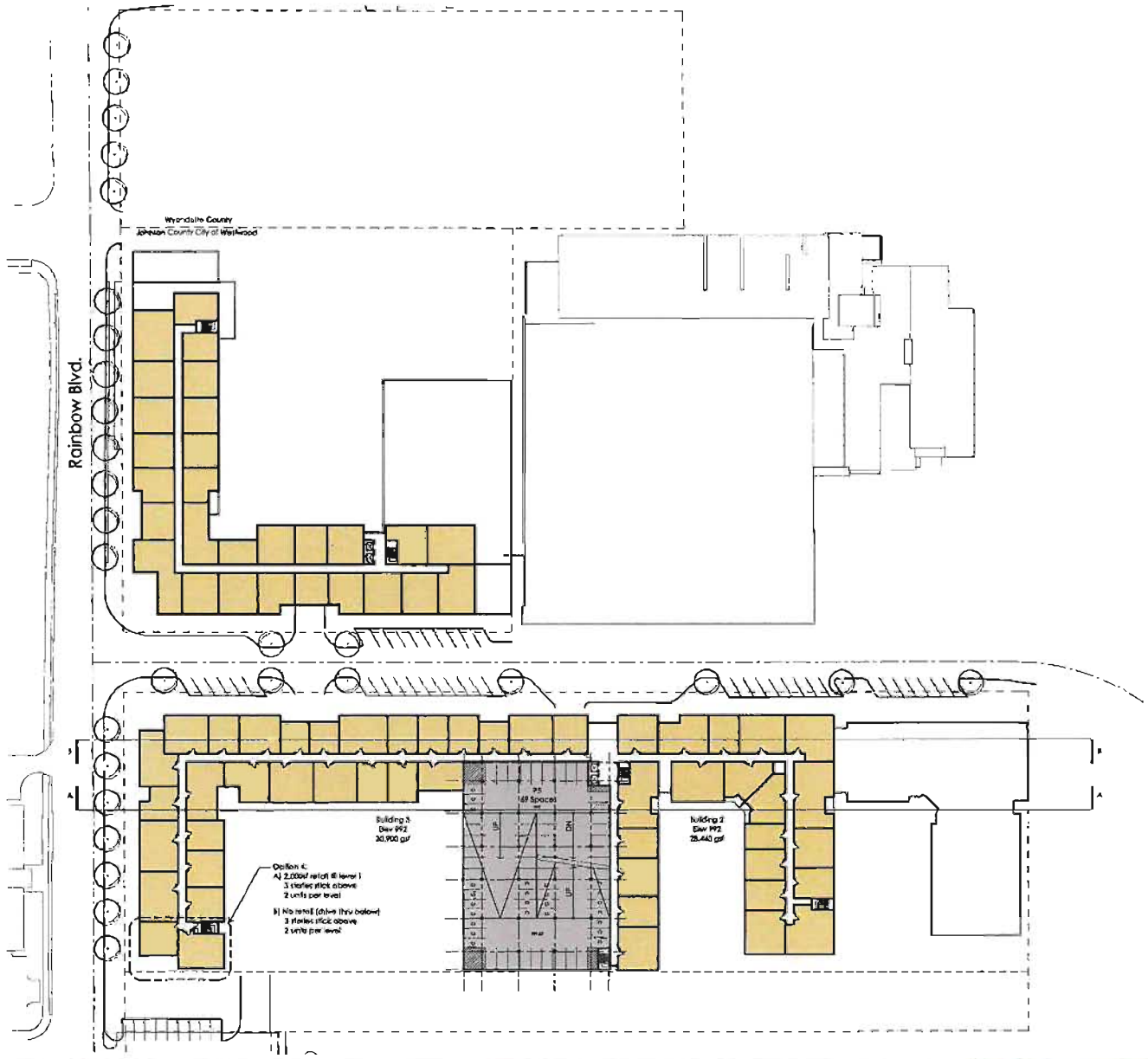
0 20 40 80

N

Level 4 Plan
Elev 981.33'

Scale: 1" = 40'-0"

0 20 40 80

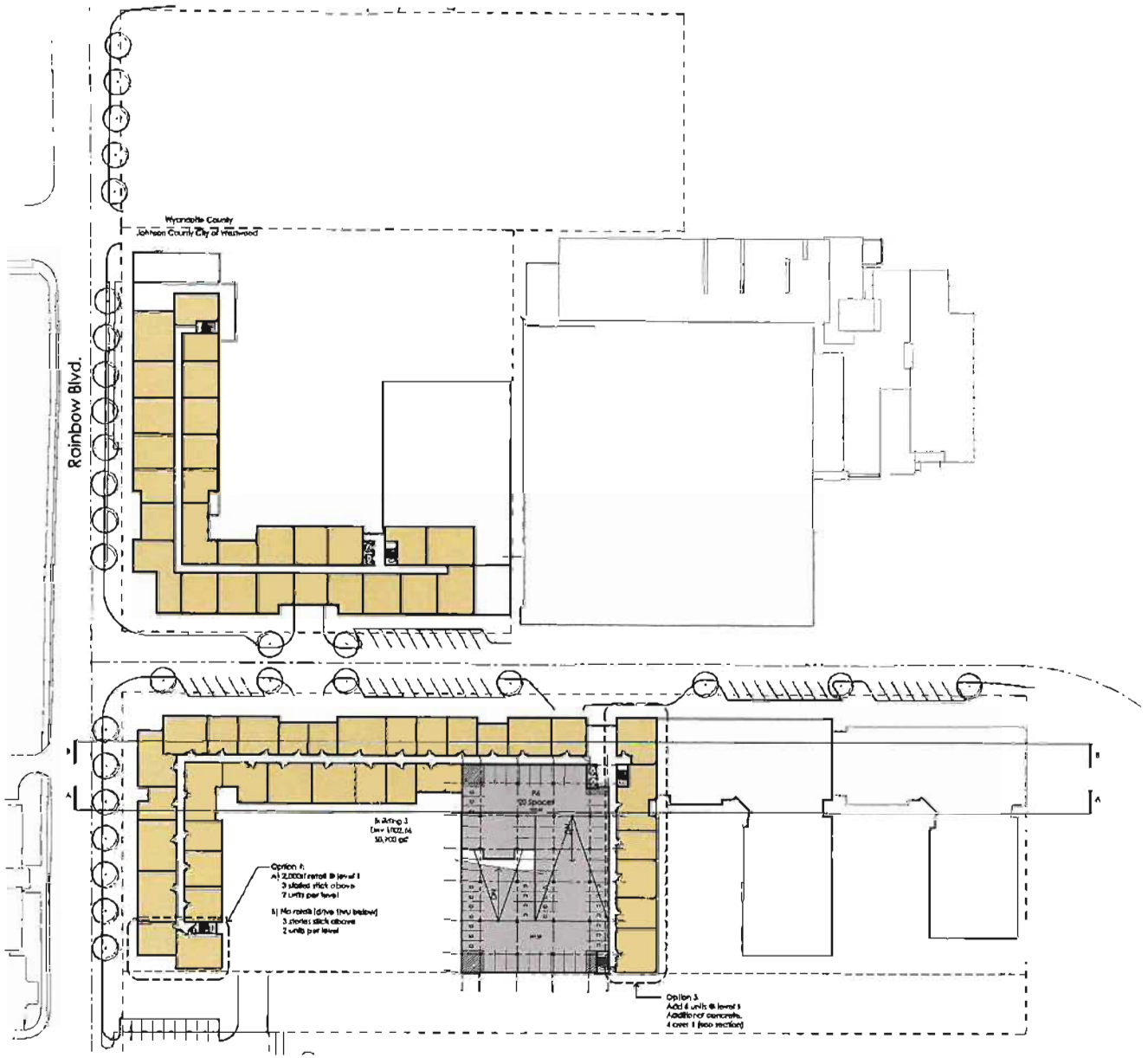


N

Level 5 Plan
Elev 992.00'

Scale: 1" = 40'-0"

0 20 40 80

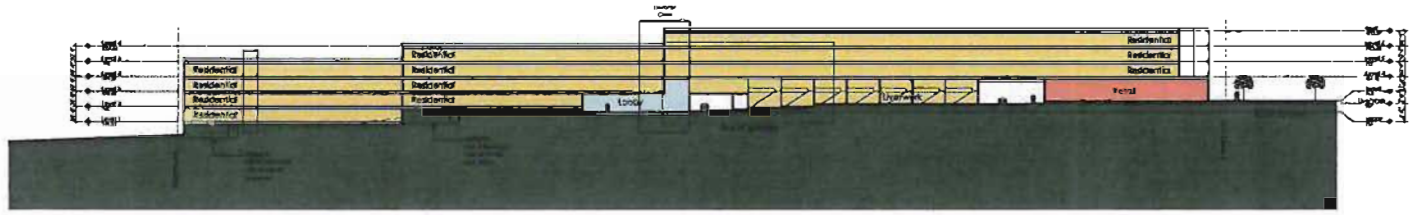


N

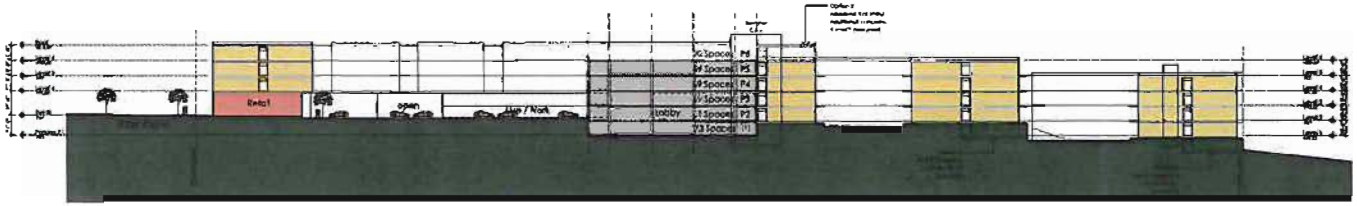
Level 6 Plan
Elev 1002.66'

Scale: 1" = 40'-0"

0 20 40 80



Parcel 2 Site Section BB



Parcel 2 Site Section AA

Scale: 1" = 40'-0"

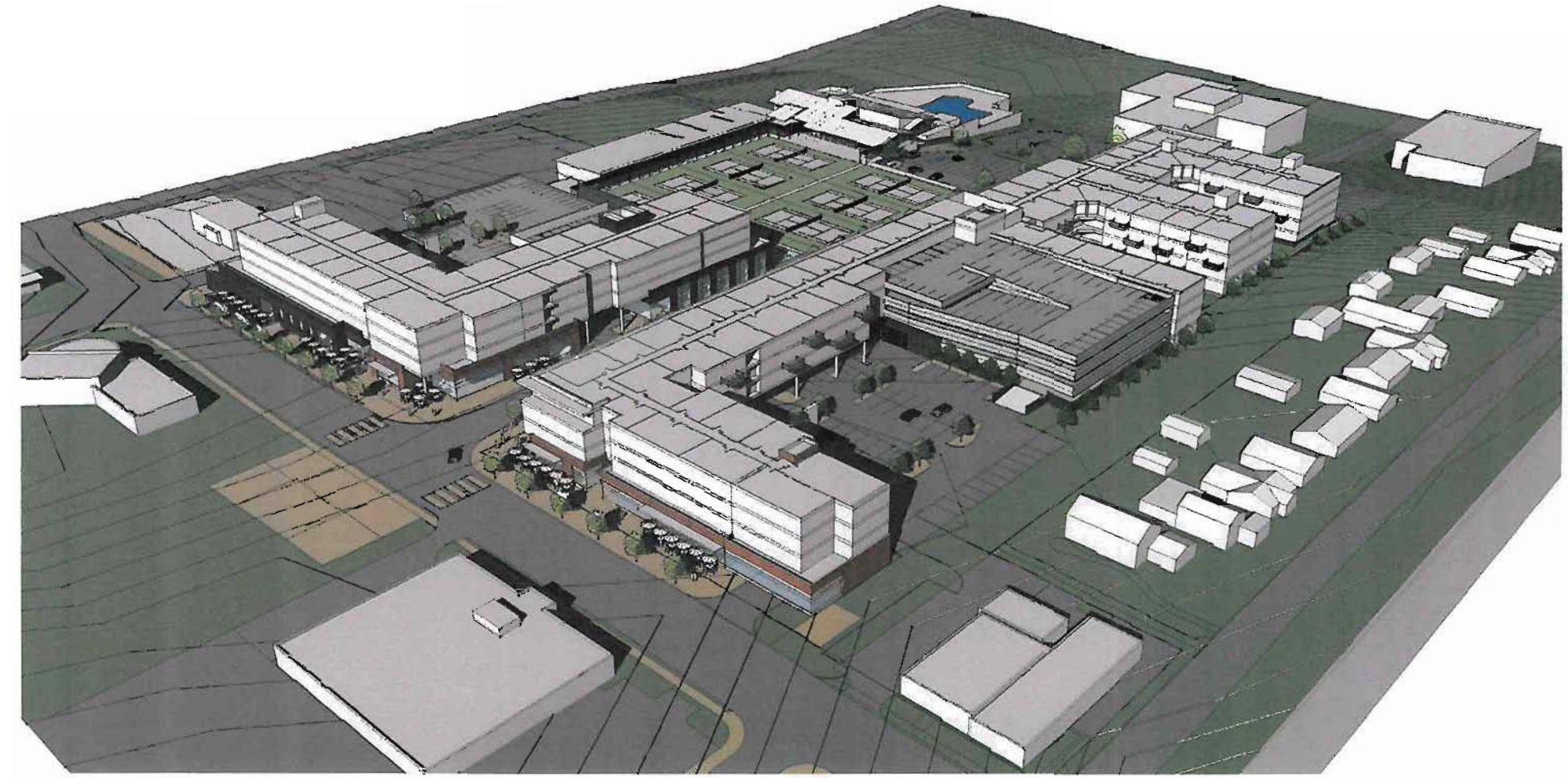
0 20 40 80

Shears Adkins Rockmore
Kuhl Projects

TANNER & WHITE

Woodside Village

Concept Plan
9 March 2011



Sheard Avenue Redevelopment
Built Projects

TANNER & WHITE

Woodside Village

Concept Plan
8 March 2011

Sheans Adkins Redmore
Mixed Projects

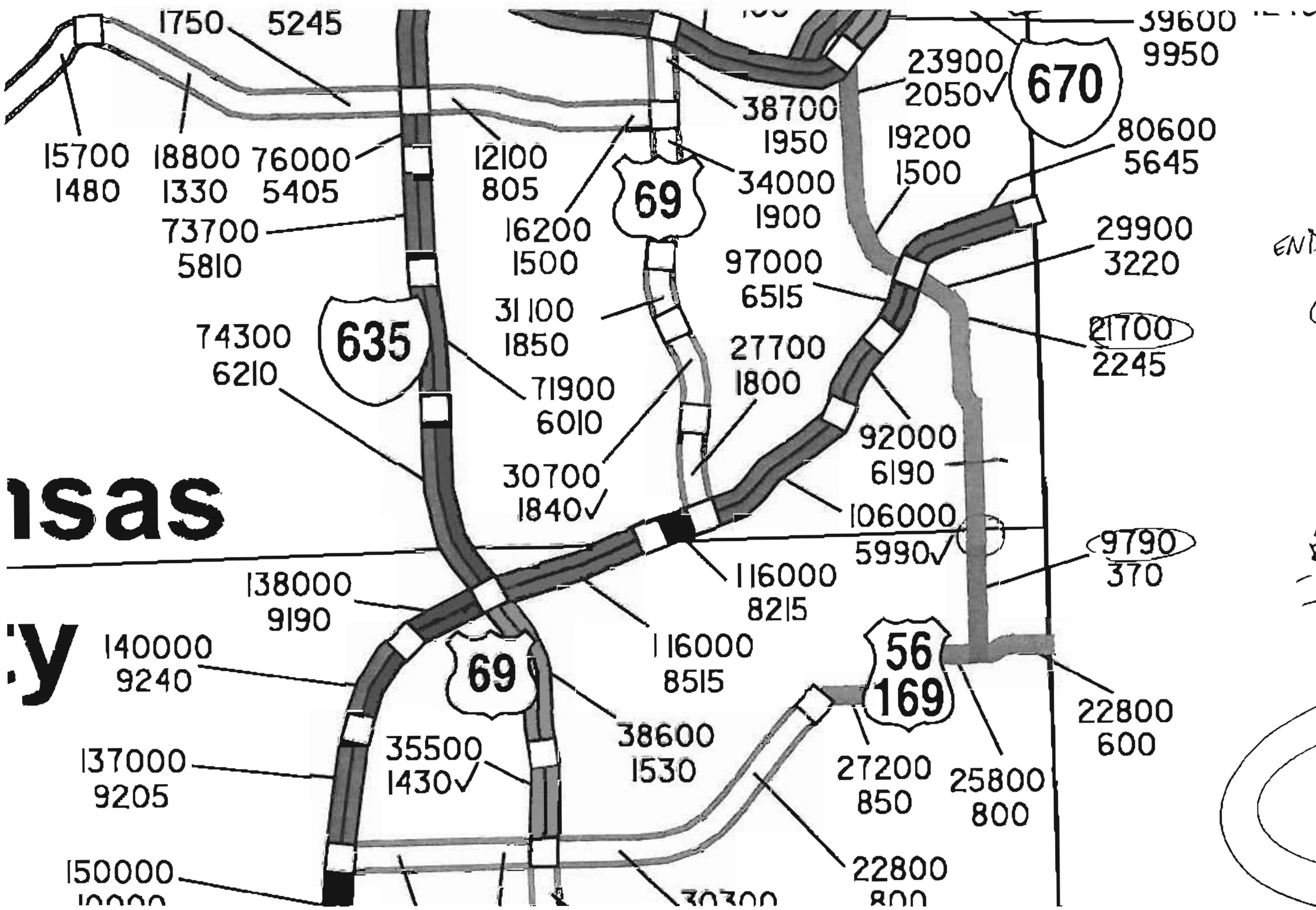
TANNER & WHITE

Woodside Village

Concept Plan
8 March 2011

KDOT ADT CALCULATIONS

Interpolated KDOT Traffic Volumes - 47th Avenue & Rainbow Blvd				
Year	ADT	ADT Change (VOL)	ADT Change (CUM. VOL)	ADT Change (%)
2004-2005	12,768	-	-	-
2005-2006	12,760	-8	-8	-0.06%
2006-2007	12,725	-35	-43	-0.27%
2007-2008	12,475	-250	-293	-1.96%
2008-2009	12,013	-462	-755	-3.70%
2009-2010	11,778	-235	-990	-1.96%



END 2005 ADT

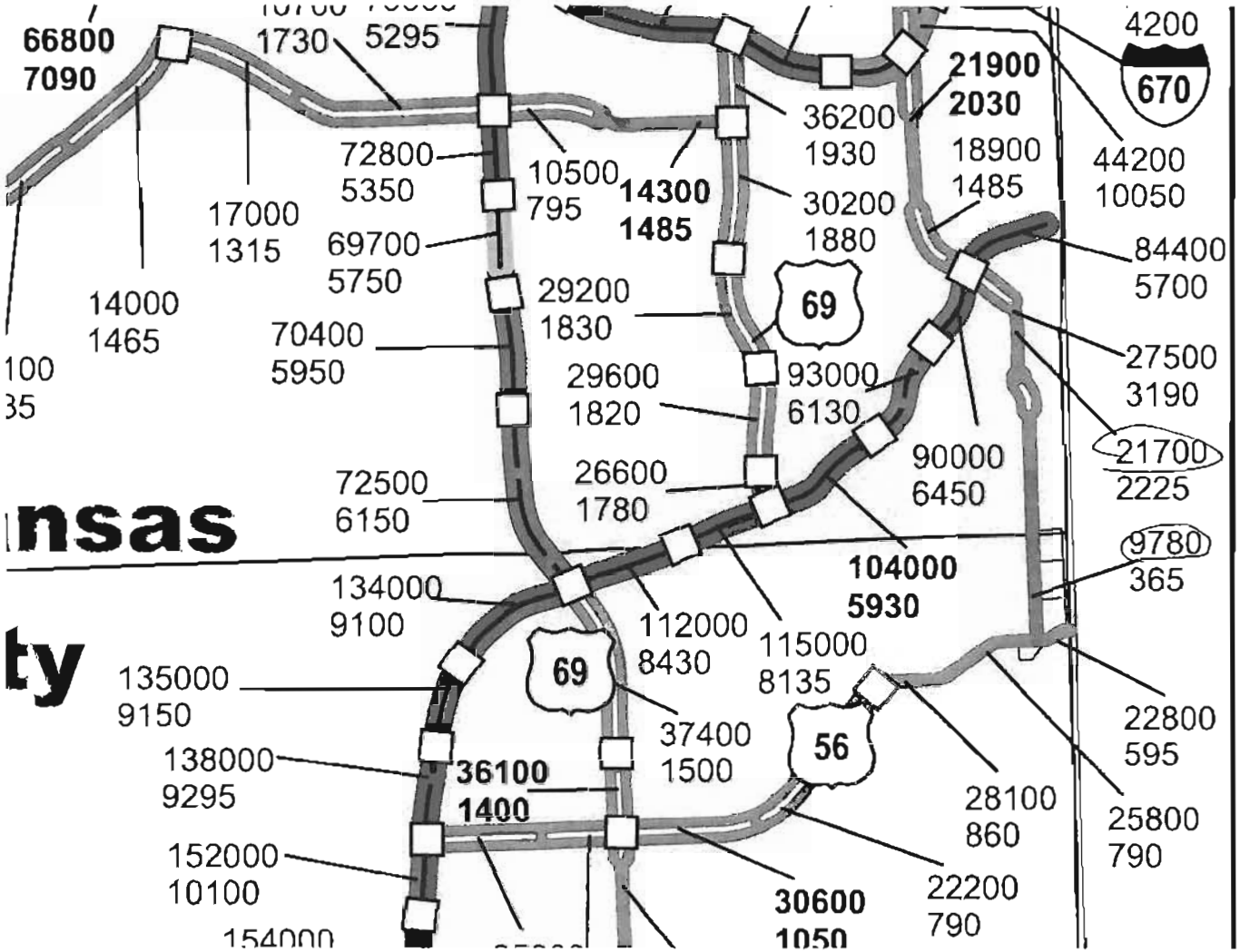
(July 2004 – June 2005)

21700
− 9790
11,910

11,910
× 0.25
2980 ±
(78)

