Maple Street/ Park Street Corridor Study Report

Maple Street/Park Street Corridor Study

Minnehaha County, South Dakota

July 30, 2019

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1. Introduction

Study Purpose

Continued development along the eastern edge of Sioux Falls and Brandon has increased traffic volumes throughout the area's transportation network. It is anticipated that this development will continue over the next couple decades, and likely increase in intensity, with the planned extension of utilities into the area and recent/upcoming Veterans Parkway (formerly known as the Eastside Corridor and then SD Highway 100 in previous studies) connections to the area's transportation network.

The Maple Street/Park Street corridor sits in the heart of this developable area, providing a key east/west connection between SD11/Splitrock Boulevard in Brandon and Veterans Parkway. Planning efforts to date have identified that this section-line road is to be an arterial roadway, providing complimentary east/west connectivity with adjacent corridors of Rice Street/Holly Boulevard to the north and Madison Street to the south. Currently, Maple Street west of Brandon is a gravel township roadway, designed to handle low traffic volumes with access to farms, fields, and low density acreage development. Improvements will be needed in order to accommodate current and future demand and the regional transportation needs throughout the northeast Sioux Falls metropolitan area.

The purpose of this study is to quantify transportation issues and needs through the study corridor and develop a fiscally-responsible plan to address these needs. Ultimately, this corridor study serves as a guide to identify and prioritize improvements to address operations, safety, and access over the next 20+ years.

Prioritized goals for this study include:

- **Build upon transportation planning completed to date** through this area, helping foster roadway network continuity and connectivity in the northeast Sioux Falls metropolitan area.
- **Establishing baseline transportation conditions**, such as traffic operations, safety, access, and long-term roadway maintenance needs to accommodate future development and traffic demand.
- **Develop and prioritize transportation solutions** that address the identified needs through a collaborative effort involving partner agencies, stakeholders, and the public. Future-year needs are prioritized by short-term (year 2030) and long-term (year 2045) corridor improvements.
- **Public awareness** to gather information and feedback on existing needs and potential improvements throughout the corridor.

Study Advisory Team

A Study Advisory Team (SAT) was organized with partner agencies to develop a single vision for the corridor, where all current and future roadway owners are invested in the long-range plan for the corridor. Members of the SAT included:

- South Dakota Department of Transportation (SDDOT)
- Federal Highway Administration
- Sioux Falls Metropolitan Planning Organization (Sioux Falls MPO)
- Minnehaha County
- City of Sioux Falls
- City of Brandon
- Split Rock Township

Corridor Location

The Maple Street/Park Street corridor is located in Minnehaha County, spanning across multiple jurisdictions and future growth areas within the Sioux Falls MPO planning area:

- Split Rock Township
  - Current roadway owner west of the Brandon city limits
- City of Brandon
  - Current roadway owner within the Brandon city limits
  - Brandon growth area extends west to Six Mile Road
- Minnehaha County
  - Future owner outside of Brandon city limits
- City of Sioux Falls
  - Sioux Falls growth area extends east to Six Mile Road

The Maple Street/Park Street corridor is classified as an arterial roadway and is positioned as an important east/west corridor along the current southern edge of Brandon. The next adjacent arterial east/west roadways are Rice Street/Holly Boulevard 1.5 miles to the north and Madison Street 1 mile to the south.

Study Area

The Maple Street/Park Street corridor study area extends between, and includes, the following intersections:

A. Maple Street/Veterans Parkway intersection
B. Park Street/Sioux Boulevard intersection
C. Sioux Boulevard/SD11/Splitrock Boulevard intersection

The study area also includes a potential extension of Park Street between Sioux Boulevard and SD11/Splitrock Boulevard.

Maple Street/Park Street corridor study intersections are identified in **Table 1**. This table lists intersections where the study team collected intersection turning movement counts, developed

traffic forecasts, and performed a traffic operations analysis of existing and future-year conditions.

An overview of the study area limits and study intersections are shown in **Figure 1**.

Table 1: Maple Street/Park Street Corridor Study Intersections

No.	Maple Street/Park Street Corridor Intersections	Intersection	Traffic Forecast Intersection	Primary Traffic Operations Analysis Intersection
1	Veterans Parkway	Existing	X	X
2	Potential Collector	Future*	X	
3	Six Mile Road	Existing	X	X
4	Potential Collector	Future*	X	
5	Indian Hills Trail (west)	Existing	X	
6	Indian Hills Trail (east) & Potential Collector	Existing/Future*	X	
7	Oak Road	Existing	X	
8	Intermediate School Drive	Existing	X	
9	Locust Street	Existing	X	X
10	Sioux Boulevard	Existing	X	X
11	Robert Bennis Elementary School Drive	Existing	X	
12	Aspen Park Road (extension)	Future**	X	
13.a	SD11/Splitrock Boulevard (via Sioux Boulevard)	Existing	X	X
13.b	SD11/Splitrock Boulevard (via Park Street extension)	Future**	X	X

** Intersection identified in Northeast Transportation Network Study*

*** Potential extension of Park Street to SD11/Splitrock Boulevard*

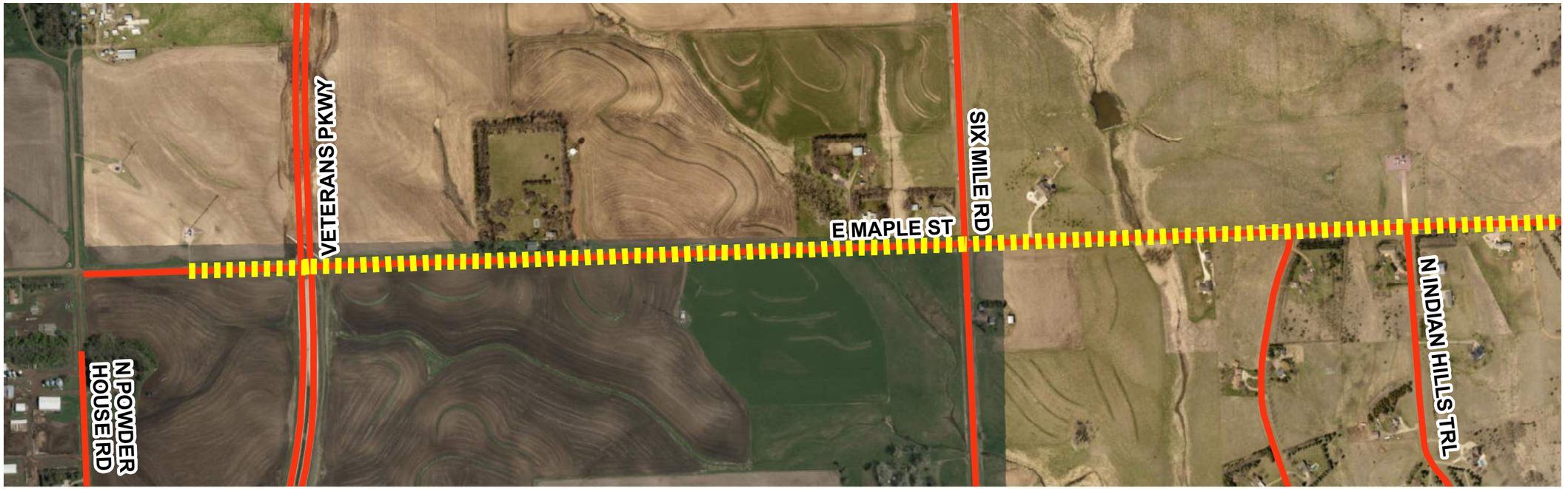
LEGEND

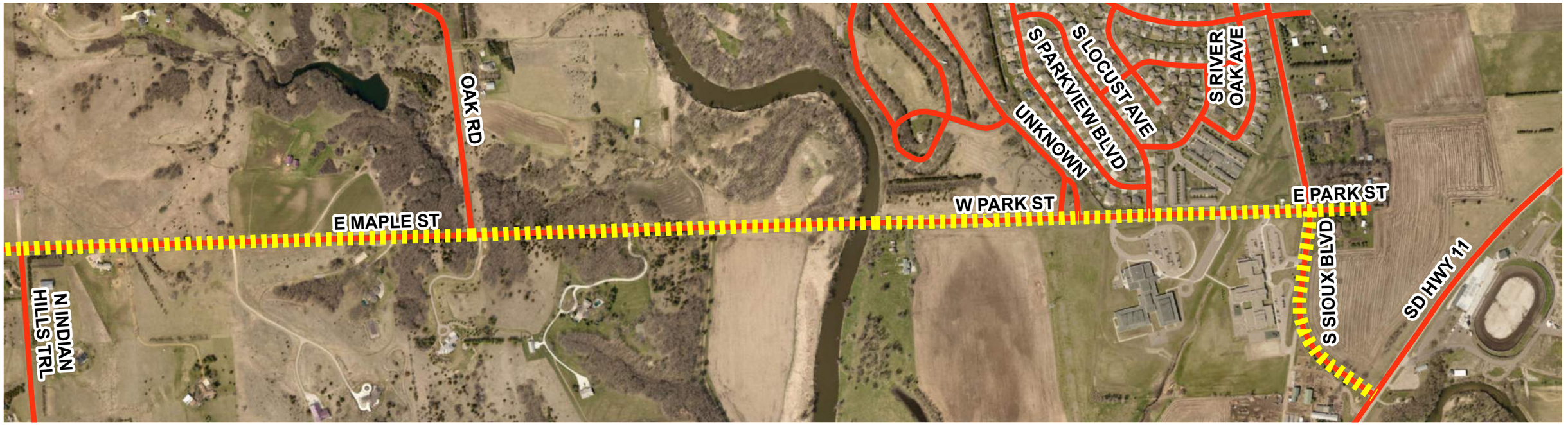
Study Corridor

Roadways

DATA SOURCE: SDDOT

0 Feet 750





MAPLE STREET / PARK STREET STUDY AREA

VETERANS PARKWAY TO SD11/SPLITROCK BOULEVARD

FIGURE 1

Growth Areas and Future Development

Much of the area surrounding the corridor west of the Big Sioux River is undeveloped, agricultural, or low density acreage type development, typical of rural areas along the periphery of Sioux Falls. To the east of the Big Sioux River is the Big Sioux State Recreation Area in the Big Sioux River valley, existing residential development, and institutional development (Brandon Valley Intermediate School and Robert Bennis Elementary School).

Sioux Falls and Brandon Growth Areas

Six Mile Road serves as the boundary between Sioux Falls and Brandon growth areas, as shown in **Figure 2**. The Sioux Falls growth area extends west of Six Mile Road and Brandon extends east. The growth area represents areas outside of the respective city's limits where the county and respective city have joint authority in zoning approvals and the city has platting jurisdiction.

Figure 3 illustrates future land use within the Sioux Falls growth area. Higher density development, such as an office park or mixed-use development, is expected along the Veterans Parkway corridor within the Sioux Falls growth area. This type of development generates high volumes of traffic, much of which would use Maple Street as their route to/from the development.

Timing of Sioux Falls growth area development is estimated in **Figure 4**. As shown, the anticipated timing of large-scale development along Maple Street in this area is anticipated towards the latter part of this study's analysis period (Tier 3: 2031-2040). This timeframe lends itself to the potential of phased improvements over several years along the Maple Street/Park Street corridor.

Between Six Mile Road and the Big Sioux River, shown in **Figure 5**, future development is expected to be low density residential with potential pockets of higher density residential, commercial, institutional and recreational land uses. The timeframe for the higher density development is likely towards the latter part of this study's 2045 planning horizon. The 2035 Brandon Comprehensive Plan growth area constraints section notes the extensive amount of municipal utilities that would need to be installed to serve this area. However, until municipal utilities are extended to this area, there are still large areas of developable land for rural/acreage-type growth. Any future development along the corridor would need access to Maple Street or Park Street and add to the current traffic volumes.

Future Development in Brandon

To the east of the Big Sioux River, there is residential development to the north of Park Street and two schools to the south. Developable land is available between the Sioux Boulevard and SD11 roadways and to the southwest of Sioux Boulevard. Much of this land is planned for a mix of residential, commercial, and recreational land uses. Improvements to the roadway network are planned in conjunction with development and may include an extension of Park Street to SD11/Splitrock Boulevard and an extension of Aspen Park Road southward to Park Street.

Figure 2: Sioux Falls Metropolitan Planning Area

Sioux Falls MPO 2040 Long-Range Transportation Plan, Figure 2-1
http://siouxfallsmpo.org/files/3815/1119/5024/SiouxFalls2040LRTP-FinalNov2015wApp.pdf

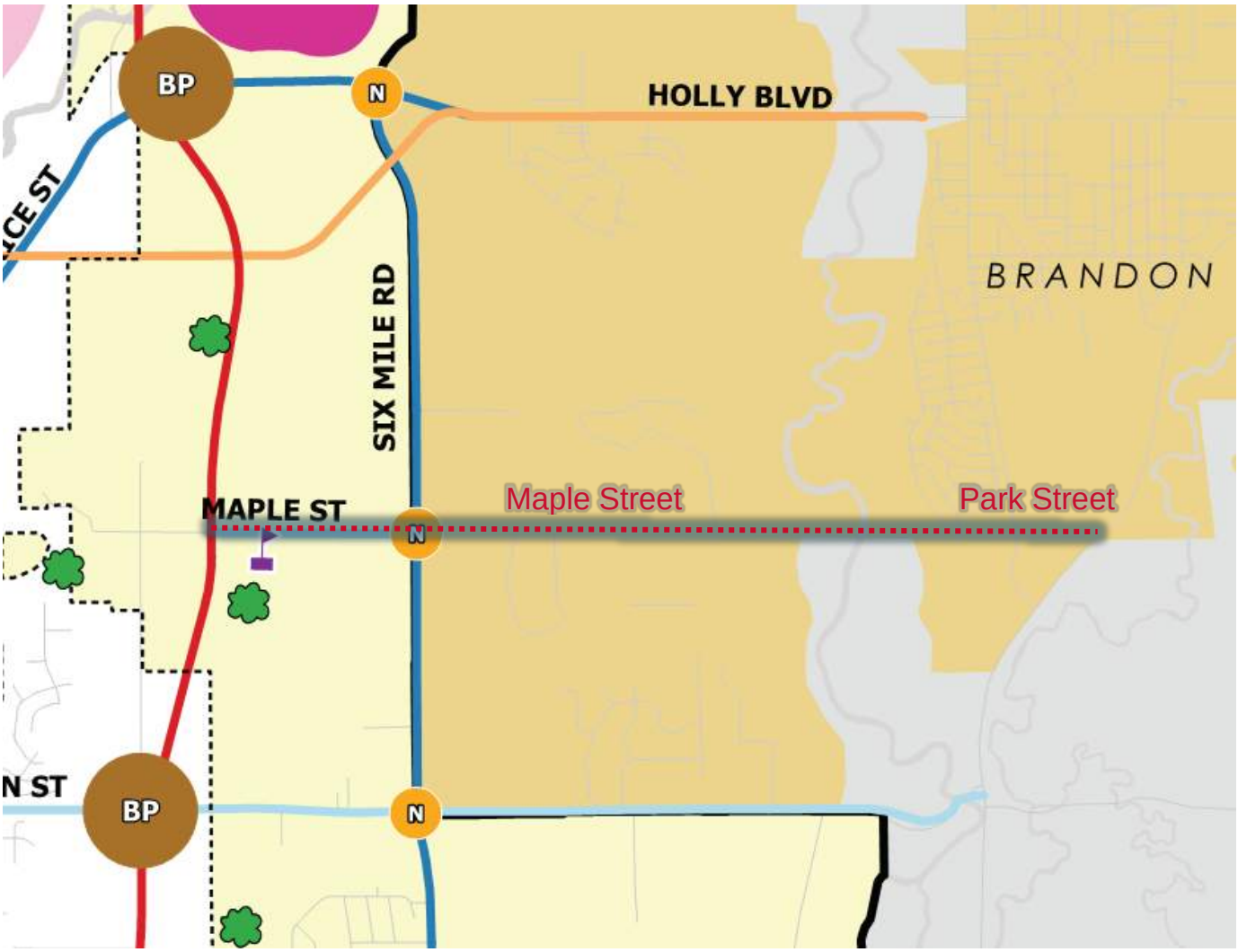


Figure 3: City of Sioux Falls 2040 Future Land Use Map

Adapted from Shape Sioux Falls 2040 Comprehensive Plan, Map 3A
https://www.siouxfalls.org/planning-dev/planning/shape

