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Executive Summary

151033 - Route 9 Corridor Study in Parkville, Missouri

New Signals along Route 9

Purpose

In conjunction with the Route 9 Corridor Study, this Executive Summary will assess intersections along Route 9 in Parkville, Missouri for the potential of installing new traffic signals. The following intersections were evaluated:

- Route 9 & Lewis Street
- Route 9 & 63rd Street
- Route 9 & 62nd Street
- Route 9 & Clark Avenue
- Route 9 & 2nd Street
- East Street & 1st Street
- Route 9 & Mattox Road

Using the available traffic counts, MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, Warrant 3, Peak Hour, and Warrant 7, Crash Experience, was assessed and Synchro models of the 1% annual growth projected traffic conditions were created to determine the effect of a new signal.

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The intersections of Route 9 & 63rd Street and Route 9 & 62nd Street do not meet the requirements needed for a signal to be installed. R9 & Lewis Street and R9 & Clark Ave appeared to be warranted for a signal. The proximity of R9 & Lewis Street to the major intersection of R9 & R45 does not meet the spacing requirements outlined in the MoDOT EPG 940.5, "At Grade Intersections Spacing." The required distance between at-grade intersections along an urban, minor roadway is 660 to 1320 ft. The distance from R9 & R45 to R9 & Lewis St is 500 ft which does not meet the required minimum spacing; therefore, a signal is not recommended for R9 & Lewis Street. The distance from R9 & R45 to R9 & Clark Ave is 1550 ft which meets the required minimum spacing.

Installation of a signal at R9 & Clark Ave could lead to several advantages for the local road network. Clark Ave meets the spacing requirements between intersections, Clark Avenue is connected to City Hall and the Community YMCA, the LOS would improve to LOS C for the future traffic volumes, and the signal would cause gaps in R9 traffic making left-turns easier for 62nd St. The QuikTrip Store #0189 Traffic Impact Study dated February 2015 stated that R9 & Lewis St and R9 & 63rd St "are on the threshold of the peak hour warrant criteria for signalization." For R9 & Lewis,

the QuikTrip Store #0189 report also recommends using pavement markings to “add an eastbound left-turn lane at the intersection with storage of approximately 75’.”

Install a new traffic signal at

- Route 9 & Clark Avenue
- East Street & 1st Street or Route 9 & 2nd Street
- Route 9 & Mattox Road

Traffic Data

Traffic data was provided by the following reports:

QuikTrip Store #0189 Traffic Impact Study, dated February 2015

- Route 9 & Lewis St
 - May 24, 2012 from 6:00-9:00AM and 3:00-6:00PM
- Route 9 & 63rd St
 - January 4, 2012 from 7:45-8:45AM and 4:45-5:45PM
- Route 9 & 62nd St
 - January 4, 2012 from 7:45-8:45AM and 4:45-5:45PM

Parkville Apartments Traffic Impact Study, dated March 2015

- Route 9 & Clark Ave
 - February 5, 2013 from 7:30-8:30AM and 5:00-6:00PM

Downtown Traffic Study, Missouri Traffic Engineering Assistance Program (TEAP), dated June 2010

- Route 9 & 2nd Street
 - March 16-19 & March 23-April 12, 2010, 24-hour counts
- East Street & 1st Street
 - March 16-19 & March 23-April 12, 2010, 24-hour counts

Matt Brown Development Traffic Impact Study, dated June 2015

- Route 9 & Mattox Rd
 - June 16, 2015 from 7:00-9:00AM and June 18, 2015 from 4:00-6:00PM

Normally, traffic counts older than 2 years are not used for evaluating traffic signals due to variations in traffic patterns, new routes, new businesses with different trip generation rates, and changes in economy. For the Route 9 Corridor Study, utilizing the available traffic data/studies was desirable. Also for this reason, only the top AM and PM peak hours were analyzed for the intersections.

Route 9 & Lewis St



Location Map

Advantages -

- Warranted for 2035 traffic

Disadvantages -

- Does not meet spacing requirements between signalized intersections.
 - 530 ft measured distance compared to 660 ft required distance.

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along Route 9 is 35 mph. Condition A requirements were evaluated for the Route 9 & Lewis St intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 150 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

Route 9 & Lewis St 2035 Adjusted Peak Hour Traffic Volumes

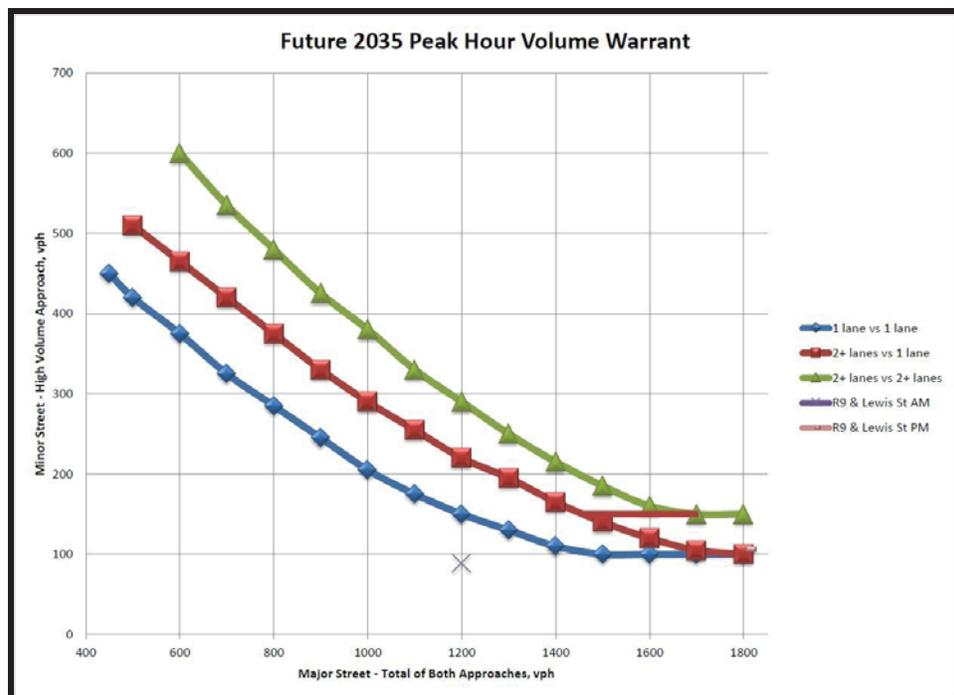
	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	1200	89
PM	1806	106

