



DESIGN GROUP, LLC

Route 9 at Mattox Road Intersection Study

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August 2015

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EXECUTIVE SUMMARY

The purpose of this Intersection Study is to examine the operational aspects of the Route 9 and Mattox Road intersection as part of the Mid-America Regional Council's (MARC), Route 9 Corridor Study in association with the City of Parkville, the City of Riverside and the Missouri Department of Transportation (MoDOT). Specific aspects of the intersection that will be studied are the need for signalization of the intersection and the need for an eastbound auxiliary right turn lane. The intersection of Route 9 and New Horizons Parkway is included in the Level-of Service (LOS) analysis due to its proximity to the Route 9 and Mattox intersection.

Traffic signal warrants are listed in the "Manual on Uniform Traffic Control Devices". The traffic analysis program "Synchro" contains the analysis package "Warrants 8" and was used in this study to perform the warrant analysis. Using the existing am peak hour traffic volumes a traffic signal is warranted for the intersection of Route 9 and Mattox Road. Warrant 2. "Four Hour Vehicular Volume" was met as well as Warrant 3 "Condition B". Route 9 at Mattox Road showed marked improvement on Mattox Road under signalized control with southbound traffic receiving the greatest benefit due to the removal of stop sign delay. With the signalization of Route 9 at Mattox Road no detrimental aspects were identified effecting Route 9 at New Horizons Parkway. A traffic signal is warranted at Route 9 and Mattox Road under existing conditions and is recommended for installation at this time.

Route 9 is a State Highway under the jurisdiction of the Missouri Department of Transportation. The requirements specified in the MoDOT Engineering Policy Guide (EPG) and/or the MoDOT Access Management Guidelines were used to warrant an auxiliary right turn lane. An auxiliary right turn lane eastbound on Route 9 approaching Mattox Road is warranted at this time and is recommended for installation.

The traffic analysis program "Synchro" was used to perform multiple traffic scenarios at the location. Combinations of stop and signal control with and without an auxiliary right turn lane performed for Route 9 at Mattox Road. All scenarios included Route 9 at New Horizons Parkway due to the proximity of this signalized intersection. The scenarios also included the year 2035 projected volumes using a 1% growth rate for the roadway. No nonacceptable conditions were identified with the signalization of Route 9 at Mattox Road.

INTRODUCTION

The purpose of this Intersection Study is to examine the operational aspects of the Route 9 and Mattox Road intersection as part of the Mid-America Regional Council's (MARC), Route 9 Corridor Study in association with the City of Parkville, the City of Riverside and the Missouri Department of Transportation (MoDOT). Specific aspects of the intersection that will be studied are the need for signalization of the intersection and the need for an eastbound auxiliary right turn lane. The intersection of Route 9 and New Horizons Parkway is included in the Level-of Service (LOS) analysis due to its proximity to the Route 9 and Mattox intersection.

LOCATION

The intersection of Route 9 and Mattox Road is located in Platte County Missouri within the City Limits of the City of Riverside. The intersection is a four-way type intersection, serving Route 9 and running east and west. To the north, the intersection serves residential areas and to the south, the intersection serves the New Horizons Industrial Park. The intersection is of particular interest as it is near the western termination of the four-lane divided cross-section of Route 9 and serves two different types of roadway user. Northerly users are more residential and southerly users are more industrial.

EXISTING CONDITIONS

Existing Roadway: Route 9 is currently a four lane divided roadway at the noted location. At the intersection, Route 9 runs approximately east-west, with connectivity to multiple major routes and the City of Kansas City, Missouri to the east. To the west, Route 9 turns northward intersecting with Route 45 and then continues north. The roadway traverses both the City of Parkville and the City of Riverside. Other routes in the vicinity that have access to Route 9 and contribute to the traffic serviced by Route 9 include, Interstate 635, US-169, US-69 and Route K.

Route 9 and Mattox Road is a two-way stop controlled intersection to the north and south. Route 9 itself has no traffic control at the location. At the intersection, Route 9 has a westbound right turn lane and both a westbound and eastbound auxiliary left turn lane. The Mattox Road approaches to both the north and south of the intersection are single lane comprised of shared left, through and right. The intersection lacks an eastbound right turn lane on Route 9. The speed limit on Route 9 is 55 miles per hour. This segment of Route 9 is relatively flat and straight with no sight distance limitations. Neither Route 9 nor Mattox Road have sidewalks, mixed use paths or bicycle facilities.

Route 9 is a divided roadway with the nearest traffic signal located approximately 2,250 feet to the east at New Horizons Parkway. To the east of Mattox Road, Route 9 is two lane westbound and three lane eastbound. To the west of Mattox Road, the roadway reverts to a two lane cross-section with the nearest traffic signal at the entrance of Park College, approximately 10,200 feet to the west. Mattox Road becomes a "T" type intersection approximately 160 feet to the north Route 9. To the east and west at the top of the T the intersection is stop controlled east/west. These east/west roads lead into residential areas. To the south, Mattox Road encounters a railroad crossing 650 feet south of the Route 9 intersection and then continues into the New Horizons Industrial Park. The noted railroad crossing is fully controlled by signals, gates and raised median islands.

ROUTE 9 AT MATTOX INTERSECTION STUDY

EXISTING PEAK HOUR TRAFFIC VOLUMES

The existing peak hour traffic volumes for the intersections of Route 9 and Mattox Road and for the intersection of Route 9 and New Horizons Parkway were taken on June 16th and 18th, 2015 by Cook Flatt and Strobel Engineers. These peak hour counts were taken on a typical weekday (Tuesday-Wednesday). The counts were taken for a duration of two hours. The full two hour counts are provided in appendix I. Table 1 below summarizes the existing AM and PM peak hour turning movement volumes at both the Mattox Road and New Horizons Parkway intersections with Route 9.

TABLE 1 EXISTING AM PEAK HOUR, ROUTE 9 @ MATTOX												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:15 AM	10	886	23	78	435	21	6	0	29	107	3	15
EXISTING PM PEAK HOUR, ROUTE 9 @ MATTOX												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:50 PM	31	575	6	34	1098	122	9	1	103	59	1	26
EXISTING AM PEAK HOUR, ROUTE 9 @ NEW HORIZONS												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:15 AM	0	764	258	136	434	0	100	0	38	0	0	0
EXISTING PM PEAK HOUR, ROUTE 9 @ NEW HORIZONS												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:45 PM	0	560	139	152	1011	0	271	0	198	0	0	0

PROJECTED PEAK HOUR TRAFFIC VOLUMES

Future volumes on Route 9 were predicted for a 20 year horizon, or the year 2035. A growth rate for Missouri Route 9 was estimated using MoDOT project J4I1709A. Project J4I1709A widened Missouri Route 9 from a two-lane roadway to a multi-lane divided roadway between Interstate 635 and Mattox Road. The projected life span of the project improvements was from 2005 to 2025 and used a 1.2% growth rate. This time frame encompasses this study’s existing time frame. Using the 2005 given AADT and a growth rate of 1.2%, an attempt was made to recreate the existing counted PM peak hour traffic volumes. A multiplication factor of 10 was placed on these PM peak hour volumes. A factor of 10 on PM peak hour volumes is a commonly used rule of thumb to estimate Average Daily Traffic when true 24 hour counts are not available. It was found that the 1.2% growth rate produced more traffic than currently exists on the roadway. The growth rate was lowered to 1% and a second iteration attempted. The results of this iteration were much closer, but still more than the known existing volumes.

According to the U.S. National Bureau of Economic Research, the most recent economic downturn began in 2007, two years after project J4I1709A forecasted a 1.2% growth rate for Missouri Route 9. It is likely

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that due to this economic downturn the traffic volume growth rate on Missouri Route 9 was considerably less than the forecasted 1.2% during that period.

According to the U.S. Census Bureau, from 2010 to 2015, Platte County has experienced 6% growth, Parkville 6.7% growth and Riverside 3.7% growth. Considering the area population growth, the location of the intersection and other available routes, a conservative 1% growth rate on Route 9 over a 20 year period was applied to both Mattox Road and New Horizons Parkway intersections and all individual turning movements for analysis. Table 2 below summarizes the projected AM and PM peak hour turning movement volumes at both Mattox Road and New Horizons Parkway.

TABLE 2 PROJECTED AM PEAK HOUR, ROUTE 9 @ MATTOX												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:15 AM	12	1081	28	95	531	26	7	0	35	131	4	18
PROJECTED PM PEAK HOUR, ROUTE 9 @ MATTOX												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:50 PM	38	702	7	41	1340	149	11	1	126	72	1	32
PROJECTED AM PEAK HOUR, ROUTE 9 @ NEW HORIZONS												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:15 AM	0	932	315	166	530	0	122	0	46	0	0	0
PROJECTED PM PEAK HOUR, ROUTE 9 @ NEW HORIZONS												
TIME	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:45 PM	0	683	170	185	1234	0	331	0	242	0	0	0

LEVEL OF SERVICE AND VOLUME/CAPACITY ANALYSES

Capacity analysis was used to quantify existing and future operational aspects of both the Route 9 and Mattox Road intersection and the Route 9 and New Horizons Parkway intersection. Although not the focal point of this study, the Route 9 and New Horizons Parkway intersection was analyzed for its interaction with Route 9 and Mattox Road because of the proximity of the two intersections.

The methodologies outlined in the Highway Capacity Manual, 2000 Edition, were used as the basis to perform the analysis in this study. The studied intersections were evaluated using Synchro 8, an analysis package based in part on the Highway Capacity Manual and its methods.

Capacity analysis defines the quality of traffic operations for an intersection using a grading system referred to as Level-of-Service (LOS). The LOS is defined in terms of average vehicle delay. Levels of service A through F have been established with the level A representing free flow conditions and the level F representing congestion with long delays. Levels-of-service definitions are depicted in Table 3.

