TRAFFIC IMPACT STUDY

Strother Crossing Development

On Independence Avenue

Lee's Summit, MO

Prepared for:

LBC Development Corp.

Prepared by:

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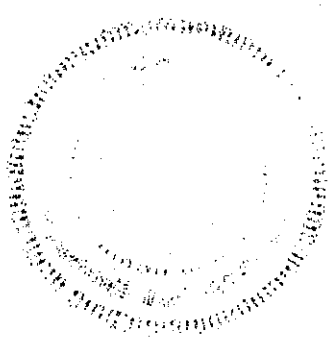
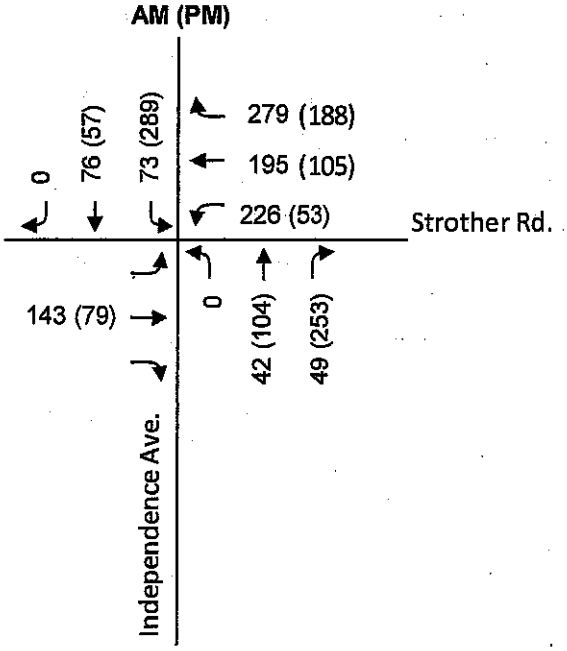


Hg Consult has been retained to review and evaluate the effects of the Strother Crossing development on Independence Avenue at Strother Road in Lee's Summit, MO. The study limits are I-470 to the east, Strother Road to the north, Hagen Rd./McBaine Dr. at Independence to the south, and the southwest corner of Independence/Strother to the west. The purpose of this study is to identify what infrastructure is necessary on Independence Avenue and the entrances to accommodate the traffic generated from the proposed development.

EXISTING CONDITIONS

Independence Ave. is an industrial collector that parallels I-470 from Woods Chapel Rd. to the north to Colburn Rd. to the south. It is 32' wide in the study area, widening to 66' at the Strother intersection. The intersection of Independence with Strother is a signalized intersection, with dedicated left-turn bays and protected left turn signal phasing in all directions (including dual lefts for the southbound approach). Turn counts were performed at the intersection in the AM and PM peak hours. The AM peak hour was from 7:15-8:15, and the PM peak hour was from 4:30-5:30. The west approach of the intersection was closed due to construction on Strother. Base volumes were retrieved from the traffic study for the school being built for the eastbound and westbound volumes. Generally speaking, the traffic movements were heaviest coming from the I-470 interchange in the AM, and going to the I-470 interchange in the PM.

Strother/Independence
Existing Peak Period
Turning Movement Counts
AM (PM)



PROPOSED DEVELOPMENT

There are 2 lots in the southwest quadrant of the Strother/Independence intersection (from here on referred to as 'the intersection'). Lot 1 is a one or two-story bank or office building at 13,200 sq. ft. A bank is assumed for this study for the higher trip generation rates. Lot 2 is 18,750 sq. ft. of mixed office/retail. Access to this site is provided by a 29' wide right-in/right-out (RI/RO) entrance on Strother 330' west of the intersection with a 65' driveway throat length, and a 28' wide RI/RO plus left-in on Independence 430' south of Strother with a 54' driveway throat length. The turn bay for the northbound left turn lane from Independence is 110'. Few vehicles are expected to make the northbound left into the site so no queueing issues are expected. The majority of traffic at the site is expected to come from the I-470 interchange. Since they can't get in from the Strother access, they'll be coming southbound from the intersection. In lieu of merging two southbound lanes to one then tapering out for a right turn lane, one of the two southbound lanes on Independence will drop at the right turn lane to this site, and one southbound lane will continue. Sidewalks are provided along Strother and Independence for the extent of the development and internally to connect the parcels. Both entrances exceed the required minimum of 225' stopping sight distance for a 35 mph roadway.