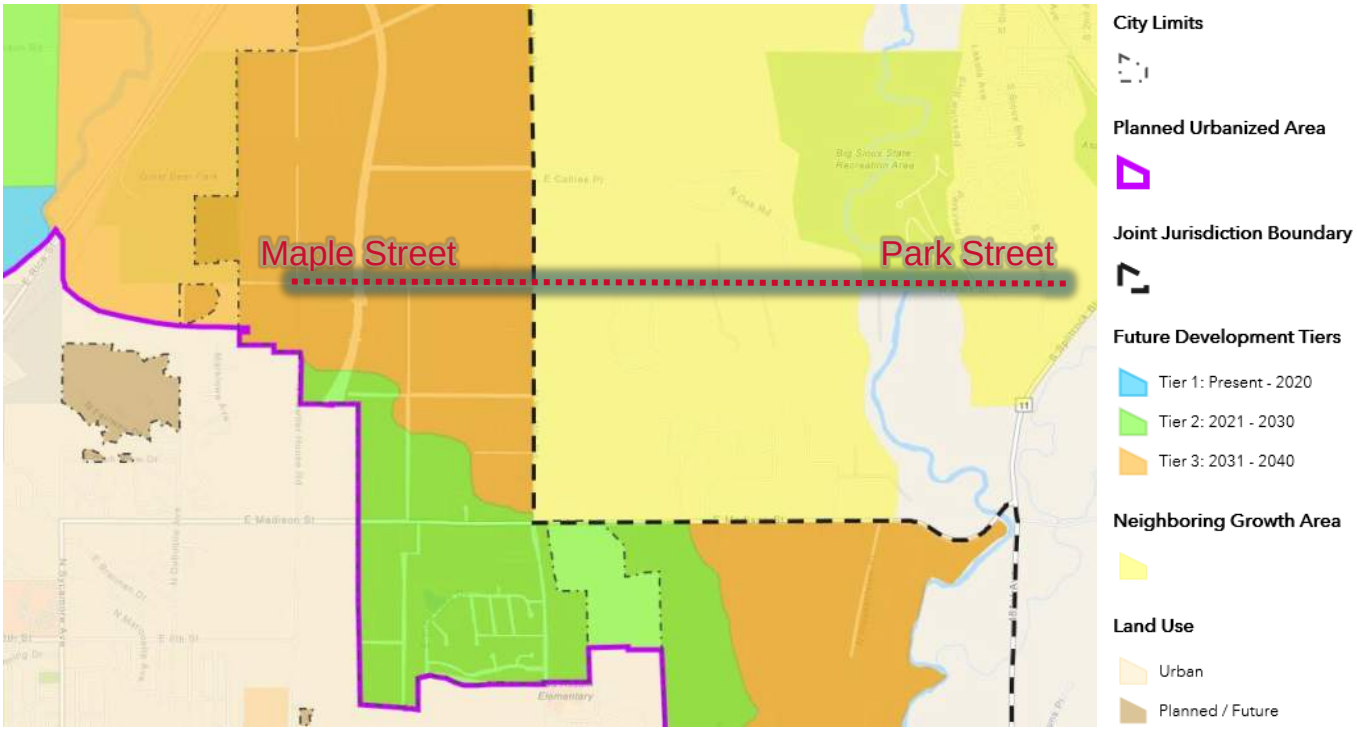


Figure 4: Sioux Falls Future Development Areas (Present – 2040)

Adapted from Shape Sioux Falls 2040 Comprehensive Plan, Map 2A https://www.siouxfalls.org/planning-dev/planning/shape

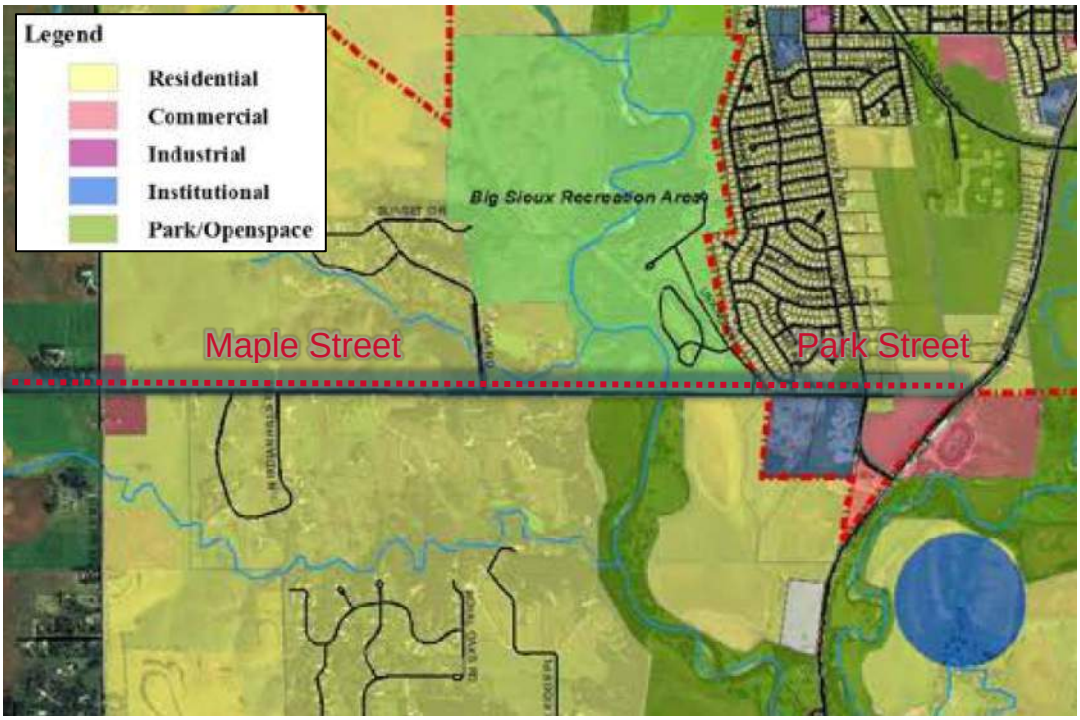


Figure 5: City of Brandon 2035 Comprehensive Plan Future Land Use Map

Adapted from 2035 Comprehensive Plan, Figure 7-2
https://cityofbrandon.org/vertical/sites/%7B23CB10F0-8C35-4CA4-9AD1-B693F0F58E76%7D/uploads/Brandon_2035_Comp_Plan_-_04-16-15_-_FINAL.pdf

Maple Street/Park Street Corridor Planning to Date

To prepare for future development, extensive planning has been completed to date in the northeast part of the Sioux Falls metropolitan area. Collectively, this effort provides a comprehensive approach to addressing regional transportation needs in the area. Maple Street/Park Street corridor improvements have been noted in the following planning studies.

Northeast Transportation Network Study (2009) – This study looked at transportation needs in the northeast part of the Sioux Falls growth area, generally bound by an area of I-90 to SD42 and Rice Street to the western edge of the Brandon Growth Area. It provided arterial and collector recommendations throughout the study area and included the following with regard to the Maple Street corridor:

- Maple Street be reconstructed as an Arterial Roadway
- Proposed collector roadway connections with Maple Street
- Identified a potential extension of Maple Street to Rice Street for further study

Study website: https://www.siouxfalls.org/public-works/special-projects/ne-transportation-network

Sioux Falls Major Street Plan (2016) – The Major Street Plan identifies Sioux Falls' future collector and arterial streets within the Sioux Falls growth area. This plan designates Maple Street west of Six Mile Road as a Type 3 arterial roadway.
Plan website: https://www.siouxfalls.org/planning-dev/planning/st-plan

Brandon 2035 Comprehensive Plan (2014) – The Major Street Plan presented in the Brandon 2035 Comprehensive Plan identifies both existing and future arterial and collector roadways. Maple Street is classified as an existing or future arterial between Six Mile Road and SD11/Sioux Boulevard. The Major Streets Plan also includes a potential future extension of Maple Street east across SD11 and Splitrock Creek as a continuation of the section-line (1-mile interval) arterial grid network.
Plan website: https://cityofbrandon.org/vertical/sites/%7B23CB10F0-8C35-4CA4-9AD1-B693F0F58E76%7D/uploads/Brandon_2035_Comp_Plan_-_04-16-15_-_FINAL.pdf

Minnehaha County 2035 Comprehensive Plan (2015) – The Minnehaha County Comprehensive Plan presents an existing and future trails and routes map, identifying the Maple Street corridor as a future municipal route. This plan includes a potential extension of Maple Street west to Rice Street.
Plan website:
https://www.minnehahacounty.org/dept/pl/comprehensive_plan/comprehensive_plan/Envision2035draft.pdf

Sioux Falls MPO 2040 Long-Range Transportation Plan (2040 LRTP) (2015) –
One component of the 2040 LRTP identifies future projects throughout the Sioux Falls metropolitan area. These projects are scored by seven guiding principles developed for this study and then subdivided by priority into Tier 1, 2, and 3.
The 2040 LRTP identifies four Maple Street projects within the Sioux Falls growth area:

- Intersection improvements at Veterans Parkway (2 projects) to add a traffic signal and turn lanes.

  - Ranked 100 and 101 in Sioux Falls Growth Area, Tier 3.
  - High score in Livability and Environmental Sustainability.
- Intersection improvements at Six Mile Road to add turn lanes.
  - Ranked # 102 in Sioux Falls Growth Area, Tier 3.
  - High score in Livability and Environmental Sustainability.
- Urban street reconstruction of Maple Street between Powderhouse Road and Six Mile Road.
  - Ranked # 51 in Sioux Falls Growth Area, Tier 2.
  - High score in Operational Efficiency

The 2040 LRTP also identifies two Maple Street/Park Street corridor projects within the Brandon Growth Area.

- Park Street extension between Sioux Boulevard and SD11/Splitrock Boulevard (new road).
  - Ranked #2 in Brandon Growth Area, Tier 1.
  - High scores for Livability and Environmental Sustainability, Connectivity and Economic Vitality, and Safety and Security, and Regional Priorities.
- Urban street reconstruction of Maple Street/Park Street between Six Mile Road and Sioux Boulevard.
  - Ranked #4 in Brandon Growth Area, Tier 1.
  - High scores for Connectivity and Economic Vitality, Livability and Environmental Sustainability, and Regional Priorities.

Plan website: http://siouxfallsmpo.org/files/3815/1119/5024/SiouxFalls2040LRTP-FinalNov2015wApp.pdf

Sioux Falls MPO Bicycle Plan (2009) – The goal of this plan is to improve bicycling throughout the Sioux Falls metropolitan area, building upon the 2005 Sioux Falls Area Long-Range Transportation Study. The plan identifies a future bicycle trail along the Maple Street corridor, connecting a future trail along the Big Sioux River parallel to Rice Street and the City of Brandon trail network.
Plan website: http://siouxfallsmpo.org/files/1313/7766/4918/MPO_Bicycle_Plan.pdf

Sioux Falls Multi-Use Trail Study (2011) – This study builds upon the 2009 Sioux Falls MPO Bicycle Plan to evaluate alternatives and focus on a single feasible concept to guide implementation. One of the sub-areas analyzed as part of this study was the Big Sioux/Brandon to Great Bear area (generally bound by I-90 to the north and Maple Street to the south). Five concepts were developed, with one of them including a trail along Maple Street.
Study website: http://siouxfallsmpo.org/files/2713/7825/2801/MPO_Multi-UseTrailStudy.pdf

2015 Sioux Falls Bike Plan (2015) – The 2015 Sioux Falls Bike Plan creates a framework for strategies and actions for bicycling in Sioux Falls. No bicycle trail projects are identified along Maple Street, though trails are noted at both ends of the Maple Street/Park Street Corridor Study's termini at Veterans Parkway and within the City of Brandon area.
Plan website: https://www.siouxfalls.org/planning-dev/planning/transportation/highlights/bicycle-planning

2. Existing Conditions

Existing Road Conditions

One of the overarching needs along this corridor is the rural township roadway segment west of the Brandon city limits. Challenges along this segment include a narrow gravel surface that requires frequent maintenance, steep side slopes, steep grades, intersection sight angles, crest curve sight distance, and winter maintenance. While the existing conditions have served traffic along the corridor well as a township road for decades, these same conditions also create challenges that are exacerbated as traffic volumes and speeds continue to increase. The following table summarizes existing roadway conditions for segments through the study area. Examples of existing cross-sections are provided in **Figure 6**.

Table 2: Existing Road Conditions

	Maple Street/Park Street				Sioux Boulevard
	Veterans Parkway to Big Sioux River	**Big Sioux River Bridge**	**Big Sioux River to Brandon City Limits**	**Brandon City Limits to Sioux Boulevard**	**Park Street to SD11/ Splitrock Boulevard**
Owner	Split Rock Township	Minnehaha County	Split Rock Township	City of Brandon	City of Brandon
Surfacing	Gravel	Concrete	Bituminous	Bituminous	Bituminous
Surface Width	24 ft.	32 ft. Deck width: 35 ft.	24 ft. w/ 8 ft. shoulders	38 ft. plus curb and gutter	22 ft.
Rural or Urban Cross-Section	Rural township	- -	Rural township	Urban	Rural
Other Cross-Sectional Elements	Roadside ditches	Built in 1979	Roadside ditches	Curb and gutter, sidewalk and shared-use path	roadside ditches; Turn lane, shared-use path, and curb and gutter in front of Robert Bennis Elementary
Functional Classification	Minor Arterial	Minor Arterial	Minor Arterial	Minor Arterial	Minor Arterial
Right-of-Way Width	66 ft.	66 ft.	66 ft.	66 ft.	66 ft.

Existing Maple Street/Park Street intersection lane configurations of primary study intersections throughout the corridor are shown in **Figure 7**.

Access

Current access along the Maple Street/Park Street corridor outside of the Brandon city limits reflects typical township road rural conditions, primarily consisting of residential/farm access, field access, and local street intersections into rural residential developments. Currently, future collector roadways in this area are conceptual and will be established as part of future development. In Brandon, access points have been established and primarily consist of driveways to the two schools and local street intersections. Additional discussion regarding existing access and future collector roadway intersections is presented in the *Maple Street/Park Street Corridor Access* technical memorandum in **Appendix A**.

Bicycle/Pedestrian Facilities

The existing Maple Street/Park Street corridor does not include separate bicycle or pedestrian facilities (sidewalk, shoulders, shared-use path, etc.) west of the Brandon city limits.

In Brandon, Park Street includes sidewalk on the south side and a shared-use path on the north side, which is part of the Brandon trail network. A shared-use path extends along the west side of Sioux Boulevard between Park Street and the northern driveway into Robert Bennis Elementary School. Marked Park Street crossing opportunities are provided at the following locations:

- Locust Street intersection
  - Crosswalks striped across all three legs
  - West leg crosswalk includes a pedestrian-actuated flashing amber beacon.
- Sioux Boulevard
  - Crosswalk striped across all four legs
  - Pedestrian-actuated push buttons for the west and north legs

Existing Traffic Volumes

The 2018 Existing Conditions volume set was developed for the existing corridor using 2018 segment and peak hour counts collected in 2018, factored to a consistent design season to account for seasonal fluctuations. Intersection turning movement volumes were balanced and smoothed across the corridor. 2018 Existing Conditions traffic volumes are provided in **Figure 8**.

Veterans Parkway – Six Mile Road

Six Mile Road – Big Sioux River

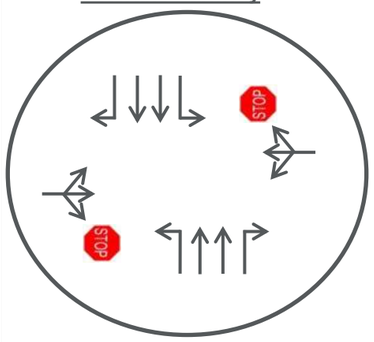
Big Sioux River Bridge

Park Street in Brandon

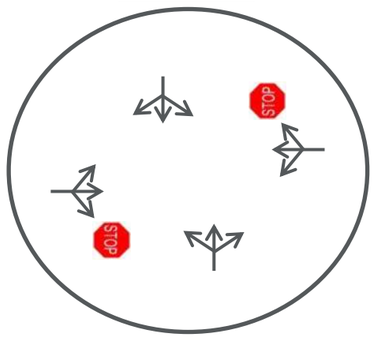
Figure 6: Existing Maple Street/Park Street Roadway Cross-Sections

2018 Existing Conditions

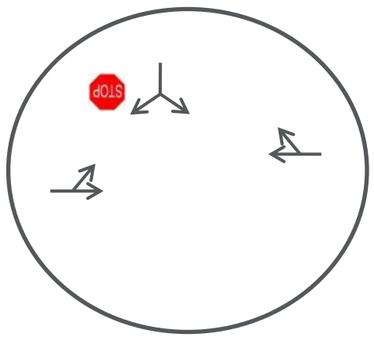
1. Maple Street & Veterans Parkway



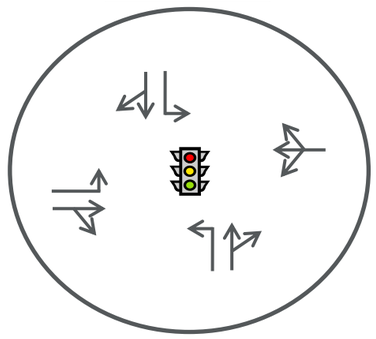
3. Maple Street & Six Mile Road



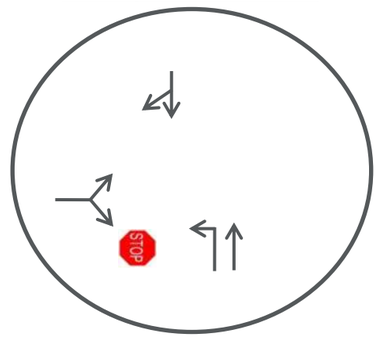
9. Park Street & Locust Street



10. Park Street & Sioux Boulevard



13. Sioux Boulevard & SD11/Splitrock Boulevard



Existing Primary Intersection Lane Configurations

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

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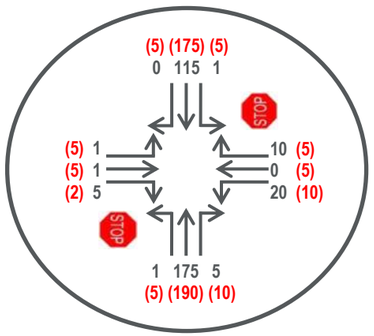
Intersection Approach Lane Configuration