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Table 3: Level of Service Definitions		
Level of Service	Non-signalized Intersection	Signalized Intersection
A	< 10 Seconds	< 10 Seconds
B	< 15 Seconds	< 20 Seconds
C	< 25 Seconds	< 35 Seconds
D	< 35 Seconds	< 55 Seconds
E	< 50 Seconds	< 80 Seconds
F	≥ 50 Seconds	≥ 80 Seconds

The results of the Synchro analysis for both AM and PM peak hour existing volumes are summarized in Table 4. The detailed Synchro 8 analysis reports of these scenarios are included in the appendix, sections III through VI.

Table 4: Intersection Level of Service for Existing Volumes				
Intersection/Movement	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Route 9 and Mattox Road (Stop Controlled)				
<i>Northbound</i>	C	24.7	C	20.8
<i>Southbound</i>	F	237.6	F	612.4
<i>Eastbound</i>	A	.1	A	.6
<i>Westbound</i>	A	1.7	A	.3
Route 9 and Mattox Road (As Signal Controlled)				
<i>Northbound</i>	A	3.9	B	11.7
<i>Southbound</i>	D	40.4	D	40.0
<i>Eastbound</i>	A	11.3	A	6.3
<i>Westbound</i>	A	4.5	A	5.5
Intersection/Movement	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Route 9 and New Horizons Parkway (Signal Controlled)				
<i>Northbound</i>	B	15.3	B	13.1
<i>Southbound</i>	NA	NA	NA	NA
<i>Eastbound</i>	A	8.3	B	10.2
<i>Westbound</i>	A	8.1	B	10.7

Route 9 at Mattox shows marked improvement under signalized control. Southbound traffic receives the greatest benefit due to the removal of stop sign delay. Signal control also benefits the northbound traffic. Signalized control is a benefit to operations both northbound and southbound at this location. Eastbound and westbound maintains a Level-of-Service A under signalized conditions. Placing a signal at this location improves this intersection's operational aspects.

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For the 20-year horizon of 2035 traffic volumes, it was assumed that Mattox Road would be a signalized intersection due to the known 2015 improvements in operational characteristics. Synchro analysis was also performed for the scenario where the intersection was not signalized. This non-signalized analysis is included in the appendix. For the purpose of brevity, only the analysis as a signalized intersections is portrayed in the following tabular results of the Synchro analysis for both AM and PM peak hour 2035 volumes. These results are summarized in Table 5. The detailed Synchro 8 analysis reports of all scenarios is included in the appendix, sections VII through X.

Table 5: Intersection Level of Service for 2035 Volumes				
Intersection/Movement	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Route 9 and Mattox Road (Signal Controlled)				
<i>Northbound</i>	A	.8	A	7.6
<i>Southbound</i>	D	47.9	E	56.5
<i>Eastbound</i>	B	13.1	A	7.3
<i>Westbound</i>	A	5.0	A	7.6
Route 9 and New Horizons Parkway (Signal Controlled)				
<i>Northbound</i>	C	33.3	D	22.6
<i>Southbound</i>	NA	NA	NA	NA
<i>Eastbound</i>	A	2.7	A	7.9
<i>Westbound</i>	B	11.7	B	21.6

Southbound traffic at Mattox Road drops to a Level-of-Service E in the 2035 signalized scenario. This is more than likely due to the lack of auxiliary turn lanes and storage on the approach. The approach is substandard in length. No scenarios were run depicting geometric revisions on this approach as such revisions are not within the scope of this study. All other approaches at each intersection maintain acceptable Levels-of-Service D or above.

SIGNAL WARRANT ANALYSIS

Traffic Signal installation is based on an engineering study of the conditions at the location of interest. Characteristics of the intersection, such as the geometrics, grades and sight distance, shall be included in the analysis. All traffic volumes, including vehicle, pedestrian and bicycle, shall also be included in the analysis for proper operations and safety of the location. When properly used, traffic signals are a valuable device for the control of vehicular traffic. They assign right-of-way to the various traffic movements and significantly affect the traffic flow.

Properly placed and designed traffic signals can:

1. Increase intersection capacity.
2. Reduce the severity or frequency of certain traffic crashes.
3. Provide orderly movement of traffic.

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4. Coordinate traffic flows between signals.
5. Interrupt heavy traffic flows to allow side street access.

Nine different traffic signal warrants are listed in the “Manual on Uniform Traffic Control Devices.” The satisfaction of any single traffic signal warrant or warrants shall not in itself require the installation of a traffic signal.

Synchro’s Warrants 8 analysis package was used to perform the warrants analysis for the Route 9 and Mattox Road intersection. Two hour AM and two hour PM counts were used. These two hour counts encompass both the AM and PM peak hour counts at the intersection of Route 9 and Mattox Road.

Using the existing peak hour traffic volumes, a traffic signal is warranted at this time for the intersection of Route 9 and Mattox Road. Warrant 2 “Four Hour Vehicular Volume” is met. Warrant 3 “Peak Hour Volume” is also met for Condition “B”. Full detailed Synchro 8 “Warrants” details are in appendix II.

AUXILIARY RIGHT TURN LANE ANALYSIS

One of the specific study aspects of the Route 9 and Mattox Road intersection is the need for an eastbound auxiliary right turn lane at the intersection. Route 9 is a State Highway under the jurisdiction of the Missouri Department of Transportation. As such, requirements specified in the MoDOT “Engineering Policy Guide” (EPG) and/or the MoDOT “Access Management Guidelines” will be used to warrant the auxiliary lane.

The MoDOT Access Management Guidelines state the following:

“In general, dedicated right-turn lanes should be provided in both rural and urban areas on two lane routes as shown in the Table 6 when the right-turn volumes at peak hour are met or exceeded.”

Posted Speed Limit (mph)	Right-Turn Volume (at Peak Hour)
35	40
45	30
55 or more	20

“On four-lane routes, these warrants can be roughly doubled to 80, 60 and 40 turning vehicles per peak hour. In such cases there will be some ability for through traffic to avoid stopping or slowing dramatically to avoid turning vehicles.” The preceding statement is logical for continuous four-lane roadways. For eastbound traffic, the intersection is approximately 2,000 feet east of where the roadway opens from two-lane to four-lane. At this location it is conceivable that drivers are still deciding whether to accelerate into the left lane and pass or stay in the right lane. Providing a definitive auxiliary right turn lane at the location provides the driver with an understandable expectation of what is happening at the intersection. This holds even truer when large commercial vehicles are involved. Because of the proximity to the two-lane to four-lane expansion, the 20 vehicle per peak hour volume warrant requirement is still reasonably valid and a dedicated auxiliary right turn lane should be considered.

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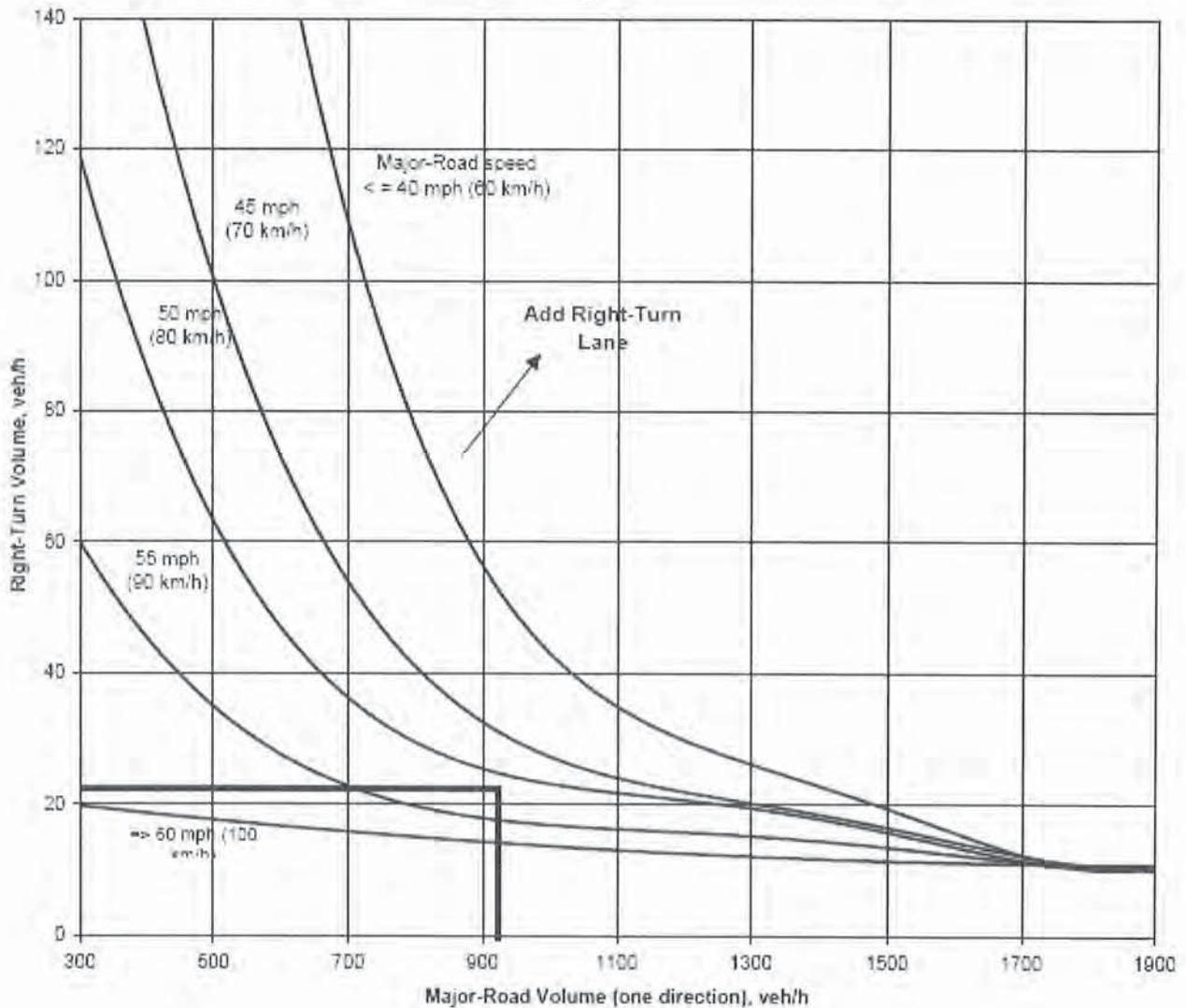
MoDOT's Access Management guidelines state that dedicated right turn lanes should be required in situations where:

1. Poor internal site design and circulation leads to backups on the mainline.
 - Not applicable in this situation.
2. The peak hour turning traffic activity is unusually high (e.g. greater than 10 percent of the daily total.)
 - Not applicable in this situation.
3. Operating speeds on the mainline route are very high (greater than 60 miles per hour) and right turns would generally not be expected by drivers.
 - Not applicable in this situation.
4. The driveway or minor public road intersection is difficult for drivers to see.
 - Not applicable in this situation.
5. The driveway entrance is gated or otherwise must be entered very slowly.
 - Not applicable in this situation.
6. Right turning traffic consists of an unusually high number of trailers or other large vehicles.
 - Applicable, past plans estimate 8% truck traffic and this serves an industrial area.
7. The intersection or driveway angle is highly skewed.
 - To be considered, Mattox Road is a skewed intersection.
8. Rear end collision experience is unusually high at a location.
 - Insufficient data. (Data received from MoDOT shows five crashes in the past four years. Two of the crashes occurred on Route 9 and three occurred on Mattox Road. Crash data is shown in appendix XI.)

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MoDOT's Engineering Policy Guide (EPG) also provides the following graphical guidance in Section 940.9.9., "Right Turn Lane Guidelines for Four-Lane Roadways". This graphical representation compares total advancing volume in the direction of the proposed right turn lane with the total right turn volume and the speed limit. Using the total AM existing advancing volume of 919 vehicles per hour, the right turn volume of 23 vehicles per hour, the 55 mph speed limit, the lines extending from the graph's axis intersect at a point both above and to the right of the 55 mph line on the graph. By the graphical means shown in Figure 1, an auxiliary right turn lane eastbound on Route 9 approaching Mattox Road is warranted.

Fig.
1



The MoDOT EPG also provides guidance on length requirements of dedicated auxiliary right turn lanes in Section 233.4, "At-Grade Intersections with Signal Control, Left and Right Turn Deceleration Distances." Auxiliary right turn lane desirable deceleration lengths and taper lengths were taken from Fig. 233.2. Figure 233.2 gives the desirable deceleration length as 240 feet and the taper length as 180 feet.

SUMMARY AND RECOMMENDATIONS

The purpose of this Intersection Study was to examine the operational aspects of the Route 9 and Mattox Road intersection as part of the Mid-America Regional Council's, Route 9 Corridor Study in association with the City of Parkville, the City of Riverside and the Missouri Department of Transportation. The specific aspects of the intersection studied were the need for signalization of the intersection and the need for an eastbound auxiliary right turn lane.

Installation of a traffic signal is to be based on an engineering study of the location and conditions. Several traffic signal warrants are listed in the "Manual on Uniform Traffic Control Devices". The Traffic analysis program Synchro contains the analysis package, Warrants 8 which was used to perform the warrant analysis. Using the existing AM peak hour traffic volumes, a traffic signal is warranted for the intersection of Route 9 and Mattox Road. Warrant 2, "Four Hour Vehicular Volume," was met, as well as Warrant 3, "Condition B." Route 9 at Mattox Road showed marked improvement under signalized control with southbound traffic receiving the greatest benefit due to the removal of stop sign delay. With the signalization of Route 9 at Mattox Road, no detrimental aspects were identified affecting Route 9 at New Horizons Parkway. A traffic signal is warranted at Route 9 and Mattox Road under existing conditions and is recommended for installation at this time.

The other specific aspect of the Route 9 and Mattox Road intersection studied was the need for an eastbound auxiliary right turn lane at the intersection. Route 9 is a State Highway under the jurisdiction of MoDOT. The requirements specified in the MoDOT "Engineering Policy Guide" (EPG) and/or the MoDOT "Access Management Guidelines" were used to warrant an auxiliary right turn lane. An auxiliary right turn lane eastbound on Route 9 approaching Mattox Road is warranted at this time and is recommended for installation.

ROUTE 9 AT MATTOX INTERSECTION STUDY

Appendix I Existing AM and PM Traffic Counts

Route 9 At Mattox Road Intersection Study

TUES 6-16-15	R9 & Mattox Rd Turning Movement Counts											
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:00 AM	2	182	5	17	75	2	1	0	4	20	0	3
7:15 AM	3	203	10	18	88	3	0	0	8	30	0	4
7:30 AM	4	236	5	16	108	6	4	0	9	31	2	4
7:45 AM	1	259	4	25	141	4	2	0	5	26	1	4
8:00 AM	2	188	4	19	98	8	0	0	7	20	0	3
8:15 AM	1	205	2	7	85	7	2	0	12	14	1	4
8:30 AM	3	192	0	9	98	8	0	0	7	22	0	10
8:45 AM	4	133	0	6	91	5	2	0	11	10	0	9

TUES 6-16-15	AM Peak Hour, R9 & Mattox Rd Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.85	10	886	23	78	435	21	6	0	29	107	3	15

THUR 6-18-15	R9 & Mattox Rd Turning Movement Counts											
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:00 PM	8	97	0	7	210	28	5	1	25	7	0	4
4:15 PM	6	94	1	2	230	25	1	1	12	15	0	4
4:30 PM	3	154	3	3	254	33	1	0	29	12	0	8
4:45 PM	7	144	1	14	241	36	2	0	17	16	0	6
5:00 PM	10	158	0	13	302	30	4	1	30	15	0	5
5:15 PM	11	119	2	4	301	23	2	0	27	16	1	7
5:30 PM	9	131	1	5	286	27	4	2	20	6	0	3
5:45 PM	6	112	2	5	216	26	3	1	8	9	0	7

THUR 6-18-15	PM Peak Hour, R9 & Mattox Rd Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.91	31	575	6	34	1098	122	9	1	103	59	1	26

Counts Provided by Cook, Flatt & Strobel Engineers

Route 9 At Mattox Road Intersection Study

TUES 6-16-15	R9 & Horizons Pkwy Turning Movement Counts											
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
7:00 AM	0	141	65	43	78	0	16	0	15	0	0	0
7:15 AM	0	174	67	38	91	0	18	0	9	0	0	0
7:30 AM	0	212	64	34	103	0	27	0	8	0	0	0
7:45 AM	0	223	67	40	130	0	40	0	6	0	0	0
8:00 AM	0	155	60	24	110	0	15	0	15	0	0	0
8:15 AM	0	169	62	19	78	0	21	0	8	0	0	0
8:30 AM	0	179	42	9	98	0	17	0	13	0	0	0
8:45 AM	0	119	35	15	83	0	19	0	8	0	0	0

TUES 6-16-15	AM Peak Hour, R9 & Horizons Pkwy Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.85	0	764	258	136	434	0	100	0	38	0	0	0

THUR 6-18-15	R9 & Horizons Pkwy Turning Movement Counts											
Time	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
4:00 PM	0	104	25	15	205	0	40	0	63	0	0	0
4:15 PM	0	98	23	11	194	0	63	0	26	0	0	0
4:30 PM	0	169	26	22	218	0	72	0	36	0	0	0
4:45 PM	0	141	36	36	225	0	66	0	26	0	0	0
5:00 PM	0	169	34	52	286	0	59	0	52	0	0	0
5:15 PM	0	125	37	37	252	0	76	0	55	0	0	0
5:30 PM	0	125	32	27	248	0	70	0	65	0	0	0
5:45 PM	0	102	27	16	204	2	43	0	38	0	0	0

THUR 6-18-15	PM Peak Hour, R9 & Horizons Pkwy Turning Movement Counts											
PHF	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
0.89	0	560	139	152	1011	0	271	0	198	0	0	0

Counts Provided by Cook, Flatt & Strobel Engineers

ROUTE 9 AT MATTOX INTERSECTION STUDY

Appendix II Synchro Warrants Results

Warrants Summary Report

3: MO RT 9

Intersection Information:

	Major Street	Minor Street
Street Name	MO RT 9	-
Direction	EB/WB	NB/SB
Number of Lanes	2	1
Approach Speed	55	30

Warrant	Met?	Notes
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Warrant 1, Eight-Hour Vehicular Volume

	No	
Condition A or B Met?	No	4 Hours met (8 required)
Condition A and B Met?	No	4 Hours met (8 required)

Warrant 2, Four-Hour Vehicular Volume

	Yes	4 Hours met (4 required)
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Warrant 3, Peak Hour

	Yes	
Condition A Met?	No	0 Hours met (1 required)
Condition B Met?	Yes	4 Hours met (1 required)

Warrant 4, Pedestrian Volume

	No	
Peds > 100 Condition Met?	No	0 Hours met (4 required)
Peds > 190 Condition Met?	No	0 Hours met (1 required)

Intersection Information:

	Major Street	Minor Street
Street Name	MO RT 9	-
Direction	EB/WB	NB/SB
Number of Lanes	2	1
Approach Speed	55	30

Warrant	Met?	Notes
---------	------	-------

Warrant 5, School Crossing

No

Warrant 6, Coordinated Signal System

No

Warrant 7, Crash Experience

No

Traffic Volume Condition? No 0 Hours met (8 required)

Ped Condition? No 4 Hours met (8 required)

Warrant 8, Roadway Network

Yes

Warrant 1: Eight-hour Vehicular Volume

3: MO RT 9

Intersection Information:

Major Street	MO RT 9
Major Direction	EB/WB
Minor Direction	NB/SB

Warrant 1 Met?

