Report Prepared for Tanner & White

Woodside Development 47th Place and Rainbow Boulevard Westwood, Kansas



Olsson Associates Project Number 010-2516 March 2011



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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:

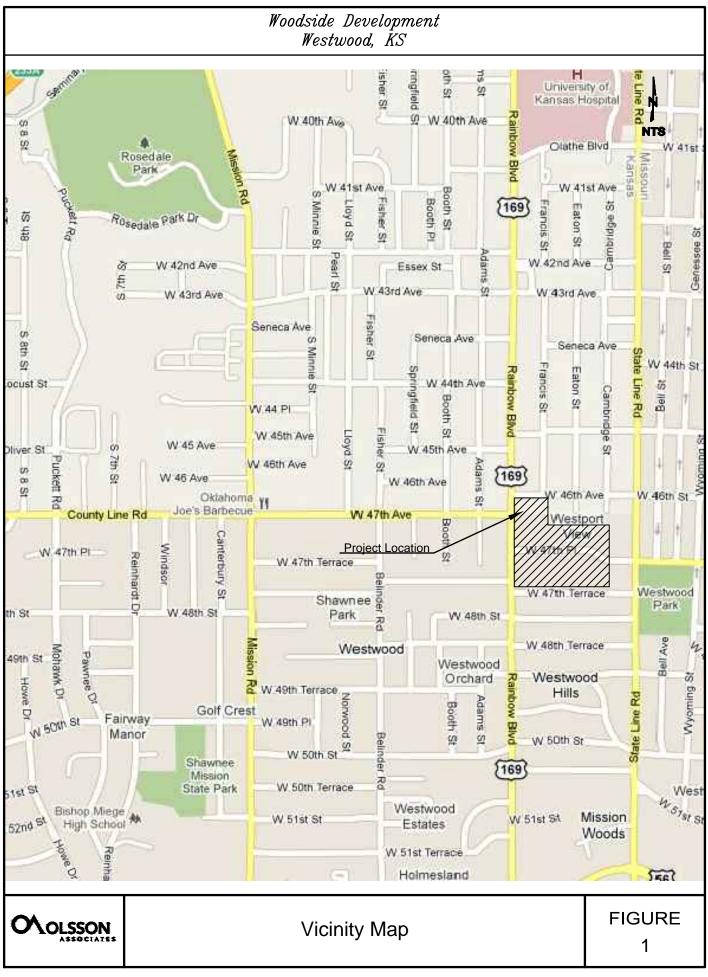
- Existing conditions
- Existing conditions plus Parcels 1 & 3 only
- Existing conditions plus Parcels 1 & 3 plus Parcels 2 & 4 (full build-out)
- Future conditions (existing conditions plus full build-out plus background traffic growth on Rainbow Boulevard)

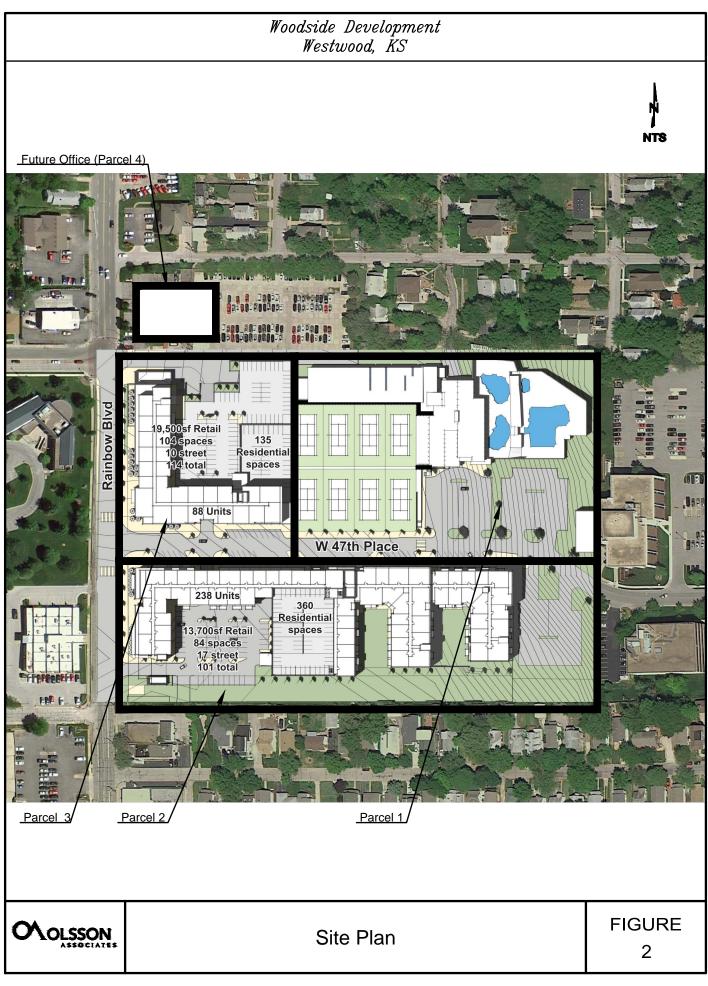
The study area intersections include the following:

- 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)





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.

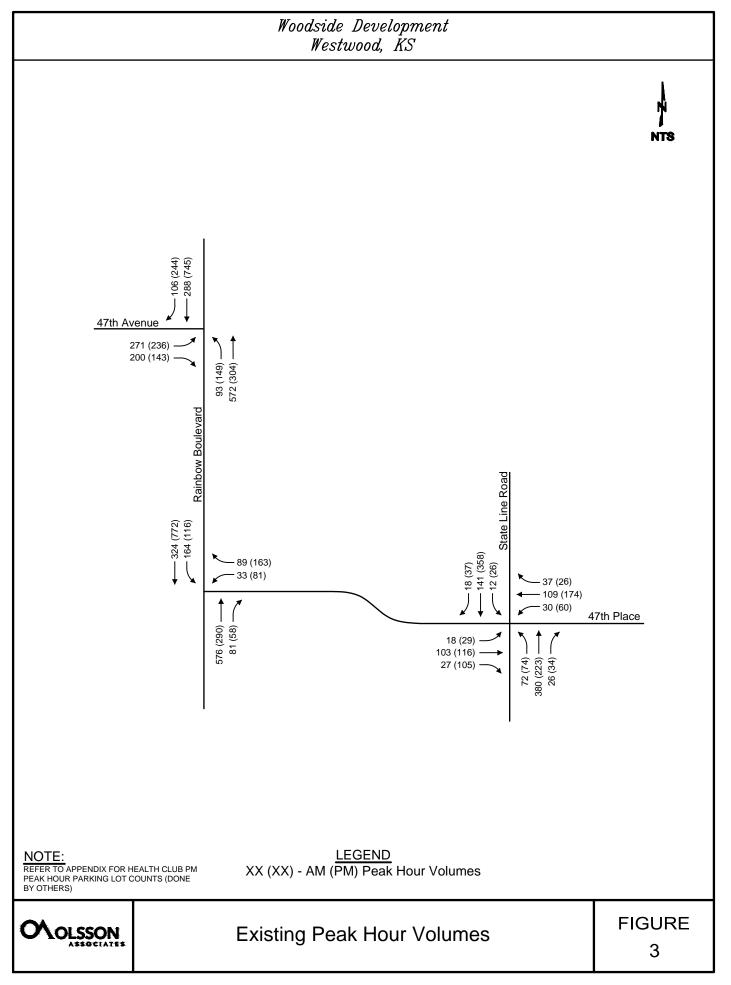
Level-of-Service Criteria								
Level of Service (LOS)	<u>Stop Control</u> Approach Delay sec/veh	Signal Control Control Delay sec/veh						
A	≤ 1 0	≤ 10						
В	>10 and ≤ 15	>10 and ≤ 20						
С	>15 and ≤ 25	>20 and ≤ 35						
D	>25 and ≤ 35	>35and ≤ 55						
E	>35 and ≤ 50	>55 and ≤ 80						
F	>50	>80						

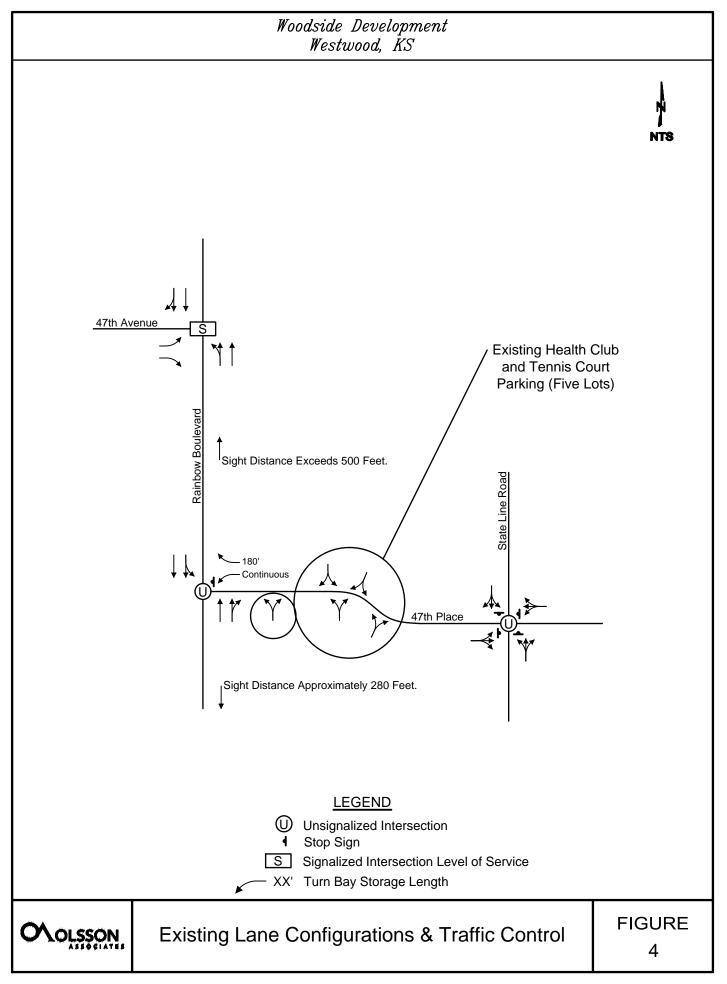
Table 1: Intersection Level of Service Summary

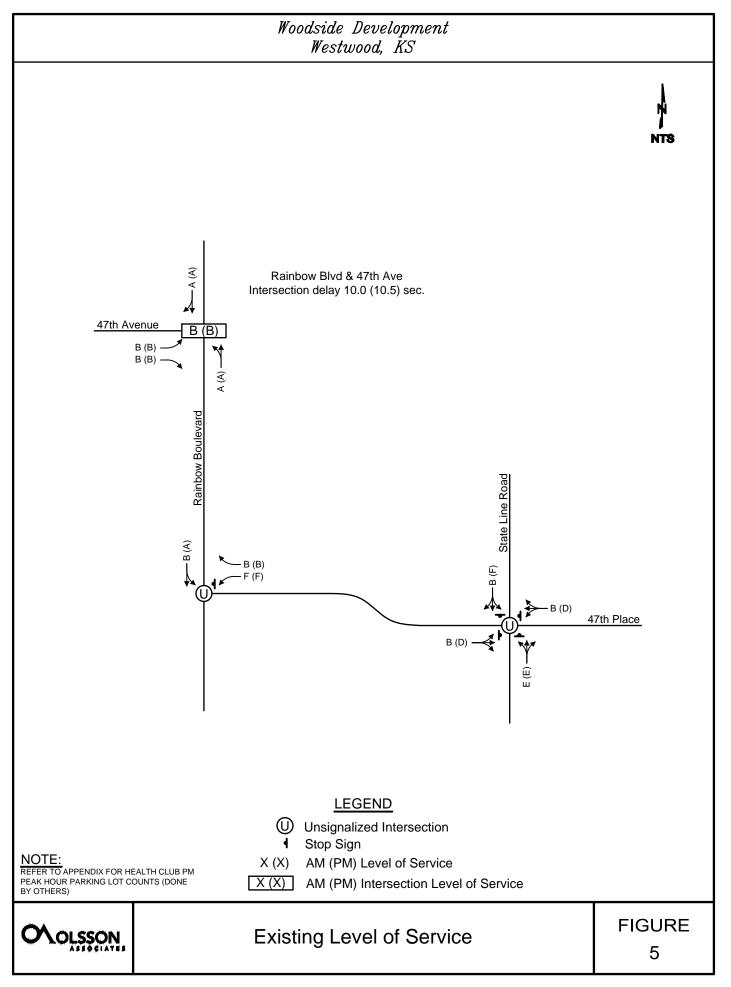
Capacity analysis was conducted for the study intersections. Currently, the signalized Tintersection at 47th Avenue and Rainbow Boulevard is expected to operate at LOS B or better during both AM and PM peak hour periods. All movements at the unsignalized study intersections are expected to operate at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







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 (Senerati	on - W	loodside Deve	elopme	ent (All P	arcels)			
ITE				Trip Gen.	Daily	Trip Dist	ribution	Daily	Trips	Parce
Code/Pag e	Land Use	Size		Avg. Rate/Eq.	Trips	Enter	Exit	Enter	Exit	
492/897* 814/1387	Health/Fitness Club Specialty Retail Center	35,00 0 19,50 0	SF SF	- Average	- 864	- 50%	- 50%	- 432	- 432	1 3
		00	Unit	-						
220/326	Apartment	88	S	Equation	657	50%	50%	329	328	3
Total					1,521			761	760	
		AN	l Peak	Hour Trip Gene	ration					
ITE		7	- oun	Trip Gen.	Peak	Trip Dist	ribution	AM Pe		_
Code/Pag e	Land Use	Size		Avg. Rate/Eq.	Hr Trips	Enter	Exit	Tri Enter	Exit	Parce I
492/898**	Health/Fitness Club Specialty Retail	35,00 0 19,50	SF	Average	0	45%	55%	0	0	1
814/1387^	Center	0	SF Unit	Equation	19	50%	50%	9	10	3
220/328	Apartment	88	S	Equation	47	20%	80%	9	38	3
Total					66			18	48	
			I D I							
		PN	ГРеак	Hour Trip Gene	ration					
ITE			Trip Gen.		Peak	Trip Distribution		PM Peak Hr Trips		Parce
Code/Pag e	Land Use	Size		Avg. Rate/Eq.	Hr Trips	Enter	Exit	Enter	Exit	I
492/899** 814/1388	Health/Fitness Club Specialty Retail Center	35,00 0 19,50 0	SF SF Unit	Equation Equation	0 68	57% 44%	43% 56%	0 30	0 38	1 3
220/329	Apartment	88	S	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*.

Roadway	То	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%

Table 3: Trip Distribution

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.

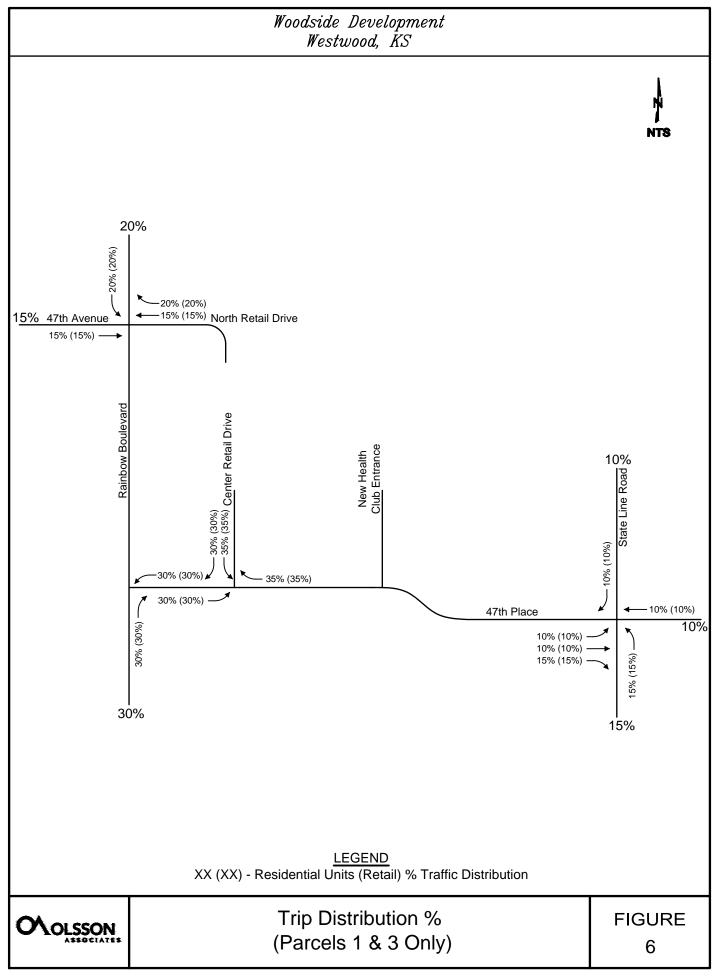
5.4 Site Circulation, Internal Capture & Lane Configurations

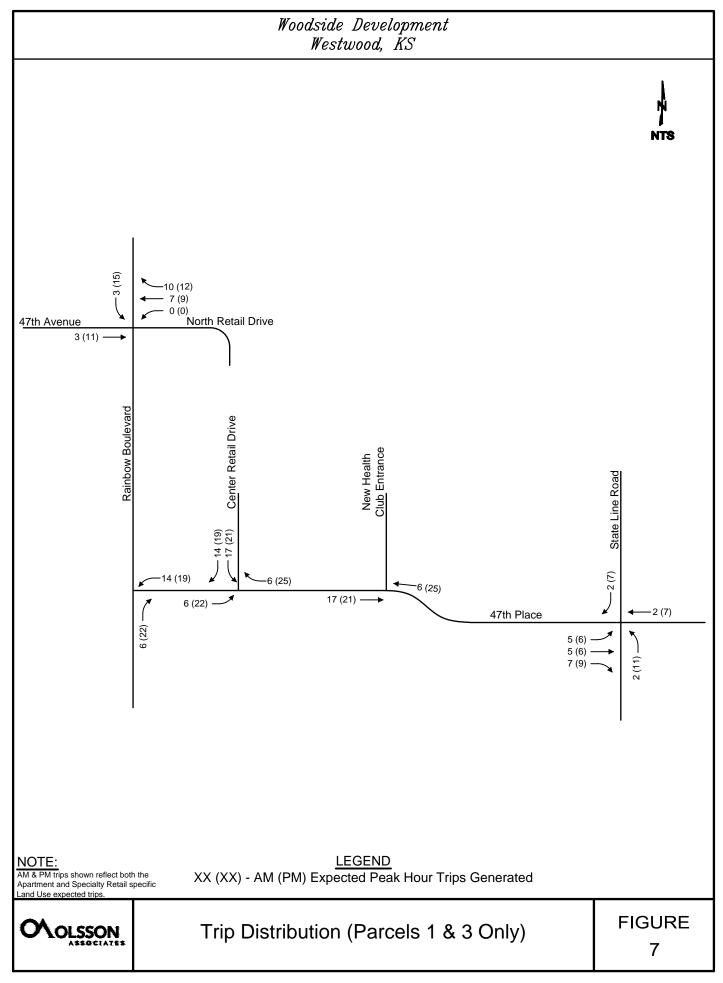
A proposed site plan was provided March 8, 2011. This plan illustrates the proposed improvements in all phases. As opposed to 47th Place potentially experiencing high volumes of pass-thru traffic in existing conditions, this particular development will benefit from consolidation of all health and fitness 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.

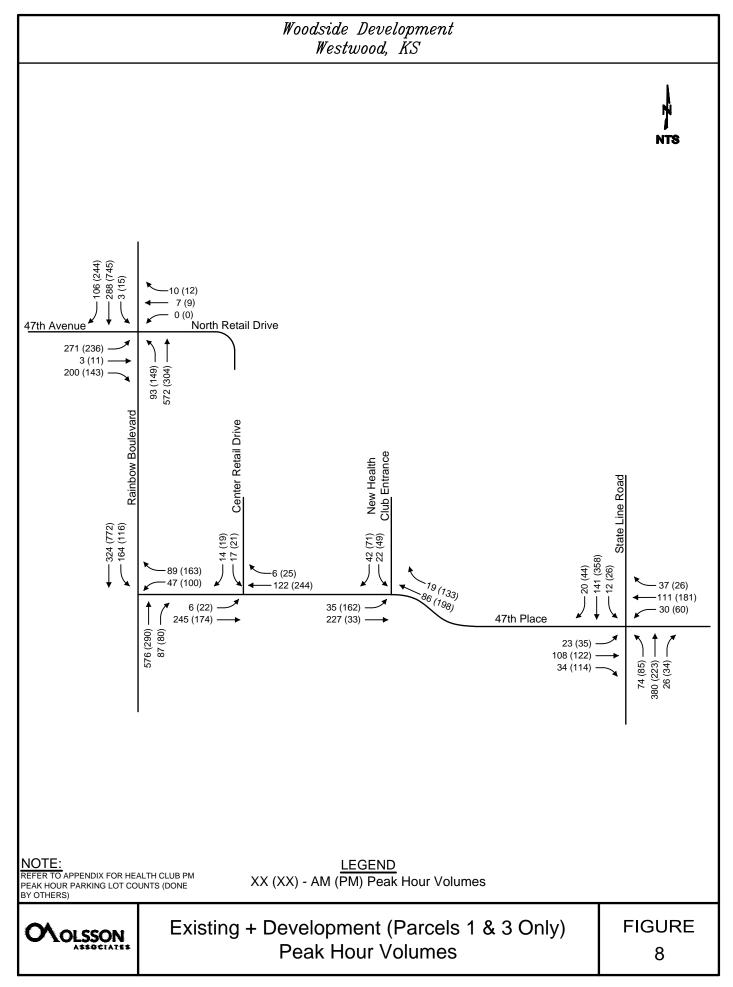
Internal trip capture between residential units and retail land uses was investigated for this site based on Chapter 7 in the 2004 version of ITE's Trip Generation Handbook. In calculations, internal trip capture was determined to be minimal (less than 12%) so for purposes of this study, internal trip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

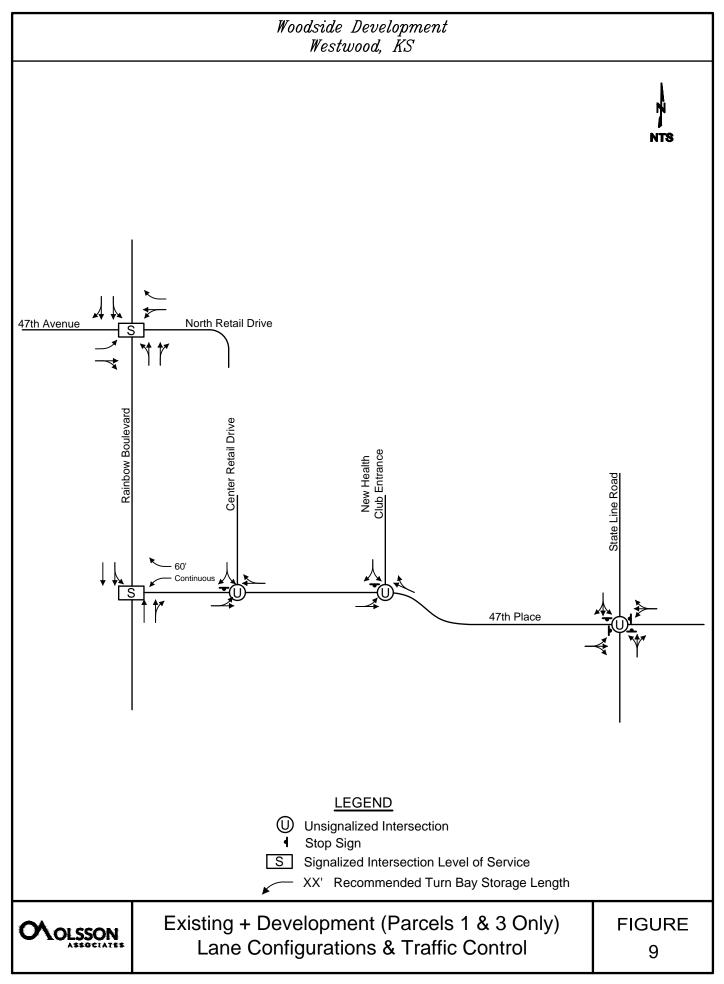
47th Place should have separate westbound left and right turn lanes. To accommodate peak hour queuing, the westbound right turn lane should accommodate at least 3 vehicles (60 feet).

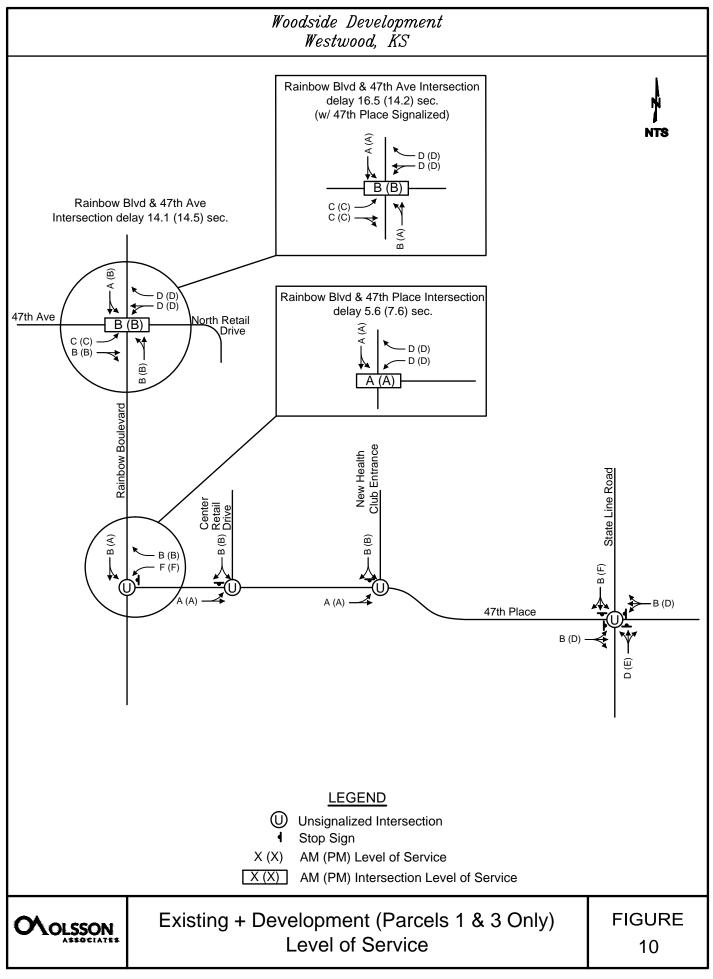
Since Rainbow Boulevard is recommended to be signalized at 47th Place, southbound lanes should be restriped to provide for a thru/left turn lane for vehicles turning onto 47th Place, similar to existing striping for northbound left turning vehicles at 47th Avenue. The same restriping should be done north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











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.

Daily Trip Generation - Woodside Development (All Parcels) Trip ITE Trip Gen. Daily **Daily Trips** Distribution Parce Code/Pag Land Use Size Avg. Rate/Eg. Trips Enter Exit Enter Exit T е 35.00 Health/Fitness Club SF 492/897* 0 1 -Specialty Retail 15,70 Average 814/1387 Center 0 SF 696 50% 50% 348 348 2 Unit 220/326 Apartment 238 2 s Equation 1,566 50% 50% 783 783 Specialty Retail 19,50 814/1387 Center 0 SF Average 864 50% 50% 432 432 3 Unit 220/326 Apartment 88 Equation 657 50% 50% 329 328 3 s 50,00 710/1203 General Office Bldg 0 SF Equation 782 50% 50% 391 391 4 Total 4,565 2,283 2,282 **AM Peak Hour Trip Generation** Trip AM Peak Hr ITE Trip Gen. Peak Distribution Trips Parce Hr Avg. Rate/Eq. Code/Pag Land Use Size Enter Exit Enter Exit T Trips е 35.00 Health/Fitness Club SF 0 492/898** 0 Average 0 45% 55% 0 1 Specialty Retail 15,70 814/1387 Center SF Equation 16 50% 50% 8 8 2 0 Unit 220/328 Apartment 238 Equation 120 20% 80% 24 96 2 s **Specialty Retail** 19,50 814/1387 SF 3 Center 0 Equation 19 50% 50% 9 10 Unit 220/328 Apartment 88 Equation 47 20% 80% 9 38 3 s 50,00 710/1204 General Office Bldg SF Equation 108 88% 12% 4 0 95 13 310 145 Total 165 **PM Peak Hour Trip Generation** Trip PM Peak Hr ITE Trip Gen. Peak Trips Distribution Parce Hr Code/Pag I Land Use Size Avg. Rate/Eq. Enter Exit Enter Exit Trips е 35,00 492/899** Health/Fitness Club SF Equation 57% 43% 0 0 1 0 0 Specialty Retail 15,70 SF 814/1388 Center Equation 44% 2 0 59 56% 26 33 Unit 2 220/329 238 149 35% 97 52 Apartment Equation 65% s

Table 4: Trip Generation (Entire Project)

	Specialty Retail	19,50								
814/1388	Center	0	SF Unit	Equation	68	44%	56%	30	38	3
220/329	Apartment	88 50,00	S	Equation	66	65%	35%	43	23	3
710/1205	General Office Bldg	Ó	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.

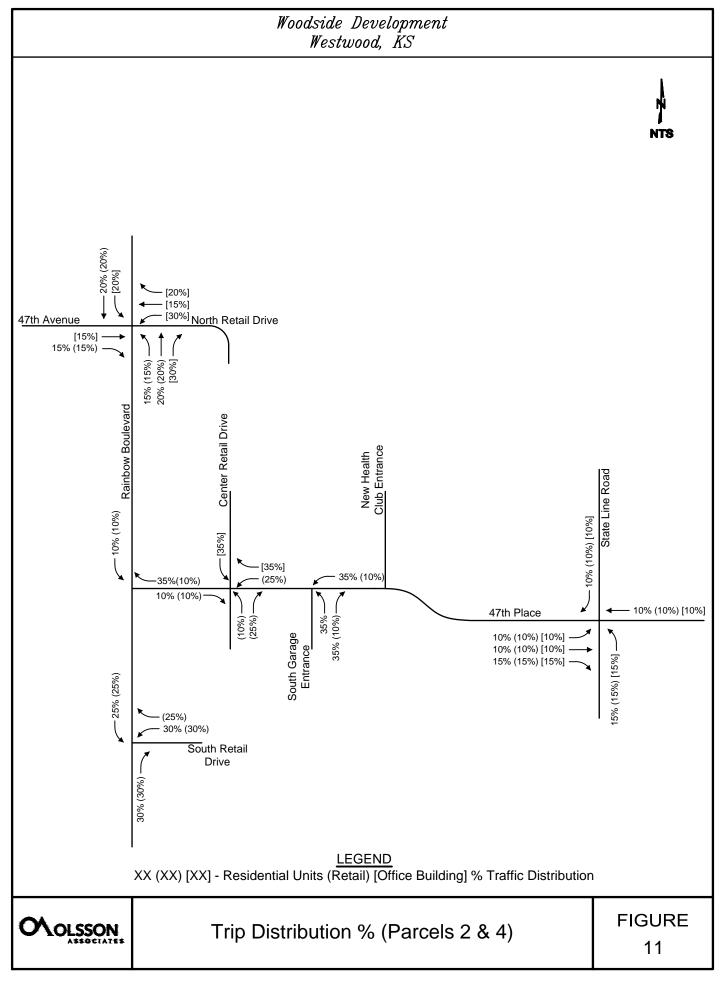
All movements at the study intersections are expected to operate at LOS D or better during the AM and PM peak hour periods with the exception of the 47th Place & State Line Road intersection during the PM peak (LOS F) and 47th Place and Rainbow Boulevard during both peak hours when analyzed as stop-controlled.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

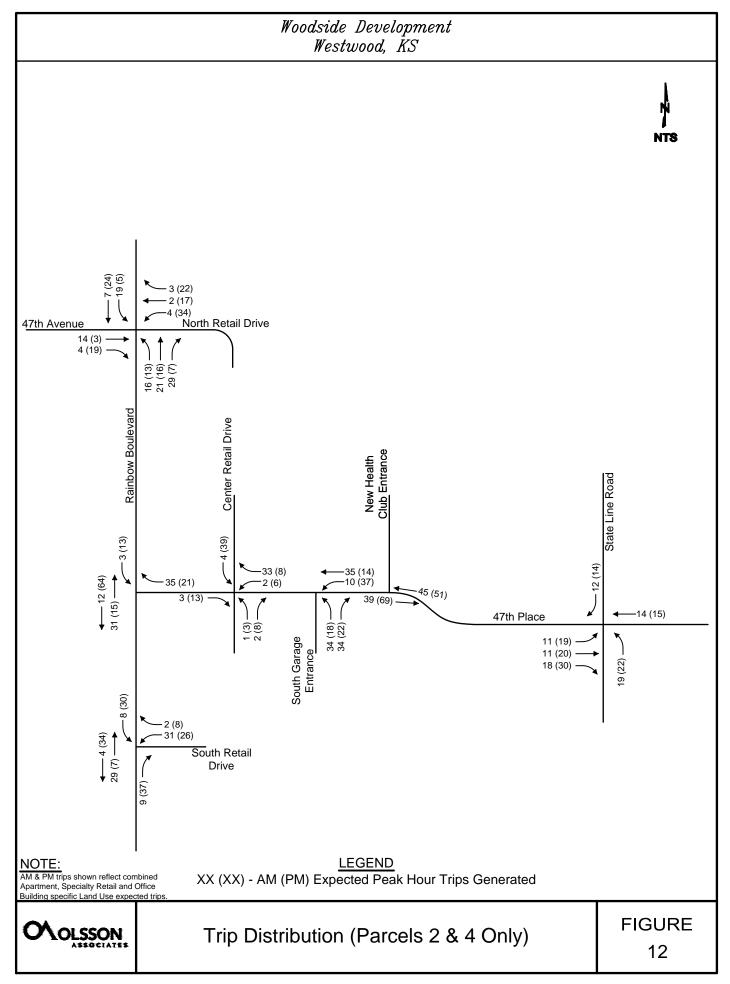
In the March 8th, 2011 site plan, the proposed south retail drive with access to Rainbow Boulevard south of 47th Place is currently staggered from 47th Terrace to the west. Moving the new south retail drive entrance further south approximately 80 feet to align with 47th Terrace to the west will eliminate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

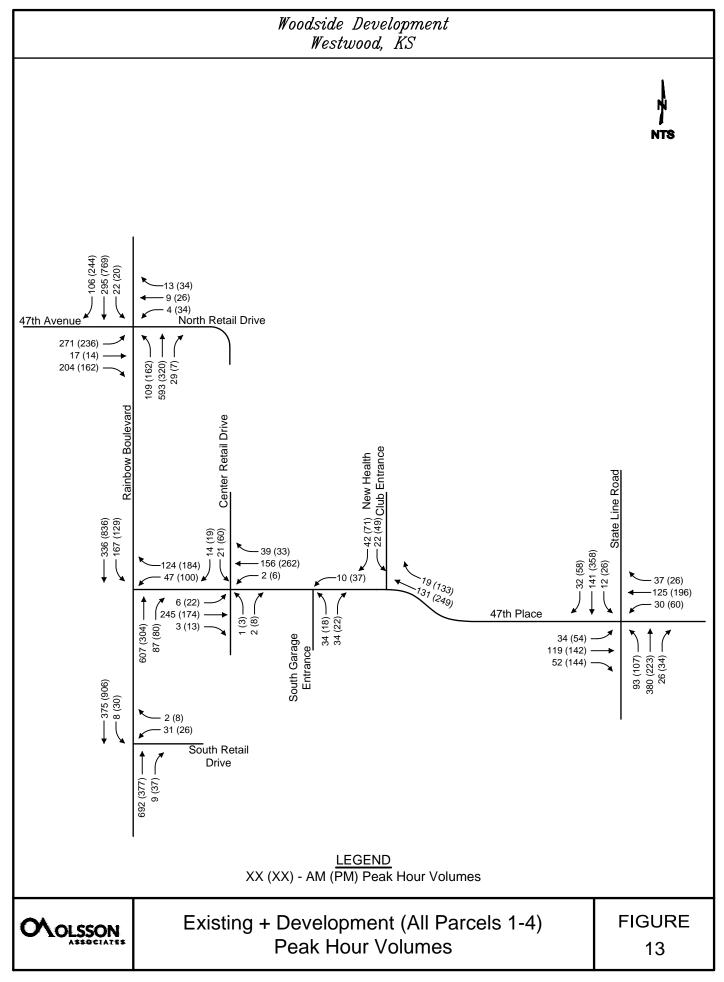
Rainbow Boulevard will be classified as a "D" route and the new south retail drive should be built as a Type 6 Access per the KDOT Corridor Management Policy. Per the policy, high volume access spacing along a "D" route is 195 feet for a Type 6 Access. The south retail drive appears to meet all KDOT's 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.