9790
+ 2978
12,768

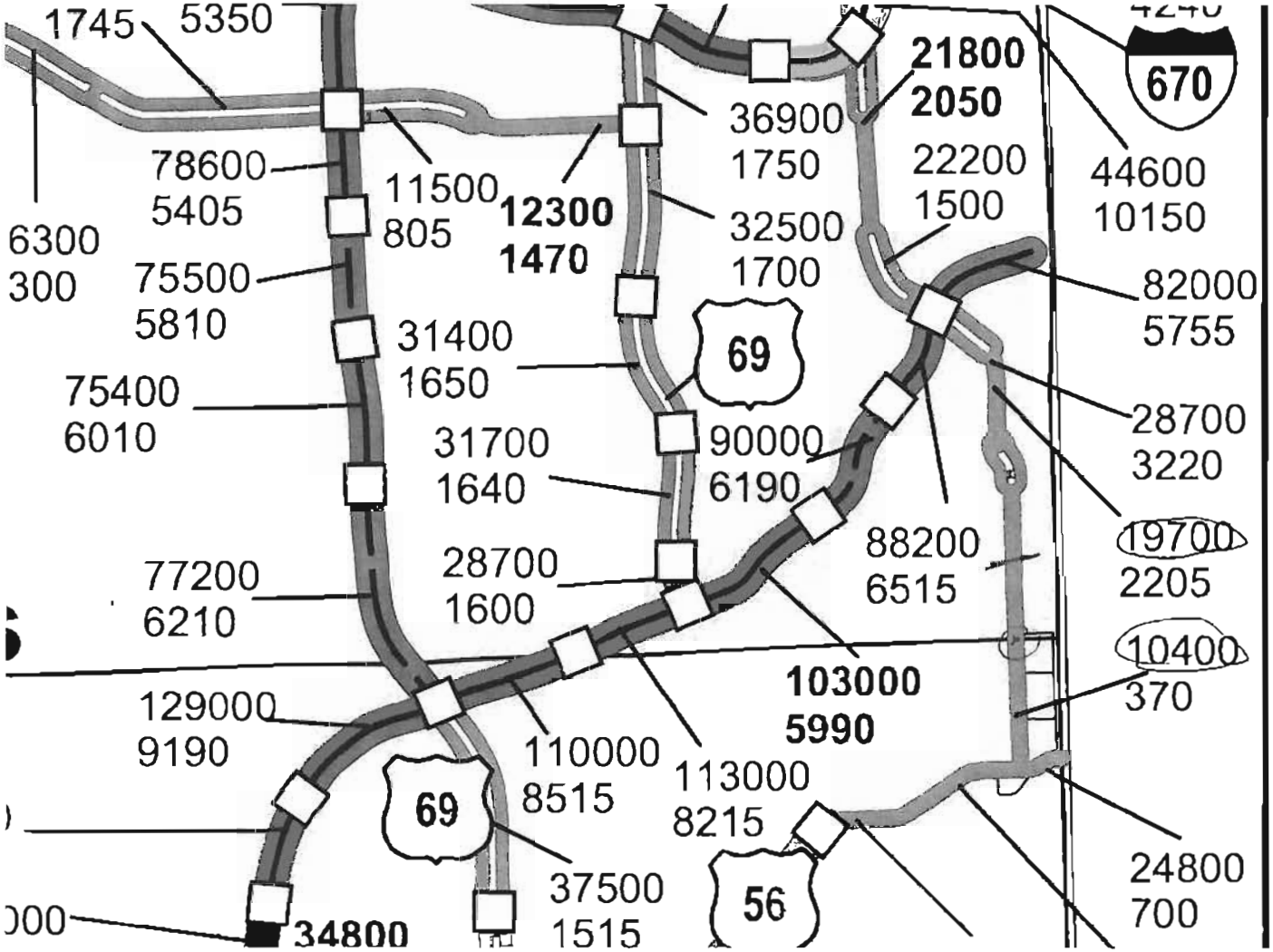
See XLS for exact ~~figures~~; #5



2006 ADT

≈12768

→ 0%± growth from 2005



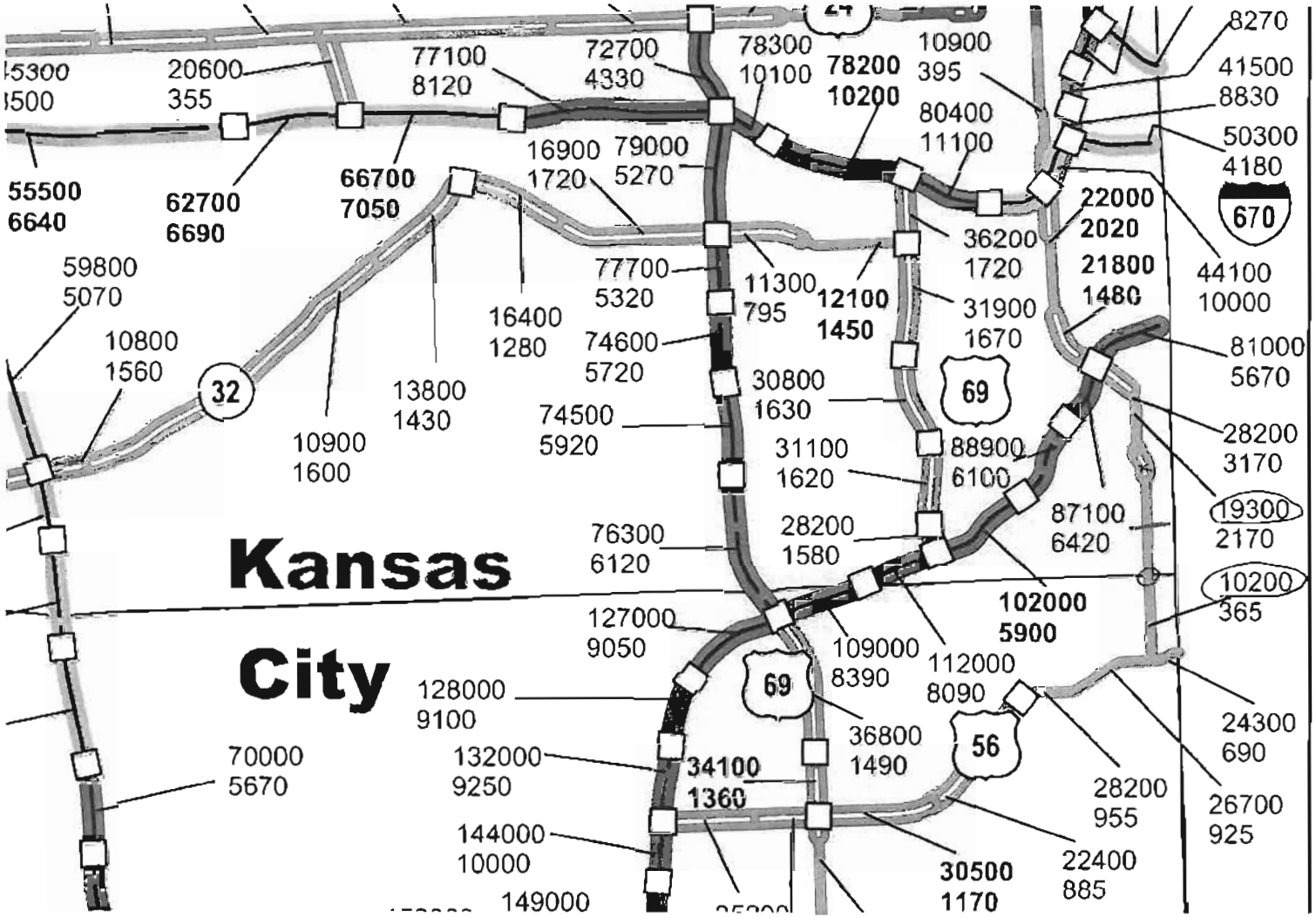
2007 ADT

19700 − 10400 = 9300

9300 × 0.25 = 2325

2325 + 10400 = 12,725

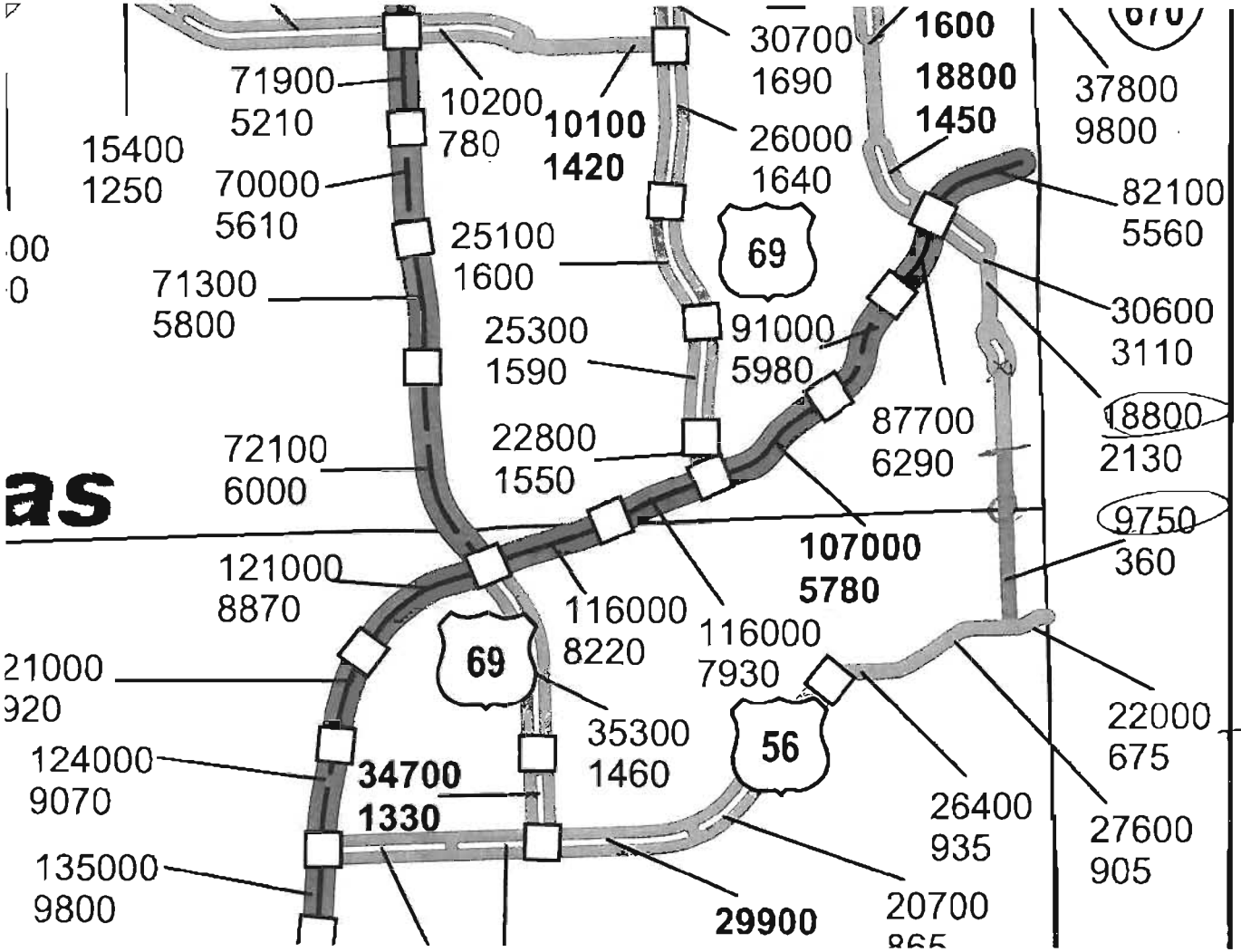
→ 0.35 % Decrease from 2006



2008 ADT

19300	9100	2275
−10200	× 0.25	+10200
9100	2275	12475

→ 1.964% Decrease from 200



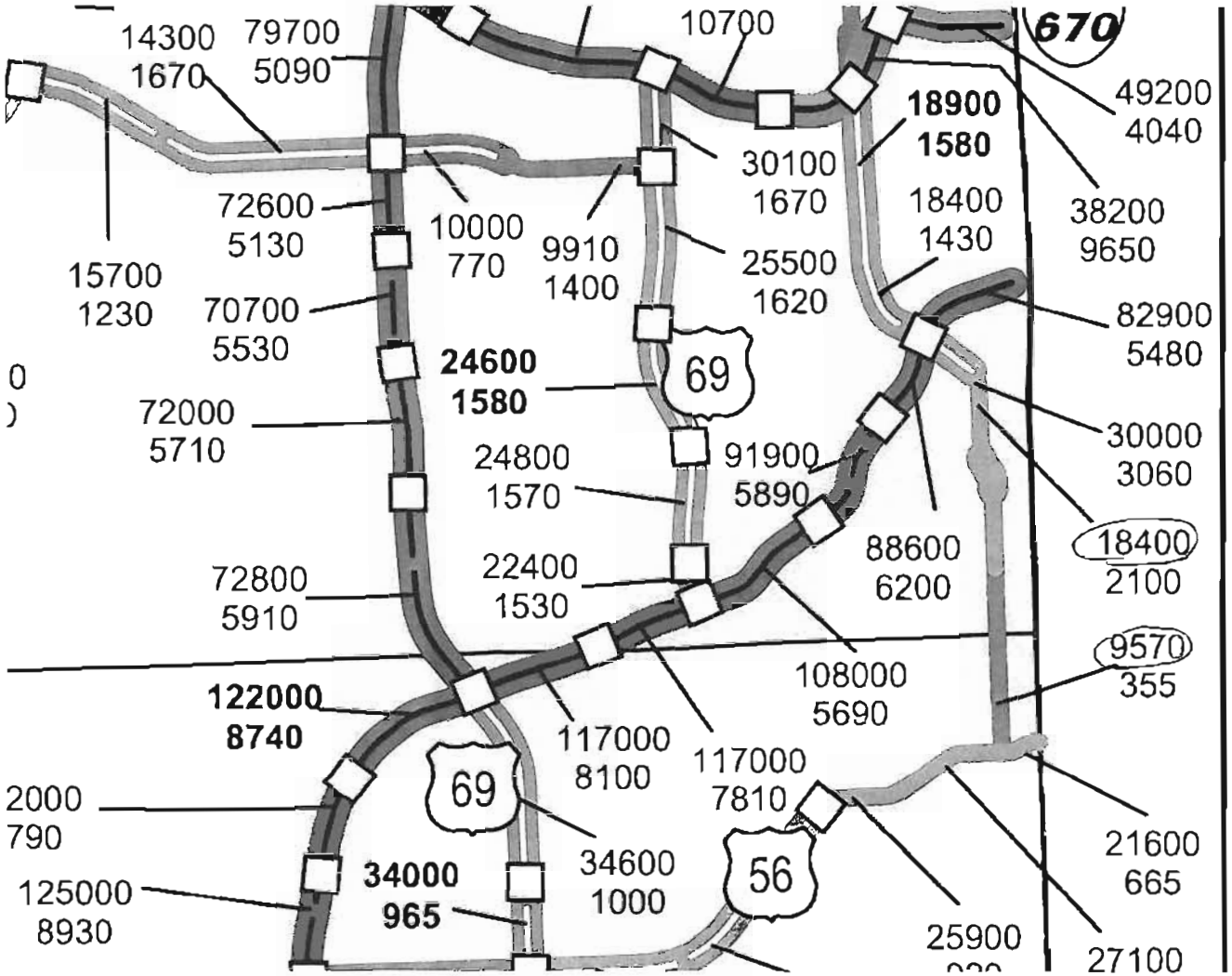
2009 ADT

18800 − 9750 = 9050

9050 × 0.25 = 2263

2263 + 9750 = 12,013

→ 3.7% Decrease from 2008



2010 ADT

$18400 - 9570 = 8830$

$8830 \times 0.25 = 2208$

$9570 + 2208 = 11778$

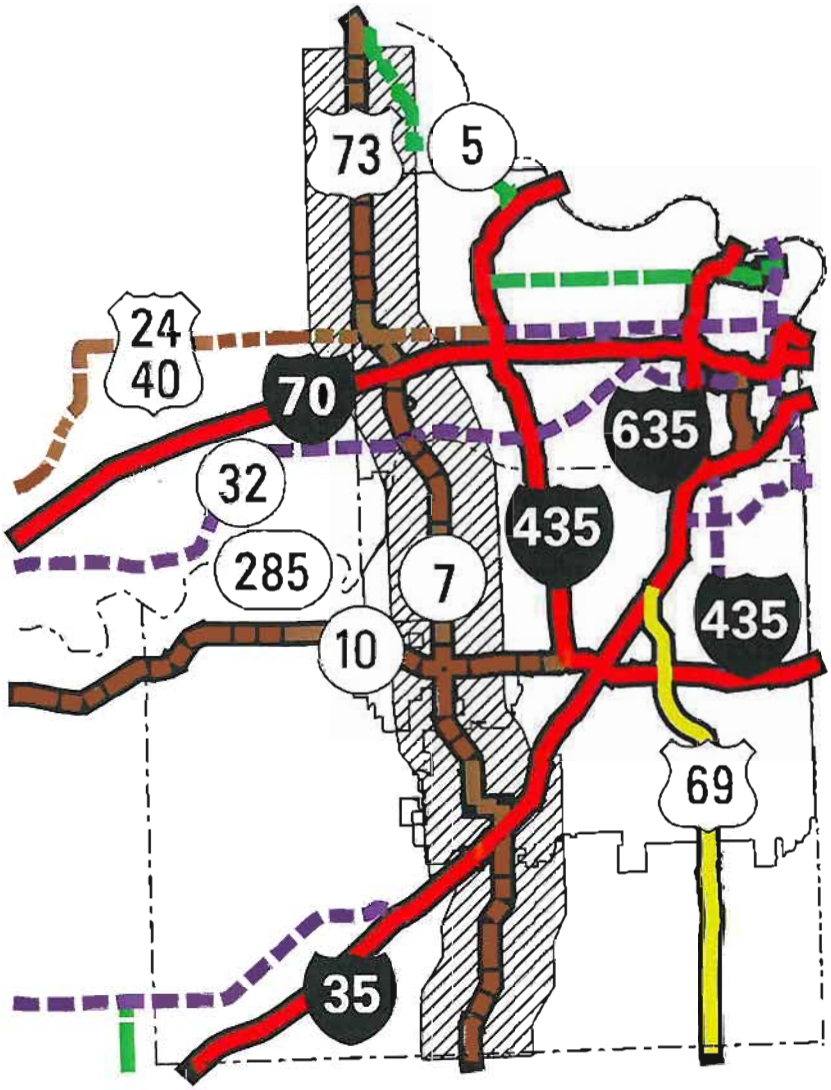
→ 1.948% Decrease from 2009

ROUGH AVERAGES

* From 2007-2010, traffic decreased by 1.99% yearly.

* From 2006-2010, traffic decreased by 1.59% yearly.

KDOT ROUTE CLASSIFICATION & NHS SYSTEM
DISTRICT ONE
Kansas City Metro Area



A Route

B Route

C Route

D Route

E Route

NHS Route *

Protected Route *

* NHS and Protected Routes are managed as "B" routes.

N

S

10 0 10
MILES

PREPARED BY THE

KANSAS DEPARTMENT OF TRANSPORTATION

BUREAU OF TRANSPORTATION PLANNING

D1STPNHS04.DGN MARCH 11, 2004

USING CANSYS DATABASE 6/03

2030 KDOT Traffic Estimations

AM PEAK HOUR

47th Avenue & Rainbow Blvd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	271	200	0	0	0	0	93	0	572	0	106	288
2030 Adds:	60	44	0	0	0	0	20	0	126	0	23	63

47th Place & Rainbow Blvd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	0	0	0	33	89	0	0	81	576	164	0	324
2030 Adds:	0	0	0	7	20	0	0	18	127	36	0	71

47th Place & State Line Rd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	18	27	103	30	37	109	72	26	380	12	18	141
2030 Adds:	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR

47th Avenue & Rainbow Blvd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	236	143	0	0	0	0	149	0	304	0	244	745
2030 Adds:	52	31	0	0	0	0	33	0	67	0	54	164

47th Place & Rainbow Blvd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	0	0	0	81	163	0	0	58	290	116	0	772
2030 Adds:	0	0	0	18	36	0	0	13	64	26	0	170

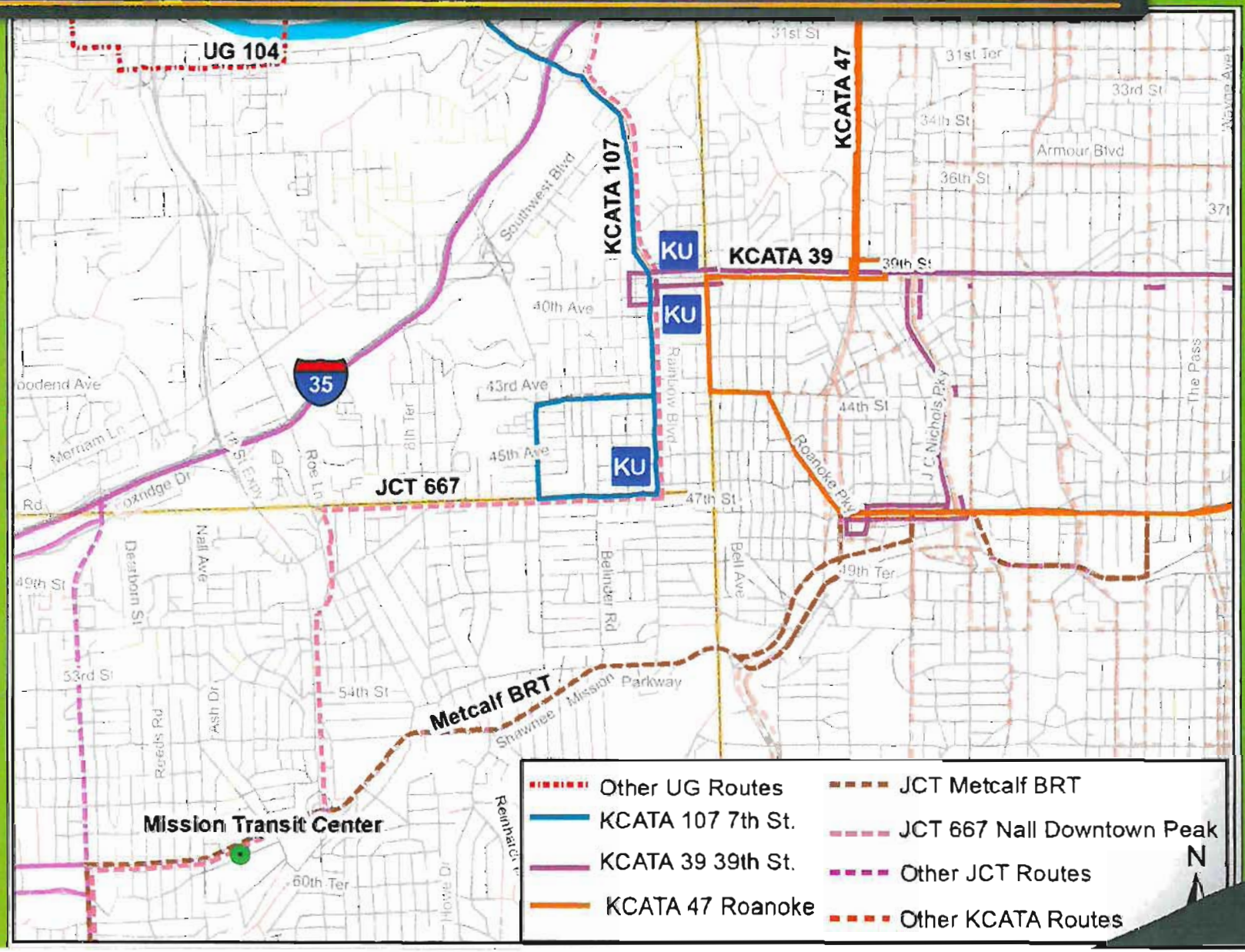
47th Place & State Line Rd

Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	29	105	116	60	26	174	74	34	223	26	37	358
2030 Adds:	0	0	0	0	0	0	0	0	0	0	0	0

**Assumed traffic growth is 1.0% Annually per KDOT request on Rainbow Boulevard only. From above, larger estimation used for growth on thru movements on Rainbow.*

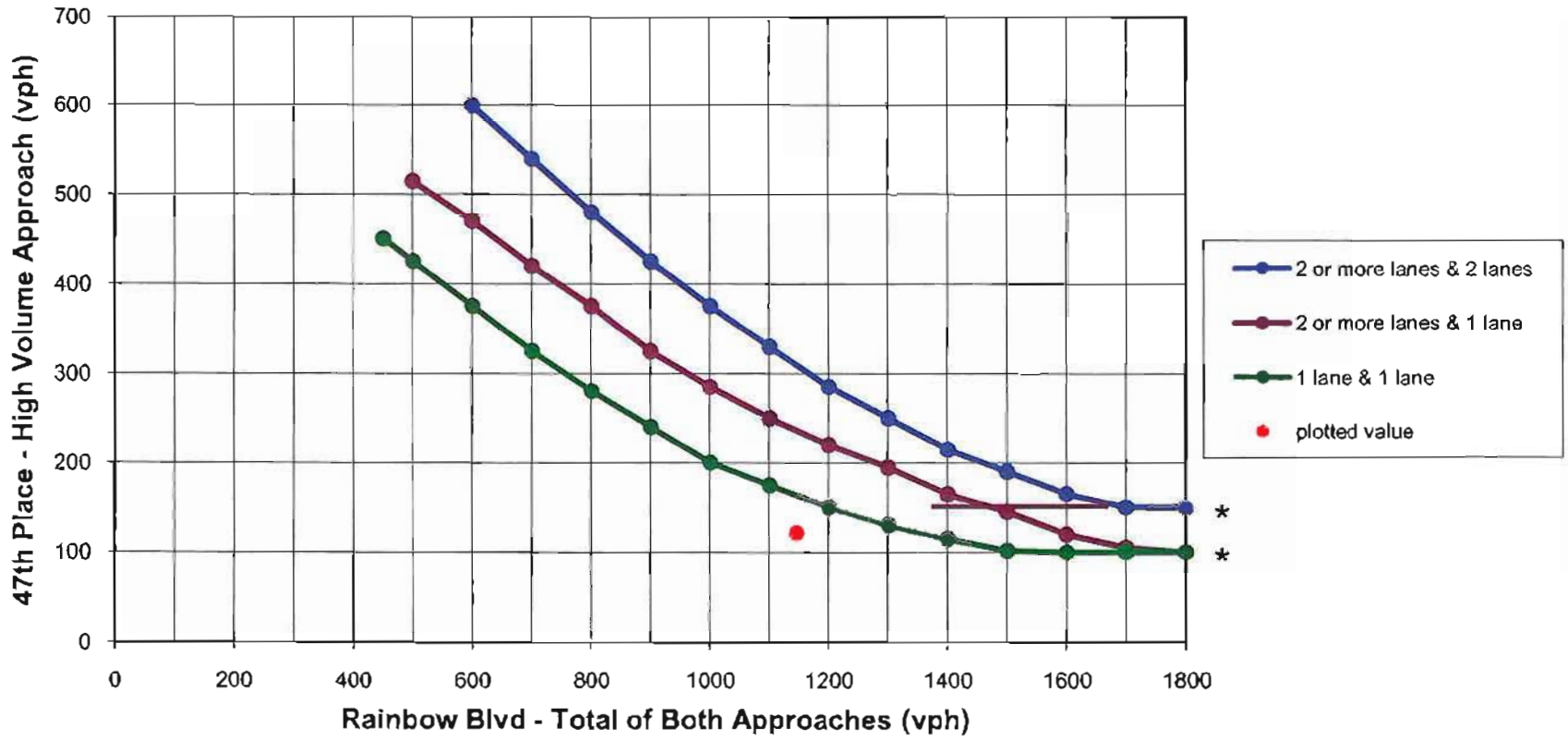
Traffic Growth Formula: 2030 VOLUME = (2010 VOLUME)(1+0.01)^{20} - (2010 VOLUME)

Existing Transit Service



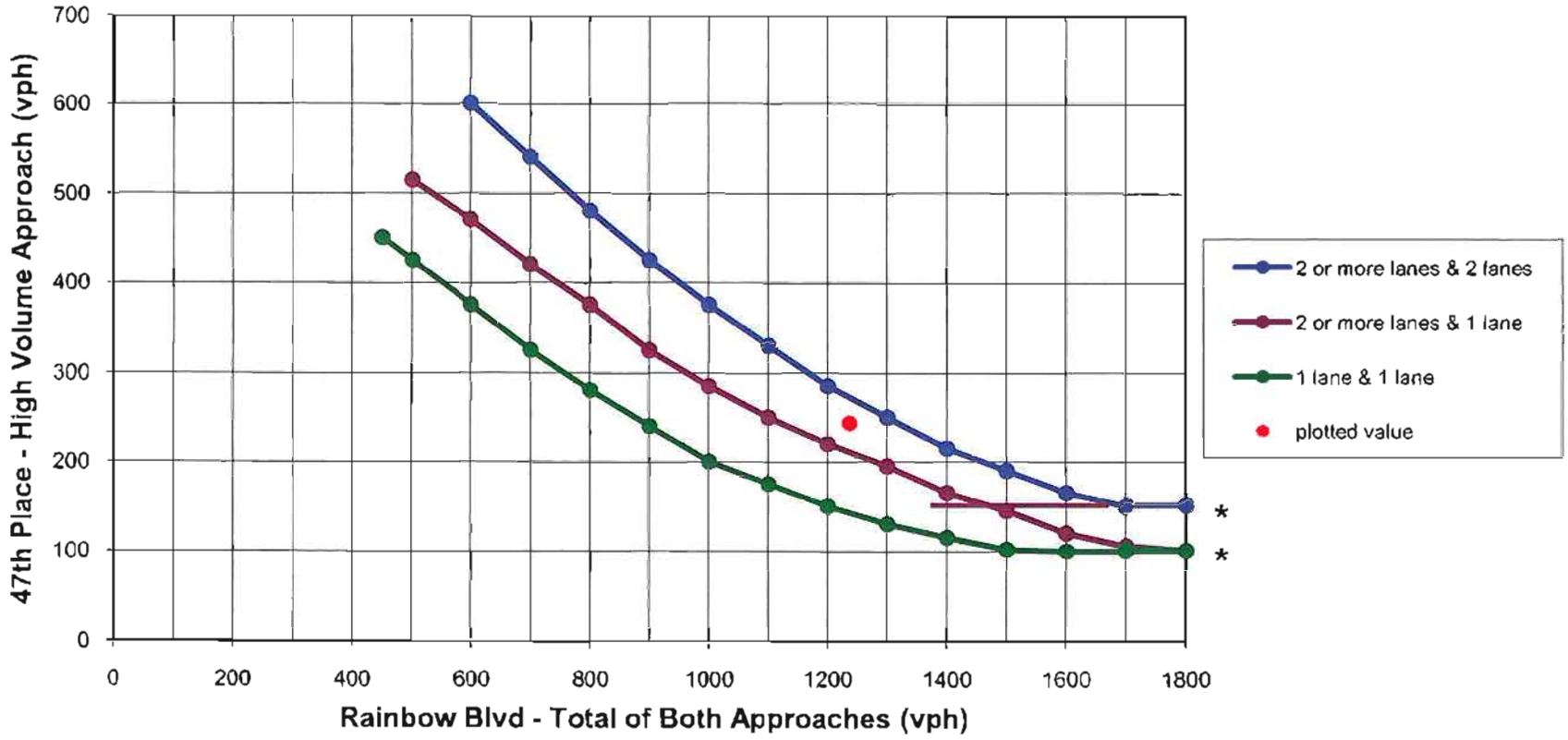
Signal Warrant Analysis

47th Place & Rainbow Blvd
Existing AM Peak Hour Volume Warrant



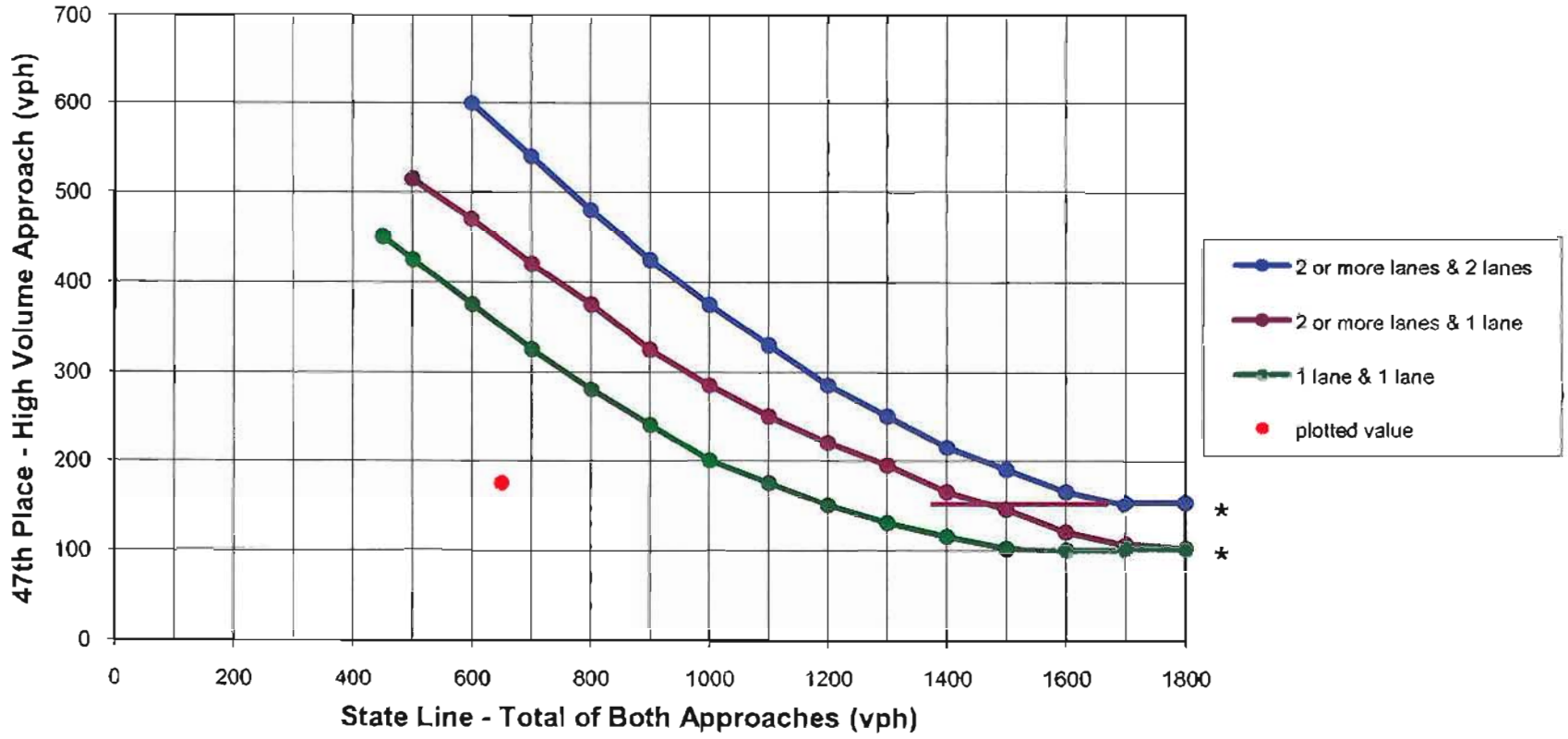
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Rainbow Blvd
Existing PM Peak Hour Volume Warrant



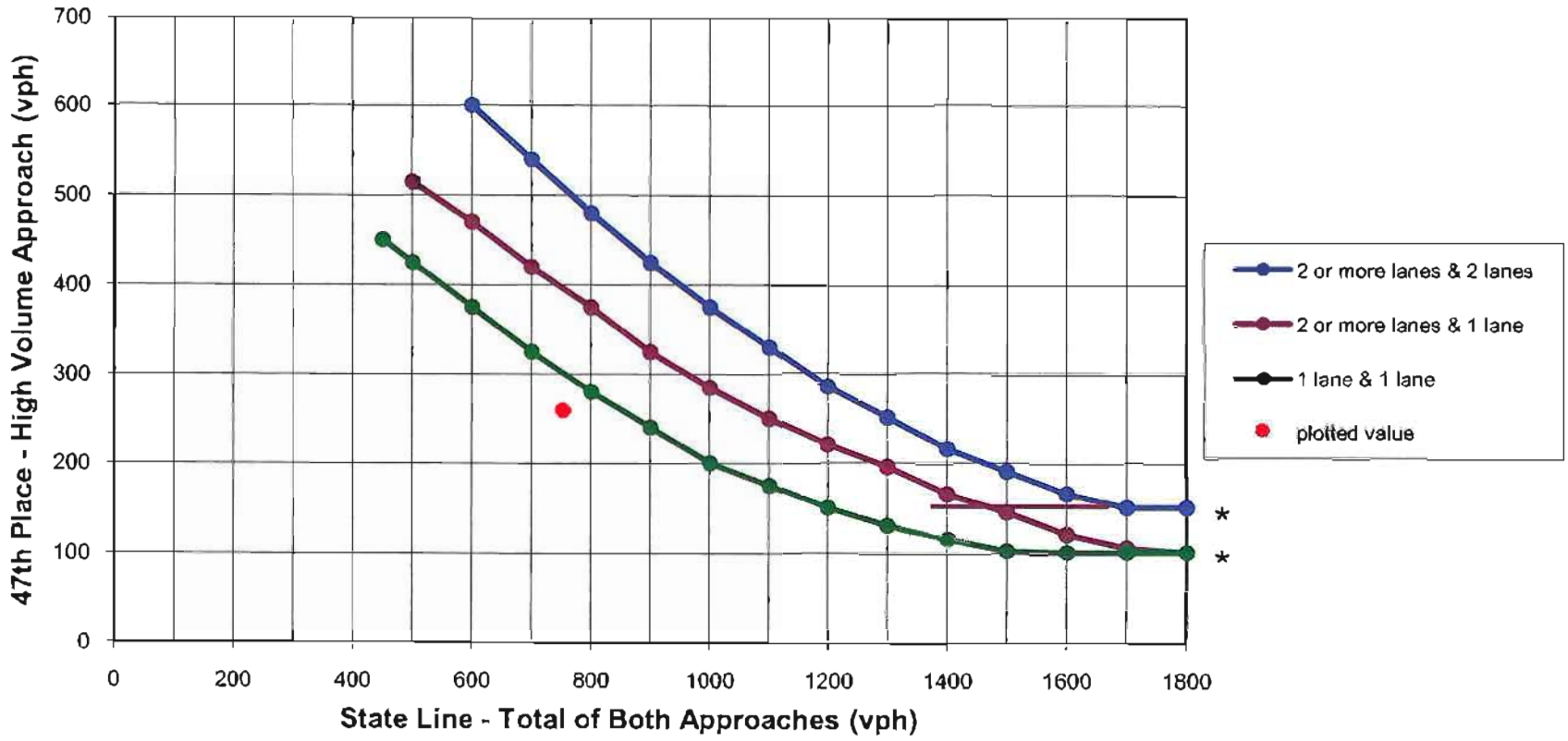
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
Existing AM Peak Hour Volume Warrant



*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.

47th Place & State Line
Existing PM Peak Hour Volume Warrant



*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.