No

Details:

Condition A or B Met?	No	4 Hours met (8 required)
Condition A and B Met?	No	4 Hours met (8 required)

Hour	Major Street Vehicles (total of both approaches)	Condition A		Condition B		High-volume Minor Approach Vehicles	Condition A		Condition B		70% Standard Met? Cond. A OR Cond. B		56% Standard Met? Cond. A AND Cond. B	
		Volume >= 70% column (420)?	Volume >= 56% column (336)?	Volume >= 70% column (630)?	Volume >= 56% column (504)?		Volume >= 70% column (105)?	Volume >= 56% column (84)?	Volume >= 70% column (53)?	Volume >= 56% column (42)?	Condition A 70% Column	Condition B 70% Column	Condition A 56% Column	Condition B 56% Column
07:00 to 08:00	1417	Yes	Yes	Yes	Yes	125	Yes	Yes	Yes	Yes	Yes*	Yes*	Yes*	Yes*
07:15 to 08:15	1453	Yes	Yes	Yes	Yes	125	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
07:30 to 08:30	1435	Yes	Yes	Yes	Yes	110	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
07:45 to 08:45	1370	Yes	Yes	Yes	Yes	105	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
08:00 to 09:00	1175	Yes	Yes	Yes	Yes	93	No	Yes	Yes	Yes	No	Yes*	Yes*	Yes*
08:15 to 09:15	856	Yes	Yes	Yes	Yes	70	No	No	Yes	Yes	No	Yes	No	Yes
08:30 to 09:30	549	Yes	Yes	No	Yes	51	No	No	No	Yes	No	No	No	Yes
08:45 to 09:45	239	No	No	No	No	19	No	No	No	No	No	No	No	No
16:00 to 17:00	1601	Yes	Yes	Yes	Yes	94	No	Yes	Yes	Yes	No	Yes*	Yes*	Yes*

16:15 to 17:15	1764	Yes	Yes	Yes	Yes	98	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
16:30 to 17:30	1866	Yes	Yes	Yes	Yes	113	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
16:45 to 17:45	1875	Yes	Yes	Yes	Yes	109	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17:00 to 18:00	1799	Yes	Yes	Yes	Yes	102	No	Yes	Yes	Yes	Yes	No	Yes*	Yes*	Yes*
17:15 to 18:15	1286	Yes	Yes	Yes	Yes	67	No	No	Yes	Yes	Yes	No	Yes	No	Yes
17:30 to 18:30	826	Yes	Yes	Yes	Yes	38	No	No	No	No	No	No	No	No	No
17:45 to 18:45	367	No	Yes	No	No	16	No	No	No	No	No	No	No	No	No

Warrant 2: Four-hour Vehicular Volume

3: MO RT 9

Intersection Information

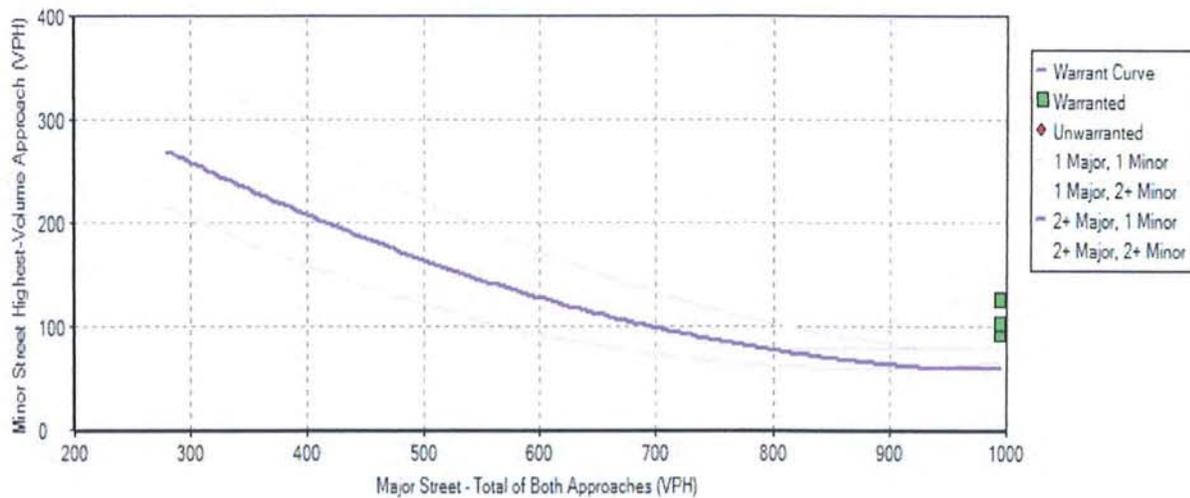
	Major Street	Minor Street
Street Name	MO RT 9	-
Direction	EB/WB	NB/SB
Number of Lanes	2	1
Approach Speed	55	30

Warrant 2 Met? Yes

Details:

Notes:	4 Hours met (4 required)
Low Population?	<input checked="" type="checkbox"/> Yes

Four-Hour Vehicular Volume
Community Population Less Than 10,000 or Major Street Approach Speed Above 40 mph



Hourly Vehicle Volumes

Hour	Major Volume	Minor Volume
07:00:00 - 08:00:00	1,417.00	125.00
08:00:00 - 09:00:00	1,175.00	93.00
16:00:00 - 17:00:00	1,601.00	94.00
17:00:00 - 18:00:00	1,799.00	102.00

Warranted Hours

Hour	Major Street Total of both approaches (VPH)	Minor Street Highest volume approach (VPH)
07:00:00 - 08:00:00	1,417.00	125.00
08:00:00 - 09:00:00	1,175.00	93.00
16:00:00 - 17:00:00	1,601.00	94.00
17:00:00 - 18:00:00	1,799.00	102.00

Note: Only data of hours warranted is represented in the above table.

Warrant 3: Peak Hour 3: MO RT 9

Intersection Information:

	Major Street	Minor Street
Street Name	MO RT 9	-
Direction	EB/WB	NB/SB
Number of Lanes	2	1
Approach Speed	55	30

Warrant 3 Met? Yes

Details:

Low Population?	Yes
Condition A Met?	No
Notes:	0 Hours met (1 required)
Minor Approach Time Delay Condition	Not Met
Minor Approach Volume Condition	Met
Total Entering Intersection Volume Condition	Not Met
Condition B Met?	Yes
Notes:	4 Hours met (1 required)

Warranted / Unwarranted

Hour	Major Street Total of both approaches (VPH)	Minor Street Highest volume approach (VPH)
7:00	1417	125
8:00	1175	93
16:00	1601	94
17:00	1799	102

Federal 2003

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8/16/2015

Warrant 4: Pedestrian Volume

3: MO RT 9

Intersestion Information:

Major Street Name	MO RT 9
Major Direction	EB/WB
Median Refuge	No
Pedestrian Speed	3.50

Warrant 4 Met? **No**

Details:

<p>Low Ped Volume Hours Met: 0 (4 Required)</p> <p>High Ped Volume Hours Met: 0 (1 Required)</p>
--

Hour	Northbound Ped Volume					Southbound Ped Volume				
	Peds	Gaps	Gaps < 60?	Peds >= 100?	Peds >= 190?	Peds	Gaps	Gaps < 60?	Peds >= 100?	Peds >= 190?

Warrant 5: School Crossing

3: MO RT 9

Intersection Information:

Major Street Name	MO RT 9
Major Direction	EB/WB

Warrant 5 Met? **No**

Details:

Time Period Interval for Students Crossing (min)	0
Number of Students Crossing in Time Period	0
Number of Adequate Gaps in Time Period	0
Other Remedial Measures Attempted?	Yes
Adjacent Signal on EB approach?	No
Distance to signal on EB Approach (ft)	-
Adjacent Signal on WB approach?	No
Distance to signal on WB Approach (ft)	-
Will New Signal Restrict Progressive Traffic?	No

Warrant 6: Coordinated Signal System

3: MO RT 9

Intersection Information:

Major Street Name	MO RT 9
Major Direction	EB/WB

Warrant 6 Met? **No**

Details:

Approach Dir/Name	Acceptable Platooning?	Adjacent Coordinating Signal?	Adjacent Intersection Distance
EB Approach (MO RT 9)	Yes	No	N/A
WB Approach (MO RT 9)	Yes	No	N/A
NB Approach (-)	Yes	No	N/A
SB Approach (-)	Yes	No	N/A

Unacceptable Platooning?
(At least one approach)

No

Distance to Closest Signal
(Must be N/A or ≥ 1000)

N/A

Warrant 7: Crash Experience

3: MO RT 9

Intersection Information:

Major Street Name	MO RT 9
Major Direction	EB/WB
Minor Direction	NB/SB

Warrant 7 Met? **No**

Details:

Low Population?	Yes
Major Street Speed Limit	55
Major Street 85th-Percentile Speed	0.00
Qualifying Crashes	0
Adequate Alternative Trials?	Yes
Traffic Volume Condition Met?	No 4 Hours Met (8 Required)
Ped Volume Condition Met?	No 0 Hours Met (8 Required)

Hour	Traffic Volumes				Pedestrian Volumes			
	Major Street Vehicles	Minor Street Vehicles	56% Standard Met? A OR B		Northbound Ped Volumes		Southbound Ped Volumes	
			Condition A	Condition B	Peds	> 80?	Peds	> 80?
07:00 to 08:00	1417	0	No	No	0	No	0	No
07:15 to 08:15	1453	0	No	No	0	No	0	No
07:30 to 08:30	1435	0	No	No	0	No	0	No
07:45 to 08:45	1370	0	No	No	0	No	0	No
08:00 to 09:00	1175	0	No	No	0	No	0	No
08:15 to 09:15	856	0	No	No	0	No	0	No
08:30 to 09:30	549	0	No	No	0	No	0	No