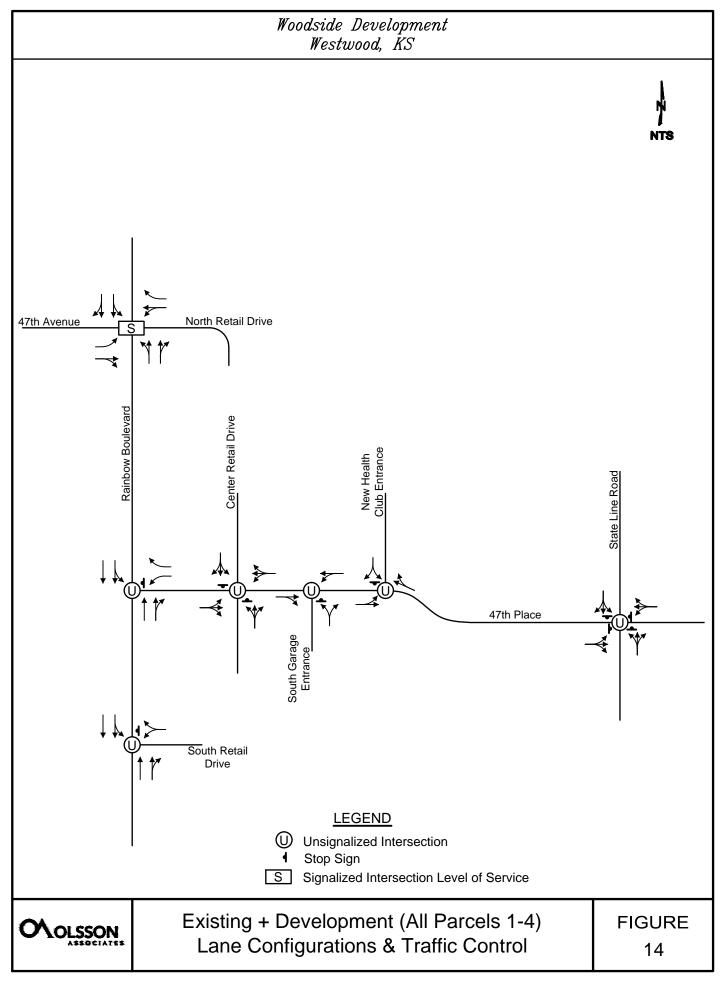
6.4 Site Circulation, Internal Capture & Lane Configurations

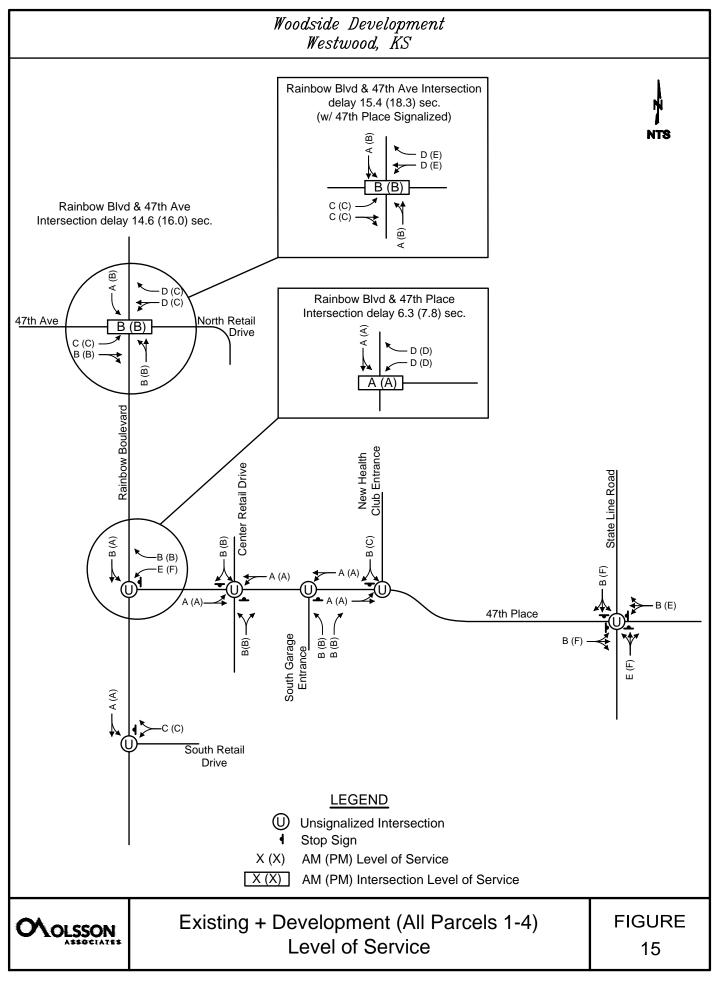
As in **Section 5.4**, internal trip capture between residential units, retail and general office building land uses was investigated for this site based on Chapter 7 in the 2004 version of ITE's Trip Generation Handbook. In calculations, internal trip capture was again determined to be minimal (less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











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 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.

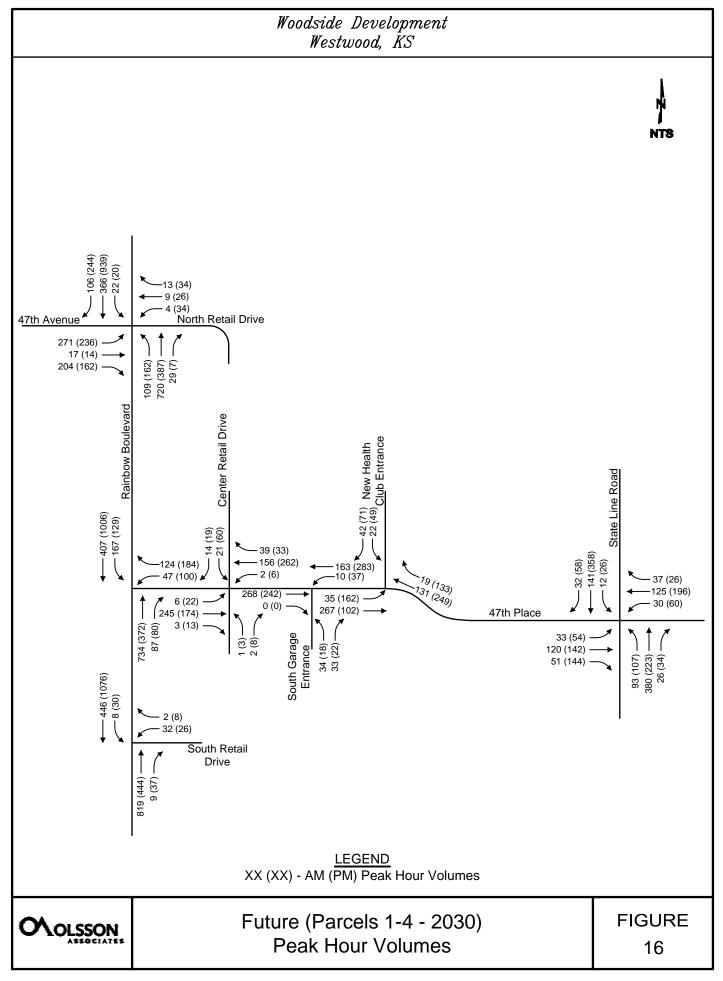
All movements at the State Line intersection are expected to operate at a LOS F except westbound traffic which may operate at a LOS E. While these levels of service may seem poor, unsignalized street movements can be expected to operate at a lower level of service during peak hour periods as higher major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

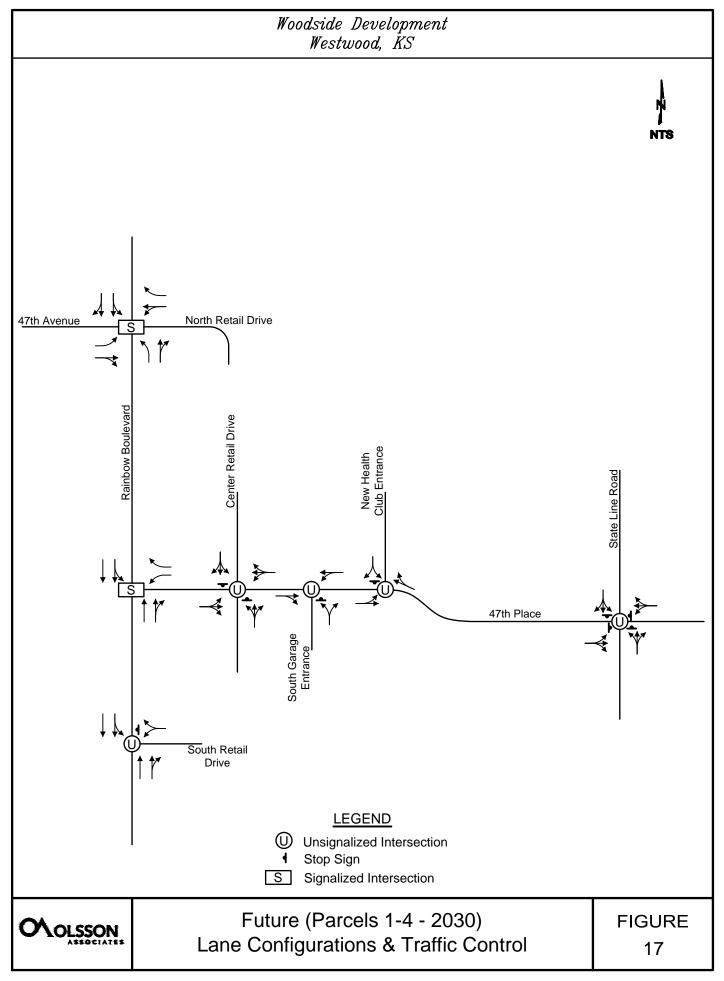
7.4 Site Circulation, Internal Capture & Lane Configurations

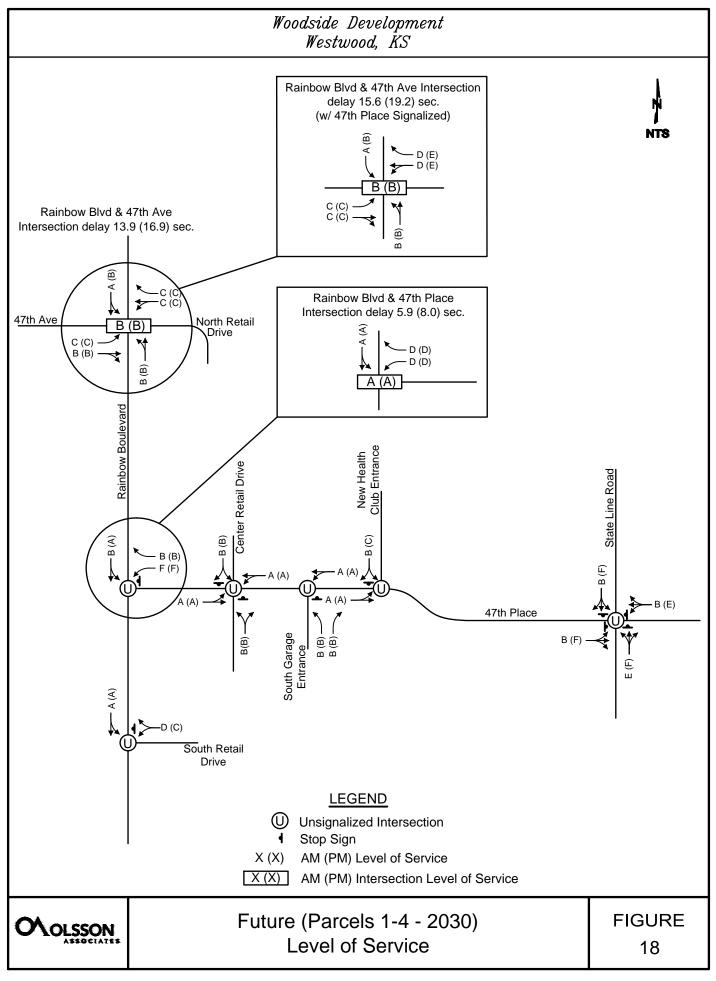
No major roadway geometry changes are recommended for future conditions based on estimated traffic growth discussed earlier.

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.







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:

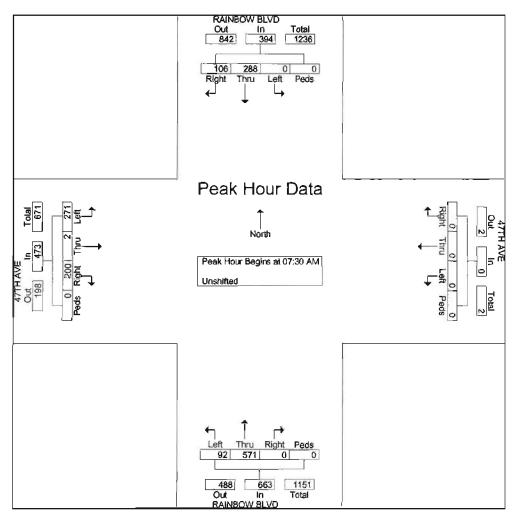
- Supplemental Information
 - Traffic Volumes
 - Parking Lot Volumes (By Others)
 - Development Schematic Plans (By Others)
 - KDOT ADT Calculations
- Existing
 - Signal Warrant Analysis
 - Capacity Analysis Reports
- Existing Plus Parcels 1 & 3
 - Signal Warrant Analysis
 - Capacity Analysis Reports
- 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

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

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Peak Hour fo	r Entire	Inters	ection	Begins	s at 07:3	MA 0															
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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	٥	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	ō	0	571	92	0	663	200	2	271	0	473	1530
% App. Total	26.9	73.1	0	0		0	Q	0	0		0	86.1	13.9	0		42.3	0.4	57.3	0		1
PHF	.914	.867	.000	.000	.887	.000	.000	000	.000	.000	.000	.892	.920	.000	.896	.833	.250	.847	.000	.924	.902

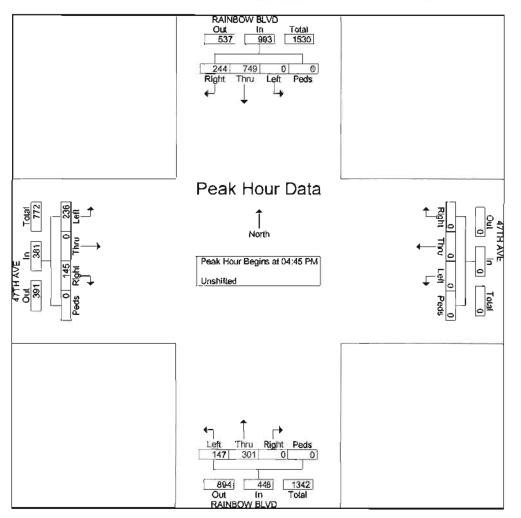


7301 West 133rd Street, Suite 200

RAINBOW BLVD 47TH AVE ΡM

Overland Park, KS 66213 File Name : Rainbow Blvd & 47th Ave PM Site Code : 00000000 Start Date : 11/16/2010 Page No : 3

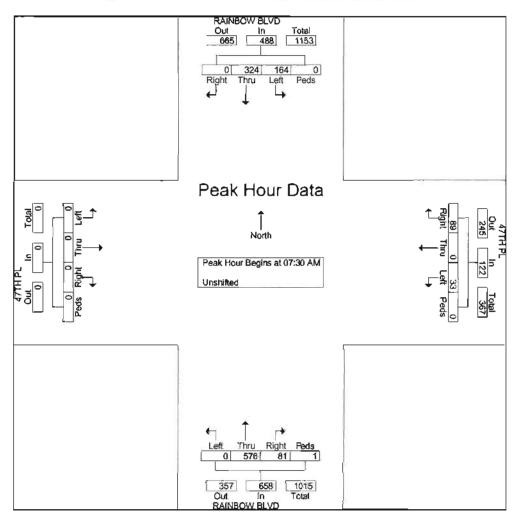
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05:00 PM	56	183	0	0	239	0	0	0	0	0	0	81	43	0	124	34	0	59	0	93	456
05:15 PM	72	217	0	0	289	0	0	0	0	0	0	83	29	0	112	43	0	59	0	102	503
05:30 PM	57	195	0	0	252	0	0	0	0	0	0	80	40	0	120	33	0	52	0	85	457
Total Volume	244	749	0	0	993	0	0	0	0	0	0	301	147	0	448	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



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

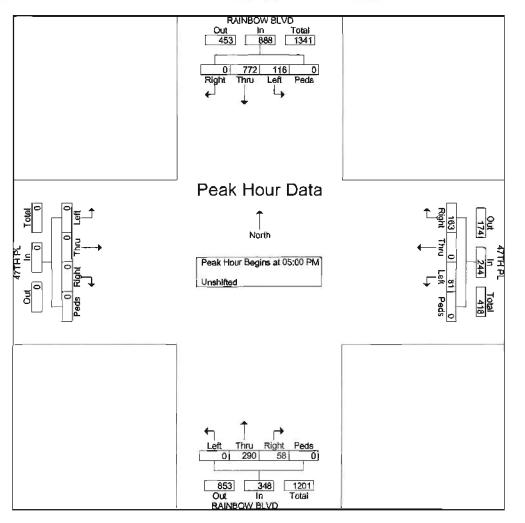
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07:45 AM	0	97	44	0	141	26	0	6	0	32	18	161	0	0	179	0	0	0	0	0	352
08:00 AM	0	71	35	0	106	21	0	10	0	31	21	161	0	0	182	0	0	0	0	0	319
08:15 AM	0	87	35	0	122	22	0	6	0	28	26	103	0	0	129	0	0	0	0	0	279
Total Volume	0	324	164	0	488	89	0	33	0	122	81	576	0	1	658	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



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

RAINBOW BLVD 47TH PL PM File Name : Rainbow Blvd & 47th PI PM Site Code : 00000000 Start Date : 11/16/2010 Page No : 3

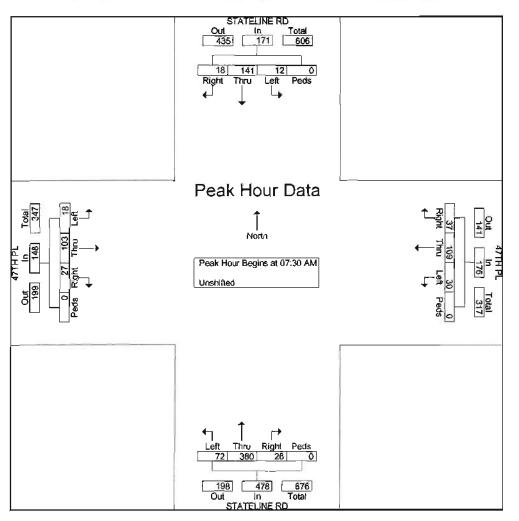
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05:15 PM	0	218	36	0	254	33	0	14	0	47	11	70	0	0	81	0	0	0	0	0	382
05:30 PM	0	190	26	0	216	48	0	16	0	64	15	74	0	0	89	0	0	0	0	0	369
05:45 PM	0	150	36	0	186	29	0	20	0	49	21	57	0	0	78	0	0	0	0	0	313
Total Volume	0	772	116	0	888	163	0	81	0	244	58	290	0	0	348	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	Ũ	0	0		
PHF	.000	.885	.806	.000	.874	.769	.000	.653	.000	.726	.690	.815	.000	.000	.870	.000	.000	.000	.000	.000	.889



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

STATELINE RD 47TH PL AM File Name : Stateline Rd & 47th PI AM Site Code : 00000000 Start Date : 11/17/2010 Page No : 3

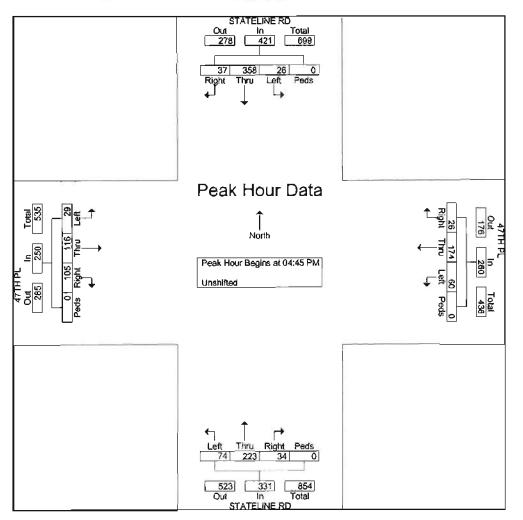
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08:00 AM	3	35	2	0	40	8	28	12	0	48	8	97	19	0	124	4	26	2	0	32	244
08:15 AM	10	31	2	0	43	12	38	6	0	56	10	101	26	0	137	6	28	7	0	41	277
Total Volume	18	141	12	0	171	37	109	30	0	176	26	380	72	0	478	27	103	18	0	148	973
% App. Total	10.5	82.5	7	0		21	61.9	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	.850	.941	.692	.000	.872	.750	.831	.643	.000	.804	.878

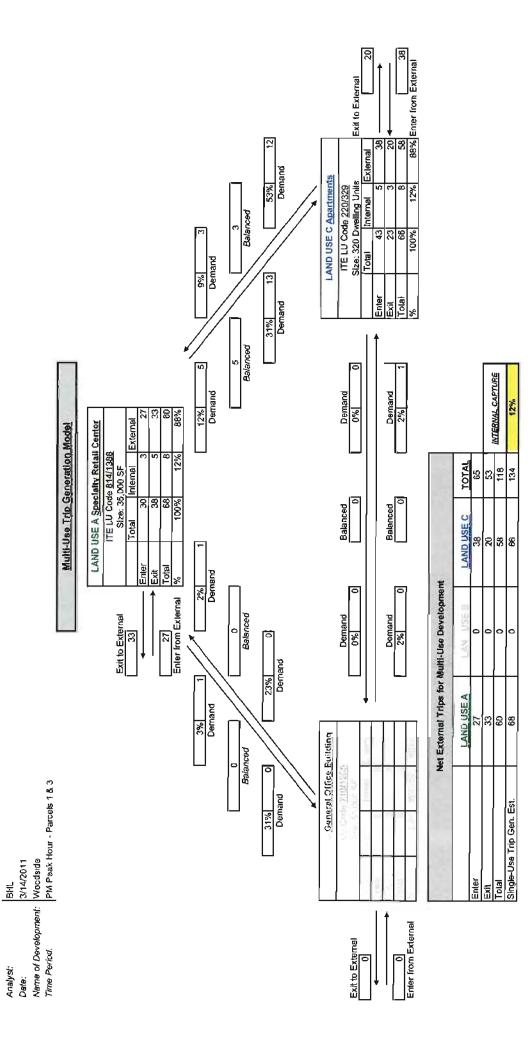


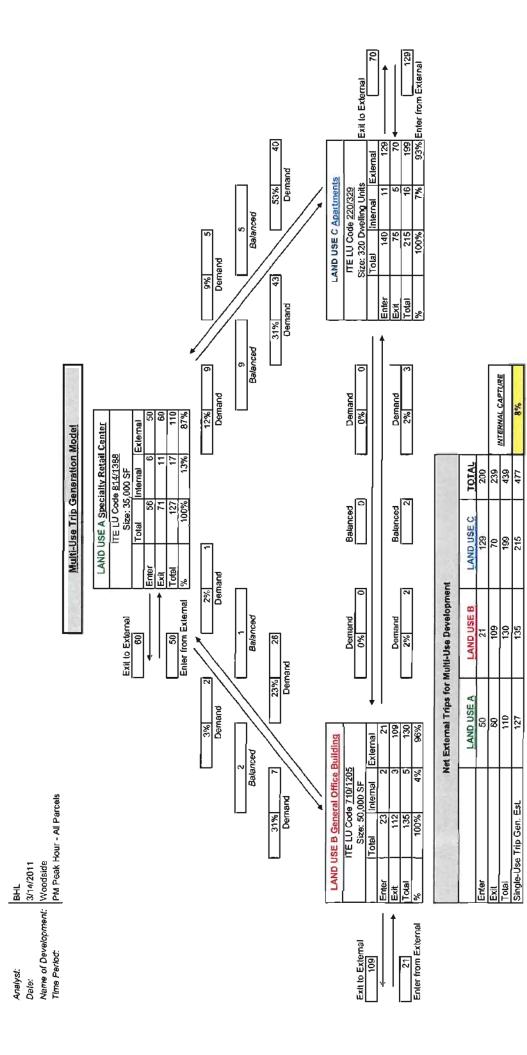
7301 West 133rd Street, Suite 200 Overland Park, KS 66213

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

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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	Û		10.3	67.4	22.4	0		42	46.4	11.6	0	20	
PHF	.925	.869	.813	.000	.892	.929	.806	.789	000	.878	.773	.796	685	.000	.919	.750	.744	.659	.000	.822	.917





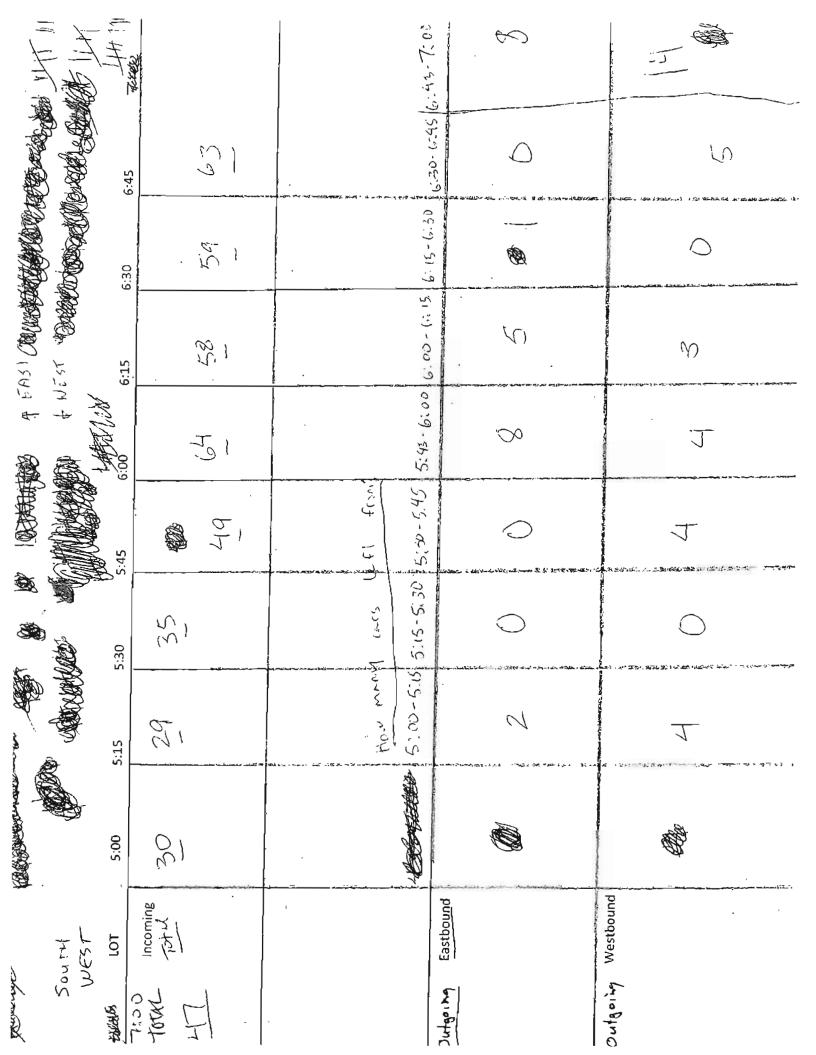


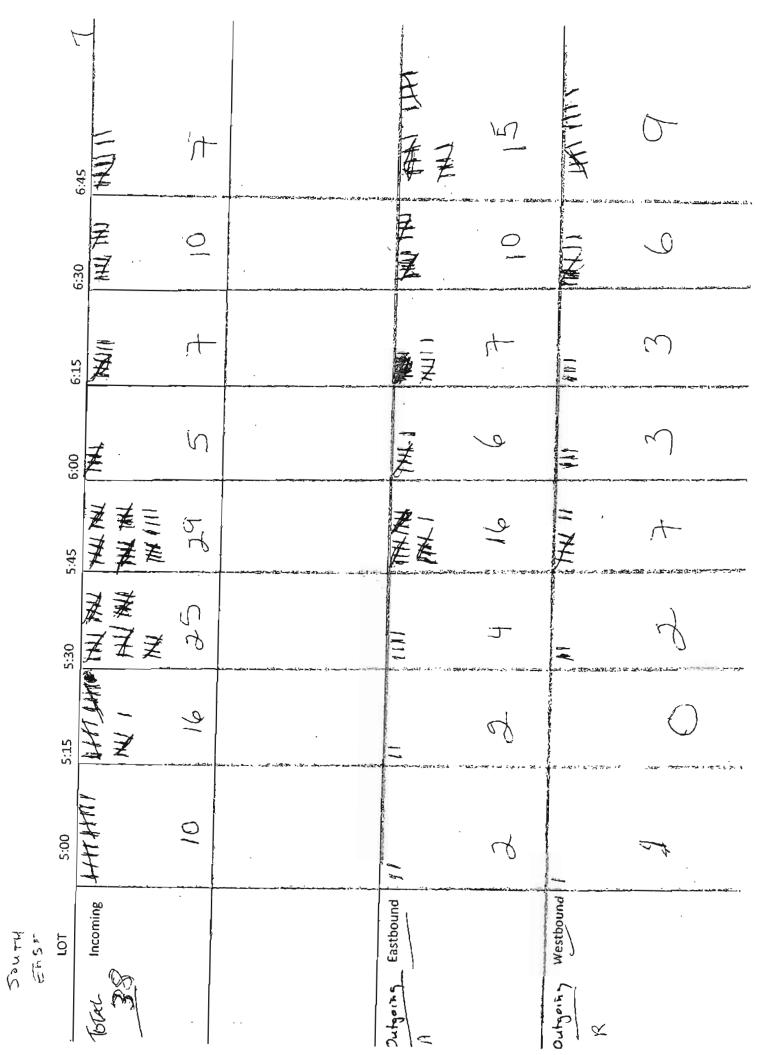
Parking Lot Volumes (By Others)



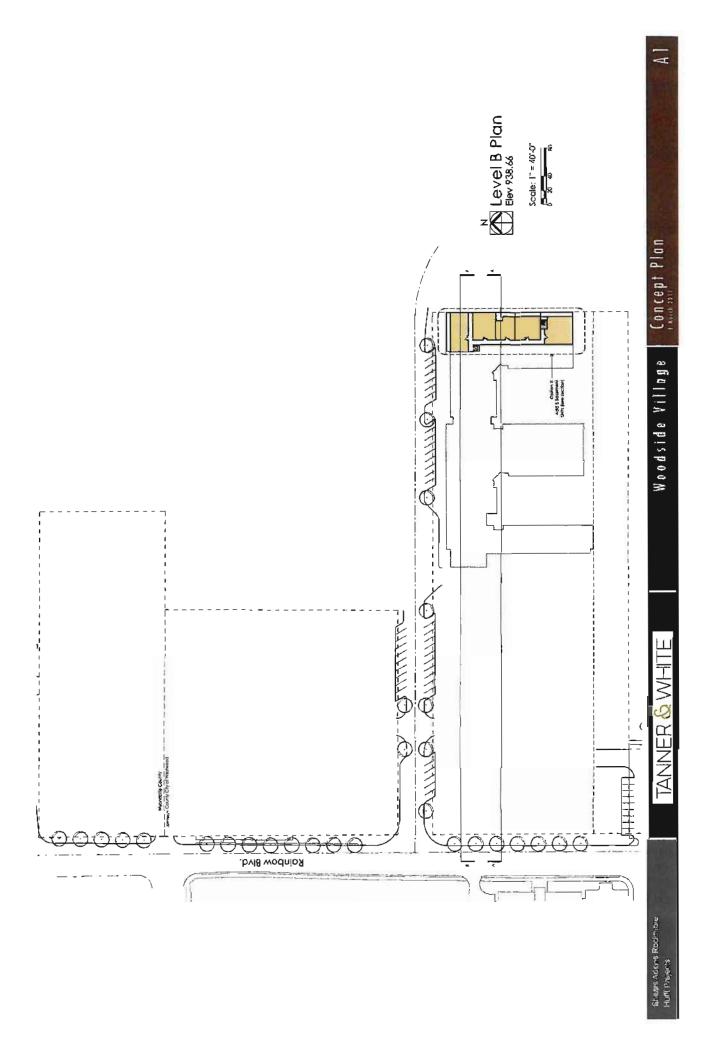
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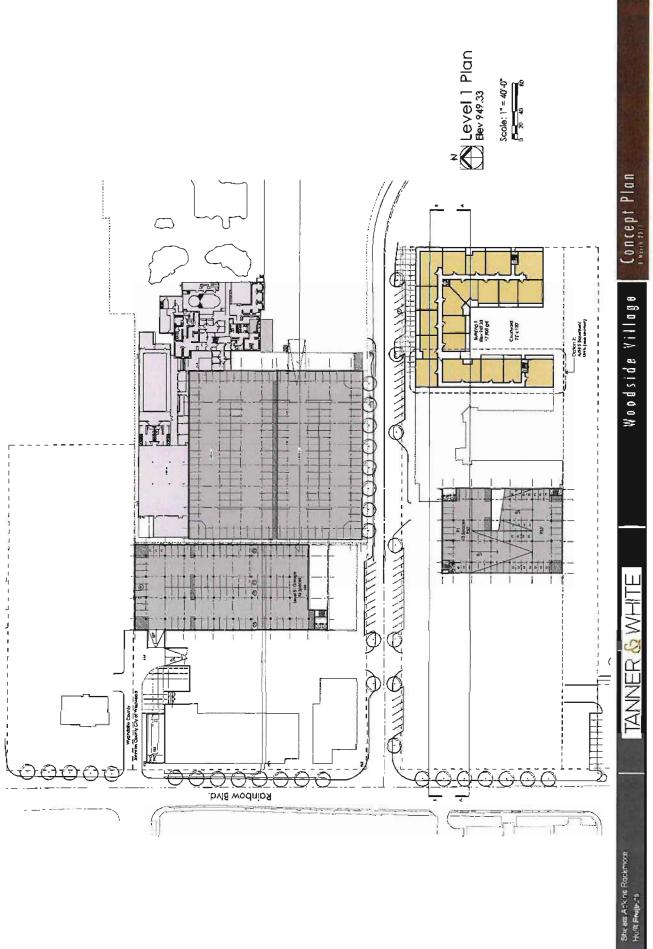
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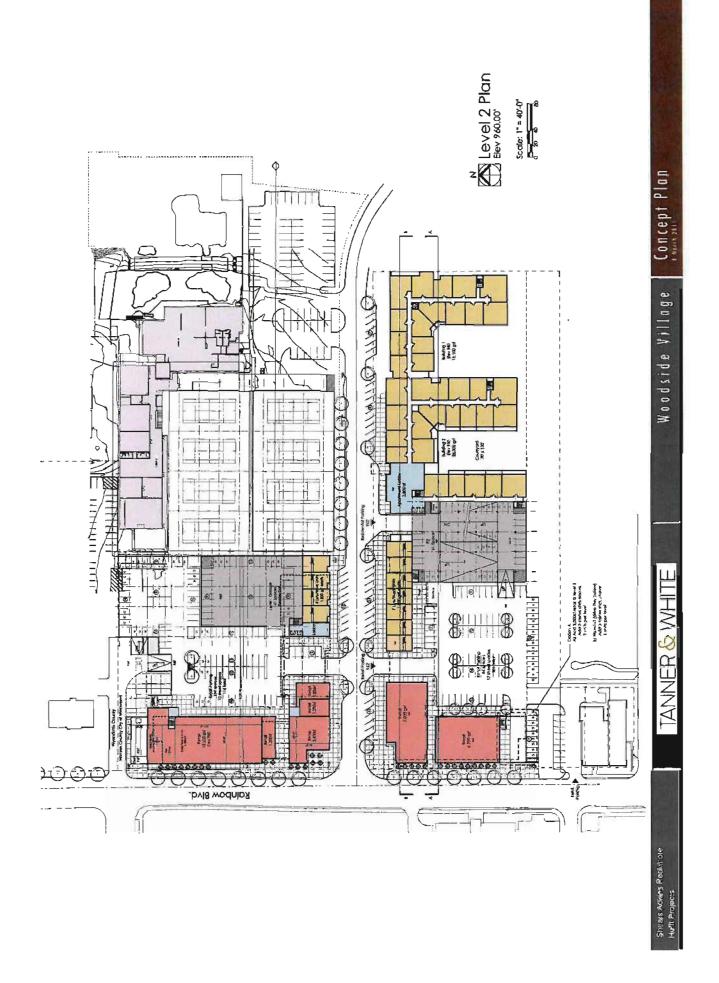