Capacity Analysis Reports

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*2/25/2011*
Analysis Time Period	*Existing AM*

Site Information

Intersection	*47th Place & Rainbow Blvd*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011*

Project Description *Woodside Development*

East/West Street: *47th Place* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*576*	*81*	*164*	*324*	
Peak-Hour Factor, PHF	*1.00*	*0.89*	*0.78*	*0.82*	*0.83*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*647*	*103*	*200*	*390*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*33*		*89*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.75*	*1.00*	*0.86*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*44*	*0*	*103*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*200*	*44*		*103*			
C (m) (veh/h)		*855*	*118*		*670*			
v/c		*0.23*	*0.37*		*0.15*			
95% queue length		*0.91*	*1.53*		*0.54*			
Control Delay (s/veh)		*10.5*	*52.6*		*11.3*			
LOS		*B*	*F*		*B*			
Approach Delay (s/veh)	--	--	*23.7*					
Approach LOS	--	--	*C*					

HCS+™ Version 5.5 Generated: 3/14/2011 7:32 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*2/25/2011*
Analysis Time Period	*Existing PM*

Site Information

Intersection	*47th Place & Rainbow Blvd*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011*

Project Description *Woodside Development*

East/West Street: *47th Place* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*290*	*58*	*116*	*772*	
Peak-Hour Factor, PHF	*1.00*	*0.81*	*0.69*	*0.81*	*0.88*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*358*	*84*	*143*	*877*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*81*		*163*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.65*	*1.00*	*0.77*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*124*	*0*	*211*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*143*	*124*		*211*			
C (m) (veh/h)		*1114*	*173*		*817*			
v/c		*0.13*	*0.72*		*0.26*			
95% queue length		*0.44*	*4.41*		*1.03*			
Control Delay (s/veh)		*8.7*	*65.9*		*10.9*			
LOS		*A*	*F*		*B*			
Approach Delay (s/veh)	--	--	*31.3*					
Approach LOS	--	--	*D*					

HCS+™ Version 5.5 Generated: 3/14/2011 7:32 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	2/25/2011
Analysis Time Period	Existing AM

Site Information

Intersection	47th Place & State Line
Jurisdiction	KCMO & Westwood, KS
Analysis Year	2011

Project ID *Woodside Development*

East/West Street: *47th Place* North/South Street: *State Line Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	18	103	27	30	109	37
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	72	380	26	12	141	18
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.80		0.79		0.87		0.84	
Flow Rate (veh/h)	183		220		547		202	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
Prop. Left-Turns	0.1		0.2		0.1		0.1	
Prop. Right-Turns	0.2		0.2		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.1		0.0		-0.0	

Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.16		0.20		0.49		0.18	
hd, final value (s)	6.70		6.59		5.74		6.36	
x, final value	0.34		0.40		0.87		0.36	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, l_s (s)	4.7		4.6		3.7		4.4	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	433		470		618		452	
Delay (s/veh)	13.12		13.96		35.53		12.85	
LOS	B		B		E		B	
Approach: Delay (s/veh)	13.12		13.96		35.53		12.85	
LOS	B		B		E		B	
Intersection Delay (s/veh)	23.88							
Intersection LOS	C							

 HCS+™ Version 5.5 Generated: 3/14/2011 7:32 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	2/25/2011
Analysis Time Period	Existing PM

Site Information

Intersection	47th Place & State Line
Jurisdiction	KCMO & Westwood, KS
Analysis Year	2011

Project ID Woodside Development

East/West Street: 47th Place | North/South Street: State Line Road

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	29	116	105	60	174	26
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	74	223	34	26	358	37
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.82		0.88		0.92		0.89	
Flow Rate (veh/h)	304		294		358		472	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.1		0.2		0.2		0.1	
Prop. Right-Turns	0.4		0.1		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.2		0.0		0.0		-0.0	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.27		0.26		0.32		0.42	
hd, final value (s)	8.42		8.65		8.29		7.92	
x, final value	0.71		0.71		0.82		1.04	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	6.4		6.7		6.3		5.9	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	408		396		424		472	
Delay (s/veh)	29.57		29.97		39.84		80.96	
LOS	D		D		E		F	
Approach: Delay (s/veh)	29.57		29.97		39.84		80.96	
LOS	D		D		E		F	
Intersection Delay (s/veh)	49.21							
Intersection LOS	E							

 HCS+™ Version 5.5 Generated: 3/14/2011 7:32 AM

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	271	200	93	572	288	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2		5.2	5.2	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00		0.99	1.00	
Satd. Flow (prot)	1770	1583		3515	3397	
Flt Permitted	0.95	1.00		0.83	1.00	
Satd. Flow (perm)	1770	1583		2926	3397	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	295	217	101	622	313	115
RTOR Reduction (vph)	0	149	0	0	45	0
Lane Group Flow (vph)	295	68	0	723	383	0
Turn Type		Perm	Perm			
Protected Phases	2			1	1	
Permitted Phases		2	1			
Actuated Green, G (s)	14.6	14.6		21.6	21.6	
Effective Green, g (s)	14.6	14.6		21.6	21.6	
Actuated g/C Ratio	0.31	0.31		0.46	0.46	
Clearance Time (s)	5.2	5.2		5.2	5.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	555	496		1356	1575	
v/s Ratio Prot	c0.17				0.11	
v/s Ratio Perm		0.04		c0.25		
v/c Ratio	0.53	0.14		0.53	0.24	
Uniform Delay, d1	13.2	11.5		8.9	7.6	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.1		0.4	0.1	
Delay (s)	14.2	11.6		9.3	7.6	
Level of Service	B	B		A	A	
Approach Delay (s)	13.1			9.3	7.6	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	46.6	Sum of lost time (s)	10.4
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	295	217	723	428
v/c Ratio	0.54	0.34	0.54	0.27
Control Delay	19.3	4.5	11.0	6.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	19.3	4.5	11.0	6.8
Queue Length 50th (ft)	62	0	63	25
Queue Length 95th (ft)	165	41	135	60
Internal Link Dist (ft)	513		249	281
Turn Bay Length (ft)	250	250		
Base Capacity (vph)	1365	1270	2257	2640
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	0.22	0.17	0.32	0.16

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	236	143	149	304	745	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2		5.2	5.2	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.92	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00		0.98	1.00	
Satd. Flow (prot)	1770	1583		3482	3128	
Flt Permitted	0.95	1.00		0.54	1.00	
Satd. Flow (perm)	1770	1583		1906	3128	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	257	155	162	330	810	265
RTOR Reduction (vph)	0	1	0	0	32	0
Lane Group Flow (vph)	257	154	0	492	1043	0
Confl. Peds. (#/hr)						745
Turn Type		Perm	Perm			
Protected Phases	2			1	1	
Permitted Phases		2	1			
Actuated Green, G (s)	13.9	13.9		28.9	28.9	
Effective Green, g (s)	13.9	13.9		28.9	28.9	
Actuated g/C Ratio	0.26	0.26		0.54	0.54	
Clearance Time (s)	5.2	5.2		5.2	5.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	462	414		1035	1699	
v/s Ratio Prot	c0.15				c0.33	
v/s Ratio Perm		0.10		0.26		
v/c Ratio	0.56	0.37		0.48	0.61	
Uniform Delay, d1	17.0	16.1		7.5	8.3	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	0.6		0.3	0.7	
Delay (s)	18.4	16.6		7.8	9.0	
Level of Service	B	B		A	A	
Approach Delay (s)	17.8			7.8	9.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	53.2	Sum of lost time (s)	10.4
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	257	155	492	1075
v/c Ratio	0.56	0.38	0.48	0.63
Control Delay	23.7	20.7	9.8	10.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.7	20.7	9.8	10.1
Queue Length 50th (ft)	75	43	43	98
Queue Length 95th (ft)	145	91	93	187
Internal Link Dist (ft)	513		249	281
Turn Bay Length (ft)	250	250		
Base Capacity (vph)	1188	1063	1281	2099
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	0.22	0.15	0.38	0.51

Intersection Summary

Signal Warrant Analysis

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place and Rainbow Blvd*
Jurisdiction	*Westwood, KS/KCK (UG)*
Analysis Year	*2011 - Ex + Parcels 1 & 3*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		576	87	164	324	
Peak-Hour Factor, PHF	1.00	0.89	0.78	0.82	0.83	1.00
Hourly Flow Rate, HFR (veh/h)	0	647	111	200	390	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				47		89
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.75	1.00	0.86
Hourly Flow Rate, HFR (veh/h)	0	0	0	62	0	103
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		200	62		103			
C (m) (veh/h)		849	118		666			
v/c		0.24	0.53		0.15			
95% queue length		0.91	2.46		0.54			
Control Delay (s/veh)		10.5	65.2		11.4			
LOS		B	F		B			
Approach Delay (s/veh)	--	--	31.6					
Approach LOS	--	--	D					

HCS+™ Version 5.5

Generated: 3/14/2011 7:50 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place and Rainbow Blvd
Jurisdiction	Westwood, KS/KCK (UG)
Analysis Year	2011 - Ex + Parcels 1 & 3

Project Description: Woodside

East/West Street: 47th Place | North/South Street: Rainbow Blvd

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		290	80	116	772	
Peak-Hour Factor, PHF	1.00	0.81	0.69	0.81	0.88	1.00
Hourly Flow Rate, HFR (veh/h)	0	358	115	143	877	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				100		163
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.65	1.00	0.77
Hourly Flow Rate, HFR (veh/h)	0	0	0	153	0	211
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		143	153		211			
C (m) (veh/h)		1085	168		802			
v/c		0.13	0.91		0.26			
95% queue length		0.45	6.69		1.06			
Control Delay (s/veh)		8.8	102.2		11.1			
LOS		A	F		B			
Approach Delay (s/veh)	--	--	49.4					
Approach LOS	--	--	E					

HCS+™ Version 5.5

Generated: 3/14/2011 7:51 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & Retail-North*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011 - Ex + Parcels 1 & 3*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Center Retail*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*245*			*122*	*6*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*1.00*	*1.00*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*6*	*266*	*0*	*0*	*132*	*6*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*17*		*14*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*18*	*0*	*15*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*6*						*33*	
C (m) (veh/h)	*1446*						*706*	
v/c	*0.00*						*0.05*	
95% queue length	*0.01*						*0.15*	
Control Delay (s/veh)	*7.5*						*10.3*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--				*10.3*		
Approach LOS	--	--				*B*		

HCS+™ Version 5.5 Generated: 3/18/2011 12:19 PM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & Retail-North*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2011 - Ex + Parcels 1 & 3*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Center Retail*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*22*	*174*			*244*	*25*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*1.00*	*1.00*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*23*	*189*	*0*	*0*	*265*	*27*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*21*		*19*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*22*	*0*	*20*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*23*						*42*	
C (m) (veh/h)	*1270*						*606*	
v/c	*0.02*						*0.07*	
95% queue length	*0.06*						*0.22*	
Control Delay (s/veh)	*7.9*						*11.4*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--					*11.4*	
Approach LOS	--	--					*B*	

HCS+™ Version 5.5

Generated: 3/18/2011 12:19 PM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	AM

Site Information

Intersection	47th Place & State Line
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011 - Ex + Parcels 1 & 3

Project ID *Woodside Village*

East/West Street: *47th Place* North/South Street: *State Line Rd*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	23	108	34	30	111	37
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	74	380	26	12	141	20
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	177		192		521		187	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.1		0.2		0.2		0.1	
Prop. Right-Turns	0.2		0.2		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.1		0.0		-0.0	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.16		0.17		0.46		0.17	
hd, final value (s)	6.35		6.32		5.50		6.04	
x, final value	0.31		0.34		0.80		0.31	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	4.4		4.3		3.5		4.0	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	427		442		641		437	
Delay (s/veh)	12.21		12.49		26.50		11.78	
LOS	B		B		D		B	
Approach: Delay (s/veh)	12.21		12.49		26.50		11.78	
LOS	B		B		D		B	
Intersection Delay (s/veh)	19.10							
Intersection LOS	C							

 HCS+™ Version 5.5 Generated: 3/14/2011 7:52 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place & State Line
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011 - Ex + Parcels 1 & 3

Project ID *Woodside Village*

East/West Street: *47th Place* North/South Street: *State Line Rd*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	35	122	114	60	181	26
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	85	223	34	26	358	44
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	293		289		370		464	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.1		0.2		0.2		0.1	
Prop. Right-Turns	0.4		0.1		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.2		0.0		0.0		-0.0	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.26		0.26		0.33		0.41	
hd, final value (s)	8.43		8.63		8.20		7.85	
x, final value	0.69		0.69		0.84		1.01	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	6.4		6.6		6.2		5.9	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	405		396		430		464	
Delay (s/veh)	27.92		28.96		41.78		73.41	
LOS	D		D		E		F	
Approach: Delay (s/veh)	27.92		28.96		41.78		73.41	
LOS	D		D		E		F	
Intersection Delay (s/veh)	46.66							
Intersection LOS	E							

HCS+™ Version 5.5 Generated: 3/14/2011 7:52 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	Brett Lauritsen	Intersection	47th Place & Health Club Ent
Agency/Co.	Olsson Associates	Jurisdiction	Westwood, KS
Date Performed	3/8/2011	Analysis Year	2011- Ex + Parcels 1 & 3
Analysis Time Period	AM		

Project Description: Woodside

East/West Street: 47th Place | North/South Street: Health Club Entrance/Exit

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	35	227			86	19
Peak-Hour Factor, PHF	0.92	0.92	1.00	1.00	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	38	246	0	0	93	20
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				22		42
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	23	0	45
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	38						68	
C (m) (veh/h)	1476						777	
v/c	0.03						0.09	
95% queue length	0.08						0.29	
Control Delay (s/veh)	7.5						10.1	
LOS	A						B	
Approach Delay (s/veh)	--	--				10.1		
Approach LOS	--	--				B		

HCS+™ Version 5.5

Generated: 3/14/2011 7:52 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	Brett Lauritsen	Intersection	47th Place & Health Club Ent
Agency/Co.	Olsson Associates	Jurisdiction	Westwood, KS
Date Performed	3/8/2011	Analysis Year	2011- Ex + Parcels 1 & 3
Analysis Time Period	PM		

Project Description

East/West Street: 47th Place	North/South Street: Health Club Entrance/Exit
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	162	33			198	133
Peak-Hour Factor, PHF	0.92	0.92	1.00	1.00	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	176	35	0	0	215	144
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				49		71
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	53	0	77
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	176						130	
C (m) (veh/h)	1200						519	
v/c	0.15						0.25	
95% queue length	0.51						0.98	
Control Delay (s/veh)	8.5						14.2	
LOS	A						B	
Approach Delay (s/veh)	--	--					14.2	
Approach LOS	--	--					B	

HCS+™ Version 5.5

Generated: 3/14/2011 7:52 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	3	200	0	7	10	93	572	0	3	288	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.85			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			1.00	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1587			1863	1583		3515			3396	
Flt Permitted	0.54	1.00			1.00	1.00		0.82			0.95	
Satd. Flow (perm)	1007	1587			1863	1583		2891			3233	
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)	295	3	217	0	8	11	101	622	0	3	313	115
RTOR Reduction (vph)	0	148	0	0	0	11	0	0	0	0	34	0
Lane Group Flow (vph)	295	72	0	0	8	0	0	723	0	0	397	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	23.7	23.7			2.2	2.2		40.6			40.6	
Effective Green, g (s)	23.7	23.7			2.2	2.2		40.6			40.6	
Actuated g/C Ratio	0.32	0.32			0.03	0.03		0.54			0.54	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	486	504			55	47		1571			1757	
v/s Ratio Prot	c0.13	0.05			0.00							
v/s Ratio Perm	c0.06					0.00		c0.25			0.12	
v/c Ratio	0.61	0.14			0.15	0.01		0.46			0.23	
Uniform Delay, d1	21.0	18.2			35.3	35.2		10.4			8.9	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	2.1	0.1			1.2	0.1		1.0			0.3	
Delay (s)	23.1	18.4			36.6	35.2		11.4			9.2	
Level of Service	C	B			D	D		B			A	
Approach Delay (s)		21.1			35.8			11.4			9.2	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	74.7	Sum of lost time (s)	10.4
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	220	8	11	723	431
v/c Ratio	0.64	0.36	0.05	0.08	0.44	0.23
Control Delay	27.6	4.5	35.4	20.6	12.0	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	4.5	35.4	20.6	12.0	8.3
Queue Length 50th (ft)	109	1	3	0	71	30
Queue Length 95th (ft)	176	42	17	16	186	86
Internal Link Dist (ft)		513	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	605	994	340	298	1641	1867
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.22	0.02	0.04	0.44	0.23

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	11	143	0	9	12	149	304	0	15	745	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			1.00	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1603			1863	1583		3482			3408	
Flt Permitted	0.53	1.00			1.00	1.00		0.52			0.95	
Satd. Flow (perm)	993	1603			1863	1583		1831			3225	
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)	257	12	155	0	10	13	162	330	0	16	810	265
RTOR Reduction (vph)	0	66	0	0	0	13	0	0	0	0	28	0
Lane Group Flow (vph)	257	101	0	0	10	0	0	492	0	0	1063	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	22.7	22.7			2.3	2.3		40.6			40.6	
Effective Green, g (s)	22.7	22.7			2.3	2.3		40.6			40.6	
Actuated g/C Ratio	0.31	0.31			0.03	0.03		0.55			0.55	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	466	494			58	49		1009			1777	
v/s Ratio Prot	c0.11	0.06			0.01							
v/s Ratio Perm	c0.06					0.00		0.27			c0.33	
v/c Ratio	0.55	0.20			0.17	0.01		0.49			0.60	
Uniform Delay, d1	20.7	18.8			34.8	34.6		10.2			11.1	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.4	0.2			1.4	0.1		1.7			1.5	
Delay (s)	22.2	19.0			36.2	34.7		11.8			12.6	
Level of Service	C	B			D	C		B			B	
Approach Delay (s)		20.9			35.3			11.8			12.6	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	10.4
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	167	10	13	492	1091
v/c Ratio	0.58	0.33	0.06	0.09	0.47	0.58
Control Delay	26.2	10.2	35.1	19.8	12.9	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	10.2	35.1	19.8	12.9	12.5
Queue Length 50th (ft)	92	23	4	0	46	105
Queue Length 95th (ft)	152	62	20	17	144	289
Internal Link Dist (ft)		513	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	609	964	345	304	1054	1885
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.17	0.03	0.04	0.47	0.58

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	3	200	0	7	10	93	572	0	3	288	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		*0.71			0.95	
Frt	1.00	0.85			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			1.00	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1587			1863	1583		2627			3396	
Flt Permitted	0.51	1.00			1.00	1.00		0.81			0.95	
Satd. Flow (perm)	955	1587			1863	1583		2146			3230	
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)	295	3	217	0	8	11	101	622	0	3	313	115
RTOR Reduction (vph)	0	152	0	0	0	11	0	0	0	0	32	0
Lane Group Flow (vph)	295	68	0	0	8	0	0	723	0	0	399	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	26.8	26.8			2.6	2.6		52.8			52.8	
Effective Green, g (s)	26.8	26.8			2.6	2.6		52.8			52.8	
Actuated g/C Ratio	0.30	0.30			0.03	0.03		0.59			0.59	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	456	473			54	46		1259			1895	
v/s Ratio Prot	c0.14	0.04			0.00							
v/s Ratio Perm	c0.06					0.00		c0.34			0.12	
v/c Ratio	0.65	0.14			0.15	0.01		0.57			0.21	
Uniform Delay, d1	26.7	23.2			42.6	42.4		11.6			8.8	
Progression Factor	1.00	1.00			1.00	1.00		0.92			1.00	
Incremental Delay, d2	3.1	0.1			1.3	0.1		1.9			0.3	
Delay (s)	29.9	23.3			43.9	42.5		12.5			9.0	
Level of Service	C	C			D	D		B			A	
Approach Delay (s)		27.1			43.1			12.5			9.0	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	220	8	11	723	431
v/c Ratio	0.70	0.38	0.06	0.10	0.54	0.21
Control Delay	36.8	5.0	40.1	22.6	12.7	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	36.8	5.0	40.1	22.6	13.0	7.7
Queue Length 50th (ft)	156	1	4	0	105	36
Queue Length 95th (ft)	196	45	18	16	302	84
Internal Link Dist (ft)		513	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	479	777	203	182	1331	2035
Starvation Cap Reductn	0	0	0	0	145	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.28	0.04	0.06	0.61	0.21

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	11	143	0	9	12	149	304	0	15	745	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			1.00	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1603			1863	1583		3482			3408	
Flt Permitted	0.75	1.00			1.00	1.00		0.52			0.95	
Satd. Flow (perm)	1399	1603			1863	1583		1845			3224	
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)	257	12	155	0	10	13	162	330	0	16	810	265
RTOR Reduction (vph)	0	115	0	0	0	13	0	0	0	0	28	0
Lane Group Flow (vph)	257	52	0	0	10	0	0	492	0	0	1064	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	22.6	22.6			2.3	2.3		57.0			57.0	
Effective Green, g (s)	22.6	22.6			2.3	2.3		57.0			57.0	
Actuated g/C Ratio	0.25	0.25			0.03	0.03		0.63			0.63	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	414	403			48	40		1169			2042	
v/s Ratio Prot	c0.10	0.03			0.01							
v/s Ratio Perm	c0.05					0.00		0.27			c0.33	
v/c Ratio	0.62	0.13			0.21	0.01		0.42			0.52	
Uniform Delay, d1	29.2	26.1			43.0	42.7		8.2			9.0	
Progression Factor	1.00	1.00			1.00	1.00		0.94			1.00	
Incremental Delay, d2	2.9	0.1			2.2	0.1		1.1			1.0	
Delay (s)	32.1	26.2			45.1	42.8		8.9			10.0	
Level of Service	C	C			D	D		A			A	
Approach Delay (s)		29.8			43.8			8.9			10.0	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	167	10	13	492	1091
v/c Ratio	0.70	0.36	0.08	0.12	0.40	0.50
Control Delay	42.7	7.7	41.3	22.3	8.6	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	42.7	7.7	41.3	22.3	8.8	8.8
Queue Length 50th (ft)	137	6	6	0	46	126
Queue Length 95th (ft)	192	50	22	18	135	232
Internal Link Dist (ft)		513	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	457	650	120	114	1231	2177
Starvation Cap Reductn	0	0	0	0	225	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.26	0.08	0.11	0.49	0.50

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	47	89	576	87	164	324
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.98			1.00
Flt Protected	0.95	1.00	1.00			0.98
Satd. Flow (prot)	1770	1583	3469			3481
Flt Permitted	0.95	1.00	1.00			0.62
Satd. Flow (perm)	1770	1583	3469			2180
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	97	626	95	178	352
RTOR Reduction (vph)	0	89	7	0	0	0
Lane Group Flow (vph)	51	8	715	0	0	530
Turn Type		Prot			Perm	
Protected Phases	8	8	2			6
Permitted Phases					6	
Actuated Green, G (s)	7.0	7.0	75.0			75.0
Effective Green, g (s)	7.0	7.0	75.0			75.0
Actuated g/C Ratio	0.08	0.08	0.83			0.83
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	138	123	2891			1817
v/s Ratio Prot	c0.03	0.00	0.21			
v/s Ratio Perm						c0.24
v/c Ratio	0.37	0.06	0.25			0.29
Uniform Delay, d1	39.4	38.5	1.6			1.7
Progression Factor	1.00	1.00	1.00			0.61
Incremental Delay, d2	1.7	0.2	0.2			0.4
Delay (s)	41.1	38.7	1.8			1.4
Level of Service	D	D	A			A
Approach Delay (s)	39.5		1.8			1.4
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	51	97	721	530
v/c Ratio	0.32	0.42	0.24	0.29
Control Delay	43.0	14.1	1.9	1.6
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	43.0	14.1	1.9	1.7
Queue Length 50th (ft)	28	0	31	11
Queue Length 95th (ft)	61	44	54	18
Internal Link Dist (ft)	95		214	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	452	477	2958	1856
Starvation Cap Reductn	0	0	0	543
Spillback Cap Reductn	0	2	90	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.11	0.20	0.25	0.40

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	100	163	290	80	116	772
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.97			1.00
Flt Protected	0.95	1.00	1.00			0.99
Satd. Flow (prot)	1770	1583	3424			3516
Flt Permitted	0.95	1.00	1.00			0.82
Satd. Flow (perm)	1770	1583	3424			2909
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	177	315	87	126	839
RTOR Reduction (vph)	0	156	18	0	0	0
Lane Group Flow (vph)	109	21	384	0	0	965
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	10.9	10.9	71.1			71.1
Effective Green, g (s)	10.9	10.9	71.1			71.1
Actuated g/C Ratio	0.12	0.12	0.79			0.79
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	214	192	2705			2298
v/s Ratio Prot	c0.06		0.11			
v/s Ratio Perm		0.01				c0.33
v/c Ratio	0.51	0.11	0.14			0.42
Uniform Delay, d1	37.0	35.2	2.2			3.0
Progression Factor	1.00	1.00	1.00			0.21
Incremental Delay, d2	1.9	0.3	0.1			0.5
Delay (s)	38.9	35.5	2.3			1.1
Level of Service	D	D	A			A
Approach Delay (s)	36.8		2.3			1.1
Approach LOS	D		A			A

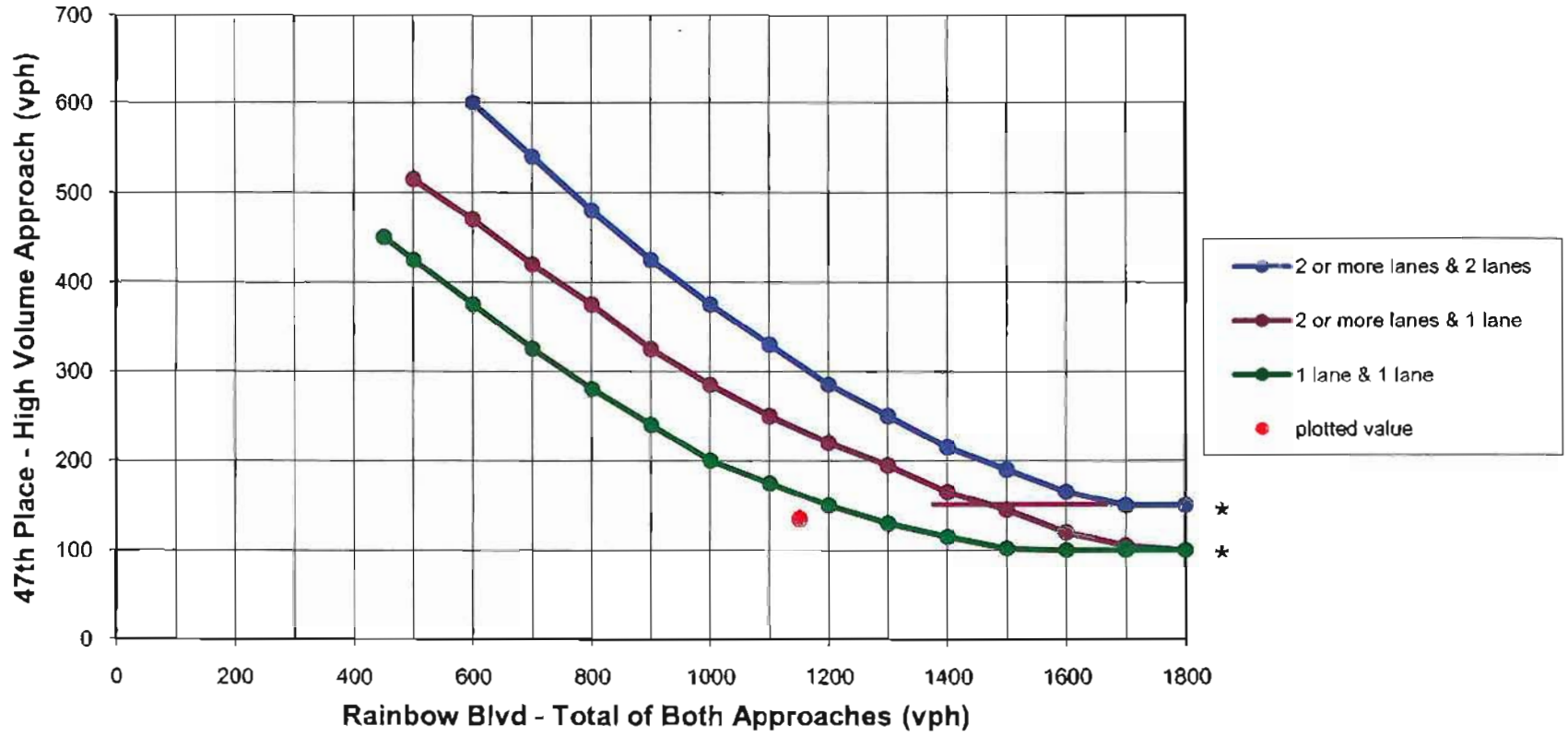
Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	177	402	965
v/c Ratio	0.51	0.51	0.15	0.42
Control Delay	44.8	11.1	2.1	1.2
Queue Delay	0.0	0.0	0.0	0.1
Total Delay	44.8	11.1	2.1	1.3
Queue Length 50th (ft)	59	0	16	11
Queue Length 95th (ft)	106	55	33	23
Internal Link Dist (ft)	95		214	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	433	521	2726	2299
Starvation Cap Reductn	0	0	0	423
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.25	0.34	0.15	0.51

Intersection Summary

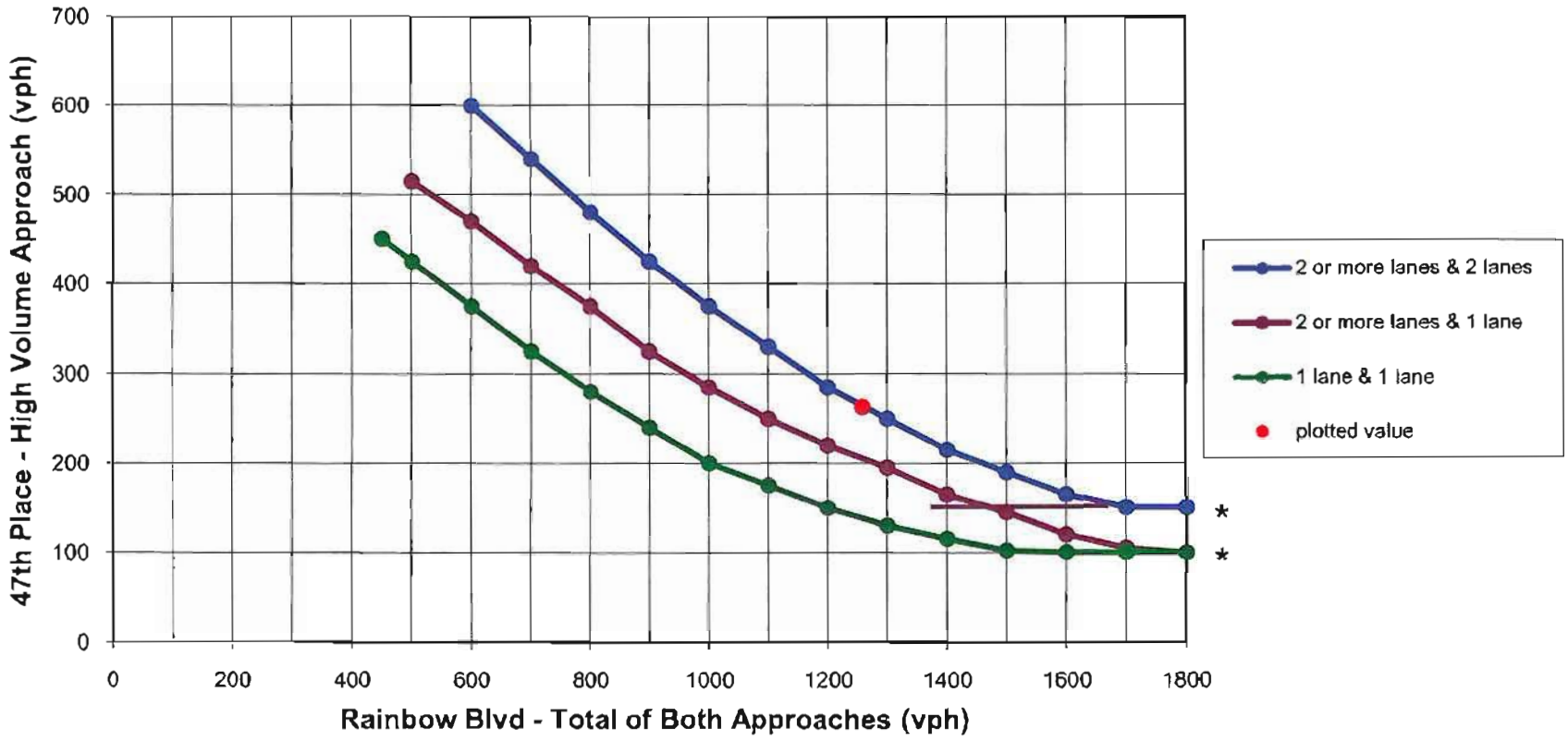
Capacity Analysis Reports

47th Place & Rainbow Blvd
AM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



