Appendix B – Traffic Memo

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MEMORANDUM

TO: Joel Dykstra

FROM: Graham Johnson, PE, PTOE (Lic. MN, SD, IA)

DATE: November 5, 2019

RE: 85th Street Access Traffic Analysis
SEH No. OWNJV149418 14.00

This memorandum summarizes the traffic analysis for 85th Street access locations between the proposed I-29 at 85th Street interchange and Sundowner Avenue and Tallgrass Avenue.

Traffic forecasts from the I-29 85th Street Interstate Justification Request (IJR) were used as a basis for the analysis, a forecast year of 2045 was prepared for that study. The forecast information was updated to include an option for either ¾ access or full access signalized intersection between the interchange and the adjacent arterials. The forecast memorandum for the updated demands is attached to this document.

The 85th Street corridor falls within four agency jurisdictions including the South Dakota Department of Transportation (SDDOT), the City of Sioux Falls, the City of Tea, and Lincoln County.

While all may have different standards, the purpose of access management is to provide vehicular access to land development in a manner that preserves the safety and efficiency of the transportation system.

INTERSECTION SPACING

85th Street is currently being designed as an access category Arterial II. This designation, according to the Sioux Falls Engineering Design Standards Manual, requires traffic signal spacing of ¼ mile (1320 feet), median openings of ¼ mile (1320 feet) and unsignalized intersection spacing of 660 feet. From the design manual, here is a description of an Arterial II:

- **Arterial II**—Routes that typically have continuity across the city. These routes serve a mixture of commercial and residential need.

Using the City of Tea Design Standards, 85th Street will be classified as a principal arterial (volume >15,000 with posted speed above 40 mph) with the number of intersections normally not spaced less than one-half mile.

The SDDOT requires control of access on an arterial street adjacent to any interchange. New interchanges require a control of access of a minimum of 660 feet, this distance is measured for both the approaching and departing directions. The departure measurement is measured from the radius of the most outside turning movement when the off-ramp is controlled. When the off-ramp is free flow into an add lane, the departure measurement begins at the point the average vehicle obtains the posted speed limit. The approach measurement starts at the beginning of a taper for the turn lanes approaching the interchange; the approach measurement is typically the most impactful.

With the proposed diverging diamond interchange (DDI) design, there is approximately 2,200 feet between the ramp terminal intersections and Sundowner Avenue or Tallgrass Avenue. Accounting for the SDDOT control of access spacing, mid-point access locations were evaluated at approximately:

- 1,200 feet east of Sundowner Avenue (West Access)
- 1,130 feet west of Tallgrass Avenue (East Access)

This access spacing does not currently meet the ¼ mile (1320 feet) spacing for either a median opening or traffic signal along the 85th Street corridor. The attached **Figure 1** shows the intersection and control of access spacing along 85th Street between Sundowner Avenue and Tallgrass Avenue.

TRAFFIC OPERATIONS

To test the viability of including a ¾ access or full access traffic signal at the proposed access locations, the Highway Capacity Software (HCS) was utilized from the previous IJR analysis for the interchange.

¾ Access

A ¾ Access intersection was evaluated at the proposed locations; a ¾ access intersection allows mainline traffic to turn left and right to the minor street, however the minor street is only allowed a right turn movement onto the mainline. The mainline left turning traffic must yield to the opposing through traffic, and the minor street right turning traffic must yield to mainline traffic before entering.

According to the forecast memorandum, the left turns from 85th Street to the proposed access locations would be relatively small, with all being less than 65 vehicle in each peak hour. The following table shows results of the analysis for the eastbound and westbound left turns as well as the northbound and southbound approaches (right turn only); the 85th Street through movements and right turn movements would have no delay at this control type.

***Table 1** - 2045 3/4 Access Operations*

Intersection Access		AM Peak Hour				PM Peak Hour			
		EB LT	WB LT	NB RT	SB RT	EB LT	WB LT	NB RT	SB RT
West Access	Volume	20	30	255	80	40	65	**295**	95
	Delay sec/veh / LOS	10.7 / B	13.5 / B	**37.7 / E**	12.9 / B	14.5 / B	17.5 / C	**89.5 / F**	18.1 / C
East Access	Volume	45	35	105	265	40	45	**195**	**200**
	Delay sec/veh / LOS	12.8 / B	12.4 / B	16.1 / C	29.6 / D	18.6 / C	17.1 / C	**37.2 / E**	**47.5 / E**

The only operational traffic problems that occur are during the PM peak hour where vehicles turn right onto 85th Street from the minor streets at the East and West intersections; they would have delays finding a gap in between the mainline 85th Street traffic; this delay would only impact the operations for the minor streets where the traffic is looking for a gap to pull out onto 85th Street. This would not impact the operations along 85th Street. If the minor delays become too great, traffic would shift towards either Sundowner Avenue or Tallgrass Avenue to access 85th Street at the signalized intersections.

As a sensitivity test, the left turn movements from 85th Street to the proposed access locations were increased in two stages. The first was an increase by a magnitude of 3-fold, the second stage was an increase of 5-fold.

The following table shows the results of the 3-fold analysis which the left turn movements all operated at a LOS D or better; the minor approach delays do not changed.

***Table 2** - 2045 3/4 Access Operations – Sensitivity 3-Fold*

Intersection Access		AM Peak Hour				PM Peak Hour			
		EB LT	WB LT	NB RT	SB RT	EB LT	WB LT	NB RT	SB RT
West Access	Volume	60	90	255	80	120	195	**295**	95
	Delay sec/veh / LOS	11.1 / B	15.1 / C	**37.7 / E**	12.9 / B	17.3 / C	29.2 / D	**89.5 / F**	18.1 / C
East Access	Volume	135	105	105	265	120	135	**195**	**200**
	Delay sec/veh / LOS	14.6 / B	13.8 / B	16.1 / C	29.6 / D	25.2 / D	22.9 / C	**37.2 / E**	**47.5 / E**

The following table shows the results of the 5-fold analysis which the left turn movements operate at failing conditions in the PM peak hour at both the West and East Access intersections.

***Table 3** - 2045 3/4 Access Operations – Sensitivity 5-Fold*

Intersection Access		AM Peak Hour				PM Peak Hour			
		EB LT	WB LT	NB RT	SB RT	EB LT	WB LT	NB RT	SB RT
West Access	Volume	100	150	255	80	200	**325**	**295**	95
	Delay sec/veh / LOS	11.6 / B	17.4 / C	**37.7 / E**	12.9 / B	22.4 / C	**83.8 / F**	**89.5 / F**	18.1 / C
East Access	Volume	225	175	105	265	**200**	**225**	**195**	**200**
	Delay sec/veh / LOS	18.0 / C	15.8 / C	16.1 / C	29.6 / D	**41.6 / E**	**37.7 / E**	**37.2 / E**	**47.5 / E**

¾ Access with 6-lane Section

Currently, 85th Street on the east side of I-29 has the potential to expand to a 6-lane roadway section. At the time of the IJR analysis, the corridor was planned to be constructed as a 4-lane, divided roadway between I-29 and Tallgrass Avenue. As development plans have started, more detailed traffic impacts are being considered near the intersection of 85th Street and Tallgrass Avenue which have resulted in increased capacity needs at the intersection.

It should be noted that any change to geometrics analyzed in the IJR would require an action of FHWA concurrence on the design changes within the 85th Street IJR study area. The degree of geometric change to the corridor or interchange design would determine the level of documentation necessary for FHWA to approve of concur with the changes.

The current understanding is the west leg of the 85th Street at Tallgrass Avenue intersection would need to include a 6-lane divided roadway; the beginning and end points of the 3rd lane in each direction is currently not fully understood. There are three potential locations to begin and end the 3rd lanes in each direction, they are as follows:

- As lanes add/drop between the East Access and Tallgrass Avenue:
  - This provides the necessary capacity at the intersection with the least roadway impacts.
  - Does not provide good lane continuity.
  - FHWA concurrence would likely only require memorandum documenting changes.
- At East Access:
  - Lanes would begin and end at northbound right turn and westbound right turn.
  - This would have roadway impacts between the access and Tallgrass Avenue.
  - Provides continuity between access and Tallgrass Avenue.
  - FHWA concurrence would likely only require memorandum documenting changes.
- At I-29:
  - Lanes would begin and end at northbound right turn and westbound right turn at I-29.
  - This would provide the most impactful with 6-lanes for almost ½ mile.
  - Provides continuity between I-29 and Tallgrass Avenue.

- The SDDOT control of access would be extended from the interchange further east on the departure of 85th Street as the northbound right turn would be a free movement into an add lane versus being controlled at the intersection traffic signal. This could ultimately shift the East Access intersection location by upwards of 200 feet, depending on the posted 85th Street speed limit, potentially reducing the intersection spacing to Tallgrass Avenue to an undesirable spacing.
    - If the posted speed on 85th Street is 40 mph, the COA is extended approximately 300' for a vehicle to accelerate to posted, for a total of 960'. This results in no change to the intersection spacing.
        - As the DDI interchange speeds will be reduced to 30 mph through the interchange, if the speed limit between the two proposed ¾ access intersections is reduced, the COA would not impact the intersection spacing.
    - If the posted speed on 85th Street is 45 mph, the COA is extended approximately 490' for a vehicle to accelerate to posted, for a total of 1150'. This results in shifting the East Access intersection approximately 200' east.
- While no significant operational change at DDI interchange, this design change would more than likely require IJR amendment to gain FHWA concurrence.

The first two options would not change the previous ¾ access operations analysis as there would remain two through lanes in each direction for the mainline left turns to yield. However, the last option would add an additional through lane in each direction, requiring longer gap times to make the mainline left turn movement.

With the additional roadway width to cross, the mainline left turns would begin to experience more delays trying to find gaps in 3-lanes of traffic. Under the base left turn demands, the eastbound and westbound left turns would only slightly increase to a LOS C for both movement in the AM peak hour; however, in the PM peak hour the delays would reach a LOS E.

Following the initial sensitivity test as before, increasing the mainline left turns by 3-fold, the eastbound and westbound left turns would again only slightly increase to a LOS D for both movements in the AM peak hour. During the PM peak hour, the delays would well exceed the LOS F criteria with between 100 and 124 seconds of delay for the left turn movements; such delays would develop long queues and likely result in riskier driver behavior attempting gaps that may not be adequate.

As the PM peak hour would incur poor LOS movements and the potential safety implications of making a left turn maneuver across 3-through lanes, if 6-lanes are required along 85th Street through the East Access, a ¾ access intersection would not be recommended. Additional analysis of a signalized option will be discussed later in this memorandum.

Full Access Signalized Intersections

The design of a DDI interchange is set up with a 2-phase signal control because the majority of the turning movements occur as yielding or free movements. Due to the short distance between ramp terminal intersections, approximately 500 feet of usable vehicle storage, and the 2-phase signal operations, a DDI typically works best with shorter cycle lengths somewhere between 70 and 90 seconds. The IJR analysis had cycle lengths of 80 and 90 seconds for the AM and PM peak hours. Due to the short cycle length of the DDI and the intersection spacing between Sundowner Avenue and Tallgrass Avenue, both of these intersections were previously analyzed as actuated-uncoordinated, otherwise known as operating "free".

Including signalized intersections below the standard intersection spacing will now require the traffic signals to be in a coordinated group between Sundowner Avenue and Tallgrass Avenue, including the two interchange signals. Signal coordination typically improves the overall intersection delay, by giving more green time to the major roadway and less time for the minor street. Without coordination along the corridor, platoons of traffic will potentially arrive at the downstream intersections on a red phase, creating significant delays at all intersections along the corridor as there is no progression.

With the addition of the two signalized access locations, the cycle length becomes critically important for the corridor. A range of cycle lengths were looked at for the corridor between 80 seconds and 130 seconds for each peak period. The AM peak is able to operate acceptably at a coordinated cycle length of 90 seconds, which works well for all intersections including the ramp terminals.

The DDI interchange signals began to have queueing issues between the ramp terminal intersections at all cycle lengths above 100 seconds in the PM peak hour. With this short of a cycle length, the Sundowner Avenue signal is operating near capacity with intersection movements at LOS E; the following Table 3 shows the approach LOS.

While all the approaches are at a LOS D, the Tallgrass Avenue intersection has intersection movements operating at LOS F and would also have queue storage issues. A longer cycle length in the coordinated system would result in acceptable operations at Tallgrass Avenue, a cycle length of approximately 120 seconds or more works for the volumes at this intersection; however this cycle length has significant impacts to the I-29 DDI ramp terminals that would result in queuing through each ramp terminal which is harmful to the safety and operations of the interchange.

One of the main constraints with the signal coordination is the number of signal phases at each intersection that must be served. As mentioned earlier, a DDI interchange operates well due to the simple 2-phase operations between the two ramp terminal intersections which allows for a short cycle length to limit delays. The intersections along 85th Street at both Sundowner Avenue and Tallgrass Avenue would operate under 8 signal phases in order to serve all the left turns and through movements for each approach; typically the more phases included require longer cycle lengths.

The following **Table 4** shows the operational results for a cycle length of 90 seconds in the AM peak and 100 seconds in the PM peak; this table represents the approach and intersection LOS, not individual movements.

***Table 4** - 2045 Full Access Traffic Signal Operations*

85th at:	AM Peak (Delay sec/veh / LOS)					PM Peak (Delay sec/veh / LOS)				
	EB Approach	WB Approach	NB Approach	SB Approach	Int.	EB Approach	WB Approach	NB Approach	SB Approach	Int.
Sundowner Ave	45.7 / D	25.1 / C	37.5 / D	42.0 / D	35.8 / D	**69.6 / E**	49.2 / D	44.3 / D	47.9 / D	51.3 / D
West Access	24.6 / C	30.5 / C	25.0 / C	29.7 / C	27.1 / C	27.4 / C	35.8 / D	53.8 / D	34.9 / C	33.2 / C
SB I-229	15.6 / B	15.3 / B	17.3 / B	15.8 / B	15.6 / B	33.5 / C	18.8 / B	22.2 / C	12.5 / B	24.9 / C
NB I-229	20.1 / C	20.8 / C	20.1 / C	20.6 / C	20.4 / C	6.4 / A	21.2 / C	28.3 / C	21.8 / C	13.3 / B
East Access	31.5 / C	34.8 / C	33.6 / C	36.6 / D	33.5 / C	30.4 / C	36.5 / D	39.2 / D	23.8 / C	33.2 / C
Tallgrass Ave**	34.6 / C	26.5 / C	39.5 / D	25.9 / C	30.4 / C	**49.9 / D**	41.6 / D	48.6 / D	**49.5 / D**	**46.9 / D**

**Includes new geometry from current 85th Street Project (Tallgrass to Louise Avenue)
Bold indicates either an approach LOS E/F or an intersection with an individual movement at LOS F or a queue storage above 1.0.

¾ Access with 6-lane Section – Signalized Intersection

To address the delays and poor LOS with a 6-lane roadway at the ¾ access intersection from the previous analysis, an alternative of signalizing the mainline left turns at the ¾ access was evaluated; an evaluation of the 4-lane roadway with 5-fold left turns was also completed under signalized control.

The simplified signal operations at a signalized ¾ access would allow for better coordination of the intersections with the DDI interchange as they both would operate with only 2-phases. In this case, the minor street approaches would still be a right out only under yield conditions, but the mainline left turns would operate under protected only left turn phases. When the left turn phase comes up, the opposing major through movement would go to a stop condition for only 10 to 20 seconds. This short duration results in a long green time for the 85th Street

through movements. To test for the worst case scenario, the mainline left turns analyzed were completed under the 5-fold volumes.

In the following evaluation, the intersection between Sundowner Avenue and the East Access intersection were coordinated together, however due to the short cycle length the Tallgrass Avenue intersection was considered uncoordinated in this analysis. The Tallgrass Avenue intersection could be coordinated on a different signal system to the east or could still be coordinated on this system until the future volumes would require a different cycle length at that intersection.

The following **Table 5** shows the operational results for the 6-lane roadway with 5-fold mainline left turns. A cycle length of 90 seconds in the AM peak and 100 seconds in the PM peak; this table represents the approach and intersection LOS, not individual movements. While there are two LOS E approaches, no movements are at a LOS F and there are no queue storage issues.

***Table 5** - 2045 Full Access Traffic Signal Operations 6-Lane*

85th at:	AM Peak (Delay sec/veh / LOS)					PM Peak (Delay sec/veh / LOS)				
	EB Approach	WB Approach	NB Approach	SB Approach	Int.	EB Approach	WB Approach	NB Approach	SB Approach	Int.
Sundowner Ave	44.6 / D	19.1 / B	42.0 / D	40.3 / D	35.0 / D	54.5 / D	21.8 / C	50.3 / D	**58.0 / E**	44.5 / D
West Access	14.2 / B	12.6 / B	n/a	n/a	12.4 / B	24.5 / C	20.5 / C	n/a	n/a	20.8 / C
SB I-229	20.5 / C	30.1 / C	19.4 / B	19.9 / B	23.2 / C	17.8 / B	31.0 / C	46.7 / D	16.9 / B	25.1 / C
NB I-229	25.8 / C	11.5 / B	17.9 / B	17.9 / B	17.7 / B	26.2 / C	20.3 / C	13.3 / B	13.3 / B	21.9 / C
East Access	8.6 / A	11.1 / B	n/a	n/a	8.5 / A	6.8 / A	10.4 / B	n/a	n/a	8.5 / A
Tallgrass Ave**	47.0 / D	16.8 / B	44.6 / D	32.0 / C	29.7 / C	**55.4 / E**	43.1 / D	48.9 / D	38.5 / D	45.3 / D

**Includes new geometry from current 85th Street Project (Tallgrass to Louise Avenue)
"n/a" indicates a minor street approach that HCS Signals doesn't provide data for; operations would be similar to unsignalized conditions.
Bold indicates either an approach LOS E/F or an intersection with an individual movement at LOS F or a queue storage above 1.0.

The following **Table 6** shows the operational results for the 4-lane roadway with 5-fold mainline left turns; the surrounding intersections are essentially unchanged from the previous 6-lane analysis. A cycle length of 90 seconds in the AM peak and 100 seconds in the PM peak; this table represents the approach and intersection LOS, not individual movements. While there are two LOS E approaches, no movements are at a LOS F and there are no queue storage issues.

