



# KITTELSON & ASSOCIATES, INC.

TRANSPORTATION ENGINEERING / PLANNING

225 E Robinson Street, Suite 450, Orlando, FL 32801 P 407.540.0555 F 407.540.0550

## MEMORANDUM

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Date: May 14, 2015 Project #: 19061

To: Ted Johnson

From: Ryan Cunningham and Lauren Nuxoll

Project: Louisville Costco

Subject: Transportation Impact Analysis for Proposed Costco Warehouse and Costco Gasoline Fuel Station – Louisville, Kentucky

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Kittelison & Associates, Inc. (KAI) prepared this memorandum to address traffic operations associated with the proposed Costco warehouse, Costco gasoline fuel station, and outparcel located in Louisville, Kentucky. The memorandum addresses the following items:

- Site Description
- Existing (2015) Conditions
- Year 2025 Background Traffic Conditions (No-Build)
- Trip Generation, Distribution and Assignment
- Year 2025 Total Traffic Conditions (Build)
- Conclusions

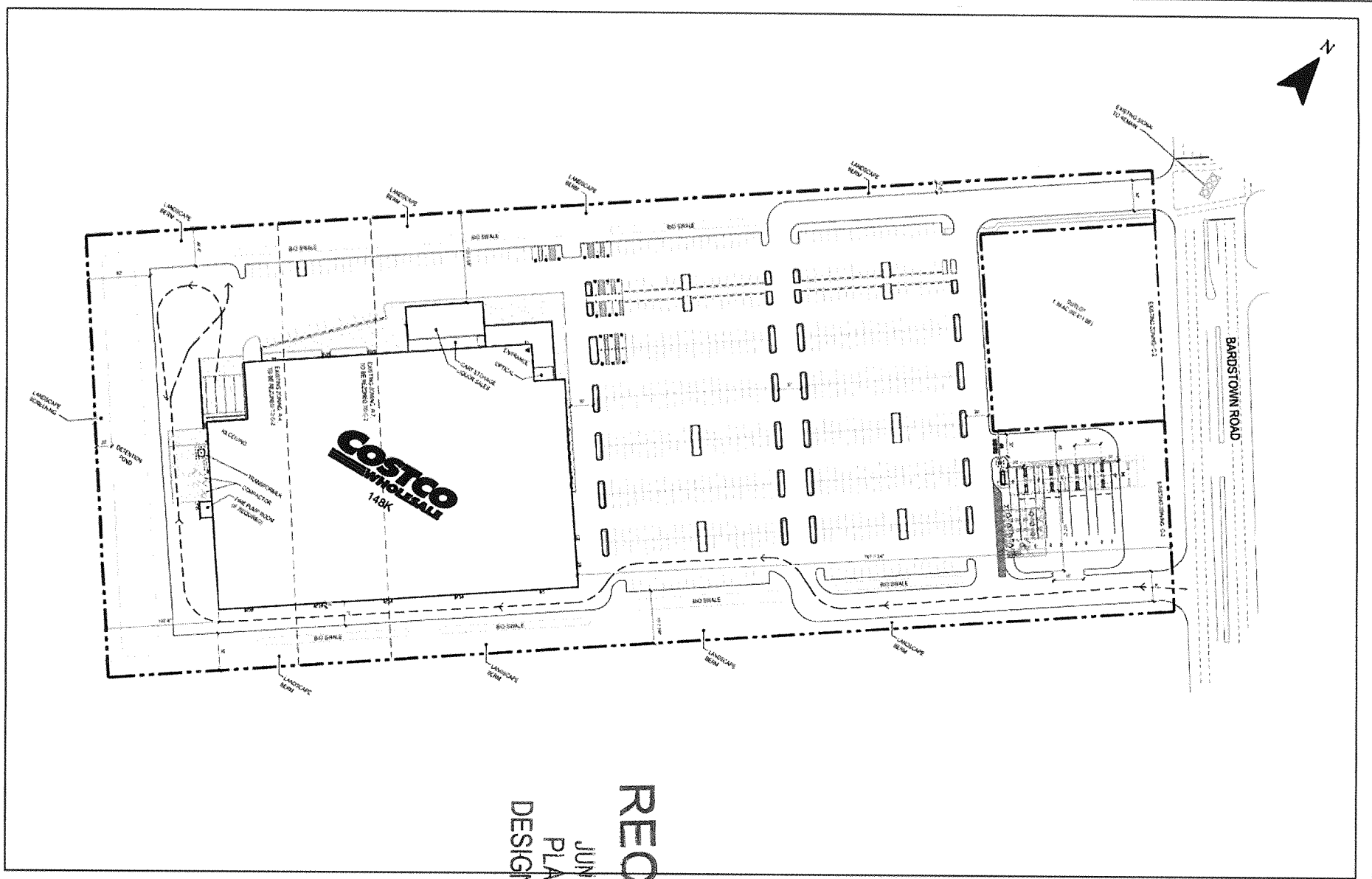
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### SITE DESCRIPTION

Costco Wholesale is proposing to develop a 160,569 square-foot Costco warehouse and a Costco gasoline 16-position fuel station. The site is located on the southwest corner of the intersection of Bardstown Road/Heather Lane in Louisville, Kentucky. The property is approximately 19.12 acres of vacant land. The anticipated build-out year of the proposed Costco is 2016. Figure 1 illustrates the proposed site plan. As shown in Figure 1, the proposed site is planned to be served by one signalized intersection and one right-in/right-out access. For the purposes of this analysis, the unoccupied outlot is assumed as a 5,000 square foot fast food restaurant with a drive-through window.

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**Costco Site Plan  
Louisville, Kentucky**

**Figure  
1**

## EXISTING CONDITIONS

The existing conditions analysis identifies site conditions and current operational characteristics of roadways within the study area.

### Land Uses and Transportation Facilities

The proposed site is located adjacent to the following land uses:

- Walmart, Target, and Lowes are located to the east.
- Residential uses are located to the south.
- Small retail pads and residential is located to the north and west.

Two intersections have been identified for analysis in the study area and are listed below:

- Bardstown Road/Heather Lane (signalized)
- Bardstown Road/Future Costco Site Access (right-in/right-out)

Table 1 provides a summary of the transportation facilities included in this analysis.

