Truck Routing Study

Elwood and Joliet, Illinois

June 2015

Prepared for:

Village of Elwood

Kimley»Horn

INTRODUCTION

Kimley-Horn and Associates, Inc. (Kimley-Horn) was retained by the Village of Elwood to evaluate the operational performance of a number of key intersections with proximity to several large intermodal and industrial facilities in Elwood and Joliet. The analyses were based on regional traffic data collected by Kimley-Horn in March of 2015 following the court-ordered closure of the west leg of Illinois Route 53 (IL 53) and Walter Strawn Drive. In addition, an evaluation of two potential routes for trucks entering/leaving the Elwood and Joliet intermodal facilities was performed to provide a high-level review of the potential feasibility of using one or both of these routes for heavy vehicles.

As a part of this study, key intersections were identified by the Village of Elwood and analyzed to determine current operations during three time periods: the hour of highest vehicle activity during the morning peak hour, the similar period during evening peak hour, and the hour of highest truck volume during the day. Queue observations were conducted for the west leg of Laraway Road at IL 53 during these peak hours to quantify existing queuing and compare to analytical outputs from capacity software. Finally, potential improvements were identified at key intersections along the two corridor routes to increase the future capacity of the corridors. This report summarizes the study methodology, analyses, and key findings.

EXISTING CONDITIONS

Kimley-Horn prepared capacity analyses at key intersections in the Elwood and Joliet area and conducted queue observations at the IL 53/Laraway Road intersection. This section of the report details the results of count data collection and summarizes the results of the capacity analyses and queue observations.

Traffic Count Data

Intersection turning movement count data was reviewed for the following intersections, which are displayed on **Exhibit 1**:

- Arsenal Road/Elwood International Port Road
- Arsenal Road/Frontage Road
- IL 53/Laraway Road
- IL 53/Schweitzer Road
- IL 53/Millsdale Road
- IL 53/Manhattan Road/Arsenal Road
- Laraway Road/Centerpoint Way

The referenced data was collected over a 13-hour period (5AM to 6PM) on Wednesday, March 18, 2015. The counts included vehicle classification to identify the respective volume of cars, light trucks, and heavy vehicles. For each intersection, the hour of highest vehicle activity during the morning (6AM to 9PM) and evening (3PM to 6PM) was identified. Additionally, the hour of highest truck volume during the day (between 5AM to 6PM) was determined. These peak hours are shown in **Table 1**. The peak hour volumes and percent of heavy vehicles at each intersection are summarized on **Exhibits 2, 3 and 4** respectively for the morning, evening, and truck peak hours.

Table 1. Existing (Year 2015) Peak Hours

Intersection	AM Peak Hour	PM Peak Hour	Truck Peak Hour
Arsenal Road/Elwood International Port Road	6:15 to 7:15 AM	4:00 to 5:00 PM	1:15 to 2:15 PM
Arsenal Road/Frontage Road	6:00 to 7:00 AM	4:00 to 5:00 PM	12:30 to 1:30 PM
IL 53/Laraway Road	6:30 to 7:30 AM	4:00 to 5:00 PM	1:00 to 2:00 PM
IL 53/Schweitzer Road	6:15 to 7:15 AM	4:15 to 5:15 PM	9:15 to 10:15 AM
IL 53/Millsdale Road	6:00 to 7:00 AM	4:15 to 5:15 PM	9:15 to 10:15 AM
IL 53/Arsenal Road/Manhattan Road	6:15 to 7:15 AM	4:15 to 5:15 PM	9:15 to 10:15 AM
Laraway Road/Centerpoint Way	8:30 to 9:30 AM	3:00 to 4:00 PM	1:15 to 2:15 PM

As shown on Exhibits 2 through 4, truck volumes account for a significant portion of traffic at each of the study intersections. The intersection of Arsenal Road/Elwood International Port Road serves as the apex of intermodal-related truck traffic. Over 18,000 vehicles per day travel thru this intersection and 71 percent of these movements are trucks—including over 10,000 articulated heavy vehicles. To put this in perspective, both I-55 north of Arsenal Road and I-80 east of I-55 carry just over 14,000 heavy vehicles on a daily basis, meaning this intersection is carrying truck volumes approaching those associated with major interstate routes.

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EXHIBIT 1
INTERSECTION LOCATIONS