***Table 6** - 2045 Full Access Traffic Signal Operations 4-Lane*

85th at:	AM Peak (Delay sec/veh / LOS)					PM Peak (Delay sec/veh / LOS)				
	EB Approach	WB Approach	NB Approach	SB Approach	Int.	EB Approach	WB Approach	NB Approach	SB Approach	Int.
Sundowner Ave	44.6 / D	19.1 / B	42.0 / D	40.3 / D	35.0 / D	54.5 / D	21.8 / C	50.3 / D	**58.0 / E**	44.5 / D
West Access	14.2 / B	12.6 / B	n/a	n/a	12.4 / B	25.0 / C	20.2 / C	n/a	n/a	20.9 / C
SB I-229	20.5 / C	30.1 / C	19.4 / B	19.9 / B	23.2 / C	17.8 / B	31.0 / C	46.7 / D	16.9 / B	25.1 / C
NB I-229	25.8 / C	11.5 / B	17.9 / B	17.9 / B	17.7 / B	26.2 / C	20.3 / C	13.3 / B	13.3 / B	21.9 / C
East Access	8.9 / A	11.0 / B	n/a	n/a	8.6 / A	7.1 / A	11.5 / B	n/a	n/a	9.2 / A
Tallgrass Ave**	47.0 / D	16.8 / B	44.6 / D	32.0 / C	29.7 / C	**55.4 / E**	43.1 / D	48.9 / D	38.5 / D	45.3 / D

**Includes new geometry from current 85th Street Project (Tallgrass to Louise Avenue)
"n/a" indicates a minor street approach that HCS Signals doesn't provide data for; operations would be similar to unsignalized conditions.
Bold indicates either an approach LOS E/F or an intersection with an individual movement at LOS F or a queue storage above 1.0.

OTHER CONSIDERATIONS

With the traffic operations accounted for in the analysis, there are other considerations that the project team considered. The following section reviews some of these considerations:

Land Use

The traffic forecasts utilized for the IJR traffic operations analysis were developed between 2015 and 2016. At the time of that analysis, the travel demand forecast model inputs were updated from the base forecast model assumptions to the then current development information. There are a total of six traffic analysis zones (TAZ) surrounding the proposed interchange area that were updated in the travel demand forecast model to reflect the proposed development area.

- Zones 287 and 288 are between Sundowner Avenue and I-29 north of 85th Street
- Zones 289 and 290 are between I-29 and Tallgrass Avenue north of 85th Street
- Zone 624 is between Sundowner Avenue and I-29 south of 85th Street
- Zone 625 is between I-29 and Tallgrass Avenue south of 85th Street

***Table 7** - Land Use - Forecast Model 2015*

TAZ	Households	Retail Jobs	Total Jobs
287	501	0	1,154
288	241	52	901
289	0	552	557
290	337	0	2,477
624	10	722	940
625	0	603	603
TOTAL	**1,089**	**1,929**	**6,632**

Significant changes to these inputs could impact the traffic forecasts for the IJR and this memorandum. As development occurs, if there are significant changes to these land use assumptions, traffic impact studies may be required to ensure the surrounding roadway network can handle the changes in traffic forecasts.

Per City of Sioux Falls design standards, a development must compare their estimated trip generation to the projected volumes from the interchange analysis to ensure the volumes would not exceed the previous traffic projections. If the estimated trip generation demands are greater than the projected traffic forecasts, a traffic impact study would be required.

Phased Control/Access Scenario

This development area won't be completely constructed at a single point in time, and therefore the project team had a discussion on whether or not a phased improvement schedule could provide a benefit. This could include constructing a full access intersection now (unsignalized or signalized), with the intent to remove and reduce access as development occurs or traffic problems begin to arise.

This approach would likely result in significant difficulties at the time of the need for the control or access change. A full access intersection, once constructed, is typically expected to be permanent by the adjacent businesses and the traveling public that use the intersection on a daily basis. Even with an agreement in place allowing the removal or reduction in access at a later date, the public and business community would see this change as a major business impact and push back on the change.

Existing Arterial Comparisons

The project team had a discussion on whether or not some of the surrounding traffic corridors follow the same design standards being set forth for the 85th Street corridor. There are two existing corridors in this project area that have similarities with the 85th Street corridor.

CR 106 is an east-west arterial between the City of Tea and the southern portion of the City of Sioux Falls; 41st Street is an east-west arterial in the City of Sioux Falls, north of the project area. Both of these corridors have similarities and difference between them.

The first major difference between these corridors and 85th Street is that CR 106 and 41st Street are existing facilities that have been in place for decades. Design standards have evolved over time, but since this is an existing facility, some of the intersections or access locations were likely in place well before the current design standards. That is why both of these corridors have undergone planning studies to make improvements to each corridor in order to improve the safety and operations of each facility.

On CR 106 the airport location on the west side of I-29, south of CR 106, creates a significant barrier to getting proper intersection spacing along CR 106; as well as the slight skew to I-29 which is closer to Sundowner Avenue than Tallgrass Avenue along CR 106. The existing development between the airport and I-29 has only a single access to get into and out of the area to the roadway network; therefore a full access intersection along CR 106 to serve the existing development area is important.

41st Street has significant safety and congestion issues which are partially due to high traffic volumes and poor intersection and access spacing. The current 41st Street project will construct a DDI at the I-29 interchange, as well as add capacity and reduce access along the corridor; many existing full access, including signalized intersections, will be reduced with the current project to improve safety and intersection spacing.

East Side versus West Side Signalized Access

Along 85th Street, the projected year 2045 traffic volumes will increase from Sundowner Avenue over to Louise Avenue. The projected volumes on the surrounding corridors were as follows:

- Sundowner Avenue : 10,000 vpd to the south and 18,000 vpd to the north
- Tallgrass Avenue : 13,000 vpd to the south and 27,000 vpd to the north
- 85th Street : 6,300 vpd west of Sundowner Avenue, 33,000 vpd east of Sundowner Avenue, 36,000 vpd west of Louise Avenue

Signalizing the East Access intersection would require us to coordinate the signal with both the Tallgrass intersection and the I-29 DDI interchange signals. Because of the larger predicted traffic volumes on the east side of the freeway, the Tallgrass Avenue intersection will require a longer cycle length than the DDI signals can accommodate, and we will start to develop major operational problems on 85th Street at Tallgrass Avenue.

Traffic signal coordination is intended to provide smooth flow along a corridor to reduce travel times by allowing platoons of vehicles to travel through multiple intersections. A well-timed, coordinated system permits continuous movement along an arterial or throughout a network of major streets with minimal stops and delays. In order to coordinate multiple intersections, the cycle length for all intersections in the system have to be identical to keep the intersections in coordination.

The traffic volumes on the west side of the freeway are somewhat lower and there is slightly better spacing between signals which allows us to have a little bit shorter signal cycle length which would potentially work with the DDI signals and allow proper coordination without major impacts to the 85th Street traffic progression.

Both the City of Sioux Falls and the City of Tea have discussed this type of scenario and have determined they would prefer to see similar treatments on each side of the freeway at the two mid-point access locations. If each side was treated differently, there is potential for development to shift between the surrounding TAZ and overload one side of the interchange. In order to ensure this doesn’t occur, both the East and West access locations should be treated in a similar manner

CONCLUSIONS

The purpose of access management is to provide vehicular access to land development in a manner that preserves the safety and efficiency of the transportation system. While, the access spacing guidelines for both the City of Sioux Falls and the City of Tea are not immediately in support of a median opening between Sundowner Avenue and I-29 and between I-29 and Tallgrass Avenue, the analysis shows that a ¾ access would operate reasonably well and would not create any significant traffic or safety issues along the 85th Street corridor.

The proposed East and West access spacing are just under the design standard criteria; the minimum intersection spacing would be approximately 1,070 feet, which is about 80% of the ¼ mile design criteria between the West Access and the I-29 DDI west ramp terminal. All other intersection spacing would be between 83% and 91% of the spacing criteria; this includes Sundowner Avenue to the West access (1,200 feet) and both distances on either side of the East access (1,100 feet, 1,130 feet).

With a median opening and access restricted to ¾ access and with two through lanes in each direction on 85th Street, both of the access intersections would operate reasonably well. The mainline 85th Street through movements and right turn movements would not be impacted by this access configuration and the left turns at the East and West ¾ access locations would operate at a LOS C or better; a sensitivity test showed that by increasing the left turn volumes by 3 times, the movement would still function at a LOS D or better; increasing by 5 times would result in LOS E/F in the PM peaks. Under the base forecasts, the only poor movement at the ¾ access would be the minor street right turn movements onto 85th Street; this delay would not impact 85th Street traffic and would stay on the development side of the intersection. The ¾ access would provide for the majority of movements into and out of the development without causing harm to the 85th Street corridor.

However, under a 6-lane roadway configuration, 3-through lanes in each direction on 85th Street, the unsignalized ¾ access would have failing operations for the mainline left turns and potentially create a safety concern with such a long crossing distance. With signalization of the mainline left turn movements, in both the 4-lane and 6-lane roadway configurations, the short phase interruption has minimal impacts to 85th Street traffic and is easily coordinated with the interchange; this would leave Tallgrass Avenue as an uncoordinated intersection or potentially coordinated on a separate system.

Under full access traffic signal control, the East and West intersection access locations would need to be coordinated with the adjacent signalized intersections at Tallgrass Ave and Sundowner Ave as well as the I-29 DDI interchange signals to ensure progression along the corridor. Due to the short cycle length required to ensure the DDI functions properly, the PM peak hour has operational problems at the Tallgrass Avenue intersection. The operational issues are not easily mitigated at Tallgrass Avenue without a longer cycle length in order to serve each movement at the intersection, the current design has dual left turn lanes and two or three through lanes for each approach.

A longer cycle length on the corridor would create a negative safety and operational problem at the I-29 DDI interchange intersections as traffic would queue through each intersection. Additionally, operating the signals as an uncoordinated system would result in vehicle platoons without progression, and arriving on red and yellow phases and potentially stopping at all intersections along the corridor; this results in significant delay increase along 85th Street. With the impacts along the corridor due to full access signalized intersections, the East Access control would not be recommended from a traffic operations and safety standpoint.

If we were to signalize the West Access intersection and coordinate the signals between Sundowner Avenue and the I-29 DDI intersection, while leaving the Tallgrass Avenue intersection uncoordinated or operating on a different coordinated system to the east, we would have a scenario that operates well as the volumes projected on the west side of I-29 are less than the east side of the freeway. The East Access would not be signalized in this scenario, rather served potentially by a ¾ access intersection to get traffic into the development; traffic leaving the development area should utilize a well-designed supporting roadway network to get traffic out to Tallgrass Avenue.

In order to not sway development to one side of the interchange over the other, both the City of Sioux Falls and the City of Tea would like to treat the mid-point access location in a similar fashion. Therefore, signalizing the west side and not the east side access is not considered reasonable.

Recommendations

As similar treatments of each access location would be preferred, it would be recommended to provide unsignalized ¾ access intersections, with the 4-lane section on 85th Street, at both the East and West Access intersections during the initial construction of the project. The only 6-lane portion of 85th Street should be designed to start on the east side of the East Access intersection and extend to Tallgrass Avenue, as these lanes start and end at the northbound and westbound right turn lanes, this would ensure only two through lanes for the mainline left turns to cross, which provided acceptable operations.

The accommodation of the potential future widening of 85th Street should consider widening on both sides of the roadway. Widening on the outside will allow for the interchange design to be utilized with minimal impacts at and through the interchange and will allow for minimal alignment shifting to accommodate the future project.

As this design change from the IJR analysis does not directly impact the I-29 interchange, a memorandum documenting the changes from the IJR will address SDDOT and FHWA considerations and provide a document for both agencies to provide concurrence on the changes from the IJR documentation.

The design of each access intersection should accommodate potential signalization of the ¾ access intersections in either the 4-lane or 6-lane roadway configuration width; this would ensure that the left turn demands would be able to operate acceptably if they fluctuate significantly from the forecasted volumes and the unsignalized movements begin to operate poorly.

The design of 85th Street should accommodate future potential expansion of 85th Street to 6-lanes from the I-29 interchange to the East Access; this could include right of way and other design features. Thus, the East and West Access locations should also be designed accordingly and with the ability to accommodate potential signalization of the ¾ access intersections at a later time.

The 85th Street IJR analysis forecasted traffic through the 2045 design year; this analysis did not indicate a 6-lane section need through this time frame. Additional development traffic impact studies conducted since the IJR was approved have indicated some needs along 85th Street that may require spot 6-lane sections, but the need is localized to the Tallgrass Avenue intersection as previously discussed in this document. As traffic projections outside of the 2045 design year could result in the need for 6-lane section, the City will continue to monitor traffic volumes beyond the 2045 design year.

gtj
Traffic Forecast Memorandum – 85th Street Access Options
Figure 1: I-29/85th St. Interchange Design
2045 HCS ¾ Access Reports
2045 HCS Signal Reports

c: Al Murra, SEH
Ross Harris, SEH
Mark Dierling, SEH

MEMORANDUM DRAFT

To: Graham Johnson, PE, PTOE
Al Murra, PE
SEH Inc

From: Haifeng Xiao, PE, PTOE
HFTE Inc

Date: August 15, 2019

Subject: Traffic Forecasts for the new ¾ and Full Access Options on 85th Street
I-29/85th Street Interchange Study

The traffic forecast memorandum dated on July 29, 2016 documented the traffic forecast assumptions, methodology and results for the I-29/85th Street Interchange Study. The 2045 intersection peak hour traffic forecasts for the Build Scenario S3 were used to conduct operations analysis to evaluate if the proposed interchange and study intersections are able to accommodate future traffic demand.

Two options with new accesses on 85th Street were recently proposed for both sides of the I-29/85th Street DDI (Diverging Diamond Interchange). One is an ¾ access option and the other is a conventional 4-leg intersection access option. The 3/4 access option provided by SEH is illustrated in **Figure 1** (the drawing for the full access option is not included in this memo). Concerns, especially with regards to traffic operations, were raised due to the closeness between the new accesses and the interchange intersections. This memorandum documents the peak hour traffic forecast assumptions, steps and results for the two new access options. The traffic forecasts will be subsequently used for traffic operations to address the concerns.

TRAFFIC FORECAST ASSUMPTIONS AND STEPS

The peak hour traffic forecasts for the two access options were developed largely based on the Sioux Falls (SF) travel demand model that was previously used for the I-29/85th Street Interchange Study. Engineering judgements and assumptions were made in the process at this level of analysis. The traffic forecasts were developed following the steps below:

- The AM (7-9am) and PM (16-18pm) trips entering/exiting the four quadrants of the I-29/85th Street were extracted from the 2045 SF travel demand model. The model included all the land uses assumed for the study Scenario S3 in the I-29/85th Street Interchange Study.
- Based on the existing traffic counts in the adjacent intersections, it was assumed the ratio of the peak hour over the 2-hour traffic volumes was 0.6 in the AM peak period while it was 0.57 in the PM peak period. These ratios were respectively applied to the 2-hour model outputs to calculate the AM and PM peak hour traffic volumes generated in the four quadrants.
- Selected links analyses were respectively conducted for the AM and PM periods to determine the directional distributions for the trips entering/exiting the quadrants. The directional percentages

were applied to the trips to calculate the turning movements entering/exiting the quadrants using the access intersections on 85th Street and Sundowner Avenue (or Tallgrass Avenue).

- Through traffic volumes on I-85th Street at the intersections were calculated based on the traffic forecasts at their adjacent intersections that were developed in the I-29/85th Street Interchange Study.
- The turning movements at Sundowner Avenue and Tallgrass Avenue were adjusted to develop traffic forecasts for the full access option while they remained unchanged from the I-29/85th Street interchange study. The traffic forecasts for the interchange intersections remain unchanged for the two access options assuming the two access options wouldn't affect system travel demand in the study area.

TRAFFIC FORECAST RESULTS

The traffic forecasts for the two access options are respectively summarized in **Table 1** and **Table 2**.