08:45 to 09:45	239	0	No	No	0	No	0	No
16:00 to 17:00	1601	0	No	No	0	No	0	No
16:15 to 17:15	1764	0	No	No	0	No	0	No
16:30 to 17:30	1866	0	No	No	0	No	0	No
16:45 to 17:45	1875	0	No	No	0	No	0	No
17:00 to 18:00	1799	0	No	No	0	No	0	No
17:15 to 18:15	1286	0	No	No	0	No	0	No
17:30 to 18:30	826	0	No	No	0	No	0	No
17:45 to 18:45	367	0	No	No	0	No	0	No

Warrant 8: Roadway Network 3: MO RT 9

Intersection Information:

Major Street Name	MO RT 9
Major Direction	EB/WB
Minor Direction	NB/SB

Warrant 8 Met? (A or B) Yes

Details:

								Growth Rates (per year)			
NB		SB		EB		WB					
L	0.00%	L	0.00%	L	0.00%	L	0.00%				
T	0.00%	T	0.00%	T	0.00%	T	0.00%				
R	0.00%	R	0.00%	R	0.00%	R	0.00%				

Condition A, Total Entering Volume

Condition B, Non-normal Business Day

Existing Peak Hour	2065
Years	20.00
Future Peak Hour	2520
Warrant 1 in 5 Years?	No
Warrant 2 in 5 Years?	Yes
Warrant 3 in 5 Years?	Yes

<u>Existing</u>	
Highest Hour	0
Second Highest Hour	0
Third Highest Hour	0
Fourth Highest Hour	0
Fifth Highest Hour	0
Yearly Growth Rate	1.00%
Years	20.00
<u>Future</u>	
Highest Hour	0
Second Highest Hour	0
Third Highest Hour	0
Fourth Highest Hour	0
Fifth Highest Hour	0

Condition A Met? Yes

Condition B Met? No

Federal 2003

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ROUTE 9 AT MATTOX INTERSECTION STUDY

Appendix III Synchro Analysis – 2015 AM PM Existing

3: MATTOX ROAD & MO RT 9
EXISTING AM PEAK HOUR

8/20/2015

Intersection	
Int Delay, s/veh	19.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	886	23	78	435	21	6	0	29	107	3	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	230	-	-	290	-	210	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	2	8	8	8	8	2	8	2	8	2	2	2
Mvmt Flow	12	1042	27	92	512	25	7	0	34	126	4	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	512	0	0	1069	0	0	1520	1774	535	1240	1788	256
Stage 1	-	-	-	-	-	-	1079	1079	-	695	695	-
Stage 2	-	-	-	-	-	-	441	695	-	545	1093	-
Critical Hdwy	4.14	-	-	4.26	-	-	7.66	6.54	7.06	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.28	-	-	3.58	4.02	3.38	3.52	4.02	3.32
Pot Cap-1 Maneuver	1050	-	-	613	-	-	77	82	475	131	80	743
Stage 1	-	-	-	-	-	-	223	293	-	399	442	-
Stage 2	-	-	-	-	-	-	549	442	-	490	288	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1050	-	-	613	-	-	63	69	475	~ 107	67	743
Mov Cap-2 Maneuver	-	-	-	-	-	-	63	69	-	~ 107	67	-
Stage 1	-	-	-	-	-	-	220	290	-	394	376	-
Stage 2	-	-	-	-	-	-	451	376	-	450	285	-

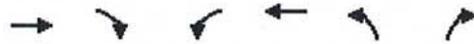
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.7	24.7	237.6
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	224	1050	-	-	613	-	-	117
HCM Lane V/C Ratio	0.184	0.011	-	-	0.15	-	-	1.257
HCM Control Delay (s)	24.7	8.5	-	-	11.9	-	-	237.6
HCM Lane LOS	C	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	0.7	0	-	-	0.5	-	-	9.5

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

5: NEW HORIZONS & MO RT 9
EXISTING AM PEAK HOUR

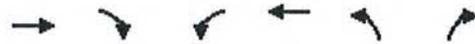
8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↗	↖↖	↑↑	↖↖	↗↗
Volume (vph)	764	258	136	434	100	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		250	570		470	0
Storage Lanes		1	2		2	2
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	0.88
Frnt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	4803	1495	3242	3343	3242	2632
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	4803	1495	3242	3343	3242	2632
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		304				45
Link Speed (mph)	55			55	45	
Link Distance (ft)	1308			1700	640	
Travel Time (s)	16.2			21.1	9.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	899	304	160	511	118	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	899	304	160	511	118	45
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	2		1	6	4	
Permitted Phases		2				4

5: NEW HORIZONS & MO RT 9
EXISTING AM PEAK HOUR

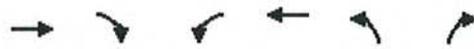
8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Detector Phase	2	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	21.0	21.0	21.0
Total Split (s)	23.0	23.0	11.0	34.0	21.0	21.0
Total Split (%)	41.8%	41.8%	20.0%	61.8%	38.2%	38.2%
Maximum Green (s)	18.0	18.0	6.0	29.0	16.0	16.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	None	Max	None	None
Walk Time (s)	5.0	5.0		5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0
Act Effct Green (s)	23.9	23.9	6.0	32.8	7.0	7.0
Actuated g/C Ratio	0.51	0.51	0.13	0.70	0.15	0.15
v/c Ratio	0.37	0.33	0.39	0.22	0.24	0.10
Control Delay	10.2	2.9	21.8	3.9	18.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.2	2.9	21.8	3.9	18.4	7.3
LOS	B	A	C	A	B	A
Approach Delay	8.3			8.1	15.3	
Approach LOS	A			A	B	
90th %ile Green (s)	18.0	18.0	6.0	29.0	8.6	8.6
90th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
70th %ile Green (s)	18.0	18.0	6.0	29.0	7.7	7.7
70th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
50th %ile Green (s)	18.0	18.0	6.0	29.0	7.0	7.0
50th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
30th %ile Green (s)	18.0	18.0	6.0	29.0	6.4	6.4
30th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
10th %ile Green (s)	44.0	44.0	0.0	44.0	0.0	0.0
10th %ile Term Code	Dwell	Dwell	Skip	Dwell	Skip	Skip
Stops (vph)	467	32	118	150	81	14
Fuel Used(gal)	17	3	4	8	2	0
CO Emissions (g/hr)	1159	202	298	545	126	27
NOx Emissions (g/hr)	226	39	58	106	24	5
VOC Emissions (g/hr)	269	47	69	126	29	6
Dilemma Vehicles (#)	72	0	0	42	0	0
Queue Length 50th (ft)	61	0	20	24	14	0
Queue Length 95th (ft)	88	31	40	41	29	10
Internal Link Dist (ft)	1228			1620	560	
Turn Bay Length (ft)		250	570		470	
Base Capacity (vph)	2451	912	414	2339	1105	927
Starvation Cap Reductn	0	0	0	0	0	0

5: NEW HORIZONS & MO RT 9
EXISTING AM PEAK HOUR

8/20/2015



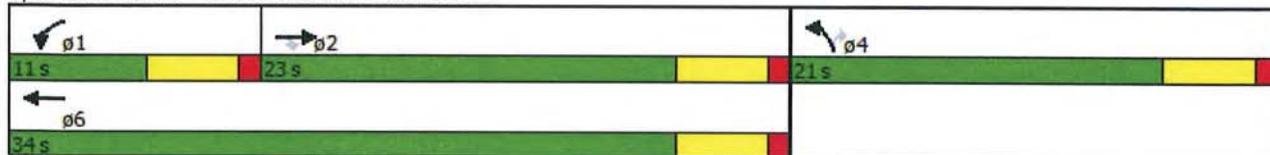
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.33	0.39	0.22	0.11	0.05

Intersection Summary

Area Type: Other
 Cycle Length: 55
 Actuated Cycle Length: 46.9
 Natural Cycle: 55
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.39
 Intersection Signal Delay: 8.8
 Intersection Capacity Utilization 34.5%
 Analysis Period (min) 15
 90th %ile Actuated Cycle: 47.6
 70th %ile Actuated Cycle: 46.7
 50th %ile Actuated Cycle: 46
 30th %ile Actuated Cycle: 45.4
 10th %ile Actuated Cycle: 49

Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 5: NEW HORIZONS & MO RT 9



3: MATTOX ROAD & MO RT 9
EXISTING PM PEAK HOUR

8/20/2015

Intersection												
Int Delay, s/veh	16.6											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	31	575	6	34	1098	122	9	1	103	59	1	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	230	-	-	290	-	210	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	8	8	8	8	2	8	2	8	2	2	2
Mvmt Flow	34	632	7	37	1207	134	10	1	113	65	1	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1207	0	0	638	0	0	1382	1984	319	1666	1988	603
Stage 1	-	-	-	-	-	-	703	703	-	1281	1281	-
Stage 2	-	-	-	-	-	-	679	1281	-	385	707	-
Critical Hdwy	4.14	-	-	4.26	-	-	7.66	6.54	7.06	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.28	-	-	3.58	4.02	3.38	3.52	4.02	3.32
Pot Cap-1 Maneuver	574	-	-	902	-	-	98	61	659	~ 63	60	442
Stage 1	-	-	-	-	-	-	381	438	-	175	235	-
Stage 2	-	-	-	-	-	-	394	235	-	610	436	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	574	-	-	902	-	-	84	55	659	~ 48	54	442
Mov Cap-2 Maneuver	-	-	-	-	-	-	84	55	-	~ 48	54	-
Stage 1	-	-	-	-	-	-	358	412	-	165	225	-
Stage 2	-	-	-	-	-	-	352	225	-	474	410	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.2	18	\$ 367.9
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	401	574	-	-	902	-	-	66
HCM Lane V/C Ratio	0.31	0.059	-	-	0.041	-	-	1.432
HCM Control Delay (s)	18	11.7	-	-	9.2	-	-	\$ 367.9
HCM Lane LOS	C	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	1.3	0.2	-	-	0.1	-	-	8