Condition A was not satisfied for the intersection since the top two vehicular hours did not meet the minimum threshold values.

Condition B requirements were evaluated for the Route 9 & Lewis St intersection: A minimum of 750 vph for total of both major street approaches with a minimum of 75 vph total for higher-volume minor street approach. Condition B appears to be satisfied for the intersection of R9 & Lewis Street since the top two vehicular hours met the minimum threshold values. Thus, Warrant 1, Condition B, appears to be satisfied for the intersection of R9 & Lewis Street.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A appears to be satisfied for the intersection of R9 & Lewis Street since the total stopped delay on the minor street is 31 veh-hours and thus exceeds 4 vehicle-hours for one lane, the volume on the minor street is 106 and thus exceeds 100 vph for one lane, and the entering volume at the intersection is 1806 and thus exceeds 800 vph for a four approach intersection. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for Route 9 & Lewis St 2035 Adjusted Volumes

Condition B appears to be satisfied for the intersection of R9 & Lewis Street since the plotted point on the graph is above the threshold curve. Thus, Warrant 3 appears to be satisfied for the intersection of R9 & Lewis Street.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of R9 & Lewis Street met the Warrant 1 combined A and B requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & Lewis St Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only		3		2		5
Injury						0
Total	0	3	0	2	0	5

There were 5 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 1 crash per year. Route 9 & Lewis St had only property-damage only and no injury crashes. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied.

Warrant Summary

- Warrant 1 - Met
- Warrant 3 - Met
- Warrant 7 - Not Met

Route 9 & 63rd St



Location Map

Advantages -

- Would impact many businesses and houses

Disadvantages -

- Not warranted for 2035 traffic

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along Route 9 is 35 mph. Condition A requirements were evaluated for the Route 9 & 63rd St intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 200 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

Route 9 & 63rd St 2035 Adjusted Peak Hour Traffic Volumes

	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	1173	59
PM	1832	63

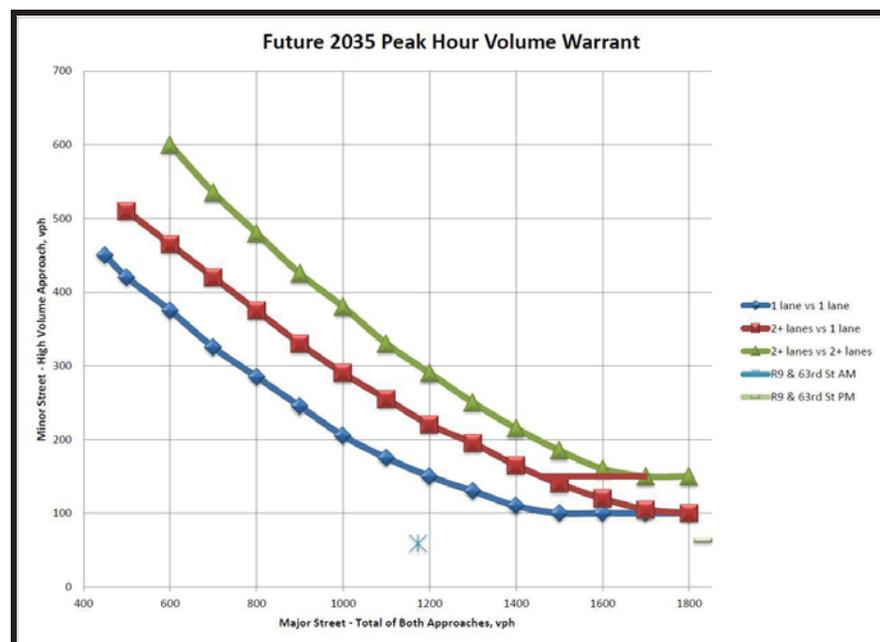
Condition A was not satisfied for the intersection since the top two vehicular hours did not meet the minimum threshold values.

Condition B requirements were evaluated for the Route 9 & 63rd St intersection: A minimum of 750 vph for total of both major street approaches with a minimum of 100 vph total for higher-volume minor street approach. Condition B is not satisfied for the intersection of R9 & 63rd Street since the top two vehicular hours did not meet the minimum threshold values.

