Appendix A:

INITIAL TRAFFIC STUDY

PARSONS BRINCKERHOFF

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TO: Tom Hall, PE
Mikael Pelfrey, PE
Project Manager(s), KYTC

FROM: Parsons Brinckerhoff

DATE: November 14, 2013

SUBJECT: US 60 Traffic Study
Item No. 5-275.00
Initial Traffic Analysis

Project Background and Study Area

The purpose of this memorandum is to document Parsons Brinckerhoff's review of the physical design improvements developed by the Kentucky Transportation Cabinet (KYTC) for the section of US 60 from the Sunset Drive / McDonald's intersection to the Laralan Avenue / Brighton Park Boulevard intersection in Frankfort, Kentucky. In addition to a review of the currently proposed changes, Parsons Brinckerhoff also is tasked with recommending any additional short-term improvements as part of this evaluation.

The study area in question is part of an overall larger corridor evaluation project on US 60 from US 460 to just north of the intersection with I-64. As part of the overall letter agreement under the Statewide Planning Services contract, Parsons Brinckerhoff will conduct this study of the larger corridor. The full corridor study area as well as the area of focus for this memo (as shown in the inset box) is shown in **Figure 1** on the following page. Directions referenced in this memo refer to the actual north / south orientation of US 60 within the study area.

This more targeted location of the two aforementioned intersections has been plagued in the past by crashes and poor levels of service due to increased traffic volumes and ensuing congestion. Recently, the KYTC Division of Design examined the area and made several improvement recommendations. A full discussion of these recommendations is provided in the memorandum from Wendy Southworth to Steve Waddle, State Highway Engineer. This memorandum is included in **Attachment A** for reference.

The recommendations largely consisted of eliminating the two-way left-turn lane (TWLTL) at this location and repurposing the pavement to make room for a dedicated left turn lane. This included the use of striping, delineators, and quick curb installation. Parsons Brinckerhoff was then asked to review the design and determine if any additional improvements were warranted. The following sections document the analyses performed and the findings.

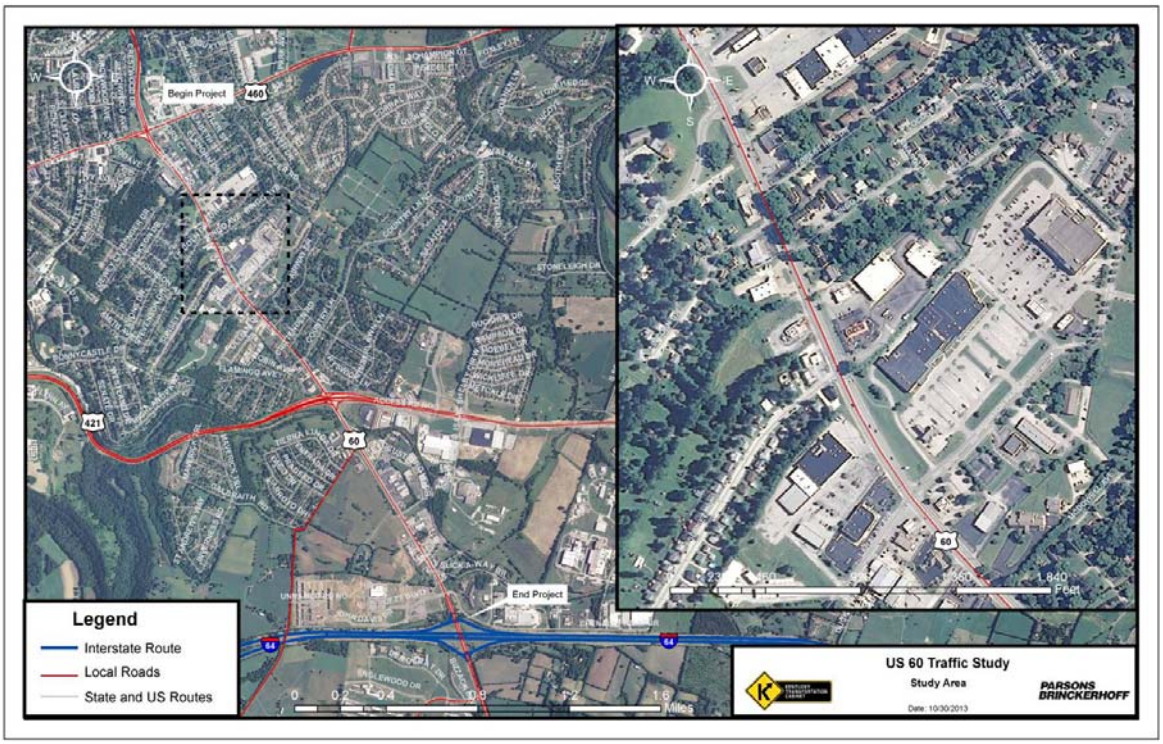


Figure 1: Study Area

Existing Conditions

Geometrics – Currently, US 60 in the project area operates as a five lane facility with four 12-foot driving lanes and a 15-foot continuous two-way left-turn lane (TWLTL). The posted speed limit is 45 mph. There is increasing levels of congestion in the area due to the commercial establishments that line US 60. Both of the intersections (Sunset Drive / McDonald's intersection and the Laralan Avenue / Brighton Park Boulevard intersection) lack the ability to store left turning vehicles adequately and vehicles block the left-most through lanes at times. Also, the TWLTL has to accommodate all left turning vehicles without dedicated lanes.

Access – Between the two intersections, there are two access points in the southbound direction of US 60. One is for the Dollar General / Dollar Tree and the other at Walgreens.

Traffic Data – Turning movement counts were performed at both intersections of concern on Wednesday, November 6, 2013 to provide data to assist with evaluating the effectiveness of KYTC's design as well as evaluating additional options. The following time periods were evaluated:

- 7:00 AM – 9:00 AM
- 11:30 AM – 1:30 PM
- 3:30 PM – 5:30 PM

The count data is included as **Attachment B** at the end of this memorandum.

Current signal timings for the traffic signals at both intersections were obtained from KYTC District 5.

Crash Data – The crash analysis performed by KYTC showed that since 2007, there have been 592 crashes on US 60 from the Eastland Park Shopping Center intersection to the US 60 / KY 421 / KY 676 intersection. Of those, 93 crashes were reported at the Laralan Avenue / Brighton Park Boulevard intersection. Based on the crash data, a very small percentage involved impaired drivers. Based on the types of crashes reported, the use of the center turn lane and the fact that vehicles turn into and out of the lane in virtually any direction creates numerous conflicting movements and increases the likelihood of a crash.

Traffic Forecast / Analysis

A preliminary traffic forecast was developed for the two intersections as well as access points immediately north and south of the two study area intersections. Historic traffic growth data was reviewed for the nearby count stations. The historic traffic growth indicated low growth along the segment (-0.01% and 0.39% along US 60 in the study area); therefore a growth rate of 0.5% per year was used to grow the 2013 turning movement counts to the year 2040. The volumes were also factored to get design hour volumes (DHVs). The volumes between the intersections were balanced using the two access points between Sunset Drive and Brighton Park Boulevard. Trip generation was performed to estimate the volumes entering and exiting the driveways immediately to the north of Sunset Drive and the south of Brighton Park Boulevard.

VISSIM microsimulation software was used to model the 2013 existing conditions and future analysis scenarios. This software was selected as the most appropriate operations analysis method to incorporate the effects of upstream / downstream traffic flow and quickly determine the impacts of making various changes in the signal timing / geometrics of this section. The existing 2013 model was calibrated to the traffic volumes. Due to schedule constraints, the model was not calibrated to other measures such as travel time or queue lengths; instead, reasonableness checks were made on the visualization. Once calibrated to the volumes, the 2040 volumes were inserted into the model to create a 2040 No Build model. Three alternatives were tested using VISSIM. These included:

1. Alternative 1: Developed by KYTC, in which left and right turn bays were added to US 60 and the left turn movement into and out of the Dollar Tree / Dollar General between Sunset Drive and Brighton Park Boulevard was eliminated. The access points were made to be right-in / right-out (RIRO). In the model, those left turning vehicles were re-assigned to the approach on the west side of the Brighton Park Boulevard intersection. The model also considers the improvement of the RIRO at the White Castle south of the intersection.

