Technical Memorandum #3

Long Range Improvements

Traffic Analysis and Operations Studies: SR 912 in East Chicago, Indiana

Prepared for:

The Indiana Department of Transportation
LaPorte District

Submitted by:

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Submitted on: June 11, 2010

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1 Introduction and Background

In late summer 2009, the Indiana Department of Transportation (INDOT) made an initial determination that the Cline Avenue (SR 912) Bridge over the Indiana Harbor Canal in East Chicago had structural issues, apparently due to suspected problems with post-tensioning cables. A detailed review determined that the structure might fail, and on November 13, 2009 SR 912 was closed between the Calumet Avenue interchange and the "Mill Interchange" near Michigan Avenue (see **Figure 1**). This section of SR 912 has remained closed, while various alternatives to replace the bridge or develop alternatives to serve area traffic are evaluated.

INDOT retained Wilbur Smith Associates (WSA) in February 2010, to investigate and analyze alternatives for both short-range and long-range treatment of traffic in the area. Part of this effort is developing three technical memoranda covering:

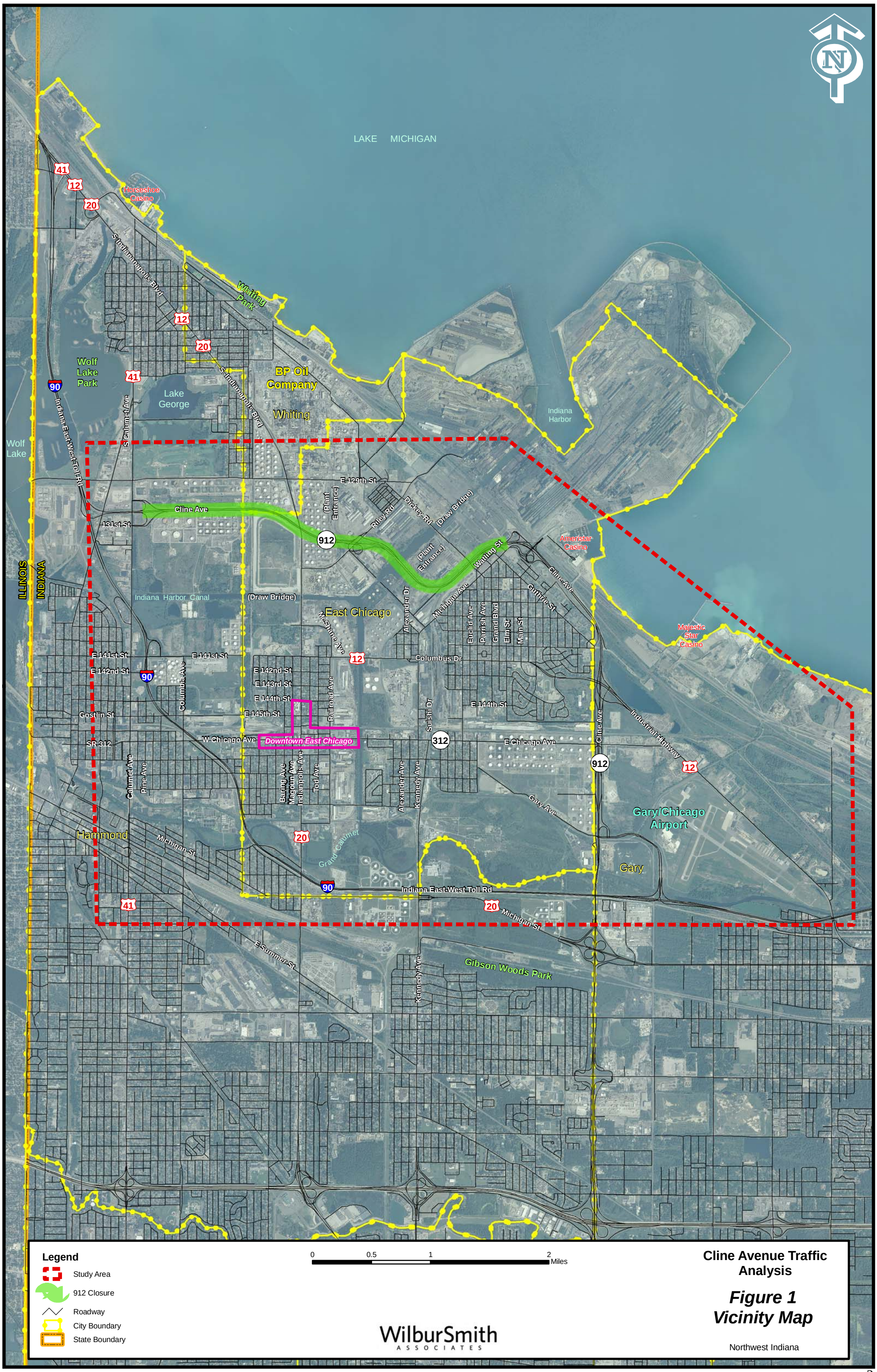
- Existing conditions,
- Potential short range improvements, and
- Potential long range improvements.

This document is the third of the three project memoranda. First, this document screens various alternatives for addressing traffic demands for the foreseeable future It applies a set of criteria that include impacts on the community as well as mobility and access concerns. From the twelve options considered, a preferred alternative is identified. Next, traffic analyses are presented for two planning horizons: 2013 and 2033. Operational performance is assessed under future travel demands, and future intersection Level of Service (LOS) is determined. The analyses incorporate short range improvements recommended in *Technical Memorandum #2, Short Range Improvements.* Improvements needed to achieve an acceptable LOS beyond the short range improvements are identified and associated costs are estimated at a planning level. Discussions of traffic signal preemption for emergency vehicles and of drawbridge operations at a key location are also included.

Figure 1 identifies the study area, representing the primary impact area affected by the SR 912 closure. Nearly all traffic diversion and impacts occur within this area given the nature of the land use and transportation system. The study area encompasses portions of the cities of East Chicago, Whiting, and Hammond, plus the west border area of Gary.

The overall goal of the project is to present and consider alternatives that meet user expectations in terms of mobility, access, and safety, and make associated recommendations. The following sections address the associated topics:

- 2 – Long range alternatives developed by the Indiana Department of Transportation (INDOT) based on input from a number of sources
- 3 – Screening of the long range alternatives to a preferred alternative based on several criteria.
- 4 – Key features of the preferred alternative.
- 5 – Traffic volume development for 2013 and 2033.
- 6 – Operational analyses under 2013 and 2033 conditions, including identification and costing of recommended improvements.
- 7 – Summary and conclusion.


LAKE MICHIGAN
Horseshoe Casino
Whiting Park
Wolf Lake Park
Lake George
BP Oil Company
Whiting
Indiana Harbor
Wolf Lake
S Indianapolis Blvd
S Calumet Ave
Indiana East-West Toll Rd
E 129th St
Cline Ave
131st St
(Plant Entrance)
Riley Rd
Dickey Rd
(Draw Bridge)
Watling St
Ameristar Casino
Majestic Star Casino
ILLINOIS
INDIANA
Indiana Harbor Canal
East Chicago
McShane Ave
Alexander Dr
Michigan Ave
Euclid Ave
Parrish Ave
Grand Blvd
Elm St
Main St
Guthrie St
Columbus Dr
E 141st St
E 142nd St
E 143rd St
E 144th St
E 145th St
Columbia Ave
Costlin St
Railroad Ave
Suishi Dr
W Chicago Ave
Downtown East Chicago
E Chicago Ave
SR 312
Industrial Highway
Calumet Ave
Pine Ave
Baring Ave
Magoun Ave
Indianapolis Ave
Tod Ave
Alexander Ave
Kennedy Ave
Gary Ave
Gary/Chicago Airport
Hammond
Michigan St
Grand Calumet
Gary
E Summer St
Gibson Woods Park
Legend
Study Area
912 Closure
Roadway
City Boundary
State Boundary
0
0.5
1
2
Miles
WilburSmith
ASSOCIATES
Cline Avenue Traffic Analysis
Figure 1
Vicinity Map
Northwest Indiana

2 Long Range Alternatives

Following the closure of the SR 912 bridge, INDOT immediately began consideration of options and alternatives to handle traffic in the study area over the long term. A series of internal meetings were held incorporating input from a number of sources including affected stakeholders, both public and private. This effort occurred primarily from early December 2009 through mid-February 2010. The result was 12 options representing a wide variety of potential solutions to the bridge failure condition. This section presents and briefly describes these alternatives. For simplicity, these are described as proceeding from the southeast to northwest when in fact traffic flow is in both directions. The figures follow the text descriptions.

2.1 Alternatives A & B

Alternatives A and B are presented in **Figure 2**. Alternative A consists of rebuilding the SR 912 bridge in kind at a cost of an estimated $150 Million. This alternative would take a few years to complete because it would first require demolition of the existing structure followed by reconstruction in place. It does reuse a portion of the existing structure resulting somewhat lower demolition cost than all other alternatives.

Alternative B represents taking no action to replace the SR 912 structure assuming a large portion of traffic would divert to the Indiana Toll Road. Alternatives A and B thus represent the greatest possible action and the least possible action to address bridge failure.

2.2 Alternative C

Alternative C is presented in **Figure 3** and consists of re-routing SR 912 to Riley Road and Dickey Street between the existing SR 912/Michigan (Mill Interchange) area and the SR 912/Riley interchange. A critical aspect is how the reconnection would occur at the east end, since Dickey Road currently crosses three sets of railroad tracks, one of which (with the IHB) carries a significant amount of train traffic (see *Technical Memorandum #1*). To address this, SR 912 from the southeast would be extended over the railroad tracks, touching down with Dickey Road northwest of the existing highway-rail grade crossings.

2.3 Alternative D

Figure 4 presents Alternative D, re-routing SR 912 from the southeast to Chicago Avenue (SR 312), then north on Indianapolis Blvd. (US 12/20), turning west on 129th Street, then south on Calumet Avenue (US 41) and back onto SR 912. This would require US marked routes and a portion of local road (129th Street) to be designated as SR 912.

2.4 Alternative E

Alternative E is similar to Alternative D, as presented in **Figure 5**. The difference is that instead of using Chicago Avenue, Columbus Drive (US 12) would be used for the east-west portion connecting to SR 912 to the southeast.

2.5 Alternative F

Alternative F, presented in **Figure 6**, is similar to Alternative C in its use of Dickey Road. However, instead of taking Riley Road it connects to 129th Street, heading west to Calumet (US 41), then south back onto SR 912.

2.6 Alternative G

Alternative G is presented in **Figure 7**. This uses Michigan Street (US 20) from SR 912 in the southeast, turning north onto Indianapolis Blvd. and continuing to 129th Street. From there it would head west to Calumet Avenue, then south back to reconnect with existing SR 912.

2.7 Alternative H

Figure 8 presents Alternative H in which SR 912 traffic is re-routed onto Chicago Avenue, proceeds west to Calumet Avenue, and reconnects to SR 912 at the existing SR 912/Calumet interchange.

2.8 Alternative I

Alternative I in **Figure 9** would connect SR 912 to Michigan Avenue in East Chicago, proceed southwest to Columbus Drive, and turn north onto Indianapolis Blvd. As with several previous alternatives, it would then head north to 129th Street, west to Calumet Avenue, then south to existing SR 912.

2.9 Alternative J

Alternative J presented in **Figure 10** is a modification of Alternative I. Instead of using Indianapolis Blvd., it would continue west from Columbus Drive onto 141st Street, which would require a new through connection on 141st just west of East Chicago High School. The route would then connect to Calumet Avenue and head north to existing SR 912.

2.10 Alternative K

Alternative K in **Figure 11** starts off like Alternative G on Michigan Street. But instead of turning onto Indianapolis Blvd., it would continue via local Michigan Street (just west of Indianapolis), connecting to Calumet Avenue. From there it would head north back to SR 912.

2.11 Alternative L

Alternative L in **Figure 12** would take a “stair-step” route through the communities via Gary Avenue, 148th Street, Kennedy Avenue and then Columbus Drive. From there it would connect with Indianapolis Blvd., 129th Street, Calumet Avenue, and back to SR 912.

Figure 2 Alternatives A & B

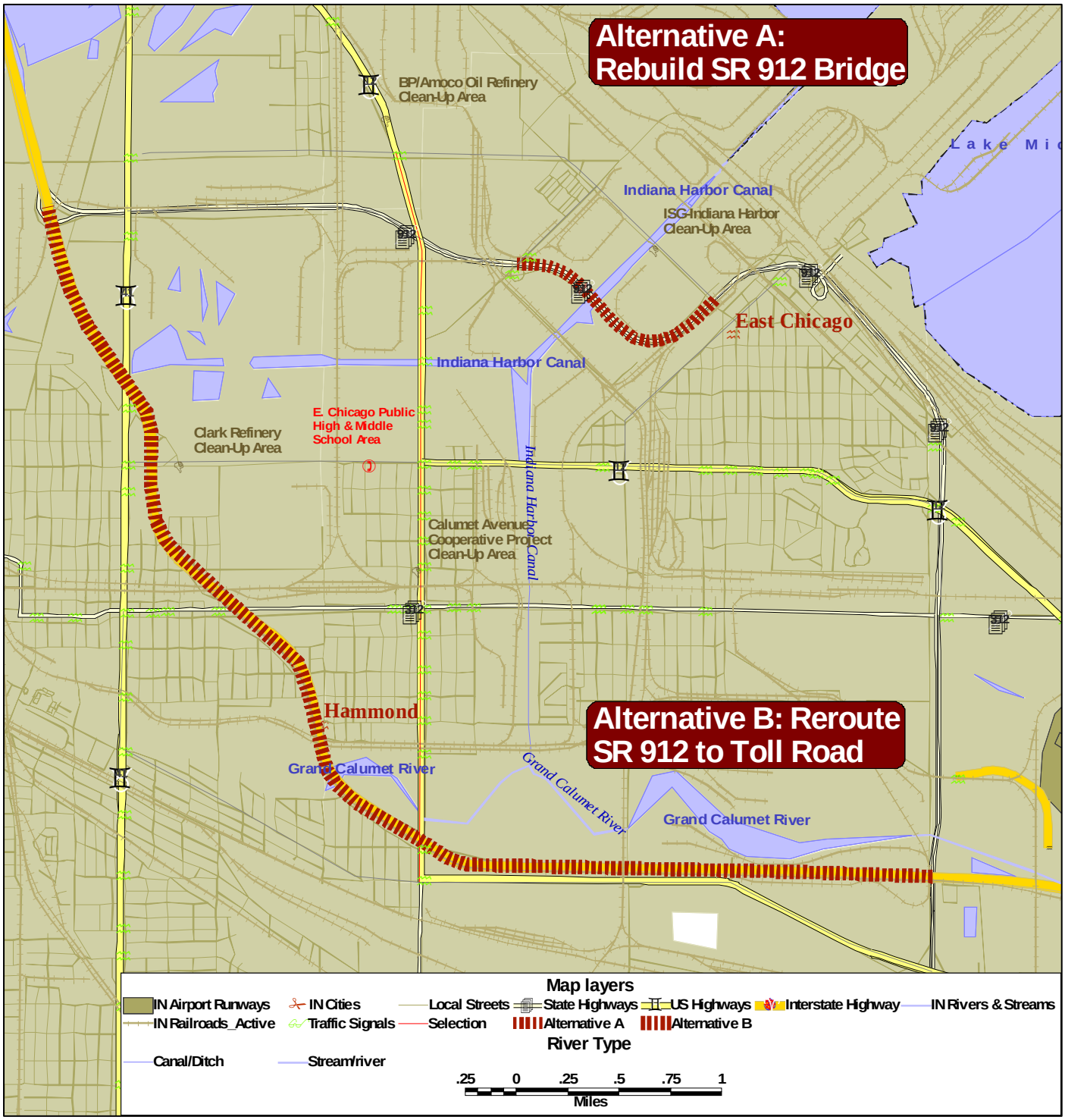


Figure 3 Alternative C

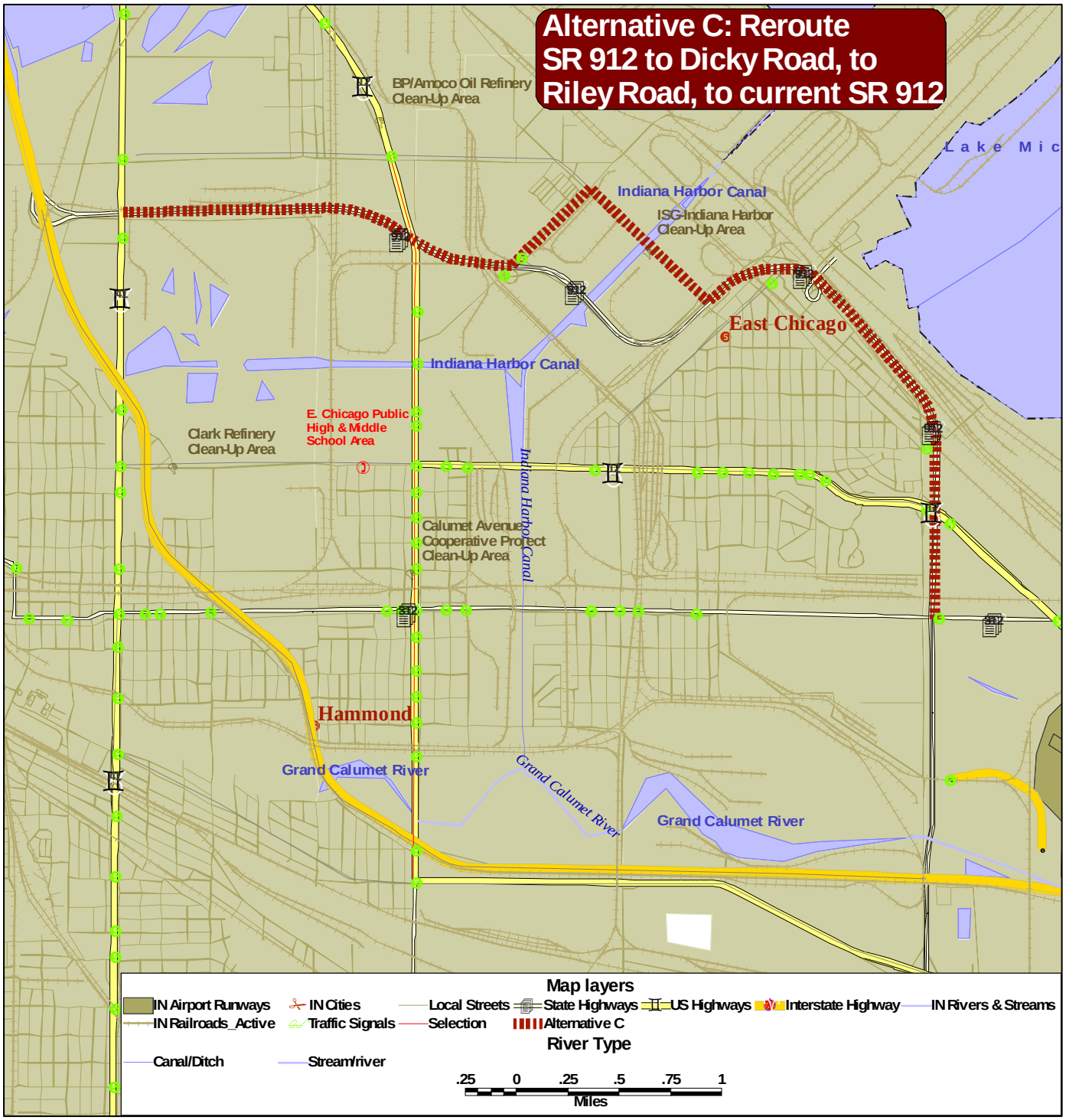


Figure 4 Alternative D

Figure 5 Alternative E

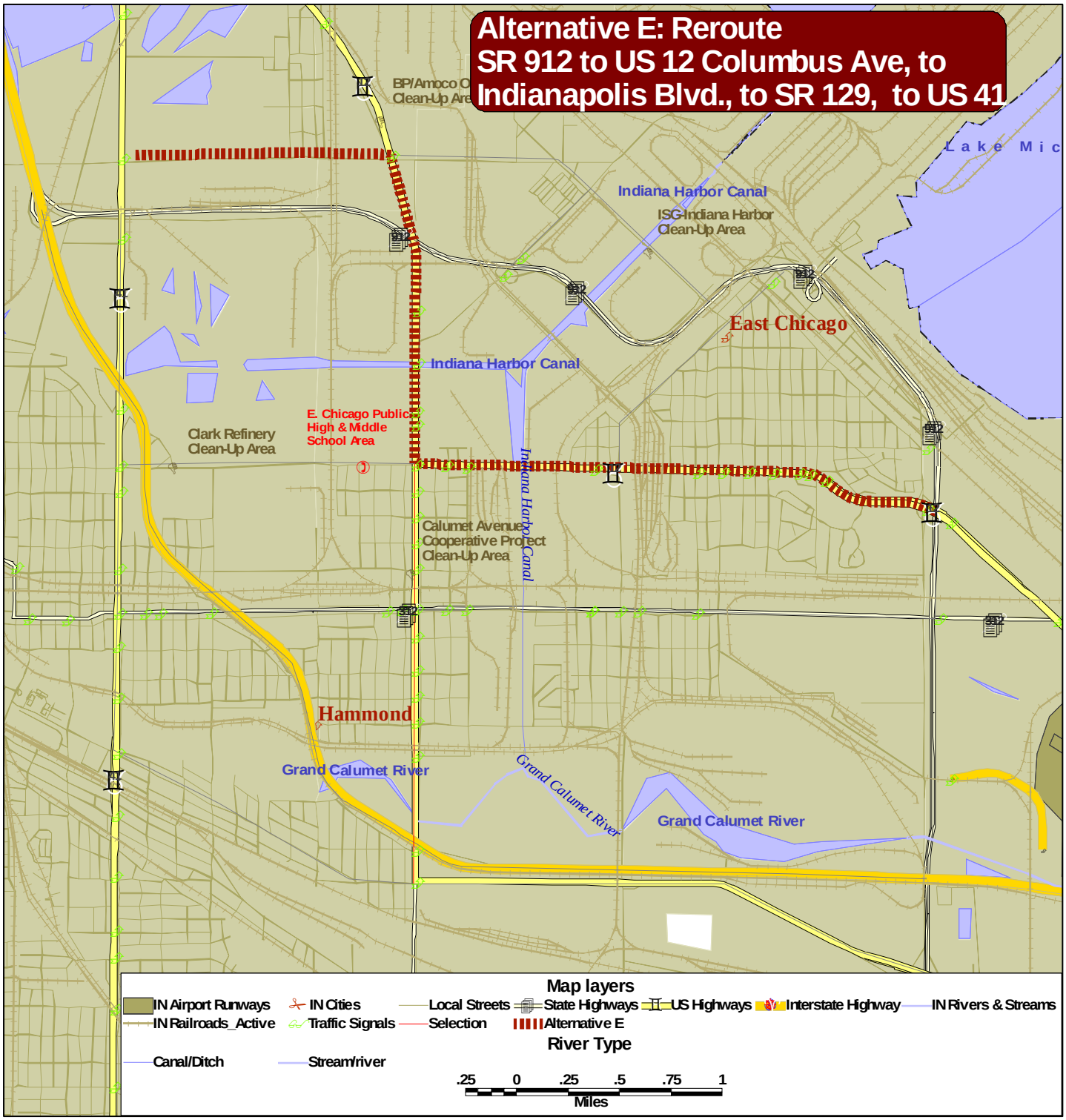


Figure 6 Alternative F

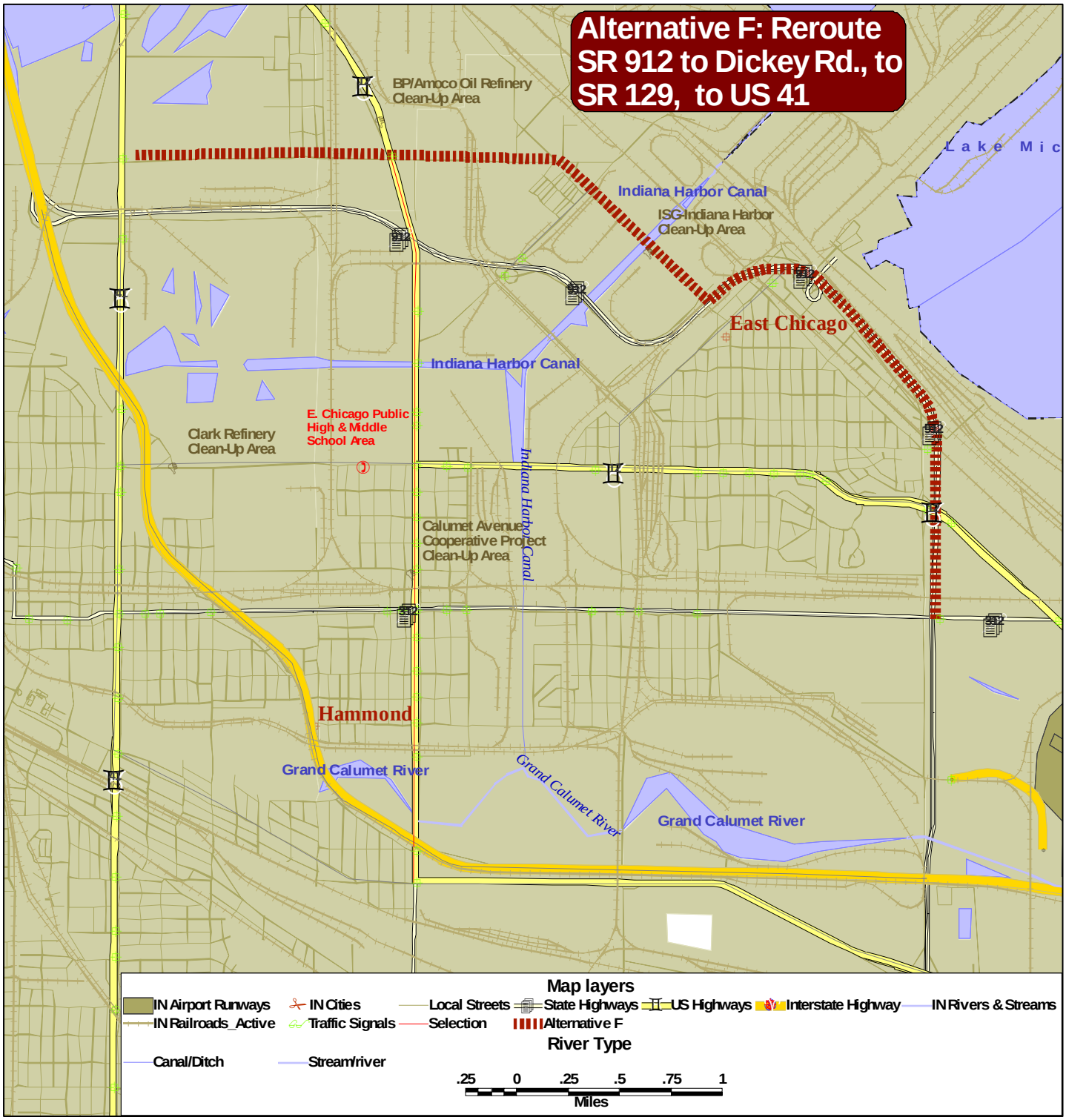


Figure 7 Alternative G

Figure 8 Alternative H

Figure 9 Alternative I

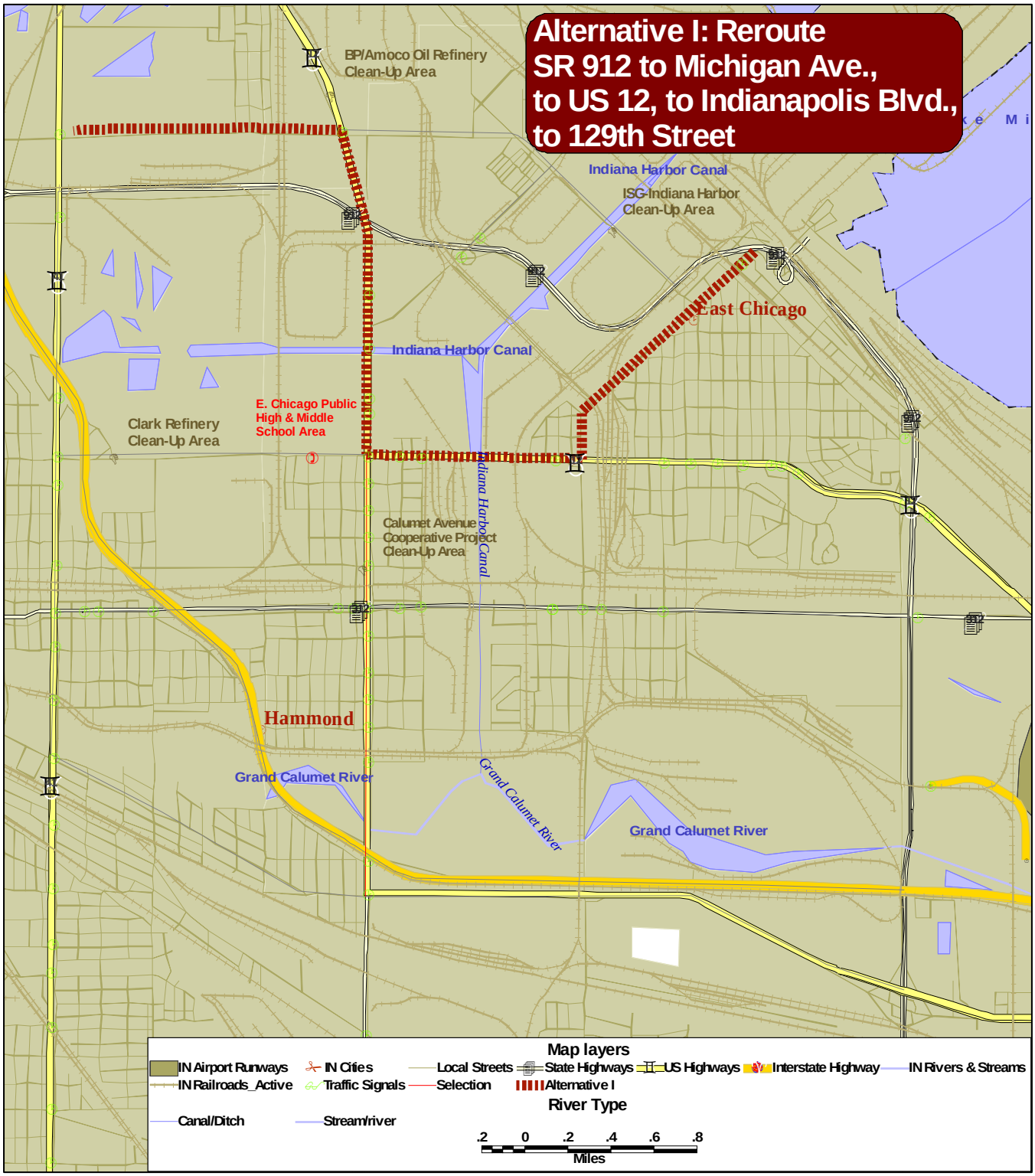


Figure 10 Alternative J

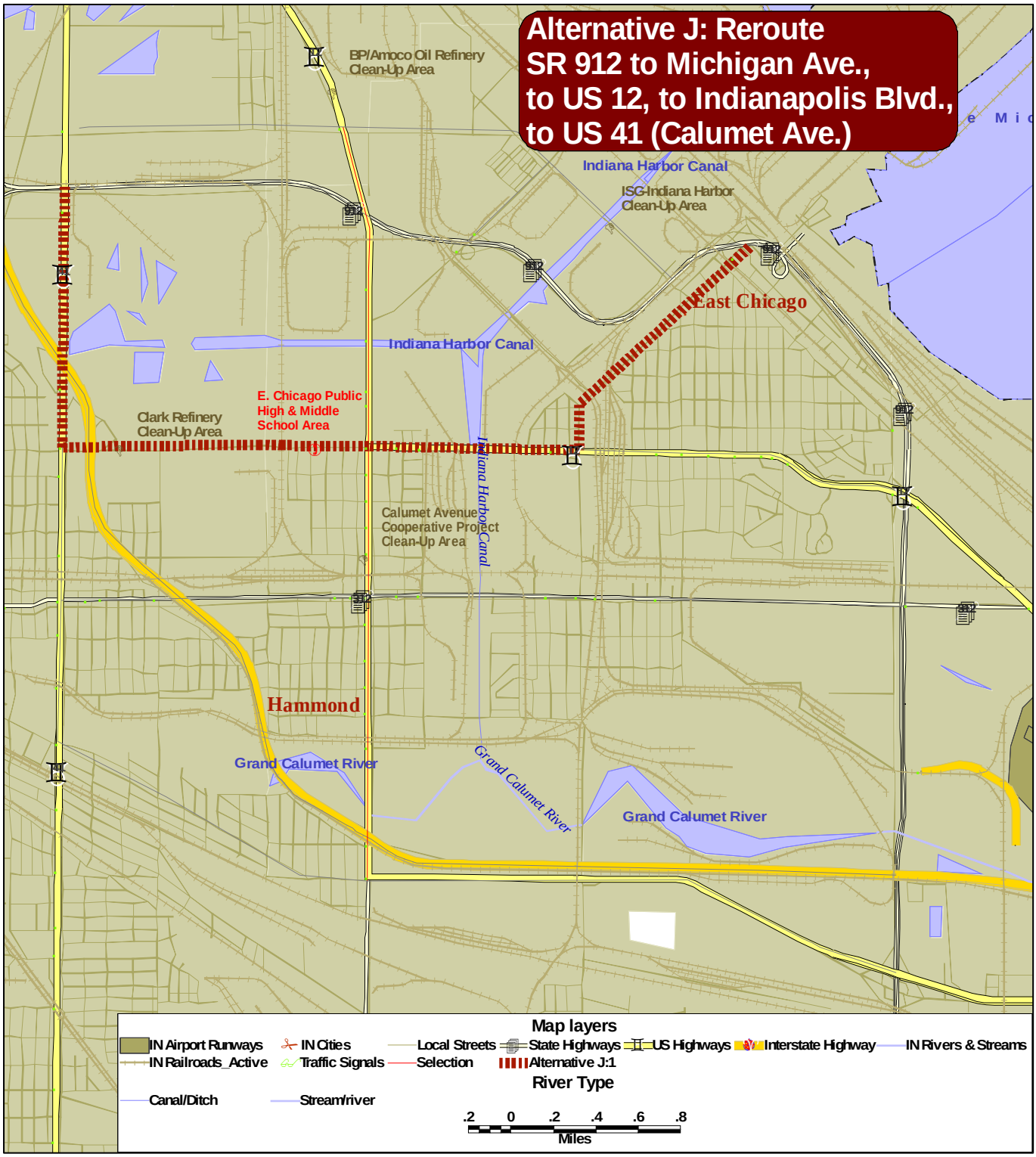


Figure 11 Alternative K

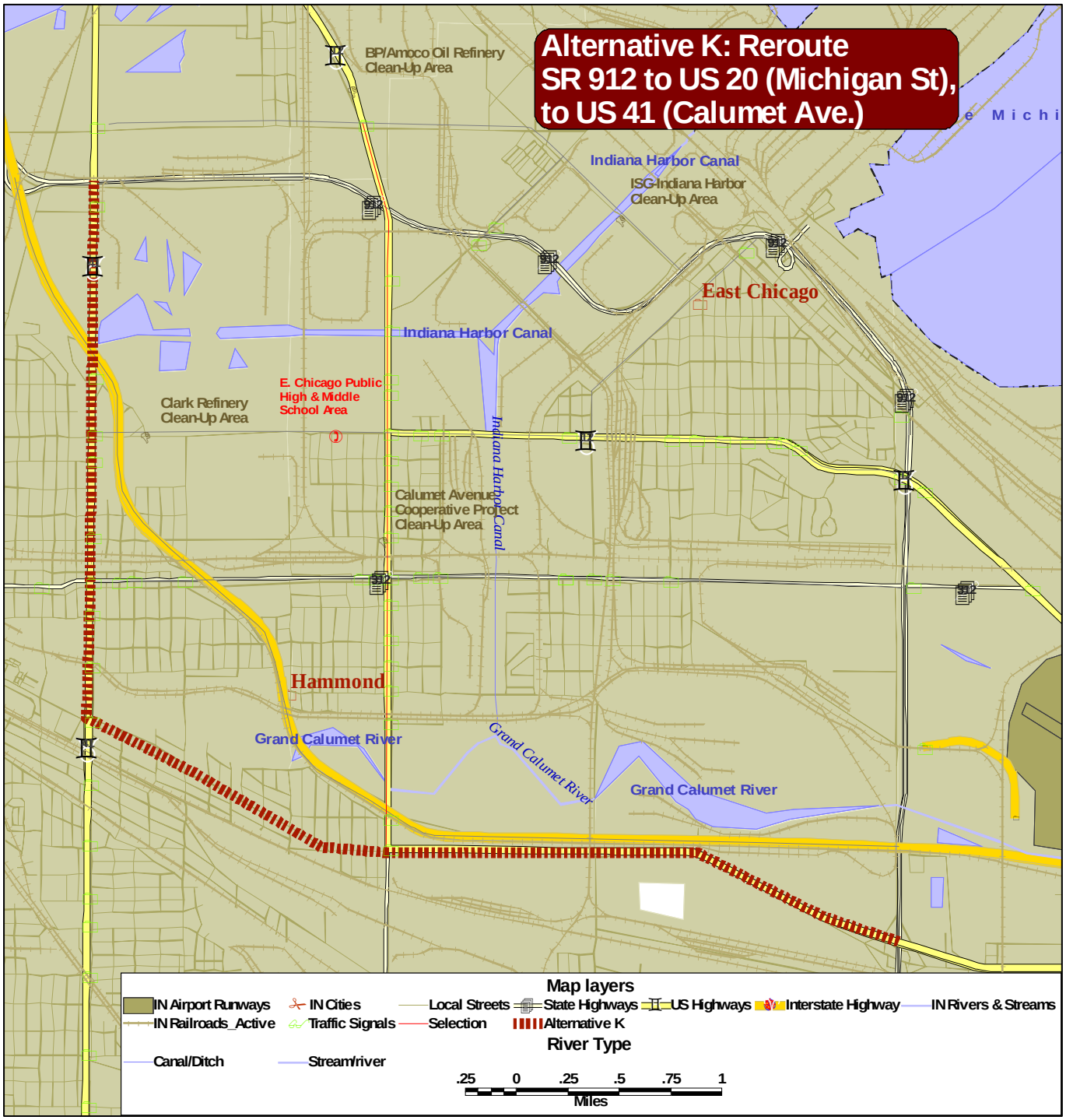
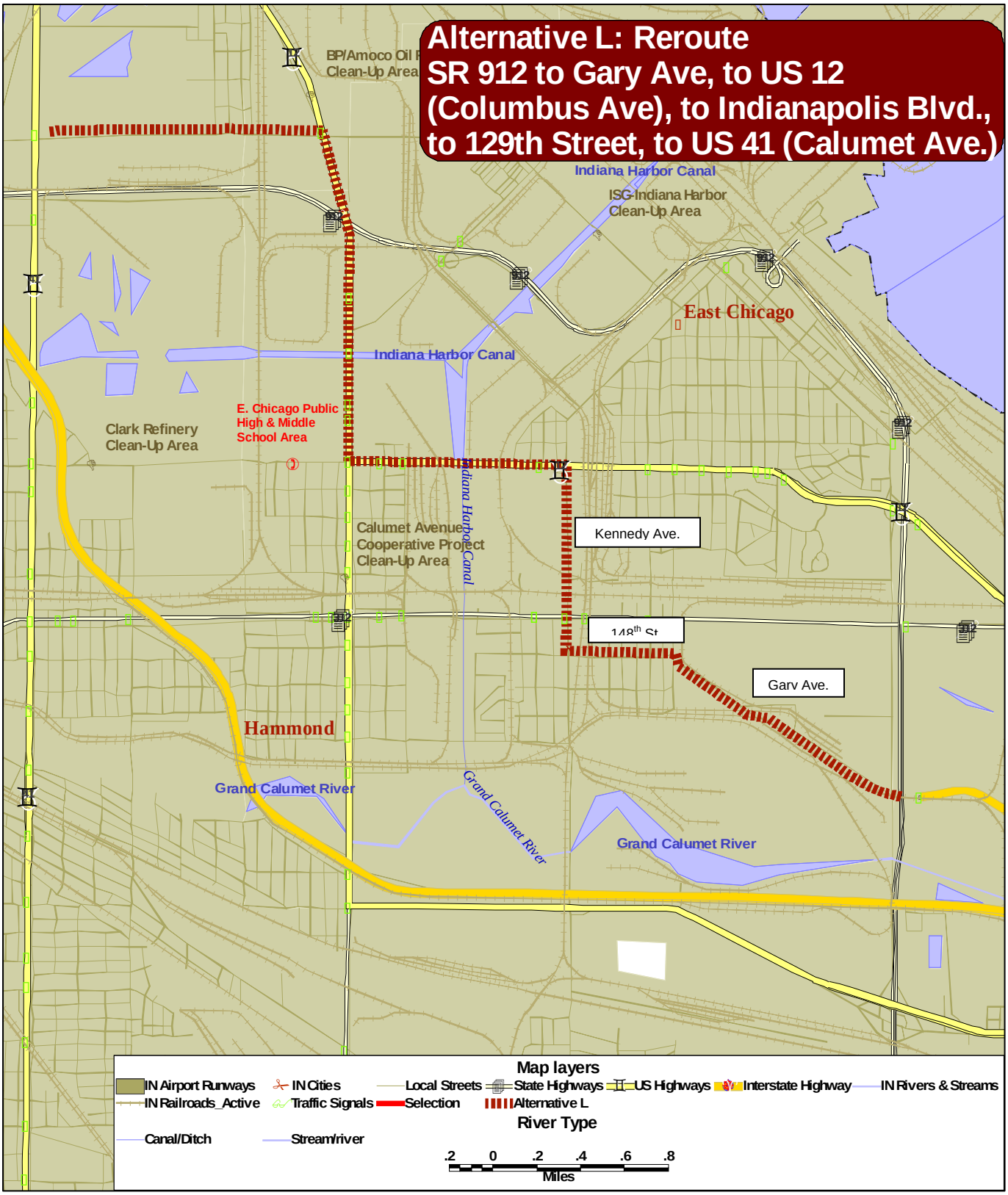


Figure 12 Alternative L



3 Screening of Long Range Alternatives

To screen the alternatives, a number of evaluation criteria have been considered. These represent a range of concerns addressing:

- Mobility
- Access and Land Use Service
- Use of Surface Streets
- Neighborhood/Community Impact (including both auto and truck intrusion)
- Travel Time
- Number of Major Highway-Rail Grade Crossings
- Cost (including demolition of existing SR 912 bridge)

Because of the differences in the values that these criteria represent, evaluation is on a qualitative, as opposed to quantitative basis. **Table 1** compares the alternatives in relation to the criteria, looking in particular for major or "fatal" flaws that would eliminate an alternative from further consideration.

Review of the table indicates that the best options are Alternative C, E, and F. Of these three, Alternative E underperforms relative to Alternative C and F. Alternative C and F are similar, with Alternative C having a much shorter length of SR 912 routed onto surface streets. Primarily for this reason, Alternative C is selected as the preferred alternative.

Table 1 Long Range Alternatives Screening

ALT.	MOBILITY	ACCESS & LAND USE SERVICE	USE OF SURFACE STREETS	NEIGHBORHOOD/ COMMUNITY INTRUSION	TRAVEL TIME	NUMBER OF MAJOR GRADE X-INGS	ESTIMATED COST (1), (2)	OVERALL EVALUATION
A	Excellent for through trips, very good for local trips depending on exact origin or destination.	Very good	Local trip circulation only	Minimal	Fastest for through trips	None	$150-160 Million	High service level but very high cost for volume served - ADT of 35,000 of which approximately 20% are through trips.
B	Excellent for through trips, Poor for local trips.	Poor – far removed from East Chicago industrial and residential areas.	Local trip circulation only	Minimal except for local trip circulation	Fast for through trips, slower for local trips.	None on Toll Road, varies for local trips depending on route.	$39 Million	Only cost is demolition of existing bridge, but alternative does not adequately serve local trips.
C	Good for through and local trips	Good	Uses 1.3 miles of Dickey and Riley	Minimal	Good as long as grade crossings on Dickey avoided and Dickey drawbridge operations limited to low vehicle traffic periods.	None as long as grade crossings on Dickey avoided.	$61-65 Million	Good balance of service for through and local trips at moderate cost.
D	Fair – heavy left turns SB on Indianapolis at Chicago and NB at 129th.	Fair –removed from East Chicago industrial area, somewhat so from residential areas.	Uses 6.3 miles of Chicago, Indianapolis, 129th, and Calumet.	Significant – passes through downtown East Chicago on Chicago Ave. and Indianapolis Blvd.	Fair	2	$46-50 Million	Low cost but does not adequately serve through and local trips and uses long distance of surface street.
E	Fair – heavy left turns SB on Indianapolis at Columbus and NB at 129th.	Better than Alt. D, but still somewhat removed from industrial and residential areas.	Uses 5.7 miles of Columbus, Indianapolis, 129th, and Calumet.	Low - close to East Chicago residential areas.	Fair	None	$45-49 Million	Better than Alt. D, but length of surface street use and remoteness from East Chi. origins/destinations unfavorable.
F	Fair-Good for both through and local trips.	Good	Uses 3.4 miles of Dickey and 129th.	Minimal	Fair-Good as long as grade crossings on Dickey avoided and Dickey drawbridge operations limited to low vehicle traffic periods.	None as long as grade crossings on Dickey avoided.	$55-59 Million	Overall reasonable but uses moderate distance of surface streets.
G	Fair – heavy left turns SB on Indianapolis at Michigan St. and NB at 129th.	Fair-Poor – removed from East Chicago industrial and residential areas.	Uses 7.7 miles of Michigan St. (US 20), Indianapolis, 129th, and Calumet.	Moderate – passes through downtown East Chicago on Indianapolis Blvd.	Fair	1	$55-59 Million	Low cost but does not adequately serve local trips and uses long distance of surface streets.

ALT.	MOBILITY	ACCESS & LAND USE SERVICE	USE OF SURFACE STREETS	NEIGHBORHOOD/ COMMUNITY INTRUSION	TRAVEL TIME	NUMBER OF MAJOR GRADE X-INGS	ESTIMATED COST (1), (2)	OVERALL EVALUATION
H	Fair-Good – heavy left turns SB on Calumet at Chicago	Fair-Poor – removed from East Chicago industrial and residential areas.	Uses 5.9 miles of Chicago and Calumet.	Significant – passes through downtown East Chicago on Chicago Ave.	Fair	4	$44-48 Million	Low cost but does not adequately serve through and local trips.
I	Fair – heavy left turns SB on Indianapolis at Columbus and NB at 129th, also requires rework of Kennedy connection to Columbus (grade separated).	Good	Uses 5.5 miles of Michigan Ave., Kennedy, Columbus, Indianapolis, 129th, and Calumet	Moderate	Fair at best	2	$44-48 Million	Uses long distance of surface streets with three difficult intersections.
J	Fair-Poor – heavy left turns SB on Calumet at 141st, requires rework of Kennedy connection to Columbus (grade separated), also requires railroad overpass to connect 141st to Columbus.	Good	Uses 5.0 miles of Michigan Ave., Kennedy, Columbus-141st, Indianapolis, and Calumet.	Severe – routes traffic in front of East Chicago High School.	Fair	2	$54-59 Million	Unacceptable due to routing past high school and overpass requirement.
K	Fair-Good - heavy left turns SB on Calumet at Michigan St.	Poor – far removed from East Chicago industrial and residential areas.	Uses 6.8 miles of Michigan St. (US 20) and Calumet.	Severe on Michigan St. between Indianapolis and Calumet.	Fair	2	$61-65 Million	Unacceptable due to poor service for local trips and degree of neighborhood intrusion.
L	Fair-Poor due to number of turns and requires rework of Kennedy connection to Columbus (grade separated).	Fair – removed from East Chicago industrial and residential areas.	Uses 6.7 miles of Gary, 148th, Kennedy, Columbus, Indianapolis, 129th, and Calumet.	Severe intrusion on 148th & portion of Kennedy.	Poor	2	$52-56 Million	Unacceptable due to indirectness of travel, inadequate service of though and local trips, and neighborhood intrusion.

(1) See **Appendix A** for planning level cost estimates of the alternatives.
(2) Demolition cost of existing SR 912 bridge is $32 Million for Alternative A, $39 Million for all other alternatives.
Alternative A replacement in kind reuses a portion of the existing structure, somewhat reducing demolition cost.

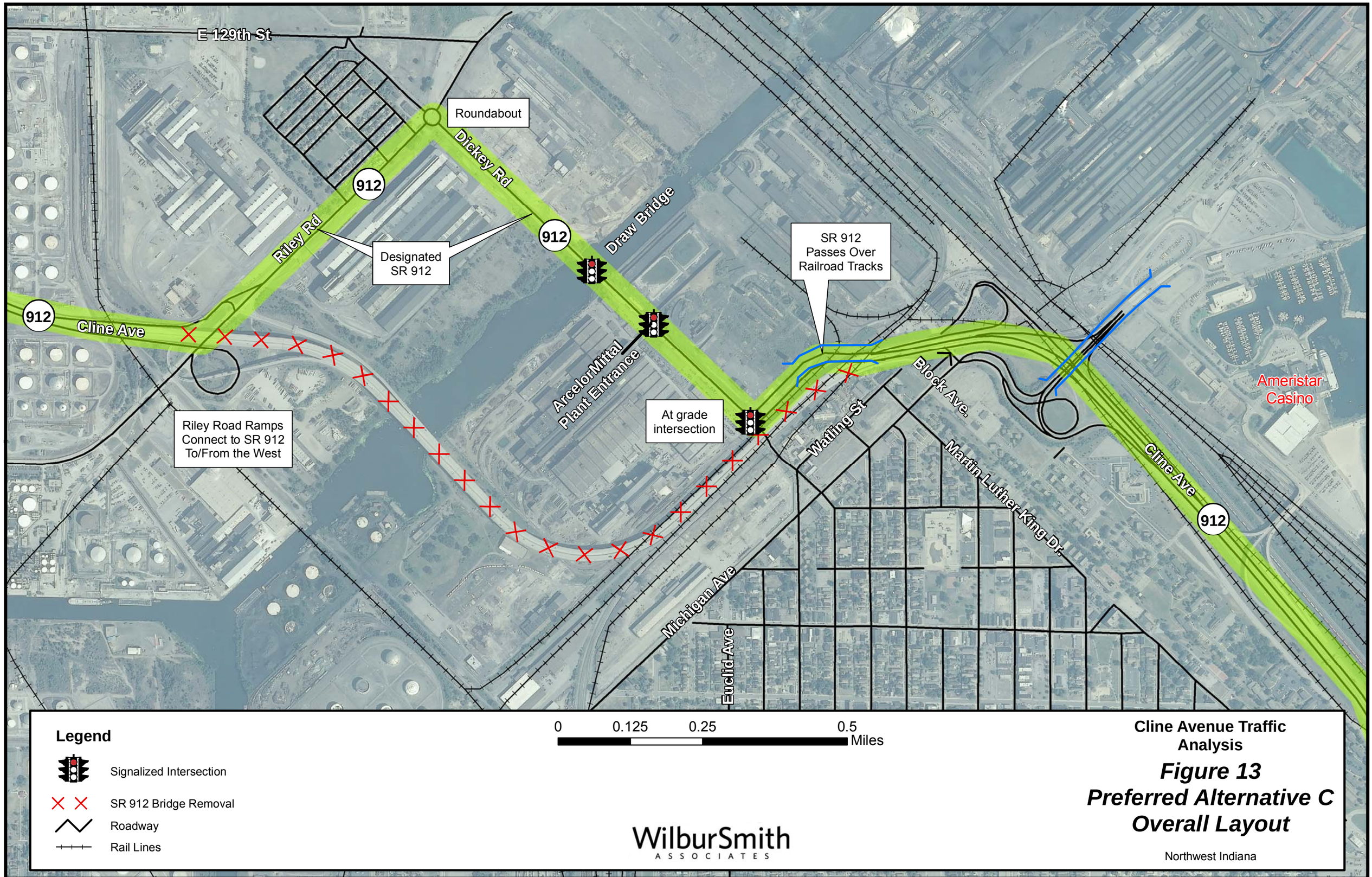
4 Preferred Alternative

The overall layout of Preferred Alternative C is presented on **Figure 13**. This alternative converts over 1.3 miles of currently local roads (Dickey Road and Riley Road) to INDOT jurisdiction and re-designates them as SR 912 between the touchdown of extended SR 912 with Dickey Road on the east and the SR 912/Riley interchange on the west. Key features of the alternative are as follows:

- East End. Extended SR 912 on the east end overpasses the three sets of railroad tracks that today lie more or less under the SR 912 bridge structure. The most critical grade crossing is with the Indiana Harbor Belt Railroad that carries approximately 28 trains per day (per *Technical Memorandum #1*, Table 1). It is important that SR 912 traffic not be disrupted by major rail activity for optimum traffic flow. SR 912 touches down with Dickey Road at a new intersection just northwest of the railroad tracks, as shown.
- Dickey Road Drawbridge. This routing uses the Dickey Road drawbridge over the Indiana Harbor Canal. As was discussed in *Technical Memorandum #1*, although bridge openings are infrequent, they can be lengthy with a few openings in excess of 20 minutes or more. It is important that active planning be undertaken to limit bridge openings to periods of low vehicle traffic, preferably overnight. This aspect is discussed further in **Section 6**.
- Dickey/Riley Intersection. Alternate design concepts have been considered for this intersection by comparing roundabout operations to signalized intersection operations, as detailed in **Section 6**. The results indicate that a fairly large diameter roundabout is the better choice.
- SR 912/Riley Interchange. The existing interchange connects to SR 912 both to the west and the east. In Alternative C, the connections to the east are removed and the connections to the SR 912 freeway to the west are rebuilt essentially in the same configurations that exist today.

Details of the intersections and roundabout are presented in **Section 6**.

The overall concept is to provide good through movement on the surface street portion while also offering reasonable access to, in particular, ArcelorMittal facilities along Dickey Road. Following sections consider future traffic volumes on the surface street portion and resulting operational performance.



Cline Avenue Traffic Analysis

Figure 13
Preferred Alternative C
Overall Layout

Northwest Indiana

5 Traffic Volume Forecasts

5.1 Data Sources

Traffic volumes were developed from two sources: intersection turning movement counts provided by INDOT and the Northwestern Indiana Regional Planning Commission (NIRPC) forecasts for the area. The INDOT counts were collected after SR 912 was closed between the Michigan/Block/SR 912 Ramp (Mill Interchange) and the SR 912/Calumet Interchange (see *Technical Memorandum #1*) for further discussion. NIRPC, as the official Metropolitan Planning Organization (MPO) for northwest Indiana, generates travel demand forecasts covering several planning horizons. NIRPC information was important to assure future volume forecasts were in line with area planning efforts. In addition, the need arose to adjust existing traffic volumes to account for the fact that at the time of the traffic counts, the SR 912/ Riley Interchange was not operational. The NIRPC forecasts offered insight into travel behavior and patterns with the interchange open.

NIRPC previously provided future year forecasts as the basis for *Traffic Volume Forecasting Report*, dated August 28, 2009 by PB. That report addressed future year scenarios with a removed SR 912 between the Mill Interchange and the SR 912/Riley Interchange, but with the second of these interchanges operational. Those 2009 forecasts therefore correspond to the same basic condition that will exist with Alternative C. For this effort, NIRPC provided detailed turning movement forecasts for three analysis horizons: 2010, 2020, and 2030. The data covered the study area intersections previously identified for this work and included an AM peak period, a PM peak period, and off-peak period volumes. For all three horizons, the forecasts covered the condition with SR 912 closed between the Mill Interchange and the SR 912/Riley Interchange. In addition, forecasts were provided for 2010 with the bridge open in order to see pattern changes brought about by the closure of the bridge.

The major task was to use these forecasts to adjust the INDOT traffic counts to reflect inclusion of the SR 912/Riley interchange. This was accomplished by inspecting the NIRPC forecasts to gather insight about travel patterns relative to the available count data. Initially, consideration was given to requesting NIRPC to re-run the travel demand model to reflect the detailed characteristics of Alternative C. It was apparent, however, that such an effort could not be completed in a timely manner to meet project schedule requirements. As a result, traffic adjustments to base year 2010 conditions were manually completed by adjusting existing volumes based on the information gleaned from inspection of the NIRPC forecasts.

5.2 Analysis Horizons and Growth Factors

On-going discussions with INDOT indicated that all of the key elements of Alternative C could be completed by roughly the summer or fall of 2012. It was decided that the initial analysis year would be 2013 to assure all parts of the alternative would be fully operational. For long range consideration, a 20 year planning horizon was selected, in this case 2033. This is consistent with US Department of Transportation planning requirements for projects that may make use of Federal funding.

The next consideration was the appropriate traffic growth rate or rates to apply. First, the August 28, 2009 *Traffic Volume Forecasting Report* was consulted. The appendix to that document

cited several growth rates, but then settled on a 1%/year straight-line rate as directed by INDOT. Thus that was the overall value applied here.

In addition, NIRPC provided socio-economic data for the study area for future year horizons covering population, households, and employment (see **Appendix B**). These data indicated that within the study area, there is little expected growth, in fact there may be a slight decline in activity. In light of the fact that much of SR 912 traffic is locally generated, it was judged that the 1%/year growth rate would be slightly high for the 2033 planning horizon. As a result, the assumed growth factors to extrapolate base year 2010 volumes to 2013 and 2033 were as follows:

- 2013: 2010 volumes x 1.03 (1%/year straight-line growth)
- 2033: 2010 volumes x 1.20 (slightly less than 1%/year straight-line growth).

5.3 Truck Percentages

In addition to total volume information, the *Traffic Volume Forecasting Report* included truck data apparently based on counts conducted in the spring of 2009. The truck data presented in the document appendix covered several intersections and interchanges, and in some cases the truck percentages were high, particularly in the Dickey Road and Riley Road area. This is consistent with observations on truck activity discussed in *Technical Memorandum #1*.

Because trucks impact operational performance and capacity, all pertinent truck data from the August 2009 report were incorporated in the traffic forecasts. The aim was to provide the most realistic characterization of traffic performance possible by including this comprehensive information.

5.4 2013 and 2033 Traffic Volume Forecasts

Traffic volume forecasts are presented at the beginning of **Appendix C** before the capacity analysis worksheets. Those graphics illustrate intersection turning movement volumes for the three time of day periods: am peak hour, early pm peak hour (PM1), and late pm peak hour (PM2), and cover the two analysis horizons of 2013 and 2033. Three analysis periods were used, as explained in *Technical Memorandum #1*, due to the fact that there are two distinct pm peak periods: one corresponding to shift change times particularly in the north portion of the study area (approximately 3:00 – 4:00 pm), and one corresponding to more usual pm peak conditions in the south portion of the study area (4:45 – 5:45 pm).

6 Operational Analyses and Related Considerations

The recommended short term improvements from *Technical Memorandum #2 – Short Range Improvements* were used as a base case for the operational analysis of the long term improvements. Three peak periods (AM, PM1 and PM2) were analyzed as described in **Section 5.4**. The Synchro software was again used to evaluate potential long range improvements. The forecasted traffic volumes for 2013 and 2033 were input into the short term Synchro model and then improvements were modeled to address any LOS E or worse conditions for individual movements. The following hierarchy of improvements was applied to achieve LOS D or better operations:

1. Intersection re-timings only
2. Intersection retimings and/or reassigned lane use within existing roadway footprint
3. Additional lane capacity and geometric improvements

The analyses were completed using the 2033 design year as a worst case. The assumption was made that all improvements would have a design life that would last until 2033. All improvements included in the 2033 Synchro model were then input into the 2013 horizon as a reference point for opening year traffic operations.

Peak Hour Factors (PHF) were kept the same as in the existing condition unless otherwise stated. Modifications were made on a case by case basis to address operational issues associated with unrealistically low PHFs. An example of this occurs when the majority of a low turning volume (5 vehicles) occurs within the 15 minute peak period, resulting in a very low PHF. When this low PHF is applied to a much larger forecast volume, resulting delays are unrealistically high due to inflated volume. In cases like this, the PHF was adjusted to the observed intersection average PHF. Intersections with adjusted PHFs were: S. Calumet Ave./131 St. (#1), and Indianapolis Blvd./Riley Rd. (#5).

It should be noted that intersections along Michigan Avenue were *not* included in the analyses (at Dickey Road, Martin Luther King Blvd., and Block St./SR 912 Ramps), despite the fact these three were included in the previous technical memoranda for existing and short range conditions. Under the Preferred Alternative, the heavy volumes previously using Michigan Avenue will be re-routed to the SR 912/Dickey intersection. The net volumes on Michigan Avenue are much less than under existing and short range conditions even in the 2033 horizon. As a result, the three intersections are omitted from long range consideration.

6.1 Recommended Improvements

Figures 14 through **22** present recommended intersection improvements on an individual site basis at those locations requiring some type of physical improvement, such as lane additions or restriping combined with signal retiming. Each figure typically illustrates changes to geometrics to increase the carrying capacity of the intersections.

6.1.1 Intersection #8 - Roundabout vs. Signalized Intersection

A roundabout and a signalized intersection were evaluated at the Dickey Rd. and Riley Rd. intersection to provide a comparison of alternatives. This location was identified to be a suitable intersection candidate for a roundabout given its uniform traffic patterns and potential for ROW purchase.

As previously described, a signal was first analyzed using Synchro software to determine required geometry to achieve acceptable LOS for each movement. The roundabout design was next analyzed using RODEL to determine the required geometry to achieve acceptable LOS per direction. RODEL is a software tool developed over several years in Great Britain and adapted for use in the US (Rodel Software Limited and Staffordshire County Council). RODEL analyzes delay by approach leg rather than by separate turning movement, because all approach leg movements tend to accept the same gap in traffic simultaneously (i.e., the left lane will proceed at the same time as the right lane). The following roundabout geometrics are determined from RODEL:

- Inscribed circle diameter – size of roundabout circulating roadway
- Approach width – width of roadway prior to roundabout
- Entry width – width of roadway at entry
- Flare length – length to transition from approach width to entry width
- Entry angle – angle between entering and exiting traffic
- Entry radius – radius of first curve prior to entering roundabout

The geometrics are developed initially using FHWA's *Roundabouts: An Informational Guide,* and Ourston's *Roundabout Design Guidelines.* Several checks are then applied to roundabouts to ensure a safe design:

- Fastest vehicle path – the maximum speed a vehicle can travel when taking the shortest path through a roundabout and not adhering to lane markings, and
- Vehicle path overlap – avoidance of vehicles cutting each other off by aligning entry angle properly (typically 20 degrees).

A comparison of the two intersection alternatives at the Dickey/Riley intersection shows an overall average of LOS A for the roundabout vs. LOS C for the signalized intersection (presented below). Based on this LOS analysis and expected safety benefits, a roundabout is recommended at the Dickey/Riley intersection. Safety benefits should accrue because of the elimination of virtually all 90 degree crossing and left turn accidents with a roundabout.

6.1.2 Failed Intersections

For two cases the intersection failed and would require significant geometric improvements to reach an acceptable LOS. The need for these improvements relates to traffic growth not associated with the Preferred Alternative, and both cases would require significant right-of-way. If traffic forecasts hold true in the future, improvements at these locations should be considered as part of other studies. Specific information on these two follows.

Calumet Ave./Chicago Ave. Intersection (#4)

- Synchro analysis was done indicating that every leg would require multiple lane additions, in some cases resulting in an 8-lane cross section
- Considered dangerous for pedestrians.
- Substantial ROW required in a built up area.
- 2033 PM2 peak failing movements included EB left, EB thru, WB left, WB thru, NB thru, SB left and SB thru; the SB left also operated at LOS E during the PM1 period.
- 2013 PM2 peak failing movements included EB, WB, and SB lefts; LOS E operations resulted for the EB thru and NB thru+right.
- This intersection also failed under existing traffic conditions.

Indianapolis Blvd./Chicago Ave.(#7)

- The vicinity is heavily developed with commercial businesses bordering the ROW line/sidewalk on all quadrants. Any geometric improvements beyond the short term recommendations would be very costly.
- Elimination of on street parking could add some additional capacity but alternative parking may need to be provided.
- 2033 PM1 experienced LOS E operations for the EB thru, WB thru+right, and the SB thru movements.
- 2013 operated at an acceptable LOS for all movements.

6.2 2013 and 2033 Capacity Analyses

Tables 1 through **6** present the results of 2013 and 2033 capacity analyses incorporating the recommended improvements. As can be seen, except for intersections #4 and #7, all movements operate at LOS D or better in both horizons and all time of day periods. There is one instance of LOS E operation for the westbound left at the Dickey/Riley intersection in the 2033 AM period in the signalized configuration, but the affected volume is very low (26 vehicles/hour) and LOS E is deemed acceptable. In general, since volume growth between 2013 and 2033 is moderate, LOSs do not change drastically over the 20 year period.

Figure 14 Recommended Long Range Improvements for Indianapolis Ave./Riley Rd. (#5)

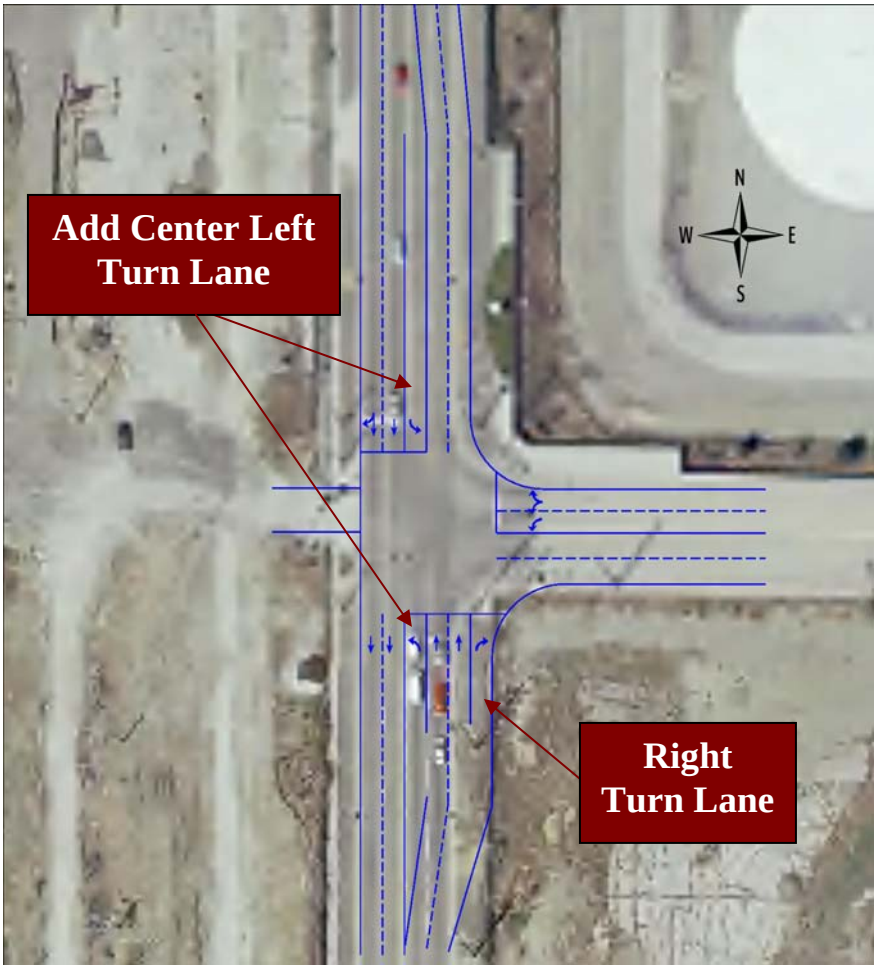


Figure 14 presents the recommended improvements to make all movements operate at LOS D or better. These include:

- Add NB right-turn lane
- Add SB center-left turn lane
- Add NB center-left turn lane for lane balancing only (not for capacity)
- lengthened signal cycle length to 108 seconds

Figure 15 Recommended Long Range Improvements for Indianapolis Ave./Columbus Dr. (#6)

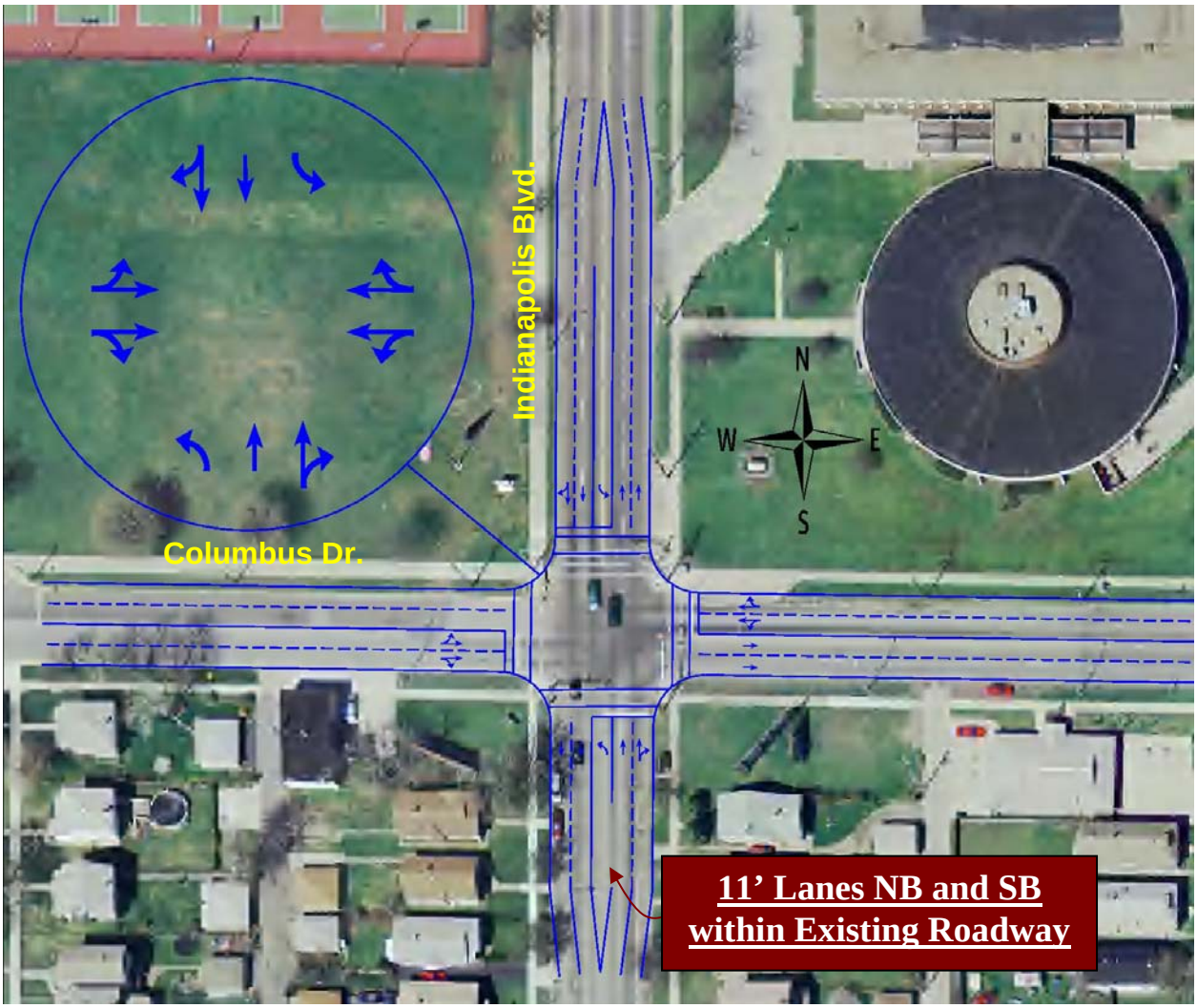


Figure 15 represents the recommended improvements to make all movements operate at LOS D or better. These include:

- Add NB left-turn lane
- Add SB left turn Lane
- Converted existing north-south lanes to 11 ft width to accommodate additional capacity (existing roadway width = 55')
- Eliminate on street parking where in conflict with additional capacity.