Table 1. Existing Transportation Facilities and Roadway Designations

Roadway	Functional Classification	Cross Section	Posted Speed (mph)	Sidewalks	Bike Lanes	On-Street Parking
Bardstown Road	Urban Principal Arterial <sup>1</sup>	6 lanes	45	Yes	No	No
Heather Lane	Local Road <sup>1</sup>	2 lanes	25	Yes	No	Yes

<sup>1</sup>Kentucky Transportation Cabinet Division of Planning Functional Classification Map (Reference 1)

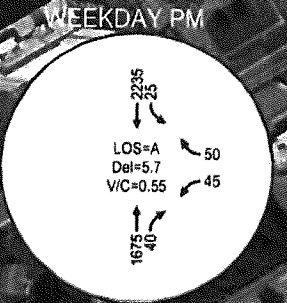
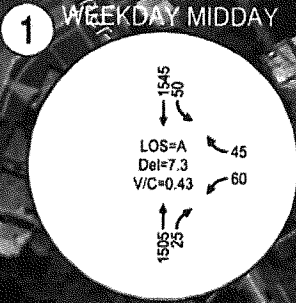
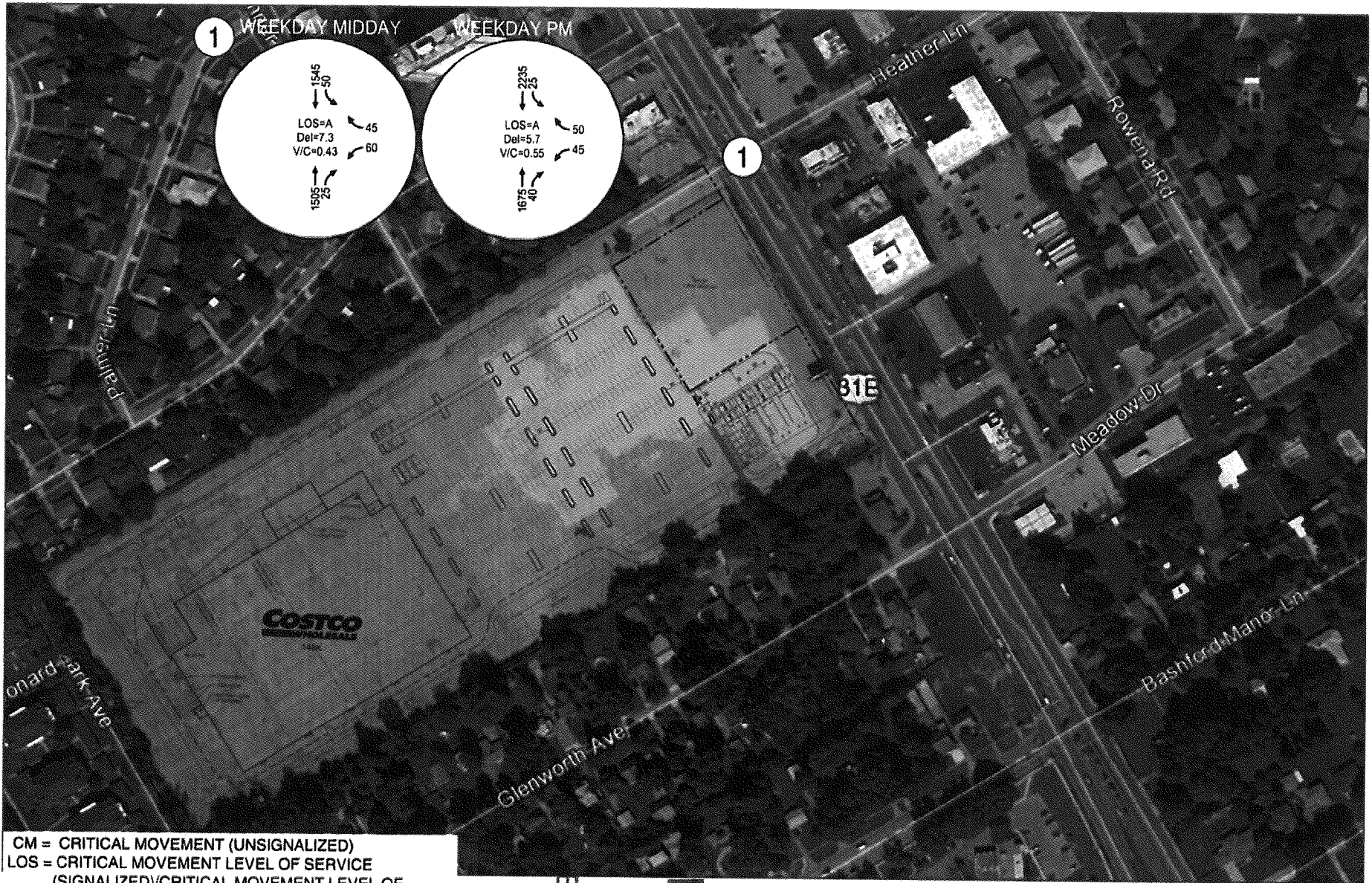
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### Traffic Volumes and Operations

Turning movement counts were obtained for the existing study intersection of Bardstown Road/Heather Lane in May 2015. The weekday counts were conducted on a typical mid-weekday day during the midday and p.m. peak periods. The peak hours for analysis were identified as 12:00 p.m. to 1:00 p.m. (midday peak hour) and 5:00 p.m. to 6:00 p.m. (p.m. peak hour).

The operational analysis was completed in accordance with the procedures from the *Highway Capacity Manual 2000* (Reference 2). A cycle length of 130 seconds was assumed with optimized splits for the signal at the study intersection. The existing turning movement counts were summarized and rounded to the nearest five vehicles for the two time periods. Figure 2 shows the existing traffic conditions. Attachment "A" contains the traffic counts. Attachment "B" contains the Year 2015 Existing Traffic Conditions Worksheets.

5/21/15



CM = CRITICAL MOVEMENT (UN SIGNALIZED)  
 LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UN SIGNALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UN SIGNALIZED)  
 V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

**2015 Existing Traffic Operations  
 Weekday Midday and PM  
 Louisville, Kentucky**

Figure  
**2**

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## YEAR 2025 BACKGROUND TRAFFIC CONDITIONS (NO BUILD)

The 2025 background traffic analysis identifies how the study area's transportation system will operate in 10 years. This analysis includes traffic growth due to general growth in the region, but does not include traffic from the proposed site.