A combination of Conditions A and B were evaluated for the Route 9 & 63rd St intersection: A minimum of 400 vph for total of both major street approaches with a minimum of 160 vph total for higher-volume minor street approach and a minimum of 600 vph for total of both major street approaches with a minimum of 80 vph total for higher-volume minor street approach. Condition A and B was not satisfied since the top two vehicular hours did not meet the minimum threshold values.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A was not satisfied for the intersection of R9 & 63rd. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for Route 9 & Lewis St 2035 Adjusted Volumes

Condition B was not satisfied for the intersection of R9 & 63rd Street since the plotted point on the graph is below the threshold curve. Thus, Warrant 3 is not satisfied for the intersection of R9 & 63rd Street.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of R9 & 63rd Street did not meet the Warrant 1 combined A and B requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & 63rd St Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only			1	1	2	4
Injury			2			2
Total	0	0	3	1	2	6

There were 6 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 1.2 crashes per year. Route 9 & Lewis St had 4 property-damage only and 2 injury crashes. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied.

Warrant Summary

- Warrant 1 - Not Met
- Warrant 3 - Not Met
- Warrant 7 - Not Met

Route 9 & 62nd St



Location Map

Advantages -

- Only access connection for 69 houses

Disadvantages -

- Not warranted for 2035 traffic

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along Route 9 is 35 mph. Condition A requirements were evaluated for the Route 9 & 62nd St intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 150 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

Route 9 & 62nd St 2035 Adjusted Peak Hour Traffic Volumes

	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	1131	13
PM	1810	5

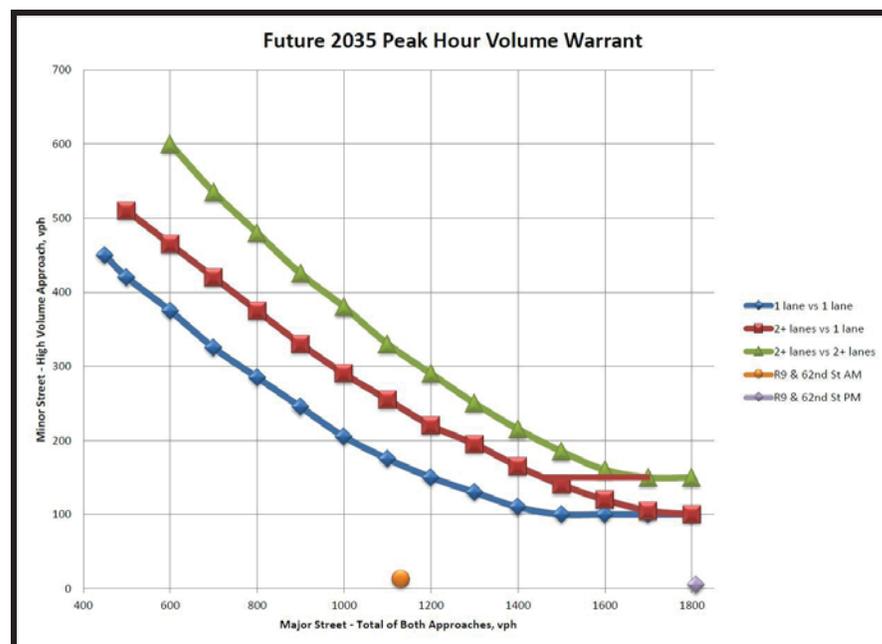
Condition A was not satisfied for the intersection since the top two vehicular hours did not meet the minimum threshold values.

Condition B requirements were evaluated for the Route 9 & 62nd St intersection: A minimum of 750 vph for total of both major street approaches with a minimum of 75 vph total for higher-volume minor street approach. Condition B is not satisfied for the intersection of R9 & 63rd Street since the top two vehicular hours did not meet the minimum threshold values.

A combination of Conditions A and B were evaluated for the Route 9 & 62nd St intersection: A minimum of 400 vph for total of both major street approaches with a minimum of 120 vph total for higher-volume minor street approach and a minimum of 600 vph for total of both major street approaches with a minimum of 60 vph total for higher-volume minor street approach. Condition A and B was not satisfied since the top two vehicular hours did not meet the minimum threshold values.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A is not satisfied for the intersection of R9 & 62nd. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for Route 9 & 62nd St 2035 Adjusted Volumes

Condition B was not satisfied for the intersection of R9 & 62nd Street since the plotted point on the graph is below the threshold curve. Thus, Warrant 3 is not satisfied for the intersection of R9 & 62nd Street.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of R9 & 62nd Street did not meet the Warrant 1 combined A and B requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & 62nd St Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only			1			1
Injury		1				1
Total	0	1	1	0	0	2

There were 2 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 0.4 crashes per year. Route 9 & 62nd St had 1 property-damage only and 1 injury crash. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied.

Warrant Summary

- Warrant 1 - Not Met
- Warrant 3 - Not Met
- Warrant 7 - Not Met

Route 9 & Clark Ave



Location Map

Advantages -

- Warranted for 2035 traffic
- Connected to City Hall and YMCA

Disadvantages -

- None

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along Route 9 is 35 mph. Condition A requirements were evaluated for the Route 9 & Clark Ave intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 200 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