Figure 16 Recommended Long Range Improvement for Dickey Rd./Riley Rd. (#8) – Roundabout

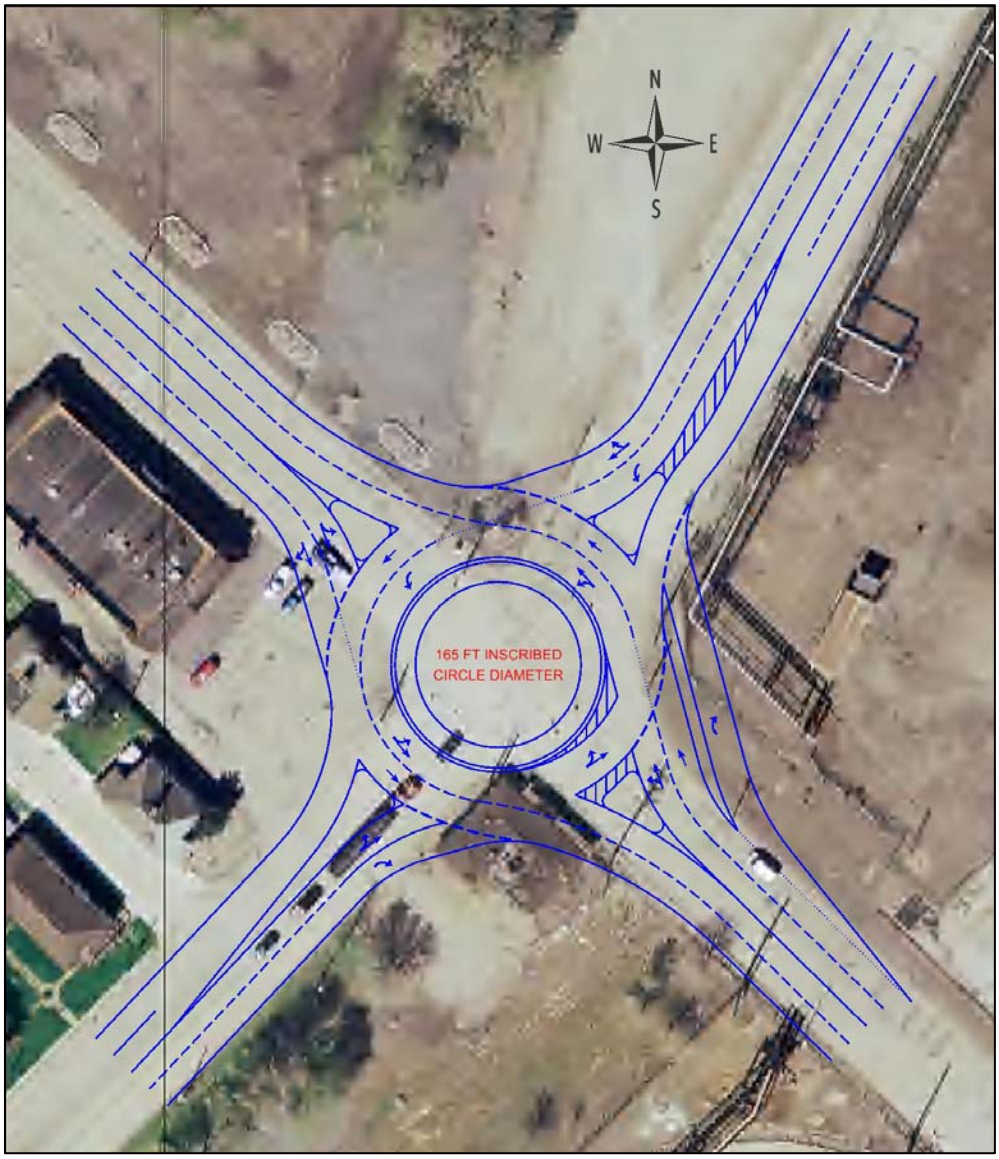
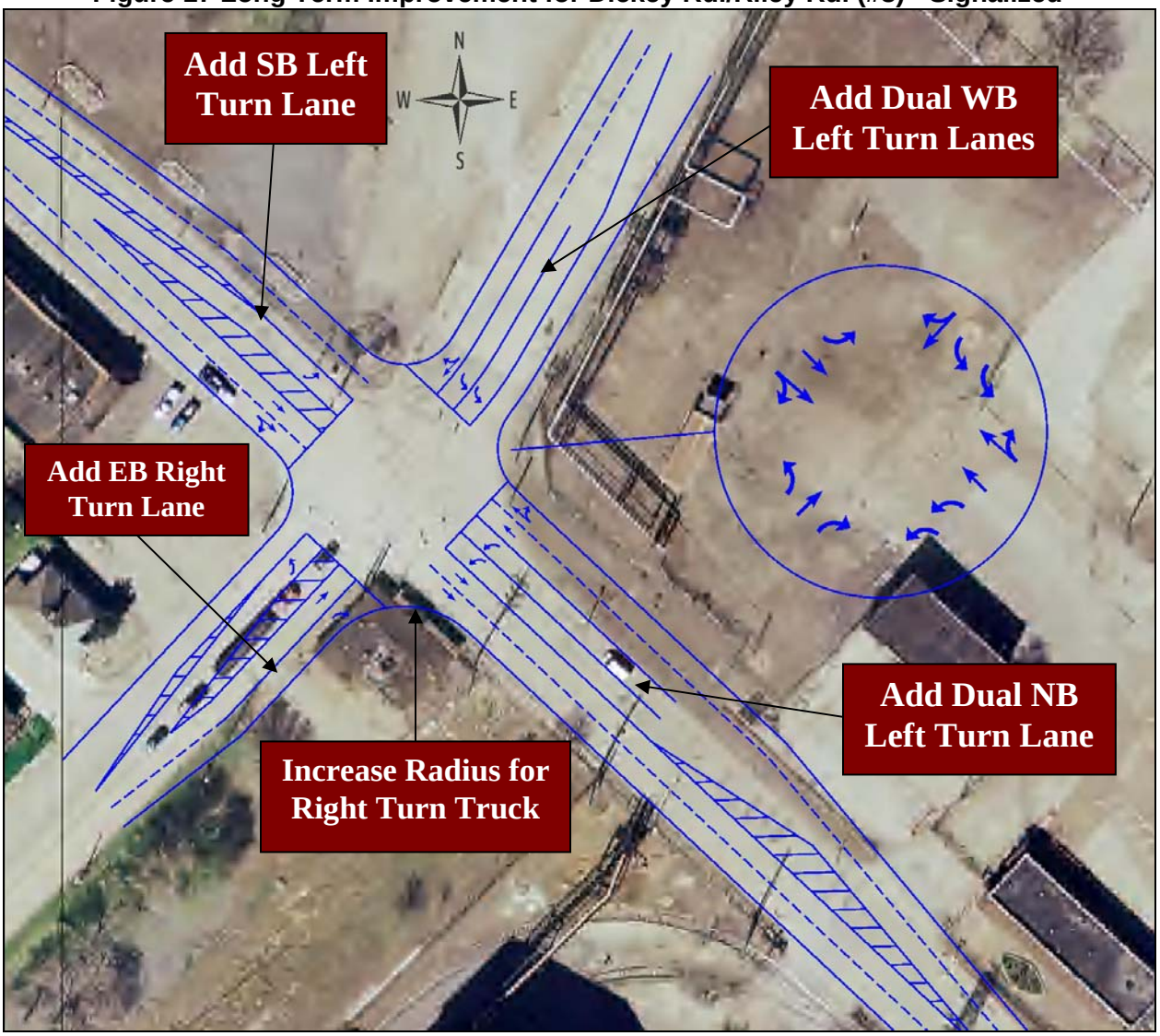


Figure 16 represents the recommended improvements to make all movements operate at LOS B or better for a modern roundabout, and LOS A for the roundabout as a whole. Roundabout impacts include:

- Slower vehicle speeds than at a signalized intersection reduce the severity of crashes, and side impact crashes are mostly eliminated
- Increased pedestrian safety because of reduced vehicle speeds, fewer vehicle conflict points, and shorter crossing distances
- Reduced delay to all vehicles as most do not make a complete stop
- ROW impacts to all four quadrants
- Reduced air pollution from vehicle emissions
- Allows for u-turn traffic.

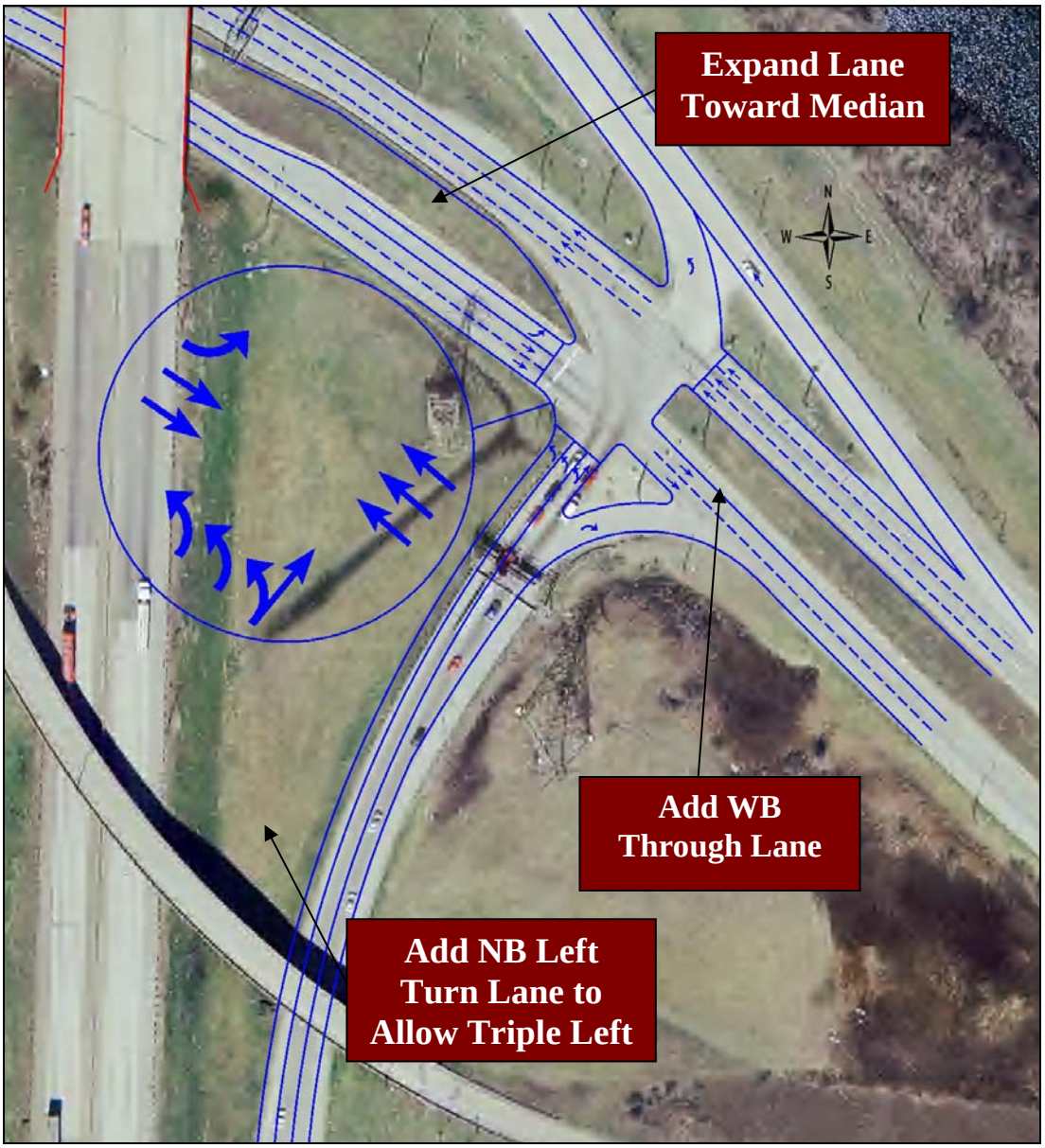
Figure 17 Long Term Improvement for Dickey Rd./Riley Rd. (#8) - Signalized



For comparison, **Figure 17** represents the recommended improvements to make all movements and the intersection as a whole operate at LOS D or better as a signalized intersection. These would include:

- Add dual NB left-turn lane
- Add SB left-turn lane for lane balancing only
- Add dual WB left-turn lanes
- Add EB right-turn lane
- Provide 80 ft radius for EB right turning trucks
- ROW required to north and east

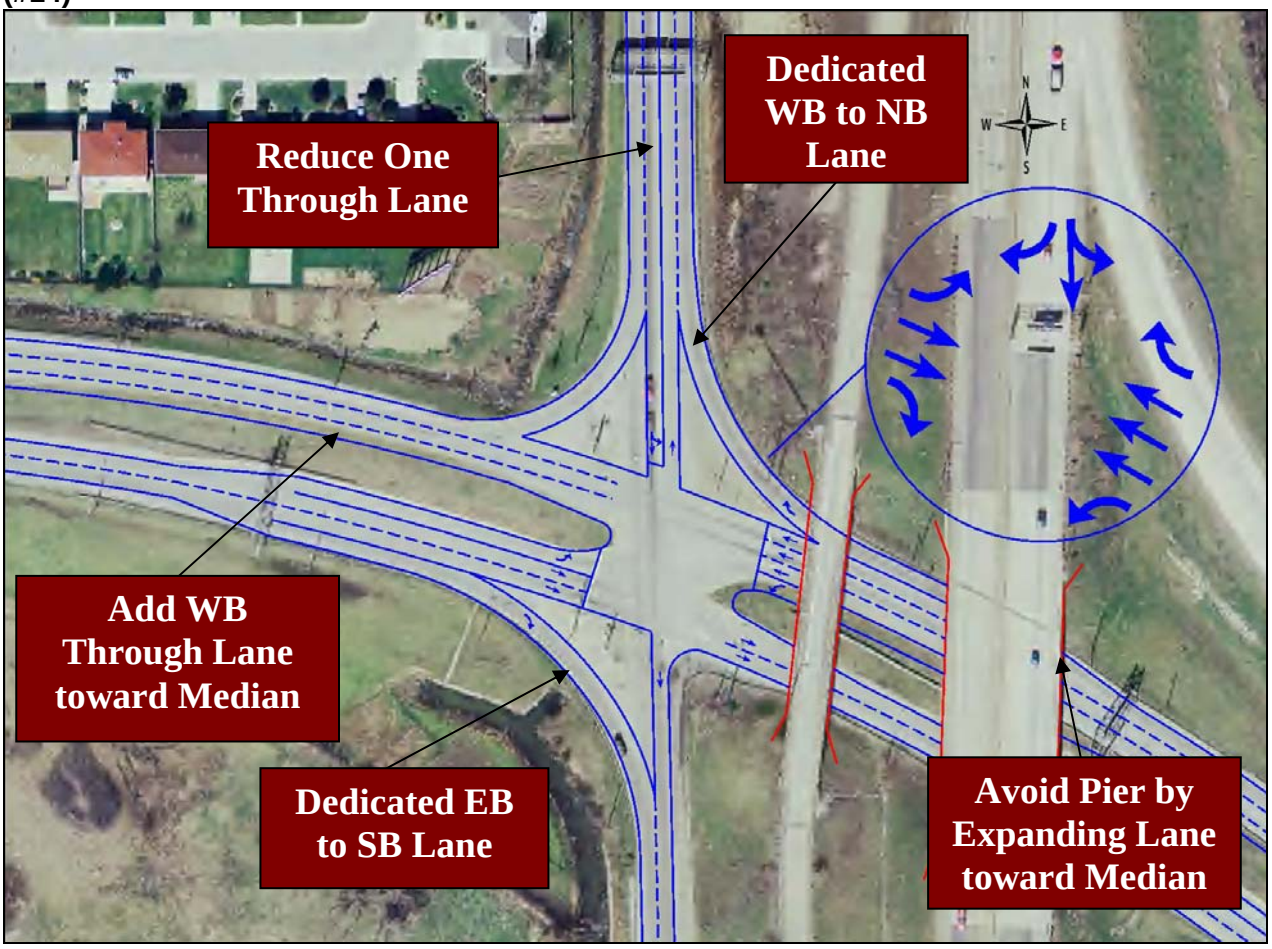
Figure 18 Long Term Improvement for US 12 (Columbus) & SR 912 East Service Road (#13)



For comparison, **Figure 18** represents the recommended improvements to make all movements and the intersection as a whole operate at LOS D or better as a signalized intersection. These would include:

- Add NB left-turn lane to allow triple left turning traffic
- Add WB through lane with expansion to median side
- No additional ROW required

Figure 19 Long Term Improvement for US 12 (Columbus) & SR 912 West Service Road (#14)



For comparison, **Figure 19** represents the recommended improvements to make all movements and the intersection as a whole operate at LOS D or better as a signalized intersection. These would include:

- Eliminate one SB through lane
- Convert one SB through lane on south leg to a receiving lane for the EB to SB movement
- Add WB through lane expanded to median to avoid adjacent piers (US 12 westbound widens to 3 lanes just west of the intersection)
- Convert One NB through lane on north leg to a dedicated receiving lane for the WB to NB movement

Figure 20 Recommended Long Term Improvement for SR 912/West Riley Ramp Terminus (#19)

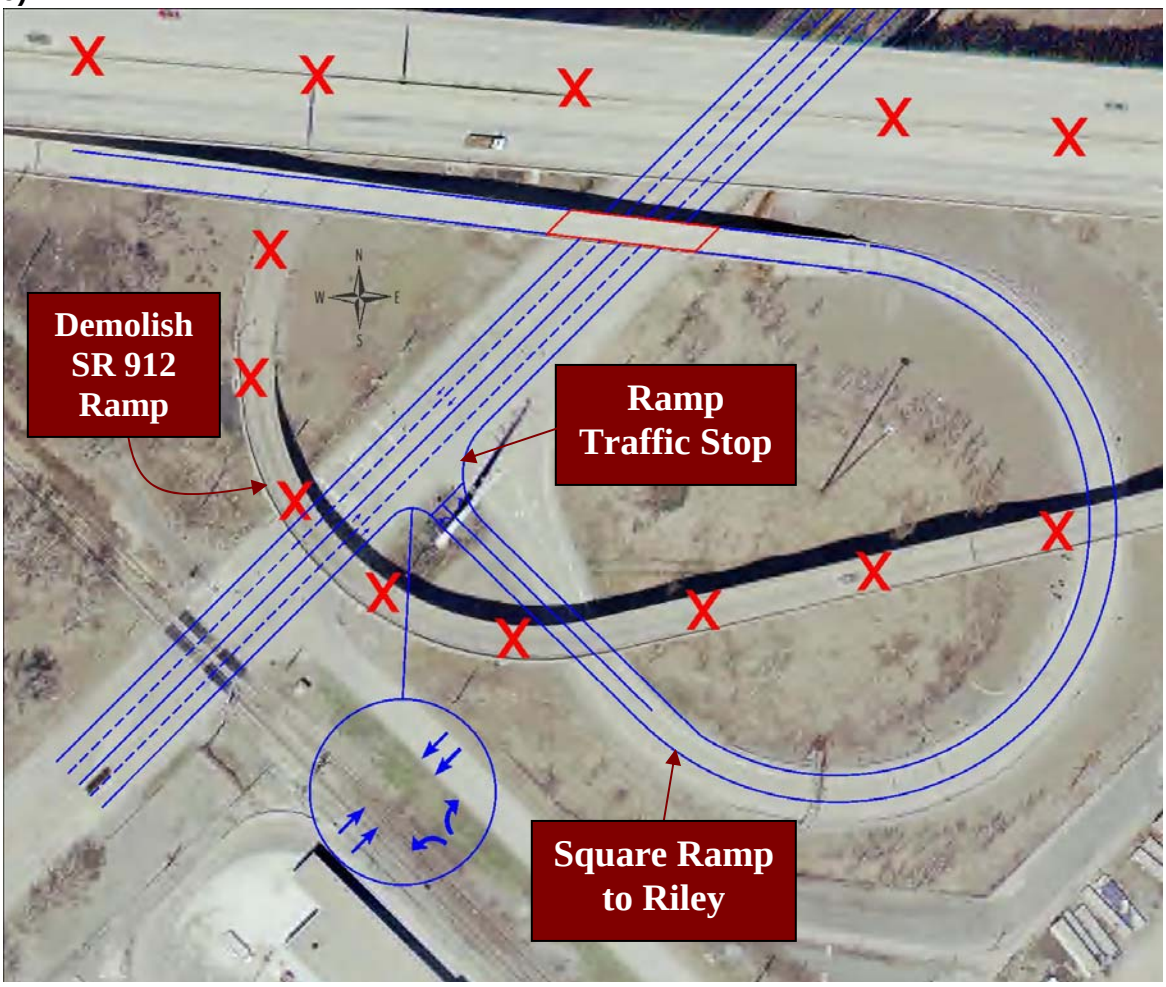


Figure 20 presents the recommended improvements to make all movements operate at LOS D or better, representing essentially the same geometry that exists at the intersection today. Actions include:

- Demolish Structures as shown
- Stop control for ramp traffic, unsignalized
- Square terminus to Riley for optimal sight distance.

Figure 21 Recommended Long Term Improvement for SR 912/East Riley Ramp Terminus (#20)

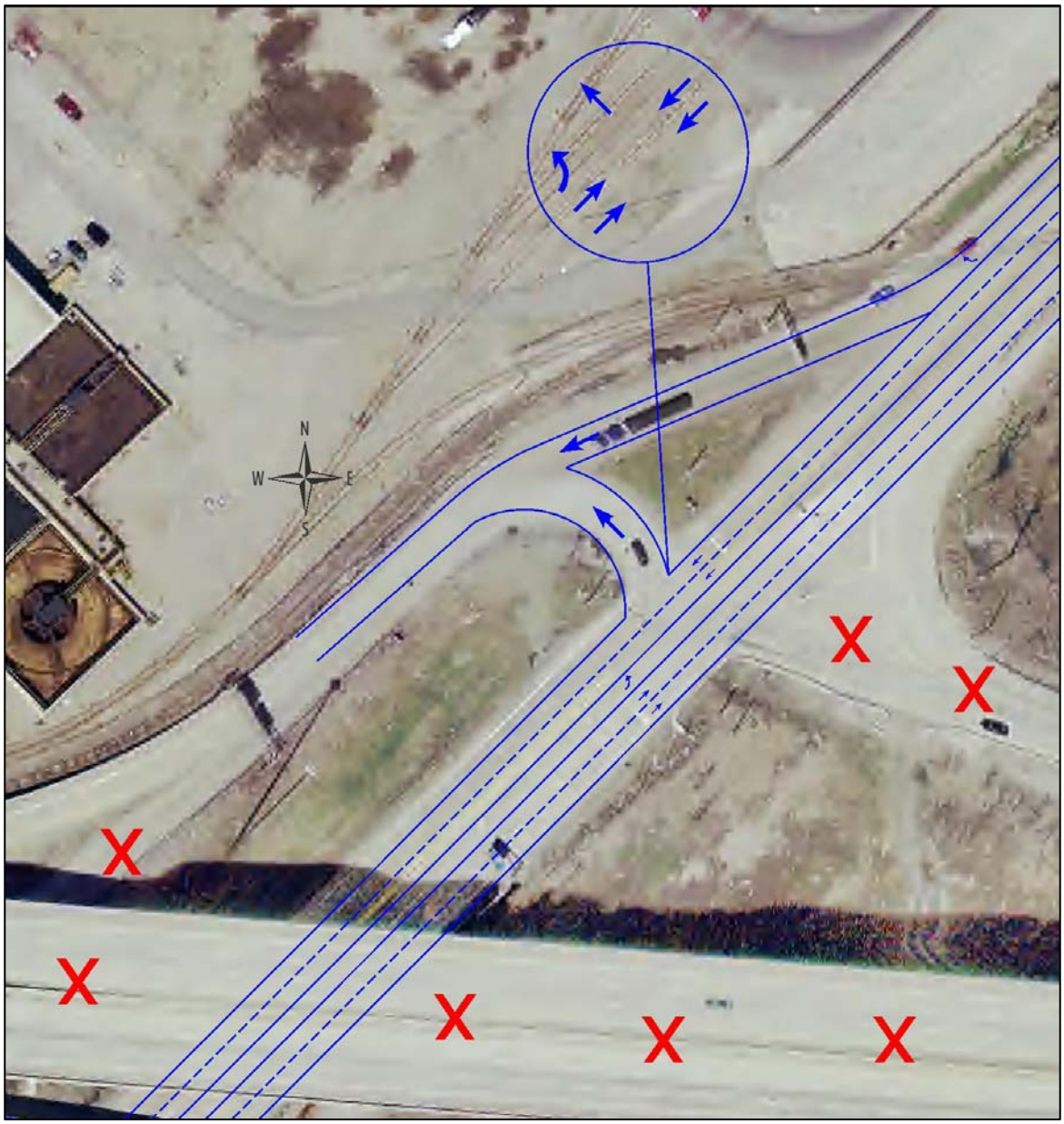


Figure 21 represents the recommended improvements to make all movements operate at LOS D or better, representing essentially the same geometry that exists at the intersection today. Actions include:

- Demolish Structures and ramp as shown
- Yield for northeast bound Riley traffic turning left onto WB SR 912 ramp
- Unsignalized.

Figure 22 Recommended Long Term Improvement for Dickey.Rd./ East SR 912 Terminus (#21)

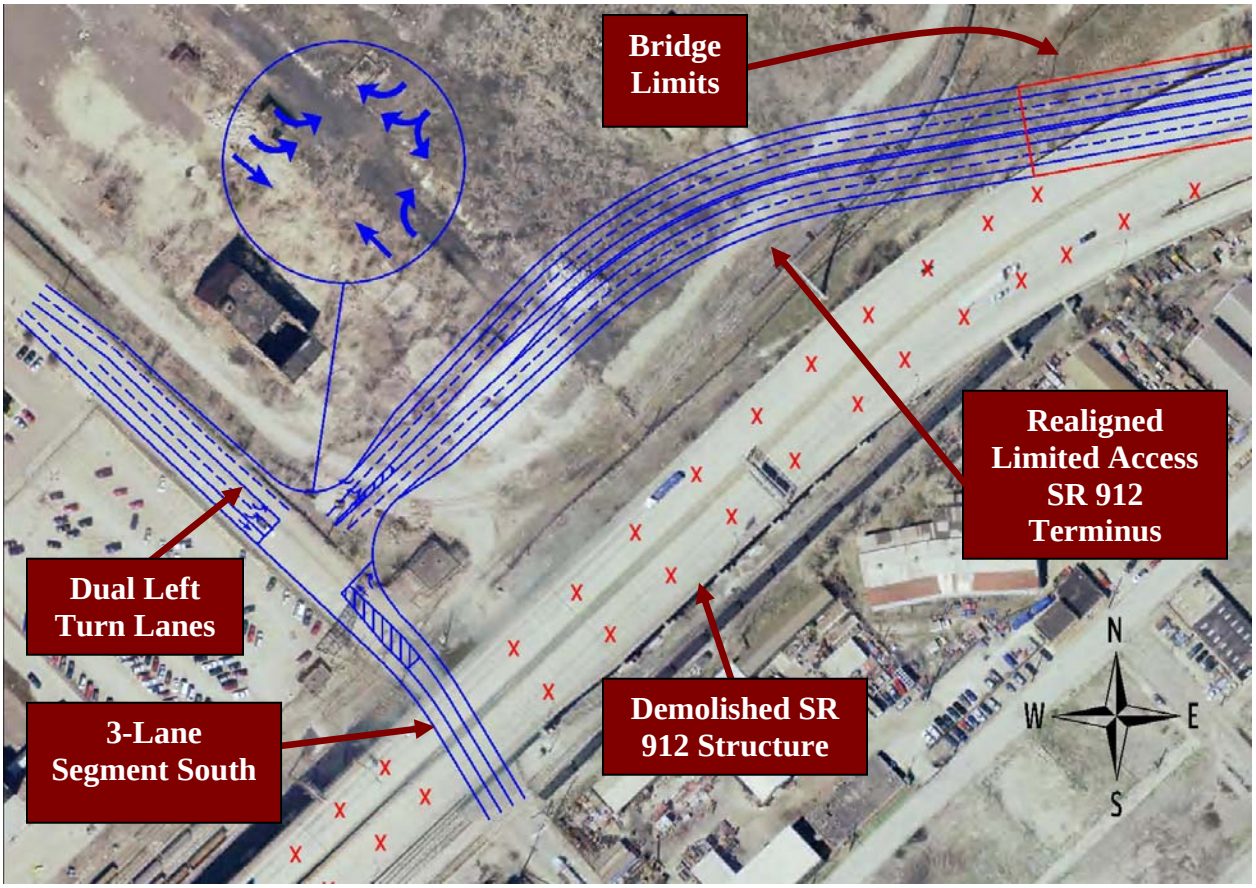


Figure 22 represents the new signalized intersection at the terminus of realigned SR 912. All movements operate at LOS D or better with the following lane configuration:

- SB dual left-turn lane to SR 912, with single SB through lane
- NB single through lane, with channelized right turn taper
- Large 80 ft NB right turn radius
- WB right turn lane and shared right-left turn lane
- ROW required.

INDOT has undertaken design of this intersection with essentially the above lane configuration except that the southbound approach has only a left turn lane and a shared through-left turn lane. Thus the *additional* improvement over INDOT's design consists of one extra through lane southbound.

Table 2 AM Peak Hour Level of Service and Delay (seconds per vehicle) – 2013 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	37.4/D			37.2/D			3.7/A	7.7/A	4.4/A	4.5/A	4.0/A		8.4/A
								7.5/A			4.1/A			
2	US 41 (Calumet) & 141st	14.7/B	14.7/B		15.4/B	15.4/B	34.5/C	22.3/C	29.2/C		17.5/B	16.3/B		26.4/C
		14.7/B			30.0/C			29.0/C			16.6/B			
3	US 41 (Calumet) & 142nd	32.3/C			32.3/C	30.5/C		2.8/A	3.9/A		3.1/A			5.8/A
					31.8/C			3.9/A						
4	US 41 (Calumet) & SR 312 (Chicago)	29.7/C	33.4/C	31.5/C	29.6/C	34.0/C	32.1/C	8.4/A	12.6/B		7.1/A	9.6/A	8.8/A	18.5/B
		32.5/C			32.8/C			12.4/B			9.1/A			
5	US 12/20 (Indianapolis) & Riley Road	0.0/A			29.5/C	29.0/C		7.4/A	16.6/B	9.6/A	11.9/B	5.6/A		14.2/B
					29.3/C			15.1/B			6.5/A			
6	US 12/20 (Indianapolis) & Columbus	27.8/C			34.6/C			11.1/B	19.5/B		11.5/B	8.7/A		21.9/C
								19.4/B			9.7/A			
7	US 20 (Indianapolis) & SR 312 (Chicago)	20.1/C	24.9/C	23.0/C	22.0/C	26.2/C		16.4/B	28.5/C		20.3/C	21.4/C	20.6/C	25.7/C
		23.6/C			25.8/C			27.6/C			21.0/B			
8	Riley Road & Dickey Road (Signalized)	25.9/C	30.5/C	24.3/C	45.4/D	17.9/B		31.5/D	19.2/C		19.9/B	18.9/B		22.6/C
		27.1/C			38.1/D			21.0/C			19.0/B			
8	Riley Road & Dickey Road (Roundabout)	3/A			4.8/A			15/B			2.4/A			11/B
11	Euclid Avenue & US 12 (Columbus)	11.6/B	12.9/B		10.6/B	19.5/B		34.3/C			26.0/C			21.9/C
		12.7/B			19.2/B									
12	Euclid Avenue & SR 312 (Chicago)	7.0/A	4.8/A		12.1/B	15.2/B		25.4/C	25.3/C		19.1/B	18.4/B		12.9/B
		6.0/A			15.2/B			25.3/C			18.6/B			
13	US 12 (Columbus) & SR 912 East Service Road	19.0/B	18.2/B		33.2/C			34.6/C	37.5/D					33.7/C
		18.5/B						35.5/D						
14	US 12 (Columbus) & SR 912 West Service Road	27.5/C	22.6/C	0.3/A	32.9/C	43.7/D	0.4/A				23.2/C		20.0/C	26.0/C
		10.1/B			31.6/C						22.1/C			
15	SR 312 (Chicago) & SR 912 East Service Road	5.7/A	5.8/A		14.4/B			15.7/B	15.3/B					14.1/B
		5.7/A						15.5/B						
16	SR 312 (Chicago) & SR 912 West Service Road	13.9/B		13.9/B	18.8/B	22.1/C					12.1/B			19.2/B
		13.9/B			21.9/C									
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							12.8/B		11.5/B				11.6/B
								11.6/B						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	7.6/A												7.6/A
21	Dickey Road & SR 912	18.7/B	5.8/A		33.9/C						44.2/D		17.0/B	29.2/C
		16.1/B									30.6/C			
22	SR 912 & Calumet North Ramp				41.8/D				7.9/A	3.1/A	4.4/A	3.6/A		11.5/B
									7.8/A		3.7/A			

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Table 3 Early PM Peak Hour Level of Service and Delay (seconds per vehicle) – 2013 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	36.0/D			40.5/D			7.4/B	8.8/B	6.8/B	4.0/A	9.0/A		10.2/B
								8.6/A			8.4/A			
2	US 41 (Calumet) & 141st	28.9/C	28.0/C		28.0/C	29.0/C	27.8/C	15.4/B	14.8/B		6.4/A	6.4/A		14.9/B
		28.3/C			28.1/C			14.9/B			6.4/A			
3	US 41 (Calumet) & 142nd	25.3/C			25.0/C	23.0/C		4.7/A	5.0/A		4.9/A			8.3/A
					24.4/C			5.0/A						
4	US 41 (Calumet) & SR 312 (Chicago)	36.1/D	47.3/D	38.4/D	40.3/D	43.9/D	33.8/C	25.0/C	31.7/C		27.4/C	25.6/C	15.4/B	33.2/C
		43.5/D			41.9/D			31.1/C			25.4/C			
5	US 12/20 (Indianapolis) & Riley Road	47.1/D			27.4/C	22.4/C		17.7/C		14.5/B	11.7/B	20.2/C		20.0/B
					25.0/C			17.4/C			19.9/B			
6	US 12/20 (Indianapolis) & Columbus	24.6/C			32.8/C			16.8/B	21.5/C		12.7/C	14.5/B		20.2/C
								21.3/C			14.0/B			
7	US 20 (Indianapolis) & SR 312 (Chicago)	28.9/C	36.3/D	27.2/C	33.7/C	37.4/D		38.9/D	33.2/C		22.6/C	40.0/D	26.5/C	34.9/C
		33.4/C			36.6/D			34.2/C			35.4/D			
8	Riley Road & Dickey Road (Signalized)	28.7/C	28.5/C	38.2/D	39.1/D	16.6/B		39.4/D	12.3/B		22.3/C	34.6/C		32.8/C
		38.0/D			33.3/C			26.8/C			34.5/C			
8	Riley Road & Dickey Road (Roundabout)	3/A			3.6/A			2.4/A			4.2/A			3.3/A
11	Euclid Avenue & US 12 (Columbus)	8.9/A	23.9/C		16.3/B	14.6/B		36.4/D			44.2/D			24.7/C
		22.4/C			14.8/B									
12	Euclid Avenue & SR 312 (Chicago)	10.1/B	8.6/A		17.9/B	19.7/B		24.5/C	24.4/C		17.5/B	16.2/B		13.6/B
		9.1/A			19.7/B			24.4/C			16.5/B			
13	US 12 (Columbus) & SR 912 East Service Road	9.2/A	9.9/A		25.1/C			18.6/B	18.9/B					18.1/B
		9.9/A						18.7/B						
14	US 12 (Columbus) & SR 912 West Service Road	17.3/B	15.6/B	1.3/A	26.7/C	27.6/C	0.4/A				25.9/C		16.2/B	13.8/B
		6.5/A			15.4/B						23.0/C			
15	SR 312 (Chicago) & SR 912 East Service Road	3.7/A	3.6/A		9.0/A			19.5/B	18.2/B					11.4/B
		3.6/A						18.8/B						
16	SR 312 (Chicago) & SR 912 West Service Road	9.7/A		10.6/B	6.9/A	8.5/A					16.2/B	20.0/C		11.2/B
		10.3/B			8.1/A						19.9/B			
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							10.4/B		10.2/B				10.2/B
								10.2/B						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	8.0/A												8.0/A
21	Dickey Road & SR 912	19.7/B	3.8/A		32.0/C						39.2/D		5.1/A	18.0/B
		16.3/B									22.5/C			
22	SR 912 & Calumet North Ramp				28.6/C				2.5/A	2.0/A	2.2/A	3.8/A		4.5/A
									2.5/A			3.8/A		

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Source: Higway Capacity Manual 2000, Exhibit 16-2

Table 4 Late PM Peak Hour Level of Service and Delay (seconds per vehicle) – 2013 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	27.2/C			41.4/D			9.7/A	11.8/B	9.5/A	5.6/A	11.7/B		13.3/B
								11.6/B			10.9/B			
2	US 41 (Calumet) & 141st	32.4/C	31.7/C		30.5/C	29.3/C	28.0/C	15.8/B	14.9/B		6.6/A	6.0/A		15.4/B
		32.0/C			28.8/C			15.0/B			6.2/A			
3	US 41 (Calumet) & 142nd	22.1/C			28.0/C	21.1/C		8.0/A	7.8/A		8.2/A			11.7/B
					25.9/C			7.8/A						
4	US 41 (Calumet) & SR 312 (Chicago)	80.6/F	77.8/E	39.1/D	176.9/F	53.2/D	33.4/C	33.4/C	73.3/E		128.2/F	38.4/D	15.7/B	70.4/E
		74.2/E			91.2/F			71.3/E			55.0/E			
5	US 12/20 (Indianapolis) & Riley Road	0.0/A			21.9/C	21.8/C		18.3/B		13.4/B	11.1/B	24.3/C		22.0/C
					21.9/C			18.0/B			24.0/C			
6	US 12/20 (Indianapolis) & Columbus	25.1/C			35.1/D			18.3/B	22.8/C		15.0/B	11.7/B		19.9/B
								22.7/C			12.9/B			
7	US 20 (Indianapolis) & SR 312 (Chicago)	28.1/C	38.6/D	33.5/C	28.0/C	39.2/D		25.6/C	28.1/C		21.7/C	35.2/D	26.6/C	32.8/C
		35.7/D			36.9/D			27.5/C			32.2/C			
8	Riley Road & Dickey Road (Signalized)	29.9/C	30.0/C	31.4/C	32.7/C	17.1/B		33.5/C	10.8/B		18.6/B		27.8/C	26.1/C
		31.3/C			29.0/C			19.2/B			27.8/C			
8	Riley Road & Dickey Road (Roundabout)	3/A			3/A			3/A			3.6/A			2.9/A
11	Euclid Avenue & US 12 (Columbus)	8.3/A	23.2/C		16.0/B	14.1/B		38.7/D			38.2/D			22.7/C
		21.6/C			14.4/B									
12	Euclid Avenue & SR 312 (Chicago)	8.1/A	7.2/A		16.0/B	17.5/B		24.0/C	24.0/C		16.1/B	15.6/B		12.6/B
		7.5/A			17.4/B			24.0/C			15.7/B			
13	US 12 (Columbus) & SR 912 East Service Road	11.8/B	12.5/B		35.6/D			21.7/C	22.1/C					22.5/C
		12.5/B						21.8/C						
14	US 12 (Columbus) & SR 912 West Service Road	21.8/C	19.7/B	1.7/A	39.3/D	42.9/D	0.4/A				29.7/C		18.1/B	18.1/B
		8.0/A			24.7/C						26.9/C			
15	SR 312 (Chicago) & SR 912 East Service Road	4.7/A	4.5/A		9.2/A			17.7/B	16.9/B					11.4/B
		4.6/A						17.3/B						
16	SR 312 (Chicago) & SR 912 West Service Road	9.9/A		10.9/B	6.8/A	8.5/A					15.2/B	18.7/C		11.3/B
		10.7/B			8.2/A						18.5/B			
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							10.4/B		9.5/A				9.7/A
								9.7/A						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	8.0/A												8.0/A
21	Dickey Road & SR 912	19.9/B	3.7/A		31.8/C						38.1/D		5.0/A	18.2/B
		16.7/B									22.0/C			
22	SR 912 & Calumet North Ramp				23.7/C				2.1/A	1.7/A	1.9/A	3.0/A		3.7/A
								2.1/A			3.0/A			

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Source: Higway Capacity Manual 2000, Exhibit 16-2

Table 5 AM Peak Hour Level of Service and Delay (seconds per vehicle) – 2033 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	36.9/D			36.6/D			3.6/A	9.2/A	4.5/A	7.1/A	4.5/A		9.5/A
								8.8/A			5.0/A			
2	US 41 (Calumet) & 141st	13.8/B	13.8/B		14.6/B	14.6/B	54.4/D	25.3/C	37.6/D		23.3/C	19.2/B		36.3/D
		13.8/B			44.9/D			37.2/D			20.1/C			
3	US 41 (Calumet) & 142nd	33.0/C			32.3/C	30.9/C		2.8/A	4.2/A		3.2/A			6.1/A
					31.9/C			4.2/A						
4	US 41 (Calumet) & SR 312 (Chicago)	35.0/C	39.2/D	36.5/D	32.9/C	38.7/D	36.3/D	8.4/A	12.9/B		7.2/A	9.5/A	8.6/A	20.2/C
		38.1/D			37.2/D			12.7/B			9.0/A			
5	US 12/20 (Indianapolis) & Riley Road	0.0/A			29.2/C	28.6/C		6.7/A	20.5/C	9.2/A	15.8/B	5.0/A		16.5/B
					28.9/C			18.0/B			6.5/A			
6	US 12/20 (Indianapolis) & Columbus	28.4/C			43.1/D			11.0/B	22.0/C		22.8/C	9.3/A		26.2/C
								21.9/C			14.1/B			
7	US 20 (Indianapolis) & SR 312 (Chicago)	25.5/C	31.3/C	28.4/C	26.8/C	33.1/C		15.6/B	28.1/C		19.2/B	18.7/B	18.0/B	27.5/C
		29.7/C			32.4/C			27.2/C			18.6/B			
8	Riley Road & Dickey Road (Signalized)	33.2/C	50.1/D	29.1/C	59.8/E	21.1/C		40.1/D	27.9/C		20.6/C	18.5/B		31.1/C
		38.5/D			49.4/D			29.7/C			18.6/B			
8	Riley Road & Dickey Road (Roundabout)	4.2/A			4.8/A			17.4/B			1.8/A			11.6/B
11	Euclid Avenue & US 12 (Columbus)	14.6/B	13.7/B		10.9/B	22.5/C		40.3/D			27.2/C			25.1/C
		13.9/B			22.2/C									
12	Euclid Avenue & SR 312 (Chicago)	8.4/A	4.6/A		12.5/B	16.6/B		27.5/C	27.3/C		21.2/C	20.3/C		14.2/B
		6.6/A			16.6/B			27.4/C			20.5/C			
13	US 12 (Columbus) & SR 912 East Service Road	22.4/C	20.8/C		38.5/D			46.6/D	52.0/D					44.2/D
		21.3/C						48.4/D						
14	US 12 (Columbus) & SR 912 West Service Road	40.6/D	25.8/C	0.3/A	36.4/D	52.3/D	0.4/A				24.8/C		21.2/C	30.6/C
		12.8/B			37.8/D						23.5/C			
15	SR 312 (Chicago) & SR 912 East Service Road	5.5/A	5.7/A		15.7/B			18.6/B	18.0/B					16.4/B
		5.6/A						18.3/B						
16	SR 312 (Chicago) & SR 912 West Service Road	14.5/B		14.5/B	21.2/C	25.4/C					13.6/B			21.8/C
		14.5/B			25.1/C									
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							13.2/B		11.9/B				12.1/B
								12.1/B						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	7.6/A												7.6/A
21	Dickey Road & SR 912	21.5/C	8.3/A		43.6/D						54.1/D		23.7/C	37.0/D
		18.9/B									38.9/D			
22	SR 912 & Calumet North Ramp				48.9/D				12.1/B	3.5/A	6.7/A	4.4/A		15.4/B
								11.9/B			4.5/A			

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Source: Higway Capacity Manual 2000, Exhibit 16-2

Table 6 Early PM Peak Hour Level of Service and Delay (seconds per vehicle) – 2033 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	34.9/C			37.4/D			13.2/B	14.4/B	10.6/B	8.0/A	13.9/B		14.8/B
								14.1/B			13.2/B			
2	US 41 (Calumet) & 141st	30.4/C	29.4/C		29.3/C	30.5/C	29.2/C	18.0/B	16.1/B		7.6/A	7.1/A		16.1/B
		29.8/C			29.5/C			16.3/B			7.2/A			
3	US 41 (Calumet) & 142nd	26.2/C			26.1/C	23.3/C		5.1/A	5.3/A		5.2/A			8.7/A
					25.3/C			5.3/A						
4	US 41 (Calumet) & SR 312 (Chicago)	41.7/D	50.2/D	38.2/D	54.7/D	44.3/D	32.5/C	33.7/C	49.4/D		55.6/E	40.2/D	18.1/B	45.1/D
		46.7/D			46.6/D			48.1/D			41.7/D			
5	US 12/20 (Indianapolis) & Riley Road	45.3/D			26.1/C	20.5/C		21.0/C		16.4/B	13.4/B	29.6/C		26.1/C
					23.4/C			20.6/C			29.0/C			
6	US 12/20 (Indianapolis) & Columbus	25.0/C			37.5/D			19.8/B	26.5/C		20.5/C	17.0/B		24.2/C
								26.3/C			18.0/B			
7	US 20 (Indianapolis) & SR 312 (Chicago)	42.1/D	58.0/E	36.6/D	46.3/D	56.4/E		53.8/D	37.7/D		36.8/D	62.4/E	32.3/C	50.6/D
		51.5/D			54.3/D			40.7/D			53.6/D			
8	Riley Road & Dickey Road (Signalized)	30.1/C	29.9/C	45.7/D	53.5/D	17.9/B		53.9/D	12.9/B		22.7/C	43.2/D		41.5/D
		45.4/D			44.1/D			34.8/C			43.1/D			
8	Riley Road & Dickey Road (Roundabout)	4.2/A			4.2/A			2.4/A			6/A			4.4/A
11	Euclid Avenue & US 12 (Columbus)	11.7/B	44.2/D		28.3/C	18.7/B		36.9/D			48.4/D			35.8/D
		40.9/D			20.1/C									
12	Euclid Avenue & SR 312 (Chicago)	11.7/B	8.6/A		18.6/B	20.7/C		27.7/C	27.8/C		19.3/B	17.6/B		14.6/B
		9.7/A			20.6/C			27.8/C			18.0/B			
13	US 12 (Columbus) & SR 912 East Service Road	13.2/B	13.8/B		33.0/C			18.5/B	18.8/B					20.7/C
		13.8/B						18.6/B						
14	US 12 (Columbus) & SR 912 West Service Road	35.7/D	22.6/C	1.8/A	35.7/D	36.7/D	0.5/A				26.1/C		16.2/B	17.3/B
		11.0/B			20.5/C						23.1/C			
15	SR 312 (Chicago) & SR 912 East Service Road	4.4/A	4.5/A		11.8/B			19.7/B	18.9/B					12.8/B
		4.5/A						19.3/B						
16	SR 312 (Chicago) & SR 912 West Service Road	13.2/B		14.3/B	8.3/A	11.5/B					16.8/B	20.0/B		14.0/B
		14.0/B			10.7/B						19.8/B			
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							10.8/B		10.7/B				10.7/B
								10.7/B						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	8.2/A												8.2/A
21	Dickey Road & SR 912	21.3/C	4.2/A		37.9/D						49.5/D		3.8/A	19.9/B
		17.6/B									27.2/C			
22	SR 912 & Calumet North Ramp				41.5/D				2.6/A	1.6/A	2.1/A	6.7/A		6.9/A
									2.6/A			6.6/A		

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Source: Higway Capacity Manual 2000, Exhibit 16-2

Table 7 Late PM Peak Hour Level of Service and Delay (seconds per vehicle) – 2033 Horizon

ID	Intersection	Eastbound			Westbound			Northbound			Southbound			Overall Intersection
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
1	US 41 (Calumet) & 131st Place	30.2/C			42.6/D			11.3/B	12.5/B	9.6/A	6.2/A	14.3/B		15.2/B
								12.2/B			13.2/B			
2	US 41 (Calumet) & 141st	33.4/C	32.6/C		31.7/C	29.6/C	28.3/C	19.1/B	16.7/B		8.3/A	6.8/A		16.6/B
		32.9/C			29.4/C			17.0/B			7.2/A			
3	US 41 (Calumet) & 142nd	22.1/C			30.6/C	20.9/C		10.4/B	9.2/A		9.8/A			13.2/B
					27.7/C			9.4/A						
4	US 41 (Calumet) & SR 312 (Chicago)	161.5/F	154.5/F	40.9/D	298.0/F	96.5/F	34.2/C	41.4/D	115.8/F		256.6/F	63.9/E	14.9/B	123.4/F
		143.5/F			155.3/F			112.1/F			102.4/F			
5	US 12/20 (Indianapolis) & Riley Road	0.0/A			23.0/C	22.8/C		16.3/B		11.9/B	10.6/B	31.3/C		25.7/C
					22.9/C			16.0/B			30.8/C			
6	US 12/20 (Indianapolis) & Columbus	28.4/C			54.0/D			25.6/C	33.8/C		28.2/C	12.5/B		28.7/C
								33.6/C			17.9/B			
7	US 20 (Indianapolis) & SR 312 (Chicago)	32.3/C	43.1/D	35.5/D	32.2/C	44.4/D		43.3/D	30.4/C		22.4/C	40.3/D	26.2/C	37.2/D
		39.5/D			41.9/D			33.1/C			35.9/D			
8	Riley Road & Dickey Road (Signalized)	31.7/C	31.7/C	38.0/D	39.9/D	18.3/B		43.1/D	12.3/B		19.7/B		34.2/C	31.7/C
		37.4/D			34.7/D			23.6/C			34.2/C			
8	Riley Road & Dickey Road (Roundabout)	3.6/A			3.6/A			2.4/A			4.2/A			3.4/A
11	Euclid Avenue & US 12 (Columbus)	13.2/B	45.4/D		25.5/C	18.8/B		38.8/D			38.2/D			34.6/D
		42.0/D			19.6/B									
12	Euclid Avenue & SR 312 (Chicago)	9.7/A	8.0/A		17.3/B	19.2/B		24.3/C	24.2/C		16.7/B	16.2/B		13.7/B
		8.6/A			19.1/B			24.2/C			16.3/B			
13	US 12 (Columbus) & SR 912 East Service Road	12.8/B	13.5/B		33.1/C			20.3/C	20.6/C					21.4/C
		13.5/B						20.4/C						
14	US 12 (Columbus) & SR 912 West Service Road	40.1/D	22.7/C	2.5/A	36.3/D	38.3/D	0.5/A				33.7/C		17.4/B	19.6/B
		11.7/B			22.1/C						29.8/C			
15	SR 312 (Chicago) & SR 912 East Service Road	4.7/A	4.5/A		9.2/A			19.0/B	18.2/B					11.9/B
		4.5/A						18.6/B						
16	SR 312 (Chicago) & SR 912 West Service Road	9.9/A		11.2/B	7.2/A	8.9/A					16.0/B	19.9/B		11.7/B
		10.9/B			8.5/A						19.6/B			
19	SR 912 Off Ramp & Riley Road West Ramp - Unsignalized							10.8/B		9.8/A				10.0/B
								10.0/B						
20	SR 912 On Ramp & Riley Road East Ramp - Unsignalized	8.1/A												8.1/A
21	Dickey Road & SR 912	21.1/C	4.0/A		37.9/D						49.5/D		3.8/A	20.0/C
		17.6/B									27.2/C			
22	SR 912 & Calumet North Ramp				41.8/D				1.9/A	1.3/A	1.6/A	4.3/A		5.4/A
								1.9/A			4.3/A			

LOS	A	B	C	D	E	F
Control Delay per Vehicle (s/veh)	≤ 10.0	> 10.0 - 20.0	> 20.0 - 35.0	> 35.0 - 55.0	> 55.0 - 80.0	> 80.0

Source: Higway Capacity Manual 2000, Exhibit 16-2

6.3 Other Mitigation Measures and Improvements

This section addresses other mitigation measures and improvements to provide as efficient a road system as possible.

6.3.1 Traffic Signal Preemption

As was discussed in *Technical Memorandum #2 Short Range Improvements*, traffic signal preemption to expedite emergency vehicle movements can help police, fire, and ambulance services provide faster and better response to incidents in the area. Traffic signal preemption uses optical sensors that pick up pulsed light flashes from special emitters mounted on emergency vehicles. The call for service then either extends green time on the subject approach or early terminates green on a conflicting approach to return right of way to the subject approach. Most traffic signal controllers accept such preempt calls and respond appropriately in support of preemption operation. Equipment needed thus consists of a receiver on a signal pole or mast arm, wiring to the signal controller, and an interface unit that connects to the signal controller. In addition, all emergency vehicles that are to be served require the special light emitter that puts in a call for a signal preempt.

In *Technical Memorandum #2*, signal preemption was selected for the three signals along Michigan Ave. at Dickey Road, Martin Luther King Blvd./Guthrie Street, and the Block Avenue/SR 912 Ramp intersections. Preemption at these three intersections should continue in the long term, particularly in light of the presence of the East Chicago Fire Station just north of the Michigan/M L King (Guthrie) intersection. New preemption should also be added at:

- SR 912/Dickey
- Dickey/(ArcelorMittal) Plant Entrance
- Indianapolis/Riley.

Addition of preemption will assist emergency providers in providing the most responsive emergency services possible in the SR 912 surface street area.

6.3.2 Dickey Road Drawbridge Operation

The Dickey Road drawbridge lies about half-way between Riley Road and the new SR 912/Dickey intersection (see **Figure 13**) spanning the Indiana Harbor Canal. As was discussed in *Technical Memorandum #1*, this drawbridge currently opens an average of once per day, ranging from zero to six openings per day in the recent past. Bridge opening times are typically less than 20 minutes, but there have been opening instances of as much as 55 minutes, plus infrequent cases of openings for bridge servicing that lasted for several hours. It is therefore highly desirable that starting as soon as possible, bridge opening times be limited to periods of low vehicle traffic on Dickey Road.

In this regard, INDOT has initiated discussions with involved parties including the US Army Corps of Engineers (COE, operators of the bridge) and BP. BP is the company that has the greatest amount of barge traffic and thus the greatest need to request bridge opening by the COE. Status of those discussions is presented here.

The COE is about to undertake a 7-10 year dredging operation on the canal that will require five barge round trips per day to dump dredged material west of Indianapolis Blvd. off the canal. Considering the pending formal re-routing of SR 912 to Riley and Dickey Roads, the COE has

agreed to schedule as many of the bridge openings overnight as possible. When that is not possible, the barge movements will avoid weekday peak vehicle periods of approximately 6:00 - 9:00 am and 3:00 – 6:00 pm, and the openings will be limited to two during daytime. The COE thus intends to minimize disruption of traffic flow along Dickey Road to the extent possible.

The dredging operation will proceed from Lake Michigan and proceed southwesterly, completing dredging northeast of Dickey Road by about 2014 or 2015. After that time, the COE will no longer require Dickey Road drawbridge opening for dredging. This means that the dredging operation as described will affect re-routed SR 912 through that time period only.

Regarding BP, the company has indicated to INDOT that they will generally limit barge movements to overnight periods. Should an occasional shipment be required during daylight hours, such shipments will avoid the weekday periods of 6:00 – 9:00 am and 3:00 – 6:00 pm. INDOT intends to develop a working agreement with BP regarding shipping times, to which the COE will also be party.

In summary, INDOT has undertaken measures to minimize the impact of drawbridge openings on re-routed SR 912 vehicle movement along Dickey Road. Bridge openings should be limited to periods of relatively low traffic flow on Dickey Road, with the result of minimized vehicle delay.

The Preferred Alternative also includes wireless communications links between the drawbridge and East Chicago police, fire, and ambulance. The drawbridge has traffic signals on its approaches that will be interconnected with other signals along Dickey Road. When a drawbridge preempt call goes into effect, that will be communicated via radio to dispatchers in the police and fire control centers. The dispatchers will then be able contact emergency vehicle drivers and generally alert them or re-route them if they are working an active emergency. Procedures and protocols for this operation will need to be developed cooperatively by INDOT in cooperation with East Chicago police, fire, and ambulance agencies.

In a similar vein, the Preferred Alternative is proposed to include warning indicators to the motoring public to inform them when the drawbridge is open (in an “up” position). This will consist of a sign with a message to the effect of “DICKEY ROAD DRAWBRIDGE OPEN WHEN FLASHING.” Next to the sign will be a flashing yellow light linked to the drawbridge via wireless communications, to be activated when the bridge is open. This installation will be placed at four to eight locations where drivers can easily decide to re-route to avoid the drawbridge. The specific locations are to be determined in preliminary and final design based on the following potential sitings:

- NB SR 912 approaching Chicago Avenue
- NB SR 912 approaching the Mill Interchange (Michigan/Block)
- SB Indiana Toll Road (I-90) approaching SR 912 (in Hammond)
- SB/EB SR 912 between Calumet Avenue and Indianapolis Boulevard
- NB Indianapolis Blvd. approaching Columbus Drive
- SB Indianapolis Blvd. approaching 129th Street
- EB 129th Street approaching Riley Road
- SWB Michigan Avenue approaching Dickey Road.

This is a relatively low cost action for which eight packages are included in project cost estimates.

6.4 Improvement Costs

Following are planning level costs for both the Preferred Alternative and supporting intersection improvements to achieve acceptable operating performance through the 2033 planning horizon.

Improvement	Cost (000s)		Comment
Preferred Alternative			
SR 912/Dickey (#21)	$17,000		Includes SR 912 ramp connection
Dickey/Riley Roundabout (#8)	$1,250		
SR 912/Riley Road Ramp Reconstruction (#19 & 20)	$8,700		
Traffic Signal Work (1 new signal, preemption equipment, radio interconnect & signal timing)	$280		
Communication of Drawbridge Openings to East Chicago Police & Fire	$20		
Communication of Drawbridge Openings to Motoring Public – 8 Locations	$80		
Existing SR 912 Bridge Demolition*	$39,000		
Sub-total		$66,330	
Other Intersection Improvements			
Indianapolis Blvd./Riley Rd. (#5)	$1,500		
Indianapolis Blvd./Columbus (#6)	$122		
Columbus Dr./SR 912 Service Road Intersections (#13 & 14)	$2,800		
SR 912/Dickey (#21) Enhancement**	$241		
Sub-total		$4,663	
TOTAL		**$70,993**	

* Expected to involve significant environmental remediation.
**In addition to basic design included under the Preferred Alternative.

The total estimated cost for all improvements is $71 Million, of which over half is for the demolition of the existing SR 912 bridge. Details of the cost estimates are provided in **Appendix D.**

7 Summary and Conclusion

Preferred Alternative

This report has considered a range of alternatives to deal with the failure of the SR 912 bridge over the Indiana Harbor Canal. Initially, INDOT developed 12 long range alternatives ranging from “do nothing” to full replacement of the bridge. These 12 alternatives underwent a screening analysis considering a range of criteria, including impacts on the community, mobility, and access concerns, as well as cost. The result of the screening was selection of Alternative C as the Preferred Alternative (see **Figure 13**). Alternative C consists of converting 1.3 mile of existing Riley Road and Dickey Road into SR 912 from a new SR 912/Dickey Road intersection to a rebuilt SR 912/Riley Road interchange. Re-aligned SR 912 will overpass the railroad tracks at the southeast end of Dickey Road to eliminate grade crossing delays. To facilitate traffic flow at the Riley/Dickey intersection along the surface street portion, a roundabout has been identified as the most efficient design. The Preferred Alternative also has supporting traffic signal improvements including signal preemption for police, fire, and ambulance; signal interconnect; and notifications to emergency providers and the motoring public when the Indiana Harbor Canal drawbridge on Dickey Road is open (up).

Future Volumes

Future traffic volumes were developed for two planning horizons: 2013 and 2033. 2013 corresponds to the first year after completion of all Preferred Alternative actions. 2033 represents a 20 year future condition in anticipation of potential use of Federal funds for some improvements. Future volumes were developed by adjusting existing traffic volumes in light of long range traffic projections by the Northwestern Indiana Regional Planning Commission (NIRPC), the designated Metropolitan Planning Organization (MPO). The adjustments also accounted for the fact that existing volume counts did not include the existence of the SR 912/Riley Road interchange. This interchange will be put back in service as part of the Preferred Alternative.

Intersection Improvements

Intersection capacity analyses were conducted to check for acceptable operating performance of all movements at study area intersections. The 2033 results indicated the need for selected intersection improvements at the following locations:

- Indianapolis Blvd. & Riley Rd. (#5) – lane additions
- Indianapolis Blvd. & Columbus Dr. (#6) - lane additions
- Riley Rd. & Dickey Rd. (#8) – development as a roundabout in preference to a signalized intersection
- Columbus Dr. & SR 912 Service Rd intersections (#13 & 14) – lane additions
- SR 912/Dickey (#21) – a lane addition over the initial INDOT concept design.

Improvements identified in the 2033 analyses were assumed to be implemented by 2013.

Improvement needs were also identified for the Calumet Ave. & Chicago Ave. (#4) and Indianapolis Blvd. & Chicago Ave. (#7) intersections. However, these needs relate to traffic growth not associated with the Preferred Alternative and would be major in scope with right of way takes. Specific improvements thus were not identified in the context of the SR 912 replacement project.

Other Actions

An important consideration for the Preferred Alternative is operation of the Dickey Road drawbridge located about half-way between the SR 912/Dickey intersection and the Riley/Dickey roundabout. Today, bridge openings are infrequent but sometimes long in duration, which could seriously disrupt SR 912 operation along Dickey Road. INDOT has initiated discussions with key involved parties, namely the US Army Corps of Engineers (COE) and BP, the major shipper requiring bridge opening. The COE maintains and regulates the Indiana Harbor Canal and the drawbridge.

The COE will be conducting dredging operations for the next four to five years that will require Dickey Road drawbridge opening about ten times a day. The COE intends to conduct most of this activity overnight, and to limit daytime openings to two per day and keep these outside of peak vehicle travel times on Dickey Road. BP has similarly stated their intent to conduct shipping movements primarily overnight and to avoid peak vehicle travel times. INDOT is in the process of developing working agreements with the COE and BP regarding operations. Overall, these steps should minimize disruption of vehicle traffic flow on the drawbridge.

Related to the above, the Preferred Alternative includes communications links between the drawbridge and East Chicago police, fire, and ambulance. Active communications will alert emergency providers when the drawbridge is open so that dispatchers can contact emergency vehicle drivers and re-route them as necessary. Similarly, four to eight special indicators will be posted on area roads to communicate to drivers that the drawbridge is open, giving them the opportunity to re-route around the bridge.

Cost

Preferred Alternative

The estimated cost of the Preferred Alternative is $66 Million, of which about 60% is for the demolition of the existing SR 912 bridge.

Intersection Improvements

Supporting area intersection improvement costs are estimated at $4.7 Million.

Total

The total planning level cost of the Preferred Alternative and supporting intersection improvements is $71 Million (rounded).

Appendix A

Long Range Alternatives Cost Estimates

The following cost estimates are at a planning level for the comparison of alternatives.

NOTE: All Costs in Thousands, covering major cost components.

3-Jun-10

ALT.	MAJOR INTERSECTION, INTERCHANGE, or STRUCTURE		MODERATE INTERSECTION		ROADWAY WIDENING		SUB-TOTAL	CONTING.	EXIST. SR 912 DEMOLITION	**TOTAL**
	Description	Cost	Description	Cost	Descrip.	Cost		25%		
A	6-lane Bridge Replacement	$123,000 (1)						n/a	$32,000	**$155,000**
B	Do-Nothing							n/a	$39,000	**$39,000**
C	SR 912/Dickey	$17,000 (2)								
	SR 912/Riley Ramp "B" & "D" Reconstruction	$6,000 (2)								
	Dickey/Riley Roundabout	$1,250								
	Sub-total	$24,250					$24,250	n/a	$39,000	**$63,250**
D	Cline/Chicago W. Ramp	$1,500	Calumet/129th	$500						
	Cline/Chicago E. Ramp	$1,500	Indianapolis/Columbus	$500						
	Indianapolis/129th	$1,500	Chicago/Euclid	$500						
	Indianapolis/Chicago	$1,500								
	Sub-total	$6,000		$1,500			$7,500	$1,875	$39,000	**$48,375**
E	Cline/Columbus W. Ramp	$1,500	Calumet/129th	$500						
	Cline/Columbus E. Ramp	$1,500	Columbus/Euclid	$500						
	Indianapolis/129th	$1,500								
	Indianapolis/Columbus	$1,500								
	Sub-total	$6,000		$1,000			$7,000	$1,750	$39,000	**$47,750**
F	SR 912/Dickey	$17,000 (2)	Calumet/129th	$500						
			Indianapolis/129th	$500						
	Sub-total	$17,000		$1,000			$18,000	n/a	$39,000	**$57,000**
G			Calumet/129th	$500						
	Indianapolis/129th	$1,500	Indianapolis/Columbus	$500						
	Indianapolis/Michigan(US 20)	$1,500	Indianapolis/Chicago	$500						
	Sub-total	$3,000		$1,500	2.5 Mi. of Michigan (US 20) @$4 Mil/mi. (3)	$10,000	$14,500	$3,625	$39,000	**$57,125**

NOTE: All Costs in Thousands, covering major cost components.

3-Jun-10

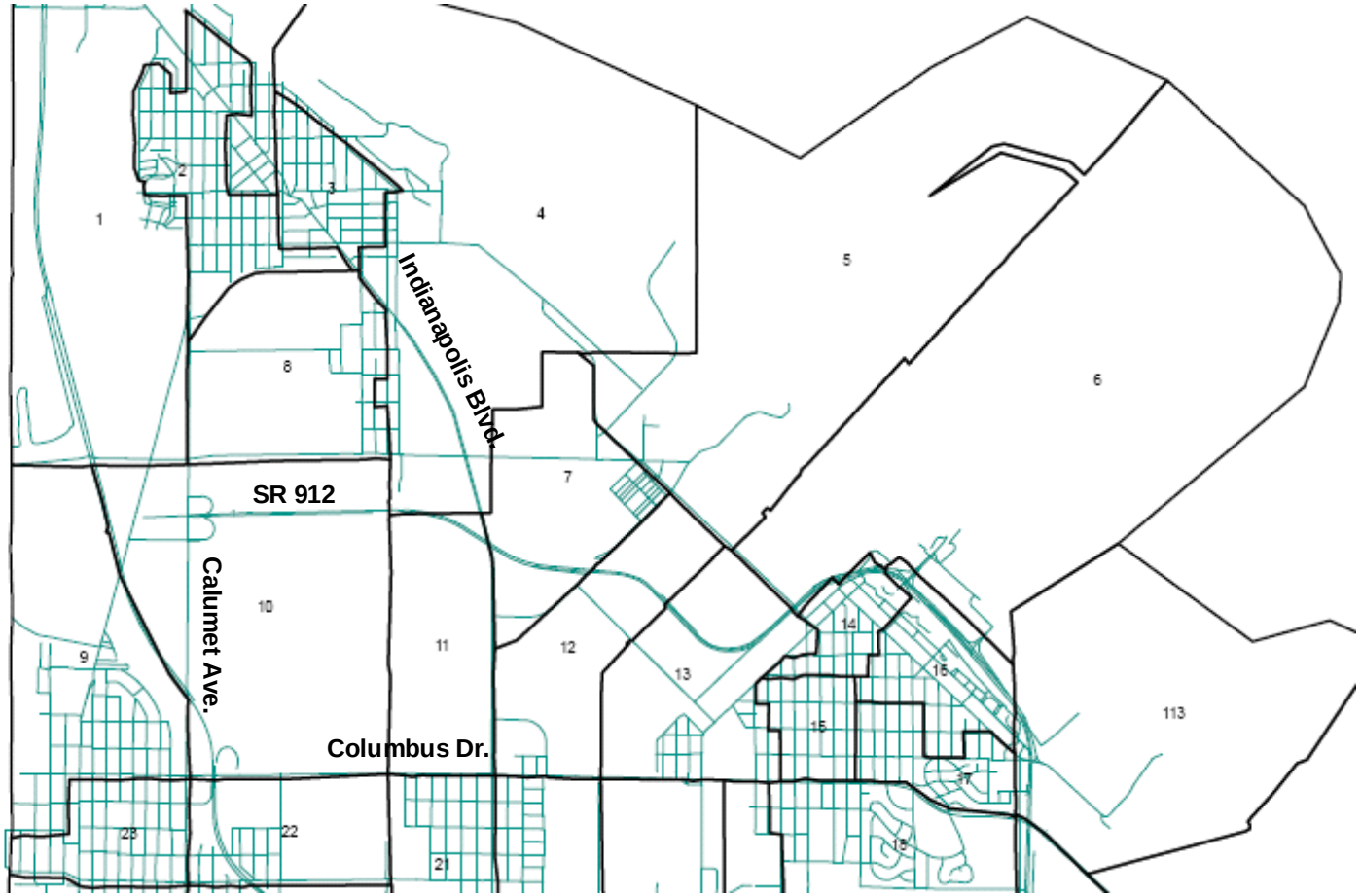
ALT.	MAJOR INTERSECTION, INTERCHANGE, or STRUCTURE		MODERATE INTERSECTION		ROADWAY WIDENING		SUB-TOTAL	CONTING.	EXIST. SR 912 DEMOLITION	**TOTAL**
	Description	Cost	Description	Cost	Descrip.	Cost		25%		
H	Cline/Columbus W. Ramp	$1,500	Indianapolis/Chicago	$500						
	Cline/Columbus E. Ramp	$1,500	Chicago/Euclid	$500						
	Calumet/Chicago	$1,500								
	Sub-total	$4,500		$1,000			$5,500	$1,375	$39,000	**$45,875**
I	Indianapolis/129th	$1,500								
	Indianapolis/Columbus	$1,500								
	Kennedy/Columbus	$2,000								
	Sub-total	$5,000	Calumet/129th	$500			$5,500	$1,375	$39,000	**$45,875**
J	141st-Columbus RR Overpass	$10,000								
	Calumet/141st	$1,500								
	Kennedy/Columbus	$2,000								
	Sub-total	$13,500	Indianapolis/Columbus	$500			$14,000	$3,500	$39,000	**$56,500**
K	Calumet/Michigan (US 20)	$1,500	Indianapolis/Michigan	$500						
			Calumet/Chicago	$500						
	Sub-total	$1,500		$1,000	4.2 Mi. of Michigan (US 20) @$4 Mil/mi. (3)	$16,800	$19,300	$4,825	$39,000	**$63,125**
L	Indianapolis/129th	$1,500								
	Indianapolis/Columbus	$1,500	Calumet/129th	$500						
	Kennedy/Columbus	$2,000	Kennedy/148th	$500						
	Sub-total	$5,000		$1,000	1.6 Mi. of Gary Ave. & 148th @$4 Mil/mi.	$6,400	$12,400	$3,100	$39,000	**$54,500**

(1) INDOT cost estimate for in-kind replacement, 6/2/10. Demolition cost less for this alternative than others due to re-use of a portion of the existing structure.
(2) INDOT cost estimate 5/20/10, and clarified in subsequent phone conversations.
(3) Assumes structure over Kennedy Ave. (~51' wide) does not need to be widened.

Appendix B

NIRPC Long Range Socio-economic Forecasts

The following page illustrates the Traffic Analysis Zones (TAZs) that cover the Study Area north of Columbus Dr. Corresponding socio-economic forecast data for this north areas and percent changes over time follow on the second page.


Indianapolis Blvd.
SR 912
Calumet Ave.
Columbus Dr.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
21
22
28
113

NIRPC SOCIO-ECONOMIC FORECASTS: 2000, 2010, 2020 & 2030

Source: Bill Brown, NIRPC, by e-mail on April 20, 2010

TAZ	POP_00	POP_10	POP_20	POP_30	HH_00	HH_10	HH_20	HH_30	TRADE	SERVICE	OTHER	EMP_00	EMP_10	EMP_20	EMP_30
1	1892	1873	1855	1836	773	787	800	814	343	1157	169	2792	3044	3295	3547
2	4751	4703	4654	4606	2095	2096	2098	2099	268	279	23	570	612	655	697
3	3716	3768	3819	3871	1523	1563	1604	1644	181	336	11	533	553	574	594
4	1523	1528	1533	1538	611	612	614	615	62	132	81	2071	1980	1890	1799
5	0	0	0	0	0	0	0	0	30	10	0	3665	3287	2909	2531
6	0	0	0	0	0	0	0	0	17	2050	23	9670	9231	8793	8354
7	540	517	493	470	168	167	167	166	0	0	3	3	3	3	3
8	846	838	829	821	327	329	331	333	136	169	148	1001	986	970	955
9	2936	2988	3040	3092	1240	1198	1155	1113	216	68	456	886	866	845	825
10	15	15	15	15	0	0	0	0	84	48	71	203	219	234	250
11	0	0	0	0	0	0	0	0	0	404	0	404	439	475	510
12	148	158	169	179	50	55	59	64	0	209	4	462	425	389	352
13	1048	1026	1004	982	432	428	424	420	117	621	102	1187	1154	1121	1088
14	1580	1551	1523	1494	522	513	503	494	77	474	10	591	609	627	645
15	3461	3464	3467	3470	1172	1182	1192	1202	147	264	0	411	423	436	448
16	3142	3124	3106	3088	1264	1274	1285	1295	77	93	2	172	179	186	193
17	3372	3358	3345	3331	1217	1223	1228	1234	182	162	110	456	465	474	483
	28970	28911	28852	28793	11394	11427	11460	11493				25077	24476	23875	23274

COMPUTED CHANGES OVER TIME (2010 to 2030), PERCENT

NIRPC Model Cline Ave Area TAZs

TAZ	POP_10	POP_20	POP_30	**POP 2010 2030**	HH_10	HH_20	HH_30	**HH 2010 - 2030**	EMP_10	EMP_20	EMP_30	**EMP 2010 - 2030**
1	-1.0%	-1.0%	-1.0%	-2.0%	1.8%	1.7%	1.7%	3.5%	9.0%	8.3%	7.6%	16.5%
2	-1.0%	-1.0%	-1.0%	-2.1%	0.1%	0.1%	0.1%	0.1%	7.4%	6.9%	6.5%	13.8%
3	1.4%	1.4%	1.4%	2.7%	2.6%	2.6%	2.5%	5.2%	3.8%	3.7%	3.5%	7.3%
4	0.3%	0.3%	0.3%	0.7%	0.2%	0.2%	0.2%	0.4%	-4.4%	-4.6%	-4.8%	-9.2%
5									-10.3%	-11.5%	-13.0%	-23.0%
6									-4.5%	-4.8%	-5.0%	-9.5%
7	-4.3%	-4.5%	-4.7%	-9.0%	-0.4%	-0.4%	-0.4%	-0.8%	0.0%	0.0%	0.0%	0.0%
8	-1.0%	-1.0%	-1.0%	-2.0%	0.6%	0.6%	0.6%	1.2%	-1.5%	-1.6%	-1.6%	-3.1%
9	1.8%	1.7%	1.7%	3.5%	-3.4%	-3.5%	-3.7%	-7.1%	-2.3%	-2.3%	-2.4%	-4.7%
10				0.0%					7.7%	7.2%	6.7%	14.3%
11									8.7%	8.0%	7.4%	16.1%
12	7.0%	6.5%	6.1%	13.1%	9.3%	8.5%	7.9%	17.1%	-7.9%	-8.6%	-9.4%	-17.2%
13	-2.1%	-2.1%	-2.2%	-4.3%	-0.9%	-0.9%	-0.9%	-1.9%	-2.8%	-2.9%	-2.9%	-5.7%
14	-1.8%	-1.8%	-1.9%	-3.7%	-1.8%	-1.8%	-1.9%	-3.6%	3.0%	3.0%	2.9%	5.9%
15	0.1%	0.1%	0.1%	0.2%	0.9%	0.8%	0.8%	1.7%	3.0%	2.9%	2.8%	5.8%
16	-0.6%	-0.6%	-0.6%	-1.2%	0.8%	0.8%	0.8%	1.6%	4.1%	3.9%	3.8%	7.8%
17	-0.4%	-0.4%	-0.4%	-0.8%	0.5%	0.5%	0.5%	0.9%	2.0%	1.9%	1.9%	3.9%
All TAZs	**-0.2%**	**-0.2%**	**-0.2%**	**-0.4%**	**0.3%**	**0.3%**	**0.3%**	**0.6%**	**-2.4%**	**-2.5%**	**-2.5%**	**-4.9%**

KEY

TAZ = Traffic Analysis Zone

POP = Population

HH = Households

EMP = Employment

e.g., POP_10 = 2010 Population

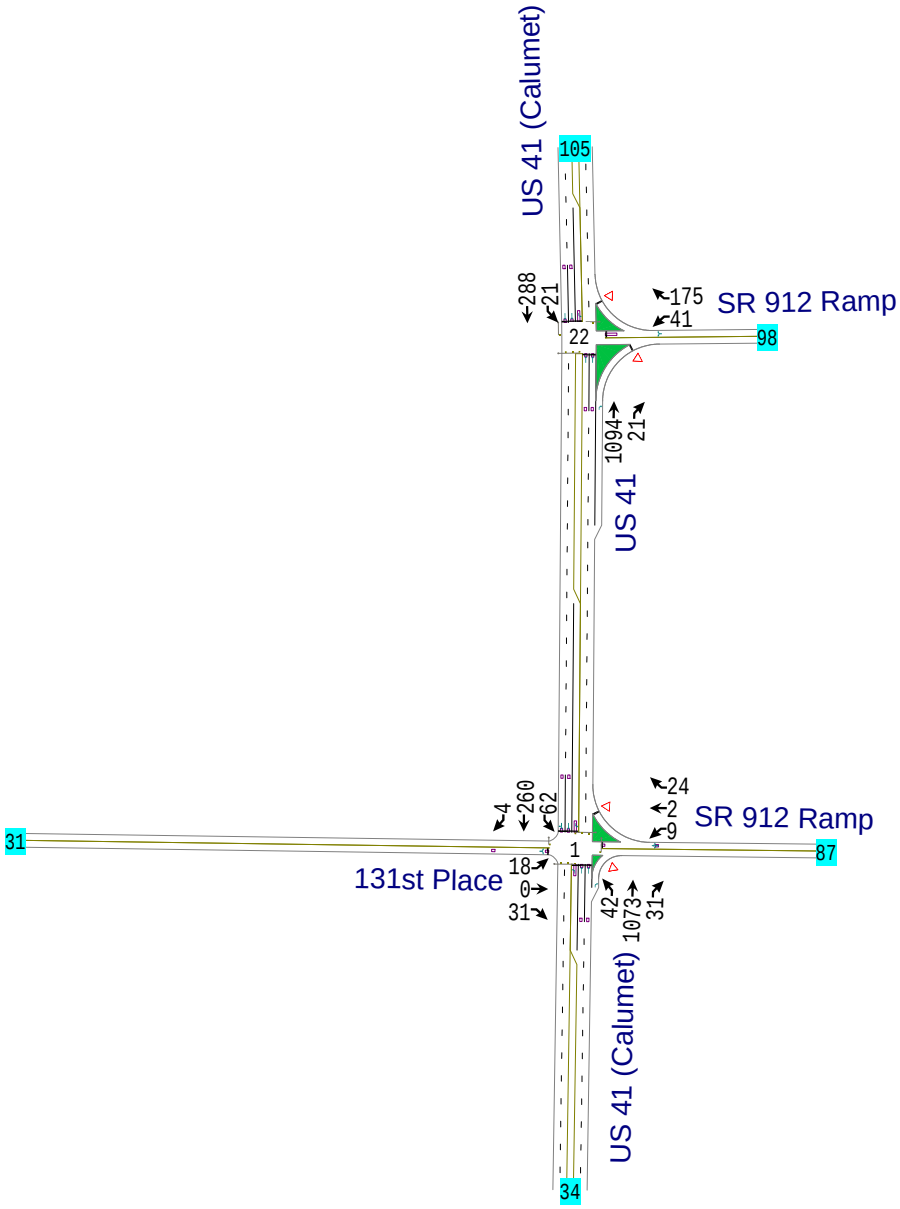
Overall, population, households, and employment are forecast to decline very slightly between 2010 and 2030.