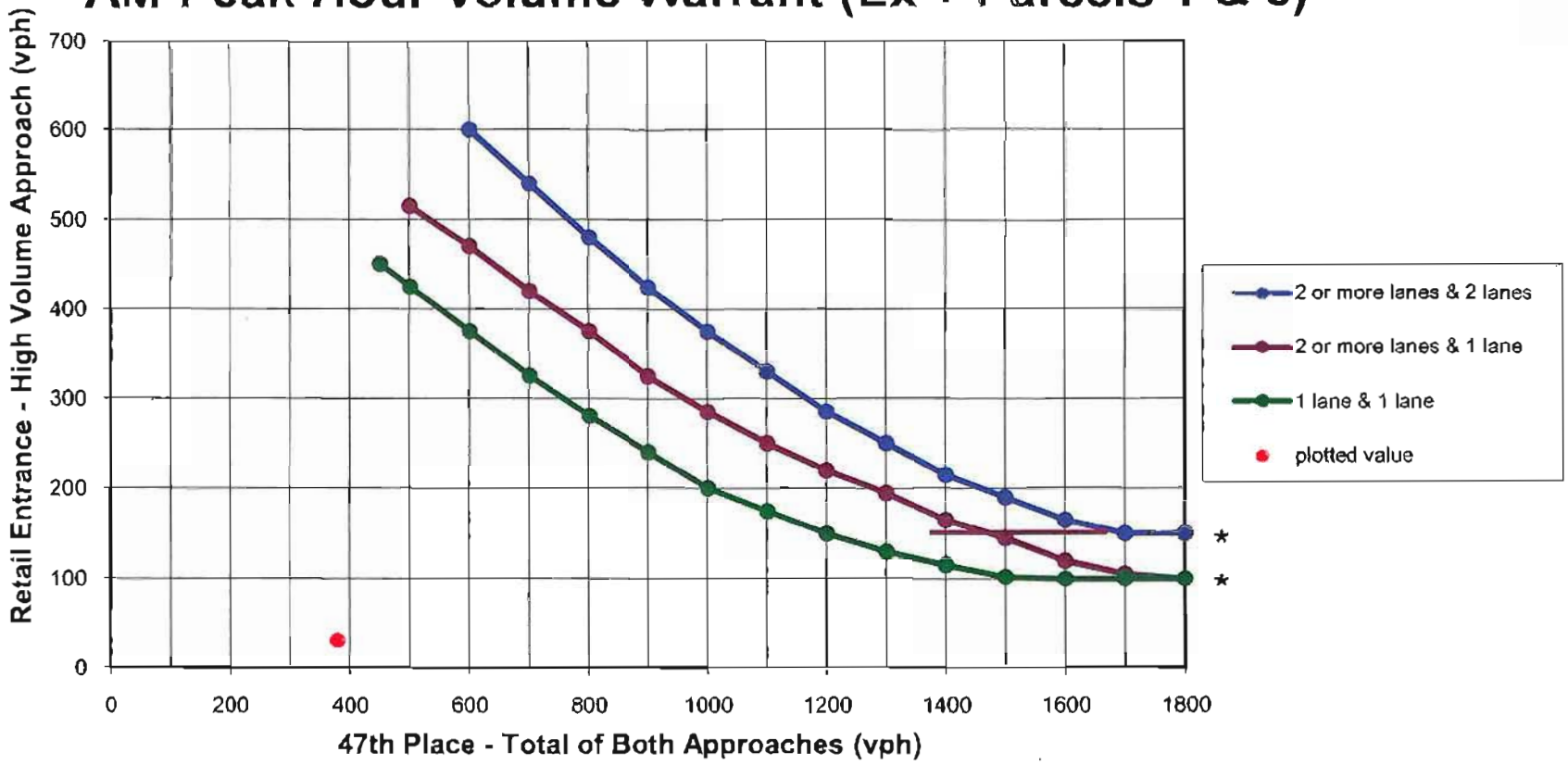
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Rainbow Blvd
PM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



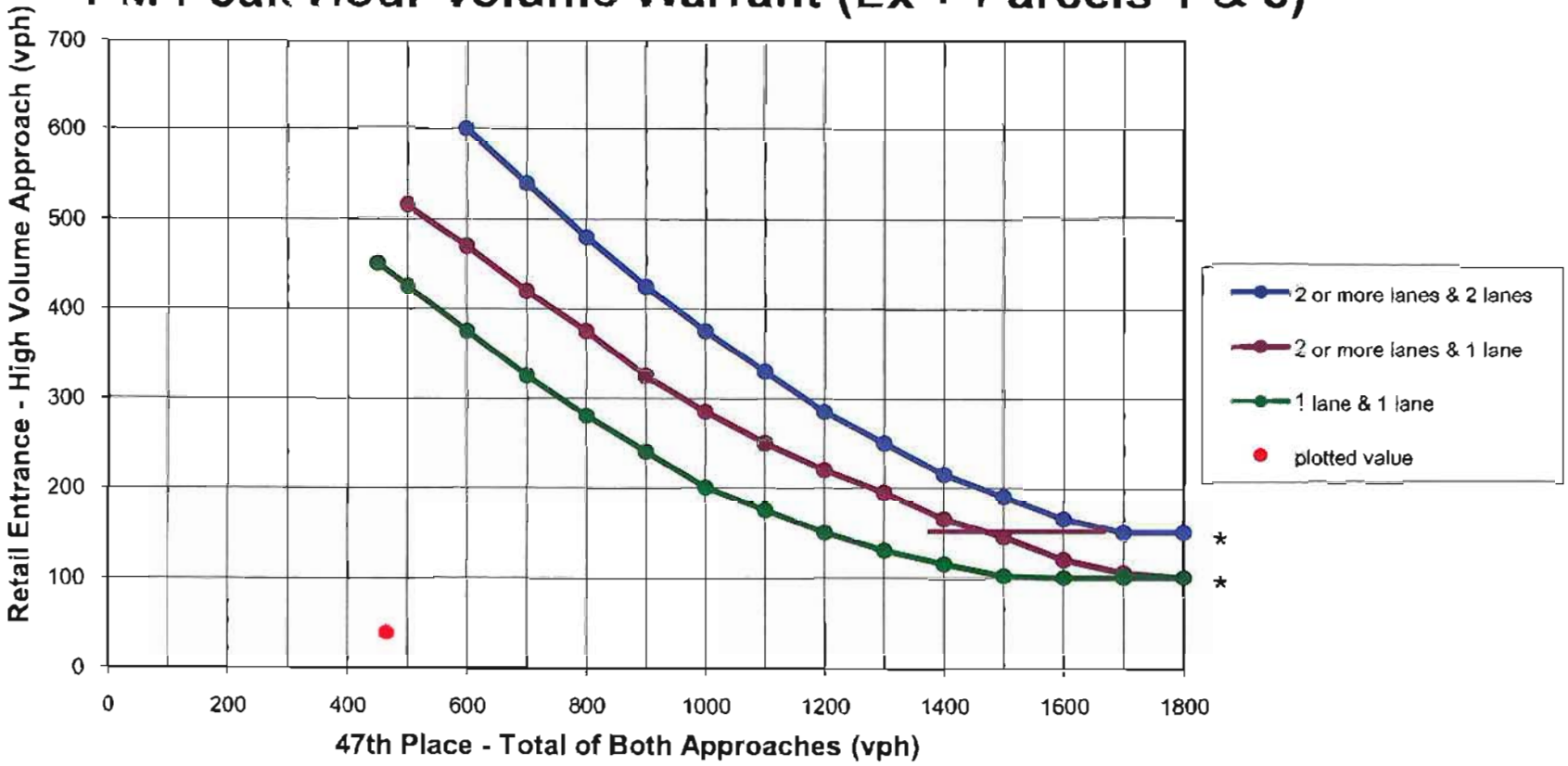
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
AM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



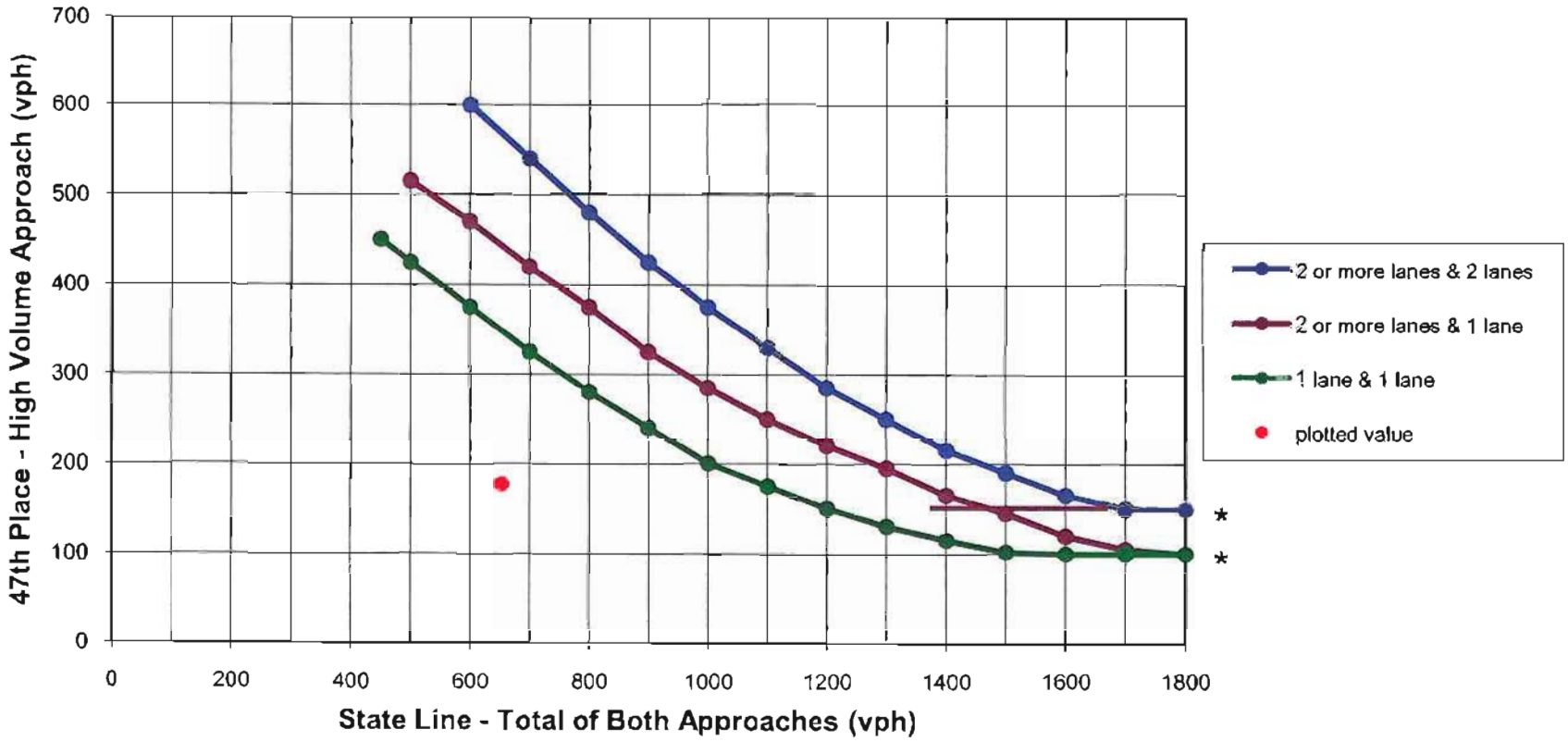
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
PM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



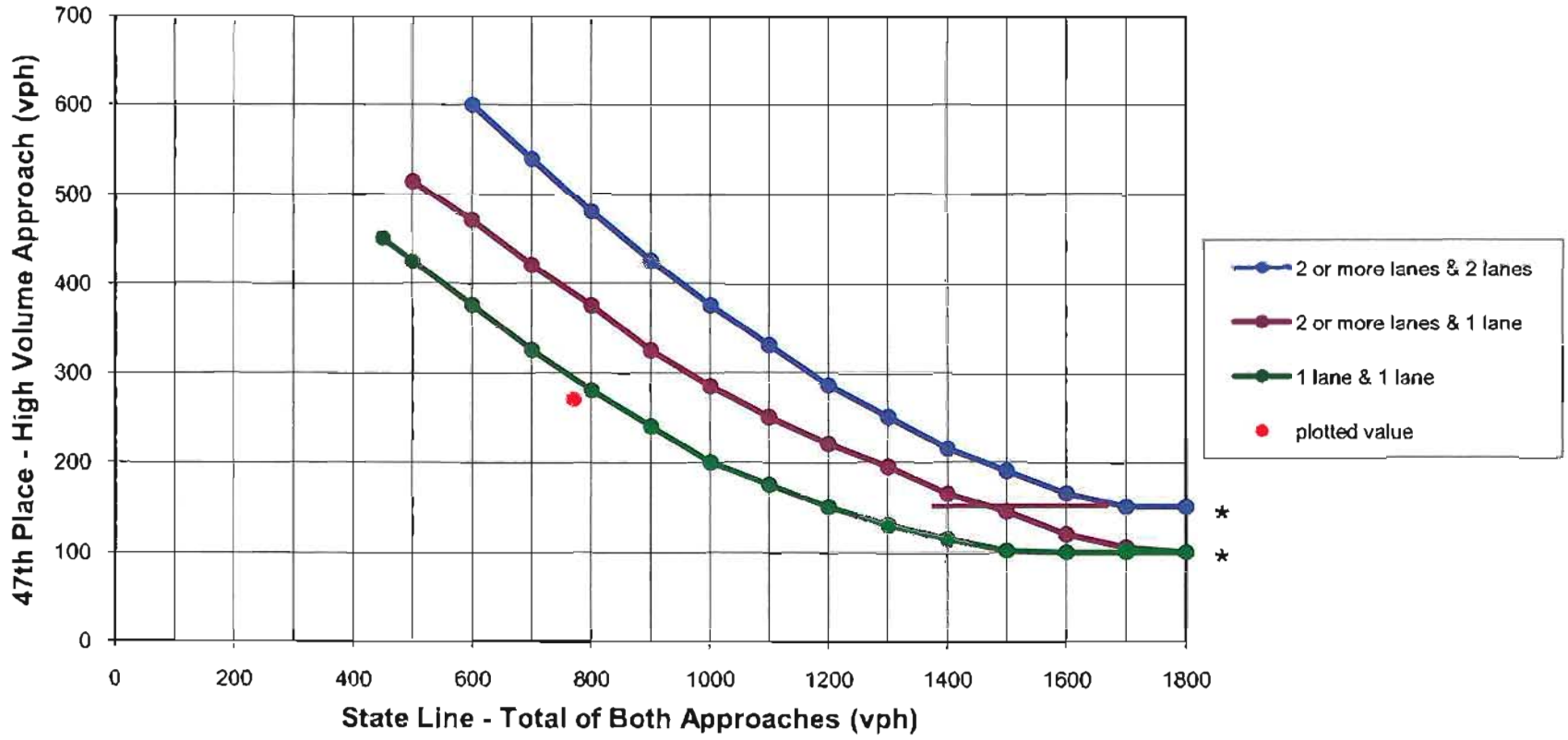
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
AM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



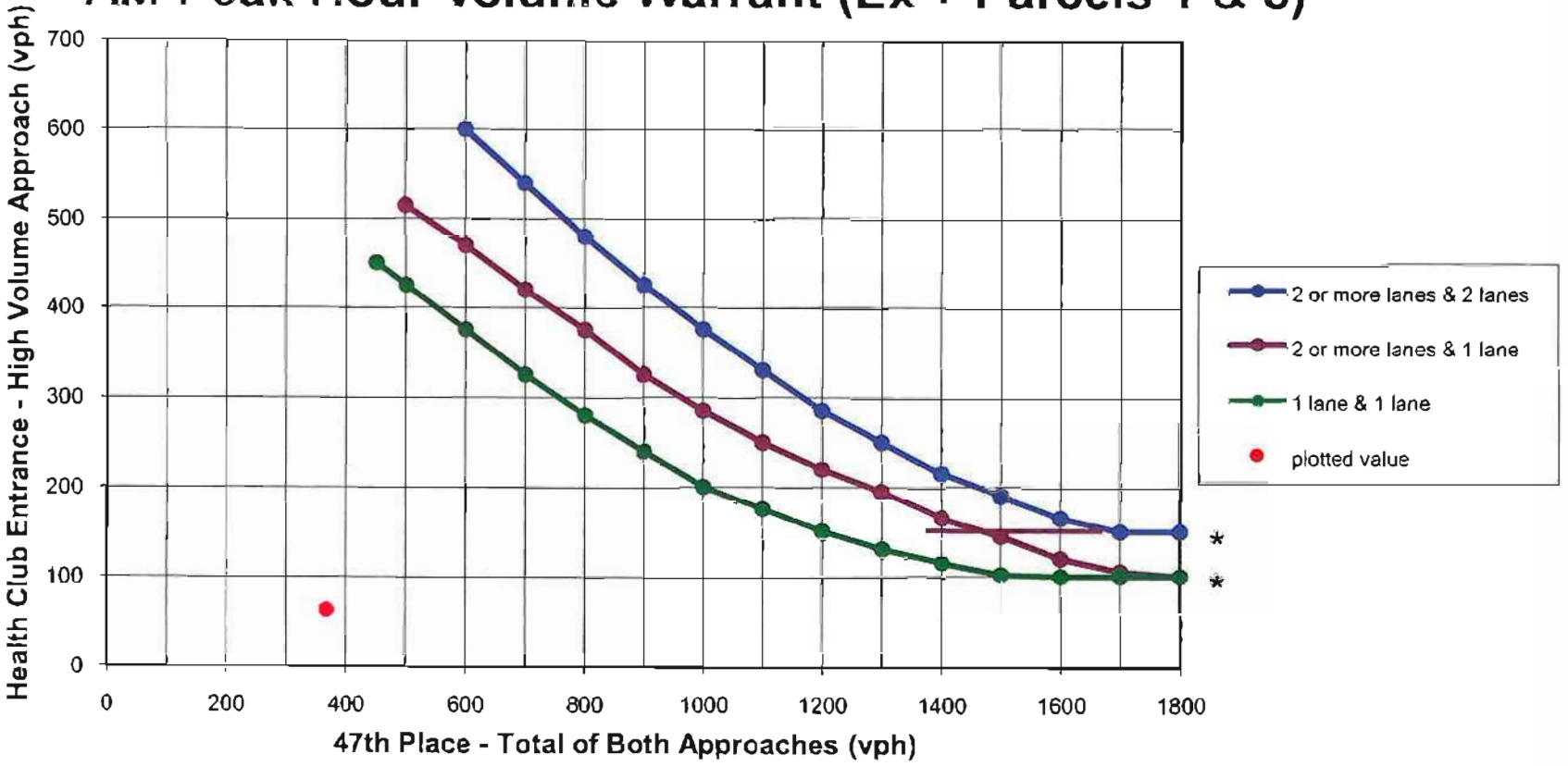
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
PM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



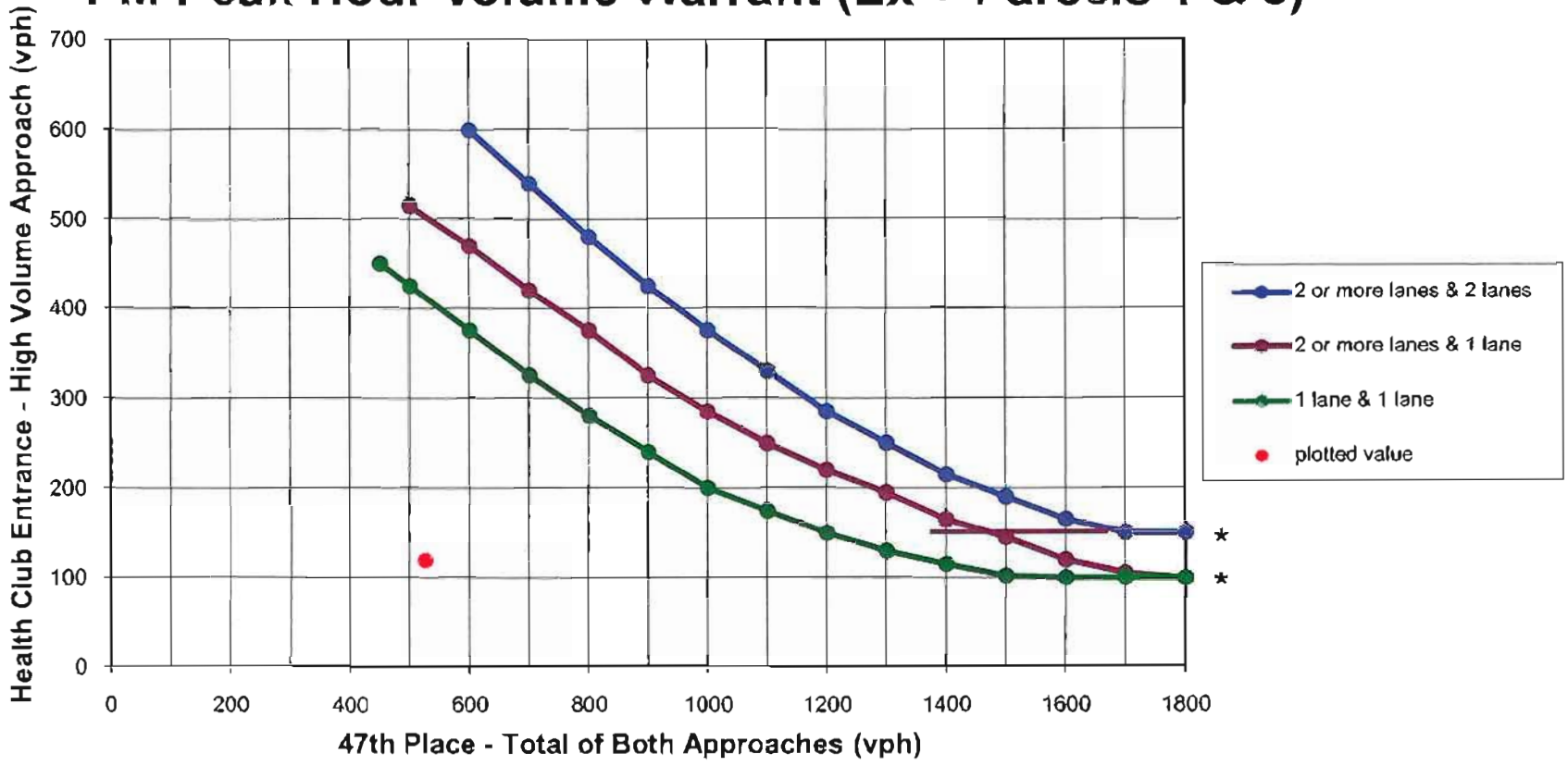
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Health Club Entrance/Exit
AM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



*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.

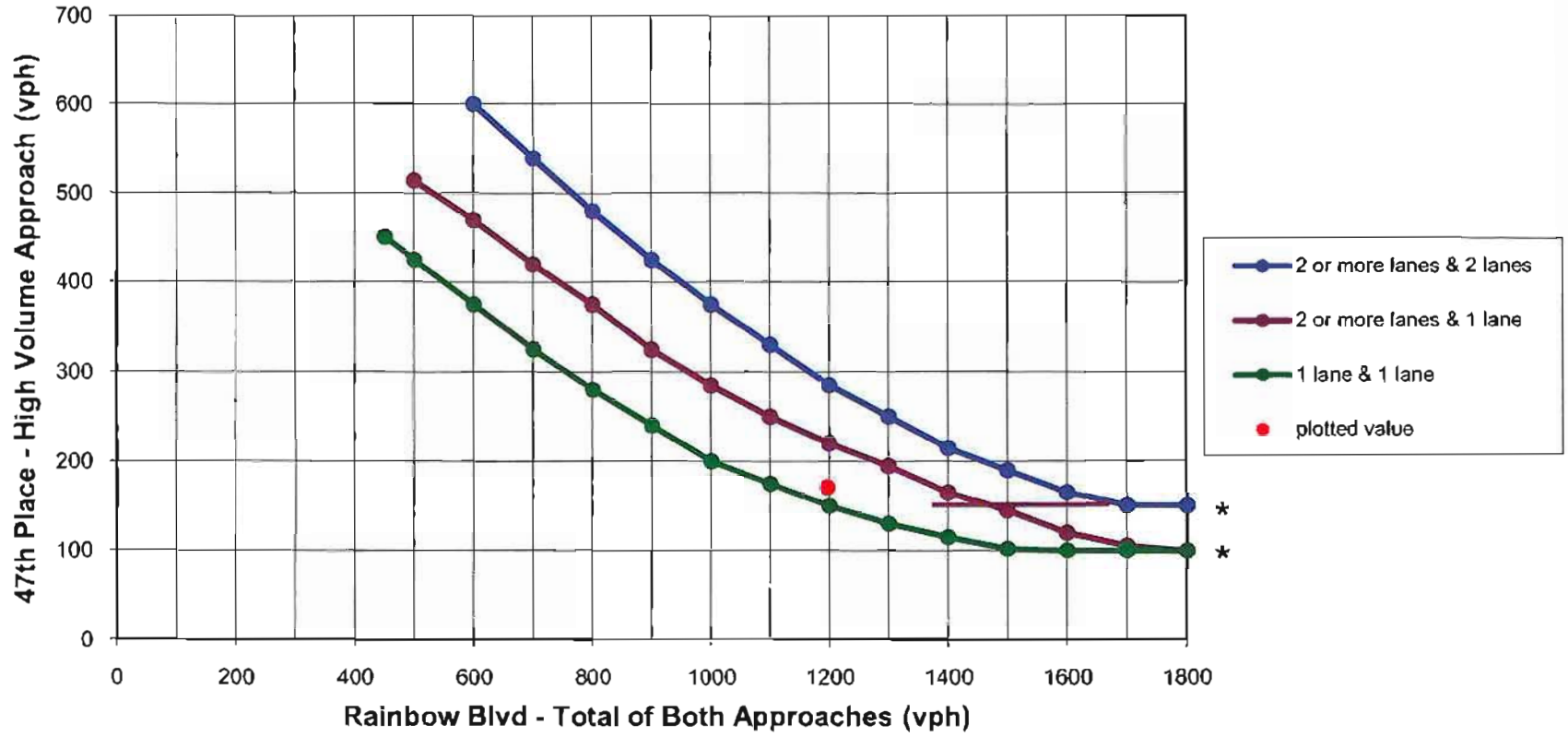
47th Place & Health Club Entrance/Exit
PM Peak Hour Volume Warrant (Ex + Parcels 1 & 3)



*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.