Development Schematic (By Others)

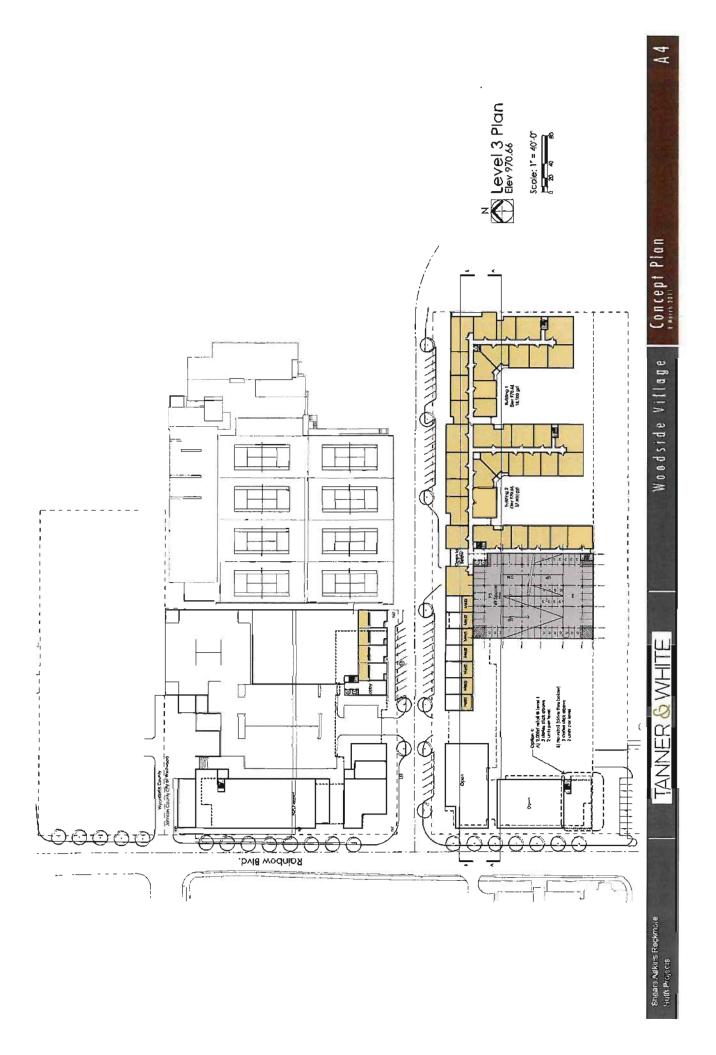


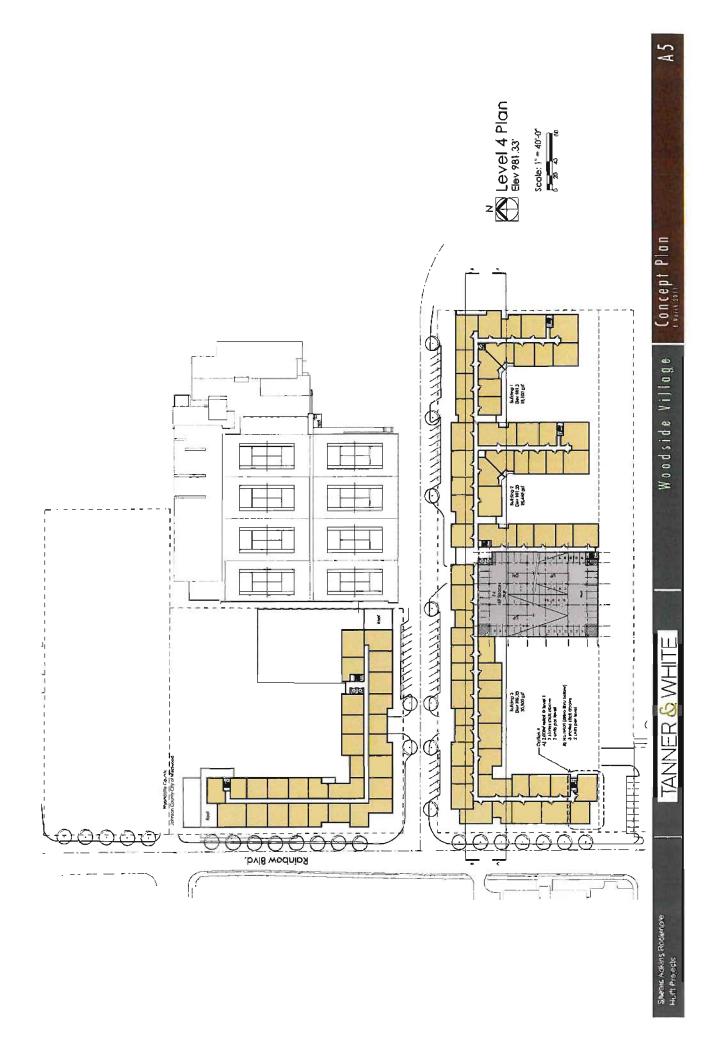


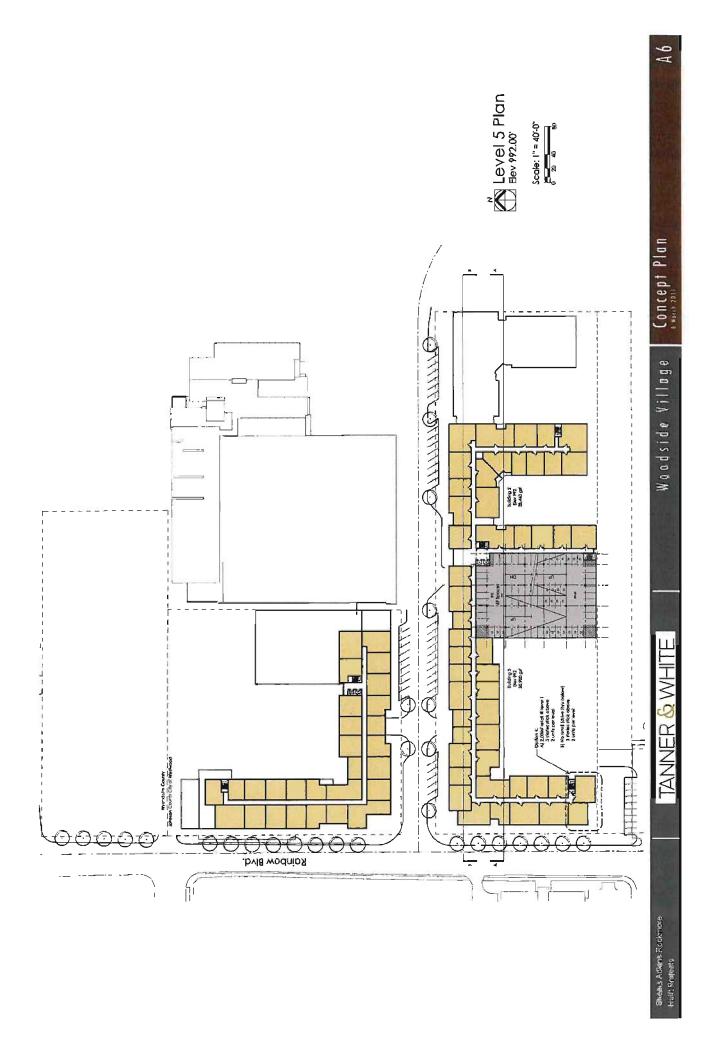
A 2

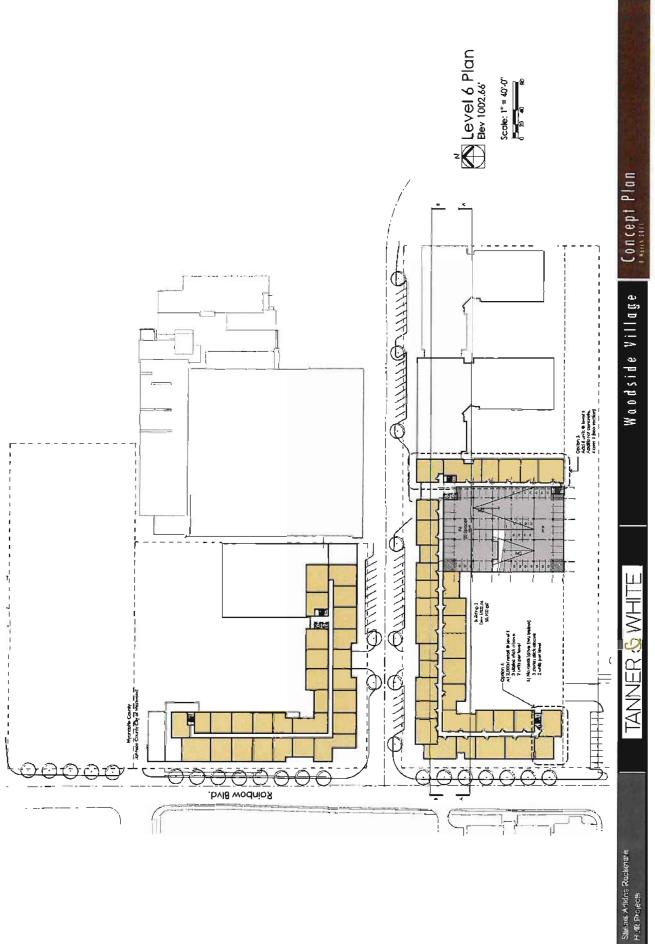


A 3

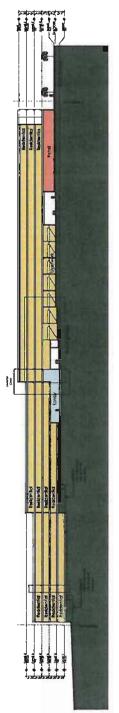


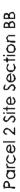


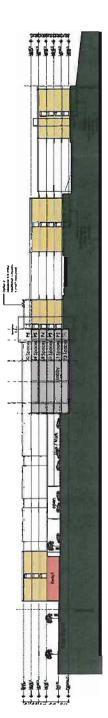




A 7







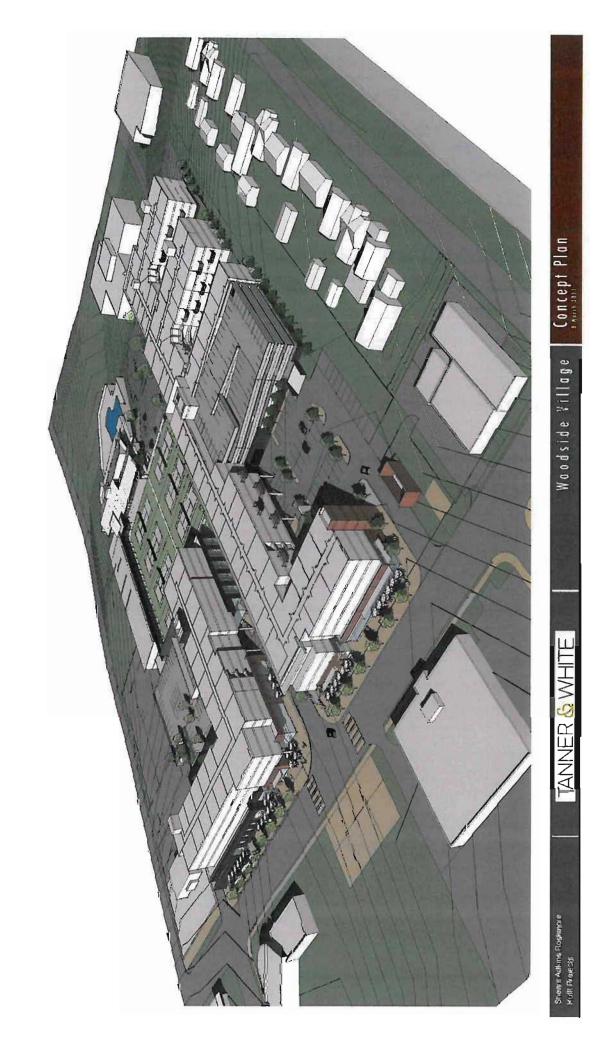
Parcel 2 Site Section AA

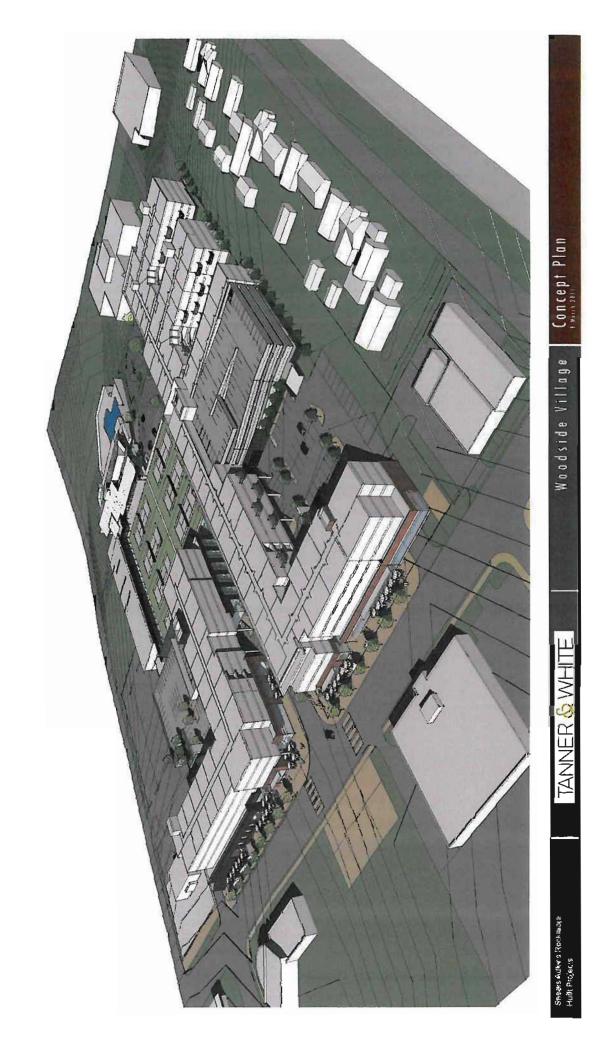
Scale:]* = 40'-0' 6 20 40 60 Woodside Village Concept Plan

4 8 4

TANNER & WHITE

Sheers Adkrts Recknore Huift Projects

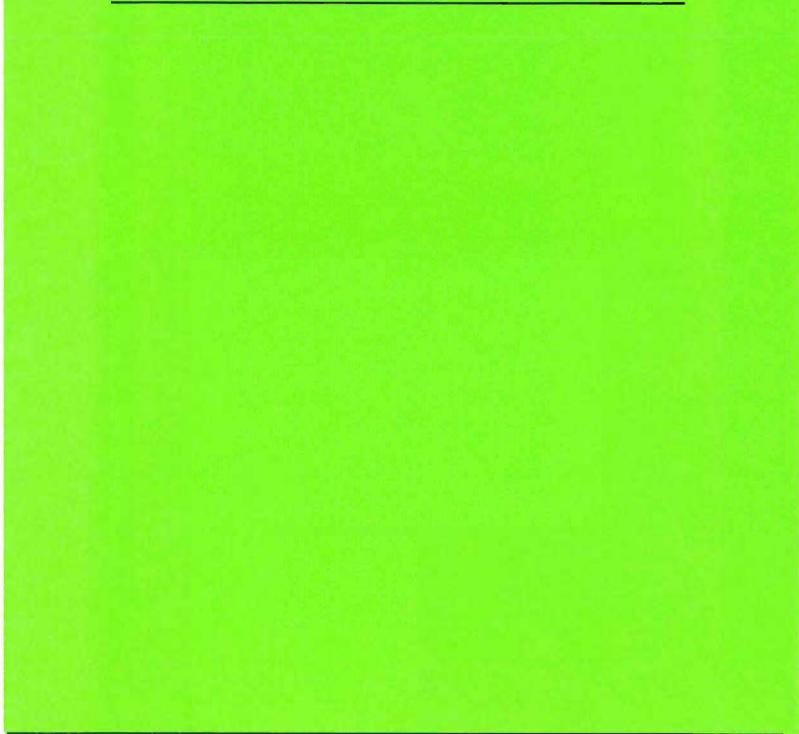




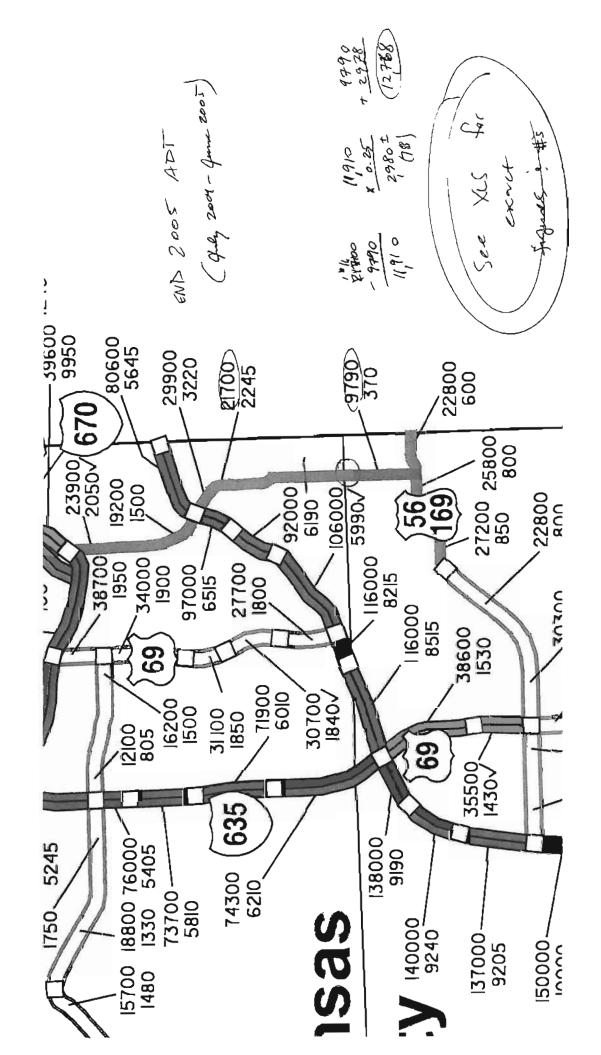


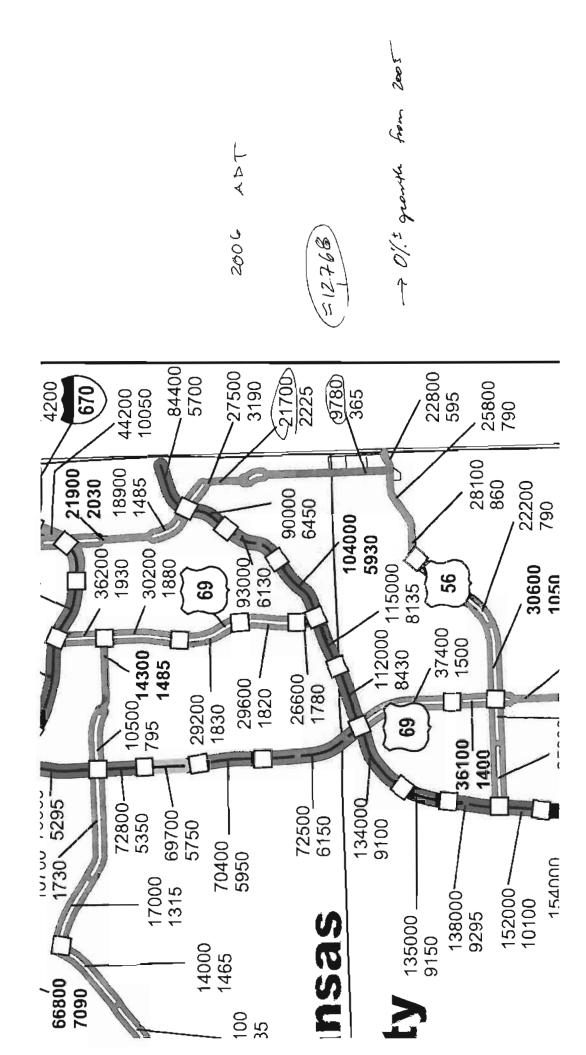
Woodside Village Щ

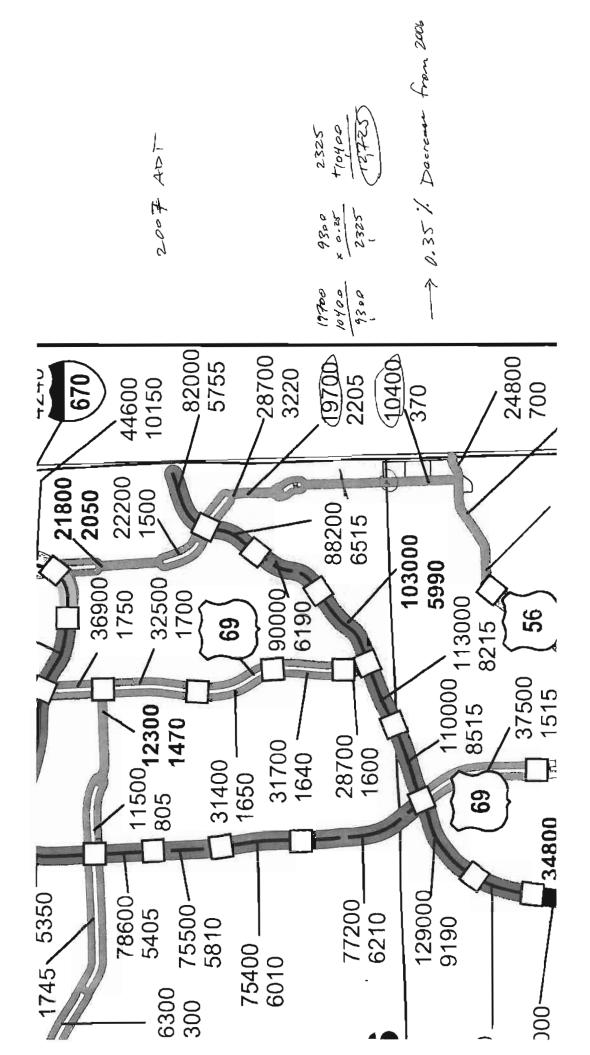
KDOT ADT CALCULATIONS

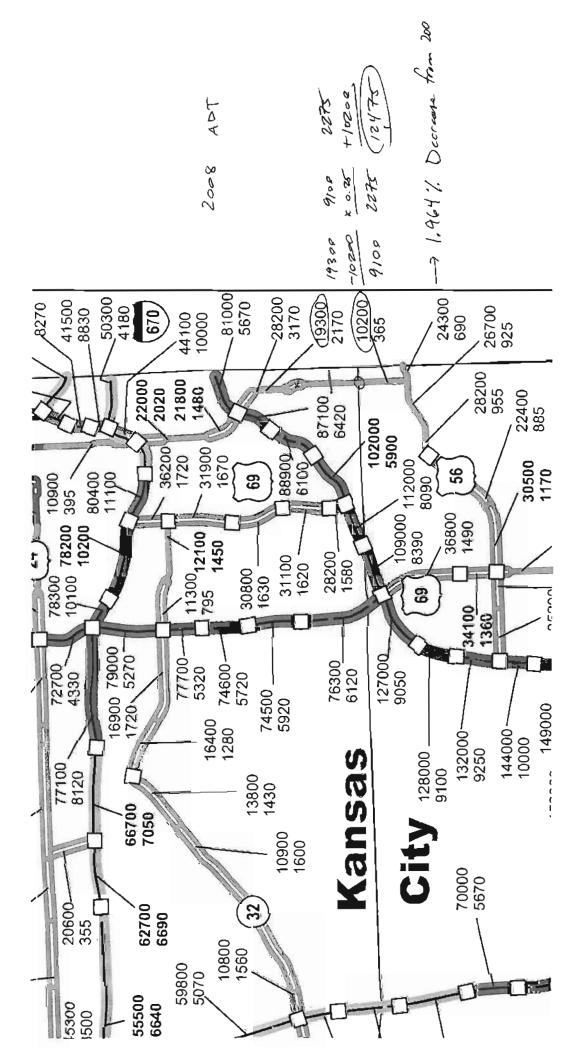


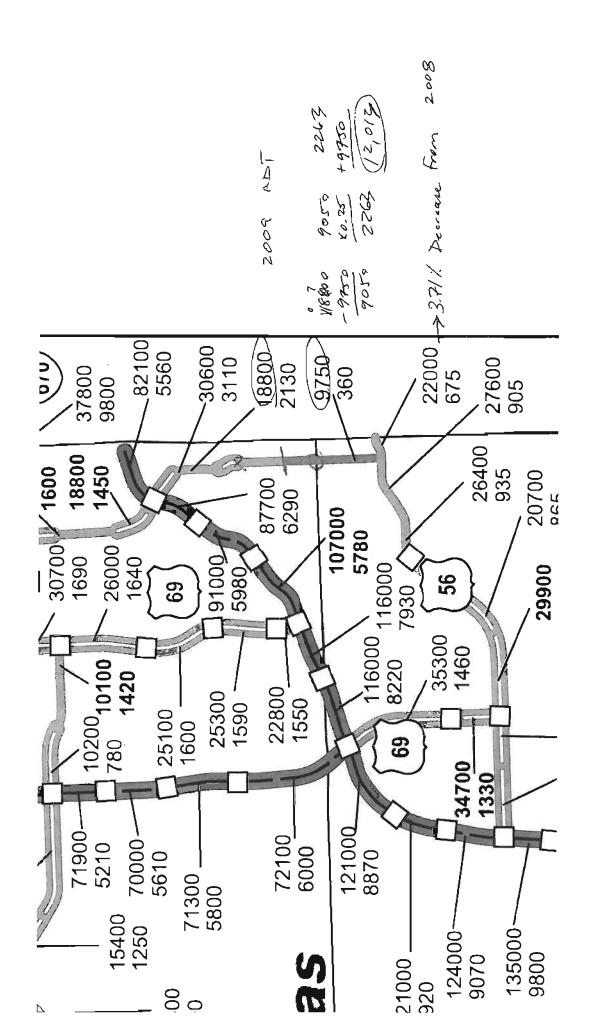
Interpolate	Interpolated KDOT Traffic Volumes - 47th Avenue & Rainbow Blvd													
Year	ADT	ADT Change (VOL)	ADT Change (CUM. VOL)	ADT Change (%)										
2004-2005	12,768	-		-										
2005-2006	12,760	-8	-8	-0.06%										
2006-2007	12,725	-35	-43	-0.27%										
2007-2008	12,475	-250	-293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

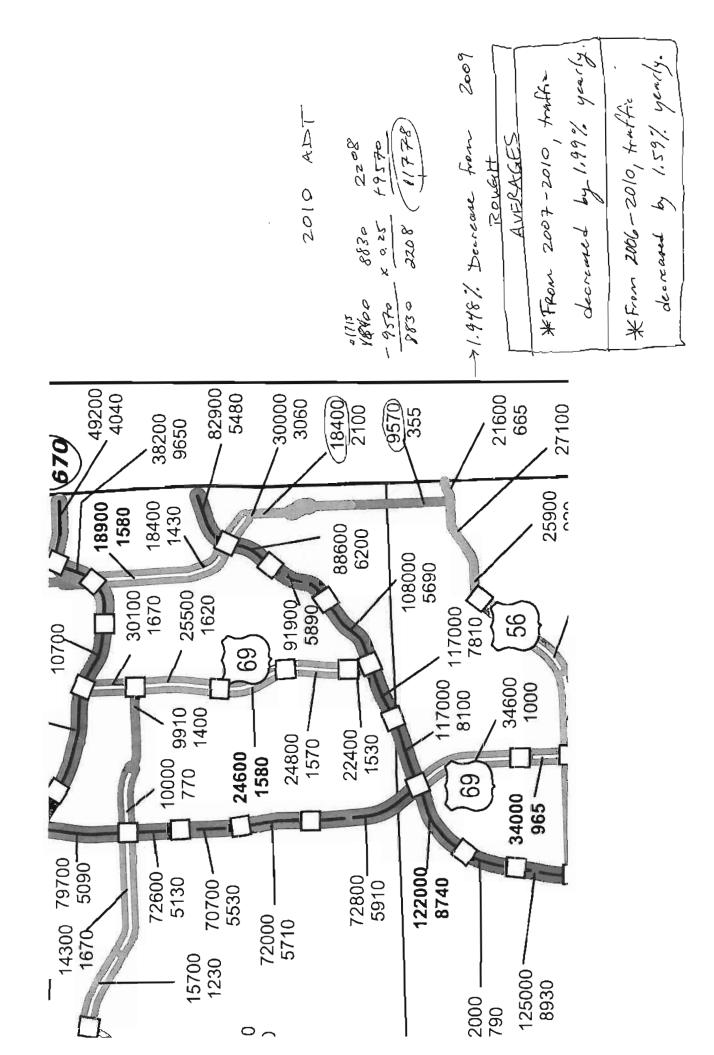




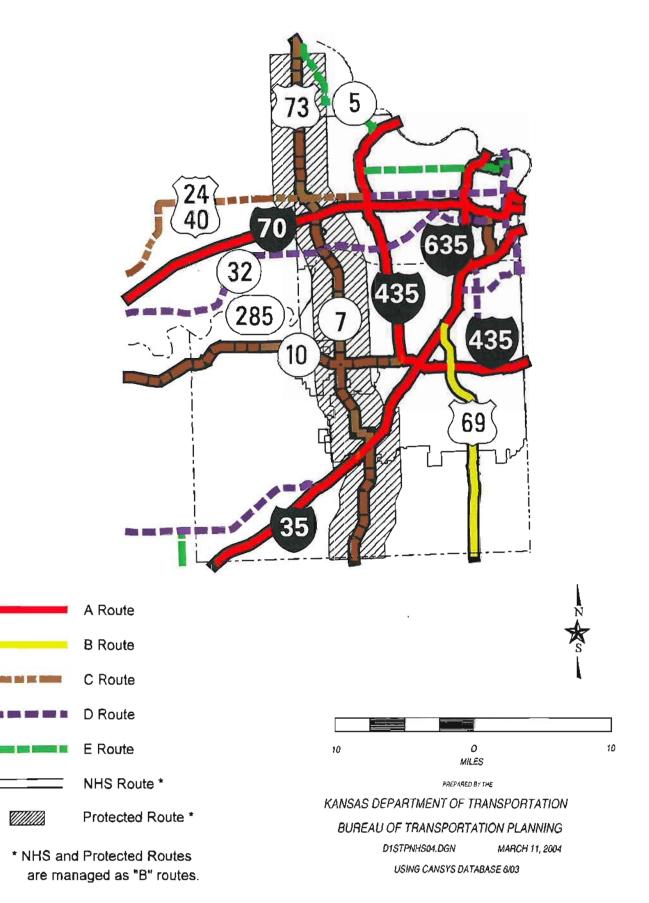








KDOT ROUTE CLASSIFICATION & NHS SYSTEM DISTRICT ONE Kansas City Metro Area



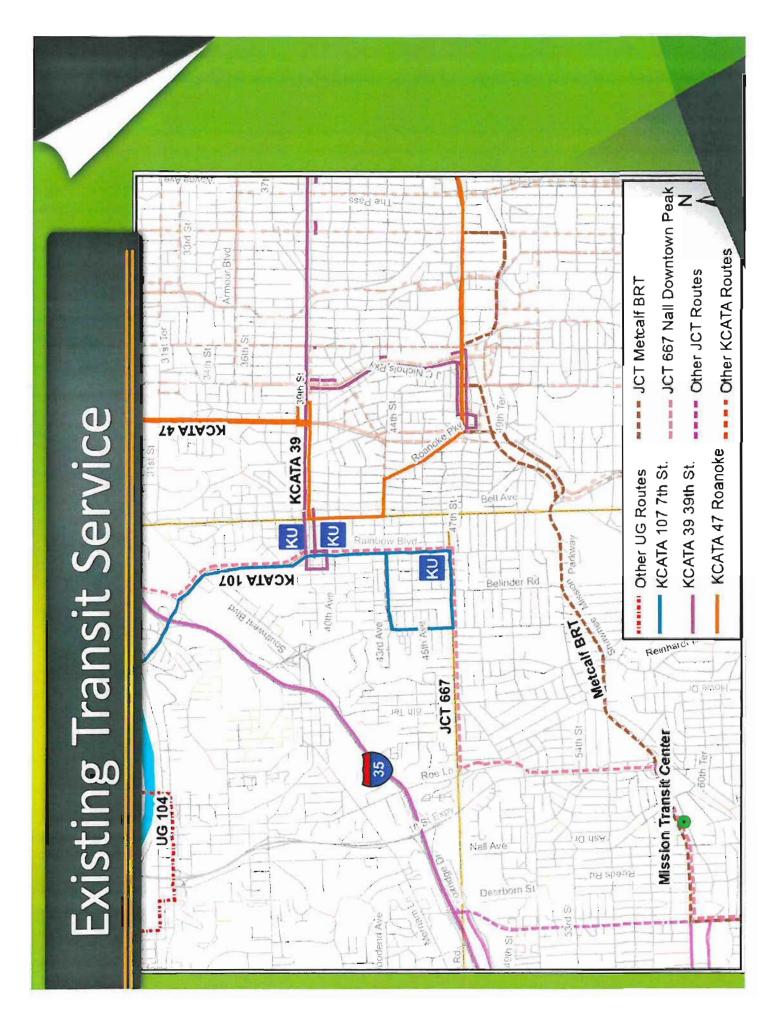
2030 KDOT Traffic Estimations

17. C.		-281		fr ly	AM PE	AK HOUI	R		2012			
				47th	Avenue	& Rainbo	w Blvd					
Year	EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	\$8T
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
				<u>47th</u>	Place &	Rainbov	v 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
				<u>47th</u>	Place &	State Lii	ne Rd			_		
Year	EBL	ÉBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	S BT
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	C