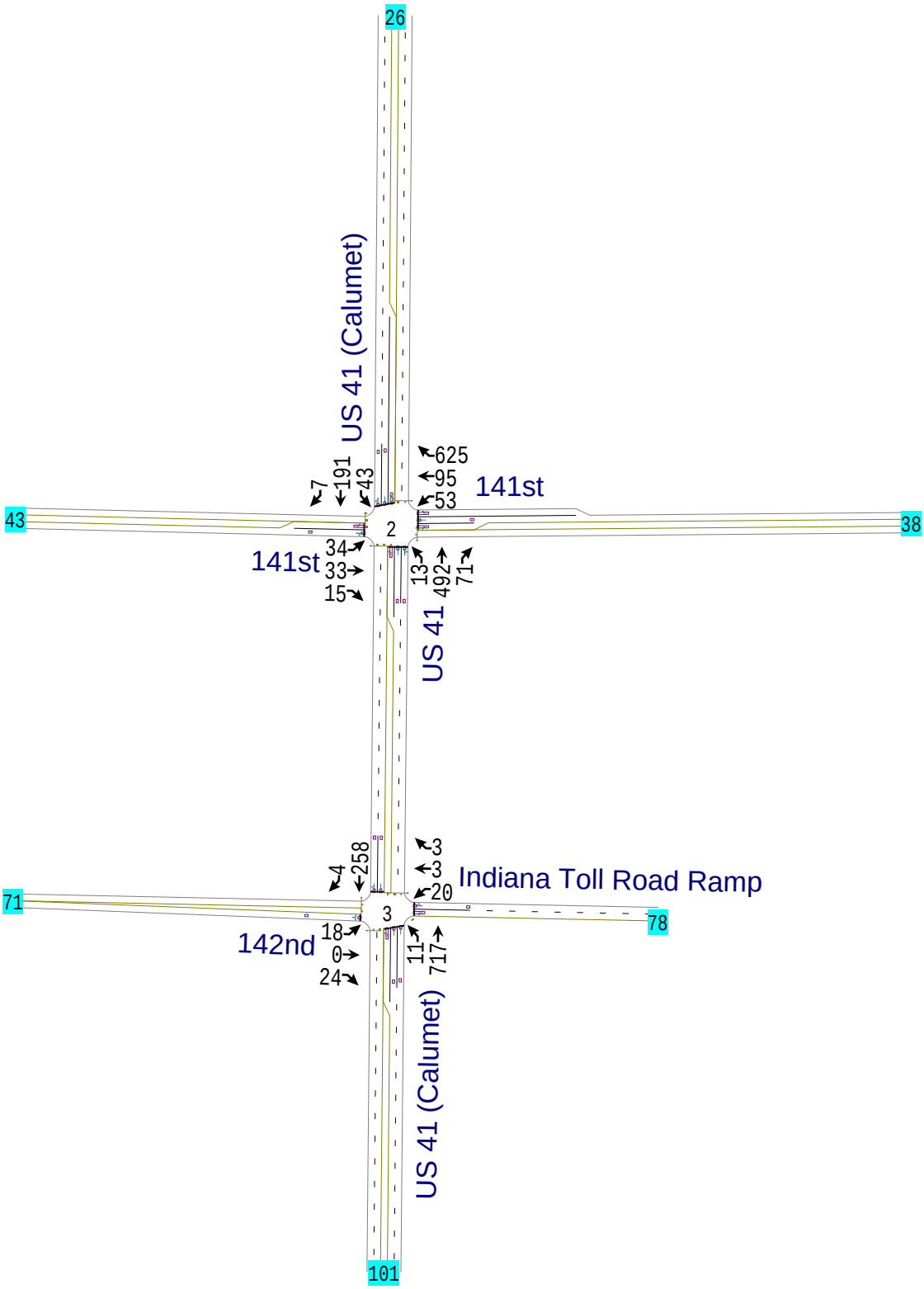
Appendix C

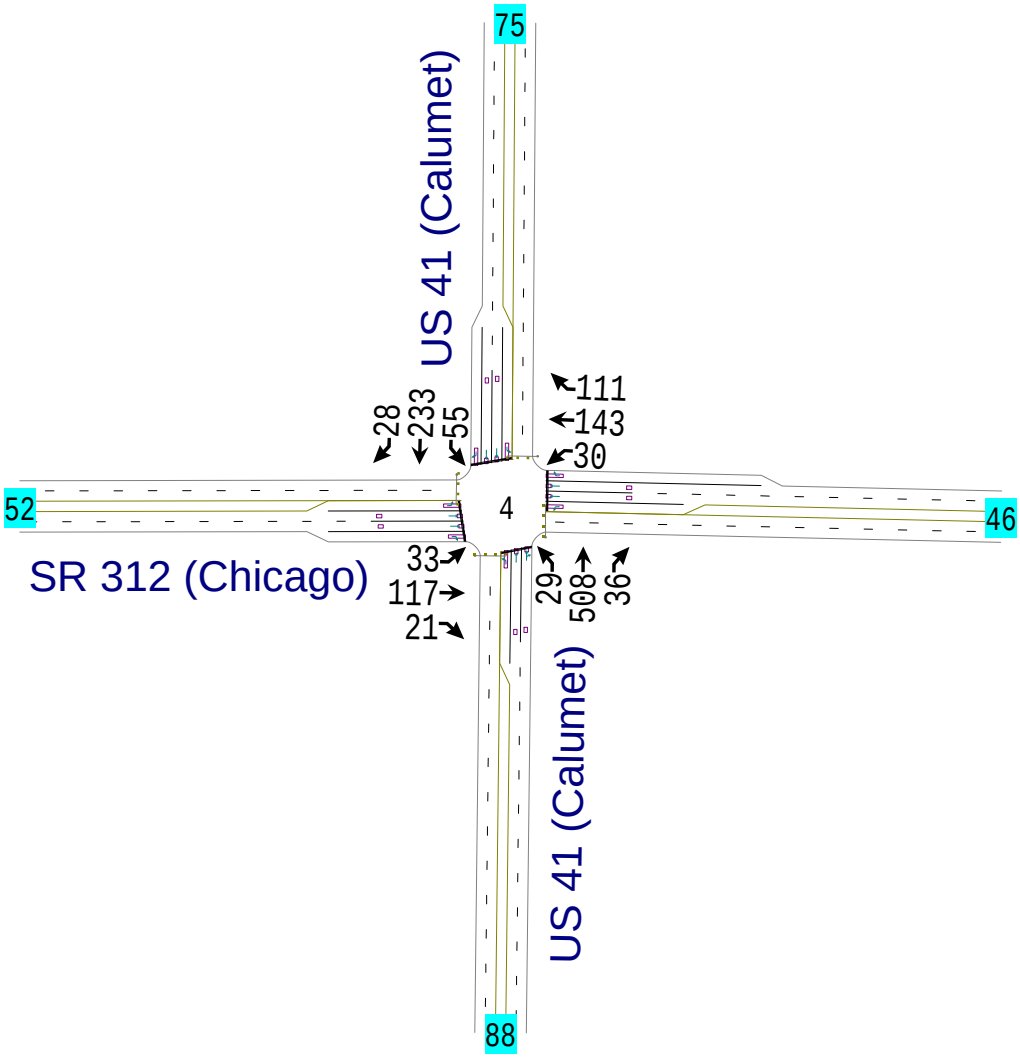
Traffic Volumes and Capacity Analysis Worksheets

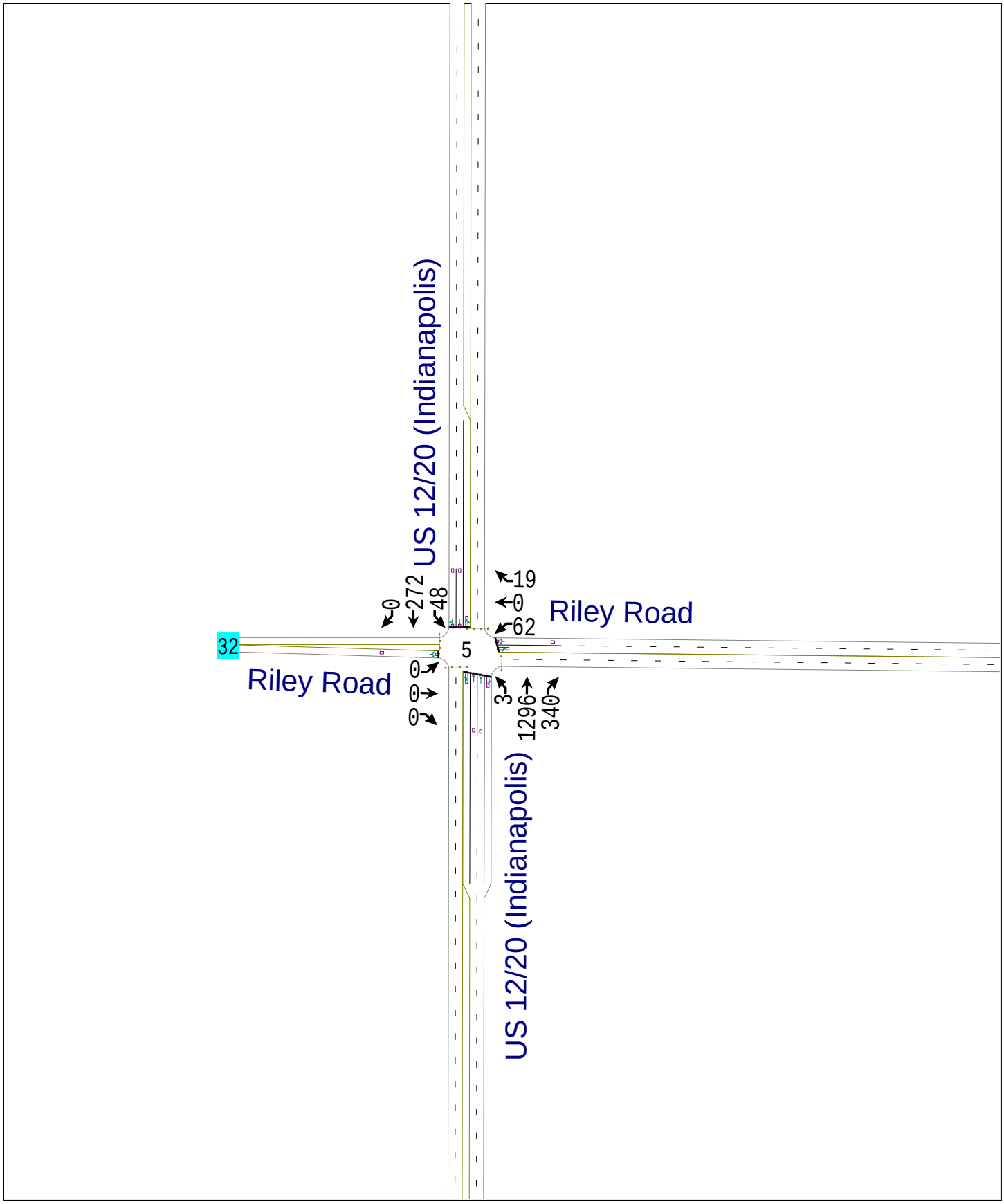
The initial pages present intersection turning movement volumes by analysis horizon and time of day period. These are followed by detailed capacity analysis worksheets for both horizons and the three time of day periods. Sections of the appendix are separated by an identifier title page.

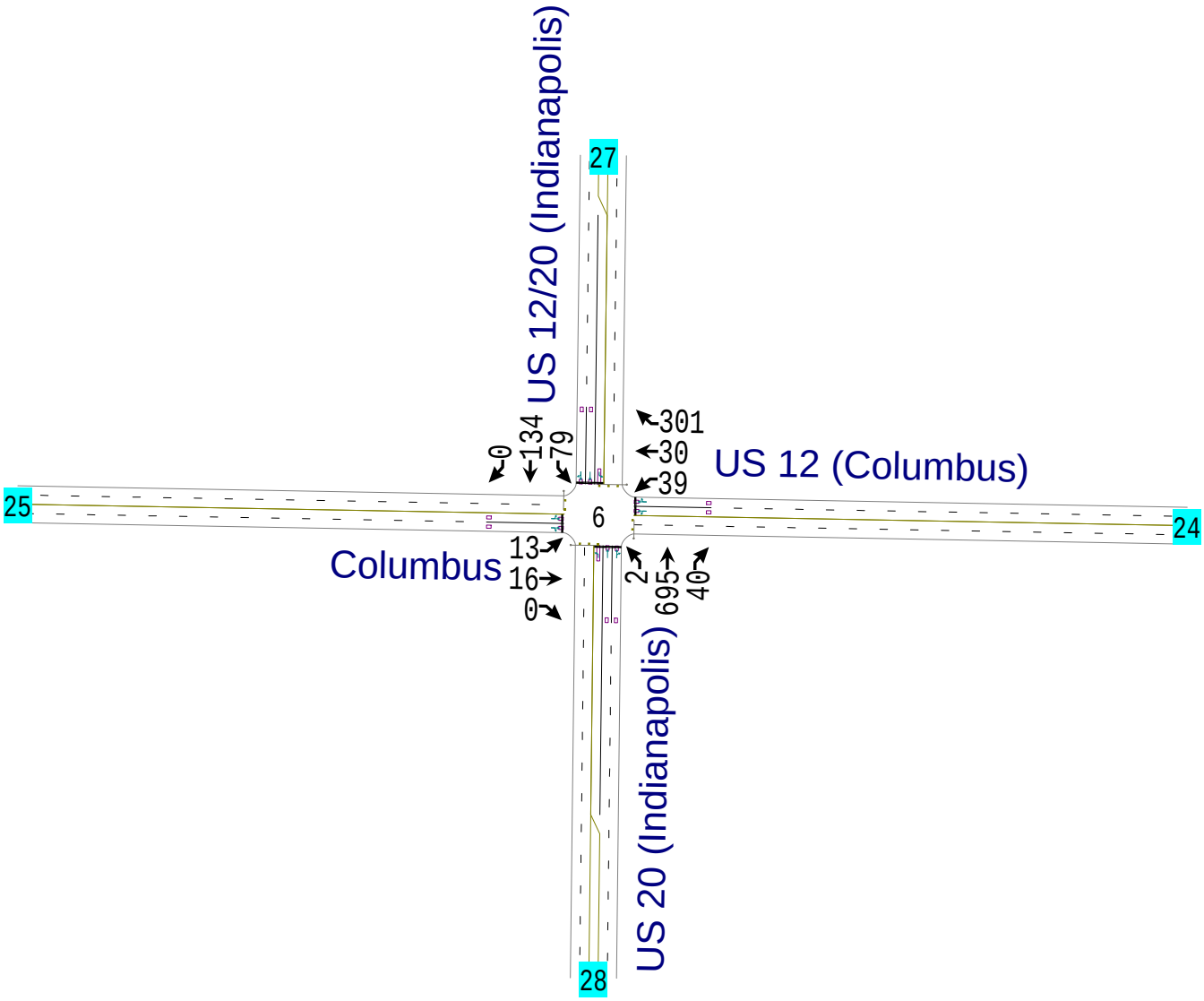
2013 AM PEAK HOUR VOLUMES

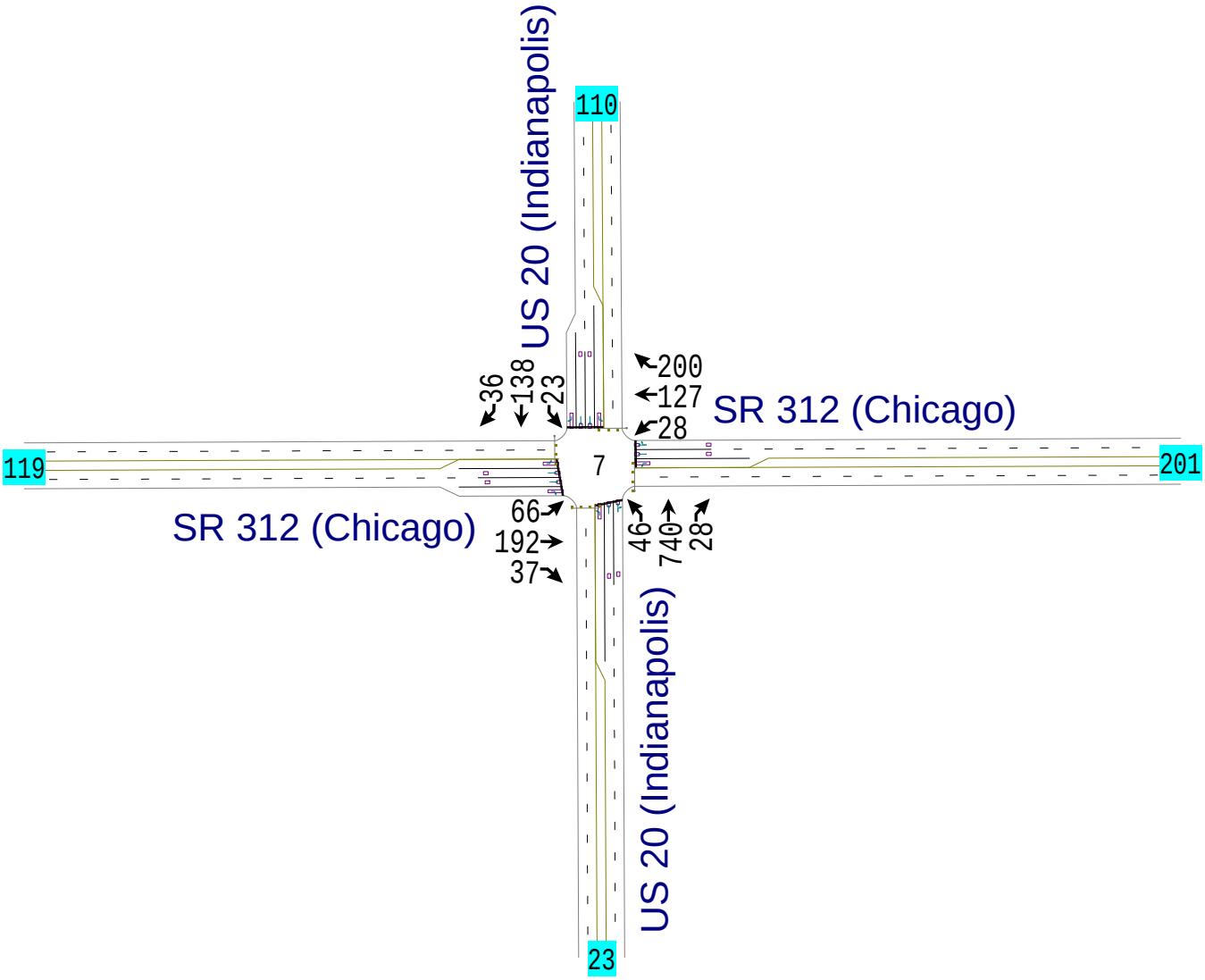

US 41 (Calumet)
105
288
21
22
175
41
SR 912 Ramp
98
1094
21
US 41
4
260
62
31
1
18
0
31
131st Place
24
2
9
SR 912 Ramp
87
42
1073
31
US 41 (Calumet)
34

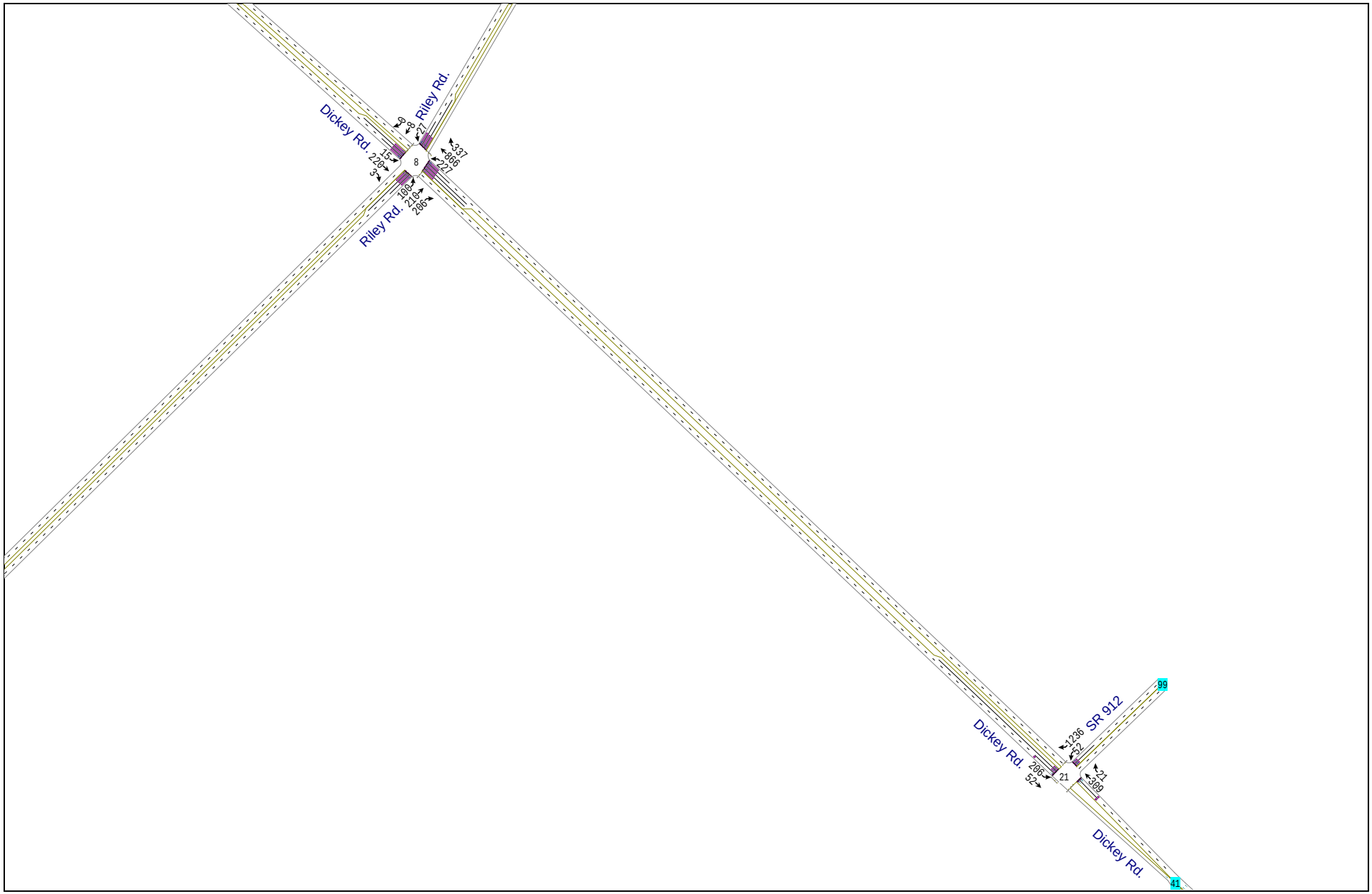

26
US 41 (Calumet)
7
191
43
625
95
53
141st
43
2
38
34
33
15
141st
13
492
71
US 41
258
4
3
3
20
Indiana Toll Road Ramp
71
3
78
18
0
24
142nd
11
717
US 41 (Calumet)
101

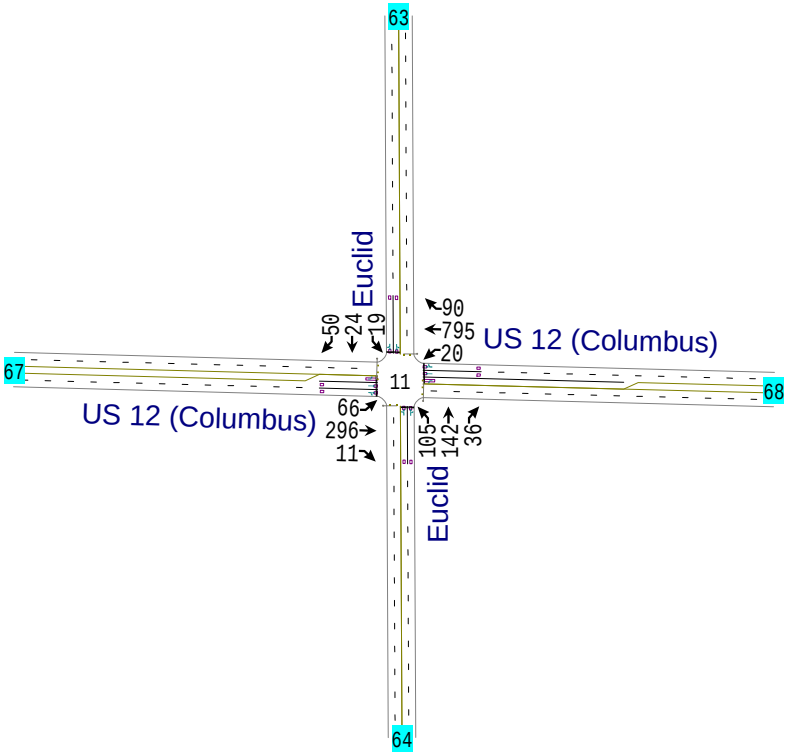

52
SR 312 (Chicago)
28
233
55
33
117
21
4
111
143
30
29
508
36
75
US 41 (Calumet)
46
US 41 (Calumet)
88

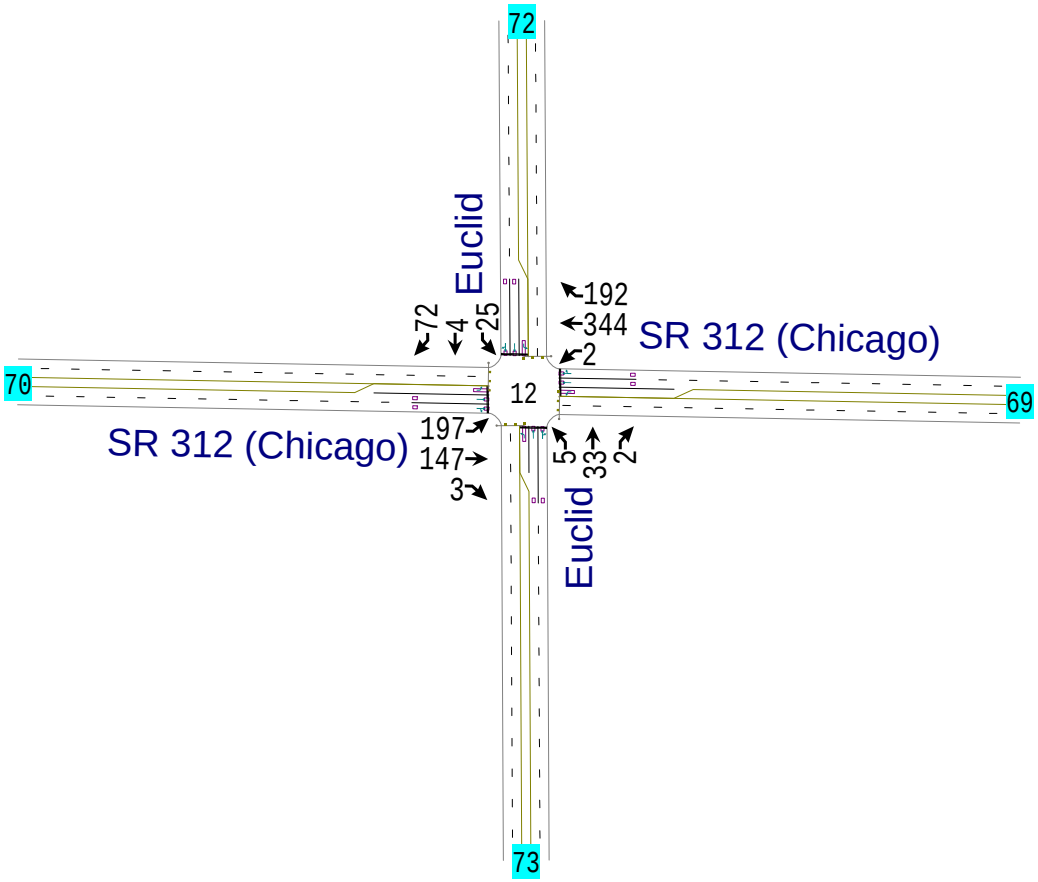

US 12/20 (Indianapolis)
0
272
48
19
0
62
Riley Road
32
5
Riley Road
0
0
0
3
1296
340
US 12/20 (Indianapolis)

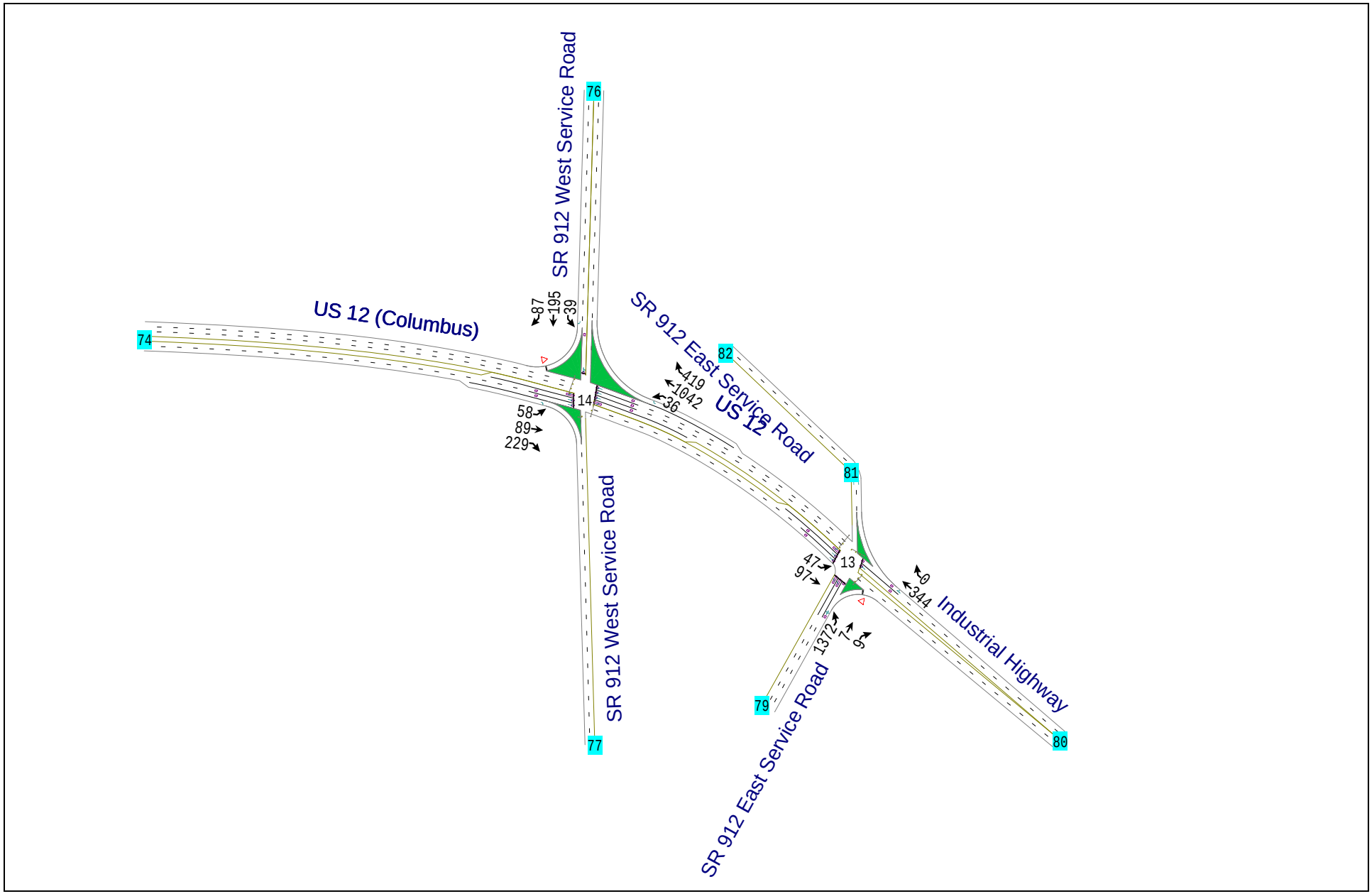

US 12/20 (Indianapolis)
27
0
134
79
301
30
39
US 12 (Columbus)
25
6
24
Columbus
13
16
0
2
695
40
US 20 (Indianapolis)
28

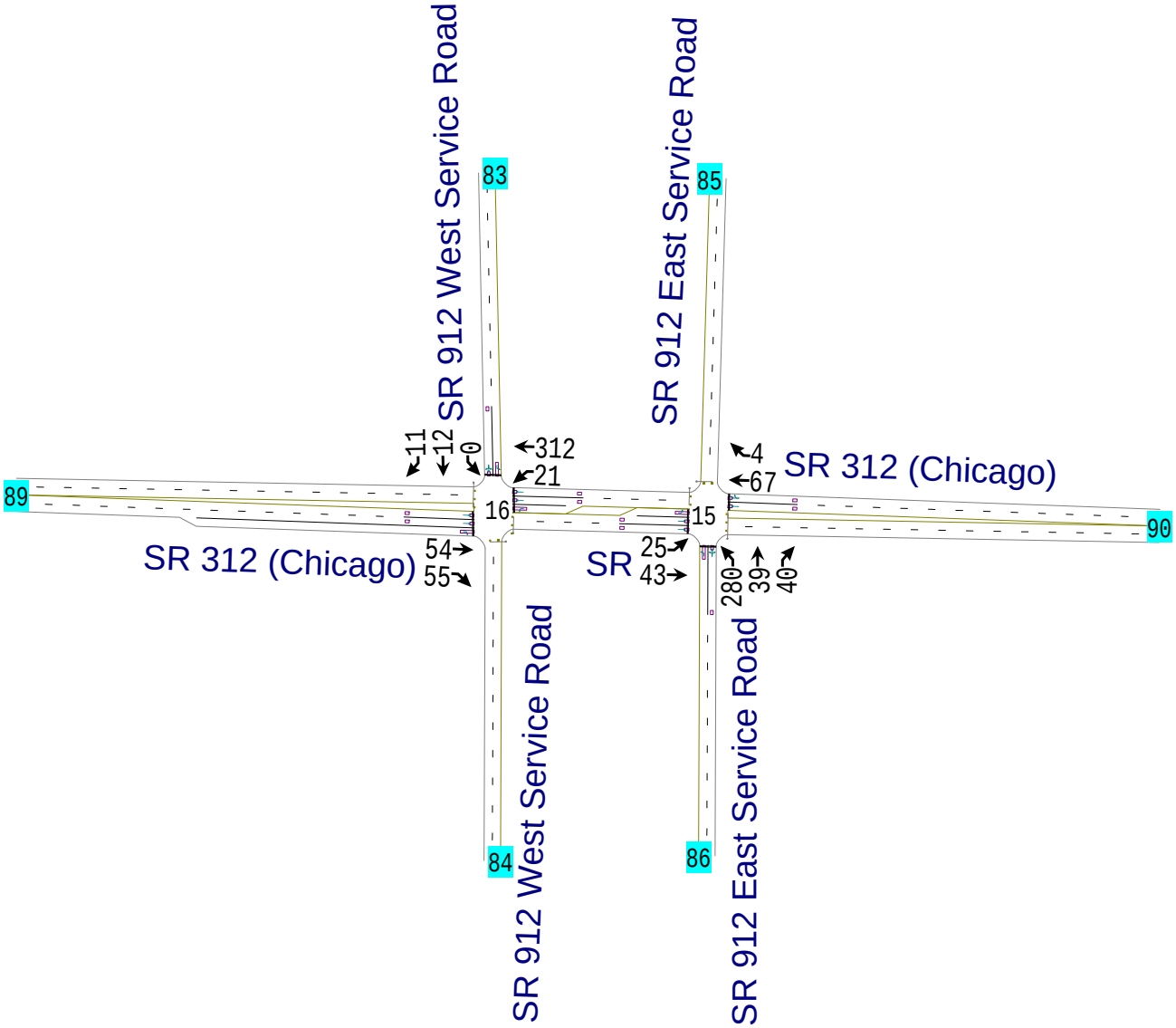

US 20 (Indianapolis)
110
36
138
23
200
127
28
SR 312 (Chicago)
119
7
201
SR 312 (Chicago)
66
192
37
46
740
28
US 20 (Indianapolis)
23

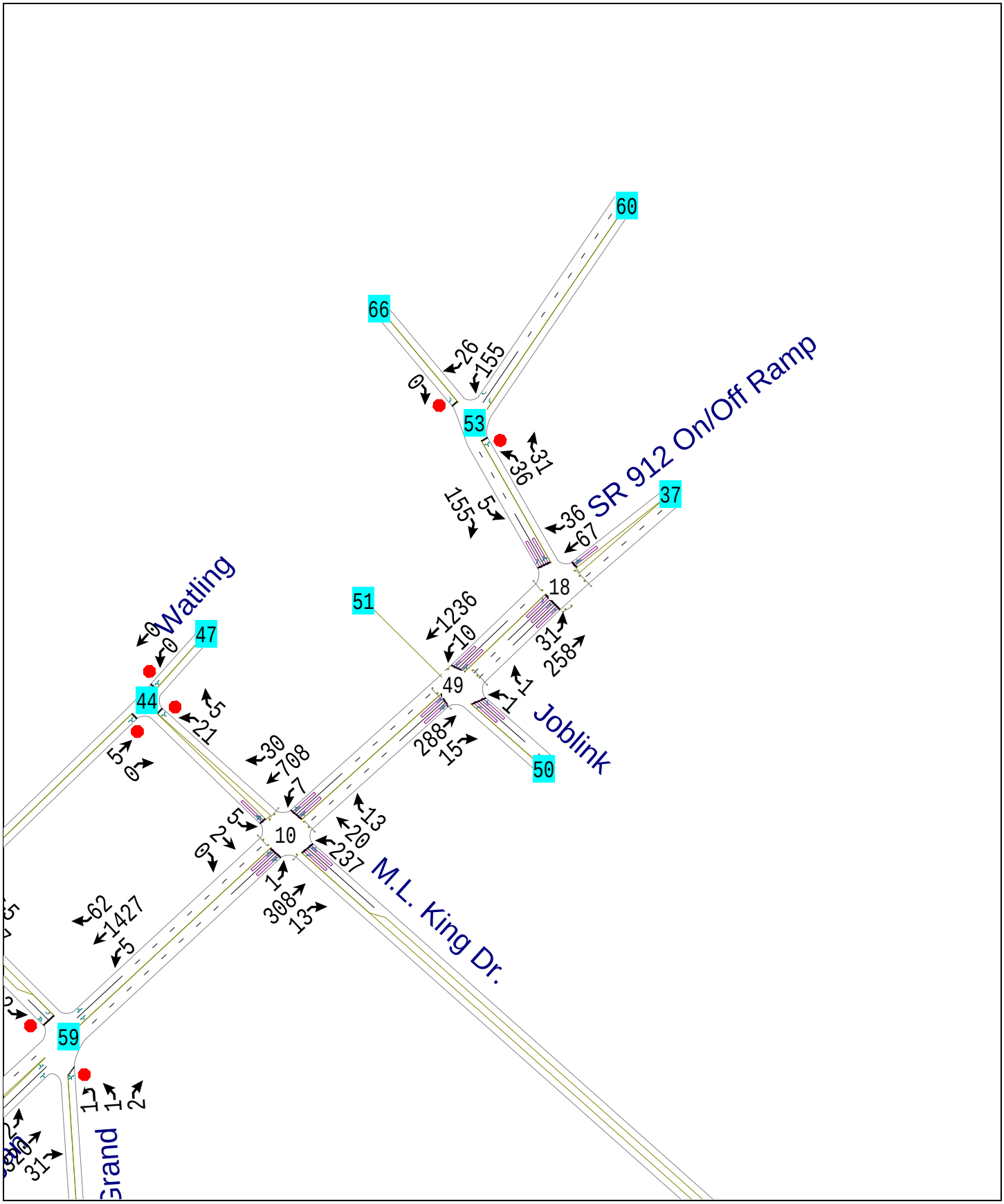

Dickey Rd.
Riley Rd.
Riley Rd.
9
8
27
15
226
52
8
337
366
21
180
216
206
Dickey Rd.
SR 912
99
1236
52
206
52
21
21
369
Dickey Rd.
41

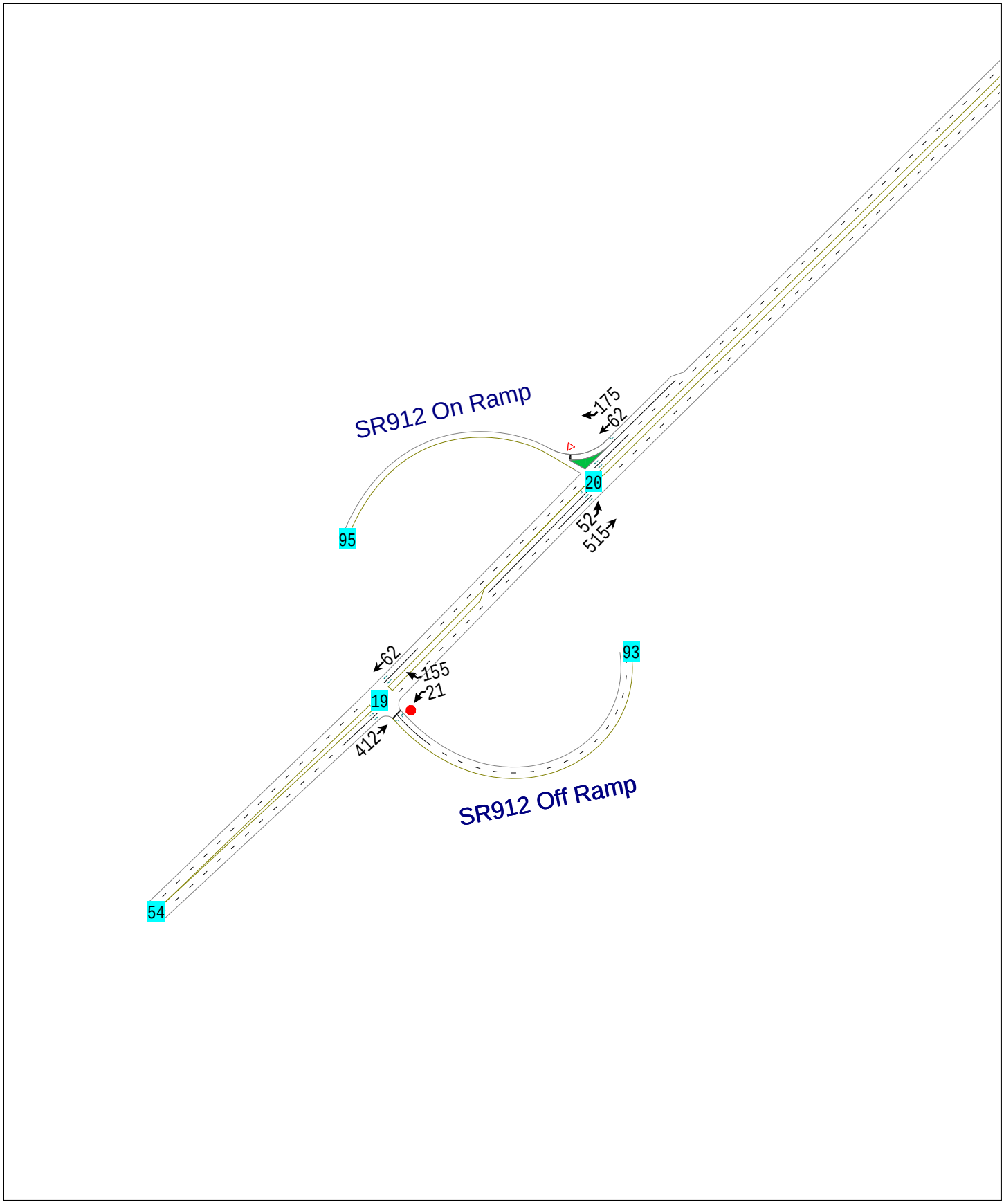

63
Euclid
50
24
19
90
795
20
US 12 (Columbus)
67
11
68
US 12 (Columbus)
66
296
11
105
142
36
Euclid
64


72
Euclid
72
4
25
192
344
2
SR 312 (Chicago)
70
12
69
197
147
3
SR 312 (Chicago)
5
33
2
Euclid
73

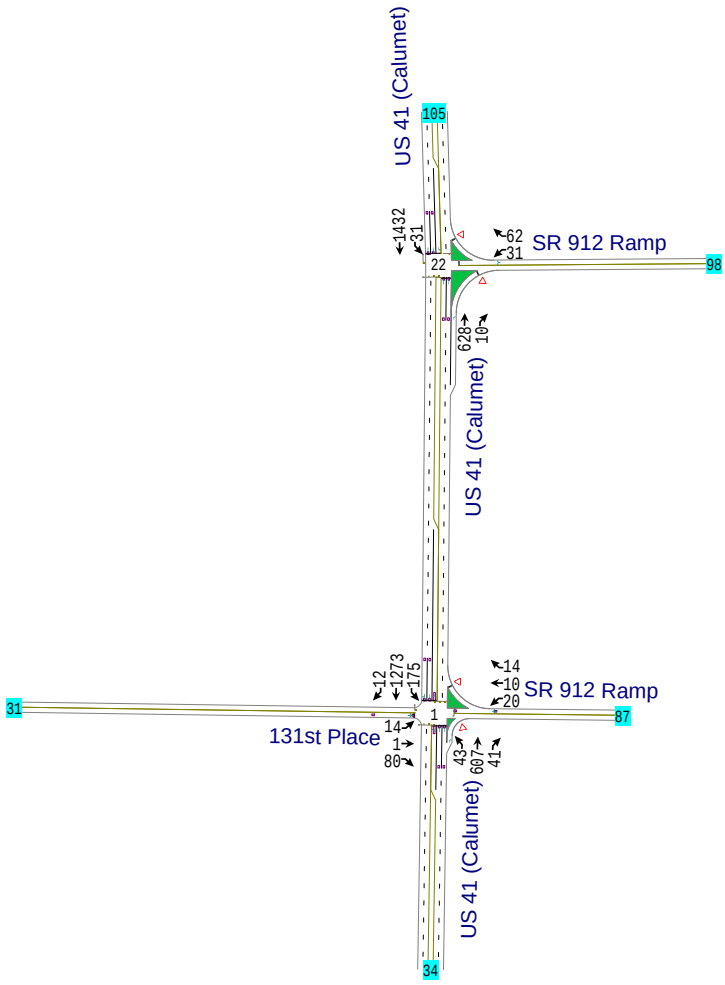

SR 912 West Service Road
76
US 12 (Columbus)
74
87
195
39
14
58
89
229
SR 912 East Service Road
82
419
1042
36
US 12
81
13
47
97
0
344
Industrial Highway
80
1372
7
9
79
SR 912 East Service Road
SR 912 West Service Road
77

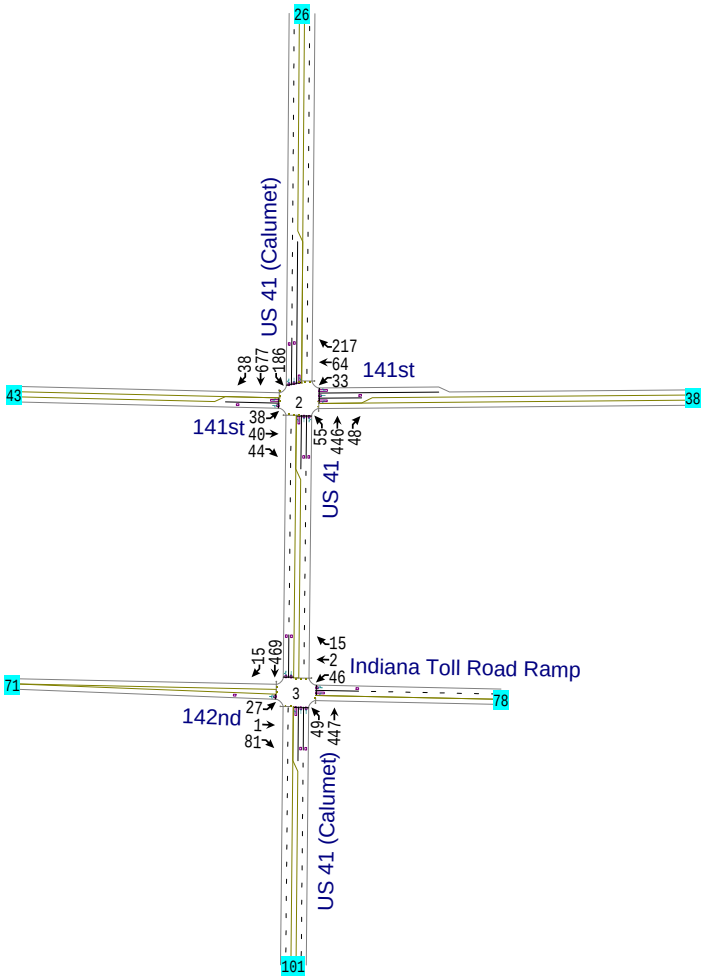

SR 912 West Service Road
SR 912 East Service Road
SR 312 (Chicago)
SR 312 (Chicago)
SR
SR 912 West Service Road
SR 912 East Service Road
83
85
89
90
84
86
11
12
0
312
21
16
54
55
4
67
15
25
43
280
39
40

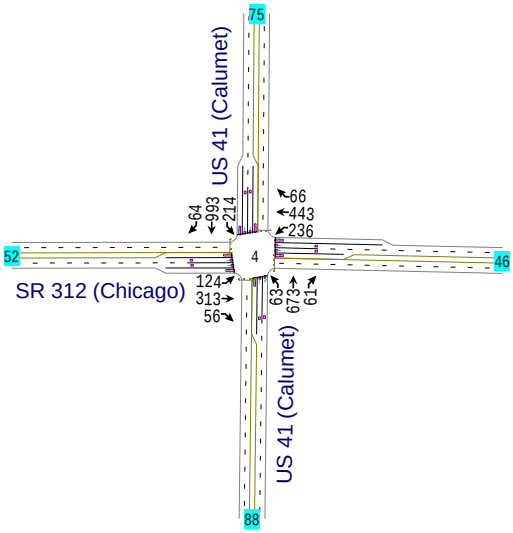

60
66
26
155
0
53
31
36
SR 912 On/Off Ramp
37
155
5
36
67
18
51
1236
10
31
258
Watling
0
0
47
44
5
21
5
0
49
1
Joblink
288
15
50
30
708
7
13
20
237
5
2
0
10
1
308
13
M.L. King Dr.
62
1427
5
59
1
1
2
20
31
Grand


SR912 On Ramp
175
62
20
52
515
95
62
155
21
19
412
93
SR912 Off Ramp
54

2013 PM1(EARLY) PEAK HOUR VOLUMES


31
12
1273
175
14
1
80
131st Place
1
14
10
20
SR 912 Ramp
87
43
607
41
US 41 (Calumet)
34
1432
31
22
62
31
SR 912 Ramp
98
628
10
US 41 (Calumet)
105
US 41 (Calumet)


26
US 41 (Calumet)
38
677
186
217
64
33
141st
43
2
38
141st
38
40
44
55
446
48
US 41
15
469
15
2
46
Indiana Toll Road Ramp
71
3
78
142nd
27
1
81
49
447
US 41 (Calumet)
101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SR 312 (Chicago)
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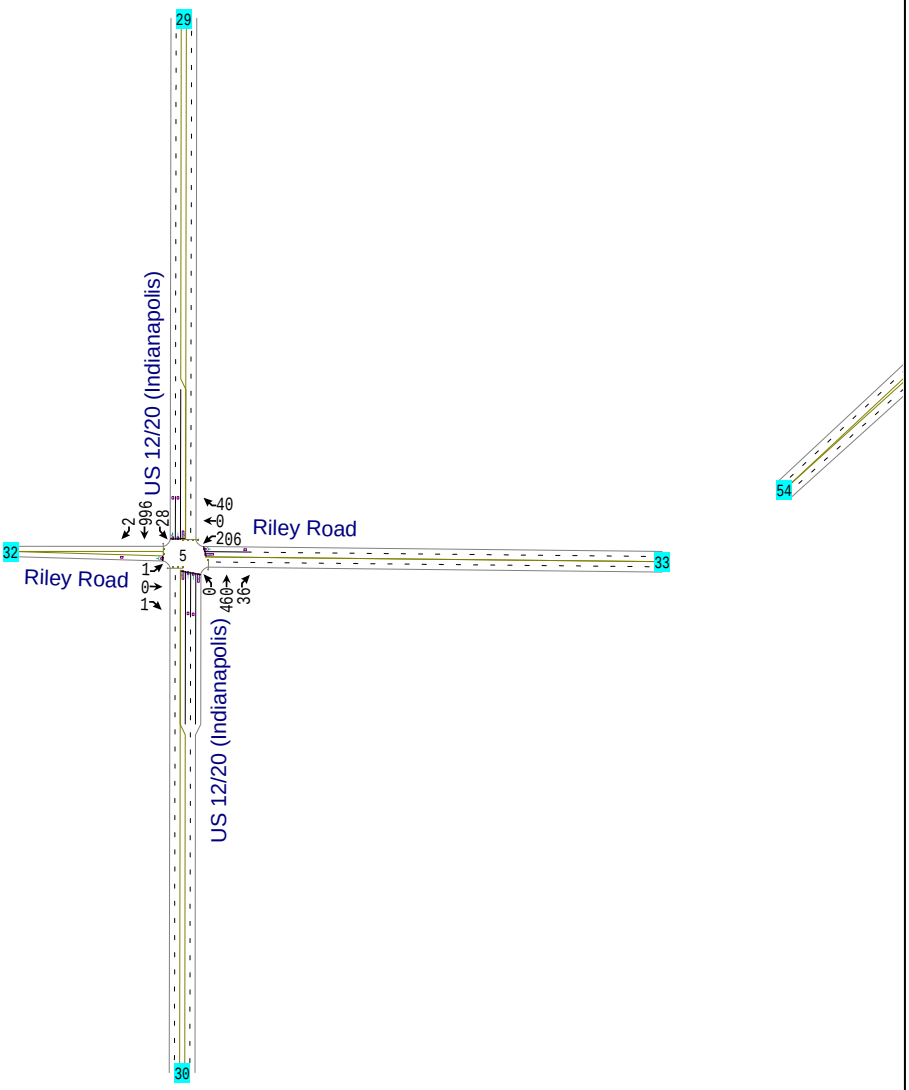
313
56
63
673
61
US 41 (Calumet)
88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US 12/20 (Indianapolis)
2
996
28
40
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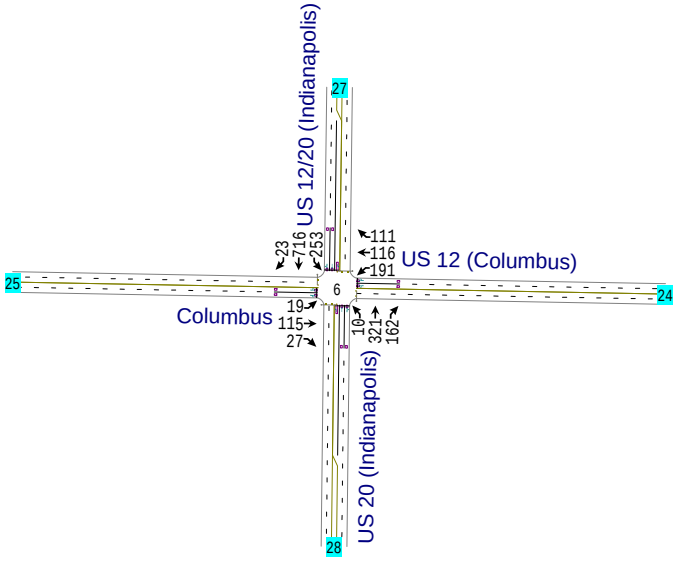
206
Riley Road
32
5
33
Riley Road
1
0
1
0
460
36
US 12/20 (Indianapolis)
30
54


US 12/20 (Indianapolis)
27
23
716
253
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Columbus
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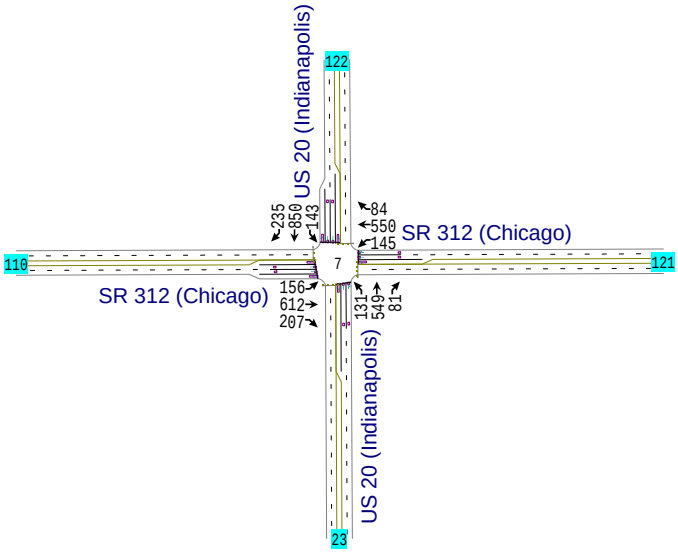
115
27
6
111
116
191
US 12 (Columbus)
24
10
321
162
US 20 (Indianapolis)
28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SR 312 (Chicago)
156
612
207
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US 20 (Indianapolis)
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549
81
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SR 312 (Chicago)
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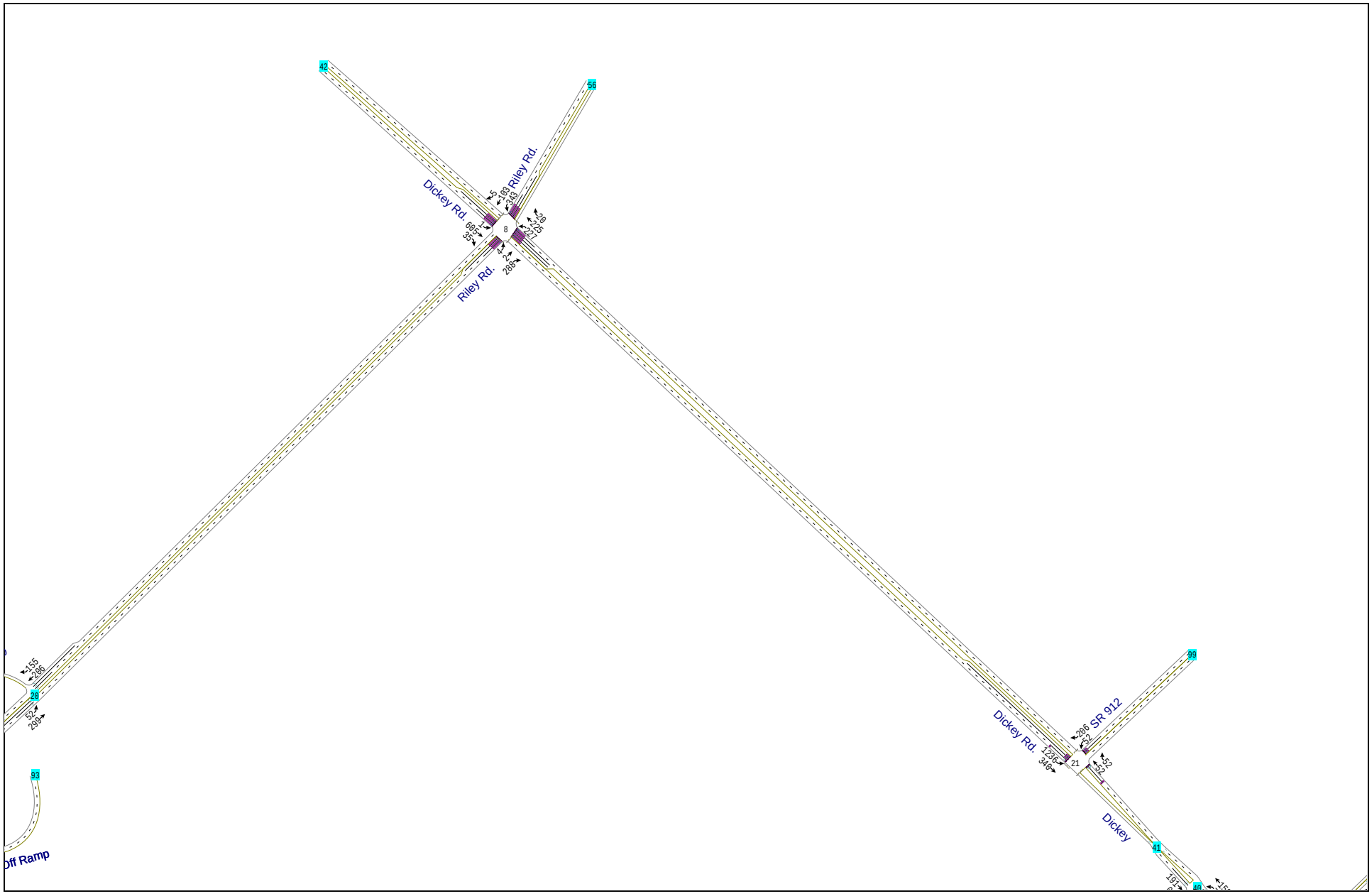
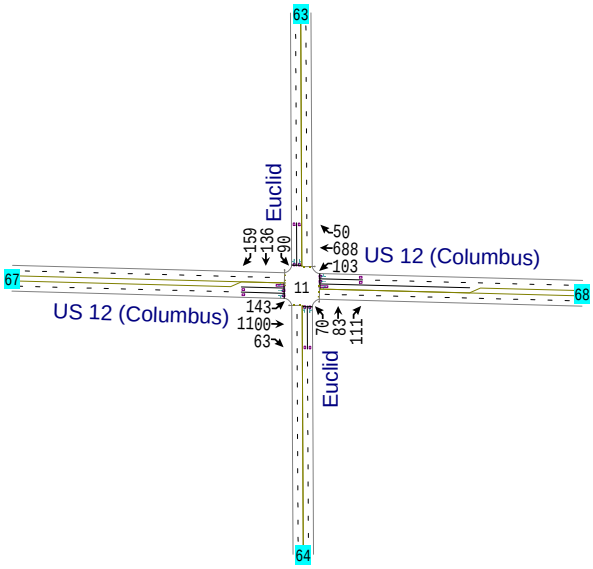
122
US 20 (Indianapolis)
235
850
143


42
56
Dickey Rd.
Riley Rd.
Riley Rd.
8
99
SR 912
Dickey Rd.
21
Dickey
41
93
Off Ramp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Euclid
159
136
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US 12 (Columbus)
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63
11
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688
103
US 12 (Columbus)
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70
83
111
Euclid
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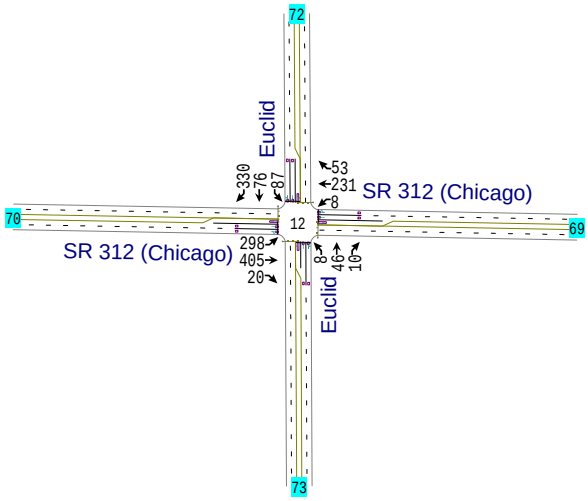
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72
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10
53
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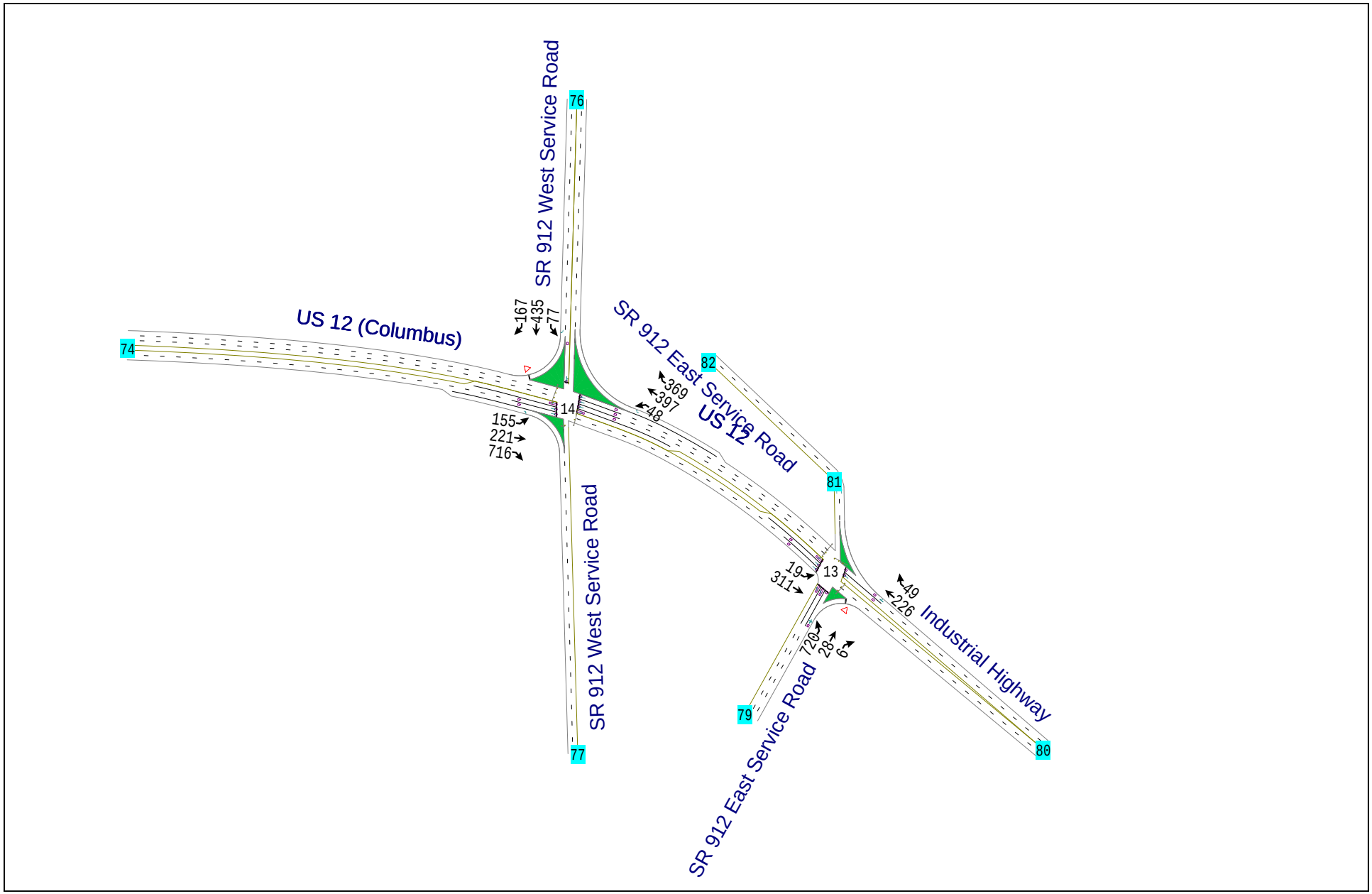
SR 312 (Chicago)
69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US 12 (Columbus)
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167
435
77
14
155
221
716
SR 912 East Service Road
82
369
397
48
US 12
81
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19
311
49
226
Industrial Highway
720
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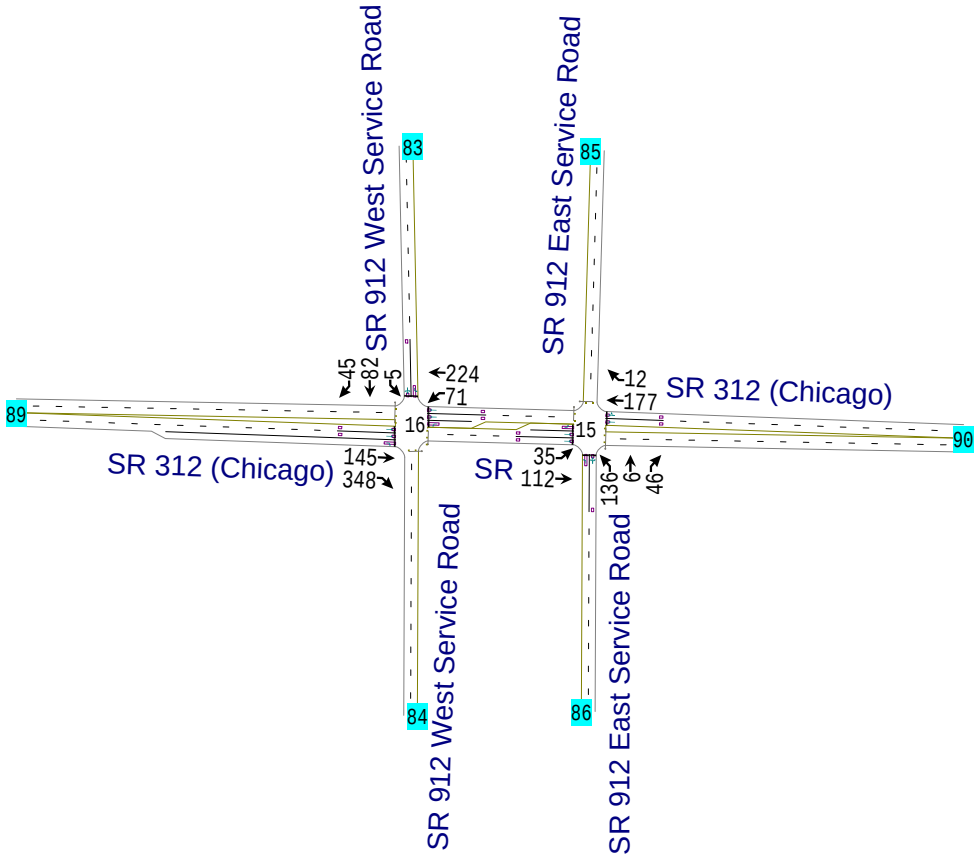
6
79
80
SR 912 West Service Road
77
SR 912 East Service Road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89
145
348
SR 912 West Service Road
84
45
82
5
16
224
71
83
SR 912 West Service Road
SR 312 (Chicago)
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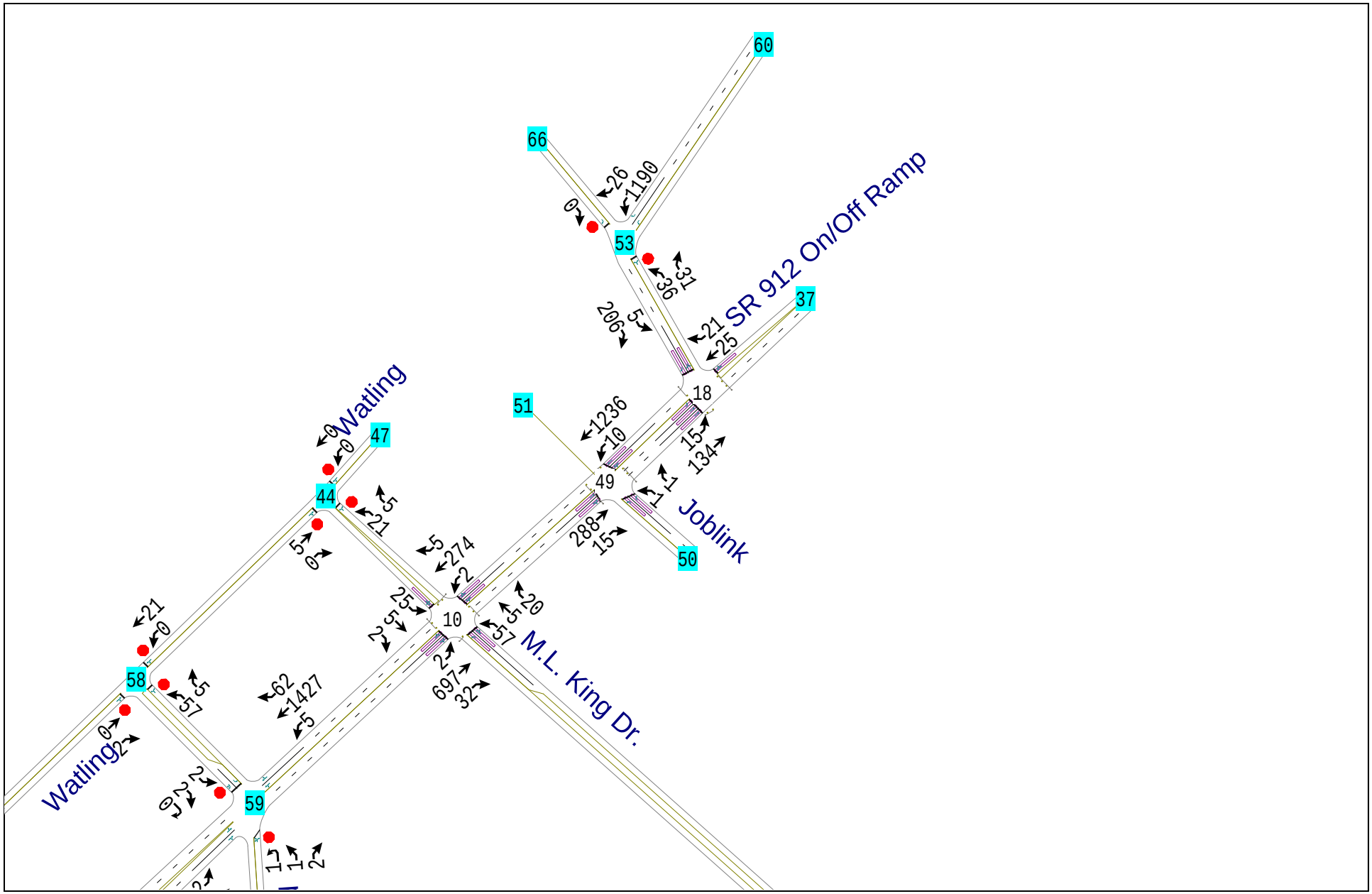
35
112
SR
15
12
177
SR 912 East Service Road
85
136
6
46
SR 912 East Service Road
86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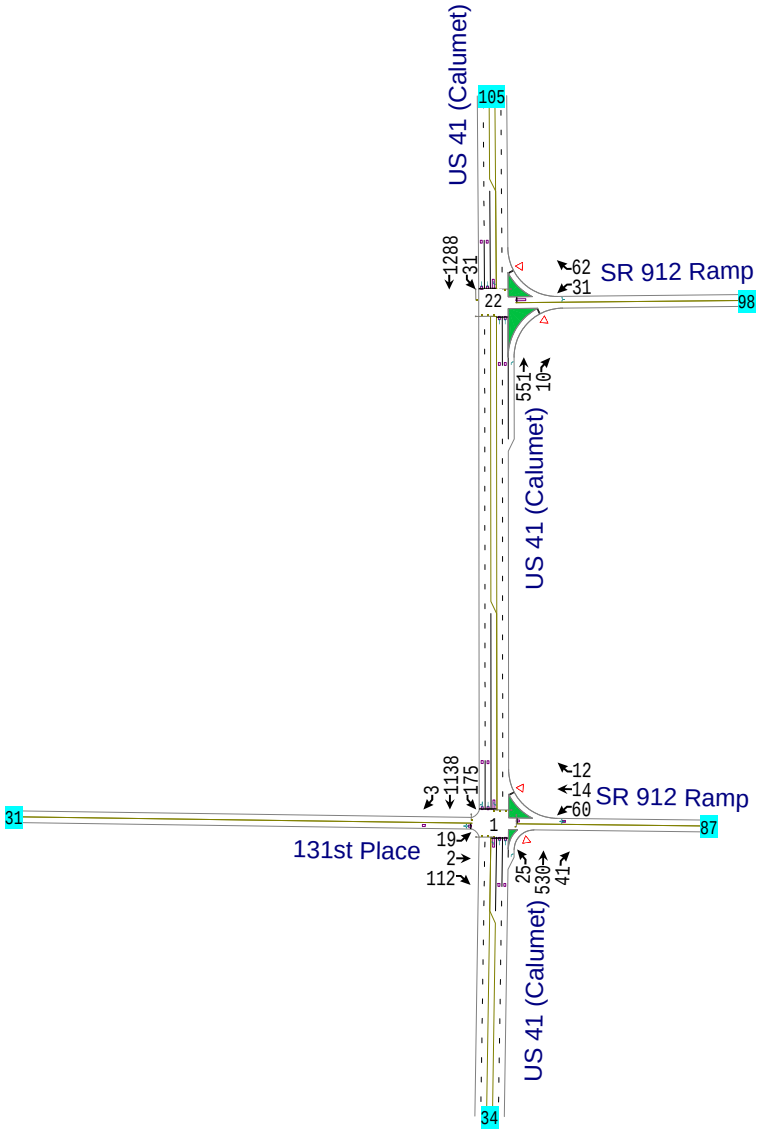
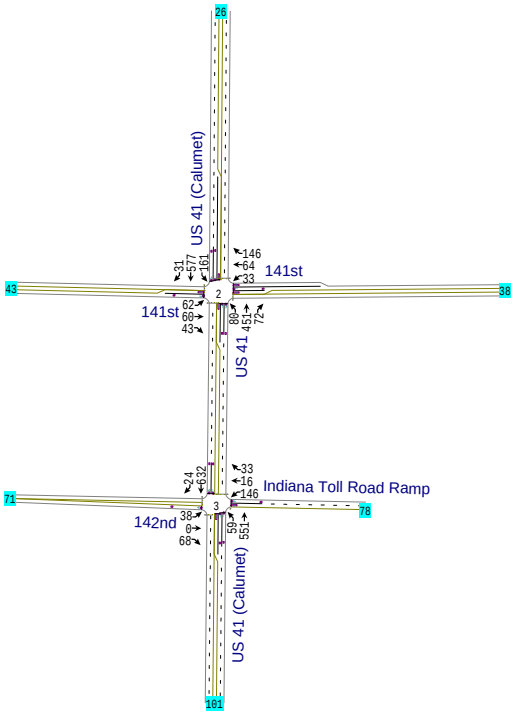
66
26
1190
0
53
31
35
206
5
21
25
37
SR 912 On/Off Ramp
18
51
1236
10
15
134
49
1
1
Joblink
288
15
50
Watling
0
0
47
44
5
21
5
0
5
274
2
25
5
2
10
20
5
57
M.L. King Dr.
2
697
32
21
0
58
5
57
62
1427
5
Watling
0
2
2
2
0
59
1
1
2