Table 1
2045 Peak Hour Traffic Forecasts for the ¾ Access Option*

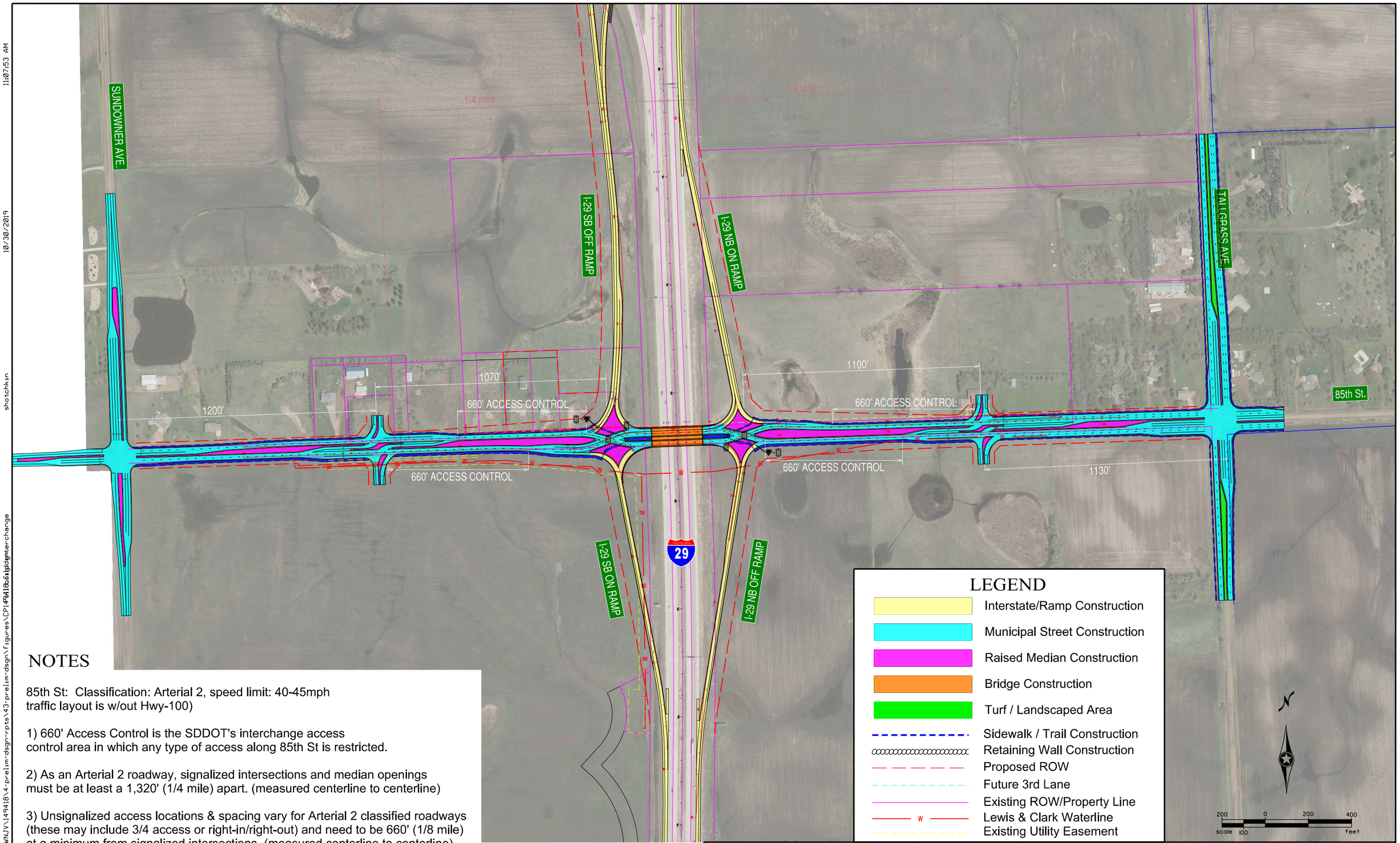
Peak Hour	85th Street Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AM	Sundowner Avenue	20	80	390	590	55	55	35	350	20	240	330	335
	West 3/4 Access			255			80	20	1,260	50	30	825	120
	I-29 SB Ramps				190		335		1410	105	270	640	
	I-29 NB Ramps	70		225				615	985			840	535
	East 3/4 Access			105			265	45	1,085	80	35	1,110	60
	Tallgrass Avenue	80	315	185	330	170	250	355	545	290	210	875	670
PM	Sundowner Avenue	25	90	390	835	65	80	40	365	20	325	555	475
	West 3/4 Access			295			95	40	1,445	105	65	1,260	120
	I-29 SB Ramps				430		580		1640	100	280	865	
	I-29 NB Ramps	70		205				655	1415			1075	690
	East 3/4 Access			195			200	40	1,465	115	45	1,565	135
	Tallgrass Avenue	155	280	335	645	360	485	310	925	425	260	1105	450

** The traffic forecasts for the adjacent intersections are included for convenience.*

Table 2
2045 Peak Hour Traffic Forecasts for the Full Access Option*

Peak Hour	85th Street Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AM	Sundowner Avenue	20	60	390	540	55	55	35	350	20	220	330	355
	West Full Access	60	5	255	100	5	80	70	1,160	50	90	765	120
	I-29 SB Ramps				190		335		1410	105	270	640	
	I-29 NB Ramps	70		225				615	985			840	535
	East Full Access	40	5	105	80	5	265	95	1,035	80	75	1,070	60
	Tallgrass Avenue	40	315	185	270	150	250	305	605	310	170	915	670
PM	Sundowner Avenue	25	70	390	745	65	80	40	365	20	305	555	495
	West Full Access	80	10	295	130	5	95	80	1,315	105	145	1,180	120
	I-29 SB Ramps				430		580		1640	100	280	865	
	I-29 NB Ramps	70		205				655	1415			1075	690
	East Full Access	80	10	195	60	10	200	100	1,405	115	95	1,485	135
	Tallgrass Avenue	75	280	335	605	340	485	250	965	445	210	1,155	450

** The traffic forecasts for the adjacent intersections are included for convenience.*



NOTES

85th St: Classification: Arterial 2, speed limit: 40-45mph
traffic layout is w/out Hwy-100)

1) 660' Access Control is the SDDOT's interchange access control area in which any type of access along 85th St is restricted.

2) As an Arterial 2 roadway, signalized intersections and median openings must be at least a 1,320' (1/4 mile) apart. (measured centerline to centerline)

3) Unsignalized access locations & spacing vary for Arterial 2 classified roadways (these may include 3/4 access or right-in/right-out) and need to be 660' (1/8 mile) at a minimum from signalized intersections. (measured centerline to centerline)

4) U-turns would be permitted at Sundowner Ave and Tallgrass Ave.

*¾ and fll access alternative is pending traffic analysis and city approval.

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

149418

DATE:
%DATE%

I-29 / 85th St. Interchange

FIGURE
No. 1

HCS7 Two-Way Stop-Control Report

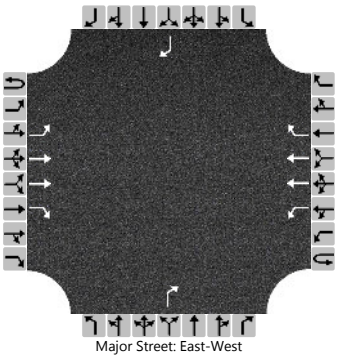
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	45	1085	80	0	35	1110	60				105				265
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		50				39						117				294
Capacity, c (veh/h)		523				526						440				431
v/c Ratio		0.10				0.07						0.27				0.68
95% Queue Length, Q_{95} (veh)		0.3				0.2						1.1				5.0
Control Delay (s/veh)		12.6				12.4						16.1				29.6
Level of Service (LOS)		B				B						C				D
Approach Delay (s/veh)	0.5				0.4				16.1				29.6			
Approach LOS									C				D			

HCS7 Two-Way Stop-Control Report

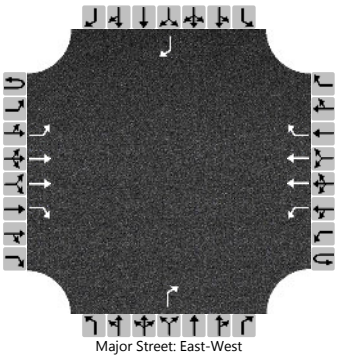
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	135	1085	80	0	105	1110	60				105				265
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		150				117						117				294
Capacity, c (veh/h)		523				526						440				431
v/c Ratio		0.29				0.22						0.27				0.68
95% Queue Length, Q_{95} (veh)		1.2				0.8						1.1				5.0
Control Delay (s/veh)		14.6				13.8						16.1				29.6
Level of Service (LOS)		B				B						C				D
Approach Delay (s/veh)	1.5				1.1				16.1				29.6			
Approach LOS									C				D			

HCS7 Two-Way Stop-Control Report

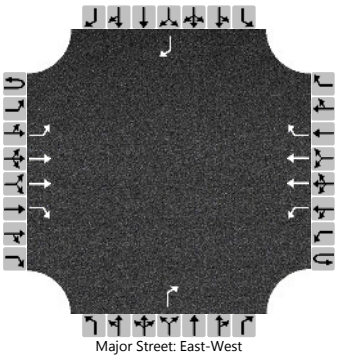
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 5x LEFTS

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	225	1085	80	0	175	1110	60				105				265
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		250				194						117				294
Capacity, c (veh/h)		523				526						440				431
v/c Ratio		0.48				0.37						0.27				0.68
95% Queue Length, Q_{95} (veh)		2.6				1.7						1.1				5.0
Control Delay (s/veh)		18.0				15.8						16.1				29.6
Level of Service (LOS)		C				C						C				D
Approach Delay (s/veh)	2.9				2.1				16.1				29.6			
Approach LOS									C				D			

HCS7 Two-Way Stop-Control Report

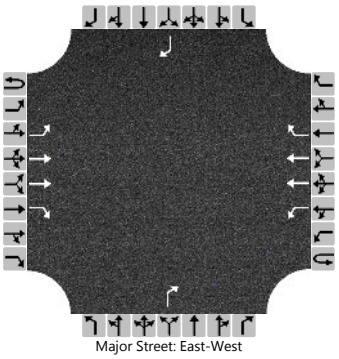
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	40	1465	115	0	45	1565	135				195				200
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		44				50						217				222
Capacity, c (veh/h)		309				348						319				293
v/c Ratio		0.14				0.14						0.68				0.76
95% Queue Length, Q_{95} (veh)		0.5				0.5						4.7				5.7
Control Delay (s/veh)		18.6				17.1						37.2				47.5
Level of Service (LOS)		C				C						E				E
Approach Delay (s/veh)	0.5				0.4				37.2				47.5			
Approach LOS									E				E			

HCS7 Two-Way Stop-Control Report

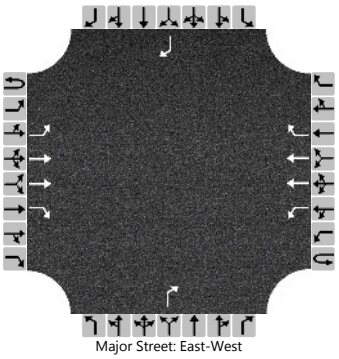
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	120	1465	115	0	135	1565	135				195				200
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		133				150						217				222
Capacity, c (veh/h)		309				348						319				293
v/c Ratio		0.43				0.43						0.68				0.76
95% Queue Length, Q_{95} (veh)		2.1				2.1						4.7				5.7
Control Delay (s/veh)		25.2				22.9						37.2				47.5
Level of Service (LOS)		D				C						E				E
Approach Delay (s/veh)	1.8				1.7				37.2				47.5			
Approach LOS									E				E			

HCS7 Two-Way Stop-Control Report

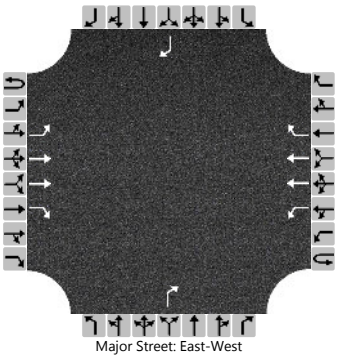
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 5x LEFTS

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	200	1465	115	0	225	1565	135				195				200
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		222				250						217				222
Capacity, c (veh/h)		309				348						319				293
v/c Ratio		0.72				0.72						0.68				0.76
95% Queue Length, Q_{95} (veh)		5.2				5.3						4.7				5.7
Control Delay (s/veh)		41.6				37.7						37.2				47.5
Level of Service (LOS)		E				E						E				E
Approach Delay (s/veh)	4.7				4.4				37.2				47.5			
Approach LOS									E				E			

HCS7 Two-Way Stop-Control Report

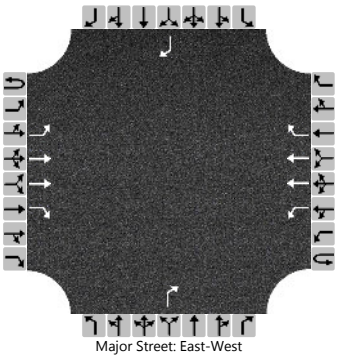
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	20	1260	50	0	30	825	120				255				80
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		22				33						283				89
Capacity, c (veh/h)		653				456						379				547
v/c Ratio		0.03				0.07						0.75				0.16
95% Queue Length, Q_{95} (veh)		0.1				0.2						5.9				0.6
Control Delay (s/veh)		10.7				13.5						37.7				12.9
Level of Service (LOS)		B				B						E				B
Approach Delay (s/veh)	0.2				0.4				37.7				12.9			
Approach LOS									E				B			

HCS7 Two-Way Stop-Control Report

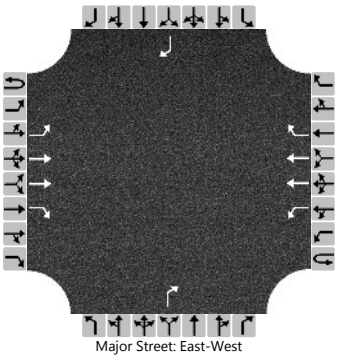
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	60	1260	50	0	90	825	120				255				80
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		67				100						283				89
Capacity, c (veh/h)		653				456						379				547
v/c Ratio		0.10				0.22						0.75				0.16
95% Queue Length, Q_{95} (veh)		0.3				0.8						5.9				0.6
Control Delay (s/veh)		11.1				15.1						37.7				12.9
Level of Service (LOS)		B				C						E				B
Approach Delay (s/veh)	0.5				1.3				37.7				12.9			
Approach LOS									E				B			

HCS7 Two-Way Stop-Control Report

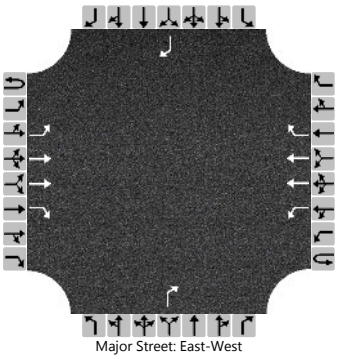
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 5x LEFTS

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	100	1260	50	0	150	825	120				255				80
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		111				167						283				89
Capacity, c (veh/h)		653				456						379				547
v/c Ratio		0.17				0.37						0.75				0.16
95% Queue Length, Q_{95} (veh)		0.6				1.7						5.9				0.6
Control Delay (s/veh)		11.6				17.4						37.7				12.9
Level of Service (LOS)		B				C						E				B
Approach Delay (s/veh)	0.8				2.4				37.7				12.9			
Approach LOS									E				B			

HCS7 Two-Way Stop-Control Report

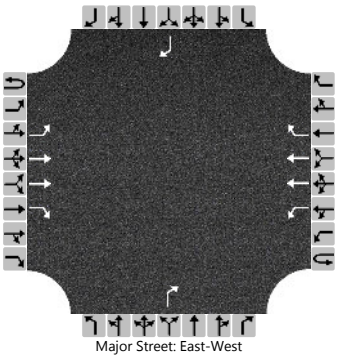
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	40	1445	105	0	65	1260	120				295				95
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		44				72						328				106
Capacity, c (veh/h)		425				359						324				379
v/c Ratio		0.10				0.20						1.01				0.28
95% Queue Length, Q_{95} (veh)		0.3				0.7						11.3				1.1
Control Delay (s/veh)		14.5				17.5						89.5				18.1
Level of Service (LOS)		B				C						F				C
Approach Delay (s/veh)	0.4				0.8				89.5				18.1			
Approach LOS									F				C			

HCS7 Two-Way Stop-Control Report

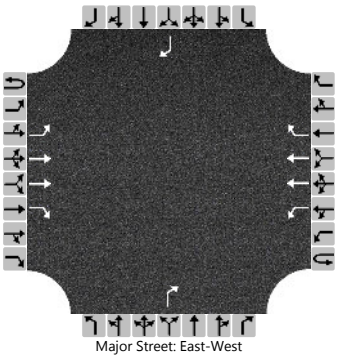
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	120	1445	105	0	195	1260	120				295				95
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		133				217						328				106
Capacity, c (veh/h)		425				359						324				379
v/c Ratio		0.31				0.60						1.01				0.28
95% Queue Length, Q_{95} (veh)		1.3				3.8						11.3				1.1
Control Delay (s/veh)		17.3				29.2						89.5				18.1
Level of Service (LOS)		C				D						F				C
Approach Delay (s/veh)	1.2				3.6				89.5				18.1			
Approach LOS									F				C			

HCS7 Two-Way Stop-Control Report

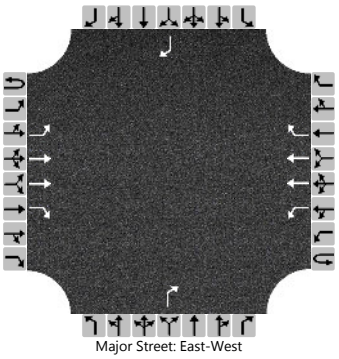
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 5x LEFTS

Site Information

Intersection	85th btwn Sundowner/I-29
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (West of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	1	0	1	2	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	200	1445	105	0	325	1260	120				295				95
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1						6.9				6.9
Critical Headway (sec)		4.16				4.16						6.96				6.96
Base Follow-Up Headway (sec)		2.2				2.2						3.3				3.3
Follow-Up Headway (sec)		2.23				2.23						3.33				3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		222				361						328				106
Capacity, c (veh/h)		425				359						324				379
v/c Ratio		0.52				1.01						1.01				0.28
95% Queue Length, Q_{95} (veh)		2.9				11.8						11.3				1.1
Control Delay (s/veh)		22.4				83.8						89.5				18.1
Level of Service (LOS)		C				F						F				C
Approach Delay (s/veh)	2.6				16.0				89.5				18.1			
Approach LOS									F				C			

HCS7 Two-Way Stop-Control Report

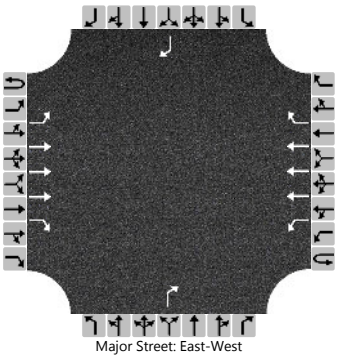
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 6lane

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	3	1	0	1	3	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	135	1085	80	0	105	1110	60				105				265
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		5.3				5.3						7.1				7.1
Critical Headway (sec)		5.36				5.36						7.16				7.16
Base Follow-Up Headway (sec)		3.1				3.1						3.9				3.9
Follow-Up Headway (sec)		3.13				3.13						3.93				3.93

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		150				117						117				294
Capacity, c (veh/h)		277				279						377				369
v/c Ratio		0.54				0.42						0.31				0.80
95% Queue Length, Q_{95} (veh)		3.0				2.0						1.3				6.8
Control Delay (s/veh)		32.3				26.9						18.8				43.9
Level of Service (LOS)		D				D						C				E
Approach Delay (s/veh)	3.4				2.2				18.8				43.9			
Approach LOS									C				E			

HCS7 Two-Way Stop-Control Report

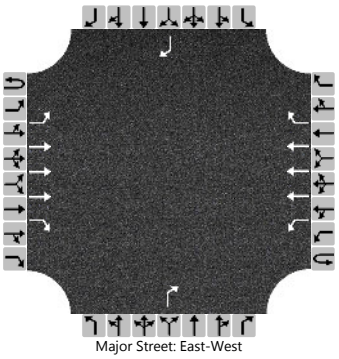
General Information

Analyst	Graham Johnson, PE, PTOE
Agency/Co.	SEH Inc.
Date Performed	8/5/2019
Analysis Year	2045
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	85th Street 3/4 Access Analysis - 6lanes