There are 7 lots in the southeast quadrant of the intersection. They are: a gas station (20 fueling stations, with convenience market and car wash), 6550 sq. ft. high-turnover restaurant, 7600 sq. ft. of fast food restaurants, 30,250 sq. ft. of mixed office/retail, and a 3-story hotel or 15,000 sq. ft. of office/retail, which was assumed for this study. There are 3 access points to this site, all along Independence. The first (northernmost) entrance is 430' south of Strother. It is 28' wide 2-lane entrance with RI/RO access due to the proximity to the Strother intersection and has a 60' driveway throat length. The majority of northbound traffic going to the gas station and about half of the northbound traffic going to one of the restaurants is assumed to use this entrance. A northbound right turn lane is provided at this entrance for the traffic expected to go to the gas station. The second entrance is a full access intersection 280' south of the first and lines up opposite the MoDOT maintenance facility entrance on the west side of Independence. It is a 40' wide 3-lane entrance to accommodate a dedicated left turn lane and a through/right turn lane exiting the development. It has a 180' left turn bay for southbound traffic as it is the first access for southbound traffic, and a 100' right turn lane for northbound traffic as this entrance will be considered the main entrance for the development, and has a 105' driveway throat length. It is expected to handle about half of the traffic generated by the restaurants and office/retail, and all of the southbound traffic going to the gas station. Trucks may access the development via this access as it is the widest and includes turn lanes. The third entrance is a 29' wide 2 lane, full access entrance 320' south of the second entrance. It is expected to handle about half of the traffic going to/from the office/retail spaces and has a driveway throat length of 55'. The proposed development includes a circulating route that provides access to all the parcels and each of the entrances so that every lot may be accessed by each entrance, which improves internal circulation and reduces the need to reenter the roadway. Sidewalks are provided along Independence for the length of the development and will connect to the existing sidewalk along Strother, as well as provided internally throughout to connect all the parcels and improve the walkability of the

development. All three entrances exceed the 225' minimum stopping sight distance for a 35 mph roadway.

See the attached sheet for the roadway and site development layout.

TRIP GENERATION

The Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition was utilized to forecast the expected traffic volumes generated by each of the developments for the AM and PM peak hours. All the developments are expected to generate a certain amount of traffic per 1,000 sq. ft. of area (except the gas station, which is based on number of fueling stations) based on numerous studies of developments of various sizes. In summary, the southwest site generates 224 trips in the AM (139 entering and 85 exiting) and 532 trips in the PM (235 entering and 297 exiting), and the southeast site generates 776 trips in the AM (428 entering, 348 exiting) and 709 trips in the PM (356 entering, 353 exiting). Not all of these are new trips added to the existing volumes. Some trips are assumed to be "pass-by" trips, meaning vehicles that are already in the network will stop at the new developments as recommended by ITE. Sites like restaurants, gas stations and banks are assumed to have "pass-by" trip percentages up to 10%. Details of the trip generation study can be found in the Appendix.

Trip distributions are assumed to estimate where traffic is coming from and going to help study the impacts to the area. 20% are expected to come from Strother to the west. 10%-30% are expected to come from Independence to the south, with the lower range being in the AM where the predominant movement is southbound, and the higher range in the PM where more vehicles are traveling northbound. The majority of traffic volume is assumed to come from and go to the I-470 interchange, which accounts for the remaining volumes.