SR912 On Ramp
155
206
20
52
299
95
93
206
232
41
19
118
Riley Road
SR912 Off Ramp
54
33

2013 PM2(LATE) PEAK HOUR VOLUMES


31
3
1138
175
19
2
112
131st Place
1
12
14
60
SR 912 Ramp
87
25
530
41
US 41 (Calumet)
34
551
10
US 41 (Calumet)
1288
31
22
62
31
SR 912 Ramp
98
105
US 41 (Calumet)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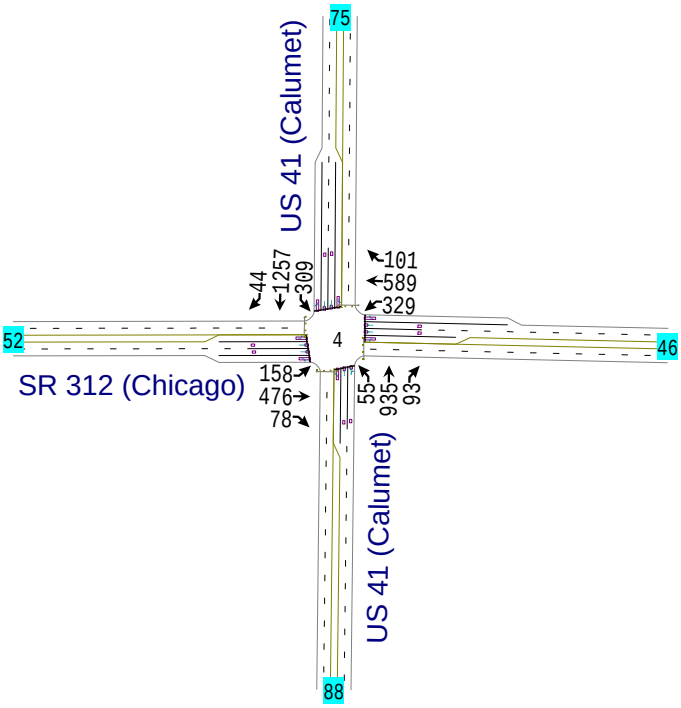
31
577
161
146
64
33
141st
43
38
2
141st
62
69
43
86
451
72
US 41
24
632
33
16
146
Indiana Toll Road Ramp
71
3
78
142nd
38
9
68
59
551
US 41 (Calumet)
101


75
US 41 (Calumet)
44
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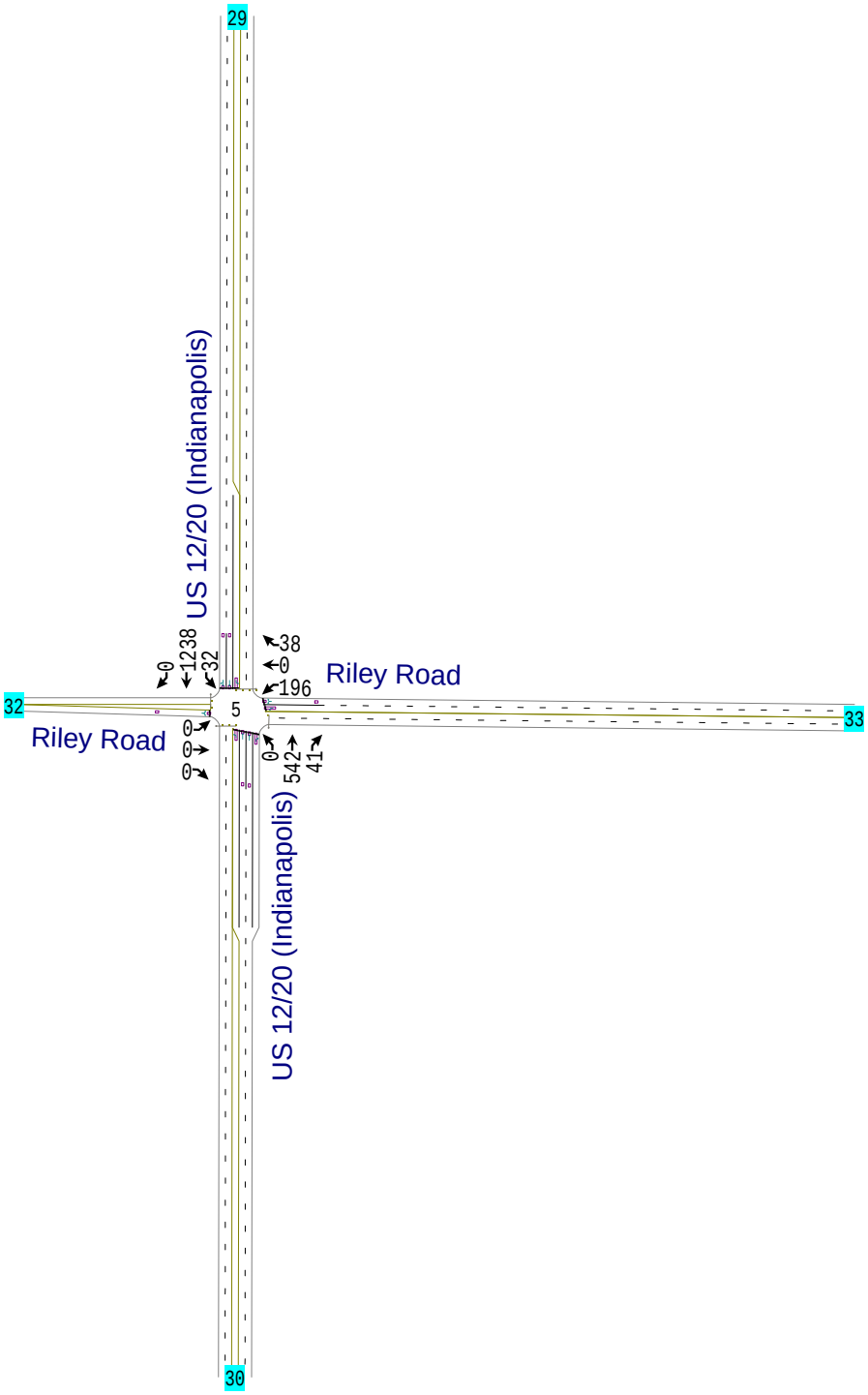
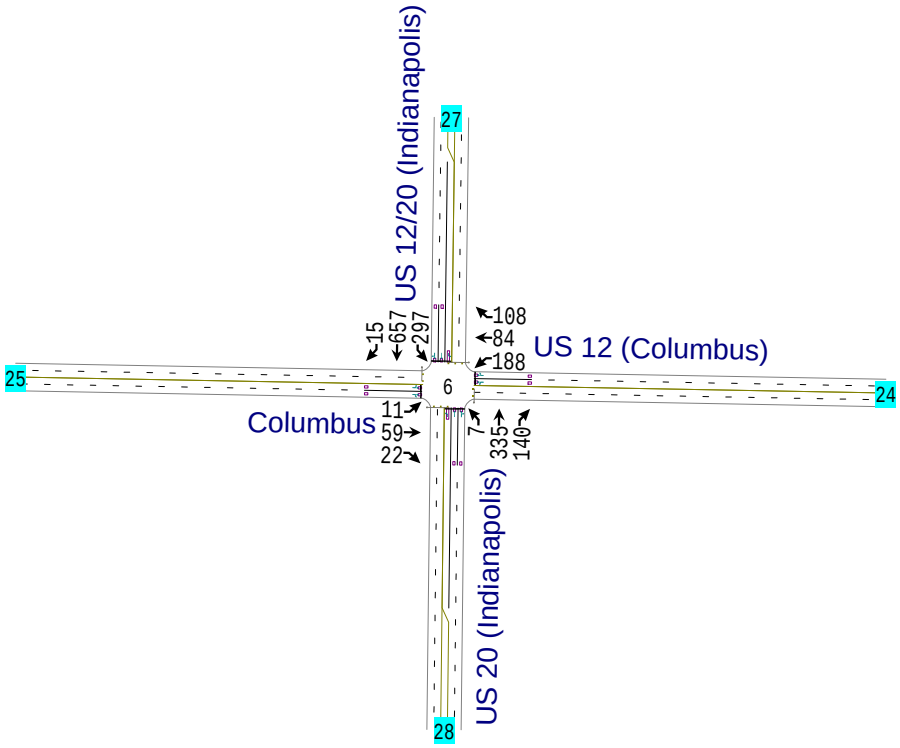
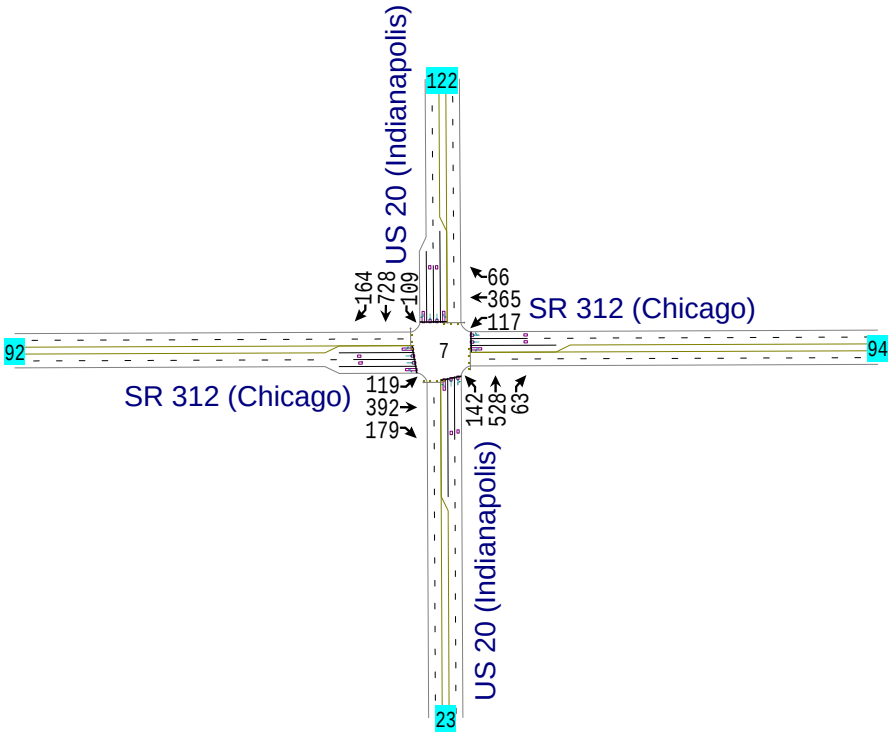
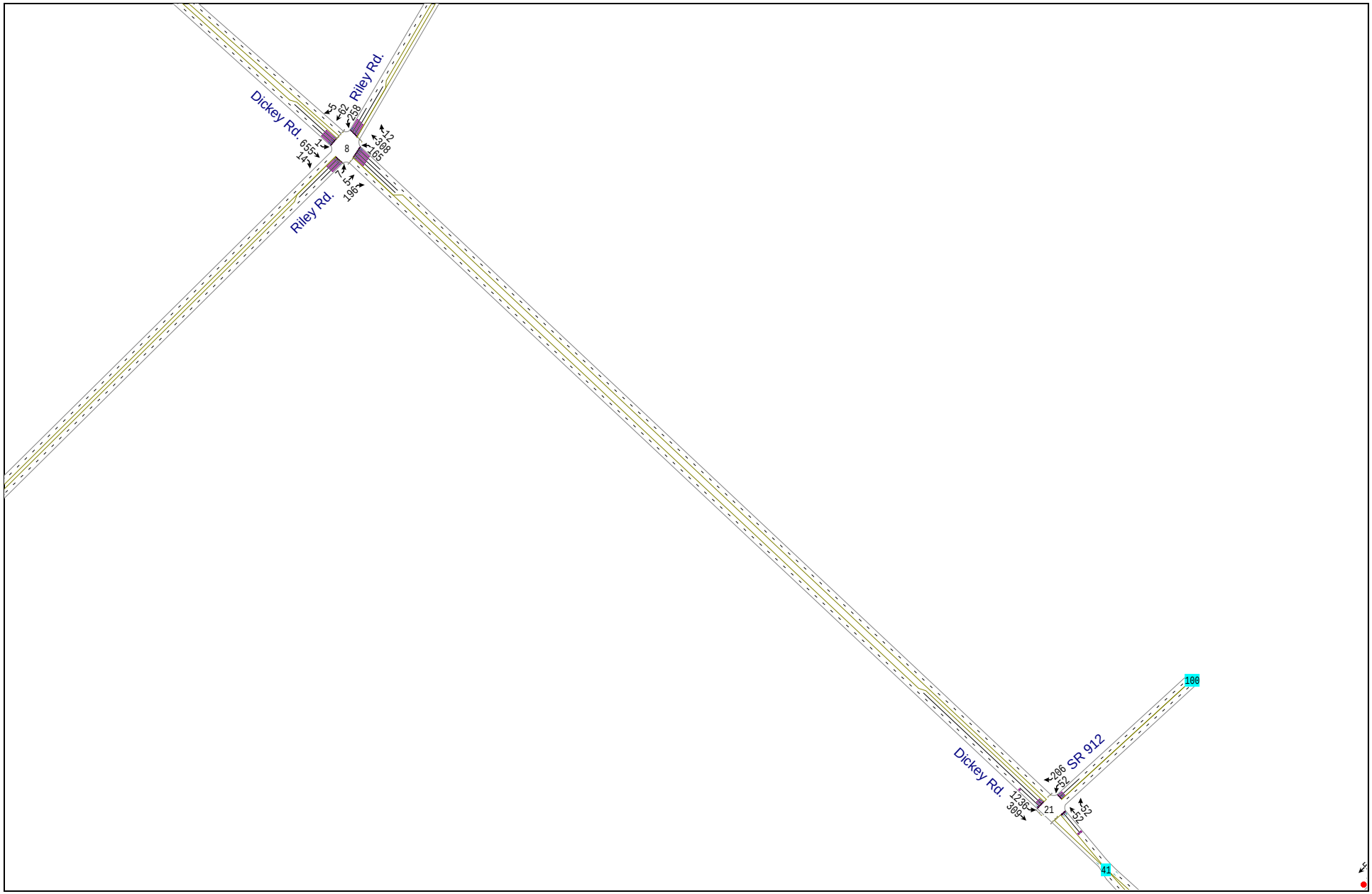
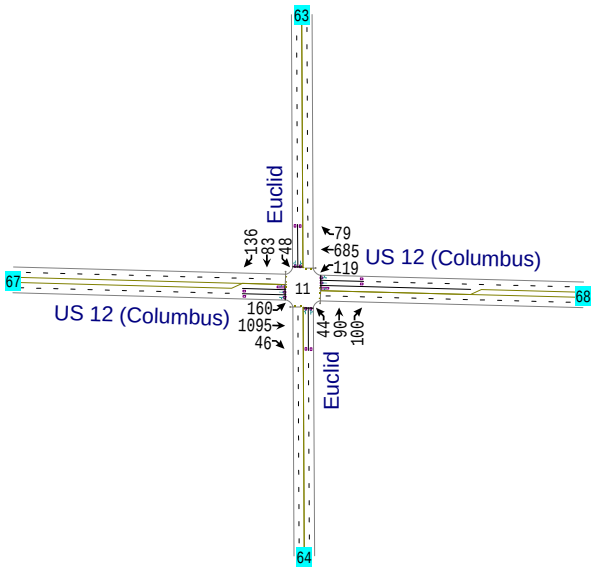
309
101
589
329
52
4
46
SR 312 (Chicago)
158
476
78
55
935
93
US 41 (Calumet)
88

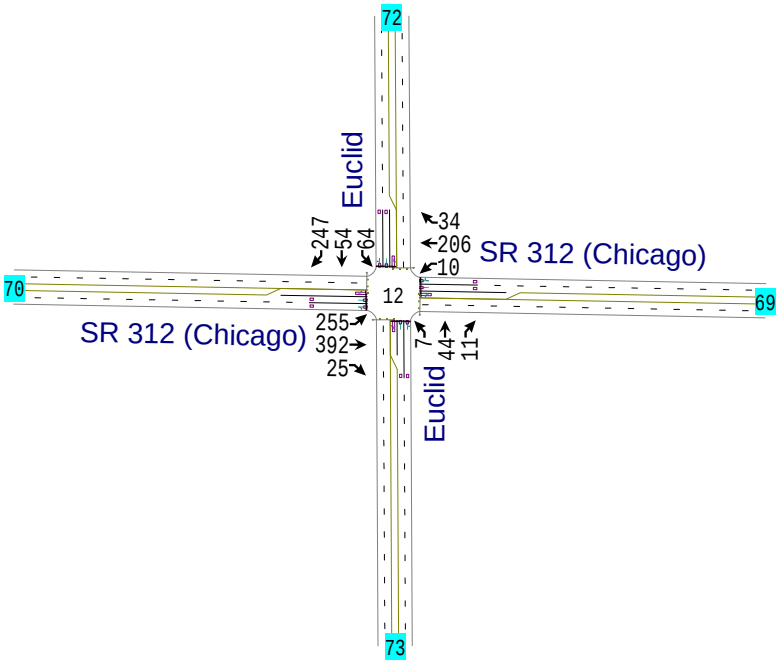

29
US 12/20 (Indianapolis)
0
1238
32
38
0
196
Riley Road
32
5
33
Riley Road
0
0
0
0
542
41
US 12/20 (Indianapolis)
30

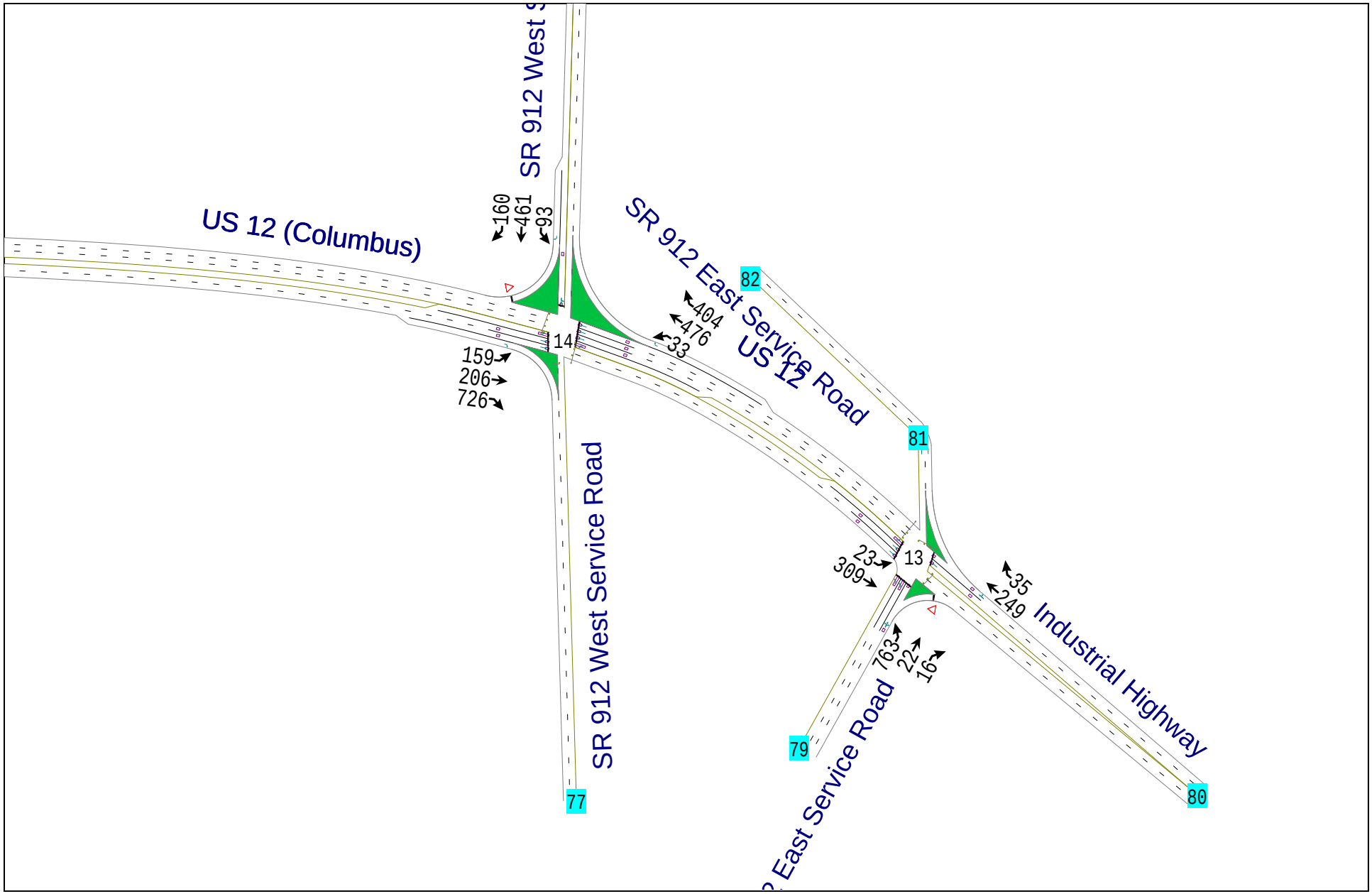

US 12/20 (Indianapolis)
27
15
657
297
108
84
188
US 12 (Columbus)
25
6
24
Columbus
11
59
22
7
335
140
US 20 (Indianapolis)
28

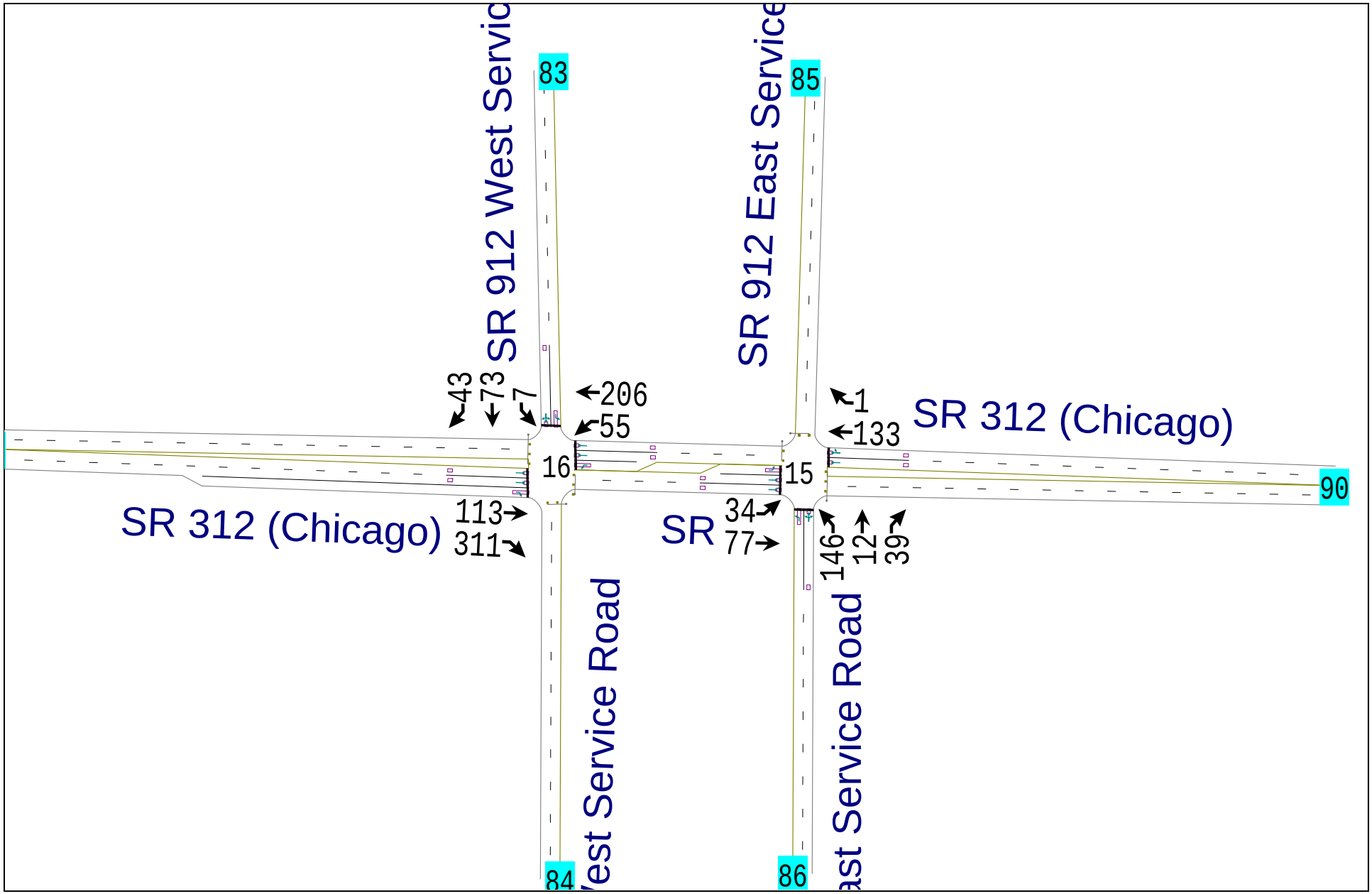

US 20 (Indianapolis)
122
23
SR 312 (Chicago)
92
94
7
164
728
109
66
365
117
119
392
179
142
528
63

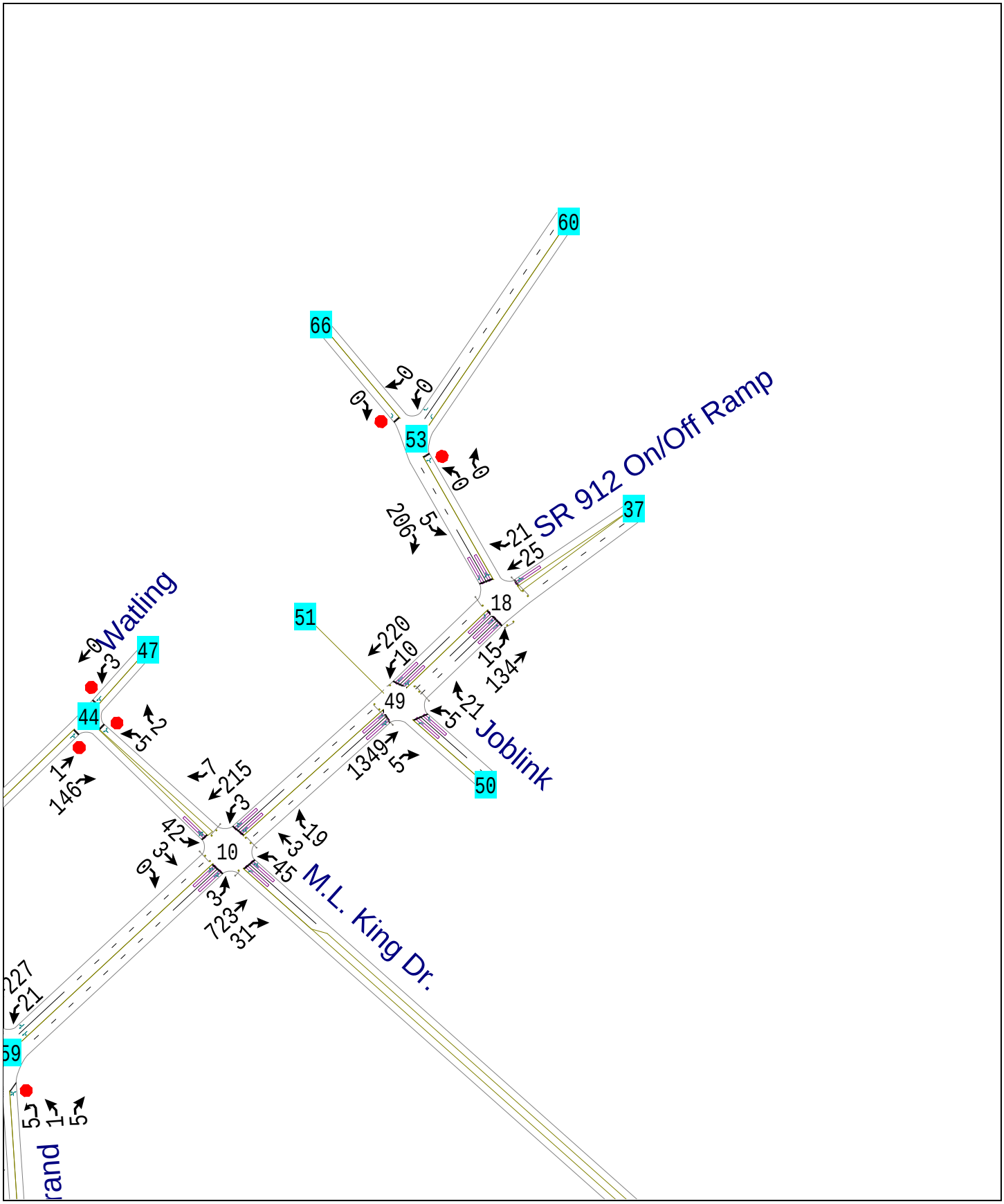

Dickey Rd.
Riley Rd.
Riley Rd.
Dickey Rd.
SR 912
8
21
100
41

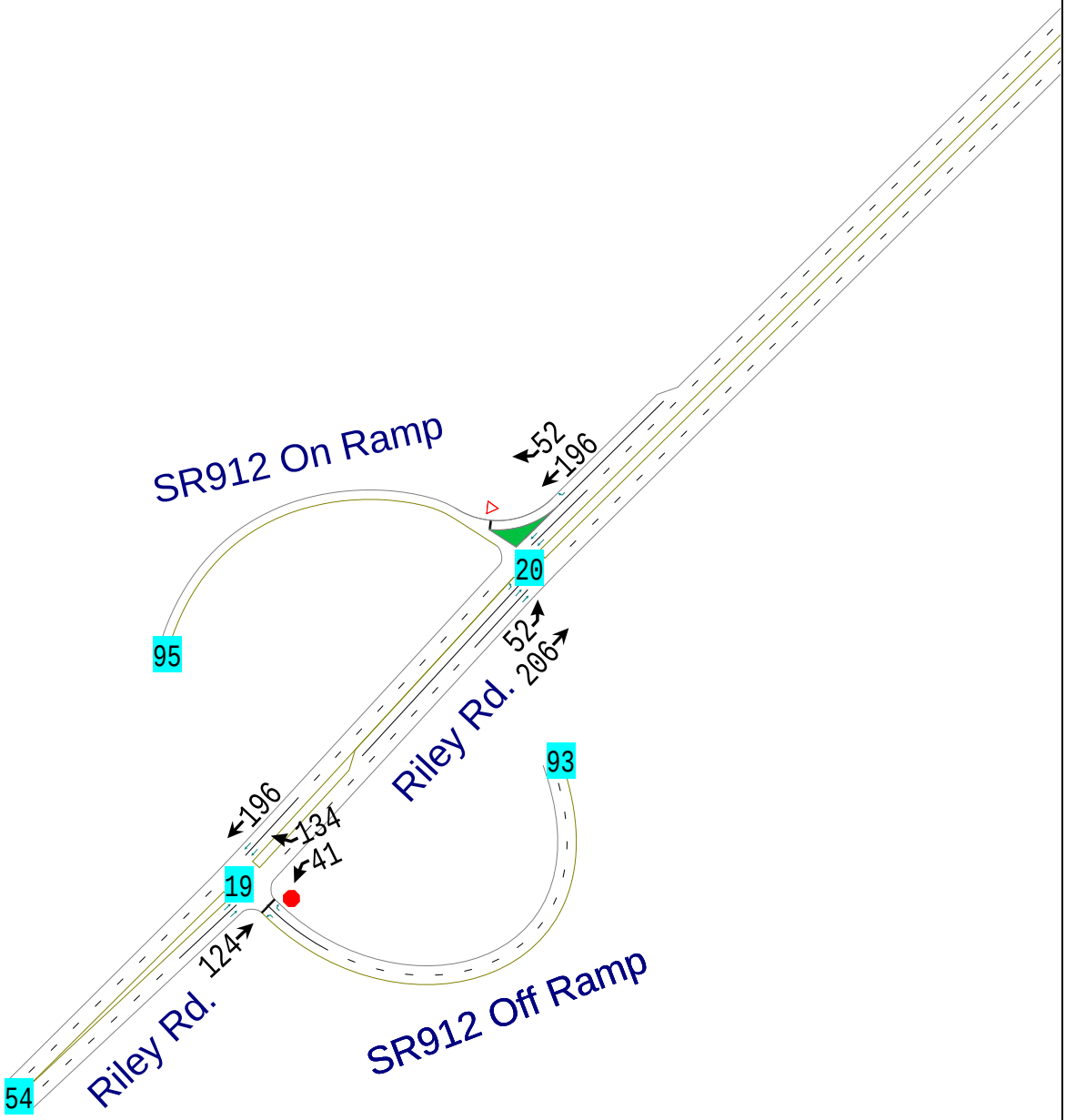

63
Euclid
136
83
48
79
685
119
US 12 (Columbus)
67
11
68
US 12 (Columbus)
160
1095
46
44
90
100
Euclid
64


72
Euclid
247
54
64
34
206
10
SR 312 (Chicago)
70
12
69
SR 312 (Chicago)
255
392
25
7
44
11
Euclid
73


US 12 (Columbus)
SR 912 West S
SR 912 East Service Road
US 12
SR 912 West Service Road
Industrial Highway
East Service Road
160
461
93
159
206
726
14
404
476
33
82
81
77
79
80
23
309
13
35
249
763
22
16


SR 912 West Servic
83
43
73
7
206
55
16
SR 312 (Chicago)
113
311
84
West Service Road
SR 912 East Service
85
1
133
SR 312 (Chicago)
15
90
34
77
SR
146
12
39
86
East Service Road


60
66
53
SR 912 On/Off Ramp
37
206
21
25
18
51
220
10
15
134
49
21
Joblink
50
1349
5
Watling
47
44
146
7
215
3
42
10
19
45
M.L. King Dr.
723
31
227
21
59
rand


SR912 On Ramp
52
196
20
95
52
206
Riley Rd.
93
196
134
41
19
124
Riley Rd.
SR912 Off Ramp
54

2013 AM PEAK HOUR CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	0	30	9	2	23	41	1042	30	60	252	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.91			0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1672			1323		1770	3539	1482	1656	3304	
Flt Permitted		0.86			0.92		0.55	1.00	1.00	0.15	1.00	
Satd. Flow (perm)		1467			1237		1030	3539	1482	269	3304	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	22	0	39	12	3	30	53	1342	39	77	324	5
RTOR Reduction (vph)	0	36	0	0	27	0	0	0	4	0	1	0
Lane Group Flow (vph)	0	25	0	0	18	0	53	1342	35	77	328	0
Heavy Vehicles (%)	2%	2%	2%	29%	29%	29%	2%	2%	9%	9%	9%	9%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		7.1			7.1		60.5	58.1	58.1	65.1	60.4	
Effective Green, g (s)		7.1			7.1		60.5	58.1	58.1	65.1	60.4	
Actuated g/C Ratio		0.08			0.08		0.71	0.68	0.68	0.77	0.71	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)		123			103		755	2422	1014	283	2351	
v/s Ratio Prot							0.00	c0.38		c0.02	0.10	
v/s Ratio Perm		c0.02			0.01		0.05		0.02	0.19		
v/c Ratio		0.21			0.17		0.07	0.55	0.03	0.27	0.14	
Uniform Delay, d1		36.3			36.2		3.6	6.8	4.3	4.0	3.9	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.1			1.1		0.0	0.9	0.1	0.5	0.1	
Delay (s)		37.4			37.2		3.7	7.7	4.4	4.5	4.0	
Level of Service		D			D		A	A	A	A	A	
Approach Delay (s)		37.4			37.2			7.5			4.1	
Approach LOS		D			D			A			A	

Intersection Summary

HCM Average Control Delay	8.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	84.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	32	15	51	92	607	13	478	69	42	185	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1768		1770	1863	1583	1770	3476		1770	3496	
Flt Permitted	0.67	1.00		0.71	1.00	1.00	0.57	1.00		0.22	1.00	
Satd. Flow (perm)	1249	1768		1320	1863	1583	1054	3476		412	3496	
Peak-hour factor, PHF	0.82	0.67	0.62	0.58	0.70	0.86	0.65	0.85	0.91	0.55	0.68	0.29
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	41	49	25	91	135	727	21	579	78	79	280	25
RTOR Reduction (vph)	0	14	0	0	0	139	0	11	0	0	7	0
Lane Group Flow (vph)	41	60	0	91	135	588	21	646	0	79	298	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	37.1	37.1		37.1	37.1	37.1	25.6	25.6		36.2	36.2	
Effective Green, g (s)	37.1	37.1		37.1	37.1	37.1	25.6	25.6		36.2	36.2	
Actuated g/C Ratio	0.43	0.43		0.43	0.43	0.43	0.30	0.30		0.42	0.42	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	536	758		566	799	679	312	1029		235	1463	
v/s Ratio Prot		0.03			0.07			c0.19		c0.02	0.09	
v/s Ratio Perm	0.03			0.07		c0.37	0.02			0.12		
v/c Ratio	0.08	0.08		0.16	0.17	0.87	0.07	0.63		0.34	0.20	
Uniform Delay, d1	14.6	14.6		15.2	15.2	22.4	21.9	26.3		16.7	16.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.3	0.2	12.1	0.4	2.9		0.9	0.3	
Delay (s)	14.7	14.7		15.4	15.4	34.5	22.3	29.2		17.5	16.3	
Level of Service	B	B		B	B	C	C	C		B	B	
Approach Delay (s)		14.7			30.0			29.0			16.6	
Approach LOS		B			C			C			B	

Intersection Summary

HCM Average Control Delay	26.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	19.8
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	0	23	19	3	3	11	696	0	0	250	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.90		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1684		1770	1676		1770	3539			3521	
Flt Permitted		0.85		0.72	1.00		0.54	1.00			1.00	
Satd. Flow (perm)		1469		1332	1676		1005	3539			3521	
Peak-hour factor, PHF	0.62	0.92	0.66	0.71	0.75	0.38	0.62	0.82	0.62	0.33	0.75	0.33
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	28	0	36	28	4	8	18	874	0	0	343	12
RTOR Reduction (vph)	0	32	0	0	7	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	32	0	28	5	0	18	874	0	0	353	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		8.3		8.3	8.3		56.1	56.1			56.1	
Effective Green, g (s)		8.3		8.3	8.3		56.1	56.1			56.1	
Actuated g/C Ratio		0.11		0.11	0.11		0.74	0.74			0.74	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		160		145	182		739	2602			2589	
v/s Ratio Prot					0.00			c0.25			0.10	
v/s Ratio Perm		c0.02		0.02			0.02					
v/c Ratio		0.20		0.19	0.03		0.02	0.34			0.14	
Uniform Delay, d1		31.0		31.0	30.4		2.7	3.6			3.0	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		1.3		1.4	0.1		0.1	0.3			0.1	
Delay (s)		32.3		32.3	30.5		2.8	3.9			3.1	
Level of Service		C		C	C		A	A			A	
Approach Delay (s)		32.3			31.8			3.9			3.1	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	76.3	Sum of lost time (s)	11.9
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	114	20	29	139	108	28	493	35	53	226	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3504		1770	3539	1583
Flt Permitted	0.64	1.00	1.00	0.66	1.00	1.00	0.57	1.00		0.34	1.00	1.00
Satd. Flow (perm)	1190	3539	1583	1227	3539	1583	1069	3504		634	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	41	147	26	37	179	139	36	635	45	68	291	35
RTOR Reduction (vph)	0	0	22	0	0	119	0	3	0	0	0	16
Lane Group Flow (vph)	41	147	4	37	179	20	36	677	0	68	291	19
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	15.2	12.0	12.0	15.2	12.0	12.0	47.7	44.5		52.1	46.7	46.7
Effective Green, g (s)	15.2	12.0	12.0	15.2	12.0	12.0	47.7	44.5		52.1	46.7	46.7
Actuated g/C Ratio	0.18	0.14	0.14	0.18	0.14	0.14	0.56	0.52		0.61	0.55	0.55
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	234	499	223	240	499	223	626	1832		460	1942	869
v/s Ratio Prot	c0.01	0.04		0.01	c0.05		0.00	c0.19		c0.01	0.08	
v/s Ratio Perm	0.02		0.00	0.02		0.01	0.03			0.08		0.01
v/c Ratio	0.18	0.29	0.02	0.15	0.36	0.09	0.06	0.37		0.15	0.15	0.02
Uniform Delay, d1	29.4	32.8	31.5	29.3	33.1	31.8	8.4	12.0		6.9	9.4	8.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.7	0.1	0.3	0.9	0.4	0.0	0.6		0.1	0.2	0.0
Delay (s)	29.7	33.4	31.5	29.6	34.0	32.1	8.4	12.6		7.1	9.6	8.8
Level of Service	C	C	C	C	C	C	A	B		A	A	A
Approach Delay (s)		32.5			32.8			12.4			9.1	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	24.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	60	0	18	3	1258	330	47	264	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	5.2		6.0	6.0	6.0	4.0	6.0	
Lane Util. Factor				0.95	0.95		1.00	0.95	1.00	1.00	0.95	
Frt				1.00	0.93		1.00	1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.97		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1573	1539		1770	3312	1524	1626	3034	
Flt Permitted				0.95	0.95		0.54	1.00	1.00	0.09	1.00	
Satd. Flow (perm)				1573	1500		1002	3312	1524	154	3034	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.80	0.80	0.85	0.80	0.80	0.76	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	0	0	0	77	0	23	4	1524	425	61	358	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	0	170	0	0	0
Lane Group Flow (vph)	0	0	0	52	30	0	4	1524	255	61	358	0
Heavy Vehicles (%)	2%	2%	2%	9%	2%	3%	2%	9%	6%	11%	19%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)				19.7	19.7		55.0	55.0	55.0	62.1	62.1	
Effective Green, g (s)				19.7	19.7		55.0	55.0	55.0	62.1	62.1	
Actuated g/C Ratio				0.21	0.21		0.60	0.60	0.60	0.68	0.68	
Clearance Time (s)				4.0	5.2		6.0	6.0	6.0	4.0	6.0	
Vehicle Extension (s)				3.0	3.0		5.5	5.5	5.5	3.0	5.5	
Lane Grp Cap (vph)				338	330		600	1984	913	154	2052	
v/s Ratio Prot				c0.03	0.02			c0.46		c0.01	0.12	
v/s Ratio Perm							0.00		0.17	0.25		
v/c Ratio				0.15	0.09		0.01	0.77	0.28	0.40	0.17	
Uniform Delay, d1				29.3	28.9		7.4	13.7	8.9	10.2	5.4	
Progression Factor				1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2				0.2	0.1		0.0	2.9	0.8	1.7	0.2	
Delay (s)				29.5	29.0		7.4	16.6	9.6	11.9	5.6	
Level of Service				C	C		A	B	A	B	A	
Approach Delay (s)		0.0			29.3			15.1			6.5	
Approach LOS		A			C			B			A	

Intersection Summary

HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	91.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	16	0	38	29	292	2	675	39	77	130	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		1.00			0.88		1.00	0.99		1.00	1.00	
Flt Protected		0.98			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3453			3088		1770	3514		1770	3539	
Flt Permitted		0.62			0.91		0.61	1.00		0.13	1.00	
Satd. Flow (perm)		2205			2825		1132	3514		240	3539	
Peak-hour factor, PHF	0.42	0.52	0.92	0.74	0.67	0.67	0.50	0.62	0.71	0.62	0.58	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	32	32	0	53	45	449	4	1121	57	128	231	0
RTOR Reduction (vph)	0	0	0	0	135	0	0	4	0	0	0	0
Lane Group Flow (vph)	0	64	0	0	412	0	4	1174	0	128	231	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		19.7			19.7		44.2	43.4		55.6	50.8	
Effective Green, g (s)		19.7			19.7		44.2	43.4		55.6	50.8	
Actuated g/C Ratio		0.22			0.22		0.50	0.49		0.63	0.57	
Clearance Time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		3.0	7.0	
Lane Grp Cap (vph)		491			629		571	1723		293	2031	
v/s Ratio Prot							0.00	c0.33		c0.04	0.07	
v/s Ratio Perm		0.03			c0.15		0.00			0.23		
v/c Ratio		0.13			0.89dr		0.01	0.68		0.44	0.11	
Uniform Delay, d1		27.5			31.3		11.1	17.3		10.4	8.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			3.3		0.0	2.2		1.0	0.1	
Delay (s)		27.8			34.6		11.1	19.5		11.5	8.7	
Level of Service		C			C		B	B		B	A	
Approach Delay (s)		27.8			34.6			19.4			9.7	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	186	36	27	123	194	45	718	27	22	134	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3215		1770	3508		1770	3539	1583
Flt Permitted	0.45	1.00	1.00	0.59	1.00		0.61	1.00		0.15	1.00	1.00
Satd. Flow (perm)	838	3539	1583	1099	3215		1138	3508		289	3539	1583
Peak-hour factor, PHF	0.76	0.73	0.75	0.61	0.90	0.90	0.62	0.81	0.48	0.61	0.78	0.55
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	87	262	49	46	141	222	75	913	58	37	177	66
RTOR Reduction (vph)	0	0	33	0	153	0	0	4	0	0	0	42
Lane Group Flow (vph)	87	262	16	46	210	0	75	967	0	37	177	24
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	40.3	34.0	34.0	36.1	31.9		45.6	39.6		42.0	37.8	37.8
Effective Green, g (s)	40.3	34.0	34.0	36.1	31.9		45.6	39.6		42.0	37.8	37.8
Actuated g/C Ratio	0.40	0.33	0.33	0.35	0.31		0.45	0.39		0.41	0.37	0.37
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	389	1180	528	417	1005		546	1362		180	1312	587
v/s Ratio Prot	c0.01	0.07		0.00	0.07		0.01	c0.28		c0.01	0.05	
v/s Ratio Perm	c0.07		0.01	0.03			0.05			0.08		0.02
v/c Ratio	0.22	0.22	0.03	0.11	0.21		0.14	0.71		0.21	0.13	0.04
Uniform Delay, d1	19.8	24.5	22.9	21.9	25.8		16.3	26.3		19.7	21.3	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4	0.1	0.1	0.5		0.1	2.2		0.6	0.1	0.1
Delay (s)	20.1	24.9	23.0	22.0	26.2		16.4	28.5		20.3	21.4	20.6
Level of Service	C	C	C	C	C		B	C		C	C	C
Approach Delay (s)		23.6			25.8			27.6			21.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	204	200	26	8	0	220	841	327	15	214	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	4.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	1827	1062	2398	1338		3183	3273		1787	3369	
Flt Permitted	0.75	1.00	1.00	0.95	1.00		0.95	1.00		0.16	1.00	
Satd. Flow (perm)	1295	1827	1062	2398	1338		3183	3273		297	3369	
Peak-hour factor, PHF	0.70	0.70	0.70	0.82	0.70	0.70	0.84	0.73	0.87	0.75	0.81	0.75
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	143	300	294	33	12	0	270	1187	387	21	272	4
RTOR Reduction (vph)	0	0	222	0	0	0	0	35	0	0	1	0
Lane Group Flow (vph)	143	300	72	33	12	0	270	1539	0	21	275	0
Heavy Vehicles (%)	10%	4%	52%	46%	42%	5%	10%	5%	10%	1%	7%	1%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	18.7	18.7	18.7	2.0	24.7		11.8	42.1		25.3	25.3	
Effective Green, g (s)	18.7	18.7	18.7	2.0	24.7		11.8	42.1		25.3	25.3	
Actuated g/C Ratio	0.24	0.24	0.24	0.03	0.32		0.15	0.55		0.33	0.33	
Clearance Time (s)	5.0	5.0	5.0	4.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.5	3.5	3.5	3.0	3.5		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	315	445	259	62	430		489	1794		98	1110	
v/s Ratio Prot		c0.16		c0.01	0.01		0.08	c0.47			0.08	
v/s Ratio Perm	0.11		0.07							0.07		
v/c Ratio	0.45	0.67	0.28	0.53	0.03		0.55	0.86		0.21	0.25	
Uniform Delay, d1	24.7	26.3	23.6	36.9	17.8		30.1	14.8		18.6	18.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	4.2	0.7	8.5	0.0		1.5	4.4		1.3	0.1	
Delay (s)	25.9	30.5	24.3	45.4	17.9		31.5	19.2		19.9	18.9	
Level of Service	C	C	C	D	B		C	B		B	B	
Approach Delay (s)		27.1			38.1			21.0			19.0	
Approach LOS		C			D			C			B	

Intersection Summary

HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	76.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2013 AM Peak Rodel Analysis - Intersection 8

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E    (m)    8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)   10.00  10.00  20.00  10.00           TIME SLICE     min     15
V    (m)    7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)   20.00  20.00  20.00  20.00           TIME COST     $/hr  15.00
PHI  (d)   30.00  30.00  30.00  30.00           FLOW PERIOD    min  15 75
DIA  (m)   50.00  50.00  50.00  50.00           FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0           FLOW PEAK am/op/pm     AM

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U)  FLOF  CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.07     3  220   15  0          1.00  85  0.75 1.701 0.75  15 45 75
EB RILEY   1.24   206  210  100  0          1.00  85  0.75 1.701 0.75  15 45 75
NB DICKEY  1.07   337  866  337  0          1.00  85  0.75 1.701 0.75  15 45 75
WB RILEY   1.45     0    8   27  0          1.00  85  0.75 1.701 0.75  15 45 75

FLOW        veh     238    516   1540     35
CAPACITY    veh    1835   1656   2032    842          AVDEL s    11.0
AVE DELAY  mins    0.04   0.05   0.25   0.08          L  O  S       B
MAX DELAY  mins    0.06   0.09   0.59   0.14          VEH HRS     7.1
AVE QUEUE   veh       0      0      7      0          COST  $   106.6
MAX QUEUE   veh       0      1     12      0
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Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.04	0.05	0.25	0.08	0.18
Average Delay (secs)	2.4	3.0	15.0	4.8	11.0
LOS	A	A	B	A	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	287	11	19	772	87	102	138	35	18	23	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.98			0.98			0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1770	3515		1770	3480			3408			3232	
Flt Permitted	0.16	1.00		0.55	1.00			0.78			0.80	
Satd. Flow (perm)	307	3515		1015	3480			2724			2609	
Peak-hour factor, PHF	0.89	0.90	0.69	0.59	0.84	0.75	0.54	0.57	0.58	0.64	0.64	0.72
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	74	328	16	33	947	119	195	249	62	29	37	70
RTOR Reduction (vph)	0	3	0	0	9	0	0	11	0	0	52	0
Lane Group Flow (vph)	74	341	0	33	1057	0	0	495	0	0	84	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	51.7	45.5		47.9	43.6			23.8			23.8	
Effective Green, g (s)	51.7	45.5		47.9	43.6			23.8			23.8	
Actuated g/C Ratio	0.57	0.50		0.52	0.48			0.26			0.26	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	273	1752		568	1662			710			680	
v/s Ratio Prot	c0.02	0.10		0.00	c0.30							
v/s Ratio Perm	0.14			0.03				c0.18			0.03	
v/c Ratio	0.27	0.19		0.06	0.64			0.70			0.12	
Uniform Delay, d1	11.0	12.7		10.5	17.9			30.5			25.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.6	0.2		0.0	1.6			3.8			0.2	
Delay (s)	11.6	12.9		10.6	19.5			34.3			26.0	
Level of Service	B	B		B	B			C			C	
Approach Delay (s)		12.7			19.2			34.3			26.0	
Approach LOS		B			B			C			C	

Intersection Summary

HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	91.3	Sum of lost time (s)	17.7
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	191	143	3	2	334	186	5	32	2	24	4	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.94		1.00	0.98		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3520		1770	3333		1770	3453		1770	3045	
Flt Permitted	0.26	1.00		0.61	1.00		0.68	1.00		0.43	1.00	
Satd. Flow (perm)	478	3520		1143	3333		1264	3453		808	3045	
Peak-hour factor, PHF	0.80	0.69	0.38	0.25	0.80	0.70	0.42	0.80	0.25	0.60	0.50	0.67
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	246	213	8	8	430	274	12	41	8	41	8	108
RTOR Reduction (vph)	0	3	0	0	106	0	0	7	0	0	83	0
Lane Group Flow (vph)	246	218	0	8	598	0	12	42	0	41	33	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	37.6	37.6		22.8	22.8		6.0	6.0		13.9	13.9	
Effective Green, g (s)	37.6	37.6		22.8	22.8		6.0	6.0		13.9	13.9	
Actuated g/C Ratio	0.62	0.62		0.37	0.37		0.10	0.10		0.23	0.23	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	523	2170		427	1246		124	340		246	694	
v/s Ratio Prot	c0.08	0.06			0.18			0.01		c0.01	0.01	
v/s Ratio Perm	c0.21			0.01			0.01			c0.03		
v/c Ratio	0.47	0.10		0.02	0.48		0.10	0.12		0.17	0.05	
Uniform Delay, d1	6.2	4.8		12.0	14.6		25.0	25.1		18.8	18.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.0		0.0	0.6		0.4	0.2		0.4	0.0	
Delay (s)	7.0	4.8		12.1	15.2		25.4	25.3		19.1	18.4	
Level of Service	A	A		B	B		C	C		B	B	
Approach Delay (s)		6.0			15.2			25.3			18.6	
Approach LOS		A			B			C			B	

Intersection Summary

HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	61.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	94	0	0	334	0	1332	7	9	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.1			6.1		6.1	6.1				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			1.00		1.00	1.00				
Flt Protected	0.95	1.00			1.00		0.95	0.95				
Satd. Flow (prot)	1770	3539			3539		2715	1357				
Flt Permitted	0.40	1.00			1.00		0.95	0.95				
Satd. Flow (perm)	740	3539			3539		2715	1357				
Peak-hour factor, PHF	0.80	0.80	0.92	0.92	0.80	0.92	0.88	0.88	0.56	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	59	121	0	0	430	0	1559	8	17	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	59	121	0	0	430	0	1060	523	0	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	21%	21%	21%	2%	2%	2%
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	58.5	58.5			46.8		64.3	64.3				
Effective Green, g (s)	58.5	58.5			46.8		64.3	64.3				
Actuated g/C Ratio	0.43	0.43			0.35		0.48	0.48				
Clearance Time (s)	4.0	6.1			6.1		6.1	6.1				
Vehicle Extension (s)	3.0	5.0			5.0		3.0	3.0				
Lane Grp Cap (vph)	379	1534			1227		1293	646				
v/s Ratio Prot	c0.01	0.03			c0.12		c0.39	0.39				
v/s Ratio Perm	0.06											
v/c Ratio	0.16	0.08			0.35		0.82	0.81				
Uniform Delay, d1	22.9	22.4			32.8		30.4	30.1				
Progression Factor	0.82	0.81			1.00		1.00	1.00				
Incremental Delay, d2	0.2	0.0			0.4		4.2	7.4				
Delay (s)	19.0	18.2			33.2		34.6	37.5				
Level of Service	B	B			C		C	D				
Approach Delay (s)		18.5			33.2			35.5			0.0	
Approach LOS		B			C			D			A	

Intersection Summary

HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.2
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	86	222	35	1012	407	0	0	0	38	189	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1840	1583
Flt Permitted	0.10	1.00	1.00	0.67	1.00	1.00					0.99	1.00
Satd. Flow (perm)	187	3539	1583	1240	5085	1583					1840	1583
Peak-hour factor, PHF	0.82	0.65	0.77	0.67	0.85	0.88	0.92	0.92	0.92	0.47	0.79	0.49
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	70	136	297	54	1226	476	0	0	0	83	246	177
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	86
Lane Group Flow (vph)	70	136	297	54	1226	476	0	0	0	0	329	91
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	58.5	58.5	135.0	46.8	46.8	135.0					63.8	63.8
Effective Green, g (s)	58.5	58.5	135.0	46.8	46.8	135.0					63.8	63.8
Actuated g/C Ratio	0.43	0.43	1.00	0.35	0.35	1.00					0.47	0.47
Clearance Time (s)	4.0	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	171	1534	1583	430	1763	1583					870	748
v/s Ratio Prot	0.02	0.04			c0.24						c0.18	
v/s Ratio Perm	0.15		0.19	0.04		c0.30						0.06
v/c Ratio	0.41	0.09	0.19	0.13	0.70	0.30					0.38	0.12
Uniform Delay, d1	25.9	22.5	0.0	30.1	38.0	0.0					22.9	19.9
Progression Factor	1.00	1.00	1.00	1.09	1.12	1.00					1.00	1.00
Incremental Delay, d2	1.6	0.1	0.3	0.2	1.2	0.4					0.4	0.1
Delay (s)	27.5	22.6	0.3	32.9	43.7	0.4					23.2	20.0
Level of Service	C	C	A	C	D	A					C	C
Approach Delay (s)		10.1			31.6			0.0			22.1	
Approach LOS		B			C			A			C	

Intersection Summary

HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	12.7
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	42	0	0	65	4	272	38	39	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.96				
Flt Protected	0.95	1.00			1.00		0.95	0.97				
Satd. Flow (prot)	1770	3539			3472		1681	1661				
Flt Permitted	0.67	1.00			1.00		0.95	0.97				
Satd. Flow (perm)	1247	3539			3472		1681	1661				
Peak-hour factor, PHF	0.60	0.75	0.92	0.92	0.81	0.33	0.60	0.63	0.57	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	41	58	0	0	83	12	467	62	70	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	13	0	0	0	0
Lane Group Flow (vph)	41	58	0	0	87	0	304	282	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	20.2	18.0			17.4		20.8	20.8				
Effective Green, g (s)	20.2	18.0			17.4		20.8	20.8				
Actuated g/C Ratio	0.35	0.31			0.30		0.36	0.36				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	458	1108			1051		608	601				
v/s Ratio Prot	c0.00	0.02			0.02		c0.18	0.17				
v/s Ratio Perm	c0.03											
v/c Ratio	0.09	0.05			0.08		0.50	0.47				
Uniform Delay, d1	12.4	13.8			14.3		14.3	14.1				
Progression Factor	0.44	0.41			1.00		1.00	1.00				
Incremental Delay, d2	0.2	0.0			0.1		1.4	1.2				
Delay (s)	5.7	5.8			14.4		15.7	15.3				
Level of Service	A	A			B		B	B				
Approach Delay (s)		5.7			14.4			15.5			0.0	
Approach LOS		A			B			B			A	

Intersection Summary

HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	11.1
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	52	53	20	303	0	0	0	0	0	12	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0						5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95						0.95	
Frt		1.00	0.85	1.00	1.00						0.95	
Flt Protected		1.00	1.00	0.95	1.00						1.00	
Satd. Flow (prot)		3539	1583	1770	3539						1673	
Flt Permitted		1.00	1.00	0.70	1.00						1.00	
Satd. Flow (perm)		3539	1583	1309	3539						1673	
Peak-hour factor, PHF	0.92	0.68	0.66	0.71	0.68	0.92	0.92	0.92	0.92	0.92	0.33	0.55
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	0	79	83	29	459	0	0	0	0	0	37	21
RTOR Reduction (vph)	0	0	57	0	0	0	0	0	0	0	13	0
Lane Group Flow (vph)	0	79	26	29	459	0	0	0	0	0	45	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		18.0	18.0	19.0	17.4						20.8	
Effective Green, g (s)		18.0	18.0	19.0	17.4						20.8	
Actuated g/C Ratio		0.31	0.31	0.33	0.30						0.36	
Clearance Time (s)		6.0	6.0	5.3	6.0						5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3						5.0	
Lane Grp Cap (vph)		1108	496	445	1071						605	
v/s Ratio Prot		0.02		c0.00	c0.13						c0.03	
v/s Ratio Perm			0.02	0.02								
v/c Ratio		0.07	0.05	0.07	0.43						0.07	
Uniform Delay, d1		13.9	13.8	13.1	16.1						12.0	
Progression Factor		1.00	1.00	1.42	1.33						1.00	
Incremental Delay, d2		0.1	0.1	0.1	0.6						0.1	
Delay (s)		13.9	13.9	18.8	22.1						12.1	
Level of Service		B	B	B	C						B	
Approach Delay (s)		13.9			21.9			0.0			12.1	
Approach LOS		B			C			A			B	

Intersection Summary

HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	17.1
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY - Intersection 19

General Information

Analyst	
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*6:00 - 7:00 AM*

Site Information

Intersection	*Riley Road & SR 912 Off Ramp*
Jurisdiction	
Analysis Year	*2013 AM*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 Off Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*412*			*62*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*457*	*0*	*0*	*68*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*21*		*154*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*23*	*0*	*171*
Percent Heavy Vehicles	*0*	*0*	*0*	*10*	*0*	*19*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*23*		*171*			
C (m) (veh/h)			*487*		*725*			
v/c			*0.05*		*0.24*			
95% queue length			*0.15*		*0.91*			
Control Delay (s/veh)			*12.8*		*11.5*			
LOS			*B*		*B*			
Approach Delay (s/veh)	--	--	*11.6*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY - Intersection 20

General Information		Site Information	
Analyst		Intersection	*Riley Road & SR 912 On Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2013 AM*
Analysis Time Period	*6:00 - 7:00 AM*		

Project Description *SR 912 Traffic Analysis*	
East/West Street: *SR 912 On Ramp*	North/South Street: *Riley Road*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*52*	*515*			*62*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*57*	*572*	*0*	*0*	*68*	*0*
Percent Heavy Vehicles	*12*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*10*	*0*	*19*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*57*							
C (m) (veh/h)	*1461*							
v/c	*0.04*							
95% queue length	*0.12*							
Control Delay (s/veh)	*7.6*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	200	50	300	20	50	1200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.99		0.86	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	3127	1696	3193		1568	1475
Flt Permitted	0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	3127	1696	3193		1568	1475
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	258	64	386	26	64	1545
RTOR Reduction (vph)	0	0	5	0	495	24
Lane Group Flow (vph)	258	64	407	0	311	779
Heavy Vehicles (%)	12%	12%	12%	12%	4%	4%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	31.5	54.9	18.4		20.6	52.1
Effective Green, g (s)	31.5	54.9	18.4		20.6	52.1
Actuated g/C Ratio	0.37	0.64	0.22		0.24	0.61
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1152	1089	687		378	985
v/s Ratio Prot	0.08	0.04	c0.13		0.20	c0.29
v/s Ratio Perm						0.24
v/c Ratio	0.22	0.06	0.59		0.82	0.79
Uniform Delay, d1	18.6	5.7	30.2		30.7	12.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.1	3.7		13.5	4.4
Delay (s)	18.7	5.8	33.9		44.2	17.0
Level of Service	B	A	C		D	B
Approach Delay (s)		16.1	33.9		30.6	
Approach LOS		B	C		C	

Intersection Summary

HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	40	170	1062	20	20	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1497		2407	1077	1203	2407
Flt Permitted	0.99		1.00	1.00	0.21	1.00
Satd. Flow (perm)	1497		2407	1077	267	2407
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	45	190	1189	22	22	313
RTOR Reduction (vph)	91	0	0	6	0	0
Lane Group Flow (vph)	144	0	1189	16	22	313
Heavy Vehicles (%)	12%	12%	50%	50%	50%	50%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	12.7		64.0	64.0	64.0	64.0
Effective Green, g (s)	12.7		64.0	64.0	64.0	64.0
Actuated g/C Ratio	0.15		0.74	0.74	0.74	0.74
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	219		1777	795	197	1777
v/s Ratio Prot	c0.10		c0.49			0.13
v/s Ratio Perm				0.02	0.08	
v/c Ratio	0.66		0.67	0.02	0.11	0.18
Uniform Delay, d1	34.9		5.9	3.0	3.2	3.4
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	6.9		2.0	0.0	1.1	0.2
Delay (s)	41.8		7.9	3.1	4.4	3.6
Level of Service	D		A	A	A	A
Approach Delay (s)	41.8		7.8			3.7
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	86.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

2013 PM1(EARLY) PEAK HOUR

CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	1	78	19	10	14	42	589	40	170	1236	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.89			0.96		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1639			1269		1770	3539	1495	1671	3523	
Flt Permitted		0.94			0.73		0.12	1.00	1.00	0.30	1.00	
Satd. Flow (perm)		1560			943		216	3539	1495	533	3523	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.25
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	18	1	100	24	13	18	54	758	52	219	1591	49
RTOR Reduction (vph)	0	90	0	0	16	0	0	0	11	0	2	0
Lane Group Flow (vph)	0	29	0	0	39	0	54	758	41	219	1638	0
Heavy Vehicles (%)	2%	2%	2%	40%	40%	40%	2%	2%	8%	8%	2%	2%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		8.1			8.1		54.2	51.3	51.3	66.4	58.5	
Effective Green, g (s)		8.1			8.1		54.2	51.3	51.3	66.4	58.5	
Actuated g/C Ratio		0.10			0.10		0.64	0.61	0.61	0.79	0.69	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		150			90		192	2149	908	555	2439	
v/s Ratio Prot							0.01	0.21		c0.05	c0.46	
v/s Ratio Perm		0.02			c0.04		0.17		0.03	0.26		
v/c Ratio		0.19			0.43		0.28	0.35	0.05	0.39	0.67	
Uniform Delay, d1		35.2			36.0		6.6	8.3	6.7	3.0	7.5	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.8			4.5		0.8	0.5	0.1	1.0	1.5	
Delay (s)		36.0			40.5		7.4	8.8	6.8	4.0	9.0	
Level of Service		D			D		A	A	A	A	A	
Approach Delay (s)		36.0			40.5			8.6			8.4	
Approach LOS		D			D			A			A	

Intersection Summary

HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	84.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	39	43	32	62	211	53	433	47	181	657	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.91		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1696		1770	1863	1583	1770	3484		1770	3506	
Flt Permitted	0.69	1.00		0.68	1.00	1.00	0.36	1.00		0.34	1.00	
Satd. Flow (perm)	1283	1696		1262	1863	1583	666	3484		625	3506	
Peak-hour factor, PHF	0.62	0.81	0.60	0.80	0.60	0.73	0.70	0.84	0.78	0.91	0.93	0.77
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	61	50	74	41	106	298	78	531	62	205	728	49
RTOR Reduction (vph)	0	61	0	0	0	246	0	8	0	0	4	0
Lane Group Flow (vph)	61	63	0	41	106	52	78	585	0	205	773	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	13.6	13.6		13.6	13.6	13.6	34.7	34.7		50.5	50.5	
Effective Green, g (s)	13.6	13.6		13.6	13.6	13.6	34.7	34.7		50.5	50.5	
Actuated g/C Ratio	0.18	0.18		0.18	0.18	0.18	0.45	0.45		0.65	0.65	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	226	298		222	328	279	299	1564		545	2290	
v/s Ratio Prot		0.04			c0.06			0.17		0.04	c0.22	
v/s Ratio Perm	0.05			0.03		0.03	0.12			c0.20		
v/c Ratio	0.27	0.21		0.18	0.32	0.19	0.26	0.37		0.38	0.34	
Uniform Delay, d1	27.6	27.3		27.1	27.8	27.1	13.3	14.1		5.9	6.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.7		0.8	1.2	0.7	2.1	0.7		0.4	0.4	
Delay (s)	28.9	28.0		28.0	29.0	27.8	15.4	14.8		6.4	6.4	
Level of Service	C	C		C	C	C	B	B		A	A	
Approach Delay (s)		28.3			28.1			14.9			6.4	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	77.3	Sum of lost time (s)	13.2
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	1	79	45	2	15	48	434	0	0	455	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.88		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1679		1770	1639		1770	3539			3517	
Flt Permitted		0.87		0.69	1.00		0.46	1.00			1.00	
Satd. Flow (perm)		1490		1288	1639		865	3539			3517	
Peak-hour factor, PHF	0.50	0.25	0.90	0.87	0.50	0.94	0.80	0.84	0.62	0.33	0.96	0.75
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	54	4	90	53	4	16	62	532	0	0	488	21
RTOR Reduction (vph)	0	75	0	0	13	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	73	0	53	7	0	62	532	0	0	507	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		11.2		11.2	11.2		43.0	43.0			43.0	
Effective Green, g (s)		11.2		11.2	11.2		43.0	43.0			43.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.65	0.65			0.65	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		252		218	278		563	2302			2288	
v/s Ratio Prot					0.00			c0.15			0.14	
v/s Ratio Perm		c0.05		0.04			0.07					
v/c Ratio		0.29		0.24	0.02		0.11	0.23			0.22	
Uniform Delay, d1		24.0		23.8	22.9		4.3	4.8			4.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		1.3		1.2	0.1		0.4	0.2			0.2	
Delay (s)		25.3		25.0	23.0		4.7	5.0			4.9	
Level of Service		C		C	C		A	A			A	
Approach Delay (s)		25.3			24.4			5.0			4.9	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	66.1	Sum of lost time (s)	11.9
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	304	54	229	430	64	61	653	59	208	964	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3495		1770	3539	1583
Flt Permitted	0.33	1.00	1.00	0.28	1.00	1.00	0.14	1.00		0.15	1.00	1.00
Satd. Flow (perm)	609	3539	1583	528	3539	1583	263	3495		282	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	154	391	70	295	554	82	79	841	76	268	1241	80
RTOR Reduction (vph)	0	0	59	0	0	64	0	6	0	0	0	27
Lane Group Flow (vph)	154	391	11	295	554	18	79	911	0	268	1241	53
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	27.4	17.2	17.2	37.2	23.0	23.0	43.3	40.2		58.4	51.3	51.3
Effective Green, g (s)	27.4	17.2	17.2	37.2	23.0	23.0	43.3	40.2		58.4	51.3	51.3
Actuated g/C Ratio	0.25	0.16	0.16	0.35	0.21	0.21	0.40	0.37		0.54	0.48	0.48
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	265	566	253	367	756	338	149	1306		349	1687	755
v/s Ratio Prot	0.06	0.11		c0.12	0.16		0.02	0.26		c0.10	0.35	
v/s Ratio Perm	0.09		0.01	c0.16		0.01	0.20			c0.31		0.03
v/c Ratio	0.58	0.69	0.04	0.80	0.73	0.05	0.53	0.70		0.77	0.74	0.07
Uniform Delay, d1	32.9	42.7	38.2	28.3	39.4	33.6	21.4	28.6		17.7	22.7	15.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.2	4.6	0.2	12.0	4.5	0.1	3.6	3.1		9.7	2.9	0.2
Delay (s)	36.1	47.3	38.4	40.3	43.9	33.8	25.0	31.7		27.4	25.6	15.4
Level of Service	D	D	D	D	D	C	C	C		C	C	B
Approach Delay (s)		43.5			41.9			31.1			25.4	
Approach LOS		D			D			C			C	

Intersection Summary

HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	107.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	0	1	200	0	39	0	447	35	27	967	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2		4.0	5.2			6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00		0.95	0.95			0.95	1.00	1.00	0.95	
Frt		0.93		1.00	0.95			1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1695		1665	1554			3112	1509	1612	3437	
Flt Permitted		1.00		0.95	0.92			1.00	1.00	0.39	1.00	
Satd. Flow (perm)		1737		1665	1481			3112	1509	665	3437	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.75	0.80	0.89	0.72	0.61	0.76	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	1	0	1	258	0	54	0	517	50	46	1311	3
RTOR Reduction (vph)	0	1	0	0	17	0	0	0	27	0	0	0
Lane Group Flow (vph)	0	1	0	160	135	0	0	517	23	46	1314	0
Heavy Vehicles (%)	2%	2%	2%	3%	2%	13%	2%	16%	7%	12%	5%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)		2.2		28.8	35.0			45.3	45.3	51.8	51.8	
Effective Green, g (s)		2.2		28.8	35.0			45.3	45.3	51.8	51.8	
Actuated g/C Ratio		0.02		0.29	0.36			0.46	0.46	0.53	0.53	
Clearance Time (s)		5.2		4.0	5.2			6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0			5.5	5.5	3.0	5.5	
Lane Grp Cap (vph)		39		489	550			1439	698	376	1817	
v/s Ratio Prot				c0.10	0.07			0.17		0.00	c0.38	
v/s Ratio Perm		0.00			c0.02				0.02	0.06		
v/c Ratio		0.03		0.33	0.25			0.36	0.03	0.12	0.72	
Uniform Delay, d1		46.9		27.0	22.2			17.0	14.4	11.5	17.6	
Progression Factor		1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3		0.4	0.2			0.7	0.1	0.1	2.5	
Delay (s)		47.1		27.4	22.4			17.7	14.5	11.7	20.2	
Level of Service		D		C	C			B	B	B	C	
Approach Delay (s)		47.1			25.0			17.4			19.9	
Approach LOS		D			C			B			B	