2. Alternative 2: Includes improvements in Alternative 1, further narrows the through travel lanes on US 60 and creates a dual left turn lane on US 60 for southbound vehicles turning left onto Brighton Park Boulevard. Signal phasing was adjusted to allow protected-only left turns at the Brighton Park Boulevard intersection, and signal timing and offsets were optimized as well.

   A preliminary planning level design was prepared to assist with the evaluation / determination of adding a second left turn lane. **Figure 2** on the following page illustrates the layout of this Alternative. To accommodate the second left turn lane, all lanes were shifted to the east to utilize the existing shoulder. Also, the through travel lanes were reduced to 11 feet with the turn lanes at 12 feet. The low stone wall constructed along the NB lanes between the two intersections would be impacted

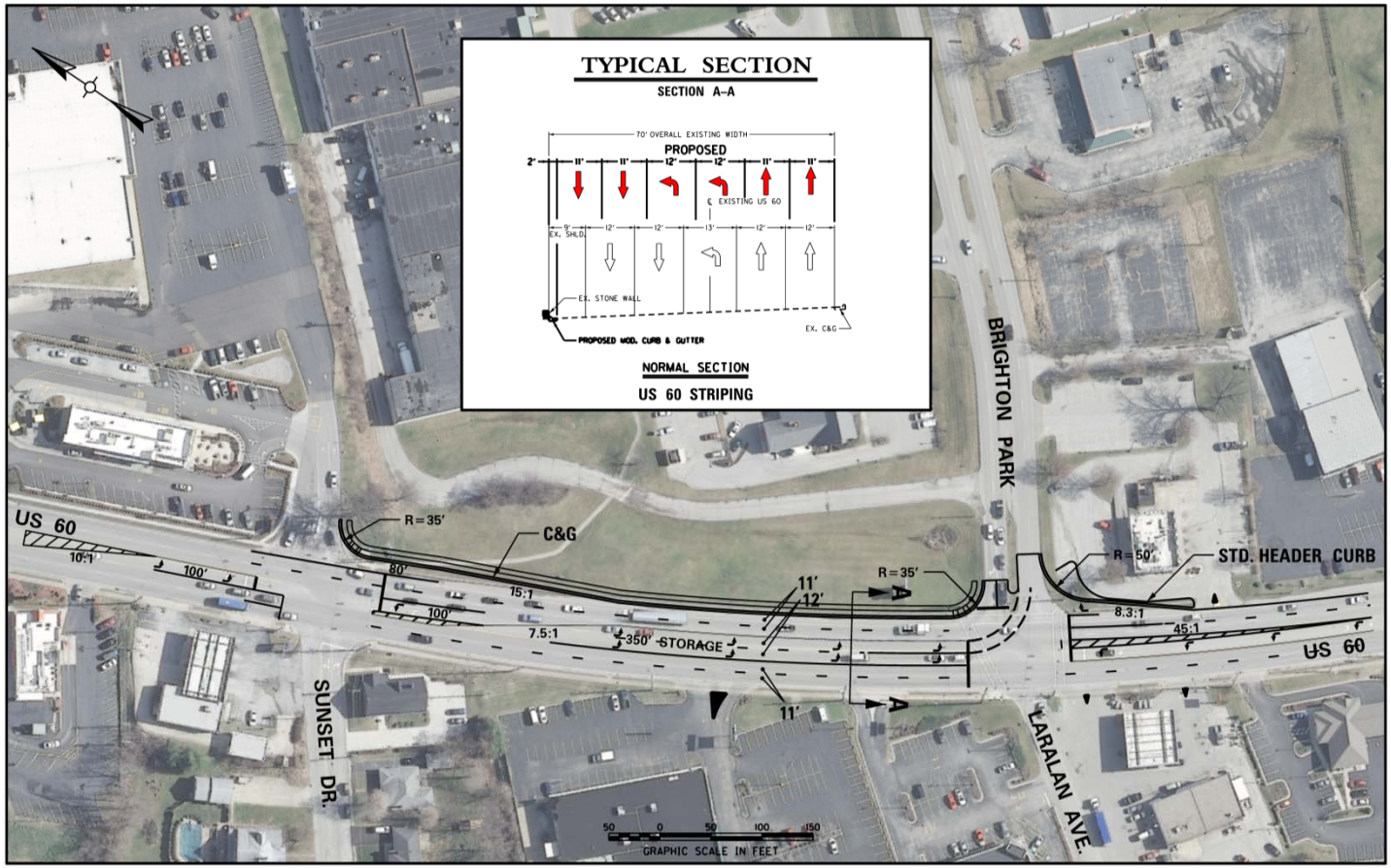


Figure 2: Alternative 2

however, part of the wall could be left in place. Final design plans would need to be developed to evaluate the full impact to the wall.

Preliminary cost estimates of the additional second left turn lane and resulting changes from the KYTC design were developed based on standard specification and bid items in the KYTC database. The resulting addition in cost for construction is $164,000. The itemized preliminary estimate is provided in **Attachment C**.

3. Alternative 3: Includes the improvements in Alternative 2, with some access modifications. The access point into the Speedway immediately south of the Brighton Park Boulevard intersection would be closed and the second access point will be a RIRO. The next access point to the south into the bank will become a RIRO as well.

As noted, these alternatives were modeled in VISSIM in the AM and PM peak periods. The mid-day period was not modeled at this time due to the short schedule. It was identified that the traffic volumes during the mid-day period are less than the AM and PM peak periods, and those two periods replicate the "worst case scenarios" of the time periods. Therefore, any alternative that works for the AM and PM peaks should also work for the mid-day.

The following tables (**Table 1** and **2**) show a comparison of the delays and Levels of Service (LOS) for each alternative in the AM and PM peaks. The best LOS / Delay for all scenarios is shown in bold italics. Detailed tables are provided in **Attachment D**.

Intersection	No-Build LOS (Delay)	Alt. 1 (KYTC) LOS (Delay)	Alt. 2 (Dual Lefts) LOS (Delay)	Alt. 3 (Add. Access Restrictions) LOS (Delay)
Sunset Dr.	B (14.4)	***B (13.6)***	B (14.2)	B (15.1)
Brighton Park Blvd.	***C (26.9)***	C (27.8)	C (34.0)	D (36.3)

Table 1: AM LOS and Delay Comparison

Intersection	No-Build LOS (Delay)	Alt. 1 (KYTC) LOS (Delay)	Alt. 2 (Dual Lefts) LOS (Delay)	Alt. 3 (Add. Access Restrictions) LOS (Delay)
Sunset Dr.	D (43.9)	C (29.7)	***B (19.7)***	C (24.7)
Brighton Park Blvd.	E (64.5)	E (56.0)	D (54.5)	***D (54.4)***

Table 2: PM LOS and Delay Comparison

Observations from the simulation models are listed below:

- Traffic conditions in the AM No Build scenario are acceptable with both intersections operating at LOS B and LSO C. Alternative 1 does not have significant operational effects on the delay and LOS. Alternatives 2 and 3 slightly increase the delay and have lower LOS; however this appears to be due to the new condition of protected-only left turns at Brighton Park Boulevard. In the No Build and Alternative 1 scenarios, there were adequate gaps for many of the left turns in the permissive phase, and the protected only movement results in longer delays for the left turns as well as less green time for the side streets.