The projected growth given to us by the City of Louisville's Traffic Engineering Department was a two-percent annual growth. This was used to develop the year 2025 traffic volumes. Figure 3 shows the year 2025 background traffic volumes and operations for the weekday midday and p.m. peak hours. *Attachment "C" contains the Year 2025 Background Traffic Conditions Worksheets.*

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## TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

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### Trip Generation

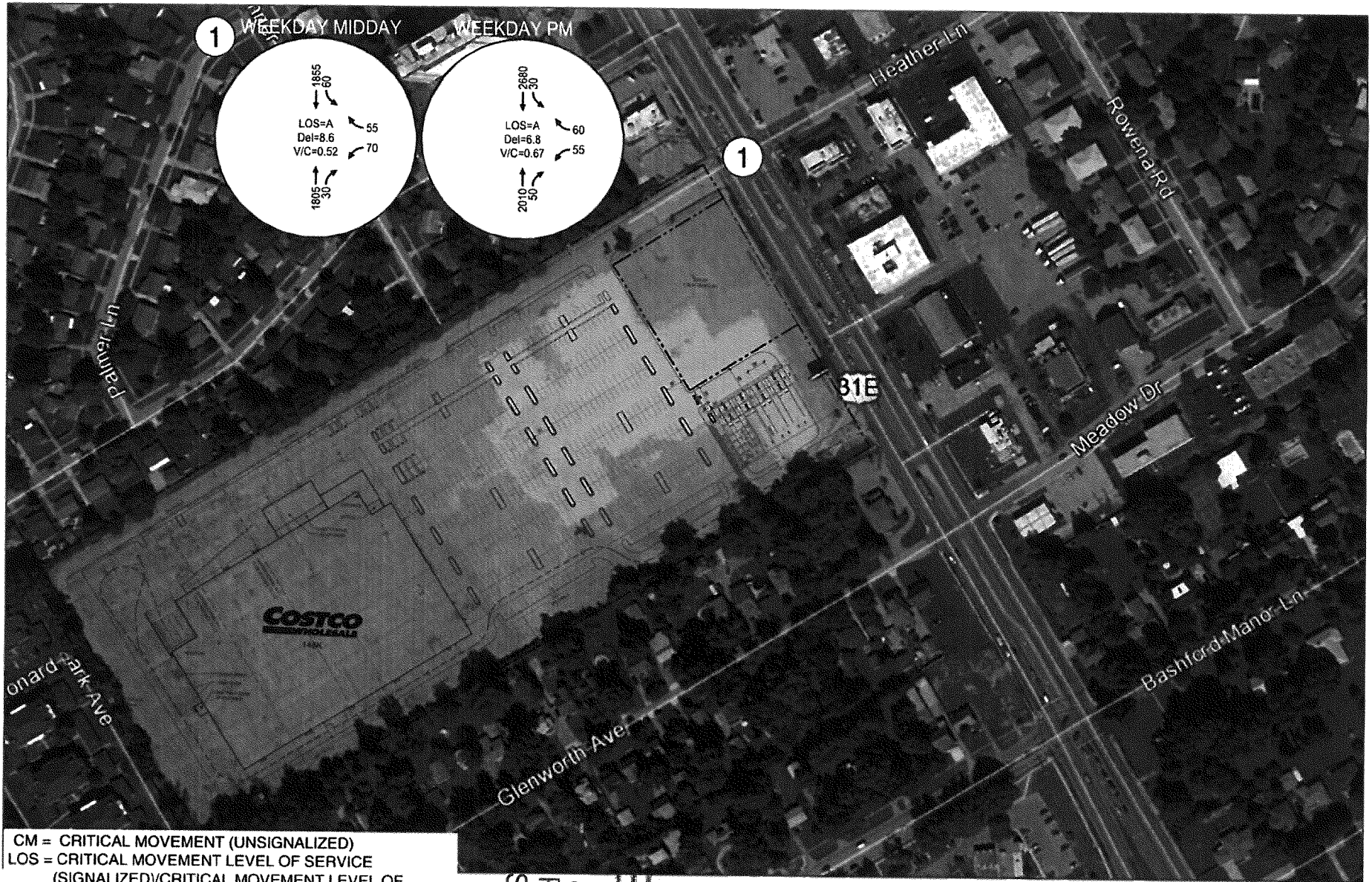
Trip generation for the proposed Costco was developed from data collected at existing Costco warehouses and Costco gasoline fuel station sites in the eastern United States. Weekday midday trip generation information is not available for Costco warehouses and gasoline fuel station sites, so Costco's p.m. peak hour trip generation information was conservatively used for the weekday midday peak hour analysis. Additionally, the Institute of Transportation Engineers (ITE) *Trip Generation, 9<sup>th</sup> Edition* (Reference 3) was used to estimate the trip generation for the fast food restaurant with a drive-through window.

With retail developments, there are several trip types that are associated with the total number of trips on the transportation system. These trip types include internal and pass-by trips. A brief description of these trip types is provided below.

*Internal Trips* – These trips occur between two or more retail uses, a residential and office use, or residential and retail use(s). These trips do not represent additional trips on the surrounding transportation system, but impact the internal site roadways and parking lots. Trips between the Costco Warehouse and the Costco Gasoline were inherently accounted for in the Costco trip database, thus no additional internal trip reduction is required to represent those internal trips. However, from past experience it is assumed 10% of the trips will be internal between Costco uses and the fast food restaurant.

*Pass-By Trips* – These trips currently exist on the roadways that provide primary access to the facility and are being made for some purpose other than visiting the facility (e.g., a trip from home to work). Pass-by trips do not result in any increase in traffic volumes within the study area. Typically, the impact of pass-by trips occurs at the site driveways, where they add turning movements. Based on pass-by rate data from similar Costco sites on the east coast, a pass-by rate of 50-percent was applied to weekday midday and p.m. peak hour volumes. An average pass-by rate of 50-percent was obtained from the ITE *Trip Generation Handbook, 3<sup>rd</sup> Edition* (Reference 4), for the fast food restaurant with a

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CM = CRITICAL MOVEMENT (UNSIGNALIZED)  
 LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)  
 Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)  
 V/C = CRITICAL CRITICAL VOLUME-TO-CAPACITY RATIO

**2025 Background Traffic Operations  
 Weekday Midday and PM  
 Louisville, Kentucky**

Figure  
**3**

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drive-through window. Therefore, a pass-by rate of 50-percent was applied to the site for the weekday midday and p.m. peak hours.

Table 2 summarizes the weekday midday and p.m. peak hour trip generation for the proposed Costco and fast food restaurant with drive-through window. All trips have been rounded to the nearest five trips.

Table 2. Trip Generation

Land Use	Size (Square Feet)	Weekday Midday Peak Hour			Weekday PM Peak Hour		
		Total	In	Out	Total	In	Out
Costco Warehouse with Gas Station	160,569	895	440	455	895	440	455
Fast Food with Drive Thru	5,000	235	120	115	165	85	80
<i>Internal Trips (10%)</i>		<i>(115)</i>	<i>(55)</i>	<i>(60)</i>	<i>(105)</i>	<i>(50)</i>	<i>(55)</i>
External Trips		1,015	505	510	955	475	480
<i>Pass-by Trips (50%)</i>		<i>(510)</i>	<i>(255)</i>	<i>(255)</i>	<i>(480)</i>	<i>(240)</i>	<i>(240)</i>
<b>Total Net New</b>		<b>505</b>	<b>250</b>	<b>255</b>	<b>475</b>	<b>235</b>	<b>240</b>

As shown in Table 2, the proposed Costco and fast food restaurant are estimated to generate approximately 505 net new weekday midday peak hour trips (250 inbound, 255 outbound) and 475 net new weekday p.m. peak hour trips (235 inbound, 240 outbound).