Intersection Summary

HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	98.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	112	26	185	113	108	10	312	157	246	695	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.97			0.96		1.00	0.95		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3399			3337		1770	3357		1770	3523	
Flt Permitted		0.85			0.73		0.31	1.00		0.33	1.00	
Satd. Flow (perm)		2898			2499		569	3357		612	3523	
Peak-hour factor, PHF	0.75	0.80	0.54	0.81	0.76	0.93	0.62	0.88	0.85	0.70	0.79	0.79
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	25	144	50	235	153	120	17	365	190	362	906	29
RTOR Reduction (vph)	0	32	0	0	34	0	0	67	0	0	2	0
Lane Group Flow (vph)	0	187	0	0	474	0	17	488	0	362	933	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		22.0			22.0		31.0	29.6		48.4	43.0	
Effective Green, g (s)		22.0			22.0		31.0	29.6		48.4	43.0	
Actuated g/C Ratio		0.26			0.26		0.37	0.35		0.58	0.51	
Clearance Time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		3.0	7.0	
Lane Grp Cap (vph)		763			658		231	1189		559	1812	
v/s Ratio Prot							0.00	0.15		c0.11	0.26	
v/s Ratio Perm		0.06			c0.19		0.03			c0.26		
v/c Ratio		0.24			0.72		0.07	0.41		0.65	0.51	
Uniform Delay, d1		24.3			28.0		16.7	20.4		10.1	13.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.4			4.8		0.1	1.1		2.6	1.0	
Delay (s)		24.6			32.8		16.8	21.5		12.7	14.5	
Level of Service		C			C		B	C		B	B	
Approach Delay (s)		24.6			32.8			21.3			14.0	
Approach LOS		C			C			C			B	

Intersection Summary

HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	83.6	Sum of lost time (s)	11.5
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	151	594	201	141	534	82	127	533	79	139	825	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	3421	1531	1711	3342		1770	3464		1770	3539	1583
Flt Permitted	0.17	1.00	1.00	0.18	1.00		0.13	1.00		0.19	1.00	1.00
Satd. Flow (perm)	313	3421	1531	331	3342		248	3464		353	3539	1583
Peak-hour factor, PHF	0.82	0.80	0.95	0.73	0.86	0.73	0.79	0.88	0.79	0.87	0.86	0.84
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	190	765	218	199	640	116	166	624	103	165	988	280
RTOR Reduction (vph)	0	0	117	0	15	0	0	13	0	0	0	116
Lane Group Flow (vph)	190	765	101	199	741	0	166	714	0	165	988	164
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	40.5	30.0	30.0	39.1	29.3		38.0	30.0		42.0	32.0	32.0
Effective Green, g (s)	40.5	30.0	30.0	39.1	29.3		38.0	30.0		42.0	32.0	32.0
Actuated g/C Ratio	0.41	0.30	0.30	0.39	0.29		0.38	0.30		0.42	0.32	0.32
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	274	1028	460	265	981		216	1041		291	1135	508
v/s Ratio Prot	0.07	c0.22		c0.07	0.22		c0.06	0.21		0.06	c0.28	
v/s Ratio Perm	0.21		0.07	0.22			0.23			0.18		0.10
v/c Ratio	0.69	0.74	0.22	0.75	0.76		0.77	0.69		0.57	0.87	0.32
Uniform Delay, d1	21.6	31.4	26.1	22.4	32.0		23.8	30.7		20.1	31.9	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.4	4.9	1.1	11.3	5.4		15.1	2.4		2.5	8.1	0.8
Delay (s)	28.9	36.3	27.2	33.7	37.4		38.9	33.2		22.6	40.0	26.5
Level of Service	C	D	C	C	D		D	C		C	D	C
Approach Delay (s)		33.4			36.6			34.2			35.4	
Approach LOS		C			D			C			D	

Intersection Summary

HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	99.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	4	2	280	333	100	5	220	218	19	1	587	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	1638	1495	3019	1346		2801	2907		970	3502	
Flt Permitted	0.66	1.00	1.00	0.95	1.00		0.95	1.00		0.58	1.00	
Satd. Flow (perm)	1135	1638	1495	3019	1346		2801	2907		591	3502	
Peak-hour factor, PHF	0.70	0.70	0.70	0.82	0.73	0.70	0.70	0.87	0.79	0.70	0.86	0.70
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	6	3	412	418	141	7	324	258	25	1	703	50
RTOR Reduction (vph)	0	0	255	0	2	0	0	8	0	0	6	0
Lane Group Flow (vph)	6	3	157	418	146	0	324	275	0	1	747	0
Heavy Vehicles (%)	11%	16%	8%	16%	42%	3%	25%	19%	59%	86%	2%	3%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	13.0	13.0	13.0	14.3	32.3		12.6	38.5		20.9	20.9	
Effective Green, g (s)	13.0	13.0	13.0	14.3	32.3		12.6	38.5		20.9	20.9	
Actuated g/C Ratio	0.16	0.16	0.16	0.18	0.40		0.16	0.48		0.26	0.26	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.5	3.5	3.5	3.0	3.5		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	183	264	241	534	538		437	1385		153	906	
v/s Ratio Prot		0.00		c0.14	0.11		c0.12	0.09			c0.21	
v/s Ratio Perm	0.01		c0.10							0.00		
v/c Ratio	0.03	0.01	0.65	0.78	0.27		0.74	0.20		0.01	0.82	
Uniform Delay, d1	28.6	28.5	31.8	31.8	16.3		32.5	12.2		22.2	28.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.0	6.4	7.4	0.3		6.9	0.1		0.0	6.3	
Delay (s)	28.7	28.5	38.2	39.1	16.6		39.4	12.3		22.3	34.6	
Level of Service	C	C	D	D	B		D	B		C	C	
Approach Delay (s)		38.0			33.3			26.8			34.5	
Approach LOS		D			C			C			C	

Intersection Summary

HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	80.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2013 PM1 Peak Rodel Analysis - Intersection 8

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E    (m)    8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)   10.00  10.00  20.00  10.00           TIME SLICE     min     15
V    (m)    7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)   20.00  20.00  20.00  20.00           TIME COST     $/hr  15.00
PHI  (d)   30.00  30.00  30.00  30.00           FLOW PERIOD    min  15 75
DIA  (m)   50.00  50.00  50.00  50.00           FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0           FLOW PEAK am/op/pm     OP

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U)  FLOF  CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.02    35  605    1  0          1.00  85  0.75 1.701 0.75  15 45 75
EB RILEY   1.08   228    2    4  0          1.00  85  0.75 1.701 0.75  15 45 75
NB DICKEY  1.24    20  225  227  0          1.00  85  0.75 1.701 0.75  15 45 75
WB RILEY   1.22     5  103  343  0          1.00  85  0.75 1.701 0.75  15 45 75

FLOW        veh     641    234    472    451
CAPACITY    veh    1623   1388   2002   1516          AVDEL s     3.3
AVE DELAY  mins    0.07   0.05   0.04   0.06          L  O  S       A
MAX DELAY  mins    0.12   0.09   0.06   0.10          VEH HRS     1.6
AVE QUEUE   veh       1      0      0      0          COST  $    24.6
MAX QUEUE   veh       1      0      0      1
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Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.07	0.05	0.04	0.06	0.06
Average Delay (secs)	4.2	3.0	2.4	3.6	3.3
LOS	A	A	A	A	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	139	1068	61	100	668	49	68	81	108	87	132	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.99			0.93			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1770	3511		1770	3496			3258			3291	
Flt Permitted	0.29	1.00		0.08	1.00			0.63			0.73	
Satd. Flow (perm)	544	3511		155	3496			2087			2422	
Peak-hour factor, PHF	0.83	0.77	0.80	0.76	0.92	0.77	0.81	0.81	0.71	0.81	0.79	0.86
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	172	1429	79	136	748	66	86	103	157	111	172	184
RTOR Reduction (vph)	0	4	0	0	7	0	0	127	0	0	106	0
Lane Group Flow (vph)	172	1504	0	136	807	0	0	219	0	0	361	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	56.4	47.4		58.0	48.2			18.0			18.0	
Effective Green, g (s)	56.4	47.4		58.0	48.2			18.0			18.0	
Actuated g/C Ratio	0.61	0.51		0.62	0.52			0.19			0.19	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	449	1791		267	1814			404			469	
v/s Ratio Prot	0.04	c0.43		c0.05	0.23							
v/s Ratio Perm	0.20			0.26				0.11			c0.15	
v/c Ratio	0.38	0.84		0.51	0.45			0.54			0.77	
Uniform Delay, d1	8.3	19.5		14.6	14.0			33.7			35.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.6	4.4		1.7	0.6			2.6			8.7	
Delay (s)	8.9	23.9		16.3	14.6			36.4			44.2	
Level of Service	A	C		B	B			D			D	
Approach Delay (s)		22.4			14.8			36.4			44.2	
Approach LOS		C			B			D			D	

Intersection Summary

HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	92.9	Sum of lost time (s)	17.7
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	289	393	19	8	224	51	8	45	10	84	74	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.97		1.00	0.96		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3517		1770	3438		1770	3398		1770	3115	
Flt Permitted	0.45	1.00		0.39	1.00		0.50	1.00		0.48	1.00	
Satd. Flow (perm)	830	3517		723	3438		931	3398		887	3115	
Peak-hour factor, PHF	0.78	0.61	0.68	1.00	0.88	0.85	0.67	0.80	0.50	0.57	0.88	0.95
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	382	664	29	8	262	62	12	58	21	152	87	347
RTOR Reduction (vph)	0	4	0	0	22	0	0	18	0	0	240	0
Lane Group Flow (vph)	382	689	0	8	302	0	12	61	0	152	194	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	34.2	34.2		16.2	16.2		8.4	8.4		19.6	19.6	
Effective Green, g (s)	34.2	34.2		16.2	16.2		8.4	8.4		19.6	19.6	
Actuated g/C Ratio	0.54	0.54		0.26	0.26		0.13	0.13		0.31	0.31	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	656	1900		185	880		124	451		375	965	
v/s Ratio Prot	c0.13	0.20			0.09			0.02		c0.05	0.06	
v/s Ratio Perm	c0.19			0.01			0.01			c0.08		
v/c Ratio	0.58	0.36		0.04	0.34		0.10	0.13		0.41	0.20	
Uniform Delay, d1	8.7	8.3		17.7	19.2		24.1	24.2		16.6	16.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	0.2		0.2	0.5		0.4	0.2		0.8	0.1	
Delay (s)	10.1	8.6		17.9	19.7		24.5	24.4		17.5	16.2	
Level of Service	B	A		B	B		C	C		B	B	
Approach Delay (s)		9.1			19.7			24.4			16.5	
Approach LOS		A			B			C			B	

Intersection Summary

HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	63.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	302	0	0	219	48	699	27	6	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1		6.6	6.6				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			0.97		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	0.96				
Satd. Flow (prot)	1770	3539			3442		2738	1375				
Flt Permitted	0.41	1.00			1.00		0.95	0.96				
Satd. Flow (perm)	769	3539			3442		2738	1375				
Peak-hour factor, PHF	0.75	0.90	0.25	0.92	0.77	0.75	0.92	0.75	0.50	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	25	346	0	0	293	66	783	37	12	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	1	0	0	0	0
Lane Group Flow (vph)	25	346	0	0	343	0	556	275	0	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	20%	20%	20%	2%	2%	2%
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2	2										
Actuated Green, G (s)	37.8	37.8			25.5		37.5	37.5				
Effective Green, g (s)	37.8	37.8			25.5		37.5	37.5				
Actuated g/C Ratio	0.43	0.43			0.29		0.43	0.43				
Clearance Time (s)	6.1	6.1			6.1		6.6	6.6				
Vehicle Extension (s)	3.0	5.0			5.0		4.0	4.0				
Lane Grp Cap (vph)	401	1520			997		1167	586				
v/s Ratio Prot	0.00	c0.10			c0.10		c0.20	0.20				
v/s Ratio Perm	0.02											
v/c Ratio	0.06	0.23			0.34		0.48	0.47				
Uniform Delay, d1	14.8	15.9			24.7		18.2	18.1				
Progression Factor	0.62	0.62			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.2			0.4		0.4	0.8				
Delay (s)	9.2	9.9			25.1		18.6	18.9				
Level of Service	A	A			C		B	B				
Approach Delay (s)		9.9			25.1			18.7			0.0	
Approach LOS		A			C			B			A	

Intersection Summary

HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	18.8
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	215	695	47	385	358	0	0	0	75	422	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1849	1583
Flt Permitted	0.38	1.00	1.00	0.59	1.00	1.00					0.99	1.00
Satd. Flow (perm)	713	3539	1583	1097	5085	1583					1849	1583
Peak-hour factor, PHF	0.83	0.84	0.86	0.69	0.87	0.87	0.92	0.92	0.92	0.89	0.85	0.64
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	186	264	832	70	456	424	0	0	0	87	511	261
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	112
Lane Group Flow (vph)	186	264	832	70	456	424	0	0	0	0	598	149
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	37.8	37.8	88.0	25.5	25.5	88.0					37.5	37.5
Effective Green, g (s)	37.8	37.8	88.0	25.5	25.5	88.0					37.5	37.5
Actuated g/C Ratio	0.43	0.43	1.00	0.29	0.29	1.00					0.43	0.43
Clearance Time (s)	6.1	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	381	1520	1583	318	1473	1583					788	675
v/s Ratio Prot	0.03	0.07			0.09						c0.32	
v/s Ratio Perm	0.18		c0.53	0.06		0.27						0.09
v/c Ratio	0.49	0.17	0.53	0.22	0.31	0.27					0.76	0.22
Uniform Delay, d1	16.3	15.5	0.0	23.7	24.4	0.0					21.4	16.0
Progression Factor	1.00	1.00	1.00	1.09	1.12	1.00					1.00	1.00
Incremental Delay, d2	1.0	0.1	1.3	0.7	0.2	0.4					4.5	0.2
Delay (s)	17.3	15.6	1.3	26.7	27.6	0.4					25.9	16.2
Level of Service	B	B	A	C	C	A					C	B
Approach Delay (s)		6.5			15.4			0.0			23.0	
Approach LOS		A			B			A			C	

Intersection Summary

HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	6.6
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	109	0	0	172	12	132	6	45	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.93				
Flt Protected	0.95	1.00			1.00		0.95	0.98				
Satd. Flow (prot)	1770	3539			3456		1681	1608				
Flt Permitted	0.59	1.00			1.00		0.95	0.98				
Satd. Flow (perm)	1099	3539			3456		1681	1608				
Peak-hour factor, PHF	0.85	0.85	0.92	0.92	0.80	0.30	0.72	0.50	0.75	0.25	0.25	0.29
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	41	132	0	0	221	41	189	12	62	0	0	0
RTOR Reduction (vph)	0	0	0	0	19	0	0	41	0	0	0	0
Lane Group Flow (vph)	41	132	0	0	243	0	134	88	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	21.0	18.7			20.0		8.9	8.9				
Effective Green, g (s)	21.0	18.7			20.0		8.9	8.9				
Actuated g/C Ratio	0.43	0.39			0.41		0.18	0.18				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	510	1370			1431		310	296				
v/s Ratio Prot	c0.00	0.04			c0.07		c0.08	0.05				
v/s Ratio Perm	0.03											
v/c Ratio	0.08	0.10			0.17		0.43	0.30				
Uniform Delay, d1	7.9	9.4			8.9		17.5	17.0				
Progression Factor	0.45	0.37			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.1			0.1		2.0	1.2				
Delay (s)	3.7	3.6			9.0		19.5	18.2				
Level of Service	A	A			A		B	B				
Approach Delay (s)		3.6			9.0			18.8			0.0	
Approach LOS		A			A			B			A	

Intersection Summary

HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	48.3	Sum of lost time (s)	11.1
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	141	338	69	217	0	0	0	0	5	80	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	3539					1681	1662	
Flt Permitted		1.00	1.00	0.59	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1092	3539					1681	1662	
Peak-hour factor, PHF	0.92	0.73	0.83	0.86	0.94	0.92	0.92	0.92	0.92	0.62	0.80	0.65
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	0	199	419	83	238	0	0	0	0	8	103	70
RTOR Reduction (vph)	0	0	257	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	199	162	83	238	0	0	0	0	7	145	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		18.7	18.7	23.6	20.0					8.9	8.9	
Effective Green, g (s)		18.7	18.7	23.6	20.0					8.9	8.9	
Actuated g/C Ratio		0.39	0.39	0.49	0.41					0.18	0.18	
Clearance Time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3					5.0	5.0	
Lane Grp Cap (vph)		1370	613	584	1465					310	306	
v/s Ratio Prot		0.06		c0.01	0.07					0.00	c0.09	
v/s Ratio Perm			c0.10	0.06								
v/c Ratio		0.15	0.26	0.14	0.16					0.02	0.47	
Uniform Delay, d1		9.6	10.1	6.6	8.9					16.1	17.6	
Progression Factor		1.00	1.00	1.00	0.94					1.00	1.00	
Incremental Delay, d2		0.1	0.5	0.2	0.1					0.1	2.4	
Delay (s)		9.7	10.6	6.9	8.5					16.2	20.0	
Level of Service		A	B	A	A					B	C	
Approach Delay (s)		10.3			8.1			0.0			19.9	
Approach LOS		B			A			A			B	

Intersection Summary

HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	48.3	Sum of lost time (s)	17.1
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY - Intersection 19

General Information

Analyst	
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*3:00 - 4:00 PM*

Site Information

Intersection	*Riley Road & SR 912 Off Ramp*
Jurisdiction	
Analysis Year	*2013 PM1*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 Off Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*122*			*206*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*135*	*0*	*0*	*228*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*41*		*232*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*45*	*0*	*257*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*45*		*257*			
C (m) (veh/h)			*710*		*947*			
v/c			*0.06*		*0.27*			
95% queue length			*0.20*		*1.10*			
Control Delay (s/veh)			*10.4*		*10.2*			
LOS			*B*		*B*			
Approach Delay (s/veh)	--	--	*10.2*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY - Intersection 20

General Information

Analyst	*JK*
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*3:00 - 4:00 PM*

Site Information

Intersection	*Riley Road & SR 912 On Ramp*
Jurisdiction	
Analysis Year	*2013 PM1*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 On Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*52*	*299*			*206*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*57*	*332*	*0*	*0*	*228*	*0*
Percent Heavy Vehicles	*16*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*57*							
C (m) (veh/h)	*1241*							
v/c	*0.05*							
95% queue length	*0.14*							
Control Delay (s/veh)	*8.0*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	1200	330	50	50	50	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.93		0.91	0.85
Flt Protected	0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	3367	1827	3211		1422	1289
Flt Permitted	0.95	1.00	1.00		0.98	1.00
Satd. Flow (perm)	3367	1827	3211		1422	1289
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	1545	425	64	64	64	258
RTOR Reduction (vph)	0	0	54	0	67	52
Lane Group Flow (vph)	1545	425	74	0	98	105
Heavy Vehicles (%)	4%	4%	4%	4%	19%	19%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	46.9	65.1	13.2		10.6	57.5
Effective Green, g (s)	46.9	65.1	13.2		10.6	57.5
Actuated g/C Ratio	0.55	0.76	0.15		0.12	0.67
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1843	1388	495		176	940
v/s Ratio Prot	c0.46	c0.23	0.02		c0.07	0.06
v/s Ratio Perm						0.02
v/c Ratio	0.84	0.31	0.15		0.56	0.11
Uniform Delay, d1	16.2	3.2	31.4		35.4	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.5	0.6	0.6		3.8	0.1
Delay (s)	19.7	3.8	32.0		39.2	5.1
Level of Service	B	A	C		D	A
Approach Delay (s)		16.3	32.0		22.5	
Approach LOS		B	C		C	

Intersection Summary

HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	85.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	60	610	10	30	1390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.91		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1519		3539	1302	1456	3539
Flt Permitted	0.98		1.00	1.00	0.39	1.00
Satd. Flow (perm)	1519		3539	1302	601	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	34	67	683	11	34	1556
RTOR Reduction (vph)	61	0	0	3	0	0
Lane Group Flow (vph)	40	0	683	8	34	1556
Heavy Vehicles (%)	12%	12%	2%	24%	24%	2%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	6.0		49.0	49.0	49.0	49.0
Effective Green, g (s)	6.0		49.0	49.0	49.0	49.0
Actuated g/C Ratio	0.09		0.75	0.75	0.75	0.75
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	140		2668	982	453	2668
v/s Ratio Prot	c0.03		0.19			c0.44
v/s Ratio Perm				0.01	0.06	
v/c Ratio	0.29		0.26	0.01	0.08	0.58
Uniform Delay, d1	27.5		2.4	2.0	2.1	3.5
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1		0.1	0.0	0.1	0.3
Delay (s)	28.6		2.5	2.0	2.2	3.8
Level of Service	C		A	A	A	A
Approach Delay (s)	28.6		2.5			3.8
Approach LOS	C		A			A

Intersection Summary

HCM Average Control Delay	4.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

2013 PM2(LATE) PEAK HOUR

CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	2	109	58	14	12	24	515	40	170	1105	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.89			0.98		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1639			1287		1770	3539	1495	1671	3538	
Flt Permitted		0.94			0.62		0.14	1.00	1.00	0.32	1.00	
Satd. Flow (perm)		1559			825		263	3539	1495	559	3538	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	23	3	140	75	18	15	31	663	52	219	1423	4
RTOR Reduction (vph)	0	101	0	0	8	0	0	0	12	0	0	0
Lane Group Flow (vph)	0	65	0	0	100	0	31	663	40	219	1427	0
Heavy Vehicles (%)	2%	2%	2%	40%	40%	40%	2%	2%	8%	8%	2%	2%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		13.5			13.5		39.9	38.4	38.4	52.0	45.5	
Effective Green, g (s)		13.5			13.5		39.9	38.4	38.4	52.0	45.5	
Actuated g/C Ratio		0.18			0.18		0.53	0.51	0.51	0.69	0.60	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)		279			148		169	1800	760	512	2132	
v/s Ratio Prot							0.00	0.19		c0.05	c0.40	
v/s Ratio Perm		0.04			c0.12		0.09		0.03	0.25		
v/c Ratio		0.23			0.67		0.18	0.37	0.05	0.43	0.67	
Uniform Delay, d1		26.6			28.9		9.2	11.2	9.4	5.0	10.0	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.6			12.5		0.5	0.6	0.1	0.6	1.7	
Delay (s)		27.2			41.4		9.7	11.8	9.5	5.6	11.7	
Level of Service		C			D		A	B	A	A	B	
Approach Delay (s)		27.2			41.4			11.6			10.9	
Approach LOS		C			D			B			B	

Intersection Summary

HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	58	42	32	62	142	78	438	70	156	560	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1777		1770	1863	1583	1770	3461		1770	3508	
Flt Permitted	0.70	1.00		0.66	1.00	1.00	0.39	1.00		0.30	1.00	
Satd. Flow (perm)	1311	1777		1221	1863	1583	721	3461		562	3508	
Peak-hour factor, PHF	0.60	0.54	0.88	0.50	0.78	0.91	0.78	0.79	0.73	0.80	0.88	0.75
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	103	111	49	66	82	161	103	571	99	201	655	41
RTOR Reduction (vph)	0	20	0	0	0	133	0	13	0	0	4	0
Lane Group Flow (vph)	103	140	0	66	82	28	103	657	0	201	692	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	13.8	13.8		13.8	13.8	13.8	36.8	36.8		52.5	52.5	
Effective Green, g (s)	13.8	13.8		13.8	13.8	13.8	36.8	36.8		52.5	52.5	
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.17	0.46	0.46		0.66	0.66	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	228	308		212	323	275	334	1602		509	2317	
v/s Ratio Prot		c0.08			0.04			0.19		c0.05	0.20	
v/s Ratio Perm	0.08			0.05		0.02	0.14			c0.22		
v/c Ratio	0.45	0.46		0.31	0.25	0.10	0.31	0.41		0.39	0.30	
Uniform Delay, d1	29.5	29.5		28.7	28.4	27.6	13.4	14.2		6.1	5.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	2.2		1.8	0.9	0.3	2.4	0.8		0.5	0.3	
Delay (s)	32.4	31.7		30.5	29.3	28.0	15.8	14.9		6.6	6.0	
Level of Service	C	C		C	C	C	B	B		A	A	
Approach Delay (s)		32.0			28.8			15.0			6.2	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	79.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	0	66	142	16	32	57	535	0	0	614	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.90		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1676		1770	1667		1770	3539			3512	
Flt Permitted		0.85		0.70	1.00		0.36	1.00			1.00	
Satd. Flow (perm)		1452		1308	1667		668	3539			3512	
Peak-hour factor, PHF	0.71	0.25	0.79	0.77	0.67	0.57	0.79	0.89	0.62	0.33	0.92	0.64
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	54	0	86	190	25	58	74	619	0	0	687	37
RTOR Reduction (vph)	0	65	0	0	44	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	75	0	190	39	0	74	619	0	0	721	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		17.8		17.8	17.8		42.2	42.2			42.2	
Effective Green, g (s)		17.8		17.8	17.8		42.2	42.2			42.2	
Actuated g/C Ratio		0.25		0.25	0.25		0.59	0.59			0.59	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		359		324	413		392	2077			2061	
v/s Ratio Prot					0.02			0.17			c0.21	
v/s Ratio Perm		0.05		c0.15			0.11					
v/c Ratio		0.21		0.59	0.10		0.19	0.30			0.35	
Uniform Delay, d1		21.5		23.8	20.8		6.9	7.4			7.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.6		4.2	0.2		1.1	0.4			0.5	
Delay (s)		22.1		28.0	21.1		8.0	7.8			8.2	
Level of Service		C		C	C		A	A			A	
Approach Delay (s)		22.1			25.9			7.8			8.2	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	71.9	Sum of lost time (s)	11.9
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	153	462	76	319	572	98	53	908	90	300	1220	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3491		1770	3539	1583
Flt Permitted	0.21	1.00	1.00	0.17	1.00	1.00	0.10	1.00		0.09	1.00	1.00
Satd. Flow (perm)	392	3539	1583	310	3539	1583	191	3491		169	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	197	595	98	411	736	126	68	1169	116	386	1571	55
RTOR Reduction (vph)	0	0	72	0	0	96	0	6	0	0	0	24
Lane Group Flow (vph)	197	595	26	411	736	30	68	1279	0	386	1571	31
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	28.0	19.0	19.0	40.0	26.0	26.0	42.2	39.0		61.0	52.8	52.8
Effective Green, g (s)	28.0	19.0	19.0	40.0	26.0	26.0	42.2	39.0		61.0	52.8	52.8
Actuated g/C Ratio	0.25	0.17	0.17	0.36	0.23	0.23	0.38	0.35		0.55	0.48	0.48
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	211	606	271	322	829	371	118	1227		338	1683	753
v/s Ratio Prot	0.08	0.17		c0.18	0.21		0.02	0.37		c0.17	0.44	
v/s Ratio Perm	0.16		0.02	c0.28		0.02	0.20			c0.45		0.02
v/c Ratio	0.93	0.98	0.10	1.28	0.89	0.08	0.58	1.04		1.14	0.93	0.04
Uniform Delay, d1	37.1	45.8	38.8	30.5	41.1	33.2	26.8	36.0		35.0	27.4	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	43.4	32.0	0.3	146.3	12.1	0.2	6.7	37.3		93.3	11.0	0.1
Delay (s)	80.6	77.8	39.1	176.9	53.2	33.4	33.4	73.3		128.2	38.4	15.7
Level of Service	F	E	D	F	D	C	C	E		F	D	B
Approach Delay (s)		74.2			91.2			71.3			55.0	
Approach LOS		E			F			E			E	

Intersection Summary

HCM Average Control Delay	70.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	111.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	93.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	190	0	37	0	526	40	31	1202	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	5.2			6.0	6.0	4.0	6.0	
Lane Util. Factor				0.95	0.95			0.95	1.00	1.00	0.95	
Frt				1.00	0.95			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1665	1561			3112	1509	1612	3438	
Flt Permitted				0.95	0.95			1.00	1.00	0.29	1.00	
Satd. Flow (perm)				1665	1532			3112	1509	491	3438	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.80	0.80	0.75	0.80	0.80	0.77	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	0	0	0	245	0	48	0	722	52	40	1608	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	27	0	0	0
Lane Group Flow (vph)	0	0	0	149	129	0	0	722	25	40	1608	0
Heavy Vehicles (%)	2%	2%	2%	3%	2%	13%	2%	16%	7%	12%	5%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)				33.3	33.3			44.6	44.6	51.1	51.1	
Effective Green, g (s)				33.3	33.3			44.6	44.6	51.1	51.1	
Actuated g/C Ratio				0.35	0.35			0.47	0.47	0.54	0.54	
Clearance Time (s)				4.0	5.2			6.0	6.0	4.0	6.0	
Vehicle Extension (s)				3.0	3.0			5.5	5.5	3.0	5.5	
Lane Grp Cap (vph)				587	551			1470	713	295	1861	
v/s Ratio Prot				c0.09	0.08			0.23		0.00	c0.47	
v/s Ratio Perm									0.02	0.07		
v/c Ratio				0.25	0.23			0.49	0.03	0.14	0.86	
Uniform Delay, d1				21.7	21.6			17.1	13.4	10.9	18.7	
Progression Factor				1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2				0.2	0.2			1.2	0.1	0.2	5.6	
Delay (s)				21.9	21.8			18.3	13.4	11.1	24.3	
Level of Service				C	C			B	B	B	C	
Approach Delay (s)		0.0			21.9			18.0			24.0	
Approach LOS		A			C			B			C	

Intersection Summary

HCM Average Control Delay	22.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	94.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	57	21	183	82	105	7	325	136	288	638	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.96			0.96		1.00	0.95		1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3386			3302		1770	3362		1770	3525	
Flt Permitted		0.88			0.75		0.30	1.00		0.31	1.00	
Satd. Flow (perm)		2982			2538		560	3362		573	3525	
Peak-hour factor, PHF	0.69	0.71	0.66	0.68	0.89	0.75	0.58	0.92	0.77	0.60	0.71	0.62
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	16	83	33	277	95	144	12	364	182	494	926	25
RTOR Reduction (vph)	0	25	0	0	47	0	0	61	0	0	2	0
Lane Group Flow (vph)	0	107	0	0	469	0	12	485	0	494	949	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		21.2			21.2		29.7	29.0		54.0	48.3	
Effective Green, g (s)		21.2			21.2		29.7	29.0		54.0	48.3	
Actuated g/C Ratio		0.25			0.25		0.35	0.34		0.63	0.57	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		3.0	7.0	
Lane Grp Cap (vph)		742			632		205	1144		644	1998	
v/s Ratio Prot							0.00	0.14		c0.18	0.27	
v/s Ratio Perm		0.04			c0.18		0.02			c0.31		
v/c Ratio		0.14			0.74		0.06	0.42		0.77	0.48	
Uniform Delay, d1		24.9			29.5		18.2	21.7		9.6	10.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			5.6		0.1	1.2		5.5	0.8	
Delay (s)		25.1			35.1		18.3	22.8		15.0	11.7	
Level of Service		C			D		B	C		B	B	
Approach Delay (s)		25.1			35.1			22.7			12.9	
Approach LOS		C			D			C			B	

Intersection Summary

HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	85.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	116	381	174	114	354	64	138	513	61	106	707	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.8	6.2	6.1	5.8	6.1		6.0	6.3		6.0	6.3	6.3
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3441		1770	3479		1770	3539	1583
Flt Permitted	0.33	1.00	1.00	0.36	1.00		0.14	1.00		0.33	1.00	1.00
Satd. Flow (perm)	611	3539	1583	666	3441		265	3479		608	3539	1583
Peak-hour factor, PHF	0.97	0.83	0.89	0.89	0.88	0.70	0.82	0.92	0.85	0.72	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	123	473	201	132	414	94	173	574	74	152	910	205
RTOR Reduction (vph)	0	0	142	0	16	0	0	9	0	0	0	78
Lane Group Flow (vph)	123	473	59	132	492	0	173	639	0	152	910	127
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	38.4	29.1	29.1	38.6	29.2		53.7	42.4		48.5	39.8	39.8
Effective Green, g (s)	38.4	29.0	29.1	38.6	29.2		53.7	42.4		48.5	39.8	39.8
Actuated g/C Ratio	0.34	0.25	0.26	0.34	0.26		0.47	0.37		0.43	0.35	0.35
Clearance Time (s)	5.8	6.1	6.1	5.8	6.1		6.0	6.3		6.0	6.3	6.3
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	301	902	405	317	883		274	1296		348	1238	554
v/s Ratio Prot	0.03	0.13		c0.03	c0.14		c0.06	0.18		0.03	c0.26	
v/s Ratio Perm	0.10		0.04	0.11			c0.23			0.15		0.08
v/c Ratio	0.41	0.52	0.15	0.42	0.56		0.63	0.49		0.44	0.74	0.23
Uniform Delay, d1	27.2	36.5	32.7	27.1	36.7		20.9	27.4		20.8	32.4	26.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.9	2.2	0.8	0.9	2.5		4.7	0.6		0.9	2.8	0.4
Delay (s)	28.1	38.6	33.5	28.0	39.2		25.6	28.1		21.7	35.2	26.6
Level of Service	C	D	C	C	D		C	C		C	D	C
Approach Delay (s)		35.7			36.9			27.5			32.2	
Approach LOS		D			D			C			C	

Intersection Summary

HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	113.8	Sum of lost time (s)	24.1
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	5	190	250	60	5	160	299	12	1	636	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	1638	1495	3019	1348		2801	2959		970	3525	
Flt Permitted	0.68	1.00	1.00	0.95	1.00		0.95	1.00		0.51	1.00	
Satd. Flow (perm)	1169	1638	1495	3019	1348		2801	2959		524	3525	
Peak-hour factor, PHF	0.70	0.31	0.70	0.70	0.57	0.70	0.70	0.80	0.60	0.70	0.82	0.70
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	10	17	280	368	108	7	235	385	21	1	799	21
RTOR Reduction (vph)	0	0	232	0	3	0	0	4	0	0	2	0
Lane Group Flow (vph)	10	17	48	368	112	0	235	402	0	1	818	0
Heavy Vehicles (%)	11%	16%	8%	16%	42%	3%	25%	19%	59%	86%	2%	3%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	9.0	9.0	9.0	13.5	27.5		10.5	38.3		22.8	22.8	
Effective Green, g (s)	9.0	9.0	9.0	13.5	27.5		10.5	38.3		22.8	22.8	
Actuated g/C Ratio	0.12	0.12	0.12	0.18	0.36		0.14	0.51		0.30	0.30	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.5	3.5	3.5	3.0	3.5		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	139	194	178	538	489		388	1495		158	1060	
v/s Ratio Prot		0.01		c0.12	c0.08		c0.08	0.14			c0.23	
v/s Ratio Perm	0.01		0.03							0.00		
v/c Ratio	0.07	0.09	0.27	0.68	0.23		0.61	0.27		0.01	0.77	
Uniform Delay, d1	29.7	29.7	30.4	29.2	16.8		30.7	10.7		18.6	24.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2	1.0	3.6	0.3		2.8	0.1		0.0	3.6	
Delay (s)	29.9	30.0	31.4	32.7	17.1		33.5	10.8		18.6	27.8	
Level of Service	C	C	C	C	B		C	B		B	C	
Approach Delay (s)		31.3			29.0			19.2			27.8	
Approach LOS		C			C			B			C	

Intersection Summary

HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	75.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

2013 PM2 Peak Rodel Analysis - Intersection 8

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E    (m)   8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)  10.00  10.00  20.00  10.00          TIME SLICE     min     15
V    (m)   7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)  20.00  20.00  20.00  20.00          TIME COST     $/hr  15.00
PHI  (d)  30.00  30.00  30.00  30.00          FLOW PERIOD    min  15 75
DIA  (m)  50.00  50.00  50.00  50.00          FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0          FLOW PEAK am/op/pm     PM

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U)  FLOF  CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.02    14  655    1  0          1.00  85  0.75 1.701 0.75  15 45 75
EB RILEY   1.08   196    5    7  0          1.00  85  0.75 1.701 0.75  15 45 75
NB DICKEY  1.22    12  308  165  0          1.00  85  0.75 1.701 0.75  15 45 75
WB RILEY   1.21     5   62  258  0          1.00  85  0.75 1.701 0.75  15 45 75

FLOW        veh     670    208    485    325
CAPACITY    veh    1796   1426   2031   1516          AVDEL s     2.9
AVE DELAY  mins    0.06   0.05   0.04   0.05          L  O  S      A
MAX DELAY  mins    0.10   0.09   0.06   0.09          VEH HRS     1.4
AVE QUEUE   veh       1      0      0      0          COST  $    20.5
MAX QUEUE   veh       1      0      0      0
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Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.06	0.05	0.04	0.05	0.05
Average Delay (secs)	3.6	3.0	2.4	3.0	2.9
LOS	A	A	A	A	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1063	45	116	665	77	43	87	97	47	81	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.98			0.94			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1770	3510		1770	3473			3277			3257	
Flt Permitted	0.24	1.00		0.08	1.00			0.70			0.74	
Satd. Flow (perm)	439	3510		151	3473			2332			2444	
Peak-hour factor, PHF	0.82	0.71	0.51	0.91	0.82	0.66	0.57	0.78	0.71	0.65	0.70	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	195	1542	91	131	835	120	78	115	141	74	119	170
RTOR Reduction (vph)	0	4	0	0	11	0	0	118	0	0	142	0
Lane Group Flow (vph)	195	1629	0	131	944	0	0	216	0	0	221	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	59.0	49.3		58.8	49.2			14.8			14.8	
Effective Green, g (s)	59.0	49.3		58.8	49.2			14.8			14.8	
Actuated g/C Ratio	0.65	0.54		0.64	0.54			0.16			0.16	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	425	1893		267	1869			378			396	
v/s Ratio Prot	0.05	c0.46		c0.05	0.27							
v/s Ratio Perm	0.25			0.26				c0.09			0.09	
v/c Ratio	0.46	0.86		0.49	0.51			0.57			0.56	
Uniform Delay, d1	7.4	18.1		14.5	13.4			35.4			35.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.9	5.1		1.6	0.8			3.3			2.9	
Delay (s)	8.3	23.2		16.0	14.1			38.7			38.2	
Level of Service	A	C		B	B			D			D	
Approach Delay (s)		21.6			14.4			38.7			38.2	
Approach LOS		C			B			D			D	

Intersection Summary

HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	91.4	Sum of lost time (s)	11.8
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	248	381	24	10	200	33	7	43	11	62	52	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3499		1770	3455		1770	3448		1770	3106	
Flt Permitted	0.44	1.00		0.47	1.00		0.62	1.00		0.44	1.00	
Satd. Flow (perm)	818	3499		883	3455		1164	3448		813	3106	
Peak-hour factor, PHF	0.86	0.87	0.67	0.62	0.72	0.63	0.58	0.77	0.92	0.74	0.81	0.85
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	297	451	37	17	286	54	12	58	12	86	66	291
RTOR Reduction (vph)	0	7	0	0	17	0	0	11	0	0	206	0
Lane Group Flow (vph)	297	481	0	17	323	0	12	59	0	86	151	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	32.1	32.1		16.2	16.2		6.4	6.4		17.2	17.2	
Effective Green, g (s)	32.1	32.1		16.2	16.2		6.4	6.4		17.2	17.2	
Actuated g/C Ratio	0.55	0.55		0.28	0.28		0.11	0.11		0.29	0.29	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	639	1910		243	952		127	375		348	909	
v/s Ratio Prot	c0.09	0.14			0.09			0.02		c0.03	0.05	
v/s Ratio Perm	c0.16			0.02			0.01			c0.04		
v/c Ratio	0.46	0.25		0.07	0.34		0.09	0.16		0.25	0.17	
Uniform Delay, d1	7.5	7.0		15.7	17.0		23.6	23.8		15.6	15.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.1		0.3	0.4		0.4	0.2		0.4	0.1	
Delay (s)	8.1	7.2		16.0	17.5		24.0	24.0		16.1	15.6	
Level of Service	A	A		B	B		C	C		B	B	
Approach Delay (s)		7.5			17.4			24.0			15.7	
Approach LOS		A			B			C			B	

Intersection Summary

HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	58.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	300	0	0	242	34	741	21	16	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1		6.6	6.6				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			0.98		1.00	0.97				
Flt Protected	0.95	1.00			1.00		0.95	0.97				
Satd. Flow (prot)	1770	3539			3462		2738	1354				
Flt Permitted	0.39	1.00			1.00		0.95	0.97				
Satd. Flow (perm)	736	3539			3462		2738	1354				
Peak-hour factor, PHF	0.79	0.90	0.25	0.92	0.86	0.71	0.90	0.58	0.29	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	29	343	0	0	290	49	848	37	57	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	4	0	0	0	0
Lane Group Flow (vph)	29	343	0	0	327	0	628	310	0	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	20%	20%	20%	2%	2%	2%
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2	2										
Actuated Green, G (s)	47.5	47.5			26.9		50.4	50.4				
Effective Green, g (s)	47.5	47.5			26.9		50.4	50.4				
Actuated g/C Ratio	0.43	0.43			0.24		0.46	0.46				
Clearance Time (s)	6.1	6.1			6.1		6.6	6.6				
Vehicle Extension (s)	3.0	5.0			5.0		4.0	4.0				
Lane Grp Cap (vph)	452	1520			842		1248	617				
v/s Ratio Prot	0.01	c0.10			c0.09		c0.23	0.23				
v/s Ratio Perm	0.02											
v/c Ratio	0.06	0.23			0.39		0.50	0.50				
Uniform Delay, d1	18.7	19.9			35.0		21.3	21.2				
Progression Factor	0.63	0.62			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.2			0.6		0.4	0.9				
Delay (s)	11.8	12.5			35.6		21.7	22.1				
Level of Service	B	B			D		C	C				
Approach Delay (s)		12.5			35.6			21.8			0.0	
Approach LOS		B			D			C			A	

Intersection Summary

HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	18.8
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	154	200	705	32	462	392	0	0	0	90	448	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1846	1583
Flt Permitted	0.30	1.00	1.00	0.58	1.00	1.00					0.99	1.00
Satd. Flow (perm)	562	3539	1583	1074	5085	1583					1846	1583
Peak-hour factor, PHF	0.82	0.72	0.77	0.73	0.88	0.93	0.92	0.92	0.92	0.80	0.87	0.79
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	193	286	943	45	541	434	0	0	0	116	530	202
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	69
Lane Group Flow (vph)	193	286	943	45	541	434	0	0	0	0	646	133
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	47.5	47.5	110.6	26.9	26.9	110.6					50.4	50.4
Effective Green, g (s)	47.5	47.5	110.6	26.9	26.9	110.6					50.4	50.4
Actuated g/C Ratio	0.43	0.43	1.00	0.24	0.24	1.00					0.46	0.46
Clearance Time (s)	6.1	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	400	1520	1583	261	1237	1583					841	721
v/s Ratio Prot	0.06	0.08			0.11						c0.35	
v/s Ratio Perm	0.14		c0.60	0.04		0.27						0.08
v/c Ratio	0.48	0.19	0.60	0.17	0.44	0.27					0.77	0.18
Uniform Delay, d1	20.8	19.6	0.0	33.1	35.4	0.0					25.2	17.9
Progression Factor	1.00	1.00	1.00	1.17	1.20	1.00					1.00	1.00
Incremental Delay, d2	0.9	0.1	1.7	0.6	0.5	0.4					4.5	0.2
Delay (s)	21.8	19.7	1.7	39.3	42.9	0.4					29.7	18.1
Level of Service	C	B	A	D	D	A					C	B
Approach Delay (s)		8.0			24.7			0.0			26.9	
Approach LOS		A			C			A			C	

Intersection Summary

HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	6.6
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	75	0	0	129	1	142	12	38	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			1.00		1.00	0.94				
Flt Protected	0.95	1.00			1.00		0.95	0.98				
Satd. Flow (prot)	1770	3539			3527		1681	1635				
Flt Permitted	0.64	1.00			1.00		0.95	0.98				
Satd. Flow (perm)	1188	3539			3527		1681	1635				
Peak-hour factor, PHF	0.82	0.75	0.92	0.92	0.75	0.25	0.91	0.43	0.86	0.25	0.25	0.29
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	41	103	0	0	177	4	161	29	46	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	27	0	0	0	0
Lane Group Flow (vph)	41	103	0	0	179	0	121	88	0	0	0	0
Turn Type	pm+pt						Perm					
Protected Phases	5	2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)	18.8	16.5			17.8		8.8	8.8				
Effective Green, g (s)	18.8	16.5			17.8		8.8	8.8				
Actuated g/C Ratio	0.41	0.36			0.39		0.19	0.19				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	515	1269			1365		322	313				
v/s Ratio Prot	c0.00	0.03			c0.05							
v/s Ratio Perm	0.03						c0.07	0.05				
v/c Ratio	0.08	0.08			0.13		0.38	0.28				
Uniform Delay, d1	8.2	9.7			9.1		16.2	15.9				
Progression Factor	0.55	0.46			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.1			0.1		1.5	1.0				
Delay (s)	4.7	4.5			9.2		17.7	16.9				
Level of Service	A	A			A		B	B				
Approach Delay (s)		4.6			9.2			17.3			0.0	
Approach LOS		A			A			B			A	

Intersection Summary

HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	110	302	53	200	0	0	0	0	7	71	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	3539					1681	1662	
Flt Permitted		1.00	1.00	0.62	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1159	3539					1681	1662	
Peak-hour factor, PHF	0.25	0.89	0.79	0.83	0.83	0.92	0.92	0.92	0.92	0.58	0.71	0.62
Growth Factor (vph)	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	0	127	394	66	248	0	0	0	0	12	103	70
RTOR Reduction (vph)	0	0	253	0	0	0	0	0	0	0	28	0
Lane Group Flow (vph)	0	127	141	66	248	0	0	0	0	11	146	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		16.5	16.5	21.4	17.8					8.8	8.8	
Effective Green, g (s)		16.5	16.5	21.4	17.8					8.8	8.8	
Actuated g/C Ratio		0.36	0.36	0.47	0.39					0.19	0.19	
Clearance Time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3					5.0	5.0	
Lane Grp Cap (vph)		1269	568	587	1369					322	318	
v/s Ratio Prot		0.04		c0.01	0.07					0.01	c0.09	
v/s Ratio Perm			c0.09	0.04								
v/c Ratio		0.10	0.25	0.11	0.18					0.03	0.46	
Uniform Delay, d1		9.8	10.4	6.9	9.3					15.1	16.5	
Progression Factor		1.00	1.00	0.97	0.90					1.00	1.00	
Incremental Delay, d2		0.1	0.5	0.2	0.1					0.1	2.2	
Delay (s)		9.9	10.9	6.8	8.5					15.2	18.7	
Level of Service		A	B	A	A					B	B	
Approach Delay (s)		10.7			8.2			0.0			18.5	
Approach LOS		B			A			A			B	

Intersection Summary

HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	17.1
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY - Intersection 19

General Information		Site Information	
Analyst		Intersection	*Riley Road & SR 912 Off Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2013 PM2*
Analysis Time Period	*4:45 - 5:45 PM*		

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 Off Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*124*			*196*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*137*	*0*	*0*	*217*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*41*		*134*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*45*	*0*	*148*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*45*		*148*			
C (m) (veh/h)			*714*		*947*			
v/c			*0.06*		*0.16*			
95% queue length			*0.20*		*0.55*			
Control Delay (s/veh)			*10.4*		*9.5*			
LOS			*B*		*A*			
Approach Delay (s/veh)	--	--	*9.7*					
Approach LOS	--	--	*A*					

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TWO-WAY STOP CONTROL SUMMARY - Intersection 20

General Information

Analyst	*JK*
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*4:45 - 5:45 M*

Site Information

Intersection	*Riley Road & SR 912 On Ramp*
Jurisdiction	
Analysis Year	*2013 PM2*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 On Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*52*	*206*			*196*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*57*	*228*	*0*	*0*	*217*	*0*
Percent Heavy Vehicles	*16*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*57*							
C (m) (veh/h)	*1254*							
v/c	*0.05*							
95% queue length	*0.14*							
Control Delay (s/veh)	*8.0*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	1200	300	50	50	50	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.93		0.91	0.85
Flt Protected	0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	3367	1863	3242		1422	1289
Flt Permitted	0.95	1.00	1.00		0.98	1.00
Satd. Flow (perm)	3367	1863	3242		1422	1289
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	1545	386	64	64	64	258
RTOR Reduction (vph)	0	0	54	0	67	52
Lane Group Flow (vph)	1545	386	74	0	98	105
Heavy Vehicles (%)	4%	2%	2%	4%	19%	19%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	46.2	64.1	12.9		10.7	56.9
Effective Green, g (s)	46.2	64.1	12.9		10.7	56.9
Actuated g/C Ratio	0.54	0.76	0.15		0.13	0.67
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1834	1408	493		179	941
v/s Ratio Prot	c0.46	c0.21	0.02		c0.07	0.06
v/s Ratio Perm						0.02
v/c Ratio	0.84	0.27	0.15		0.55	0.11
Uniform Delay, d1	16.2	3.2	31.2		34.8	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.7	0.5	0.6		3.4	0.1
Delay (s)	19.9	3.7	31.8		38.1	5.0
Level of Service	B	A	C		D	A
Approach Delay (s)		16.7	31.8		22.0	
Approach LOS		B	C		C	

Intersection Summary

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	84.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

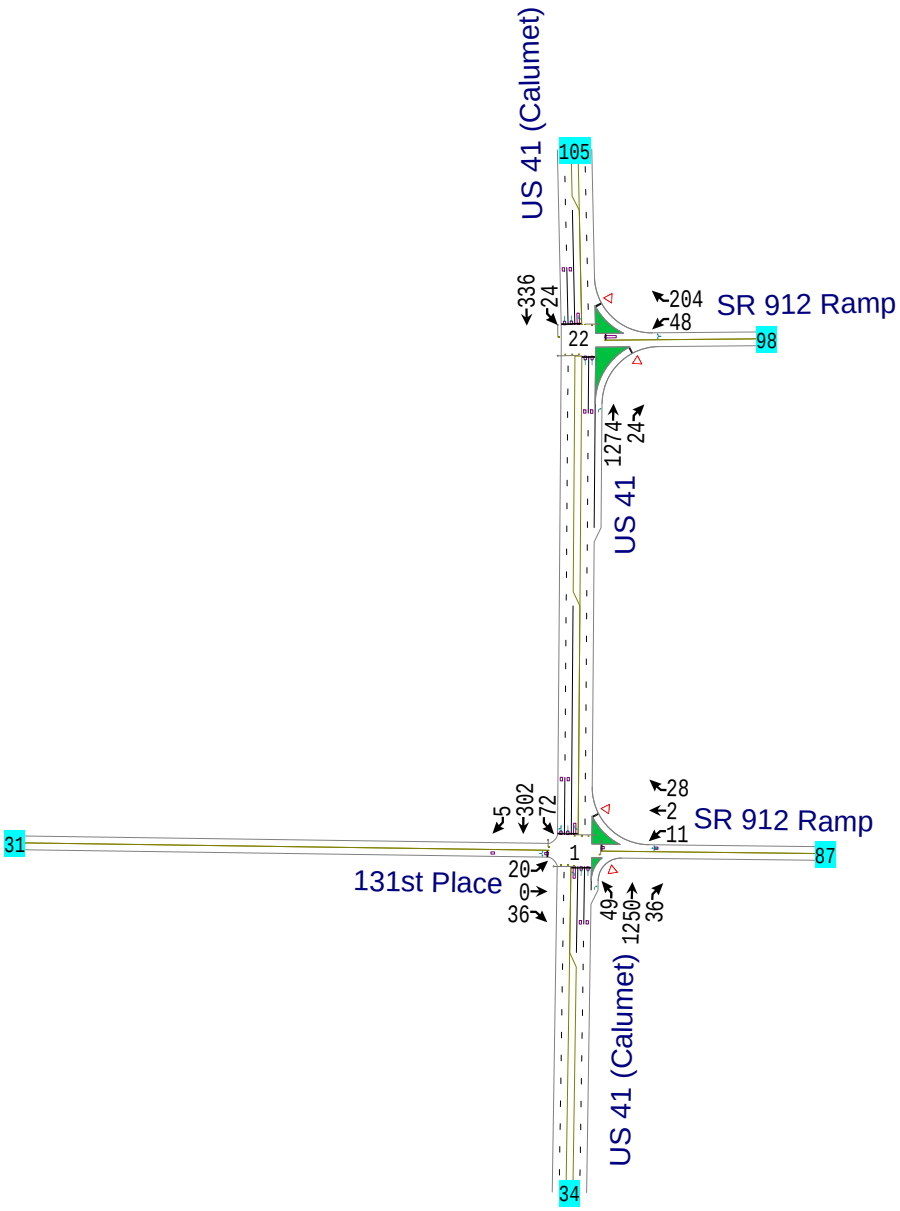
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	60	535	10	30	1250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.91		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1519		3539	1302	1456	3539
Flt Permitted	0.98		1.00	1.00	0.43	1.00
Satd. Flow (perm)	1519		3539	1302	652	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	103%	103%	103%	103%	103%	103%
Adj. Flow (vph)	34	67	599	11	34	1399
RTOR Reduction (vph)	60	0	0	3	0	0
Lane Group Flow (vph)	41	0	599	8	34	1399
Heavy Vehicles (%)	12%	12%	2%	24%	24%	2%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	5.8		41.6	41.6	41.6	41.6
Effective Green, g (s)	5.8		41.6	41.6	41.6	41.6
Actuated g/C Ratio	0.10		0.75	0.75	0.75	0.75
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	159		2657	978	490	2657
v/s Ratio Prot	c0.03		0.17			c0.40
v/s Ratio Perm				0.01	0.05	
v/c Ratio	0.26		0.23	0.01	0.07	0.53
Uniform Delay, d1	22.8		2.1	1.7	1.8	2.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9		0.0	0.0	0.1	0.2
Delay (s)	23.7		2.1	1.7	1.9	3.0
Level of Service	C		A	A	A	A
Approach Delay (s)	23.7		2.1			3.0
Approach LOS	C		A			A

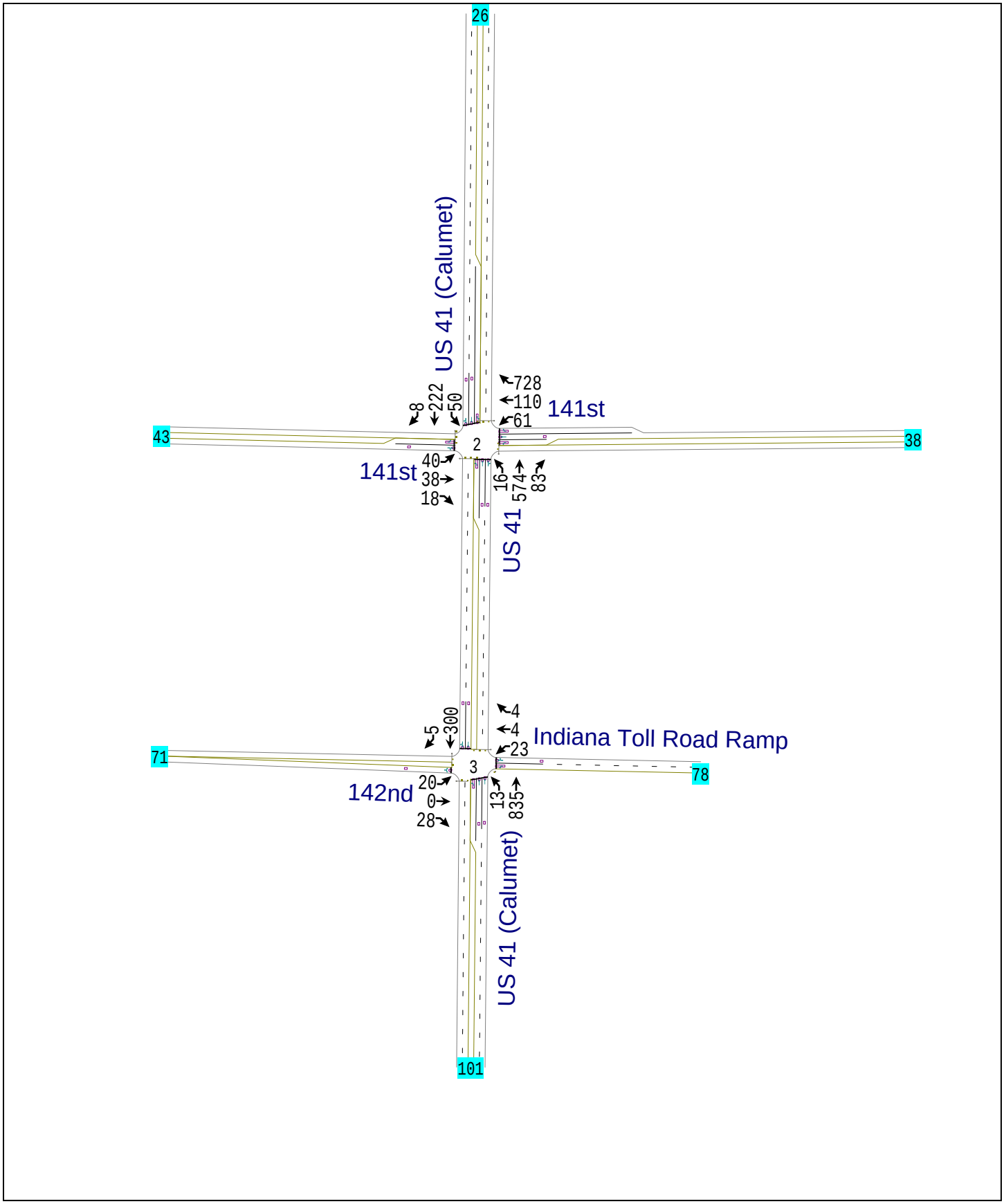
Intersection Summary

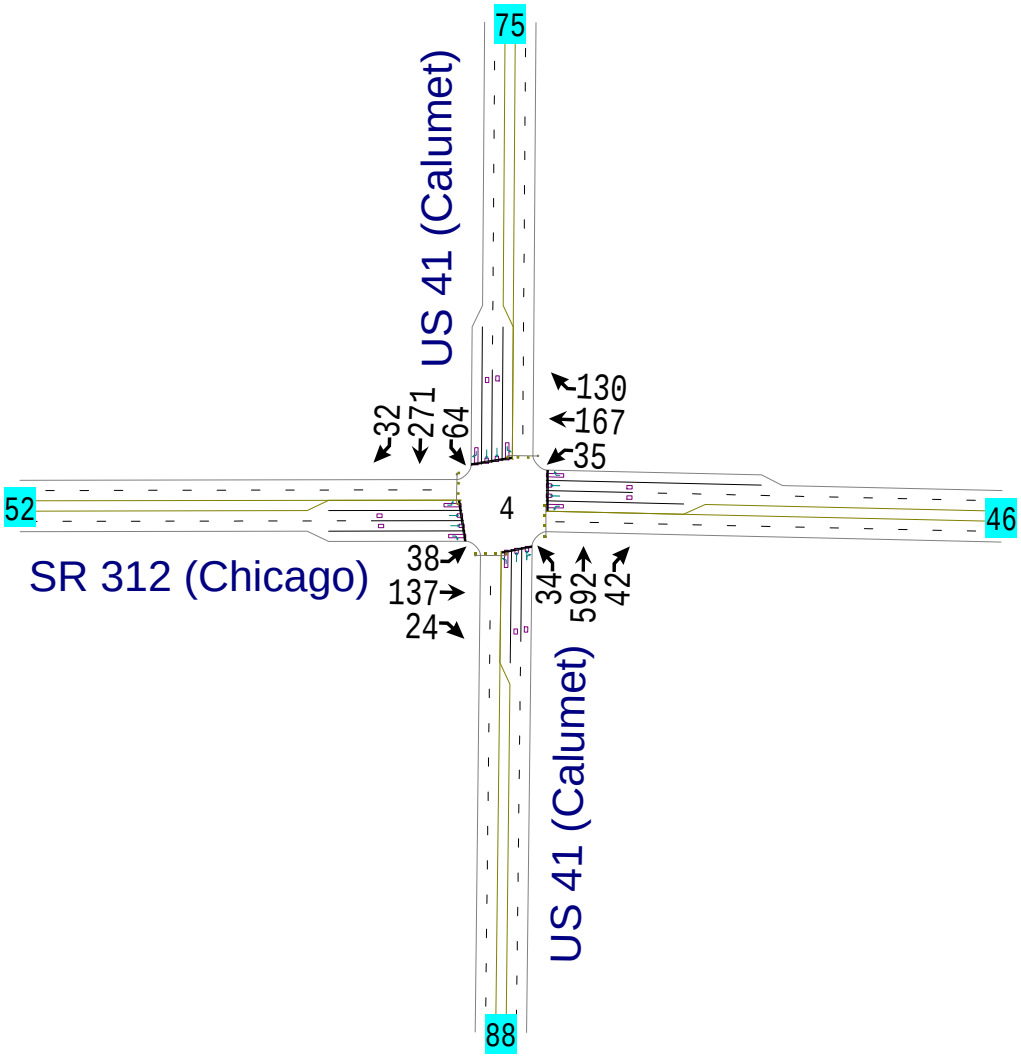
HCM Average Control Delay	3.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	55.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		

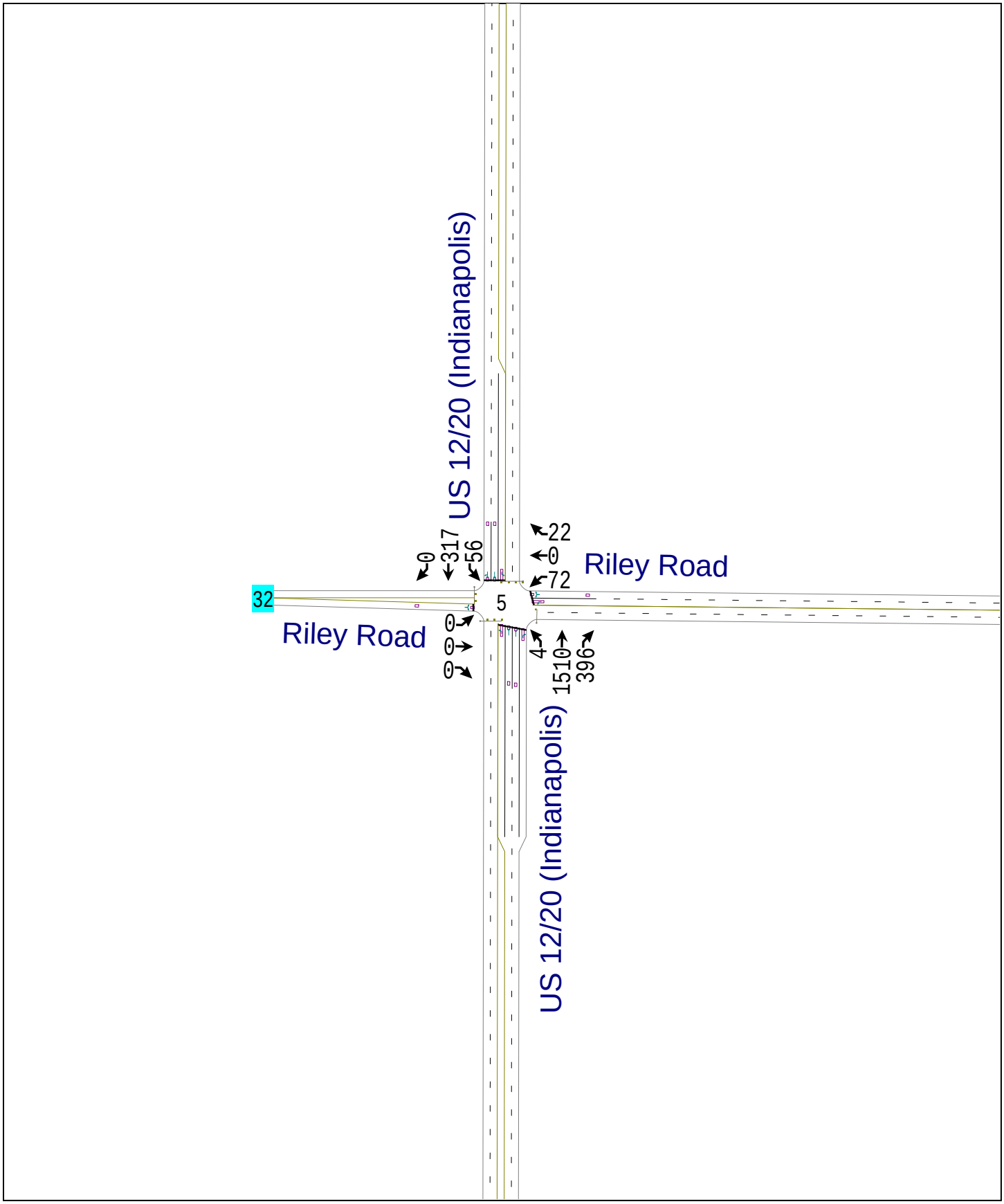
c Critical Lane Group

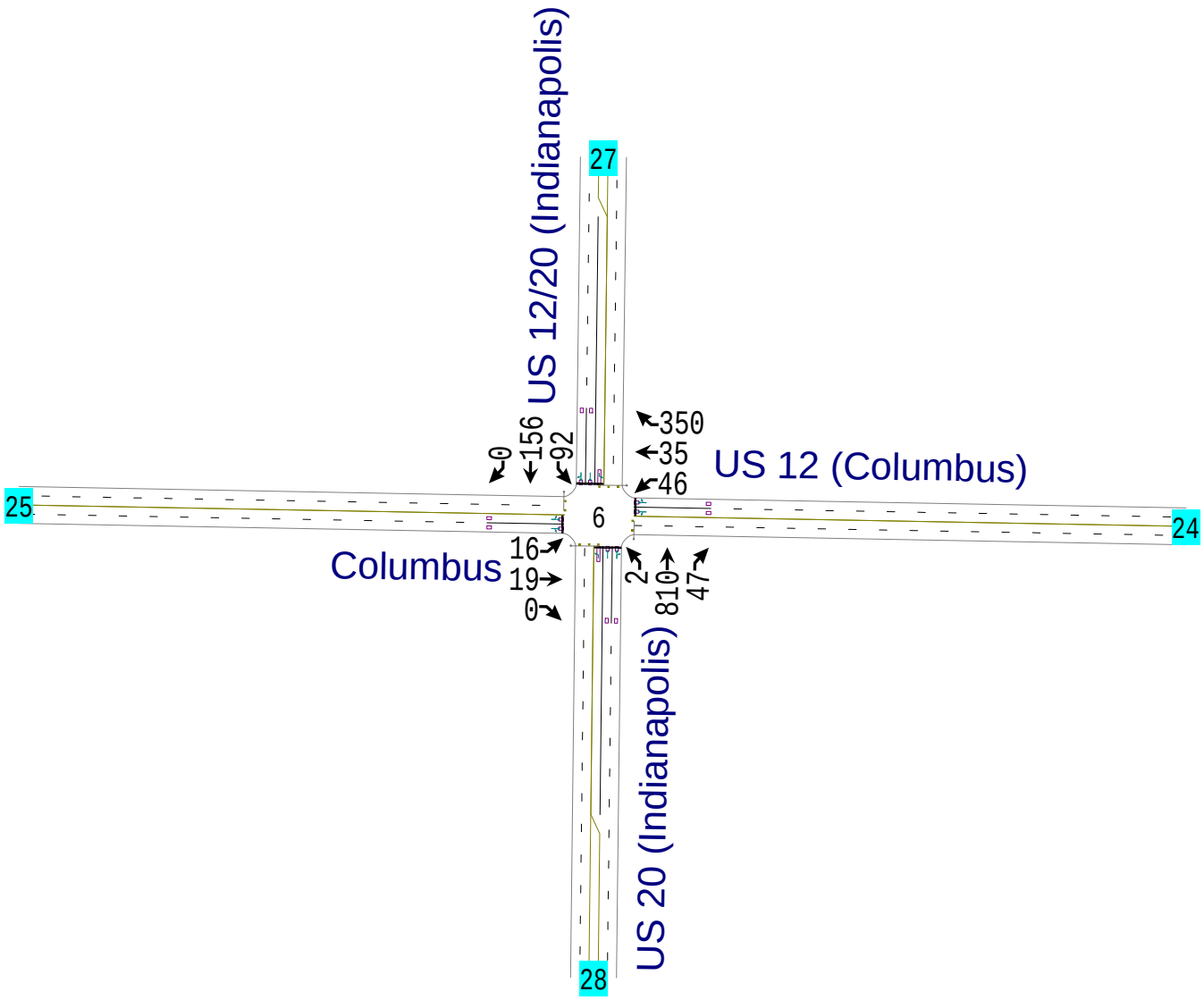
2033 AM PEAK HOUR VOLUMES

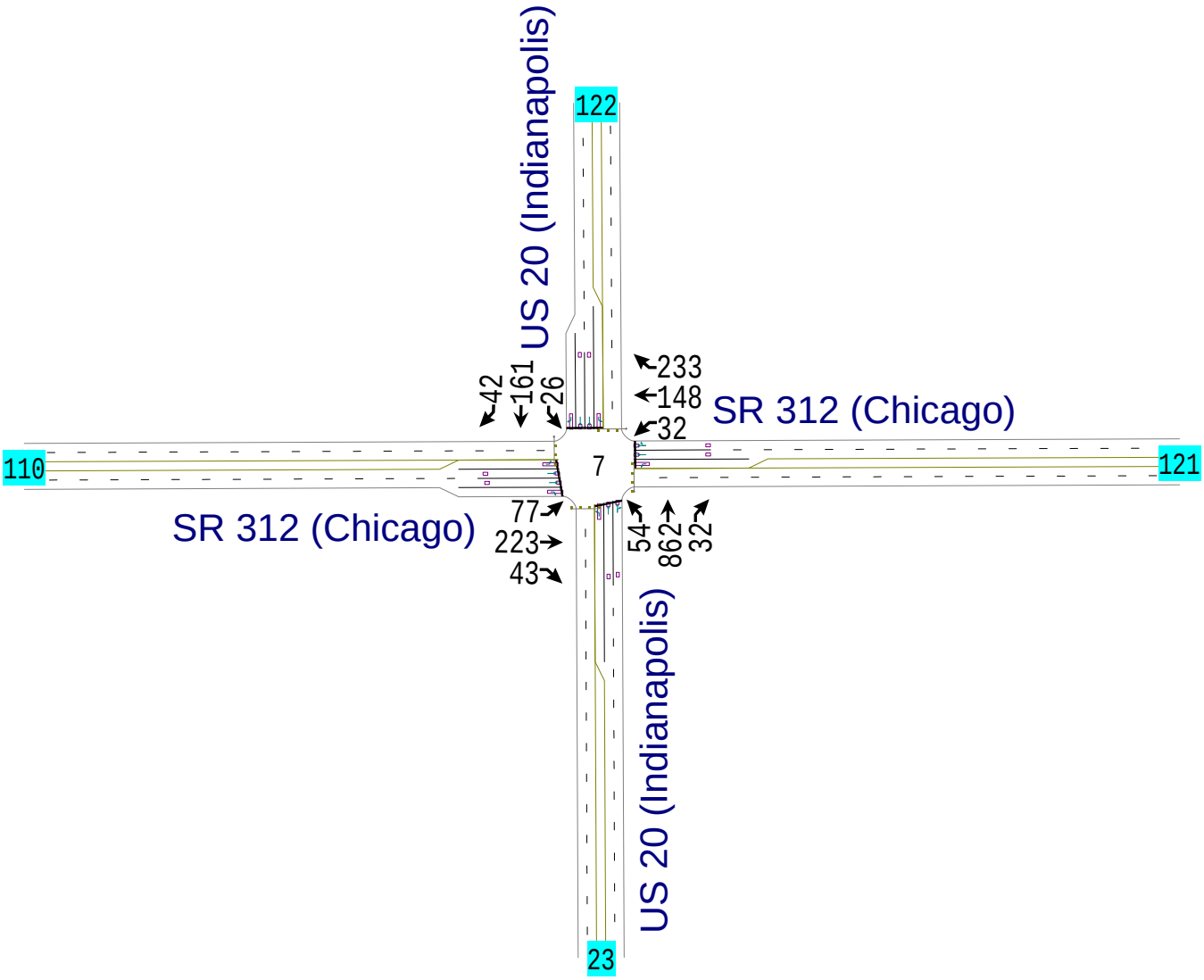

US 41 (Calumet)
105
336
24
22
204
48
SR 912 Ramp
98
1274
24
US 41
5
302
72
1
20
0
36
131st Place
31
28
2
11
SR 912 Ramp
87
49
1250
36
US 41 (Calumet)
34

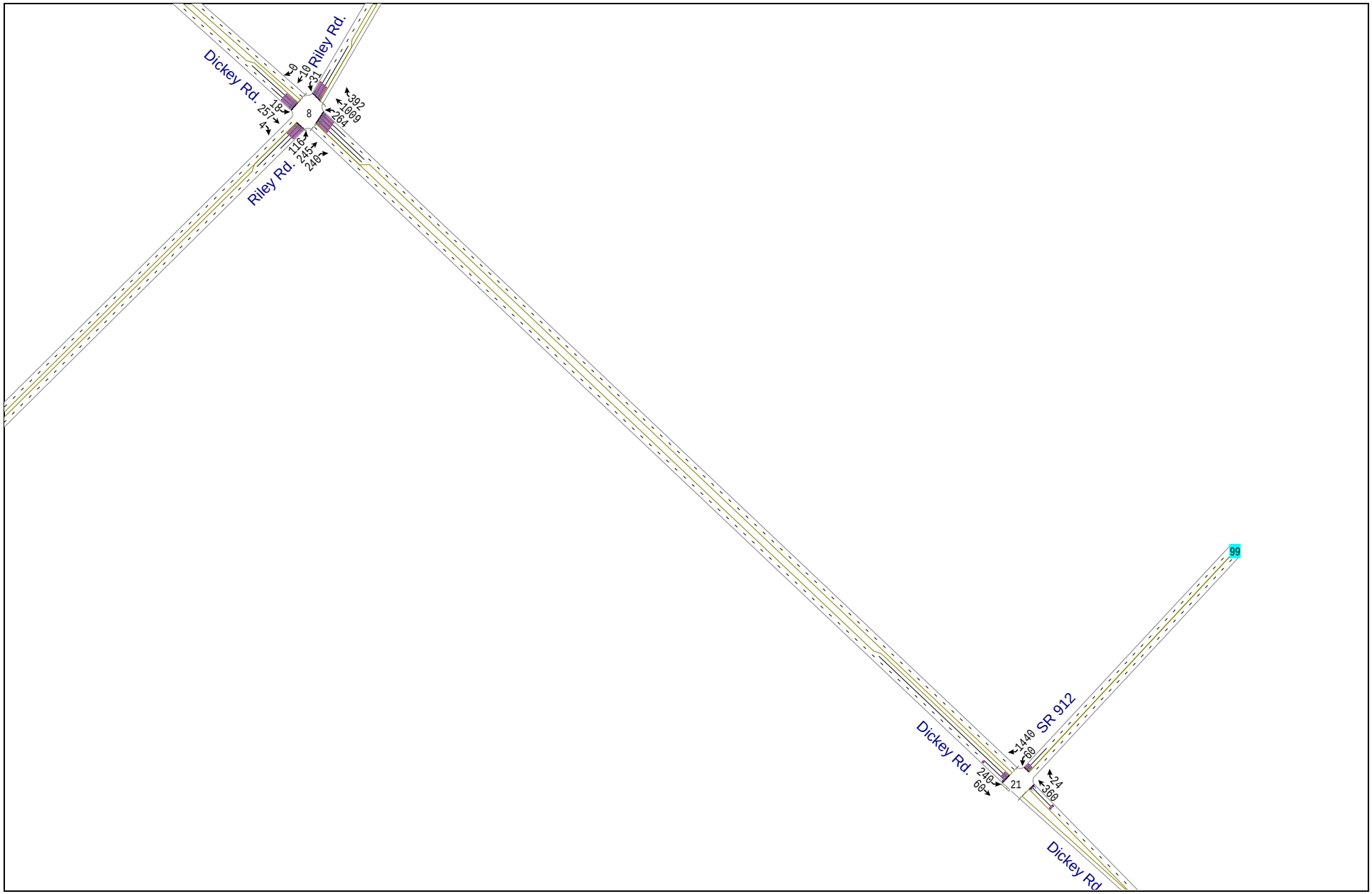

26
US 41 (Calumet)
728
110
61
141st
8
222
50
43
2
38
40
38
18
141st
16
574
83
US 41
4
4
23
Indiana Toll Road Ramp
5
300
71
3
78
20
0
28
142nd
13
835
US 41 (Calumet)
101