- Traffic conditions in the PM No Build scenario are less than desirable at both intersections, operating at LOS D and E respectively. Alternative 1 results in slightly better LOS and delay. Alternative 2 further improves the LOS and delay bringing both intersections to a LOS D or better. Alternative 3 shows even better LOS at Brighton Park Boulevard but a poorer LOS at Sunset Drive. Upon further examination of the models, it appears this is because more traffic is able to be processed in Alternative 3, as the reduction in left turns at driveways appears to aid the flow of traffic. At Sunset Drive, more vehicles are able to make it through the intersection in Alternative 3 than in Alternative 2, and the Brighton Park Boulevard intersection is able to pass 269 more vehicles through the intersection in Alternative 3 when compared to Alternative 2.

- A benefit of VISSIM is the ability to visualize the operations. When watching the various models, particularly in the PM peaks, there is a significant difference visually between Alternatives 1 and 2. In Alternative 1, vehicles often fill the SB left turn lane approaching Brighton Park Boulevard and block SB thru traffic. The addition of the dual lefts reduces the queues, clearing the roadway between Sunset Drive and Brighton Park Boulevard. Vehicles attempting to turn left into and out of the Speedway and bank on US 60 just south of Brighton Park Boulevard cause friction in the model, which results in vehicles slowing down and sometimes the stopping the through vehicles (which has been reported in field observations). When these movements were eliminated in Alternative 3, it resulted in more vehicles being able to pass through both intersections during the green phase, as discussed in the previous note.

In addition to delay and LOS, the model was also able to calculate queue lengths at the intersections. Detailed tables are included in **Attachment D** that show average and maximum queue lengths at each approach of both intersections.

The queue length analysis shows that in general, the queue lengths are fairly consistent in the AM peak, with the northbound left turning queue at Brighton Park Boulevard increasing in length in Alternatives 2 and 3, as a result of it becoming a protected only phase. In the PM peak, the southbound left turning queues at Brighton Park Boulevard decrease by about half in the Alternatives 2 and 3, due to the dual left turn lanes. In the No Build and Alternative 1 scenarios, the southbound left turn queues are much longer than the storage length of the left turn bay.

One final measures that VISSIM is able to produce is overall network performance values. These values consider all vehicles in the simulated system, not just the results at the intersections. The network performance values are shown in the following tables (**Table 3** and **4**) for the peak periods. The highlighted numbers represent the best performance for each measure.

Performance Measure	Unit	No-Build	Alt. 1 (KYTC)	Alt. 2 (Dual Lefts)	Alt. 3 (Add. Access Restrictions)
Average Delay	Seconds	***37.9***	38.1	42.0	47.7
Stopped Delay	Hours	***26.0***	26.3	31.1	36.0
Total Delay Time	Hours	***44.5***	44.7	48.8	54.2
Average Speed	Mile per Hour	***16.3***	16.2	15.4	14.2
Total Travel Time	Hours	***75.6***	***75.6***	79.5	84.3

Table 3: AM Network Performance Measures

Performance Measure	Unit	No-Build	Alt. 1 (KYTC)	Alt. 2 (Dual Lefts)	Alt. 3 (Add. Access Restrictions)
Average Delay	Seconds	113.2	79.3	***63.3***	78.7
Stopped Delay	Hours	95.6	75.0	***59.4***	77.3
Total Delay Time	Hours	138.5	109.7	***87.0***	109.3
Average Speed	Mile per Hour	7.4	10.7	***12.5***	10.7
Total Travel Time	Hours	171.3	151.8	***129.0***	151.7

Table 4: PM Network Performance Measures

As shown in **Table 3**, the traffic operations do not necessarily improve with each option; however this is more closely tied to the added delay of protecting the left turn movements. On the other hand, the improvements greatly improve traffic operations in the PM peak period, particularly for Alternative 2. This is expected as the volumes are higher any many of the conflicting movements are eliminated.

Proposed Improvement Summary

The results of the analysis by Parsons Brinckerhoff shows that:

- The KYTC design will improve the traffic operations of US 60 and specifically the two intersections.
- The LOS remains at a LOS C or above during the AM peak period and improves the LOS to LOS C (from D) at one intersection. However, the LOS is at LOS E at the Brighton Park Boulevard intersection, though just barely as the delay threshold is 55 seconds for LOS D and the delay is at 56 seconds for this intersection.
- The addition of a second left turn lane (Alternative 2) improves the LOS to LOS D or better for all intersections and time periods. However, the reduction in delay in the PM peak period is not substantially less than that for Alternative 1.

Recommendation

To summarize, Alternative 2 with the dual left turn lanes provides the overall best improvement in traffic operations. The recommendation from this memorandum would be to implement Alternative 2 pending the determination by the KYTC that the additional improvement cost justifies the expense. Otherwise, Alternative 1 (original design by KYTC) will provide some measured relief in traffic operations.

It should be noted that this recommendation is a preliminary design based on aerial mapping. KYTC should confirm lane widths, both existing and proposed, will fit within the existing typical sections, excluding areas with right-turn lanes.

ATTACHMENT A – KYTC DESIGN MEMORANDUM

TO: Steve Waddle, PE
State Highway Engineer, Kentucky Transportation Cabinet

THROUGH: Jeff Jasper, PE
Director of Division of Highway Design, Kentucky Transportation Cabinet

FROM: Wendy Southworth, PE
Division of Highway Design

SUBJECT: US 60 Traffic Study in Frankfort (Includes US 60 and Sunset Dr./McDonalds Intersection and US 60 and Laralan Ave./Brighton Park Blvd. Intersection)

Per your request, a preliminary traffic engineering study has been performed on US 60 between the US 60 and Sunset Drive/McDonalds intersection and the US 60 and Laralan Ave./Brighton Park Blvd. intersection. Currently US 60 operates as a 5-lane facility with four 12 foot driving lanes and a 15 foot continuous center turning lane with a posted speed limit of 45 mph. Several issues with both the US 60 and Sunset Dr./McDonalds intersection and the US 60 and Brighton Park Blvd./Laralan Ave. intersection have attributed to the increased congestion in this area. Currently both intersections have minimal designated length of storage for vehicles turning left into McDonalds and into Kroger from eastbound US 60. Since the center lane operates as a two way turning lane, all left turn vehicles from US 60 in both the east and west directions have to utilize this lane when making a left turn movement. Also adding to the congestion are those vehicles using this lane as a refuge when making a left turn out of the side streets and shopping centers onto US 60, therefore greatly increasing the number of conflicting vehicle patterns throughout this area.

To further understand the vehicle conflicts within the study area, the crash data from the US 60/Eastland Park Shopping Center intersection to the US 60/Country Lane intersection (the intersection just west of US 60/KY421/KY676 Interchange) was obtained from the GIS Crash Data Layer. Since 2007 there have been a total of 592 crashes within this area. Five hundred and thirty two of these crashes were located on US 60 and more specifically 93 of the 592 crashes were located at the US 60 and Brighton Park Blvd./Laralan Ave. intersection and 65 of the 592 were located at the US 60 and Sunset Dr./McDonalds intersection. Based on the crash data information available within GIS, a very small percentage of the crashes involved speeding and/or drugs and alcohol, therefore it can be concluded that speeding is not an issue throughout this study area. According to the GIS Crash information, 410 of the 592 crashes (69%) involved a distracted driver, and further 35% were tagged as crashes due to aggressive driving. Twenty-six percent (155 of 592) of the crashes resulted while a vehicle was making a turn or merging, 53% (314 of 592) were rear end collisions, 9% (55 of 592) were side swipes, 24% (142 of 592) involved a vehicle that was hit at an angle and 57% (337 of 592) of the crashes involved a stopped vehicle. Based on the crash data statistics given, it can be determined that the availability of vehicles to use the center turn lane in all directions, creates numerous conflicting traffic movements and further enhances any distraction of the drivers.