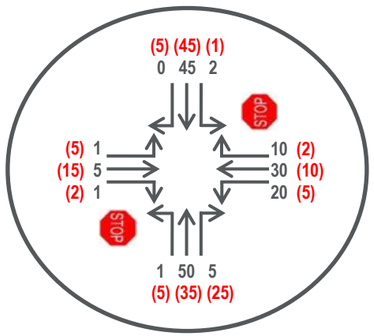
Segment Through Lane Configuration

FIGURE 7

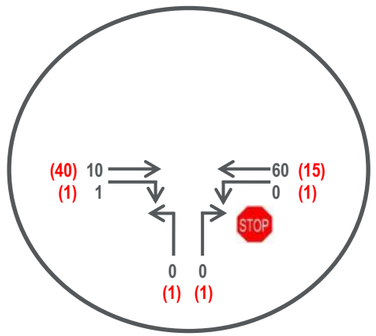
1. Maple St & Veterans Pkwy



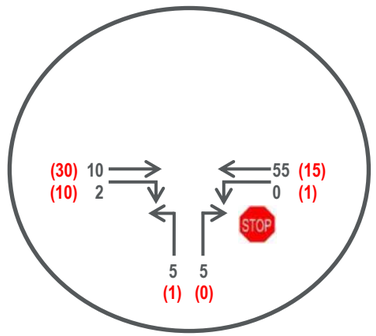
3. Maple St & Six Mile Rd



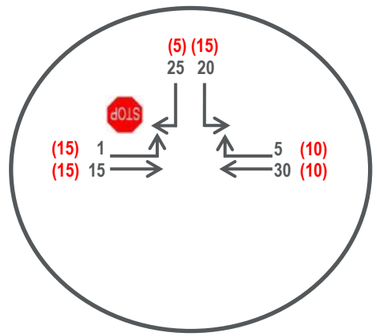
5. Maple St & Indian Hills Tr W



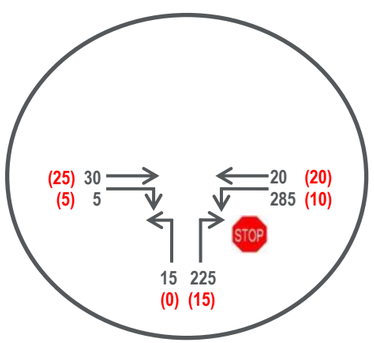
6. Maple St & Indian Hills Tr E



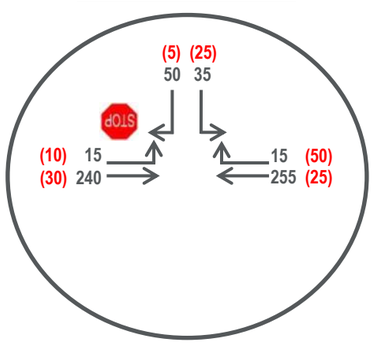
7. Maple St & Oak Rd



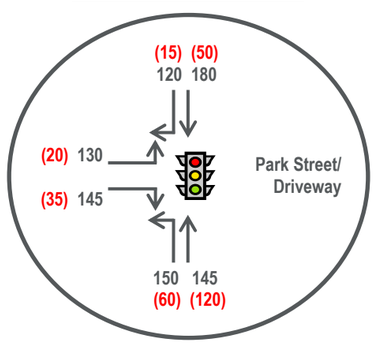
8. Park St & Intermediate School Driveway



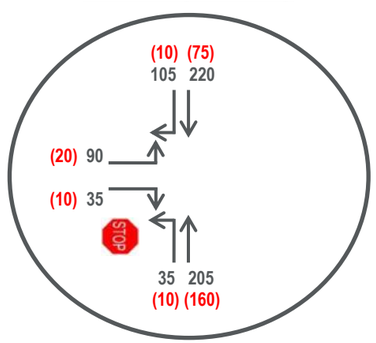
9. Park St & Locust St



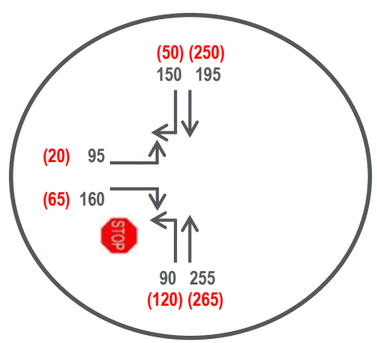
10. Park St & Sioux Blvd



11. Sioux Blvd & Robert Bennis Elementary Driveway



13. Sioux Blvd & SD11/Splitrock Blvd



2018 Existing Conditions Traffic Volumes

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

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- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume
- Existing Traffic Control

FIGURE 8

Crash History Review

Crash data for years 2013 through 2017 was provided by the South Dakota Department of Transportation. Crashes were reviewed to identify any historical crash trends or high frequency areas to help develop potential crash mitigation measures that will be carried into design.

Crashes were categorized as either an intersection or roadway segment-related crash. In addition to a review of crash frequency for each category, exposure was also assessed through the calculation of crash rates and weighted crash rates. A weighted crash rate accounts for injury and fatal crashes through the weighting process. An average crash rate calculation reflects total crash frequency, regardless of injury severity.

Intersection crash rates and weighted crash rates are calculated in terms of crashes per million entering vehicles (crashes/MEV). Segment crash rates and weighted crash rates are calculated in terms of crashes per million vehicle miles traveled (crashes/MVMT). Weighted crash rates were calculated using average daily traffic from the most recently collected daily traffic counts and by weighting each crash in accordance with its severity: fatal crash (12), injury crash (3), and property damage crash (1).

Intersection crashes and segment crashes are summarized in **Table 3** and **Table 4**, respectively. All crashes within the study area are shown graphically in **Figure 9**.

Table 3: Maple Street/Park Street Intersection Crash Rates

Intersection	Total # Crashes	Daily Entering Volume (vpd)	Crash Rate (crashes/MEV)	Weighted Crash Rate (crashes/MEV)
Veterans Parkway	0[a]	-	0	0
Six Mile Road	2	5,850	0.19	0.37
Indian Hills Trail (East) [b]	1	640	0.85	2.55
Locust Avenue [b]	2	2,275	0.48	0.96
SD Hwy 11/Splitrock Blvd	5	4,435	0.62	0.86

[a] *Built-out intersection with Maple Street opened in 2018.*

[b] *Local street intersection, shown for informational purposes in this table. Crash(es) are also included in the segment total.*

Table 4: Maple Street/Park Street Segment Crash Rates

Segment	Total # Crashes	Segment Volume (vpd)	Segment Length (mi.)	Crash Rate (crashes/ MVMT)	Weighted Crash Rate (crashes/ MVMT)
Powder House Road to Six Mile Road	1	190	0.97	3.0	3.0
Six Mile Road to Brandon City Limit	8	615 / 480	1.0 / 0.8	4.2	6.3
Brandon City Limit to Sioux Boulevard	2	1,945	0.25	2.3	4.5
Park Street to SD Hwy 11/Splitrock Blvd	0	1,945	0.23	0	0

Overall, there were 18 crashes reported along the study corridor between 2013 and 2017.

5 of the 18 crashes involved an injury

- 2 incapacitating injury crashes
- 2 non-incapacitating injury crashes
- 1 possible injury crash

The crashes were split between single-vehicle and multi-vehicle crashes:

- Multi-vehicle crashes
    - 3 angle crashes
    - 5 rear-end crashes
- Vehicle/pedestrian/bicycle crash
    - 1 vehicle-pedalcycle crash (Locust Street intersection)
- Single-vehicle crashes
    - 8 roadway departure crashes
    - 1 vehicle-animal crash

Crashes are generally dispersed across the corridor, with the following concentrations:

- 8 crashes on the township segment between Six Mile Road and the Brandon City Limits
    - Predominantly roadway departure crashes striking a variety of objects
    - Speed was noted as a contributing factor in 3 crashes
    - Resulted in greatest segment crash rate and weighted crash rate
- 5 crashes at the SD Hwy 11/Splitrock Boulevard and Sioux Boulevard intersection
    - 3 angle crashes involving vehicles from all approaches
    - 2 rear-end crashes involving eastbound vehicles

Snowy or icy road conditions noted in 7 of the 18 crashes.

Additional information regarding these crashes can be found in the *Crash Analysis of Existing Conditions* Technical Memorandum, in **Appendix B**.

LEGEND

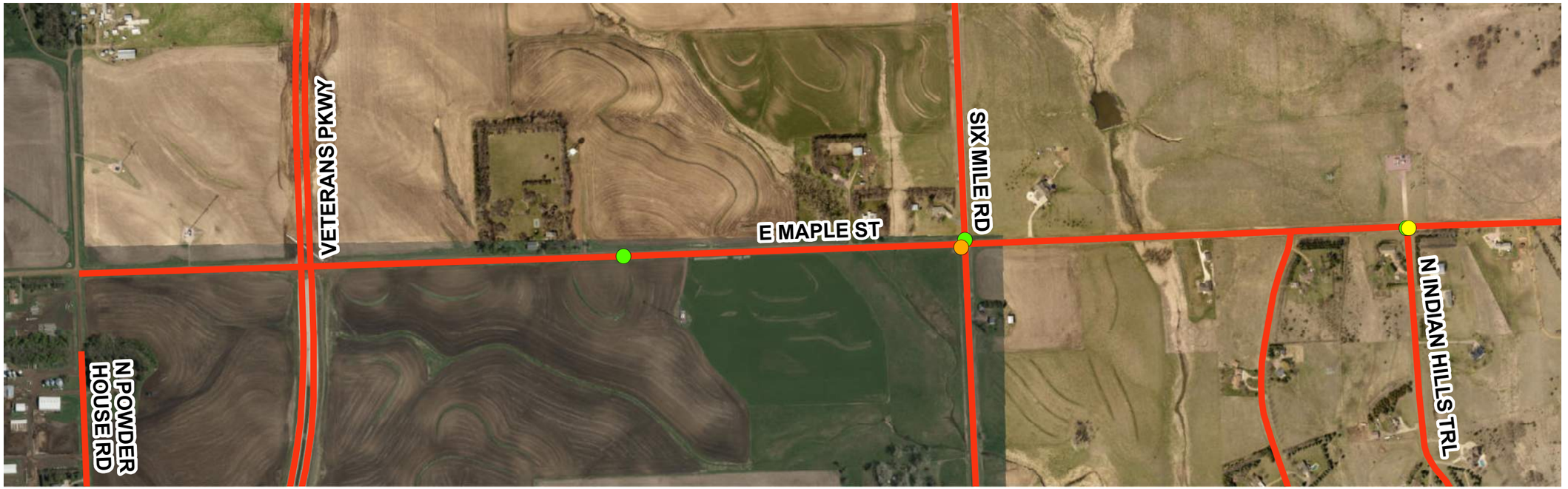
- Roadways

Injury Severity

- Incapacitating
- Non-incapacitating
- Possible
- No injury
- Wild animal hit

DATA SOURCE: SDDOT

0 Feet 750



MAPLE STREET / PARK STREET CRASH HISTORY

2013 - 2017

FIGURE 9

3. Traffic Forecasts

Traffic forecast scenarios were developed to determine short and long-term improvements that provide a flexible build-out plan that enhances the corridor with anticipated development for the next 20+ years. The following lists future-year traffic forecast scenarios developed for this study and how each volume set was used in the identification of operational needs and potential solutions.

2030 Interim Build Conditions – planning horizon for short-term needs over the next ten years along the corridor.

- Build Conditions scenario - forecast volumes developed to identify solutions that address short-term operational needs.

2045 Planning Horizon – planning horizon for long-term needs over the next 20+ years from the year of initial project completion.

- Forecast volumes developed for both a No-Build Conditions scenario and a Build Conditions scenario.
    - No-Build Conditions scenario – to understand future operational needs.
    - Build Conditions scenario – to develop solutions that address future operational needs.

Future-year No-Build and Build Condition volume scenarios were developed using the most current version of the Sioux Falls MPO travel demand model, year 2045. This model reflects a fiscally constrained transportation network, plus an extension of Veterans Parkway west to I-29. As part of the forecasting process, the travel demand model land use information was reviewed and compared to recent and known development plans. School capacity was also reviewed for both adjacent schools to account for schools being at maximum capacity in the future years. The travel demand model output was post-processed using methodology consistent with *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

The future-year No-Build Conditions reflects a scenario where the Maple Street/Park Street corridor is a paved, 2-lane roadway. This creates an induced demand condition that allows for the identification of traffic operations-based needs. This scenario does not modify intersection lane configurations or traffic control.

The Build Conditions scenarios incorporate needed cross-section and intersection improvements to meet level of service goals for the study. This includes the addition of turn lanes and modifications to traffic control.

Planned north/south collectors, as identified in the Northeast Transportation Network Study[1], were incorporated in the future-year No-Build and Build scenarios. A proposed Park Street extension to SD11/Splitrock Boulevard was included in the 2030 and 2045 Build Conditions scenarios.

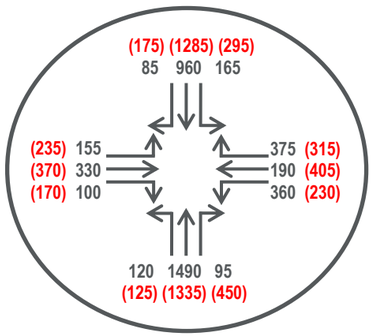
[1] https://www.siouxfalls.org/public-works/special-projects/ne-transportation-network

A summary of traffic forecasts developed for this study are included in the following figures:

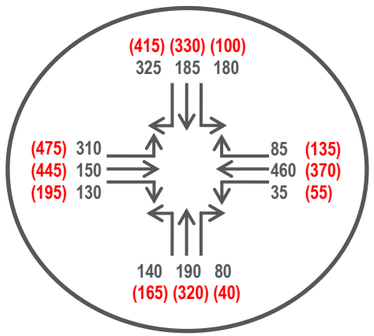
- **Figure 10: 2045 Traffic Forecasts (No-Build Conditions)**
- **Figure 11: 2045 Traffic Forecasts (Build Conditions)**
- **Figure 12: 2030 Traffic Forecasts (Interim Build Conditions)**

Additional information on the development of the existing and future-year conditions traffic volumes is provided in the *Traffic Forecasts* technical memorandum located in **Appendix C**.

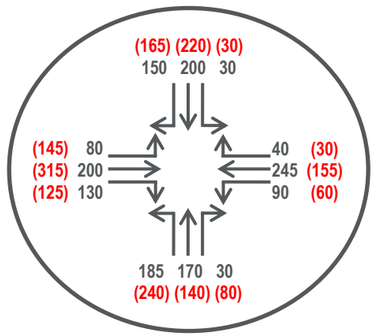
1. Maple St & Veterans Pkwy



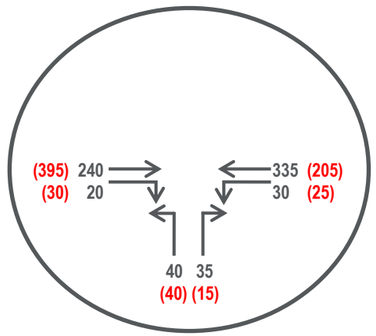
2. Maple St & Future Collector



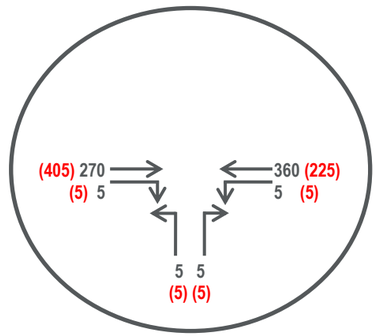
3. Maple St & Six Mile Rd



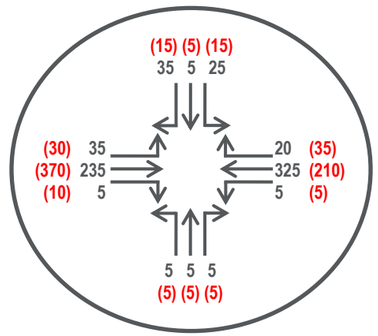
4. Maple St & Future Collector



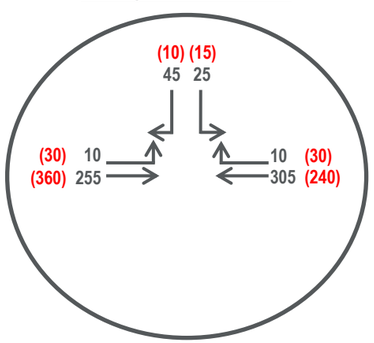
5. Maple St & Indian Hills Tr W



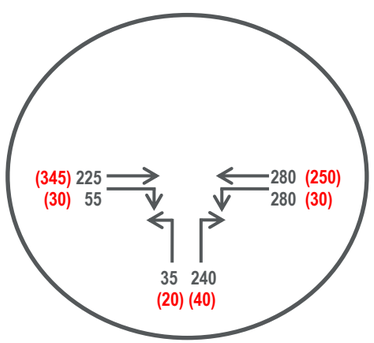
6. Maple St & Indian Hills Tr E/ Future Collector



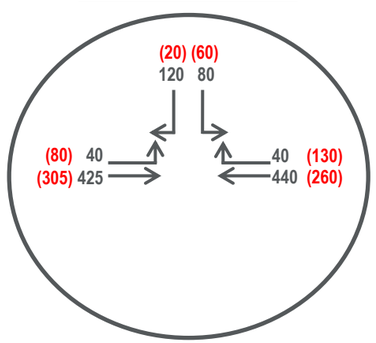
7. Maple St & Oak Rd



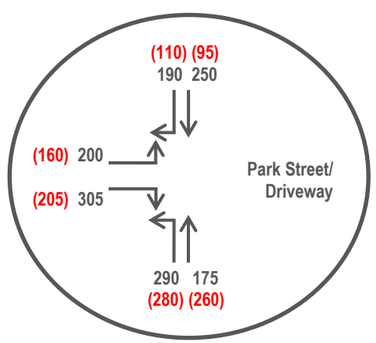
8. Park St & Intermediate School Driveway