Site Information

Intersection	85th btwn I-29/Tallgrass
Jurisdiction	City of Sioux Falls
East/West Street	85th Street
North/South Street	3/4 Access (East of I-29)
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	3	1	0	1	3	1		0	0	1		0	0	1
Configuration		L	T	R		L	T	R				R				R
Volume (veh/h)	0	120	1465	115	0	135	1565	135				195				200
Percent Heavy Vehicles (%)	3	3			3	3						3				3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				Yes				Yes			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

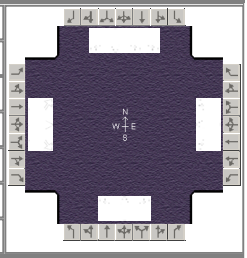
Base Critical Headway (sec)		5.3				5.3						7.1				7.1
Critical Headway (sec)		5.36				5.36						7.16				7.16
Base Follow-Up Headway (sec)		3.1				3.1						3.9				3.9
Follow-Up Headway (sec)		3.13				3.13						3.93				3.93

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		133				150						217				222
Capacity, c (veh/h)		141				164						274				252
v/c Ratio		0.95				0.91						0.79				0.88
95% Queue Length, Q_{95} (veh)		6.6				6.7						6.1				7.5
Control Delay (s/veh)		124.0				104.2						54.1				72.8
Level of Service (LOS)		F				F						F				F
Approach Delay (s/veh)	8.8				7.7				54.1				72.8			
Approach LOS									F				F			

HCS7 Signalized Intersection Results Summary

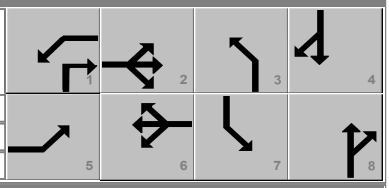
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Sundowner	File Name	85th St Corridor 2045 AM.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	350	20	220	330	355	20	60	390	540	55	55

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	9.5	13.9	3.1	2.1	9.8	12.5
Yellow	5.0	5.0	5.0	5.0	5.0	5.0
Red	1.5	1.5	1.5	1.5	1.5	1.5



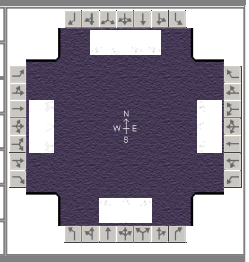
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.3	3.0	1.2	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.6	30.0	16.0	36.4	8.6	19.0	25.0	35.4
Change Period, ($Y+R_c$), s	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	2.9	3.1	2.9	3.1
Queue Clearance Time (g_s), s	2.0		11.5		3.2	14.5	18.0	4.2
Green Extension Time (g_e), s	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.8
Phase Call Probability	0.62		1.00		0.43	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.43	1.00	1.00	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	39	389	22	244	366	283	22	67	267	600	61	50
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1772	1502	1688	1772	1502	1688	1772	1502	1639	1772	1502
Queue Service Time (g_s), s	0.0	18.7	1.0	9.5	11.4	7.6	1.2	3.0	12.5	16.0	2.2	2.1
Cycle Queue Clearance Time (g_c), s	0.0	18.7	1.0	9.5	11.4	7.6	1.2	3.0	12.5	16.0	2.2	2.1
Green Ratio (*g/C*)	0.17	0.26	0.26	0.28	0.33	0.33	0.02	0.14	0.24	0.21	0.32	0.32
Capacity (*c*), veh/h	272	463	392	258	588	499	40	247	368	673	568	482
Volume-to-Capacity Ratio (*X*)	0.143	0.841	0.057	0.945	0.622	0.567	0.556	0.270	0.725	0.892	0.108	0.104
Back of Queue (*Q*), ft/ln (95 th percentile)	32.2	372.1	16.8	223.4	168.1	90.5	23.2	56.1	235.4	284.7	37.8	30.7
Back of Queue (*Q*), veh/ln (95 th percentile)	1.3	14.6	0.7	8.8	6.6	3.6	0.9	2.2	9.3	11.2	1.5	1.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.21	0.00	0.11	0.64	0.00	0.00	0.15	0.00	0.78	0.47	0.00	0.20
Uniform Delay (d_1), s/veh	32.5	31.5	24.9	22.4	13.3	1.8	43.5	34.7	31.2	34.8	21.5	16.8
Incremental Delay (d_2), s/veh	0.1	16.7	0.3	36.7	4.2	3.9	4.4	0.2	6.1	11.4	0.0	0.0
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	0.0
Control Delay (*d*), s/veh	32.6	48.2	25.2	59.1	17.5	5.7	47.9	34.9	37.3	46.2	21.5	16.8
Level of Service (LOS)	C	D	C	E	B	A	D	C	D	D	C	B
Approach Delay, s/veh / LOS	45.7	D		25.1	C		37.5	D		42.0	D	
Intersection Delay, s/veh / LOS	35.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.33	B	2.32	B	2.44	B	2.11	B
Bicycle LOS Score / LOS	1.23	A	1.96	B	1.07	A	1.66	B

HCS7 Signalized Intersection Results Summary

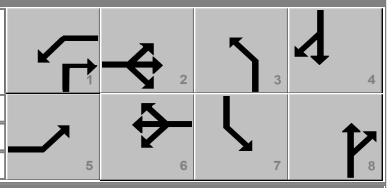
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Sundowner	File Name	85th St Corridor 2045 PM 100.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	40	365	20	305	555	495	25	70	390	745	65	80

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

Green	3.5	4.5	23.5	2.7	17.7	9.1
Yellow	5.0	5.0	5.0	5.0	5.0	5.0
Red	1.5	1.5	1.5	1.5	1.5	1.5



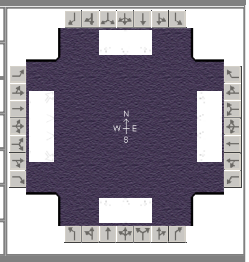
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	10.0	30.0	21.0	41.0	9.2	15.6	33.4	39.8
Change Period, ($Y+R_c$), s	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Max Allow Headway (MAH), s	3.0	0.0	3.0	0.0	2.9	3.1	2.9	3.1
Queue Clearance Time (g_s), s	4.0		16.5		3.6	11.1	26.7	5.4
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9
Phase Call Probability	0.71		1.00		0.54	1.00	1.00	1.00
Max Out Probability	0.00		1.00		1.00	1.00	1.00	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	44	406	22	324	590	366	28	78	267	828	72	72
Adjusted Saturation Flow Rate (s), veh/h/ln	1688	1772	1502	1688	1772	1502	1688	1772	1502	1639	1772	1502
Queue Service Time (g_s), s	2.0	22.7	1.1	14.5	32.7	21.1	1.6	4.2	9.1	24.7	2.8	3.4
Cycle Queue Clearance Time (g_c), s	2.0	22.7	1.1	14.5	32.7	21.1	1.6	4.2	9.1	24.7	2.8	3.4
Green Ratio (g/C)	0.27	0.23	0.23	0.40	0.34	0.34	0.03	0.09	0.24	0.27	0.33	0.33
Capacity (c), veh/h	132	416	353	324	611	517	45	161	354	883	590	500
Volume-to-Capacity Ratio (X)	0.337	0.974	0.063	0.998	0.966	0.708	0.612	0.484	0.754	0.938	0.122	0.144
Back of Queue (Q), ft/ln (95 th percentile)	35.8	502.8	19.8	269.5	551.6	287.7	32.5	80.7	266.6	418.8	50.2	50.6
Back of Queue (Q), veh/ln (95 th percentile)	1.4	19.8	0.8	10.6	21.7	11.3	1.3	3.2	10.5	16.5	2.0	2.0
Queue Storage Ratio (RQ) (95 th percentile)	0.24	0.00	0.13	0.77	0.00	0.00	0.22	0.00	0.89	0.70	0.00	0.34
Uniform Delay (d_1), s/veh	30.1	37.9	29.7	20.6	31.8	28.1	48.1	43.2	35.5	35.7	23.2	23.4
Incremental Delay (d_2), s/veh	0.6	38.1	0.3	39.0	21.6	5.1	4.9	0.8	7.9	16.4	0.0	0.0
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	0.0
Control Delay (d), s/veh	30.6	76.0	30.0	59.7	53.3	33.1	53.0	44.1	43.5	52.1	23.2	23.4
Level of Service (LOS)	C	E	C	E	D	C	D	D	D	D	C	C
Approach Delay, s/veh / LOS	69.6	E		49.2	D		44.3	D		47.9	D	
Intersection Delay, s/veh / LOS	51.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.34	B	2.30	B	2.52	C	2.11	B
Bicycle LOS Score / LOS	1.27	A	2.70	C	1.10	A	2.09	B

HCS7 Signalized Intersection Results Summary

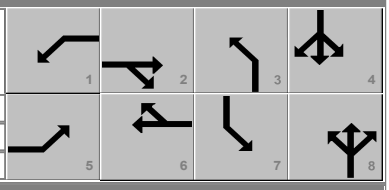
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal West	File Name	85th St Corridor 2045 AM.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	1160	50	90	765	120	60	5	255	100	5	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	52	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.3	26.0	8.0	4.1	2.4	14.2
Yellow	4.5	4.5	4.5	4.5	0.0	4.5
Red	1.5	1.5	1.5	1.5	0.0	1.5



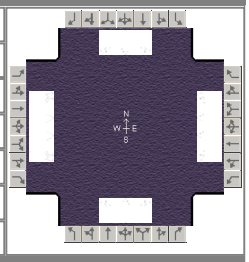
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.3	43.3	14.0	46.0	10.1	20.2	12.5	22.7
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	3.2	3.4	3.2	3.4
Queue Clearance Time (g_s), s	6.1		7.3		4.8	13.6	6.9	5.4
Green Extension Time (g_e), s	0.1	0.0	1.4	0.0	0.1	0.6	0.0	0.6
Phase Call Probability	0.86		0.92		0.81	1.00	0.94	1.00
Max Out Probability	0.00		0.54		0.00	0.00	1.00	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	78	1289	56	100	849	133	67	6	200	111	6	67
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502	1688	1772	1502	1688	1772	1502
Queue Service Time (g_s), s	4.1	31.3	1.8	5.3	20.4	7.3	2.8	0.2	11.6	4.9	0.2	3.4
Cycle Queue Clearance Time (g_c), s	4.1	31.3	1.8	5.3	20.4	7.3	2.8	0.2	11.6	4.9	0.2	3.4
Green Ratio (*g/C*)	0.06	0.41	0.41	0.09	0.44	0.44	0.23	0.16	0.16	0.23	0.19	0.19
Capacity (*c*), veh/h	100	1398	622	150	1498	667	414	280	238	421	328	278
Volume-to-Capacity Ratio (*X*)	0.781	0.922	0.089	0.668	0.567	0.200	0.161	0.020	0.842	0.264	0.017	0.240
Back of Queue (*Q*), ft/ln (95 th percentile)	76.9	320.2	26.8	104.1	349.8	187.1	52.2	4.7	145.7	89.4	4.5	56.3
Back of Queue (*Q*), veh/ln (95 th percentile)	3.0	12.6	1.1	4.1	13.8	7.4	2.1	0.2	5.7	3.5	0.2	2.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.26	0.00	0.09	0.35	0.00	0.62	0.17	0.00	0.49	0.30	0.00	0.19
Uniform Delay (d_1), s/veh	41.7	18.4	10.9	42.8	28.1	25.5	27.8	32.0	20.8	28.5	30.0	31.3
Incremental Delay (d_2), s/veh	2.2	5.6	0.1	1.7	1.4	0.6	0.1	0.0	3.1	0.1	0.0	0.2
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	0.0
Control Delay (*d*), s/veh	43.9	24.1	11.1	44.5	29.5	26.1	27.8	32.0	23.9	28.7	30.0	31.4
Level of Service (LOS)	D	C	B	D	C	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	24.6	C		30.5	C		25.0	C		29.7	C	
Intersection Delay, s/veh / LOS	27.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.24	B	2.12	B	2.45	B	2.45	B
Bicycle LOS Score / LOS	1.66	B	1.38	A	0.94	A	0.79	A

HCS7 Signalized Intersection Results Summary

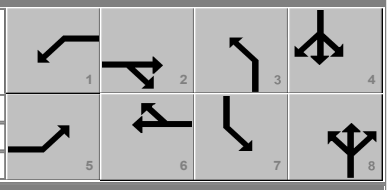
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal West	File Name	85th St Corridor 2045 PM 100.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	1315	105	145	1180	120	80	10	295	130	5	95

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	68	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.5	4.2	43.5	5.8	3.3	12.6
Yellow	4.5	0.0	4.5	4.5	0.0	4.5
Red	1.5	0.0	1.5	1.5	0.0	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	3.0	1.1	3.0	1.1	3.0
Phase Duration, s	12.5	49.5	16.7	53.7	11.8	18.6	15.2	21.9
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	3.2	3.4	3.2	3.4
Queue Clearance Time (g_s), s	7.1		10.8		6.3	12.5	9.3	6.2
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.4
Phase Call Probability	0.92		0.99		0.92	1.00	0.98	1.00
Max Out Probability	0.85		0.19		0.53	1.00	1.00	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	89	1461	117	154	1252	127	89	11	161	144	6	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502	1688	1772	1502	1688	1772	1502
Queue Service Time (g_s), s	5.1	42.9	4.2	8.8	34.5	7.6	4.3	0.6	10.5	7.3	0.3	4.2
Cycle Queue Clearance Time (g_c), s	5.1	42.9	4.2	8.8	34.5	7.6	4.3	0.6	10.5	7.3	0.3	4.2
Green Ratio (*g/C*)	0.07	0.43	0.43	0.11	0.48	0.48	0.22	0.13	0.13	0.22	0.16	0.16
Capacity (*c*), veh/h	110	1467	653	181	1610	716	392	223	189	396	282	239
Volume-to-Capacity Ratio (*X*)	0.809	0.996	0.179	0.850	0.778	0.178	0.227	0.050	0.852	0.365	0.020	0.302
Back of Queue (*Q*), ft/ln (95 th percentile)	80.2	320	58.9	160	526.7	186.6	81.1	11	224	137	5.3	71.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.2	12.6	2.3	6.3	20.7	7.3	3.2	0.4	8.8	5.4	0.2	2.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.27	0.00	0.20	0.53	0.00	0.62	0.27	0.00	0.75	0.46	0.00	0.24
Uniform Delay (d_1), s/veh	41.5	15.9	14.8	39.3	32.5	26.3	32.3	38.4	42.8	33.5	35.4	37.1
Incremental Delay (d_2), s/veh	2.1	11.6	0.2	9.2	2.7	0.4	0.1	0.0	23.9	0.2	0.0	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	0.0
Control Delay (*d*), s/veh	43.5	27.5	14.9	48.5	35.2	26.7	32.4	38.5	66.7	33.7	35.5	37.4
Level of Service (LOS)	D	C	B	D	D	C	C	D	E	C	D	D
Approach Delay, s/veh / LOS	27.4	C		35.8	D		53.8	D		34.9	C	
Intersection Delay, s/veh / LOS	33.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.14	B	2.46	B	2.45	B
Bicycle LOS Score / LOS	1.86	B	1.81	B	0.92	A	0.85	A

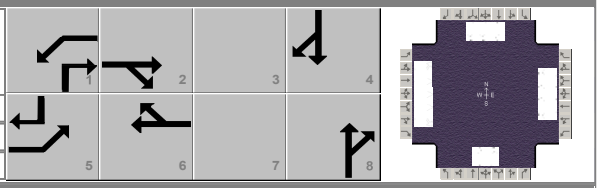
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Segment Distance, ft	500
Jurisdiction	SDDOT	Duration, h	0.250	Freeway Direction	North-South
Intersection	85th St at I-29 SB	PHF	0.90	Arterial Direction	East-West
File Name	85th St Corridor 2045 AM.xus				
Project Description	85th Corridor				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	1	1410	105	1	640	270		0	190		0	335
Intersection Two Demand (*v*), veh/h	1	985	615	1	840	535		0	225		0	70

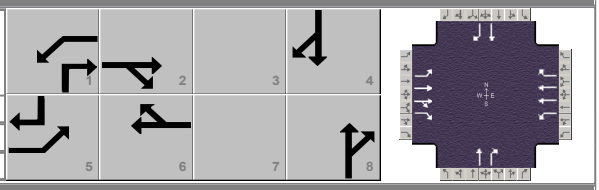
Signal One Information	
Cycle, s	90.0
Offset, s	14
Uncoordinated	No
Force Mode	Fixed

Green	35.0	37.0	5.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0
Red	0.0	1.0	0.0	0.0	0.0	0.0



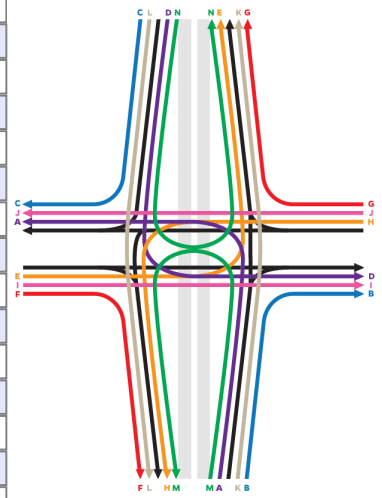
Signal Two Information	
Cycle, s	90.0
Offset, s	4
Uncoordinated	No
Force Mode	Fixed

Green	31.0	8.0	36.0	1.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	1.0	1.0	0.0	0.0	0.0	0.0