When discussing the traffic issues within this study area, the vehicle volumes have to be determined to understand the traffic patterns during peak times of day. Traffic volumes were investigated during normal peak morning and peak afternoon times for both the US 60 and Sunset Dr./McDonalds Intersection and US 60 and Laralan Ave./Brighton Park Blvd.

Intersection. The table below illustrates the traffic volumes that were collected during the morning peak (7:30 – 8:30) and the afternoon peak (4:00 – 5:00).

US 60 and Brighton Park Blvd./Laralan Ave. Intersection (vehicles/hour)

	US 60 Eastbound			US 60 Westbound			Brighton Park Blvd.			Laralan Ave.		
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
AM	90	1566	112	173	1465	68	133	25	104	18	11	68
PM	87	1980	504	407	1811	126	590	54	713	58	191	209

US 60 and Sunset Dr./McDonalds Intersection (vehicles/hour)

	US 60 Eastbound			US 60 Westbound			McDonalds			Sunset Drive		
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
AM	18	1591	101	119	1494	33	122	14	101	119	40	32
PM	50	2455	112	119	2214	76	72	11	202	126	18	47

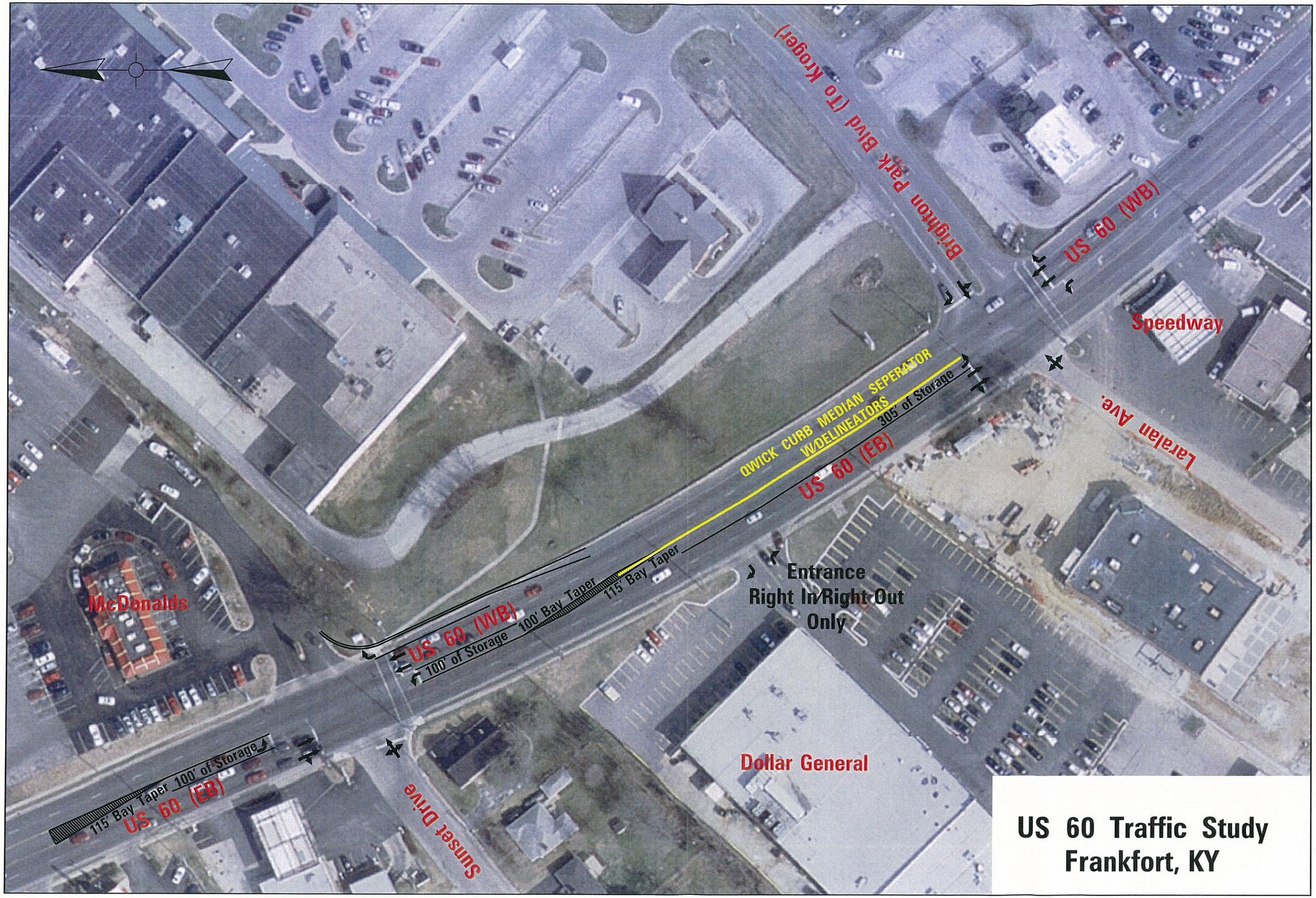
The volume count information that was obtained in the field revealed that the afternoon volumes were the overall daily peak volumes. Further, it was these volumes that were used to conduct a turn lane warrant analysis to determine the turn lane lengths needed for left turning vehicles from US 60 to Brighton Park Blvd. and from US 60 to the McDonalds shopping area. By determining the turn lane length, the necessary storage lengths based on the volumes of left turning vehicles were determined. The storage length for the left turn lane from US 60 eastbound to the McDonalds shopping area would need to be 100 feet with an additional 115 feet for the bay taper where there is currently 85 feet designated as storage for this turning lane. The storage length for the left turn from US 60 eastbound onto Brighton Park Blvd. would optimally need to be 490 feet with an additional 115 feet for the bay taper where there is currently 90 feet designated as storage for this turning lane. Because a storage length of 490 feet would not allow the appropriate left turn lane design for the left turn off of US 60 westbound onto Sunset Drive, a reduced storage length of 305 feet would need to be utilized. Further the entrance located just west of the US 60 and Brighton Park Blvd/Laralan Ave intersection into Dollar General should become a right-in, right-out only entrance. The storage length for the left turn lane from US 60 westbound onto Sunset Drive would need to be 100 feet with an additional 100 feet of bay taper. A right turn lane analysis was performed for US 60 westbound vehicles turning right into the McDonalds shopping area and a right turn lane was warranted with a storage length of 115 feet and a bay taper of 100 feet. There currently is not a right turn lane at this location.

After analyzing the crash data along with the volumes on the two intersections, it has been determined that several issues are causing congestion within the study area. Further analysis of the study area would need to be completed in order to find a long term solution for the congestion issues. However, the short term, low cost solutions presented should reduce congestion and crashes within the study area. These solutions include: providing a more defined left turn lane (by adding channelization curb with delineator posts to prevent the center lane from operating as a two way turn lane) for those turning left from US 60 eastbound into McDonalds and onto Brighton Park Blvd. and expanding the length of storage for these left turning vehicles. Adding a right turn lane into the McDonalds shopping area would help to more easily move some of the traffic through the intersection but would require more roadway construction since there is currently not a turn lane present. See the attachment for the pictorial representation of these short term solutions.

Estimated cost to improve left turn lanes:	$50,300 (includes striping and channelization with delineators)
Estimated cost to construct right turn lane:	$34,500 (not including R/W purchase and utility relocation expenses)

In summary, there are several possible short term design solutions for reducing the congestion and number of crashes within the study area (adding defined left turn lanes by using channelization curb with delineator posts and adding a right turn lane into McDonalds), but a more detailed traffic analysis may need to be performed, and additional design alternatives studied so that long term solutions can be determined (for example, back access road between Kroger and McDonalds).

If there are any questions or comments concerning the results as explained above, please feel free to contact KYTC-Division of Highway Design.