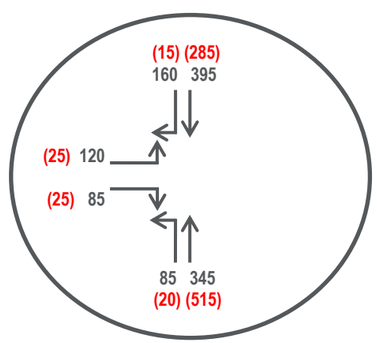
9. Park St & Locust St



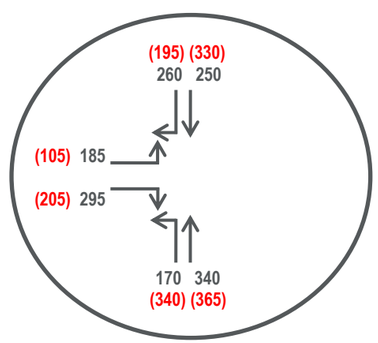
10. Park St & Sioux Blvd



11. Sioux Blvd & Robert Bennis Elementary Driveway



13. Sioux Blvd & SD11/Splitrock Blvd



2045 Traffic Forecasts (No-Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

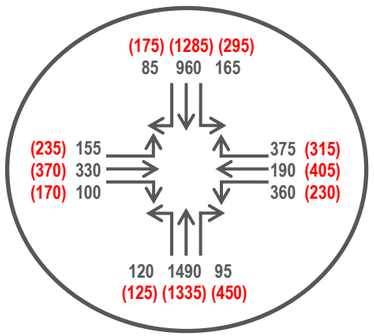
LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

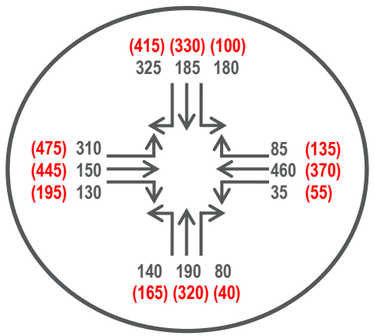
N

FIGURE 10

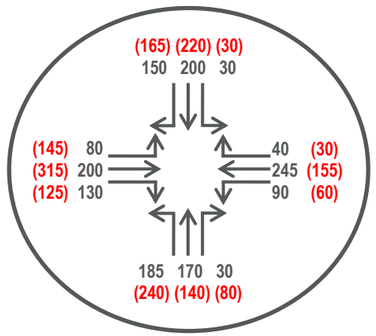
1. Maple St & Veterans Pkwy



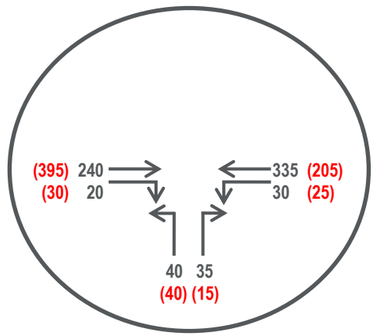
2. Maple St & Future Collector



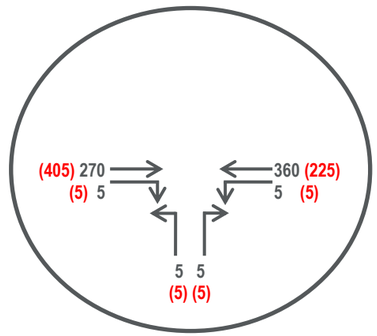
3. Maple St & Six Mile Rd



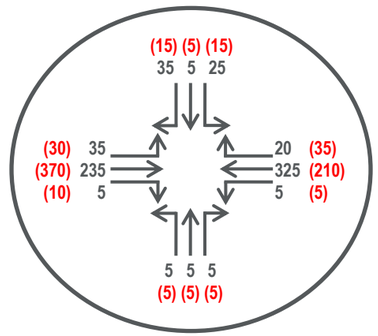
4. Maple St & Future Collector



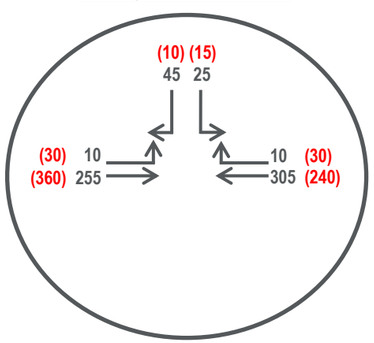
5. Maple St & Indian Hills Tr W



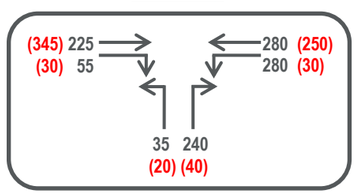
6. Maple St & Indian Hills Tr E/ Future Collector



7. Maple St & Oak Rd



8. Park St & Intermediate School Driveway



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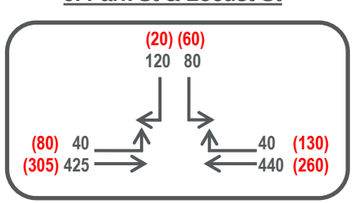

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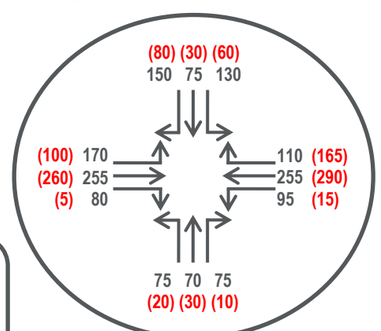

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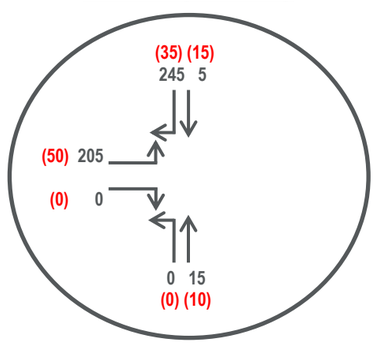
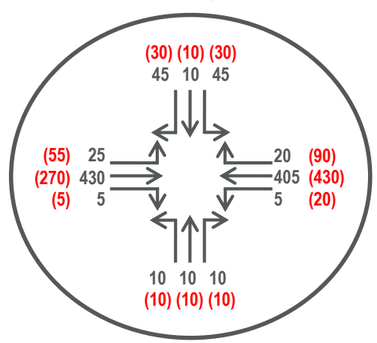
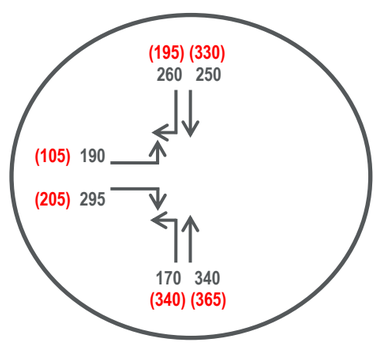


12. Park St & Aspen Park Rd



13. Park St & SD11/Splitrock Blvd



2045 Traffic Forecasts (Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

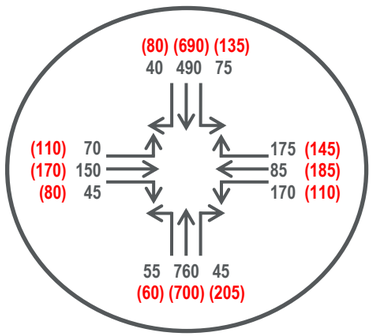
N

LEGEND

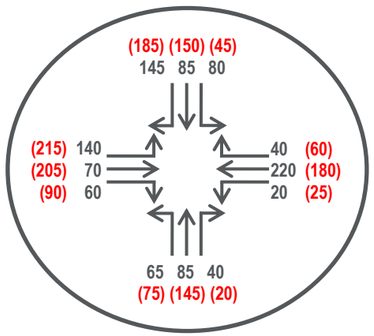
- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

FIGURE 11

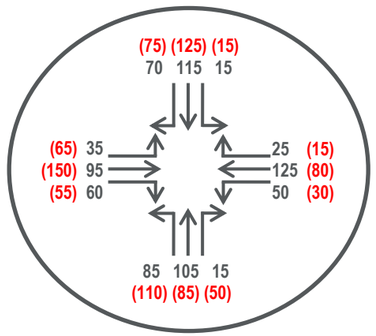
1. Maple St & Veterans Pkwy



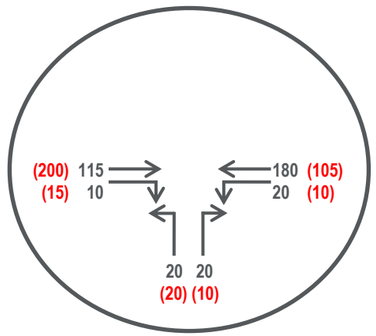
2. Maple St & Future Collector



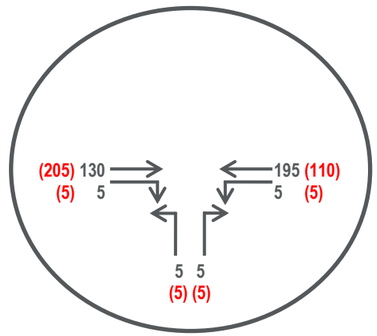
3. Maple St & Six Mile Rd



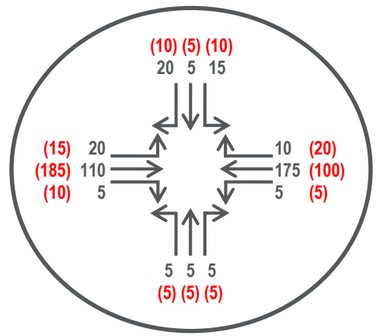
4. Maple St & Future Collector



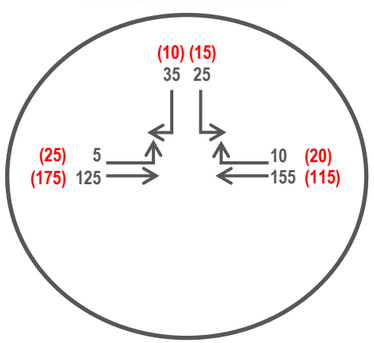
5. Maple St & Indian Hills Tr W



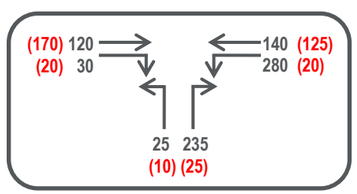
6. Maple St & Indian Hills Tr E/ Future Collector



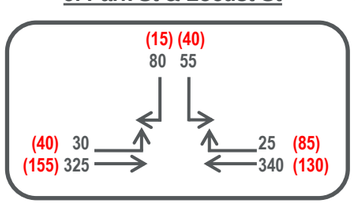
7. Maple St & Oak Rd



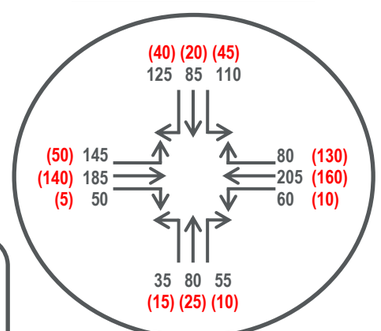
8. Park St & Intermediate School Driveway



9. Park St & Locust St



10. Park St & Sioux Blvd



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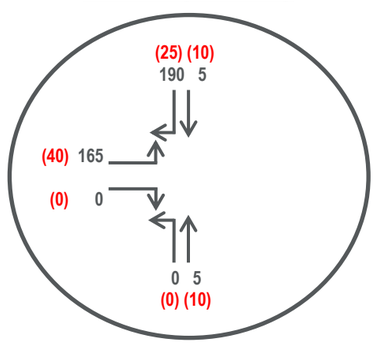

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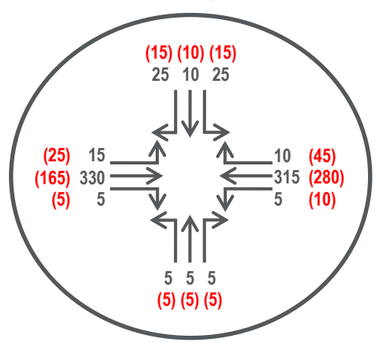
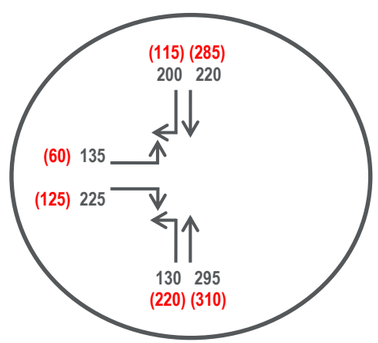


13. Park St & SD11/Splitrock Blvd



2030 Traffic Forecasts (Interim Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

N

LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

FIGURE 12

4. Traffic Operations Analysis Methodology

Peak hour level of service (LOS) was calculated for Maple Street/Park Street analysis intersections using Synchro/SimTraffic 10 traffic analysis software and methodology described in the 6th Edition of the Highway Capacity Manual (HCM6). HCM6 analysis methods measure intersection average control delay in terms of seconds of delay per vehicle (sec/veh) and applies a LOS value in accordance with thresholds presented in **Table 5**.

Table 5: Intersection Level of Service Thresholds

LOS	Intersection Delay per Vehicle (sec/veh)	
	Signalized Intersections	**Two-Way Stop-Control*, All-Way Stop-Control, and Roundabouts**
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 - 35	> 15 - 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Transportation Research Board, HCM6.

** Two-way stop-control LOS reflects worst-case stop-controlled approach.*

The following minimum allowable LOS thresholds have been established for this study.

Signalized Intersections

- Minimum allowable LOS – LOS C
- Individual movements LOS D or better

Two-Way Stop-Controlled (TWSC) Intersections

- Minimum allowable LOS – LOS C
- Lower LOS may be acceptable as it is reported on the side-street approach

Weighted intersection delay was also calculated to present a second average delay measure for Maple Street/Park Street intersections that are stop-controlled from the local (minor) street approach. This method accounts for the operational benefits afforded to the major, high volume through movements that are not stop or signal-controlled at intersections. HCM6 reporting in Synchro 10 provides an average intersection delay value that reflects the weighted average delay of all vehicles entering the intersection. A LOS measure is applied to this average intersection delay value using HCM6 All-Way Stop-Control LOS thresholds.

These LOS thresholds are used to identify areas of operational needs along the corridor in the 2018 Existing Conditions and 2045 No-Build Conditions scenarios. In the future-year Build Conditions scenarios, these thresholds are used to guide the development of potential improvements and subsequent evaluation of concepts.

5. Existing and Future No-Build Conditions Traffic Operations

The following provides a summary of the 2018 Existing Conditions and 2045 No-Build Conditions intersection traffic operations analyses. Additional information on these analyses, including HCM6-based Synchro analysis reports, is provided in the *Existing and Future No-Build Conditions Traffic Operations* technical memorandum in **Appendix D**.

Existing and 2045 No-Build Conditions - Daily Traffic Volumes

The City of Sioux Falls and Minnehaha County have been collecting traffic counts along the corridor for several years, tracking the growth in traffic volumes with development through the area. Recent jumps in traffic volumes have been associated with the opening of the Brandon Valley Intermediate School in 2015 and the connection with Veterans Parkway in 2017.

The following summarizes historic traffic volumes along the corridor and represents a calculated Average Annual Daily Traffic (AADT) volume. This AADT volume represents an average volume across the entire year, taking into consideration daily and monthly fluctuations in traffic volumes, and is calculated by applying a seasonal factor to a 24-hour count. Because traffic volumes are typically collected when weather is good during the spring/summer/fall months, raw count volumes are often greater than the presented AADT volumes.

Maple Street – Six Mile Road to Oak Road

- 2018: 830 vpd
- 2016: 660 vpd
- 2013: 350 vpd

Maple Street – Veterans Parkway to Six Mile Road

- 2018: 190 vpd
- 2013: 100 vpd

NCHRP Synthesis 485: Converting Paved Roads to Unpaved Roads surveyed 48 local, state, and federal agencies that have converted paved roads to gravel roads. A review of guidance manuals was also conducted. Part of this synthesis was understanding the threshold range to where the benefits outweighed the costs for a paved road and vice-versa for a gravel road. The general threshold range for when a gravel road should be considered for conversion of reconstruction to a paved (bituminous, concrete, etc.) road is around 170 to 250 vehicles per day. This takes into account both road construction/maintenance costs and user costs.

With regard to road construction and maintenance costs, gravel roadways that function adequately at the upper limits of this range typically have roadway characteristics such as quality gravel with frequent resurfacing with new/additional gravel, a good roadway base, and frequent maintenance (blading, dust control, etc.). Traffic characteristics also affect gravel road

performance and maintenance needs, with low travel speeds and minimal truck/heavy vehicle volumes being associated with better performing gravel roads.

User costs are higher on gravel surfaces than on paved surfaces, which are paid directly by those that travel on the roadway. Gravel roads increase fuel consumption, generate additional tire wear, causes extra engine wear from dust, and leads to increased maintenance and repair costs. According to the Federal Highway Administration's *Gravel Roads Construction and Maintenance Guide (2015)*, road user costs would be expected to be between 1.3 and 1.4 times greater on a gravel road compared to a paved road.

Existing traffic volumes along the study corridor, particularly east of Six Mile Road, exceed the threshold of when a conversion to a paved road should be considered. In several instances, volumes are over three times the upper reaches of this threshold range. Raw counts for the 2018 and 2016 volumes exceeded 900 and 800 vehicles over a 24-hour period, respectively. Therefore, a need for a paved surface in the short-term has been established based on a roadway maintenance and user cost standpoint.