Interchange Results

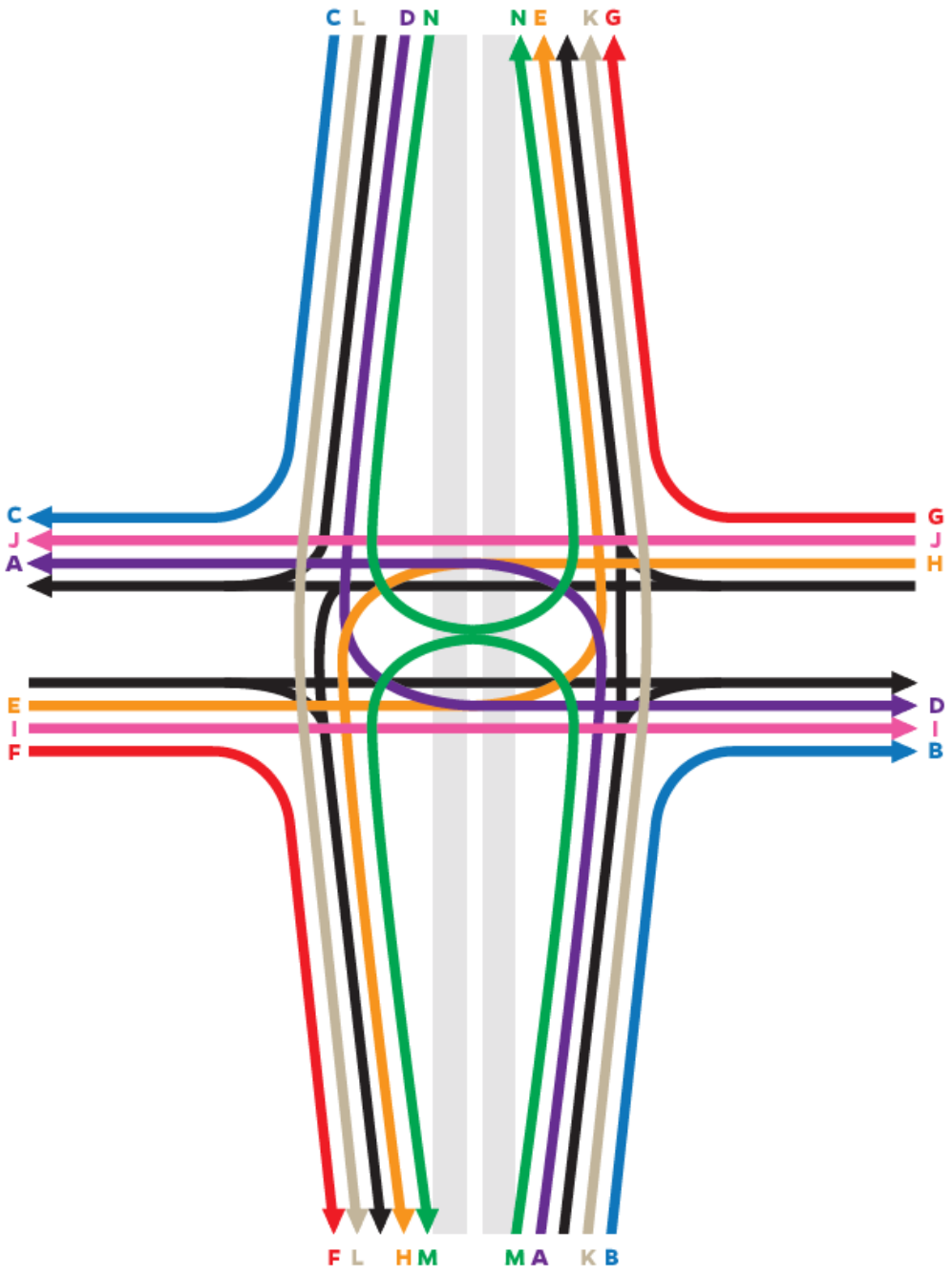
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	14.7	0.0	14.7	No	No	A
B	250	20.1	0.0	20.1	No	No	B
C	372	15.8	0.0	15.8	No	No	B
D	0	13.9	0.0	13.9	No	No	A
E	1	39.2	0.0	39.2	No	No	C
F	61	15.8	0.0	15.8	No	No	B
G	261	21.6	0.0	21.6	No	No	B
H	1	32.7	0.0	32.7	No	No	C
I	1093	29.7	0.0	29.7	No	No	B
J	710	35.3	0.0	35.3	No	No	C
K	0		0.0		-	-	-
L	0		0.0		-	-	-
M	0		0.0		-	-	
N	0		0.0		-	-	
Interchange ETT (s/veh) and LOS				27.3	B		



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	11.8	15.8	11.8	12.1	14.7	16.6		0.0	17.3		0.0	15.8
Level of Service (LOS)	B	B	B	B	B	B			B			B
Approach Delay, s/veh / LOS	15.6	B		15.3	B		17.3	B		15.8	B	
Intersection Delay, s/veh / LOS	15.6						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	23.4	13.9	30.1	20.6	20.5	21.6		0.0	20.1		0.0	20.6
Level of Service (LOS)	C	B	C	C	C	C			C			C
Approach Delay, s/veh / LOS	20.1	C		20.8	C		20.1	C		20.6	C	
Intersection Delay, s/veh / LOS	20.4						C					

Interchange Graphic



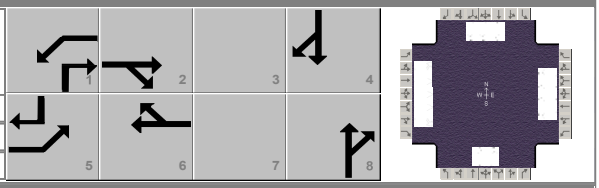
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Segment Distance, ft	500
Jurisdiction	SDDOT	Duration, h	0.250	Freeway Direction	North-South
Intersection	85th St at I-29 SB	PHF	0.90	Arterial Direction	East-West
File Name	85th St Corridor 2045 PM 100.xus				
Project Description	85th Corridor				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	1	1640	100	1	865	280		0	430		0	580
Intersection Two Demand (*v*), veh/h	1	1415	655	1	1075	690		0	205		0	70

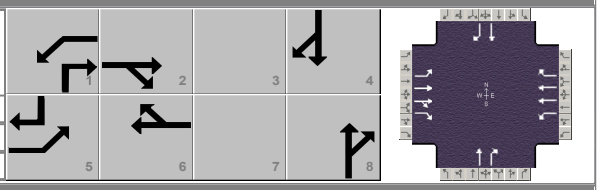
Signal One Information	
Cycle, s	100.0
Offset, s	17
Uncoordinated	No
Force Mode	Fixed

Green	33.0	4.0	42.0	8.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	1.0	0.0	0.0	0.0



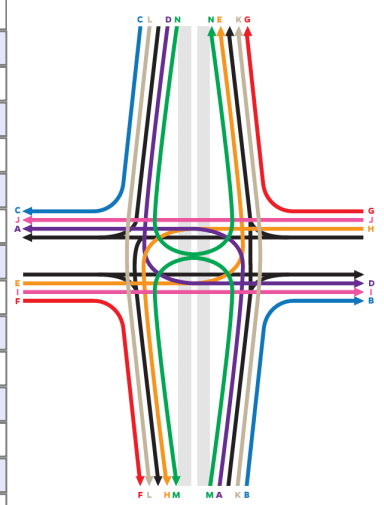
Signal Two Information	
Cycle, s	100.0
Offset, s	11
Uncoordinated	No
Force Mode	Fixed

Green	35.0	18.0	31.0	2.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	1.0	1.0	0.0	0.0	0.0	0.0



Interchange Results

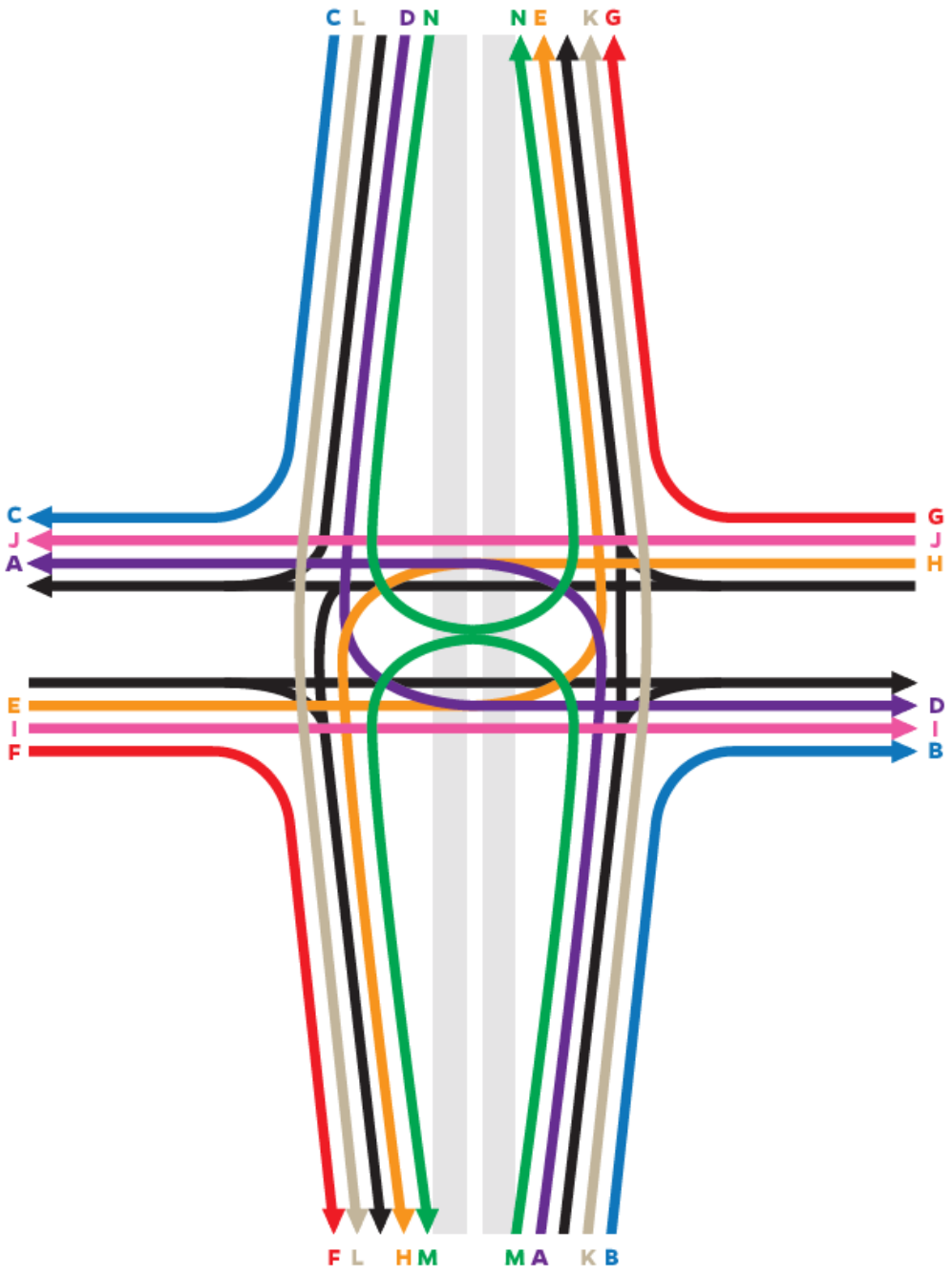
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.6	0.0	19.6	No	No	B
B	228	28.3	0.0	28.3	No	No	B
C	644	12.5	0.0	12.5	No	No	A
D	0	6.4	0.0	6.4	No	No	A
E	1	54.4	0.0	54.4	No	No	C
F	56	33.9	0.0	33.9	No	No	C
G	401	19.9	0.0	19.9	No	No	B
H	1	29.3	0.0	29.3	No	No	B
I	1571	40.3	0.0	40.3	No	No	C
J	889	41.2	0.0	41.2	No	No	C
K	0		0.0		-	-	-
L	0		0.0		-	-	-
M	0		0.0		-	-	
N	0		0.0		-	-	
Interchange ETT (s/veh) and LOS				32.8	C		



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	16.8	33.9	21.8	7.7	19.6	16.0		0.0	22.2		0.0	12.5
Level of Service (LOS)	B	C	C	A	B	B			C			B
Approach Delay, s/veh / LOS	33.5	C		18.8	B		22.2	C		12.5	B	
Intersection Delay, s/veh / LOS	24.9						C					

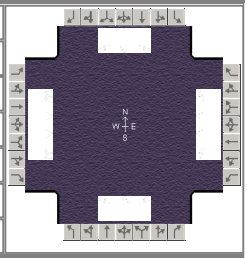
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	20.5	6.4	6.2	33.4	21.6	19.9		0.0	28.3		0.0	21.8
Level of Service (LOS)	C	A	A	C	C	B			C			C
Approach Delay, s/veh / LOS	6.4	A		21.2	C		28.3	C		21.8	C	
Intersection Delay, s/veh / LOS	13.3						B					

Interchange Graphic



HCS7 Signalized Intersection Results Summary

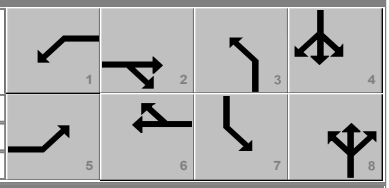
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 AM.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	95	1035	80	75	1070	60	40	5	105	80	5	265

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	8	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.6	1.5	40.6	3.4	2.0	13.0
Yellow	4.5	0.0	4.5	4.5	0.0	4.5
Red	1.5	0.0	1.5	1.5	0.0	1.5



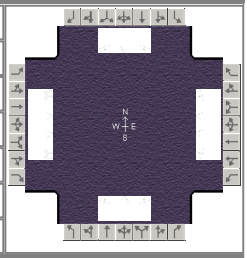
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	1.1	3.0	1.1	3.0
Phase Duration, s	13.1	48.1	11.6	46.6	9.4	19.0	11.3	21.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	3.2	3.4	3.2	3.4
Queue Clearance Time (g_s), s	7.5		6.2		3.9	7.2	6.0	14.3
Green Extension Time (g_e), s	0.2	0.0	0.1	0.0	0.0	0.7	0.0	0.7
Phase Call Probability	0.93		0.88		0.67	1.00	0.89	1.00
Max Out Probability	0.00		0.00		0.00	0.00	1.00	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	105	1149	89	83	1189	67	44	6	94	89	6	211
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502	1688	1772	1502	1688	1772	1502
Queue Service Time (g_s), s	5.5	28.3	4.3	4.2	30.5	3.7	1.9	0.2	5.2	4.0	0.2	12.3
Cycle Queue Clearance Time (g_c), s	5.5	28.3	4.3	4.2	30.5	3.7	1.9	0.2	5.2	4.0	0.2	12.3
Green Ratio (*g/C*)	0.08	0.47	0.47	0.06	0.45	0.45	0.20	0.14	0.14	0.20	0.17	0.17
Capacity (*c*), veh/h	133	1579	703	104	1522	677	374	255	216	380	295	250
Volume-to-Capacity Ratio (*X*)	0.795	0.727	0.126	0.800	0.781	0.098	0.119	0.022	0.436	0.234	0.019	0.846
Back of Queue (*Q*), ft/ln (95 th percentile)	100.6	446.9	109.7	70.7	444.2	93.2	35.7	4.8	86.6	73.5	4.6	206.8
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	17.6	4.3	2.8	17.5	3.7	1.4	0.2	3.4	2.9	0.2	8.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.34	0.00	0.37	0.24	0.00	0.31	0.12	0.00	0.29	0.24	0.00	0.69
Uniform Delay (d_1), s/veh	38.9	29.0	20.7	35.8	33.6	24.5	29.3	33.1	35.2	30.1	31.4	36.4
Incremental Delay (d_2), s/veh	3.1	2.3	0.3	2.0	1.6	0.1	0.1	0.0	0.5	0.1	0.0	3.0
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	0.0
Control Delay (*d*), s/veh	42.1	31.3	21.0	37.8	35.2	24.6	29.4	33.1	35.7	30.2	31.4	39.4
Level of Service (LOS)	D	C	C	D	D	C	C	C	D	C	C	D
Approach Delay, s/veh / LOS	31.5	C		34.8	C		33.6	C		36.6	D	
Intersection Delay, s/veh / LOS	33.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.20	B	2.45	B	2.45	B
Bicycle LOS Score / LOS	1.60	B	1.59	B	0.73	A	0.99	A

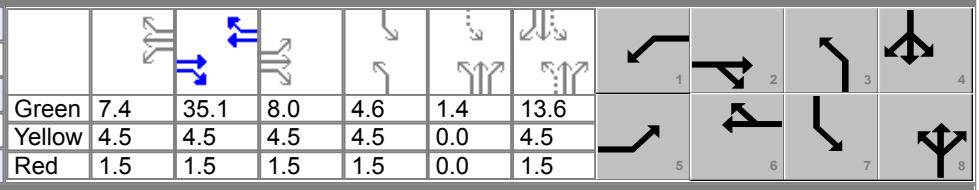
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 PM 100.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	1405	115	95	1485	135	80	10	195	60	10	200

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	61	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.4	35.1	8.0	4.6	1.4	13.6
Yellow	4.5	4.5	4.5	4.5	0.0	4.5
Red	1.5	1.5	1.5	1.5	0.0	1.5

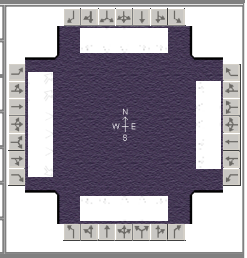
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	1.1	3.0	1.1	3.0
Phase Duration, s	14.0	55.1	13.4	54.4	12.0	21.0	10.6	19.6
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	3.2	3.4	3.2	3.4
Queue Clearance Time (g_s), s	8.4		7.7		6.5	12.2	5.3	12.8
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0	0.1	0.8	0.1	0.8
Phase Call Probability	0.95		0.93		0.92	1.00	0.84	1.00
Max Out Probability	1.00		0.00		0.04	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	111	1560	128	98	1528	139	89	11	161	67	11	167
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502	1688	1772	1502	1688	1772	1502
Queue Service Time (g_s), s	6.4	43.1	4.2	5.7	44.4	8.4	4.5	0.5	10.2	3.3	0.5	10.8
Cycle Queue Clearance Time (g_c), s	6.4	43.1	4.2	5.7	44.4	8.4	4.5	0.5	10.2	3.3	0.5	10.8
Green Ratio (*g/C*)	0.08	0.49	0.49	0.07	0.48	0.48	0.20	0.15	0.15	0.20	0.14	0.14
Capacity (*c*), veh/h	136	1657	737	124	1634	727	356	265	225	352	240	204
Volume-to-Capacity Ratio (*X*)	0.819	0.942	0.173	0.787	0.935	0.191	0.250	0.042	0.716	0.190	0.046	0.818
Back of Queue (*Q*), ft/ln (95 th percentile)	142.8	527.5	61	80.1	548	120.2	83.9	10.7	175.5	62.1	10.9	109.3
Back of Queue (*Q*), veh/ln (95 th percentile)	5.6	20.8	2.4	3.2	21.6	4.7	3.3	0.4	6.9	2.4	0.4	4.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.48	0.00	0.20	0.27	0.00	0.40	0.28	0.00	0.58	0.21	0.00	0.36
Uniform Delay (d_1), s/veh	43.1	20.9	12.4	47.0	36.7	12.3	34.2	36.4	40.5	33.7	37.6	15.8
Incremental Delay (d_2), s/veh	20.6	8.5	0.3	0.4	1.4	0.1	0.1	0.0	1.6	0.1	0.0	3.1
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	0.0
Control Delay (*d*), s/veh	63.7	29.4	12.7	47.4	38.0	12.3	34.3	36.4	42.1	33.8	37.6	18.9
Level of Service (LOS)	E	C	B	D	D	B	C	D	D	C	D	B
Approach Delay, s/veh / LOS	30.4	C		36.5	D		39.2	D		23.8	C	
Intersection Delay, s/veh / LOS	33.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.16	B	2.21	B	2.45	B	2.46	B
Bicycle LOS Score / LOS	1.97	B	2.06	B	0.92	A	0.89	A