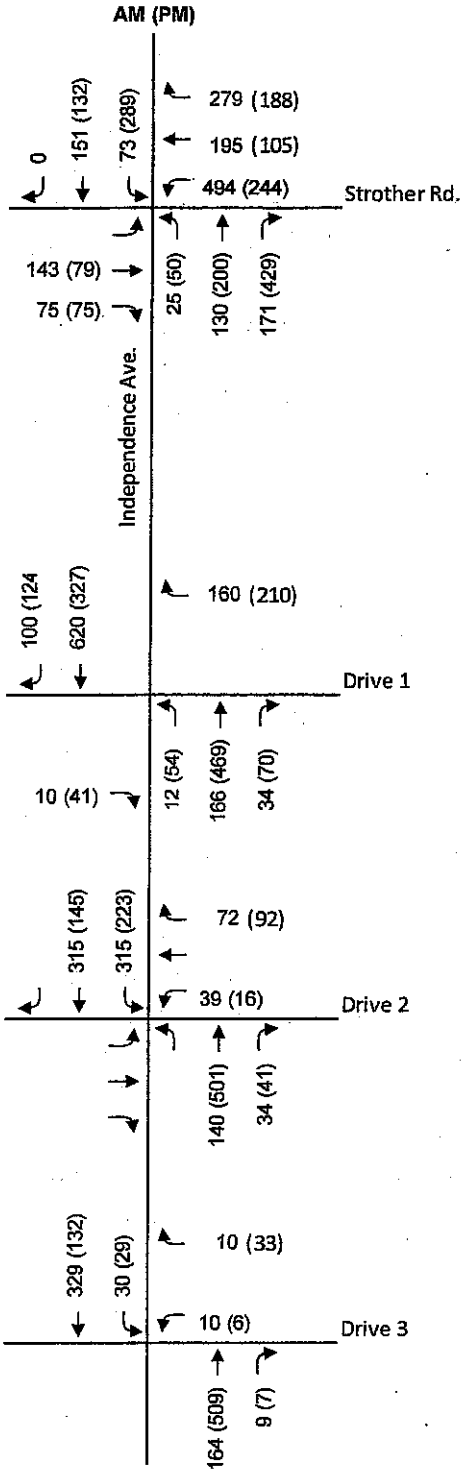
In addition to analyzing the impacts from the development, future traffic was added for another scenario to analyze the traffic impacts to the area. The approved planned area added is the "I-470 Business and Technology Center" directly to the south on Independence Avenue. It includes Frontier Justice and the Urgent Care center (which are already built and reflected in the existing volumes) and a planned 850,000 sq. ft. of developable area, of which 80% is planned to be warehousing and 20% offices, and Sky Zone, a recreational area currently under construction. The trips generated from these lots were added to the through 'Build' volumes to reflect the added volumes to the network. The trip details for these developments can be found in the Appendix labeled 'South Independence'. In summary, it added 312 southbound and 59 northbound trips to the AM peak hour, and 105 southbound and 293 northbound trips in the PM peak hour. The analyses for these impacts are referred to as 'Future' in the Synchro models.

The following pages show the peak hour traffic volumes on Independence Avenue at Strother Rd and each of the entrances for the 'Build' and 'Future' scenarios used in the traffic analysis.

Strother/Independence

'Build' Peak Period

Turning Movement Counts

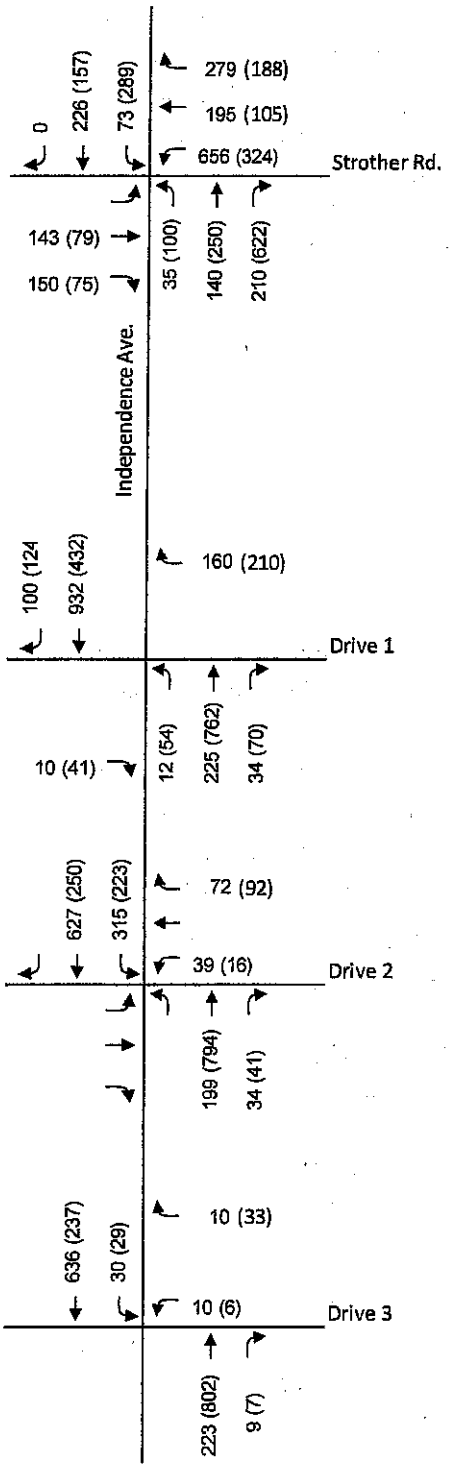


Strother/Independence

'Future' Peak Period

Turning Movement Counts

AM (PM)



TRAFFIC ANALYSIS

Traffic was analyzed using Synchro traffic modeling software, the industry standard for intersections based on the Highway Capacity Manual. Synchro calculates several Measures of Effectiveness (MOEs) based on traffic volumes, lane configurations, and type of intersection control. Some of the more commonly used MOE's are Delay, Queue lengths, and Level of Service. Level of Service (LOS) is a qualitative measure used to relate the quality of traffic service. The HCM defines LOS for signalized and unsignalized intersections as a function of the average vehicle control delay. LOS ranges from A (unimpeded driving, no delays) to F (highly congested roads, high delays).