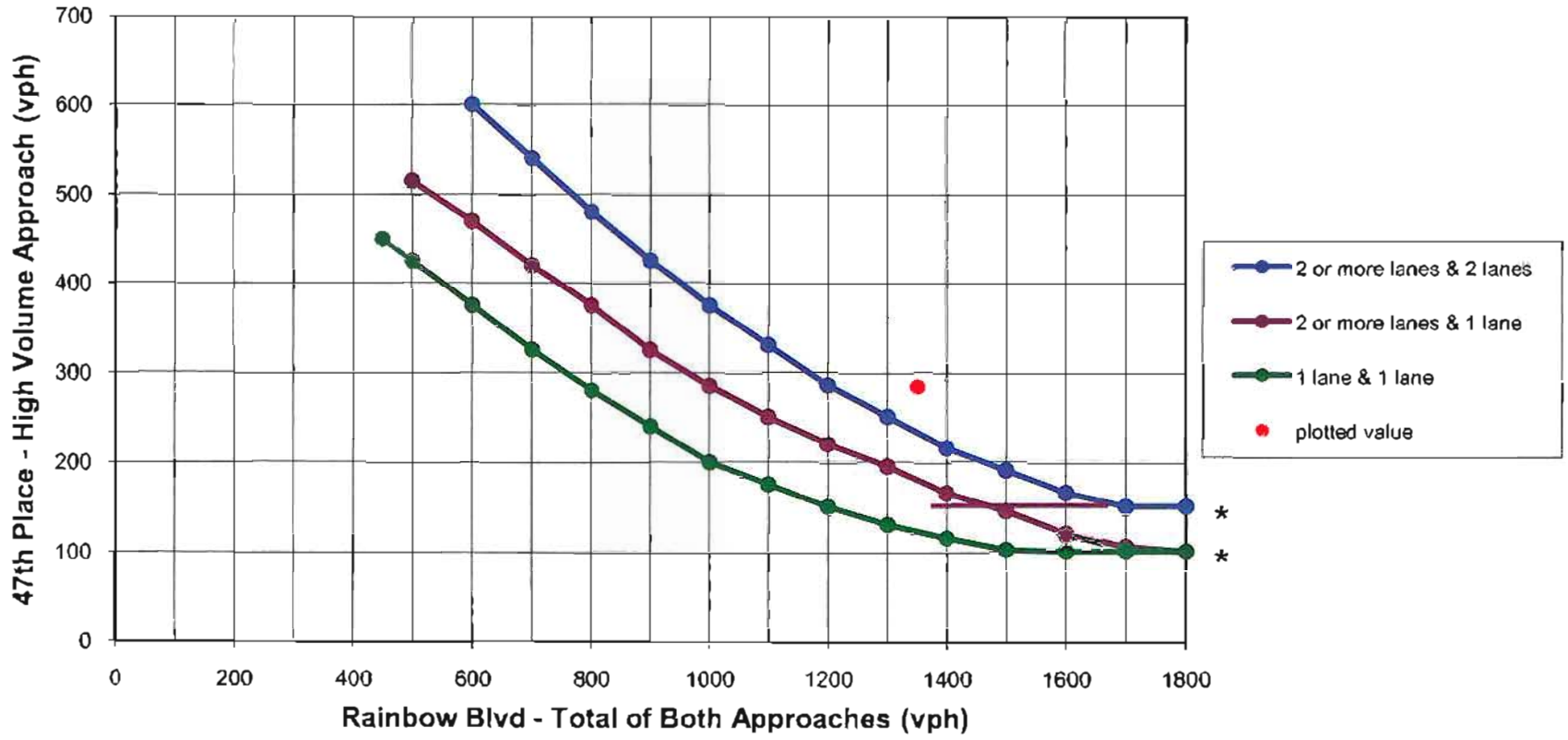
Signal Warrant Analysis

47th Place & Rainbow Blvd
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



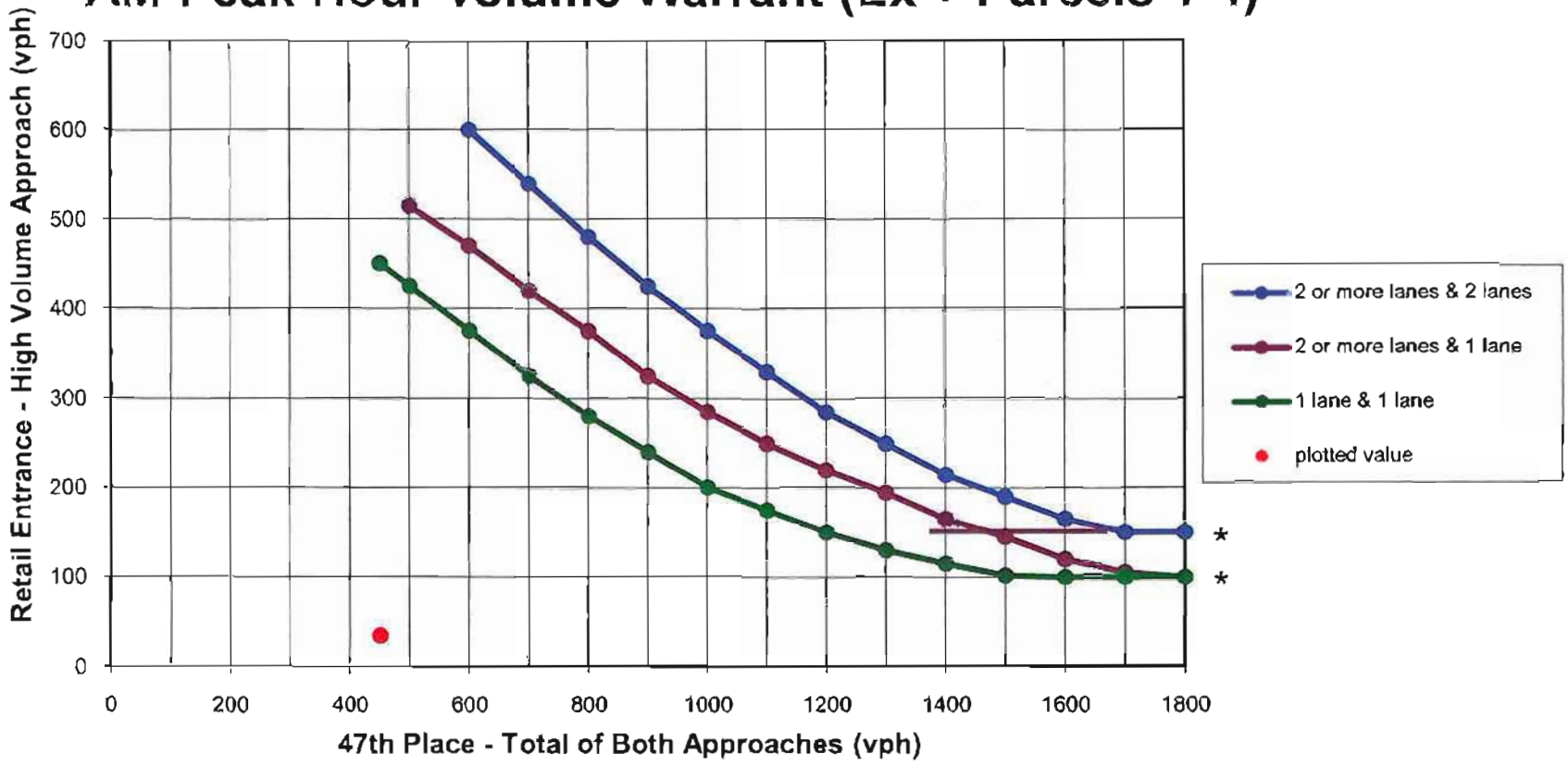
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Rainbow Blvd
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



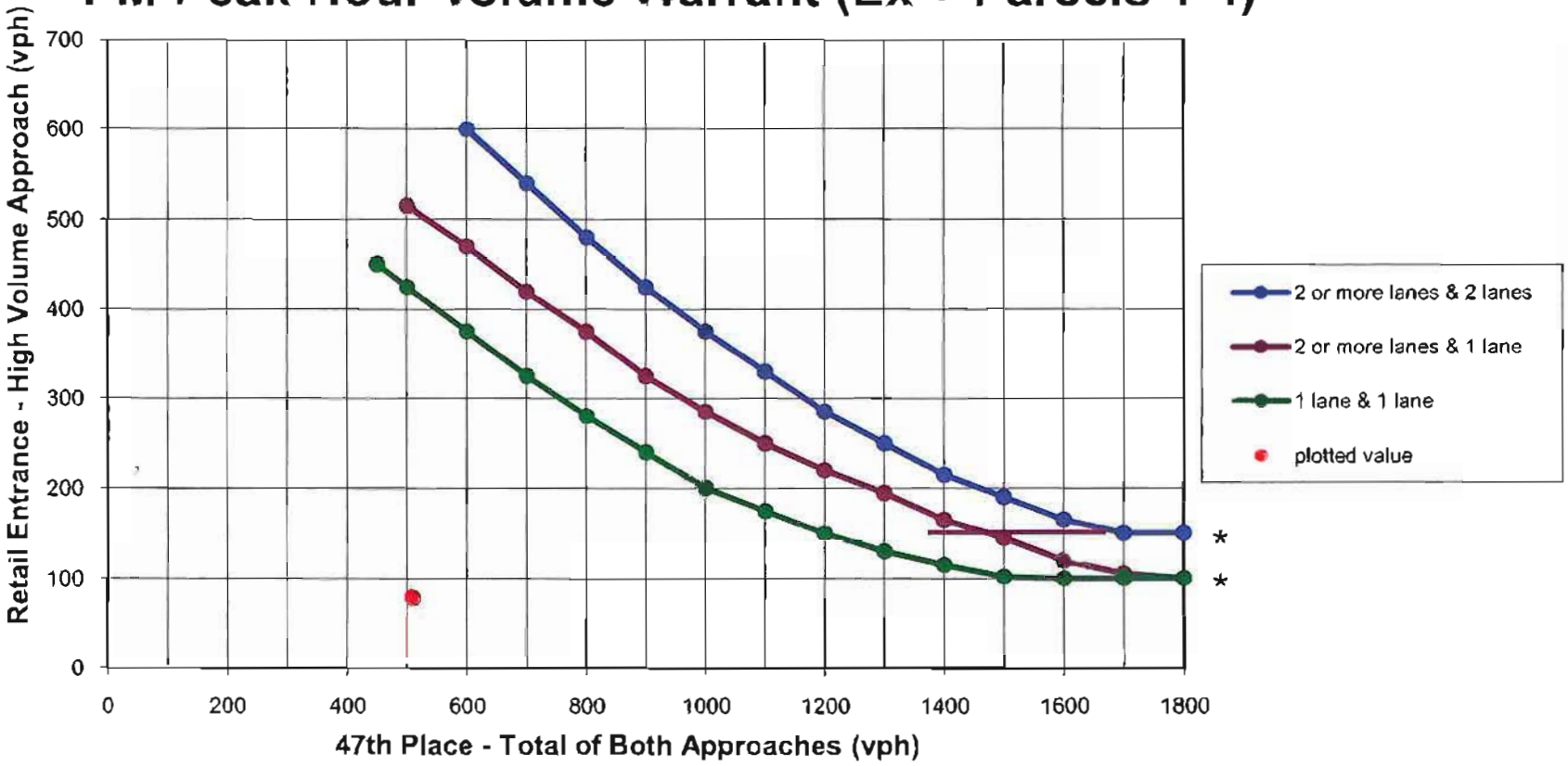
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



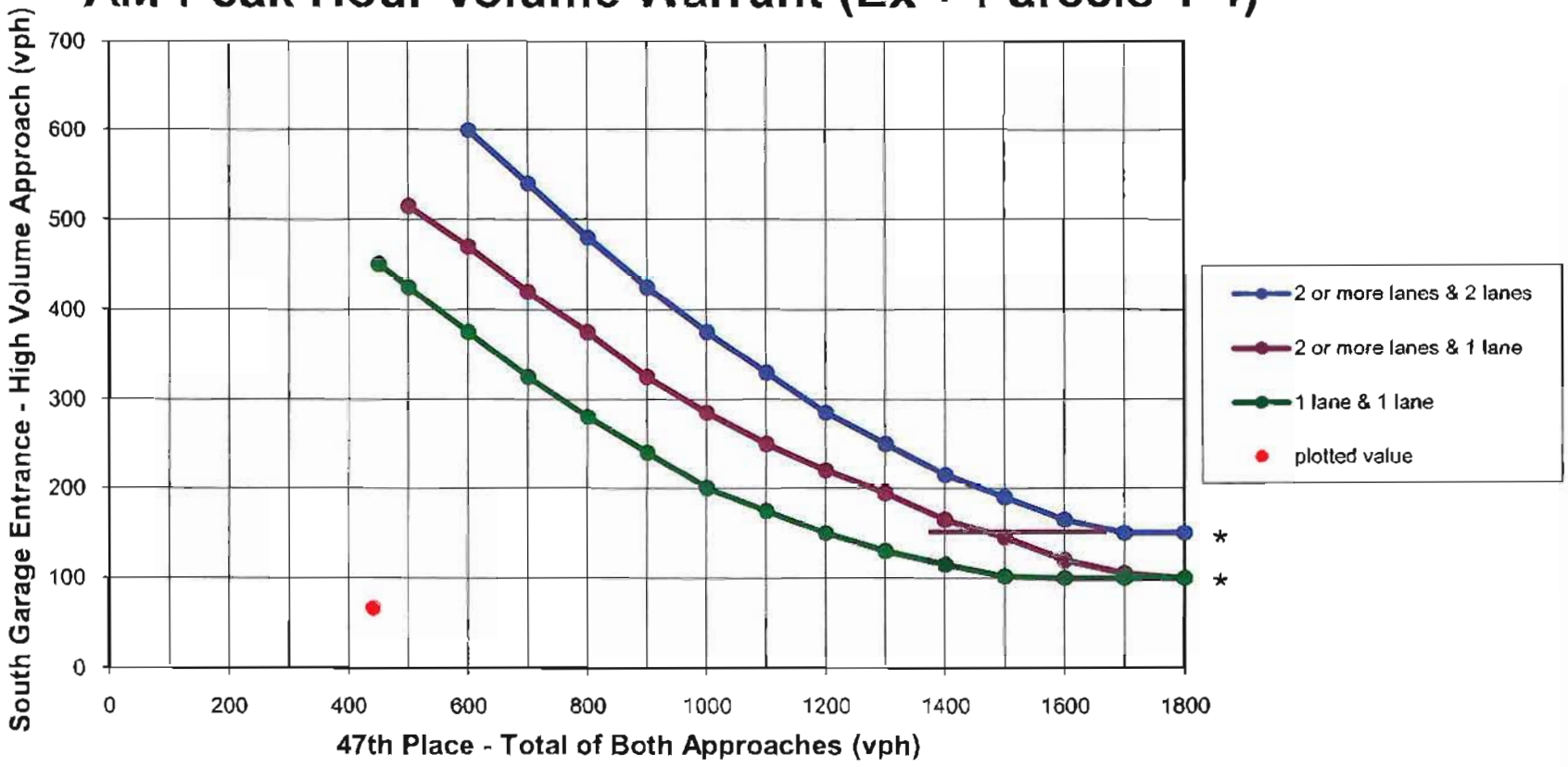
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



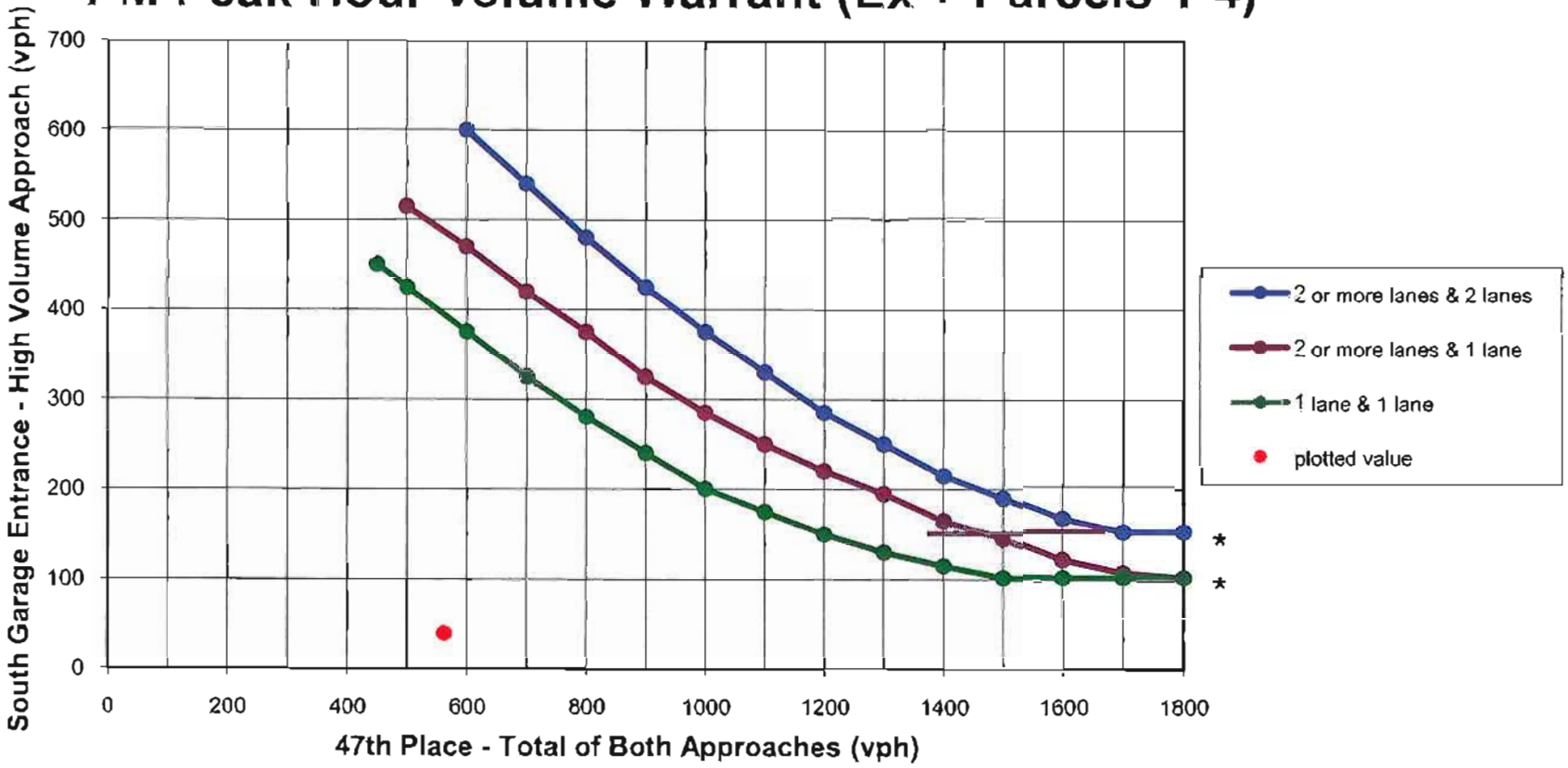
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & South Garage Entrance
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



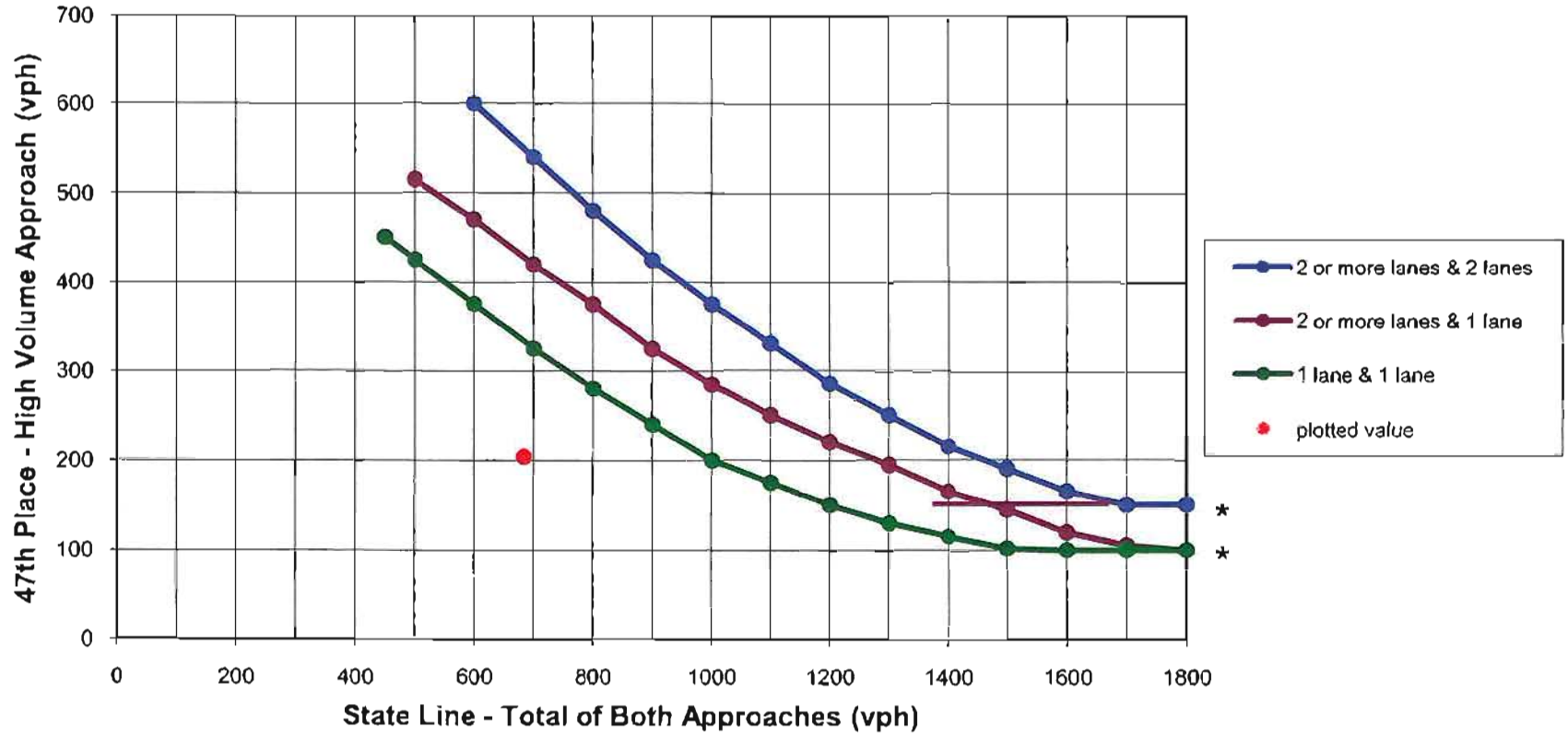
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & South Garage Entrance
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



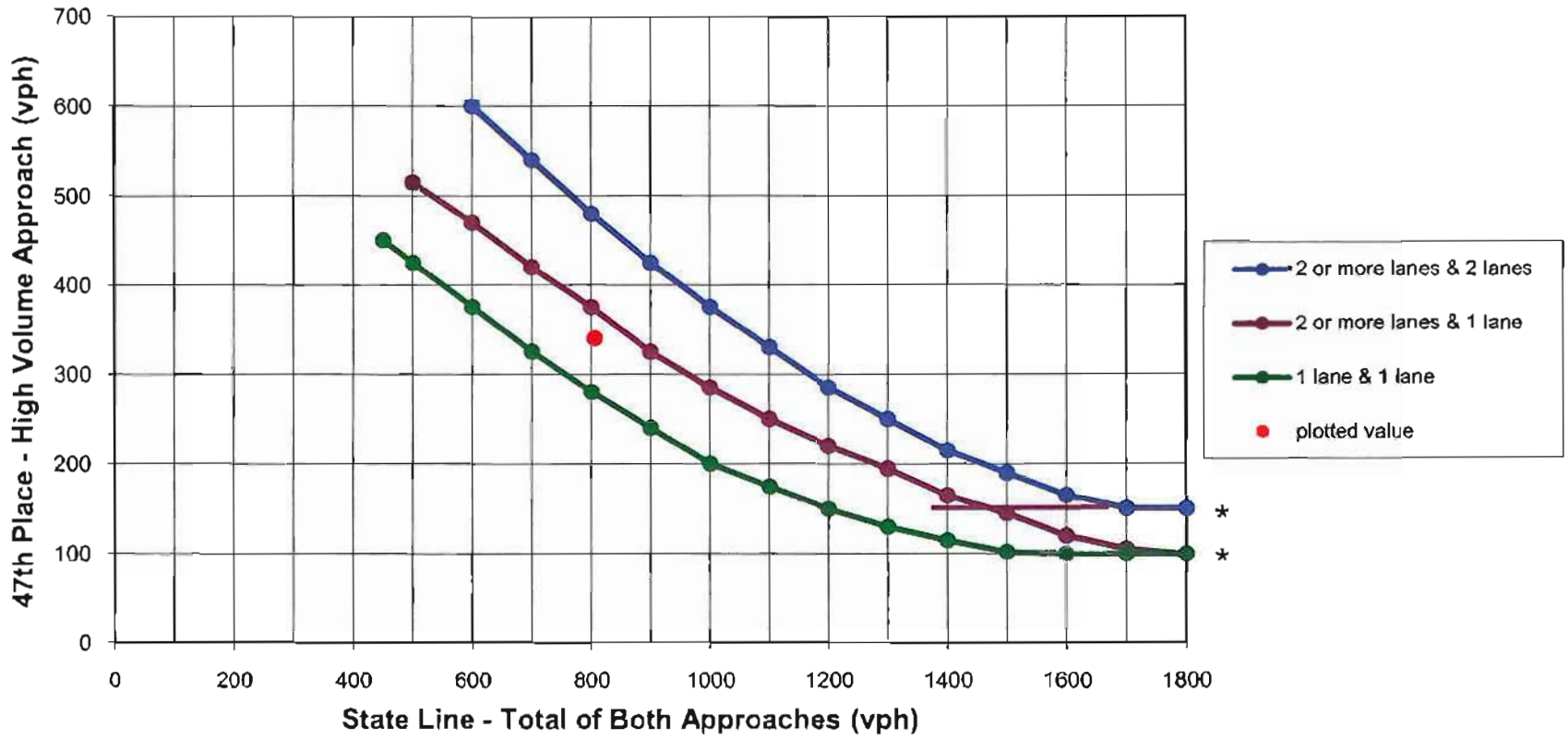
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



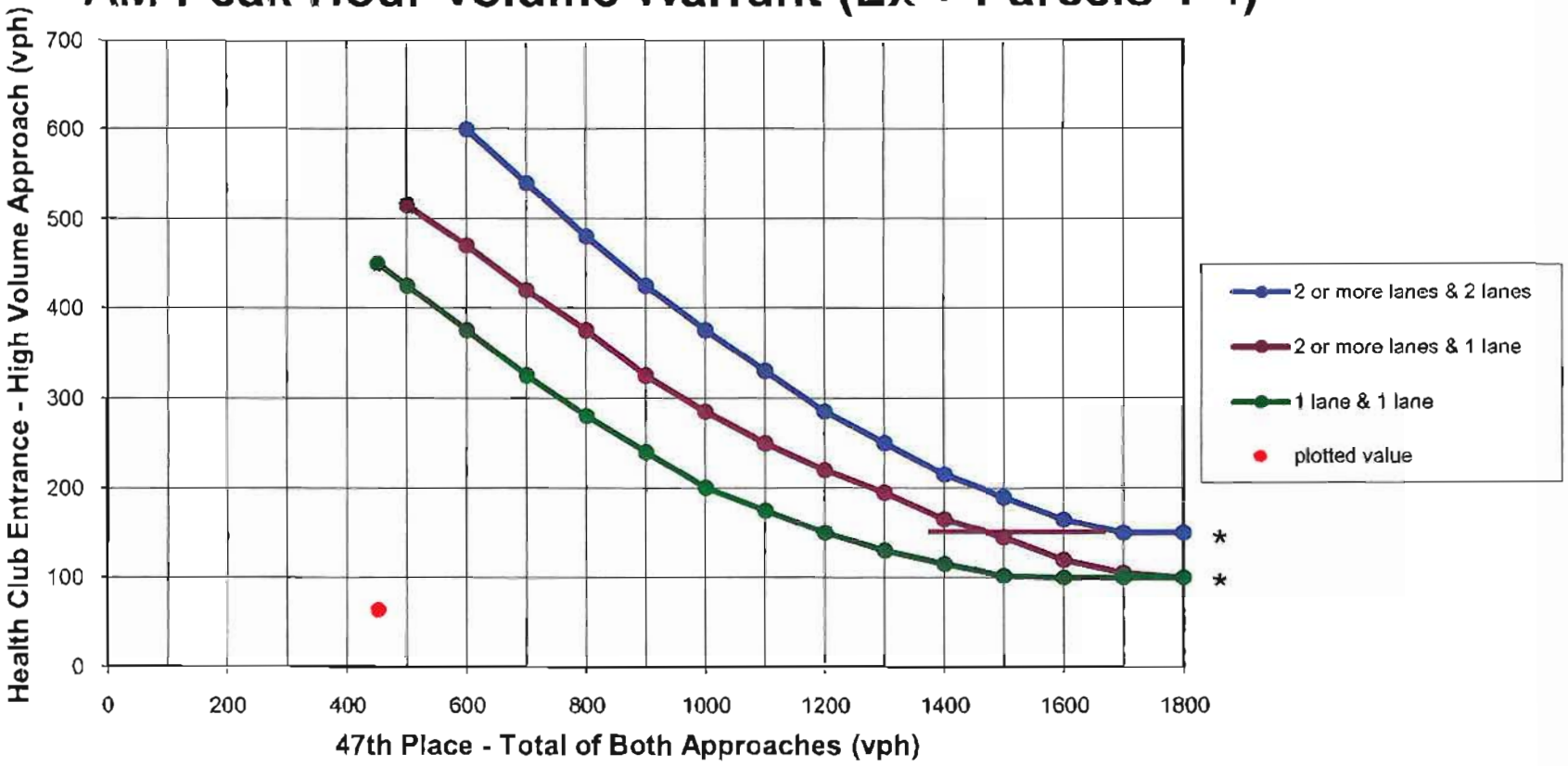
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



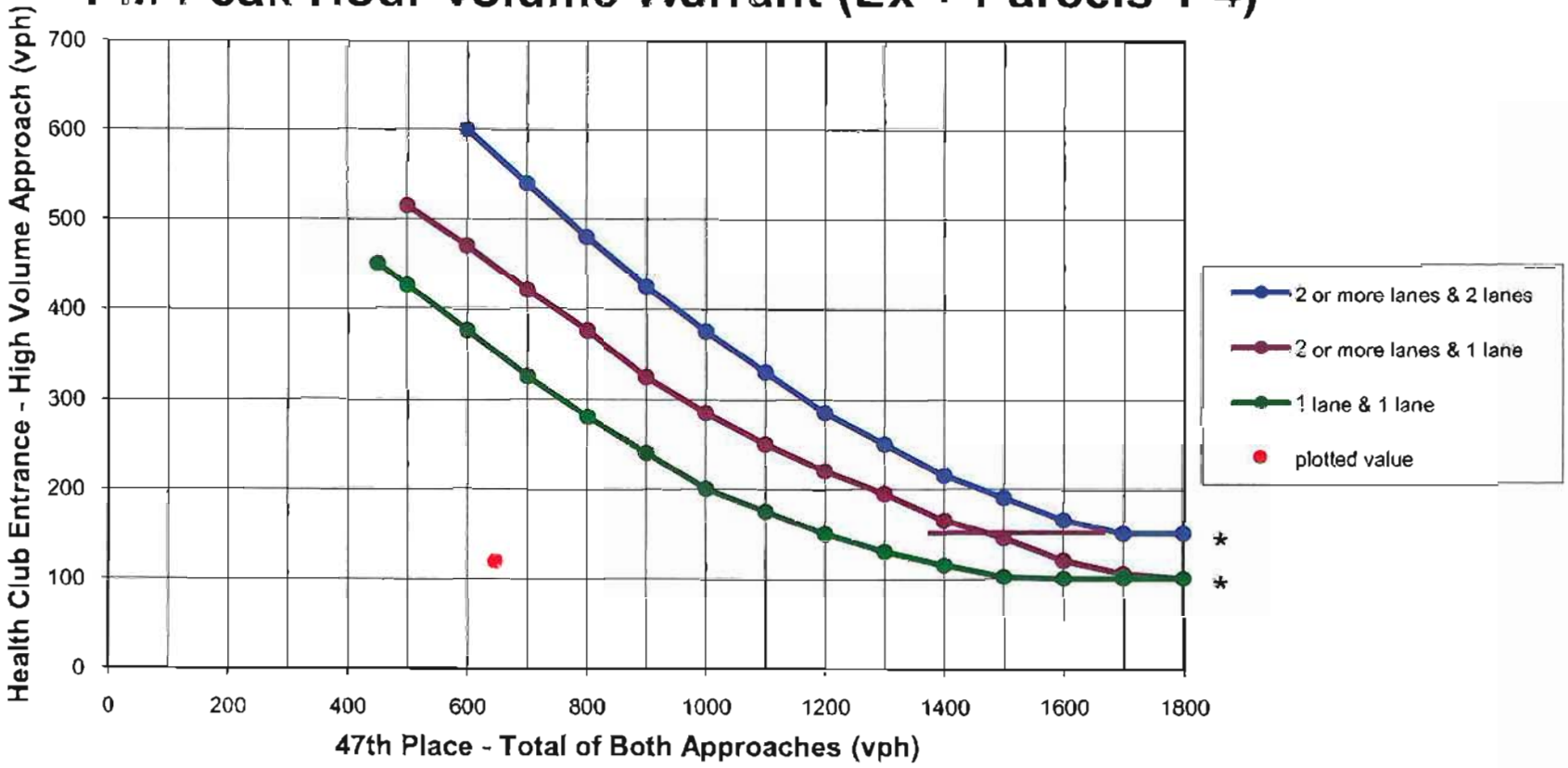
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Health Club Entrance/Exit
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



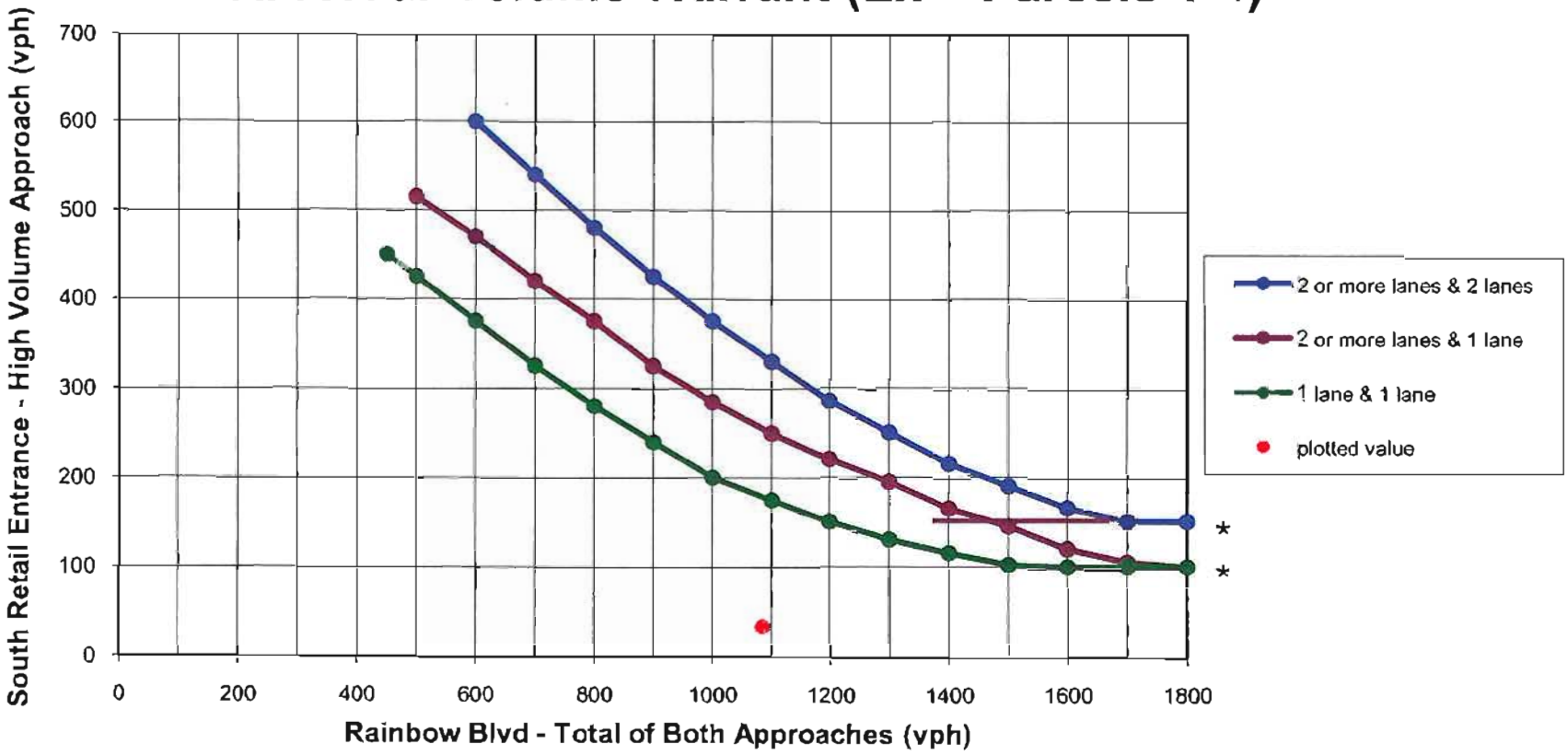
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Health Club Entrance/Exit
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