Route 9 & Clark Ave 2035 Adjusted Peak Hour Traffic Volumes

	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	1106	95
PM	1716	149

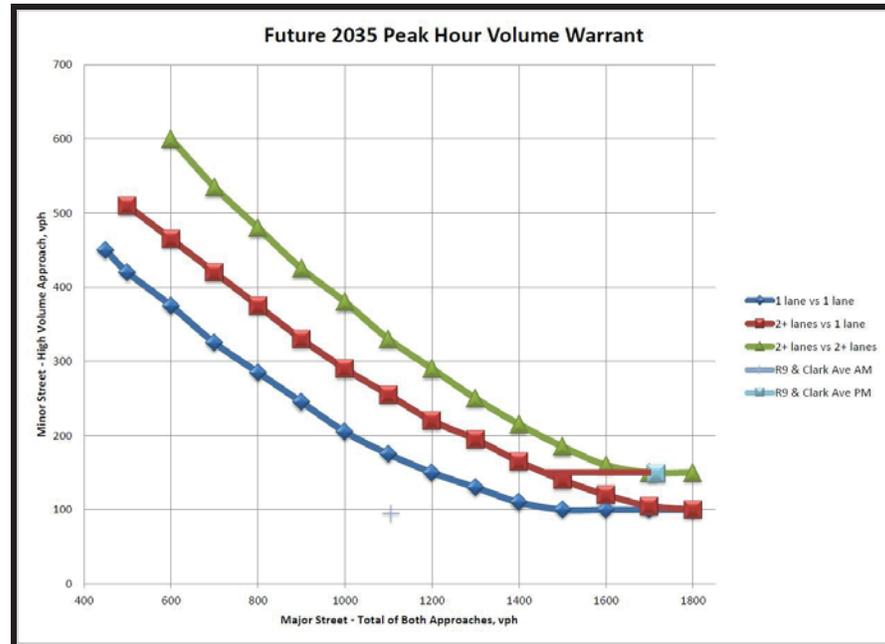
Condition A was not satisfied for the intersection since the top two vehicular hours did not meet the minimum threshold values.

Condition B requirements were evaluated for the Route 9 & Clark Ave intersection: A minimum of 750 vph for total of both major street approaches with a minimum of 100 vph total for higher-volume minor street approach. Condition B is not satisfied for the intersection of R9 & 63rd Street since the second highest vehicular hour did not meet the minimum threshold values.

A combination of Conditions A and B were evaluated for the Route 9 & Clark Ave intersection: A minimum of 400 vph for total of both major street approaches with a minimum of 160 vph total for higher-volume minor street approach and a minimum of 600 vph for total of both major street approaches with a minimum of 80 vph total for higher-volume minor street approach. Condition A and B was not satisfied since the top two vehicular hours did not meet the minimum threshold values.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A appears to be satisfied for the intersection of R9 & Clark Ave since the total stopped delay on the minor street is 6 veh-hours and thus exceeds 5 vehicle-hours for more than one lane, the volume on the minor street is 149 and thus nearly equals 150 vph for more than one lane, and the entering volume at the intersection is 1716 and thus exceeds 650 vph for a three approach intersection. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for Route 9 & Clark Ave 2035 Adjusted Volumes

Condition B appears to be satisfied for the intersection of R9 & Clark Ave since the plotted point on the graph nearly equal to the threshold curve (149 compared to 150). Thus, Warrant 3 appears to be satisfied for the intersection of R9 & Clark Ave.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of R9 & Clark Ave did not meet the Warrant 1 combined A and B requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & Clark Ave Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only		1		1	1	3
Injury						0
Total	0	1	0	1	1	3

There were 3 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 0.6 crash per year. Route 9 & Lewis St had only property-damage only and no injury crashes. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable

pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied for the intersection.

Warrant Summary

- Warrant 1 - Not Met
- Warrant 3 - Met
- Warrant 7 - Not Met

Performance Measures Route 9 from Lewis St to Clark Ave



Location Map

Synchro models of the 1% annual growth projected traffic conditions were created to determine the effect of a new signal in this area.

Two performance measures commonly used for Traffic Impact Studies are vehicle delay and level-of-service (LOS). Vehicle delay is the average delay, in seconds, experienced by one vehicle passing through the intersection. The quality of traffic operation at an intersection is defined through level-of-service (LOS) which consists of assignments of 'A' for free-flowing conditions through 'F' for congested conditions. The procedures and methodology for determining the LOS are outlined in the Highway Capacity Manual (HCM 2010), produced by the Transportation Research Board. LOS 'A' through 'D' is considered acceptable. The results of the Synchro models are in the table below.

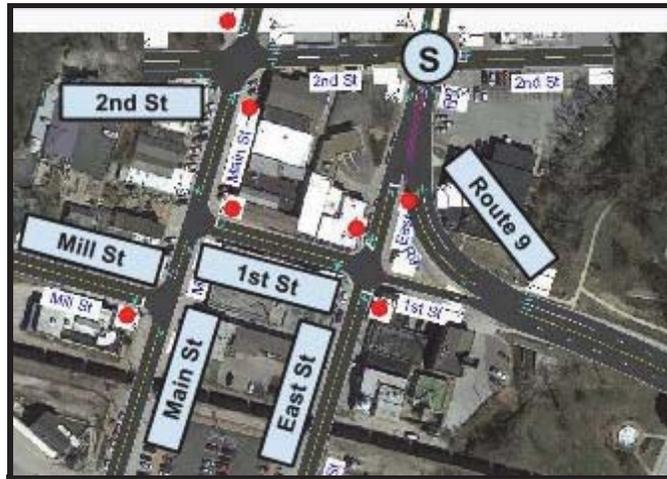
Synchro Results, Adding a Signal at Side Streets