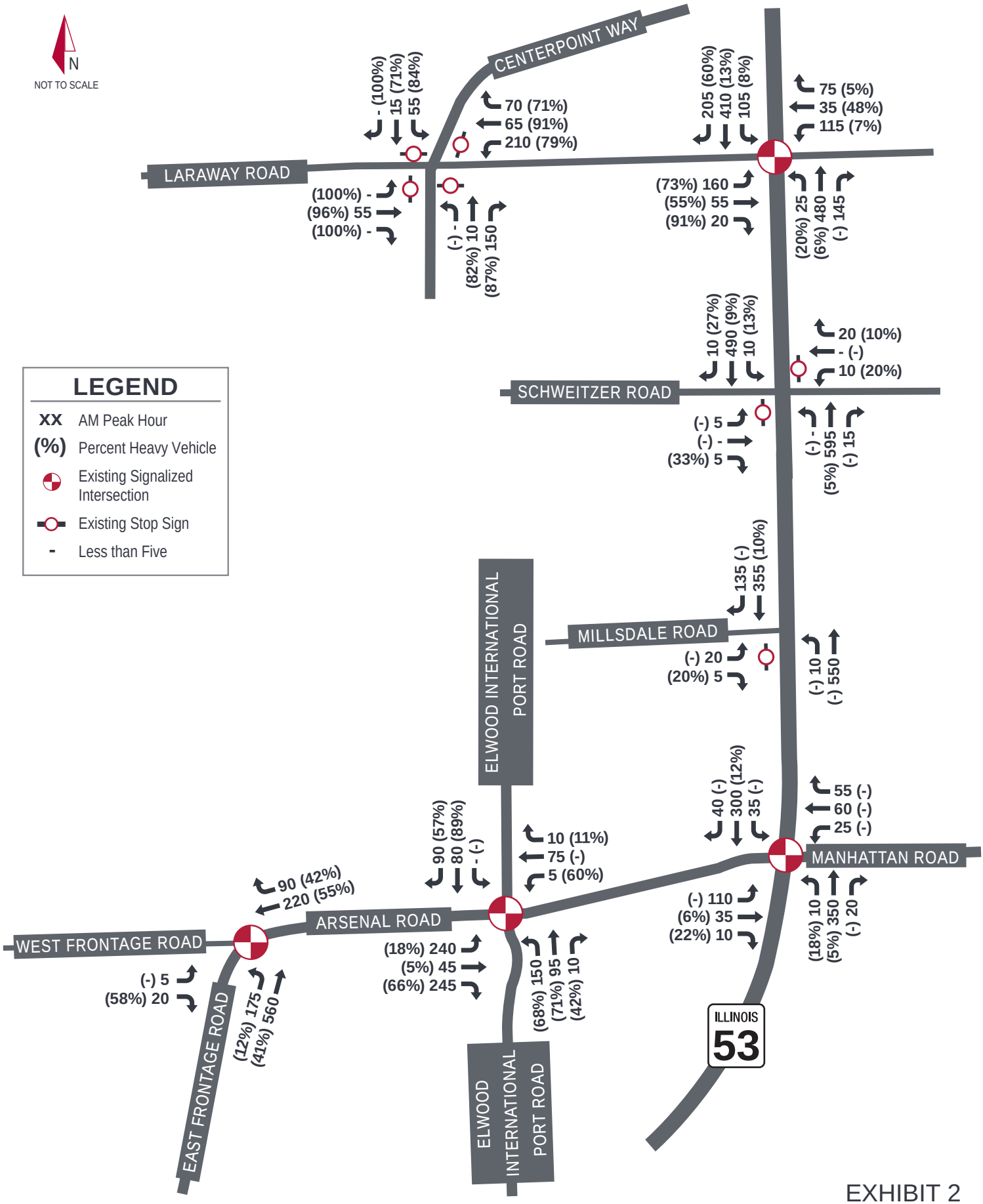

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EXHIBIT 2

EXISTING 2015 TRAFFIC VOLUMES
MORNING PEAK HOUR

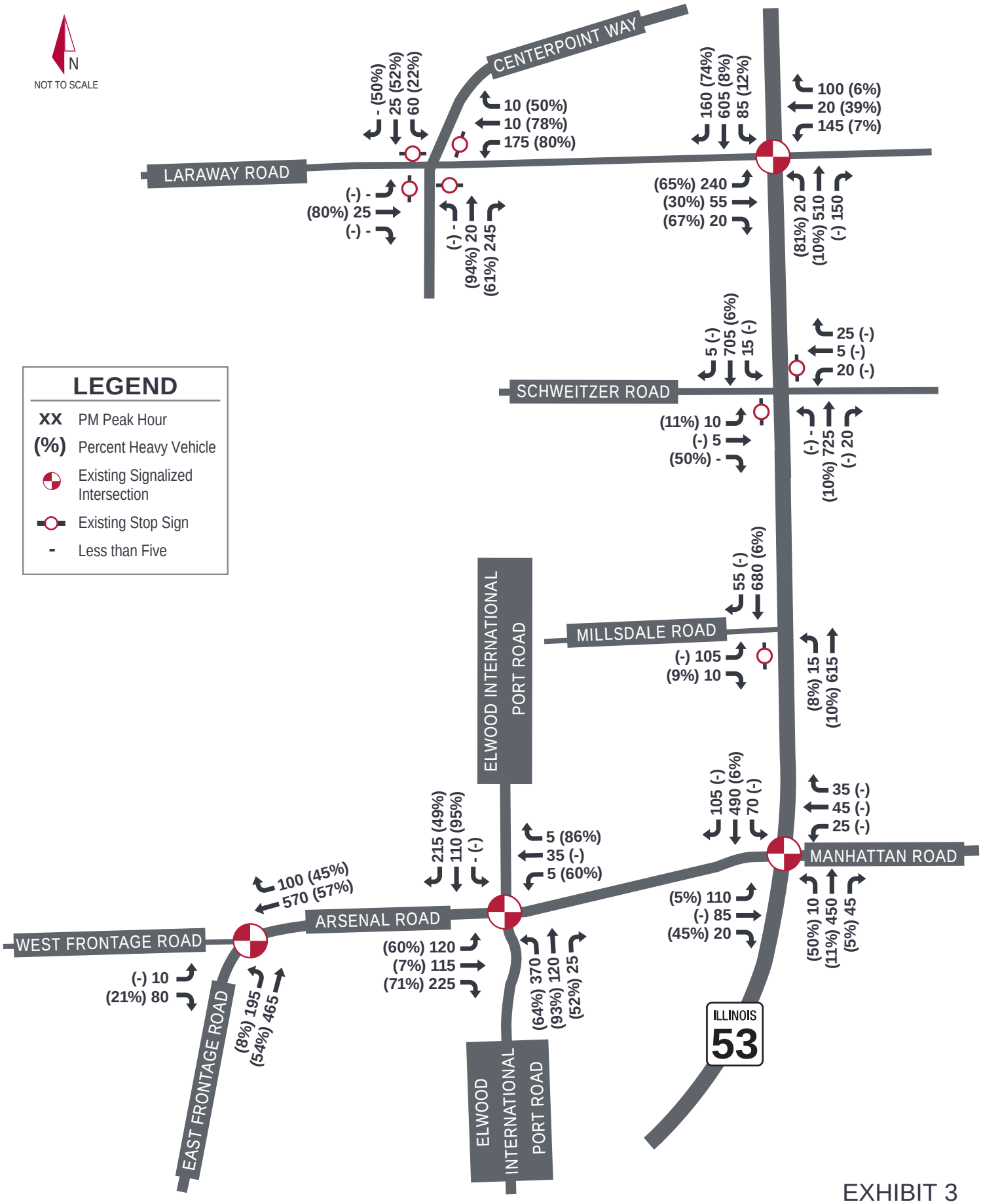

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EXHIBIT 3

EXISTING 2015 TRAFFIC VOLUMES
EVENING PEAK HOUR

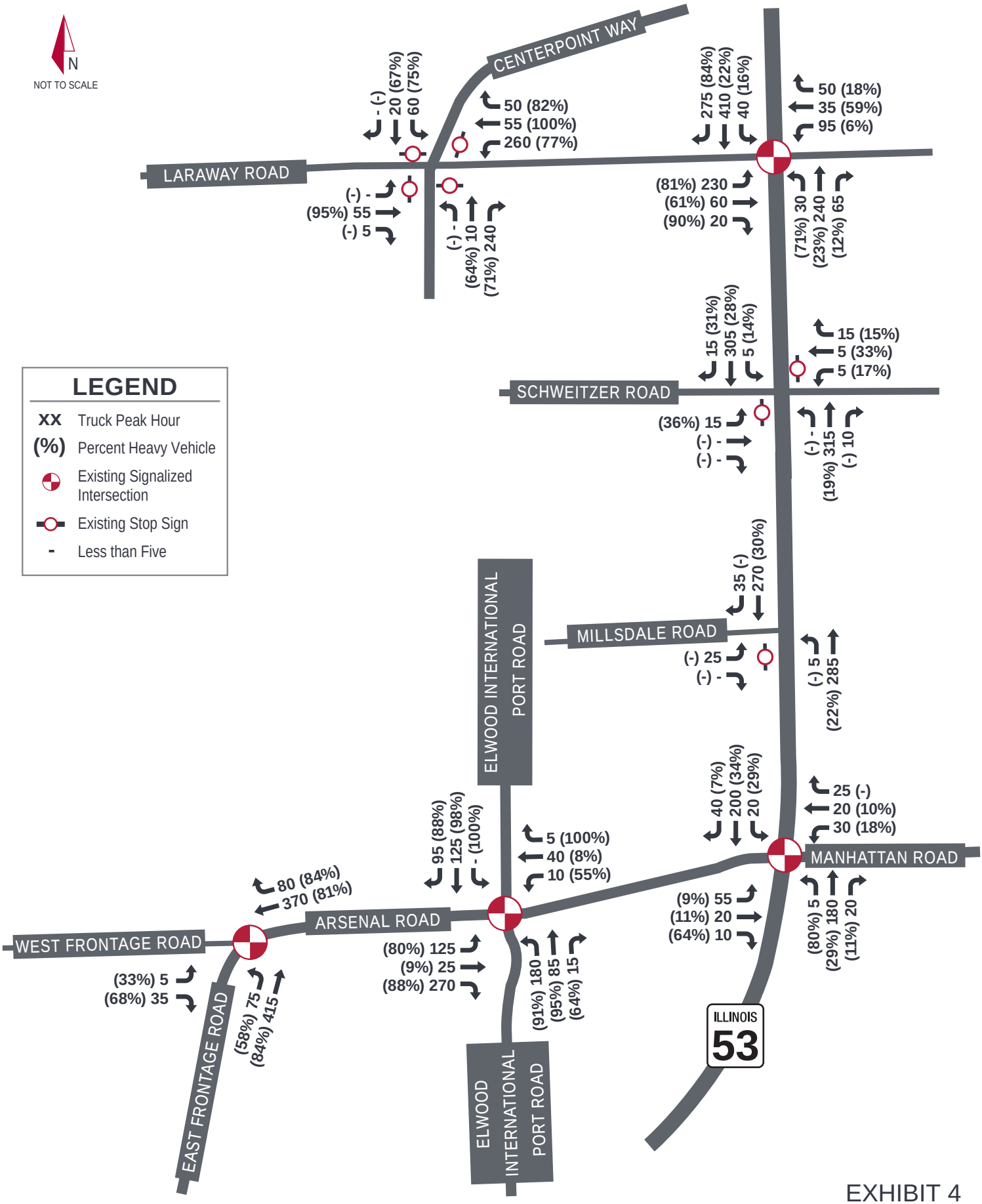

EXHIBIT 4

EXISTING 2015 TRAFFIC VOLUMES
TRUCK PEAK HOUR

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Existing Capacity Analyses

Capacity analyses were conducted to assess the existing conditions at key area intersections. The capacity of an intersection, or its ability to accommodate traffic volumes, is expressed in terms of Level of Service (LOS), based on the average vehicle delay per vehicle passing through an intersection. Levels of Service range from A to F, with LOS A as the highest (best traffic flow and least delay), LOS E as saturated or at-capacity conditions, and LOS F as the lowest (oversaturated conditions). The minimum LOS that is generally accepted by reviewing agencies in northeastern Illinois is LOS D.

The LOS grades shown below, which are provided in the Transportation Research Board's Highway Capacity Manual (HCM), quantify and categorize the driver's discomfort, frustration, fuel consumption, and travel times experienced as a result of intersection control and the resulting traffic queuing. A detailed description of each LOS rating can be found in **Table 2**.

Table 2. Level of Service Grading Descriptions[1]

Level of Service	Description
A	Minimal control delay; traffic operates at primarily free-flow conditions; unimpeded movement within traffic stream.
B	Minor control delay at signalized intersections; traffic operates at a fairly unimpeded level with slightly restricted movement within traffic stream.
C	Moderate control delay; movement within traffic stream more restricted than at LOS B; formation of queues contributes to lower average travel speeds.
D	Considerable control delay that may be substantially increased by small increases in flow; average travel speeds continue to decrease.
E	High control delay; average travel speed no more than 33 percent of free flow speed.
F	Extremely high control delay; extensive queuing and high volumes create exceedingly restricted traffic flow.

1 - Highway Capacity Manual 2010

The range of control delay for each rating (as detailed in the HCM) is shown in **Table 3**. Because signalized intersections are expected to carry a larger volume of vehicles and stopping is required during red time, note that higher delays are tolerated for the corresponding LOS ratings.

Table 3. Level of Service Grading Criteria[1]

Level of Service	Control Delay per Vehicle (s/veh) at:	
	Unsignalized Intersections	Signalized Intersections
A	0 – 10	0 – 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F[2]	> 50	> 80

1 - Highway Capacity Manual 2010

2 - All movements with a Volume to Capacity (v/C) ratio greater than 1 receive a rating of LOS F.

Based on the HCM standards, capacity results were identified for the study intersections under existing conditions. Due to the amount of articulated trucks present in the corridor, the HCS 2010 inputs were adjusted to reflect the maximum permitted heavy vehicle length of 70 feet, which is reflected in the displayed queue storage ratio. For the purposes of this study, the 95th percentile queue lengths were calculated assuming all heavy vehicles are WB-65 vehicles (73.5 feet in length) and would leave 6 feet of spacing between the vehicles in front of them.

Signal timings were obtained from the Illinois Department of Transportation (IDOT) for the intersections of IL 53/Laraway Road and Manhattan Road/Arsenal Road. It should be noted that the intersections with IL 53 were analyzed as single intersections that run "free" (actuated and uncoordinated with no set cycle length) based on timing information provided by IDOT staff.

Additionally, signal timings were provided from the Will County Division of Transportation (WCDOT) for the Arsenal Road intersections at Elwood International Port Road and Frontage Road. It should be noted that the Arsenal Road/Frontage Road intersection is part of an interconnected signal system from the intersection with ExxonMobil Gate A (located to the south) to the intersection with ExxonMobil driveway (located 2,550 feet east of the Arsenal Road/Frontage Road intersection).

Capacity analyses for the study intersections do not include any right-turn-on-red (RTOR) volumes per IDOT requirements, despite the fact that these movements are permitted. The results can therefore be assumed to be conservative since RTOR movements could, and do, occur at the study intersections.

The capacity analysis results for the study intersection are summarized in **Table 4**. It should be noted that the truck peak hour reflects the hour of highest truck activity at each intersection. Therefore, although this hour has the highest volume of truck traffic, the total volume of traffic through the intersection may be higher during another peak hour due to the amount of passenger vehicle traffic. As such, operations at an intersection may be worse during a morning or evening peak hour despite a lower volume of truck traffic.

Table 4. Existing (Year 2015) Levels of Service [1]

Intersection	AM Peak Hour		PM Peak Hour		Truck Peak Hour	
	Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Arsenal Road/Elwood International Port Road ★						
Northbound Approach	26	C	27	C	23	C
Southbound Approach	22[3]	B	26[3]	C	23[3]	C
Eastbound Approach[2]	24	C	29	C	27	C
Westbound Approach	31[3]	D	51[3]	D	51[3]	D
Overall Intersection	*25*	*C*	*28*	*C*	*26*	*C*
Arsenal Road/Frontage Road ★						
Northbound Approach	1	A	2	A	1	A
Southbound Approach	3	A	5	A	4	A
Eastbound Approach	41	D	38	D	34	C
Overall Intersection	*2*	*A*	*6*	*A*	*4*	*A*
IL 53/Laraway Road ★						
Northbound Approach	26[3]	C	28[3]	C	27[3]	C
Southbound Approach	25	C	24	C	27[4]	C
Eastbound Approach	40	D	75[3]	E	48	D
Westbound Approach	42	D	40	D	38	D
Overall Intersection	*29*	*C*	*35*	*C*	*32*	*C*
IL 53/Schweitzer Road △						
Northbound Left-Turn/Through	9	A	10-	A	8	A
Southbound Left-Turn	10-	A	10-	A	8	A
Eastbound Approach	14	B	17	C	11	B
Westbound Approach	14	B	23	C	13	B
IL 53/Millsdale Road △						
Northbound Left-Turn	9	A	10-	A	8	A
Eastbound Approach	13	B	24	C	11	B
IL 53/Arsenal Road/Manhattan Road ★						
Northbound Approach	15	B	16	B	12	B
Southbound Approach	14	B	14	B	12	B
Eastbound Approach	52	D	63	E	29	C
Westbound Approach	52	D	61	E	28	C
Overall Intersection	*25*	*C*	*25+*	*C*	*17*	*B*

★ - Signalized Intersection △ - Minor-Leg Stop-Controlled Intersection

1 - Based upon HCM 2010 procedures

2 - To account for the impacts of the free flow eastbound right-turn on the operation of the intersection, the volume for the movement was removed from the analysis.

3 - Left-turn movement operates at LOS F.

4 - Left-turn movement operates at LOS E.

Table 4. Existing (Year 2015) Levels of Service [1] *(Continued)*

Intersection	AM Peak Hour		PM Peak Hour		Truck Peak Hour	
	Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Laraway Road/Centerpoint Way ▲						
Northbound Approach	13	B	17	C	17	C
Southbound Approach	12	B	11	B	13	B
Eastbound Approach	12	B	11	B	12	B
Westbound Approach	18	C	18	C	27	D
Overall Intersection	*15+*	*C*	*16*	*C*	*21*	*C*

▲ - All-Way Stop-Controlled Intersection

As shown in Table 4, the study intersections generally operate acceptably during the morning, evening, and truck peak hours. This is particularly note-worthy as the counts were performed nearly two months after the Walter Strawn closure went into effect and likely represent the performance of the transportation network after some level of equilibrium had been established following the closure. With minor exceptions, the study network was able to accommodate the associated redistribution of intermodal traffic while maintaining adequate performance during a variety of peak traffic conditions.

It should be noted that this analysis reviews operations at these key intersections during the periods with the highest vehicle activity respective to each intersection. In some cases, particular movements operate with delay exceeding the threshold for LOS D. These cases are detailed below within a summary of existing operations at each of the study intersections.

Arsenal Road/Elwood International Port Road

The Arsenal Road/Elwood International Port Road intersection appears to operate free with the eastbound right-turn operating free-flow (no delay). As such, green time is allocated to various movements at the intersection based upon the relative demand for each movement/lane group at the intersection. The westbound and southbound left-turn movements operate at LOS F during the study peak hours. Since count data shows minimal demand (0 to 5 vehicles) for these movements during the peak hours, the green time allocated to them makes up a small percentage of the total green time allocated to the signal. For example, if a westbound left-turning vehicle arrives right after the green time for this movement has ended, then this motorist will have to wait through the green time allocated to all other movements. Based on field observations, it appears that this wait time could exceed 80 seconds, which is the minimum threshold for LOS F. Due to the low volume of vehicles affected, this does not have a significant impact on the delay for the westbound approach or overall intersection. All 95th percentile queues shown during the study peak hours can be accommodated within the provided storage bays.

Arsenal Road/Frontage Road

The Arsenal Road/Frontage Road intersection operates acceptably, with very low delay for vehicles traveling north- and southbound through the intersection. As previously noted, the capacity analysis does not consider the ability for vehicles to make a RTOR, despite the fact that these movements are not prohibited at the intersection. Therefore, the delays and queueing shown in the analysis for the

southbound and eastbound right-turns are likely lower than the capacity results indicate. Based upon the capacity analysis, the 95th percentile queues are accommodated within the available storage.

IL 53/Laraway Road

The IL 53/Laraway Road intersection performs acceptably, with the overall intersection operating at LOS D or better during all peak hours. The northbound left-turn movement is shown to operate at LOS F during the peak hours, presumably due in part to the protected-only phasing in place for these movements. Similarly, the southbound left-turn is shown to operate at LOS E during the truck peak hour, and the eastbound left-turn is shown to operate at LOS F during the evening peak hour. All other movements and approaches operate at LOS D or better. The 95th percentile queue for the eastbound left-turning movement is shown to be the highest during the evening peak hour at approximately 590 feet, which would extend into the eastbound through lane, or as observed in the field, into the westbound left-turn lane provided at Stone City Drive. During the evening and truck peak hours, the 95th percentile queue for the northbound left-turning movement is also shown to extend beyond the provided storage by approximately 30 feet. Since the taper would provide a width of approximately 9 feet at this location, the queues for this movement would likely be accommodated without affecting through traffic.