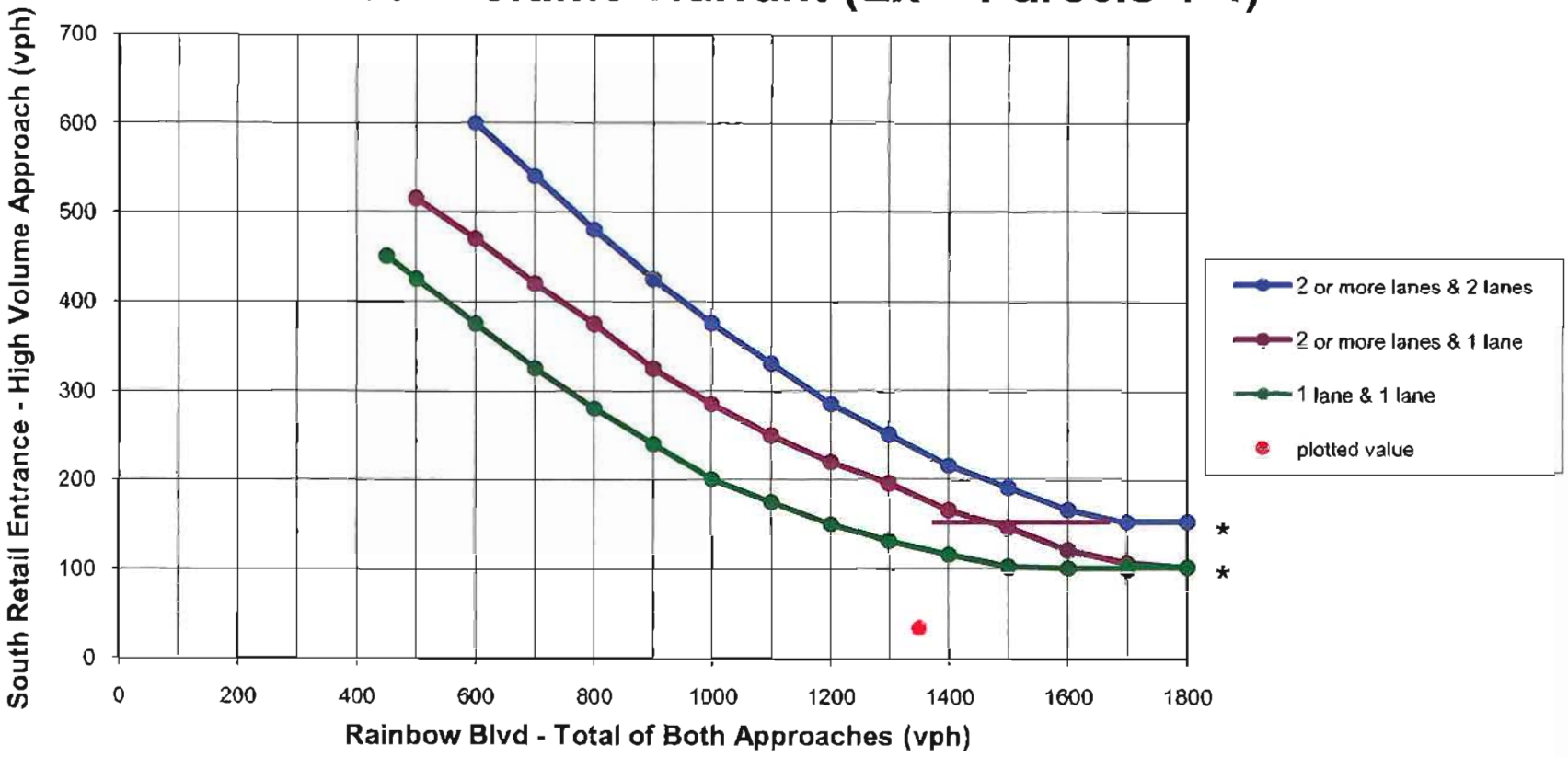
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

South Retail Entrance & Rainbow Blvd
AM Peak Hour Volume Warrant (Ex + Parcels 1-4)



*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.

South Retail Entrance & Rainbow Blvd
PM Peak Hour Volume Warrant (Ex + Parcels 1-4)



*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.

Capacity Analysis Reports

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & Rainbow Blvd*
Jurisdiction	*Westwood, KS/KCK (UG)/KDOT*
Analysis Year	*2011 - Ex + Parcels 1-4*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*607*	*87*	*167*	*336*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*659*	*94*	*181*	*365*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*47*		*124*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*51*	*0*	*134*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*181*	*51*		*134*			
C (m) (veh/h)		*853*	*130*		*675*			
v/c		*0.21*	*0.39*		*0.20*			
95% queue length		*0.80*	*1.66*		*0.74*			
Control Delay (s/veh)		*10.4*	*49.5*		*11.6*			
LOS		*B*	*E*		*B*			
Approach Delay (s/veh)	--	--	*22.1*					
Approach LOS	--	--	*C*					

HCS+™ Version 5.5 Generated: 3/14/2011 8:19 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place & Rainbow Blvd
Jurisdiction	Westwood, KS/KCK (UG)/KDOT
Analysis Year	2011 - Ex + Parcels 1-4

Project Description: Woodside

East/West Street: 47th Place | North/South Street: Rainbow Blvd

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		305	80	129	836	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	331	86	140	908	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				100		184
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	108	0	199
Percent Heavy Vehicles	0	0	0	2	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		140	108		199			
C (m) (veh/h)		1138	179		837			
v/c		0.12	0.60		0.24			
95% queue length		0.42	3.32		0.93			
Control Delay (s/veh)		8.6	51.7		10.6			
LOS		A	F		B			
Approach Delay (s/veh)	--	--	25.1					
Approach LOS	--	--	D					

HCS+™ Version 5.5

Generated: 3/14/2011 8:19 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & Retail*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011 - Ex + Parcels 1-4*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Center Retail*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*245*	*3*	*2*	*156*	*39*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*6*	*266*	*3*	*2*	*169*	*42*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*0*	*2*	*21*	*0*	*14*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*1*	*0*	*2*	*22*	*0*	*15*
Percent Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*6*	*2*		*3*			*37*	
C (m) (veh/h)	*1360*	*1295*		*644*			*598*	
v/c	*0.00*	*0.00*		*0.00*			*0.06*	
95% queue length	*0.01*	*0.00*		*0.01*			*0.20*	
Control Delay (s/veh)	*7.7*	*7.8*		*10.6*			*11.4*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*10.6*			*11.4*		
Approach LOS	--	--	*B*			*B*		

HCS+™ Version 5.5

Generated: 3/18/2011 12:20 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*PM*

Site Information

Intersection	*47th Place & Retail*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011 - Ex + Parcels 1-4*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Center Retail*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*22*	*174*	*13*	*6*	*262*	*33*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*23*	*189*	*14*	*6*	*284*	*35*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*3*	*0*	*8*	*60*	*0*	*19*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*3*	*0*	*8*	*65*	*0*	*20*
Percent Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*23*	*6*		*11*			*85*	
C (m) (veh/h)	*1241*	*1369*		*659*			*473*	
v/c	*0.02*	*0.00*		*0.02*			*0.18*	
95% queue length	*0.06*	*0.01*		*0.05*			*0.65*	
Control Delay (s/veh)	*8.0*	*7.6*		*10.6*			*14.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*10.6*			*14.3*		
Approach LOS	--	--	*B*			*B*		

HCS+™ Version 5.5 Generated: 3/18/2011 12:20 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & South Garage*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011 - Ex + Parcels 1-4*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *South Garage*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*268*	*0*	*10*	*163*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*291*	*0*	*10*	*177*	*0*
Percent Heavy Vehicles	*0*	–	–	*2*	–	–
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*34*		*0*			
Peak-Hour Factor, PHF	*0.92*	*1.00*	*0.92*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*10*		*36*				
C (m) (veh/h)		*1271*		*535*				
v/c		*0.01*		*0.07*				
95% queue length		*0.02*		*0.22*				
Control Delay (s/veh)		*7.9*		*12.2*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*12.2*					
Approach LOS	--	--	*B*					

HCS+™ Version 5.5

Generated: 3/17/2011 2:49 PM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & South Garage*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2011 - Ex + Parcels 1-4*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place*	North/South Street: *South Garage*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		242	0	37	283	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	263	0	40	307	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	18		22			
Peak-Hour Factor, PHF	0.92	1.00	0.92	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	19	0	23	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		40		42				
C (m) (veh/h)		1301		562				
v/c		0.03		0.07				
95% queue length		0.10		0.24				
Control Delay (s/veh)		7.9		11.9				
LOS		A		B				
Approach Delay (s/veh)	--	--	11.9					
Approach LOS	--	--	B					

HCS+™ Version 5.5

Generated: 3/14/2011 8:20 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	AM

Site Information

Intersection	47th Place & State Line Rd
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011- Ex + Parcels 1-4

Project ID *Woodside*

East/West Street: *47th Place* North/South Street: *State Line Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	34	119	52	30	125	37
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	93	380	26	12	141	32
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	221		207		542		200	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.2		0.2		0.1	
Prop. Right-Turns	0.3		0.2		0.1		0.2	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.1		0.0		-0.1	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.20		0.18		0.48		0.18	
hd, final value (s)	6.66		6.74		5.86		6.46	
x, final value	0.41		0.39		0.88		0.36	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	4.7		4.7		3.9		4.5	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	471		457		606		450	
Delay (s/veh)	14.20		13.93		37.39		13.04	
LOS	B		B		E		B	
Approach: Delay (s/veh)	14.20		13.93		37.39		13.04	
LOS	B		B		E		B	
Intersection Delay (s/veh)	24.70							
Intersection LOS	C							

 HCS+™ Version 5.5 Generated: 3/17/2011 2:49 PM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place & State Line Rd
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011- Ex + Parcels 1-4

Project ID *Woodside*

East/West Street: *47th Place* North/South Street: *State Line Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	54	142	144	60	196	26
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	107	223	34	26	358	58
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	368		306		394		480	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.2		0.3		0.1	
Prop. Right-Turns	0.4		0.1		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.2		0.0		0.0		-0.0	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.33		0.27		0.35		0.43	
hd, final value (s)	9.13		9.66		9.19		9.12	
x, final value	0.93		0.82		1.01		1.22	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	7.1		7.7		7.2		7.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	393		368		394		480	
Delay (s/veh)	60.89		44.39		78.12		146.41	
LOS	F		E		F		F	
Approach: Delay (s/veh)	60.89		44.39		78.12		146.41	
LOS	F		E		F		F	
Intersection Delay (s/veh)	88.53							
Intersection LOS	F							

 HCS+™ Version 5.5 Generated: 3/14/2011 8:20 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	Brett Lauritsen	Intersection	47th Place & Health Club Ent
Agency/Co.	Olsson Associates	Jurisdiction	Westwood, KS
Date Performed	3/8/2011	Analysis Year	2011 - Ex + Parcels 1-4
Analysis Time Period	AM		

Project Description: Woodside

East/West Street: 47th Place | North/South Street: Health Club Entrance/Exit

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	35	266			131	19
Peak-Hour Factor, PHF	0.92	0.92	1.00	1.00	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	38	289	0	0	142	20
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				22		42
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	23	0	45
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	38						68	
C (m) (veh/h)	1417						709	
v/c	0.03						0.10	
95% queue length	0.08						0.32	
Control Delay (s/veh)	7.6						10.6	
LOS	A						B	
Approach Delay (s/veh)	--	--				10.6		
Approach LOS	--	--				B		

HCS+™ Version 5.5

Generated: 3/14/2011 8:20 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & Health Club Ent*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2011 - Ex + Parcels 1-4*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place*	North/South Street: *Health Club Entrance/Exit*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*162*	*102*			*249*	*133*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*1.00*	*1.00*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*176*	*110*	*0*	*0*	*270*	*144*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*49*		*71*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*53*	*0*	*77*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*176*						*130*	
C (m) (veh/h)	*1145*						*452*	
v/c	*0.15*						*0.29*	
95% queue length	*0.54*						*1.18*	
Control Delay (s/veh)	*8.7*						*16.1*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--					*16.1*	
Approach LOS	--	--					*C*	

HCS+™ Version 5.5 Generated: 3/14/2011 8:20 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	AM

Site Information

Intersection	Rainbow Blvd & Retail/Apt Sout
Jurisdiction	Westwood, KS/KCK (UG)/KDOT
Analysis Year	2011 - Ex + Parcels 1-4

Project Description Woodside

East/West Street: Retail/Apt South | North/South Street: Rainbow Blvd

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		692	9	8	375	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	752	9	8	407	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				31		2
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	33	0	2
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		8		35				
C (m) (veh/h)		847		256				
v/c		0.01		0.14				
95% queue length		0.03		0.47				
Control Delay (s/veh)		9.3		21.3				
LOS		A		C				
Approach Delay (s/veh)	--	--	21.3					
Approach LOS	--	--	C					

HCS+™ Version 5.5 Generated: 3/17/2011 2:49 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*PM*

Site Information

Intersection	*Rainbow Blvd & Retail/Apt Sout*
Jurisdiction	*Westwood, KS/KCK (UG)/KDOT*
Analysis Year	*2011 - Ex + Parcels 1-4*

Project Description *Woodside*

East/West Street: *Retail/Apt South* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		377	37	30	906	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	409	40	32	984	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				26		8
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	28	0	8
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		32		36				
C (m) (veh/h)		1108		282				
v/c		0.03		0.13				
95% queue length		0.09		0.43				
Control Delay (s/veh)		8.3		19.6				
LOS		A		C				
Approach Delay (s/veh)	--	--	19.6					
Approach LOS	--	--	C					

HCS+™ Version 5.5 Generated: 3/14/2011 8:21 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	17	204	4	9	13	109	593	29	22	295	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		0.99			0.96	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3492			3398	
Flt Permitted	0.53	1.00			1.00	1.00		0.80			0.90	
Satd. Flow (perm)	980	1604			1863	1583		2799			3056	
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)	295	18	222	4	10	14	118	645	32	24	321	115
RTOR Reduction (vph)	0	151	0	0	0	14	0	3	0	0	30	0
Lane Group Flow (vph)	295	89	0	0	14	0	0	792	0	0	430	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	24.0	24.0			2.4	2.4		40.6			40.6	
Effective Green, g (s)	24.0	24.0			2.4	2.4		40.6			40.6	
Actuated g/C Ratio	0.32	0.32			0.03	0.03		0.54			0.54	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	486	513			60	51		1515			1654	
v/s Ratio Prot	c0.13	0.06										
v/s Ratio Perm	c0.06				0.01	0.00		c0.28			0.14	
v/c Ratio	0.61	0.17			0.23	0.01		0.52			0.26	
Uniform Delay, d1	20.9	18.4			35.4	35.1		11.0			9.2	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	2.1	0.2			2.0	0.1		1.3			0.4	
Delay (s)	23.1	18.5			37.4	35.2		12.3			9.6	
Level of Service	C	B			D	D		B			A	
Approach Delay (s)		21.0			36.3			12.3			9.6	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	240	14	14	795	460
v/c Ratio	0.64	0.39	0.09	0.09	0.50	0.26
Control Delay	27.5	5.2	35.6	19.5	12.9	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.5	5.2	35.6	19.5	12.9	9.0
Queue Length 50th (ft)	109	6	5	0	82	33
Queue Length 95th (ft)	175	48	25	18	215	97
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	605	1004	339	299	1586	1756
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.24	0.04	0.05	0.50	0.26

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	14	162	34	26	34	162	320	7	20	769	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			0.97	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3474			3411	
Flt Permitted	0.42	1.00			0.72	1.00		0.52			0.94	
Satd. Flow (perm)	777	1605			1342	1583		1832			3207	
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)	257	15	176	37	28	37	176	348	8	22	836	265
RTOR Reduction (vph)	0	60	0	0	0	33	0	1	0	0	26	0
Lane Group Flow (vph)	257	131	0	0	65	4	0	531	0	0	1097	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	23.2	23.2			7.3	7.3		40.2			40.2	
Effective Green, g (s)	23.2	23.2			7.3	7.3		40.2			40.2	
Actuated g/C Ratio	0.31	0.31			0.10	0.10		0.54			0.54	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	388	505			133	157		998			1747	
v/s Ratio Prot	c0.10	0.08										
v/s Ratio Perm	c0.11				0.05	0.00		0.29			c0.34	
v/c Ratio	0.66	0.26			0.49	0.02		0.93dl			0.63	
Uniform Delay, d1	20.5	18.9			31.5	30.0		10.8			11.6	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	4.2	0.3			2.8	0.1		2.0			1.7	
Delay (s)	24.7	19.2			34.3	30.1		12.8			13.3	
Level of Service	C	B			C	C		B			B	
Approach Delay (s)		22.4			32.8			12.8			13.3	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	73.8	Sum of lost time (s)	10.4
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	191	65	37	532	1123
v/c Ratio	0.67	0.35	0.41	0.17	0.93dl	0.62
Control Delay	29.6	12.2	38.4	12.4	13.9	13.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.6	12.2	38.4	12.4	13.9	13.5
Queue Length 50th (ft)	92	34	29	0	79	172
Queue Length 95th (ft)	155	80	65	25	137	262
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	386	927	443	548	1014	1798
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.21	0.15	0.07	0.52	0.62

Intersection Summary

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	17	204	4	9	13	109	593	29	22	295	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		0.99			0.96	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3492			3398	
Flt Permitted	0.75	1.00			0.95	1.00		0.79			0.89	
Satd. Flow (perm)	1394	1604			1774	1583		2782			3048	
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)	295	18	222	4	10	14	118	645	32	24	321	115
RTOR Reduction (vph)	0	160	0	0	0	14	0	3	0	0	29	0
Lane Group Flow (vph)	295	80	0	0	14	0	0	792	0	0	431	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	25.0	25.0			2.7	2.7		54.6			54.6	
Effective Green, g (s)	25.0	25.0			2.7	2.7		54.6			54.6	
Actuated g/C Ratio	0.28	0.28			0.03	0.03		0.61			0.61	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	459	446			53	47		1688			1849	
v/s Ratio Prot	c0.12	0.05										
v/s Ratio Perm	c0.06				0.01	0.00		c0.28			0.14	
v/c Ratio	0.64	0.18			0.26	0.01		0.47			0.23	
Uniform Delay, d1	27.8	24.7			42.7	42.4		9.7			8.1	
Progression Factor	1.00	1.00			1.00	1.00		0.89			1.00	
Incremental Delay, d2	3.1	0.2			2.7	0.1		0.9			0.3	
Delay (s)	30.8	24.9			45.3	42.4		9.6			8.4	
Level of Service	C	C			D	D		A			A	
Approach Delay (s)		28.2			43.9			9.6			8.4	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	240	14	14	795	460
v/c Ratio	0.72	0.43	0.11	0.11	0.44	0.23
Control Delay	41.0	6.8	41.0	20.9	9.1	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.3	0.0
Total Delay	41.0	6.8	41.0	20.9	9.4	6.9
Queue Length 50th (ft)	156	8	8	0	75	40
Queue Length 95th (ft)	211	57	26	19	202	83
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	503	741	134	133	1787	1980
Starvation Cap Reductn	0	0	0	0	376	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.32	0.10	0.11	0.56	0.23

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	14	162	34	26	34	162	320	7	20	769	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.96	
Flt Protected	0.95	1.00			0.97	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3474			3411	
Flt Permitted	0.71	1.00			0.52	1.00		0.51			0.94	
Satd. Flow (perm)	1331	1605			962	1583		1811			3205	
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)	257	15	176	37	28	37	176	348	8	22	836	265
RTOR Reduction (vph)	0	94	0	0	0	33	0	1	0	0	27	0
Lane Group Flow (vph)	257	97	0	0	65	4	0	531	0	0	1096	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	25.7	25.7			8.6	8.6		53.9			53.9	
Effective Green, g (s)	25.7	25.7			8.6	8.6		53.9			53.9	
Actuated g/C Ratio	0.29	0.29			0.10	0.10		0.60			0.60	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	438	458			92	151		1085			1919	
v/s Ratio Prot	c0.08	0.06										
v/s Ratio Perm	c0.09				0.07	0.00		0.29			c0.34	
v/c Ratio	0.59	0.21			0.71	0.02		0.49			0.57	
Uniform Delay, d1	28.0	24.5			39.5	36.9		10.2			11.0	
Progression Factor	1.00	1.00			1.00	1.00		0.93			1.00	
Incremental Delay, d2	2.0	0.2			21.8	0.1		1.6			1.2	
Delay (s)	30.0	24.7			61.3	37.0		11.1			12.2	
Level of Service	C	C			E	D		B			B	
Approach Delay (s)		27.8			52.5			11.1			12.2	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	191	65	37	532	1123
v/c Ratio	0.61	0.36	0.62	0.18	0.48	0.57
Control Delay	34.3	9.8	62.9	13.7	12.3	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	34.3	9.8	62.9	13.7	12.5	12.5
Queue Length 50th (ft)	122	25	36	0	66	176
Queue Length 95th (ft)	173	68	76	27	167	288
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	461	669	147	274	1107	1983
Starvation Cap Reductn	0	0	0	0	136	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.29	0.44	0.14	0.55	0.57

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	47	124	607	87	167	336
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.98			1.00
Flt Protected	0.95	1.00	1.00			0.98
Satd. Flow (prot)	1770	1583	3472			3481
Flt Permitted	0.95	1.00	1.00			0.61
Satd. Flow (perm)	1770	1583	3472			2152
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	135	660	95	182	365
RTOR Reduction (vph)	0	123	6	0	0	0
Lane Group Flow (vph)	51	12	749	0	0	547
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.1	8.1	73.9			73.9
Effective Green, g (s)	8.1	8.1	73.9			73.9
Actuated g/C Ratio	0.09	0.09	0.82			0.82
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	159	142	2851			1767
v/s Ratio Prot	c0.03		0.22			
v/s Ratio Perm		0.01				c0.25
v/c Ratio	0.32	0.09	0.26			0.31
Uniform Delay, d1	38.4	37.6	1.8			1.9
Progression Factor	1.00	1.00	1.00			0.49
Incremental Delay, d2	1.2	0.3	0.2			0.4
Delay (s)	39.5	37.8	2.1			1.4
Level of Service	D	D	A			A
Approach Delay (s)	38.3		2.1			1.4
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	51	135	755	547
v/c Ratio	0.32	0.51	0.26	0.31
Control Delay	42.8	14.1	2.1	1.5
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	42.8	14.1	2.1	1.7
Queue Length 50th (ft)	28	0	33	11
Queue Length 95th (ft)	61	51	58	21
Internal Link Dist (ft)	95		158	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	472	521	2856	1766
Starvation Cap Reductn	0	0	0	515
Spillback Cap Reductn	0	1	28	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.11	0.26	0.27	0.44

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	100	184	305	80	129	836
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.97			1.00
Flt Protected	0.95	1.00	1.00			0.99
Satd. Flow (prot)	1770	1583	3429			3516
Flt Permitted	0.95	1.00	1.00			0.81
Satd. Flow (perm)	1770	1583	3429			2872
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	200	332	87	140	909
RTOR Reduction (vph)	0	176	17	0	0	0
Lane Group Flow (vph)	109	24	402	0	0	1049
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	10.9	10.9	71.1			71.1
Effective Green, g (s)	10.9	10.9	71.1			71.1
Actuated g/C Ratio	0.12	0.12	0.79			0.79
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	214	192	2709			2269
v/s Ratio Prot	c0.06		0.12			
v/s Ratio Perm		0.02				c0.37
v/c Ratio	0.51	0.13	0.15			0.46
Uniform Delay, d1	37.0	35.3	2.2			3.1
Progression Factor	1.00	1.00	1.00			0.26
Incremental Delay, d2	1.9	0.3	0.1			0.6
Delay (s)	38.9	35.6	2.4			1.4
Level of Service	D	D	A			A
Approach Delay (s)	36.8		2.4			1.4
Approach LOS	D		A			A

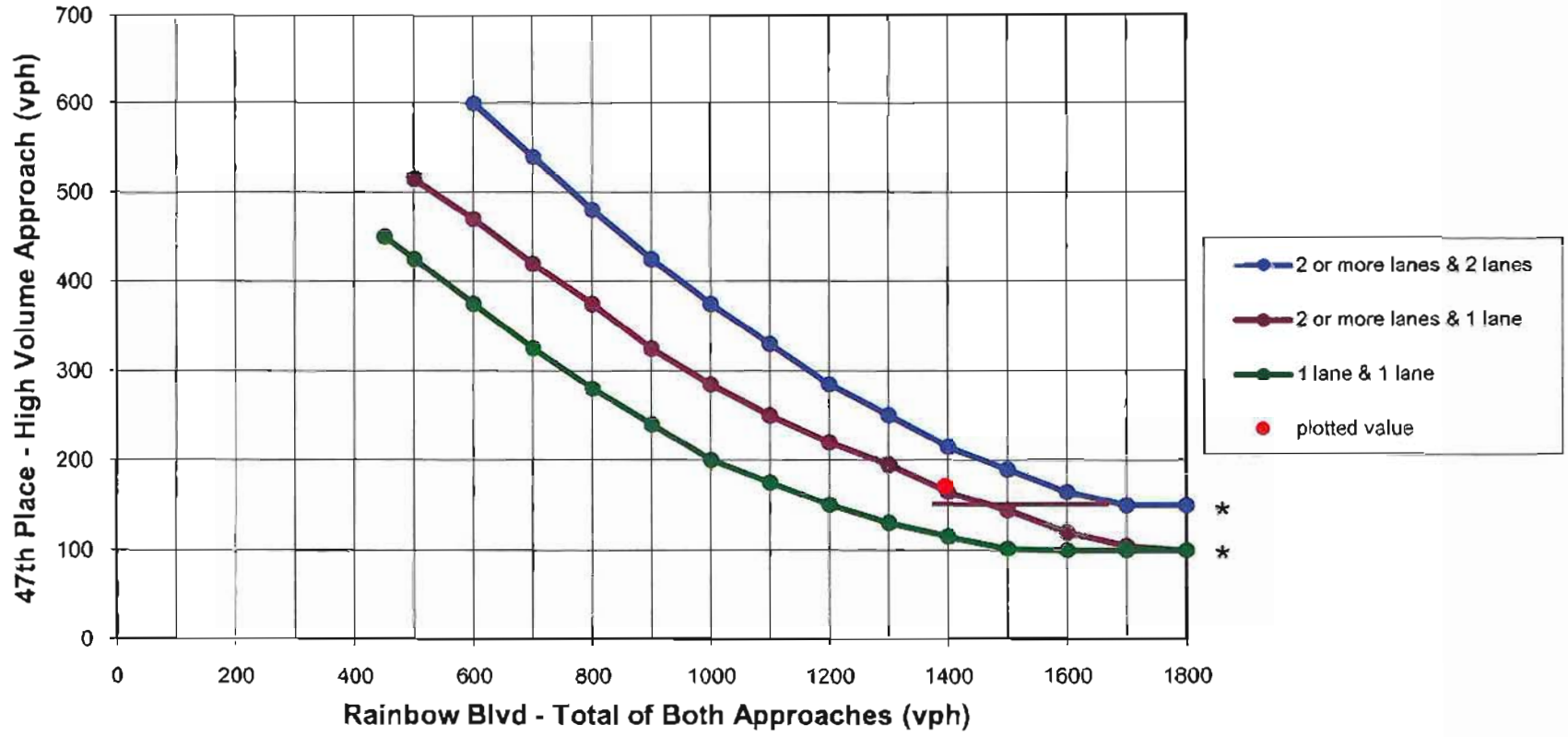
Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	200	419	1049
v/c Ratio	0.51	0.54	0.15	0.46
Control Delay	44.8	11.2	2.2	1.5
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	44.8	11.2	2.2	1.7
Queue Length 50th (ft)	59	0	17	11
Queue Length 95th (ft)	106	58	35	20
Internal Link Dist (ft)	95		158	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	413	523	2728	2272
Starvation Cap Reductn	0	0	0	475
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.26	0.38	0.15	0.58