	Performance Measures	AM 2035, Lewis	PM 2035, Lewis	AM 2035, 63rd	PM 2035, 63rd	AM 2035, 62nd	PM 2035, 62nd	AM 2035, Clark	PM 2035, Clark
Result for R9 & Lewis	NB Delay, s	3.4	8.2	1.0	0.5	1.0	0.5	1.0	0.5
	NB LOS	A	A	A	A	A	A	A	A
	EB Delay, s	20.2	22.4	69.8	1060.4	69.8	1060.4	69.8	1060.4
	EB LOS	C	C	F	F	F	F	F	F
	SB Delay, s	6.5	8.5	0.4	0.4	0.4	0.4	0.4	0.4
	SB LOS	A	A	A	A	A	A	A	A
	WB Delay, s	15.5	14.4	32.6	195.9	32.6	195.9	32.6	195.9
	WB LOS	B	B	D	F	D	F	D	F
Result for R9 & 63rd	NB Delay, s	0.6	0.9	3.2	7.4	0.6	0.9	0.6	0.9
	NB LOS	A	A	A	A	A	A	A	A
	EB Delay, s	27	198.5	19.0	18.8	27	198.5	27	198.5
	EB LOS	D	F	B	B	D	F	D	F
	SB Delay, s	0	0	6.2	7.4	0	0	0	0
	SB LOS	A	A	A	A	A	A	A	A
Result for R9 & 62nd	NB Delay, s	0	0	0	0	1.8	3.2	0	0
	NB LOS	A	A	A	A	A	A	A	A
	SB Delay, s	0.1	0.3	0.1	0.3	3.3	2.2	0.1	0.3
	SB LOS	A	A	A	A	A	A	A	A
	WB Delay, s	14.2	22.1	14.2	22.1	15.0	15.6	14.2	22.1
	WB LOS	B	C	B	C	B	B	B	C

	Performance Measures	AM 2035, Lewis	PM 2035, Lewis	AM 2035, 63rd	PM 2035, 63rd	AM 2035, 62nd	PM 2035, 62nd	AM 2035, Clark	PM 2035, Clark
Result for R9 & Clark	NB Delay, s	0.6	0.1	0.6	0.1	0.6	0.1	2.7	8.5
	NB LOS	A	A	A	A	A	A	A	A
	EB Delay, s	28.1	145.2	28.1	145.2	28.1	145.2	23.6	22.3
	EB LOS	D	F	D	F	D	F	C	C
	SB Delay, s	0	0	0	0	0	0	5.2	7.0
	SB LOS	A	A	A	A	A	A	A	A

The results show that installing a signal at R9 & Lewis, R9 & 63rd, or R9 & Clark will greatly improve traffic from the minor road entering Route 9 traffic. The minor road approach for R9 & Lewis changed from LOS F to C for AM eastbound traffic, LOS D to B for AM westbound traffic, LOS F to C for PM eastbound traffic, and LOS F to B for AM westbound traffic. The minor road approach for R9 & 63rd changed from LOS D to B for AM eastbound traffic and LOS F to B for PM eastbound traffic. The minor road approach for R9 & Clark changed from LOS D to C for AM eastbound traffic and LOS F to C for PM eastbound traffic.

Route 9 & 2nd St



Location Map

Warrant 1 -
Traffic counts not provided.

Warrant 3 -
Traffic counts not provided.

Warrant 7 -
MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. It is unknown if the intersection of R9 & 2nd St met the Warrant 1 requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & 2nd St Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only	2	1				3
Injury	1					1
Total	3	1	0	0	0	4

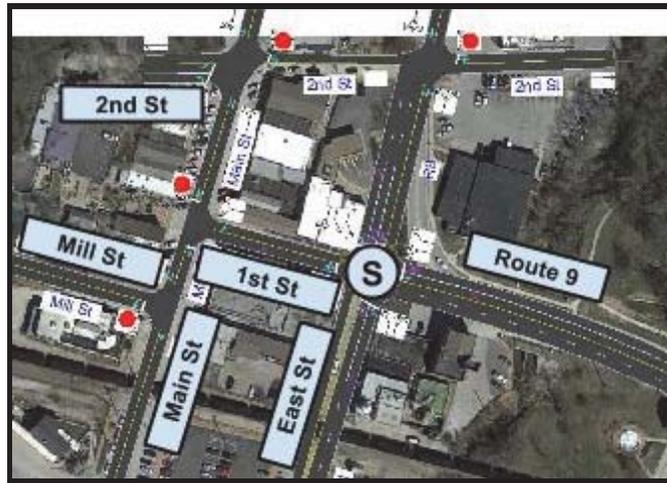
There were 4 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 0.8 crash per year. Route 9 & 2nd St had 3 property-damage only crashes and 1 injury crash. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable

pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied for the intersection.

Warrant Summary

- Warrant 1 - Unknown
- Warrant 3 - Unknown
- Warrant 7 - Not Met

East St & 1st St



Location Map

Advantages -

- Warranted for 2035 traffic

Disadvantages -

- None

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along East St is 25 mph. Condition A requirements were evaluated for the East St & 1st St intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 200 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