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

5: NEW HORIZONS & MO RT 9
EXISTING PM PEAK HOUR

8/20/2015

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↗	↙↙	↑↑	↙↙	↗↗
Volume (vph)	560	139	152	1011	271	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		250	570		470	0
Storage Lanes		1	2		2	2
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	0.88
Frnt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	4803	1495	3242	3343	3242	2632
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	4803	1495	3242	3343	3242	2632
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		156				222
Link Speed (mph)	55			55	45	
Link Distance (ft)	1308			1700	640	
Travel Time (s)	16.2			21.1	9.7	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	629	156	171	1136	304	222
Shared Lane Traffic (%)						
Lane Group Flow (vph)	629	156	171	1136	304	222
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	CI+Ex			CI+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	2		1	6	4	
Permitted Phases		2				4

5: NEW HORIZONS & MO RT 9
EXISTING PM PEAK HOUR

8/20/2015



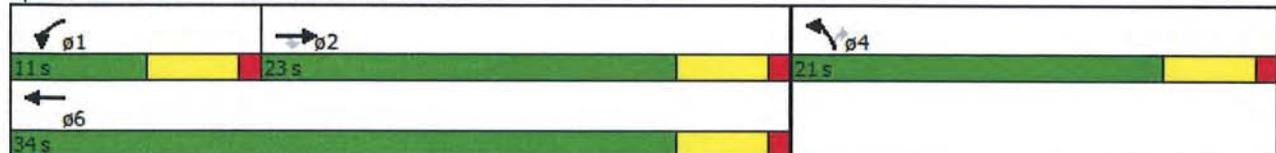
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Detector Phase	2	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	21.0	21.0	21.0
Total Split (s)	23.0	23.0	11.0	34.0	21.0	21.0
Total Split (%)	41.8%	41.8%	20.0%	61.8%	38.2%	38.2%
Maximum Green (s)	18.0	18.0	6.0	29.0	16.0	16.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	None	Max	None	None
Act Effct Green (s)	20.4	20.4	6.0	29.0	9.9	9.9
Actuated g/C Ratio	0.42	0.42	0.12	0.59	0.20	0.20
v/c Ratio	0.32	0.22	0.43	0.57	0.46	0.31
Control Delay	11.6	3.7	24.4	8.0	19.5	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.6	3.7	24.4	8.0	19.5	4.3
LOS	B	A	C	A	B	A
Approach Delay	10.0			10.2	13.1	
Approach LOS	B			B	B	
90th %ile Green (s)	18.0	18.0	6.0	29.0	13.8	13.8
90th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
70th %ile Green (s)	18.0	18.0	6.0	29.0	10.9	10.9
70th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
50th %ile Green (s)	18.0	18.0	6.0	29.0	9.7	9.7
50th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
30th %ile Green (s)	18.0	18.0	6.0	29.0	8.6	8.6
30th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
10th %ile Green (s)	29.0	29.0	0.0	29.0	7.1	7.1
10th %ile Term Code	Hold	Hold	Skip	MaxR	Gap	Gap
Stops (vph)	361	22	133	567	219	30
Fuel Used(gal)	13	2	5	23	5	1
CO Emissions (g/hr)	886	116	340	1613	344	96
NOx Emissions (g/hr)	172	23	66	314	67	19
VOC Emissions (g/hr)	205	27	79	374	80	22
Dilemma Vehicles (#)	56	0	0	102	0	0
Queue Length 50th (ft)	45	0	23	86	39	0
Queue Length 95th (ft)	77	29	50	160	66	21
Internal Link Dist (ft)	1228			1620	560	
Turn Bay Length (ft)		250	570		470	
Base Capacity (vph)	1996	712	397	1981	1060	1010
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.22	0.43	0.57	0.29	0.22

5: NEW HORIZONS & MO RT 9
 EXISTING PM PEAK HOUR

8/20/2015

Intersection Summary	
Area Type:	Other
Cycle Length:	55
Actuated Cycle Length:	49
Natural Cycle:	55
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	10.7
Intersection LOS:	B
Intersection Capacity Utilization:	44.0%
ICU Level of Service:	A
Analysis Period (min):	15
90th %ile Actuated Cycle:	52.8
70th %ile Actuated Cycle:	49.9
50th %ile Actuated Cycle:	48.7
30th %ile Actuated Cycle:	47.6
10th %ile Actuated Cycle:	46.1

Splits and Phases: 5: NEW HORIZONS & MO RT 9



ROUTE 9 AT MATTOX INTERSECTION STUDY

Appendix IV Synchro Analysis – 2015 AM PM Existing, Mattox with EB Rt. Lane

3: MATTOX ROAD & MO RT 9
EXISTING AM PEAK HOUR (RIGHT MATTOX)

8/20/2015

Intersection

Int Delay, s/veh 19.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	886	23	78	435	21	6	0	29	107	3	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	230	-	230	290	-	210	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	2	8	8	8	8	2	8	2	8	2	2	2
Mvmt Flow	12	1042	27	92	512	25	7	0	34	126	4	18

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	512	0	0	1042	0	0	1507	1761	521	1240	1761	256
Stage 1	-	-	-	-	-	-	1066	1066	-	695	695	-
Stage 2	-	-	-	-	-	-	441	695	-	545	1066	-
Critical Hdwy	4.14	-	-	4.26	-	-	7.66	6.54	7.06	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.28	-	-	3.58	4.02	3.38	3.52	4.02	3.32
Pot Cap-1 Maneuver	1050	-	-	629	-	-	79	84	485	131	84	743
Stage 1	-	-	-	-	-	-	227	297	-	399	442	-
Stage 2	-	-	-	-	-	-	549	442	-	490	297	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1050	-	-	629	-	-	65	71	485	~ 107	71	743
Mov Cap-2 Maneuver	-	-	-	-	-	-	65	71	-	~ 107	71	-
Stage 1	-	-	-	-	-	-	224	294	-	394	377	-
Stage 2	-	-	-	-	-	-	453	377	-	450	294	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.7	24	233
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	230	1050	-	-	629	-	-	118
HCM Lane V/C Ratio	0.179	0.011	-	-	0.146	-	-	1.246
HCM Control Delay (s)	24	8.5	-	-	11.7	-	-	233
HCM Lane LOS	C	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	0.6	0	-	-	0.5	-	-	9.5

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (RIGHT MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↑	↑↑	↑↑	↑↑	↑↑
Volume (vph)	764	258	136	434	100	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		250	570		470	0
Storage Lanes		1	2		2	2
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	0.88
Fr _t		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	4803	1495	3242	3343	3242	2632
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	4803	1495	3242	3343	3242	2632
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		304				45
Link Speed (mph)	55			55	45	
Link Distance (ft)	1307			1700	640	
Travel Time (s)	16.2			21.1	9.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	899	304	160	511	118	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	899	304	160	511	118	45
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	CI+Ex			CI+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	2		1	6	4	
Permitted Phases		2				4

5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (RIGHT MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Detector Phase	2	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	22.0	22.0	9.0	31.0	20.0	20.0
Total Split (%)	43.1%	43.1%	17.6%	60.8%	39.2%	39.2%
Maximum Green (s)	18.0	18.0	5.0	27.0	16.0	16.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	None	Max	None	None
Walk Time (s)	5.0	5.0		5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0
Act Effct Green (s)	23.3	23.3	5.0	30.6	6.9	6.9
Actuated g/C Ratio	0.54	0.54	0.12	0.71	0.16	0.16
v/c Ratio	0.35	0.32	0.42	0.21	0.23	0.10
Control Delay	8.2	2.5	21.3	3.3	16.2	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.2	2.5	21.3	3.3	16.2	6.6
LOS	A	A	C	A	B	A
Approach Delay	6.8			7.6	13.6	
Approach LOS	A			A	B	
90th %ile Green (s)	18.0	18.0	5.0	27.0	8.4	8.4
90th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
70th %ile Green (s)	18.0	18.0	5.0	27.0	7.5	7.5
70th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
50th %ile Green (s)	18.0	18.0	5.0	27.0	6.9	6.9
50th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
30th %ile Green (s)	18.0	18.0	5.0	27.0	6.3	6.3
30th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
10th %ile Green (s)	42.0	42.0	0.0	42.0	0.0	0.0
10th %ile Term Code	Dwell	Dwell	Skip	Dwell	Skip	Skip
Stops (vph)	433	31	121	142	81	14
Fuel Used(gal)	16	3	4	8	2	0
CO Emissions (g/hr)	1094	199	301	532	123	27
NOx Emissions (g/hr)	213	39	59	103	24	5
VOC Emissions (g/hr)	253	46	70	123	28	6
Dilemma Vehicles (#)	79	0	0	46	0	0
Queue Length 50th (ft)	50	0	18	19	12	0
Queue Length 95th (ft)	74	27	38	35	26	9
Internal Link Dist (ft)	1227			1620	560	
Turn Bay Length (ft)		250	570		470	
Base Capacity (vph)	2597	948	377	2377	1207	1008
Starvation Cap Reductn	0	0	0	0	0	0

5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (RIGHT MATTOX)

8/20/2015

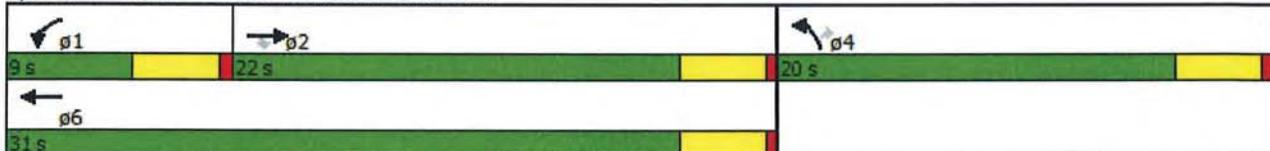


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.32	0.42	0.21	0.10	0.04

Intersection Summary

Area Type: Other
 Cycle Length: 51
 Actuated Cycle Length: 43
 Natural Cycle: 50
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.42
 Intersection Signal Delay: 7.6
 Intersection Capacity Utilization 32.0%
 Analysis Period (min) 15
 90th %ile Actuated Cycle: 43.4
 70th %ile Actuated Cycle: 42.5
 50th %ile Actuated Cycle: 41.9
 30th %ile Actuated Cycle: 41.3
 10th %ile Actuated Cycle: 46