IL 53/Schweitzer Road

The minor-leg stop-controlled intersection of IL 53/Schweitzer Road operates acceptably with all approaches and movements at LOS C or better. Based upon the capacity analysis, the existing storage length provided for the southbound left-turn lane accommodates the 95th percentile queues of less than one vehicle. The existing median on IL 53 allows for minor leg vehicles crossing or turning left onto IL 53 to complete these movements in two stages (crossing each direction of traffic in separately with a pause within the median width). The ability for vehicles to make two-stage left-turn and through movements, combined with the low volume of traffic for these legs, results in 95th percentile queues of less than one vehicle in length for the minor street.

IL 53/Millsdale Road

The minor-leg stop-controlled intersection of IL 53/Millsdale operates acceptably with all approaches and movements operating at LOS C or better. Based upon the capacity analysis, the 95th percentile queues of less than one vehicle for the northbound left-turn can be accommodated within the available storage. The eastbound left-turn operates similarly to the minor legs of the IL 53/Schweitzer Road intersection, with the longest 95th percentile queue for the movement shown as less than two vehicles during the evening peak hour.

IL 53/Arsenal Road/Manhattan Road

The signalized intersection of IL 53/Arsenal Road/Manhattan Road generally operates acceptably under existing conditions. The majority of movements and approaches operate at LOS D or better. During the evening peak hour, the east- and westbound approaches are shown to operate at LOS E. This delay is primarily a result of the longer cycle length. A vehicle arriving at the end of the green phase for this movement would likely have to wait over the 55-second threshold for LOS D for the phase to return to these legs. Based upon the capacity analysis, the 95th percentile queues for the north- and southbound left-turns are contained within the provided storage bays.

Laraway Road/Centerpoint Way

The all-way stop-controlled Laraway Road/Centerpoint Way intersection operates at LOS D or better for all approaches. Due to the slight north-south offset of the intersection, the existing pavement on the east leg is striped with exclusive left- and right-turn lanes, with no provision for through movements. Therefore, in order to account for the westbound through movement in the analysis, the east leg was assumed to operate with a shared left-turn/through lane and an exclusive right-turn lane.

Laraway Road Queue Observations

It is understood that there are concerns about vehicle queuing that occurs along the west leg of IL 53/Laraway Road, particularly given the intersection's proximity to the Laraway Elementary School and the at-grade rail crossing west of the school. While the elementary school has plans to relocate and has purchased property to do so once the existing facility is sold, Kimley-Horn performed an evaluation of vehicle queuing to better understand the magnitude of the issue presently.

To quantify the existing queuing that occurs on the west leg, observations were conducted at the intersection on Thursday, May 22, 2015, during the three study peak hours. As previously detailed, these peak hours occurred at the intersection from 6:30AM to 7:30AM during the morning, from 4:00PM to 5:00PM in the evening, and from 1:00PM to 2:00PM (the hour of highest truck volume during the day). A summary of the queue observations is detailed in **Table 5**.

Table 5. Summary of Observed Queue Distances (Eastbound approach of IL 53/Laraway Road)

	Approximate Observed Queue Length (feet)		
Type	AM Peak Hour	PM Peak Hour	Truck Peak Hour
Observed Minimum	0	0	0
Observed Maximum	640	640	715
Calculated Average	185	175	250
Calculated 95th Percentile	481	475	585

In most cases, the majority of eastbound left turns would clear within the provided green time. The maximum queue observed—approximately 715 feet—extended to the intersection with Stone City Drive. Vehicles anticipating making an eastbound left-turn would stack within the westbound left-turn lane provided for access to Stone City Drive, which allowed for through and right-turning vehicles to bypass the left-turn queue. During the analyzed peak hours, the calculated 95th percentile queues (ranging between 475 and 585 feet) extended into the taper of the Stone City Drive westbound left-turn lane. During the AM and PM peak hours, the average queues are calculated as 189 and 175 feet. Both of which would be accommodated within the existing 200 feet of storage. During the hour of heaviest truck activity, the average observed queue for the movement was calculated to be 250 feet, which would result in the queue extending into the provided 200-foot taper length.

The 95th percentile queues calculated from the queue observations were compared to those projected in the capacity analysis. This comparison is shown in **Table 6.**

Table 6. Comparison of 95th Percentile Queues (Eastbound Approach of IL 53/Laraway Road)

Calculated from:	95th Percentile Queue Length (feet)		
	AM Peak Hour	PM Peak Hour	Truck Peak Hour
Queue Observations	480	475	585
Capacity Analysis	520	585	350

As shown in Table 6, the observed 95th percentile queues were shorter during the morning and evening peak hours than shown in the capacity analysis, and the observed 95th percentile queues were longer during the truck peak hour than shown in the capacity analysis. These variations are most likely due to day-to-day fluctuations in the amount of traffic traveling through the intersection.

Based upon these observations, existing eastbound queues do appear to regularly exceed the storage provided for left-turns at the IL 53/Laraway intersection, but were not observed to extend west such that they would impact the Laraway Elementary School access driveways or the at-grade rail crossing. While it is possible that an occasional event may result in more significant queuing on the west leg, observations would suggest that impacts to either location (school or crossing) are anomalies as opposed to typical occurrences.

ROUTING CAPACITY

At the direction of the Village of Elwood, Kimley-Horn was asked to evaluate, from a traffic operations perspective, two identified routes that could individually, or in combination, be used to accommodate safe access for trucks and overweight/oversized vehicles associated with the intermodal facilities. This section of the report outlines the methodology for evaluating these two potential routes, provides an overview of the route scenarios, and details the evaluation of each. Potential intersection improvements are also identified at key intersections along each route based on the evaluation process.

Evaluation Methodology

The following steps were taken as part of the evaluation process for the key intersections:

(1) Improvements that are warranted or needed to mitigate existing capacity deficiencies were identified based upon turn lane guidelines contained in the IDOT *Bureau of Design and Environment (BDE) Manual* and signal warrant guidelines contained within the *Illinois Manual on Uniform Traffic Control Devices (IL MUTCD).*
(2) Movements that primarily serve traffic to/from the intermodal facilities were identified for each key intersection.
(3) Kimley-Horn identified critical movements and/or approaches that are most likely to develop unacceptable operations or, when exceeding available storage, would constrain area traffic traveling through the intersection.
(4) The critical peak hour was determined based on the results of existing capacity analyses.
(5) Critical movements were increased to reflect the higher utilization likely to result from continued growth at the intermodals until maximums associated with capacity (LOS E) or queuing were reached.
(6) Where deemed appropriate, a final stage of analysis was conducted to reach an ultimate capacity for one or more critical movements assuming the improvements/mitigation measures identified in *Step 5* were completed.

The results of the evaluation were then compared for the key intersections along each route. The available capacity along a particular route was limited to the minimum amount of capacity that was determined to be available at the evaluated intersections.

Route Scenarios

Two potential routes have been identified to accommodate overweight and oversized trucks traveling between I-55 and I-80 and the Elwood and Joliet Intermodal facilities. The routes are as follows:

Route Scenario 1 (Arsenal Road to I-55) would have trucks traveling to/from the intermodal facilities using Arsenal Road to access I-55 and includes the following key intersections:

- Arsenal Road/Elwood International Port Road
- Arsenal Road/Frontage Road

*Route Scenario 2 (*Laraway Road to IL 53 to I-80*)* would have trucks traveling to/from the intermodal facilities using Laraway Road and IL 53 to access I-80 and includes the following key intersections:

- IL 53/Laraway Road
- Laraway Road/Centerpoint Way

Each route was evaluated using the methodology outlined above. The findings of this evaluation are detailed below for each intersection and route scenario.

Route Scenario 1: Arsenal Road to I-55

Arsenal Road/Elwood International Port Road

(1) Based upon turn lane guidelines contained in the *BDE Manual*, additional turn lanes are not warranted at this signalized intersection.
(2) The through and right-turn movements on the north leg, left-turn and through movements on the south leg, and left- and right-turn movements on the west leg primarily serve traffic to/from the intermodal facilities.
(3) Since the signal at the Arsenal Road/Elwood International Port Road intersection currently operates "free," the intersection is able to accommodate increases in the volume of vehicles through the intersection without having a significant impact on delay. While the northbound left-turns and southbound right-turn seem to be the critical movement at the intersection due to the existing 95th percentiles nearing the provided storage, it is unlikely that the queues would affect through or other turning vehicles on these legs. Stacking for the northbound left-turn movement would occur in the inside through lane, which terminates into the outer turn lane at the intersection with Arsenal Road, allowing extended storage for the movement. Similarly, the outer through lane on the north leg becomes the outer turn lane for the southbound right-turn movement. Therefore, the spillback of these queues would not constrain other movements at the intersection. As such, the intersection will likely be constrained by the storage provided for the eastbound left-turn movement or a movement/approach (other than the existing failures of the west- and southbound left-turns) operating at LOS E.
(4) Based upon the capacity analysis, the evening peak hour was determined to be the critical peak hour for the intersection.
(5) The northbound left-turn would begin to operate at LOS E with a 50 percent in traffic on the critical movements (a total increase of approximately 580 vehicles through the intersection as 390 trucks and 200 cars).

Arsenal Road/Frontage Road

(1) Additional turn lanes are not warranted at this signalized intersection for existing conditions based upon turn lane guidelines contained in the *BDE Manual*.
(2) The north- and southbound through movements primarily serve traffic to/from the intermodal facilities.
(3) The critical constraints for this intersection are the queue for the northbound left-turn or a movement/approach operating at LOS E.

(4) Based upon the capacity analysis, the critical peak hour was determined to be the evening peak hour.
(5) With the addition of roughly 200 percent growth on the north- and southbound critical movements (an increase of 1,035 vehicles as roughly 575 trucks and 460 cars), the v/c ratio for the southbound through movement would exceed one, resulting in the movement being classified as LOS F. The overall intersection is shown to operate at LOS C under this condition.

Route Summary

Without modifications to the geometry at the key intersections studied along this corridor, the route should be able to accommodate an increase of nearly 580 vehicles (390 trucks and 200 cars). It appears that the operations at the Arsenal Road/International Port Road intersection would begin to constrain this route; however, since the Arsenal Road/Frontage Road intersection is part of an interconnected system, additional count data should be collected at these signals and the overall performance of the signal system should be verified.

Route Scenario 2: Laraway Road to IL 53 to I-80

IL 53/Laraway Road

(1) Based upon turn lane guidelines contained in the *BDE*, the existing volumes at the intersection warrant right-turn lanes on the north and south legs. Assuming a passenger car equivalent (PCE) of 1.5, the volume of eastbound left-turns would be equivalent to approximately 325 vehicles during the truck peak hour. Therefore, a dual left-turn lane is also warranted for the intersection on the west leg. Given this high volume of articulated trucks currently making this movement, the dual left-turn lane would need to be designed with geometrics to allow heavy vehicles to make simultaneous side-by-side left turns. With the addition of dual turn lanes, the signal timings should be modified to limit the east- and westbound left-turns to protected-only phasing. Additionally, maximum green times for the movements may be adjusted to better service the intersection.
(2) The movements primarily serving traffic to/from the intermodal facilities are the eastbound left-turn and southbound right-turn.
(3) In addition to ensuring all movements operate at LOS D or better, the available capacity of the intersection is constrained by the queue for the eastbound left-turn. Ideally, the queue for this movement would not extend beyond 385 feet, which is the distance to the start of the taper for the westbound left-turn at Stone City Drive. If the dual left-turn lanes were designed to be side-by-side with the westbound left-turn lane, the eastbound queue could extend to the limits of the westbound turn lane, or approximately 700 feet.
(4) Based upon the existing capacity analysis, the evening peak hour was determined to be the critical period for this intersection.
(5) The 95th percentile queue for the dual eastbound left-turn was evaluated for the critical evening peak hour with the addition of the warranted intersection improvements to determine how much capacity could be added prior to the queue extending beyond 385 feet. It was determined that when an additional 20 percent is added to the critical movements (80 vehicles as 50 trucks and 30 cars) the 95th percentile eastbound dual left-turn extends beyond 385 feet. At this critical point, the overall intersection would operate as LOS C and all movements

would operate at LOS D or better with the north and south legs operating at LOS B. With the indicated improvements, a similar increase in volumes would occur during the truck peak hour is shown to result in all movements operating at LOS D or better, and the 95th percentile queue for the eastbound left-turn is not shown to exceed 385 feet.

(6) The 95th percentile queue for the dual eastbound left-turn was then evaluated for the critical evening peak hour with the addition of the warranted intersection improvements to determine when the queue would extending beyond 700 feet. It was determined that when 90 percent is added to the critical movements (320 vehicles as 220 trucks and 100 cars) the 95th percentile eastbound dual left-turn extends beyond 700 feet. At this critical point, the east leg also operates at LOS E.

Laraway Road/Centerpoint Way

(1) Additional turn lanes are not warranted at the all-way stop-controlled intersection of Laraway Road/Centerpoint Way, and the existing volumes do not warrant a signal. A preliminary signal warrant evaluation indicates that the volume on the critical movements would need to be increased by an average of approximately 215 vehicles per hour over a twelve-hour period in order to consider installing a signal for future conditions.