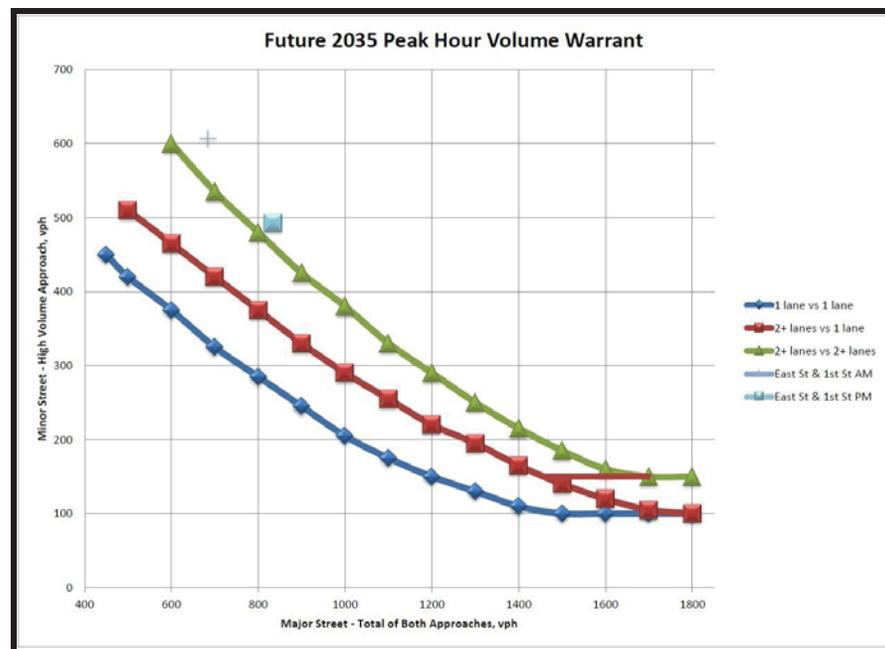
East St & 1st St 2035 Adjusted Peak Hour Traffic Volumes

	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	684	607
PM	834	493

Condition A was satisfied for the intersection since the top two vehicular hours met the minimum threshold values. Thus, Warrant 1, Condition A, appears to be satisfied for the intersection of East Street & 1st Street.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A is not satisfied for the intersection of East St & 1st St since the total stopped delay on the minor street is 1.7 veh-hours and thus is less than 5 vehicle-hours for more than one lane. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for East St & 1st St 2035 Adjusted Volumes

Condition B appears to be satisfied for the intersection of East St & 1st St since the plotted point on the graph above the threshold curve. Thus, Warrant 3 appears to be satisfied for the intersection of East St & 1st St.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of East St &

1st St met the Warrant 1 requirements. The table below shows the local crashes from 2010 to 2014.

East St & 1st St and Route 9 & 1st St Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only	3	4	4	7	7	25
Injury			1			1
Total	3	4	5	7	7	26

There were 26 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 5.2 crashes per year. East St & 1st St had 25 property-damage only crashes and 1 injury crash. Crash frequency at this intersection was significant enough to warrant installing a traffic signal. There was no discernable pattern or consistency among the crashes. Thus, Warrant 7 appears to be satisfied for the intersection.

Warrant Summary

- Warrant 1 - Met
- Warrant 3 - Met
- Warrant 7 - Met

Route 9 & Mattox Rd



Location Map

Advantages -

- Warranted for 2035 traffic

Disadvantages -

- None

Warrant 1 -

MUTCD Signal Warrant 1, Eight-Hour Vehicular Volume, was assessed using 2035 projected traffic volumes. If the volume for the highest eight hours of a day are all higher than the thresholds of Condition A or B, then the signal is warranted.

Parkville, Missouri is not in an isolated community and the speed limit along Route 9 is 55 mph. Condition A requirements were evaluated for the Route 9 & Mattox Rd intersection: A minimum of 500 vph for total of both major street approaches with a minimum of 150 vph total for higher-volume minor street approach. The peak hour traffic volumes for the major approaches and the higher minor approach for the future year, 2035, are shown in the table below. These values have been adjusted to account for a large number of right-turns in accordance with the MoDOT Engineering Policy Guide (EPG) Table 902.3.1.

Route 9 & Mattox Rd 2035 Adjusted Peak Hour Traffic Volumes

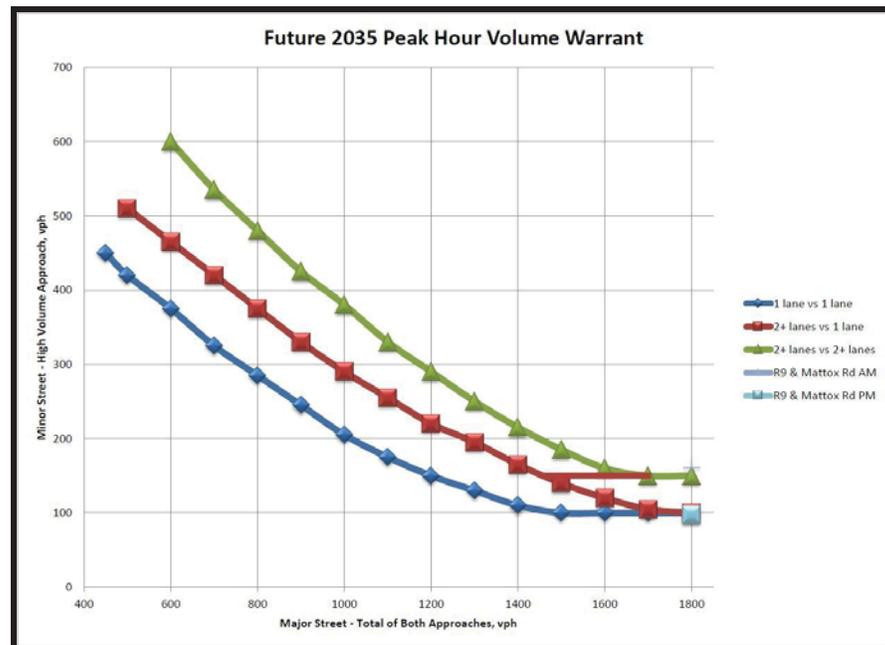
	Major Street - Total of Both Approaches, vph	Minor Street - High Volume Approach, vph
AM	1845	161
PM	2371	97

Condition A was not satisfied for the intersection of R9 & Mattox Road since the second highest vehicular hour did not meet the minimum threshold values.