HCS7 Signalized Intersection Results Summary

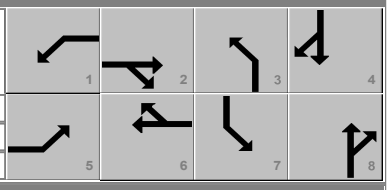
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Tallgrass	File Name	85th St Corridor 2045 AM.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	305	605	310	170	915	670	40	315	185	270	150	250

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	57	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.1	16.4	11.3	3.4	0.8	15.2
Yellow	4.5	4.5	4.5	4.5	4.5	4.5
Red	1.5	1.5	1.5	1.5	1.5	1.5



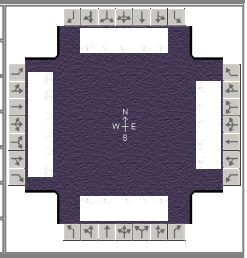
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	17.3	39.6	13.1	35.5	9.4	21.2	16.1	27.9
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (MAH), s	3.0	0.0	3.0	0.0	3.0	3.1	3.0	3.1
Queue Clearance Time (g_s), s	11.2		7.1		3.2	13.9	10.0	17.5
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0	0.0	1.3	0.1	1.7
Phase Call Probability	1.00		0.99		0.67	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.00	0.49	1.00	0.15

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	339	672	278	189	1017	744	44	350	206	300	167	278
Adjusted Saturation Flow Rate (s), veh/h/ln	1639	1609	1502	1639	1687		1639	1687	1502	1639	1687	
Queue Service Time (g_s), s	9.2	10.6	15.8	5.1	26.1		1.2	8.7	11.9	8.0	3.5	
Cycle Queue Clearance Time (g_c), s	9.2	10.6	15.8	5.1	26.1		1.2	8.7	11.9	8.0	3.5	
Green Ratio (g/C)	0.13	0.37	0.37	0.08	0.33		0.04	0.17	0.17	0.11	0.24	
Capacity (c), veh/h	411	1803	561	259	1104		122	568	253	369	822	
Volume-to-Capacity Ratio (X)	0.825	0.372	0.495	0.730	0.921		0.364	0.616	0.813	0.814	0.203	
Back of Queue (Q), ft/ln (95 th percentile)	182.6	173.7	263.4	93.4	441.6		21.6	155	213.3	164.6	61.7	
Back of Queue (Q), veh/ln (95 th percentile)	7.2	6.8	10.4	3.7	17.4		0.9	6.1	8.4	6.5	2.4	
Queue Storage Ratio (RQ) (95 th percentile)	0.46	0.00	0.88	0.31	0.00		0.05	0.00	0.53	0.25	0.00	
Uniform Delay (d_1), s/veh	42.5	25.8	32.7	40.5	29.2		42.3	34.7	36.1	39.0	27.1	
Incremental Delay (d_2), s/veh	8.6	0.4	2.1	2.6	13.7		0.7	0.4	10.0	10.2	0.0	
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	
Control Delay (d), s/veh	51.1	26.2	34.8	43.1	42.9	0.0	43.0	35.1	46.1	49.3	27.1	0.0
Level of Service (LOS)	D	C	C	D	D	A	D	D	D	D	C	A
Approach Delay, s/veh / LOS	34.6	C		26.5	C		39.5	D		25.9	C	
Intersection Delay, s/veh / LOS	30.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.57	C	2.59	C	2.72	C	2.80	C
Bicycle LOS Score / LOS	1.20	A	2.10	B	0.98	A	1.10	A

HCS7 Signalized Intersection Results Summary

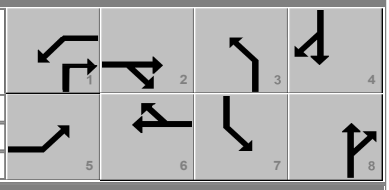
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Tallgrass	File Name	85th St Corridor 2045 PM 100.xus		
Project Description	85th Corridor				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	250	965	445	210	1155	450	75	280	335	605	340	485

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	94	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	9.0	23.1	6.9	4.5	8.5	12.0
Yellow	4.5	4.5	4.5	4.5	4.5	4.5
Red	1.5	1.5	1.5	1.5	1.5	1.5



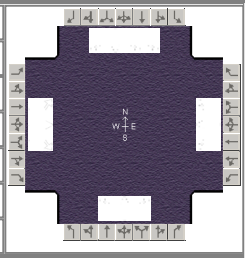
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	12.9	42.0	15.0	44.1	10.5	18.0	25.0	32.5
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (MAH), s	3.0	0.0	3.0	0.0	3.0	3.1	3.0	3.1
Queue Clearance Time (g_s), s	8.9		9.0		4.5	14.0	21.0	28.5
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Phase Call Probability	1.00		1.00		0.90	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.00	1.00	1.00	1.00

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	278	1071	494	233	1283	500	83	311	239	672	378	539
Adjusted Saturation Flow Rate (s), veh/h/ln	1639	1609	1502	1639	1687		1639	1687	1502	1639	1687	
Queue Service Time (g_s), s	6.9	17.9	31.0	7.0	38.0		2.5	8.9	12.0	19.0	9.3	
Cycle Queue Clearance Time (g_c), s	6.9	17.9	31.0	7.0	38.0		2.5	8.9	12.0	19.0	9.3	
Green Ratio (g/C)	0.07	0.36	0.36	0.09	0.38		0.05	0.12	0.21	0.19	0.26	
Capacity (c), veh/h	226	1737	540	296	1286		148	405	316	623	894	
Volume-to-Capacity Ratio (X)	1.230	0.617	0.914	0.789	0.998		0.564	0.768	0.757	1.080	0.423	
Back of Queue (Q), ft/ln (95 th percentile)	244.2	220.3	352.6	142.7	649		46.1	183.6	255	480.8	164.5	
Back of Queue (Q), veh/ln (95 th percentile)	9.6	8.7	13.9	5.6	25.6		1.8	7.2	10.0	18.9	6.5	
Queue Storage Ratio (RQ) (95 th percentile)	0.61	0.00	0.94	0.48	0.00		0.12	0.00	0.64	0.74	0.00	
Uniform Delay (d_1), s/veh	49.8	25.2	27.9	44.6	30.9		46.8	42.7	37.1	40.5	30.4	
Incremental Delay (d_2), s/veh	116.0	0.5	9.4	9.7	24.6		1.3	7.9	9.1	59.4	0.1	
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	165.8	25.8	37.3	54.3	55.5	0.0	48.0	50.5	46.2	99.9	30.5	0.0
Level of Service (LOS)	F	C	D	D	E	A	D	D	D	F	C	A
Approach Delay, s/veh / LOS	49.9	D		41.6	D		48.6	D		49.5	D	
Intersection Delay, s/veh / LOS	46.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.74	C	2.60	C	2.73	C	2.71	C
Bicycle LOS Score / LOS	1.50	B	2.15	B	1.01	A	1.80	B

HCS7 Signalized Intersection Results Summary

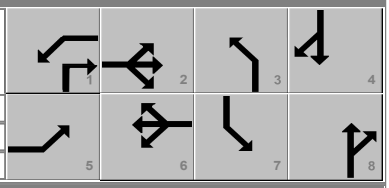
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Sundowner	File Name	85th St Corridor 2045 AM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lan 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	350	20	240	330	335	20	80	390	590	55	55

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.1	5.4	23.5	2.1	11.5	11.8
Yellow	5.0	0.0	5.0	5.0	5.0	5.0
Red	1.5	0.0	1.5	1.5	1.5	1.5



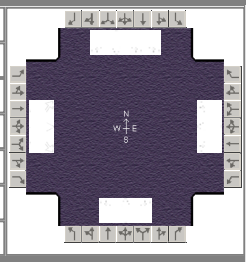
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.6	30.0	15.0	35.4	8.6	18.3	26.7	36.4
Change Period, ($Y+R_c$), s	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	2.9	3.1	2.9	3.1
Queue Clearance Time (g_s), s	3.4		9.8		3.2	13.8	19.5	4.1
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.8
Phase Call Probability	0.62		0.99		0.43	1.00	1.00	1.00
Max Out Probability	0.02		1.00		0.01	1.00	0.51	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	39	389	22	205	282	200	22	89	267	656	61	44
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1772	1502	1688	1772	1502	1688	1772	1502	1639	1772	1502
Queue Service Time (g_s), s	1.4	18.7	1.0	7.8	7.5	5.3	1.2	4.1	11.8	17.5	2.1	1.8
Cycle Queue Clearance Time (g_c), s	1.4	18.7	1.0	7.8	7.5	5.3	1.2	4.1	11.8	17.5	2.1	1.8
Green Ratio (*g/C*)	0.36	0.26	0.26	0.36	0.32	0.32	0.02	0.13	0.23	0.22	0.33	0.33
Capacity (*c*), veh/h	399	462	392	292	569	482	40	233	339	735	588	498
Volume-to-Capacity Ratio (*X*)	0.097	0.841	0.057	0.701	0.495	0.416	0.556	0.382	0.786	0.892	0.104	0.089
Back of Queue (*Q*), ft/ln (95 th percentile)	23	372.1	16.8	167.6	118	70.3	23.2	76.8	253.7	297.7	37	26.7
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	14.6	0.7	6.6	4.6	2.8	0.9	3.0	10.0	11.7	1.5	1.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00	0.11	0.42	0.00	0.00	0.15	0.00	0.85	0.50	0.00	0.18
Uniform Delay (d_1), s/veh	19.5	31.5	24.9	26.1	12.2	10.4	43.5	35.8	32.8	33.9	20.8	20.7
Incremental Delay (d_2), s/veh	0.0	16.7	0.3	5.3	2.6	2.3	4.4	0.4	10.7	9.6	0.0	0.0
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	0.0
Control Delay (*d*), s/veh	19.5	48.2	25.2	31.4	14.9	12.6	47.9	36.1	43.4	43.5	20.8	20.7
Level of Service (LOS)	B	D	C	C	B	B	D	D	D	D	C	C
Approach Delay, s/veh / LOS	44.6	D		19.1	B		42.0	D		40.3	D	
Intersection Delay, s/veh / LOS	35.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.33	B	2.30	B	2.44	B	2.11	B
Bicycle LOS Score / LOS	1.23	A	1.96	B	1.11	A	1.74	B

HCS7 Signalized Intersection Results Summary

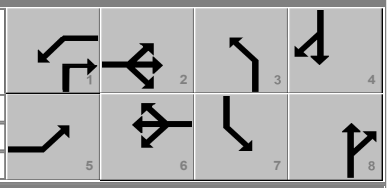
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Sundowner	File Name	85th St Corridor 2045 PM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lane 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	365	20	305	555	475	25	90	390	835	65	80

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

Green	3.5	2.5	25.4	2.7	19.3	7.5
Yellow	5.0	5.0	5.0	5.0	5.0	5.0
Red	1.5	1.5	1.5	1.5	1.5	1.5



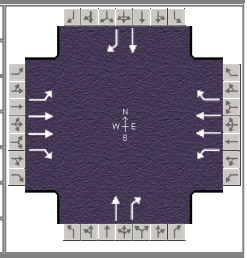
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	10.0	31.9	19.1	41.0	9.2	14.0	35.0	39.8
Change Period, ($Y+R_c$), s	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0	2.9	3.1	2.9	3.1
Queue Clearance Time (g_s), s	3.7		12.5		3.6	9.5	30.2	5.4
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.8
Phase Call Probability	0.71		1.00		0.54	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.15	1.00	1.00	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	44	406	22	249	453	225	28	100	211	928	72	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1772	1502	1688	1772	1502	1688	1772	1502	1639	1772	1502
Queue Service Time (g_s), s	1.7	22.1	1.1	10.5	17.0	6.7	1.6	5.5	7.5	28.2	2.8	3.4
Cycle Queue Clearance Time (g_c), s	1.7	22.1	1.1	10.5	17.0	6.7	1.6	5.5	7.5	28.2	2.8	3.4
Green Ratio (*g/C*)	0.38	0.25	0.25	0.38	0.34	0.34	0.03	0.08	0.20	0.28	0.33	0.33
Capacity (*c*), veh/h	295	451	382	316	611	517	45	133	301	934	590	500
Volume-to-Capacity Ratio (*X*)	0.151	0.899	0.058	0.787	0.743	0.434	0.612	0.752	0.701	0.993	0.122	0.144
Back of Queue (*Q*), ft/ln (95 th percentile)	28.8	448.1	19.1	205.6	193.6	82.2	32.5	137.2	219.3	506.5	50.2	50.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.1	17.6	0.8	8.1	7.6	3.2	1.3	5.4	8.6	19.9	2.0	2.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.19	0.00	0.13	0.51	0.00	0.00	0.22	0.00	0.73	0.84	0.00	0.34
Uniform Delay (d_1), s/veh	21.3	36.0	28.2	29.2	14.0	11.3	48.1	45.3	37.2	35.7	23.2	23.4
Incremental Delay (d_2), s/veh	0.1	23.5	0.3	5.8	5.0	1.6	4.9	19.1	6.0	27.7	0.0	0.0
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	0.0
Control Delay (*d*), s/veh	21.4	59.5	28.5	34.9	19.0	12.9	53.0	64.5	43.2	63.4	23.2	23.4
Level of Service (LOS)	C	E	C	C	B	B	D	E	D	E	C	C
Approach Delay, s/veh / LOS	54.5	D		21.8	C		50.3	D		58.0	E	
Intersection Delay, s/veh / LOS	44.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.41	B	2.30	B	2.59	C	2.11	B
Bicycle LOS Score / LOS	1.27	A	2.57	C	1.05	A	2.26	B

HCS7 Signalized Intersection Results Summary

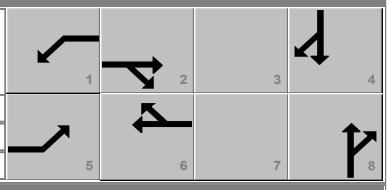
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New 3/4 Signal West	File Name	85th St Corridor 2045 AM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lan 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	1260	50	150	825	120		0	255		0	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.5	1.2	66.3	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



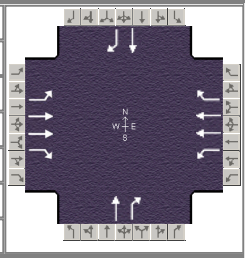
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	13.5	72.3	14.7	73.5		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	7.5		8.7			3.0		3.0
Green Extension Time (g_e), s	0.1	0.0	0.1	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.01		0.06			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	105	1321	52	136	748	109		0	172		0	56
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	5.5	24.1	1.3	6.7	12.1	4.4		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	5.5	24.1	1.3	6.7	12.1	4.4		0.0			0.0	
Green Ratio (*g/C*)	0.08	0.74	0.74	0.10	0.75	0.75		0.01			0.01	
Capacity (*c*), veh/h	141	2483	1105	164	2529	1126		20			20	
Volume-to-Capacity Ratio (*X*)	0.743	0.532	0.047	0.829	0.296	0.097		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	94.7	315.3	12.6	101.4	178.8	44.8		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.7	12.4	0.5	4.0	7.0	1.8		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.32	0.00	0.04	0.34	0.00	0.15		0.00			0.00	
Uniform Delay (d_1), s/veh	40.0	12.0	5.2	28.9	9.0	8.7		0.0			0.0	
Incremental Delay (d_2), s/veh	1.2	0.3	0.0	4.8	0.3	0.1		0.0			0.0	
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	41.2	12.4	5.3	33.7	9.3	8.8		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	B	A	C	A	A			A			A
Approach Delay, s/veh / LOS	14.2	B		12.6	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	12.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.99	B	1.88	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	1.78	B	1.49	A	0.77	A	0.58	A

HCS7 Signalized Intersection Results Summary

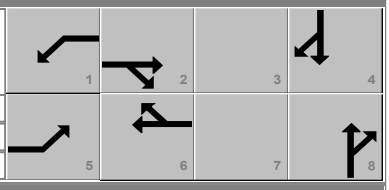
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New 3/4 Signal West	File Name	85th St Corridor 2045 PM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lane 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	1445	105	325	1260	120		0	295		0	95

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	13.7	4.2	67.1	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	19.7	73.1	23.9	77.3		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	13.7		17.8			3.0		3.0
Green Extension Time (g_e), s	0.0	0.0	0.1	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	202	1459	106	284	1101	105		0	217		0	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	11.7	35.8	3.9	15.8	21.4	4.7		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	11.7	35.8	3.9	15.8	21.4	4.7		0.0			0.0	
Green Ratio (*g/C*)	0.14	0.67	0.67	0.18	0.71	0.71		0.01			0.01	
Capacity (*c*), veh/h	232	2263	1007	302	2405	1070		18			18	
Volume-to-Capacity Ratio (*X*)	0.872	0.645	0.105	0.939	0.458	0.098		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	179.2	463	49	243.3	322.2	58.5		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.1	18.2	1.9	9.6	12.7	2.3		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.60	0.00	0.16	0.81	0.00	0.20		0.00			0.00	
Uniform Delay (d_1), s/veh	41.9	21.6	9.6	24.2	12.7	10.8		0.0			0.0	
Incremental Delay (d_2), s/veh	8.6	0.4	0.1	28.1	0.5	0.1		0.0			0.0	
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	50.5	22.0	9.7	52.3	13.2	10.9		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	C	A	D	B	B			A			A
Approach Delay, s/veh / LOS	24.5	C		20.5	C		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	20.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.01	B	1.90	B	2.47	B	2.47	B
Bicycle LOS Score / LOS	2.09	B	2.05	B	0.85	A	0.61	A