Splits and Phases: 5: NEW HORIZONS & MO RT 9



3: MATTOX & MO RT 9
 EXISTING PM PEAK HOUR (RIGHT MATTOX)

8/20/2015

Intersection												
Int Delay, s/veh	16.6											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	31	575	6	34	1098	122	9	1	103	59	1	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	230	-	230	290	-	210	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	8	8	8	8	2	8	2	8	2	2	2
Mvmt Flow	34	632	7	37	1207	134	10	1	113	65	1	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1207	0	0	632	0	0	1379	1981	316	1666	1981	603
Stage 1	-	-	-	-	-	-	700	700	-	1281	1281	-
Stage 2	-	-	-	-	-	-	679	1281	-	385	700	-
Critical Hdwy	4.14	-	-	4.26	-	-	7.66	6.54	7.06	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.28	-	-	3.58	4.02	3.38	3.52	4.02	3.32
Pot Cap-1 Maneuver	574	-	-	907	-	-	98	61	662	~ 63	61	442
Stage 1	-	-	-	-	-	-	382	440	-	175	235	-
Stage 2	-	-	-	-	-	-	394	235	-	610	440	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	574	-	-	907	-	-	84	55	662	~ 48	55	442
Mov Cap-2 Maneuver	-	-	-	-	-	-	84	55	-	~ 48	55	-
Stage 1	-	-	-	-	-	-	359	414	-	165	225	-
Stage 2	-	-	-	-	-	-	352	225	-	474	414	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.2	17.9	\$ 367.9
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	402	574	-	-	907	-	-	66
HCM Lane V/C Ratio	0.309	0.059	-	-	0.041	-	-	1.432
HCM Control Delay (s)	17.9	11.7	-	-	9.1	-	-	\$ 367.9
HCM Lane LOS	C	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	1.3	0.2	-	-	0.1	-	-	8

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

5: NEW HORIZONS & MO RT 9
 EXISTING PM PEAK HOUR (RIGHT MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↗	↖	↑↑	↖	↗
Volume (vph)	560	139	152	1011	271	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		250	570		470	0
Storage Lanes		1	2		2	2
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	0.88
Fr _t		0.850				0.850
Fl _t Protected			0.950		0.950	
Satd. Flow (prot)	4803	1495	3242	3343	3242	2632
Fl _t Permitted			0.950		0.950	
Satd. Flow (perm)	4803	1495	3242	3343	3242	2632
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		156				222
Link Speed (mph)	55			55	45	
Link Distance (ft)	1308			1700	640	
Travel Time (s)	16.2			21.1	9.7	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	629	156	171	1136	304	222
Shared Lane Traffic (%)						
Lane Group Flow (vph)	629	156	171	1136	304	222
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	CI+Ex			CI+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	2		1	6	4	
Permitted Phases		2				4

5: NEW HORIZONS & MO RT 9
 EXISTING PM PEAK HOUR (RIGHT MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Detector Phase	2	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	21.0	21.0	21.0
Total Split (s)	23.0	23.0	11.0	34.0	21.0	21.0
Total Split (%)	41.8%	41.8%	20.0%	61.8%	38.2%	38.2%
Maximum Green (s)	18.0	18.0	6.0	29.0	16.0	16.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max	None	Max	None	None
Act Effct Green (s)	20.4	20.4	6.0	29.0	9.9	9.9
Actuated g/C Ratio	0.42	0.42	0.12	0.59	0.20	0.20
v/c Ratio	0.32	0.22	0.43	0.57	0.46	0.31
Control Delay	11.6	3.7	24.4	8.0	19.5	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.6	3.7	24.4	8.0	19.5	4.3
LOS	B	A	C	A	B	A
Approach Delay	10.0			10.2	13.1	
Approach LOS	B			B	B	
90th %ile Green (s)	18.0	18.0	6.0	29.0	13.8	13.8
90th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
70th %ile Green (s)	18.0	18.0	6.0	29.0	10.9	10.9
70th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
50th %ile Green (s)	18.0	18.0	6.0	29.0	9.7	9.7
50th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
30th %ile Green (s)	18.0	18.0	6.0	29.0	8.6	8.6
30th %ile Term Code	MaxR	MaxR	Max	MaxR	Gap	Gap
10th %ile Green (s)	29.0	29.0	0.0	29.0	7.1	7.1
10th %ile Term Code	Hold	Hold	Skip	MaxR	Gap	Gap
Stops (vph)	361	22	133	567	219	30
Fuel Used(gal)	13	2	5	23	5	1
CO Emissions (g/hr)	886	116	340	1613	344	96
NOx Emissions (g/hr)	172	23	66	314	67	19
VOC Emissions (g/hr)	205	27	79	374	80	22
Dilemma Vehicles (#)	56	0	0	102	0	0
Queue Length 50th (ft)	45	0	23	86	39	0
Queue Length 95th (ft)	77	29	50	160	66	21
Internal Link Dist (ft)	1228			1620	560	
Turn Bay Length (ft)		250	570		470	
Base Capacity (vph)	1996	712	397	1981	1060	1010
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.22	0.43	0.57	0.29	0.22

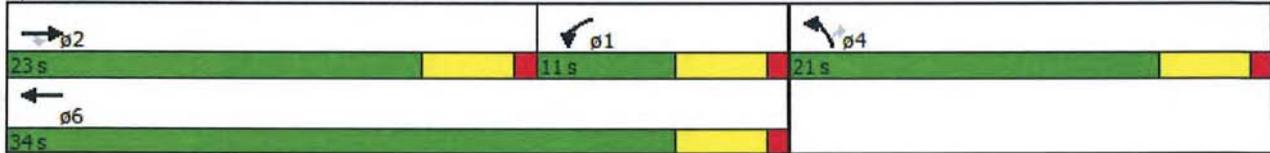
5: NEW HORIZONS & MO RT 9
 EXISTING PM PEAK HOUR (RIGHT MATTOX)

8/20/2015

Intersection Summary

Area Type:	Other
Cycle Length:	55
Actuated Cycle Length:	49
Natural Cycle:	55
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	10.7
Intersection LOS:	B
Intersection Capacity Utilization:	44.0%
ICU Level of Service:	A
Analysis Period (min):	15
90th %ile Actuated Cycle:	52.8
70th %ile Actuated Cycle:	49.9
50th %ile Actuated Cycle:	48.7
30th %ile Actuated Cycle:	47.6
10th %ile Actuated Cycle:	46.1

Splits and Phases: 5: NEW HORIZONS & MO RT 9



ROUTE 9 AT MATTOX INTERSECTION STUDY

Appendix V Synchro Analysis – 2015 AM PM Existing, Mattox with Signal

3: MATTOX ROAD & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	886	23	78	435	21	6	0	29	107	3	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	230		0	290		210	0		0	0		0
Storage Lanes	1		0	1		1	0		0	0		0
Taper Length (ft)	100			100			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.996				0.850		0.888			0.984	
Fl _t Protected	0.950			0.950				0.992			0.959	
Satd. Flow (prot)	1770	3329	0	1671	3343	1583	0	1550	0	0	1758	0
Fl _t Permitted	0.463			0.195				0.950			0.729	
Satd. Flow (perm)	862	3329	0	343	3343	1583	0	1484	0	0	1336	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5				68		68			8	
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		1213			950			605			134	
Travel Time (s)		15.0			11.8			13.8			3.0	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	8%	8%	8%	8%	2%	8%	2%	8%	2%	2%	2%
Adj. Flow (vph)	12	1042	27	92	512	25	7	0	34	126	4	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	12	1069	0	92	512	25	0	41	0	0	148	0
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6		6	4			8		

3: MATTOX ROAD & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2		1	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0	20.0	20.0	20.0		20.0	20.0	
Total Split (s)	8.0	44.0		12.0	48.0	48.0	24.0	24.0		24.0	24.0	
Total Split (%)	10.0%	55.0%		15.0%	60.0%	60.0%	30.0%	30.0%		30.0%	30.0%	
Maximum Green (s)	4.0	40.0		8.0	44.0	44.0	20.0	20.0		20.0	20.0	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	53.7	49.5		58.4	56.7	56.7		13.6			13.6	
Actuated g/C Ratio	0.67	0.62		0.73	0.71	0.71		0.17			0.17	
v/c Ratio	0.02	0.52		0.25	0.22	0.02		0.13			0.63	
Control Delay	4.6	11.4		6.7	4.3	0.0		3.9			40.4	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	
Total Delay	4.6	11.4		6.7	4.3	0.0		3.9			40.4	
LOS	A	B		A	A	A		A			D	
Approach Delay		11.3			4.5			3.9			40.4	
Approach LOS		B			A			A			D	
90th %ile Green (s)	4.3	40.0		8.3	44.0	44.0	19.7	19.7		19.7	19.7	
90th %ile Term Code	Max	Coord		Max	Coord	Coord	Hold	Hold		Gap	Gap	
70th %ile Green (s)	0.0	44.4		7.4	55.8	55.8	16.2	16.2		16.2	16.2	
70th %ile Term Code	Skip	Coord		Gap	Coord	Coord	Hold	Hold		Gap	Gap	
50th %ile Green (s)	0.0	47.6		6.7	58.3	58.3	13.7	13.7		13.7	13.7	
50th %ile Term Code	Skip	Coord		Gap	Coord	Coord	Hold	Hold		Gap	Gap	
30th %ile Green (s)	0.0	50.8		6.1	60.9	60.9	11.1	11.1		11.1	11.1	
30th %ile Term Code	Skip	Coord		Gap	Coord	Coord	Hold	Hold		Gap	Gap	
10th %ile Green (s)	0.0	64.5		0.0	64.5	64.5	7.5	7.5		7.5	7.5	
10th %ile Term Code	Skip	Coord		Skip	Coord	Coord	Hold	Hold		Gap	Gap	
Stops (vph)	4	505		26	115	0		3			106	
Fuel Used(gal)	0	18		1	5	0		0			2	
CO Emissions (g/hr)	11	1291		74	359	9		15			123	
NOx Emissions (g/hr)	2	251		14	70	2		3			24	
VOC Emissions (g/hr)	3	299		17	83	2		3			28	
Dilemma Vehicles (#)	0	57		0	29	0		0			0	
Queue Length 50th (ft)	1	151		9	27	0		0			66	
Queue Length 95th (ft)	7	237		31	68	0		10			106	
Internal Link Dist (ft)		1133			870			525			54	
Turn Bay Length (ft)	230			290		210						
Base Capacity (vph)	639	2059		384	2369	1141		422			340	
Starvation Cap Reductn	0	0		0	0	0		0			0	
Spillback Cap Reductn	0	0		0	0	0		0			0	
Storage Cap Reductn	0	0		0	0	0		0			0	
Reduced v/c Ratio	0.02	0.52		0.24	0.22	0.02		0.10			0.44	