The table below gives the average vehicle delay ranges for each Level of Service.

Level of Service (LOS)	Control Delay per Vehicle (sec.)	
	Signalized	Unsignalized
A	<= 10	<= 10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	> 80	> 50

The existing conditions were analyzed as a baseline to compare the effects of future development and traffic growth. Since the proposed driveways haven't been built yet, the existing conditions simply analyzed the signalized intersection of Independence and Strother. As already mentioned, Strother Road is closed west of the intersection so previous data and studies were used to gather through traffic volumes. While counting traffic, no queueing or delay problems occurred at the intersection. Granted, it was without the west leg of the intersection in operation, but adding the fairly unsubstantial volumes didn't have much of an impact in the Synchro models. Below are the results for the Existing AM and PM peak hours. In all tables, Delay is the average control delay per vehicle and listed in seconds.

Existing AM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	8/A	19/B	25/C	18/B	18/B

Existing PM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	7/A	39/D	21/C	12/B	19/B

Analyzed next are the "Build" models studying the effects of the proposed developments at the entrances and the Strother intersection. The entrances are stop controlled, and the main movements northbound and southbound on Independence are "free", with just the left turns yielding to the oncoming throughs. The main throughs have no delay and the vehicles turning left into the site have

very little delay, resulting in little to no delay for the approach which can skew overall intersection delays and levels of service. More telling is delays broken down by approach so one can see unskewed data on approaches that are stop controlled. Below are Delay and LOS tables of the Independence intersections for the Build AM and Build PM scenarios.

Build AM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	28/C	54/D	41/D	20/C	29/C
Drive 1	0/A	0/A	13/B	10/B	2/A
Drive 2	0/A	4/A	-	21/C	6/A
Drive 3	0/A	1/A	-	11/B	1/A

Build PM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	28/C	54/D	40/D	20/D	29/C
Drive 1	1/A	0/A	13/B	10/B	2/A
Drive 2	0/A	4/A	-	21/C	6/A
Drive 3	0/A	1/A	-	11/B	1/A

As noted, the northbound and southbound approaches at the entrances have little to no delay. The stop-controlled approaches don't have much more delay, indicating there are plenty of gaps on Independence to exit. Westbound left turn signal timing was increased to limit the queue to the turn bay.

Finally, the "Future" scenarios were analyzed. Note it is not tied to a year, but to trips generated from future development plans added to the through volumes on Independence. Below are the LOS tables for the Future AM and Future PM scenarios.

Future AM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	33/C	79/E	43/D	20/B	34/C
Drive 1	1/A	0/A	18/B	11/B	1/A
Drive 2	0/A	3/A	-	49/E	6/A
Drive 3	0/A	1/A	-	15/B	1/A

Future PM - Avg. Delay/LOS					
Independence at	NB	SB	EB	WB	Intersection
Strother	23/C	58/E	17/B	50/D	37/D
Drive 1	1/A	0/A	11/B	29/D	4/A
Drive 2	0/A	6/A	-	29/D	4/A
Drive 3	0/A	2/A	-	19/C	1/A

The additional through volumes make the westbound lefts wait a bit of a longer to exit Drive 2 in particular as they also have to wait for the southbound lefts as the 49 second delay for the westbound approach would indicate. However, having a dedicated left turn lane helps free up the second lane for the majority of the vehicles that are turning right to go northbound, and Drive 3 can act as a better and more direct "relief valve" exit for left turners heading south out of the development as they wouldn't have to wait for the high number of southbound left turners at Drive 2. The signal times are stretched to try and keep westbound left turning vehicles in the storage bay, but additional measures may be required in the future such as changing the phasing to a protected/permissive left to accomplish this. Intersection levels of service of C and D indicate intersection capacity is available. Synchro output files are included in the Appendix.

To conclude, it is believed the proposed improvements for turn lanes, channelized movements and entrances are sufficient in handling the traffic generated by the proposed developments as well as future increases in traffic along Independence. Additionally, the newly reconstructed signalized intersection at Strother has been designed to handle future traffic growth and no improvements are necessary except some changes to the signal timings. Should Independence develop further in the future, additional changes such as signal phasing at the Independence/Strother intersection may be necessary to contain the queue for the westbound left-turning traffic.

Sincerely,

Eric Reinkemeyer, P.E., PTOE
Hg Consult