US 60 Traffic Study
Frankfort, KY

ATTACHMENT B – TURNING MOVEMENT COUNTS

Type of peak hour being reported: Intersection Peak

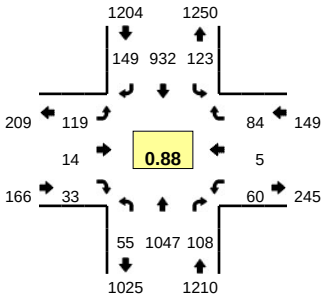
Method for determining peak hour: Total Entering Volume

LOCATION: US 60 Versailles Rd -- Brighton Park Blvd/Laralan Ave

QC JOB #: 11368001

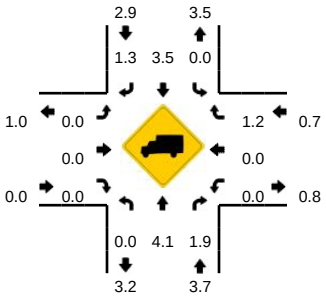
CITY/STATE: Frankfort, KY

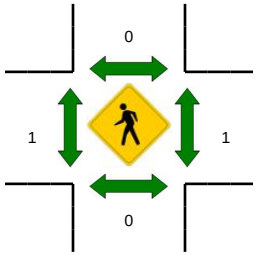
DATE: Wed, Nov 06 2013

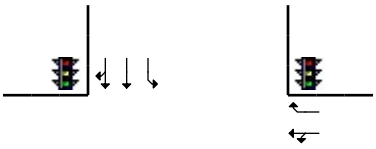


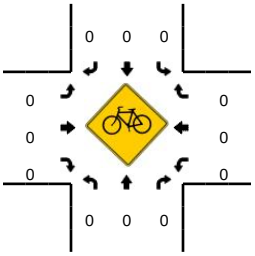
Peak-Hour: 7:15 AM -- 8:15 AM

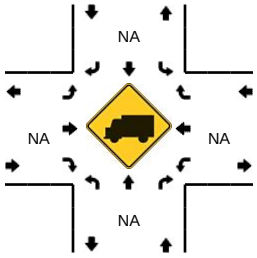
Peak 15-Min: 7:45 AM -- 8:00 AM

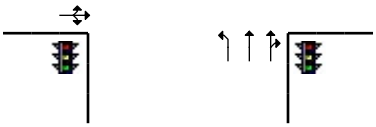


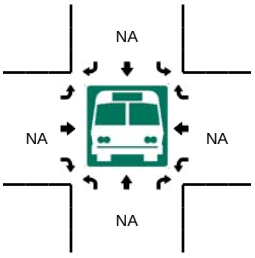












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Brighton Park Blvd/Laralan Ave (Eastbound)				Brighton Park Blvd/Laralan Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	6	149	9	0	19	164	17	0	0	0	0	0	8	1	12	0	385	
7:15 AM	13	255	26	0	18	248	49	0	23	1	7	0	7	1	16	0	664	
7:30 AM	24	260	25	0	36	236	54	0	48	7	16	0	17	4	15	0	742	
7:45 AM	14	293	27	0	39	270	30	0	37	4	7	0	21	0	31	0	773	2564
8:00 AM	4	239	30	0	30	178	16	0	11	2	3	0	15	0	22	0	550	2729
8:15 AM	1	221	28	0	40	159	15	0	16	0	3	0	16	1	33	0	533	2598
8:30 AM	2	186	27	0	64	258	21	0	14	2	5	0	17	3	40	0	639	2495
8:45 AM	5	163	38	0	33	147	9	0	8	0	3	0	25	0	32	0	463	2185

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	56	1172	108	0	156	1080	120	0	148	16	28	0	84	0	124	0	3092
Heavy Trucks	0	48	0		0	48	0		0	0	0		0	0	0		96
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

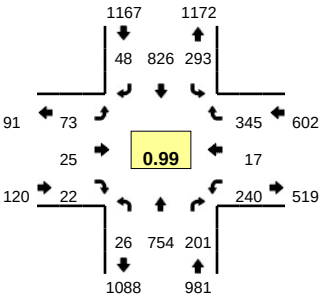
Method for determining peak hour: Total Entering Volume

LOCATION: US 60 Versailles Rd -- Brighton Park Blvd/Laralan Ave

QC JOB #: 11368002

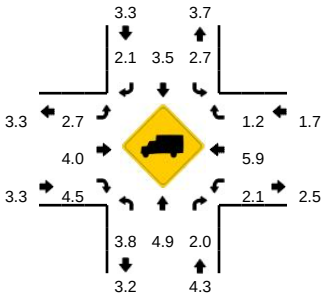
CITY/STATE: Frankfort, KY

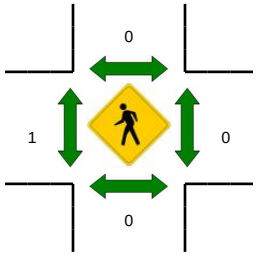
DATE: Wed, Nov 06 2013

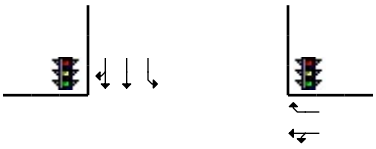


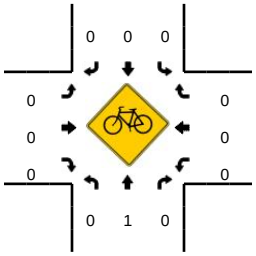
Peak-Hour: 12:00 PM -- 1:00 PM

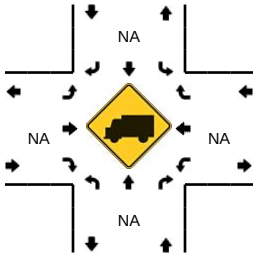
Peak 15-Min: 12:15 PM -- 12:30 PM

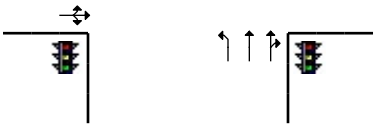


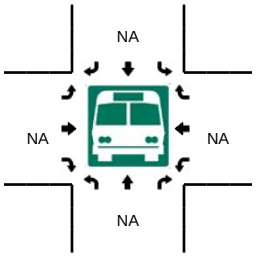












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Brighton Park Blvd/Laralan Ave (Eastbound)				Brighton Park Blvd/Laralan Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
11:30 AM	8	172	52	0	70	181	22	0	8	7	5	0	30	4	61	0	620	
11:45 AM	9	164	54	0	67	204	11	0	20	6	8	0	53	7	65	0	668	
12:00 PM	8	200	47	0	93	194	7	0	21	7	7	0	51	4	78	0	717	
12:15 PM	2	186	57	0	71	197	13	0	20	6	2	0	67	5	99	0	725	2730
12:30 PM	7	180	51	0	74	222	12	0	11	4	7	0	59	4	82	0	713	2823
12:45 PM	9	188	46	0	55	213	16	0	21	8	6	0	63	4	86	0	715	2870
1:00 PM	8	178	50	0	47	192	9	0	17	7	8	0	59	2	74	0	651	2804
1:15 PM	5	161	47	0	68	214	14	0	14	3	1	0	52	2	65	0	646	2725

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	744	228	0	284	788	52	0	80	24	8	0	268	20	396	0	2900
Heavy Trucks	0	40	4		8	24	4		4	0	0		4	4	4		96
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

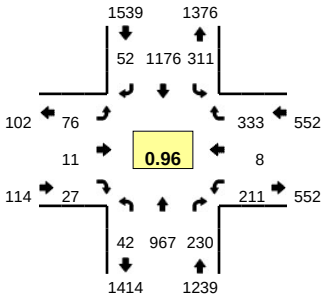
Method for determining peak hour: Total Entering Volume