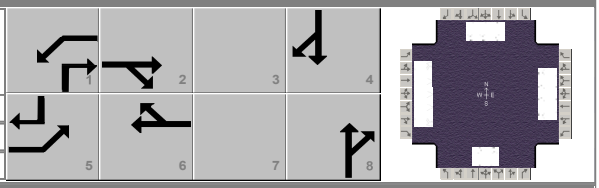
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Segment Distance, ft	500
Jurisdiction	SDDOT	Duration, h	0.250	Freeway Direction	North-South
Intersection	85th St at I-29 SB	PHF	0.90	Arterial Direction	East-West
File Name	85th St Corridor 2045 AM 3qrt 6-Ln.xus				
Project Description	85th Corridor 6-Lan 3/4 Access Signal				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	1	1410	105	1	640	270		0	190		0	335
Intersection Two Demand (*v*), veh/h	1	985	615	1	840	535		0	225		0	70

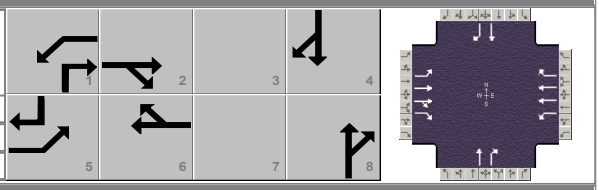
Signal One Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	36.0	44.0	1.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0
Red	0.0	1.0	0.0	0.0	0.0	0.0



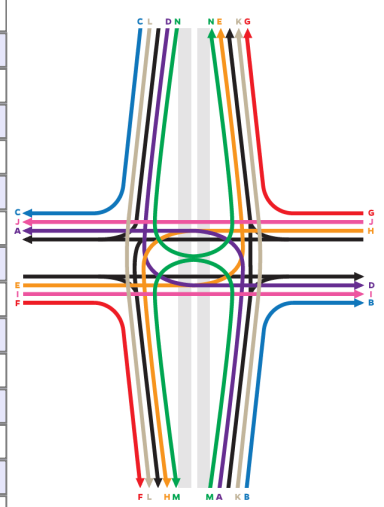
Signal Two Information	
Cycle, s	90.0
Offset, s	69
Uncoordinated	No
Force Mode	Fixed

Green	36.0	5.0	35.0	1.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	1.0	0.0	0.0	0.0



Interchange Results

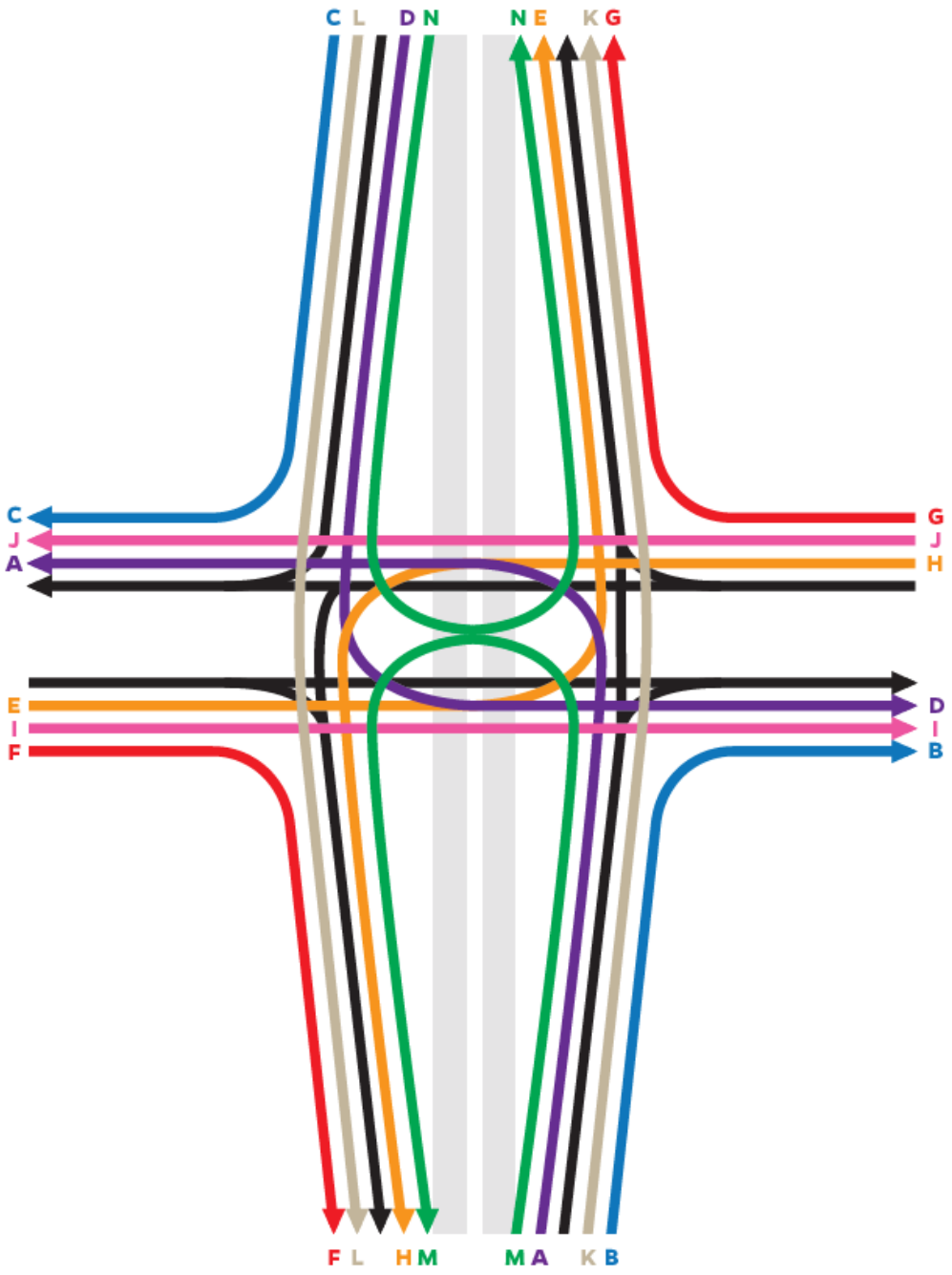
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	30.7	0.0	30.7	No	No	C
B	250	0.0	0.0	0.0	No	No	A
C	372	19.9	0.0	19.9	No	No	B
D	0	26.6	0.0	26.6	No	No	B
E	1	39.3	0.0	39.3	No	No	C
F	52	20.6	0.0	20.6	No	No	B
G	517	0.0	0.0	0.0	No	No	A
H	1	27.4	0.0	27.4	No	No	B
I	954	47.3	0.0	47.3	No	No	C
J	620	49.6	0.0	49.6	No	No	C
K	0		0.0		-	-	-
L	0		0.0		-	-	-
M	0		0.0		-	-	
N	0		0.0		-	-	
Interchange ETT (s/veh) and LOS				30.5	C		



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	13.8	20.6	16.0	8.5	30.7	28.4		0.0	19.4		0.0	19.9
Level of Service (LOS)	B	C	B	A	C	C			B			B
Approach Delay, s/veh / LOS	20.5	C		30.1	C		19.4	B		19.9	B	
Intersection Delay, s/veh / LOS	23.2						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	18.7	26.6	22.4	16.4	18.8	0.0		0.0	0.0		0.0	17.9
Level of Service (LOS)	B	C	C	B	B	A			A			B
Approach Delay, s/veh / LOS	25.8	C		11.5	B		0.0	A		17.9	B	
Intersection Delay, s/veh / LOS	17.7						B					

Interchange Graphic



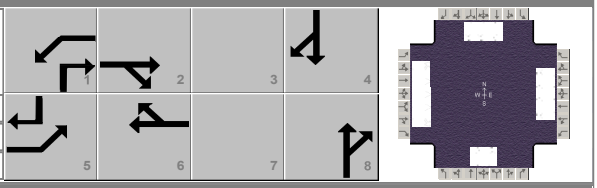
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Segment Distance, ft	500
Jurisdiction	SDDOT	Duration, h	0.250	Freeway Direction	North-South
Intersection	85th St at I-29 SB	PHF	0.90	Arterial Direction	East-West
File Name	85th St Corridor 2045 PM 3qrt 6-Ln.xus				
Project Description	85th Corridor 6-Lane 3/4 Access Signal				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h	1	1640	100	1	865	280		0	430		0	580
Intersection Two Demand (*v*), veh/h	1	1415	655	1	1075	690		0	205		0	70

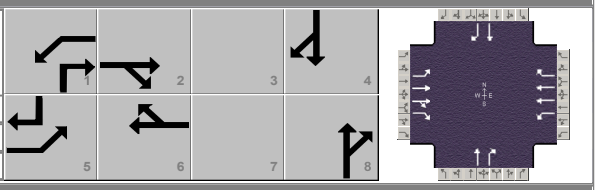
Signal One Information	
Cycle, s	100.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	36.0	10.0	40.0	1.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	1.0	0.0	0.0	0.0	0.0



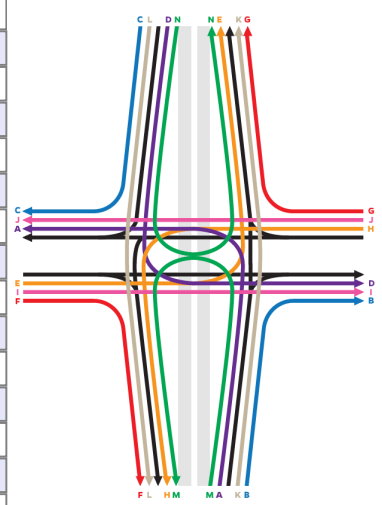
Signal Two Information	
Cycle, s	100.0
Offset, s	69
Uncoordinated	No
Force Mode	Fixed

Green	34.0	2.0	50.0	1.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	1.0	0.0	0.0	0.0



Interchange Results

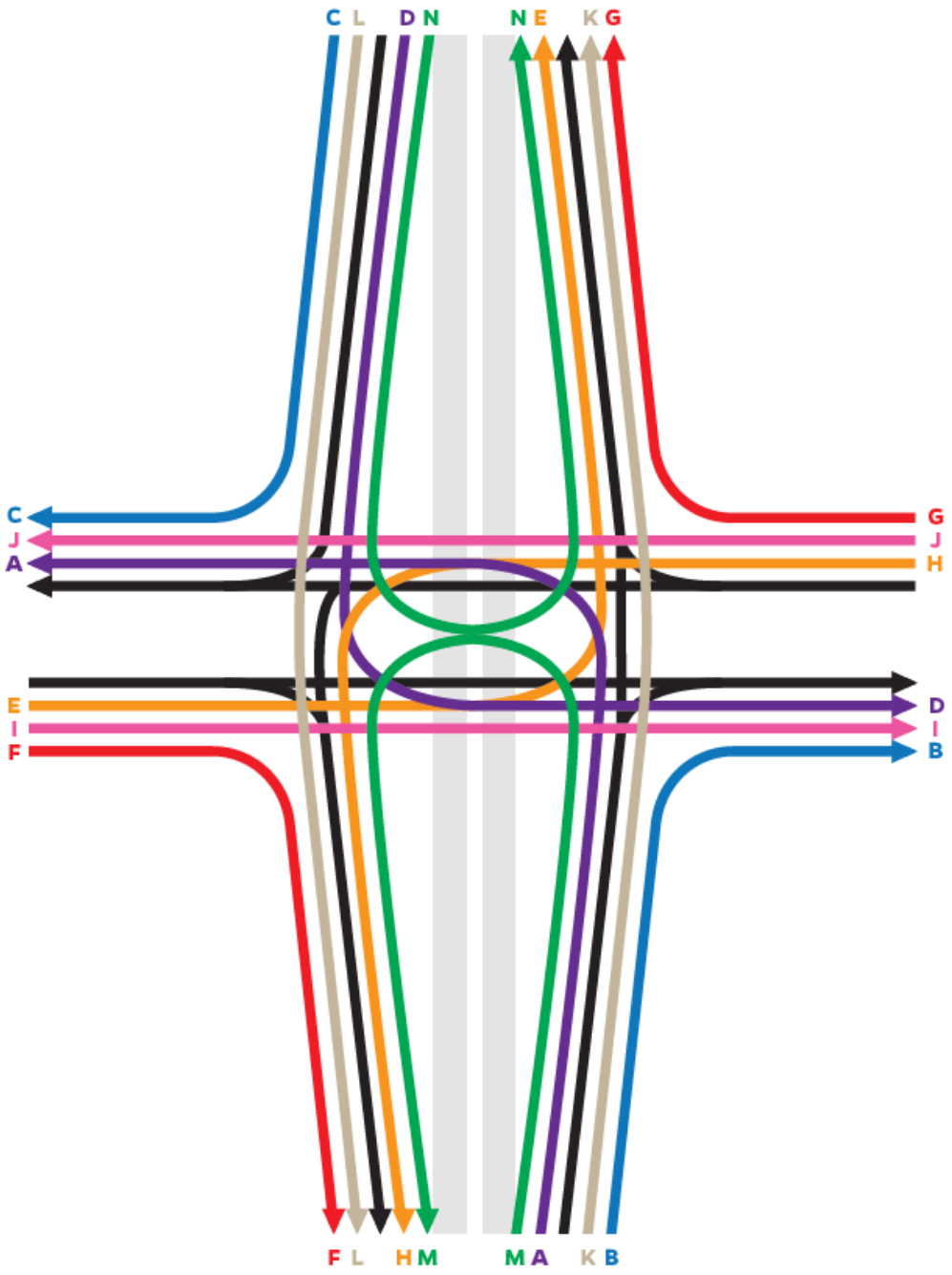
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	31.7	0.0	31.7	No	No	C
B	228	0.0	0.0	0.0	No	No	A
C	644	16.9	0.0	16.9	No	No	B
D	0	27.3	0.0	27.3	No	No	B
E	1	33.6	0.0	33.6	No	No	C
F	45	17.9	0.0	17.9	No	No	B
G	673	0.0	0.0	0.0	No	No	A
H	1	47.7	0.0	47.7	No	No	C
I	1340	45.2	0.0	45.2	No	No	C
J	845	65.1	0.0	65.1	No	No	D
K	0		0.0		-	-	-
L	0		0.0		-	-	-
M	0		0.0		-	-	
N	0		0.0		-	-	
Interchange ETT (s/veh) and LOS				33.7	C		



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	5.9	17.9	13.8	14.4	31.7	28.5		0.0	46.7		0.0	16.9
Level of Service (LOS)	A	B	B	B	C	C			D			B
Approach Delay, s/veh / LOS	17.8	B		31.0	C		46.7	D		16.9	B	
Intersection Delay, s/veh / LOS	25.1						C					

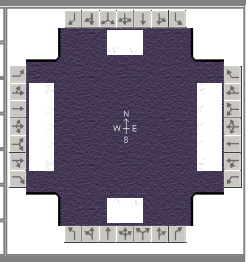
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	15.7	27.3	20.5	21.4	33.4	0.0		0.0	0.0		0.0	13.3
Level of Service (LOS)	B	C	C	C	C	A			A			B
Approach Delay, s/veh / LOS	26.2	C		20.3	C		0.0	A		13.3	B	
Intersection Delay, s/veh / LOS	21.9						C					

Interchange Graphic



HCS7 Signalized Intersection Results Summary

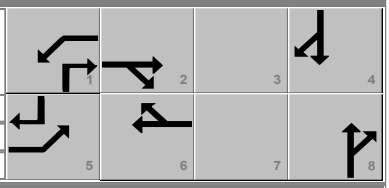
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 AM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lan 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	225	1085	80	175	1110	60		0	105		0	265

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.2	1.4	62.5	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



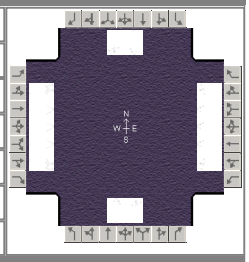
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	18.5	69.8	17.2	68.5		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	12.4		11.1			3.0		3.0
Green Extension Time (g_e), s	0.2	0.0	0.1	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.02		1.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	195	940	69	174	1105	60		0	117		0	294
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1609	1502	1688	1609	1502		1772			1772	
Queue Service Time (g_s), s	10.4	1.6	0.1	9.1	8.2	1.1		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	10.4	1.6	0.1	9.1	8.2	1.1		0.0			0.0	
Green Ratio (*g/C*)	0.14	0.71	0.71	0.12	0.69	0.69		0.01			0.01	
Capacity (*c*), veh/h	235	3424	1065	209	3350	1042		20			20	
Volume-to-Capacity Ratio (*X*)	0.829	0.274	0.065	0.833	0.330	0.057		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	208.9	15.2	1.9	171.4	91.3	12.5		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.2	0.6	0.1	6.7	3.6	0.5		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.70	0.00	0.01	0.57	0.00	0.04		0.00			0.00	
Uniform Delay (d_1), s/veh	43.2	0.9	0.2	38.5	5.5	4.4		0.0			0.0	
Incremental Delay (d_2), s/veh	4.8	0.2	0.1	9.2	0.2	0.1		0.0			0.0	
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	48.0	1.1	0.3	47.7	5.6	4.5		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	A	A	D	A	A			A			A
Approach Delay, s/veh / LOS	8.6	A		11.1	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	8.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.85	B	1.86	B	2.73	C	2.73	C
Bicycle LOS Score / LOS	1.34	A	1.31	A	0.68	A	0.97	A

HCS7 Signalized Intersection Results Summary

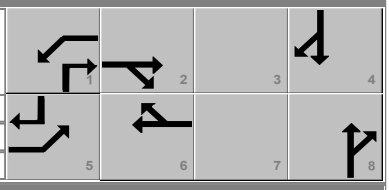
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 PM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lane 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	200	1465	115	225	1565	135		0	195		0	200

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.6	1.4	71.0	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