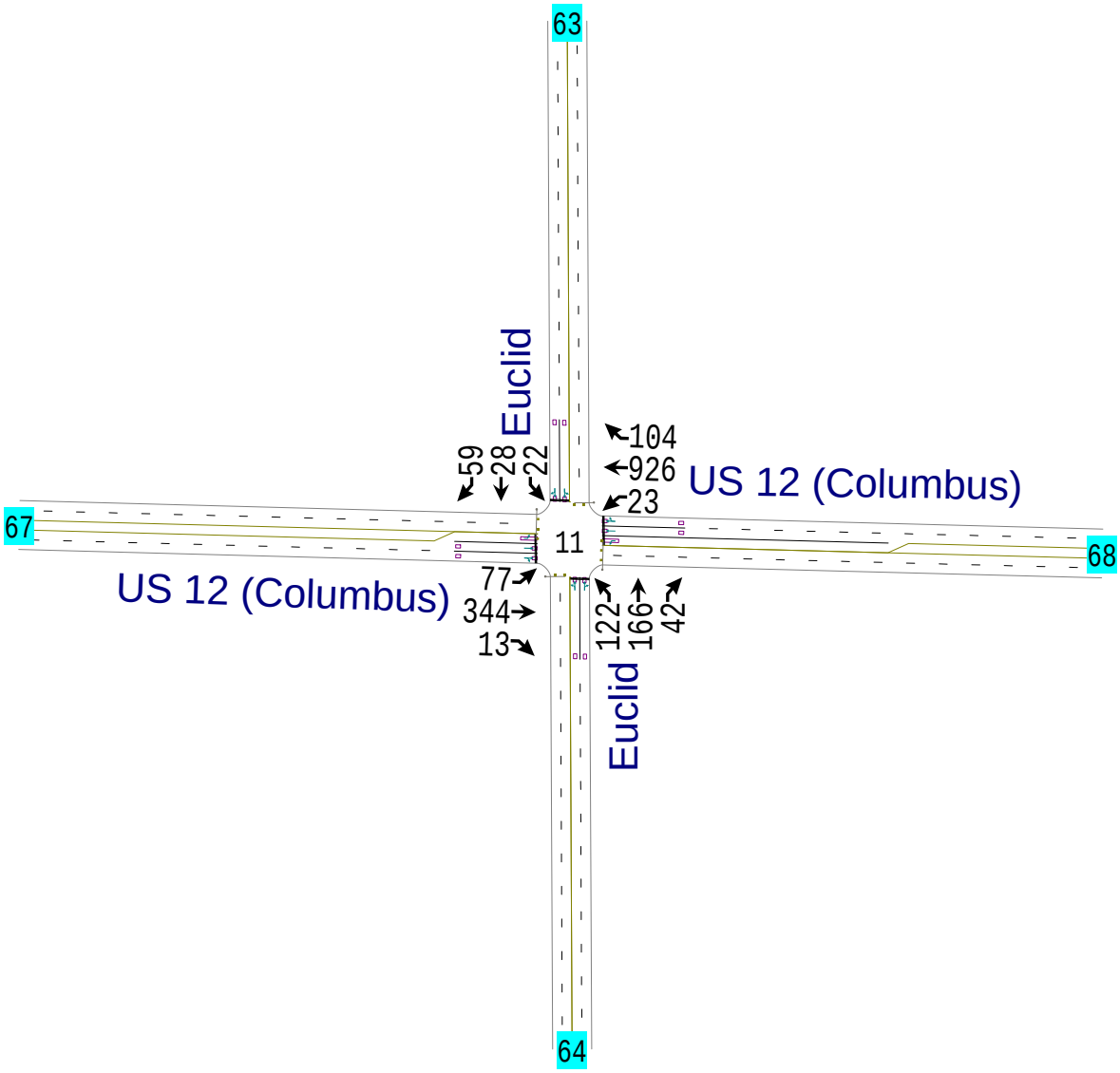

US 41 (Calumet)
75
32
271
64
130
167
35
52
4
46
SR 312 (Chicago)
38
137
24
34
592
42
US 41 (Calumet)
88

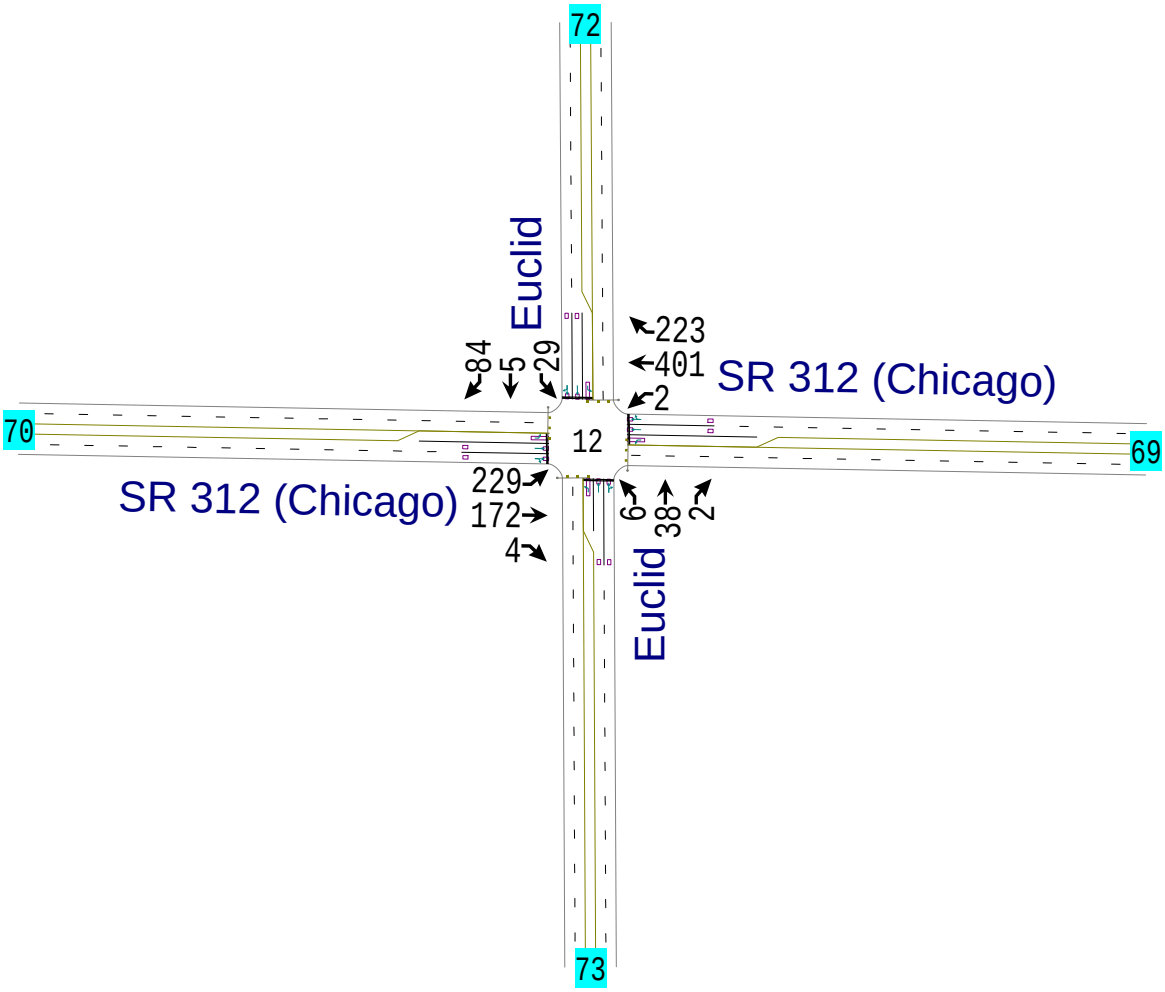

US 12/20 (Indianapolis)
0
317
56
32
Riley Road
0
0
0
5
22
0
72
Riley Road
4
1510
396
US 12/20 (Indianapolis)

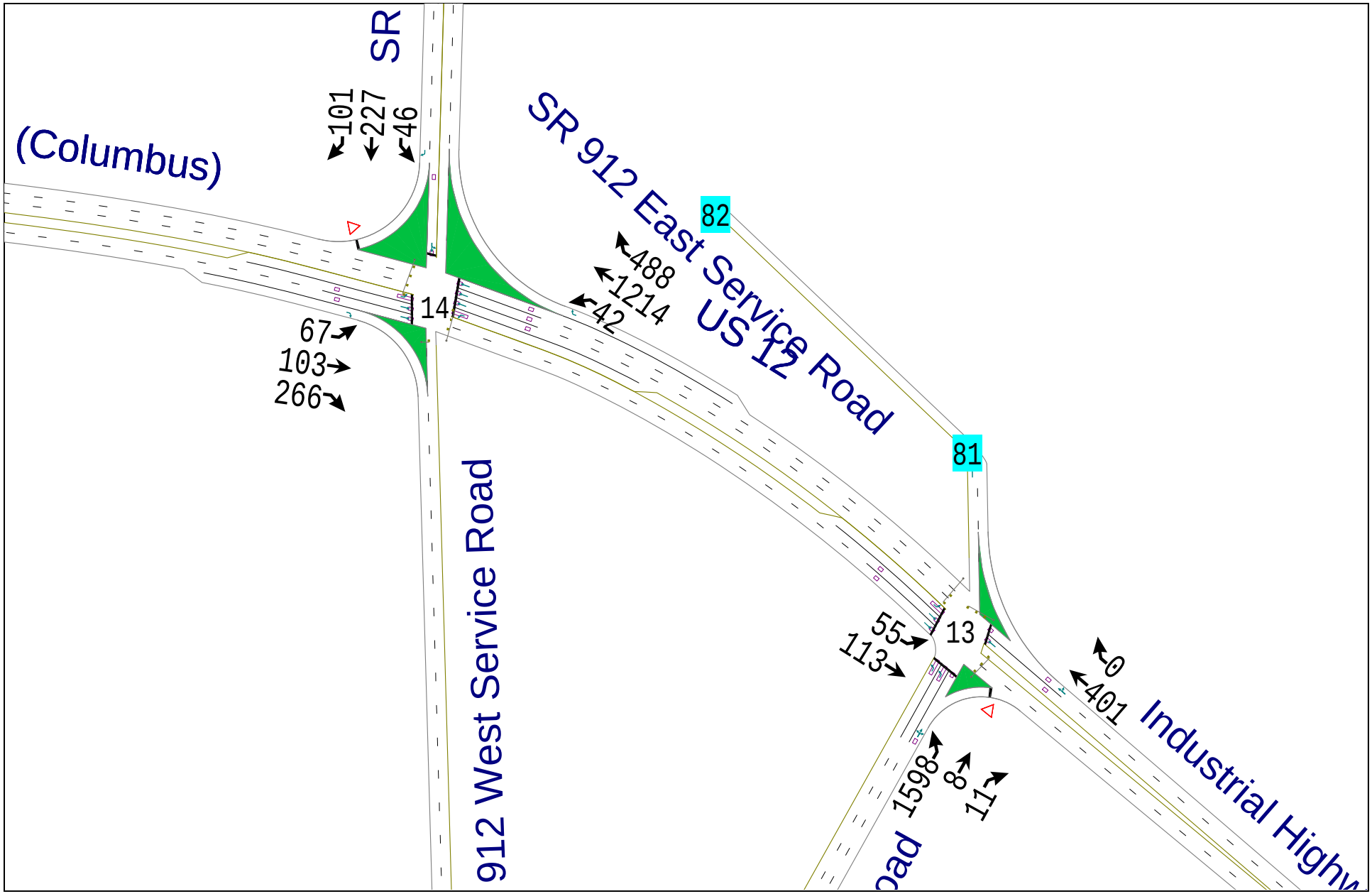

US 12/20 (Indianapolis)
27
0
156
92
350
35
46
US 12 (Columbus)
25
6
24
Columbus
16
19
0
2
810
47
US 20 (Indianapolis)
28

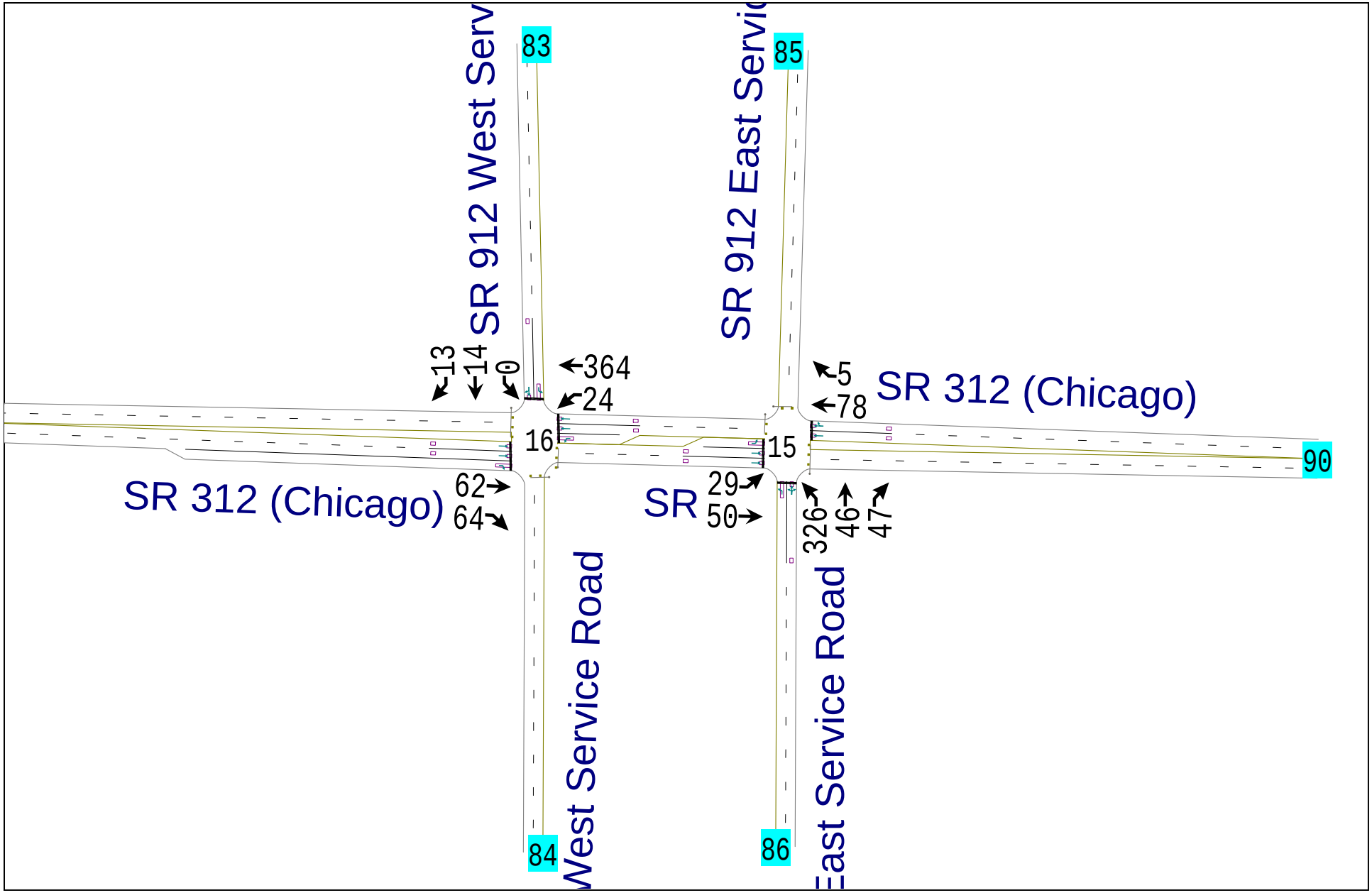

110
SR 312 (Chicago)
77
223
43
42
161
26
US 20 (Indianapolis)
23
7
54
862
32
233
148
32
SR 312 (Chicago)
122
US 20 (Indianapolis)
121

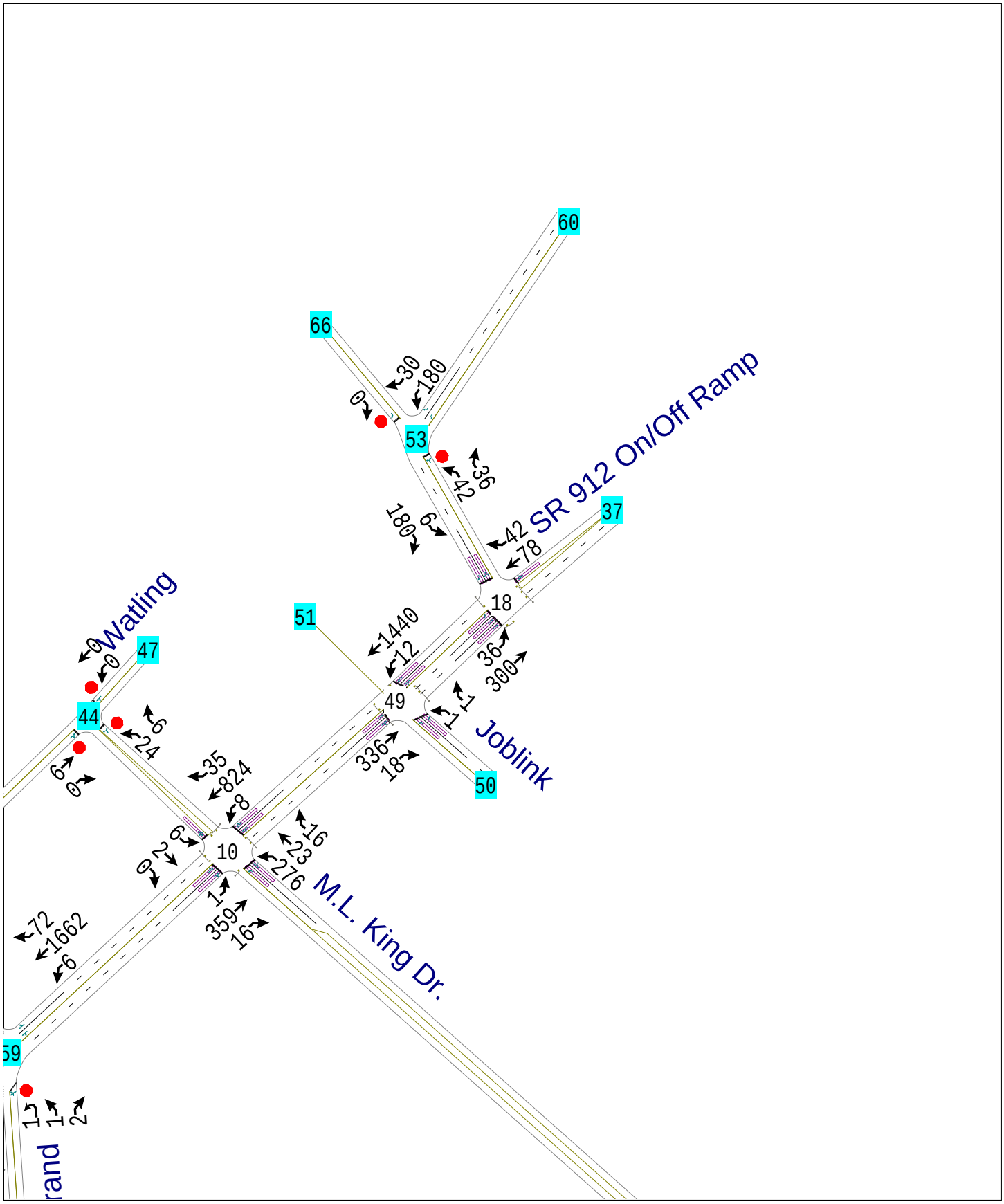

Dickey Rd.
Riley Rd.
Riley Rd.
8
0
10
31
18
257
4
392
1069
264
116
245
240
99
SR 912
Dickey Rd.
Dickey Rd
1440
69
240
60
21
24
360

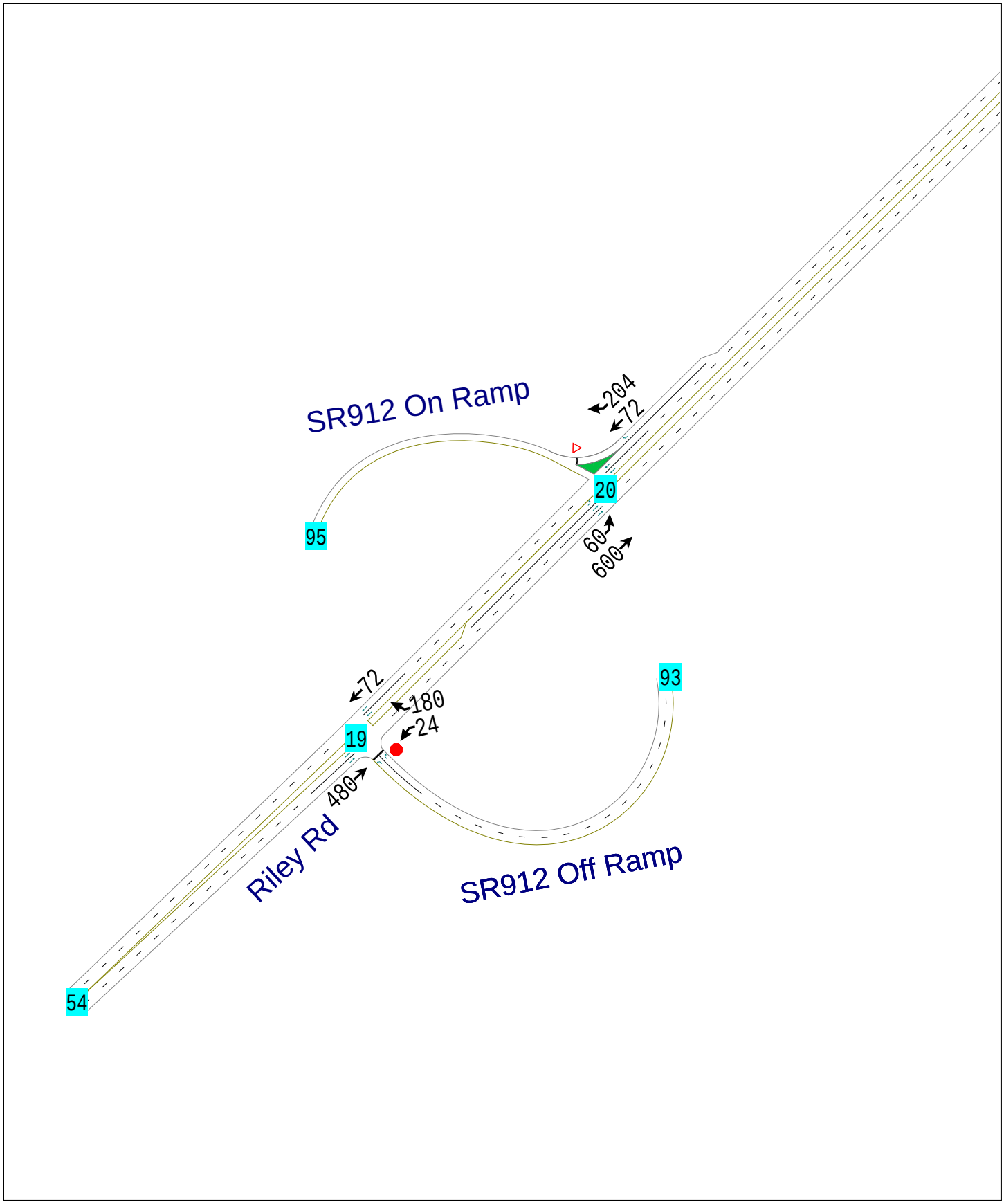

63
Euclid
59
28
22
104
926
23
US 12 (Columbus)
67
11
68
US 12 (Columbus)
77
344
13
122
166
42
Euclid
64


72
Euclid
84
5
29
223
401
2
SR 312 (Chicago)
70
12
69
SR 312 (Chicago)
229
172
4
6
38
2
Euclid
73

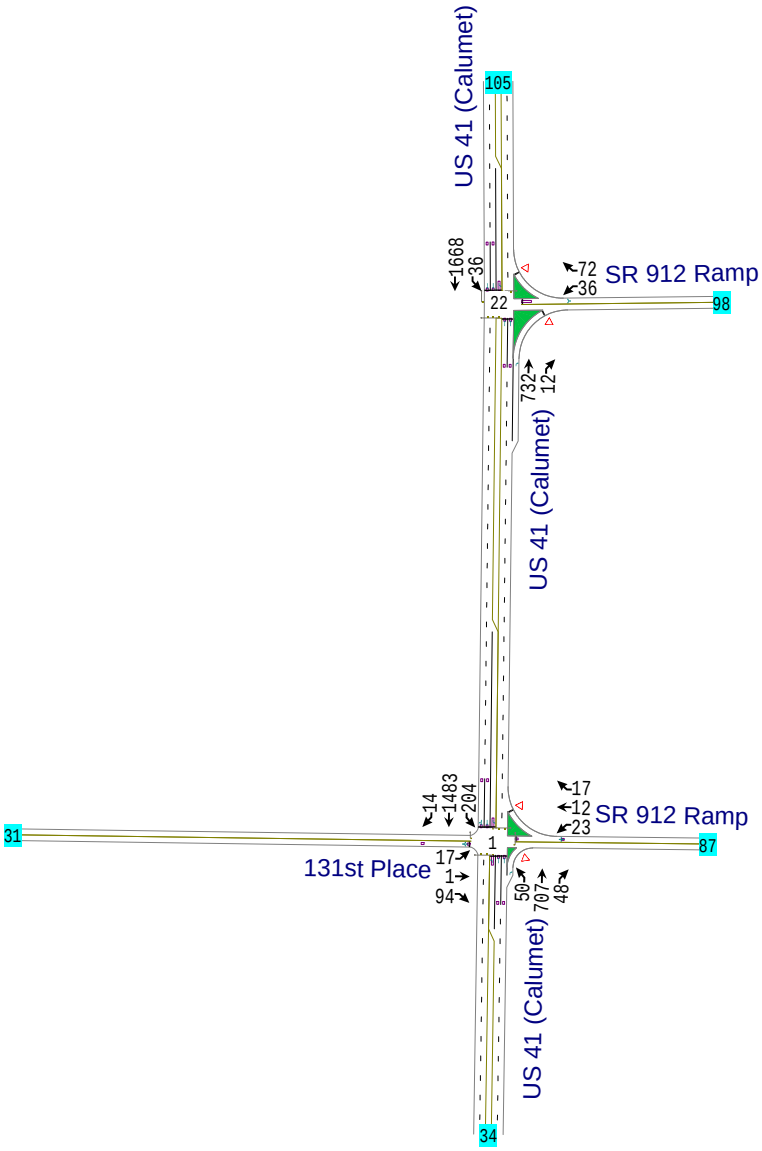

SR
(Columbus)
101
227
46
SR 912 East Service Road
US 12
82
488
1214
42
14
67
103
266
912 West Service Road
81
55
113
13
0
401
Industrial Highw
1598
8
11
oad

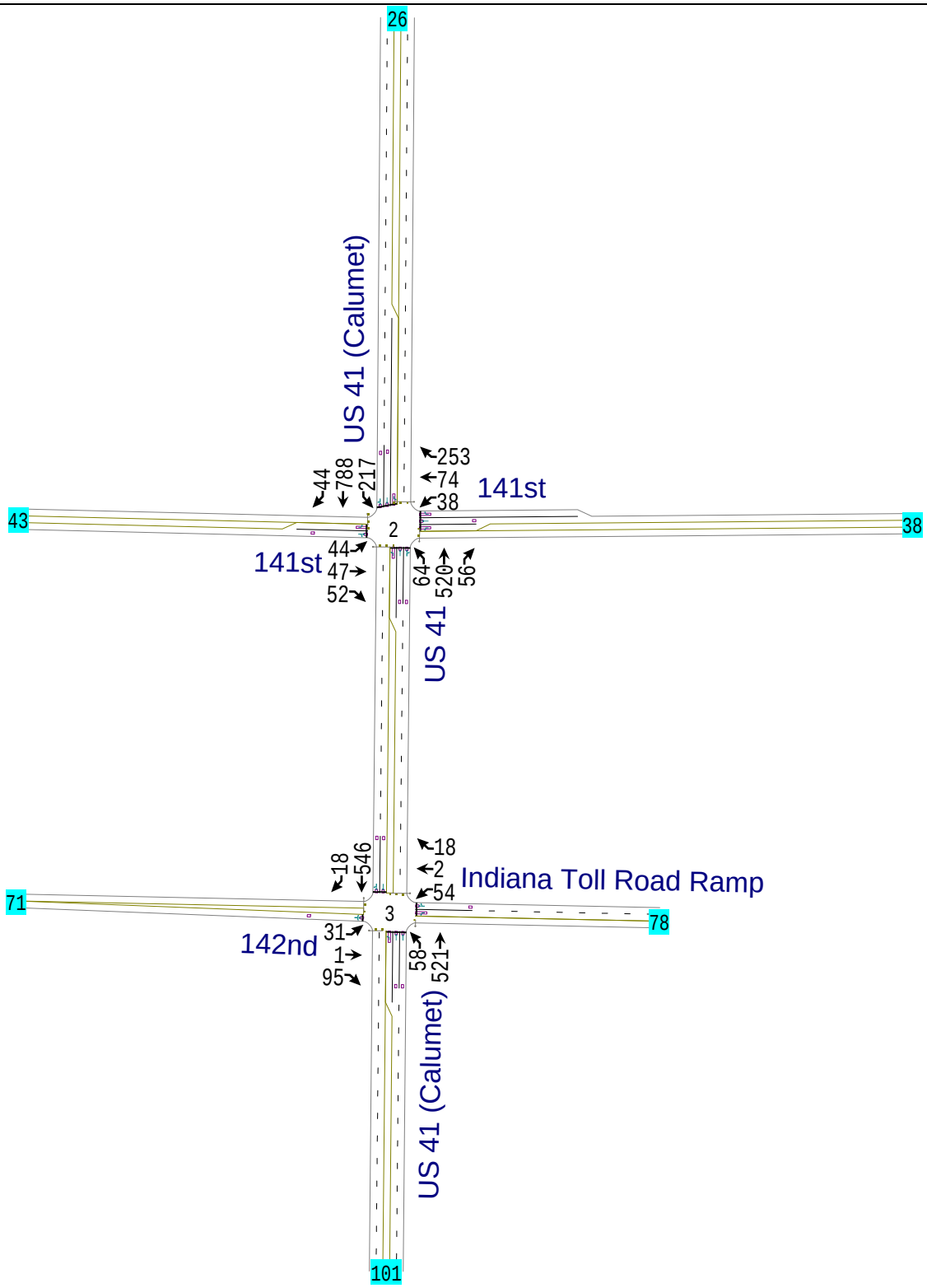

SR 312 (Chicago)
SR 312 (Chicago)
SR 912 West Serv
SR 912 East Servic
West Service Road
East Service Road
SR
83
84
85
86
90
13
14
0
364
24
16
62
64
5
78
15
29
50
326
46
47

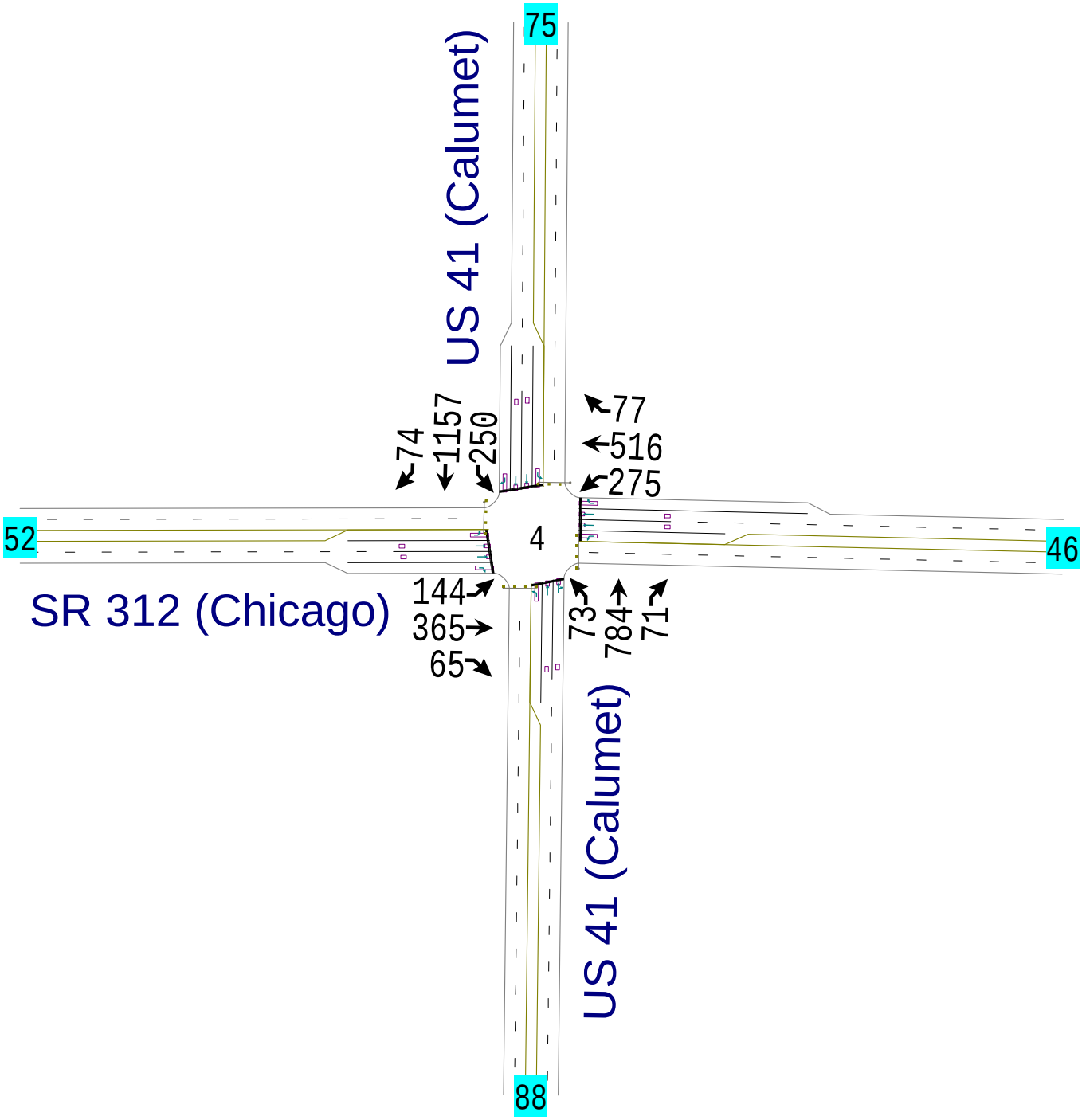

60
66
30
180
0
53
36
42
SR 912 On/Off Ramp
37
180
6
42
78
18
51
1440
12
36
300
Watling
0
47
0
44
6
24
49
1
Joblink
6
0
35
824
336
18
50
8
16
23
10
2
0
276
M.L. King Dr.
1
359
16
72
1662
6
59
1
1
2
rand

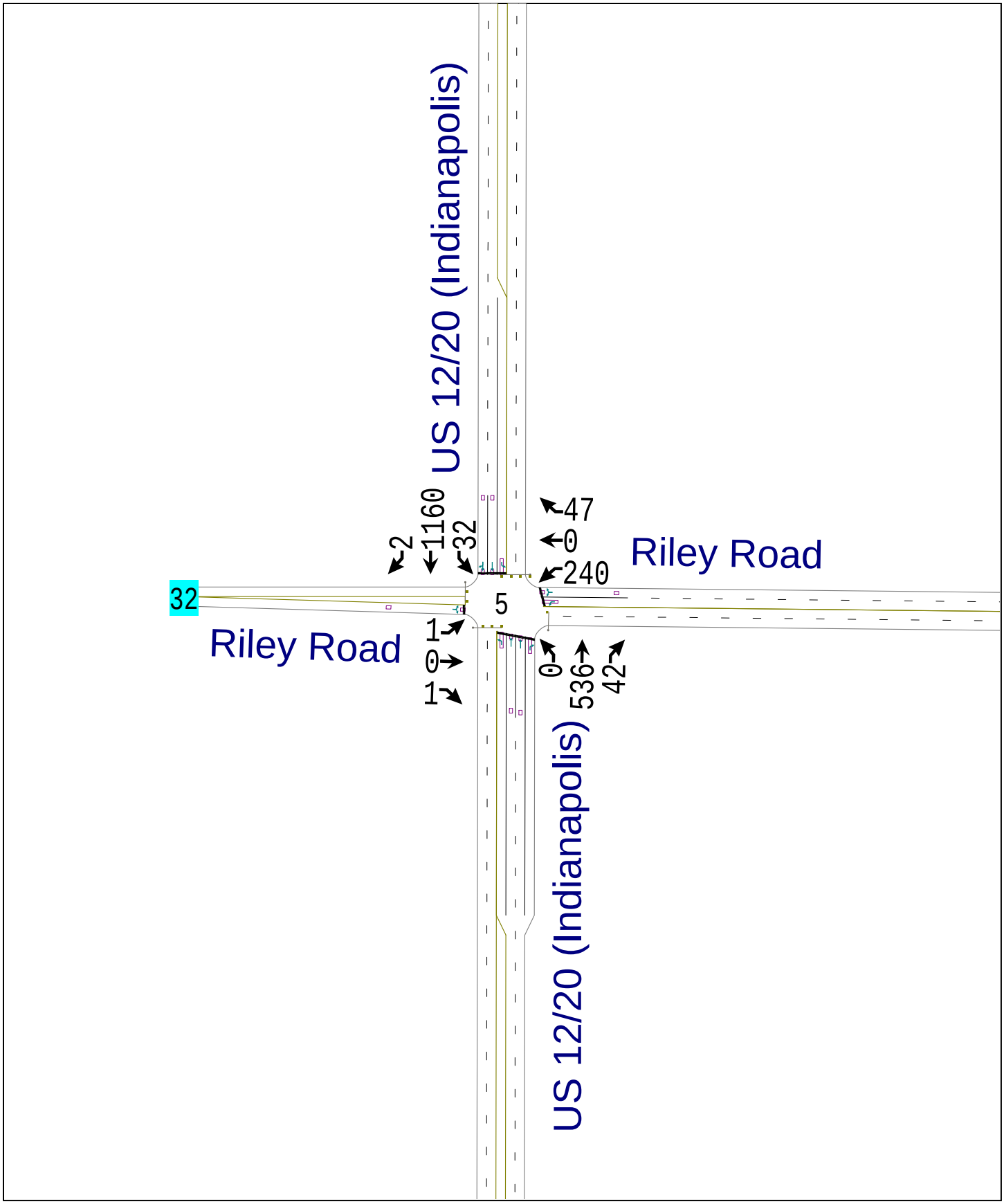

SR912 On Ramp
204
72
20
95
60
600
72
180
24
19
93
480
Riley Rd
SR912 Off Ramp
54

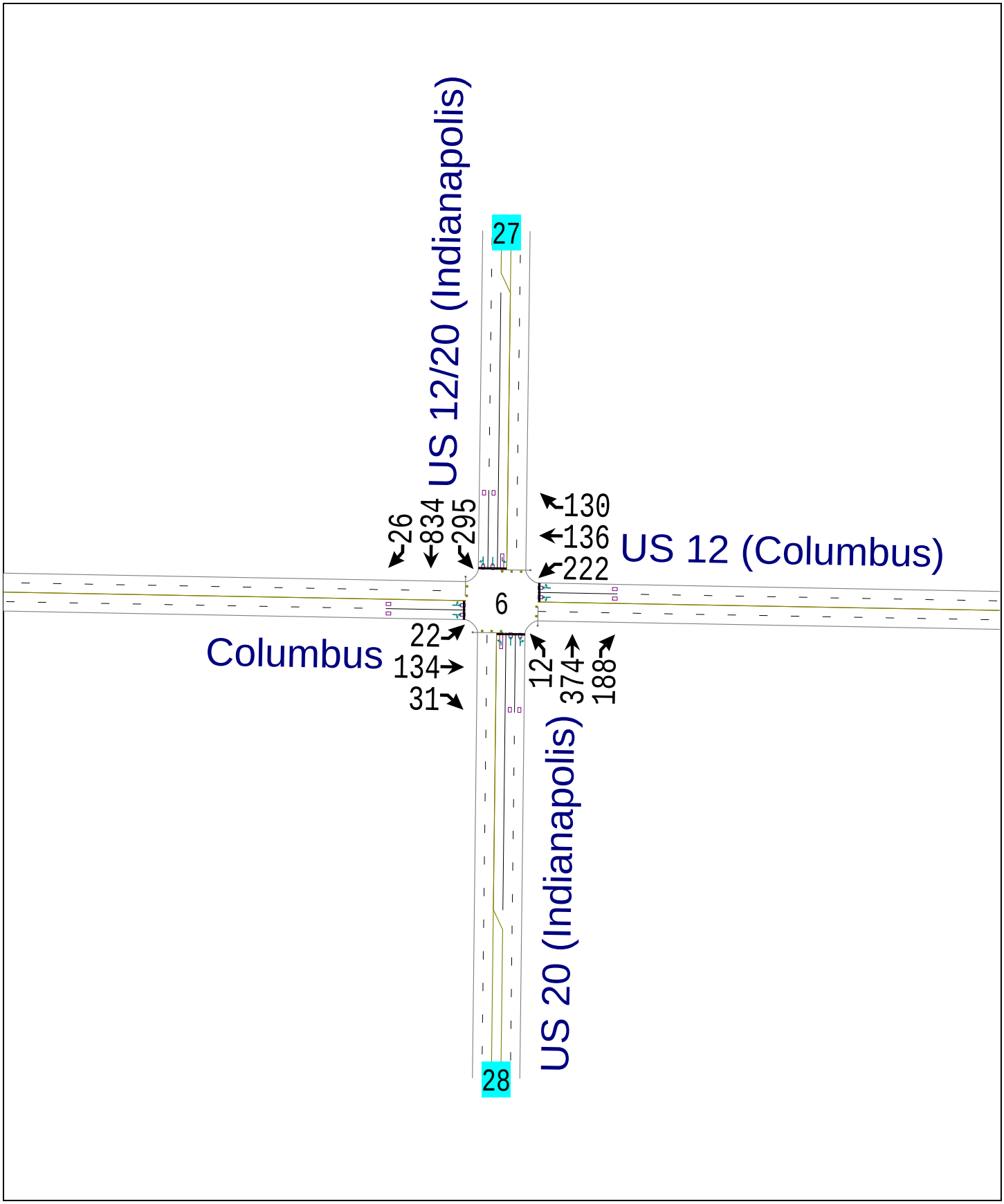
2033 PM1(EARLY) PEAK HOUR VOLUMES

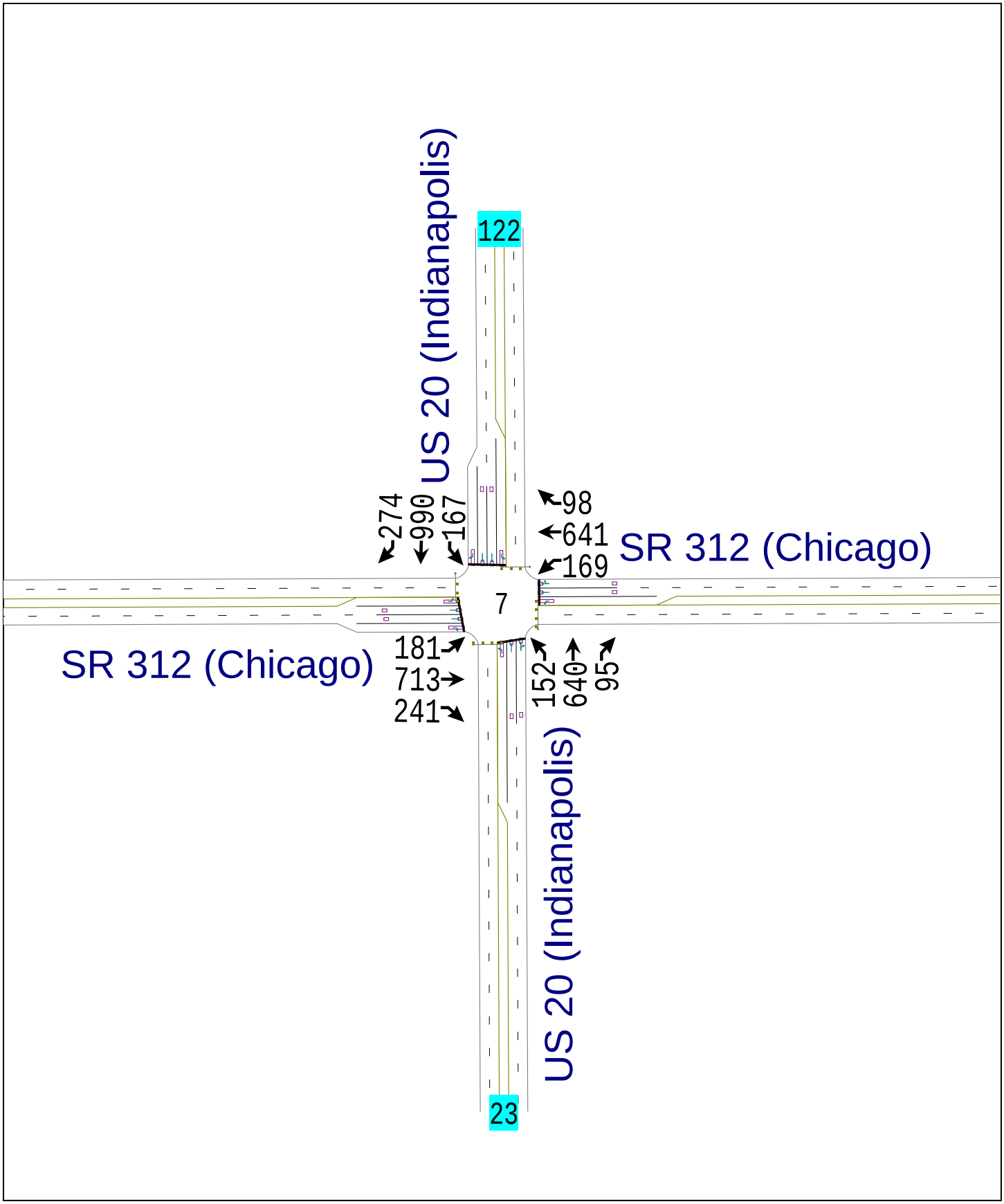

31
14
1483
204
1
17
1
94
131st Place
17
12
23
SR 912 Ramp
87
50
707
48
US 41 (Calumet)
34
1668
36
22
72
36
SR 912 Ramp
98
732
12
US 41 (Calumet)
105

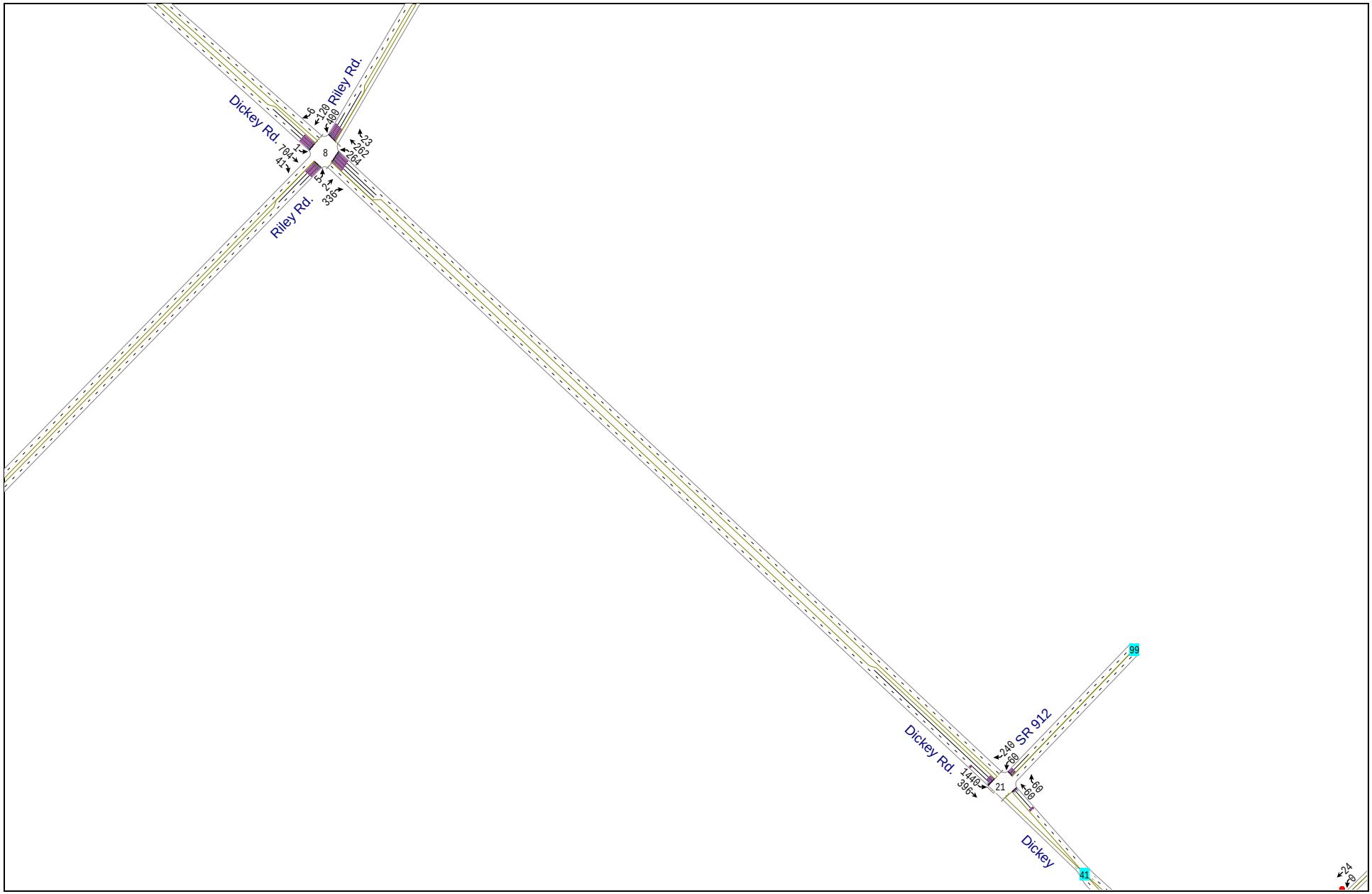

26
US 41 (Calumet)
253
74
38
141st
44
788
217
43
2
38
44
47
52
141st
64
520
56
US 41
18
546
18
2
54
Indiana Toll Road Ramp
71
3
78
31
1
95
142nd
58
521
US 41 (Calumet)
101

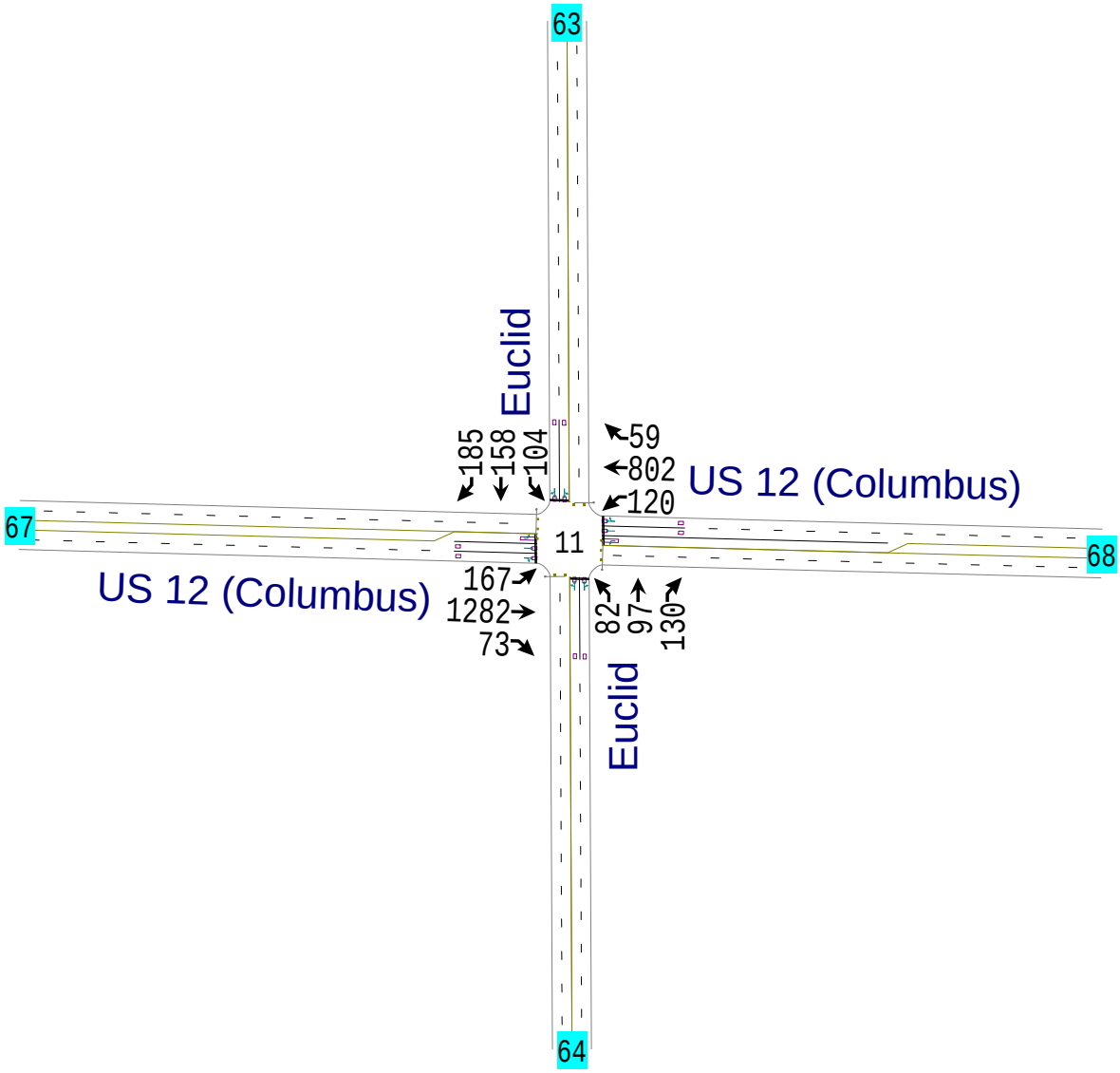

52
SR 312 (Chicago)
144
365
65
74
1157
250
4
US 41 (Calumet)
88
73
784
71
77
516
275
US 41 (Calumet)
75
46

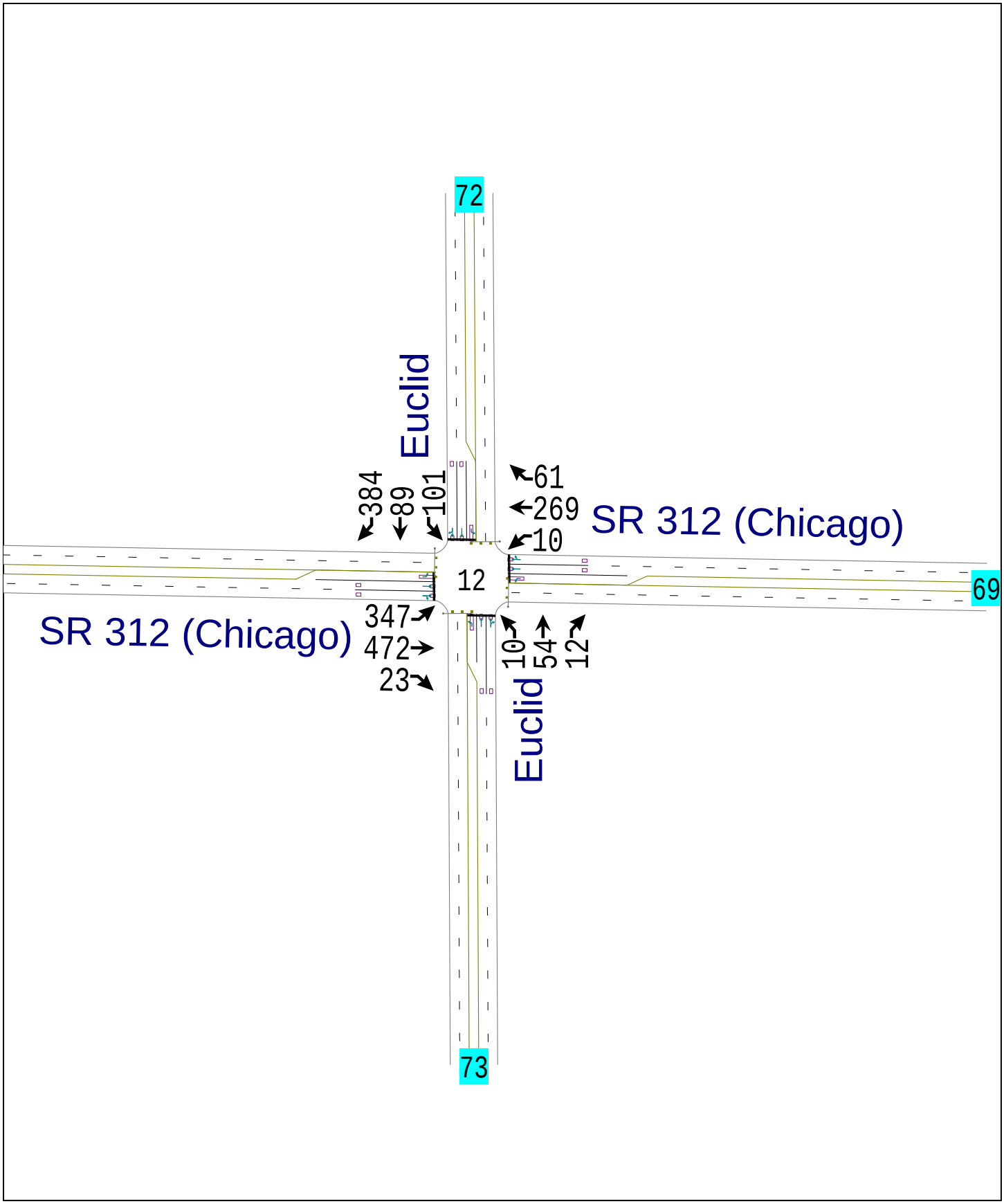

US 12/20 (Indianapolis)
2
1160
32
47
0
240
Riley Road
32
5
Riley Road
1
0
1
0
536
42
US 12/20 (Indianapolis)

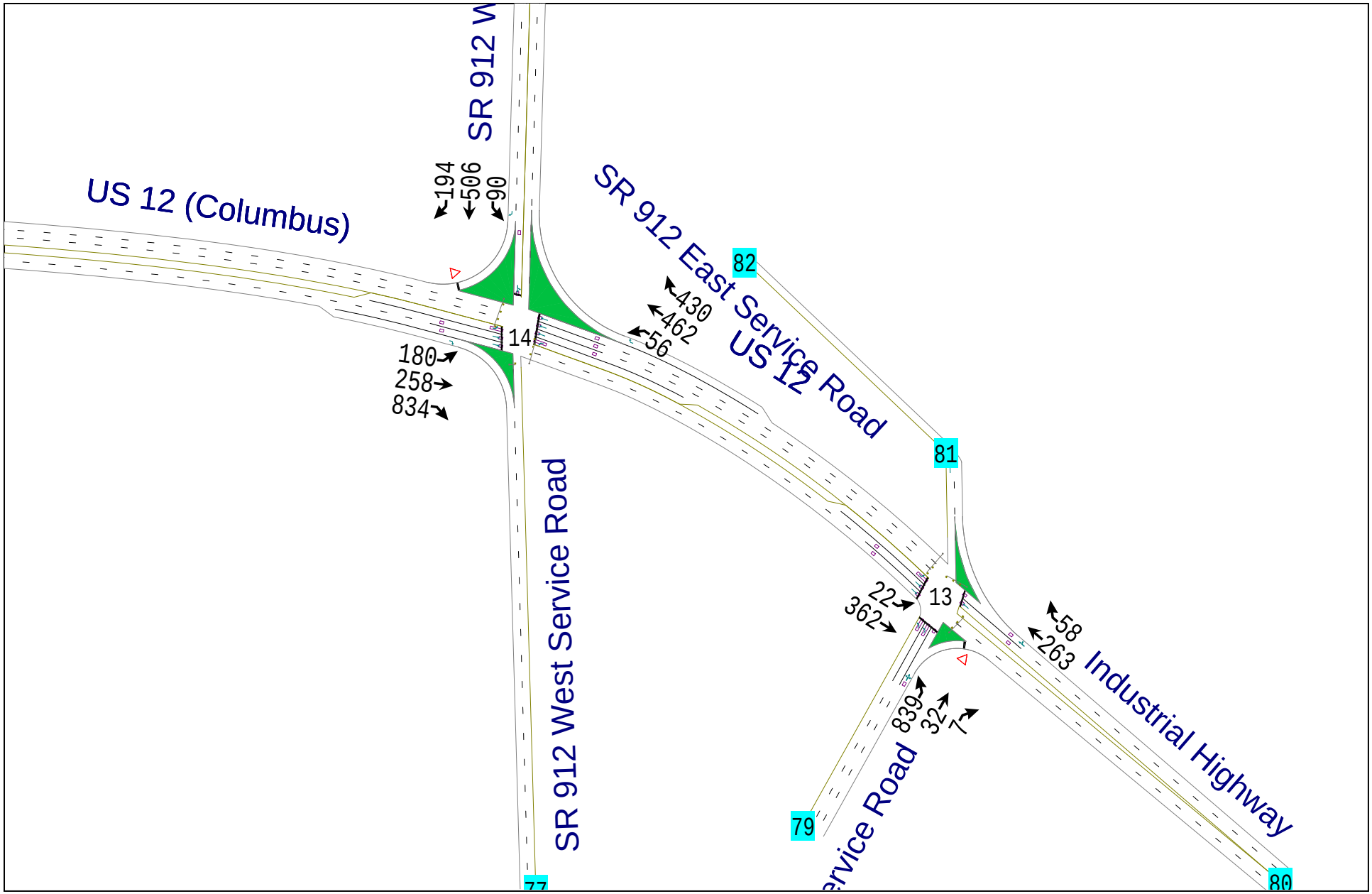

US 12/20 (Indianapolis)
27
26
834
295
130
136
222
US 12 (Columbus)
6
Columbus
22
134
31
12
374
188
US 20 (Indianapolis)
28

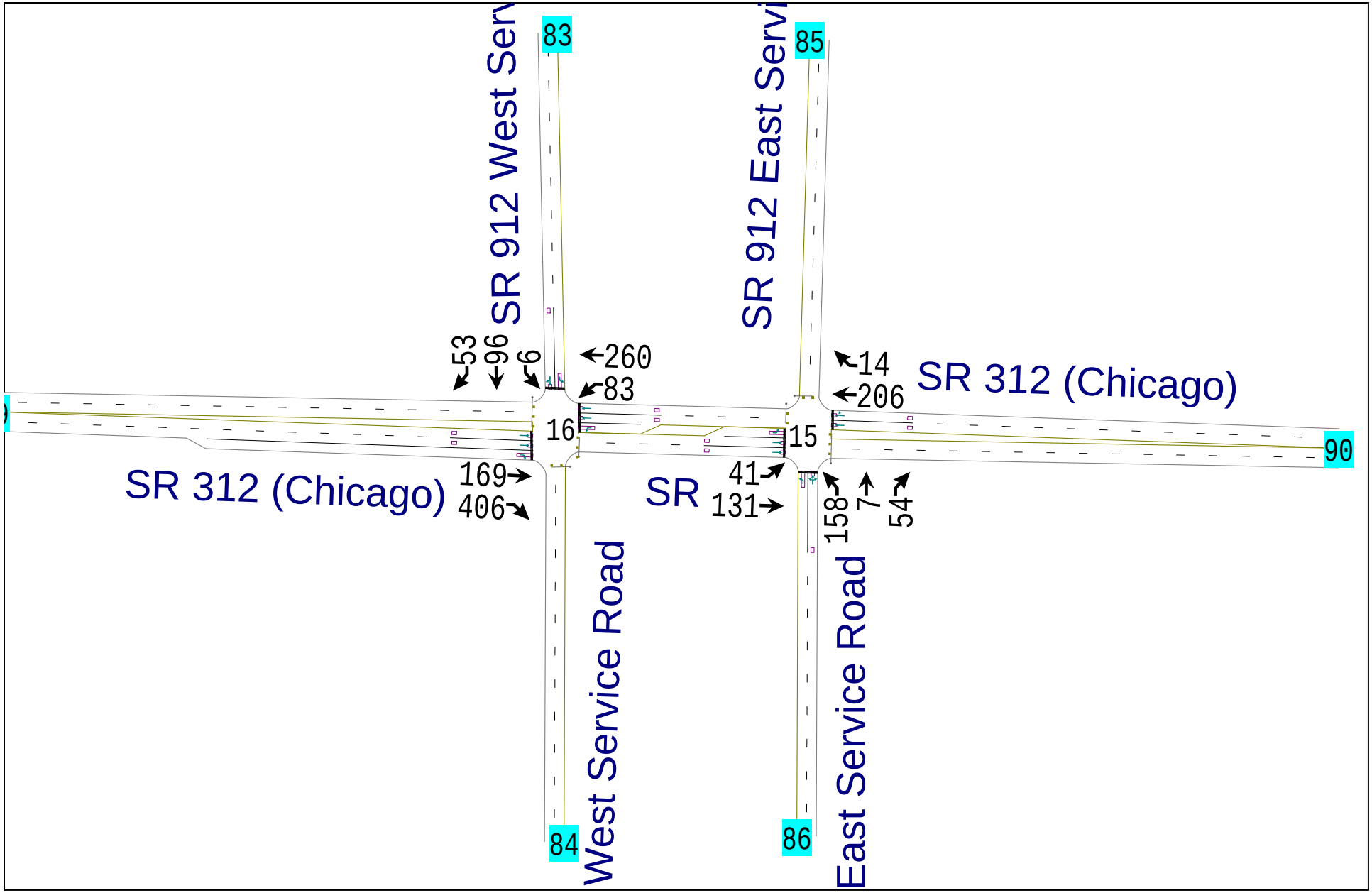

US 20 (Indianapolis)
122
274
990
167
98
641
169
SR 312 (Chicago)
7
SR 312 (Chicago)
181
713
241
152
640
95
US 20 (Indianapolis)
23

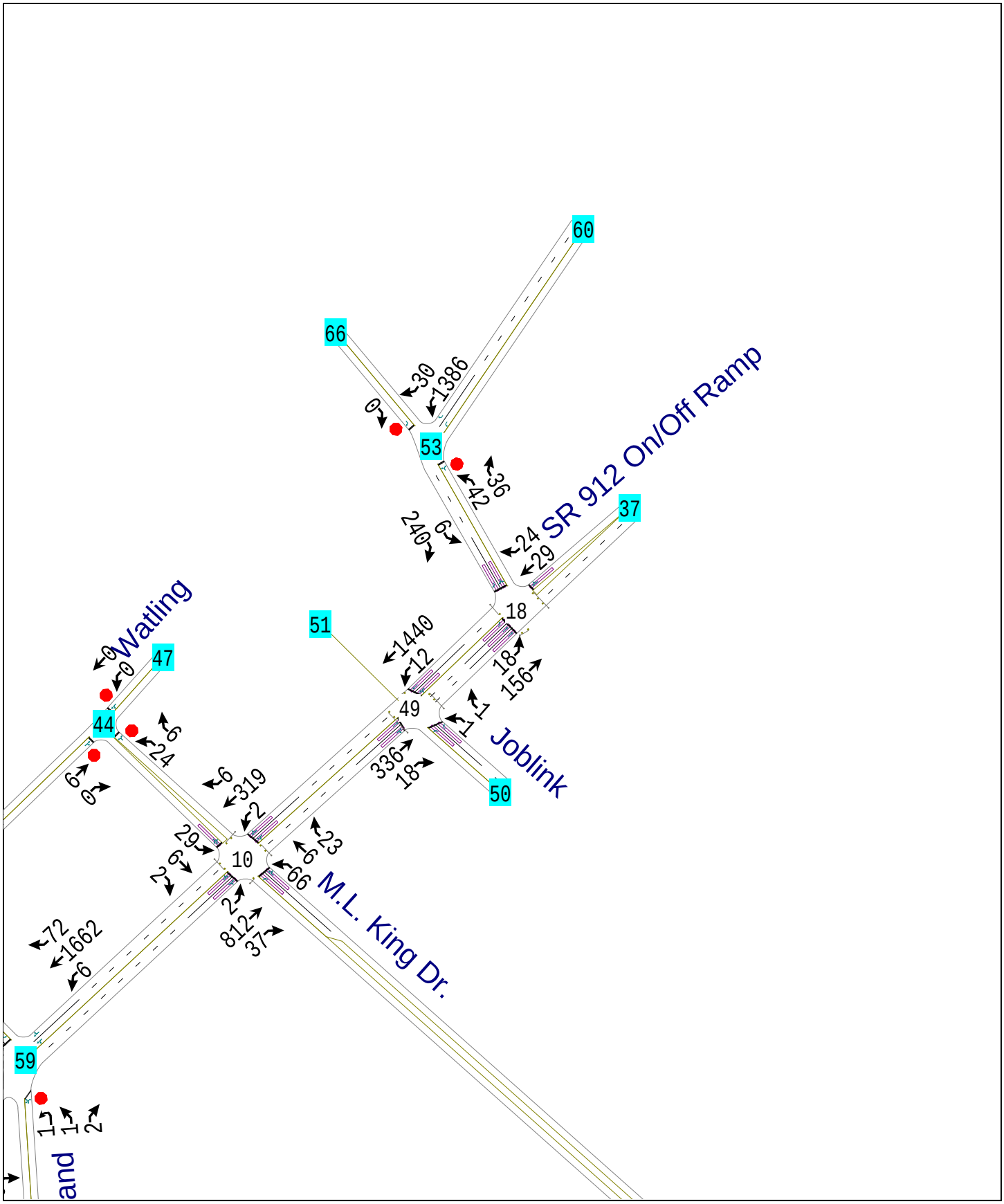

Dickey Rd.
Riley Rd.
Riley Rd.
6
120
400
23
262
264
704
41
8
52
336
Dickey Rd.
240
SR 912
60
1440
396
21
69
69
Dickey
99
41
24
9

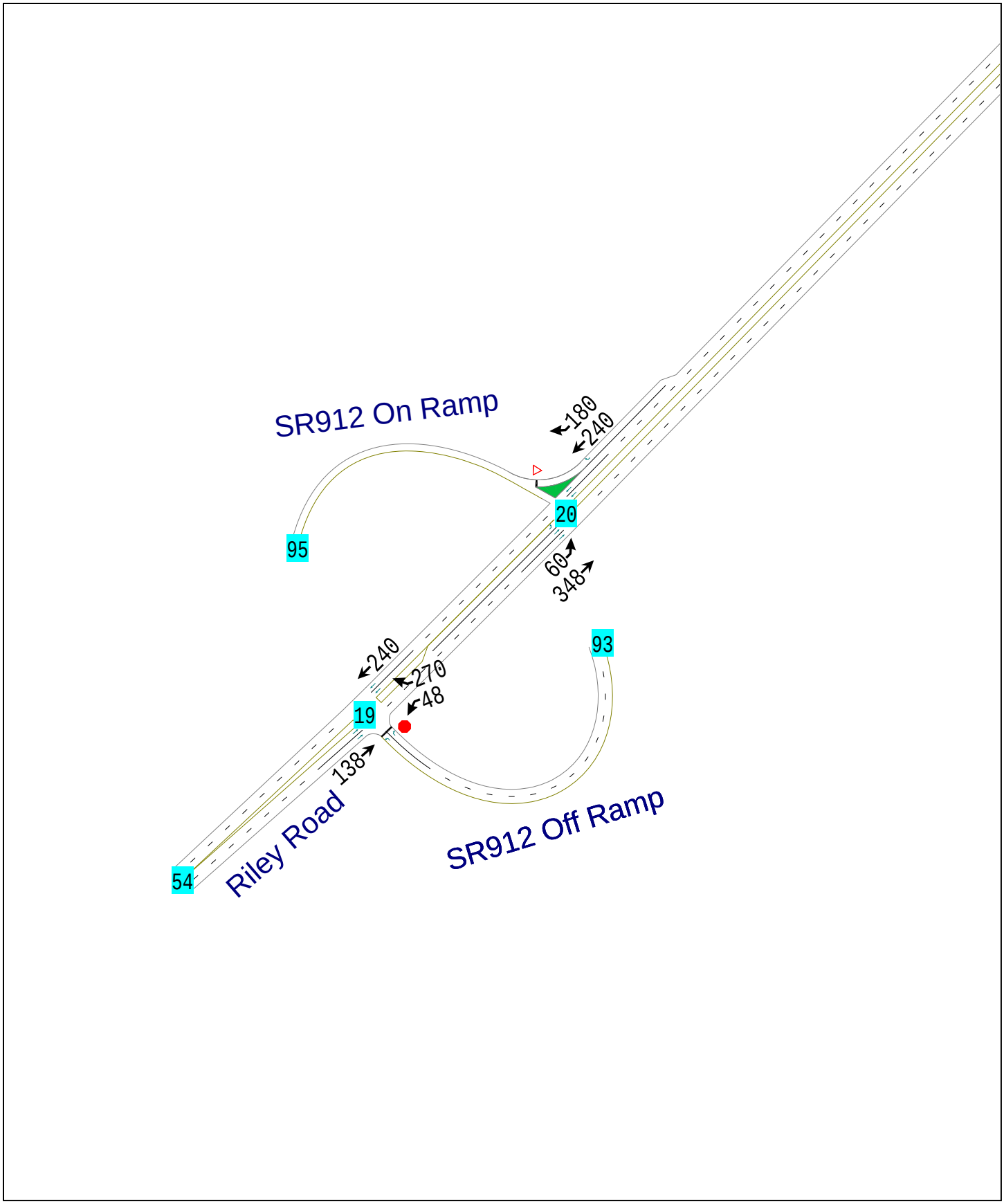

63
Euclid
185
158
104
59
802
120
US 12 (Columbus)
67
11
68
US 12 (Columbus)
167
1282
73
82
97
130
Euclid
64


72
Euclid
384
89
101
61
269
10
SR 312 (Chicago)
12
69
SR 312 (Chicago)
347
472
23
10
54
12
Euclid
73

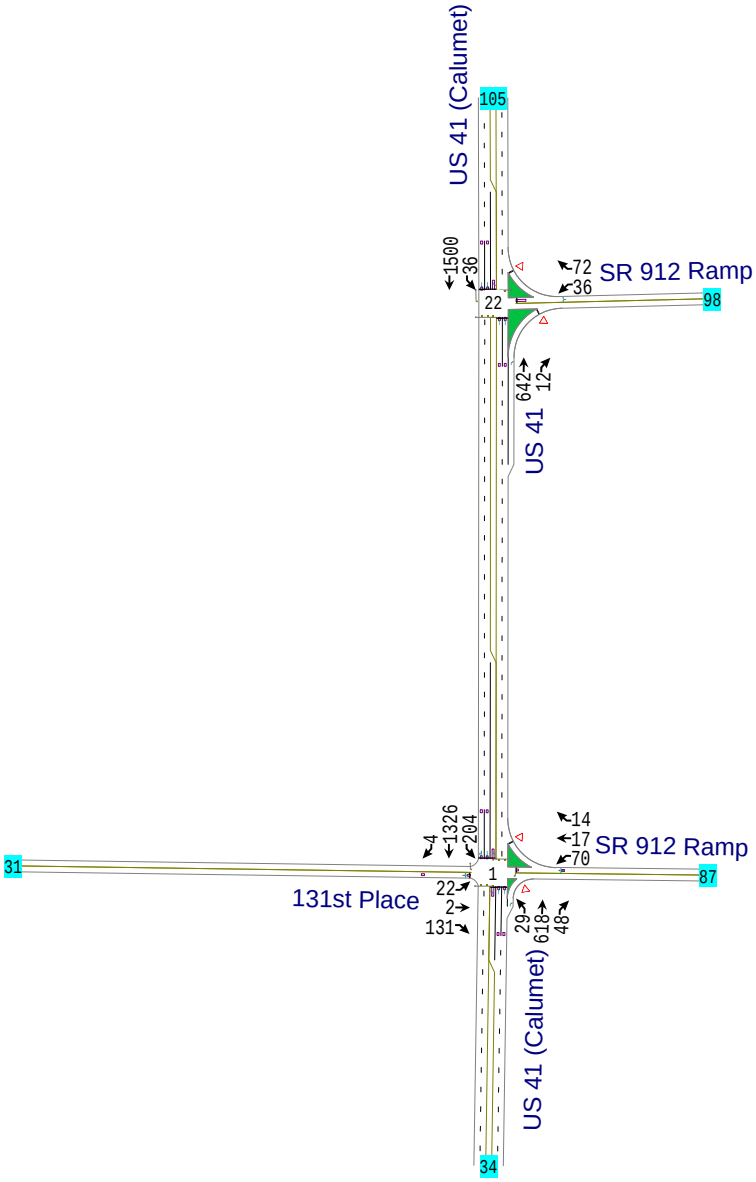

SR 912 W
US 12 (Columbus)
194
506
90
SR 912 East Service Road
US 12
82
430
462
56
14
180
258
834
81
SR 912 West Service Road
22
362
13
58
263
Industrial Highway
839
32
7
79
80
77