Condition B requirements were evaluated for the Route 9 & Mattox Road intersection: A minimum of 750 vph for total of both major street approaches with a minimum of 75 vph total for higher-volume minor street approach. Condition B is satisfied for the intersection of R9 & Mattox Road since the second highest vehicular hour met the minimum threshold values.

Warrant 3 -

MUTCD Signal Warrant 3, Peak Hour, was assessed using 2035 projected traffic volumes. If the peak hour volume was higher than the thresholds of Condition A or B, then the signal is warranted. Condition A is met if the total stopped delay on the minor street is equal to or exceeds 4 vehicle-hours for one lane or 5 vehicle-hours for more than one lane, the volume on the minor street is equal to or exceeds 100 vph for one lane or 150 vph for more than one lane, and the entering volume at the intersection is equal to or exceeds 650 vph for a three approach intersection or 800 vph for a four approach intersection. Condition A appears to be satisfied for the intersection of R9 & Mattox Rd since the total stopped delay on the minor street is 53 veh-hours and thus exceeds 4 vehicle-hours for one lane, the volume on the minor street is 161 and thus exceeds 100 vph for one lane, and the entering volume at the intersection is 1845 and thus exceeds 800 vph for a four approach intersection. Condition B is met if the plotted point marker on the following graph is above the threshold curve.



Warrant 3, Condition B for East St & 1st St 2035 Adjusted Volumes

Condition B appears to be satisfied for the intersection of R9 & Mattox Rd since the plotted point on the graph is above the threshold curve. Thus, Warrant 3 appears to

be satisfied for the intersection of R9 & Mattox Rd.

Warrant 7 -

MUTCD Signal Warrant 7, Crash Experience, was assessed using 2035 projected traffic volumes and crash record details provided by Missouri State Highway Patrol. The signal is warranted if enforcement has not reduced crash frequency, five or more crashes occur within a year, and either Condition A or Condition B is met using the Warrant 1 combined Conditions A and B thresholds. The intersection of R9 & Mattox Rd meet the Warrant 1 requirements. The table below shows the local crashes from 2010 to 2014.

Route 9 & Mattox Rd Crash Records

	2010	2011	2012	2013	2014	Total
Property-Damage Only			3	1	2	6
Injury		1				1
Total	0	1	3	1	2	7

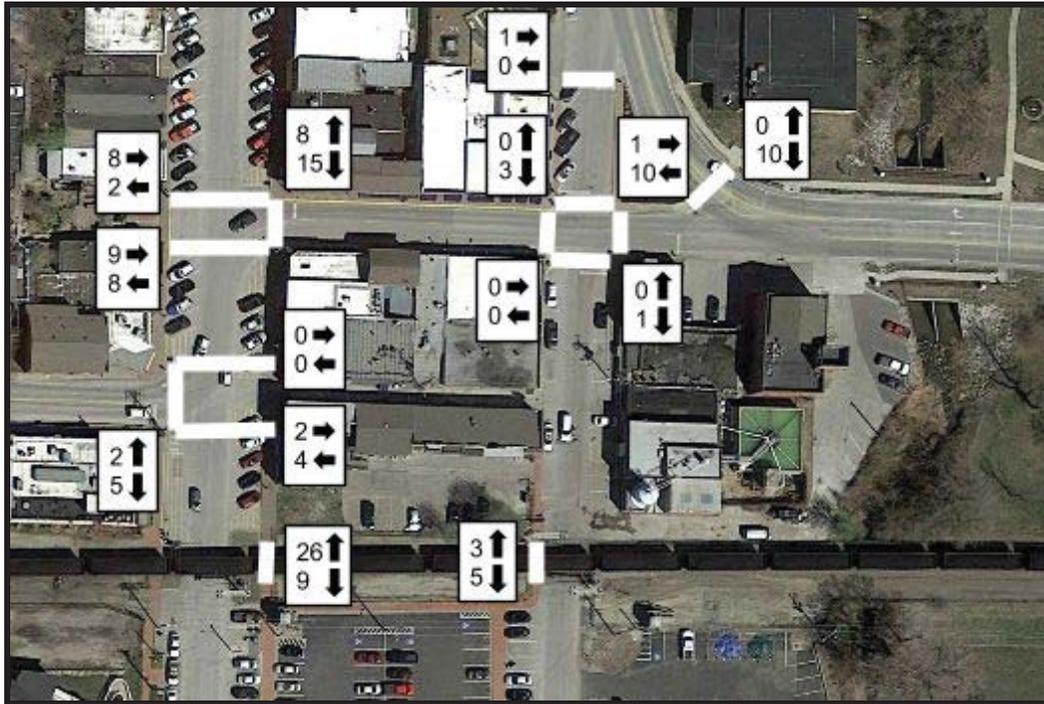
There were 7 total crashes in the vicinity of the intersection in the previous 5 years which was an average of 1.4 crashes per year. Route 9 & Mattox Rd had 6 property-damage only crashes and 1 injury crash. Crash frequency at this intersection was not significant enough to warrant installing a traffic signal. There was no discernable pattern or consistency among the crashes. Thus, Warrant 7 does not appear to be satisfied for the intersection.