(2) The movements primarily serving traffic to/from the intermodal facilities are the westbound left-turn and northbound right-turn movements.

(3) The available capacity at this intersection is constrained by ensuring all lane groups operate at LOS D or better. Therefore, the delay for the critical movements drive the operations at the intersection.

(4) Based upon the existing capacity analysis, the truck peak hour was determined to be the critical period for this intersection. During the truck peak hour, the westbound through/left-turn lane operates very near the threshold for LOS D; therefore, when the critical movements are increased by more than 5 percent of their volume (an addition of approximately 25 vehicles through the intersection) the westbound through/left-turn lane group begins to operate at LOS E.

(5) In order to add additional capacity at the intersection, various alternatives could be considered, including the following:

- Consider installing a northbound free-flow right-turn lane to reduce the number of vehicles traveling through the intersection.
- Installing a traffic signal. The signal could potentially operate “free,” dwelling on the westbound approach. Additionally, a northbound right-turn overlap phase could be implemented to allow the heaviest volume movements to run simultaneously during the dwell phase.
- Consider geometric alternates (including the realignment of Laraway Road), which would allow for increased capacity for the heaviest volume movements.

Route Summary

If this route were to be selected for use, significant investment in the IL 53/Laraway Road intersection would likely be required to provide currently warranted improvements. Additionally, alternatives should be evaluated at the Laraway Road/Centerpoint Way intersection to allow for current northbound right-turn and westbound left-turning traffic to occur simultaneously. With these improvements, the corridor could likely accommodate an increase of up to 320 vehicles (220 trucks/100 cars).

CONCLUSIONS

In summary, Kimley-Horn finds that the studied intersections generally operate acceptably despite the high number of heavy vehicles that most of these intersections experience throughout the day. This operational analysis was conducted based on data gathered following the closure of Walter Strawn Drive and the associated redistribution of intermodal traffic. As such, the data indicates that the roadway network studied largely has adequate capacity for and is accommodating the car and heavy vehicle traffic currently being generated by the intermodal facilities without the use of the Walter Strawn connection to IL 53. In most cases, vehicle queuing at these intersections is contained within the provided storage or has limited impact on other movements on the approach. On the west leg of IL 53/Laraway Road, left-turn queues exceeding the available storage were observed more frequently, but were accommodated within the shared taper (and even the westbound left-turn lane) for Stone City Drive. If truck traffic were to continue to grow along this corridor, more frequent blockages of the Stone City Drive left-turn lane may begin to impact operations for westbound vehicles and potentially impact functionality at the IL 53/Laraway intersection.

Kimley-Horn evaluated two routes that individually, or in combination, could mitigate impacts related to the closure of Walter Strawn Road at the Union Pacific rail crossing west of IL 53. This review was performed from a very conceptual level, and more detailed and diverse analysis would be required to make formal recommendations related to a “preferred” route or alternative. That said, it appears that both of the routes considered can or could (with currently warranted improvements) accommodate meaningful increases in intermodal traffic without significant impacts to other traffic using these key intersections. The Arsenal Road corridor, well located to serve both intermodal facilities, appears to have the most capacity with an increase of 580 vehicles possible without significant impacts. The Laraway Road corridor, well located to serve the preference demand to and from the north, appears to require a larger initial investment to provide warranted operational improvements that would then allow an increase of roughly 340 vehicles.

If desirable, a more in-depth engineering study of these routes should be performed to quantify and evaluate the impacts associated with their uses as alternate routes due to the closure of Walter Strawn at the Union Pacific rail crossing. Such a study should include an examination of the operational impacts associated with continued growth at the intermodals and development of properties surrounding them; quantification and analysis of the rerouting of heavy and overweight/oversized vehicles on the transportation infrastructure as well as the environmental, right-of-way, pavement, utility, and drainage impacts associated with their use; and a detailed and comprehensive cost estimate to more fully weigh these alternatives.

APPENDIX

Existing HCS2010 Capacity Reports

Traffic Count Data

Queue Observation Data

EXISTING HCS2010 CAPACITY REPORTS

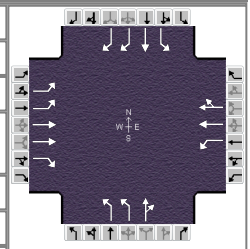
AM Peak Hour

PM Peak Hour

Truck Peak Hour

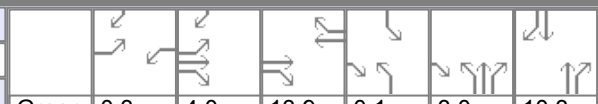
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.85
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				

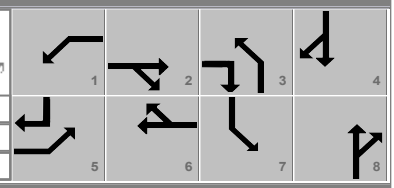


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	45	0	5	75	10	150	95	10	1	80	90

Signal Information			
Cycle, s	59.6	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.3	4.0	13.9	0.1	3.0	10.3						
Yellow	3.0	3.0	4.5	3.0	3.0	4.5						
Red	1.0	1.0	1.5	1.0	1.0	1.5						



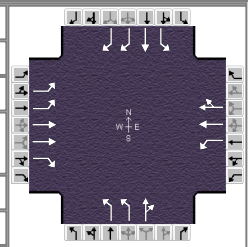
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	45	0	5	75	10	150	95	10	1	80	90
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	18	5	66	60	2		68	68		2	89	57
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	12.0
Turn Bay Length, ft	265	0	460	520	0		435	0		220	0	275
Grade (*Pg*), %	0	0	0	0	0	0	0	0	0	0	0	0
Speed Limit, mi/h	50	50	50	55	55	55	45	45	45	45	45	45

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	30.0	45.0	15.0	45.0	30.0	45.0	15.0	45.0
Yellow Change Interval (*Y*), s	3.0	4.5	3.0	4.5	3.0	4.5	3.0	4.5
Red Clearance Interval (R_c), s	1.0	1.5	1.0	1.5	1.0	1.5	1.0	1.5
Minimum Green (G_{min}), s	3	15	3	15	3	8	3	8
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	7.0	3.0	7.0	3.0	7.0	5.0	5.0
Recall Mode	Off	Off	Off	Off	Off	Off	Off	Off
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Walk (*Walk*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedestrian Clearance Time (*PC*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

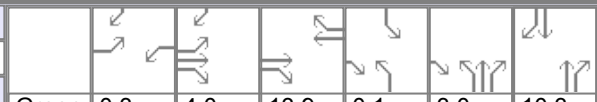
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.85
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				

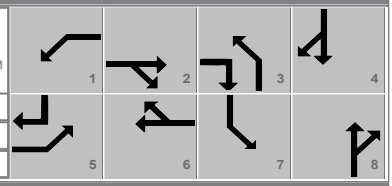


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	45	0	5	75	10	150	95	10	1	80	90

Signal Information			
Cycle, s	59.6	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.3	4.0	13.9	0.1	3.0	10.3
Yellow	3.0	3.0	4.5	3.0	3.0	4.5
Red	1.0	1.0	1.5	1.0	1.0	1.5



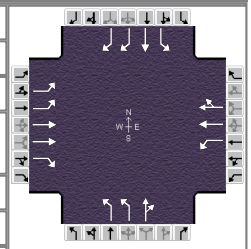
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	3.0
Phase Duration, s	12.3	28.0	4.3	19.9	11.1	23.3	4.1	16.3
Change Period, ($Y+R_c$), s	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Max Allow Headway (*MAH*), s	3.9	11.0	3.9	11.0	4.0	6.8	6.0	6.8
Queue Clearance Time (g_s), s	7.4	2.6	2.3	3.3	6.8	7.3	2.0	6.8
Green Extension Time (g_e), s	1.0	4.1	0.0	4.1	0.6	3.5	0.0	3.5
Phase Call Probability	0.99	1.00	0.09	0.93	0.95	1.00	0.02	1.00
Max Out Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	282	53	0	6	50	50	176	124		1	94	106
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1489	1813	970	1131	1863	1787	1046	1112		1774	1058	908
Queue Service Time (g_s), s	5.4	0.6	0.0	0.3	1.3	1.3	4.8	5.3		0.0	4.8	2.5
Cycle Queue Clearance Time (g_c), s	5.4	0.6	0.0	0.3	1.3	1.3	4.8	5.3		0.0	4.8	2.5
Green Ratio (*g/C*)	0.14	0.37	0.49	0.00	0.23	0.23	0.12	0.29		0.00	0.17	0.31
Capacity (*c*), veh/h	416	1337	473	5	435	417	248	323		3	183	567
Volume-to-Capacity Ratio (*X*)	0.678	0.040	0.000	1.102	0.115	0.119	0.711	0.382		0.396	0.515	0.187
Available Capacity (c_a), veh/h	1497	2734	846	284	1404	1347	1051	838		446	798	1622
Back of Queue (*Q*), veh/ln (95th percentile)	3.1	0.3	0.0	0.7	0.9	0.9	2.2	2.6		0.2	2.3	0.8
Queue Storage Ratio (*RQ*) (95th percentile)	0.39	0.00	0.00	0.07	0.00	0.00	0.27	0.00		0.03	0.00	0.15
Uniform Delay (d_1), s/veh	24.4	12.1	0.0	29.7	18.0	18.0	25.3	16.9		29.8	22.4	15.0
Incremental Delay (d_2), s/veh	1.9	0.1	0.0	214.4	0.5	0.6	3.7	3.4		125.5	4.7	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay (*d*), s/veh	26.3	12.1	0.0	244.2	18.6	18.6	29.1	20.3		155.3	27.1	15.3
Level of Service (LOS)	C	B		F	B	B	C	C		F	C	B
Approach Delay, s/veh / LOS	24.1	C		31.1	C		25.5	C		21.7	C	
Intersection Delay, s/veh / LOS	24.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.9	C	2.8	C	3.1	C
Bicycle LOS Score / LOS	0.8	A	0.6	A	1.0	A	0.8	A

HCS 2010 Signalized Intersection Intermediate Values

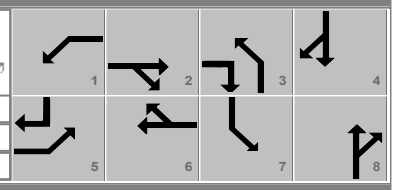
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.85
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	45	0	5	75	10	150	95	10	1	80	90

Signal Information			
Cycle, s	59.6	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.3	4.0	13.9	0.1	3.0	10.3						
Yellow	3.0	3.0	4.5	3.0	3.0	4.5						
Red	1.0	1.0	1.5	1.0	1.0	1.5						



	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.847	0.952	0.602	0.625	0.980	1.000	0.595	0.595	1.000	0.980	0.529	0.637
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	0.971	0.952	1.000	1.000	1.000	1.000	0.971	1.000	1.000	1.000	1.000	0.885
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000			0.959			0.983			0.000	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h	2978	3627		1131	3229		2092	1006		1774	1058	
Platoon Ratio (R_p)	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.11	0.50		0.11	0.50	0.50	0.11	0.50		0.23	0.23	0.23

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Green Ratio (*g/C*)	0.14	0.37	0.00	0.23	0.12	0.29	0.00	0.17
Permitted Saturation Flow Rate (s_p), veh/h/ln	0	1115	0	0	0	0	0	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	0.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0
Permitted Service Time (g_u), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		970						908
Protected Right Effective Green Time (g_R), s		7.1						8.3

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.710	0.00	2.224	0.00	2.107	0.00	2.336	0.00
Pedestrian F_s / F_{delay}	0.000	0.099	0.000	0.115	0.000	0.109	0.000	0.121
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	737.17	11.89	467.38	17.51	580.54	15.02	345.50	20.40
Bicycle F_w / F_v	-3.64	0.28	-3.64	0.09	-3.64	0.50	-3.64	0.33

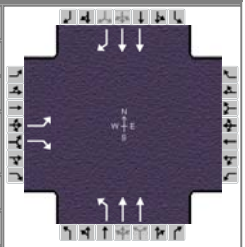
--- Messages ---

No errors or warnings exist.