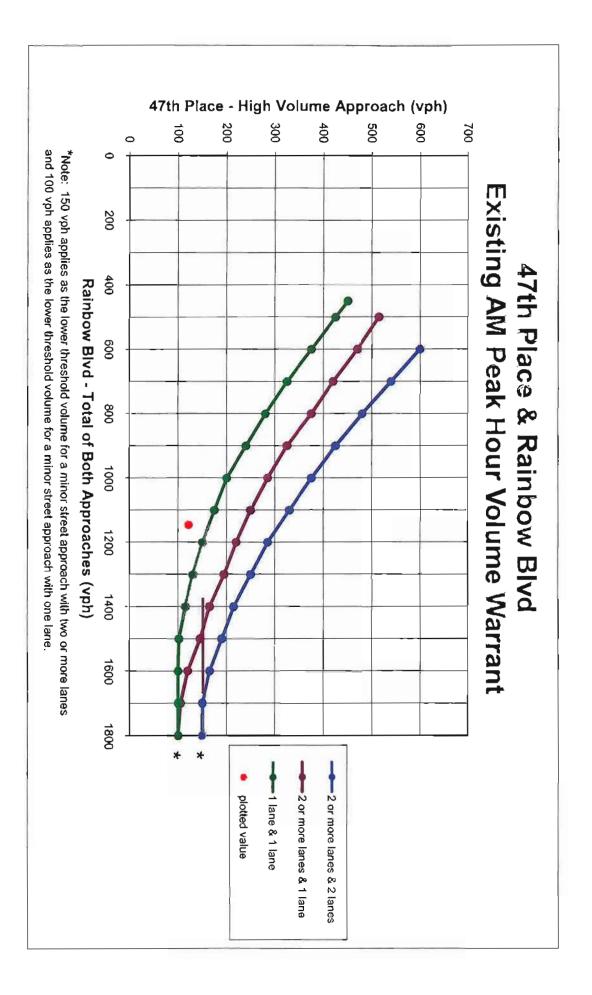
					PM PE	AK HOUI	R					
				47th	Avenue	& Rainbo	w Blvd					
Year	E8L	E8R	EBT	W8L	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	236	143	0	0	0	0	149	0	304	0	244	745
2030 Adds:	52	31	0	0	0	0	33	0	67	0	54	164
				<u>47th</u>	Place &	Rainbov	v Blvd					
Year	EBL	EBR	EBT	W8L	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
2010	0	0	0	81	163	0	0	58	290	116	0	772
2030 Adds:	0	0	0	18	36	0	0	13	64	26	0	170
					Place &	State Lii	ne Rd					
Year	EBL	EBR	E8T	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	20	0	0

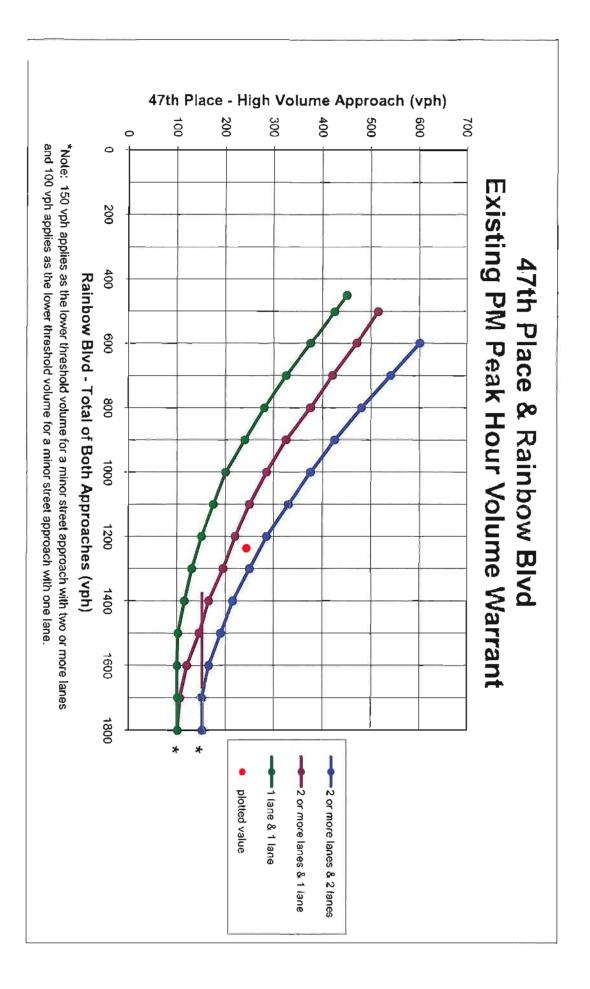
*Assumed traffic growth is 1.0% Annually per KDOT request on Rainbow Boulevard only. From above, larger estimation used for growth on thru movements on Rainbow.

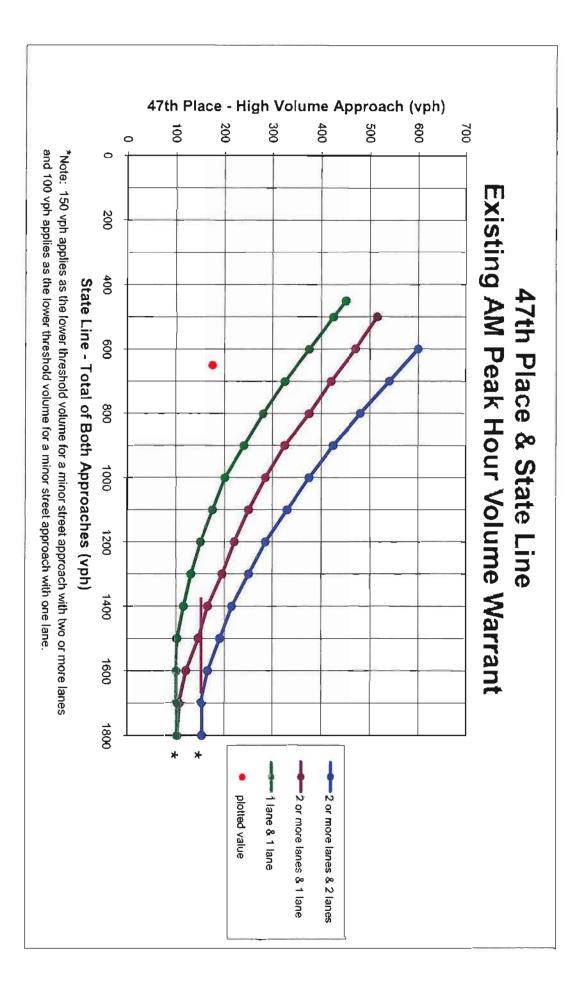
Traffic Growth Formula: 2030 VOLUME = (2010 VOLUME)(1+0.01)²⁰ - (2010 VOLUME)

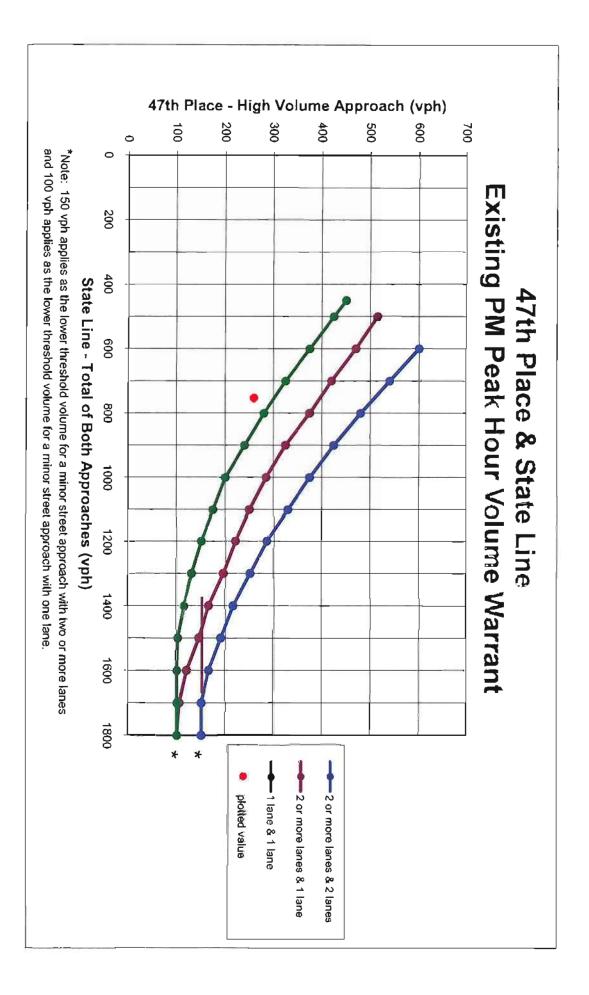


Signal Warrant Analysis

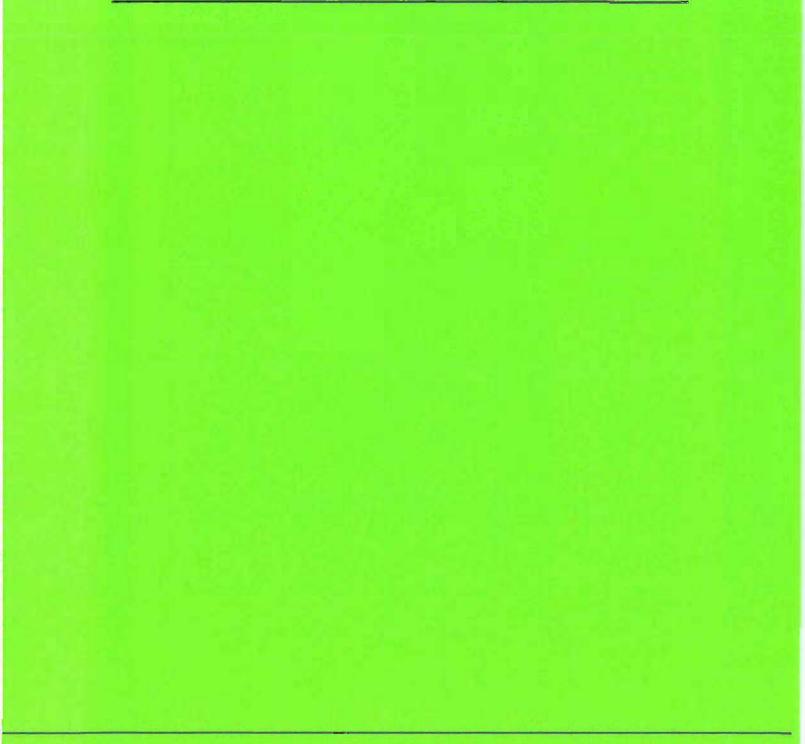








Capacity Analysis Reports



				_						
General Information				nforma	ation					
Analyst	Brett Laur		Interse			47th Plac		bow Blvd		
Agency/Co.	Olsson A		Jurisdi				Westwood, KS			
Date Performed	2/25/2011		Analys	Analysis Year 2011						
Analysis Time Period	Existing A									
Project Description We		oment								
East/West Street: 47th					reet: Rainbo	w Blvd				
ntersection Orientation:			Study	ouoa (I	nrs): 0.25					
Vehicle Volumes ar	nd Adjustme									
Major Street		Northbound				Southbou	Ing			
Vovement	1	2	3		4	5		6		
1.)	L	Т	R		L	T 204		_R		
/olume (veh/h)	1.00	576	81		164 0.82	324		1.00		
Peak-Hour Factor, PHF Hourly Flow Rate, HFR	1.00	0.89	0.78			0.83				
veh/h)	0	647	103		200	390		0		
Percent Heavy Vehicles	0	-	-		2			-		
Иедіап Туре				Undivided						
RT Channelized			0					0		
anes	0	2	0		0	2		0		
Configuration		T	TR		LT	T				
Upstream Signal		0				0				
Minor Street	_	Eastbound				Westbou	nđ			
Movement	7	8	9		10	11		12		
	L	Т	R		L	Т		R		
/olume (veh/h)					33			89		
Peak-Hour Factor, PHF	1.00	1.00	1.00		0.75	1.00		0.86		
Hourly Flow Rate, HFR ∨eh/h)	0	0	0		44	0		103		
Percent Heavy Vehicles	0	0	0		2	0		2		
Percent Grade (%)		0				0				
lared Approach		N				N				
Storage		0				0				
RT Channelized			0				_	0		
Lanes	0	0	0		1	0		1		
Configuration					L			R		
Delay, Queue Length, a	and Level of Se	rvice								
Approach	Northbound	Southbound		Westbo	und		Eastboun	d		
Viovement	1	4	7	8	9	10	11	12		
Lane Configuration		LT	L		R					
/ (veh/h)		200	44		103	1		1		
C (m) (veħ/ħ)		855	118		670			1		
		0.23	0.37		0.15			+		
95% queue length		0.91	1.53		0.54					
Control Delay (s/veh)		10.5	52.6	<u> </u>	11.3					
LOS		B	F		В					
Approach Delay (s/veh)				23.7						
Approach LOS				С						

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		O-WAY STOP				_				
General Information	n		Site I	nforma	tion					
Analyst	Brett Laur	ritsen	Interse	ction		47th Plac	e & Rainb	ow Blvd		
Agency/Co.	Olsson A	ssociates	Jurisdi			Westwoo	d, KS			
Date Performed	2/25/2011		Analys	is Year		2011				
Analysis Time Period	Existing F	РМ								
Project Description W		oment	·							
East/West Street: 47th					reet: Rainbo	w Blvd				
ntersection Orientation:	North-South		Study I	Period (h	nrs): 0.2 5		-			
Vehicle Volumes ar	nd Adjustme	nts								
Major Street		Northbound					ind			
Vovement	1	2	3		4	5		6		
	L	Ť	Ŕ		L	Т		R		
/olume (veh/h)		290	58		116	772				
Peak-Hour Factor, PHF	1.00	0.81	0.69		0.81	0.88		1.00		
lourly Flow Rate, HFR veh/h)	0	358	84		143	877		0		
Percent Heavy Vehicles	0				2	1				
Vedian Type				Undivided			—			
RT Channelized			0					0		
anes	0	2	0		0	2		0		
Configuration		T	TR		LT	T				
Jpstream Signal		0				0				
Ainor Street		Eastbound				Westbou	Ind			
Novement	7	8	9		10	11		12		
	L	Т	R		L	Т		R		
/olume (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			0		211		
⁵ ercent Heavy Vehicles	0	0	0		2	0		2		
Percent Grade (%)		0				0				
Flared Approach		N				N				
Storage		0				0				
RT Channelized			0			1		0		
Lanes	0	0	0		1	1 0		1		
Configuration					Ĺ	· ·		R		
Delay, Queue Length, a	nd Level of Se	rvice				-				
pproach	Northbound	Southbound	,	Westbou	Ind		Eastbound	3		
Vovement	1	4	7	8	9	10	11	12		
ane Configuration		LT	Ĺ	-	R		<u> </u>	+		
/ (veh/h)		143	124		211	1	i	+		
C (m) (veh/h)		1114	173		817		-	+		
					_			-		
//c		0.13	0.72		0.26	+				
35% queue length		0.44	4.41		1.03					
Control Delay (s/veh)		8.7	65.9		10.9		<u> </u>			
OS		A	F		В					
Datas (aliah)	1	-		31.3						
Approach Delay (s/veh)										

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General Information					Site Infor	mation				
Analyst	Brett L	aurilsen			Intersection			7th Place	& State Line	<i></i>
Agency/Co.		Associate)s		Burisdiction			KCMO & Westwood, KS		
Date Performed	2/25/2	-			Analysis Yea	ŕ	2	011		
Analysis Time Period	Existin	g AM			<u> </u>					
Project ID Woodside Develop		_								
East/West Street: 47th Place					North/South S	Street: State Li	ne Road			
Volume Adjustments	and Site C	haracte								
Approach Movement					8			Westbou T	nd I	R
Volume (veh/h)	18	-		03	27	30		109		37
%Thrus Left Lane	- ^	<u> </u>						,00		0/
Approach	<u> </u>		North	bound				Southbou	ind	-
Movement	L			Г	<u>R</u>	L		T		R
Volume (veh/h)	7.	2	3	80	26	12		141		18
%Thrus Left Lane										
	East			Wed	tbound	Nort	hbound	1	South	bound
	L1	L2		L1	L2	L1			L1	L2
Configuration										L2
Configuration	LTR			LTR		LTR	+		LTR	
PHF	0.80			0.79		0.87			0.84	
Flow Rate (veh/h)	183 2			220		547 2		<u> </u>	202	
% Heavy Vehicles		4	\rightarrow		1		4	_		
No. Lanes		1 1	\rightarrow		1 1		1 1		1	
Geometry Group Duration, T		<u> </u>				.25	/			
		N#7			0	.20	_			
Saturation Headway	1	VVOrks	neet							
Prop. Lefi-Turns	0.1	<u> </u>	\rightarrow	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	
nLT-adj	0.2	0.2		0.2	0.2	0.2	0.2		0.2	0.2
hRT-ad}	-0.6	-0.6	;	-0.6	-0.6	-0.6	-0.6	5	-0.6	-0.6
hHV-adj	1.7	1.7	-	1.7	1.7	1.7	1.7		1.7	1.7
nadj, computed	-0.1			-0.1		0.0			-0.0	
Departure Headway a	nd Service	Time								
hd, initial value (s)	3.20	T		3.20		3.20			3.20	
, initial	0.16			0.20		0.49			0.18	
nd, final value (s)	6.70			6.59		5.74			6.36	
, final value	0.34			0.40		0.87	1		0.36	
Nove-up time, m (s)		.0			.0		2.0		2.	0
Service Time, Is (s)	4.7			4.6		3.7			4.4	
							<u> </u>			
Capacity and Level of	1									
	East	bound		West	bound	Nort	hbound		South	bound
	L1	L2		L1	1.2	L1	L2		L1	L2
Capacity (veh/h)	433			470		618			452	
)elay (s/veh)	13.12			13.96		35.53		1	12.85	
.OS	В			В		E 55.55			В	
pproach: Delay (s/veh)					.96		.53		12.	<u>85</u>
	13.12									_
LOS	B				3		E		B	ſ
ntersection Delay (s/veh)					23	.88				

				Inv. t. t				
General Information		-		Site Infor	mation			
Analyst	Brett L	auritsen		Intersection			Place & State Line	
Agency/Co.		Associales		Uurisdiction	•) & Westwood, K	5
Date Performed Analysis Time Period	2/25/20 Existin			Analysis Yea	2011			
		у ги — — — — — — — — — — — — — — — — — — —		- <u>1</u>				
Project ID Woodside Develop				b				
East/West Street: 47th Place				North/South S	Street: State Lin	e Road		
Volume Adjustments	and Site Cl							
Approach Movement	_ _	<u> </u>	Eastbound	Ŕ		We	stbound τ	R
Volume (veh/h)	L			105	L 60		174	26
Thrus Left Lane		<u> </u>	116				1/4	20
Approach			lorthbound					
Movement	L		Т		- ι		τ	R
/olume (veh/h)	74	f	223	34	26		358	37
%Thrus Left Lane				• ·				
	East	bound	Wes	stbound	Norti	hbound	South	bound
	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	
6 Heavy Vehicles	2		2		2		2	
lo. Lanes	-	1		1		1	1	1
Seometry Group	-	1		1		1	1	r
Duration, T				0	.25		•	
Saturation Headway	Adiustment	Workshee	et					
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	
nLT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
nRT-adj	-0.6	<u>-0.6</u>	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
nHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
adj, computed	-0.2		0.0		0.0		-0.0	
Departure Headway a	nd Service	Time						
d, initial value (s)	3.20		3.20		3.20		3.20	
, initial	0.27		0.26		0.32		0.42	
d, final value (s)	8.42		8.65		8.29	<u> </u>	7.92	
, final value	0.71		0.00		0.82		1.04	
Nove-up lime, m (s)	2.	0		2.0		.0	2.	0
		ř		T T		<u> </u>		ř –
Service Time, t _s (s)	6.4		6.7	<u> </u>	6.3		5.9	
Capacity and Level of	Service							
	East	bound	Wes	tbound	North	bound	South	bound
	Lí	L2	L1	L2	L1	L2	L1	L2
apacity (vet/h)	408		396		424		472	
			_					
)elay (s/veh)	29.57		29,97		39.84	L	80.96	
OS	D		D		E		F	
oproach: Delay (s/veh)	2	9 <u>.</u> 57	29	.97	39.	.84	80.	96
LOS				D		F		
ntersection Delay (s/veh)).21			
ntersection LOS	<u> </u>				E			_

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Existing AM 963: 47th Ave & Rainbow Blvd

	٦	\mathbf{r}	-	<u>†</u>	Ļ	4			
Movement	EBL	EBR	NBL	NBT	SBT	SBR		1 March 1	
Lane Configurations	5	7		44	† ħ	_			
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				
Fit 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			1
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			s			
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	A SUME	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	В	В		А	А				
Approach Delay (s)	13.1			9.3	7.6				
Approach LOS	8			А	А				
Intersection Summary									
HCM Average Control Delay	Ý		10.0	H	CM Level	of Service		B	
HCM Volume to Capacity ra			0.53						
Actuated Cycle Length (s)			46.6	Su	im of lost	time (s)	10.	4	
Intersection Capacity Utiliza	tion		57.9%		U Level o			B	
Analysis Period (min)			15						
c Critical Lane Group									

	۶	>	1	Ļ
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		2.272		10.3

Existing PM 963: 47th Ave & Rainbow Blvd

	٨	\mathbf{r}	*	1	Ļ	~		
Movement	EBL	EBR	NBL	NBT	SBT	SBR	3845	
Lane Configurations	7	1		± † ►	41			
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			
Fit 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	THE Y H	1035	1699	Sel Street	C	
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	В	В		A	А			
Approach Delay (s)	17.8			7.8	9.0			
Approach LOS	В			A	А			
Intersection Summary								
HCM Average Control Delay	1	100	10.5	H	CM Level	of Service	Telepide	
HCM Volume to Capacity ra	tio		0.59					
Actuated Cycle Length (s)			53.2		um of lost			
Intersection Capacity Utilization	tion		70.0%	IC	U Level o	of Service		
Analysis Period (min)			15					
c Critical Lane Group								

c Critical Lane Group

	٦	>	1	Ļ
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	1111000	110		

Signal Warrant Analysis

					MARY				
General Information	n		Site I	nformati	ion				
Analyst	Brett Laur	itsen	Interse	ection			e and Rai	inbow	
Agency/Co.	Olsson As		Jurisdi	ation		Blvd			
Date Performed	3/8/2011			is Year		Westwood, K\$/KCK (UG) 2011 - Ex + Parcels 1 & 3			
Analysis Time Period	AM					2011- E		51003	
Project Description W	ondeide								
East/West Street: 47th		-	North/9	South Stre	et: Rainbo	w Rivd			
ntersection Orientation:				Period (hrs		-			
Vehicle Volumes ar									
Major Street		Northbound				Southbou	INC		
Movement	1 1	2	3		4	5		6	
	L L	Ť	Ř		Ĺ	Ť		Ř	
Volume (veh/h)		576	87		164	324			
Peak-Hour Factor, PHF	1.00	0.89	0.78		0.82	0,83		1.00	
Hounly Flow Rate, HFR	0	647	111		200	390		0	
(veh/h)	_		-						
Percent Heavy Vehicles	0								
Median Type	<u> </u>	1		Undivided					
RT Channelized			0			<u> </u>		0	
anes	0	2	0		0	2		0	
Configuration			TR		LT	<u><u></u></u>			
Jpstream Signal		0				0			
Vinor Street		Eastbound	1			Westbou	und		
Movement	7	8	9		10	11		12	
	L	Т	R		L	Т		R	
/olume (veh/h) Peak-Hour Factor, PHF	1.00	1.00	1.00		47 0.75	1.00		89 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		1 -	0					0	
Lanes	0	0	0		1	0		1	
Configuration	Ť	<u> </u>			L	Ť		R	
Delay, Queue Length, a	nd Level of Ser								
Approach	Northbound	Southbound		Vestboun	d		Eastbound	4	
Novement	1	4	7	8	9	10	11	12	
		4 			R			- ¹⁶	
ane Configuration			L			 			
v (veh/h)		200	62		103				
C (m) (veh/h)		849	118		666			- 	
/c		0.24	0.53		0.15				
35% queue length		0.91	2.46		0.54				
Control Delay (s/veh)		10.5	65.2		11.4				
.0\$		8	F		B				
pproach Delay (s/veh)		••		31.6				-	
		<u>57.5</u>							

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				-					
General Information	n		Site	nforma	tion				
Analyst	Brett Lau	ritsen	Interse	ection			e and Rai	nbow	
Agency/Co.	Olsson A	ssociates	Jurisdi	ction		Blvd Westwood, KS/KCK (UG)			
Date Performed	3/8/2011			ais Year		2011 - Ex + Parcels 1 & 3			
Analysis Time Period	РM					2017-22		3700	
Project Description We	oodsidə								
East/West Street: 47th			North/S	South Sti	reet: Rainbo	w Blvd	_		
Intersection Orientation:	North-South		Study	Period (h	ws): 0.25				
Vehicle Volumes ar	nd Adjustme	nts					_		
Major Street		Northbound				Southbo	und		
Movement	1	2	3		4	5		6	
	L	Т	R		L	Т		Ŕ	
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	-	- 1		2	-			
Median Type				Undivid					
RT Channelized	-		0			1		0	
Lanes	0	2	0		0	2		0	
Configuration	Ť				LT	<u> </u>		0	
Upstream Signal		0				0			
Minor Street		Eastbound				Westbol	bou		
Movement	7	8	9	_	10	11		12	
	L	T	R		L	τ		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	T			N			
Storage		0				0			
RT Channelized			0			-		0	
Lanes	0	0	0		1	0		1	
Configuration					L			R	
Delay, Queue Length, a	nd Level of Se	rvice							
Approach	Northbound	Southbound	,	Westbou	Ind		Eastbound	1	
Novement	1	4	7	8	9	10	11	12	
ane Configuration		LT	L		R		<u> </u>	1	
/ (veh/h)		143	153		211				
C (m) (veh/h)		1085	168		802				
//c		0.13	0.91		0.26				
35% queue length		0.45	6.69		1.06				
			102.2		11.1				
Control Delay (s/veh)		8.8							
LOS		A	F	(0.1	B	<u> </u>			
Approach Delay (s/veh)				49.4					
Approach LOS			E						

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	O-WAY STOP	001111					
n		Site I	nforma	ation			
Brett Lau	ritsen	Interse	ection		47th Plac	e & Retail	-North
Olsson A	ssociates	Jurisdi	iction		Westwoo	d, KS	
3/8/2011		Analys	sis Year		2011 - Ex	(+ Parcels	:1&3
AM							
Place		North/S	South St	reet: Cente	r Retail		
East-West		Study	Period (I	n r s): 0.25			
nd Adjustme	ents						
	Eastbound				Westbou	Ind	
1	2	3		4	5		6
Ĺ	Т	R		L	T		R
6	245				122		6
0.92	0.92	1.00		1.00	0.92		0.92
6	266	0		0	132		6
2				0	~		
			Undivi	ded			
		0					0
0	1	0		0	1		0
LT							TR
	0				0		
	Northbound				Southbou	Ind	
7	8	9		10	11		12
L	Т	R		L	Τ		R
				17			14
1.00	1.00	1.00		0.92	1.00		0.92
0	0	0		18	0		15
0	0	0		2	0		2
	0				0		
	N				N		
	0				0		
		0					0
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0.01						0.15	
				1	1	10.3	1
7.5						10.3	
7.5 A						10.3 B	
	Olsson A 3/8/2011 AM bodside Place East-West nd Adjustme 1 L 6 0 2 0 1 0 LT 0 LT 1.00 0 0 LT 0 LT 0 1.00 0 0 1.00 0 0 1.00 0 0 1.00 0 0 0 1.00 0 0 0 0 0 0 0 0 0 0 0 0	Brett Lauritsen Olsson Associates 3/8/2011 AM bodside Place East-West nd Adjustments L T 6 245 0.92 6 2 6 2 0 1 2 6 245 0.92 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Brett Lauritsen Interse Olsson Associates Jurisdi 3/8/2011 Analys AM Interse bodside Place Place North/S East-West Study I nd Adjustments Study I nd Adjustments Interse L T R 6 0.92 0.92 0.92 0.92 0 0 1 2 0.92 0.92 0.92 0.92 1.00 1.00 0 1 0 0 1 0 1.00 1.00 1.00 1.00 1.00 1.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 <td< td=""><td>Brett Lauritsen Intersection Olsson Associates Jurisdiction 3/8/2011 Analysis Year AM Analysis Year boodside Place Place North/South St East-West Study Period (I 1 2 3 L T R 6 245 1.00 6 266 0 2 0.92 0.92 1.00 6 266 0 2 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0</td></td<> <td>Brett Lauritsen Intersection 3/8/2011 Jurisdiction AM Analysis Year AM Analysis Year AM Analysis Year Place North/South Street: Center East-West Study Period (hrs): 0.25 nd Adjustments Eastbound 1 2 3 4 L T R L 6 245 </td> <td>Brett Lauritsen Intersection 47th Plac Olsson Associates Jurisdiction Westwood 3/8/2011 Am Intersection Westwood AM Amalysis Year 2011 - Exited and the section Westwood Place North/South Street: Center Retail Eastbound Westbout 1 2 3 4 5 Image: Study Period (hrs): 0.25 122 122 0.92 0.92 1.00 1.00 0.92 6 266 0 0 132 2 - 0 - 0 1 0 0 1 1 0 0 1 10 1 0 0 1 10 1 0 1 0 1 1 1 0 1 0 1 1 1 0 0 1 1 1 1 0</td> <td>Brett Lauritsen Intersection 47th Place & Retail Olsson Associates Jurisdiction Westwood, KS 3/8/2011 Analysis Year 2011 - Ex + Parcels bodside Place North/South Street: Center Retail East-West Study Period (hrs): 0.25 nd Adjustments 1 2 3 4 5 L T R L T 6 6 245 122 0.92 0.92 1.00 1.00 0.92 6 266 0 0 132 122 0.92 - - 0 - - 0 - 0 - 0 - - 0 - - 0 - - 0 - - 0 - - 0 - - - 0 - - - - 0 - - - - - - - 0 - - -</td>	Brett Lauritsen Intersection Olsson Associates Jurisdiction 3/8/2011 Analysis Year AM Analysis Year boodside Place Place North/South St East-West Study Period (I 1 2 3 L T R 6 245 1.00 6 266 0 2 0.92 0.92 1.00 6 266 0 2 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0	Brett Lauritsen Intersection 3/8/2011 Jurisdiction AM Analysis Year AM Analysis Year AM Analysis Year Place North/South Street: Center East-West Study Period (hrs): 0.25 nd Adjustments Eastbound 1 2 3 4 L T R L 6 245	Brett Lauritsen Intersection 47th Plac Olsson Associates Jurisdiction Westwood 3/8/2011 Am Intersection Westwood AM Amalysis Year 2011 - Exited and the section Westwood Place North/South Street: Center Retail Eastbound Westbout 1 2 3 4 5 Image: Study Period (hrs): 0.25 122 122 0.92 0.92 1.00 1.00 0.92 6 266 0 0 132 2 - 0 - 0 1 0 0 1 1 0 0 1 10 1 0 0 1 10 1 0 1 0 1 1 1 0 1 0 1 1 1 0 0 1 1 1 1 0	Brett Lauritsen Intersection 47th Place & Retail Olsson Associates Jurisdiction Westwood, KS 3/8/2011 Analysis Year 2011 - Ex + Parcels bodside Place North/South Street: Center Retail East-West Study Period (hrs): 0.25 nd Adjustments 1 2 3 4 5 L T R L T 6 6 245 122 0.92 0.92 1.00 1.00 0.92 6 266 0 0 132 122 0.92 - - 0 - - 0 - 0 - 0 - - 0 - - 0 - - 0 - - 0 - - 0 - - - 0 - - - - 0 - - - - - - - 0 - - -

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	TW	O-WAY STOP	CONTR	OL S	UMI	MARY			
General Informatio	n		Site I	nforn	nati	on			
Analyst	Brett Lau	ritsen	Inters				47th Plac	e & Retai	l-North
Agency/Co.		ssociates	Jurisd				Westwoo		
Date Performed	3/8/2011			sis Yea	IF		2011 - EX	+ Parcel	s 1 & 3
Analysis Time Period	РM								
	loodside								
East/West Street: 47th			North/	South S	Stree	et: Center	Retail		
Intersection Orientation:	East-West		Study	Period	(hrs): 0.25			
Vehicle Volumes a	nd Adjustme	ents							
Major Street		Eastbound					Westbou	nd	
Movement	1	2	3			4	5		6
	L	Т	R			L	Т		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	_		1	Undi	video	d			
RT Channelized	_	_	0						0
Lanes	0	1	0			0	1		0
Configuration	LT								TR
Upstream Signal		0					0		
Minor Street		Northbound					Southbou	ind	
Movement	7	8	9			10	11		12
	L	Т	R			L	Т		R
Volume (veh/h)	1.00					21			19
Peak-Hour Factor, PHF Hourly Flow Rate, HFR	1.00	1.00	1.00	,		0.92	1.00		0.92
(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, a	and Level of Se	arvice							
Approach	Eastbound	Westbound	1	Northb	ound		S	outhboun	đ
Movemeni	1	4	7	8		9	10	11	12
ane Configuration	LT							LR	
/ (veh/h)	23							42	1
C (m) (veh/h)	1270							606	1
//c	0.02							0.07	1
95% queue length	0.06							0.22	+
Control Delay (s/veh)	7.9							11.4	-
	A							B	+
									1
Approach Delay (s/veh)								11.4	
Approach LOS	∽ orida, All Rights Res			MT+TM				B ated: 3/18/20	