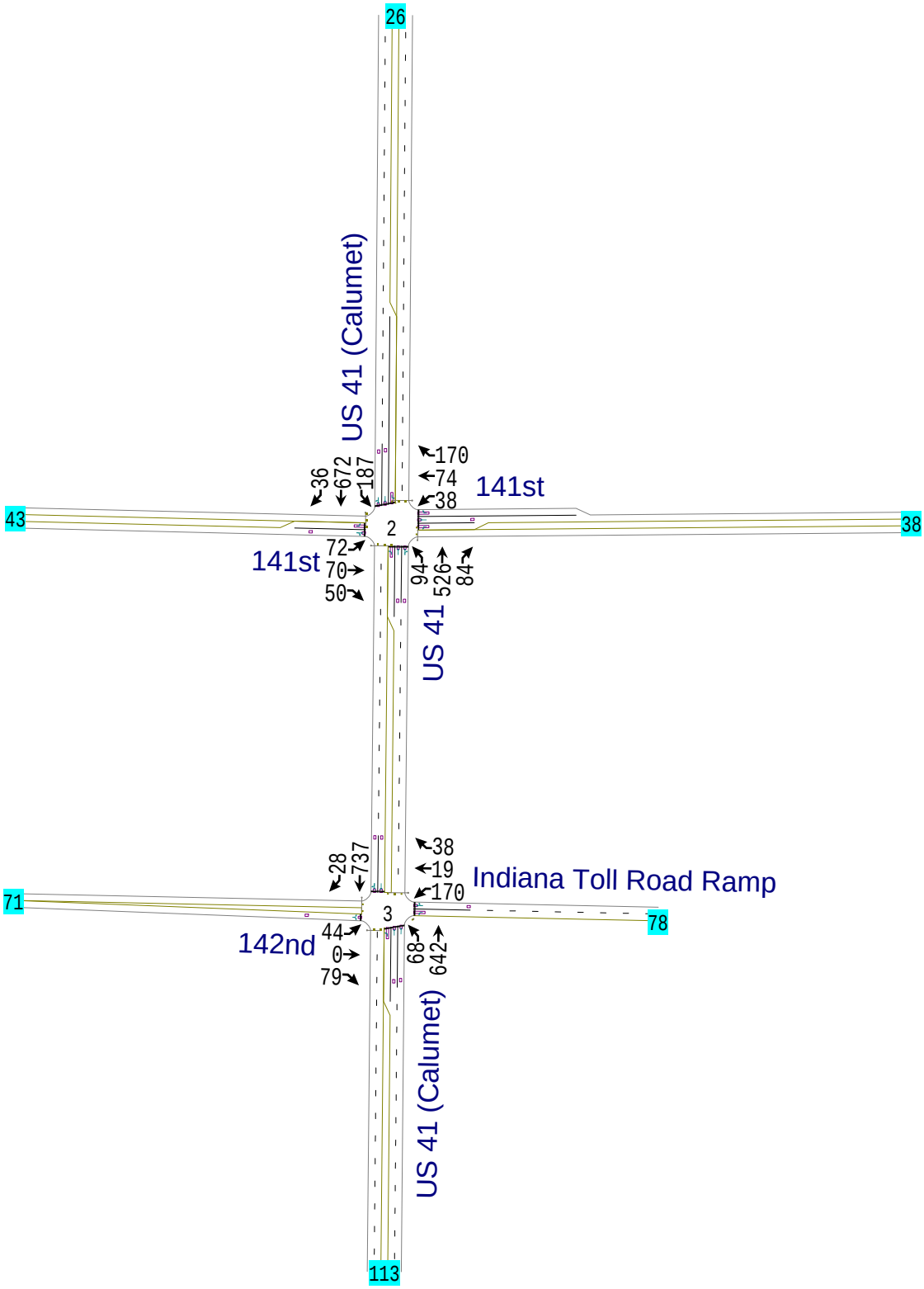

SR 912 West Serv
83
53
96
6
260
83
16
169
406
SR 312 (Chicago)
West Service Road
84
SR 912 East Servi
85
14
206
SR 312 (Chicago)
15
90
41
131
SR
158
7
54
East Service Road
86

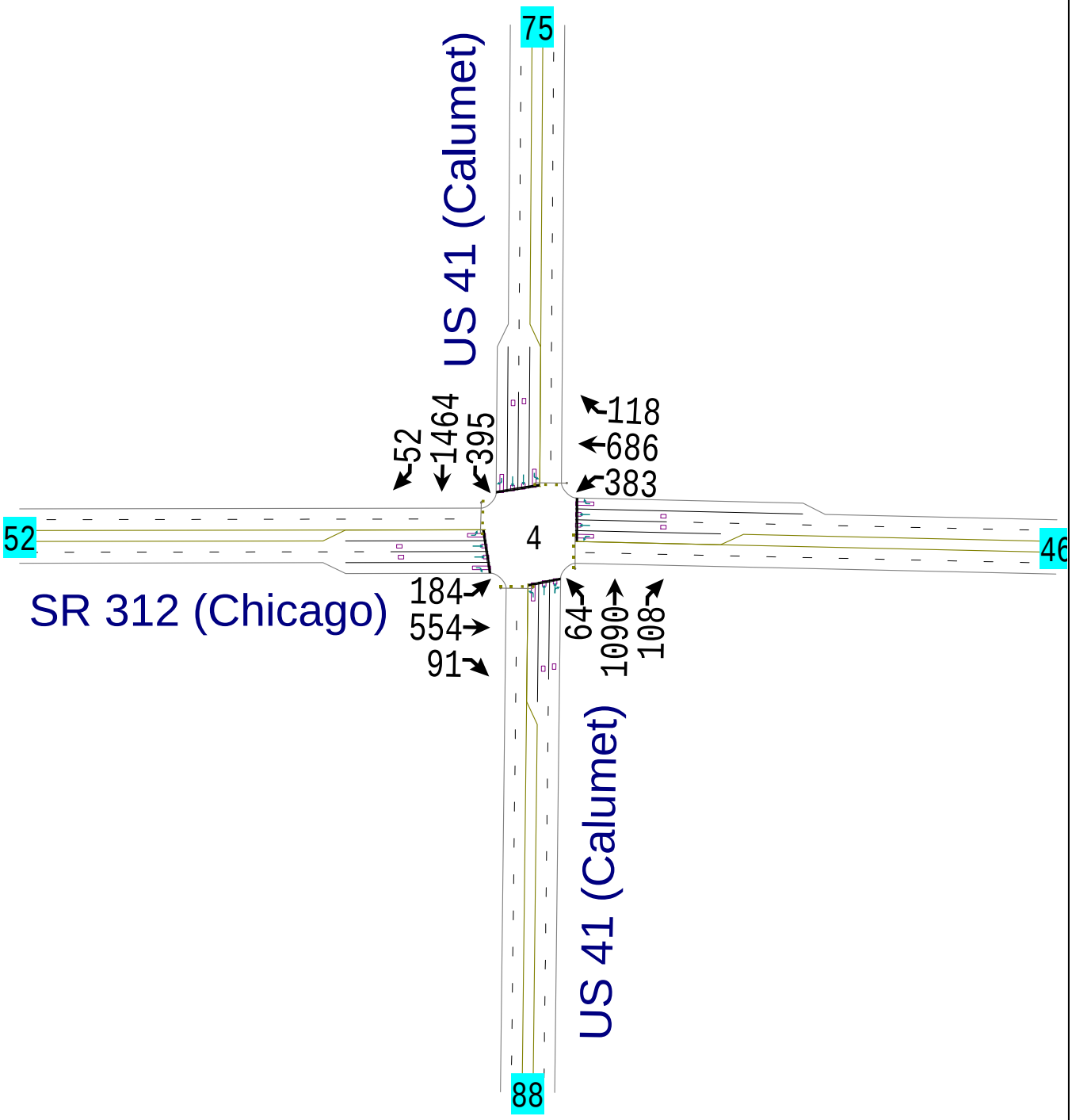

60
66
30
1386
0
53
42
36
SR 912 On/Off Ramp
37
240
6
24
29
18
51
1440
12
18
156
Watling
0
0
47
44
6
24
6
0
49
1
1
Joblink
336
18
50
6
319
2
29
6
2
10
23
6
66
2
812
37
M.L. King Dr.
72
1662
6
59
1
1
2
and

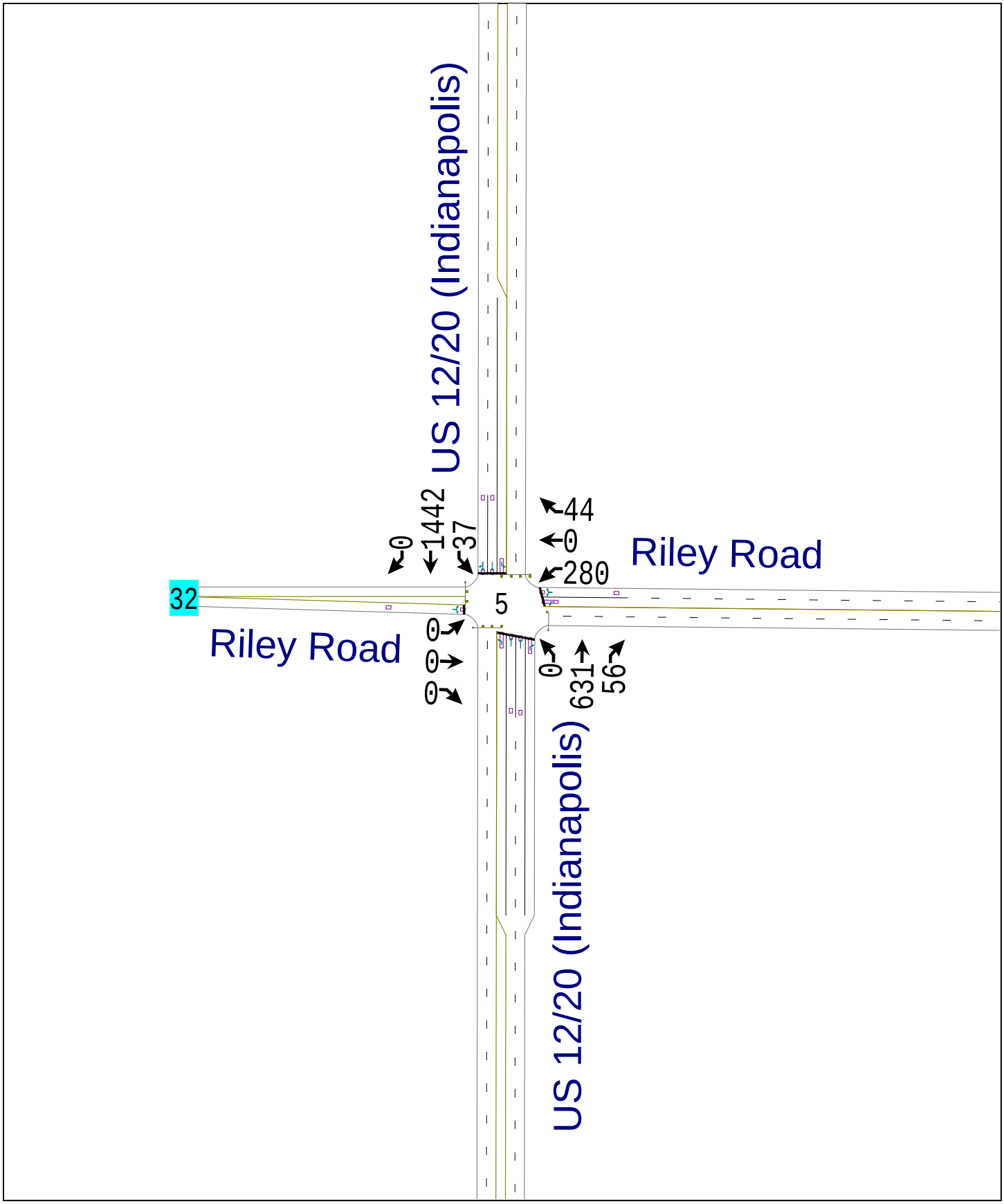

SR912 On Ramp
180
240
20
95
60
348
93
240
270
48
19
138
Riley Road
SR912 Off Ramp
54

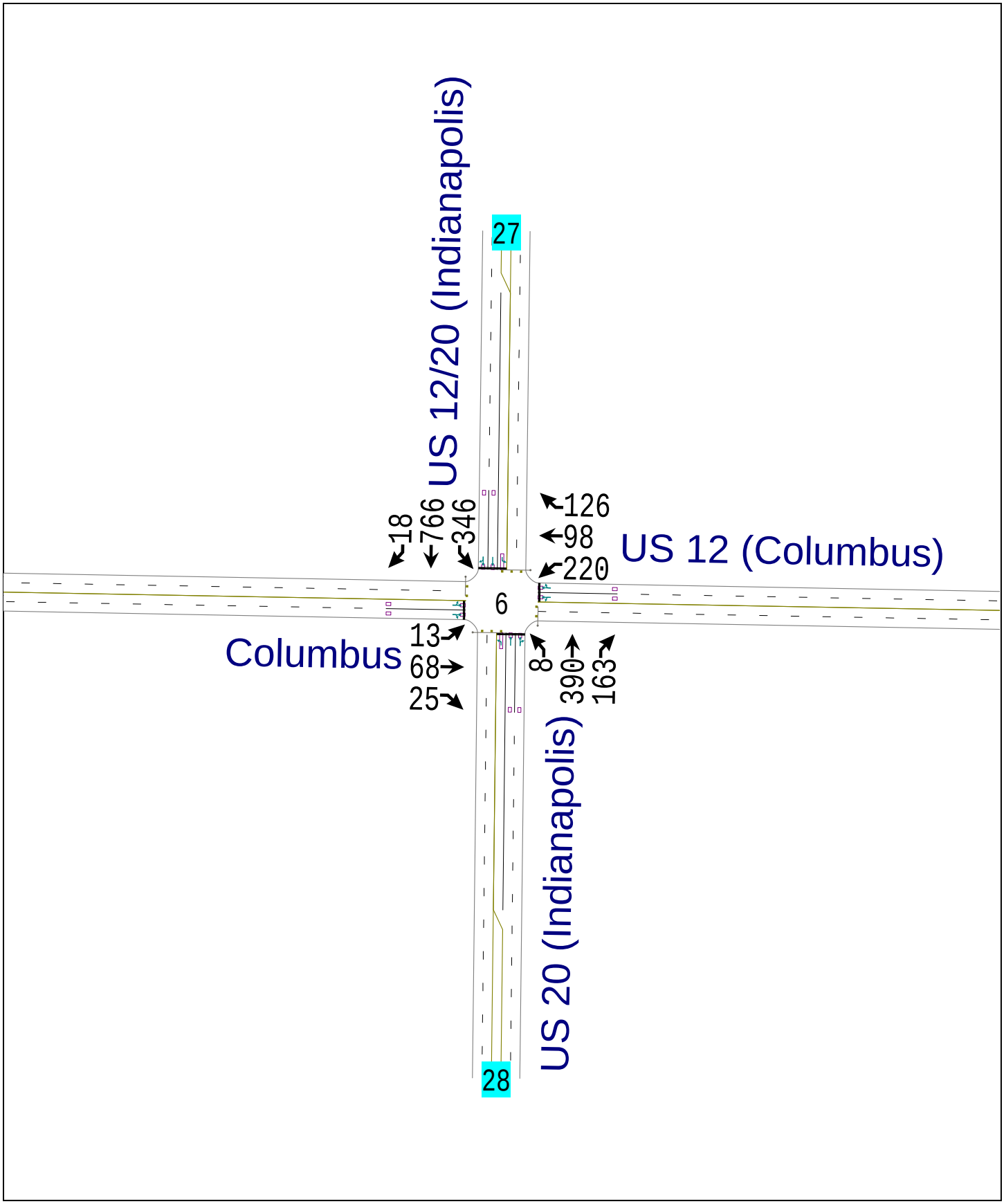
2033 PM2(LATE) PEAK HOUR VOLUMES

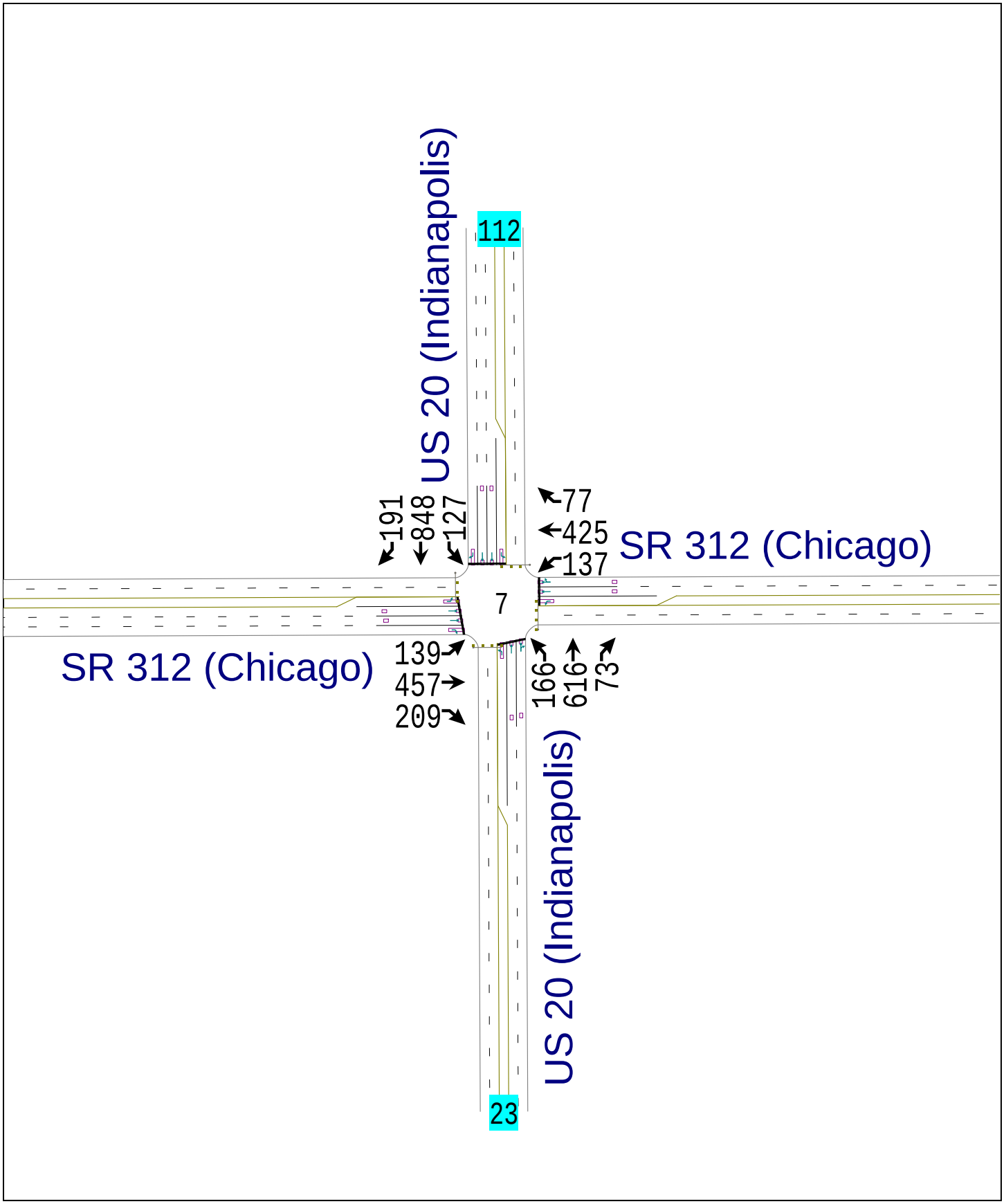

31
4
1326
204
22
1
2
131
131st Place
14
17
70
SR 912 Ramp
87
29
618
48
US 41 (Calumet)
34
1500
36
22
72
36
SR 912 Ramp
98
642
12
US 41
105
US 41 (Calumet)

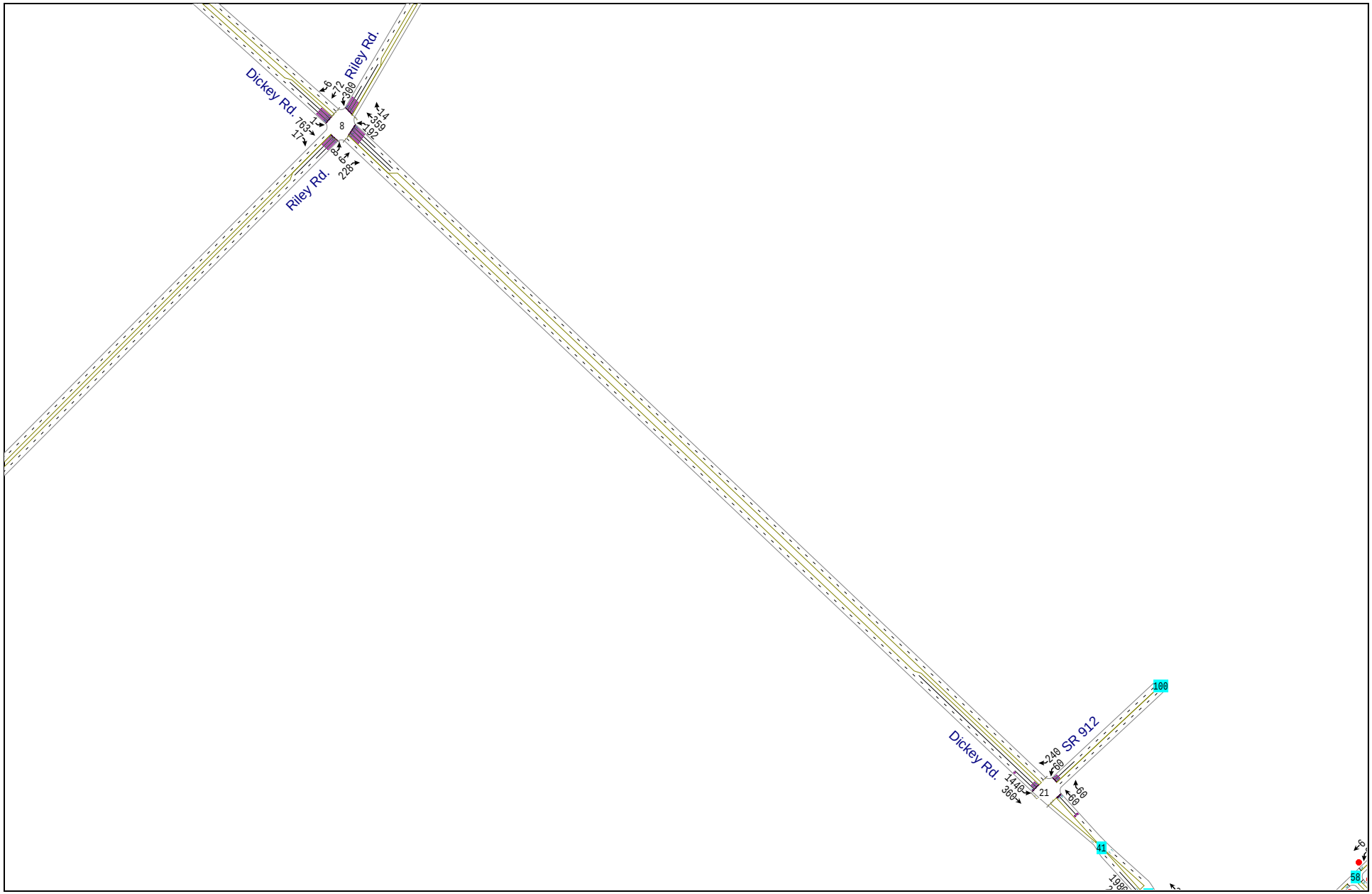

26
US 41 (Calumet)
170
74
38
141st
36
672
187
43
2
38
72
141st
70
50
94
526
84
US 41
38
19
170
Indiana Toll Road Ramp
28
737
71
3
78
44
142nd
0
79
68
642
US 41 (Calumet)
113


US 41 (Calumet)
75
52
1464
395
118
686
383
52
4
46
SR 312 (Chicago)
184
554
91
64
1090
108
US 41 (Calumet)
88


US 12/20 (Indianapolis)
0
1442
37
32
Riley Road
0
0
0
5
44
0
280
Riley Road
0
631
56
US 12/20 (Indianapolis)


US 12/20 (Indianapolis)
27
18
766
346
126
98
220
US 12 (Columbus)
6
Columbus
13
68
25
8
390
163
US 20 (Indianapolis)
28


US 20 (Indianapolis)
112
191
848
127
77
425
137
SR 312 (Chicago)
7
SR 312 (Chicago)
139
457
209
166
616
73
US 20 (Indianapolis)
23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Riley Rd.
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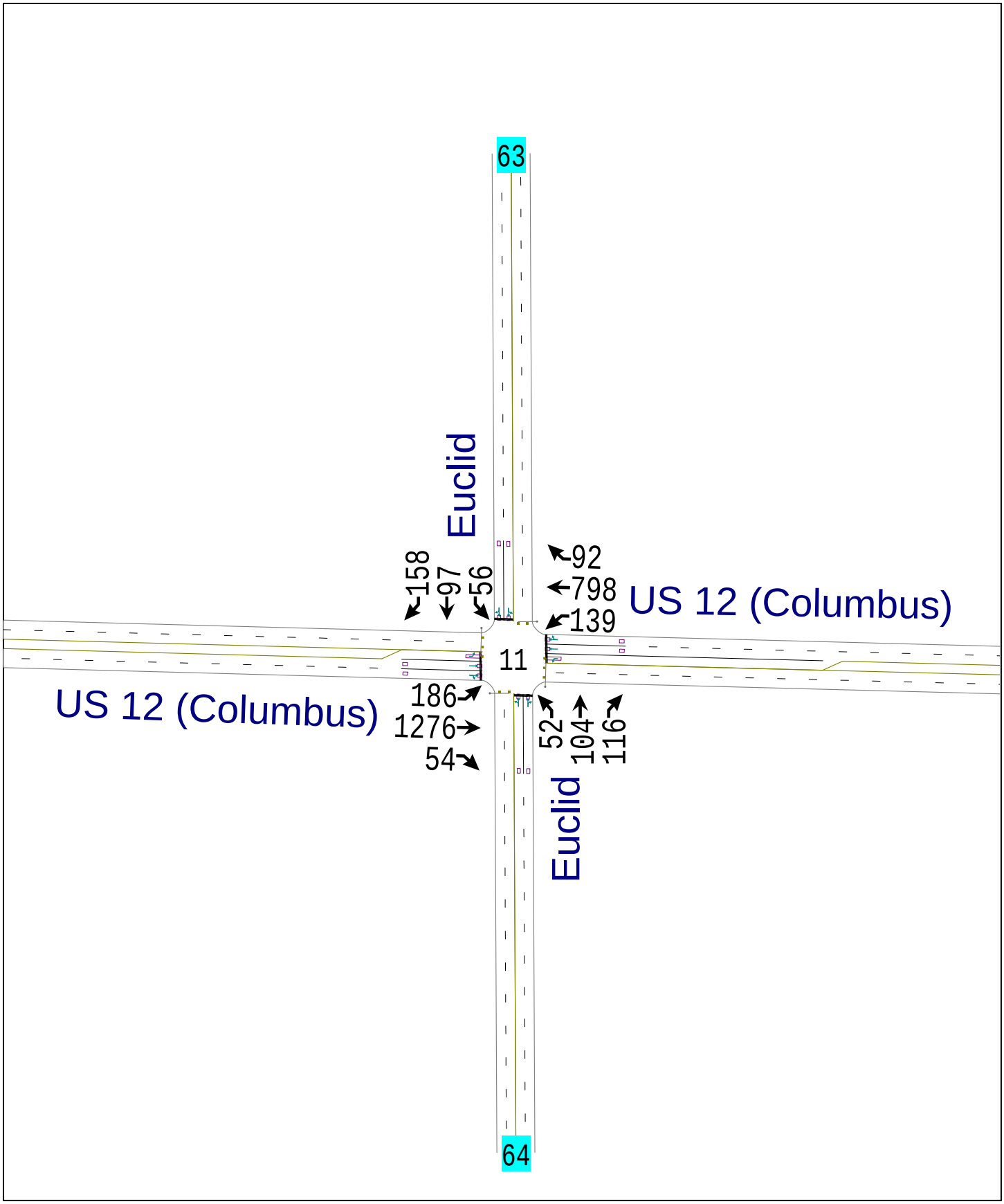
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Euclid
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Euclid
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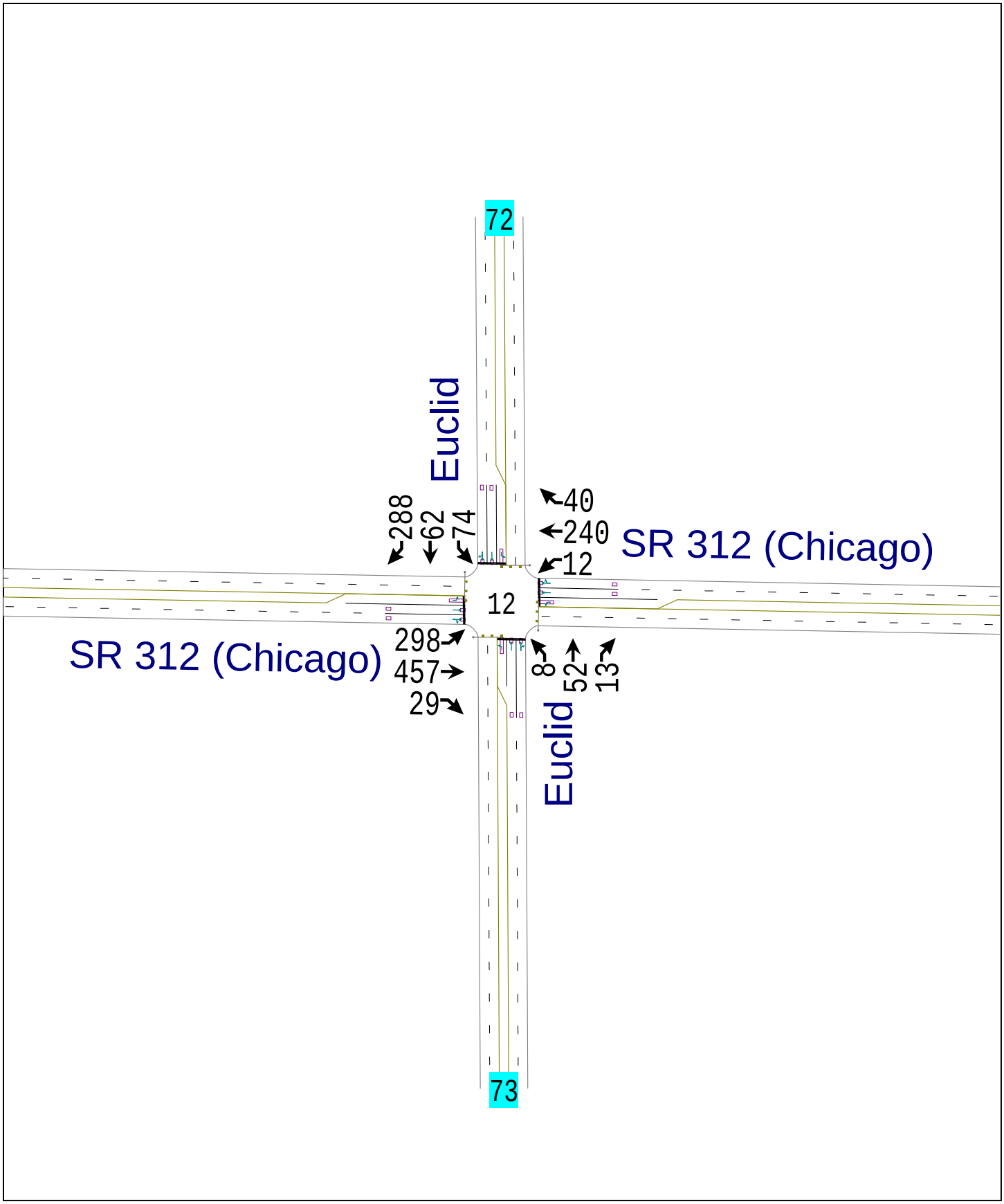
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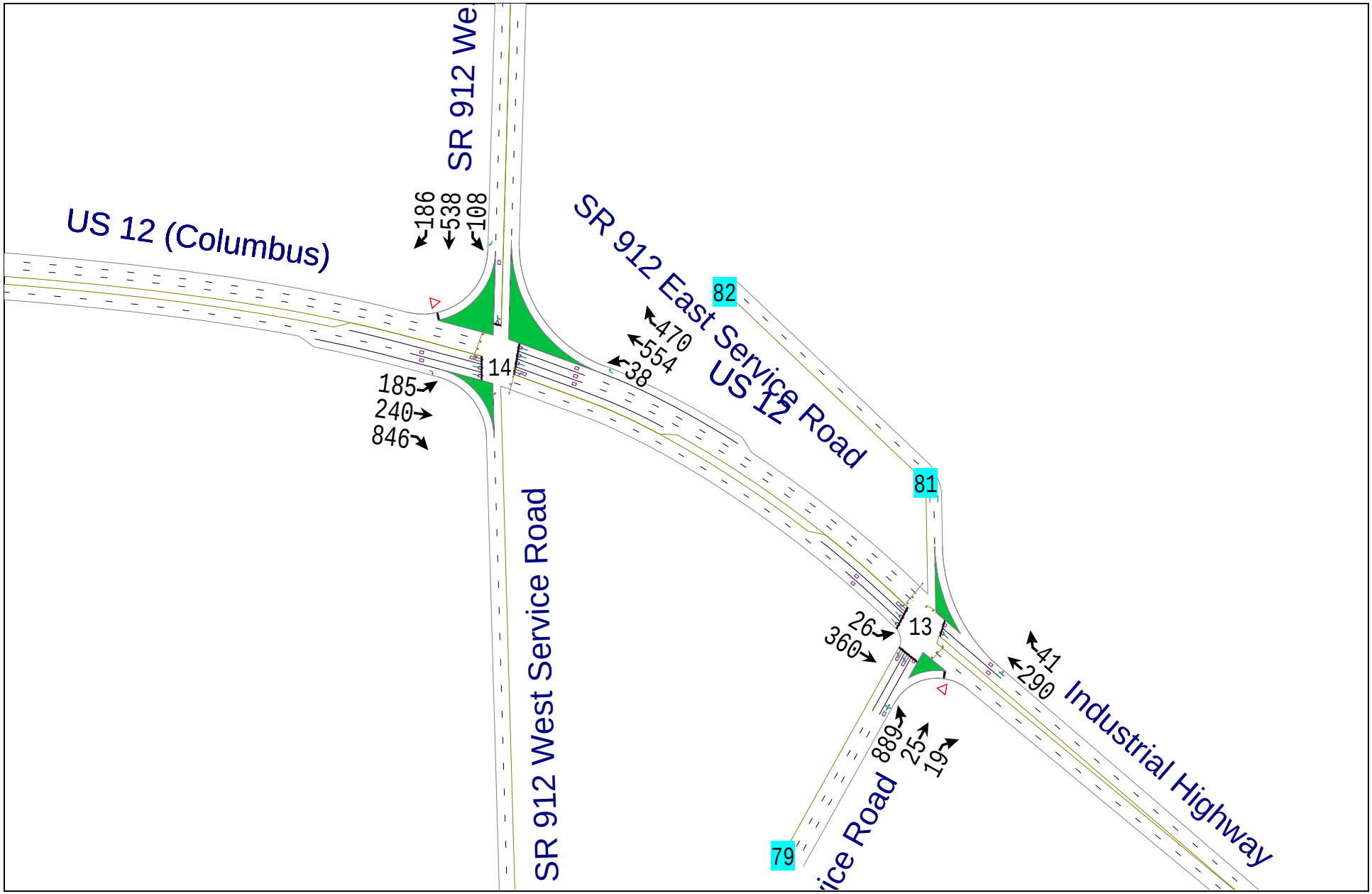
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SR 912 East Service Road
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ice Road
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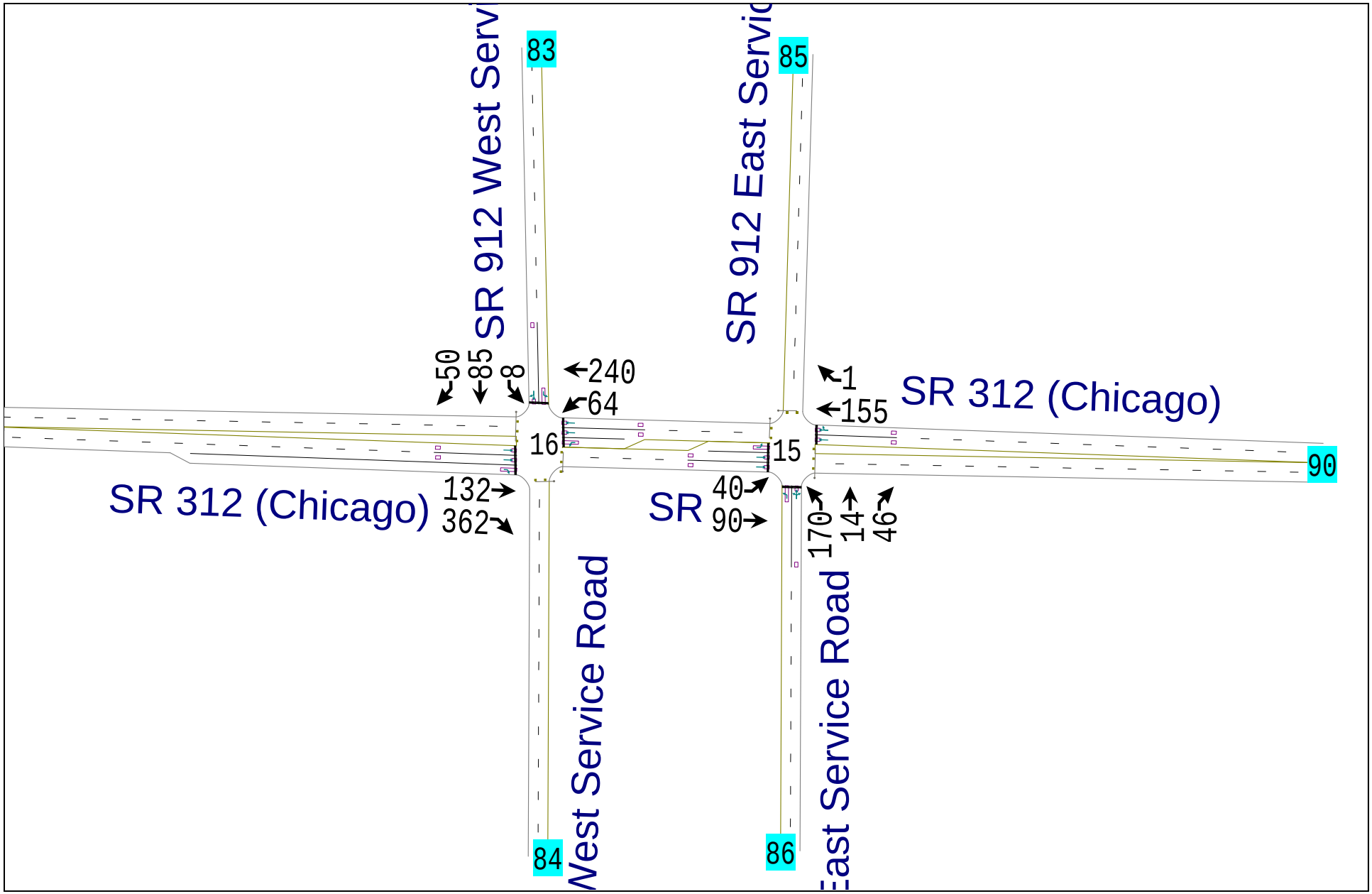
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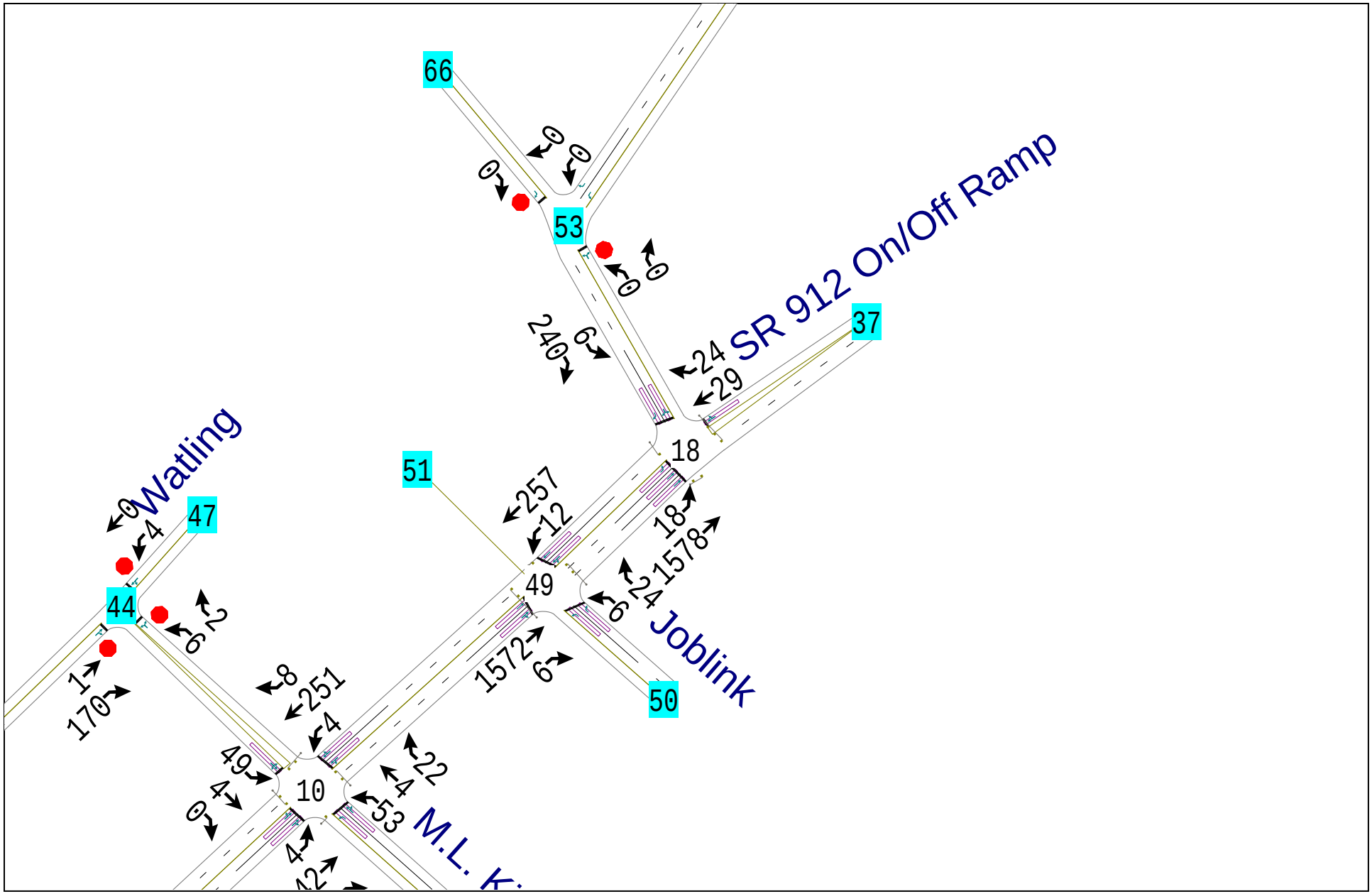
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SR 912 On/Off Ramp
Watling
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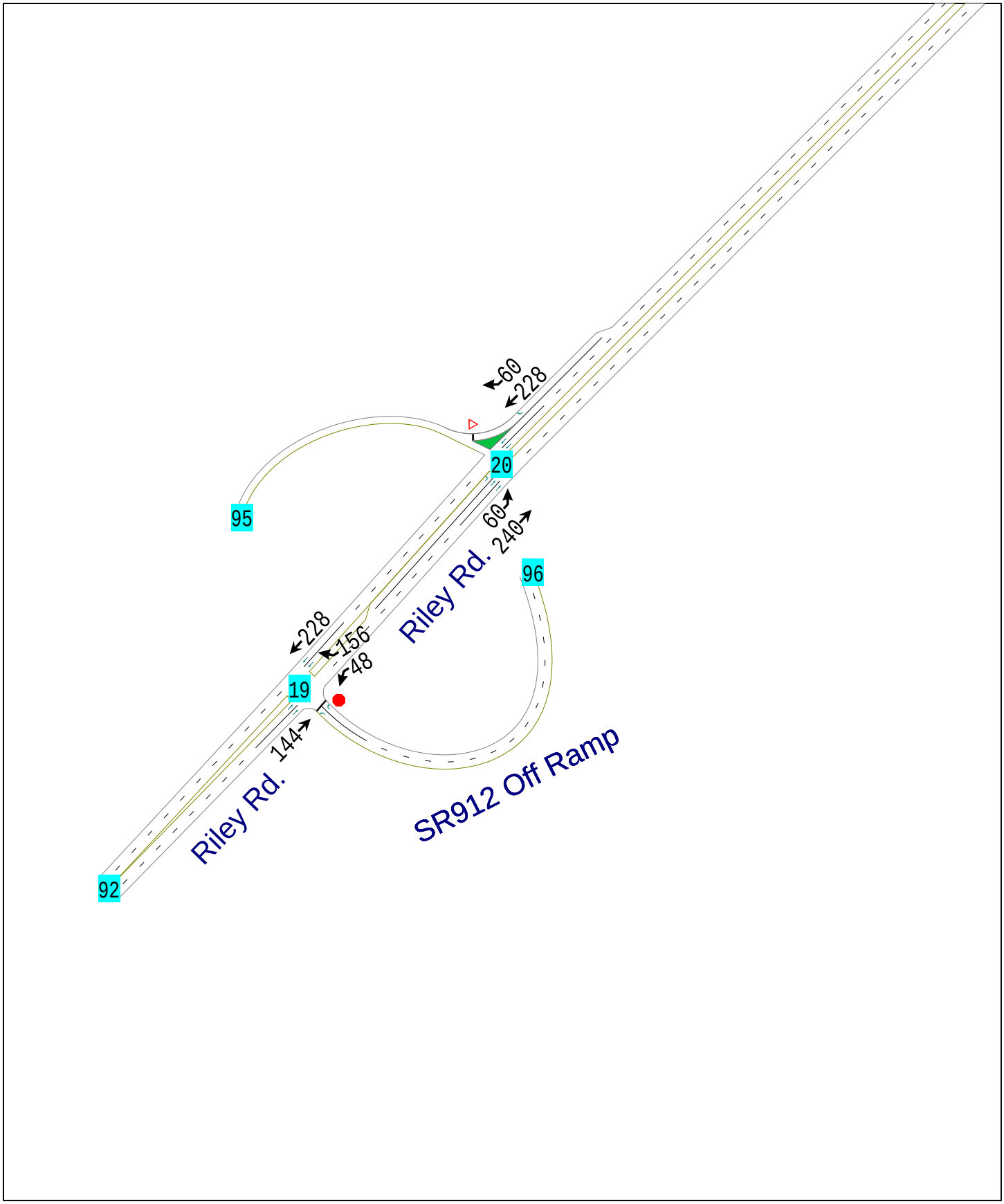
M.L. K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19
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Riley Rd.
SR912 Off Ramp
92

2033 AM PEAK HOUR CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	0	30	9	2	23	41	1042	30	60	252	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.91			0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1673			1322		1770	3539	1482	1656	3304	
Flt Permitted		0.87			0.92		0.52	1.00	1.00	0.11	1.00	
Satd. Flow (perm)		1479			1232		977	3539	1482	190	3304	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	26	0	45	14	3	34	62	1563	45	90	378	6
RTOR Reduction (vph)	0	41	0	0	31	0	0	0	5	0	1	0
Lane Group Flow (vph)	0	30	0	0	20	0	62	1563	40	90	383	0
Heavy Vehicles (%)	2%	2%	2%	29%	29%	29%	2%	2%	9%	9%	9%	9%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		7.3			7.3		59.9	56.8	56.8	63.1	58.4	
Effective Green, g (s)		7.3			7.3		59.9	56.8	56.8	63.1	58.4	
Actuated g/C Ratio		0.09			0.09		0.71	0.68	0.68	0.75	0.70	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)		129			107		728	2399	1005	225	2303	
v/s Ratio Prot							0.00	c0.44		c0.02	0.12	
v/s Ratio Perm		c0.02			0.02		0.06		0.03	0.28		
v/c Ratio		0.23			0.19		0.09	0.65	0.04	0.40	0.17	
Uniform Delay, d1		35.6			35.5		3.5	7.8	4.5	6.0	4.4	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.3			1.2		0.1	1.4	0.1	1.2	0.2	
Delay (s)		36.9			36.6		3.6	9.2	4.5	7.1	4.5	
Level of Service		D			D		A	A	A	A	A	
Approach Delay (s)		36.9			36.6			8.8			5.0	
Approach LOS		D			D			A			A	

Intersection Summary

HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	83.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	32	15	51	92	607	13	478	69	42	185	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1769		1770	1863	1583	1770	3476		1770	3496	
Flt Permitted	0.66	1.00		0.70	1.00	1.00	0.54	1.00		0.14	1.00	
Satd. Flow (perm)	1223	1769		1306	1863	1583	1005	3476		265	3496	
Peak-hour factor, PHF	0.82	0.67	0.62	0.58	0.70	0.86	0.65	0.85	0.91	0.55	0.68	0.29
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	48	57	29	106	158	847	24	675	91	92	326	29
RTOR Reduction (vph)	0	16	0	0	0	122	0	12	0	0	7	0
Lane Group Flow (vph)	48	70	0	106	158	725	24	754	0	92	348	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	42.4	42.4		42.4	42.4	42.4	25.0	25.0		35.8	35.8	
Effective Green, g (s)	42.4	42.4		42.4	42.4	42.4	25.0	25.0		35.8	35.8	
Actuated g/C Ratio	0.46	0.46		0.46	0.46	0.46	0.27	0.27		0.39	0.39	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	567	821		606	864	734	275	951		173	1369	
v/s Ratio Prot		0.04			0.08			c0.22		c0.02	0.10	
v/s Ratio Perm	0.04			0.08		c0.46	0.02			0.18		
v/c Ratio	0.08	0.09		0.17	0.18	0.99	0.09	0.79		0.53	0.25	
Uniform Delay, d1	13.7	13.7		14.3	14.4	24.3	24.7	30.8		20.2	18.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.3	0.2	30.1	0.6	6.8		3.1	0.4	
Delay (s)	13.8	13.8		14.6	14.6	54.4	25.3	37.6		23.3	19.2	
Level of Service	B	B		B	B	D	C	D		C	B	
Approach Delay (s)		13.8			44.9			37.2			20.1	
Approach LOS		B			D			D			C	

Intersection Summary

HCM Average Control Delay	36.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	91.4	Sum of lost time (s)	19.8
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	0	23	19	3	3	11	696	0	0	250	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.90		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1685		1770	1683		1770	3539			3520	
Flt Permitted		0.85		0.86	1.00		0.51	1.00			1.00	
Satd. Flow (perm)		1466		1607	1683		948	3539			3520	
Peak-hour factor, PHF	0.62	0.92	0.66	0.71	0.75	0.38	0.62	0.82	0.62	0.33	0.75	0.33
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	33	0	42	32	5	9	21	1019	0	0	400	15
RTOR Reduction (vph)	0	37	0	0	8	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	38	0	32	6	0	21	1019	0	0	413	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		8.6		8.6	8.6		57.1	57.1			57.1	
Effective Green, g (s)		8.6		8.6	8.6		57.1	57.1			57.1	
Actuated g/C Ratio		0.11		0.11	0.11		0.74	0.74			0.74	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		162		178	187		698	2604			2590	
v/s Ratio Prot					0.00			c0.29			0.12	
v/s Ratio Perm		c0.03		0.02			0.02					
v/c Ratio		0.23		0.18	0.03		0.03	0.39			0.16	
Uniform Delay, d1		31.5		31.3	30.8		2.8	3.8			3.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		1.5		1.0	0.1		0.1	0.4			0.1	
Delay (s)		33.0		32.3	30.9		2.8	4.2			3.2	
Level of Service		C		C	C		A	A			A	
Approach Delay (s)		33.0			31.9			4.2			3.2	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	6.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	77.6	Sum of lost time (s)	11.9
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	114	20	29	139	108	28	493	35	53	226	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3504		1770	3539	1583
Flt Permitted	0.62	1.00	1.00	0.59	1.00	1.00	0.55	1.00		0.29	1.00	1.00
Satd. Flow (perm)	1157	3539	1583	1103	3539	1583	1020	3504		546	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	48	171	30	44	208	162	42	740	52	80	339	40
RTOR Reduction (vph)	0	0	26	0	0	139	0	4	0	0	0	17
Lane Group Flow (vph)	48	171	4	44	208	23	42	788	0	80	339	23
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	15.9	12.6	12.6	18.1	13.7	13.7	56.7	53.4		61.7	55.9	55.9
Effective Green, g (s)	15.9	12.6	12.6	18.1	13.7	13.7	56.7	53.4		61.7	55.9	55.9
Actuated g/C Ratio	0.17	0.13	0.13	0.19	0.14	0.14	0.59	0.56		0.64	0.58	0.58
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	212	464	207	238	504	225	627	1945		424	2056	920
v/s Ratio Prot	0.01	0.05		c0.01	c0.06		0.00	c0.22		c0.01	0.10	
v/s Ratio Perm	0.03		0.00	0.03		0.01	0.04			0.11		0.01
v/c Ratio	0.23	0.37	0.02	0.18	0.41	0.10	0.07	0.41		0.19	0.16	0.03
Uniform Delay, d1	34.4	38.2	36.4	32.5	37.6	35.9	8.3	12.3		7.0	9.3	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0	0.1	0.4	1.1	0.4	0.0	0.6		0.2	0.2	0.1
Delay (s)	35.0	39.2	36.5	32.9	38.7	36.3	8.4	12.9		7.2	9.5	8.6
Level of Service	C	D	D	C	D	D	A	B		A	A	A
Approach Delay (s)		38.1			37.2			12.7			9.0	
Approach LOS		D			D			B			A	

Intersection Summary

HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	96.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	60	0	18	3	1258	330	47	264	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	5.2		6.0	6.0	6.0	4.0	6.0	
Lane Util. Factor				0.95	0.95		1.00	0.95	1.00	1.00	0.95	
Frt				1.00	0.93		1.00	1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.97		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1573	1539		1770	3312	1524	1626	3034	
Flt Permitted				0.95	0.95		0.51	1.00	1.00	0.07	1.00	
Satd. Flow (perm)				1573	1501		946	3312	1524	123	3034	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.80	0.80	0.85	0.80	0.80	0.76	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	0	0	0	90	0	27	4	1776	495	70	417	0
RTOR Reduction (vph)	0	0	0	0	22	0	0	0	195	0	0	0
Lane Group Flow (vph)	0	0	0	60	35	0	4	1776	300	70	417	0
Heavy Vehicles (%)	2%	2%	2%	9%	2%	3%	2%	9%	6%	11%	19%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)				16.4	16.4		51.5	51.5	51.5	58.7	58.7	
Effective Green, g (s)				16.4	16.4		51.5	51.5	51.5	58.7	58.7	
Actuated g/C Ratio				0.19	0.19		0.61	0.61	0.61	0.69	0.69	
Clearance Time (s)				4.0	5.2		6.0	6.0	6.0	4.0	6.0	
Vehicle Extension (s)				3.0	3.0		5.5	5.5	5.5	3.0	5.5	
Lane Grp Cap (vph)				303	297		572	2004	922	141	2093	
v/s Ratio Prot				c0.04	0.02			c0.54		c0.02	0.14	
v/s Ratio Perm							0.00		0.20	0.32		
v/c Ratio				0.20	0.12		0.01	0.89	0.32	0.50	0.20	
Uniform Delay, d1				28.8	28.4		6.7	14.3	8.3	13.1	4.7	
Progression Factor				1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2				0.3	0.2		0.0	6.2	0.9	2.7	0.2	
Delay (s)				29.2	28.6		6.7	20.5	9.2	15.8	5.0	
Level of Service				C	C		A	C	A	B	A	
Approach Delay (s)		0.0			28.9			18.0			6.5	
Approach LOS		A			C			B			A	

Intersection Summary

HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	16	0	38	29	292	2	675	39	77	130	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		1.00			0.88		1.00	0.99		1.00	1.00	
Flt Protected		0.98			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3453			3088		1770	3514		1770	3539	
Flt Permitted		0.58			0.91		0.59	1.00		0.08	1.00	
Satd. Flow (perm)		2048			2818		1092	3514		157	3539	
Peak-hour factor, PHF	0.42	0.52	0.92	0.74	0.67	0.67	0.50	0.62	0.71	0.62	0.58	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	37	37	0	62	52	523	5	1306	66	149	269	0
RTOR Reduction (vph)	0	0	0	0	90	0	0	4	0	0	0	0
Lane Group Flow (vph)	0	74	0	0	547	0	5	1368	0	149	269	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		21.6			21.6		47.3	46.5		57.5	52.7	
Effective Green, g (s)		21.6			21.6		47.3	46.5		57.5	52.7	
Actuated g/C Ratio		0.23			0.23		0.51	0.50		0.62	0.57	
Clearance Time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		3.0	7.0	
Lane Grp Cap (vph)		479			659		565	1770		220	2021	
v/s Ratio Prot							0.00	c0.39		c0.05	0.08	
v/s Ratio Perm		0.04			c0.19		0.00			0.37		
v/c Ratio		0.15			1.09dr		0.01	0.77		0.68	0.13	
Uniform Delay, d1		28.1			33.6		11.0	18.6		14.8	9.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			9.5		0.0	3.4		8.0	0.1	
Delay (s)		28.4			43.1		11.0	22.0		22.8	9.3	
Level of Service		C			D		B	C		C	A	
Approach Delay (s)		28.4			43.1			21.9			14.1	
Approach LOS		C			D			C			B	

Intersection Summary

HCM Average Control Delay	26.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	92.3	Sum of lost time (s)	17.2
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	186	36	27	123	194	45	718	27	22	134	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3214		1770	3507		1770	3539	1583
Flt Permitted	0.37	1.00	1.00	0.55	1.00		0.62	1.00		0.12	1.00	1.00
Satd. Flow (perm)	695	3539	1583	1028	3214		1157	3507		219	3539	1583
Peak-hour factor, PHF	0.76	0.73	0.75	0.61	0.90	0.90	0.62	0.81	0.48	0.61	0.78	0.55
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	101	306	58	53	164	259	87	1064	68	43	206	76
RTOR Reduction (vph)	0	0	41	0	149	0	0	4	0	0	0	43
Lane Group Flow (vph)	101	306	17	53	274	0	87	1128	0	43	206	33
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	39.2	32.1	32.1	35.2	30.1		53.7	48.5		53.5	48.4	48.4
Effective Green, g (s)	39.2	32.1	32.1	35.2	30.1		53.7	48.5		53.5	48.4	48.4
Actuated g/C Ratio	0.35	0.29	0.29	0.32	0.27		0.48	0.44		0.48	0.44	0.44
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	315	1025	459	361	873		590	1535		177	1546	691
v/s Ratio Prot	c0.02	0.09		0.01	0.09		0.01	c0.32		c0.01	0.06	
v/s Ratio Perm	c0.09		0.01	0.04			0.06			0.11		0.02
v/c Ratio	0.32	0.30	0.04	0.15	0.31		0.15	0.73		0.24	0.13	0.05
Uniform Delay, d1	24.9	30.6	28.2	26.6	32.1		15.5	25.8		18.5	18.7	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.7	0.1	0.2	0.9		0.1	2.3		0.7	0.1	0.1
Delay (s)	25.5	31.3	28.4	26.8	33.1		15.6	28.1		19.2	18.7	18.0
Level of Service	C	C	C	C	C		B	C		B	B	B
Approach Delay (s)		29.7			32.4			27.2			18.6	
Approach LOS		C			C			C			B	

Intersection Summary

HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	204	200	26	8	0	220	841	327	15	214	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	1827	1062	2398	1338		3183	3273		1787	3369	
Flt Permitted	0.75	1.00	1.00	0.95	1.00		0.95	1.00		0.12	1.00	
Satd. Flow (perm)	1293	1827	1062	2398	1338		3183	3273		223	3369	
Peak-hour factor, PHF	0.70	0.70	0.70	0.82	0.70	0.70	0.84	0.73	0.87	0.75	0.81	0.75
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	166	350	343	38	14	0	314	1382	451	24	317	5
RTOR Reduction (vph)	0	0	268	0	0	0	0	33	0	0	1	0
Lane Group Flow (vph)	166	350	75	38	14	0	314	1800	0	24	321	0
Heavy Vehicles (%)	10%	4%	52%	46%	42%	5%	10%	5%	10%	1%	7%	1%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	19.1	19.1	19.1	2.8	26.9		11.6	50.3		33.7	33.7	
Effective Green, g (s)	19.1	19.1	19.1	2.8	26.9		11.6	50.3		33.7	33.7	
Actuated g/C Ratio	0.22	0.22	0.22	0.03	0.31		0.13	0.58		0.39	0.39	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.5	3.5	3.5	3.0	3.5		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	283	400	233	77	413		423	1888		86	1302	
v/s Ratio Prot		c0.19		c0.02	0.01		0.10	c0.55			0.10	
v/s Ratio Perm	0.13		0.07							0.11		
v/c Ratio	0.59	0.88	0.32	0.49	0.03		0.74	0.95		0.28	0.25	
Uniform Delay, d1	30.5	32.9	28.6	41.5	21.1		36.4	17.3		18.4	18.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.3	19.1	1.0	4.9	0.0		7.1	11.6		2.1	0.1	
Delay (s)	33.8	52.0	29.6	46.4	21.1		43.5	29.0		20.5	18.3	
Level of Service	C	D	C	D	C		D	C		C	B	
Approach Delay (s)		39.5			39.6			31.1			18.4	
Approach LOS		D			D			C			B	

Intersection Summary

HCM Average Control Delay	32.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	87.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