LOCATION: US 60 Versailles Rd -- Brighton Park Blvd/Laralan Ave

QC JOB #: 11368003

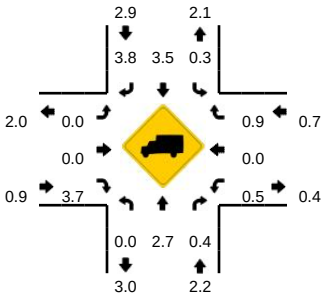
CITY/STATE: Frankfort, KY

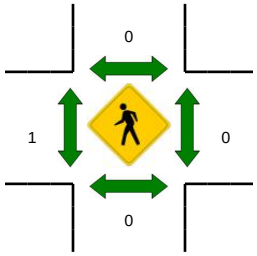
DATE: Wed, Nov 06 2013

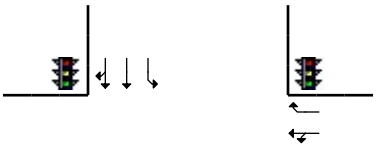


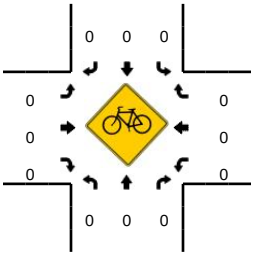
Peak-Hour: 4:30 PM -- 5:30 PM

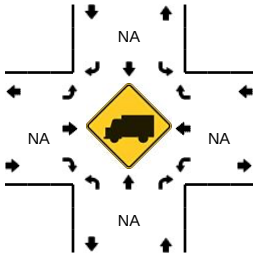
Peak 15-Min: 4:45 PM -- 5:00 PM

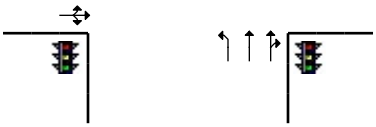


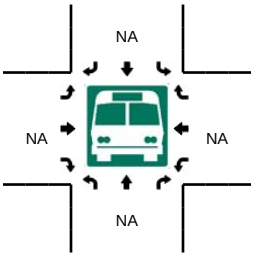












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Brighton Park Blvd/Laralan Ave (Eastbound)				Brighton Park Blvd/Laralan Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	4	218	38	0	66	232	12	0	24	0	10	0	49	3	85	0	741	
3:45 PM	11	210	53	0	79	257	14	0	16	5	4	0	41	1	64	0	755	
4:00 PM	5	186	43	0	75	293	9	0	25	3	9	0	47	4	87	0	786	
4:15 PM	5	202	49	0	64	291	9	0	21	6	9	0	49	1	81	0	787	3069
4:30 PM	10	234	47	0	69	313	15	0	17	2	5	0	43	4	71	0	830	3158
4:45 PM	8	234	52	0	91	312	8	0	19	3	13	0	59	2	93	0	894	3297
5:00 PM	15	239	57	0	62	258	16	0	24	3	4	0	64	1	87	0	830	3341
5:15 PM	9	260	74	0	89	293	13	0	16	3	5	0	45	1	82	0	890	3444

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	32	936	208	0	364	1248	32	0	76	12	52	0	236	8	372	0	3576
Heavy Trucks	0	44	0		4	60	4		0	0	4		0	0	0		116
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

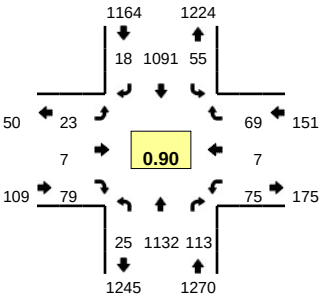
Type of peak hour being reported: Intersection Peak

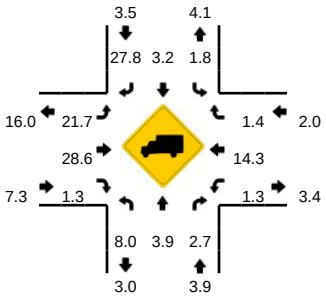
Method for determining peak hour: Total Entering Volume

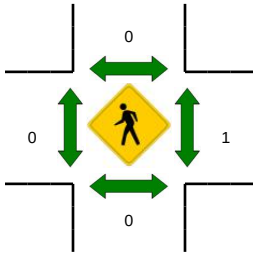
LOCATION: US 60 Versailles Rd -- Sunset Dr
CITY/STATE: Frankfort, KY

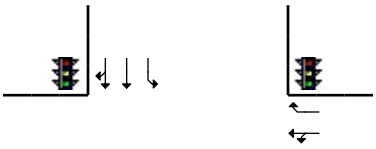
QC JOB #: 11368004
DATE: Wed, Nov 06 2013

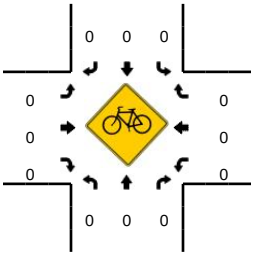
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

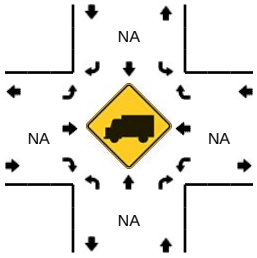


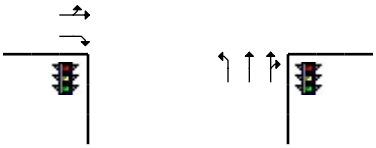


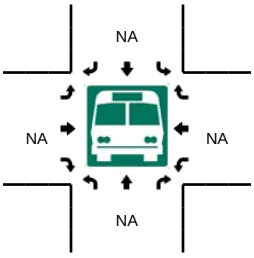












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Sunset Dr (Eastbound)				Sunset Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	4	139	20	0	11	193	4	0	3	0	8	0	12	0	14	0	408	
7:15 AM	8	261	24	0	12	271	7	0	2	1	16	0	13	1	14	0	630	
7:30 AM	9	278	29	0	15	335	3	0	10	2	22	0	19	3	14	0	739	
7:45 AM	5	354	34	0	10	276	2	0	4	1	18	0	24	2	16	0	746	2523
8:00 AM	3	239	26	0	18	209	6	0	7	3	23	0	19	1	25	0	579	2694
8:15 AM	5	234	20	0	15	218	4	0	3	3	8	0	18	1	13	0	542	2606
8:30 AM	7	208	18	0	9	196	2	0	3	1	8	0	17	2	7	0	478	2345
8:45 AM	4	176	19	0	12	175	1	0	1	2	5	1	14	4	9	0	423	2022

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	1416	136	0	40	1104	8	0	16	4	72	0	96	8	64	0	2984
Heavy Trucks	0	56	4		0	40	0		0	0	0		0	0	0		100
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

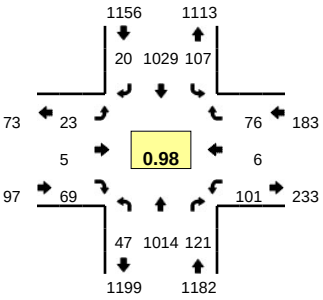
Type of peak hour being reported: Intersection Peak

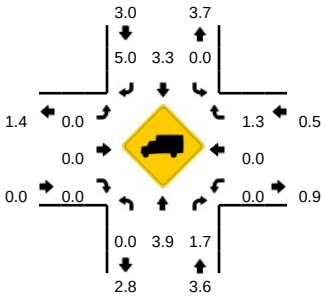
Method for determining peak hour: Total Entering Volume

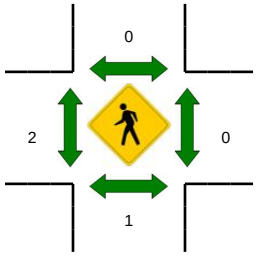
LOCATION: US 60 Versailles Rd -- Sunset Dr
CITY/STATE: Frankfort, KY