### Trip Distribution and Assignment

The distribution of Costco site-generated trips onto the roadway system was based upon a market study conducted for the site. The distribution of the fast food restaurant site-generated trips was based upon existing travel patterns in the site vicinity.

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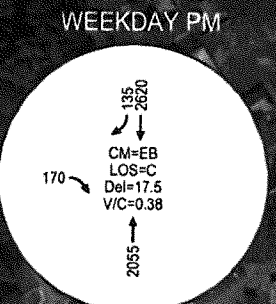
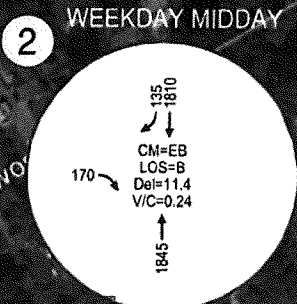
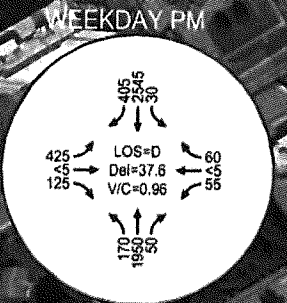
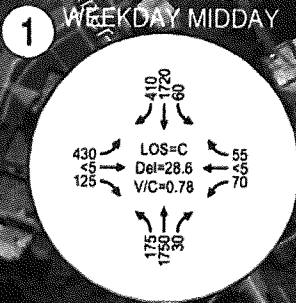
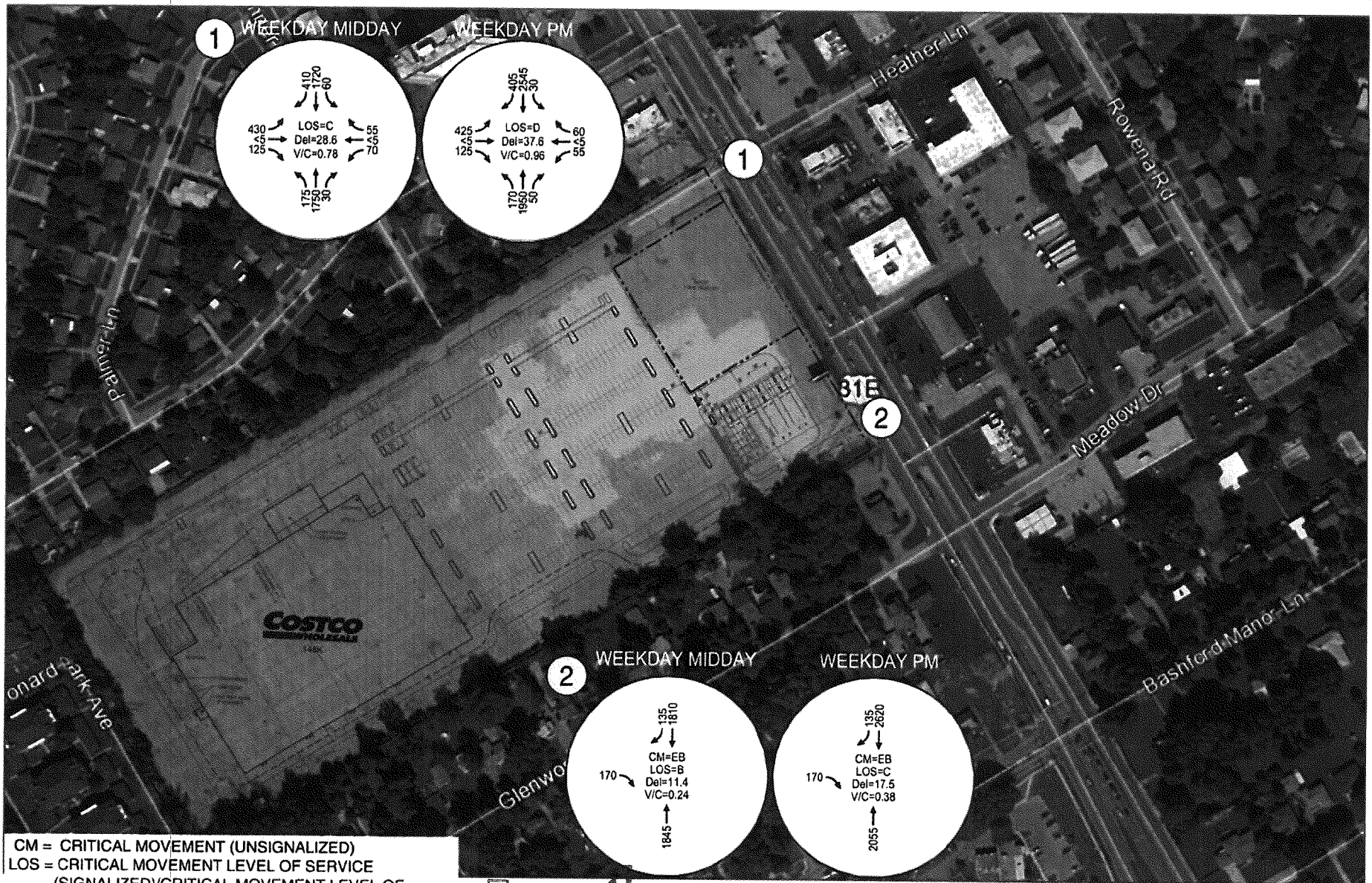
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### YEAR 2025 TOTAL TRAFFIC CONDITIONS (BUILD)

The 2025 total traffic conditions analysis forecasts how the study area's transportation system will operate with traffic from the proposed Costco and fast food restaurant 10 years from now. Background traffic growth between 2015 and 2025 was assumed as a two percent annual growth. The year 2025 background traffic volumes for the weekday midday and p.m. peak hours shown in Figure 3 were added to the total site generated traffic in Table 2. Figure 4 shows the 2025 total traffic volumes and operations.

In the analysis it was assumed the westbound leg would have a left-turn lane and a shared through-right lane and the eastbound would have dual left-turn lanes and a shared through-right lane due to the high left-turning volumes. Protected left-turn phasing was used for westbound and eastbound left-turns. Attachment "D" contains the Year 2025 Total Traffic Conditions Worksheets.

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CM = CRITICAL MOVEMENT (UNSIGNALIZED)  
 LOS = CRITICAL MOVEMENT LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)  
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**2025 Total Traffic Operations  
 Weekday Midday and PM  
 Louisville, Kentucky**

Figure  
**4**

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## CONCLUSIONS

The results of the traffic impact analysis indicate that the proposed development can be constructed while maintaining acceptable levels of service on the surrounding transportation system. The findings of this analysis and our recommendations are discussed below.