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General Information				Site Inform	nation			
Analyst	Brett La	auritsen		Intersection		47th P	lace & Stale Line	θ
Agency/Co.		Associates		Jurisdiction			vood, KS/KCMO	
Date Performed	3/8/201	1		Analysis Yea	r	2011 -	Ex + Parcels 1	& 3
Analysis Time Period	АМ							
Project ID Woodside Village				_				_
East/West Street: 47th Place				North/South S	treet: State Lin	e Rd		
Volume Adjustments	and Site Cl							
Approach	- L		astbound	R		we	stbound T	R
Volume (veh/h)	23		108	34	30		111	37
%Thrus Left Lane								
Approach	_	N	orthbound			Sou	thbound	-
Movement	Ļ		т	R	L		Т	R
/olume (veh/h)	74		380	26	12		141	20
%Thrus Left Lane								
	East	ound	Wes	tbound	Nort	bound	South	nbound
	L1	L2	L1	1.2	L1	L2	L1	L2
	LTR	L2	LTR		LTR		LTR	
Configuration	0.92		0.92		0.92		0.92	├───
Flow Rate (veh/h)	177		192		521		187	
Heavy Vehicles	2		2		2		2	<u> </u>
No. Lanes	4	l		1	_	1		1
Seometry Group				1		1		1
Duration, T	 			•	.25	<u> </u>		/
		Markahar		0.	.20			
Saturation Headway		worksnee		T			0.4	<u> </u>
Prop. Left-Turns	0.1		0.2		0.2		0.1	<u> </u>
Prop. Right-Turns	0.2		0.2		0.1		0.1	<u> </u>
Prop. Heavy Vehicle	0.0		0.0		0.0		0.0	
nLT-ədj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
nRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
nHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
nadj, computed	-0.1		-0.1		0.0		-0.0	
Departure Headway a	nd Service	Time	•					_
nd, initial value (s)	3.20		3.20		3.20		3.20	
<, initial	0,16		0.17		0.46		0.17	
nd, final value (s)	6.35		6.32		5.50		6.04	
, final value	0.31		0.34		0.80		0.31	
Nove-up lime, m (s)	2.	0		2.0		.0		.0
Service Time, I, (s)	4.4		4.3		3.5		4.0	
								I
Capacity and Level o							T	
		bound		lbound		nbound		bound
	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	
.OS	В		В		D	1	В	1
opproach: Delay (s/veh)	<u> </u>) 01		.49		.50		.78
		2.21						
LOS	<u> </u>	В	1	B		0	E	
ntersection Delay (s/veh)					0.10			_
ntersection LOS					С			

Page 1 of 1

General Information				Site Infor	mation			
Analyst	Bratt	auritsen		Intersection		47th F	Place & State Lin	e
Agency/Co.		n Associates		Jurisoliction		Westw	vood, KS/KCMO	
Date Performed	3/8/20	11		Analysis Yea	r	2011 -	Ex + Parcels 1	& 3
Analysis Time Period	PM							
Project ID Woodside Village						-		
East/West Street: 47th Place				North/South S	Street: State Lir	ne Rd		
Volume Adjustments	and Site C	haracteri						
Approach Movement			Eastbound		<u> </u>	We	stbound T	
Volume (veh/h)	L 38	5	т 122	114	L 60		181	R 26
%Thrus Left Lane		<u> </u>	122	,,,,			,,,,	20
Approach			Northbound		_		thbound	
Movement	ι		T	R	L L		Т	8
/olume (veh/h)	8	5	223	34	26		358	44
%Thrus Left Lane								
t	Eac	เbอมกต่	10/0	stbound	Mart	hbound	 	проли
							· · ·	
• • •		L2		L2	L1	12		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	Worksh	eet					
^o rop. Left-Tums	0.1		0.2		0.2		0.1	
Prop. Right-Turns	0.4		0.1		0.1		0.1	
rop. Heavy Vehicle	0.0		0.0		0.0		0.0	
1LT-adj	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
RT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
HV-ad	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
adj, computed	-0.2		0.0		0.0		-0.0	
Departure Headway a	-	Time	0.0		0.0		0.0	
-		1111 <u>1</u>		1				
nd, initial value (s)	3.20		3,20	+	3.20		3.20	
(, initial	0.26		0.26		0.33		0.41	
nd, final value (s)	8.43	ł	8.63		8.20		7.85	<u> </u>
k, final value Nove-up time, m (s)	0.69	.0	0.69	2.0	0.84	2.0	1.01	.0
		1		2.0				1
Service Time, t _s (s)	6.4		6.6		6.2		5.9	
Capacity and Level o	f Service							
	Easl	bound	We	stbound	Norti	hbound	South	bound
	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	
OS	D		D		E		F	
oproach: Delay (s/veh)	2	7. 9 2	2	8.96		.78		41
LOS		D		D		E	F	-
ntersection Delay (s/veh)				46	66			
ntersection LOS					E			

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		O-WAY STOP							
General Informatio	n		Site I	nfor m	atior	1			
Analyst	Brett Lau	ritsen	Inters	ection			47th Plac	e & Health	Club E
Agency/Co.	Olsson A	ssociates	Jurisd	iction			Westwoo		
Date Performed	3/8/2011		Analy	sis Yeai	ŕ		2011- Ex	+ Parcels	1&3
Analysis Time Period	AM								
Project Description W									
East/West Street: 47th							Club Entran	ce/Exit	
Intersection Orientation:	East-West		Study	Period ((hrs):	0.25			
Vehicle Volumes a	nd Adjustme	nts							
Major Street		Eastbound					Westbou	nd	
Movement	1	2	3			4	5		6
		Ϋ́	R			L	۲		R
Volume (veh/h)	35	227		-+		0.0	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				Undiv	vided				
RT Channelized			0						0
Lanes	0	1	0			0	1		0
Configuration	LT								TR
Jpstream Signal		0					0		
Minor Street		Northbound					Southbou	Ind	
Movement	7	8	9			10	11		12
	L	Ť	Ŕ			L	Т		R
Volume (veh/h)						22			42
Peak-Hour Factor, PHF	1.00	1.00	1.00	<u>, </u>	0.	92	1.00		0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0		2	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, a	Ind Level of Se	rvice							
Approach	Eastbound	Westbound		Northbo	ound		s	outhbound	}
Viovement	1	4	7	8		9	10	11	12
ane Configuration	LT				\neg		1	LR	
/ (veh/h)	38							68	1
C (m) (veh/h)	1476							777	
//c	0.03				-+			0.09	1
95% queue length	0.08							0.29	
Control Delay (s/veh)	7.5				-+-			10.1	+
OS	7.5 A							8	
Approach Delay (s/veh)								10.1	
Approach LOS		-						B	

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	TW	O-WAY STOP	CONTR	DL SI	JMN	IARY		_	
General Information	า		Site II	ıform	atio	n			
Analyst	Brett Lau	ritsen	Interse	ction	_		47th Plac	e & Healt	h Club Ent
Agency/Co.		ssociates	Jurisdi				Westwoo		
Date Performed	3/8/2011		Analys	is Yea	r		2011- Ex	+ Parcels	1&3
Analysis Time Period	РM								
Project Description									
East/West Street: 47th	Place		North/S	outh S	stree	t: Health (Club Entran	cə/Exit	
Intersection Orientation:	East-West	_	Study F	Period	(hrs)	: 0.25			
Vehicle Volumes ar	nd Adjustme	nts							
Major Street		Eastbound	-				Westbou	nd	
Movement	1	2	3			4	5		6
	L	Ť	R			L	ĩ		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				Undiv	/idea	1			
RT Channelized			0						0
Lanes	0	1	0			0 —	1		0
Configuration	LT								TR
Upstream Signal		0					0		
Minor Street		Northbound					Southbou	Ind	
Movement	7	8	9			10	11		12
	L	Т	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							<u>LR</u>		
Delay, Queue Length, a	nd Level of Se	rvice							
Approach	Eastbound	Westbound		Northbe	ound		S	outhbour	d
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							8	1
Approach Delay (s/veħ)	••			l	_			14.2	
Approach LOS								B	
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Existing Plus Parcels 1 & 3 AM 963: 47th Ave & Rainbow Blvd

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBF
Lane Configurations	ሻ	f.			र्भ	7		412			412	
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	
Fri	1.00	0.85			1.00	0.85		1.00			0.96	
FIt Protected	0.95	1.00			1.00	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1587			1863	1583		3515			3396	
FIt 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
Тига Туре	pm+pt	- 14		Perm		Perm	Perm			Perm		
Protected Phases	7	4			8	CO COL		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	С	В			D	D		8			A	
Approach Delay (s)		21.1			35.8			11.4			9.2	
Approach LOS		С			D			В			A	
Intersection Summary	and some state											
HCM Average Control Dela	¥		14.0	H	CM Level	of Service			В			
HCM Volume to Capacity ra	atio		0.50									
Actuated Cycle Length (s)			74.7	St	um of lost	time (s)			10.4			
Intersection Capacity Utiliza	tion		64.6%			of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Existing Plus Parcels 1 & 3 AM 963: 47th Ave & Rainbow Blvd

	٦		-	•	1	Ļ
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
ntersection Summary						

Existing Plus Parcels 1 & 3 PM 963: 47th Ave & Rainbow Blvd

	٨	-+	\mathbf{r}	4	+	Ł	-	1	*	5	Ļ	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	Y.	ţ,			Ą	1		ፋፑ			ፋፑ	
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	
Fit 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
Tum Type	pm+pt			Perm	1(2)	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	С	В			D	С		В			В	
Approach Delay (s)		20.9			35.3			11.8			12.6	
Approach LOS		С			D			В			В	
Intersection Summary												
HCM Average Control Dela			14.4	Н	CM Level	of Service	•		В			
HCM Volume to Capacity r	atio		0.57									
Actuated Cycle Length (s)			73.7		um of losi				10.4			
Intersection Capacity Utiliz	ation		74.3%	IC	U Level	of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

c Critical Lane Group

Existing Plus Parcels 1 & 3 PM 963: 47th Ave & Rainbow Blvd

	٦	-	-	×.	Ť	+
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						

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL.	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٦	ħ			4	1		414			412	
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	
Fit Protected	0.95	1.00			1.00	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1587			1863	1583		2627			3396	
Fit Permitted	0.51	1.00			1.00	1.00		0.81			0.95	
Satd. Flow (perm)	955	1587			1863	1583		2146		244.3	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		617 3	3.0	
Larre 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	С	С			D	D		8			А	
Approach Delay (s)		27.1			43.1			12.5			9.0	
Approach LOS		С			D			8			А	
Intersection Summary				The second							M L SIR	코모뷰
HCM Average Control Dela	y		16.4	Н	CM Level	of Service	9		В			
HCM Volume to Capacity ra			0.59									
Actuated Cycle Length (s)			90.0	S	um of los	t time (s)			10.4			
Intersection Capacity Utiliza	ation		64.6%			of Service			С			
Analysis Period (min)			15									
c Critical Lane Group												

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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					e i se	25,29

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٦	₽			4	1		412			472	
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	121 24		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	С	С			D	D		А			A	
Approach Delay (s)		29.8			43.8			8.9			10.0	
Approach LOS		С			D			A			Á	
Intersection Summary												
HCM Average Control Delay			14.2	H	CM Level	of Service			B			
HCM Volume to Capacity ratio			0.55									
Actualed Cycle Length (s)			90.0					10.4				
Intersection Capacity Utilization			74.3%			of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

	٦	-	←		1	↓ ·
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				2.24		

Existing Plus Parcels 1 & 3 AM 15: 47th Place & Rainbow Blvd

	*	×.	1	/	5	Ļ
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	ሻ	F	† T+		-	^
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	SIG	RUMANE.	4.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frt	1.00	0.85	0.98			1.00
Fit Protected	0.95	1.00	1.00			0.98
Satd. Flow (prot)	1770	1583	3469			3481
Fit Permitted	0.95	1.00	1.00			0.62
Satd. Flow (perm)	1770	1583	3469			2180
	0.92	0.92	0.92	0.92	0.92	0.92
Peak-hour factor, PHF	0.92		626			
Adj. Flow (vph)		97		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	1. 34		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	U	1.8			1.4
Approach LOS	00.0 D		A			A
Intersection Summary			1. 1997		C. 41 St	
And the same is not a second to be a	21.4		EC	11	CMLovel	of Convior
HCM Average Control Dela			5.6	TI:	CIM Level	of Service
HCM Volume to Capacity r	310		0.30			Free (a)
Actuated Cycle Length (s)			90.0		um of lost	
Intersection Capacity Utiliz	ation		45.7%	IC	U Level o	of Service
Analysis Period (min)			15			
o Critical Lana Group						

3/18/2011

c Critical Lane Group

Existing Plus Parcels 1 & 3 AM 15: 47th Place & Rainbow Blvd

	4		1	Ļ
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			1.11	

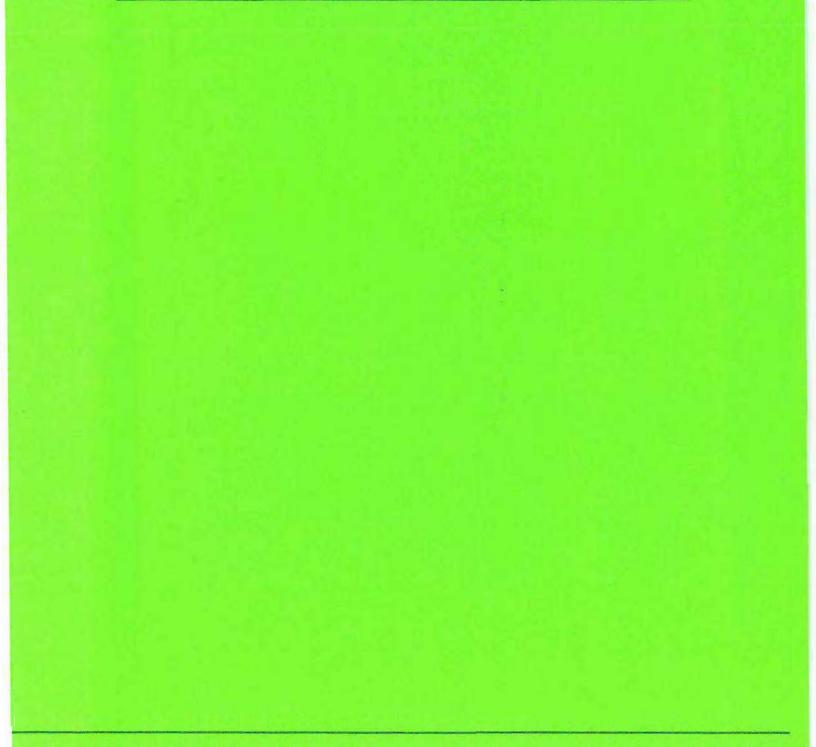
Existing Plus Parcels 1 & 3 PM 15: 47th Place & Rainbow Blvd

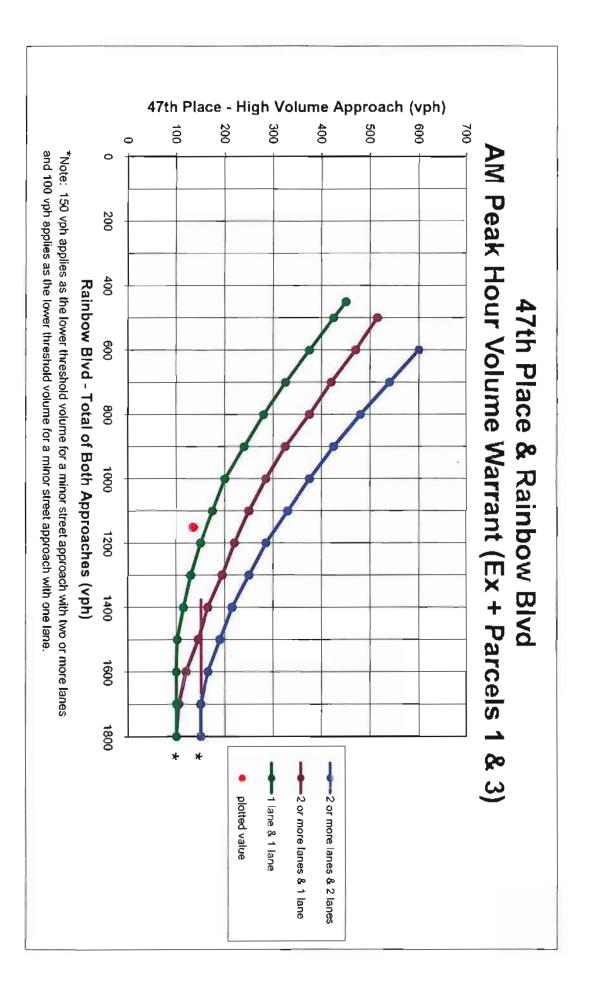
	1	×.	1	-	5	ļ	
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	۲	7	41			^	
Volume (vph)	100	163	290	80	116	772	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0			4.0	
Lane Util. Factor	1.00	1.00	0.95			0.95	
Frt	1.00	0.85	0.97			1.00	
FIt Protected	0.95	1.00	1.00			0.99	
Satd. Flow (prot)	1770	1583	3424			3516	
Fit 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	AL AN	121	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	А			А	
Approach Delay (s)	36.8		2.3			1.1	
Approach LOS	D		A			А	
Intersection Summary			Comments.				
HCM Average Control Delay	,		7.6	H	CM Level	of Service	
HCM Volume to Capacity rat	tio		0.43				
Actuated Cycle Length (s)			90.0		um of lost		
Intersection Capacity Utilizat	tion		50.8%	IC	U Level o	of Service	
Analysis Period (min)			15				
c Critical Lane Group							

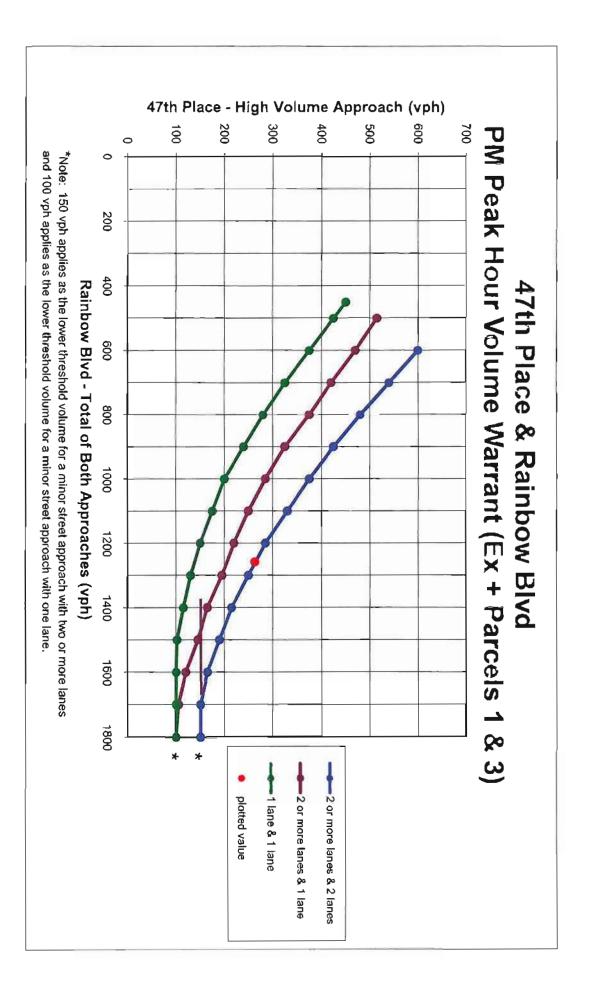
Existing Plus Parcels 1 & 3 PM 15: 47th Place & Rainbow Blvd

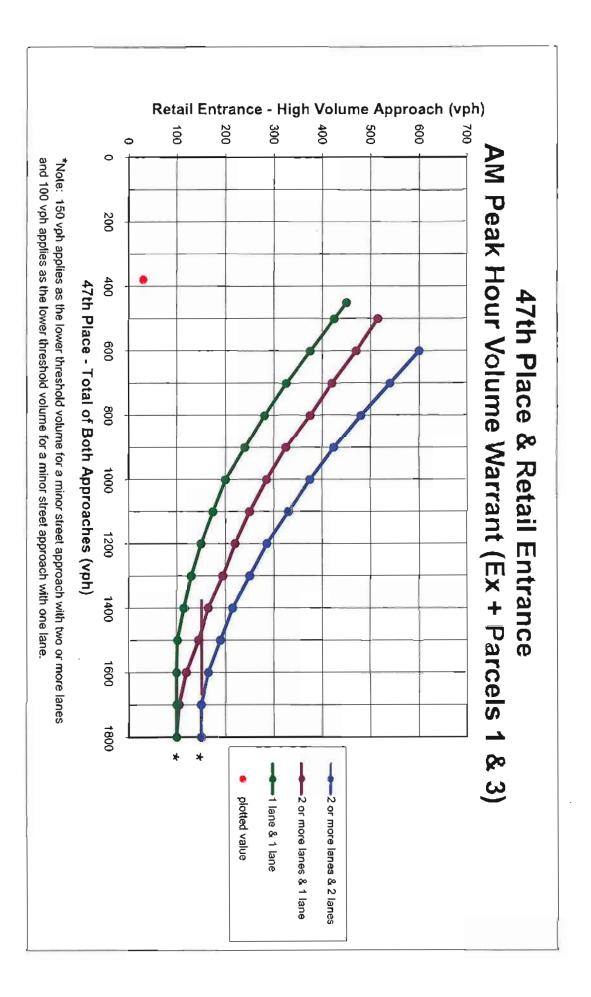
	~	×.	Ť	Ţ
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	177	402	965
v/c Ratio	0.51	0.51	0.15	0.42
Control Delay	44.8	11.1	2.1	1.2
Queue Delay	0.0	0.0	0.0	0.1
Total Delay	44.8	11.1	2.1	1.3
Queue Length 50th (ft)	59	0	16	11
Queue Length 95th (ft)	106	55	33	23
Internal Link Dist (ft)	95		214	249
Turn 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				1000