Existing Conditions – Peak Hour Intersection Operations

The Existing Conditions traffic operations analysis reflects a scenario that analyzes the current network, using recently collected traffic counts (2018) and existing roadway conditions such as number of lanes, intersection traffic control, speed limits, signal timings, etc. The following summarizes results from this analysis at the primary study intersections.

Table 6: Maple Street/Park Street Corridor Intersections – Existing Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC* (Weighted)	10.2 (1.1)	B (A)	11.4 (1.0)	B (A)
Six Mile Road	TWSC* (Weighted)	9.8 (4.0)	A (A)	9.8 (2.7)	A (A)
Locust Avenue	TWSC* (Weighted)	15.1 (2.3)	C (A)	9.4 (2.5)	A (A)
Sioux Boulevard	Signal	20.3	C	9.0	A
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC* (Weighted)	19.9 (6.2)	C (A)	12.5 (2.7)	B (A)

** Two-way stop-control LOS reflects worst-case stop-controlled approach.*
(Weighted) reflects the weighted average intersection delay and LOS.

2045 No-Build Conditions – Peak Hour Intersection Operations

The purpose of the 2045 No-Build Conditions analysis is to identify future-year needs and help guide the subsequent development of potential improvements within the study area. The following tables summarize this analysis at the primary study intersections.

Table 7: Maple Street/Park Street Corridor Intersections – 2045 No-Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC* (Weighted)	**~ (~)**	**F (F)**	**~ (~)**	**F (F)**
Six Mile Road	TWSC* (Weighted)	**~ (~)**	**F (F)**	**~ (~)**	**F (F)**
Locust Avenue	TWSC* (Weighted)	54.2 (9.8)	F (A)	24.1 (3.1)	C (A)
Sioux Boulevard	Signal	**59.6**	**E**	18.8	B
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC* (Weighted)	**664.4 (213.7)**	**F (F)**	**1187.6 (241.8)**	**F (F)**

** Two-way stop-control LOS reflects worst-case stop-controlled approach.*

~ Volume exceeds capacity on minor approaches and computation not defined.

(Weighted) reflects the weighted average intersection delay and LOS.

Locations not meeting LOS goals for this study are noted in **RED**.

6. Summary of Maple Street/Park Street Corridor Transportation Needs

Growth and Development – Sioux Falls and Brandon future land-use plans illustrate the anticipated growth of both municipalities along the study corridor. While the timeframe for much of this growth is dependent on the extension of utilities, it is expected to begin in the near future and extend for multiple decades. This will lead to evolving traffic patterns and continual increase in traffic demand throughout the area. Short and long-term needs will be addressed through two improvement scenarios (2030 and 2045) within this study.

Planning – To address the anticipated development, The City of Sioux Falls, City of Brandon, Minnehaha County, and Sioux Falls MPO have collectively identified future projects to address transportation needs in the area. The Maple Street/Park Street corridor has been identified as an east/west arterial corridor providing important connections throughout the area. Spacing of parallel east/west arterials are consistent with the area's grid network, approximately 1.5 miles south of Rice Street/Holly Boulevard and 1 mile north of Madison Street.

Maintenance Needs – Maple Street traffic volumes have grown to over 800 vpd east of Six Mile Road, with raw counts exceeding 900 vehicles over a 24-hour period. This daily volume is over

three times greater than the typical range of daily traffic volume (170-250 vpd) for when a gravel road should be converted/reconstructed to a paved road based on roadway benefits and costs. Maintenance of gravel roads exceeding 250 vpd becomes notably more expensive, as maintenance frequency is increased (blading, dust control, spot gravel, etc.), the gravel needs to be added to the surface more frequently, and the need for quality gravel is heightened (leading to more expense).

Access Management Needs – Existing access density and spacing outside of the Brandon city limits reflects a typical rural township roadway. With anticipated development and increasing traffic volumes throughout the corridor, access management will be an important component of future roadway improvements and development of adjacent parcels.

Roadway Safety – The overarching need for improvement along this corridor is growing traffic volumes and a roadway that aligns with the desired function. Maple Street is currently a township roadway west of the Brandon City limits, in both design characteristics and jurisdiction. Increasing traffic volumes and the potential for high vehicular speeds along the township segment have exacerbated challenges facing the township cross-section, including sight distance, narrow gravel roadway surface, gravel maintenance, steep grades, steep ditches, and winter maintenance.

There were seven roadway departure crashes along Maple street west of the Brandon City limits from 2013 to 2017. Potential crash mitigation measures to this segment include improving the roadway to current design standards and desired functionality, such as typical section, vertical curvature, roadway surfacing, and roadside design. These improvements are also expected to benefit winter weather-related safety.

Intersection Safety – Intersection-related crashes were most frequent at the higher-volume intersections. Vehicle conflict exposure will continue to increase at all intersections as traffic volumes increase throughout the corridor, from both the Maple Street/Park Street approaches and many of the side-street/driveway approaches. Existing geometrics also contribute to safety concerns such as sight distance and approach grades.

Pedestrian/Bicycle Safety – Pedestrian/bicycle crossings of Park Street will need to be reviewed this study. Two schools south of Park Street create a high demand of school children crossings and vehicle-pedestrian/bicyclist exposure is expected to increase as vehicular volumes increase. One vehicle/pedestrian/bicycle crash, resulting in an injury was noted at the Park Street and Locust Street intersection between 2013 and 2017. Consideration to pedestrian/bicycle crossings of Park Street and Sioux Boulevard is important with the projected increases in traffic volumes.

To the west of the Brandon City limits, the corridor currently lacks pedestrian or bicycle facilities along the corridor. Corridor improvements provide an opportunity to connect the trail network in Brandon to the shared-use path along Veterans Parkway in Sioux Falls.

Traffic Operations – The 2045 traffic demand creates operational needs for modification to lane configurations and/or traffic control at the following primary intersections:

- Veterans Parkway (TWSC weighted average intersection LOS F)
- Six Mile Road (TWSC weighted average intersection LOS F)
- Sioux Boulevard (signalized intersection LOS E)
- SD11/Splitrock Boulevard (TWSC weighted average intersection LOS F)

Improvements will be needed at these intersections to meet the operational goals of LOS C for the primary corridor intersections.

7. Build Scenarios, Roadway Design Guidelines, and Assumptions

Build Scenarios

Two Build scenarios were developed to address both short and long-term traffic operations needs throughout the corridor. These scenarios incorporate the respective traffic forecasts, based on anticipated levels of growth and development throughout the Sioux Falls metropolitan area. The following goals were established for the two scenarios:

A. 2045 Build Conditions

a. Understand and addresses long-term operational needs through year 2045 traffic forecasts.
b. Develop a plan for future improvements through year 2045, determining whether they should be incorporated as part of the:
    i. 2030 Interim Build Conditions improvements or
    ii. Long-term plan for 2045 Build Conditions improvements

B. 2030 Interim Build Conditions

a. Understand and addresses short-term operational needs through year 2030 traffic forecasts.
b. To develop a project that collectively addresses issues related to the challenges currently facing the existing rural township roadway.

Design Considerations for Analysis

As this corridor spans multiple jurisdictions, both in terms of current and future owners, it is important to understand likely design guidelines that will be applied in both the 2030 and 2045 Build Conditions analyses. The following discusses assumptions used in the traffic operations analysis with regard to potential design guidelines and future segment ownership. These assumptions are for this analysis only and are subject to change if a project moves into design.

Analysis speeds

The ‘posted’ speed limits used in the traffic operations analysis are reflective of the future owner (growth area) and potential timeline of short and long-term needs.

- Veterans Parkway to Six Mile Road: 40 mph
- Six Mile Road to Brandon city limits: 45 mph
- Brandon city limits to SD11/Splitrock Boulevard: 30 mph

Right-of-way Width

Minnehaha County, City of Sioux Falls, and City of Brandon standard right-of-way width is 100 feet for a minor arterial roadway, which is planned for this study corridor. It is anticipated that the entire 100 feet will be acquired as part of an initial project and thus right-of-way does not constrain future improvements at primary study intersections.

Cross-Section Characteristics

The traffic operations analysis will determine a minimum lane configuration along the corridor and at primary study intersections. The analysis will also indicate locations for consideration of turn lanes at minor intersections and driveways.

Specifics regarding whether the roadway is going to be constructed as an urban or rural cross-section, how drainage will be accommodated, pavement type, etc. will be further evaluated in design.

Veterans Parkway and Maple Street Intersection

The Veterans Parkway and Maple Street intersection configuration developed through the SD100 Corridor Preservation study and subsequent environmental documentation was used as the ultimate build-out for this study in the 2045 Build Conditions analysis. Findings from this study were used to both validate the Veterans Parkway build-out configuration and identify any potential modifications to the Maple Street approaches.

Currently, Veterans Parkway infrastructure is built-out on the northbound/southbound approaches but striped for less capacity as shown in **Figure 13**. The primary goal of the 2030 Interim Build Conditions is to identify what configuration is needed between the existing and ultimate build-out configurations.

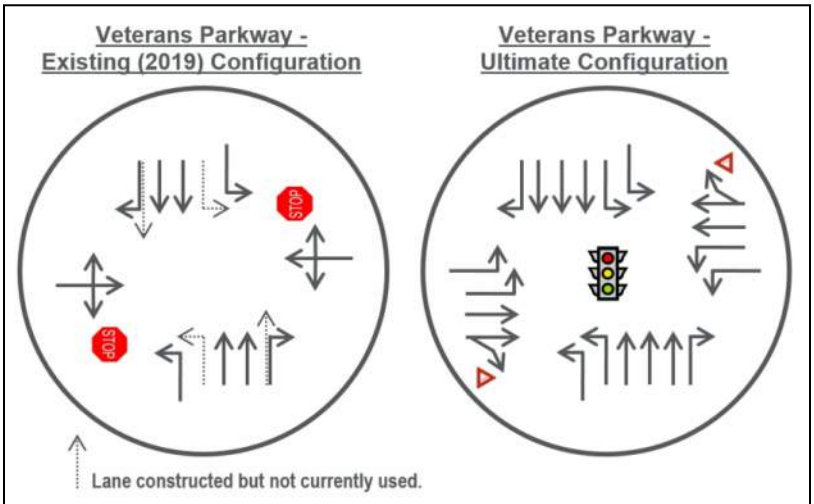


Figure 13: Veterans Parkway and Maple Street Intersection Configurations

Ultimate configuration from the *Traffic Analysis Update – Hwy100 from Madison Street to Maple Street* technical memorandum (12/15/14)

Park Street Extension

A potential extension of Park Street to SD11/Splitrock Boulevard is incorporated in the 2045 Build Conditions and 2030 Interim Build Conditions analyses with the following modifications:

- Existing intersection of Sioux Boulevard and SD11/Splitrock Boulevard is removed.
    - Sioux Boulevard will continue southward from the elementary school to potential residential development identified in The Hollows development sketch (see the *Traffic Forecasts* technical memorandum).
- No changes to driveway access locations or purpose for Robert Bennis Elementary School or the Intermediate School.
- Aspen Park Road and Park Street intersection added within The Hollows development, east of Sioux Boulevard.

A supplemental analysis without the Park Street extension was conducted for the 2045 Build Conditions.

8. Maple Street/Park Street Corridor Build Conditions Traffic Operations Analysis

The following section presents a summary of the 2030 and 2045 Build Conditions traffic operations analysis. This analysis identifies and evaluates proposed improvements to address study needs and operational goals, including:

- Intersection traffic operations
- Intersection traffic signal warrants
- Turn lanes

Additional information on these analyses, and the supporting output sheets from the respective analysis tool are provided in the *2030 and 2045 Build Conditions Traffic Operations* technical memorandum in **Appendix E**.

2030 and 2045 Build Conditions Intersection Traffic Operations

The proposed intersection and corridor improvements were developed in Synchro to meet LOS goals established for this study. The intersections were incrementally built-out to determine the minimum number of through lanes and turn lanes needed to meet these goals, and thus represent a ‘minimum build condition’.

The resulting intersection operations for the 2030 Interim Build Conditions and 2045 Build Conditions are provided in **Table 8** and **Table 9**, respectively.

Table 8: Maple Street/Park Street Corridor Intersections – 2030 Interim Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	Signal	25.5	C	28.0	C
Six Mile Road	Signal AWSC	13.8 12.0	B B	16.0 12.9	B B
Locust Avenue	TWSC* (Weighted)	18.6 (3.2)	C (A)	11.7 (2.1)	B (A)
Sioux Boulevard	Signal	21.4	C	15.5	B
SD11/Splitrock Boulevard	Signal	11.7	B	11.7	B

** Two-way stop-control LOS reflects worst-case stop-controlled approach.*
(Weighted) reflects the weighted average intersection delay and LOS.

Table 9: Maple Street/Park Street Corridor Intersections – 2045 Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	Signal	33.2	C	35.0	C
Six Mile Road	Signal	18.2	C	23.6	C
Locust Avenue	TWSC* (Weighted)	47.3 (8.6)	E (A)	20.7 (2.7)	C (A)
Sioux Boulevard	Signal	29.2	C	19.4	B
SD11/Splitrock Boulevard	Signal	16.3	B	15.0	B

** Two-way stop-control LOS reflects worst-case stop-controlled approach.*
(Weighted) reflects the weighted average intersection delay and LOS.

A supplemental analysis was conducted at the Park Street and Sioux Boulevard intersection where Park Street is not extended east to SD11/Splitrock Boulevard. Volumes used in this analysis reflect those presented in the 2045 No-Build Conditions. The following table presents traffic operations of the minimum intersection lane configurations at the Sioux Boulevard and SD11/Splitrock Boulevard intersections.

Table 10: Maple Street/Park Street Corridor Intersections – 2045 Build Conditions with No Park Street Extension

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Sioux Boulevard	Signal	29.2	C	14.7	B
SD11/Splitrock Boulevard	Signal	16.3	B	15.0	B

The minimum lane configurations to meet operational goals of this study are summarized in the following tables and figures:

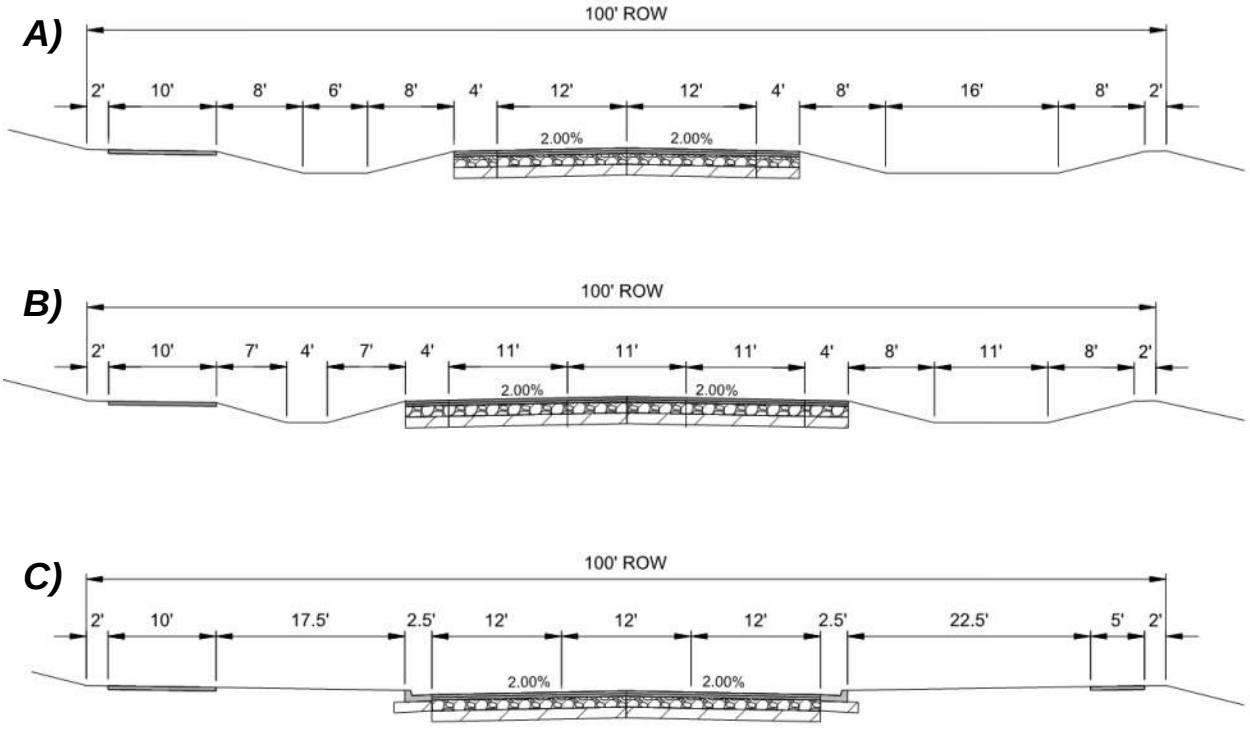
- Roadway Cross-Sections
    - **Table 11** – Minimum Build Conditions Typical Roadway Cross-Sections
    - **Figure 14** – Typical 2-Lane and 3-Lane Cross-Sections
    - **Figure 15** – Typical 5-Lane Urban Cross-Section

- Intersections
    - **Table 12** – Primary intersection lane configurations
    - **Figure 16** – Primary intersection lane configuration (graphical representation)

Table 11: Maple Street/Park Street Minimum Build Conditions – Typical Roadway Cross-Section

