III. C.

DATE: September 8, 2010

TO: Planning & Public Works Committee

FROM: Brian McGownd, PWD\CE

SUBJECT: Stop Sign Request – Chesterfield Commons Drive at Frontage Road

We received a request from THF Realty to install stop signs on Chesterfield Commons Drive at Frontage Road. The Frontage Road is the east-west road immediately adjacent to the shops (including Wal-Mart) within Chesterfield Commons. This intersection experiences significant congestion/delays at various times throughout the week.

Per City Council policy, Staff prepared the attached analysis. As you can see on page 8 of the analysis the installation of the requested stop signs are warranted per the MUTCD, and in fact, the overall operation of the intersection improves from a LOS D to LOS B.

Therefore, **staff requests the Planning & Public Works Committee to recommend approval of the attached ordinance which will authorize the placement of stop signs on both northbound and southbound Chesterfield Commons Drive at Frontage Road, and to forward to City Council for their consideration.**

I would like to commend Susan Mueller, Principal Engineer and Justin Wyse, Project Planner for the excellent analysis that they performed. A new software package called SYNCHRO was utilized to determine intersection delay and Level of Service of the existing 2-way stop condition and the proposed 4-way stop condition. The software shows a simulation of the operation of the intersection in both conditions, which is a very valuable tool for analyzing existing and proposed conditions.

If you need additional information or have any questions please advise.

attachments

cc: Mike Geisel, Director of Planning & Public Works
Aimee Nassif, Planning & Development Services Director
Susan Mueller, Principal Engineer
Justin Wyse, Project Planner

BILL NO. _____ ORDINANCE NO. _____

AN ORDINANCE AMENDING ORDINANCE NUMBER 35, SCHEDULE VI, INTERSECTION STOPS, OF THE ORDINANCES OF THE CITY OF CHESTERFIELD BY ADDING PROVISIONS THERETO TO INCLUDE CHESTERFIELD COMMONS DRIVE AT FRONTAGE ROAD.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHESTERFIELD, ST. LOUIS COUNTY, MISSOURI, AS FOLLOWS:

Section 1. Ordinance Number 35, Section 3, Schedule VI, as it relates to intersection stop signs, is hereby amended by adding the following provision thereto:

Intersection	*Traffic on Highway, Road, Street or Alley Listed Below Shall Stop*
Frontage Road	Chesterfield Commons Drive (north and southbound)

Section 2. In all other respects, Ordinance Number 35 is in full force and effect.

Section 3. This ordinance shall be in full force and effect from and after its passage and approval.

Passed and approved this _____ day of _____ , 2010.

_____
MAYOR

ATTEST:

_____
CITY CLERK

[FIRST READING HELD: _____]