--- Comments ---

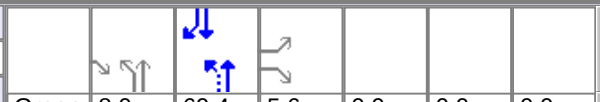
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:00 AM)	PHF	0.84
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 6:00
File Name	Ex - AM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				

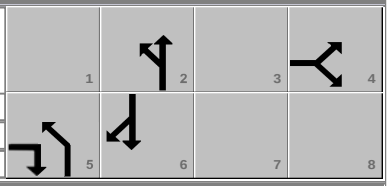


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5		20				175	560			220	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.0	69.4	5.6	0.0	0.0	0.0
Yellow	3.5	5.0	4.5	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



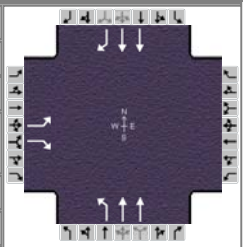
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5		20				175	560			220	90
Initial Queue (Q_b), veh/h	0		0				0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900		1900				1900	2000			2000	1900
Parking (N_m), man/h		None						None			None	
Heavy Vehicles (P_{HV}), %	2		58				12	41			55	42
Ped / Bike / RTOR, /h							0	0	0	0	0	0
Buses (N_b), buses/h	0		0				0	0			0	0
Arrival Type (*AT*)	3		3				3	4			4	3
Upstream Filtering (*I*)	1.00		1.00				1.00	1.00			1.00	1.00
Lane Width (*W*), ft	12.0		12.0				12.0	12.0			12.0	12.0
Turn Bay Length, ft	240		0				275	0			0	400
Grade (*Pg*), %	0		0				0	0			0	0
Speed Limit, mi/h	45		45				45	45			45	45

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		26.0			30.0	74.0		44.0
Yellow Change Interval (*Y*), s	4.0				3.5	5.0		5.0
Red Clearance Interval (R_c), s	1.0				0.0	2.0		2.0
Minimum Green (G_{min}), s	5				8	15		15
Start-Up Lost Time (*lt*), s	2.0				2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0				2.0	2.0		2.0
Passage (*PT*), s	7.0				7.0	7.0		7.0
Recall Mode	Off				Off	Min		Min
Dual Entry	No				No	Yes		Yes
Walk (*Walk*), s	0.0				0.0	0.0		0.0
Pedestrian Clearance Time (*PC*), s	0.0				0.0	0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No				0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0				12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50					No	0.50		No	0.50	

HCS 2010 Signalized Intersection Results Summary

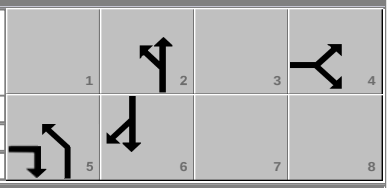
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:00 AM)	PHF	0.84
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 6:00
File Name	Ex - AM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5		20				175	560			220	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	8.0	69.4	5.6	0.0	0.0	0.0	
Yellow	3.5	5.0	4.5	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



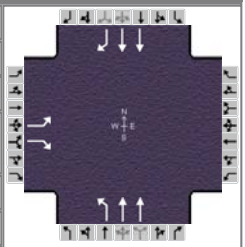
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		7.3
Phase Duration, s		12.1			11.5	87.9		76.4
Change Period, ($Y+R_c$), s		6.5			3.5	7.0		7.0
Max Allow Headway (*MAH*), s		6.2			8.0	0.0		0.0
Queue Clearance Time (g_s), s		4.1			5.1			
Green Extension Time (g_e), s		0.1			3.0	0.0		0.0
Phase Call Probability		0.56			1.00			
Max Out Probability		0.00			0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	6		24				208	667			262	107
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1774		1019				1616	1350			1228	1134
Queue Service Time (g_s), s	0.3		2.1				3.1	0.0			0.9	3.2
Cycle Queue Clearance Time (g_c), s	0.3		2.1				3.1	0.0			0.9	3.2
Green Ratio (*g/C*)	0.06		0.14				0.79	0.81			0.69	0.69
Capacity (*c*), veh/h	100		139				895	2184			1704	786
Volume-to-Capacity Ratio (*X*)	0.060		0.171				0.233	0.305			0.154	0.136
Available Capacity (c_a), veh/h	346		280				1418	2184			1704	786
Back of Queue (*Q*), veh/ln (95th percentile)	0.3		1.0				1.2	0.2			0.4	1.2
Queue Storage Ratio (*RQ*) (95th percentile)	0.03		0.00				0.13	0.00			0.00	0.13
Uniform Delay (d_1), s/veh	44.7		38.2				2.5	0.0			1.2	5.2
Incremental Delay (d_2), s/veh	0.5		1.2				0.6	0.4			0.2	0.4
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	45.2		39.4				3.1	0.4			1.4	5.5
Level of Service (LOS)	D		D				A	A			A	A
Approach Delay, s/veh / LOS	40.6		D	0.0			1.0		A	2.6		A
Intersection Delay, s/veh / LOS	2.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	0.6	A	2.2	B
Bicycle LOS Score / LOS		F			1.2	A	0.8	A

HCS 2010 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:00 AM)	PHF	0.84
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 6:00
File Name	Ex - AM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5		20				175	560			220	90

Signal Information													
Cycle, s	100.0	Reference Phase	2										
Offset, s	0	Reference Point	Begin										
Uncoordinated	No	Simult. Gap E/W	On										
Force Mode	Fixed	Simult. Gap N/S	On										
				Green	8.0	69.4	5.6	0.0	0.0	0.0			
				Yellow	3.5	5.0	4.5	0.0	0.0	0.0			
				Red	0.0	2.0	2.0	0.0	0.0	0.0			

	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	1.000	0.633	0.000	0.000	0.000	0.893	0.709	1.000	1.000	0.645	0.704
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	0.952	1.000
Left-Turn Adjustment Factor (f_{LT})		0.000					0.952	0.000			1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000						1.000			0.000	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000						1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000						1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h		0					1616	2769			2519	
Platoon Ratio (R_p)		0.00					1.00	1.33			1.33	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.23		0.23				0.50	0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		5.0			3.5	7.0		7.0
Green Ratio (*g/C*)		0.06			0.79	0.81		0.69
Permitted Saturation Flow Rate (s_p), veh/h/ln		1774			1014	0		782
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								0
Permitted Effective Green Time (g_p), s		0.0			71.4	0.0		0.0
Permitted Service Time (g_u), s		0.0			68.4	0.0		0.0
Permitted Queue Service Time (g_{ps}), s					0.8			
Time to First Blockage (g_f), s		0.0			0.0	0.0		69.4
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1019						0
Protected Right Effective Green Time (g_R), s		8.0						0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	2.107	0.00	2.107	0.00	0.000	0.00	1.557	0.00
Pedestrian F_s / F_{delay}	0.000	0.163	0.000	0.162	0.000	0.024	0.000	0.062
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b		57.78		56.18	1617.49	1.83	1387.05	4.70
Bicycle F_w / F_v	-3.64		-3.64		-3.64	0.72	-3.64	0.30

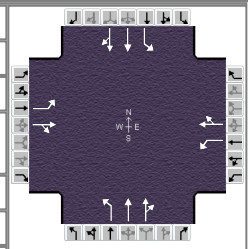
--- Messages ---

No errors or warnings exist.

--- Comments ---

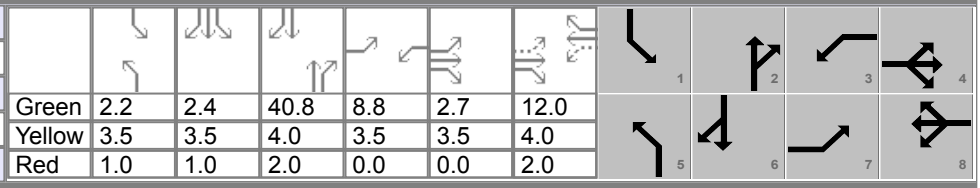
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:30 AM)	PHF	0.82
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 6:30
File Name	Ex - AM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	55	20	115	35	75	25	480	145	105	410	205

Signal Information			
Cycle, s	96.9	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.2	2.4	40.8	8.8	2.7	12.0						
Yellow	3.5	3.5	4.0	3.5	3.5	4.0						
Red	1.0	1.0	2.0	0.0	0.0	2.0						

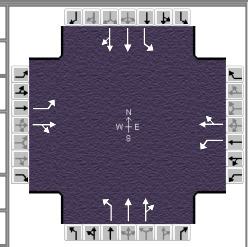
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	55	20	115	35	75	25	480	145	105	410	205
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	73	65		7	19		20	5		8	29	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0		11.0	11.0		11.0	11.0		11.0	11.0	
Turn Bay Length, ft	200	0		215	0		130	0		350	0	
Grade (*Pg*), %	0	0	0	0	0	0	0	0	0	0	0	0
Speed Limit, mi/h	45	45	45	45	45	45	50	50	50	50	50	50

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	15.0	40.0	15.0	40.0	15.0	45.0	15.0	45.0
Yellow Change Interval (*Y*), s	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
Red Clearance Interval (R_c), s	0.0	2.0	0.0	2.0	1.0	2.0	1.0	2.0
Minimum Green (G_{min}), s	3	10	3	10	4	20	4	20
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	7.0	3.0	7.0
Recall Mode	Off	Off	Off	Off	Off	Off	Off	Off
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Walk (*Walk*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedestrian Clearance Time (*PC*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS 2010 Signalized Intersection Results Summary

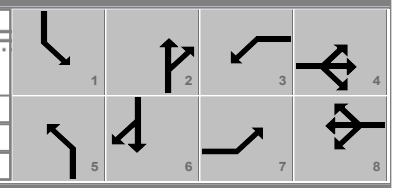
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:30 AM)	PHF	0.82
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 6:30
File Name	Ex - AM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	55	20	115	35	75	25	480	145	105	410	205

Signal Information			
Cycle, s	96.9	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	2.2	2.4	40.8	8.8	2.7	12.0
Yellow	3.5	3.5	4.0	3.5	3.5	4.0
Red	1.0	1.0	2.0	0.0	0.0	2.0



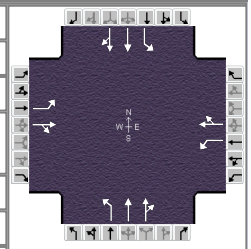
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	18.5	24.2	12.3	18.0	6.7	46.8	13.6	53.7
Change Period, (Y+R_c), s	3.5	6.0	3.5	6.0	4.5	6.0	4.5	6.0
Max Allow Headway (*MAH*), s	4.0	5.0	4.0	5.0	3.9	11.2	3.9	11.2
Queue Clearance Time (g_s), s	17.0	9.2	8.9	10.8	4.0	17.8	9.3	20.3
Green Extension Time (g_e), s	0.0	1.2	0.2	1.2	0.0	23.0	0.1	23.4
Phase Call Probability	0.99	1.00	0.98	1.00	0.56	1.00	0.97	1.00
Max Out Probability	1.00	0.00	0.15	0.00	0.00	0.96	0.19	0.96

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	195	91		140	134		30	396	366	128	396	354
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1046	1099		1691	1422		1508	1810	1665	1675	1473	1307
Queue Service Time (g_s), s	15.0	7.2		6.9	8.8		2.0	15.7	15.8	7.3	18.1	18.3
Cycle Queue Clearance Time (g_c), s	15.0	7.2		6.9	8.8		2.0	15.7	15.8	7.3	18.1	18.3
Green Ratio (*g*/*C*)	0.30	0.19		0.22	0.12		0.02	0.42	0.42	0.09	0.49	0.49
Capacity (*c*), veh/h	260	206		344	176		35	761	701	158	724	643
Volume-to-Capacity Ratio (*X*)	0.749	0.444		0.407	0.760		0.874	0.520	0.522	0.813	0.547	0.550
Available Capacity (c_a), veh/h	260	453		451	587		233	840	773	259	724	643
Back of Queue (*Q*), veh/ln (95th percentile)	8.0	3.5		5.0	6.1		2.0	10.7	10.1	5.9	10.0	9.2
Queue Storage Ratio (*RQ*) (95th percentile)	2.30	0.00		0.65	0.00		0.53	0.00	0.00	0.48	0.00	0.00
Uniform Delay (d_1), s/veh	30.4	34.9		32.6	41.1		47.2	20.8	20.8	43.1	17.1	17.2
Incremental Delay (d_2), s/veh	11.4	2.1		0.8	9.2		43.8	2.5	2.8	9.6	3.0	3.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.8	37.0		33.4	50.2		91.0	23.4	23.6	52.7	20.1	20.5
Level of Service (LOS)	D	D		C	D		F	C	C	D	C	C
Approach Delay, s/veh / LOS	40.3	D		41.6	D		26.1	C		25.0	C	
Intersection Delay, s/veh / LOS	29.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	2.3	B	2.3	B
Bicycle LOS Score / LOS	1.0	A	0.9	A	1.1	A	1.2	A

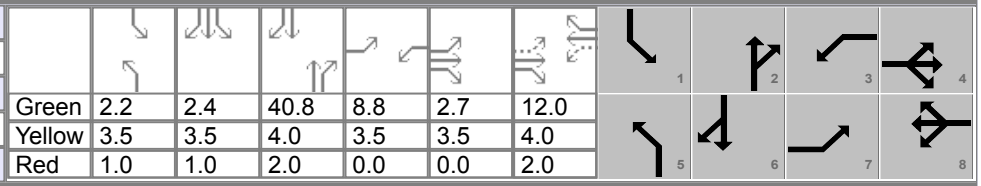
HCS 2010 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:30 AM)	PHF	0.82
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 6:30
File Name	Ex - AM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	55	20	115	35	75	25	480	145	105	410	205