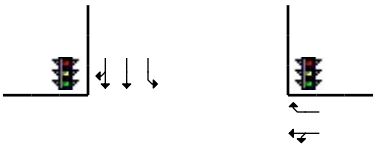
QC JOB #: 11368005
DATE: Wed, Nov 06 2013

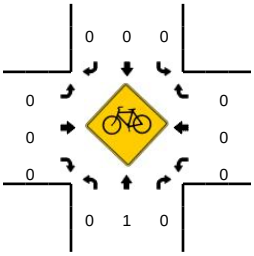
Peak-Hour: 12:00 PM -- 1:00 PM
Peak 15-Min: 12:00 PM -- 12:15 PM

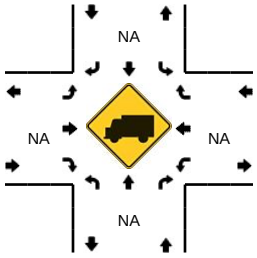


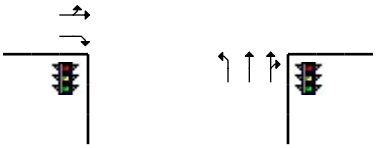


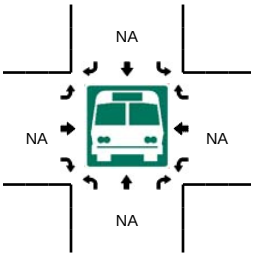












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Sunset Dr (Eastbound)				Sunset Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
11:30 AM	9	196	25	0	26	254	4	0	6	1	14	0	14	1	15	0	565	
11:45 AM	13	209	29	0	12	269	3	0	6	0	12	0	20	0	16	1	590	
12:00 PM	12	258	25	0	37	264	10	0	8	0	21	0	21	0	14	0	670	
12:15 PM	11	272	35	0	22	246	4	0	2	0	11	0	27	3	21	0	654	2479
12:30 PM	12	223	33	0	24	268	3	0	9	5	19	0	26	1	17	0	640	2554
12:45 PM	12	261	28	0	24	251	3	0	4	0	18	0	27	2	24	0	654	2618
1:00 PM	11	230	30	0	14	234	7	0	10	0	14	0	19	5	23	0	597	2545
1:15 PM	10	205	23	0	18	257	7	0	3	1	9	0	32	3	14	0	582	2473

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	48	1032	100	0	148	1056	40	0	32	0	84	0	84	0	56	0	2680
Heavy Trucks	0	44	0		0	24	0		0	0	0		0	0	0		68
Pedestrians		4				0				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

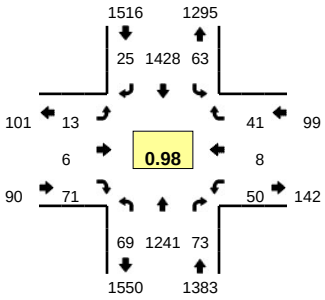
Method for determining peak hour: Total Entering Volume

LOCATION: US 60 Versailles Rd -- Sunset Dr

CITY/STATE: Frankfort, KY

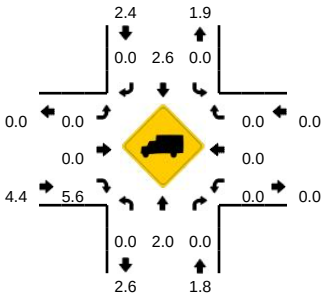
QC JOB #: 11368006

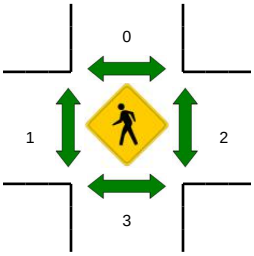
DATE: Wed, Nov 06 2013

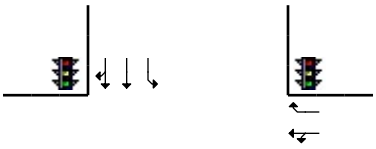


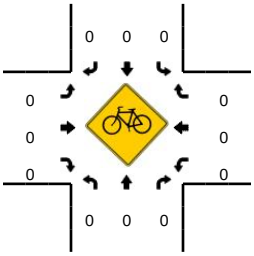
Peak-Hour: 4:30 PM -- 5:30 PM

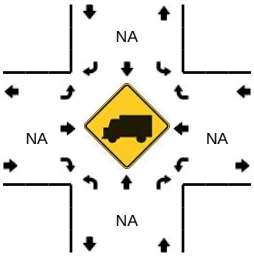
Peak 15-Min: 5:15 PM -- 5:30 PM

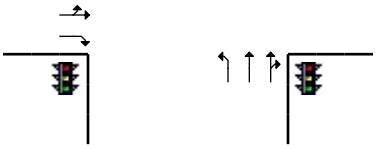


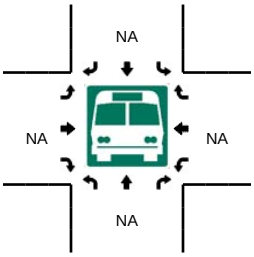












15-Min Count Period Beginning At	US 60 Versailles Rd (Northbound)				US 60 Versailles Rd (Southbound)				Sunset Dr (Eastbound)				Sunset Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	16	287	13	0	13	295	13	0	5	4	6	0	20	1	9	0	682	
3:45 PM	7	248	20	0	20	322	6	0	6	3	13	0	13	1	8	0	667	
4:00 PM	12	252	19	0	15	341	8	0	4	1	10	0	16	0	14	0	692	
4:15 PM	12	278	16	0	17	326	10	0	5	2	19	0	26	1	14	0	726	2767
4:30 PM	25	278	18	0	6	365	6	0	1	1	22	0	16	0	5	0	743	2828
4:45 PM	16	307	16	1	22	374	7	0	5	1	16	0	10	3	8	0	786	2947
5:00 PM	16	322	20	0	17	329	6	0	5	0	21	0	15	2	16	0	769	3024
5:15 PM	11	334	19	0	18	360	6	0	2	4	12	0	9	3	12	0	790	3088

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	44	1336	76	0	72	1440	24	0	8	16	48	0	36	12	48	0	3160
Heavy Trucks	0	16	0		0	28	0		0	0	8		0	0	0		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/8/2013 4:33 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