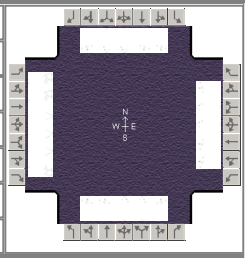
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	18.6	77.0	20.0	78.4		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (MAH), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	12.4		14.6			3.0		3.0
Green Extension Time (g_e), s	0.2	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			0.95		0.95
Max Out Probability	0.02		1.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (v), veh/h	176	1290	101	216	1501	129		0	50		0	56
Adjusted Saturation Flow Rate (s), veh/h/ln	1688	1609	1502	1688	1609	1502		1772			1772	
Queue Service Time (g_s), s	10.4	1.9	0.1	12.6	12.4	2.6		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	10.4	1.9	0.1	12.6	12.4	2.6		0.0			0.0	
Green Ratio (g/C)	0.13	0.71	0.71	0.14	0.72	0.72		0.01			0.01	
Capacity (c), veh/h	212	3427	1066	236	3496	1088		18			18	
Volume-to-Capacity Ratio (X)	0.830	0.376	0.095	0.913	0.429	0.119		0.000			0.000	
Back of Queue (Q), ft/ln (95 th percentile)	205.4	17.7	2.5	165.8	97	24.3		0			0	
Back of Queue (Q), veh/ln (95 th percentile)	8.1	0.7	0.1	6.5	3.8	1.0		0.0			0.0	
Queue Storage Ratio (RQ) (95 th percentile)	0.68	0.00	0.01	0.55	0.00	0.08		0.00			0.00	
Uniform Delay (d_1), s/veh	48.5	0.7	0.1	42.4	5.5	4.2		0.0			0.0	
Incremental Delay (d_2), s/veh	4.8	0.2	0.1	5.3	0.0	0.0		0.0			0.0	
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	53.3	0.9	0.3	47.7	5.6	4.2		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	A	A	D	A	A			A			A
Approach Delay, s/veh / LOS	6.8	A		10.4	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	8.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.07	B	2.06	B	2.74	C	2.74	C
Bicycle LOS Score / LOS	1.58	B	1.66	B	0.57	A	0.58	A

HCS7 Signalized Intersection Results Summary

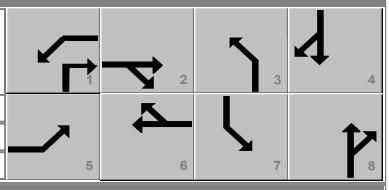
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Tallgrass	File Name	85th St Corridor 2045 AM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lan 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	355	545	290	210	875	670	80	315	185	330	170	250

Signal Information			
Cycle, s	117.8	Reference Phase	2
Offset, s	68	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	13.2	1.8	48.2	5.0	4.5	15.0
Yellow	4.5	0.0	4.5	4.5	4.5	4.5
Red	1.5	0.0	1.5	1.5	1.5	1.5



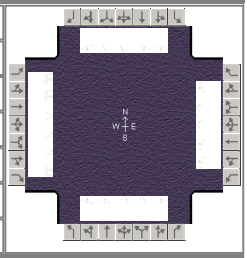
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	19.2	21.0	54.2	56.0	11.0	21.0	21.5	31.5
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	3.0	3.1	3.1	3.0	3.1	3.0	3.1
Queue Clearance Time (g_s), s	12.7	13.0	7.3	52.0	5.1	13.9	14.9	22.9
Green Extension Time (g_e), s	0.5	1.3	4.5	0.0	0.1	1.1	0.6	0.6
Phase Call Probability	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.23	1.00	0.00	0.03	0.00	1.00

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	304	466	120	233	972	744	89	350	94	367	189	278
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1639	1609	1502	1639	1687		1639	1687	1502	1639	1687	
Queue Service Time (g_s), s	10.7	11.0	8.9	5.3	27.4		3.1	11.9	3.7	12.9	5.5	
Cycle Queue Clearance Time (g_c), s	10.7	11.0	8.9	5.3	27.4		3.1	11.9	3.7	12.9	5.5	
Green Ratio (*g/C*)	0.11	0.13	0.13	0.41	0.42		0.04	0.13	0.54	0.13	0.22	
Capacity (*c*), veh/h	368	615	191	1342	1432		139	430	806	432	732	
Volume-to-Capacity Ratio (*X*)	0.825	0.758	0.626	0.174	0.679		0.639	0.813	0.117	0.849	0.258	
Back of Queue (*Q*), ft/ln (95 th percentile)	195.7	195.2	146.1	90.6	405.7		59.5	218.8	20.5	230.5	101.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.7	7.7	5.8	3.6	16.0		2.3	8.6	0.8	9.1	4.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.49	0.00	0.49	0.30	0.00		0.15	0.00	0.05	0.35	0.00	
Uniform Delay (d_1), s/veh	51.1	49.6	17.7	22.1	27.4		55.5	50.0	7.4	50.0	38.3	
Incremental Delay (d_2), s/veh	1.7	0.7	1.2	0.0	1.1		1.8	1.4	0.0	2.9	0.1	
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	52.9	50.3	18.9	22.1	28.5	0.0	57.3	51.4	7.4	52.9	38.3	0.0
Level of Service (LOS)	D	D	B	C	C	A	E	D	A	D	D	A
Approach Delay, s/veh / LOS	47.0	D		16.8	B		44.6	D		32.0	C	
Intersection Delay, s/veh / LOS	29.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.71	C	2.57	C	2.74	C	2.94	C
Bicycle LOS Score / LOS	1.12	A	2.10	B	0.93	A	1.18	A

HCS7 Signalized Intersection Results Summary

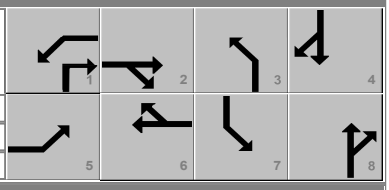
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	Tallgrass	File Name	85th St Corridor 2045 PM 3qrt 6-Ln.xus		
Project Description	85th Corridor 6-Lane 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	310	925	425	260	1105	450	155	280	335	645	360	485

Signal Information			
Cycle, s	152.3	Reference Phase	2
Offset, s	68	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	14.9	8.5	43.6	10.1	20.0	19.2
Yellow	4.5	4.5	4.5	4.5	4.5	4.5
Red	1.5	1.5	1.5	1.5	1.5	1.5



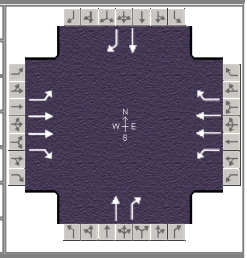
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.9	35.4	49.6	64.0	16.1	25.2	42.2	51.2
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.0	3.0	3.0	3.0	3.0	3.1	3.0	3.1
Queue Clearance Time (g_s), s	14.5	27.0	12.5	56.0	9.9	19.0	34.5	47.3
Green Extension Time (g_e), s	0.4	2.4	3.5	2.0	0.2	0.2	1.6	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.50	0.86	0.00	1.00	0.00	1.00

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	273	814	198	289	1228	500	172	311	239	717	400	539
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1639	1609	1502	1639	1687		1639	1687	1502	1639	1687	
Queue Service Time (g_s), s	12.5	25.0	18.7	10.5	54.0		7.9	13.5	17.0	32.5	14.4	
Cycle Queue Clearance Time (g_c), s	12.5	25.0	18.7	10.5	54.0		7.9	13.5	17.0	32.5	14.4	
Green Ratio (*g/C*)	0.10	0.19	0.19	0.29	0.38		0.07	0.13	0.41	0.24	0.30	
Capacity (*c*), veh/h	322	932	290	937	1285		218	425	618	779	1002	
Volume-to-Capacity Ratio (*X*)	0.848	0.873	0.683	0.308	0.955		0.789	0.732	0.386	0.920	0.399	
Back of Queue (*Q*), ft/ln (95 th percentile)	226.5	383.9	131.7	193.2	828.8		152.8	255.5	163.2	514	253	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.9	15.1	5.2	7.6	32.6		6.0	10.1	6.4	20.2	10.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.57	0.00	0.44	0.64	0.00		0.38	0.00	0.41	0.79	0.00	
Uniform Delay (d_1), s/veh	67.6	59.7	12.3	42.6	45.9		70.1	64.2	5.3	56.7	42.8	
Incremental Delay (d_2), s/veh	2.7	1.0	1.0	0.1	14.9		2.4	5.0	0.1	8.4	0.1	
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	70.3	60.7	13.3	42.7	60.8	0.0	72.5	69.2	5.4	65.1	42.8	0.0
Level of Service (LOS)	E	E	B	D	E	A	E	E	A	E	D	A
Approach Delay, s/veh / LOS	55.4	E		43.1	D		48.9	D		38.5	D	
Intersection Delay, s/veh / LOS	45.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.77	C	2.59	C	2.75	C	3.01	C
Bicycle LOS Score / LOS	1.38	A	2.15	B	1.08	A	1.85	B

HCS7 Signalized Intersection Results Summary

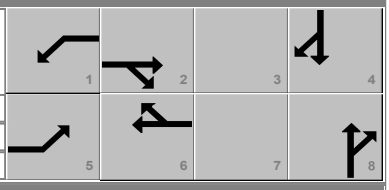
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New 3/4 Signal West	File Name	85th St Corridor 2045 AM 3qrt 4-Ln.xus		
Project Description	85th Corridor - 4-ln Sign 3/4 Access				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	1260	50	150	825	120		0	255		0	80

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.5	1.2	66.3	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



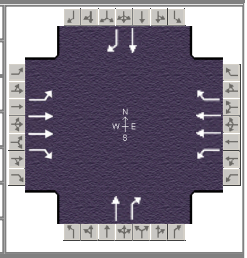
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	13.5	72.3	14.7	73.5		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	7.5		8.7			3.0		3.0
Green Extension Time (g_e), s	0.1	0.0	0.1	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.01		0.06			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	105	1321	52	136	748	109		0	172		0	56
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	5.5	24.1	1.3	6.7	12.1	4.4		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	5.5	24.1	1.3	6.7	12.1	4.4		0.0			0.0	
Green Ratio (*g/C*)	0.08	0.74	0.74	0.10	0.75	0.75		0.01			0.01	
Capacity (*c*), veh/h	141	2483	1105	164	2529	1126		20			20	
Volume-to-Capacity Ratio (*X*)	0.743	0.532	0.047	0.829	0.296	0.097		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	94.7	315.3	12.6	101.4	178.8	44.8		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.7	12.4	0.5	4.0	7.0	1.8		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.32	0.00	0.04	0.34	0.00	0.15		0.00			0.00	
Uniform Delay (d_1), s/veh	40.0	12.0	5.2	28.9	9.0	8.7		0.0			0.0	
Incremental Delay (d_2), s/veh	1.2	0.3	0.0	4.8	0.3	0.1		0.0			0.0	
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	41.2	12.4	5.3	33.7	9.3	8.8		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	B	A	C	A	A			A			A
Approach Delay, s/veh / LOS	14.2	B		12.6	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	12.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.99	B	1.88	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	1.78	B	1.49	A	0.77	A	0.58	A

HCS7 Signalized Intersection Results Summary

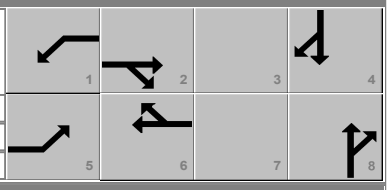
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New 3/4 Signal West	File Name	85th St Corridor 2045 PM 3qrt 4-Ln.xus		
Project Description	85th Corridor - 4Ln 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	1445	105	325	1260	120		0	295		0	95

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	13.7	5.0	66.3	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



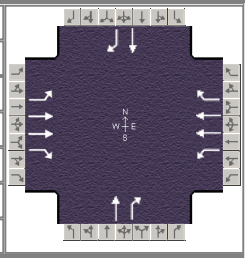
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	19.7	72.3	24.7	77.3		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	13.7		18.7			3.0		3.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	202	1459	106	298	1156	110		0	217		0	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	11.7	36.1	3.9	16.7	21.8	4.5		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	11.7	36.1	3.9	16.7	21.8	4.5		0.0			0.0	
Green Ratio (*g/C*)	0.14	0.66	0.66	0.19	0.71	0.71		0.01			0.01	
Capacity (*c*), veh/h	232	2235	995	316	2405	1070		18			18	
Volume-to-Capacity Ratio (*X*)	0.872	0.653	0.107	0.943	0.481	0.103		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	178.7	465.6	49.3	255.5	317.5	56.1		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.0	18.3	1.9	10.1	12.5	2.2		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.60	0.00	0.16	0.85	0.00	0.19		0.00			0.00	
Uniform Delay (d_1), s/veh	42.0	22.2	9.9	24.6	12.1	9.8		0.0			0.0	
Incremental Delay (d_2), s/veh	8.3	0.4	0.1	28.8	0.5	0.1		0.0			0.0	
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	50.4	22.6	9.9	53.4	12.6	10.0		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	C	A	D	B	A			A			A
Approach Delay, s/veh / LOS	25.0	C		20.2	C		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	20.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.01	B	1.90	B	2.47	B	2.47	B
Bicycle LOS Score / LOS	2.09	B	2.05	B	0.85	A	0.61	A

HCS7 Signalized Intersection Results Summary

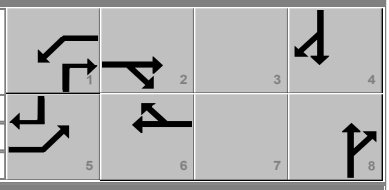
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	AM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 AM 3qrt 4-Ln.xus		
Project Description	85th Corridor - 4-ln Sign 3/4 Access				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	225	1085	80	175	1110	60		0	105		0	265

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.2	1.3	62.5	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



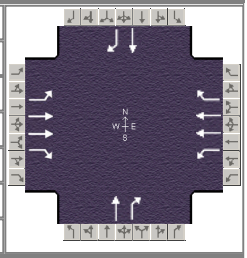
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	18.5	69.8	17.2	68.5		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	12.4		11.1			3.0		3.0
Green Extension Time (g_e), s	0.2	0.0	0.2	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.02		0.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	195	940	69	174	1105	60		0	117		0	294
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	10.4	2.7	0.1	9.1	13.4	1.1		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	10.4	2.7	0.1	9.1	13.4	1.1		0.0			0.0	
Green Ratio (*g/C*)	0.14	0.71	0.71	0.12	0.69	0.69		0.01			0.01	
Capacity (*c*), veh/h	235	2390	1064	211	2341	1042		20			20	
Volume-to-Capacity Ratio (*X*)	0.829	0.393	0.065	0.827	0.472	0.057		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	208.9	25.9	1.9	156.9	151.5	12.5		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.2	1.0	0.1	6.2	6.0	0.5		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.70	0.00	0.01	0.52	0.00	0.04		0.00			0.00	
Uniform Delay (d_1), s/veh	43.2	1.0	0.2	38.4	6.3	4.4		0.0			0.0	
Incremental Delay (d_2), s/veh	4.8	0.4	0.1	2.0	0.4	0.1		0.0			0.0	
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	48.0	1.4	0.3	40.5	6.7	4.5		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	A	A	D	A	A			A			A
Approach Delay, s/veh / LOS	8.9	A		11.0	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	8.6						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.85	B	1.86	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	1.76	B	1.72	B	0.68	A	0.97	A

HCS7 Signalized Intersection Results Summary

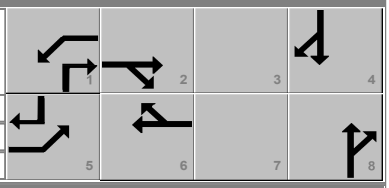
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.250
Analyst	Graham Johnson	Analysis Date	Jun 15, 2016	Area Type	Other
Jurisdiction	SDDOT	Time Period	PM Peak	PHF	0.90
Urban Street	85th Street	Analysis Year	2045 Build	Analysis Period	1> 16:45
Intersection	New Signal East	File Name	85th St Corridor 2045 PM 3qrt 4-Ln.xus		
Project Description	85th Corridor - 4Ln 3/4 Access Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	1465	115	225	1565	135		0	195		0	200

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.6	1.4	71.0	1.0	0.0	0.0
Yellow	4.5	0.0	4.5	1.0	0.0	0.0
Red	1.5	0.0	1.5	1.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	3.0	2.0	3.0		7.0		7.0
Phase Duration, s	18.6	77.0	20.0	78.4		3.0		3.0
Change Period, ($Y+R_c$), s	6.0	6.0	6.0	6.0		2.0		2.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.4
Queue Clearance Time (g_s), s	12.4		14.6			3.0		3.0
Green Extension Time (g_e), s	0.2	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			0.95		0.95
Max Out Probability	0.02		1.00			1.00		1.00

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		8	18		4	14
Adjusted Flow Rate (*v*), veh/h	176	1290	101	216	1501	129		0	50		0	56
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1687	1502	1688	1687	1502		1772			1772	
Queue Service Time (g_s), s	10.4	3.6	0.1	12.6	22.1	2.6		0.0			0.0	
Cycle Queue Clearance Time (g_c), s	10.4	3.6	0.1	12.6	22.1	2.6		0.0			0.0	
Green Ratio (*g/C*)	0.13	0.71	0.71	0.14	0.72	0.72		0.01			0.01	
Capacity (*c*), veh/h	212	2395	1066	236	2444	1088		18			18	
Volume-to-Capacity Ratio (*X*)	0.830	0.539	0.095	0.913	0.614	0.119		0.000			0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	205.4	31.6	2.5	165.8	171.3	24.3		0			0	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.1	1.2	0.1	6.5	6.7	1.0		0.0			0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.01	0.55	0.00	0.08		0.00			0.00	
Uniform Delay (d_1), s/veh	48.5	0.7	0.1	42.4	6.8	4.2		0.0			0.0	
Incremental Delay (d_2), s/veh	4.8	0.6	0.1	5.3	0.1	0.0		0.0			0.0	
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	53.3	1.4	0.3	47.7	7.0	4.2		0.0	0.0		0.0	0.0
Level of Service (LOS)	D	A	A	D	A	A			A			A
Approach Delay, s/veh / LOS	7.1	A		11.5	B		0.0	A		0.0	A	
Intersection Delay, s/veh / LOS	9.2						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.07	B	2.06	B	2.47	B	2.47	B
Bicycle LOS Score / LOS	2.12	B	2.25	B	0.57	A	0.58	A