Signal Information			
Cycle, s	96.9	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.2	2.4	40.8	8.8	2.7	12.0						
Yellow	3.5	3.5	4.0	3.5	3.5	4.0						
Red	1.0	1.0	2.0	0.0	0.0	2.0						

	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.578	0.606	1.000	0.935	0.840	1.000	0.833	0.952	1.000	0.926	0.775	1.000
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.954			0.891			0.920			0.887	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h	1046	806		1691	452		1508	2705		1675	1911	
Platoon Ratio (R_p)	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.30	0.15		0.11	0.15		0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	4.5	6.0	4.5	6.0
Green Ratio (*g/C*)	0.30	0.19	0.22	0.12	0.02	0.42	0.09	0.49
Permitted Saturation Flow Rate (s_p), veh/h/ln	737	0	1239	0	0	0	0	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	14.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0
Permitted Service Time (g_u), s	3.2	0.0	9.0	0.0	0.0	0.0	0.0	0.0
Permitted Queue Service Time (g_{ps}), s	3.2		0.4					
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	2.107	0.00	2.107	0.00	1.557	0.00	1.557	0.00
Pedestrian F_s / F_{delay}	0.000	0.139	0.000	0.145	0.000	0.112	0.000	0.101
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	375.06	31.99	248.17	37.19	841.67	16.26	983.49	12.52
Bicycle F_w / F_v	-3.64	0.47	-3.64	0.45	-3.64	0.65	-3.64	0.72

--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*TLS*
Agency/Co.	*Kimley-Horn*
Date Performed	*5/26/2015*
Analysis Time Period	*AM Peak Hour (6:15 AM)*

Site Information

Intersection	*IL 53/Schweitzer Road*
Jurisdiction	*IDOT*
Analysis Year	*Existing (2015)*

Project Description *Elwood Truck Routing Study*

East/West Street: *Schweitzer Road* | North/South Street: *IL Route 53*

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)	*1*	*595*	*15*	*10*	*490*	*10*
Peak-Hour Factor, PHF	*0.82*	*0.82*	*0.82*	*0.82*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*1*	*725*	*18*	*12*	*597*	*12*
Percent Heavy Vehicles	*2*	--	--	*13*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration	*LT*		*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1*	*5*	*10*	*1*	*20*
Peak-Hour Factor, PHF	*0.82*	*0.82*	*0.82*	*0.82*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*6*	*1*	*6*	*12*	*1*	*24*
Percent Heavy Vehicles	*2*	*2*	*33*	*20*	*2*	*10*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*1*	*1*	*0*
Configuration		*LTR*		*L*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*L*	*L*		*TR*		*LTR*	
v (veh/h)	*1*	*12*	*12*		*25*		*13*	
C (m) (veh/h)	*966*	*791*	*259*		*613*		*401*	
v/c	*0.00*	*0.02*	*0.05*		*0.04*		*0.03*	
95% queue length	*0.00*	*0.05*	*0.15*		*0.13*		*0.10*	
Control Delay (s/veh)	*8.7*	*9.6*	*19.6*		*11.1*		*14.3*	
LOS	*A*	*A*	*C*		*B*		*B*	
Approach Delay (s/veh)	--	--	*13.9*			*14.3*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*TLS*
Agency/Co.	*Kimley-Horn*
Date Performed	*5/26/2015*
Analysis Time Period	*AM Peak Hour (6:00 AM)*

Site Information

Intersection	*IL 53/Millsdale Road*
Jurisdiction	*IDOT*
Analysis Year	*Existing (2015)*

Project Description *Elwood Truck Routing Study*

East/West Street: *Millsdale Road* | North/South Street: *IL Route 53*

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)	*10*	*550*			*355*	*135*
Peak-Hour Factor, PHF	*0.82*	*0.82*	*1.00*	*1.00*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*12*	*670*	*0*	*0*	*432*	*164*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*1*
Configuration	*L*	*T*			*T*	*R*
Upstream Signal		*0*			*0*	

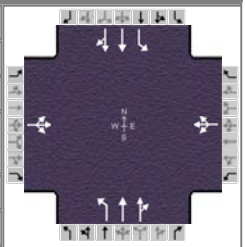
Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*20*		*5*			
Peak-Hour Factor, PHF	*0.82*	*1.00*	*0.82*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*24*	*0*	*6*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*20*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*						*LR*	
v (veh/h)	*12*						*30*	
C (m) (veh/h)	*976*						*482*	
v/c	*0.01*						*0.06*	
95% queue length	*0.04*						*0.20*	
Control Delay (s/veh)	*8.7*						*13.0*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--				*13.0*		
Approach LOS	--	--				*B*		

HCS 2010 Signalized Intersection Input Data

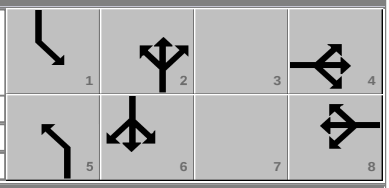
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.82
Intersection	IL 53/Manhattan/Arsenal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - IL 53 - Manhattan.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	35	10	25	60	55	10	350	20	35	300	40

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.8	1.3	43.2	12.1	11.2	0.0						
Yellow	3.5	0.0	4.0	4.0	4.0	0.0						
Red	0.0	0.0	2.0	2.0	2.0	0.0						



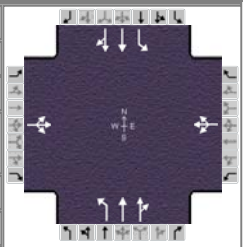
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	35	10	25	60	55	10	350	20	35	300	40
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %		5			2		18	5		3	11	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft		12.0			12.0		12.0	12.0		11.0	11.0	
Turn Bay Length, ft		0			0		235	0		305	0	
Grade (*Pg*), %	0	0	0	0	0	0	0	0	0	0	0	0
Speed Limit, mi/h	50	50	50	50	50	50	55	55	55	55	55	55

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		19.0		19.0	18.0	78.0	18.0	78.0
Yellow Change Interval (*Y*), s	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
Red Clearance Interval (R_c), s	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0
Minimum Green (G_{min}), s	3	8	3	8	3	20	3	20
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	5.0	3.0	5.0	3.0	7.0	3.0	7.0
Recall Mode	Min	Off	Min	Off	Off	Off	Off	Off
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Walk (*Walk*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedestrian Clearance Time (*PC*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

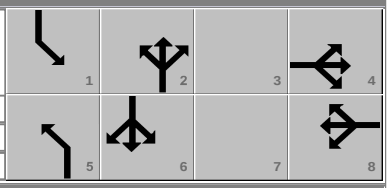
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.82
Intersection	IL 53/Manhattan/Arsenal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - IL 53 - Manhattan.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	35	10	25	60	55	10	350	20	35	300	40

Signal Information												
Cycle, s	90.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	0.8	1.3	43.2	12.1	11.2	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.5	0.0	4.0	4.0	4.0	0.0		
				Red	0.0	0.0	2.0	2.0	2.0	0.0		



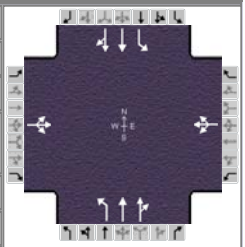
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		12.0		12.0	1.1	4.0	1.1	4.0
Phase Duration, s		18.1		17.2	4.3	49.2	5.6	50.5
Change Period, ($Y+R_c$), s		6.0		6.0	3.5	6.0	3.5	6.0
Max Allow Headway (*MAH*), s		5.9		6.0	3.9	11.0	3.9	11.0
Queue Clearance Time (g_s), s		11.6		10.7	2.4	8.8	3.1	8.5
Green Extension Time (g_e), s		0.7		0.6	0.0	34.4	0.1	34.4
Phase Call Probability		0.99		0.99	0.26	1.00	0.66	1.00
Max Out Probability		0.52		0.34	0.00	0.31	0.00	0.31

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		189			171		12	227	224	43	210	204
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1728			1725		1533	1810	1775	1757	1712	1641
Queue Service Time (g_s), s		9.6			8.7		0.4	6.7	6.8	1.1	6.4	6.5
Cycle Queue Clearance Time (g_c), s		9.6			8.7		0.4	6.7	6.8	1.1	6.4	6.5
Green Ratio (*g/C*)		0.13			0.12		0.49	0.48	0.48	0.50	0.49	0.49
Capacity (*c*), veh/h		233			214		428	867	851	495	845	810
Volume-to-Capacity Ratio (*X*)		0.811			0.798		0.029	0.262	0.263	0.086	0.249	0.252
Available Capacity (c_a), veh/h		365			364		721	1567	1537	806	1482	1421
Back of Queue (*Q*), veh/ln (95th percentile)		8.2			7.6		0.2	4.5	4.5	0.7	4.0	3.9
Queue Storage Ratio (*RQ*) (95th percentile)		0.00			0.00		0.03	0.00	0.00	0.06	0.00	0.00
Uniform Delay (d_1), s/veh		37.9			38.4		12.2	14.0	14.0	11.7	13.2	13.2
Incremental Delay (d_2), s/veh		13.8			13.4		0.0	0.7	0.8	0.1	0.7	0.7
Initial Queue Delay (d_3), s/veh		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		51.6			51.8		12.2	14.7	14.7	11.8	13.9	13.9
Level of Service (LOS)		D			D		B	B	B	B	B	B
Approach Delay, s/veh / LOS	51.6	D		51.8	D		14.6	B		13.7	B	
Intersection Delay, s/veh / LOS	24.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	2.1	B	2.1	B
Bicycle LOS Score / LOS	0.8	A	0.8	A	0.9	A	0.9	A

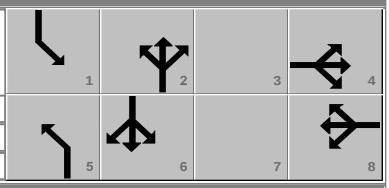
HCS 2010 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	AM Peak Hour (6:15 AM)	PHF	0.82
Intersection	IL 53/Manhattan/Arsenal	Analysis Year	Existing (2015)	Analysis Period	1> 6:15
File Name	Ex - AM - IL 53 - Manhattan.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	35	10	25	60	55	10	350	20	35	300	40

Signal Information												
Cycle, s	90.0	Reference Phase	2									
Offset, s	0	Reference Point	End	Green	0.8	1.3	43.2	12.1	11.2	0.0		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.5	0.0	4.0	4.0	4.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	0.0	2.0	2.0	2.0	0.0		



	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	0.952	1.000	1.000	0.980	1.000	0.847	0.952	1.000	0.971	0.901	1.000
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})		0.955			0.926		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000			0.000			0.981			0.959	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h		390			739		1533	3393		1757	2967	
Platoon Ratio (R_p)		1.00			1.00		1.00	1.00		1.00	1.00	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)		0.24			0.23		0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		3.5		6.0	3.5	6.0	3.5	6.0
Green Ratio (*g/C*)		0.13		0.12	0.49	0.48	0.50	0.49
Permitted Saturation Flow Rate (s_p), veh/h/ln		0		0	836	0	926	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s		0.0		0.0	43.2	0.0	43.2	0.0
Permitted Service Time (g_u), s		0.0		0.0	36.0	0.0	36.4	0.0
Permitted Queue Service Time (g_{ps}), s					0.1		0.3	
Time to First Blockage (g_f), s		0.0		0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	2.107	0.00	2.107	0.00	1.389	0.00	1.389	0.00
Pedestrian F_s / F_{delay}	0.000	0.142	0.000	0.159	0.000	0.100	0.000	0.098
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	247.81	34.56		52.29	958.81	12.20	987.56	11.54
Bicycle F_w / F_v	-3.64	0.31	-3.64	0.28	-3.64	0.38	-3.64	0.38

--- Messages ---

No errors or warnings exist.