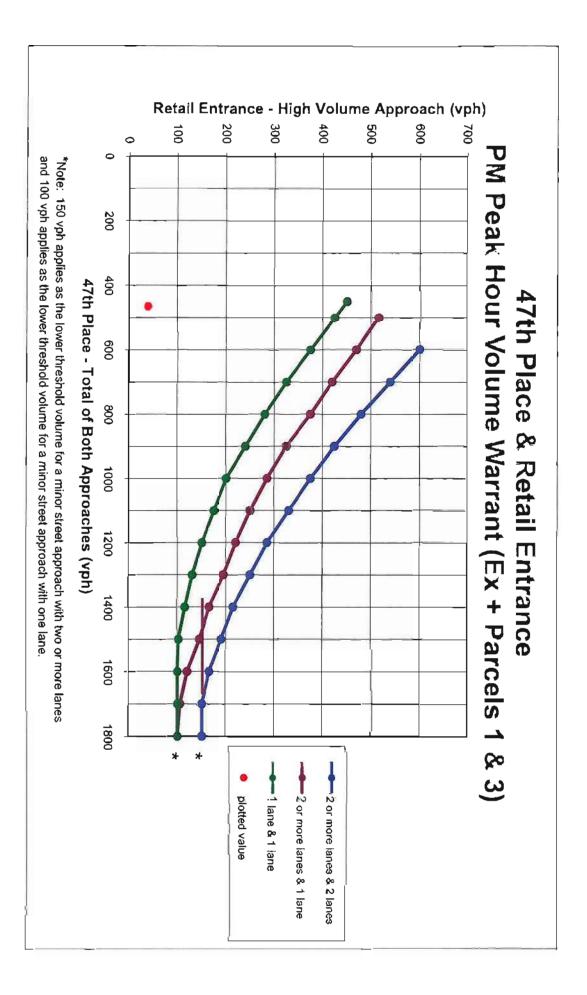
Capacity Analysis Reports

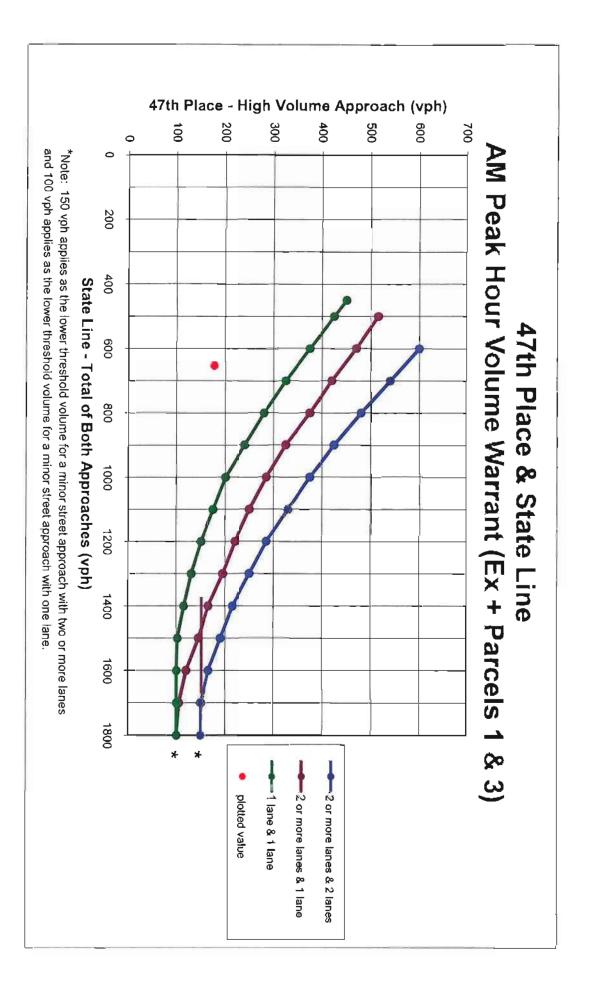


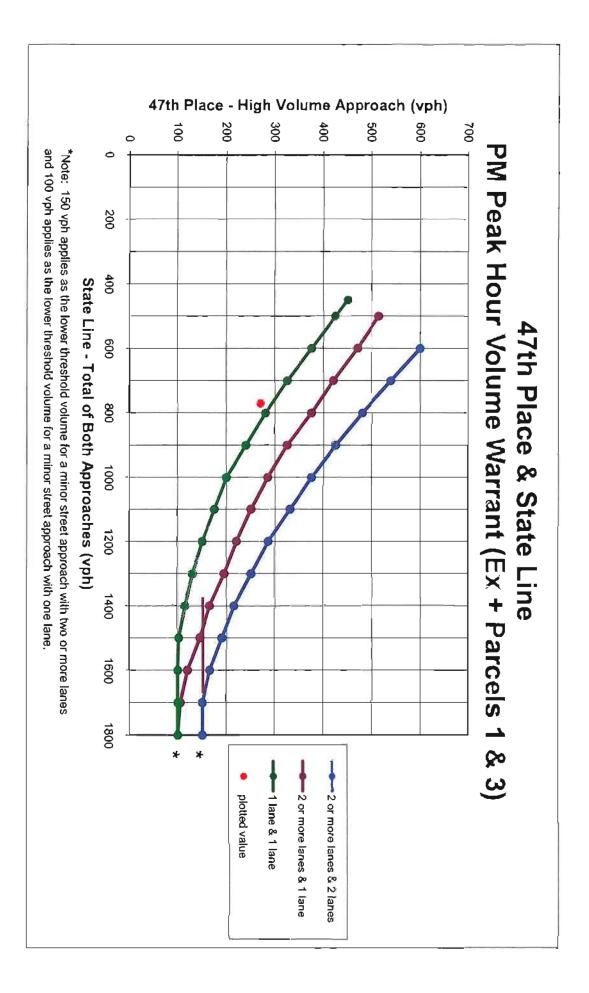


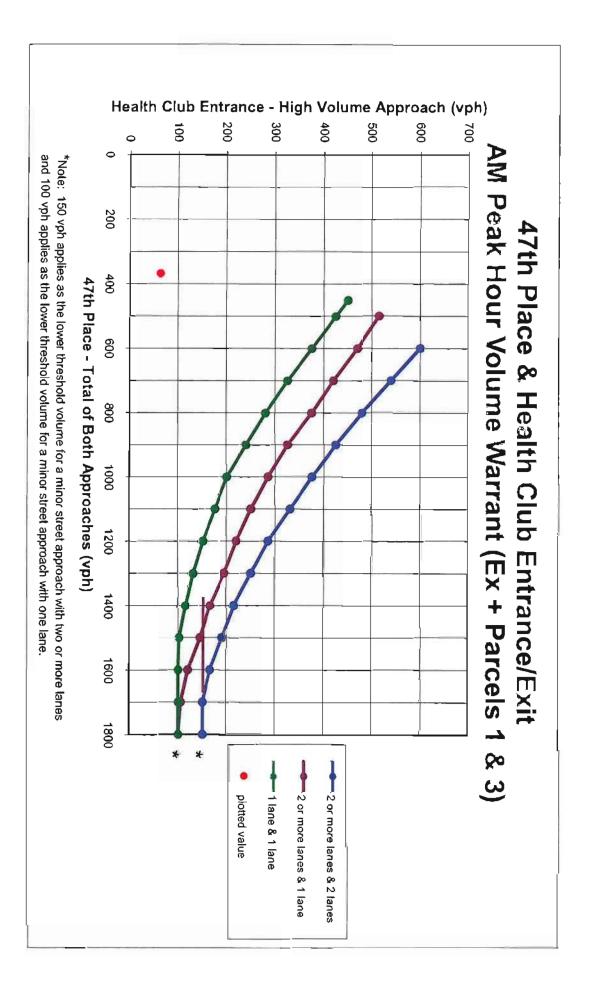


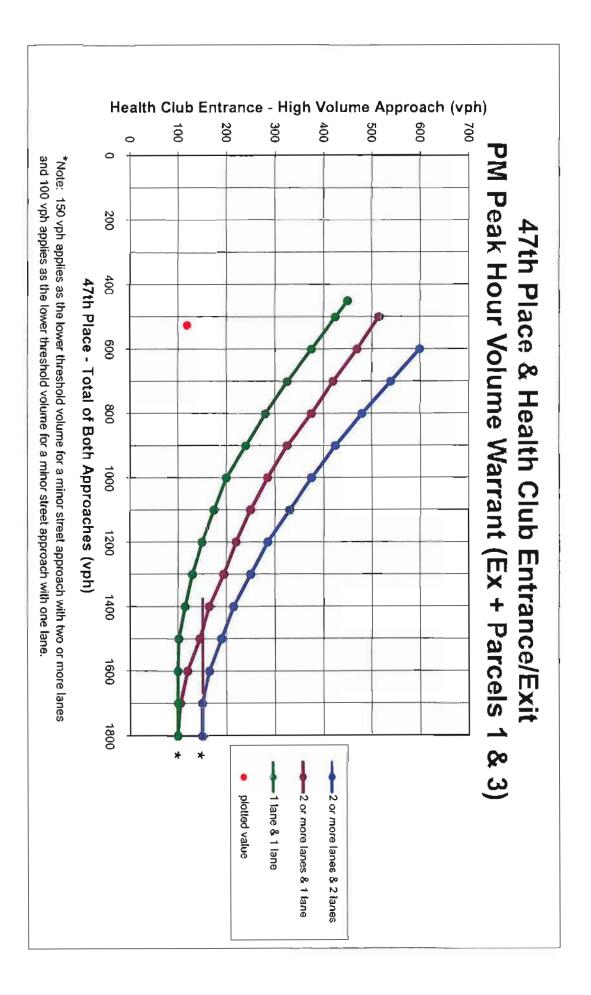




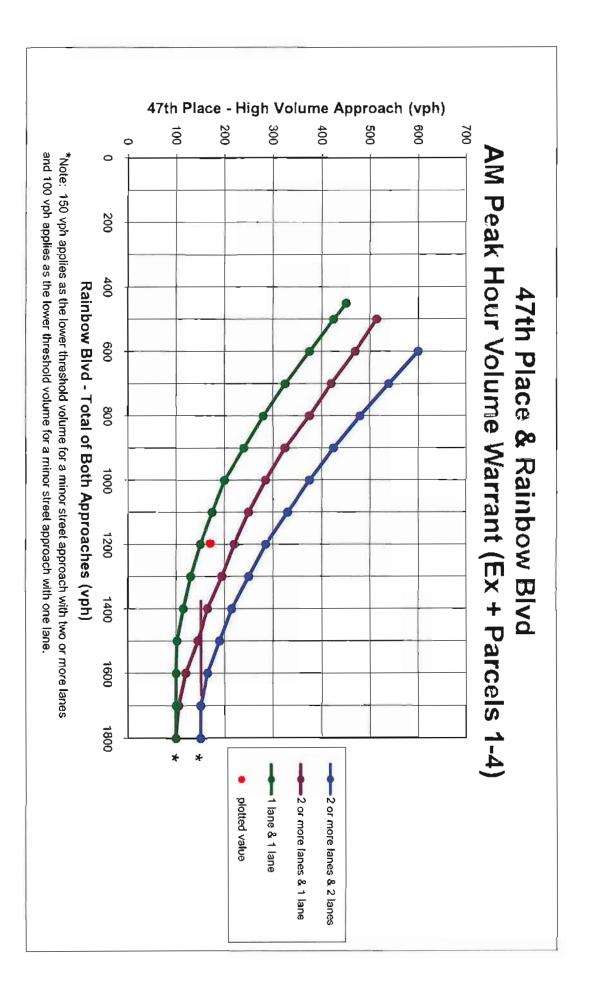


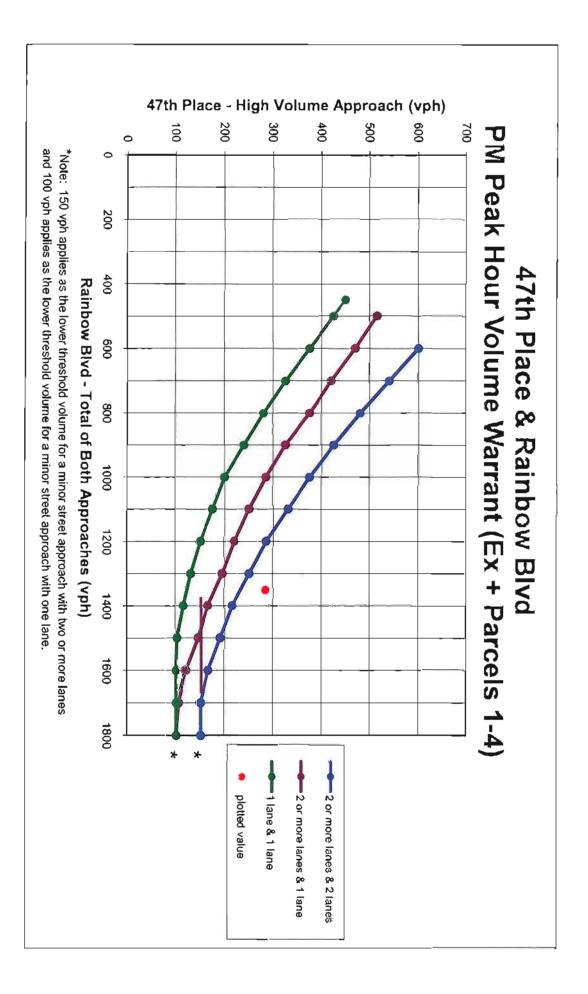


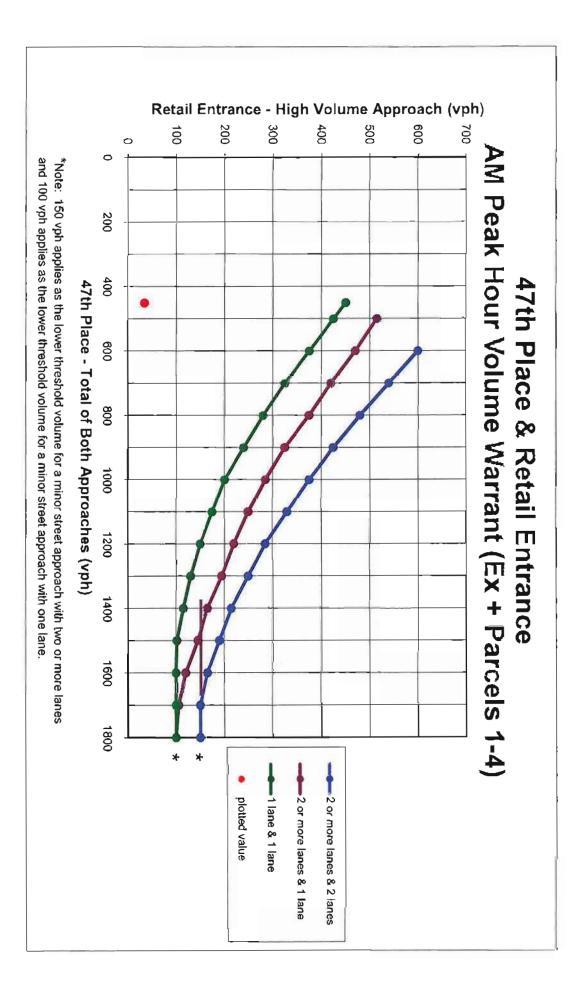


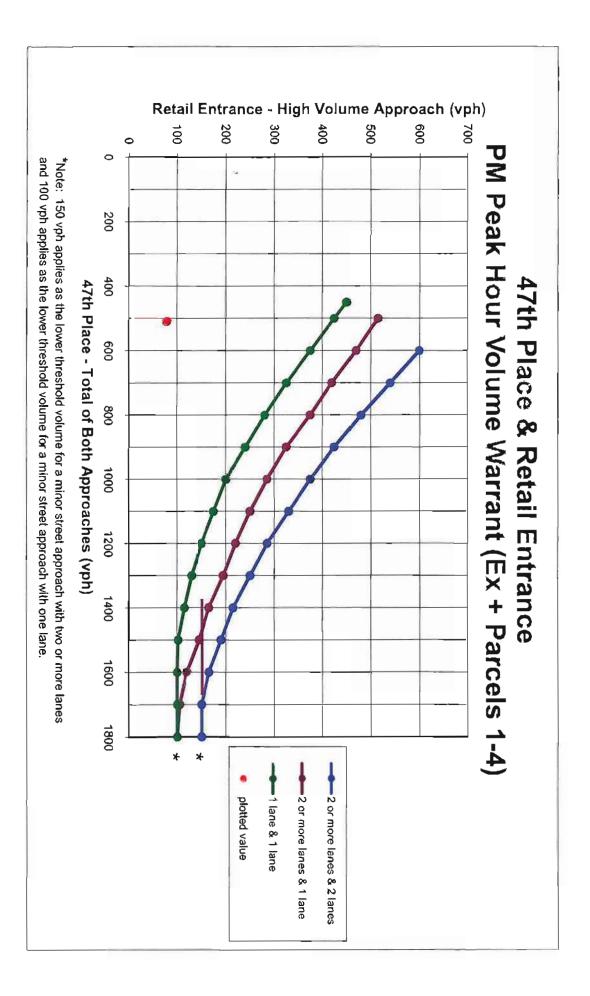


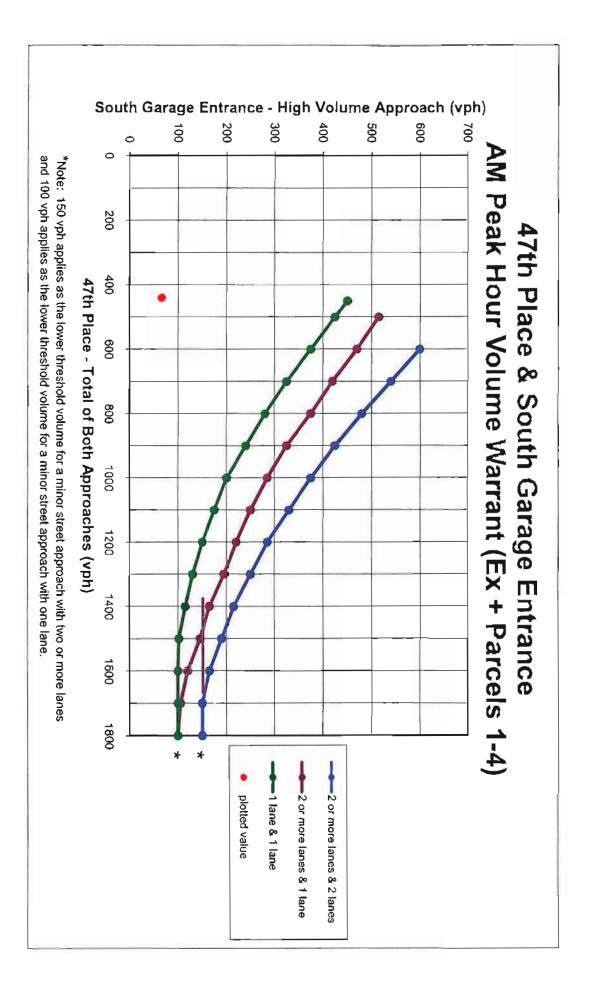
Signal Warrant Analysis

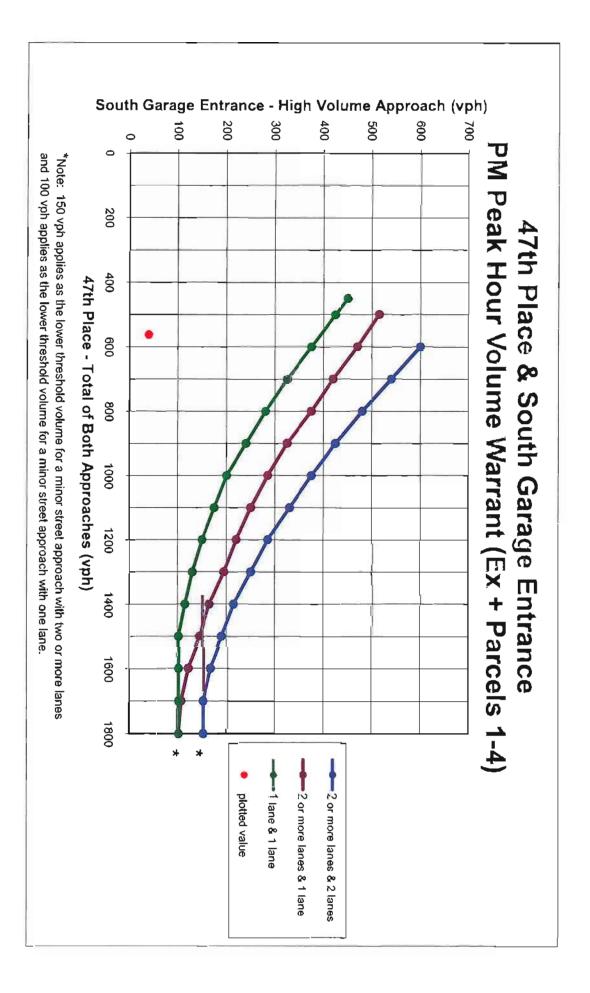


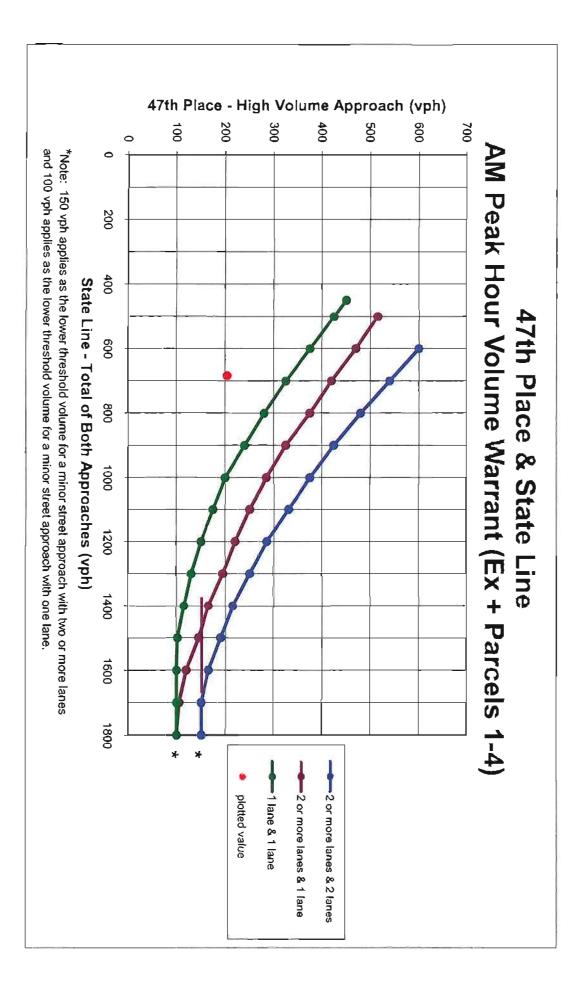


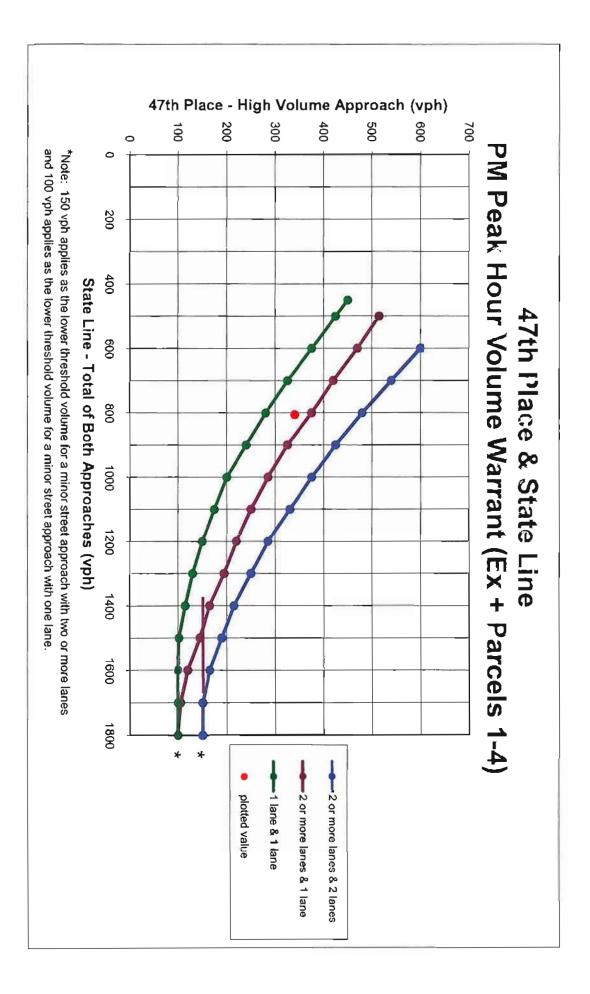


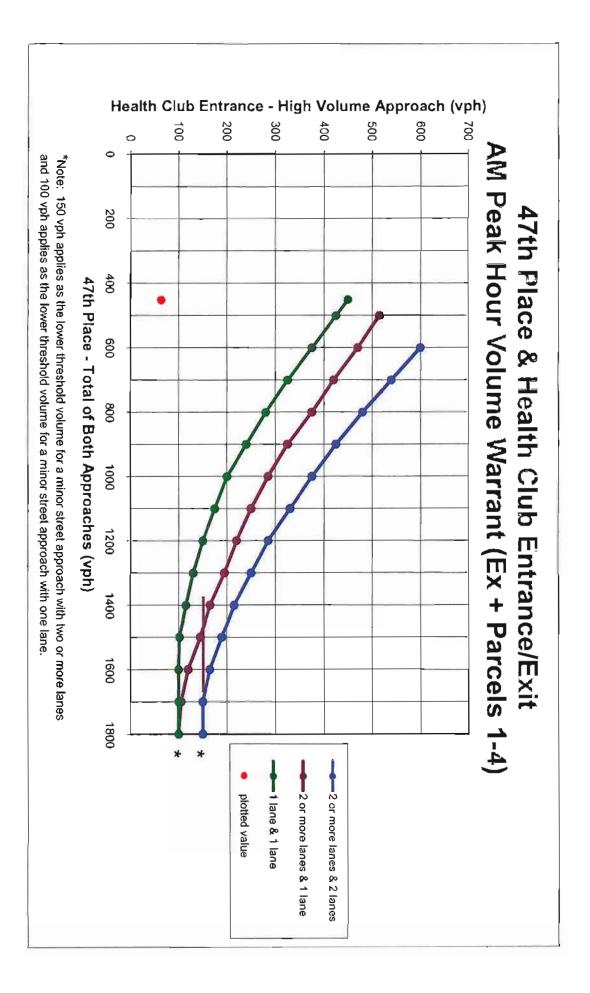


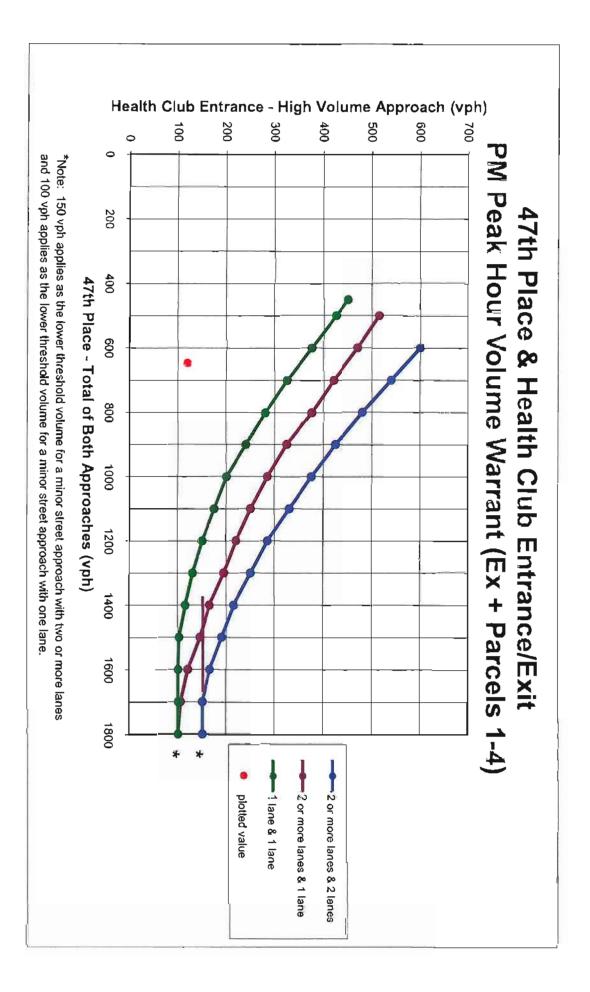


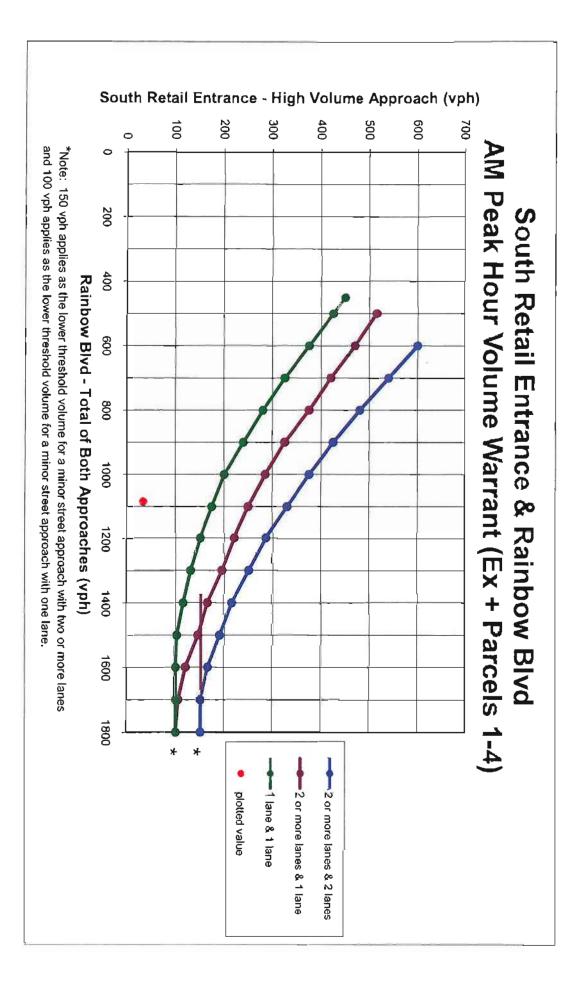


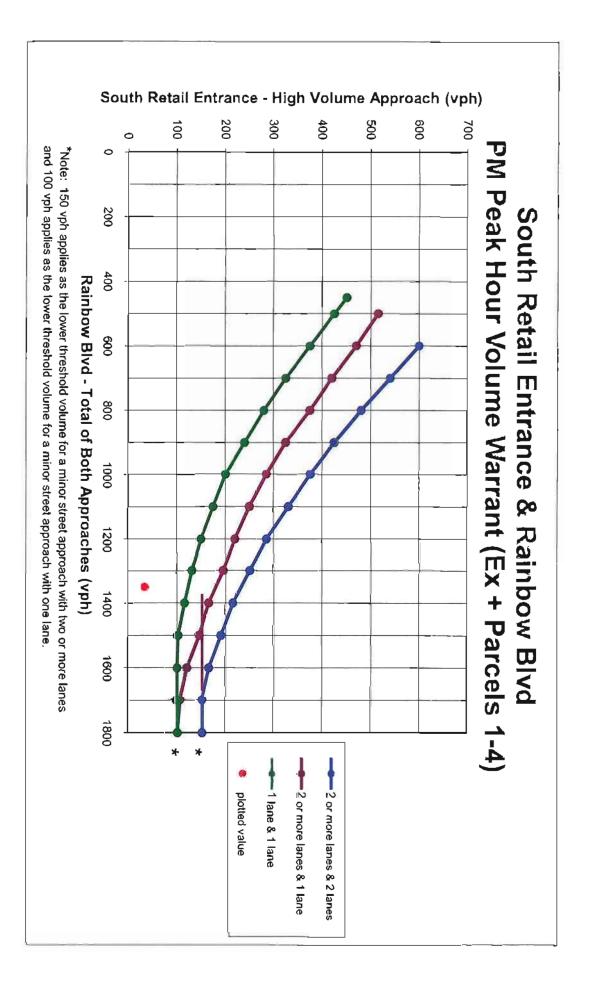




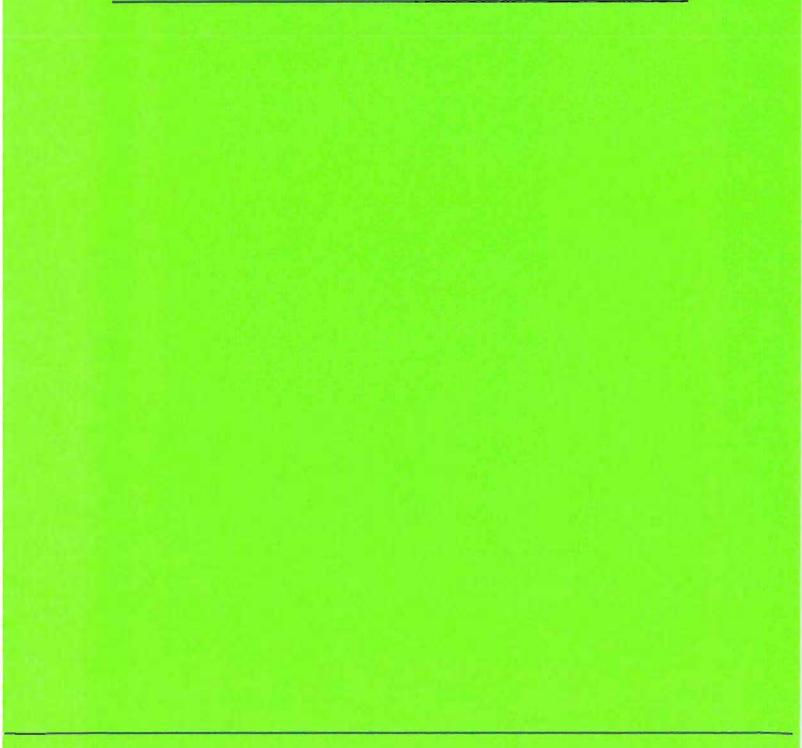








Capacity Analysis Reports



		O-WAY STOP							
General Informatio	n		Site	nformati	on				
Analyst	Brett Lau	ritsen	Interse	ection			e & Rainb		
Agency/Co.		ssociates	Jurisdi	ction		Westwood, KS/KCK			
Date Performed	3/8/2011		Analua	ia Veer		(UG)/KD	(+ Parcels	- 1 1	
Analysis Time Period	AM			sis Year		2011-20	(+ Parcen	51-4	
Project Description W	nodside								
East/West Street: 47th			North/S	South Stree	et: <i>Rainbo</i>	w Blvd			
Intersection Orientation:				Period (hrs					
Vehicle Volumes a	nd Adiustme	nts			·				
Major Street		Northbound				Southbou	Ind		
Movement	1	2	3		4	5		6	
	L	- Τ	R		L	Ť		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	0	659	94		181	365		0	
(veh/h) Percent Heavy Vehicles	0							-	
Median Type				Undivide	2			-	
RT Channelized		-	0		0			0	
Lanes	0	2	0		0	2		0	
Configuration		<u> </u>			LT			<u> </u>	
Upstream Signal		0			L7				
Minor Street		Eastbound				Westbou	und		
Movement	7				10	11		12	
	, L	Τ	9 R			Τ		8	
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			134	
Percent Heavy Vehicles	0	0	0		2	0		0	
Percent Grade (%)		0				0			
Flared Approach		N				N			
Storage		0							
RT Channelized			0					0	
Lanes	0	0	0		1	0		1	
Configuration					L			R	
Delay, Queue Length, a	and Level of Se	rvice							
Approach	Northbound	Southbound		Westbound	1	6	Eastbound	ł	
Movement	1	4	7	8	9	10	11	12	
Lane Configuration		LT	L		R			1	
v (veh/h)		181	51		134	1			
C (m) (veh/h)		853	130		675		_		
//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			+	
,		10.4 B	+9.5 E		B				
LOS			2	20.4	0				
Approach Delay (s/veh)				22.1					
Approach LOS				С					

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Cananal Ifa		O-WAY STOP		Norm of				
General Information	١			nformati	on			
Analyst	Brett Laur	ritsen	Interse	ction		47th Plac	e & Rainb d, KS/KCI	
Agency/Co.	Olsson As	ssociates	Jurísdi	ction		(UG)/KD0		`
Date Performed	3/8/2011		Analys	is Year			+ Parcel	s 1-4
Analysis Time Period	PM							
Project Description Wa	oodside							
East/West Street: 47th	Place				et: Rainbo	w Blvd		
Intersection Orientation:	North-South		Study F	Period (hrs	s): 0.25			
Vehicle Volumes ar	d Adjustme	nts						
Major Street		Northbound				Southbou	nd	
Movement	1	2	3		4	5		6
	L.	Ť	R		L	Ť		R
Volume (veh/h)	1.00	305	80		129	836		4.00
Peak-Hour Factor, PHF Hourly Flow Rate, HFR	1.00	0.92	0.92		0.92	0.92		1.00
louny riow Rate, HFR (veh/h)	0	331	86		140	908		0
Percent Heavy Vehicles	0				2			
Median Type			Undivid		d			
RT Channelized			0					0
Lanes	0	2	0		0	2	-	0
Configuration		Т	TR		LT	Т		
Upstream Signal		0				0		
Minor Street	Eastboun					Westbou	nd	
Movement	7	8	9		10	11		12
	L	Т	R		L	Т		R
√olume (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	Õ		1	0		1
Configuration					L			Ŕ
Delay, Queue Length, a	nd Level of Se	rvice						
Approach	Northbound	Southbound		Weslboun	d		Eastbound	9
Novement	1	4	7	8	9	10	11	12
ane Configuration		LT	L		R			
v (veh/h)		140	108		199			
C (m) (veh/h)		1138	179		837	1		
//c		0.12	0.60		0.24		<u> </u>	
95% queue length		0.42	3.32		0.93			
Control Delay (s/veh)		8.6	51.7		10.6			
LOS		8.0 A	57.7 F		B		-	+
			F	25.1				
Approach Delay (s/veh)								
Approach LOS	-			D		Gene		

HCS+TM Version 5.5

Generated: 3/14/2011 8:19 AM

		O-WAY STOP									
General Informatio	n		Site II	1form	atic	on					
Analyst	Brett Lau	rítsen	Interse	Intersection				47th Place & Retail			
Agency/Co.		ssociates	Jurisdi				Westwood, KS				
Date Performed	3/8/2011		Analys	is Year	,		2011 - Ex + Parcels 1-4				
Analysis Time Period	AM										
Project Description W					4	. <u>O</u>	Datal				
East/West Street: 47th Intersection Orientation:			Study f			t: Center	Retall				
			Sludy r		nisj	. 0.23					
Vehicle Volumes a	nd Adjustme										
Major Street		Eastbound	1 2				Westbou	nd	6		
Movement	1 L	2 T	3 R			4 L	5 T		6 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)	б	266	3			2	169		42		
Percent Heavy Vehicles	2				2						
Median Type		-	Undlvide			1		•			
RT Channelized			0						0		
Lanes	0	1	0			0	1		0		
Configuration	LTR				LTR						
Upstream Signal		0					0				
Minor Street		Northbound					Southbou	ind			
Movement	7	8	9		10		11		12		
	L	Т	Ŕ			L	Т		R		
Volume (veh/h)	1	0	2		21		0		14		
Peak-Hour Factor, PHF	0. <u>92</u>	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		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 Leng <u>th,</u> a	and Level of Se	rvice									
Approach	Eastbound	Westbound	1	Vorthbo	ound		S	outhboun	d		
Movement	1	4	7	8		9	10	11	12		
Lane Configuration	LTR	LTR		LTR	2			LTR			
v (veh/h)	6	2		3				37			
C (m) (veh/h)	1360	1295		644				598			
	0.00	0.00	0.0					0.06	1		
95% queue length	0.01			0.01				0.20	1		
Control Delay (s/veh)	7.7			10.6	_			11.4	1		
LOS	A							B	+		
Approach Delay (s/veh)			B 10.6						1		
1.1				70.0 B	,		11.4 B				
Approach LOS		~		D			1				

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	1 1 1	O-WAY STOP	CONTR	OL SI		MARY					
General Informatio	n		Site I	nform	nati	on					
Ānalyst	Brett Lau	ritsen	Interse	Intersection				e & Retail			
Agency/Co.	Olsson A	ssociates	Jurisđ	Jurisdiction				Westwood, KS			
Date Performed	3/8/2011		Analys	sis Yea	ſ		2011 - Ex	(+ Parcels	51-4		
Analysis Time Period	РM	_			_						
	loodside										
East/West Street: 47th				North/South Street: Center Retail							
ntersection Orientation:	East-West		Study I	Period	(hrs): 0.25					
Vehicle Volumes a	nd Adjustme	ents									
Major Street		Eastbound					Westbou	nd			
Movement	1	2	3			4	5		6		
	L	Т	R			L	Т		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		
lourly Flow Rate, HFR veh/h)	23	189	14			6	284		35		
Percent Heavy Vehicles	2				2		-		-		
Median Type			Undiv		vided						
RT Channelized			0						0		
anes	0	1	0			0	1		0		
Configuration	LTR					LTR					
Jpstream Signal		0					0				
linor Street	Northbound						Southbou	ind			
Viovement	7	8	9		10		11		12		
	L	Т	R				Т		R		
/olume (veh/h)	3	0	8		60		0		19		
Peak-Hour Factor, PHF	0.92	0.92	<i>0.92</i>	2		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	T{				N				
Storage		0					0				
RT Channelized			0						0		
anes	0	1	0			0	1		0		
Configuration		LTR					LTR				
Jelay, Queue Length, a	and Level of Se	ervice									
Approach	Eastbound			Vorthbo	ound	1	S	outhbound	1		
Novement	1	4	7	8		9	10	11	12		
ane Configuration	LTR			LTR	2			LTR			
/ (veh/ħ)	23	6		11				85			
C (m) (veh/h)	1241	1369		659				473	1		
//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			
					,				┨───		
.OS	А	A		B				B	1		
pproach Delay (s/veh)	~			10.6	5			14.3			
Approach LOS				В			В				

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		O-WAY STOP								
General Informatio	n		Site I	n form	atic	n				
Analyst	Brett Lau	ritsen	Interse	ection			47th Place & South Garage			
Agency/Co.		ssociates	Jurisđ	ction			Westwood, KS			
Date Performed	3/8/2011		Analys	sis Year	r		2011 - Ex	(+ Parce	ls 1-4	
Analysis Time Period	AM									
Project Description W										
East/West Street: 47th			North/S	South S	itree	t: South (Garage			
ntersection Orientation:	East-West		Study I	Period ((hrs):	: 0.25	_			
Vehicle Volumes ar	nd Adjustme	nts								
Major Street		Eastbound					Westbou	ind		
Movement	1	2	3			4	5		6	
	L	Ť	R			L	Τ		R	
/olume (veh/h)		268	0			10	163			
Peak-Hour Factor, PHF	1.00	0.92	0.92		0.92		0.92		1.00	
lourly Flow Rate, HFR veh/h)	о	291	0			10	177		0	
Percent Heavy Vehicles	0	-	-		2		-		-	
Median Type					ivided					
RT Channelized			0						0	
anes	0	1	0			0	1		0	
Configuration			TR			LT				
Jpstream Signal		0					0			
Minor Street	Northbound						Southbou	Ind		
Novement	7 8		9		10		11		12	
	L	Т	R			L	T		R	
/olume (veh/h)	34		0							
Peak-Hour Factor, PHF	0.92	1.00	0. 9 2			1.00	1.00		1.00	
Hourly Flow Rate, HFR	36	0	0		0		0		0	
Percent Heavy Vehicles	2	0	2		0		0		0	
Percent Grade (%)		0					0			
Plared Approach		N					N			
Storage		0					0			
RT Channelized			0						0	
_anes	0	0	0			0	0		0	
Configuration		LR				-		-+-	-	
Delay, Queue Length, a	nd Level of Se					-				
Approach	Eastbound	Westbound		Northbo	bund		9	outhbour	nd	
Movement	1	4	7	8		9	10	11	12	
ane Configuration	•	LT	,	LR		5				
(veh/h)		10		36						
C (m) (veh/h)		1271		535						
//c		0.01		0.07						
95% queue length		0.02		0.22	_					
Control Delay (s/veh)		7.9		12.2						
							-			
		A		B						
Approach Delay (s/veh)				12.2	?					
pproach LOS				В			1			

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		O-WAY STOP								
General Information	า		Site lı	nformat	i on					
Analyst	Brett Lau	ritsen	Interse	ection		47th Plac	47th Place & South Garage			
Agency/Co.	Olsson A	ssociates	Jurisdi	ction			Westwood, KS			
Date Performed	3/8/2011		Analys	is Year		2011 - Ex	(+ Parce	ls 1-4		
Analysis Time Period	PM									
Project Description Wa	oodside									
East/West Street: 47th			North/S	South Stre	et: South	Garage				
Intersection Orientation:	East-West		Study F	Period (hr	s): 0.25					
Vehicle Volumes ar	nd Adiustme	nts								
Major Street		Eastbound				Westbou	Ind			
Movement	1	2	3		4	5		6		
	L	Т	Ŕ		L	Т		R		
/oluma (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				Undivide	ed		•			
RT Channelized			0					0		
anes	0	1	0		0	1		0		
Configuration			TR		LT					
Jpstream Signal		0				0				
Vilnor Street	Northbound					Southbou	und .			
Novement	7	8	9		10	11		12		
	L	T	R		L	Τ		R		
/olume (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		
anes	0	0	0		0	0	— -	0		
Configuration			+ `					~		
Delay, Queue Length, a	nd level of Co									
Approach	Eastbound	Westbound	1	Vorthbour	nd		outhbou	nd		
/iovement	1	4	7	8	9	10	11	12		
ane Configuration	1	LT	· ·	LR						
		40				╉╼────	 			
/ (veh/h)				42						
C (m) (veh/h)		1301		562		<u> </u>				
//c		0.03		0.07				_		
95% queue length		0.10		0.24						
Control Delay (s/veh)		7.9		11.9						
	-	A		В						
.os										
.OS Approach Delay (s/veh)	_	_		11.9						

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General Information				Site Infor	mation						
Analyst	Brett I	auritsen		Intersection		47ih P	lece & State Line	e Rd			
Agency/Co.		Associates		Jurisdiction Westwood, KS/KCMO							
Date Performed	3/8/20	11		Analysis Year 2011- Ex + Parcels 1-4							
Analysis Time Period	AM_										
Project ID Woodside											
East/West Street: 47th Place				North/South S	Street: State Lin	e Road					
/olume Adjustments	and Site C										
Approach Movement	ι		Eastbound T	R		We	stbound	Ŕ			
Volume (veh/h)	34	1	119	52	30		125	37			
%Thrus Left Lane		<u> </u>		VL			120	Ç,			
Approach			bnuodrhoN		_	Sour	thbound				
viovement	L		T	Ŕ	Ļ		τ	R			
/olume (veh/h)	9:	3	380	26	12		141	32			
%Thrus Left Lane											
	East	bound	Wei	sibound	North	ibound	South	bound			
	L1	L2	L1	L2	L1	L2	L1	L2			
	LTR	L2	LTR		LTR	<u> </u>	LTR				
Configuration								<u> </u>			
PHF	0.92		0.92	+	0.92		0.92 200	 			
Flow Rate (veh/h)	227		207	+	2		200				
% Heavy Venicies Vo. Lanes		1		1	-	1	2	1			
Geometry Group		, 1		1		1					
Duration, T		,			0.25			ſ			
Saturation Headway	<u> </u>	Maskaha	<u></u>		.20			_			
		T			0.0						
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			
nRT-adj	-0.6	-0.6	-0.6	-0,6	-0.6	-0.6	-0.6	-0.6			
nHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7			
nadj, computed	-0.1		-0.1		0.0		-0.1				
Departure Headway a	nd Service	Time									
nd, initial value (s)	3.20		3.20		3.20		3.20				
x, initial	0.20	1	0.18		0.48		0.18				
nd, final value (s)	6.66		6.74		5.86		6.46				
, final value	0.41		0.39		0.88		0.36				
Move-up time, m (s)		.0		2.0	2	.0	2.	0			
Service Time, t _s (s)	4.7		4.7		3.9		4.5				
Capacity and Level o				1				<u> </u>			
School & and Cerel O	1	bound	\Ale	slbound	North	bound	Sauth.	ibound			
	-			L2	L1	L2		L2			
N <i>H L</i> N N	L1	L2	L1				L1				
Capacity (veh/h)	471	ļ	457	<u> </u>	606		450	L			
Delay (s/veh)	14.20		13.93	<u> </u>	37.39		13.04				
.0\$	В		В		E		В				
Approach: Delay (s/veh)	1	4.20	13	3.93	37	37.39 13.					
LOS		В		B E B							
ntersection Delay (s/veh)		-			4.70						
ntersection LOS					C						

General Information				Site Infor	mation	_			
				Intersection 47th Place & State Line				a Dd	
analyst Brett Lauritsen gency/Co. Olsson Associates							Wood, KS/KCMO		
Date Performed 3/8/2011				Analysis Year 2011			- Ex + Parcels 1-4		
Analysis Time Period	PM								
Project ID Woodside									
Easl/West Street: 47th Place)			North/South S	Street: State Lin	e Road			
Volume Adjustments	and Site C	haracteris	tics						
Approach			Eastbound			We		stbound	
Movement	L		T R		L		T R		
Volume (veh/h)	54		142	144	60		196	26	
%Thrus Left Lane									
Approach		1	Northbound			Sou	thbound		
Movement	L		т 223	R 34			T R 358 58		
Volume (veh/h)	70	<i>''</i>	223	34	20		358	38	
%Thrus Left Lane									
	Eastbound		Westbound		Norti	hbound	Southbound		
	L1	1/2	L1	L2	Lí	L2	L1	L2	
Configuration	LTR		LTR		LTR		LTR		
PHF	0.92		0.92		0.92		0.92		
Flow Rale (veh/h)	368		306		394		480		
% Heavy Vehicles	2		2		2		2	_	
No. Lanes	1	1		1		1	1		
Geometry Group	1			1 1			1		
Duration, T			•	0	.25		•		
Saturation Headway	Adlustment	Workshe	et						
Prop. Left-Turns	0.2		0.2		0.3	Г	0.1		
Prop. Right-Turns	0.4	<u> </u>	0.1		0.1		0.1		
Prop. Heavy Vehicle	0.0		0.0		0.0		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	
nHV-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 a	and Service	Time					-		
nd, initial value (s)	3.20		3.20		3.20		3.20		
c, initial	0.33		0.27		0.35		0.43		
hd, final value (s)	9.13		9.66		9.19		9.12		
k, final value	0.93		0.82		1.01		1.22		
Move-up lime, m (s)	2.0		2	2.0		.0	2.0		
Service Time, t _e (s)	7.1		7.7		7.2		7.1		
Capacity and Level o								I	
Sabacity and Feadlo	1	have d						4	
	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		
.08	F	1	E		F		F		
		0.00		20		10		44	
Approach: Delay (s/veh)	60.89		44.39		78.12		146.41		
LOS		F			E F			F	
Intersection Delay (s/veh)	1			88	3.53				