### Conclusions

- All of the study intersections currently operate at acceptable levels of service during the weekday midday and p.m. peak hours.
- All of the study intersections are projected to operate at acceptable levels of service under the year 2025 background conditions, weekday midday and p.m. peak hours.
- The proposed development is estimated to generate 505 net new weekday midday peak hour trips (250 in/255 out) and 475 net new weekday p.m. peak hour trips (235 in/240 out).
- The intersection's eastbound approach is proposed to operate with dual left-turn lanes and a shared thru-right lane. One new signal head facing each of the eastbound and westbound approaches will be needed to provide exclusive left-turn phasing for the eastbound and westbound approaches.
- All of the study intersections are anticipated to operate at acceptable levels of service in the year 2025 total traffic conditions during the weekday midday and p.m. peak hours.

We trust that the information provided adequately address the transportation impact analysis for the proposed Costco and fast food restaurant development. Please contact us at (407) 540-0555 if you have any questions.

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## REFERENCES

1. Kentucky Transportation Cabinet. *Functional Classification Map - Jefferson County*. 2015
2. Transportation Research Board. *Highway Capacity Manual*. 2000.
3. Institute of Transportation Engineers. *Trip Generation*, 8<sup>th</sup> Edition. 2008.
4. Institute of Transportation Engineers. *Trip Generation Handbook*, 3<sup>rd</sup> Edition. August 2014.

## ATTACHMENTS

- A. Traffic Counts
- B. Year 2015 Existing Traffic Conditions Worksheets
- C. Year 2025 Background Traffic Conditions Worksheets
- D. Year 2025 Total Traffic Conditions Worksheets

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Attachment A Traffic Counts

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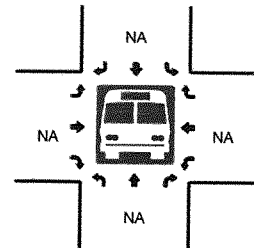
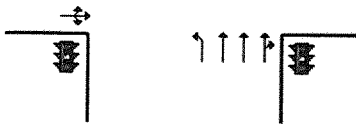
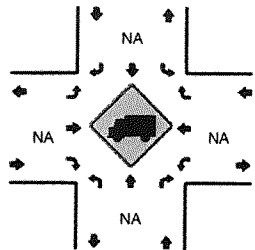
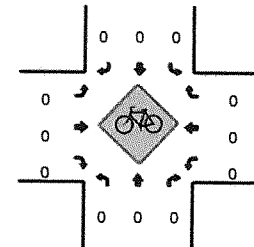
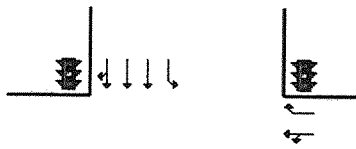
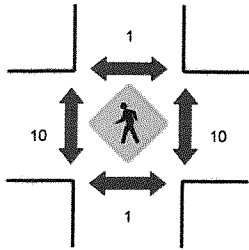
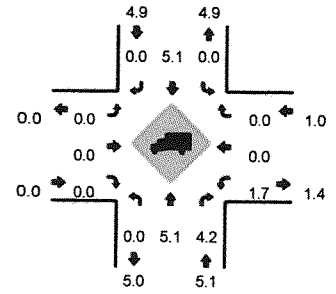
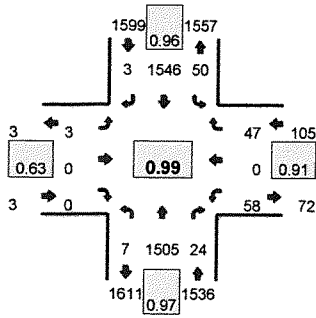
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Bardstown Rd -- Heather Ln  
 CITY/STATE: Louisville, KY

QC JOB #: 13378702  
 DATE: Wed, May 06 2015

Peak-Hour: 12:00 PM -- 1:00 PM  
 Peak 15-Min: 12:30 PM -- 12:45 PM



15-Min Count Period Beginning At	Bardstown Rd (Northbound)				Bardstown Rd (Southbound)				Heather Ln (Eastbound)				Heather Ln (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	0	388	6	2	6	365	1	0	0	0	0	0	8	0	16	0	792	
12:15 PM	0	356	4	3	18	403	1	1	2	0	0	0	17	0	9	0	814	
12:30 PM	0	375	5	2	16	396	0	1	0	0	0	0	15	0	11	0	821	
12:45 PM	0	386	9	0	8	382	1	0	1	0	0	0	18	0	11	0	816	3243
1:00 PM	0	334	10	1	10	373	2	0	0	0	2	0	11	0	12	0	755	3206
1:15 PM	0	342	5	2	9	404	0	1	0	0	0	0	9	0	16	0	788	3180
1:30 PM	0	387	7	0	16	402	0	2	0	0	0	0	10	0	14	0	838	3197
1:45 PM	0	356	6	1	10	386	1	3	1	0	0	0	9	0	11	0	784	3165

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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	0	1500	20	8	64	1584	0	4	0	0	0	0	60	0	44	0	3284
Heavy Trucks	0	72	0		0	84	0		0	0	0	0	0	0	0		156
Pedestrians		4				0				16				12			32
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

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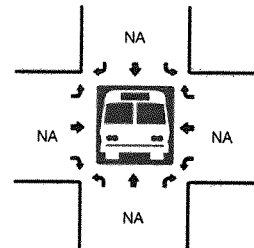
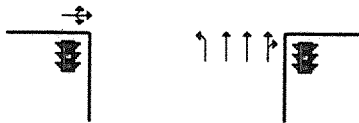
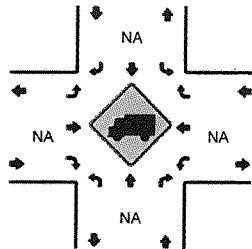
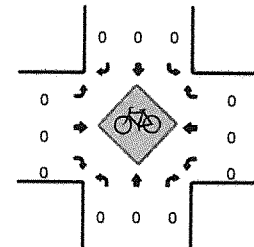
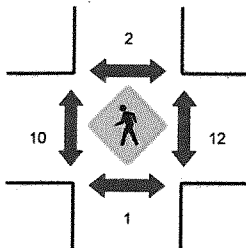
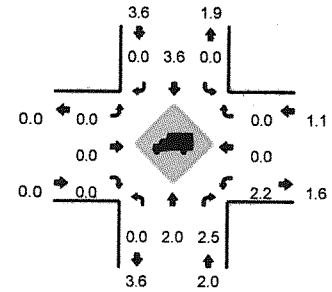
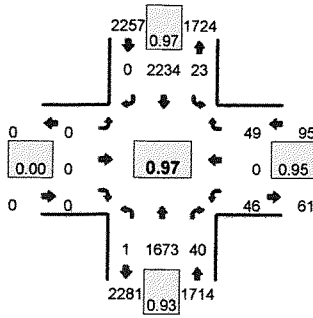
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Bardstown Rd -- Heather Ln  
CITY/STATE: Louisville, KY