2030 Interim Build Conditions	2045 Build Conditions
Veterans Parkway to Six Mile Road – 3-lane section or – 2-lane section with turn lanes (1 through lane in each direction)	Veterans Parkway to Six Mile Road – 5-lane section (2 through lanes in each direction)
Six Mile Road to SD11/Splitrock Boulevard – 3-lane section or – 2-lane section with turn lanes (1 through lane in each direction)	Six Mile Road to SD11/Splitrock Boulevard – 3-lane section or – 2-lane section with turn lanes (1 through lane in each direction)

Figure 14: Maple Street/Park Street Typical Roadway Cross-Section – 2-Lane and 3-Lane



A) 2-Lane Rural Section; B) 3-Lane Rural Section (2-Lane with Center Turn Lane); C) 3-Lane Urban Section

Figure 15: Maple Street/Park Street Typical Roadway Cross-Section – 5-Lane Urban

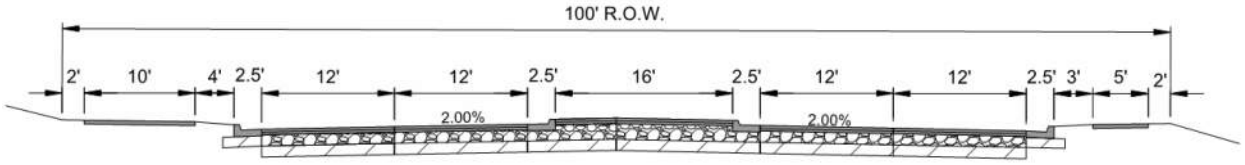
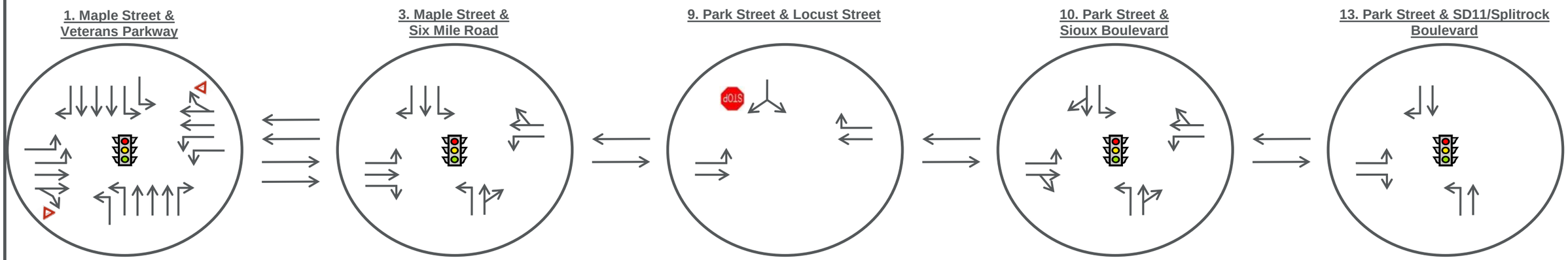


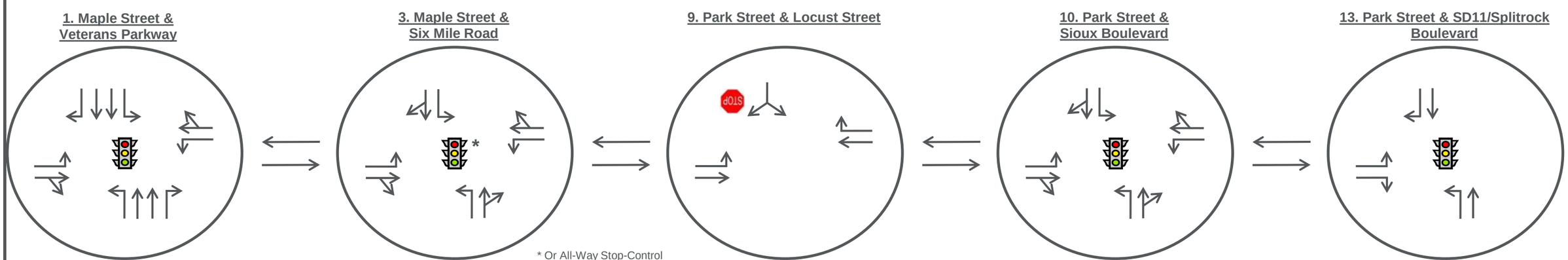
Table 12: Maple Street/Park Street Corridor Minimum Build Conditions – Primary Intersection Lane Configurations

2030 Interim Build Conditions	2045 Build Conditions
1. Veterans Parkway – Existing configuration on Veterans Parkway approaches – Single through and left-turn lane on Maple Street approaches – Signalize	1. Veterans Parkway – Full build-out of intersection – Signalize
3. Six Mile Road – Left-turn lanes on all four approaches – Stop-control, review updated counts and forecasts during design for determination of two-way stop-controlled approaches or all-way stop control warrants.	3. Six Mile Road – Left-turn lanes on all four approaches – SB and EB right-turn lanes – Signalize
9. Locust Street – EB left-turn lane – WB right-turn lane – Stop-control from Locust Street approach	9. Locust Street – EB left-turn lane – WB right-turn lane – Stop-control from Locust Street approach
10. Sioux Boulevard *With Park Street extension to SD11/Splitrock Blvd* – Left-turn lanes on all four approaches – Maintain signalized intersection	10. Sioux Boulevard *With Park Street extension to SD11/Splitrock Blvd* – Left-turn lanes on all four approaches – Maintain signalized intersection
10. Sioux Boulevard *Maintain existing Sioux Boulevard connection with SD11/Splitrock Blvd* – Maintain signalized intersection	10. Sioux Boulevard *Maintain existing Sioux Boulevard connection with SD11/Splitrock Blvd* – Add right-turn lane to separate high-volume right and through movements – Maintain signalized intersection
13. SD11/Splitrock Boulevard *At Park Street or SD11/Sioux Boulevard* – Left and right-turn lanes on Park Street approach – NB left-turn lane – SB left-turn lane – Signalize	13. SD11/Splitrock Boulevard *At Park Street or SD11/Sioux Boulevard* – Left and right-turn lanes on Park Street approach – NB left-turn lane – SB left-turn lane – Signalize

2045 Minimum Build Conditions



2030 Minimum Interim Build Conditions



* Or All-Way Stop-Control

Minimum Build Conditions - Primary Intersections and Corridor Through Lanes

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

N

LEGEND

Intersection Approach Lane Configuration

Segment Through Lane Configuration

FIGURE 16

Intersection Traffic Signal Warrants

Traffic control signal warrants were reviewed at the following intersections:

- Six Mile Road and Maple Street – future-year traffic operations
- Locust Street and Park Street – proximity to school and pedestrian crossings
- SD11/Splitrock Boulevard and Future Park Street – future-year traffic operations

This warrant analysis looks at future-year hourly traffic volumes reflective of the 2030 Interim Build Conditions and 2045 Build Conditions. Methodology used in the review is based on Chapter 4C of 2009 Manual on Uniform Traffic Control Devices (MUTCD). With available data, the traffic signal warrant review conducted using Highway Capacity Software version 7 (HCS7) focused on the following:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour

Findings for traffic control signal warrants 1-3 are summarized in the following table.

Table 13: Traffic Signal Warrant Analysis Summary – Warrants 1-3

Maple Street/Park Street Intersection	2030			2045			Analysis Year Warrant Met
	Warrant 1 *8-Hour*	**Warrant 2** *4-Hour*	**Warrant 3** *Peak Hour*	**Warrant 1** *8-Hour*	**Warrant 2** *4-Hour*	**Warrant 3** *Peak Hour*	
Six Mile Road	n/a	-	-	n/a	**X**	**X**	**2045**
Locust Street	n/a	-	-	n/a	-	-	**Not met**
SD11/Splitrock Boulevard	-	**X**	**X**	-	**X**	**X**	**2030**

X *indicates warrant met*

The remaining warrants 4 through 9 were reviewed as follows:

- Warrant 4, Pedestrian Volumes (at Locust Street)
  - Pedestrian volume counts do not meet conditions required to satisfy Warrant 4.
- Warrant 5, School Crossing (at Locust Street)
  - Available gaps in traffic and student volumes must meet conditions to satisfy Warrant 5.
    - Student volumes exceed the minimum of 20 students in the peak hour. However, available gaps in traffic were not measured as part of this study.
    - Warrant 5 was not met based on available data.
- Warrant 6, Coordinated Signal System – no intersections are within a coordinated system.
- Warrant 7, Crash Experience – none of these intersections have experienced five or more reported crashes within a 12-month period over the last five years.
- Warrant 8, Roadway Network – intersection is not part of two major routes.
- Warrant 9, Grade Crossing – none of these intersections are near a grade crossing.

Turn Lanes

A turn lane evaluation was conducted for study intersections and driveways along the Maple Street/Park Street corridor using 2030 Interim Build and 2045 Build Conditions traffic forecasts, focusing on:

- Turn lanes at primary study intersections
- Turn lane warrants at minor street intersections and driveway access locations
- Recommended turn lane lengths

This evaluation serves as a tool to aid conceptual design. Conclusions from this evaluation do not require installation, or non-installation, of a turn lane. Turn lanes to crossroads and driveways provide operational and safety benefits to arterial roadway traffic by minimizing through traffic hazards and interference.

Engineering judgment and other factors such as lane balance, access density, route continuity, or sight distance, contribute to the ultimate determination whether a turn lane is constructed. Additionally, future development intensity, timeframe, and desired access play a role in the level of demand at these future minor street intersections and driveways.

Primary Study Intersection Turn Lanes

Major street intersection turn lane needs were determined by operational analysis in the previous section. Minimum build configurations reflect the minimum turn lane needs at these primary study intersections.

Turn lanes beyond those needed to achieve study LOS goals provide operational benefits by reducing delay at signalized intersections. The following table summarizes the potential reduction in delay at the Maple Street/Park Street intersections with Six Mile Road and Sioux Boulevard.

Table 14: Maple Street/Park Street Intersections – 2045 Build Conditions Delay Comparison with Additional Right-Turn Lanes

Maple Street/ Park Street Intersection	Minimum Required Right-Turn Lanes[1]	Added Right-Turn Lanes[2]	AM Peak Period Avg. Delay (sec/veh)		PM Peak Period Avg. Delay (sec/veh)	
			Minimum Required Configuration	*W/ Additional RT Lanes*	*Minimum Required Configuration*	*W/ Additional RT Lanes*
Six Mile Road	EB, SB	NB, WB	18.2	17.1	23.6	21.0
Sioux Boulevard	None	EB, WB, NB, SB	29.2	17.9	19.4	15.2

[1] Configuration with minimum required turn lanes to meet study LOS goals, as presented in Table 9 and Figure 16.

[2] Configuration with right-turn lanes on all four intersection quadrants.

Delay is reduced with the inclusion of additional right-turn lanes at both intersections. The reduction is most pronounced at the Sioux Boulevard intersection, as there were no right-turn lanes required to meet LOS goals for this study. Delay reduction at Six Mile Road was

significantly less as right-turn lanes were required, and thus already included, for the two movements with the greatest right-turn demand.

A summary of 2030 Interim Build Conditions is presented in **Table 15**.

Table 15: Maple Street/Park Street Intersections – 2030 Interim Build Conditions Delay Comparison with Additional Right-Turn Lanes

Maple Street/ Park Street Intersection	Minimum Required Right-Turn Lanes[1]	Added Right-Turn Lanes[2]	AM Peak Period Avg. Delay (sec/veh)		PM Peak Period Avg. Delay (sec/veh)	
			Minimum Required Configuration	*W/ Additional RT Lanes*	*Minimum Required Configuration*	*W/ Additional RT Lanes*
Six Mile Road	None	EB, WB, NB, SB	13.8	12.6	16.0	14.2
Sioux Boulevard	None	EB, WB, NB, SB	21.4	16.4	15.5	13.7

[1] Configuration with minimum required turn lanes to meet study LOS goals, as presented in Table 8 and Figure 16.

[2] Configuration with right-turn lanes on all four intersection quadrants.

Six Mile Road is signalized for this comparison.

Minor Street Intersection/Driveway Access Turn Lane Warrants

Maple Street/Park Street approaches were evaluated at the following minor street or driveway access intersections:

- Future collector roadway (between Veterans Parkway to Six Mile Road)
- Future collector road (between Six Mile Road and Indian Hills Trail west)
- Indian Hills Trail west
- Indian Hills Trail east and future collector road
- Oak Road
- Intermediate School Drive
- Locust Street
- Robert Bennis Elementary School Drive
- Future Aspen Park Road

Turn lane warrant criteria used in this analysis is based on standards for turn lanes presented in the City of Sioux Falls Design Standards and City of Brandon Design Standards. These standards consider the relationship between traffic volumes, posted (or future) speed limits, and the number of lanes on the facility in the determination of whether a turn lane is warranted. Analysis conditions reflect those established in the 2030 Interim Build Conditions and 2045 Build Conditions scenarios, respectively.

The following table summarizes Maple Street/Park Street intersection approach locations that meet turn lane warrant criteria. Given the potential development in the area, it is recommended that turn lanes still be planned at locations not meeting warrants to not constrain inclusion when addressing future needs.

Table 16: Maple Street/Park Street Corridor Minor Street/Driveway Access Intersections – Turn Lane Volume Warrant Review

Minor Intersection or Access Driveway	Turn Movement	2030 Turn Lane Volume Warrant Satisfied?	2045 Turn Lane Volume Warrant Satisfied?
Future Collector Road (between Veterans Parkway and Six Mile Road)	EB LT	Yes	Yes
	EB RT	Yes	Yes
	WB LT	Yes	Yes
	WB RT	Yes	Yes
Future Collector Road (between Six Mile Road and IHT west)	EB RT	Yes	Yes
	WB LT	Yes	Yes
Indian Hills Trail (west)	EB RT	No	No
	WB LT	No	No
Indian Hills Trail (east) and Future Collector Road	EB LT	Yes	Yes
	EB RT	No	No
	WB LT	No	No
	WB RT	Yes	Yes
Oak Road	EB LT	Yes	Yes
	WB RT	Yes	Yes
Intermediate School Drive	EB RT	No	No
	WB LT	Yes	Yes
Locust Street	EB LT	Yes	Yes
	WB RT	Yes	Yes
Robert Bennis Elementary School Drive**	NB LT	Yes	Yes
	SB RT	Yes	Yes
Future Aspen Park Road**	EB LT	No	Yes
	EB RT	No	No
	WB LT	No	No
	WB RT	No	Yes

*** Volumes for these two intersections reflect the highest volume condition from a potential Park Street extension. Robert Bennis Elementary School Drive shows conditions without the Park Street extension and Aspen Park Road is shown with the Park Street extension.*

Turn Lane Design

Turn lane design guidelines along Maple Street/Park Street and local cross-streets are based on City of Sioux Falls Design Standards and City of Brandon Design Standards. Turn lane design for Veterans Parkway and SD11/Splitrock Boulevard is based on design guidelines presented in the SDDOT Road Design Manual. Recommended minimum turn lane lengths are provided in **Appendix E**.

9.Bicycle/Pedestrian Facilities

Bicycle/pedestrian connectivity will be an important element of potential future improvements along the Maple Street/Park Street corridor. This includes both linear east/west facilities along the corridor and crossings of Maple Street and Park Street throughout the corridor. While many of the details will be finalized in design, the following presents recommendations for facilities and crossings of Park Street near the schools.

Bicycle and Pedestrian Facilities

It is recommended that a shared-use path extend the length of the corridor, providing important connections between the shared-use path that parallels Veterans Parkway to the west and the existing Brandon trail network and localized sidewalks to the east. While the final determination of bicycle/pedestrian cross-sectional elements and crossing locations will be set in design, the inclusion of a shared-use path along the corridor will provide the desired connectivity and provide a facility for both bicyclists and pedestrians away from the vehicular travel lanes.

Park Street Crossings at Locust Street and Sioux Boulevard

A field review of Park Street crosswalks was conducted as part of this study on the morning of October 18, 2010, to understand common crossing patterns of students heading to school. Considerably fewer pedestrians used crosswalks at the signalized Sioux Boulevard intersection compared to the unsignalized Locust Street intersection. There is currently a pedestrian-actuated flashing beacon system on the west side of the Locust Street intersection, however, it was never activated by a student walking to school that morning. A school staff member stationed at the intersection was stopping traffic for kids to cross throughout the intersection.

In anticipation of traffic volumes increasing with the potential improvements west of Brandon, traffic signal and pedestrian hybrid beacon warrants were reviewed for pedestrian crossings of Park Street around the Locust Street intersection. Findings from this review, consistent with guidance provided in the 2009 MUTCD, are summarized below. For additional details refer to the *2030 and 2045 Build Conditions Traffic Operations* technical memorandum in **Appendix E**.

Existing crossing information –

- Park Street Pedestrian AM Peak Hour Crossing Volume (2018 counts)
    - West Leg: 56 pedestrians per hour (pph)
    - East Leg: 17 pph
    - Total/Consolidated North/South Park Street Crossings: 73 pph
- Park Street 2-Way Vehicular AM Peak Hour Volume (2018 counts)
    - West Leg: 539 vph
    - East Leg: 547 vph
- Park Street 2-Way Vehicular AM Peak Hour Volume (2030 Build Conditions forecast)
    - West Leg: 1025 vph
    - East Leg: 985 vph
- Crossing Distance: approximately 45 feet (map measured)

Traffic Signal Warrant – Warrant 4, Pedestrian Volumes, and Warrant 5, School Crossing, in the 2009 MUTCD were not met based on volumes and/or available data. However, a gap study is recommended to provide a full review of Warrant 5, School Crossing.