Intersection Summary

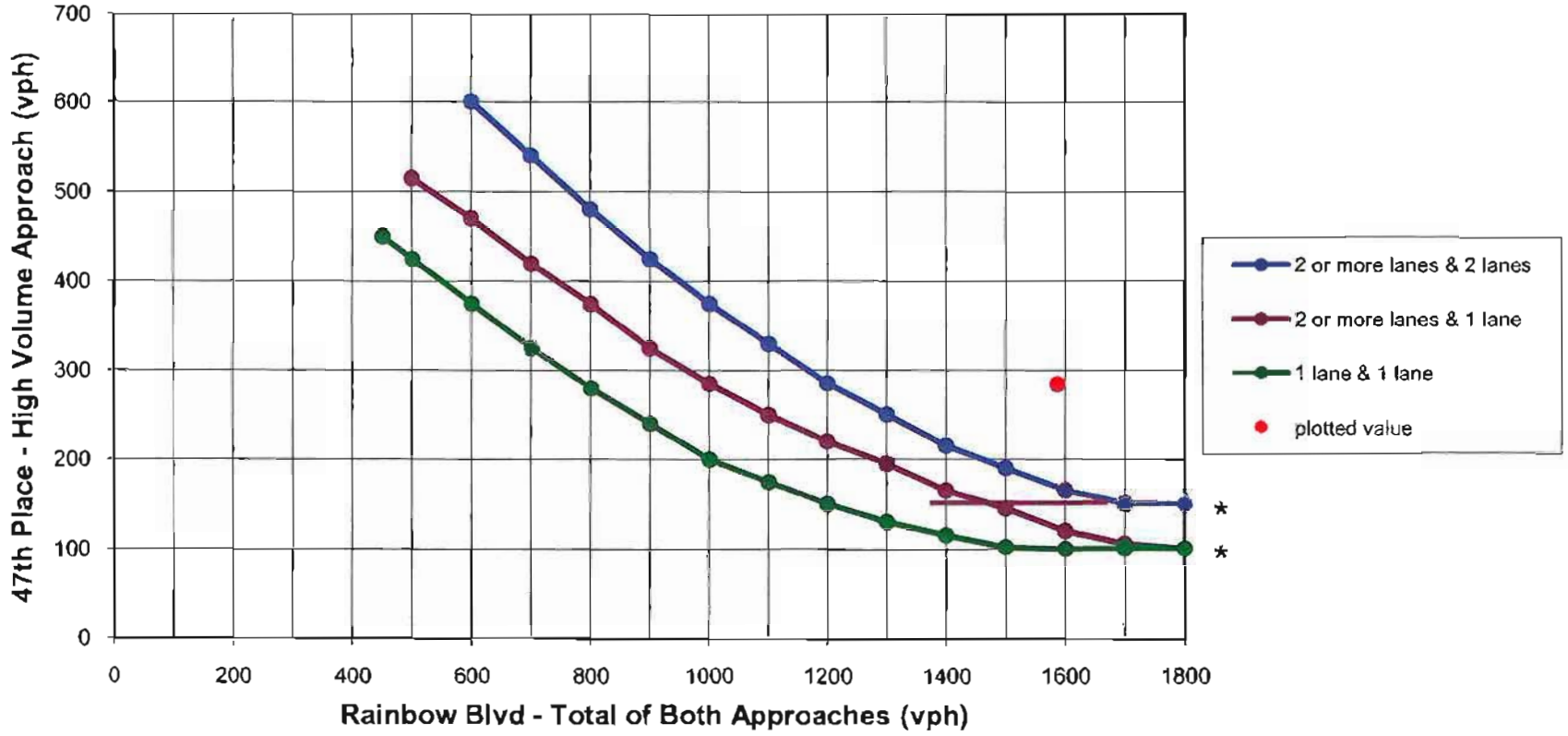
Signal Warrant Analysis

47th Place & Rainbow Blvd
AM Peak Hour Volume Warrant (2030)



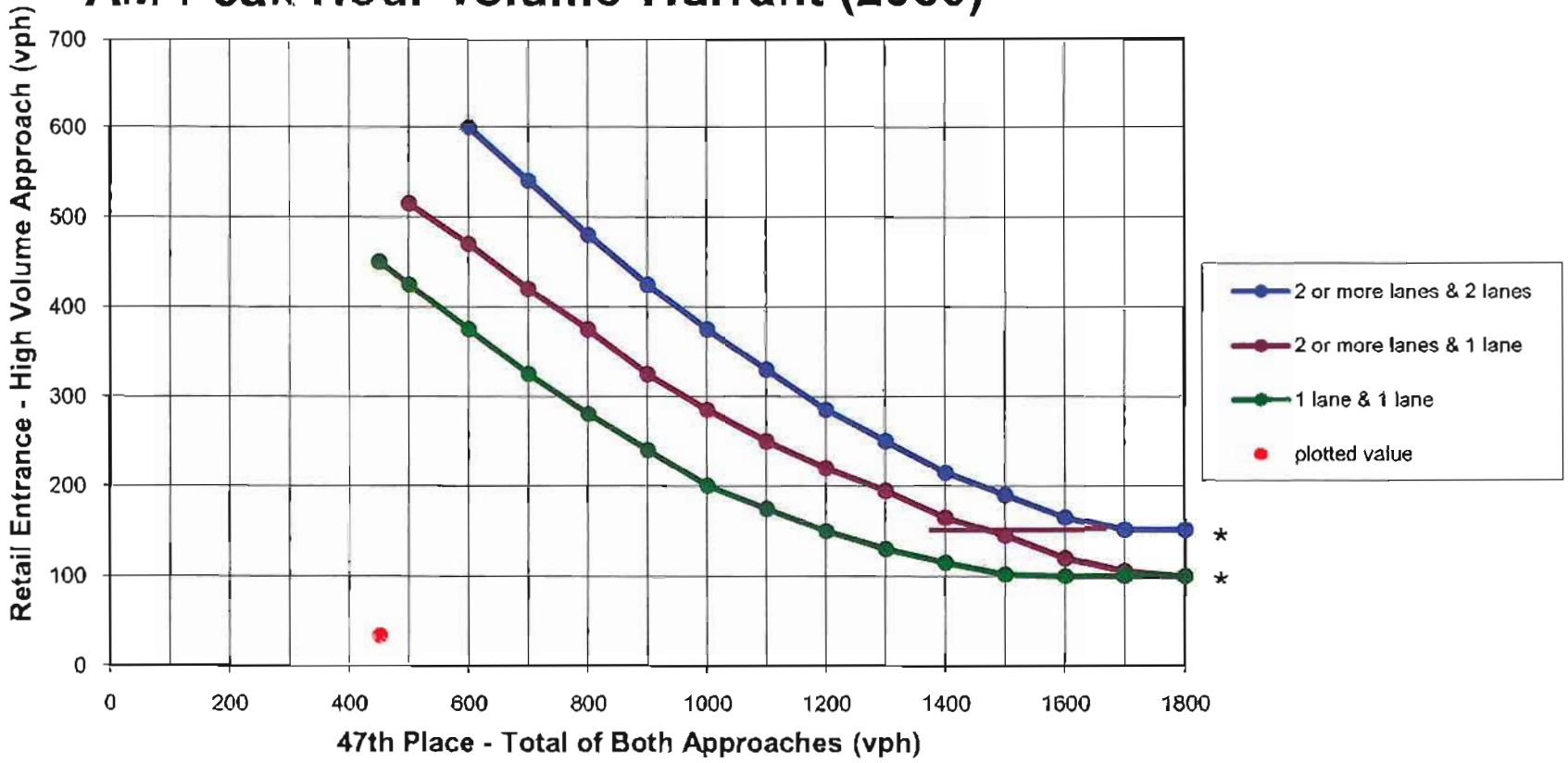
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Rainbow Blvd
PM Peak Hour Volume Warrant (2030)



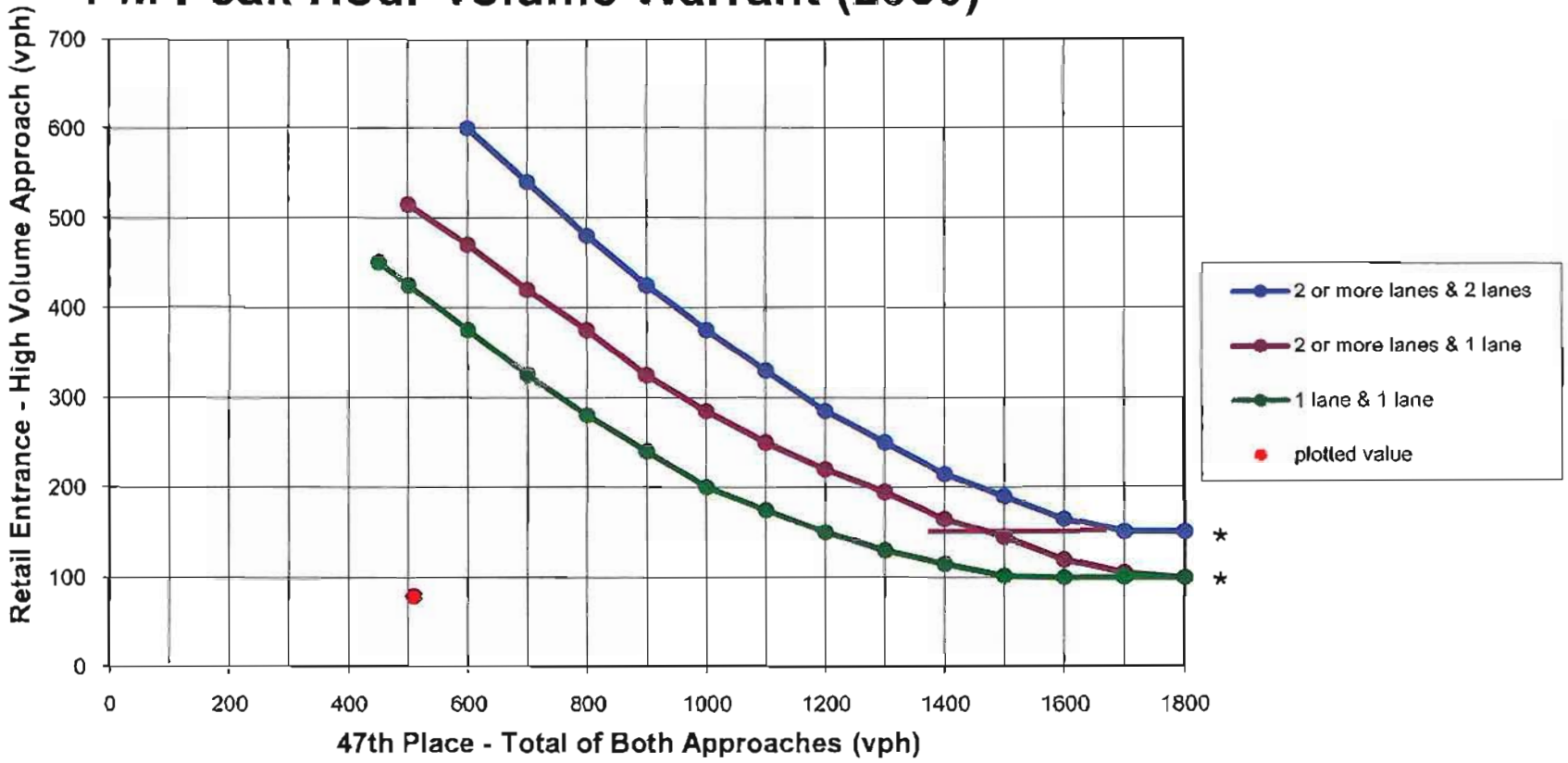
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
AM Peak Hour Volume Warrant (2030)



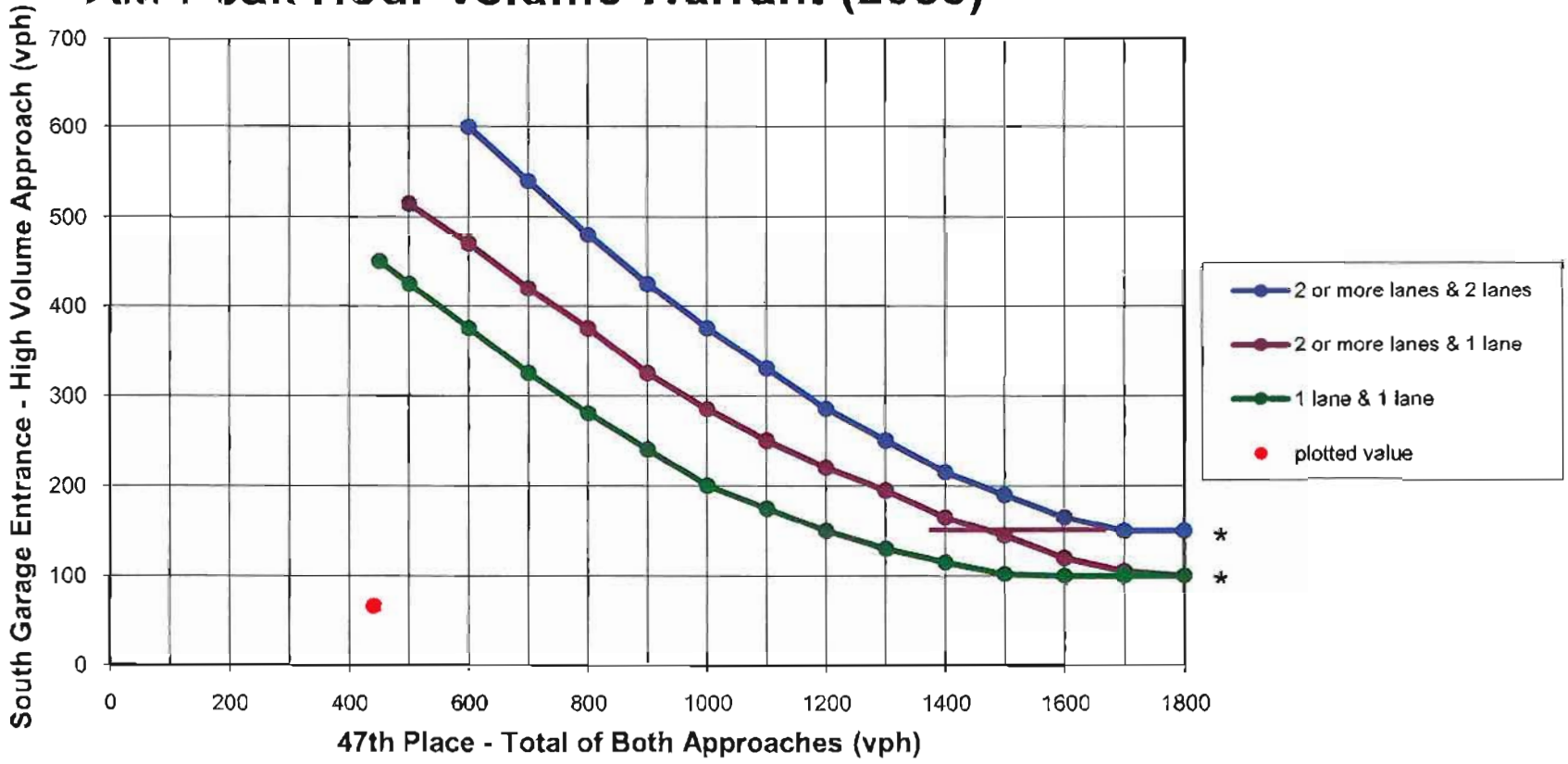
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Retail Entrance
PM Peak Hour Volume Warrant (2030)



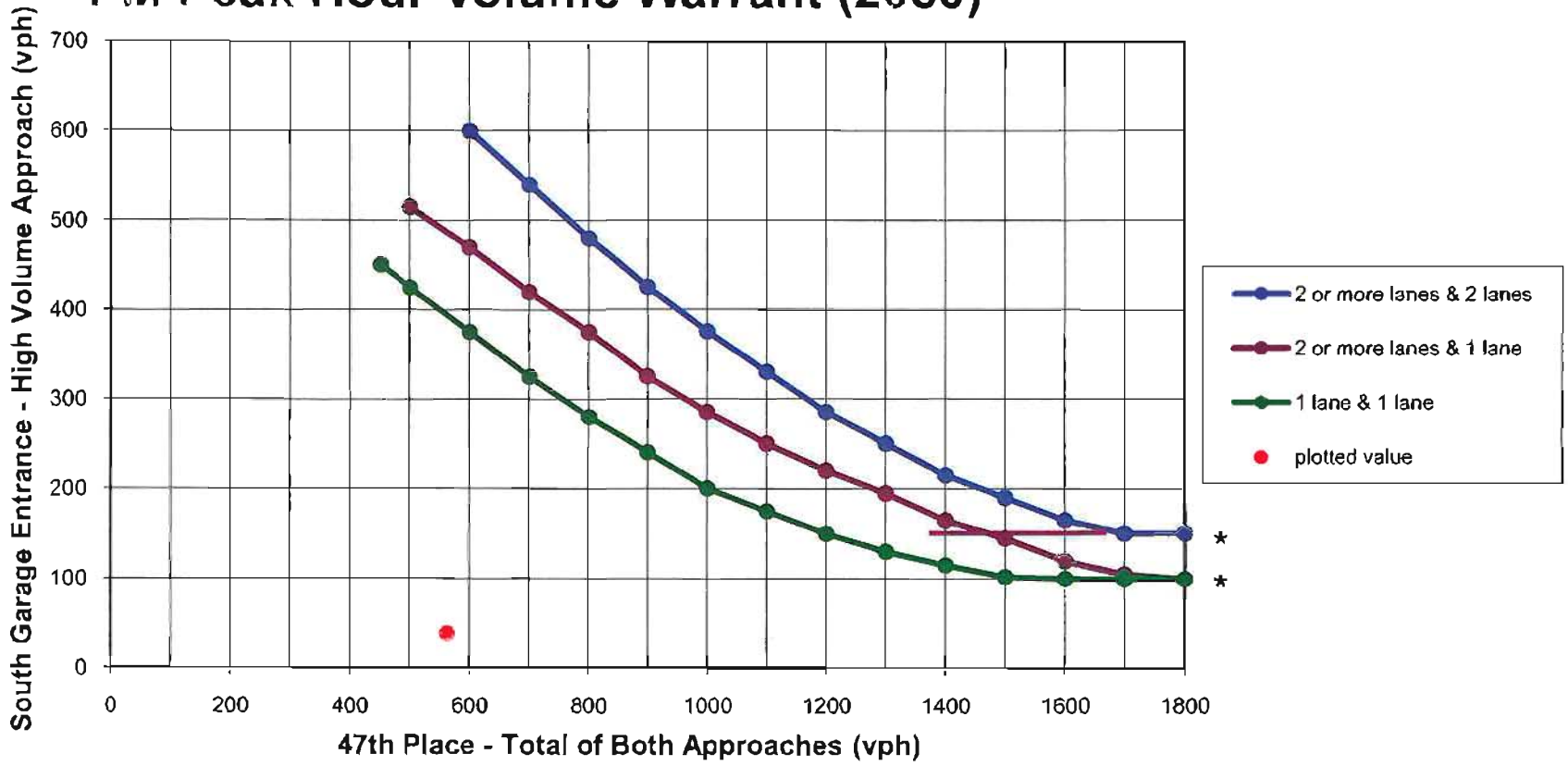
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & South Garage Entrance
AM Peak Hour Volume Warrant (2030)



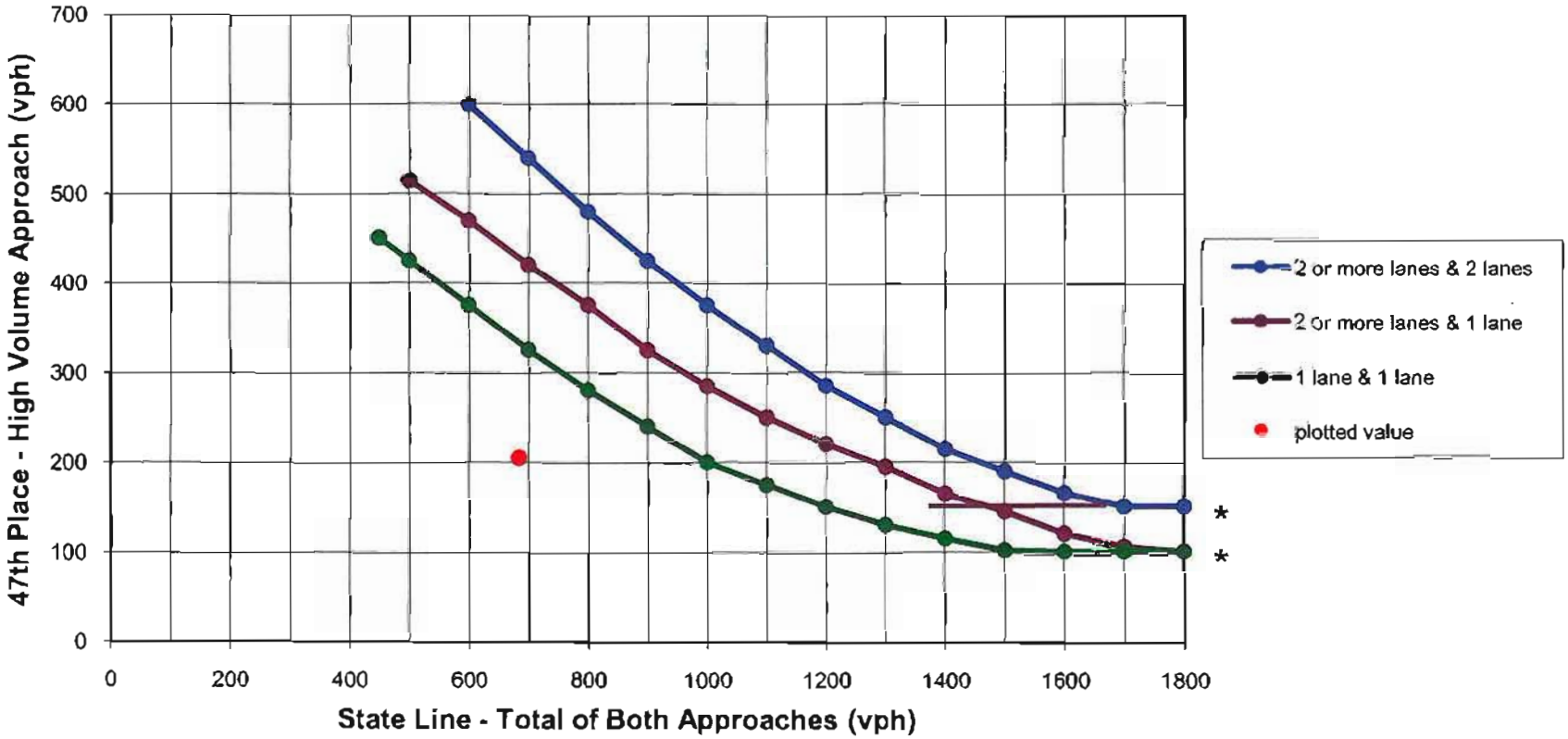
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & South Garage Entrance
PM Peak Hour Volume Warrant (2030)



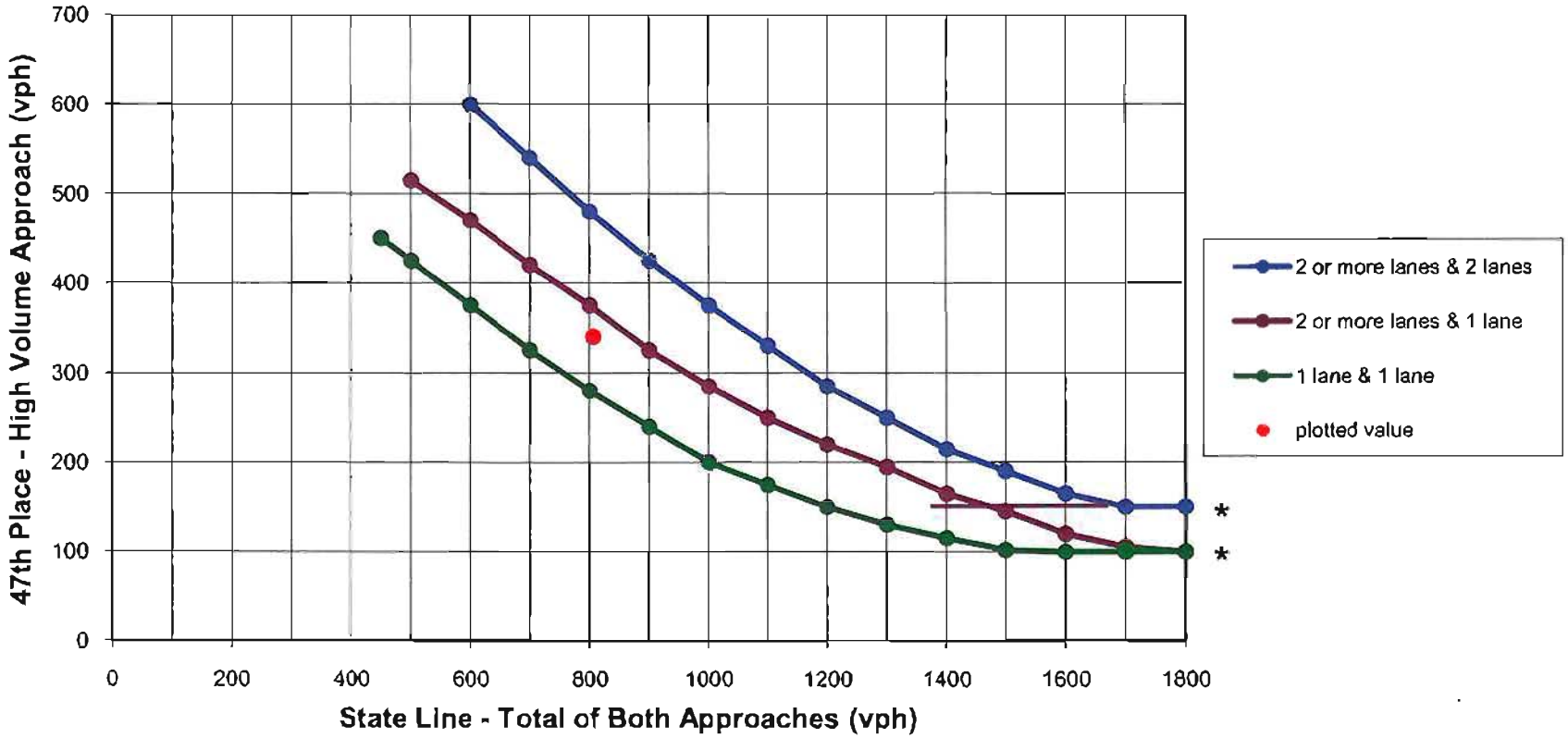
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
AM Peak Hour Volume Warrant (2030)



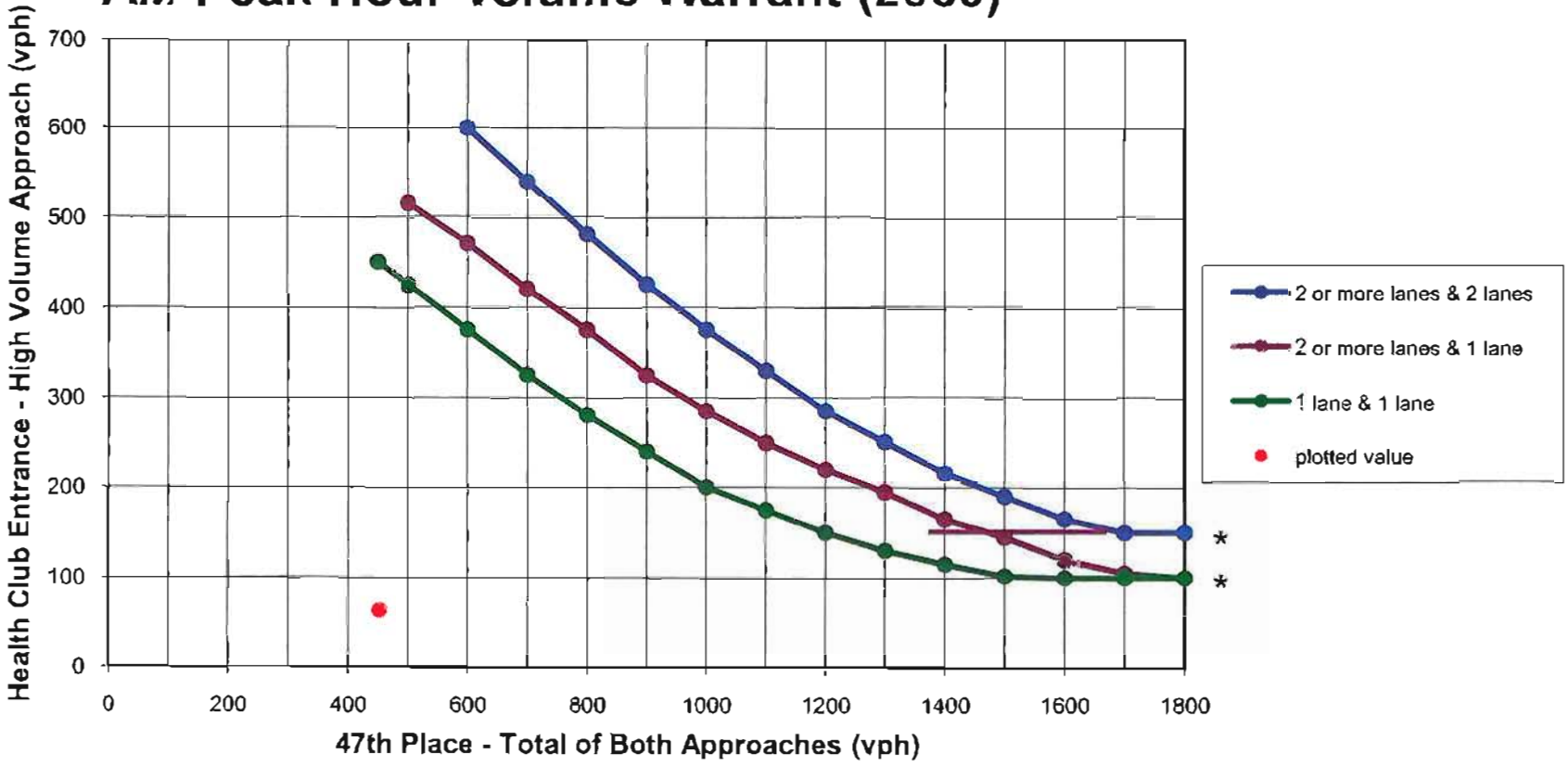
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & State Line
PM Peak Hour Volume Warrant (2030)



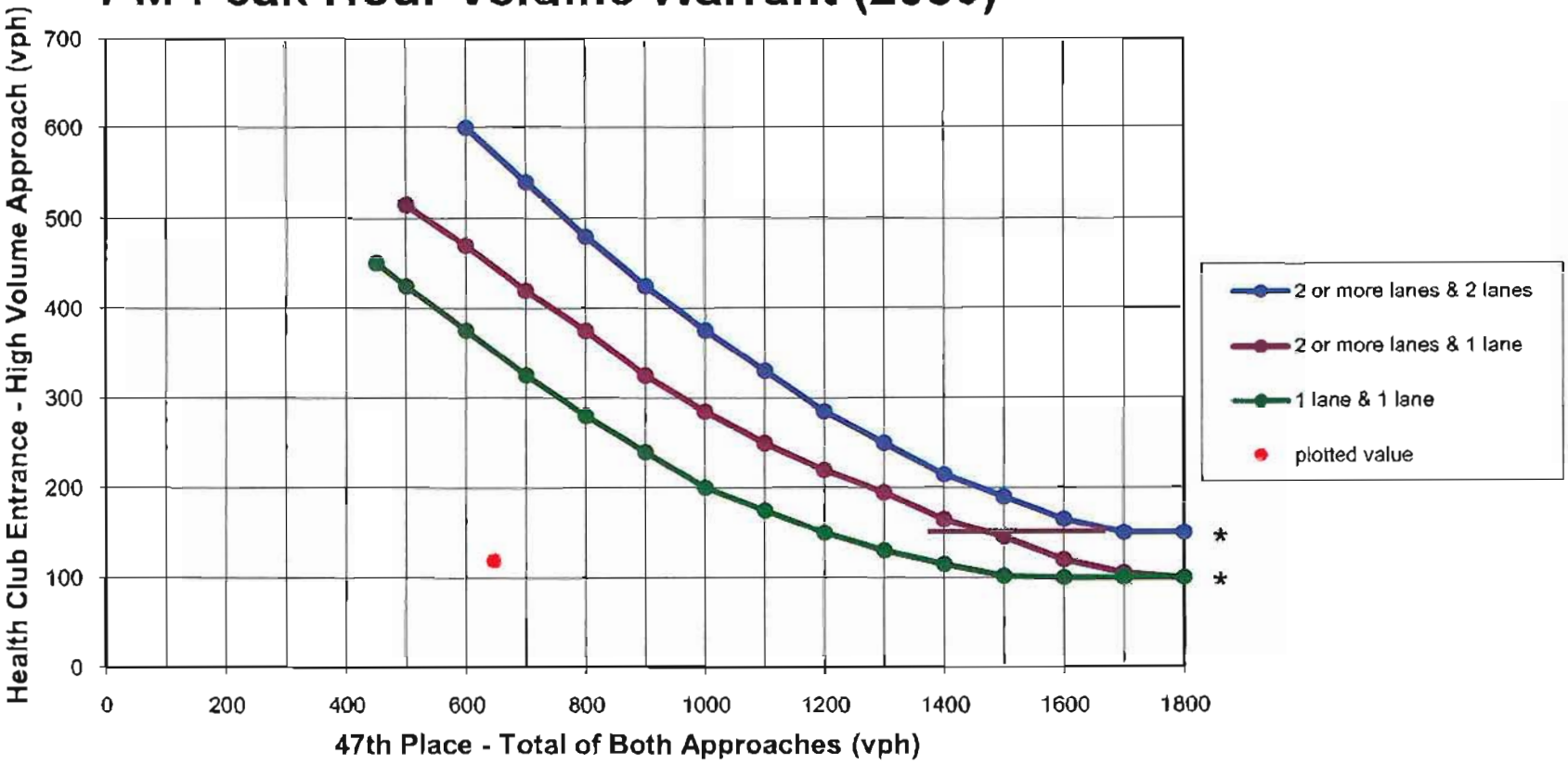
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Health Club Entrance/Exit
AM Peak Hour Volume Warrant (2030)