QC JOB #: 13378701  
DATE: Wed, May 06 2015

Peak-Hour: 5:00 PM -- 6:00 PM  
Peak 15-Min: 5:00 PM -- 5:15 PM



15-Min Count Period Beginning At	Bardstown Rd (Northbound)				Bardstown Rd (Southbound)				Heather Ln (Eastbound)				Heather Ln (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	405	2	0	8	471	0	0	0	0	0	0	11	0	10	0	907	
4:15 PM	0	408	13	1	6	490	0	0	0	0	0	0	14	0	12	0	944	
4:30 PM	0	453	6	1	8	530	0	0	0	0	0	0	9	0	9	0	1016	
4:45 PM	0	360	5	2	20	536	0	0	0	0	0	0	9	0	8	0	940	3807
5:00 PM	0	442	13	0	1	573	0	0	0	0	0	0	9	0	13	0	1051	3951
5:15 PM	0	420	13	0	4	558	0	1	0	0	0	0	12	0	11	0	1019	4026
5:30 PM	0	420	4	1	6	584	0	1	0	0	0	0	9	0	16	0	1041	4051
5:45 PM	0	391	10	0	10	519	0	0	0	0	0	0	16	0	9	0	955	4066

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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	0	1768	52	0	4	2292	0	0	0	0	0	0	36	0	52	0	4204
Heavy Trucks	0	44	4		0	52	0		0	0	0		0	0	0		100
Pedestrians	0				0				12				12				24
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad Stopped Buses																	0

Comments:

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Attachment B Year 2015 Existing Traffic  
Conditions Worksheets

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HCM Signalized Intersection Capacity Analysis  
101: Bardstown Rd & Heather Ln

5/14/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↗	↖	↑↑↑		↖	↑↑↑	
Volume (vph)	3	0	0	58	0	47	7	1505	24	50	1546	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.91		1.00	0.91	
Frbp, ped/bikes		1.00			1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00			1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1801			1765	1592	1805	4924		1805	4938	
Flt Permitted		0.71			0.76	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1340			1405	1592	1805	4924		1805	4938	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	3	0	0	60	0	48	7	1552	25	52	1594	3
RTOR Reduction (vph)	0	0	0	0	0	44	0	1	0	0	0	0
Lane Group Flow (vph)	0	3	0	0	60	4	7	1576	0	52	1597	0
Confl. Peds. (#/hr)	1		1	1		1	10		10	10		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	5%	4%	0%	5%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		9.7			9.7	9.7	1.4	100.3		8.0	106.9	
Effective Green, g (s)		9.7			9.7	9.7	1.4	100.3		8.0	106.9	
Actuated g/C Ratio		0.07			0.07	0.07	0.01	0.77		0.06	0.82	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		99			104	118	19	3799		111	4060	
v/s Ratio Prot							0.00	c0.32		c0.03	0.32	
v/s Ratio Perm		0.00			c0.04	0.00						
v/c Ratio		0.03			0.58	0.03	0.37	0.41		0.47	0.39	
Uniform Delay, d1		55.8			58.2	55.8	63.9	5.0		58.9	3.0	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			7.5	0.1	11.7	0.3		3.1	0.3	
Delay (s)		55.9			65.7	55.9	75.5	5.3		62.0	3.3	
Level of Service		E			E	E	E	A		E	A	
Approach Delay (s)		55.9			61.3			5.6			5.2	
Approach LOS		E			E			A			A	

Intersection Summary

HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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HCM Signalized Intersection Capacity Analysis  
201: Bardstown Rd & Heather Ln

5/14/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↑↑↑		↔	↑↑↑	
Volume (vph)	0	0	0	46	0	49	1	1673	40	23	2234	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	0.91		1.00	0.91	
Frbp, ped/bikes					1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	
Frt					1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected					0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)					1765	1588	1805	5060		1805	4988	
Flt Permitted					0.76	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)					1407	1588	1805	5060		1805	4988	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	47	0	51	1	1725	41	24	2303	0
RTOR Reduction (vph)	0	0	0	0	0	48	0	1	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	47	3	1	1765	0	24	2303	0
Confl. Peds. (#/hr)	2		1	1		2	10		12	12		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	2%	2%	0%	4%	0%
Turn Type				Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)					8.6	8.6	1.2	104.5		4.9	108.2	
Effective Green, g (s)					8.6	8.6	1.2	104.5		4.9	108.2	
Actuated g/C Ratio					0.07	0.07	0.01	0.80		0.04	0.83	
Clearance Time (s)					4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)					93	105	16	4067		68	4151	
v/s Ratio Prot							0.00	0.35		c0.01	c0.46	
v/s Ratio Perm					c0.03	0.00						
v/c Ratio					0.51	0.03	0.06	0.43		0.35	0.55	
Uniform Delay, d1					58.6	56.8	63.8	3.8		61.0	3.4	
Progression Factor					1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2					4.3	0.1	1.6	0.3		3.1	0.5	
Delay (s)					62.9	56.9	65.5	4.2		64.1	3.9	
Level of Service					E	E	E	A		E	A	
Approach Delay (s)		0.0			59.8			4.2			4.6	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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HCM Signalized Intersection Capacity Analysis  
 101: Bardstown Rd & Heather Ln

5/14/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↗	↖	↑↑↑		↖	↑↑↑	
Volume (vph)	4	0	0	70	0	56	8	1806	29	60	1855	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes		1.00			1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00			1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1801			1765	1592	1805	4924		1805	4938	
Flt Permitted		0.66			0.76	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1244			1403	1592	1805	4924		1805	4938	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	4	0	0	72	0	58	8	1862	30	62	1912	4
RTOR Reduction (vph)	0	0	0	0	0	53	0	1	0	0	0	0
Lane Group Flow (vph)	0	4	0	0	72	5	8	1891	0	62	1916	0
Confl. Peds. (#/hr)	1		1	1		1	10		10	10		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	5%	4%	0%	5%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		12.0			12.0	12.0	1.5	97.4		8.6	104.5	
Effective Green, g (s)		12.0			12.0	12.0	1.5	97.4		8.6	104.5	
Actuated g/C Ratio		0.09			0.09	0.09	0.01	0.75		0.07	0.80	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		114			129	146	20	3689		119	3969	
v/s Ratio Prot							0.00	c0.38		c0.03	0.39	
v/s Ratio Perm		0.00			c0.05	0.00						
v/c Ratio		0.04			0.56	0.04	0.40	0.51		0.52	0.48	
Uniform Delay, d1		53.7			56.5	53.7	63.8	6.6		58.7	4.1	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			5.2	0.1	12.6	0.5		4.1	0.4	
Delay (s)		53.9			61.6	53.8	76.4	7.1		62.8	4.5	
Level of Service		D			E	D	E	A		E	A	
Approach Delay (s)		53.9			58.1			7.4			6.3	
Approach LOS		D			E			A			A	