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	TW	O-WAY STOP	CONTR	OL SI	UMI	MARY				
General Informatio	n		Site I	nform	natio	on				
Analyst	Brett Lau	ritsen	Interse	ection			47th Plac	e & Heal	th Club Ent	
Agency/Co.		ssociates	Jurisd				Westwoo			
Date Performed	3/8/2011			sis Yea	r		2011 - Ex	,	ls 1-4	
Analysis Time Period	AM									
Project Description W	loodside									
East/West Street: 47th			North/S	South S	Stree	et: Health	Club Entran	ce/Exit		
Intersection Orientation:	East-West		Study	Period	(hrs)): 0,25				
Vehicle Volumes a	nd Adjustme	nts								
Major Street		Eastbound					Westbound			
Movement	1	2	3	4		4	5		6	
	L	Ť	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				Undiv	video	d				
RT Channelized			0						0	
Lanes	0	1	0			0 _	1		0	
Configuration	LT								TR	
Upstream Signal		0					0			
Minor Street		Northbound					Southbou	ind		
Movement	7	8	9			10	11		12	
	ι L	Т	R			L	Т		Ŕ	
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	
Laņes	0	0	0			0	0		0	
Configuration							LR			
Delay, Queue Length, a	and Level of Se	rvice								
Approach	Eastbound	Westbound		Northbo	ουπά	1	S	outhbour	nd	
Movement	1	4	7	8		9	10	11	12	
Lane Configuration	LT						-	LR		
v (veh/h)	38							68		
C (m) (veh/h)	1417			<u> </u>			1	709	1	
v/c	0.03							0.10		
95% queue length	0.08							0.32		
Control Delay (s/veh)	7.6								+	
• • •								10.6		
LOS	A					l		B		
Approach Delay (s/veh)								10.6		
Approach LOS		=-					В			

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	TW	O-WAY STOP	CONTR	OL SI	UMN	IARY				
General Informatio	n		Site Ir	nform	natio	n				
Analyst	Brett Lau	ritsen	Interse	ction			47th Plac	e & Health	Club Ent	
Agency/Co.	Olsson A	ssociates	Jurisdi				Westwood, KS			
Date Performed	3/8/2011		Analys		r		2011 - Ex + Parcels 1-4			
Analysis Time Period	PM					_				
Project Description W	'oodside									
East/West Street: 47th	Place		North/S	South S	Streel	: Health	Club Entran	ce/Exit		
Intersection Orientation:	East-West		Study F	Period	(hrs)	0.25				
Vehicle Volumes a	nd Adiustme	nts								
Major Street		Eastbound					Westbou			
Movement	1	2	3		4		5		6	
	L	Т	R			L	٦		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				Undiv	vided					
RT Channelized			0						0	
Lanes	0	Ţ	0			0	1		0	
Configuration	LT								TR	
Upstream Signal		0					0			
Minor Street		Northbound			Southbou	Ind				
Movement	7	8	9			10	11		12	
	L	Т	R			L	Т		R	
Vol ume (veh/ħ)						49			71	
Peak-Hour Factor, PHF	1.00	1.00	1.00			0. 9 2	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, a	and Level of Se	rvice								
Approach	Eastbound	Westbound	١	Vorthb	ound		s	outhbound	d	
Movement	1	4	7	8		9	10	11	12	
Lane Configuration	LT							LR	1	
v (veh/h)	176				- 1		1	130	1	
C (m) (veh/h)	1145							452	1	
v/c	0.15							0.29	1	
95% queue length	0.73						+	1.18		
, <u> </u>										
Control Delay (s/veh)	8.7						+	16.1		
LOS	A							С		
Approach Delay (s/veh)	-						L	16.1 C		
Approach LOS							1			

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<u> </u>		O-WAY STOP							
General Information	n		Site I	nformat	ion				
A h . i	<u> </u>		Interse	ction		Rainbow	Blvd & Re	atail/Apt	
Analyst Agency/Co.	Brett Lau Olsson As					Sout Westwood, KS/KCK			
Date Performed	3/8/2011	SOCIALOS	— Uurisdi	ction	(UG)/KDOT				
Analysis Time Period	AM		Analysis Year				(+ Parcel	s 1-4	
Project Description W	oodside								
East/West Street: Retai					et: Rainbo	w Blvd			
Intersection Orientation:	North-South		Study I	Period (hr	s): 0.25				
Vehicle Volumes ar	nd Adjustme	nts							
Major Street		Northbound				Southbou	IND		
Movement	1	2	3	4		5		6	
Valuma (uab/b)	L	T 692	R 9		L 8	T 375		R	
Volume (veh/h) Peak-Hour Factor, PHF	1.00	0.92	0.92		0.92	0.92		1.00	
Hourly Flow Rate, HFR									
(veh/ĥ)	0	752	9		8	407		0	
Percent Heavy Vehicles	0				2			_	
Median Typ e		<u> </u>		Undivide	əd	-			
RT Channelized			0					0	
_anes	0	2	0		0	2		0	
Configuration		r	TR		LT	7			
Upstream Signal		0				0			
Minor Street		Eastbound				Westbou	nd		
Movement	7	8	9		10	11	12		
(.)	L	<u>т</u>	R		L	Т		<u>R</u>	
Volume (veh/h) Peak-Hour Factor, PHF	1.00	1.00	1.00		31 0.92	1.00		2 0.92	
Hourly Flow Rate, HFR			1						
(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, a	Ind Level of Se	rvice							
Approach	Northbound	Southbound		Westbour	d	E	Eastbound	1	
Vovement	1	4	7	8	9	10	11	12	
ane Configuration		LT		LR		1			
/ (veh/h)		8		35					
C (m) (veh/h)		847		256					
//c		0.01		0.14					
95% queue length		0.03		0.47		1			
Control Delay (s/veh)		9.3		21.3	1	-			
OS		9.3 A		21.3 C					
		A		21.3					
Approach Delay (s/veh)									
Approach LOS				С					

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General Informatio	n		Site I	nformat	tion				
Applust	Deetter			ection			Blvd & Re	tail/Apt	
Analyst Agency/Co.	Brett Lau Olsson As					Sout	d, KS/KCF		
Date Performed	3/8/2011	550018185	beinut	iction		(UG)/KD		`	
Analysis Time Period	PM		Analy	sis Year			+ Parcels	s 1-4	
	F								
	loodside								
East/West Street: Retain					eet: Rainbo	ow Blvd			
Intersection Orientation:	North-South		<u></u> Study	Period (hi	r <u>s):</u> 0.25	_			
Vehicle Volumes ar	nd Adjustme								
Major Street		Northbound				Southbo	und		
Movement	1	2	3		4	5		6	
Volume (veh/h)		T 	R 37		L 30	<u>т</u> 906		R	
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	-	- 1		2				
Median Type			•	Undivid			I		
RT Channelized			0					0	
Lanes	0	2	0		0	2		0	
Configuration		Т	TR		LT	r			
Upstream Signal		0				0			
Minor Street		Eastbound				Westbou	Ind		
Movernent	7	8	9		10	11		12	
	L	Т	R		L	Т		R	
Volume (veh/h)	1.00	1.00	4.00		26	1.00		8	
Peak-Hour Factor, PHF Hourly Flow Rate, HFR	1.00	1.00	1.00	,	0.92	1.00		0.92	
(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	
anes	0	0	0		0	0		0	
Configuration						LR			
Delay, Queue Length, a	ind Level of Se	rvice							
Approach	Northbound	Southbound		Westbour	nd		Eastbound		
Movement	· 1	4	7	8	9	10	11	12	
ane Configuration		LT		LR					
v (veh/h)		32		36					
C (m) (veh/h)		1108		282			_		
//c		0.03		0.13					
95% queue length		0.0 9		0.43				1	
Control Delay (s/veh)		8.3		19.6		1			
_OS		A		C		1			
						+		1	
Approach Delay (s/veh)				19.6					

HCS+TM Version 5.5

Generated: 3/14/2011 8:21 AM

Existing Plus All Parcels 1-4 AM 963: 47th Ave & Rainbow Blvd

	٦	-	\mathbf{r}	4	←		•	1	1	5	ţ	-
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	¥j.	12			4	1		41			ፋፑ	
Volume (vph)	271	17	204	4	9	13	109	593	29	22	295	106
Ideal Flow (vphol)	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	
Fit Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3492			3398	
Fit 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		1.01	3.0	3.0	1	3.0	La Ma		3.0	5.83
Lane Grp Cap (vph)	486	513			60	51		1515			1654	
v/s Ratio Prot	c0.13	0.06										
v/s Ratio Perm	0.06				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	С	В			D	D		В			A	
Approach Delay (s)		21.0			36.3			12.3			9.6	
Approach LOS		С			D			8			А	
Intersection Summary	100											
HCM Average Control Dela			14.5	Н	CM Level	of Service	•		В			
HCM Volume to Capacity ra	atio		0.54									
Actualed Cycle Length (s)			75.0		um of los				10.4			
Intersection Capacity Utilization	ation		67.3%	IC	CU Level	of Service			С			
Analysis Period (min)			15									
c Critical Lane Group												

Existing Plus All Parcels (1-4) AM 963: 47th Ave & Rainbow Blvd

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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		- 101				

Existing Plus All Parcels (1-4) PM 963: 47th Ave & Rainbow Blvd

3/10/2011	3/1	8/201	1
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٦	₽.			र्भ	7		ፋኈ			412	
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	
Fit Protected	0.95	1.00			0.97	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3474			3411	
Fit 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	С	В			С	С		В			В	
Approach Delay (s)		22.4			32.8			12.8			13.3	
Approach LOS		С			С			в			В	
Intersection Summary				Sec. 1								
HCM Average Control Dela	у		15.9	H	CM Level	of Service	•		В			
HCM Volume to Capacity ra	atio		0.62									
Actuated Cycle Length (s)			73.8	S	um of lost	time (s)			10.4			
Intersection Capacity Utiliza	ation		78.0%			of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

Existing Plus All Parcels (1-4) PM 963: 47th Ave & Rainbow Blvd

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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	
Reduced v/c Ratio Intersection Summary dl Defacto Left Lane, Rec					0.52	0.62	

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٦	ħ			4	7		412			412	
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	
Fit Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3492			3398	
FIt 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			А	
Approach Delay (s)		28.2			43.9			9.6			8.4	
Approach LOS		С			D			А			А	
Intersection Summary				E TU	CTP-10			1.515				
HCM Average Control Dela	Y		15.3	H	CM Level	of Service)		В	_		
HCM Volume to Capacity ra			0.52									
Actuated Cycle Length (s)			90.0	Su	um of losi	time (s)			10,4			
Intersection Capacity Utiliza	ation		67.3%			of Service			C			
Analysis Period (min)			15						20			
c Critical Lane Group												

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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	12 Stole	E.C.	4436	-		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ň	Þ			4	1		412			412	
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	
Fit Protected	0.95	1.00			0.97	1.00		0.98			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3474			3411	
Fit Permitted	0.71	1.00			0.52	1.00		0.51			0.94	
Satd. Flow (perm)	1331	1605	1 Andrews		962	1583	EAdt	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	1.55	100	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	С	С			E	D		В			8	
Approach Delay (s)		27.8			52.5			11.1			12.2	
Approach LOS		Ċ			D			В			В	
Intersection Summary		and the second					614					
HCM Average Control Dela	ay		17.0	Н	CM Leve	of Service	e		В			
HCM Volume to Capacity ra	atio		0.57									
Actuated Cycle Length (s)			90.0	S	um of los	t time (s)			10.4			
Intersection Capacity Utilization	ation		78.0%			of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

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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 (fl)	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						

Existing Plus All Parcels (1-4) AM 15: 47th Place & Rainbow Blvd

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Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	٦	7	^			††	
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	
Fit Protected	0.95	1.00	1.00			0.98	
Satd. Flow (prot)	1770	1583	3472			3481	
FIt 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	Artis	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	А			A	
Approach Delay (s)	38.3		2.1			1.4	
Approach LOS	D		A			A	
Intersection Summary			1120				
HCM Average Control Delay	у		6.3	H	CM Level	of Service	
HCM Volume to Capacity ra	tio		0.31				
Actuated Cycle Length (s)			90.0	Su	im of lost	time (s)	
Intersection Capacity Utiliza	tion		47.0%			of Service	
Analysis Period (min)			15				
c Critical Lane Group							

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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

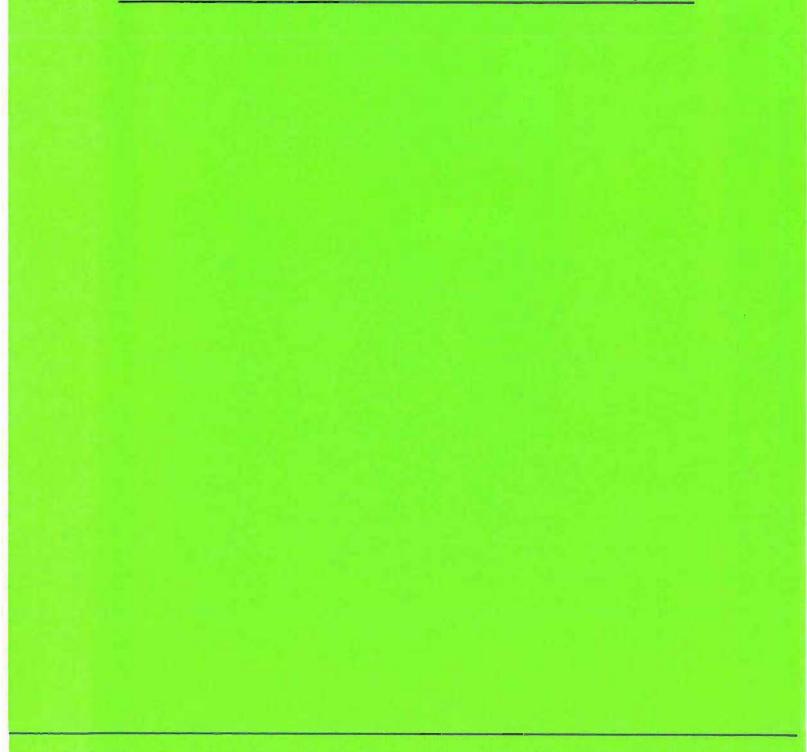
Existing Plus All Parcels (1-4) PM 15: 47th Place & Rainbow Blvd

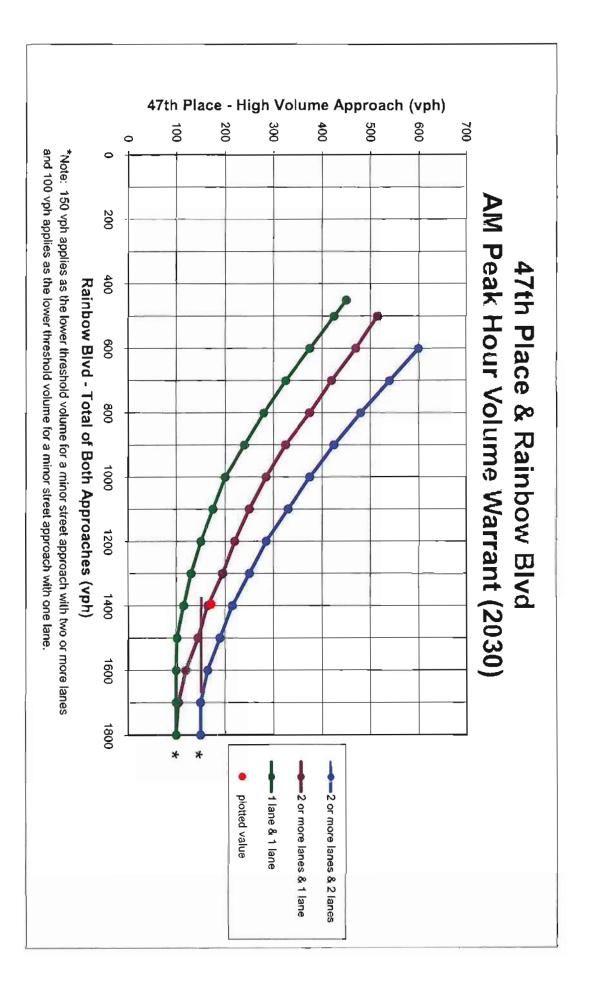
	1	×.	1	1	1	Ļ
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	٣	1	† Ъ			ŤŤ.
Volume (vph)	100	184	305	80	129	836
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	1.00	1.00	0.95			0.95
Frt	1.00	0.85	0.97			1.00
Fit Protected	0.95	1.00	1.00			0.99
Satd. Flow (prot)	1770	1583	3429			3516
Fit 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	103	Perm	402	0	Perm	10-13
Protected Phases	8	L SUU	2		renn	6
Permitted Phases	G	0	2		6	0
	10.9	10.0	71.1		0	71.1
Actuated Green, G (s)		10.9				
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	А			A
Approach Delay (s)	36.8		2.4			1.4
Approach LOS	D		А			A
Intersection Summary						
HCM Average Control Dela			7.8	H	CM Level	of Service
HCM Volume to Capacity r			0.47			
Actuated Cycle Length (s)			90.0	SL	um of lost	time (s)
Intersection Capacity Utiliz	ation		53.4%	IC	U Level o	f Service
Analysis Period (min)			15			
c Critical Lane Group						

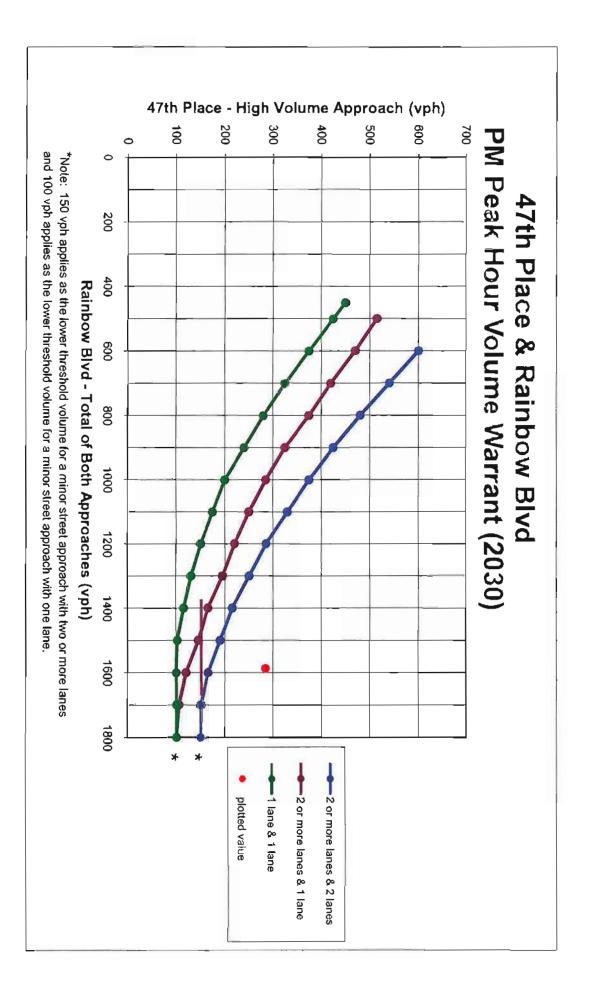
Existing Plus All Parcels (1-4) PM 15: 47th Place & Rainbow Blvd

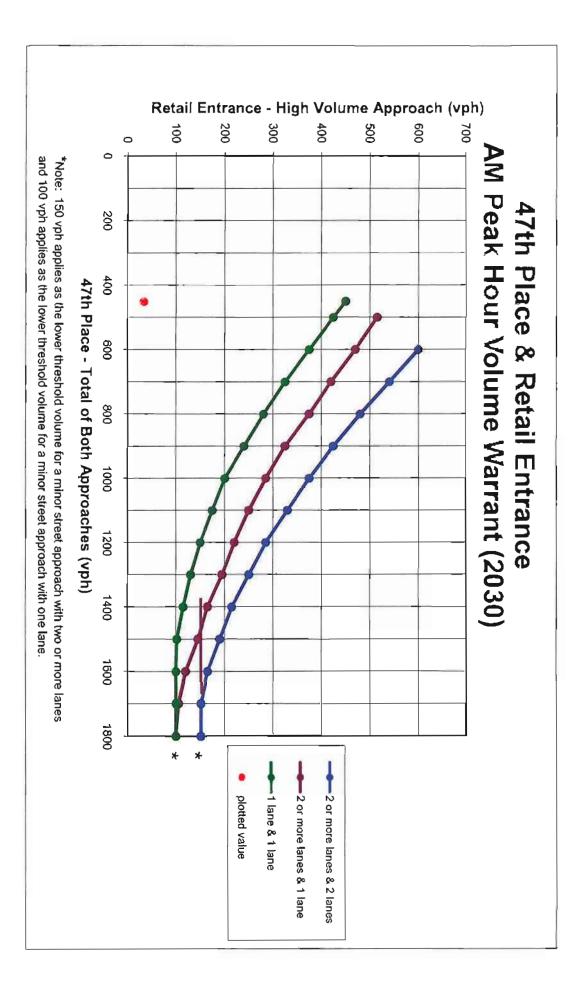
	F	•	†	Ļ
Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	109	200	419	1049
v/c Ratio	0.51	0.54	0.15	0.46
Control Delay	44.8	11.2	2.2	1.5
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	44.8	11.2	2.2	1.7
Queue Length 50th (ft)	59	0	17	11
Queue Length 95th (ft)	106	58	35	20
Internal Link Dist (ft)	95		158	249
Turn 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		193.2		1