MEMORANDUM

DATE: August 13, 2010

TO: Brian McGownd, PWD/CE
Aimee Nassif, PDSD

CC: Annissa McCaskill-Clay, Lead Senior Planner

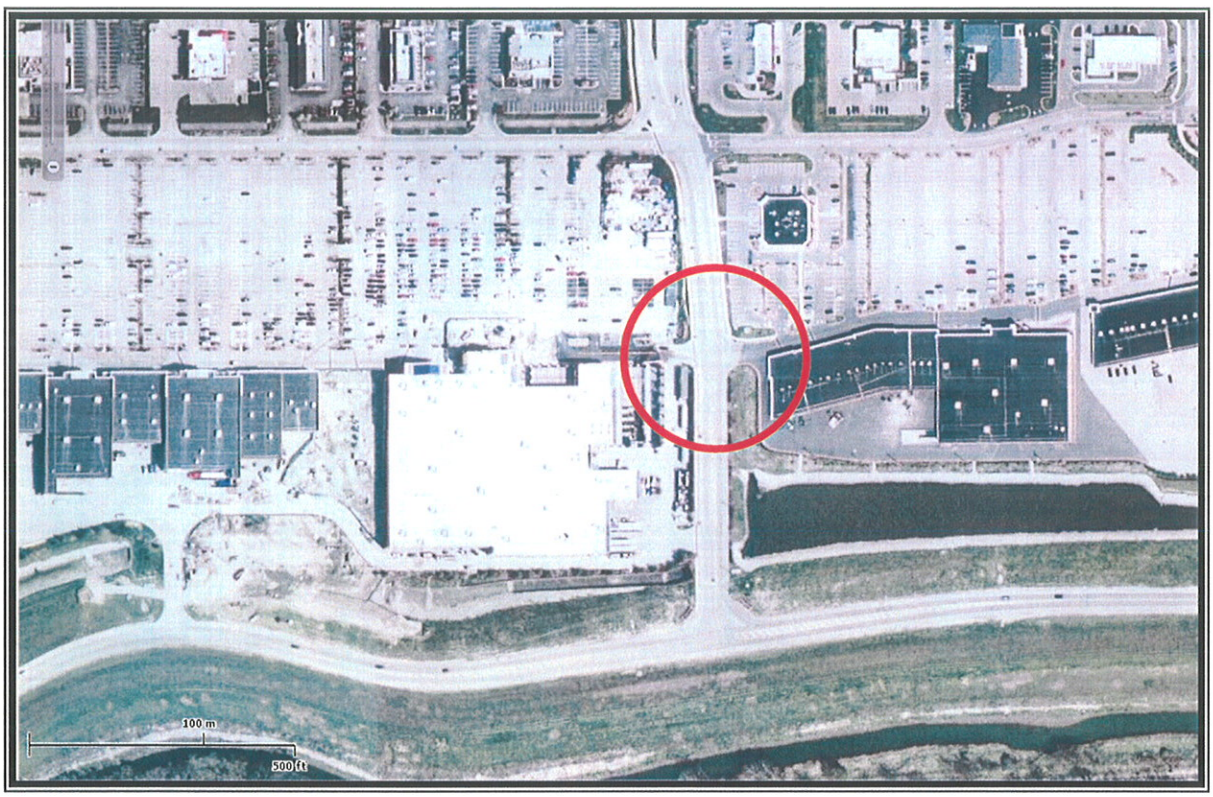
FROM: Susan Mueller, Principal Engineer S Mueller
Justin Wyse, Project Planner

RE: Chesterfield Commons Drive Intersection Control Analysis

Introduction

As requested, staff has completed an analysis of the existing operations along Chesterfield Commons Drive at its intersection with the frontage road serving the Walmart Supercenter at 100 THF Blvd, and the Shoe Stop at 90 THF Blvd. The intersection is located within Chesterfield Commons Subdivision. Chesterfield Commons Drive has a single through traffic lane and a single dedicated left turn lane in both the NB and SB directions entering this intersection. The frontage road has one traffic lane in the EB and WB direction entering the intersection.

Figure 1: Analysis Intersection



Field Observations

Traffic counters were placed on the six (6) approach lanes into the intersection to determine Average Annual Daily Traffic (AADT) volumes and Peak Hour weekday and weekend volumes. Based on the results of the data collected, two field observations were conducted to monitor traffic operations at the study intersection. The first visit was conducted on a Friday between the hours of 12:15 P.M. and 2:15 P.M. A second field observation was conducted on a Saturday between the hours of 11:45 A.M. – 2:00 P.M. Based upon data collected by the traffic counters, these time periods contained the weekday peak volume and the weekend peak volume periods.

During these observations, several issues were noted that impacted the operations of the intersection:

1. Landscaping along the perimeter of the intersection is creating a sight barrier. Vehicles entering the intersection on both the EB and WB frontage approaches must pull ahead of the painted stop bars to determine if vehicles are present on NB and SB Chesterfield Commons Drive. The driver view of the STOP sign for EB exiting vehicles is blocked by an ornamental tree. These concerns are illustrated below in Figure 2, Figure 3, and Figure 4.

Figure 2: Vegetation in Sight Distance Triangle on WB Approach

Figure 3: Vegetation in Sight Distance Triangle on EB Approach

Figure 4: Tree Blocking EB STOP sign

2. A number of drivers entering the intersection from the frontage road erroneously interpret the intersection as a multi-way (4-way) stop. We believe this interpretation is most likely due to the painted white stop bars on the left turn bays of Chesterfield Commons Drive. These stop bars create the appearance of a multi-way stop control at this intersection. (see Figure 5).