Intersection Summary

HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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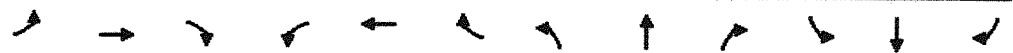
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HCM Signalized Intersection Capacity Analysis  
 201: Bardstown Rd & Heather Ln

5/14/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↗	↖	↑↑↑		↖	↑↑↑	
Volume (vph)	0	0	0	55	0	59	1	2008	48	28	2681	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor					1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes					1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	
Frt					1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected					0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)					1765	1588	1805	5060		1805	4988	
Flt Permitted					0.76	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)					1407	1588	1805	5060		1805	4988	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	57	0	61	1	2070	49	29	2764	0
RTOR Reduction (vph)	0	0	0	0	0	57	0	1	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	57	4	1	2118	0	29	2764	0
Confl. Peds. (#/hr)	2		1	1		2	10		12	12		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	2%	2%	0%	4%	0%
Turn Type				Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)					9.4	9.4	1.2	103.8		4.8	107.4	
Effective Green, g (s)					9.4	9.4	1.2	103.8		4.8	107.4	
Actuated g/C Ratio					0.07	0.07	0.01	0.80		0.04	0.83	
Clearance Time (s)					4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)					3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)					101	114	16	4040		66	4120	
v/s Ratio Prot							0.00	0.42		c0.02	c0.55	
v/s Ratio Perm					c0.04	0.00						
v/c Ratio					0.56	0.04	0.06	0.52		0.44	0.67	
Uniform Delay, d1					58.3	56.1	63.8	4.5		61.3	4.4	
Progression Factor					1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2					7.0	0.1	1.6	0.5		4.6	0.9	
Delay (s)					65.4	56.2	65.5	5.0		65.9	5.3	
Level of Service					E	E	E	A		E	A	
Approach Delay (s)		0.0			60.6			5.1			5.9	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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HCM Signalized Intersection Capacity Analysis  
 101: Bardstown Rd & Heather Ln

5/14/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔		↔	↔		↔	↑↑↑		↔	↑↑↑	
Volume (vph)	428	2	125	70	2	56	177	1749	29	60	1718	410
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.91		1.00	0.91	
Frbp, ped/bikes	1.00	0.99		1.00	0.98		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.85		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3502	1596		1770	1591		1805	4926		1805	4815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3502	1596		1770	1591		1805	4926		1805	4815	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	441	2	129	72	2	58	182	1803	30	62	1771	423
RTOR Reduction (vph)	0	114	0	0	56	0	0	1	0	0	29	0
Lane Group Flow (vph)	441	17	0	72	4	0	182	1832	0	62	2165	0
Confl. Peds. (#/hr)	1		1	1		1	10		10	10		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	5%	4%	0%	5%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	19.8	15.6		8.3	4.1		16.9	82.5		7.6	73.2	
Effective Green, g (s)	19.8	15.6		8.3	4.1		16.9	82.5		7.6	73.2	
Actuated g/C Ratio	0.15	0.12		0.06	0.03		0.13	0.63		0.06	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	533	191		113	50		234	3126		105	2711	
v/s Ratio Prot	c0.13	c0.01		0.04	0.00		c0.10	0.37		0.03	c0.45	
v/s Ratio Perm												
v/c Ratio	0.83	0.09		0.64	0.08		0.78	0.59		0.59	0.80	
Uniform Delay, d1	53.4	50.9		59.4	61.1		54.7	13.8		59.7	22.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.2	0.2		11.2	0.7		14.9	0.8		8.6	2.6	
Delay (s)	63.6	51.1		70.6	61.8		69.7	14.6		68.3	25.1	
Level of Service	E	D		E	E		E	B		E	C	
Approach Delay (s)		60.8			66.6			19.6			26.3	
Approach LOS		E			E			B			C	

Intersection Summary

HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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HCM Unsignalized Intersection Capacity Analysis  
 102: Bardstown Rd & Costco Access #2

5/14/2015



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑↑	↑↑↑	
Volume (veh/h)	0	171	0	1843	1810	135
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	176	0	1900	1866	139
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					926	
pX, platoon unblocked	0.68	0.68	0.68			
vC, conflicting volume	2569	692	2005			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1647	0	814			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	76	100			
cM capacity (veh/h)	62	738	556			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	176	633	633	633	746	746	512
Volume Left	0	0	0	0	0	0	0
Volume Right	176	0	0	0	0	0	139
cSH	738	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.24	0.37	0.37	0.37	0.44	0.44	0.30
Queue Length 95th (ft)	23	0	0	0	0	0	0
Control Delay (s)	11.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	11.4	0.0			0.0		
Approach LOS	B						

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	55.2%		ICU Level of Service B
Analysis Period (min)	15		

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# HCM Signalized Intersection Capacity Analysis

## 201: Bardstown Rd & Heather Ln

5/14/2015

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↑		↔	↑		↔	↑↑↑		↔	↑↑↑	
Volume (vph)	424	2	125	55	2	59	170	1951	48	28	2544	406
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.91		1.00	0.91	
Frbp, ped/bikes	1.00	0.99		1.00	0.97		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	0.85		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3502	1596		1770	1568		1805	5064		1805	4892	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3502	1596		1770	1568		1805	5064		1805	4892	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	437	2	129	57	2	61	175	2011	49	29	2623	419
RTOR Reduction (vph)	0	110	0	0	59	0	0	2	0	0	17	0
Lane Group Flow (vph)	437	21	0	57	4	0	175	2058	0	29	3025	0
Confl. Peds. (#/hr)	2		1	1		2	10		12	12		10
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	0%	2%	2%	0%	4%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	17.0	14.6		5.6	3.2		13.7	90.2		3.6	80.1	
Effective Green, g (s)	17.0	14.6		5.6	3.2		13.7	90.2		3.6	80.1	
Actuated g/C Ratio	0.13	0.11		0.04	0.02		0.11	0.69		0.03	0.62	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	457	179		76	38		190	3513		49	3014	
v/s Ratio Prot	c0.12	c0.01		0.03	0.00		c0.10	0.41		0.02	c0.62	
v/s Ratio Perm												
v/c Ratio	0.96	0.12		0.75	0.09		0.92	0.59		0.59	1.00	
Uniform Delay, d1	56.1	51.9		61.5	62.0		57.6	10.3		62.5	25.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	30.9	0.3		33.4	1.1		43.4	0.7		17.7	17.3	
Delay (s)	87.0	52.2		94.9	63.0		101.0	11.0		80.2	42.3	
Level of Service	F	D		F	E		F	B		F	D	
Approach Delay (s)		79.0			78.2			18.0			42.6	
Approach LOS		E			E			B			D	