Pedestrian Hybrid Beacon – Based on guidelines provided in Figure 4F-1 of 2009 MUTCD, it was concluded that existing (2018) volumes do not warrant a pedestrian hybrid beacon. The approximate vehicular volume threshold for 75 pedestrian crossings per hour and a 45-foot crossing distance is 1,050 vph. The 2045 forecast peak hour volume approaches this threshold. Therefore, it is recommended that the crossing be monitored and periodically reviewed as pedestrian crossing and vehicular volumes increase.

Interim Measures – Until a traffic signal is warranted at Locust Street or a pedestrian hybrid beacon is warranted in the area west of Sioux Boulevard, the following interim measures are recommended to promote safe crossing opportunities at the intersection:

- Maintain traffic signal with pedestrian crossing capabilities at Sioux Boulevard.
- Install a pedestrian-actuated rectangular rapid flashing beacon (RRFB) at/near the Locust Street intersection.
    - Studies have shown that RRFBs have considerably higher compliance rates for motorists recognizing and stopping for pedestrians at the crosswalks.
- Educate parents, students, and school faculty on safe crossing practices at this location:
    - Instruct students to activate the RRFB for all crossings.
    - Educate parents on the importance of using the RRFB system to cross the street.
    - Instruct staff acting as crossing guards or monitoring the crossings to wear a uniform and use equipment that is highly visible and easily identifiable by the public, follow proper crossing procedures, and teach students how to safety use the crosswalks.

10. Access Management

Access management is an important component to preserving functionality of a roadway network. It incorporates several techniques to balance vehicular access to development with roadway safety, efficiency, and operations. Current access spacing throughout the corridor reflects typical rural conditions along a township roadway. The following presents a strategy to manage access along the corridor as traffic volumes increase, land surrounding the corridor is developed, and improvements are made to the corridor. A more detailed discussion of this strategy is provided in the *Maple Street/Park Street Corridor Access* technical memorandum in **Appendix A**.

Sioux Falls and Brandon Access Criteria

The City of Sioux Falls and City of Brandon have adopted similar access management criteria, outlined in their respective Engineering Design Standards guidelines. Four access categories

have been developed for arterial streets, summarized from the Engineering Design Standards documents as follows:

- Regional – Routes which provide regional continuity.
- Arterial I – Routes which provide regional continuity and are spaced approximately 3 miles from the next parallel Arterial I roadway. These routes primarily serve high commercial and commuter needs.
- Arterial II – Routes that typically have continuity across the city. These routes serve a mixture of commercial and residential needs.
- Arterial III – Routes that typically do not continue across the city. These routes serve mainly residential and neighborhood commercial uses.

The access spacing criteria for each of the four arterial access categories are summarized in **Table 17**.

Table 17: Access Spacing on Arterial Roadways

Classification	Signal Spacing	Median Opening	Unsignalized Intersection Spacing
Regional Arterial/Expressway	1/2 mile	1/2 mile	2640
Arterial I	1/4 mile	1/4 mile	1320
Arterial II	1/4 mile	1/4 mile	varies
Arterial III	1/4 mile	660	varies

Source: Sioux Falls Engineering Design Standards, Table 8.0, and Brandon Engineering Design Standards, Table 8.0

Existing Roadway Access Classification

The following presents access criteria and priorities for the Maple Street/Park Street study corridor and primary crossroads.

Crossroad – Veterans Parkway

Veterans Parkway has a corridor-specific access plan, as described in the *SD100 Access and Noise Plan* (developed in February 2007).

Veterans Parkway access points through the Maple Street area are presented in Exhibit 3 of the *SD100 Access and Noise Plan*.

The access plan also identified access criteria for side-street access points closest to Veterans Parkway, shown in **Table 18**. This criteria is based on maintaining proper traffic signal spacing and preventing interference with traffic operations of Veterans Parkway intersections. Maple Street falls under the arterial street type.

Table 18: Veterans Parkway (SD100) Side Street Access Spacing

STREET TYPE	SPACING CRITERIA
MAJOR COLLECTOR (18TH, 33RD, UNNAMED BETWEEN MAPLE, MADISON)	TRAFFIC SIGNAL - 1/4 MILE
	INTERSECTION - 450 FEET
ARTERIAL	FULL INTERSECTION - 1/4 MILE
	PARTIAL INTERSECTION* - 660 FEET

* partial intersection may include right in/right-out and left-in movements

Source: Table 2 in the SD100 Access and Noise Plan

Refer to the *SD100 Access and Noise Plan* for additional details on Veterans Parkway access, Maple Street access within the Veterans Parkway corridor no access zone, and variance requests.

Maple Street/Park Street: Veterans Parkway to Six Mile Road
Joint Jurisdiction: Minnehaha County and City of Sioux Falls

The City of Sioux Falls currently identifies Maple Street identified as a **priority 2 arterial street** with full build as a multi-lane roadway with median. Future access spacing is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: ¼-mile locations
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Crossroad – Six Mile Road
Jurisdiction: Minnehaha County
Future Joint Jurisdiction: City of Sioux Falls and City of Brandon

The City of Sioux Falls currently identifies Six Mile Road as a **priority 3 arterial street**. Future access spacing is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: 660-ft. spacing
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Maple Street/Park Street: Six Mile Road to SD11/Splitrock Boulevard
Joint Jurisdiction: Minnehaha County and City of Brandon (west of Brandon city limits)
Jurisdiction: City of Brandon (within Brandon city limits)

The City of Brandon currently identifies Maple Street/Park Street as a **priority 2 arterial street**, extending the current City of Sioux Falls access classification east from Six Mile Road. Future access spacing along this segment is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: ¼-mile locations
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Crossroad – SD11/Splitrock Boulevard
Jurisdiction: SDDOT

The SDDOT currently classifies SD11/Splitrock Boulevard as **urban fringe** access through the Sioux Boulevard intersection and potential Park Street extension intersection location. Access spacing is allowed as follows:

- Access density: 5 accesses/side/mile
- Signal spacing: ¼-mile spacing
- Median opening spacing:
    - ½ mile spacing for full access
    - ¼ mile spacing for directional access
- Minimum Unsignalized intersection spacing: 1,000 feet.

Maple Street/Park Street Corridor Access Management Plan

It is desired that the Maple Street/Park Street corridor access be modified to meet Sioux Falls and Brandon access criteria for a priority 2 arterial streets. A variety of techniques to modify existing access points and manage access through future development are pertinent to this corridor, such as:

- Removal of access
- Combining access
- Relocating access
- Restricting movements to/from access
- Adding turn lanes
- Spacing of future roadways consistent with access criteria

The access management plan for existing segments of this corridor is tied to three key activities related to traffic demand and land development along the corridor:

1. Reconstruction of the Maple Street/Park Street corridor to a paved roadway (short-term).
    - Opportunities for access consolidation and relocation of driveways will be further investigated during design of an initial Maple Street/Park Street reconstruction project.
2. Redevelopment of adjacent parcels, including the construction of potential collector roads (ongoing).

    - Existing access locations that do not meet priority 2 access criteria will be removed when the parcel is redeveloped.
    - Redevelopment plan will propose and analyze proposed new access locations to Maple Street/Park Street and/or future intersecting collector roads.
3. Expansion of Maple Street/Park Street segments to add capacity when dictated by development and traffic demand (long-term).
    - Access management techniques will be reviewed during any future capacity expansion along the corridor.
    - Expansion to a 5-lane section may include a median and restriction movement access points.

The final determination of access modifications will be made by the jurisdiction with approval authority for the respective Maple Street/Park Street corridor segment and/or crossroad.

The access management plan for new segments of Park Street within the City of Brandon is as follows:

- New access spacing shall meet requirements established for priority 2 access criteria.
- A new intersection with SD11/Splitrock Boulevard requires SDDOT approval. It will be subject to the SDDOT access permit requirements and latest access criteria along SD11/Splitrock Boulevard as defined by State of South Dakota Administrative Rule Article 70:09.
- If the Sioux Boulevard intersection with SD11/Splitrock Boulevard is closed due to a new Park Street intersection with SD11/Splitrock Boulevard, it will be important to coordinate the closure and transportation connectivity with affected property owners and Brandon Valley School District. It is recommended that:
    - An internal roadway be extended between Sioux Boulevard, south of the southern Robert Bennis Elementary driveway, and a new intersection on the Park Street extension. This will provide 2-way internal circulation to the schools and other development in the area.
    - Extension of Sioux Boulevard further south to a potential new access to SD11/Splitrock Boulevard.

11. Conceptual Plan and Profile Layout

A conceptual plan and profile was developed based on the 2030 Initial Build Conditions recommendations to determine feasibility of the concept and present a layout with potential property impacts to the public. A topographic survey was not conducted as part of this study and thus 4-foot contours provided by Minnehaha County were used in the concept development.

The profile west of Brandon was based on a design speed of 50 mph, which would likely result in a posted speed of 45 mph. The goal of this profile was to meet design speed guidelines while providing a balance of filling low areas and cutting hill crests.

A conceptual plan and profile reflective of recommendations contained within this report are provided in **Appendix F**. This appendix also provides a graphical representation of potential scenarios for a Park Street extension to SD11/Splitrock Boulevard.

The plan-view illustrates potential grading impacts based on a 100-foot ROW, 50 mph design speed, conceptual profile, current roadside design guidelines, and the available 4-foot contours. The resulting 'grading limits' line demonstrates challenges with topography and existing access that will be further vetted in design when a topographic survey is available. These potential impacts were also conveyed to adjacent property owners to start the conversation of potential mitigation measures, such as retaining walls or steep slopes, that will be discussed in future land owner meetings. For this study, a graphical representation of potential retaining walls in either cut or fill sections was presented to the stakeholders and public.

12. Estimate of Costs

An estimated conceptual cost range was determined based on findings and recommendations in this report. It is important to understand these costs are conceptual and decisions in design, such as the inclusion of retaining walls, will have a significant impact on final costs.

Along this corridor, notable components of the conceptual costs include:

- Grading – Topography through much of this area is challenging. Significant cut and fill will be needed to achieve desired design speeds.
- Right-of-Way/Property Impacts – 100-foot ROW is planned for this corridor. Beyond this 100-feet, property impacts due to cut and fill may be significant. The use of retaining walls, which will be further identified and vetted in design, can mitigate cut and fill-related ROW impacts.
- Retaining Walls – While retaining walls can mitigate cut and fill–related impacts, they are a considerable project cost.
- Surfacing – Costs associated with the construction of the roadway and bicycle/pedestrian facilities.

The estimated cost range for implementation of recommendations presented in this corridor range between $8 million and $12 million. Grading, retaining walls, and potential property impacts contribute to the range in costs and will be further vetted in design after completion of a topographic survey.

13. Public Involvement

Two sets of stakeholder and public meetings were held in conjunction with this study to gather information and feedback on existing needs and potential improvements throughout the corridor. Each set of meetings were held in conjunction with study milestones:

- Stakeholder and Public Meetings #1 – Gather feedback on study corridor issues and needs.
- Stakeholder and Public Meetings #2 – Present proposed modifications for feedback and refinement prior to finalizing study reports.

Study stakeholders were invited to participate in small-group discussions with the SAT in conjunction with each public meeting. This provided an opportunity for more informal, one-on-one discussions with those that have a strong interest in transportation improvements along the corridor. Stakeholders included adjacent property owners, emergency responders, and government representatives.

The first set of stakeholder and public meetings were held November 27, 2018, at the Brandon Valley High School and Brandon Valley Intermediate School, respectively. These meetings focused on gathering feedback on corridor issues and needs. Several comments were received regarding challenges or concerns the users face along the corridor throughout the year. These needs have been reflected within this report. Comments were also received regarding a desire to maintain the roadway as it currently exists, a township gravel road.

The second set of stakeholder and public meetings were held on April 30, 2019, at the Brandon City Library and Brandon Intermediate School, respectively. These meetings focused on presenting proposed improvements to address the corridor issues and needs from the first set of meetings. The stakeholder meetings were focused on adjacent property owners and provided them an opportunity to discuss potential impacts, such as grading, to their property. The evening public meeting presented an overview of the study to date, summarized key overarching needs for improvement, analysis findings, and potential improvements. Conceptual design elements included typical cross-sections, potential for retaining walls, roadway plan and profile views, and grading impacts.

Comments received at the stakeholder and public meetings often centered on speeds (design speed and posted speed), a desire to see turn lanes at minor road access locations not warranted by traffic volumes, path connectivity, and general statements of support or opposition of the project.

A study website was maintained by the SDDOT for the duration of this study.

14. Recommendations

The following summarizes minimum build recommendations for the Maple Street/Park Street corridor for years 2030 and 2045.

2045 Build Conditions

Maple Street/Park Street Corridor Cross-Section

- Veterans Parkway to Six Mile Road: minimum of two through lanes in each direction
    - 5-lane section (includes center left-turn lane)
- Six Mile Road to SD11/Splitrock Boulevard: minimum of one through lane in each direction
    - 3-lane section (includes center left-turn lane or 2-lane section with left-turn lane)

Primary Intersection Configurations and Traffic Control

- Veterans Parkway
    - Full build-out needed to meet LOS goals
    - Signalize
- Six Mile Road
    - Left-turn lanes in all directions
    - SB and EB right-turn lanes
    - Signalize
- Locust Street
    - EB left-turn and WB left-turn lanes
    - Stop-control from Locust Street approach
- Sioux Boulevard – intersection configuration scenarios below are dependent on SDDOT approval for Park Street access to SD11/Splitrock Boulevard and conditions of the permit (see Access Management recommendations for further information on SDDOT SD11/Splitrock Boulevard access requirements)
    - *If Park Street is extended east and access to SD11/Splitrock Boulevard is permitted by the SDDOT, with or without a condition of approval requiring closure of the existing Sioux Boulevard:*
        - Left-turn lanes in all directions
        - Signalize
    - *If Park Street is not extended to SD11/Splitrock Boulevard and the existing Sioux Boulevard connection with SD11/Splitrock Boulevard is maintained (maintain existing SD11/Splitrock Boulevard access location):*
        - Left-turn lanes in all directions
        - Add right-turn lane for high volume movement(s)
        - Signalize
- SD11/Splitrock Boulevard
    - Split left and right-turn traffic on Park Street or Sioux Boulevard
    - NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
    - Signalize

Minor Street/Driveway Intersections
All other intersections are recommended to be stop-controlled from the minor-street approach with turn lanes as identified in **Table 16**.

Additional Considerations
It is recommended that turn lanes be considered through a benefit/cost analysis during design at locations along the Maple Street/Park Street corridor where warrants were not met or traffic operations did not require installation to meet study LOS goals. The inclusion of turn lanes at these locations provides operational and safety benefits to traffic traversing the corridor by removing turning traffic from the through lanes.

Consideration should be given to a future 5-lane cross-section needs throughout the corridor beyond year 2045. As a primary east/west corridor in the northeast part of the Sioux Falls metropolitan area, it is anticipated that future traffic volumes will continue to rise. A long range plan of potentially extending Park Street across the Big Sioux River would provide direct access to the Maple Street/Park Street corridor for another part of Brandon. To the west, a possible extension of Maple Street over to Rice Street provides another east/west connection that would be of interest to many motorists.

2030 Interim Build

Maple Street/Park Street Corridor Cross-Section

- Veterans Parkway to Six Mile Road: minimum of one through lane in each direction
    - 3-lane section or 2-lane section with left-turn lane
    - Layout should consider future expansion to 5-lane section
- Six Mile Road to SD11/Splitrock Boulevard: minimum of one through lane in each direction
    - 3-lane section or 2-lane section with left-turn lane

Primary Intersection Configurations and Traffic Control

- Veterans Parkway
    - Existing configuration for Veterans Parkway approaches
    - Left-turn lanes on Maple Street approaches
    - Signalize
- Six Mile Road
    - Left-turn lanes in all directions
    - Signalize or all-way stop-control
- Locust Street
    - EB left-turn and WB right-turn lanes
    - Stop-control from Locust Street approach
- Sioux Boulevard
    - Left-turn lanes in all directions
    - Signalize
- SD11/Splitrock Boulevard

- Split left and right-turn traffic on Park Street or Sioux Boulevard
- NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
- Signalize

Minor Street/Driveway Intersections
Similar to the year 2045 minimum build recommendations, all other intersections are recommended to be stop-controlled from the minor-street approach with turn lanes as identified in **Table 16**.

Additional Considerations
It is recommended that turn lanes be considered at all locations where warrants were not met due to the operational and safety benefits they provide to traffic along the Maple Street/Park Street corridor.

It is also recommended that the development of 2030 improvements consider needs identified in the 2045 Build Conditions, such as future cross-sectional needs, turn lanes, and intersection traffic control. In many instances, inclusion of these turn lane and traffic control improvements in year 2030 will provide operational and safety benefits to traffic traversing the corridor.

Access Management

As the existing access density and spacing west of the Brandon city limits reflects a typical township road outside, a variety of access management measures will need to be undertaken as land is developed surrounding the corridor and traffic volumes increase.

The access management plan for existing segments of this corridor is tied to three key activities related to traffic demand and land development along the corridor:

1. Reconstruction of the Maple Street/Park Street corridor to a paved roadway (short-term).
    - Opportunities for access consolidation and relocation of driveways will be further investigated during design of an initial Maple Street/Park Street reconstruction project.
2. Redevelopment of adjacent parcels, including the construction of potential collector roads (ongoing).
    - Existing access locations that do not meet priority 2 access criteria will be removed when the parcel is redeveloped.
    - Redevelopment plan will propose and analyze proposed new access locations to Maple Street/Park Street and/or future intersecting collector roads.
3. Expansion of Maple Street/Park Street segments to add capacity when dictated by development and traffic demand (long-term).
    - Access management techniques will be reviewed during any future capacity expansion along the corridor.
    - Expansion to a 5-lane section may include a median and restriction movement access points.