Figure 5: Appearance of Stop Bar on Southbound Approach

3. Due to high WB traffic volume along the frontage road and the stop controlled pedestrian crossing at the Walmart Outdoor Living entrance, vehicle queues were observed during peak hour that backed up into and interfered with traffic on Chesterfield Commons Drive. Figure 6 shows the proximity (150') of the intersection and the Outdoor Living entrance STOP sign in the Wal-Mart Supercenter parking lot. It was also noted that the white painted YIELD pavement markings at each of the Walmart store entrances conflict with the posted STOP signs, shown in Figure 7. As these Walmart entrance STOP signs contribute to a back-up of traffic on the frontage road, consideration should be given to replacement of the STOP signs with YIELD signs.

Figure 6: STOP Sign Located Within Private Lot

Figure 7: Conflicting YIELD and STOP

Data Collection and Analysis

The Manual for Uniform Traffic Control Devices (MUTCD) Section 2B.06 and 2B.07 contains guidance in terms of crash rates, entering vehicular volumes, and average vehicular delay for application of stop control. The Highway Capacity Manual 2000 (HCM) provides methodology for determination of level of service (LOS) of a street or intersection facility.

Crash Data

Crash data in the Law Enforcement Traffic System (LETS) was reviewed for a period of three years on Chesterfield Commons Drive. As can be seen in Figure 8, the majority of traffic accidents on Chesterfield Commons Drive occur at its intersection with THF Boulevard. In total, there were 26 accidents in 3 years along Chesterfield Commons Drive. Based on the information provided by law enforcement records, 2 accidents in 3 years were proximate to the study intersection. This intersection crash rate of 0.67 crashes per year is very low and falls well below the MUTCD stop control crash rate warrant of 5.0 crashes per year.

Figure 8: Crash Data from LETS

Before/After/At	Cross Location	Accident	Citation	Warning	Complaint
PVT CHESTERFIELD COMMONS					
Before	CRD CHESTERFIELD AIRPORT RD	1	0	0	0
After	CRD CHESTERFIELD AIRPORT RD	0	0	0	0
At	CRD CHESTERFIELD AIRPORT RD	6	13	2	0
Before	PVT THF BLVD	0	0	0	0
After	PVT THF BLVD	0	0	0	0
At	PVT THF BLVD	16	17	0	0
Before	CST EDISON AVE	2	0	0	0
After	CST EDISON AVE	0	0	0	0
At	CST EDISON AVE	1	33	3	0

Volume Data

Traffic volume data was collected for each lane of traffic entering the intersection and was compared to the MUTCD volumetric warrants.

Vehicular volumes entering the intersection from the major street approaches average **530 vph** for the 8 hours between 11 am and 7 pm on Friday and **478 vph** on Saturday during the same eight hour time interval. Major street volumes exceed the minimum multi-way stop warrant C1 of 300 vph in an eight hour interval on both days.

Vehicular volumes entering the intersection from the minor street approaches average **340 vph** for the 8 hours between 11 am and 7 pm on Friday and **385 vph** on Saturday during the same eight hour time interval. Minor street volumes exceed the minimum multi-way stop volume warrant C2 of 200 vph in an eight hour interval on both days.

Delay Data

SYNCHRO traffic software was used to calculate the intersection delay and level of service (LOS) as defined by the HCM 2000 edition at the study intersection. A base scenario was created to calculate delay and LOS as the intersection currently operates. Figure 9 shows the results of the existing conditions analysis. The listed delay data is taken from the SYNCHRO non-signalized HCM analysis report which is attached as Exhibit A.

Figure 9: Existing Conditions Operations Analysis

	Approach Summary			
	EB	WB	NB	SB
Avg. Delay	73 sec	30 sec	8 sec	8 sec
LOS	F	D	A	A

Intersection Summary		
Avg. Delay	ICU	HCM LOS
32 seconds	61%	D

Both EB and WB frontage road approaches meet or exceed the multi-way stop delay warrant C2 of 30 seconds per vehicle during the peak hour. For comparison purposes, a 30 second delay is equivalent to a LOS D. The EB frontage road approach experiences **73 seconds** of delay during the peak hour. The intersection as a whole operates at a LOS D and the average delay per vehicle during the peak hour is 32 seconds.