### Intersection Summary

HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

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HCM Unsignalized Intersection Capacity Analysis  
 202: Bardstown Rd & Costco Access #2

5/14/2015



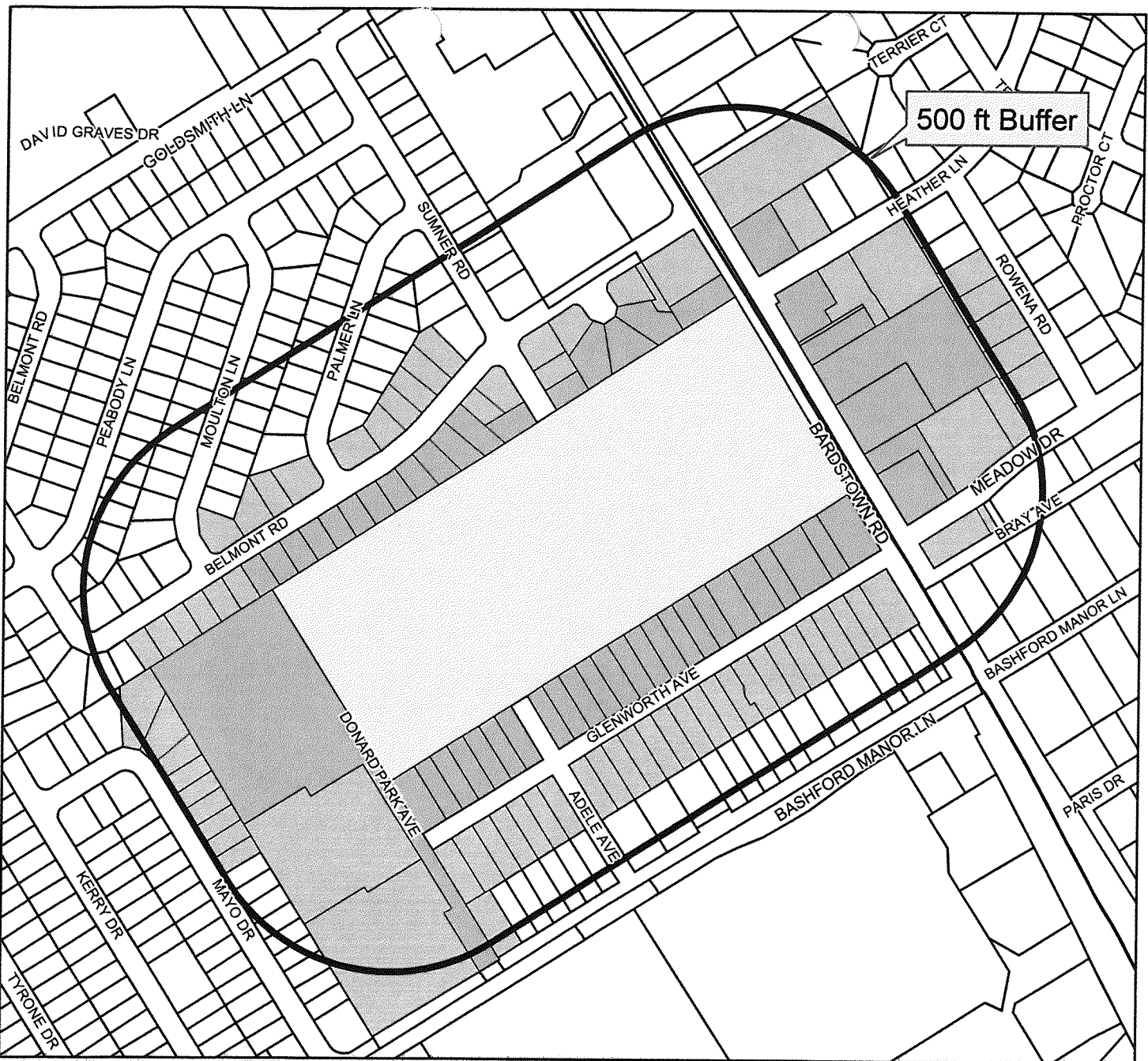
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑↑	↑↑↗	
Volume (veh/h)	0	171	0	2057	2622	135
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	176	0	2121	2703	139
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					926	
pX, platoon unblocked	0.42	0.42	0.42			
vC, conflicting volume	3480	971	2842			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2091	0	586			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	62	100			
cM capacity (veh/h)	20	462	423			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	176	707	707	707	1081	1081	680
Volume Left	0	0	0	0	0	0	0
Volume Right	176	0	0	0	0	0	139
cSH	462	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.38	0.42	0.42	0.42	0.64	0.64	0.40
Queue Length 95th (ft)	44	0	0	0	0	0	0
Control Delay (s)	17.5	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C						
Approach Delay (s)	17.5	0.0					0.0
Approach LOS	C						

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		70.9%	ICU Level of Service C
Analysis Period (min)		15	

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




**KRS 100.214 (2)**

Notice of the hearing shall be given at least fourteen (14) days in advance of the hearing by first-class mail, with certification by the commission secretary or other officer of the planning commission that the notice was mailed, to the mayor and city clerk of any city of the fifth or sixth class so affected, to an owner of every parcel of property adjoining at any point the property the classification of which is proposed to be changed, to an owner of every parcel of property directly across the street from said property, and to an owner of every parcel of property which adjoins at any point the adjoining property or the property directly across the street from said property; provided, however, that no first-class mail notice, required by this subsection, shall be required to be given to any property owner whose property is more than five hundred (500) feet from the property which is proposed to be changed. It shall be the duty of the person or persons proposing the map amendment to furnish to the planning commission the names and addresses of the owners of all property as described in this subsection. Records maintained by the property valuation administrator may be relied upon conclusively to determine the identity and address of said owner. In the event such property is in condominium or cooperative forms of ownership, then the person notified by mail shall be the president or chairman of the owner group which administers property commonly owned by the condominium or cooperative owners. A joint notice may be mailed to two (2) or more co-owners of an adjoining property who are listed in the property valuation administrator's records as having the same address.

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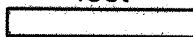
**Legend**

-  Subject Site
-  1st Tier Property
-  2nd Tier Property



**Pre-App Tax Map  
15ZONE1008**

feet



400

Map Created: 4/2/2015



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