--- Comments ---

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*TLS*
Agency/Co.	*Kimley-Horn*
Date Performed	*5/26/2015*
Analysis Time Period	*AM Peak Hour (8:30 AM)*

Site Information

Intersection	*Laraway/Centerpoint*
Jurisdiction	*Joliet*
Analysis Year	*Existing (2015)*

Project ID *Elwood Truck Routing Study*

East/West Street: *Laraway Road* North/South Street: *Centerpoint Way*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*1*	*55*	*1*	*210*	*65*	*70*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*1*	*10*	*150*	*55*	*15*	*1*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*LT*	*R*	*L*	*TR*	*LTR*	
PHF	*0.94*		*0.94*	*0.94*	*0.94*	*0.94*	*0.94*	
Flow Rate (veh/h)	*60*		*292*	*74*	*1*	*169*	*74*	
% Heavy Vehicles	*97*		*82*	*71*	*2*	*86*	*82*	
No. Lanes	*1*		*2*		*2*		*1*	
Geometry Group	*4b*		*5*		*5*		*4b*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.0*		*0.8*	*0.0*	*1.0*	*0.0*	*0.8*	
Prop. Right-Turns	*0.0*		*0.0*	*1.0*	*0.0*	*0.9*	*0.0*	
Prop. Heavy Vehicle	*1.0*		*0.8*	*0.7*	*0.0*	*0.9*	*0.8*	
hLT-adj	*0.2*	*0.2*	*0.5*	*0.5*	*0.5*	*0.5*	*0.2*	*0.2*
hRT-adj	*-0.6*	*-0.6*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.6*	*-0.6*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*1.6*		*1.8*	*0.5*	*0.5*	*0.8*	*1.5*	

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	
x, initial	*0.05*		*0.26*	*0.07*	*0.00*	*0.15*	*0.07*	
hd, final value (s)	*7.73*		*7.29*	*6.01*	*6.67*	*6.94*	*7.87*	
x, final value	*0.13*		*0.59*	*0.12*	*0.00*	*0.33*	*0.16*	
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*5.4*		*5.0*	*3.7*	*4.4*	*4.6*	*5.6*	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*310*		*487*	*324*	*251*	*419*	*324*	
Delay (s/veh)	*11.57*		*19.99*	*9.56*	*9.38*	*12.96*	*12.09*	
LOS	*B*		*C*	*A*	*A*	*B*	*B*	
Approach: Delay (s/veh)	*11.57*		*17.88*		*12.93*		*12.09*	
LOS	*B*		*C*		*B*		*B*	
Intersection Delay (s/veh)	*15.42*							
Intersection LOS	*C*							

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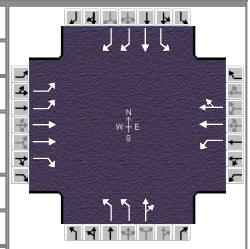
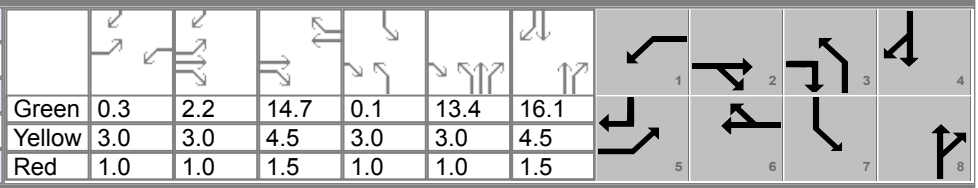
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	115	0	5	35	5	370	120	25	1	110	215

Signal Information												
Cycle, s	74.8	Reference Phase	2									
Offset, s	0	Reference Point	Begin	Green	0.3	2.2	14.7	0.1	13.4	16.1		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	3.0	3.0	4.5	3.0	3.0	4.5		
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.5	1.0	1.0	1.5		



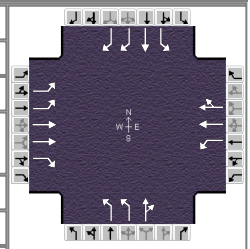
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	115	0	5	35	5	370	120	25	1	110	215
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900	2000	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	60	7	71	60	14		64	87		2	95	49
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	12.0
Turn Bay Length, ft	265	0	460	520	0		435	0		220	0	275
Grade (*Pg*), %	0	0	0	0	0	0	0	0	0	0	0	0
Speed Limit, mi/h	50	50	50	55	55	55	45	45	45	45	45	45

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	30.0	45.0	15.0	45.0	30.0	45.0	15.0	45.0
Yellow Change Interval (*Y*), s	3.0	4.5	3.0	4.5	3.0	4.5	3.0	4.5
Red Clearance Interval (R_c), s	1.0	1.5	1.0	1.5	1.0	1.5	1.0	1.5
Minimum Green (G_{min}), s	3	15	3	15	3	8	3	8
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	7.0	3.0	7.0	3.0	7.0	5.0	5.0
Recall Mode	Off	Off	Off	Off	Off	Off	Off	Off
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Walk (*Walk*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedestrian Clearance Time (*PC*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS 2010 Signalized Intersection Results Summary

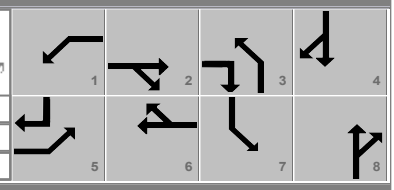
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	115	0	5	35	5	370	120	25	1	110	215

Signal Information			
Cycle, s	74.8	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.3	2.2	14.7	0.1	13.4	16.1	
Yellow	3.0	3.0	4.5	3.0	3.0	4.5	
Red	1.0	1.0	1.5	1.0	1.0	1.5	



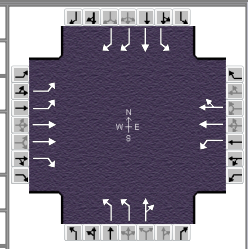
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	3.0
Phase Duration, s	10.6	26.9	4.3	20.7	21.4	39.5	4.1	22.1
Change Period, ($Y+R_c$), s	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Max Allow Headway (*MAH*), s	3.9	11.1	3.9	11.1	4.0	6.7	6.0	6.7
Queue Clearance Time (g_s), s	6.5	4.1	2.3	2.9	16.0	10.3	2.0	10.2
Green Extension Time (g_e), s	0.4	4.9	0.0	4.9	1.4	5.9	0.0	5.9
Phase Call Probability	0.94	1.00	0.11	0.98	1.00	1.00	0.02	1.00
Max Out Probability	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	136	131	0	6	23	23	420	165		1	125	244
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1098	1779	942	1131	1667	1595	1071	985		1774	1026	956
Queue Service Time (g_s), s	4.5	2.1	0.0	0.3	0.8	0.9	14.0	8.3		0.0	8.2	7.6
Cycle Queue Clearance Time (g_c), s	4.5	2.1	0.0	0.3	0.8	0.9	14.0	8.3		0.0	8.2	7.6
Green Ratio (*g/C*)	0.09	0.28	0.51	0.00	0.20	0.20	0.23	0.45		0.00	0.22	0.30
Capacity (*c*), veh/h	193	994	483	5	327	313	500	441		2	221	580
Volume-to-Capacity Ratio (*X*)	0.706	0.131	0.000	1.114	0.070	0.073	0.840	0.373		0.479	0.566	0.421
Available Capacity (c_a), veh/h	880	2140	786	227	1002	959	859	592		356	617	1318
Back of Queue (*Q*), veh/ln (95th percentile)	2.2	1.4	0.0	0.7	0.6	0.6	6.3	3.3		0.3	3.8	2.9
Queue Storage Ratio (*RQ*) (95th percentile)	0.43	0.00	0.00	0.07	0.00	0.00	0.78	0.00		0.03	0.00	0.50
Uniform Delay (d_1), s/veh	33.2	20.2	0.0	37.3	24.5	24.5	27.4	13.7		37.4	26.2	20.8
Incremental Delay (d_2), s/veh	4.7	0.3	0.0	223.0	0.4	0.5	3.9	2.4		182.0	4.8	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Control Delay (*d*), s/veh	37.9	20.4	0.0	260.3	24.9	25.0	31.2	16.1		219.4	31.0	21.9
Level of Service (LOS)	D	C		F	C	C	C	B		F	C	C
Approach Delay, s/veh / LOS	29.3	C		51.1	D		27.0	C		25.6	C	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	3.0	C	2.8	C	3.1	C
Bicycle LOS Score / LOS	0.7	A	0.5	A	1.5	A	1.1	A

HCS 2010 Signalized Intersection Intermediate Values

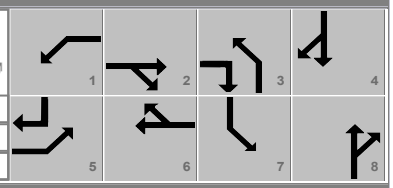
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	WCDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	Arsenal/Elwood Intermodal	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Elwood Intermodal.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	115	0	5	35	5	370	120	25	1	110	215

Signal Information			
Cycle, s	74.8	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.3	2.2	14.7	0.1	13.4	16.1						
Yellow	3.0	3.0	4.5	3.0	3.0	4.5						
Red	1.0	1.0	1.5	1.0	1.0	1.5						



	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.625	0.935	0.585	0.625	0.877	1.000	0.610	0.535	1.000	0.980	0.513	0.671
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	0.971	0.952	1.000	1.000	1.000	1.000	0.971	1.000	1.000	1.000	1.000	0.885
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.000			0.957			0.970			0.000	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h	2196	3559		1131	2863		2143	816		1774	1026	
Platoon Ratio (R_p)	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.11	0.50		0.11	0.50	0.50	0.11	0.50		0.23	0.23	0.23

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Green Ratio (*g/C*)	0.09	0.28	0.00	0.20	0.23	0.45	0.00	0.22
Permitted Saturation Flow Rate (s_p), veh/h/ln	0	0	0	0	0	0	0	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Permitted Service Time (g_u), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Permitted Queue Service Time (g_{ps}), s								
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		942						956
Protected Right Effective Green Time (g_R), s		17.5						6.6

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.710	0.00	2.224	0.00	2.107	0.00	2.336	0.00
Pedestrian F_s / F_{delay}	0.000	0.119	0.000	0.128	0.000	0.098	0.000	0.126
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	558.81	19.41	392.26	24.16	895.26	11.41	430.57	23.02
Bicycle F_w / F_v	-3.64	0.22	-3.64	0.04	-3.64	0.97	-3.64	0.61

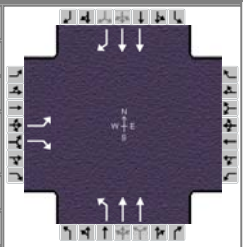
--- Messages ---

No errors or warnings exist.

--- Comments ---

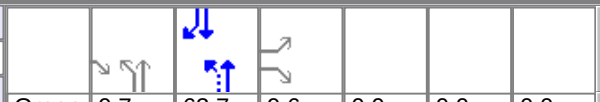
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.79
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				

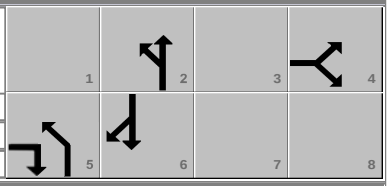


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10		80				195	465			570	100

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.7	63.7	9.6	0.0	0.0	0.0						
Yellow	3.5	5.0	4.5	0.0	0.0	0.0						
Red	0.0	2.0	2.0	0.0	0.0	0.0						



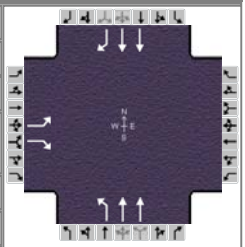
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10		80				195	465			570	100
Initial Queue (Q_b), veh/h	0		0				0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900		1900				1900	2000			2000	1900
Parking (N_m), man/h		None						None			None	
Heavy Vehicles (P_{HV}), %	2		21				8	54			57	45
Ped / Bike / RTOR, /h							0	0	0	0	0	0
Buses (N_b), buses/h	0		0				0	0			0	0
Arrival Type (*AT*)	3		3				3	4			4	3
Upstream Filtering (*I*)	1.00		1.00				1.00	1.00			1.00	1.00
Lane Width (*W*), ft	12.0		12.0				12.0	12.0			12.0	12.0
Turn Bay Length, ft	240		0				275	0			0	400
Grade (*Pg*), %	0		0				0	0			0	0
Speed Limit, mi/h	45		45				45	45			45	45

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s		26.0			30.0	74.0		44.0
Yellow Change Interval (*Y*), s	4.0				3.5	5.0		5.0
Red Clearance Interval (R_c), s	1.0				0.0	2.0		2.0
Minimum Green (G_{min}), s	5				8	15		15
Start-Up Lost Time (*l*t), s	2.0				2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0				2.0	2.0		2.0
Passage (*PT*), s	7.0				7.0	7.0		7.0
Recall Mode	Off				Off	Min		Min
Dual Entry	No				No	Yes		Yes
Walk (*Walk*), s	0.0				0.0	0.0		0.0
Pedestrian Clearance Time (*PC*), s	0.0				0.0	0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25				0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0				9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No				0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0				12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50					No	0.50		No	0.50	

HCS 2010 Signalized Intersection Results Summary

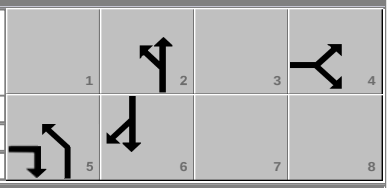
General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.79
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10		80				195	465			570	100

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	9.7	63.7	9.6	0.0	0.0	0.0	
Yellow	3.5	5.0	4.5	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