The major leg vehicle volume, minor leg vehicle volume, and minor leg delay warrants as defined in Section 2B.076 of the MUTCD support installation of a multi-way (4-way) stop.

Multi-Way Stop LOS Analysis

SYNCHRO was used to analyze the intersection with multi-way stop control. The results of this control modification are shown in Figure 10. The delay data is taken from the SYNCHRO non-signalized HCM analysis report which is attached as Exhibit B. As can be seen, the introduction of a multi-way stop significantly reduces the delay on the EB and WB approaches and slightly increases the delay to the NB and SB approaches. Average delay for the intersection is reduced by 54% to 14.2 seconds and the overall intersection operation improves from LOS D to LOS B.

Figure10: Alternative 1 Operations Analysis

	Approach Summary					
	EB	WB	NB		SB	
			LT	Thru + RT	LT	Thru + RT
Avg. Delay	17 sec	16 sec	10 sec	11 sec	10 sec	13 sec
LOS	C	C	B		B	

Intersection Summary			
Avg. Delay	ICU	HCM LOS	
14.6	61%	B	

Recommendation

Based on field observations and operational analysis of the study intersection, the following recommendations are being made.

1. Inform THF that landscape pruning, trimming or removal is necessary to restore view of the EB STOP sign and sight distance for WB and EB movements into the intersection.

2. Recommend City Council authorization for a multi-way (4-way) stop on Chesterfield Commons Drive at the intersection with this frontage road..

3. Recommend THF consider YIELD sign control at the Walmart Outdoor Living entrance in lieu of STOP sign control.

EXHIBIT A

SYNCHRO HCM Unsignalized Intersection Capacity Analysis for Existing Conditions

HCM Unsignalized Intersection Capacity Analysis
3: Chesterfield Commons Drive & 7/22/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	150	113	59	62	192	38	35	77	46	37	83	139
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	163	123	64	67	209	41	38	84	50	40	90	151
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	552	456	166	481	507	109	241			134		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	552	456	166	481	507	109	241			134		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	37	74	93	81	53	96	97			97		
cM capacity (veh/h)	258	473	879	352	443	945	1325			1451		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	350	317	38	134	40	241
Volume Left	163	67	38	0	40	0
Volume Right	64	41	0	50	0	151
cSH	362	449	1325	1700	1451	1700
Volume to Capacity	0.97	0.71	0.03	0.08	0.03	0.14
Queue Length 95th (ft)	268	136	2	0	2	0
Control Delay (s)	73.4	30.1	7.8	0.0	7.6	0.0
Lane LOS	F	D	A		A	
Approach Delay (s)	73.4	30.1	1.7		1.1	
Approach LOS	F	D				

Intersection Summary				
Average Delay	32.0			
Intersection Capacity Utilization	61.5%	ICU Level of Service	B	
Analysis Period (min)	15			

EXHIBIT B

SYNCHRO HCM Unsignalized Intersection Capacity
Analysis for Alternative 1: 4-Way Stop Analysis

HCM Unsignalized Intersection Capacity Analysis
3: Chesterfield Commons Drive & 7/22/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	150	113	59	62	192	38	35	77	46	37	83	139
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	163	123	64	67	209	41	38	84	50	40	90	151

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	350	317	38	134	40	241
Volume Left (vph)	163	67	38	0	40	0
Volume Right (vph)	64	41	0	50	0	151
Hadj (s)	0.02	0.00	0.53	-0.23	0.53	-0.40
Departure Headway (s)	6.0	6.0	7.7	6.9	7.5	6.5
Degree Utilization, x	0.58	0.53	0.08	0.26	0.08	0.44
Capacity (veh/h)	569	552	408	452	442	502
Control Delay (s)	16.9	15.6	10.2	11.1	9.9	13.2
Approach Delay (s)	16.9	15.6	10.9		12.8	
Approach LOS	C	C	B		B	

Intersection Summary				
Delay	14.6			
HCM Level of Service	B			
Intersection Capacity Utilization	61.5%	ICU Level of Service	B	
Analysis Period (min)	15			