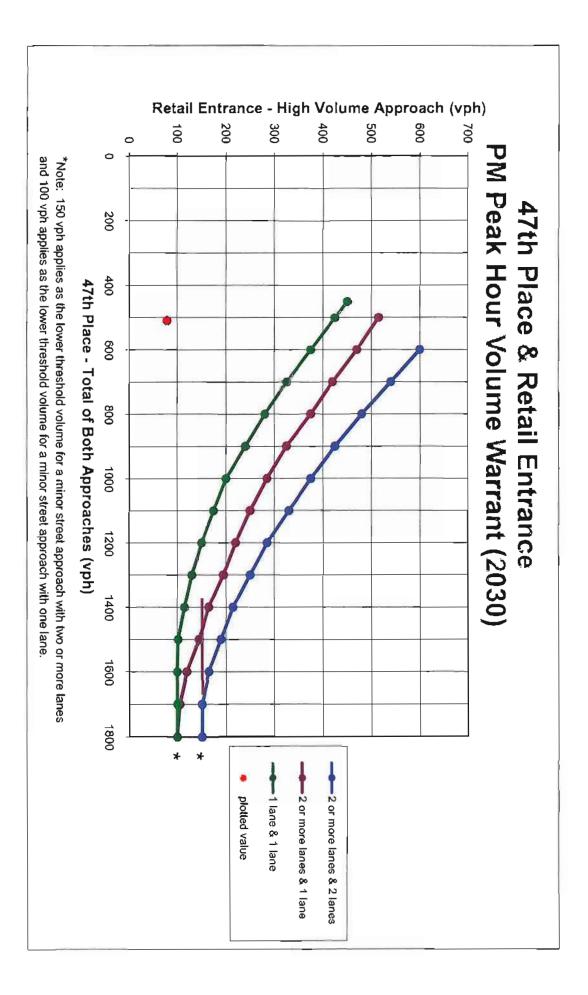
Signal Warrant Analysis

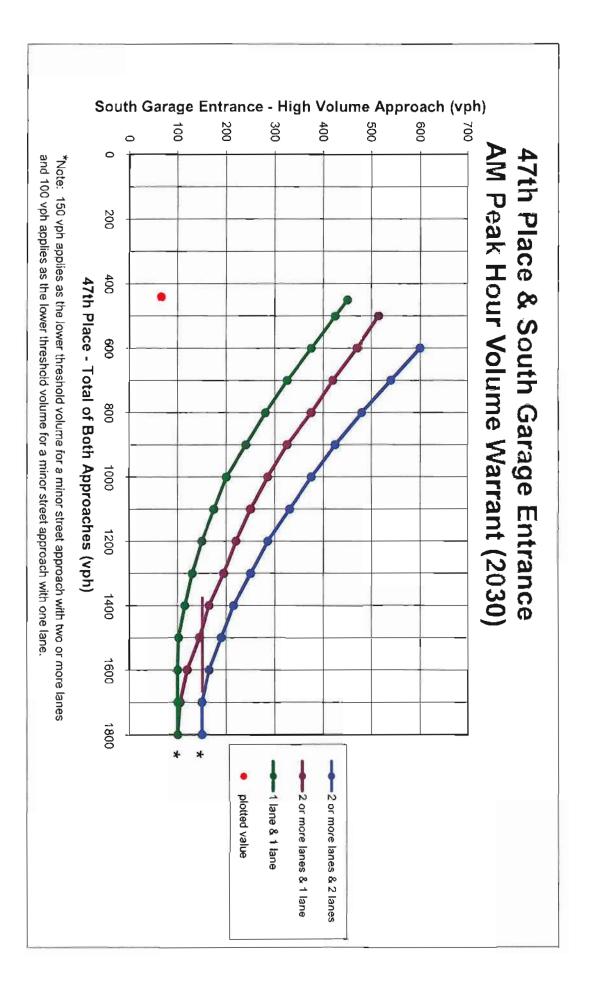


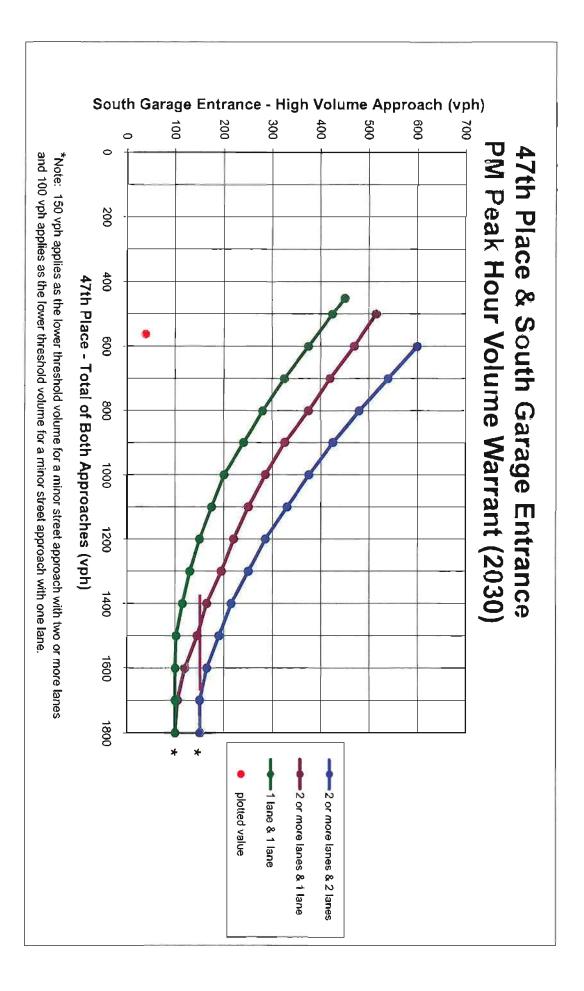


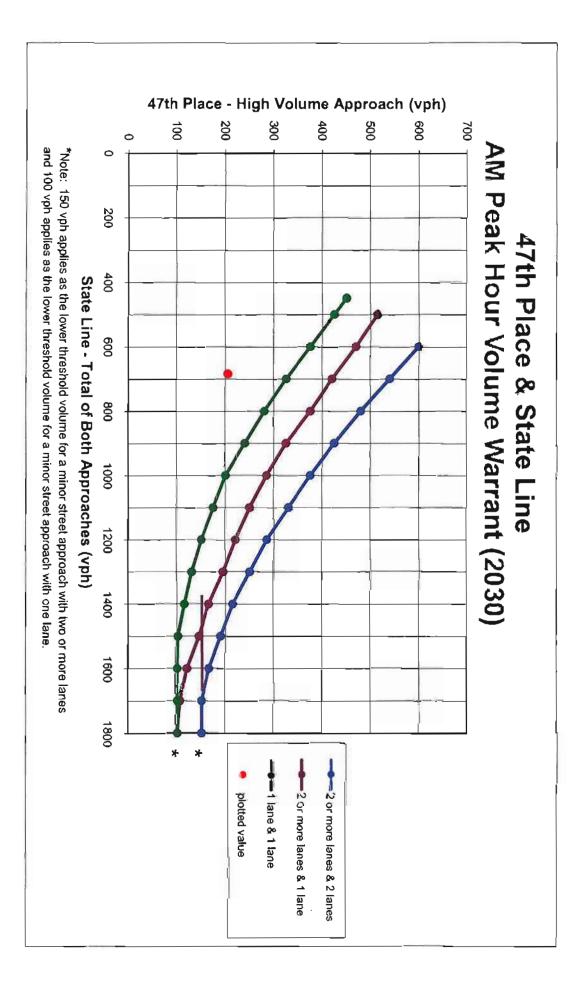


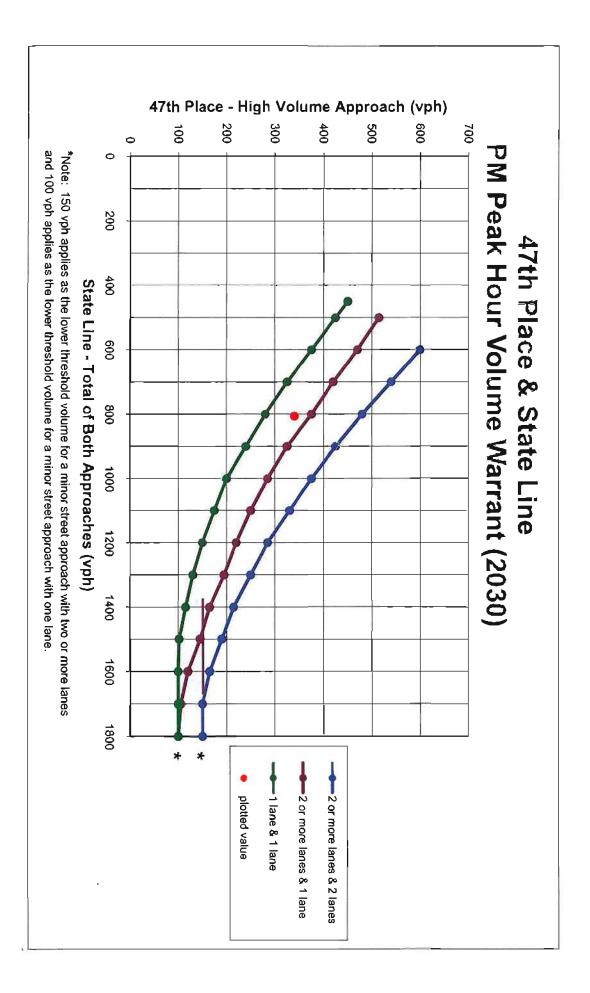


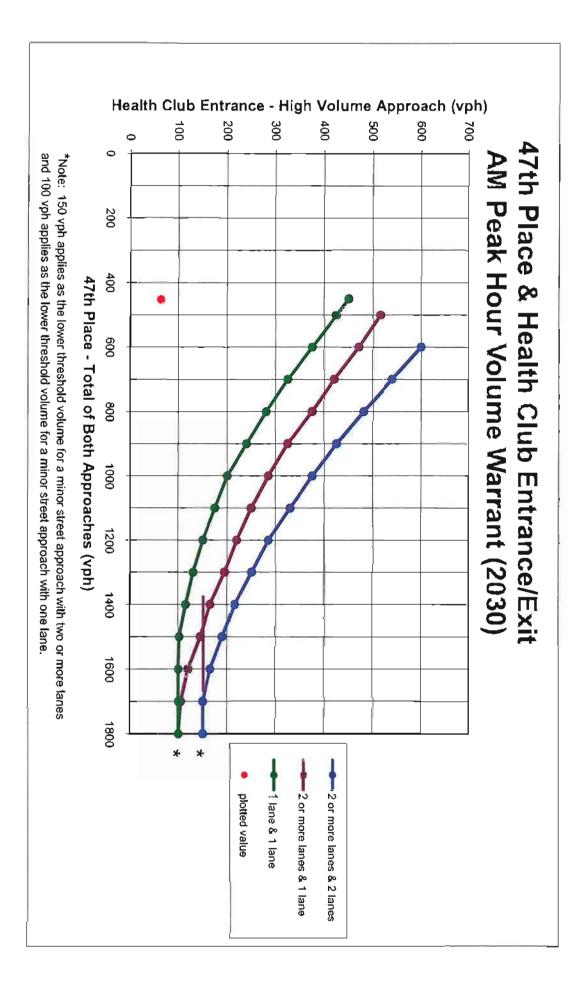


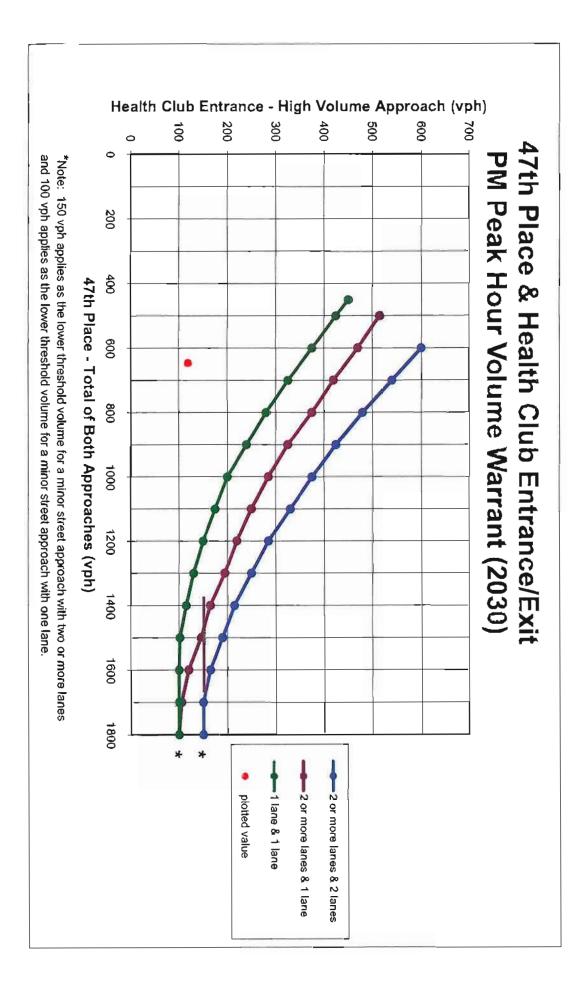


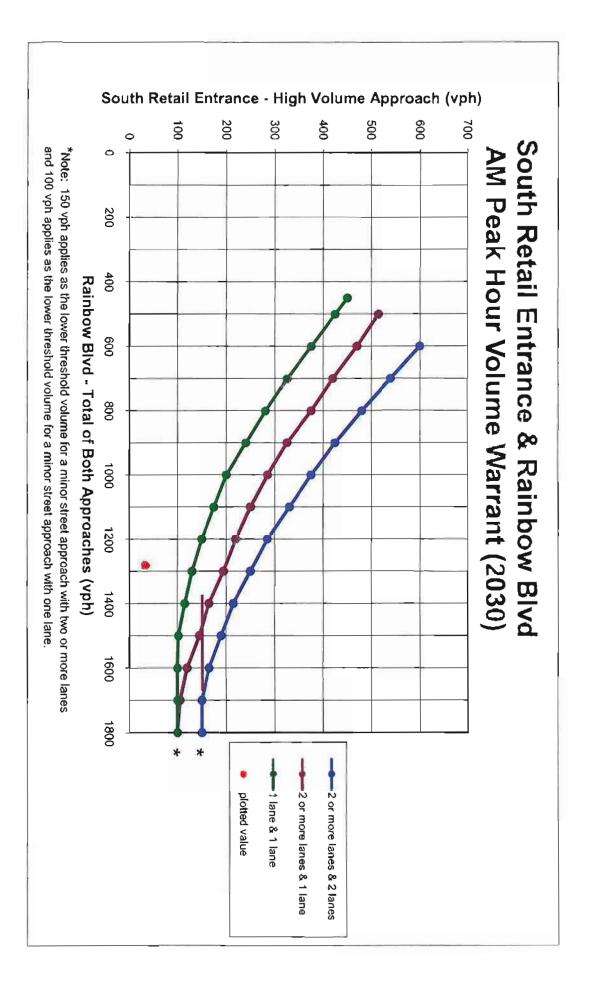


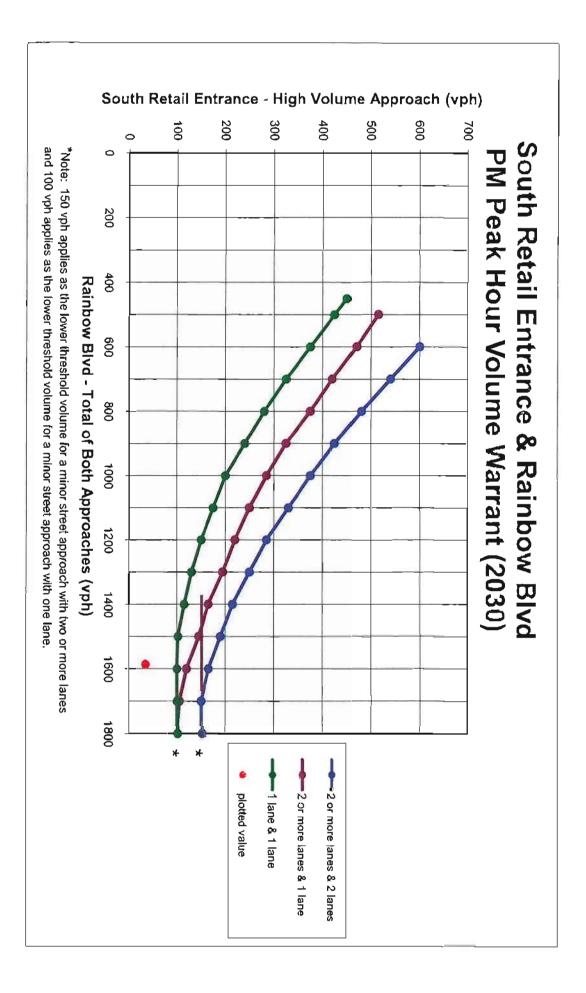




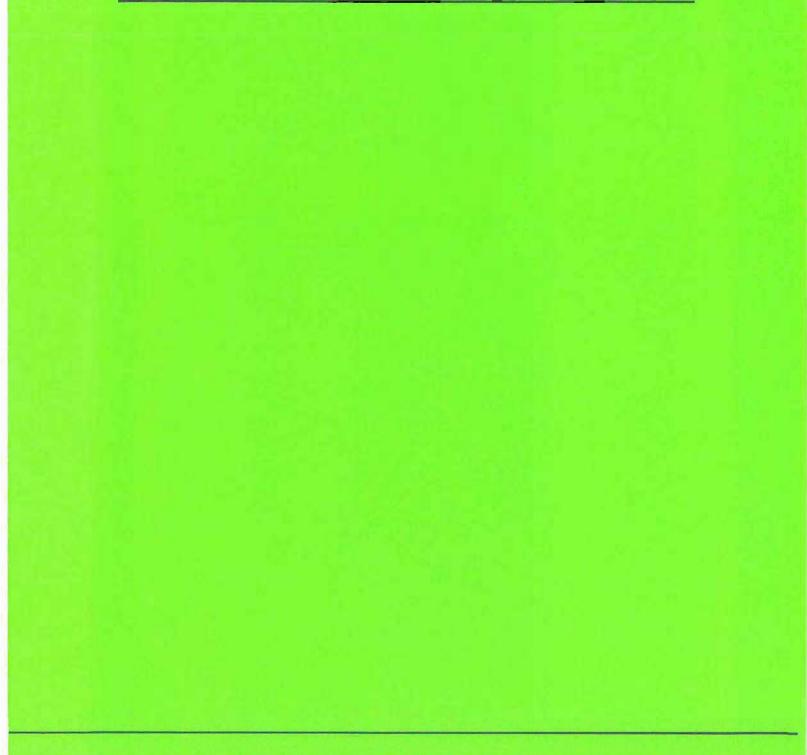








Capacity Analysis Reports



÷				-			-		
General Information			Site	nformat	ion				
Analyst	Brett Laurit	sen	Interse	ection			e & Rainl		
Agency/Co.	Olsson Ass		ibainul	ction			d, KS/KC	κ	
Date Performed	3/8/2011			is Year		(UG)/KDOT 2011 - Ex + Parcels 1-4 203			
Analysis Time Period	AM			is redi		<u>2011 - E</u>	(+ Faicei	8 1=4 200	
Project Description Woo	deide								
East/West Street: 47th Pl			North/S	South Stre	et: Rainbo	w Blvd			
	North-South			Period (hr.					
Vehicle Volumes and		te							
Vajor Street		Northbound				Southbo	Ind	_	
	1	2	3	3		5		6	
KOVEINER	L L	Ť	R		4 L	T T		Ř	
√olume (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	0	797	94		181	442		0	
(veh/h)	-		94						
Percent Heavy Vehicles	0				2		"		
Vedian Type				Undivid	ed				
RT Channelized			0					0	
_anes	0	2	0		0	2		0	
Configuration		T	TR		LT	T			
Jpstream Signal		0				0			
Minor Street		Eastbound				Westbou	ind		
Movement	7	8	9		10	11		12	
	L	T	R		L	Ţ		R	
/olume (veh/h)					47			124	
Peak-Hour Factor, PHF	1.00	1.00	00 1.00 0.92		1.00		0.92		
Hourly Flow Rate, HFR (veh/h)	0	0	0	0		0	0 134		
Percent Heavy Vehicles	0	0	0	0 2		0		0	
Percent Grade (%)		0	-			0		-	
Flared Approach		N	Т			N			
Storage		0				0			
RT Channelized			0		-			0	
	0	0			1	0		1	
_anes Configuration					L		_	R	
Delay, Queue Length, and	Northbound	Southbound		Masthour		1	Coethour		
				Westbour	9		Eastboun	_	
Movement	1	4	7	8	_	10	11	12	
ane Configuration		LT	L		R				
/ (veh/h)		181	51		134	L	 	_	
C (m) (veh/h)		757	96		617		<u> </u>		
//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				
.OS		В	F		В				
Approach Delay (s/veh)		-		30.7			·		
Approach LOS			<u> </u>	D		<u> </u>			

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Generated: 3/14/2011 8:41 AM

		D-WAY STOP							
General Information			Site I	forma	tion				
Analyst	Brett Lauri	itsen	Interse	ction			e & Rainl		
Agency/Co.	Olsson As		Jurisdi	ction			d, KS/KC	K	
Date Performed	3/8/2011					(UG)/KDOT 2011 - Ex + Parcels 1-4 203			
Analysis Time Period	PM			is Year		2011 - EX + Parceis 1-4 203			
Project Description Woo	odsida			_			-		
East/West Street: 47th P.			North/S	South Str	eet: Rainboy	N RIVA		_	
Intersection Orientation:					rs): 0.25				
Vehicle Volumes and		ite.							
Major Street		Northbound				Southbo	Ind		
Movement	1	2	3		4	5		6	
	Ĺ	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	0	404	86		140	1093		0	
(veh/h) Percent Heavy Vehicles	0				2				
Vedian Type		-		Undivia					
RT Channelized	<u> </u>		0		150			0	
	0	2	0		0	2	-+	0	
Lanes Configuration	0	<u> </u>	TR			<u></u> T			
Upstream Signal		0				0			
Minor Street	<u> </u>	Eastbound				Westbou			
Movement	7	8	9		10	11		12	
	, L	<u>τ</u>	Ř		L	T			
Volume (veh/h)		· · ·	1 ···		100	· ·		184	
Peak-Hour Factor, PHF	1.00	1.00			1.00		0.92		
Hourly Flow Rate, HFR (veh/h)	0	0	0		108	0			
Percent Heavy Vehicles	0	0	0		2	0		0	
Percent Grade (%)		0				0			
Flared Approach		N				N		_	
Storage		0				0			
RT Channelized		1	0					0	
Lanes	0	0	0		1	0		1	
Configuration					L			R	
Delay, Queue Length, an	d Level of Ser	vice							
Approach	Northbound	Southbound		Westbou	nd		Eastboun	đ	
Movement	1	4	7	8	9	10	11	12	
Lane Configuration		LT	L		R		1		
/ (veh/h)		140	108		199				
C (m) (veh/h)		1070	138	_	799		1		
		0,13	0.78		0.25		ł	_	
95% queue length		0.45	4.76		0.98				
					_		 		
Control Delay (s/veh)		8.9	89.8		11.0			_	
		A	F		В				
Approach Delay (s/veh)			Ļ	38.7					
Approach LOS		-		Е					

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		O-WAY STOP							
General Information	<u>1</u>		Site I	nforma	tion				
Analyst	Brett Lau	ritsen	Interse				e & Retail		
Agency/Co.		ssociales	Jurisdi	ction		Westwoo			
Date Performed	3/8/2011		Analys	is Year			(+ Parcels	1-4	
Analysis Time Period	AM					2030	_		
Project Description W	oodeida								
East/West Street: 47th			North/S	South Str	eet:				
ntersection Orientation:			North/South Street: Study Period (hrs): 0.25						
Vehicle Volumes ar		nts	-, -						
Major Street		Eastbound				Westbou	nd		
Movement	1	2	3		4	5		6	
	L	T	R		L	Т		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				Undivid	ded				
RT Channelized			0					0	
Lanes	0	1	0		0	1		0	
Configuration	LTR				LTR				
Jpstream Signal		0				0			
Minor Street		Northbound				Southbou	und		
Movement	7	8	9		10	11	_	12	
	L	Т	R		L	Т		R	
Volume (veh/h)	1	0	2 0.92		21	0	·	14	
Peak-Hour Factor, PHF Hourly Flow Rate, HFR	0.92	0.92			0.92	0,92		0.92	
(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, a	nd Level of Se	rvice							
Approach	Eastbound	Westbound		Northbou	und	S	outhbound		
Movement	1	4	7	8	9	10	11	12	
ane Configuration	LTR	LTR	1	LTR			LTR		
v (veh/h)	6	2		3			37	1	
C (m) (veh/h)	1360	1295		644			598	1	
	0.00	0.00		0.00			0.06	<u> </u>	
35% queue length	0.01	0.00		0.01			0.20		
Control Delay (s/veh)	7.7	7.8		10,6	-		11.4		
LOS		7.0 A		70.0 B			B		
	A			10.6			11.4		
Approach Delay (s/veh)									
Approach LOS				B			B		

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	TW	O-WAY STOP	CONTR	OL SU	MMARY				
General Informatio	n		Site I	nforma	tion				
Analyst	Brett Lau	rítsen	Interse			47th Plac	e & Retail		
Agency/Co.		ssociates	Jurisdi			Westwoo			
Date Performed	3/8/2011			is Year		2030 Con	ditions		
Analysis Time Period	РM								
Project Description W	oodside				-				
East/West Street: 47th	Place		North/S	South Sta	eet: Center	Retail			
Intersection Orientation:	East-West		Study Period (hrs): 0.25						
Vehicle Volumes a	nd Adjustme	ents							
Major Street	1	Eastbound				Westbou	nð		
Movement	1	2	3		4	5		6	
	L	Ĩ	R	ĩ	L	Ť		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			_	Undivid	led				
RT Channelized			0					0	
Lanes	0	1	0		0	• ·		0	
Configuration	LTR				LTR				
Jpstream Signal		0				0			
Minor Street		Northbound				Southbou	ind		
Movemeni	7	8	9		10	11		12	
	L	Т	R		L	ĩ		R	
/olume (veh/ħ)	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	
anes	0	1	0		0	1		0	
Configuration		LTR				LTR			
Delay, Queue Length, a	and Level of Se	ervice							
Approach	Eastbound	Westbound	1	Vorthbou	nd	S	outhbound	\$	
Vovement	1	4	7	8	9	10	11	12	
ane Configuration	LTR	LTR		LTR			LTR	1	
/ (veh/h)	23	6		11			85		
C (m) (veh/h)	1241	1369		659			473	1	
	0.02	0.00		0.02			0.18	 	
	0.02	0.00		0.02		+	0.65		
95% queue longth					_				
Control Delay (s/veh)	8.0	7.6		10.6	_	╆╴──┥	14.3		
LOS	A	A		B			В		
Approach Delay (s/veh)				10.6			14.3	-	
Approach LOS				8			в		

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		O-WAY STOP	CONTR	OL SU	JMMARY					
General Information	1		Site I	nform	ation					
Analyst	Brett Lau	ritsen	Interse	ection		47th Plac	e & South	n Garage		
Agency/Co.	Olsson A	ssociates	Jurisdi	iction		Westwoo	d, KS			
Date Performed	3/8/2011		Analys	sis Year	r					
Analysis Time Period	AM									
Project Description W	oodside									
East/West Street: 47th	Place		North/S	South S	treet: South	Garage				
ntersection Orientation:	East-West		Study Period (hrs): 0.25							
Vehicle Volumes ar	nd Adjustme	nts								
Major Street		Eastbound				Westbou	Ind			
Movement	1	2	3		4	5		6		
	L	Ť	R		L	Т		Ŕ		
/olume (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	-		_		-				
Vedian Type				Undiv	<i>vided</i>					
RT Channelized			0					0		
anes	0	1	0		0	1		0		
Configuration	_		TR		LT			_		
Jpstream Signal		0				0				
Minor Street		Northbound			-	Southbou	Ind			
Movement	7	8	9		10	11		12		
	L	T	R		L	Τ		R		
/olume (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		
_anes	0	0	0		0	0		0		
Configuration		LR				Ť		*		
Delay, Queue Length, a	nd Level of Se	1	-							
Approach	Eastbound	Westbound		Northbo	bund		outhboun	d		
Vovement	1	4	7	8		10	11	12		
ane Configuration	1	LT	'	LR		10				
÷										
/ (veh/h)		10		36						
C (m) (veh/h)		1271		535				_		
//¢		0.01		0.07						
95% queue length		0.02		0.22						
Control Delay (s/veh)		7.9		12.2	2					
							i			
		А		В						
		A 		B 12.2	<u>}</u>					

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General Information	ו		Site II	oform	atio	n				
Analyst	Brett Lau	ritean	Interse				47th Plac	a & South	Garace	
Agency/Co.	Olsson A		Jurisdi				Westwoo		l Oaloge	
Date Performed	3/8/2011	300002000		is Year	-		2011 Ex -		1-4 2030	
Analysis Time Period	PM			10100			2011 24	7 0,00,0	, , 2000	
Project Description Wa										
East/West Street: 47th			North/S	South S	freet	South C	arage			
ntersection Orientation:			Study F				Julogo			
· · · · · · · · · · · · · · · · · · ·					<u>, , , , , , , , , , , , , , , , , , , </u>	0.20			_	
Vehicle Volumes ar	id Adjustine						Westbou	~ d		
Major Street Novement	1	Eastbound 2	3			4	5		6	
		<u> </u>	R			4 L	<u>- 5</u> Т		R	
/olume (veh/h)	<u> </u>	242	0			37	283		N	
Peak-Hour Factor, PHF	1.00	0.92	0.92			0.92	0.92		1.00	
Hourly Flow Rate, HFR	0	263	0.02			40	307		0	
veh/h)	0				_	2				
Percent Heavy Vehicles	0			1 lo di	ide d	2	-			
viedian Type RT Channelized	_			Undiv	0000			0		
			0	<u> </u>					-	
anes	0	1	0			0	1		0	
Configuration			TR			LT				
Jpstream Signal		0					0			
Minor Street		Northbound					Southbor	Ind		
Novement	7	8	9			10	11		12	
	L	T	R			L	Ť		R	
/olume (veh/h)	18		22			4 6 5				
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	
anes	0	0	0			0	0		0	
Configuration		LR								
Delay, Queue Length, a	nd Level of Se	-								
Approach	Eastbound	Westbound	1	Northbo	ound		S	outhboun	d	
Novement	1	4	7	8	T	9	10	11	12	
ane Configuration	,	LT		LR	-				<u>-</u>	
		40		42				_		
(veh/h)				<u> </u>						
C (m) (veh/h)		1301		562						
//c		0.03	L	0.07	+					
35% queue length		0.10		0.24	1					
Control Delay (s/veh)		7.9		11.9	2					
.OS		А		В						
pproach Delay (s/veh)				11.9	,					

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General Information				Site Infor	mation			
Analyst		auritsen		Intersection		47/h 4	Place & State Lin	e Rd
Agency/Co.		aunisen Associates		Jurisdiction			wood, KS/KCMO	
Date Performed	3/8/20			Analysis Yea	r		Ex + Parcels 1-	
Analysis Time Period	AM							
Project ID Woodside				[
EastWest Street: 47th Place	9			North/South 9	Street: State Lin	ne Road		
Volume Adjustments	and Site C	haracteris						_
Approach Movement			Eastbound T		- .	We	stbound	
volume (veh/h)	<u> </u>	1	119	8 52	L 		T 125	R 37
%Thrus Left Lane			119	52	- 30		120	37
			No of the same of		_ <u> </u>			
Approach Movement	-		Northbound	R	L	500	Alhbound T	R
Volume (veh/h)	9.	3	380	26	12		141	32
%Thrus Left Lane		-		20	1 12			
	Eas	bound		slbound	Not		South	nporud
	+	L2	_				· · · ·	
0f				L2		12		L2
Configuration	LTR		LTR		LTR		LTR	──
	0.92	 	0.92		0.92		0.92	
Flow Rate (veh/h)	221	 	207	┥───	542	L	200	└──
% Heavy Vehicles	2		2		2		2	
No, Lanes		1		1		1		1
Seometry Group		1		1		1		1
Duration, T				0	.25			
Saturation Headway	Adjustment	Workshe	et					
Prop. Left-Turns	0.2		0.2		0.2		0.1	
Prop. Right-Turns	0.3	1	0.2		0.1		0.2	
Yop. Heavy Vehicle	0.0	 	0.0	+	0.0		0.0	
	0.0	0.2		0.0		0.0		
ILT-adj		0.2	0.2	0.2	0.2	0.2	0.2	0.2
nRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0,6
nHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
adj, compuled	-0.1		-0.1		0.0		-0.1	
Departure Headway a	and Service	Time						
id, initial value (s)	3.20		3.20		3.20		3.20	
k, initial	0.20		0.18		0.48		0.18	-
d, final value (s)	6.66		6.74		5.86		6.46	1
, final value	0.41		0.39		0.88		0.36	1
/ove-up time, m (s)		.0		2.0		.0		0
Service Time, t _s (s)	4.7		4.7		3.9		4.5	
Capacity and Level o	f Servíce	<u> </u>						
	East	bound	We	stbound	North	nporug	South	bound
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	471		457		606		450	
)elay (s/veh)	14,20		13.93		37.39		13.04	
OS	В	İ	В	1	E	1	B	-
pproach: Delay (s/veh)		4.20		3.93		.39		04
LOS	<u> </u>	B	_	B		E	E	
ntersection Delay (s/veh)		ם				_		
THERECTION LIEISV (S/VEN)	1			24	1.70			

General Information				Cita Inform	motion			
				Site Inform	nation			
Analysi	Brett La			Uurisdiction			lace & State Line lood, KS/KCMO	ə Rd
Agency/Co. Date Performed	Olsson / 3/8/201	Associates I		Analysis Yea	r		Ex + Parcels 1-4	2030
Analysis Time Period	PM	,						
Project ID Woodside								
East/West Street: 47th Place)			North/South S	itreet: Stale Lin	le Road		
Volume Adjustments	and Site Ch	aracteris	tics					
Approach			Eastbound			Wes	stbound	
Movement	L		ĩ	R	L		Ϋ́	R
volume (veh/h)	54		142	144	60		196	26
Thrus Left Lane								
Approach		L L	lorthbound		,	Sout	thbound	
Movement Volume (veh/h)	L 107		т 223	R 34	L 		358	R 58
	107		225	54	20		358	00
%Thrus Left Lane	<u></u>		<u> </u>		<u> </u>	- 1		
	Eastb	ound	Wes	stbound	Nori	hbound	South	ponq
	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	
Seometry Group	1			1		1	1	
Duration, T				0.	.25			
Saturation Headway	Adjustment V	Norkshe	ət					
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	1	0.0	
nLT-adi	0.2	0,2	0.2	0,2	0.2	0.2	0.2	0.2
nRT-adj	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0,6	-0,6
nHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
nadj, computed	-0.2	1.7	0.0	1.7	0.0	1.7		1.7
			0.0		0.0		-0.0	
Departure Headway a		Ime						
nd, initial value (s)	3.20		3.20		3.20		3.20	
k, initial	0.33		0.27		0.35		0.43	
nd, final value (s)	9.13		9.66		9.19		9.12	
k, final value	0.93	<u></u>	0.82		1.01		1.22	
Move-up time, m (s)	2.0	/		2.0	1	.0	2.	0
Service Time, t _s (s)	7.1		7.7		7.2		7.1	
Capacity and Level of	f Service							
	Eastbo	ound	Wes	itbound	Nort	bound	South	bound
	L1	L2	L1	L2	L1	L2	L1	L2
Capacily (veh/h)	393		368		394		480	
Delay (s/veh)	60.89		44.39	+	78.12		146.41	ļ
.0S	F		E		F		F	
Approach: Delay (s/veh)	60	.89	44	.39		.12	146	.41
LOS	/	5		E		r —	F	
ntersection Delay (s/veh)				88	.53			
ntersection LOS					F			

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	TW	O-WAY STOP	CONTR	OL SI	JMI	MARY			
General Informatio	n		Site I	nform	natio	on			
Analyst	Brett Lau	ritsen	Interse	ection			47th Plac	e & Healt)	h Club Ent
Agency/Co.	Olsson A	ssociates	Jurisd	iction			Westwoo	d, KS	
Date Performed	3/8/2011		Analys	sis Yea	T		2011 Ex ·	+ Parcels	1-4 2030
Analysis Time Period	AM								
Project Description W	oodside								
East/West Street: 47th			North/S	South S	Stree	t: Health	Club Entran	ce/Exit	
Intersection Orientation:	East-West		Study	Períod	(hrs)	: 0.25			
Vehicle Volumes a	nd Adjustme	nts							
Major Street		Eastbound					Westbou	nđ	
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				Undiv	/idec	1			
RT Channelized			0						0
Lanes	0	1	0			0	1		0
Configuration	LT								TR
Upstream Signal		0					0		
Minor Street		Northbound					Southbou	und	
Movement	7	8	9			10	11		12
	Ŀ	Т	R			L	Т		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				1		0
Lanes	0	0	0			0	ō		0
Configuration		-					LR		
Delay, Queue Length, a	and Level of Se	rvice		•				<u>-</u>	
Approach	Eastbound	Westbound		Vorthbo	ound		S	outhboun	d
Movement	1	4	7	8		9	10	11	12
Lane Configuration	LT		· · · ·			*		LR	1
∨ (veh/h)	38							68	
C (m) (veh/h)	1417							709	1
v/c	0.03							0.10	1
95% queue length	0.08							0.32	+
	7.6					<u> </u>			
Control Delay (s/veh)							<u>├</u>	10.6	
LOS	A							В	
Approach Delay (s/veh)		~=					l	10.6	
Approach LOS								В	

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	TV	VO-WAY STOP	CONTR	OL S	UM	MARY		*	
General Informatio	n		Site I	nforn	natio	วก			
Analyst	Brett La	uritsen	Interse	ection			47th Plac	e & Hea	Ith Club E
Agency/Co.		Associates	Jurisd				Westwoo		
Date Performed	3/8/2011	1	Analys		Г			,	s 1-4 2030
Analysis Time Period	PM								· · · · ·
Project Description W	loodside								
East/West Street: 47th			North/S	South S	Stree	t: Health	Club Entran	ce/Exit	
Intersection Orientation:	East-West		Study	Períod	(hrs)): 0.25			
Vehicle Volumes a	nd Adjustm	ents					_		
Major Street		Eastbound					Westbou	nđ	
Movement	1	2	3			4	5		6
	L	T	R			L	Т		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				Undi	video	1			
RT Channelized			0						0
Lanes	0	1	0			0	1		0
Configuration	LT								TR
Upstream Signal		0					0		
Minor Street		Northbound					Southbou	Ind	
Movement	7	8	9			10	11		12
	L	Т	R			L	Т		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, a	and Level of S	ervice							
Арргоасћ	Eastbound	Westbound	1	Vorthb	ound		s	outhbou	nd
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	1 1						0.29	
95% queue length	0.54							1.18	
Control Delay (s/veh)	8.7							16.1	-
		┨────┦					<u> </u>		_
LOS	A	├ ─── 						C	
Approach Delay (s/veh)		~						16.1	
Approach LOS	 orida. All Rights Res							C	

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	-				IMARY			
General Information	n		Site I	nformat	tion			
		44	Interse	ection			Blvd & Re	ail/Apt
Analyst	Brett Lau					Sout	1 40440	<i>(</i>
Agency/Co. Date Performed	Olsson A: 3/8/2011	ssociates		ction		(UG)/KD	d, KS/KCI OT	۲
Analysis Time Period	AM		Anatys	sis Year			(+ Parcel	s 1-4 203
	oodside		I					
East/West Street: Retai					et: Rainbo	w Blvd		
ntersection Orientation:	North-South		Study	Period (hr	rs): 0.25			
Vehicle Volumes ar	nd Adjustme	nts	_					
Major Street		Northbound	_			Southbou	bnu	
Vovement	1	2	3		4	5		6
(aluma (uch/h)	<u> </u>	Т 819	R 9		L 8	Ť		R
/olume (veh/h) Peak-Hour Factor, PHF	1.00	0.92	0.92	, – –	0.92	446 0.92		1.00
Hourly Flow Rate, HFR		-						
(veh/h)	0	890	9		8	484		0
Percent Heavy Vehicles	0				2			
Median Type				Undivid	ed			
RT Channelized			0					0
anes	0	2	0		0	2		0
Configuration		T	TR		LT	Т		
Jpstream Signal		0				0		
Ainor Street		Eastbound				Westbou	ind	
lovement	7	8 T	9		10	11		12
	L		Ŕ		L 31	Т		R 2
/olume (veh/h) 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		
Iared Approach		N				N		
Storage		0				0		
RT Channelized			0					0
anes	0	0	0		0	0		0
Configuration						LR		
)elay, Queue Length, a	rid Level of Sei	vice						
Approach	Northbound	Southbound		Westbour	nd		Eastbound	\$
Aovement	1	4	7	8	9	10	11	12
ane Configuration		LT		LR				
(veh/h)		8		35				
(m) (veh/h)		751		197				
/c		0.01		0.18				
5% queue length	_	0.03		0.63				
Control Delay (s/veh)		9.8		27.2			-	-
.OS		A		D	1		<u> </u>	
pproach Delay (s/veh)		-		27.2	1			
pproach LOS				 D		1		

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		O-WAY STOP						
General Information	ı		Site li	nformati	ion			
		-	Interse	oction			Blvd & Ret	ail/Apt
Analyst	Brett Laur					Sout	1.100	,
Agency/Co.	Olsson As	<u>soci</u> ates	— Jurisdi	ction		(UG)/KDC	d, KS/KCK	
Date Performed Analysis Time Period	3/8/2011 PM		Analys	is Year			+ Parcels	1-4 203
Analysis fille Period	17-191			10 1 00.			1 41040	. , 200
Project Description Wo	odside						_	
ast/West Street: Retail	/Apt South		North/S	South Stre	et: Rainbo	w Blvd		
ntersection Orientation:	North-South		Study F	Period (hrs	s): 0.25			
/ehicle Volumes an	d Adjustmer	its						
lajor Street		Northbound				Southbou	ind	
Movement	1	2	3		4	5		6
	L	Ť	R		L	T		R
/olume (veh/h)		444	37		30	1076		1.00
Peak-Hour Factor, PHF	1.00	0.92	0.92		0.92	0.92		1.00
lourly Flow Rate, HFR veh/h)	0	482	40		32	1169		0
Percent Heavy Vehicles	0				2			
ledian Type	_			Undivide	эd			
RT Channelized			0					0
anes	0	2	0		0	2		0
Configuration		T	TR		LT	T		
Jpstream Signal		0				0		
Minor Street		Eastbound				Westbou	nd	10
Novement	7	8 T	9 R		<u>10</u>	<u>11</u> T		12 R
	L		R R		26		_	8
/olume (veh/h) ^p eak-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	1		0					0
anes	0	0	0		0	0		0
Configuration						LR		
Delay, Queue Length, a	nd Level of Ser	vice						
Approach	Northbound	Southbound		Westbour	d	6	Eastbound	
Novement	1	4	7	8	9	10	11	12
ane Configuration		LT		LR				
(veh/h)		32		36	1		_	1
C (m) (veh/h)		1041		224		<u> </u>		1
		0.03		0.16				1
95% queue length		0.10		0.56	1			1
Control Delay (s/veh)		8.6		24.1				+
				C 24.1		+		
OS		A						
pproach Delay (s/veh)				24.1				
Approach LOS		-		С				

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Existing Plus All Parcels 2030 AM 963: 47th Ave & Rainbow Blvd

	۶	-	\mathbf{r}	1	4	•	•	1	1	\$	Ļ	~
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٣	Þ			र्स	۴		47			412	
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	
Fit Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3499			3418	
Fit 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	E SE	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	С	В			С	С		В			А	
Approach Delay (s)		20.7			34.0			13.1			9.5	
Approach LOS		С			С			В			A	
Intersection Summary												
HCM Average Control Dela	y		14.4	H	CM Level	of Service	9		В			
HCM Volume to Capacity ra	atio		0.61									
Actuated Cycle Length (s)			70.9	S	um of losi	time (s)			10.4			
Intersection Capacity Utiliza	ation		72.8%			of Service			С			
Analysis Period (min)			15									
c Critical Lane Group												

Existing Plus All Parcels 2030 AM 963: 47th Ave & Rainbow Blvd

	٦	-	-		1	Ţ	
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							

Existing Plus All Parcels 2030 PM 963: 47th Ave & Rainbow Blvd

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBF
Lane Configurations	٦	4			र्भ	*		41>			41	
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	
Fit Protected	0.95	1.00			0.97	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1605			1811	1583		3482			3429	
FIt 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									THEFT	
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	С	в			С	С		В			8	
Approach Delay (s)		23.1			32.4			13.7			15.1	
Approach LOS		С			С			В			8	
Intersection Summary					1	1. 192			15.815			
HCM Average Control Dela	у		16.9	н	CM Level	of Service			8			
HCM Volume to Capacity ra			0.69									
Actuated Cycle Length (s)			73.1	Si	im of lost	time (s)			10.4			
Intersection Capacity Utiliza	ation		84.5%			of Service			E			
Analysis Period (min)			15									

c Critical Lane Group

Existing Plus All Parcels 2030 PM 963: 47th Ave & Rainbow Blvd

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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	
nternal Link Dist (ft)		394	88		249	281	
Turn Bay Length (fl)	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	

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ň	4			र्स	7		ብ ጉ			47	
Volume (vph)	271	17	204	4	9	13	109	720	29	22	366	106
Ideal Flow (vphpi)	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	
Fit Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1604			1837	1583		3499			3418	
Fit 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	C. C.		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	С	С			D	D		8			A	
Approach Delay (s)		28.5			44.4			11.0			9.0	
Approach LOS		С			D			В			А	
Intersection Summary												
HCM Average Control Dela	ау		15.5	Н	CM Level	of Service	9		В			
HCM Volume to Capacity r			0.59									
Actuated Cycle Length (s)			90.0	S	um of los	t time (s)			10.4			
Intersection Capacity Utiliza	ation		72.8%			of Service			С			
Analysis Period (min)			15									
c Critical Lane Group												

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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						-

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	٦	4Î			4	1		472			412	
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	
Fit 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	R.C.L	1002	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	С			E	D		В			В	
Approach Delay (s)		30.3			58.5			11.0			12.5	
Approach LOS		С			E			В			В	
Intersection Summary		h H		32.39	الا الم	3133						
HCM Average Control Dela	зу		17.3	Н	CM Level	of Service	9		В			
HCM Volume to Capacity ra	atio		0.64									
Actuated Cycle Length (s)			90.0	S	um of lost	time (s)			10.4			
Intersection Capacity Utiliza	ation		84.5%			of Service			E			
			15									
Analysis Period (min) dl Defacto Left Lane. Re		though la	15									

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

c Critical Lane Group

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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	

Existing Plus All Parcels 2030 AM 15: 47th Place & Rainbow Blvd

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Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations	۲	F	41			††	
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	
Fit 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	BUNGER
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		А			А	
Intersection Summary							
HCM Average Control Delay			5.9	H	CM Level	of Service	
HCM Volume to Capacity rat	tio		0.36				
Actuated Cycle Length (s)			90.0		um of lost		
Intersection Capacity Utilizat	ion		52.5%	IC	U Level o	f Service	
Analysis Period (min)			15				
c Critical Lane Group							

Existing Plus All Parcels 2030 AM 15: 47th Place & Rainbow Blvd

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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				D'ALT

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Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations	٦	1	↑ ₽			††			
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			
Fit Protected	0.95	1.00	1.00			0.99			
Satd. Flow (prot)	1770	1583	3445			3519			
FIt 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		No. of Concession, Name		
Protected Phases	8	, enn	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	100	0.14						
v/s Ratio Perm	00.00	0.02	0.11			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			
						C BEADERINE TO			
Intersection Summary HCM Average Control Delay	,		8.6		CMLovel	of Service		A	-
HCM Volume to Capacity rat			0.54	T IN	JIM LEVEL			~	
Actuated Cycle Length (s)	0		90.0	C	um of lost	time (s)		8.0	
Intersection Capacity Utilizat	tion		59.9%			of Service		B	
Analysis Period (min)	uon		15	10	O Level (0014100		U	
Analysis Fellou (IIIII)			10						

Existing Plus All Parcels 2030 PM 15: 47th Place & Rainbow Blvd

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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		Contraction of the local division of the loc		1000