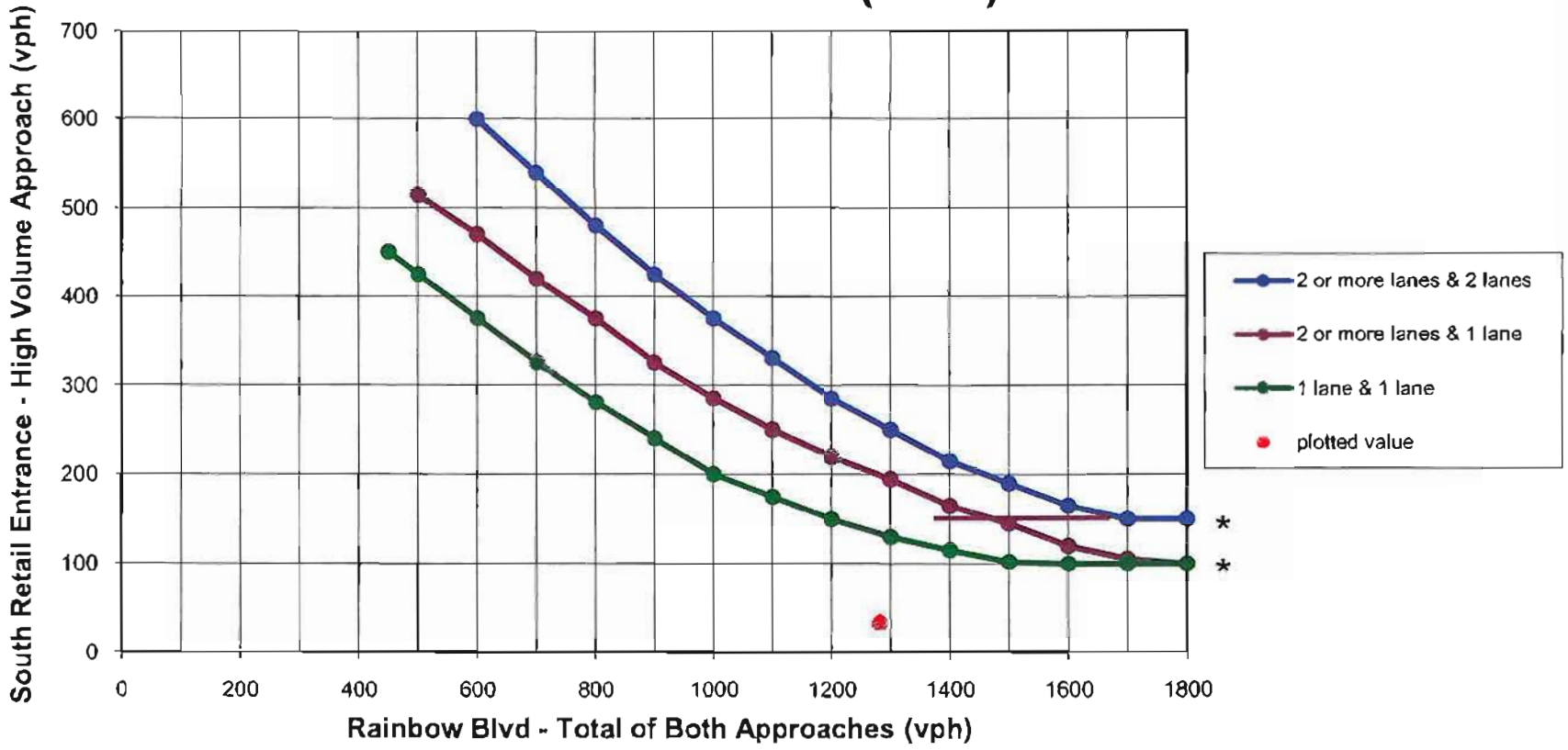
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

47th Place & Health Club Entrance/Exit
PM Peak Hour Volume Warrant (2030)



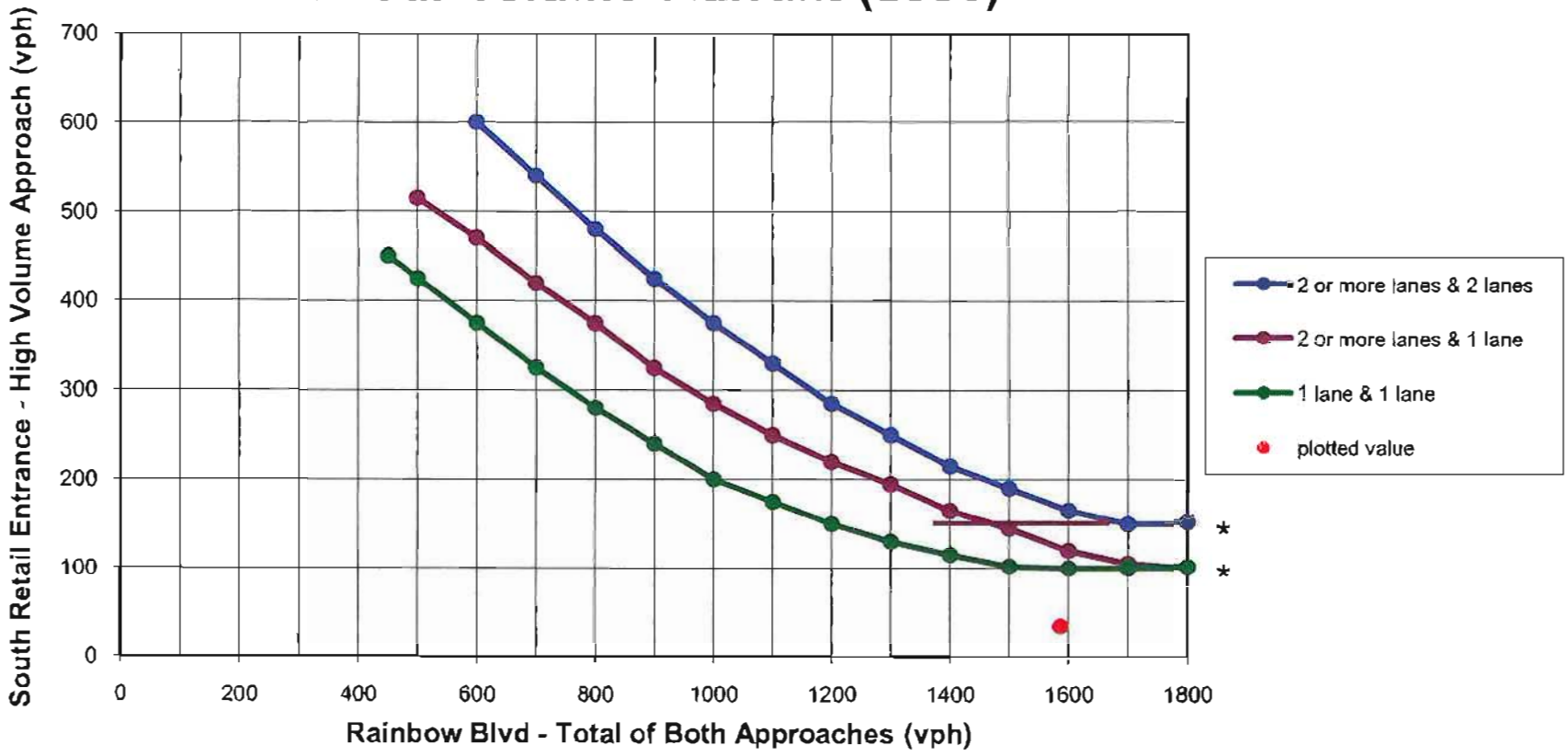
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

South Retail Entrance & Rainbow Blvd
AM Peak Hour Volume Warrant (2030)



*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.

South Retail Entrance & Rainbow Blvd
PM Peak Hour Volume Warrant (2030)



*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.

Capacity Analysis Reports

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & Rainbow Blvd*
Jurisdiction	*Westwood, KS/KCK (UG)/KDOT*
Analysis Year	*2011 - Ex + Parcels 1-4 2030*

Project Description *Woodside*

East/West Street: *47th Place* North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*734*	*87*	*167*	*407*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*797*	*94*	*181*	*442*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*47*		*124*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*51*	*0*	*134*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*181*	*51*		*134*			
C (m) (veh/h)		*757*	*96*		*617*			
v/c		*0.24*	*0.53*		*0.22*			
95% queue length		*0.93*	*2.39*		*0.82*			
Control Delay (s/veh)		*11.2*	*78.8*		*12.4*			
LOS		*B*	*F*		*B*			
Approach Delay (s/veh)	--	--	*30.7*					
Approach LOS	--	--	*D*					

HCS+™ Version 5.5 Generated: 3/14/2011 8:41 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place & Rainbow Blvd
Jurisdiction	Westwood, KS/KCK (UG)/KDOT
Analysis Year	2011 - Ex + Parcels 1-4 2030

Project Description: Woodside

East/West Street: 47th Place | North/South Street: Rainbow Blvd

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		372	80	129	1006	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	404	86	140	1093	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				100		184
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	108	0	199
Percent Heavy Vehicles	0	0	0	2	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		140	108		199			
C (m) (veh/h)		1070	138		799			
v/c		0.13	0.78		0.25			
95% queue length		0.45	4.76		0.98			
Control Delay (s/veh)		8.9	89.8		11.0			
LOS		A	F		B			
Approach Delay (s/veh)	--	--	38.7					
Approach LOS	--	--	E					

HCS+™ Version 5.5

Generated: 3/14/2011 8:41 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	AM

Site Information

Intersection	47th Place & Retail
Jurisdiction	Westwood, KS
Analysis Year	2011 - Ex + Parcels 1-4 2030

Project Description: Woodside

East/West Street: 47th Place | North/South Street:

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	6	245	3	2	156	39
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	6	266	3	2	169	42
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	1	0	2	21	0	14
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	1	0	2	22	0	15
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	6	2		3			37	
C (m) (veh/h)	1360	1295		644			598	
v/c	0.00	0.00		0.00			0.06	
95% queue length	0.01	0.00		0.01			0.20	
Control Delay (s/veh)	7.7	7.8		10.6			11.4	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	10.6			11.4		
Approach LOS	--	--	B			B		

HCS+™ Version 5.5

Generated: 3/18/2011 12:21 PM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & Retail*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2030 Conditions*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Center Retail*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*22*	*174*	*13*	*6*	*262*	*33*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*23*	*189*	*14*	*6*	*284*	*35*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*3*	*0*	*8*	*60*	*0*	*19*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*3*	*0*	*8*	*65*	*0*	*20*
Percent Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*23*	*6*		*11*			*85*	
C (m) (veh/h)	*1241*	*1369*		*659*			*473*	
v/c	*0.02*	*0.00*		*0.02*			*0.18*	
95% queue length	*0.06*	*0.01*		*0.05*			*0.65*	
Control Delay (s/veh)	*8.0*	*7.6*		*10.6*			*14.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*10.6*			*14.3*		
Approach LOS	--	--	*B*			*B*		

 HCS+™ Version 5.5 Generated: 3/18/2011 12:21 PM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & South Garage*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	
Analysis Time Period	*AM*		

Project Description *Woodside*

East/West Street: *47th Place*	North/South Street: *South Garage*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*268*	*0*	*10*	*163*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*291*	*0*	*10*	*177*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*34*		*0*			
Peak-Hour Factor, PHF	*0.92*	*1.00*	*0.92*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*10*		*36*				
C (m) (veh/h)		*1271*		*535*				
v/c		*0.01*		*0.07*				
95% queue length		*0.02*		*0.22*				
Control Delay (s/veh)		*7.9*		*12.2*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--		*12.2*				
Approach LOS	--	--		*B*				

HCS+™ Version 5.5 Generated: 3/17/2011 2:50 PM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & South Garage*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2011 Ex + Parcels 1-4 2030*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *South Garage*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*242*	*0*	*37*	*283*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*263*	*0*	*40*	*307*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*18*		*22*			
Peak-Hour Factor, PHF	*0.92*	*1.00*	*0.92*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*19*	*0*	*23*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*40*		*42*				
C (m) (veh/h)		*1301*		*562*				
v/c		*0.03*		*0.07*				
95% queue length		*0.10*		*0.24*				
Control Delay (s/veh)		*7.9*		*11.9*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*11.9*					
Approach LOS	--	--	*B*					

HCS+™ Version 5.5 Generated: 3/14/2011 8:42 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	AM

Site Information

Intersection	47th Place & State Line Rd
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011- Ex + Parcels 1-4 2030

Project ID *Woodside*

East/West Street: *47th Place* North/South Street: *State Line Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	34	119	52	30	125	37
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	93	380	26	12	141	32
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	221		207		542		200	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.2		0.2		0.1	
Prop. Right-Turns	0.3		0.2		0.1		0.2	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.1		-0.1		0.0		-0.1	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.20		0.18		0.48		0.18	
hd, final value (s)	6.66		6.74		5.86		6.46	
x, final value	0.41		0.39		0.88		0.36	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	4.7		4.7		3.9		4.5	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	471		457		606		450	
Delay (s/veh)	14.20		13.93		37.39		13.04	
LOS	B		B		E		B	
Approach: Delay (s/veh)	14.20		13.93		37.39		13.04	
LOS	B		B		E		B	
Intersection Delay (s/veh)	24.70							
Intersection LOS	C							

HCS+™ Version 5.5 Generated: 3/17/2011 2:50 PM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Brett Lauritsen
Agency/Co.	Olsson Associates
Date Performed	3/8/2011
Analysis Time Period	PM

Site Information

Intersection	47th Place & State Line Rd
Jurisdiction	Westwood, KS/KCMO
Analysis Year	2011- Ex + Parcels 1-4 2030

Project ID *Woodside*

East/West Street: *47th Place* North/South Street: *State Line Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	54	142	144	60	196	26
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	107	223	34	26	358	58
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LTR		LTR		LTR		LTR	
PHF	0.92		0.92		0.92		0.92	
Flow Rate (veh/h)	368		306		394		480	
% Heavy Vehicles	2		2		2		2	
No. Lanes	1		1		1		1	
Geometry Group	1		1		1		1	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2		0.2		0.3		0.1	
Prop. Right-Turns	0.4		0.1		0.1		0.1	
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
hLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
hRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	-0.2		0.0		0.0		-0.0	

Departure Headway and Service Time

hd, initial value (s)	3.20		3.20		3.20		3.20	
x, initial	0.33		0.27		0.35		0.43	
hd, final value (s)	9.13		9.66		9.19		9.12	
x, final value	0.93		0.82		1.01		1.22	
Move-up time, m (s)	2.0		2.0		2.0		2.0	
Service Time, t_s (s)	7.1		7.7		7.2		7.1	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	393		368		394		480	
Delay (s/veh)	60.89		44.39		78.12		146.41	
LOS	F		E		F		F	
Approach: Delay (s/veh)	60.89		44.39		78.12		146.41	
LOS	F		E		F		F	
Intersection Delay (s/veh)	88.53							
Intersection LOS	F							

 HCS+™ Version 5.5 Generated: 3/17/2011 2:50 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*47th Place & Health Club Ent*
Jurisdiction	*Westwood, KS*
Analysis Year	*2011 Ex + Parcels 1-4 2030*

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Health Club Entrance/Exit*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*266*			*131*	*19*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*1.00*	*1.00*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*38*	*289*	*0*	*0*	*142*	*20*
Percent Heavy Vehicles	*2*	–	–	*0*	--	–
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*22*		*42*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*23*	*0*	*45*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*38*						*68*	
C (m) (veh/h)	*1417*						*709*	
v/c	*0.03*						*0.10*	
95% queue length	*0.08*						*0.32*	
Control Delay (s/veh)	*7.6*						*10.6*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--					*10.6*	
Approach LOS	--	--					*B*	

HCS+™ Version 5.5

Generated: 3/14/2011 8:42 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Brett Lauritsen*	Intersection	*47th Place & Health Club Ent*
Agency/Co.	*Olsson Associates*	Jurisdiction	*Westwood, KS*
Date Performed	*3/8/2011*	Analysis Year	*2011 Ex + Parcels 1-4 2030*
Analysis Time Period	*PM*		

Project Description *Woodside*

East/West Street: *47th Place* | North/South Street: *Health Club Entrance/Exit*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*162*	*102*			*249*	*133*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*1.00*	*1.00*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*176*	*110*	*0*	*0*	*270*	*144*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*49*		*71*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*53*	*0*	*77*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*176*						*130*	
C (m) (veh/h)	*1145*						*452*	
v/c	*0.15*						*0.29*	
95% queue length	*0.54*						*1.18*	
Control Delay (s/veh)	*8.7*						*16.1*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--					*16.1*	
Approach LOS	--	--					*C*	

HCS+™ Version 5.5 Generated: 3/14/2011 8:42 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*AM*

Site Information

Intersection	*Rainbow Blvd & Retail/Apt Sout*
Jurisdiction	*Westwood, KS/KCK (UG)/KDOT*
Analysis Year	*2011 - Ex + Parcels 1-4 2030*

Project Description *Woodside*

East/West Street: *Retail/Apt South* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		819	9	8	446	
Peak-Hour Factor, PHF	1.00	0.92	0.92	0.92	0.92	1.00
Hourly Flow Rate, HFR (veh/h)	0	890	9	8	484	0
Percent Heavy Vehicles	0	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				31		2
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.92	1.00	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	33	0	2
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		8		35				
C (m) (veh/h)		751		197				
v/c		0.01		0.18				
95% queue length		0.03		0.63				
Control Delay (s/veh)		9.8		27.2				
LOS		A		D				
Approach Delay (s/veh)	--	--	27.2					
Approach LOS	--	--	D					

HCS+™ Version 5.5 Generated: 3/17/2011 3:38 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Brett Lauritsen*
Agency/Co.	*Olsson Associates*
Date Performed	*3/8/2011*
Analysis Time Period	*PM*

Site Information

Intersection	*Rainbow Blvd & Retail/Apt Sout*
Jurisdiction	*Westwood, KS/KCK (UG)/KDOT*
Analysis Year	*2011 - Ex + Parcels 1-4 2030*

Project Description *Woodside*

East/West Street: *Retail/Apt South* | North/South Street: *Rainbow Blvd*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*444*	*37*	*30*	*1076*	
Peak-Hour Factor, PHF	*1.00*	*0.92*	*0.92*	*0.92*	*0.92*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*482*	*40*	*32*	*1169*	*0*
Percent Heavy Vehicles	*0*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*26*		*8*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.92*	*1.00*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*28*	*0*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*32*		*36*				
C (m) (veh/h)		*1041*		*224*				
v/c		*0.03*		*0.16*				
95% queue length		*0.10*		*0.56*				
Control Delay (s/veh)		*8.6*		*24.1*				
LOS		*A*		*C*				
Approach Delay (s/veh)	--	--	*24.1*					
Approach LOS	--	--	*C*					

HCS+™ Version 5.5

Generated: 3/14/2011 8:43 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	17	204	4	9	13	109	720	29	22	366	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		0.99			0.97	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3499			3418	
Flt Permitted	0.52	1.00			1.00	1.00		0.80			0.90	
Satd. Flow (perm)	968	1604			1863	1583		2803			3067	
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)	295	18	222	4	10	14	118	783	32	24	398	115
RTOR Reduction (vph)	0	152	0	0	0	14	0	2	0	0	22	0
Lane Group Flow (vph)	295	88	0	0	14	0	0	931	0	0	515	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	22.2	22.2			2.5	2.5		38.3			38.3	
Effective Green, g (s)	22.2	22.2			2.5	2.5		38.3			38.3	
Actuated g/C Ratio	0.31	0.31			0.04	0.04		0.54			0.54	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	467	502			66	56		1514			1657	
v/s Ratio Prot	c0.13	0.05										
v/s Ratio Perm	c0.07				0.01	0.00		c0.33			0.17	
v/c Ratio	0.63	0.17			0.21	0.01		0.61			0.31	
Uniform Delay, d1	20.2	17.7			33.2	33.0		11.2			9.0	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	2.8	0.2			1.6	0.1		1.9			0.5	
Delay (s)	23.0	17.9			34.9	33.1		13.1			9.5	
Level of Service	C	B			C	C		B			A	
Approach Delay (s)		20.7			34.0			13.1			9.5	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.9	Sum of lost time (s)	10.4
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	240	14	14	933	537
v/c Ratio	0.67	0.40	0.08	0.09	0.59	0.31
Control Delay	28.4	5.4	32.5	18.1	13.1	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.4	5.4	32.5	18.1	13.1	8.9
Queue Length 50th (ft)	104	5	5	0	101	42
Queue Length 95th (ft)	171	49	23	16	238	106
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	507	1088	553	480	1591	1759
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.22	0.03	0.03	0.59	0.31

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	14	162	34	26	34	162	387	7	20	939	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.97	
Flt Protected	0.95	1.00			0.97	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3482			3429	
Flt Permitted	0.42	1.00			0.72	1.00		0.52			0.94	
Satd. Flow (perm)	777	1605			1342	1583		1836			3225	
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)	257	15	176	37	28	37	176	421	8	22	1021	265
RTOR Reduction (vph)	0	34	0	0	0	33	0	1	0	0	20	0
Lane Group Flow (vph)	257	157	0	0	65	4	0	604	0	0	1288	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	22.6	22.6			7.3	7.3		40.1			40.1	
Effective Green, g (s)	22.6	22.6			7.3	7.3		40.1			40.1	
Actuated g/C Ratio	0.31	0.31			0.10	0.10		0.55			0.55	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	377	496			134	158		1007			1769	
v/s Ratio Prot	c0.09	0.10										
v/s Ratio Perm	c0.12				0.05	0.00		0.33			c0.40	
v/c Ratio	0.68	0.32			0.49	0.02		1.28dl			0.73	
Uniform Delay, d1	20.6	19.3			31.1	29.7		11.1			12.4	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	5.0	0.4			2.8	0.1		2.6			2.7	
Delay (s)	25.7	19.7			33.9	29.7		13.7			15.1	
Level of Service	C	B			C	C		B			B	
Approach Delay (s)		23.1			32.4			13.7			15.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	73.1	Sum of lost time (s)	10.4
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	191	65	37	605	1308
v/c Ratio	0.69	0.37	0.41	0.17	1.28dl	0.72
Control Delay	31.2	16.2	38.0	12.3	14.8	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	16.2	38.0	12.3	14.8	15.3
Queue Length 50th (ft)	92	48	28	0	92	217
Queue Length 95th (ft)	155	97	65	25	161	330
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	370	922	466	574	1025	1819
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.21	0.14	0.06	0.59	0.72

Intersection Summary

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	17	204	4	9	13	109	720	29	22	366	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		0.99			0.97	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3499			3418	
Flt Permitted	0.53	1.00			1.00	1.00		0.79			0.89	
Satd. Flow (perm)	980	1604			1863	1583		2777			3055	
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)	295	18	222	4	10	14	118	783	32	24	398	115
RTOR Reduction (vph)	0	159	0	0	0	14	0	2	0	0	24	0
Lane Group Flow (vph)	295	81	0	0	14	0	0	931	0	0	513	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	25.6	25.6			2.4	2.4		54.0			54.0	
Effective Green, g (s)	25.6	25.6			2.4	2.4		54.0			54.0	
Actuated g/C Ratio	0.28	0.28			0.03	0.03		0.60			0.60	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	437	456			50	42		1666			1833	
v/s Ratio Prot	c0.14	0.05										
v/s Ratio Perm	c0.06				0.01	0.00		c0.34			0.17	
v/c Ratio	0.68	0.18			0.28	0.01		0.56			0.28	
Uniform Delay, d1	27.7	24.3			43.0	42.6		10.8			8.7	
Progression Factor	1.00	1.00			1.00	1.00		0.89			1.00	
Incremental Delay, d2	4.1	0.2			3.1	0.1		1.3			0.4	
Delay (s)	31.8	24.5			46.0	42.7		11.0			9.0	
Level of Service	C	C			D	D		B			A	
Approach Delay (s)		28.5			44.4			11.0			9.0	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	295	240	14	14	933	537
v/c Ratio	0.73	0.42	0.12	0.12	0.53	0.27
Control Delay	40.2	6.5	41.8	21.5	10.6	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	40.2	6.5	41.8	21.5	10.9	8.0
Queue Length 50th (ft)	158	8	8	0	88	50
Queue Length 95th (ft)	207	56	27	19	255	105
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	438	698	124	119	1764	1960
Starvation Cap Reductn	0	0	0	0	255	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.34	0.11	0.12	0.62	0.27

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	236	14	162	34	26	34	162	387	7	20	939	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95			0.95	
Frt	1.00	0.86			1.00	0.85		1.00			0.97	
Flt Protected	0.95	1.00			0.97	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3482			3429	
Flt Permitted	0.71	1.00			0.49	1.00		0.50			0.94	
Satd. Flow (perm)	1331	1605			919	1583		1777			3222	
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)	257	15	176	37	28	37	176	421	8	22	1021	265
RTOR Reduction (vph)	0	46	0	0	0	34	0	1	0	0	18	0
Lane Group Flow (vph)	257	145	0	0	65	3	0	604	0	0	1290	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			1			1	
Permitted Phases	4			8		8	1			1		
Actuated Green, G (s)	23.9	23.9			8.4	8.4		55.7			55.7	
Effective Green, g (s)	23.9	23.9			8.4	8.4		55.7			55.7	
Actuated g/C Ratio	0.27	0.27			0.09	0.09		0.62			0.62	
Clearance Time (s)	5.2	5.2			5.2	5.2		5.2			5.2	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	404	426			86	148		1100			1994	
v/s Ratio Prot	c0.07	0.09										
v/s Ratio Perm	c0.10				0.07	0.00		0.34			c0.40	
v/c Ratio	0.64	0.34			0.76	0.02		0.99dl			0.65	
Uniform Delay, d1	29.4	26.7			39.8	37.1		9.9			10.9	
Progression Factor	1.00	1.00			1.00	1.00		0.91			1.00	
Incremental Delay, d2	3.3	0.5			30.9	0.1		1.9			1.6	
Delay (s)	32.7	27.2			70.7	37.1		11.0			12.5	
Level of Service	C	C			E	D		B			B	
Approach Delay (s)		30.3			58.5			11.0			12.5	
Approach LOS		C			E			B			B	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.4
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	257	191	65	37	605	1308
v/c Ratio	0.66	0.42	0.67	0.18	0.99dl	0.64
Control Delay	38.5	19.9	69.7	13.9	12.0	12.9
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.1
Total Delay	38.5	19.9	69.7	13.9	12.2	13.0
Queue Length 50th (ft)	125	58	36	0	82	218
Queue Length 95th (ft)	181	106	77	27	190	353
Internal Link Dist (ft)		394	88		249	281
Turn Bay Length (ft)	250					
Base Capacity (vph)	457	693	182	343	1122	2053
Starvation Cap Reductn	0	0	0	0	105	0
Spillback Cap Reductn	0	1	0	0	0	77
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.28	0.36	0.11	0.59	0.66

Intersection Summary

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	47	124	734	87	167	407
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.98			1.00
Flt Protected	0.95	1.00	1.00			0.99
Satd. Flow (prot)	1770	1583	3483			3488
Flt Permitted	0.95	1.00	1.00			0.59
Satd. Flow (perm)	1770	1583	3483			2097
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	135	798	95	182	442
RTOR Reduction (vph)	0	123	6	0	0	0
Lane Group Flow (vph)	51	12	887	0	0	624
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.1	8.1	73.9			73.9
Effective Green, g (s)	8.1	8.1	73.9			73.9
Actuated g/C Ratio	0.09	0.09	0.82			0.82
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	159	142	2860			1722
v/s Ratio Prot	c0.03		0.25			
v/s Ratio Perm		0.01				c0.30
v/c Ratio	0.32	0.09	0.31			0.36
Uniform Delay, d1	38.4	37.6	1.9			2.1
Progression Factor	1.00	1.00	1.00			0.47
Incremental Delay, d2	1.2	0.3	0.3			0.6
Delay (s)	39.5	37.8	2.2			1.5
Level of Service	D	D	A			A
Approach Delay (s)	38.3		2.2			1.5
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	51	135	893	624
v/c Ratio	0.32	0.51	0.31	0.36
Control Delay	42.9	14.1	2.3	1.7
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	42.9	14.1	2.3	1.8
Queue Length 50th (ft)	28	0	42	11
Queue Length 95th (ft)	61	51	72	18
Internal Link Dist (ft)	95		158	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	413	473	2864	1723
Starvation Cap Reductn	0	0	0	398
Spillback Cap Reductn	0	6	151	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.12	0.29	0.33	0.47

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	100	184	372	80	129	1006
Ideal Flow (vphpl)	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
Frt	1.00	0.85	0.97			1.00
Flt Protected	0.95	1.00	1.00			0.99
Satd. Flow (prot)	1770	1583	3445			3519
Flt Permitted	0.95	1.00	1.00			0.81
Satd. Flow (perm)	1770	1583	3445			2868
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	200	404	87	140	1093
RTOR Reduction (vph)	0	176	15	0	0	0
Lane Group Flow (vph)	109	24	476	0	0	1233
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	10.8	10.8	71.2			71.2
Effective Green, g (s)	10.8	10.8	71.2			71.2
Actuated g/C Ratio	0.12	0.12	0.79			0.79
Clearance Time (s)	4.0	4.0	4.0			4.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	212	190	2725			2269
v/s Ratio Prot	c0.06		0.14			
v/s Ratio Perm		0.02				c0.43
v/c Ratio	0.51	0.13	0.17			0.54
Uniform Delay, d1	37.1	35.4	2.3			3.4
Progression Factor	1.00	1.00	1.00			0.92
Incremental Delay, d2	2.1	0.3	0.1			0.8
Delay (s)	39.2	35.7	2.4			3.9
Level of Service	D	D	A			A
Approach Delay (s)	36.9		2.4			3.9
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	200	491	1233
v/c Ratio	0.51	0.55	0.18	0.54
Control Delay	44.9	11.3	2.3	4.4
Queue Delay	0.0	0.0	0.0	0.5
Total Delay	44.9	11.3	2.3	4.9
Queue Length 50th (ft)	59	0	22	98
Queue Length 95th (ft)	106	58	43	13
Internal Link Dist (ft)	95		158	249
Turn Bay Length (ft)		200		
Base Capacity (vph)	334	461	2739	2267
Starvation Cap Reductn	0	0	0	525
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.33	0.43	0.18	0.71

Intersection Summary