ATTACHMENT C – PLANNING-LEVEL COST ESTIMATE

BID ITEM		Unit Price	QUANTITY	Unit	ALT 1
	Pavement	$43.33	310	SQ. YD.	$13,084.15
	Pavement @ Islands	$30.00	30	SQ. YD.	$900.00
20196ED	Earthwork	$14.00	292	CU. YD.	$4,375.00
22664EN	WATER BLASTING EXISTING STRIPE	$0.44	4150	LIN. FT.	$1,826.00
02726	Staking	$7.00	600	FT.	$4,200.00
02650	Maintain & Control Traffic	$15,000.00	1	LS	$15,000.00
10020NS	Fuel Adjustment	$1,000.00	1	LS	$1,000.00
10030NS	Asphalt Adjustment	$2,000.00	1	LS	$2,000.00
01810	STANDARD CURB AND GUTTER	$25.00	800	LIN. FT.	$20,000.00
01875	STD. HEADER CURB	$18.00	170	LIN. FT.	$3,060.00
02720	SIDEWALK-4 IN CONCRETE	$42.00	380	SQ. YD.	$15,960.00
05985	SEEDING AND PROTECTION	$1,200.00	0.5	ACRE	$600.00
05990	SODDING	$4.50	400	SQ. YD.	$1,800.00
06514	PAVE STRIPING-PERM PAINT-4 IN	$0.55	5300	LIN. FT.	$2,915.00
06567	PAVE MARKING-THERMO STOP BAR-12IN	$7.00	170	LIN. FT.	$1,190.00
06569	PAVE MARKING-THERMO CROSS-HATCH	$3.00	2600	SQ. FT.	$7,800.00
01825	ISLAND CURB AND GUTTER	$36.00	165	LIN. FT.	$5,940.00
03289	SIDEWALK RAMP TYPE 3	$1,250.00	2	EACH	$2,500.00
20997ED	REMOVE TRAFFIC ISLAND	$800.00	1	EACH	$800.00
06417	FLEXIBLE DELINEATOR POST-W	$24.00	50	EACH	$1,200.00
06407	SBM ALUM SHEET SIGNS .125 IN	$14.00	8	SQ FT	$112.00
06410	STEEL POST TYPE 1	$8.00	48	LIN. FT.	$384.00
06574	PAVE MARKING-THERMO CURV ARROW	$105.00	16	EACH	$1,680.00
23157EN	TRAFFIC SIGNAL POLE BASE	$940.00	3	CU YD	$2,820.00
04941	REMOVE POLE BASE	$800.00	3	EACH	$2,400.00
04700	POLE 30 FT MTG HT	$1,000.00	3	EACH	$3,000.00
20093NS835	INSTALL PEDESTRIAN HEAD-LED	$400.00	2	EACH	$800.00
23222EC	INSTALL SIGNAL PEDESTAL	$500.00	2	EACH	$1,000.00
23206EC	INSTALL CONTROLLER CABINET	$2,200.00	1	EACH	$2,200.00
21688EN	REM DRY STONE MASONRY WALL	$10.00	330	LIN. FT.	$3,300.00
21687EN	DRY STONE MASONRY WALL 18" TALL	$60.00	170	LIN. FT.	$10,200.00
02568	Mobilization	6.00%			$5,274.61
02569	Demobilizatiom	3.00%			$2,637.30
SubTotal	SubTotal				$142,000
15% Contingency	15% Contingency				$21,300
Total	**Total**				$164,000

ATTACHMENT D – DETAILED ANALYSIS TABLES

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	20.8	C	14.4	B
	WB	13.1	B		
	WB	47.0	D		
	SB	10.9	B		
US 60 and Brighton Park Blvd.	EB	55.6	E	26.9	C
	WB	24.5	C		
	WB	37.6	D		
	SB	24.0	C		

Table 1: AM No Build Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	20.4	C	13.6	B
	WB	11.7	B		
	WB	42.5	D		
	SB	11.1	B		
US 60 and Brighton Park Blvd.	EB	56.0	E	27.8	C
	WB	24.3	C		
	WB	40.4	D		
	SB	25.0	C		

Table 2: AM Alternative 1 Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	22.2	C	14.2	B
	WB	12.6	B		
	WB	42.2	D		
	SB	11.5	B		
US 60 and Brighton Park Blvd.	EB	57.6	E	34.0	C
	WB	32.9	C		
	WB	43.6	D		
	SB	30.1	C		

Table 3: AM Alternative 2 Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	25.0	C	15.1	B
	WB	11.3	B		
	WB	46.3	D		
	SB	14.1	B		
US 60 and Brighton Park Blvd.	EB	57.4	E	36.3	D
	WB	34.5	C		
	WB	40.2	D		
	SB	33.5	C		

Table 4: AM Alternative 3 Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	41.9	D	43.9	D
	WB	19.2	B		
	WB	53.0	D		
	SB	65.8	E		
US 60 and Brighton Park Blvd.	EB	72.5	E	64.5	E
	WB	80.7	F		
	WB	63.9	E		
	SB	51.8	D		

Table 5: PM No Build Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	37.7	D	29.7	C
	WB	19.3	B		
	WB	50.3	D		
	SB	36.8	D		
US 60 and Brighton Park Blvd.	EB	78.2	E	56.0	E
	WB	67.3	F		
	WB	67.9	E		
	SB	41.6	D		

Table 6: PM Alternative 1 Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	25.6	C	19.7	B
	WB	16.7	B		
	WB	49.1	D		
	SB	20.1	C		
US 60 and Brighton Park Blvd.	EB	76.4	E	54.5	D
	WB	63.0	E		
	WB	62.3	E		
	SB	42.5	D		

Table 7: PM Alternative 2 Delay and LOS

Intersection	Movement	Approach Delay (seconds)	Approach LOS	Intersection Delay (seconds)	Intersection LOS
US 60 and Sunset Drive	EB	36.0	D	24.7	C
	WB	18.0	B		
	WB	53.8	D		
	SB	27.9	C		
US 60 and Brighton Park Blvd.	EB	74.9	E	54.4	D
	WB	62.2	E		
	WB	57.3	E		
	SB	45.0	D		

Table 8: PM Alternative 3 Delay and LOS

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	9	69
		R	1	63
	NB	L	1	46
		TR	77	665
	WB	LTR	48	226
	SB	L	6	83
		TR	34	388
US 60 and Brighton Park Blvd.	EB	LTR	68	263
	NB	L	10	216
		TR	136	616
	WB	LT	31	145
		R	1	61
	SB	L	61	555
		TR	118	697

Table 9: AM No Build Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	8	32
		R	1	22
	NB	L	2	23
		TR	55	503
	WB	LTR	43	145
	SB	L	6	48
		TR	39	439
US 60 and Brighton Park Blvd.	EB	LTR	81	201
	NB	L	11	82
		TR	133	842
	WB	LT	32	74
		R	1	16
	SB	L	48	179
		TR	112	760

Table 10: AM Alternative 1 Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	9	70
		R	2	60
	NB	L	2	48
		TR	58	618
	WB	LTR	43	226
	SB	L	4	64
		TR	39	534
US 60 and Brighton Park Blvd.	EB	LTR	83	263
	NB	L	97	601
		TR	156	616
	WB	LT	36	152
		R	1	114
	SB	L	42	157
		TR	131	696

Table 11: AM Alternative 2 Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	10	32
		R	3	27
	NB	L	2	22
		TR	44	446
	WB	LTR	48	147
	SB	L	6	54
		TR	50	509
US 60 and Brighton Park Blvd.	EB	LTR	96	218
	NB	L	120	413
		TR	142	840
	WB	LT	34	75
		R	0	12
	SB	L	41	145
		TR	167	939

Table 12: AM Alternative 3 Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	5	63
		R	11	131
	NB	L	63	807
		TR	143	959
	WB	LTR	34	194
	SB	L	7	226
		TR	428	623
US 60 and Brighton Park Blvd.	EB	LTR	55	269
	NB	L	264	618
		TR	496	632
	WB	LT	216	517
		R	54	349
	SB	L	333	721
		TR	369	743

Table 13: PM No Build Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	5	62
		R	8	115
	NB	L	80	833
		TR	164	972
	WB	LTR	33	183
	SB	L	12	240
		TR	255	617
US 60 and Brighton Park Blvd.	EB	LTR	79	269
	NB	L	662	1078
		TR	760	1086
	WB	LT	222	535
		R	72	414
	SB	L	273	714
		TR	222	742

Table 14: PM Alternative 1 Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	5	42
		R	14	157
	NB	L	45	681
		TR	112	919
	WB	LTR	39	226
	SB	L	6	87
		TR	153	610
US 60 and Brighton Park Blvd.	EB	LTR	86	263
	NB	L	520	1075
		TR	619	1086
	WB	LT	227	562
		R	64	359
	SB	L	89	332
		TR	259	738

Table 15: PM Alternative 2 Queue Lengths

Intersection	Approach	Movement	Average Queue Length (feet)	Maximum Queue Length (feet)
US 60 and Sunset Drive	EB	LT	5	71
		R	8	129
	NB	L	54	878
		TR	124	1002
	WB	LTR	35	193
	SB	L	8	186
		TR	182	613
US 60 and Brighton Park Blvd.	EB	LTR	94	263
	NB	L	525	1066
		TR	576	1084
	WB	LT	181	525
		R	54	391
	SB	L	102	367
		TR	256	743

Table 16: PM Alternative 3 Queue Lengths