2033 AM Peak Rodel Analysis - Intersection 8

```
E    (m)    8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)   10.00  10.00  20.00  10.00           TIME SLICE     min     15
V    (m)    7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)   20.00  20.00  20.00  20.00           TIME COST     $/hr  15.00
PHI  (d)   30.00  30.00  30.00  30.00           FLOW PERIOD    min  15 75
DIA  (m)   50.00  50.00  50.00  50.00           FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0           FLOW PEAK am/op/pm     AM

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U) FLOF CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.07     4  257   18  0          1.00 85 0.75 1.701 0.75 15 45 75
EB RILEY   1.24   240  245  240  0          1.00 85 0.75 1.701 0.75 15 45 75
NB DICKEY  1.07   392 1009    0  0          1.00 85 0.75 1.701 0.75 15 45 75
WB RILEY   1.45     0   10   31  0          1.00 85 0.75 1.701 0.75 15 45 75

FLOW        veh     279    725   1401     41
CAPACITY    veh    2079   1627   1870    859          AVDEL s    11.6
AVE DELAY  mins    0.03   0.07   0.29   0.08          L  O  S       B
MAX DELAY  mins    0.05   0.13   0.70   0.13          VEH HRS     7.9
AVE QUEUE   veh       0      1      7      0          COST  $   118.4
MAX QUEUE   veh       0      1     14      0
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Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.03	0.07	0.29	0.08	0.19
Average Delay (secs)	1.8	4.2	17.4	4.8	11.6
LOS	A	A	B	A	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	287	11	19	772	87	102	138	35	18	23	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.98			0.98			0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1770	3514		1770	3480			3409			3231	
Flt Permitted	0.11	1.00		0.52	1.00			0.77			0.73	
Satd. Flow (perm)	209	3514		960	3480			2690			2392	
Peak-hour factor, PHF	0.89	0.90	0.69	0.59	0.84	0.75	0.54	0.57	0.58	0.64	0.64	0.72
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	86	383	19	39	1103	139	227	291	72	34	43	82
RTOR Reduction (vph)	0	3	0	0	9	0	0	11	0	0	60	0
Lane Group Flow (vph)	86	399	0	39	1233	0	0	579	0	0	99	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	54.7	48.4		51.1	46.6			25.8			25.8	
Effective Green, g (s)	54.7	48.4		51.1	46.6			25.8			25.8	
Actuated g/C Ratio	0.57	0.50		0.53	0.48			0.27			0.27	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	221	1764		547	1682			720			640	
v/s Ratio Prot	c0.03	0.11		0.00	c0.35							
v/s Ratio Perm	0.20			0.03				c0.22			0.04	
v/c Ratio	0.39	0.23		0.07	0.73			0.80			0.15	
Uniform Delay, d1	13.3	13.5		10.9	19.9			32.9			27.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.3	0.2		0.1	2.6			7.4			0.2	
Delay (s)	14.6	13.7		10.9	22.5			40.3			27.2	
Level of Service	B	B		B	C			D			C	
Approach Delay (s)		13.9			22.2			40.3			27.2	
Approach LOS		B			C			D			C	

Intersection Summary

HCM Average Control Delay	25.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	96.4	Sum of lost time (s)	17.7
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	191	143	3	2	334	186	5	32	2	24	4	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3521		1770	3333		1770	3448		1770	3048	
Flt Permitted	0.21	1.00		0.59	1.00		0.67	1.00		0.43	1.00	
Satd. Flow (perm)	382	3521		1103	3333		1241	3448		807	3048	
Peak-hour factor, PHF	0.80	0.69	0.38	0.25	0.80	0.70	0.42	0.80	0.25	0.60	0.50	0.67
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	286	249	9	10	501	319	14	48	10	48	10	125
RTOR Reduction (vph)	0	3	0	0	102	0	0	9	0	0	98	0
Lane Group Flow (vph)	286	255	0	10	718	0	14	49	0	48	37	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	41.5	41.5		25.0	25.0		6.1	6.1		14.0	14.0	
Effective Green, g (s)	41.5	41.5		25.0	25.0		6.1	6.1		14.0	14.0	
Actuated g/C Ratio	0.64	0.64		0.38	0.38		0.09	0.09		0.22	0.22	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	511	2248		424	1282		116	324		232	656	
v/s Ratio Prot	c0.11	0.07			0.22			0.01		c0.01	0.01	
v/s Ratio Perm	c0.25			0.01			0.01			c0.03		
v/c Ratio	0.56	0.11		0.02	0.56		0.12	0.15		0.21	0.06	
Uniform Delay, d1	6.9	4.6		12.4	15.7		27.0	27.1		20.7	20.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	0.0		0.0	0.9		0.6	0.3		0.5	0.0	
Delay (s)	8.4	4.6		12.5	16.6		27.5	27.3		21.2	20.3	
Level of Service	A	A		B	B		C	C		C	C	
Approach Delay (s)		6.6			16.6			27.4			20.5	
Approach LOS		A			B			C			C	

Intersection Summary

HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	94	0	0	334	0	1332	7	9	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1		6.6	6.6				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			1.00		1.00	1.00				
Flt Protected	0.95	1.00			1.00		0.95	0.95				
Satd. Flow (prot)	1770	3539			3539		2715	1358				
Flt Permitted	0.33	1.00			1.00		0.95	0.95				
Satd. Flow (perm)	609	3539			3539		2715	1358				
Peak-hour factor, PHF	0.80	0.80	0.92	0.92	0.80	0.92	0.88	0.88	0.56	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	69	141	0	0	501	0	1816	10	19	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	69	141	0	0	501	0	1235	609	0	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	21%	21%	21%	2%	2%	2%
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	62.8	62.8			49.8		72.6	72.6				
Effective Green, g (s)	62.8	62.8			49.8		72.6	72.6				
Actuated g/C Ratio	0.42	0.42			0.34		0.49	0.49				
Clearance Time (s)	6.1	6.1			6.1		6.6	6.6				
Vehicle Extension (s)	3.0	5.0			5.0		3.0	3.0				
Lane Grp Cap (vph)	312	1501			1190		1331	666				
v/s Ratio Prot	c0.01	0.04			c0.14		c0.45	0.45				
v/s Ratio Perm	0.08											
v/c Ratio	0.22	0.09			0.42		0.93	0.91				
Uniform Delay, d1	26.6	25.6			38.0		35.3	34.9				
Progression Factor	0.83	0.81			1.00		1.00	1.00				
Incremental Delay, d2	0.4	0.1			0.5		11.3	17.1				
Delay (s)	22.4	20.8			38.5		46.6	52.0				
Level of Service	C	C			D		D	D				
Approach Delay (s)		21.3			38.5			48.4			0.0	
Approach LOS		C			D			D			A	

Intersection Summary

HCM Average Control Delay	44.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	148.1	Sum of lost time (s)	18.8
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	56	86	222	35	1012	407	0	0	0	38	189	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1840	1583
Flt Permitted	0.07	1.00	1.00	0.65	1.00	1.00					0.99	1.00
Satd. Flow (perm)	133	3539	1583	1213	5085	1583					1840	1583
Peak-hour factor, PHF	0.82	0.65	0.77	0.67	0.85	0.88	0.92	0.92	0.92	0.47	0.79	0.49
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	82	159	346	63	1429	555	0	0	0	97	287	206
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	69
Lane Group Flow (vph)	82	159	346	63	1429	555	0	0	0	0	384	137
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	62.8	62.8	148.1	49.8	49.8	148.1					72.6	72.6
Effective Green, g (s)	62.8	62.8	148.1	49.8	49.8	148.1					72.6	72.6
Actuated g/C Ratio	0.42	0.42	1.00	0.34	0.34	1.00					0.49	0.49
Clearance Time (s)	6.1	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	133	1501	1583	408	1710	1583					902	776
v/s Ratio Prot	0.03	0.04			c0.28						c0.21	
v/s Ratio Perm	0.23		0.22	0.05		c0.35						0.09
v/c Ratio	0.62	0.11	0.22	0.15	0.84	0.35					0.43	0.18
Uniform Delay, d1	32.4	25.7	0.0	34.4	45.4	0.0					24.3	21.1
Progression Factor	1.00	1.00	1.00	1.05	1.10	1.00					1.00	1.00
Incremental Delay, d2	8.2	0.1	0.3	0.2	2.4	0.4					0.4	0.1
Delay (s)	40.6	25.8	0.3	36.4	52.3	0.4					24.8	21.2
Level of Service	D	C	A	D	D	A					C	C
Approach Delay (s)		12.8			37.8			0.0			23.5	
Approach LOS		B			D			A			C	

Intersection Summary

HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	148.1	Sum of lost time (s)	12.7
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	42	0	0	65	4	272	38	39	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.96				
Flt Protected	0.95	1.00			1.00		0.95	0.97				
Satd. Flow (prot)	1770	3539			3467		1681	1660				
Flt Permitted	0.63	1.00			1.00		0.95	0.97				
Satd. Flow (perm)	1180	3539			3467		1681	1660				
Peak-hour factor, PHF	0.60	0.75	0.92	0.92	0.81	0.33	0.60	0.63	0.57	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	48	67	0	0	96	15	544	72	82	0	0	0
RTOR Reduction (vph)	0	0	0	0	10	0	0	14	0	0	0	0
Lane Group Flow (vph)	48	67	0	0	101	0	354	330	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	25.9	22.6			21.0		24.2	24.2				
Effective Green, g (s)	25.9	22.6			21.0		24.2	24.2				
Actuated g/C Ratio	0.39	0.34			0.32		0.37	0.37				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	496	1219			1110		620	612				
v/s Ratio Prot	c0.00	0.02			0.03		c0.21	0.20				
v/s Ratio Perm	c0.03											
v/c Ratio	0.10	0.05			0.09		0.57	0.54				
Uniform Delay, d1	12.4	14.4			15.6		16.5	16.3				
Progression Factor	0.43	0.40			1.00		1.00	1.00				
Incremental Delay, d2	0.2	0.0			0.1		2.0	1.7				
Delay (s)	5.5	5.7			15.7		18.6	18.0				
Level of Service	A	A			B		B	B				
Approach Delay (s)		5.6			15.7			18.3			0.0	
Approach LOS		A			B			B			A	

Intersection Summary

HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	65.6	Sum of lost time (s)	11.1
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	52	53	20	303	0	0	0	0	0	12	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0						5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	
Frt		1.00	0.85	1.00	1.00						0.95	
Flt Protected		1.00	1.00	0.95	1.00						1.00	
Satd. Flow (prot)		3539	1583	1770	3539						1764	
Flt Permitted		1.00	1.00	0.69	1.00						1.00	
Satd. Flow (perm)		3539	1583	1293	3539						1764	
Peak-hour factor, PHF	0.92	0.68	0.66	0.71	0.68	0.92	0.92	0.92	0.92	0.92	0.33	0.55
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	0	92	96	34	535	0	0	0	0	0	44	24
RTOR Reduction (vph)	0	0	63	0	0	0	0	0	0	0	15	0
Lane Group Flow (vph)	0	92	33	34	535	0	0	0	0	0	53	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		22.6	22.6	22.7	21.0						24.2	
Effective Green, g (s)		22.6	22.6	22.7	21.0						24.2	
Actuated g/C Ratio		0.34	0.34	0.35	0.32						0.37	
Clearance Time (s)		6.0	6.0	5.3	6.0						5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3						5.0	
Lane Grp Cap (vph)		1219	545	460	1133						651	
v/s Ratio Prot		0.03		c0.00	c0.15						c0.03	
v/s Ratio Perm			0.02	0.02								
v/c Ratio		0.08	0.06	0.07	0.47						0.08	
Uniform Delay, d1		14.5	14.4	14.3	17.9						13.5	
Progression Factor		1.00	1.00	1.47	1.38						1.00	
Incremental Delay, d2		0.1	0.1	0.1	0.7						0.1	
Delay (s)		14.5	14.5	21.2	25.4						13.6	
Level of Service		B	B	C	C						B	
Approach Delay (s)		14.5			25.1			0.0			13.6	
Approach LOS		B			C			A			B	

Intersection Summary

HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	65.6	Sum of lost time (s)	17.1
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY - Intersection 19

General Information		Site Information	
Analyst		Intersection	*Riley Road & SR 912 Off Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2033 AM*
Analysis Time Period	*6:00 - 7:00 AM*		

Project Description *SR 912 Traffic Analysis*	
East/West Street: *SR 912 Off Ramp*	North/South Street: *Riley Road*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*443*			*66*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*492*	*0*	*0*	*73*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*22*		*166*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*24*	*0*	*184*
Percent Heavy Vehicles	*0*	*0*	*0*	*10*	*0*	*19*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*24*		*184*			
C (m) (veh/h)			*461*		*705*			
v/c			*0.05*		*0.26*			
95% queue length			*0.16*		*1.04*			
Control Delay (s/veh)			*13.2*		*11.9*			
LOS			*B*		*B*			
Approach Delay (s/veh)	--	--	*12.1*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY Intersection 20

General Information		Site Information	
Analyst		Intersection	*Riley Road & SR 912 On Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2033 AM*
Analysis Time Period	*6:00 - 7:00 AM*		

Project Description *SR 912 Traffic Analysis*	
East/West Street: *SR 912 On Ramp*	North/South Street: *Riley Road*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*60*	*600*			*72*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*66*	*666*	*0*	*0*	*80*	*0*
Percent Heavy Vehicles	*12*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*10*	*0*	*19*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*66*							
C (m) (veh/h)	*1446*							
v/c	*0.05*							
95% queue length	*0.14*							
Control Delay (s/veh)	*7.6*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	200	50	300	20	50	1200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.99		0.86	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	3127	1696	3193		1569	1475
Flt Permitted	0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	3127	1696	3193		1569	1475
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	300	75	450	30	75	1800
RTOR Reduction (vph)	0	0	6	0	486	13
Lane Group Flow (vph)	300	75	474	0	453	923
Heavy Vehicles (%)	12%	12%	12%	12%	4%	4%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	28.2	49.3	16.1		26.5	54.7
Effective Green, g (s)	28.2	49.3	16.1		26.5	54.7
Actuated g/C Ratio	0.33	0.57	0.19		0.31	0.64
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1028	975	599		485	1026
v/s Ratio Prot	0.10	0.04	c0.15		0.29	c0.30
v/s Ratio Perm						0.33
v/c Ratio	0.29	0.08	0.79		0.93	0.90
Uniform Delay, d1	21.4	8.1	33.3		28.8	13.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.2	10.3		25.3	10.5
Delay (s)	21.5	8.3	43.6		54.1	23.7
Level of Service	C	A	D		D	C
Approach Delay (s)		18.9	43.6		38.9	
Approach LOS		B	D		D	

Intersection Summary

HCM Average Control Delay	37.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	40	170	1062	20	20	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1613		2407	1583	1203	2407
Flt Permitted	0.99		1.00	1.00	0.16	1.00
Satd. Flow (perm)	1613		2407	1583	201	2407
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	52	222	1385	26	26	365
RTOR Reduction (vph)	65	0	0	7	0	0
Lane Group Flow (vph)	209	0	1385	19	26	365
Heavy Vehicles (%)	12%	2%	50%	2%	50%	50%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	14.9		64.6	64.6	64.6	64.6
Effective Green, g (s)	14.9		64.6	64.6	64.6	64.6
Actuated g/C Ratio	0.17		0.72	0.72	0.72	0.72
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	269		1737	1143	145	1737
v/s Ratio Prot	c0.13		c0.58			0.15
v/s Ratio Perm				0.01	0.13	
v/c Ratio	0.78		0.80	0.02	0.18	0.21
Uniform Delay, d1	35.7		8.2	3.5	4.0	4.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	13.1		3.9	0.0	2.7	0.3
Delay (s)	48.9		12.1	3.5	6.7	4.4
Level of Service	D		B	A	A	A
Approach Delay (s)	48.9		11.9			4.5
Approach LOS	D		B			A

Intersection Summary

HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2033 PM1(EARLY) PEAK HOUR

CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	1	78	19	10	14	42	589	40	170	1236	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.89			0.96		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1640			1269		1770	3539	1495	1671	3523	
Flt Permitted		0.94			0.72		0.09	1.00	1.00	0.23	1.00	
Satd. Flow (perm)		1553			928		173	3539	1495	396	3523	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.25
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	21	2	117	28	15	21	63	884	60	255	1854	58
RTOR Reduction (vph)	0	85	0	0	18	0	0	0	12	0	2	0
Lane Group Flow (vph)	0	55	0	0	46	0	63	884	48	255	1910	0
Heavy Vehicles (%)	2%	2%	2%	40%	40%	40%	2%	2%	8%	8%	2%	2%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		10.3			10.3		46.3	43.1	43.1	64.1	55.9	
Effective Green, g (s)		10.3			10.3		46.3	43.1	43.1	64.1	55.9	
Actuated g/C Ratio		0.12			0.12		0.55	0.51	0.51	0.76	0.66	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		190			113		155	1807	763	542	2333	
v/s Ratio Prot							0.02	0.25		c0.09	c0.54	
v/s Ratio Perm		0.04			c0.05		0.21		0.03	0.27		
v/c Ratio		0.29			0.40		0.41	0.49	0.06	0.47	0.82	
Uniform Delay, d1		33.7			34.2		11.4	13.5	10.4	5.1	10.5	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.1			3.2		1.7	1.0	0.2	2.9	3.3	
Delay (s)		34.9			37.4		13.2	14.4	10.6	8.0	13.9	
Level of Service		C			D		B	B	B	A	B	
Approach Delay (s)		34.9			37.4			14.1			13.2	
Approach LOS		C			D			B			B	

Intersection Summary

HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	84.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	39	43	32	62	211	53	433	47	181	657	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.91		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1696		1770	1863	1583	1770	3484		1770	3505	
Flt Permitted	0.68	1.00		0.67	1.00	1.00	0.31	1.00		0.29	1.00	
Satd. Flow (perm)	1262	1696		1239	1863	1583	586	3484		537	3505	
Peak-hour factor, PHF	0.62	0.81	0.60	0.80	0.60	0.73	0.70	0.84	0.78	0.91	0.93	0.77
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	72	58	86	48	124	347	91	619	72	239	848	58
RTOR Reduction (vph)	0	65	0	0	0	283	0	9	0	0	5	0
Lane Group Flow (vph)	72	79	0	48	124	64	91	682	0	239	901	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	15.2	15.2		15.2	15.2	15.2	37.2	37.2		53.6	53.6	
Effective Green, g (s)	15.2	15.2		15.2	15.2	15.2	37.2	37.2		53.6	53.6	
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.45	0.45		0.65	0.65	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	234	314		230	345	293	266	1581		498	2291	
v/s Ratio Prot		0.05			c0.07			0.20		0.06	c0.26	
v/s Ratio Perm	0.06			0.04		0.04	0.16			c0.26		
v/c Ratio	0.31	0.25		0.21	0.36	0.22	0.34	0.43		0.48	0.39	
Uniform Delay, d1	28.9	28.5		28.3	29.2	28.4	14.5	15.2		6.9	6.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.9		0.9	1.3	0.8	3.5	0.9		0.7	0.5	
Delay (s)	30.4	29.4		29.3	30.5	29.2	18.0	16.1		7.6	7.1	
Level of Service	C	C		C	C	C	B	B		A	A	
Approach Delay (s)		29.8			29.5			16.3			7.2	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	1	79	45	2	15	48	434	0	0	455	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.88		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1679		1770	1642		1770	3539			3518	
Flt Permitted		0.87		0.64	1.00		0.43	1.00			1.00	
Satd. Flow (perm)		1489		1185	1642		797	3539			3518	
Peak-hour factor, PHF	0.50	0.25	0.90	0.87	0.50	0.94	0.80	0.84	0.62	0.33	0.96	0.75
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	62	5	105	62	5	19	72	620	0	0	569	24
RTOR Reduction (vph)	0	84	0	0	16	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	88	0	62	8	0	72	620	0	0	591	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		11.7		11.7	11.7		44.0	44.0			44.0	
Effective Green, g (s)		11.7		11.7	11.7		44.0	44.0			44.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.65	0.65			0.65	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		258		205	284		519	2303			2290	
v/s Ratio Prot					0.01			c0.18			0.17	
v/s Ratio Perm		c0.06		0.05			0.09					
v/c Ratio		0.34		0.30	0.03		0.14	0.27			0.26	
Uniform Delay, d1		24.6		24.4	23.2		4.5	5.0			5.0	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		1.7		1.7	0.1		0.6	0.3			0.3	
Delay (s)		26.2		26.1	23.3		5.1	5.3			5.2	
Level of Service		C		C	C		A	A			A	
Approach Delay (s)		26.2			25.3			5.3			5.2	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	67.6	Sum of lost time (s)	11.9
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	304	54	229	430	64	61	653	59	208	964	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3495		1770	3539	1583
Flt Permitted	0.27	1.00	1.00	0.23	1.00	1.00	0.11	1.00		0.10	1.00	1.00
Satd. Flow (perm)	506	3539	1583	424	3539	1583	208	3495		187	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	180	456	81	344	645	96	92	980	88	312	1446	93
RTOR Reduction (vph)	0	0	67	0	0	73	0	6	0	0	0	28
Lane Group Flow (vph)	180	456	14	344	645	23	92	1062	0	312	1446	65
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	28.9	18.4	18.4	40.2	25.7	25.7	40.8	35.8		57.0	48.0	48.0
Effective Green, g (s)	28.9	18.4	18.4	40.2	25.7	25.7	40.8	35.8		57.0	48.0	48.0
Actuated g/C Ratio	0.26	0.17	0.17	0.37	0.24	0.24	0.37	0.33		0.52	0.44	0.44
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	255	596	267	375	833	373	149	1146		347	1556	696
v/s Ratio Prot	0.07	0.13		c0.15	0.18		0.03	0.30		c0.14	c0.41	
v/s Ratio Perm	0.12		0.01	c0.19		0.01	0.20			0.33		0.04
v/c Ratio	0.71	0.77	0.05	0.92	0.77	0.06	0.62	0.93		0.90	0.93	0.09
Uniform Delay, d1	33.1	43.3	38.1	28.1	39.0	32.4	26.3	35.4		31.0	29.0	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.6	6.8	0.2	26.6	5.3	0.1	7.4	13.9		24.7	11.2	0.3
Delay (s)	41.7	50.2	38.2	54.7	44.3	32.5	33.7	49.4		55.6	40.2	18.1
Level of Service	D	D	D	D	D	C	C	D		E	D	B
Approach Delay (s)		46.7			46.6			48.1			41.7	
Approach LOS		D			D			D			D	

Intersection Summary

HCM Average Control Delay	45.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	109.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	0	1	200	0	39	0	447	35	27	967	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2		4.0	5.2			6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00		0.95	0.95			0.95	1.00	1.00	0.95	
Frt		0.93		1.00	0.95			1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1695		1665	1555			3112	1509	1612	3437	
Flt Permitted		0.94		0.95	0.87			1.00	1.00	0.33	1.00	
Satd. Flow (perm)		1628		1665	1397			3112	1509	560	3437	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.75	0.80	0.89	0.72	0.61	0.76	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	2	0	2	300	0	62	0	603	58	53	1527	3
RTOR Reduction (vph)	0	2	0	0	15	0	0	0	33	0	0	0
Lane Group Flow (vph)	0	2	0	186	161	0	0	603	25	53	1530	0
Heavy Vehicles (%)	2%	2%	2%	3%	2%	13%	2%	16%	7%	12%	5%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)		3.2		29.9	37.1			40.6	40.6	47.8	47.8	
Effective Green, g (s)		3.2		29.9	37.1			40.6	40.6	47.8	47.8	
Actuated g/C Ratio		0.03		0.31	0.39			0.42	0.42	0.50	0.50	
Clearance Time (s)		5.2		4.0	5.2			6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0			5.5	5.5	3.0	5.5	
Lane Grp Cap (vph)		54		518	588			1315	638	314	1710	
v/s Ratio Prot				c0.11	0.08			0.19		0.01	c0.45	
v/s Ratio Perm		0.00			c0.02				0.02	0.08		
v/c Ratio		0.04		0.36	0.27			0.46	0.04	0.17	0.89	
Uniform Delay, d1		45.0		25.7	20.2			19.9	16.3	13.1	21.9	
Progression Factor		1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3		0.4	0.3			1.2	0.1	0.3	7.7	
Delay (s)		45.3		26.1	20.5			21.0	16.4	13.4	29.6	
Level of Service		D		C	C			C	B	B	C	
Approach Delay (s)		45.3			23.4			20.6			29.0	
Approach LOS		D			C			C			C	

Intersection Summary

HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	96.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	112	26	185	113	108	10	312	157	246	695	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.97			0.96		1.00	0.95		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3399			3337		1770	3357		1770	3523	
Flt Permitted		0.82			0.72		0.26	1.00		0.25	1.00	
Satd. Flow (perm)		2799			2448		489	3357		465	3523	
Peak-hour factor, PHF	0.75	0.80	0.54	0.81	0.76	0.93	0.62	0.88	0.85	0.70	0.79	0.79
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	29	168	58	274	178	139	19	425	222	422	1056	33
RTOR Reduction (vph)	0	31	0	0	33	0	0	70	0	0	2	0
Lane Group Flow (vph)	0	224	0	0	558	0	19	577	0	422	1087	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		24.4			24.4		29.1	27.6		49.5	44.0	
Effective Green, g (s)		24.4			24.4		29.1	27.6		49.5	44.0	
Actuated g/C Ratio		0.28			0.28		0.33	0.32		0.57	0.51	
Clearance Time (s)		7.5			7.5		4.0	5.7		4.0	5.7	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		3.0	7.0	
Lane Grp Cap (vph)		784			686		185	1064		532	1780	
v/s Ratio Prot							0.00	0.17		c0.16	0.31	
v/s Ratio Perm		0.08			c0.23		0.03			c0.29		
v/c Ratio		0.29			0.81		0.10	0.54		0.79	0.61	
Uniform Delay, d1		24.5			29.2		19.5	24.5		12.6	15.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.4			8.2		0.2	2.0		8.0	1.6	
Delay (s)		25.0			37.5		19.8	26.5		20.5	17.0	
Level of Service		C			D		B	C		C	B	
Approach Delay (s)		25.0			37.5			26.3			18.0	
Approach LOS		C			D			C			B	

Intersection Summary

HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	11.5
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	151	594	201	141	534	82	127	533	79	139	825	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1711	3421	1531	1711	3343		1770	3464		1770	3539	1583
Flt Permitted	0.12	1.00	1.00	0.12	1.00		0.10	1.00		0.16	1.00	1.00
Satd. Flow (perm)	218	3421	1531	216	3343		190	3464		289	3539	1583
Peak-hour factor, PHF	0.82	0.80	0.95	0.73	0.86	0.73	0.79	0.88	0.79	0.87	0.86	0.84
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	221	891	254	232	745	135	193	727	120	192	1151	326
RTOR Reduction (vph)	0	0	97	0	12	0	0	11	0	0	0	96
Lane Group Flow (vph)	221	891	157	232	868	0	193	836	0	192	1151	230
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	48.1	33.1	33.1	48.7	33.4		50.1	39.2		49.7	39.0	39.0
Effective Green, g (s)	48.1	33.1	33.1	48.7	33.4		50.1	39.2		49.7	39.0	39.0
Actuated g/C Ratio	0.41	0.28	0.28	0.41	0.28		0.42	0.33		0.42	0.33	0.33
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	278	957	428	282	944		226	1148		255	1167	522
v/s Ratio Prot	0.10	c0.26		c0.11	0.26		c0.08	0.24		0.07	c0.33	
v/s Ratio Perm	0.22		0.10	0.23			0.28			0.25		0.15
v/c Ratio	0.79	0.93	0.37	0.82	0.92		0.85	0.73		0.75	0.99	0.44
Uniform Delay, d1	27.7	41.5	34.2	28.9	41.1		28.3	34.9		25.0	39.4	31.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	14.5	16.6	2.4	17.3	15.3		25.5	2.9		11.9	23.0	1.2
Delay (s)	42.1	58.0	36.6	46.3	56.4		53.8	37.7		36.8	62.4	32.3
Level of Service	D	E	D	D	E		D	D		D	E	C
Approach Delay (s)		51.5			54.3			40.7			53.6	
Approach LOS		D			D			D			D	

Intersection Summary

HCM Average Control Delay	50.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	118.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	4	2	280	333	100	5	220	218	19	1	587	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	1638	1495	3019	1347		2801	2908		970	3502	
Flt Permitted	0.65	1.00	1.00	0.95	1.00		0.95	1.00		0.55	1.00	
Satd. Flow (perm)	1109	1638	1495	3019	1347		2801	2908		564	3502	
Peak-hour factor, PHF	0.70	0.70	0.79	0.82	0.73	0.70	0.70	0.87	0.79	0.70	0.86	0.70
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	7	3	425	487	164	9	377	301	29	2	819	58
RTOR Reduction (vph)	0	0	243	0	2	0	0	8	0	0	6	0
Lane Group Flow (vph)	7	3	182	487	171	0	377	322	0	2	871	0
Heavy Vehicles (%)	11%	16%	8%	16%	42%	3%	25%	19%	59%	86%	2%	3%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	13.9	13.9	13.9	15.1	34.0		13.0	41.1		23.1	23.1	
Effective Green, g (s)	13.9	13.9	13.9	15.1	34.0		13.0	41.1		23.1	23.1	
Actuated g/C Ratio	0.16	0.16	0.16	0.18	0.40		0.15	0.48		0.27	0.27	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	181	268	244	536	538		428	1404		153	951	
v/s Ratio Prot		0.00		c0.16	0.13		c0.13	0.11			c0.25	
v/s Ratio Perm	0.01		c0.12							0.00		
v/c Ratio	0.04	0.01	0.75	0.91	0.32		0.88	0.23		0.01	0.92	
Uniform Delay, d1	30.0	29.8	33.9	34.3	17.6		35.3	12.8		22.7	30.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.0	11.8	19.1	0.3		18.6	0.1		0.0	13.1	
Delay (s)	30.1	29.9	45.7	53.5	17.9		53.9	12.9		22.7	43.2	
Level of Service	C	C	D	D	B		D	B		C	D	
Approach Delay (s)		45.4			44.1			34.8			43.1	
Approach LOS		D			D			C			D	

Intersection Summary

HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

2033 PM1 Peak Rodel Analysis - Intersection 8

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E    (m)   8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)  10.00  10.00  20.00  10.00          TIME SLICE     min     15
V    (m)   7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)  20.00  20.00  20.00  20.00          TIME COST     $/hr  15.00
PHI  (d)  30.00  30.00  30.00  30.00          FLOW PERIOD    min  15 75
DIA  (m)  50.00  50.00  50.00  50.00          FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0          FLOW PEAK am/op/pm     OP

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U)  FLOF  CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.02    41  704   41  0          1.00  85  0.75 1.701 0.75  15 45 75
EB RILEY   1.08   336    2    5  0          1.00  85  0.75 1.701 0.75  15 45 75
NB DICKEY  1.24    23  262  264  0          1.00  85  0.75 1.701 0.75  15 45 75
WB RILEY   1.22     6  120  400  0          1.00  85  0.75 1.701 0.75  15 45 75

FLOW        veh    786    343    549    526
CAPACITY    veh   1524   1243   1975   1459          AVDEL s     4.4
AVE DELAY  mins   0.10   0.07   0.04   0.07          L  O  S      A
MAX DELAY  mins   0.20   0.14   0.07   0.12          VEH HRS     2.7
AVE QUEUE   veh      1      0      0      1          COST  $    40.4
MAX QUEUE   veh      2      1      1      1
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Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.10	0.07	0.04	0.07	0.07
Average Delay (secs)	6.0	4.2	2.4	4.2	4.4
LOS	A	A	A	A	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	139	1068	61	100	668	49	68	81	108	87	132	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.99			0.93			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1770	3511		1770	3497			3258			3291	
Flt Permitted	0.21	1.00		0.08	1.00			0.60			0.69	
Satd. Flow (perm)	393	3511		155	3497			1972			2298	
Peak-hour factor, PHF	0.83	0.77	0.80	0.76	0.92	0.77	0.81	0.81	0.71	0.81	0.79	0.86
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	201	1664	92	158	871	76	101	120	183	129	201	215
RTOR Reduction (vph)	0	4	0	0	6	0	0	141	0	0	109	0
Lane Group Flow (vph)	201	1752	0	158	941	0	0	263	0	0	436	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	59.9	49.5		56.9	48.0			22.4			22.4	
Effective Green, g (s)	59.9	49.5		56.9	48.0			22.4			22.4	
Actuated g/C Ratio	0.61	0.50		0.58	0.49			0.23			0.23	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	384	1764		235	1704			448			523	
v/s Ratio Prot	0.06	c0.50		c0.06	0.27							
v/s Ratio Perm	0.26			0.33				0.13			c0.19	
v/c Ratio	0.52	0.99		0.67	0.55			0.59			0.83	
Uniform Delay, d1	10.3	24.3		20.8	17.7			33.9			36.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.4	19.9		7.5	1.0			3.0			12.1	
Delay (s)	11.7	44.2		28.3	18.7			36.9			48.4	
Level of Service	B	D		C	B			D			D	
Approach Delay (s)		40.9			20.1			36.9			48.4	
Approach LOS		D			C			D			D	

Intersection Summary

HCM Average Control Delay	35.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	98.5	Sum of lost time (s)	11.8
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	289	393	19	8	224	51	8	45	10	84	74	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.97		1.00	0.96		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3517		1770	3438		1770	3401		1770	3115	
Flt Permitted	0.40	1.00		0.35	1.00		0.63	1.00		0.42	1.00	
Satd. Flow (perm)	748	3517		646	3438		1183	3401		791	3115	
Peak-hour factor, PHF	0.78	0.61	0.68	1.00	0.88	0.85	0.67	0.80	0.50	0.57	0.88	0.95
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	445	773	34	10	305	72	14	68	24	177	101	404
RTOR Reduction (vph)	0	4	0	0	21	0	0	22	0	0	284	0
Lane Group Flow (vph)	445	803	0	10	356	0	14	70	0	177	221	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	36.6	36.6		17.0	17.0		6.3	6.3		19.5	19.5	
Effective Green, g (s)	36.6	36.6		17.0	17.0		6.3	6.3		19.5	19.5	
Actuated g/C Ratio	0.56	0.56		0.26	0.26		0.10	0.10		0.30	0.30	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	660	1962		167	891		114	327		372	926	
v/s Ratio Prot	c0.16	0.23			0.10			0.02		c0.07	0.07	
v/s Ratio Perm	c0.22			0.02			0.01			c0.07		
v/c Ratio	0.67	0.41		0.06	0.40		0.12	0.21		0.48	0.24	
Uniform Delay, d1	8.9	8.3		18.3	20.1		27.1	27.4		18.1	17.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	0.3		0.3	0.6		0.6	0.4		1.1	0.2	
Delay (s)	11.7	8.6		18.6	20.7		27.7	27.8		19.3	17.6	
Level of Service	B	A		B	C		C	C		B	B	
Approach Delay (s)		9.7			20.6			27.8			18.0	
Approach LOS		A			C			C			B	

Intersection Summary

HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	302	0	0	219	48	699	27	6	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1		6.6	6.6				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			0.97		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	0.96				
Satd. Flow (prot)	1770	3539			3441		2738	1375				
Flt Permitted	0.35	1.00			1.00		0.95	0.96				
Satd. Flow (perm)	659	3539			3441		2738	1375				
Peak-hour factor, PHF	0.75	0.90	0.25	0.92	0.77	0.75	0.92	0.75	0.50	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	29	403	0	0	341	77	912	43	14	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	1	0	0	0	0
Lane Group Flow (vph)	29	403	0	0	401	0	648	320	0	0	0	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	20%	20%	20%	2%	2%	2%
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2	2										
Actuated Green, G (s)	42.3	42.3			30.2		54.2	54.2				
Effective Green, g (s)	42.3	42.3			30.2		54.2	54.2				
Actuated g/C Ratio	0.39	0.39			0.28		0.50	0.50				
Clearance Time (s)	6.1	6.1			6.1		6.6	6.6				
Vehicle Extension (s)	3.0	5.0			5.0		4.0	4.0				
Lane Grp Cap (vph)	316	1371			952		1359	682				
v/s Ratio Prot	0.01	c0.11			c0.12		c0.24	0.23				
v/s Ratio Perm	0.03											
v/c Ratio	0.09	0.29			0.42		0.48	0.47				
Uniform Delay, d1	21.4	23.1			32.3		18.1	18.1				
Progression Factor	0.61	0.59			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.2			0.6		0.4	0.7				
Delay (s)	13.2	13.8			33.0		18.5	18.8				
Level of Service	B	B			C		B	B				
Approach Delay (s)		13.8			33.0			18.6			0.0	
Approach LOS		B			C			B			A	

Intersection Summary

HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	109.2	Sum of lost time (s)	18.8
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	215	695	47	385	358	0	0	0	75	422	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1849	1583
Flt Permitted	0.33	1.00	1.00	0.56	1.00	1.00					0.99	1.00
Satd. Flow (perm)	610	3539	1583	1052	5085	1583					1849	1583
Peak-hour factor, PHF	0.83	0.84	0.86	0.69	0.87	0.87	0.92	0.92	0.92	0.89	0.85	0.64
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	217	307	970	82	531	494	0	0	0	101	596	304
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	93
Lane Group Flow (vph)	217	307	970	82	531	494	0	0	0	0	697	211
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	42.3	42.3	109.2	30.2	30.2	109.2					54.2	54.2
Effective Green, g (s)	42.3	42.3	109.2	30.2	30.2	109.2					54.2	54.2
Actuated g/C Ratio	0.39	0.39	1.00	0.28	0.28	1.00					0.50	0.50
Clearance Time (s)	6.1	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	300	1371	1583	291	1406	1583					918	786
v/s Ratio Prot	0.04	0.09			0.10						c0.38	
v/s Ratio Perm	c0.24		c0.61	0.08		0.31						0.13
v/c Ratio	0.72	0.22	0.61	0.28	0.38	0.31					0.76	0.27
Uniform Delay, d1	27.3	22.4	0.0	31.0	31.9	0.0					22.2	16.0
Progression Factor	1.00	1.00	1.00	1.12	1.14	1.00					1.00	1.00
Incremental Delay, d2	8.4	0.2	1.8	1.0	0.3	0.5					3.9	0.3
Delay (s)	35.7	22.6	1.8	35.7	36.7	0.5					26.1	16.2
Level of Service	D	C	A	D	D	A					C	B
Approach Delay (s)		11.0			20.5			0.0			23.1	
Approach LOS		B			C			A			C	

Intersection Summary

HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	109.2	Sum of lost time (s)	6.6
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	109	0	0	172	12	132	6	45	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.93				
Flt Protected	0.95	1.00			1.00		0.95	0.98				
Satd. Flow (prot)	1770	3539			3456		1681	1608				
Flt Permitted	0.57	1.00			1.00		0.95	0.98				
Satd. Flow (perm)	1053	3539			3456		1681	1608				
Peak-hour factor, PHF	0.85	0.85	0.92	0.92	0.80	0.30	0.72	0.50	0.75	0.25	0.25	0.29
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	48	154	0	0	258	48	220	14	72	0	0	0
RTOR Reduction (vph)	0	0	0	0	20	0	0	37	0	0	0	0
Lane Group Flow (vph)	48	154	0	0	286	0	156	113	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	24.2	19.8			22.1		13.4	13.4				
Effective Green, g (s)	24.2	19.8			22.1		13.4	13.4				
Actuated g/C Ratio	0.42	0.35			0.39		0.24	0.24				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	502	1229			1340		395	378				
v/s Ratio Prot	c0.01	0.04			c0.08		c0.09	0.07				
v/s Ratio Perm	0.03											
v/c Ratio	0.10	0.13			0.21		0.39	0.30				
Uniform Delay, d1	9.7	12.7			11.6		18.4	17.9				
Progression Factor	0.43	0.35			1.00		1.00	1.00				
Incremental Delay, d2	0.2	0.1			0.2		1.4	0.9				
Delay (s)	4.4	4.5			11.8		19.7	18.9				
Level of Service	A	A			B		B	B				
Approach Delay (s)		4.5			11.8			19.3			0.0	
Approach LOS		A			B			B			A	

Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	141	338	69	217	0	0	0	0	5	80	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	3539					1770	1750	
Flt Permitted		1.00	1.00	0.54	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1013	3539					1770	1750	
Peak-hour factor, PHF	0.92	0.73	0.83	0.86	0.94	0.92	0.92	0.92	0.92	0.62	0.80	0.65
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	0	232	489	96	277	0	0	0	0	10	120	81
RTOR Reduction (vph)	0	0	319	0	0	0	0	0	0	0	27	0
Lane Group Flow (vph)	0	232	170	96	277	0	0	0	0	10	174	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		19.8	19.8	28.8	22.1					13.4	13.4	
Effective Green, g (s)		19.8	19.8	28.8	22.1					13.4	13.4	
Actuated g/C Ratio		0.35	0.35	0.51	0.39					0.24	0.24	
Clearance Time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3					5.0	5.0	
Lane Grp Cap (vph)		1229	550	601	1372					416	411	
v/s Ratio Prot		0.07		c0.02	0.08					0.01	c0.10	
v/s Ratio Perm			c0.11	0.06								
v/c Ratio		0.19	0.31	0.16	0.20					0.02	0.42	
Uniform Delay, d1		13.0	13.6	7.4	11.6					16.8	18.5	
Progression Factor		1.00	1.00	1.08	0.98					1.00	1.00	
Incremental Delay, d2		0.2	0.7	0.3	0.2					0.0	1.5	
Delay (s)		13.2	14.3	8.3	11.5					16.8	20.0	
Level of Service		B	B	A	B					B	B	
Approach Delay (s)		14.0			10.7			0.0			19.8	
Approach LOS		B			B			A			B	

Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	17.1
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY- Intersection 19

General Information

Analyst	*JK*
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*3:00 - 4:00 PM*

Site Information

Intersection	*Riley Road & SR 912 Off Ramp*
Jurisdiction	
Analysis Year	*2033 PM1*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 Off Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*138*			*240*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*153*	*0*	*0*	*266*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*48*		*270*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*53*	*0*	*300*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*53*		*300*			
C (m) (veh/h)			*673*		*935*			
v/c			*0.08*		*0.32*			
95% queue length			*0.26*		*1.39*			
Control Delay (s/veh)			*10.8*		*10.7*			
LOS			*B*		*B*			
Approach Delay (s/veh)	--	--	*10.7*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY - Intersection 20

General Information

Analyst	*JK*
Agency/Co.	*WSA*
Date Performed	*5/21/2010*
Analysis Time Period	*3:00 - 4:00 PM*

Site Information

Intersection	*Riley Road & SR 912 On Ramp*
Jurisdiction	
Analysis Year	*2033 PM1*

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 On Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*60*	*348*			*240*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*66*	*386*	*0*	*0*	*266*	*0*
Percent Heavy Vehicles	*16*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*66*							
C (m) (veh/h)	*1199*							
v/c	*0.06*							
95% queue length	*0.17*							
Control Delay (s/veh)	*8.2*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	1200	330	50	50	50	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.93		0.91	0.85
Flt Protected	0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	3367	1827	3211		1423	1289
Flt Permitted	0.95	1.00	1.00		0.98	1.00
Satd. Flow (perm)	3367	1827	3211		1423	1289
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	1800	495	75	75	75	300
RTOR Reduction (vph)	0	0	67	0	64	51
Lane Group Flow (vph)	1800	495	83	0	128	132
Heavy Vehicles (%)	4%	4%	4%	4%	19%	19%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	52.7	67.1	9.4		11.2	63.9
Effective Green, g (s)	52.6	67.1	9.4		11.2	63.9
Actuated g/C Ratio	0.60	0.76	0.11		0.13	0.72
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	2006	1388	342		180	1006
v/s Ratio Prot	c0.53	c0.27	0.03		c0.09	0.08
v/s Ratio Perm						0.02
v/c Ratio	0.90	0.36	0.24		0.71	0.13
Uniform Delay, d1	15.5	3.5	36.2		37.0	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.7	0.7	1.7		12.5	0.1
Delay (s)	21.3	4.2	37.9		49.5	3.8
Level of Service	C	A	D		D	A
Approach Delay (s)		17.6	37.9		27.2	
Approach LOS		B	D		C	

Intersection Summary

HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	10.1
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	60	610	10	30	1390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.91		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1615		2911	1583	1456	2911
Flt Permitted	0.98		1.00	1.00	0.35	1.00
Satd. Flow (perm)	1615		2911	1583	536	2911
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	39	78	796	13	39	1813
RTOR Reduction (vph)	72	0	0	2	0	0
Lane Group Flow (vph)	45	0	796	11	39	1813
Heavy Vehicles (%)	12%	2%	24%	2%	24%	24%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	7.0		73.7	73.7	73.7	73.7
Effective Green, g (s)	7.0		73.7	73.7	73.7	73.7
Actuated g/C Ratio	0.08		0.81	0.81	0.81	0.81
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	125		2365	1286	436	2365
v/s Ratio Prot	c0.03		0.27			c0.62
v/s Ratio Perm				0.01	0.07	
v/c Ratio	0.36		0.34	0.01	0.09	0.77
Uniform Delay, d1	39.7		2.2	1.6	1.7	4.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8		0.4	0.0	0.4	2.4
Delay (s)	41.5		2.6	1.6	2.1	6.7
Level of Service	D		A	A	A	A
Approach Delay (s)	41.5		2.6			6.6
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2033 PM2(LATE) PEAK HOUR

CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	2	109	58	14	12	24	515	40	170	1105	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.89			0.98		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1639			1766		1770	3539	1583	1770	3538	
Flt Permitted		0.95			0.54		0.10	1.00	1.00	0.27	1.00	
Satd. Flow (perm)		1567			992		181	3539	1583	508	3538	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	27	3	164	87	21	18	36	772	60	255	1658	4
RTOR Reduction (vph)	0	90	0	0	7	0	0	0	13	0	0	0
Lane Group Flow (vph)	0	104	0	0	119	0	36	772	47	255	1662	0
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		13.8			13.8		43.5	41.2	41.2	55.6	48.3	
Effective Green, g (s)		13.8			13.8		43.5	41.2	41.2	55.6	48.3	
Actuated g/C Ratio		0.17			0.17		0.55	0.52	0.52	0.70	0.61	
Clearance Time (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		4.0			4.0		3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)		272			172		145	1836	821	505	2152	
v/s Ratio Prot							0.01	0.22		c0.06	c0.47	
v/s Ratio Perm		0.07			c0.12		0.13		0.03	0.29		
v/c Ratio		0.38			0.69		0.25	0.42	0.06	0.50	0.77	
Uniform Delay, d1		29.0			30.8		10.4	11.8	9.5	5.4	11.5	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.2			11.8		0.9	0.7	0.1	0.8	2.8	
Delay (s)		30.2			42.6		11.3	12.5	9.6	6.2	14.3	
Level of Service		C			D		B	B	A	A	B	
Approach Delay (s)		30.2			42.6			12.2			13.2	
Approach LOS		C			D			B			B	

Intersection Summary

HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	58	42	32	62	142	78	438	70	156	560	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1777		1770	1863	1583	1770	3461		1770	3508	
Flt Permitted	0.70	1.00		0.59	1.00	1.00	0.35	1.00		0.25	1.00	
Satd. Flow (perm)	1295	1777		1105	1863	1583	643	3461		465	3508	
Peak-hour factor, PHF	0.60	0.54	0.88	0.50	0.78	0.91	0.78	0.79	0.73	0.80	0.88	0.75
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	120	129	57	77	95	187	120	665	115	234	764	48
RTOR Reduction (vph)	0	20	0	0	0	152	0	14	0	0	5	0
Lane Group Flow (vph)	120	166	0	77	95	35	120	766	0	234	807	0
Turn Type	Perm			Perm		Perm	Perm			pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8			4		4	2			6		
Actuated Green, G (s)	15.3	15.3		15.3	15.3	15.3	37.6	37.6		53.8	53.8	
Effective Green, g (s)	15.3	15.3		15.3	15.3	15.3	37.6	37.6		53.8	53.8	
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.46	0.46		0.65	0.65	
Clearance Time (s)	6.6	6.6		6.6	6.6	6.6	6.6	6.6		6.6	6.6	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0	7.0	7.0		3.0	7.0	
Lane Grp Cap (vph)	241	330		205	346	294	294	1581		456	2293	
v/s Ratio Prot		c0.09			0.05			0.22		c0.06	0.23	
v/s Ratio Perm	0.09			0.07		0.02	0.19			c0.28		
v/c Ratio	0.50	0.50		0.38	0.27	0.12	0.41	0.48		0.51	0.35	
Uniform Delay, d1	30.1	30.1		29.3	28.7	27.9	14.9	15.6		7.3	6.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.4	2.5		2.4	0.9	0.4	4.2	1.1		1.0	0.4	
Delay (s)	33.4	32.6		31.7	29.6	28.3	19.1	16.7		8.3	6.8	
Level of Service	C	C		C	C	C	B	B		A	A	
Approach Delay (s)		32.9			29.4			17.0			7.2	
Approach LOS		C			C			B			A	

Intersection Summary

HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	82.3	Sum of lost time (s)	13.2
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	0	66	142	16	32	57	535	0	0	614	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95			0.95	
Frt		0.92		1.00	0.90		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1676		1770	1668		1770	3539			3512	
Flt Permitted		0.84		0.66	1.00		0.30	1.00			1.00	
Satd. Flow (perm)		1442		1237	1668		556	3539			3512	
Peak-hour factor, PHF	0.71	0.25	0.79	0.77	0.67	0.57	0.79	0.89	0.62	0.33	0.92	0.64
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	63	0	100	221	29	67	87	721	0	0	801	43
RTOR Reduction (vph)	0	73	0	0	49	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	90	0	221	47	0	87	721	0	0	841	0
Turn Type	Perm			Perm			Perm					
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6					
Actuated Green, G (s)		20.6		20.6	20.6		43.3	43.3			43.3	
Effective Green, g (s)		20.6		20.6	20.6		43.3	43.3			43.3	
Actuated g/C Ratio		0.27		0.27	0.27		0.57	0.57			0.57	
Clearance Time (s)		5.9		5.9	5.9		6.0	6.0			6.0	
Vehicle Extension (s)		5.0		5.0	5.0		7.0	7.0			7.0	
Lane Grp Cap (vph)		392		336	453		318	2022			2006	
v/s Ratio Prot					0.03			0.20			c0.24	
v/s Ratio Perm		0.06		c0.18			0.16					
v/c Ratio		0.23		0.66	0.10		0.27	0.36			0.42	
Uniform Delay, d1		21.4		24.5	20.7		8.3	8.7			9.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.6		6.1	0.2		2.1	0.5			0.6	
Delay (s)		22.1		30.6	20.9		10.4	9.2			9.8	
Level of Service		C		C	C		B	A			A	
Approach Delay (s)		22.1			27.7			9.4			9.8	
Approach LOS		C			C			A			A	

Intersection Summary

HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	75.8	Sum of lost time (s)	11.9
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	153	462	76	319	572	98	53	908	90	329	1220	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3491		1770	3539	1583
Flt Permitted	0.22	1.00	1.00	0.18	1.00	1.00	0.10	1.00		0.09	1.00	1.00
Satd. Flow (perm)	414	3539	1583	339	3539	1583	183	3491		166	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	230	693	114	478	858	147	80	1362	135	494	1830	64
RTOR Reduction (vph)	0	0	64	0	0	114	0	7	0	0	0	15
Lane Group Flow (vph)	230	693	50	478	858	33	80	1490	0	494	1830	49
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	26.0	18.0	18.0	37.0	25.0	25.0	44.0	40.8		61.8	54.6	54.6
Effective Green, g (s)	26.0	18.0	18.0	37.0	25.0	25.0	44.0	40.8		61.8	54.6	54.6
Actuated g/C Ratio	0.23	0.16	0.16	0.33	0.23	0.23	0.40	0.37		0.56	0.49	0.49
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	7.0		3.0	7.0	7.0
Lane Grp Cap (vph)	195	575	257	307	799	357	119	1285		339	1744	780
v/s Ratio Prot	0.09	0.20		c0.21	0.24		0.02	0.43		c0.22	0.52	
v/s Ratio Perm	0.19		0.03	c0.31		0.02	0.25			c0.59		0.03
v/c Ratio	1.18	1.21	0.19	1.56	1.07	0.09	0.67	1.16		1.46	1.05	0.06
Uniform Delay, d1	40.3	46.4	40.1	31.9	42.9	33.9	27.5	35.0		35.1	28.1	14.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	121.2	108.1	0.8	266.1	53.6	0.2	13.9	80.8		221.5	35.8	0.2
Delay (s)	161.5	154.5	40.9	298.0	96.5	34.2	41.4	115.8		256.6	63.9	14.9
Level of Service	F	F	D	F	F	C	D	F		F	E	B
Approach Delay (s)		143.5			155.3			112.1			102.4	
Approach LOS		F			F			F			F	

Intersection Summary

HCM Average Control Delay	123.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	108.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	233	0	37	0	526	47	31	1202	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor				0.95	0.95			0.95	1.00	1.00	0.95	
Frt				1.00	0.96			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.97			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1665	1578			3112	1509	1612	3438	
Flt Permitted				0.95	0.95			1.00	1.00	0.23	1.00	
Satd. Flow (perm)				1665	1553			3112	1509	397	3438	
Peak-hour factor, PHF	0.80	0.92	0.80	0.80	0.92	0.80	0.80	0.75	0.80	0.80	0.77	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	0	0	0	350	0	56	0	842	70	46	1873	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	35	0	0	0
Lane Group Flow (vph)	0	0	0	206	188	0	0	842	35	46	1873	0
Heavy Vehicles (%)	2%	2%	2%	3%	2%	13%	2%	16%	7%	12%	5%	2%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4						2		2	6		
Actuated Green, G (s)				32.0	32.0			46.1	46.1	52.5	52.5	
Effective Green, g (s)				32.0	32.0			46.1	46.1	52.5	52.5	
Actuated g/C Ratio				0.35	0.35			0.50	0.50	0.57	0.57	
Clearance Time (s)				4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)				3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)				576	546			1551	752	257	1951	
v/s Ratio Prot				c0.12	0.12			0.27		0.00	c0.54	
v/s Ratio Perm									0.02	0.10		
v/c Ratio				0.36	0.34			0.54	0.05	0.18	0.96	
Uniform Delay, d1				22.6	22.5			16.0	11.9	10.3	19.0	
Progression Factor				1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2				0.4	0.4			0.4	0.0	0.3	12.3	
Delay (s)				23.0	22.8			16.3	11.9	10.6	31.3	
Level of Service				C	C			B	B	B	C	
Approach Delay (s)		0.0			22.9			16.0			30.8	
Approach LOS		A			C			B			C	

Intersection Summary

HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	92.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	57	21	183	82	105	7	325	136	288	638	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.96			0.96		1.00	0.95		1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3386			3302		1770	3362		1770	3525	
Flt Permitted		0.83			0.74		0.26	1.00		0.20	1.00	
Satd. Flow (perm)		2818			2505		480	3362		365	3525	
Peak-hour factor, PHF	0.69	0.71	0.66	0.68	0.89	0.75	0.58	0.92	0.77	0.60	0.71	0.62
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	19	96	38	323	111	168	14	424	212	576	1078	29
RTOR Reduction (vph)	0	29	0	0	46	0	0	66	0	0	2	0
Lane Group Flow (vph)	0	124	0	0	556	0	14	570	0	576	1105	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		22.7			22.7		25.8	25.0		61.0	55.2	
Effective Green, g (s)		22.7			22.7		25.8	25.0		61.0	55.2	
Actuated g/C Ratio		0.24			0.24		0.28	0.27		0.65	0.59	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		5.0			5.0		3.0	7.0		7.0	7.0	
Lane Grp Cap (vph)		683			607		143	897		702	2077	
v/s Ratio Prot							0.00	0.17		c0.27	0.31	
v/s Ratio Perm		0.04			c0.22		0.03			c0.26		
v/c Ratio		0.18			0.91dl		0.10	0.64		0.82	0.53	
Uniform Delay, d1		28.1			34.6		25.3	30.3		17.8	11.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			19.4		0.3	3.4		10.4	1.0	
Delay (s)		28.4			54.0		25.6	33.8		28.2	12.5	
Level of Service		C			D		C	C		C	B	
Approach Delay (s)		28.4			54.0			33.6			17.9	
Approach LOS		C			D			C			B	

Intersection Summary

HCM Average Control Delay	28.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	93.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	116	381	174	114	354	64	138	513	61	106	707	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.8	6.1	6.1	5.8	6.1		6.0	6.3		6.0	6.3	6.3
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3441		1770	3479		1770	3539	1583
Flt Permitted	0.24	1.00	1.00	0.28	1.00		0.09	1.00		0.25	1.00	1.00
Satd. Flow (perm)	456	3539	1583	515	3441		170	3479		475	3539	1583
Peak-hour factor, PHF	0.97	0.83	0.89	0.89	0.88	0.70	0.82	0.92	0.85	0.72	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	144	551	235	154	483	110	202	669	86	177	1060	238
RTOR Reduction (vph)	0	0	177	0	17	0	0	8	0	0	0	141
Lane Group Flow (vph)	144	551	58	154	576	0	202	747	0	177	1060	97
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	38.6	28.9	28.9	38.8	29.0		56.6	43.9		52.8	42.0	42.0
Effective Green, g (s)	38.6	28.9	28.9	38.8	29.0		56.6	43.9		52.8	42.0	42.0
Actuated g/C Ratio	0.33	0.25	0.25	0.33	0.25		0.48	0.37		0.45	0.36	0.36
Clearance Time (s)	5.8	6.1	6.1	5.8	6.1		6.0	6.3		6.0	6.3	6.3
Vehicle Extension (s)	3.0	7.0	7.0	3.0	7.0		3.0	5.0		3.0	5.0	5.0
Lane Grp Cap (vph)	258	870	389	274	849		255	1299		332	1264	565
v/s Ratio Prot	0.05	0.16		c0.05	c0.17		c0.09	0.21		0.05	c0.30	
v/s Ratio Perm	0.14		0.04	0.14			0.30			0.19		0.06
v/c Ratio	0.56	0.63	0.15	0.56	0.68		0.79	0.57		0.53	0.84	0.17
Uniform Delay, d1	29.7	39.6	34.7	29.6	40.1		27.9	29.4		20.8	34.7	25.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	3.5	0.8	2.6	4.4		15.4	1.0		1.6	5.6	0.3
Delay (s)	32.3	43.1	35.5	32.2	44.4		43.3	30.4		22.4	40.3	26.2
Level of Service	C	D	D	C	D		D	C		C	D	C
Approach Delay (s)		39.5			41.9			33.1			35.9	
Approach LOS		D			D			C			D	

Intersection Summary

HCM Average Control Delay	37.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	18.1
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	5	190	250	60	5	160	299	12	1	636	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		0.97	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1626	1638	1495	3019	1349		2801	2960		970	3525	
Flt Permitted	0.67	1.00	1.00	0.95	1.00		0.95	1.00		0.48	1.00	
Satd. Flow (perm)	1148	1638	1495	3019	1349		2801	2960		492	3525	
Peak-hour factor, PHF	0.70	0.31	0.70	0.70	0.57	0.70	0.70	0.80	0.60	0.70	0.82	0.70
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	12	19	326	429	126	9	274	448	24	2	931	24
RTOR Reduction (vph)	0	0	210	0	3	0	0	4	0	0	2	0
Lane Group Flow (vph)	12	19	116	429	132	0	274	468	0	2	953	0
Heavy Vehicles (%)	11%	16%	8%	16%	42%	3%	25%	19%	59%	86%	2%	3%
Turn Type	Perm		Perm	Prot			Prot			Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2		6					4		
Actuated Green, G (s)	11.2	11.2	11.2	15.0	31.2		10.9	41.9		26.0	26.0	
Effective Green, g (s)	11.2	11.2	11.2	15.0	31.2		10.9	41.9		26.0	26.0	
Actuated g/C Ratio	0.13	0.13	0.13	0.18	0.38		0.13	0.50		0.31	0.31	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.5	3.5	3.5	3.0	3.5		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	155	221	201	545	506		367	1492		154	1103	
v/s Ratio Prot		0.01		c0.14	0.10		c0.10	0.16			c0.27	
v/s Ratio Perm	0.01		c0.08							0.00		
v/c Ratio	0.08	0.09	0.58	0.79	0.26		0.75	0.31		0.01	0.86	
Uniform Delay, d1	31.4	31.5	33.7	32.5	18.0		34.8	12.1		19.7	26.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2	4.3	7.4	0.3		8.3	0.1		0.0	7.4	
Delay (s)	31.7	31.7	38.0	39.9	18.3		43.1	12.3		19.7	34.2	
Level of Service	C	C	D	D	B		D	B		B	C	
Approach Delay (s)		37.4			34.7			23.6			34.2	
Approach LOS		D			C			C			C	

Intersection Summary

HCM Average Control Delay	31.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	83.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2033 PM2 Peak Rodel Analysis - Intersection 8

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E    (m)   8.20   8.20   9.14   8.20          TIME PERIOD    min     90
L'   (m)  10.00  10.00  20.00  10.00          TIME SLICE     min     15
V    (m)   7.20   7.20   7.20   7.20          RESULTS PERIOD min  15 75
RAD  (m)  20.00  20.00  20.00  20.00          TIME COST     $/hr  15.00
PHI  (d)  30.00  30.00  30.00  30.00          FLOW PERIOD    min  15 75
DIA  (m)  50.00  50.00  50.00  50.00          FLOW TYPE  pcu/veh    VEH
GRAD SEP      0      0      0      0          FLOW PEAK am/op/pm     PM

LEG NAME  PCU  FLOWS (1st exit 2nd etc...U)  FLOF  CL   FLOW RATIO    FLOW TIME
SB DICKEY  1.02    17  763    1  0          1.00  85  0.75 1.701 0.75  15 45 75
EB RILEY   1.08   228    6    8  0          1.00  85  0.75 1.701 0.75  15 45 75
NB DICKEY  1.22    14  359  192  0          1.00  85  0.75 1.701 0.75  15 45 75
WB RILEY   1.21     6   72  300  0          1.00  85  0.75 1.701 0.75  15 45 75

FLOW        veh    781    242    565    378
CAPACITY    veh   1726   1315   2029   1457          AVDEL s     3.4
AVE DELAY  mins   0.07   0.06   0.04   0.06          L  O  S      A
MAX DELAY  mins   0.13   0.10   0.07   0.10          VEH HRS     1.9
AVE QUEUE   veh      1      0      0      0          COST  $    28.1
MAX QUEUE   veh      1      0      1      0
```

Summary of Delay at Dickey/Riley Roundabout (#8)					
Approach	SB Dickey	EB Riley	NB Dickey	WB Riley	ALL
Average Delay (mins)	0.07	0.06	0.04	0.06	0.06
Average Delay (secs)	4.2	3.6	2.4	3.6	3.4
LOS	A	A	A	A	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1063	45	116	665	77	43	87	97	47	81	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.98			0.94			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1770	3510		1770	3472			3277			3258	
Flt Permitted	0.15	1.00		0.09	1.00			0.66			0.70	
Satd. Flow (perm)	284	3510		161	3472			2204			2318	
Peak-hour factor, PHF	0.82	0.71	0.51	0.91	0.82	0.66	0.57	0.78	0.71	0.65	0.70	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	227	1797	106	153	973	140	91	134	164	87	139	198
RTOR Reduction (vph)	0	4	0	0	10	0	0	133	0	0	161	0
Lane Group Flow (vph)	227	1899	0	153	1103	0	0	256	0	0	263	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	61.6	49.9		54.6	46.4			17.5			17.5	
Effective Green, g (s)	61.6	49.9		54.6	46.4			17.5			17.5	
Actuated g/C Ratio	0.66	0.53		0.59	0.50			0.19			0.19	
Clearance Time (s)	5.7	5.9		5.7	5.9			6.1			6.1	
Vehicle Extension (s)	3.3	7.0		3.3	7.0			5.0			5.0	
Lane Grp Cap (vph)	374	1877		236	1727			413			435	
v/s Ratio Prot	c0.08	c0.54		0.06	0.32							
v/s Ratio Perm	0.33			0.32				c0.12			0.11	
v/c Ratio	0.61	1.01		0.65	0.64			0.62			0.60	
Uniform Delay, d1	10.4	21.7		19.3	17.3			34.8			34.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.9	23.7		6.2	1.5			4.0			3.5	
Delay (s)	13.2	45.4		25.5	18.8			38.8			38.2	
Level of Service	B	D		C	B			D			D	
Approach Delay (s)		42.0			19.6			38.8			38.2	
Approach LOS		D			B			D			D	

Intersection Summary

HCM Average Control Delay	34.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	93.3	Sum of lost time (s)	17.7
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	248	381	24	10	200	33	7	43	11	62	52	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3499		1770	3455		1770	3447		1770	3107	
Flt Permitted	0.40	1.00		0.44	1.00		0.51	1.00		0.48	1.00	
Satd. Flow (perm)	739	3499		816	3455		947	3447		889	3107	
Peak-hour factor, PHF	0.86	0.87	0.67	0.62	0.72	0.63	0.58	0.77	0.92	0.74	0.81	0.85
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	346	526	43	19	333	63	14	67	14	101	77	339
RTOR Reduction (vph)	0	7	0	0	17	0	0	12	0	0	236	0
Lane Group Flow (vph)	346	562	0	19	379	0	14	69	0	101	180	0
Turn Type	pm+pt			Perm			Perm			pm+pt		
Protected Phases	1	6			2			4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	34.2	34.2		17.2	17.2		8.5	8.5		19.2	19.2	
Effective Green, g (s)	34.2	34.2		17.2	17.2		8.5	8.5		19.2	19.2	
Actuated g/C Ratio	0.54	0.54		0.27	0.27		0.14	0.14		0.31	0.31	
Clearance Time (s)	4.0	5.0		5.0	5.0		4.5	4.5		4.0	4.5	
Vehicle Extension (s)	3.5	5.0		5.0	5.0		3.5	3.5		3.5	3.5	
Lane Grp Cap (vph)	615	1902		223	945		128	466		365	948	
v/s Ratio Prot	c0.12	0.16			0.11			0.02		c0.03	0.06	
v/s Ratio Perm	c0.19			0.02			0.01			c0.05		
v/c Ratio	0.56	0.30		0.09	0.40		0.11	0.15		0.28	0.19	
Uniform Delay, d1	8.4	7.8		17.0	18.6		23.9	24.0		16.2	16.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.2		0.3	0.6		0.4	0.2		0.5	0.1	
Delay (s)	9.7	8.0		17.3	19.2		24.3	24.2		16.7	16.2	
Level of Service	A	A		B	B		C	C		B	B	
Approach Delay (s)		8.6			19.1			24.2			16.3	
Approach LOS		A			B			C			B	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	300	0	0	242	34	741	21	16	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1		6.6	6.6				
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91				
Frt	1.00	1.00			0.98		1.00	0.97				
Flt Protected	0.95	1.00			1.00		0.95	0.97				
Satd. Flow (prot)	1770	3539			3463		3221	1593				
Flt Permitted	0.38	1.00			1.00		0.95	0.97				
Satd. Flow (perm)	708	3539			3463		3221	1593				
Peak-hour factor, PHF	0.79	0.90	0.25	0.92	0.86	0.71	0.90	0.58	0.29	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	33	400	0	0	338	57	988	43	66	0	0	0
RTOR Reduction (vph)	0	0	0	0	11	0	0	5	0	0	0	0
Lane Group Flow (vph)	33	400	0	0	384	0	731	361	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2	2										
Actuated Green, G (s)	47.1	47.1			33.9		56.0	56.0				
Effective Green, g (s)	47.1	47.1			33.9		56.0	56.0				
Actuated g/C Ratio	0.41	0.41			0.29		0.48	0.48				
Clearance Time (s)	6.1	6.1			6.1		6.6	6.6				
Vehicle Extension (s)	3.0	5.0			5.0		4.0	4.0				
Lane Grp Cap (vph)	353	1439			1014		1558	770				
v/s Ratio Prot	0.01	c0.11			c0.11		c0.23	0.23				
v/s Ratio Perm	0.03											
v/c Ratio	0.09	0.28			0.38		0.47	0.47				
Uniform Delay, d1	21.3	23.0			32.6		20.0	20.0				
Progression Factor	0.60	0.58			1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.2			0.5		0.3	0.6				
Delay (s)	12.8	13.5			33.1		20.3	20.6				
Level of Service	B	B			C		C	C				
Approach Delay (s)		13.5			33.1			20.4			0.0	
Approach LOS		B			C			C			A	

Intersection Summary

HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	115.8	Sum of lost time (s)	18.8
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	154	200	705	32	462	392	0	0	0	90	448	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	4.0	6.1	6.1	4.0					6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	1.00					1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00					0.99	1.00
Satd. Flow (prot)	1770	3539	1583	1770	5085	1583					1846	1583
Flt Permitted	0.28	1.00	1.00	0.55	1.00	1.00					0.99	1.00
Satd. Flow (perm)	523	3539	1583	1026	5085	1583					1846	1583
Peak-hour factor, PHF	0.82	0.72	0.77	0.73	0.88	0.93	0.92	0.92	0.92	0.80	0.87	0.79
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	225	333	1099	53	630	506	0	0	0	135	618	235
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	75
Lane Group Flow (vph)	225	333	1099	53	630	506	0	0	0	0	753	160
Turn Type	pm+pt		Free	Perm		Free				Split		Perm
Protected Phases	5	2			6					4	4	
Permitted Phases	2		Free	6		Free						4
Actuated Green, G (s)	47.1	47.1	115.8	33.9	33.9	115.8					56.0	56.0
Effective Green, g (s)	47.1	47.1	115.8	33.9	33.9	115.8					56.0	56.0
Actuated g/C Ratio	0.41	0.41	1.00	0.29	0.29	1.00					0.48	0.48
Clearance Time (s)	6.1	6.1		6.1	6.1						6.6	6.6
Vehicle Extension (s)	3.0	5.0		5.0	5.0						4.0	4.0
Lane Grp Cap (vph)	289	1439	1583	300	1489	1583					893	766
v/s Ratio Prot	0.05	0.09			0.12						c0.41	
v/s Ratio Perm	c0.27		c0.69	0.05		0.32						0.10
v/c Ratio	0.78	0.23	0.69	0.18	0.42	0.32					0.84	0.21
Uniform Delay, d1	27.7	22.5	0.0	30.5	33.1	0.0					26.1	17.2
Progression Factor	1.00	1.00	1.00	1.17	1.15	1.00					1.00	1.00
Incremental Delay, d2	12.4	0.2	2.5	0.6	0.4	0.5					7.6	0.2
Delay (s)	40.1	22.7	2.5	36.3	38.3	0.5					33.7	17.4
Level of Service	D	C	A	D	D	A					C	B
Approach Delay (s)		11.7			22.1			0.0			29.8	
Approach LOS		B			C			A			C	

Intersection Summary

HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	115.8	Sum of lost time (s)	6.6
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	75	0	0	129	1	142	12	38	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	6.0			6.0		5.8	5.8				
Lane Util. Factor	1.00	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			1.00		1.00	0.94				
Flt Protected	0.95	1.00			1.00		0.95	0.98				
Satd. Flow (prot)	1770	3539			3527		1681	1636				
Flt Permitted	0.62	1.00			1.00		0.95	0.98				
Satd. Flow (perm)	1154	3539			3527		1681	1636				
Peak-hour factor, PHF	0.82	0.75	0.92	0.92	0.75	0.25	0.91	0.43	0.86	0.25	0.25	0.29
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	48	120	0	0	206	5	187	33	53	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	28	0	0	0	0
Lane Group Flow (vph)	48	120	0	0	209	0	138	107	0	0	0	0
Turn Type	pm+pt						Split					
Protected Phases	5	2			6		8	8				
Permitted Phases	2											
Actuated Green, G (s)	20.8	18.6			20.0		9.6	9.6				
Effective Green, g (s)	20.8	18.6			20.0		9.6	9.6				
Actuated g/C Ratio	0.43	0.38			0.41		0.20	0.20				
Clearance Time (s)	5.3	6.0			6.0		5.8	5.8				
Vehicle Extension (s)	5.0	5.3			5.3		5.0	5.0				
Lane Grp Cap (vph)	519	1346			1443		330	321				
v/s Ratio Prot	c0.00	0.03			c0.06		c0.08	0.07				
v/s Ratio Perm	0.04											
v/c Ratio	0.09	0.09			0.14		0.42	0.33				
Uniform Delay, d1	8.3	9.7			9.1		17.2	16.9				
Progression Factor	0.54	0.46			1.00		1.00	1.00				
Incremental Delay, d2	0.2	0.1			0.1		1.8	1.3				
Delay (s)	4.7	4.5			9.2		19.0	18.2				
Level of Service	A	A			A		B	B				
Approach Delay (s)		4.5			9.2			18.6			0.0	
Approach LOS		A			A			B			A	

Intersection Summary

HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.19		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	11.1
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	110	302	53	200	0	0	0	0	7	71	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	3539					1770	1750	
Flt Permitted		1.00	1.00	0.61	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1140	3539					1770	1750	
Peak-hour factor, PHF	0.25	0.89	0.79	0.83	0.83	0.92	0.92	0.92	0.92	0.58	0.71	0.62
Growth Factor (vph)	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	0	148	459	77	289	0	0	0	0	14	120	81
RTOR Reduction (vph)	0	0	284	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	148	175	77	289	0	0	0	0	14	172	0
Turn Type			Perm	pm+pt						Split		
Protected Phases		2		1	6					4	4	
Permitted Phases			2	6								
Actuated Green, G (s)		18.6	18.6	23.6	20.0					9.6	9.6	
Effective Green, g (s)		18.6	18.6	23.6	20.0					9.6	9.6	
Actuated g/C Ratio		0.38	0.38	0.48	0.41					0.20	0.20	
Clearance Time (s)		6.0	6.0	5.3	6.0					5.8	5.8	
Vehicle Extension (s)		5.3	5.3	5.0	5.3					5.0	5.0	
Lane Grp Cap (vph)		1346	602	597	1447					347	344	
v/s Ratio Prot		0.04		c0.01	0.08					0.01	c0.10	
v/s Ratio Perm			c0.11	0.05								
v/c Ratio		0.11	0.29	0.13	0.20					0.04	0.50	
Uniform Delay, d1		9.8	10.6	6.9	9.3					15.9	17.5	
Progression Factor		1.00	1.00	1.01	0.94					1.00	1.00	
Incremental Delay, d2		0.1	0.6	0.2	0.2					0.1	2.4	
Delay (s)		9.9	11.2	7.2	8.9					16.0	19.9	
Level of Service		A	B	A	A					B	B	
Approach Delay (s)		10.9			8.5			0.0			19.6	
Approach LOS		B			A			A			B	

Intersection Summary

HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	17.1
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

TWO-WAY STOP CONTROL SUMMARY- Intersection 19

General Information		Site Information	
Analyst		Intersection	*Riley Road & SR 912 Off Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2033 PM2*
Analysis Time Period	*4:45 - 5:45 PM*		

Project Description *SR 912 Traffic Analysis*

East/West Street: *SR 912 Off Ramp* | North/South Street: *Riley Road*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*144*			*228*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*160*	*0*	*0*	*253*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*48*		*156*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*53*	*0*	*173*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*		*R*			
v (veh/h)			*53*		*173*			
C (m) (veh/h)			*673*		*930*			
v/c			*0.08*		*0.19*			
95% queue length			*0.26*		*0.68*			
Control Delay (s/veh)			*10.8*		*9.8*			
LOS			*B*		*A*			
Approach Delay (s/veh)	--	--	*10.0*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY- Intersection 20

General Information		Site Information	
Analyst	*JK*	Intersection	*Riley Road & SR 912 On Ramp*
Agency/Co.	*WSA*	Jurisdiction	
Date Performed	*5/21/2010*	Analysis Year	*2033 PM2*
Analysis Time Period	*4:45 - 5:45 M*		

Project Description *SR 912 Traffic Analysis*	
East/West Street: *SR 912 On Ramp*	North/South Street: *Riley Road*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*60*	*240*			*228*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*66*	*266*	*0*	*0*	*253*	*0*
Percent Heavy Vehicles	*16*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*5*	*0*	*13*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*66*							
C (m) (veh/h)	*1213*							
v/c	*0.05*							
95% queue length	*0.17*							
Control Delay (s/veh)	*8.1*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

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Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (vph)	1200	300	50	50	50	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	0.97	1.00	0.95		1.00	0.95
Frt	1.00	1.00	0.93		0.91	0.85
Flt Protected	0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	3367	1827	3211		1423	1289
Flt Permitted	0.95	1.00	1.00		0.98	1.00
Satd. Flow (perm)	3367	1827	3211		1423	1289
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	1800	450	75	75	75	300
RTOR Reduction (vph)	0	0	67	0	64	51
Lane Group Flow (vph)	1800	450	83	0	128	132
Heavy Vehicles (%)	4%	4%	4%	4%	19%	19%
Turn Type	Prot					pm+ov
Protected Phases	1	6	2		8	1
Permitted Phases						8
Actuated Green, G (s)	52.7	67.1	9.4		11.2	63.9
Effective Green, g (s)	52.7	67.1	9.4		11.2	63.9
Actuated g/C Ratio	0.60	0.76	0.11		0.13	0.72
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	2010	1388	342		180	1006
v/s Ratio Prot	c0.53	c0.25	0.03		c0.09	0.08
v/s Ratio Perm						0.02
v/c Ratio	0.90	0.32	0.24		0.71	0.13
Uniform Delay, d1	15.4	3.4	36.2		37.0	3.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.6	0.6	1.7		12.5	0.1
Delay (s)	21.1	4.0	37.9		49.5	3.8
Level of Service	C	A	D		D	A
Approach Delay (s)		17.6	37.9		27.2	
Approach LOS		B	D		C	

Intersection Summary

HCM Average Control Delay	20.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	30	60	535	10	30	1250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.91		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1615		2911	1583	1456	2911
Flt Permitted	0.98		1.00	1.00	0.39	1.00
Satd. Flow (perm)	1615		2911	1583	592	2911
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	120%	120%	120%	120%	120%	120%
Adj. Flow (vph)	39	78	698	13	39	1630
RTOR Reduction (vph)	72	0	0	2	0	0
Lane Group Flow (vph)	45	0	698	11	39	1630
Heavy Vehicles (%)	12%	2%	24%	2%	24%	24%
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	7.1		76.3	76.3	76.3	76.3
Effective Green, g (s)	7.1		76.3	76.3	76.3	76.3
Actuated g/C Ratio	0.08		0.83	0.83	0.83	0.83
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	125		2430	1321	494	2430
v/s Ratio Prot	c0.03		0.24			c0.56
v/s Ratio Perm				0.01	0.07	
v/c Ratio	0.36		0.29	0.01	0.08	0.67
Uniform Delay, d1	40.0		1.6	1.3	1.3	2.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8		0.3	0.0	0.3	1.5
Delay (s)	41.8		1.9	1.3	1.6	4.3
Level of Service	D		A	A	A	A
Approach Delay (s)	41.8		1.9			4.3
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	91.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Appendix D

Preferred Alternative
Improvement Cost Estimates

LONG RANGE IMPROVEMENTS

A. PREFERRED ALTERNATIVE

SR 912/Dickey Road Connection $17,000,000

Source: Cost estimate provided by INDOT La Porte District via e-mail, May 20, 2010.

Intersection #8: Dickey Road at Riley Road Roundabout

Improvement: It is proposed to construct a roundabout at this location. The intersection is currently signalized. The right of way required to construct the facility would be primarily corner cuts from each quadrant. There is what appears to be an abandoned building in the southeast quadrant that would have to be purchased and removed. In the southwest quadrant, the parking lot would be impacted by the facility. In the design phase of this project it may be possible to shift the location of the roundabout to the north and east to reduce the impacts. In both north quadrants, there would be lesser impacts to facilities. Utility poles in the vicinity would have to be relocated.

Construction Costs: Typical roundabouts of this size historically cost from $500,000 to $ 750,000. The primary issue at this location is the maintenance of traffic, primarily truck traffic. It is assumed that this will add a significant cost to the overall budget of the project. For budgeting purposes it is suggested to use $1,250,000.

Roundabout $1,250,000

SR 912/Riley Road Ramp Reconstruction $6,000,000

Source: Cost estimate provided by INDOT La Porte District via e-mail, May 20, 2010.

Traffic Signal Work

Costs per intersection:

- New signal -$200,000 (Calumet/SR 912 North Ramp)
- $10,000 for traffic signal preemption equipment (3 intersections: SR 912/Dickey, Dickey/(ArcelorMittal) Plant Entrance, Indianapolis/Riley). Assume preemption emitters will have already been procured by police, fire, and ambulance as part of short range improvements.
- $4,000 for radio equipment (6 intersections: Dickey/Plant Entrance, SR 912/Dickey, Dickey/Michigan, Indianapolis/Riley, Indianapolis/McShane, and Indianapolis/Columbus)
- $4,000 for signal retiming (6 intersections: Dickey/Plant Entrance, SR 912/Dickey, Dickey/Michigan, Indianapolis/Riley, Indianapolis/McShane, and Indianapolis/Columbus)

New Signal	1 x $200,000	$200,000
Preemption Equipment	3 x $10,000 `	$30,000
Radio Equipment	6 x $4,000/each	$24,000
Timing Optimization	6 x $4,000/each	$24,000
Total		$278,000 Say $280,000

Communications Link between Dickey Drawbridge and Police, Fire, and Ambulance

3 Contact Closure Radios	$12,000
3 Contact Closure Transceivers	$1, 000
Installation	$3,000
Appurtenances (notification lights, etc)	$2,000
Total	$18,000 Say, $20,000

Communications Link between Dickey Drawbridge and Motoring Public – 8 Locations
Assume power available in close proximity to each site.

Contact Closure Radio + Transceiver	8 x $4,300	$34,400
Sign + Yellow Flasher	8 x $2,500	$20,000
Installation	8 x $3,000	$24,000
Total		$78,400 Say, $80,000

Existing SR 912 Bridge Demolition (includes Riley Rd. Ramps B&D removal) $39,000,000

Source: Cost estimate provided by INDOT La Porte District via e-mail, June 2, 2010.

PREFFERRED ALTERNATIVE TOTAL $63,630,000

B. SUPPORTING INTERSECTION IMPROVEMENTS

Intersection 5: Indianapolis Blvd. (US 20/US12) and Riley Road

Existing R/W on Indianapolis Blvd. (US 20/US12) is approximately 90 feet. Existing R/W on Riley road is 66 feet.

Improvements to the intersection are:

1. Add median left turn lane to existing 4-lane curbed section on Indianapolis Blvd. on both the north and south approaches.
2. Add right turn lane to south approach of Indianapolis Blvd. .
3. Modify Signal to new geometry.
4. No improvements to the Riley Road Approach.

Considerations:

1. Indianapolis Blvd. should be widened on both sides of the roadway to reduce limits of construction and to reduce impacts to utilities and R/W in corridor. R/W will be required in the SE quadrant to construct right turn lane regardless.

Costs: $1,500,000

Intersection #6: Indianapolis and Columbus Drive (US 12)

Existing Condition: Indianapolis Blvd. is a 4-lane north-south route with 90' of R/W, and Columbus Drive (US 12) is a 4-lane east-west route with 80' of R/W. Indianapolis also has parking on the both sides of the south leg. The pavement width of Indianapolis Blvd. is approximately 55' for both the north and south approaches.

Improvement: Resurface and restripe the north (500') and south (300') approaches of Indianapolis to provide left turn lanes with 2 thru lanes for both north and south traffic. Modify signal and loops to accommodate new geometrics. Also, request the local agency to revise the parking ordinance on the south approach of Indianapolis. No work is anticipated on Columbus Drive (US12).

Costs:

Striping		$2,000.00
Modify Signal		$50,000.00
Surface Mill 1.5"	800' x 55'/ 9sft/sys = 4888 sys @ $3.00/sys ~	$15,000.00

HMA Surface	4888sys x 165#/sys/2000#/Ton = 403 Tons @ $100/Ton ~	$40,000.00
Miscellaneous		$15,000.00
Total		$122,000.00

Intersections #13 & 14: Improvements to US 12 at the SR 912 Service Road Intersections:

Improvements to the intersections are:

1. Provide three lanes for NB off ramp movement at east intersection, carrying through three lanes WB through the west intersection to the point for existing WB is 3 lanes.
2. Modify west intersection to provide EB to SB and WB to NB ~continuous movements, adjust SB approach to accommodate.

Costs:

1)	Replace signals 2@$150,000 each	$300,000
2)	Replace 2 overhead sign structures 2@$100,000 each	$200,000
3)	Add third thru WB lane with shoulder/curb on US 12 in median (2200 lft) 2200' x 16'/9 sft/sys x $200.00/ sys	$782,000
4)	Reconstruct WB left turn lane and West Ramp termini 550' x 12'/9 sft/sys x $200.00 /sys	$147,000
5)	Upgrade barrier for median pier protection of SR 912 bridge over US 12.	$100,000
6)	Add 800'left turn lane to SR 912 NB exit ramp 800'x 16' /9 sft/sys x $200.00/ sys	$285,000
7)	Pier protection for SR 912 SB Ramp Bridge to East bound US 12	$100,000
8)	Maintenance of traffic	$200,000
9)	Mobilization	$125,000
10)	Miscellaneous (25%) (includes drainage, patching, etc.)	$530,000
	Total	$2,769,000
		Say, $2,800,000

Intersection # 21: Dickey Road/East SR 912 Terminus

Assuming costs for the signal at intersection is incorporated in the INDOT project of Preferred Alternative. Assuming all widening is to the north.

Costs:

Curb	1,000' @ $30.00/ft	$30,000.00
Surface Milling 1.5"	1,000' x 48'/9sft/sys = 5,333 sys @ $3.00/sys	$16,000.00
HMA for Widening	1,000' x 12'/9sft/sys = 1,333 sys@ $85/sys	$113,305.00
HMA Surface	5,333 sys + 1,333 sys ~ 6700sys @ $5/sys	$33,500.00
Miscellaneous	25%	$48,000.00
Total		$240,805.00 Say, $241,000

SUPORTING INTERSECTION IMPROVEMENTS TOTAL $4,663,000