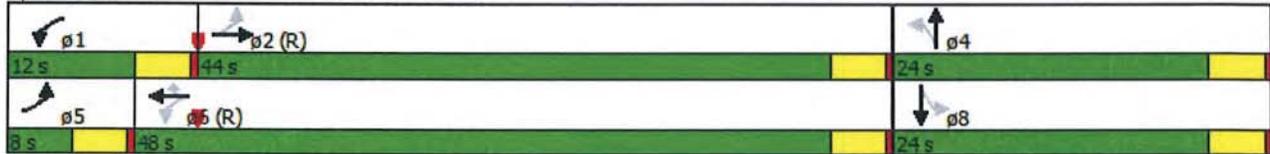
3: MATTOX ROAD & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015

Intersection Summary

Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	49 (61%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.63
Intersection Signal Delay:	11.2
Intersection Capacity Utilization	53.2%
Analysis Period (min)	15
	Intersection LOS: B
	ICU Level of Service A

Splits and Phases: 3: MATTOX ROAD & MO RT 9



5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↑	↑↑	↑↑	↑↑	↑↑
Volume (vph)	764	258	136	434	100	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		250	570		470	0
Storage Lanes		1	2		2	2
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	0.97	0.95	0.97	0.88
Flt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	4803	1495	3242	3343	3242	2632
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	4803	1495	3242	3343	3242	2632
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		304				45
Link Speed (mph)	55			55	45	
Link Distance (ft)	1314			1700	640	
Travel Time (s)	16.3			21.1	9.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	899	304	160	511	118	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	899	304	160	511	118	45
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	CI+Ex			CI+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	2		1	6	4	
Permitted Phases		2				4

5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Detector Phase	2	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	41.0	41.0	17.0	58.0	22.0	22.0
Total Split (%)	51.3%	51.3%	21.3%	72.5%	27.5%	27.5%
Maximum Green (s)	37.0	37.0	13.0	54.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	None	C-Max	None	None
Act Effct Green (s)	52.4	52.4	9.3	66.5	8.3	8.3
Actuated g/C Ratio	0.66	0.66	0.12	0.83	0.10	0.10
v/c Ratio	0.29	0.28	0.43	0.18	0.35	0.14
Control Delay	2.6	0.6	36.0	2.1	35.8	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.6	0.6	36.0	2.1	35.8	11.7
LOS	A	A	D	A	D	B
Approach Delay	2.1			10.2	29.2	
Approach LOS	A			B	C	
90th %ile Green (s)	45.6	45.6	11.9	61.5	10.5	10.5
90th %ile Term Code	Coord	Coord	Gap	Coord	Gap	Gap
70th %ile Green (s)	48.5	48.5	10.3	62.8	9.2	9.2
70th %ile Term Code	Coord	Coord	Gap	Coord	Gap	Gap
50th %ile Green (s)	50.4	50.4	9.3	63.7	8.3	8.3
50th %ile Term Code	Coord	Coord	Gap	Coord	Gap	Gap
30th %ile Green (s)	52.4	52.4	8.2	64.6	7.4	7.4
30th %ile Term Code	Coord	Coord	Gap	Coord	Gap	Gap
10th %ile Green (s)	65.3	65.3	6.7	76.0	0.0	0.0
10th %ile Term Code	Coord	Coord	Gap	Coord	Skip	Skip
Stops (vph)	87	0	122	82	89	12
Fuel Used(gal)	8	2	5	6	2	0
CO Emissions (g/hr)	585	152	330	446	157	28
NOx Emissions (g/hr)	114	30	64	87	31	5
VOC Emissions (g/hr)	136	35	77	103	36	6
Dilemma Vehicles (#)	19	0	0	24	0	0
Queue Length 50th (ft)	20	0	39	22	28	0
Queue Length 95th (ft)	26	0	61	36	48	14
Internal Link Dist (ft)	1234			1620	560	
Turn Bay Length (ft)		250	570		470	
Base Capacity (vph)	3148	1084	526	2779	729	627
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.28	0.30	0.18	0.16	0.07

5: NEW HORIZONS & MO RT 9
 EXISTING AM PEAK HOUR (SIG MATTOX)

8/20/2015

Intersection Summary

Area Type: Other
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
 Natural Cycle: 50
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.43
 Intersection Signal Delay: 6.9
 Intersection Capacity Utilization 32.0%
 Analysis Period (min) 15

Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 5: NEW HORIZONS & MO RT 9



3: MATTOX ROAD & MO RT 9
 EXISTING PM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕		↖	↕	↗		↕			↕	
Volume (vph)	31	575	6	34	1098	122	9	1	103	59	1	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	230		0	290		210	0		0	0		0
Storage Lanes	1		0	1		1	0		0	0		0
Taper Length (ft)	100			100			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt		0.998				0.850		0.877			0.974	
Flt Protected	0.950			0.950				0.996			0.962	
Satd. Flow (prot)	1770	3336	0	1671	3343	1583	0	1537	0	0	1745	0
Flt Permitted	0.194			0.399				0.976			0.591	
Satd. Flow (perm)	361	3336	0	702	3343	1583	0	1507	0	0	1072	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				134		113			16	
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		1213			950			605			134	
Travel Time (s)		15.0			11.8			13.8			3.0	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	2%	8%	8%	8%	8%	2%	8%	2%	8%	2%	2%	2%
Adj. Flow (vph)	34	632	7	37	1207	134	10	1	113	65	1	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	639	0	37	1207	134	0	124	0	0	82	0
Enter Blocked Intersection	No											
Lane Alignment	Left	Left	Right									
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6		6	4			8		

3: MATTOX ROAD & MO RT 9
 EXISTING PM PEAK HOUR (SIG MATTOX)

8/20/2015



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2		1	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0	20.0	20.0	20.0		20.0	20.0	
Total Split (s)	8.0	42.0		8.0	42.0	42.0	20.0	20.0		20.0	20.0	
Total Split (%)	11.4%	60.0%		11.4%	60.0%	60.0%	28.6%	28.6%		28.6%	28.6%	
Maximum Green (s)	4.0	38.0		4.0	38.0	38.0	16.0	16.0		16.0	16.0	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	53.4	51.7		53.6	51.8	51.8		8.8			8.8	
Actuated g/C Ratio	0.76	0.74		0.77	0.74	0.74		0.13			0.13	
v/c Ratio	0.09	0.26		0.06	0.49	0.11		0.43			0.55	
Control Delay	3.2	5.3		2.5	5.3	1.1		12.1			37.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	
Total Delay	3.2	5.3		2.5	5.3	1.1		12.1			37.7	
LOS	A	A		A	A	A		B			D	
Approach Delay		5.2			4.8			12.1			37.7	
Approach LOS		A			A			B			D	
90th %ile Green (s)	6.5	38.7		6.7	38.9	38.9	12.6	12.6		12.6	12.6	
90th %ile Term Code	Gap	Coord		Gap	Coord	Coord	Hold	Hold		Gap	Gap	
70th %ile Green (s)	6.0	41.6		6.1	41.7	41.7	10.3	10.3		10.3	10.3	
70th %ile Term Code	Gap	Coord		Gap	Coord	Coord	Hold	Hold		Gap	Gap	
50th %ile Green (s)	0.0	53.4		0.0	53.4	53.4	8.6	8.6		8.6	8.6	
50th %ile Term Code	Skip	Coord		Skip	Coord	Coord	Hold	Hold		Gap	Gap	
30th %ile Green (s)	0.0	55.0		0.0	55.0	55.0	7.0	7.0		7.0	7.0	
30th %ile Term Code	Skip	Coord		Skip	Coord	Coord	Hold	Hold		Gap	Gap	
10th %ile Green (s)	0.0	66.0		0.0	66.0	66.0	0.0	0.0		0.0	0.0	
10th %ile Term Code	Skip	Coord		Skip	Coord	Coord	Skip	Skip		Skip	Skip	
Stops (vph)	8	196		7	351	5		28			59	
Fuel Used(gal)	0	9		0	14	1		1			1	
CO Emissions (g/hr)	28	611		25	1001	60		67			69	
NOx Emissions (g/hr)	6	119		5	195	12		13			13	
VOC Emissions (g/hr)	7	142		6	232	14		16			16	
Dilemma Vehicles (#)	0	36		0	66	0		0			0	
Queue Length 50th (ft)	3	30		2	52	0		4			27	
Queue Length 95th (ft)	10	104		m8	190	13		45			65	
Internal Link Dist (ft)		1133			870			525			54	
Turn Bay Length (ft)	230			290		210						
Base Capacity (vph)	394	2466		619	2473	1206		431			257	
Starvation Cap Reductn	0	0		0	0	0		0			0	
Spillback Cap Reductn	0	0		0	0	0		0			0	
Storage Cap Reductn	0	0		0	0	0		0			0	
Reduced v/c Ratio	0.09	0.26		0.06	0.49	0.11		0.29			0.32	