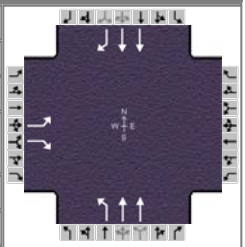
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		7.3
Phase Duration, s		16.1			13.2	83.9		70.7
Change Period, ($Y+R_c$), s		6.5			3.5	7.0		7.0
Max Allow Headway (*MAH*), s		6.2			8.0	0.0		0.0
Queue Clearance Time (g_s), s		8.6			6.2			
Green Extension Time (g_e), s		0.5			3.5	0.0		0.0
Phase Call Probability		0.96			1.00			
Max Out Probability		0.08			0.01			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	13		101				247	589			722	127
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1774		1331				1675	1236			1213	1110
Queue Service Time (g_s), s	0.6		6.6				4.2	0.0			7.4	4.7
Cycle Queue Clearance Time (g_c), s	0.6		6.6				4.2	0.0			7.4	4.7
Green Ratio (*g/C*)	0.10		0.19				0.75	0.77			0.64	0.64
Capacity (*c*), veh/h	170		257				622	1902			1545	707
Volume-to-Capacity Ratio (*X*)	0.074		0.395				0.397	0.309			0.467	0.179
Available Capacity (c_a), veh/h	346		389				1069	1902			1545	707
Back of Queue (*Q*), veh/ln (95th percentile)	0.5		4.0				2.3	0.2			2.4	1.9
Queue Storage Ratio (*RQ*) (95th percentile)	0.06		0.00				0.24	0.00			0.00	0.21
Uniform Delay (d_1), s/veh	41.2		35.3				4.2	0.0			3.3	7.4
Incremental Delay (d_2), s/veh	0.4		2.1				1.9	0.4			1.0	0.6
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	41.6		37.4				6.1	0.4			4.3	8.0
Level of Service (LOS)	D		D				A	A			A	A
Approach Delay, s/veh / LOS	37.8		D	0.0			2.1		A	4.9		A
Intersection Delay, s/veh / LOS	5.7						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	0.6	A	2.2	B
Bicycle LOS Score / LOS		F			1.2	A	1.2	A

HCS 2010 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	Jun 1, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.79
Intersection	Arsenal/Frontage	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - Arsenal - Frontage.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10		80				195	465			570	100

Signal Information													
Cycle, s	100.0	Reference Phase	2										
Offset, s	0	Reference Point	Begin										
Uncoordinated	No	Simult. Gap E/W	On										
Force Mode	Fixed	Simult. Gap N/S	On										
				Green	9.7	63.7	9.6	0.0	0.0	0.0			
				Yellow	3.5	5.0	4.5	0.0	0.0	0.0			
				Red	0.0	2.0	2.0	0.0	0.0	0.0			

	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	1.000	0.826	0.000	0.000	0.000	0.926	0.649	1.000	1.000	0.637	0.690
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	0.952	1.000
Left-Turn Adjustment Factor (f_{LT})		0.000					0.952	0.000			1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000						1.000			0.000	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000						1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000						1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h		0					1675	2535			2487	
Platoon Ratio (R_p)		0.00					1.00	1.33			1.33	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.23		0.23				0.50	0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		5.0			3.5	7.0		7.0
Green Ratio (*g*/*C*)		0.10			0.75	0.77		0.64
Permitted Saturation Flow Rate (s_p), veh/h/ln		1774			688	0		841
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								0
Permitted Effective Green Time (g_p), s		0.0			65.7	0.0		0.0
Permitted Service Time (g_u), s		0.0			56.3	0.0		0.0
Permitted Queue Service Time (g_{ps}), s					5.3			
Time to First Blockage (g_f), s		0.0			0.0	0.0		63.7
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		1331						0
Protected Right Effective Green Time (g_R), s		9.7						0.0

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	2.107	0.00	2.107	0.00	0.000	0.00	1.557	0.00
Pedestrian F_s / F_{delay}	0.000	0.163	0.000	0.162	0.000	0.039	0.000	0.076
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b		57.78		56.18	1538.44	2.66	1274.24	6.58
Bicycle F_w / F_v	-3.64		-3.64		-3.64	0.69	-3.64	0.70

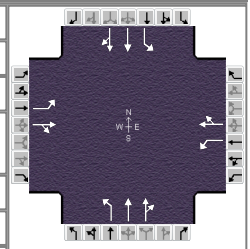
--- Messages ---

No errors or warnings exist.

--- Comments ---

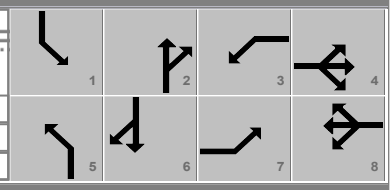
HCS 2010 Signalized Intersection Input Data

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	55	20	145	20	100	20	510	150	85	605	160

Signal Information			
Cycle, s	95.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.8	0.8	41.6	10.0	1.5	11.6						
Yellow	3.5	3.5	4.0	3.5	3.5	4.0						
Red	1.0	1.0	2.0	0.0	0.0	2.0						

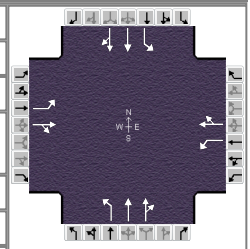
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	55	20	145	20	100	20	510	150	85	605	160
Initial Queue (Q_b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s_o), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N_m), man/h		None			None			None			None	
Heavy Vehicles (P_{HV}), %	65	40		7	11		81	9		12	22	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N_b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (*AT*)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (*I*)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (*W*), ft	12.0	12.0		11.0	11.0		11.0	11.0		11.0	11.0	
Turn Bay Length, ft	200	0		215	0		130	0		350	0	
Grade (*Pg*), %	0	0	0	0	0	0	0	0	0	0	0	0
Speed Limit, mi/h	45	45	45	45	45	45	50	50	50	50	50	50

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	15.0	40.0	15.0	40.0	15.0	45.0	15.0	45.0
Yellow Change Interval (*Y*), s	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
Red Clearance Interval (R_c), s	0.0	2.0	0.0	2.0	1.0	2.0	1.0	2.0
Minimum Green (G_{min}), s	3	10	3	10	4	20	4	20
Start-Up Lost Time (*lt*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (*e*), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (*PT*), s	3.0	4.0	3.0	4.0	3.0	7.0	3.0	7.0
Recall Mode	Off	Off	Off	Off	Off	Off	Off	Off
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Walk (*Walk*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pedestrian Clearance Time (*PC*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0	No	25	0	No	25	0	No	25	0	No	25
Walkway / Crosswalk Width / Length, ft	9.0	12	0	9.0	12	0	9.0	12	0	9.0	12	0
Street Width / Island / Curb	0	0	No	0	0	No	0	0	No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

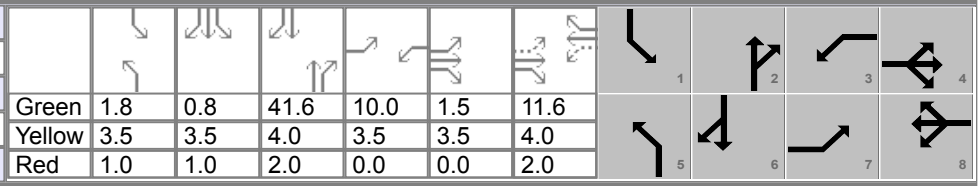
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	55	20	145	20	100	20	510	150	85	605	160

Signal Information			
Cycle, s	95.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.8	0.8	41.6	10.0	1.5	11.6
Yellow	3.5	3.5	4.0	3.5	3.5	4.0
Red	1.0	1.0	2.0	0.0	0.0	2.0

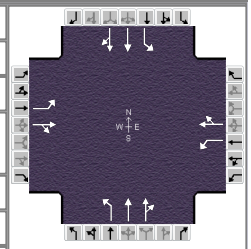
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	18.5	22.6	13.5	17.6	6.3	47.6	11.6	52.9
Change Period, ($Y+R_c$), s	3.5	6.0	3.5	6.0	4.5	6.0	4.5	6.0
Max Allow Headway (*MAH*), s	4.0	5.1	4.0	5.1	3.9	11.2	3.9	11.2
Queue Clearance Time (g_s), s	17.0	7.5	10.0	10.4	3.8	17.6	7.6	21.8
Green Extension Time (g_e), s	0.0	1.2	0.2	1.2	0.0	24.0	0.1	22.4
Phase Call Probability	1.00	1.00	0.99	1.00	0.45	1.00	0.92	1.00
Max Out Probability	1.00	0.00	0.41	0.00	0.00	0.97	0.03	0.98

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	273	85		165	136		23	390	360	97	451	418
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1097	1295		1691	1488		1000	1743	1606	1616	1557	1444
Queue Service Time (g_s), s	15.0	5.5		8.0	8.4		1.8	15.5	15.6	5.6	19.7	19.8
Cycle Queue Clearance Time (g_c), s	15.0	5.5		8.0	8.4		1.8	15.5	15.6	5.6	19.7	19.8
Green Ratio (*g/C*)	0.30	0.17		0.23	0.12		0.02	0.44	0.44	0.07	0.49	0.49
Capacity (*c*), veh/h	274	226		372	182		19	760	701	121	766	711
Volume-to-Capacity Ratio (*X*)	0.995	0.378		0.443	0.751		1.196	0.512	0.515	0.799	0.588	0.589
Available Capacity (c_a), veh/h	274	543		460	625		157	823	758	254	766	711
Back of Queue (*Q*), veh/ln (95th percentile)	9.7	3.2		5.7	6.1		2.3	10.2	9.6	4.5	11.1	10.5
Queue Storage Ratio (*RQ*) (95th percentile)	2.62	0.00		0.75	0.00		1.08	0.00	0.00	0.39	0.00	0.00
Uniform Delay (d_1), s/veh	34.1	34.8		31.6	40.5		46.8	19.5	19.5	43.4	17.3	17.3
Incremental Delay (d_2), s/veh	53.1	1.5		0.8	8.6		158.1	2.5	2.7	11.4	3.3	3.6
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	87.2	36.3		32.4	49.0		204.8	22.0	22.2	54.8	20.6	20.9
Level of Service (LOS)	F	D		C	D		F	C	C	D	C	C
Approach Delay, s/veh / LOS	75.1	E		39.9	D		27.5	C		24.2	C	
Intersection Delay, s/veh / LOS	34.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	2.3	B	2.3	B
Bicycle LOS Score / LOS	1.1	A	1.0	A	1.1	A	1.3	A

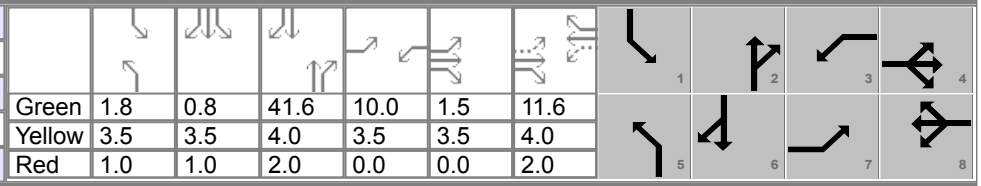
HCS 2010 Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	Kimley-Horn			Duration, h	0.25
Analyst	TLS	Analysis Date	May 26, 2015	Area Type	Other
Jurisdiction	IDOT	Time Period	PM Peak Hour (4:00 PM)	PHF	0.88
Intersection	IL 53/Laraway Road	Analysis Year	Existing (2015)	Analysis Period	1> 16:00
File Name	Ex - PM - IL 53 - Laraway.xus				
Project Description	Elwood Truck Routing Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	55	20	145	20	100	20	510	150	85	605	160

Signal Information			
Cycle, s	95.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.8	0.8	41.6	10.0	1.5	11.6						
Yellow	3.5	3.5	4.0	3.5	3.5	4.0						
Red	1.0	1.0	2.0	0.0	0.0	2.0						

	EB			WB			NB			SB		
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicle Adjustment Factor (f_{HV})	0.606	0.714	1.000	0.935	0.901	1.000	0.552	0.917	1.000	0.893	0.820	1.000
Approach Grade Adjustment Factor (f_g)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.952	0.000		0.952	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.954			0.870			0.922			0.927	
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Movement Saturation Flow Rate (*s*), veh/h	1097	950		1691	248		1000	2622		1616	2400	
Platoon Ratio (R_p)	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Proportion of Vehicles Arriving on Green (*P*)												
Incremental Delay Factor (*k*)	0.50	0.15		0.11	0.15		0.11	0.50	0.50	0.11	0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)	3.5	6.0	3.5	6.0	4.5	6.0	4.5	6.0
Green Ratio (*g/C*)	0.30	0.17	0.23	0.12	0.02	0.44	0.07	0.49
Permitted Saturation Flow Rate (s_p), veh/h/ln	771	0	1246	0	0	0	0	0
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s	13.6	0.0	11.6	0.0	0.0	0.0	0.0	0.0
Permitted Service Time (g_u), s	3.2	0.0	9.1	0.0	0.0	0.0	0.0	0.0
Permitted Queue Service Time (g_{ps}), s	3.2		0.4					
Time to First Blockage (g_f), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	2.107	0.00	2.107	0.00	1.557	0.00	1.557	0.00
Pedestrian F_s / F_{delay}	0.000	0.140	0.000	0.145	0.000	0.109	0.000	0.101
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b	348.37	32.51	243.89	36.75	872.28	15.15	983.85	12.30
Bicycle F_w / F_v	-3.64	0.59	-3.64	0.50	-3.64	0.64	-3.64	0.80

--- Messages ---

WARNING: If demand exceeds capacity, a multiple-period analysis should be conducted.

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---