Warrant Summary

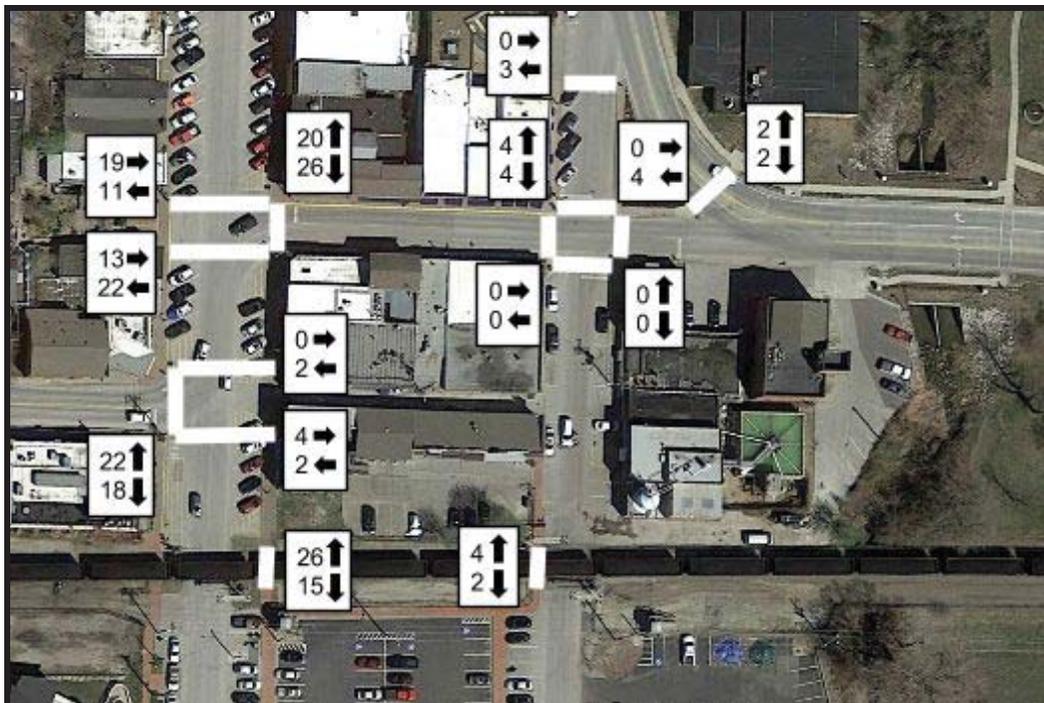
- Warrant 1 - Met
- Warrant 3 - Met
- Warrant 7 - Not Met

Pedestrians

Downtown Pedestrian Volume Counts were provided by the Parkville Regional Multi-Modal Access and Livable Community Study dated July 31, 2013. The counts are shown in the figures below.



Pedestrian Volume Counts, Friday, September 28, 2012 11:30AM to 12:30PM



Pedestrian Volume Counts, Saturday, September 29, 2012 11:00AM to 12:00PM

Both of the given days were around 70 degrees and had no precipitation. Given the limited data provided, several conclusions can be made:

- A majority of downtown pedestrian crossings are on Main St
 - Likely due to the convenience of parking
- Pedestrians are crossing without regard to crossing pavement markings.
 - The north and south leg of Main St & Mill St does not have a marked crossing
 - The north leg of Main St & 1st St does not have a marked crossing
 - The east leg of East St & 1st St does not have a marked crossing
 - The south leg of East St & Route 9 does not have a marked crossing
- The southeast corner of East St & 1st St is not utilized.
 - Likely due to the sidewalk width in front of the American Water building and the lack of a sidewalk ramp
- The number of pedestrians entering downtown from the east is higher during the weekday
 - Likely due to the majority of Park University students living off campus and thus they are less likely to walk to downtown on the weekends
- The number of pedestrians using Main St is higher during the weekend
 - Likely due to commercial tourism or increased leisure time during the weekends
 - Note that the nearby Farmer's Market is open 7:00AM to 12:00PM on Saturdays, April through October
- The number of pedestrians leaving downtown to head east is very low
 - Likely due to the majority of parking in downtown is along Main St or south of the railroad track

Recommendations to improve pedestrian safety include to following:

- Add crossing pavement markings for the north and south leg of Main St & Mill St and the north leg of Main St & 1st St
 - The number of pedestrians could easily top 20 peds/hour
 - Pedestrians are crossing at these locations regardless so pavement markings can improve their visibility
 - Normally the spacing between crosswalks should be greater than 150 ft while the distance between these intersections is 90 ft, yet these crossing pavement markings are in a pedestrian traveled downtown setting
- Add ADA-approved colored truncated domes at the crosswalk ramps
- Add curb turnouts where possible to decrease the time pedestrians spend within the roadway and to increase their visibility before they cross
- Remove the trail crossing and crosswalk ramps across R9 to the east of the box culvert bridge
 - Normally midblock/trail crossings are not recommended within 660 ft of a traffic signal and this crossing is 280 ft from a signal planned for East St & 1st St (or 400 ft from an alternative signal planned for Route 9 & 2nd St

- The Livable Community Study showed that although the speed limit is 25 mph along Route 9, the 85th percentile speed is 35 mph (a common metric used to determine speed limit)
- The ADT is higher than recommended maximum for having a trail crossing (~12,000 ADT max)
- An additional lane is planned to be added to westbound Route 9 through this area
 - This is likely not leave adequate room to reconstruct a sidewalk on the south side of the roadway
 - There would be no space for a central island refuge for pedestrians although they would have to cross four lanes