The final determination of access modifications will be made by the jurisdiction with approval authority for the respective Maple Street/Park Street corridor segment and/or crossroad.

The access management plan for new segments of Park Street within the City of Brandon is as follows:

- New access spacing along Park Street shall meet requirements established for priority 2 access criteria.
- A new Park Street intersection with SD11/Splitrock Boulevard requires SDDOT approval. It will be subject to the SDDOT access permit requirements and latest access criteria along SD11/Splitrock Boulevard as defined by State of South Dakota Administrative Rule Article 70:09.
- If SDDOT access permit conditions for a new Park Street intersection with SD11/Splitrock Boulevard require closure of the Sioux Boulevard and SD11/Splitrock Boulevard intersection it will be important to coordinate the closure and transportation connectivity with affected property owners and Brandon Valley School District. It is recommended that:
    - An internal roadway be extended between Sioux Boulevard, south of the southern Robert Bennis Elementary driveway, and a new intersection on the Park Street extension. This will provide 2-way internal circulation to the schools and other development in the area.
    - Extension of Sioux Boulevard further south to a potential new access to SD11/Splitrock Boulevard.

Bicycle/Pedestrian Facilities

A bicycle/pedestrian shared-use path is recommended along the corridor to provide the desired connectivity between the shared-use path along Veterans Parkway, the existing Brandon trail network, and residential development along the corridor. It is anticipated that cross-sectional elements, crossing locations, and crossing features will be finalized in design.

Recommendations for Park Street crossings are as follows:

- Maintain traffic signal and pedestrian crossing opportunities at Sioux Boulevard
- Traffic signal and pedestrian hybrid beacon are currently not warranted at/near Locust Street, but monitor warrants as traffic volumes grow.
- Install a pedestrian-actuated rectangular rapid flashing beacon (RRFB) at/near the Locust Street intersection.
- Educate parents, students, and school faculty on safe crossing practices at this location:
    - Instruct students to activate the RRFB for all crossings.
    - Educate parents on the importance of using the RRFB system to cross the street.
    - Instruct staff acting as crossing guards or monitoring the crossings to wear a uniform and use equipment that is highly visible and easily identifiable by the public, follow proper crossing procedures, and teach students how to safety use the crosswalks.

15. Appendix

A. Maple Street/Park Street Corridor Access Technical Memorandum
B. Crash Analysis of Existing Conditions Technical Memorandum
C. Traffic Forecasts Technical Memorandum
D. Existing and Future No-Build Conditions Traffic Operations Technical Memorandum
E. 2030 and 2045 Build Conditions Traffic Operations Technical Memorandum
F. Maple Street/Park Street Corridor Conceptual Plan and Profile

Appendix A. Maple Street/Park Street Corridor Access Technical Memorandum

Technical Memo

Date:	Friday, April 12, 2019
Project:	Maple Street/Park Street Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Maple Street/Park Street Corridor Access

Access management is an important component to preserving functionality of a roadway network. It incorporates several techniques to balance vehicular access to development with roadway safety, efficiency, and operations.

The purpose of this memorandum is to develop an access plan for the Maple Street/Park Street corridor through the following steps:

1. Identify existing access locations along the Maple Street/Park Street corridor,
2. Present City of Sioux Falls, City of Brandon, Minnehaha County, and South Dakota Department of Transportation (SDDOT) access criteria for the Maple Street/Park Street corridor and primary crossroads,
3. Compare existing access to the respective access criteria, and
4. Develop a long-term access plan with recommendations for short and long-term implementation.

Existing Access and Potential Future Collector Roadways

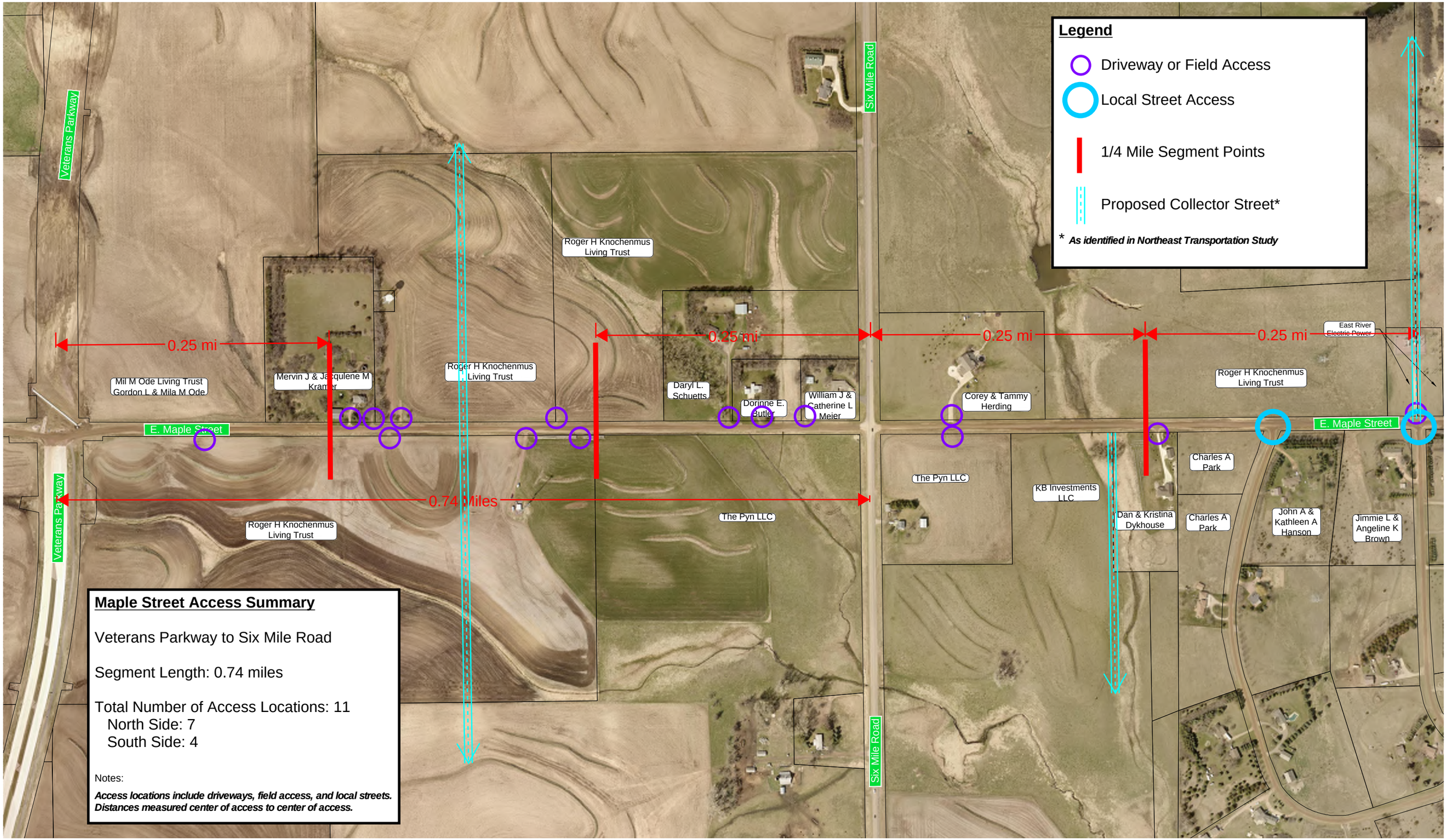
The Maple Street/Park Street access summary, shown in **Figure 1**, depict the following existing access locations:

- Existing driveway or field access
- Existing local street access

Proposed collector roadways, as identified in the Northeast Transportation Network Study[1], are also identified.

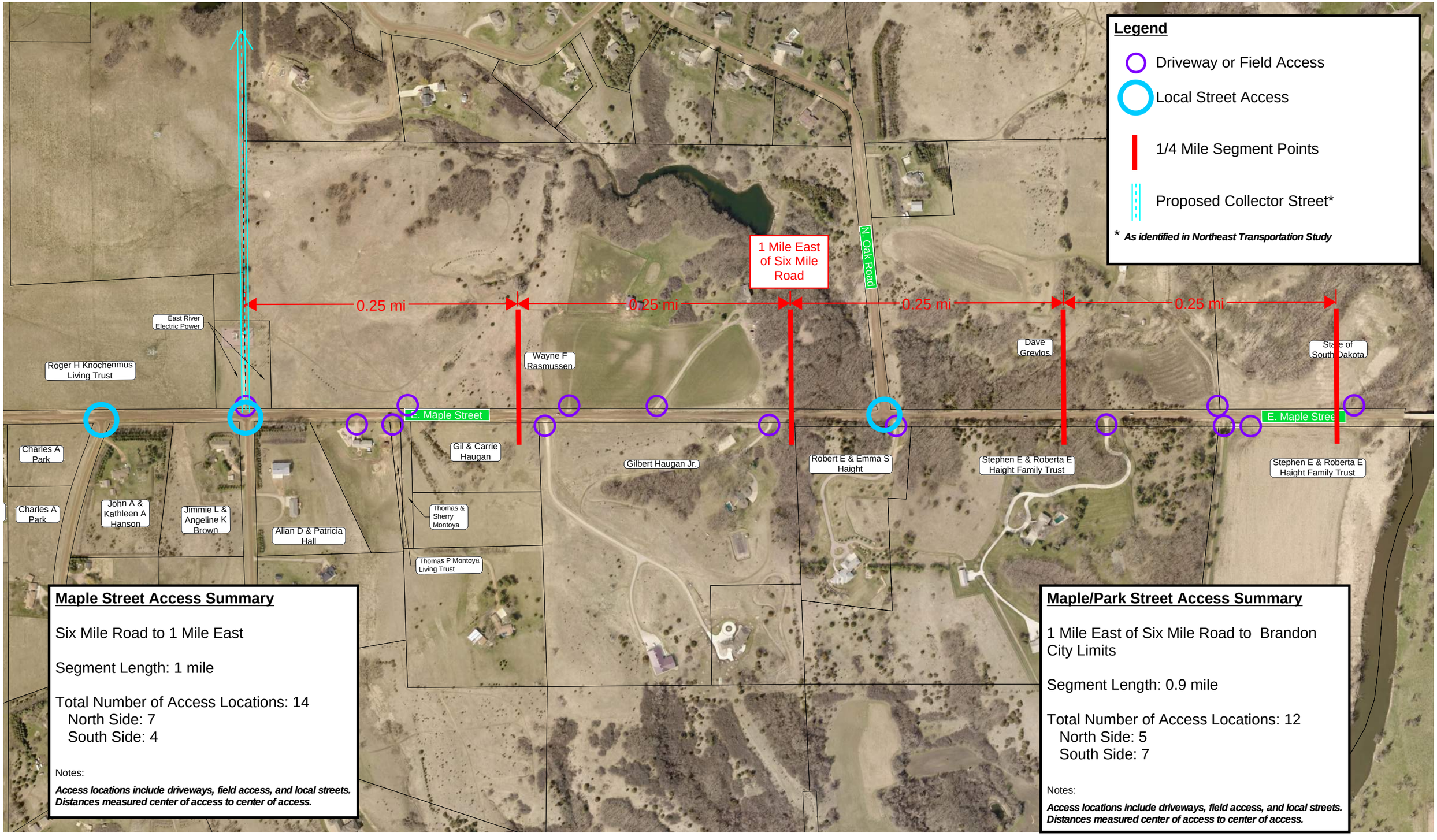
¼-mile marks are noted on the figures and represent potential full movement access locations given the current City of Sioux Falls access priority.

[1] http://www.siouxfalls.org/public-works/special-projects/ne-transportation-network



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

Figure 1, April 2019



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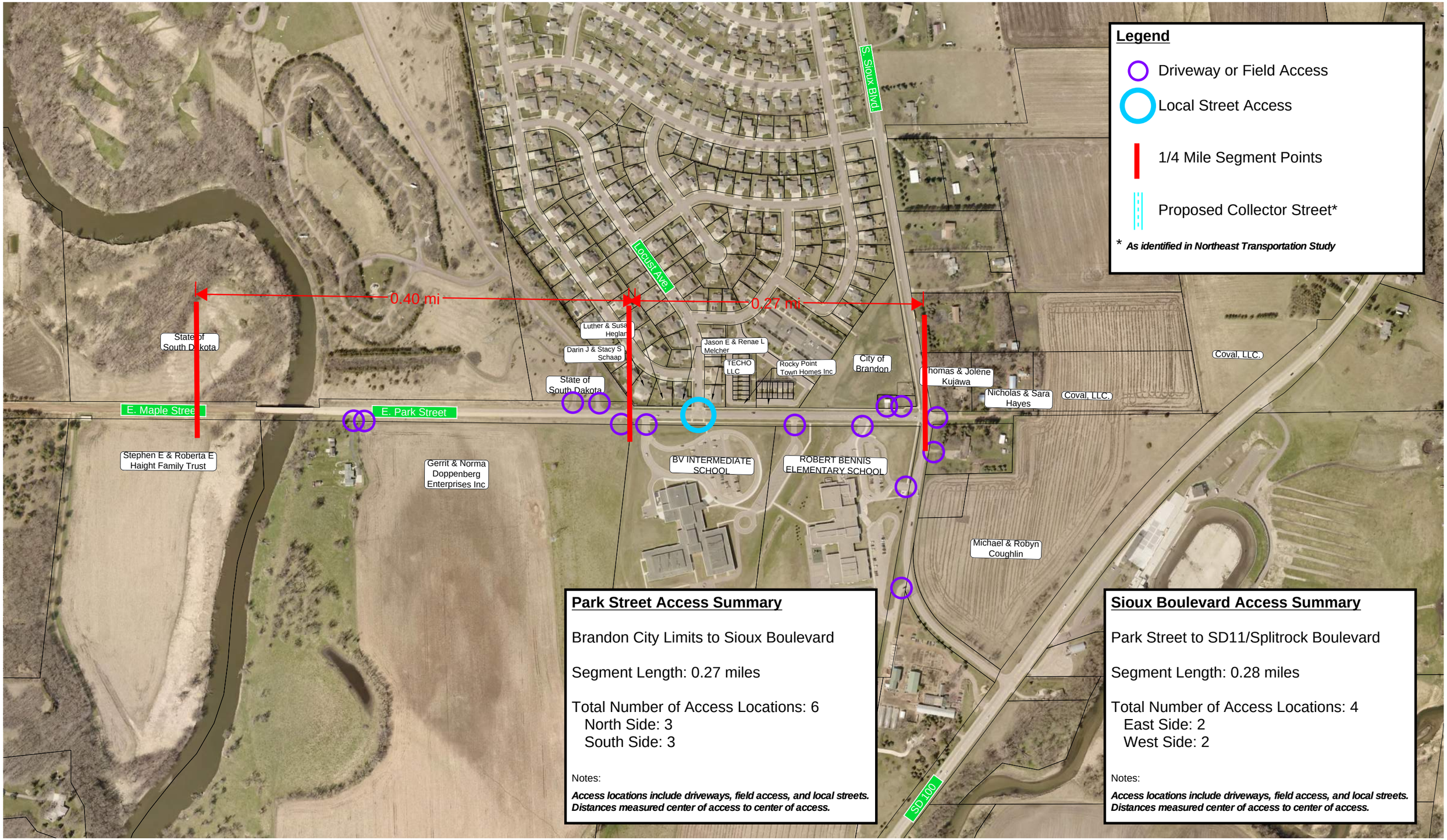
MAPLE STREET / PARK STREET CORRIDOR STUDY FROM VETERANS PARKWAY TO SD11

Figure 1, April 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

Figure 1, April 2019

Maple Street/Park Street Corridor Access Criteria

The City of Sioux Falls and City of Brandon have adopted similar access management criteria, outlined in their respective Engineering Design Standards guidelines. Four access categories have been developed for arterial streets, summarized from the Engineering Design Standards documents as follows:

- Regional – Routes which provide regional continuity.
- Arterial I – Routes which provide regional continuity and are spaced approximately 3 miles from the next parallel Arterial I roadway. These routes primarily serve high commercial and commuter needs.
- Arterial II – Routes that typically have continuity across the city. These routes serve a mixture of commercial and residential needs.
- Arterial III – Routes that typically do not continue across the city. These routes serve mainly residential and neighborhood commercial uses.

The access spacing criteria for each of the four arterial access categories are summarized in **Table 1**.

Table 1: Access Spacing on Arterial Roadways

Classification	Signal Spacing	Median Opening	Unsignalized Intersection Spacing
Regional Arterial/Expressway	1/2 mile	1/2 mile	2640
Arterial I	1/4 mile	1/4 mile	1320
Arterial II	1/4 mile	1/4 mile	varies
Arterial III	1/4 mile	660	varies

Source: Sioux Falls Engineering Design Standards, Table 8.0, and Brandon Engineering Design Standards, Table 8.0

The following presents access criteria and priorities for the Maple Street/Park Street study corridor and primary crossroads.

Crossroad – Veterans Parkway

Veterans Parkway (was also known as SD100 and the Eastside Corridor) has a corridor-specific access plan, as described in the SD100 Access and Noise Plan (developed in February 2007).

Veterans Parkway access points through the Maple Street area are presented in Exhibit 3 of the SD100 Access and Noise Plan (see **Figure 2**).

The access plan also identified access criteria for side-street access points closest to Veterans Parkway, shown in **Table 2**. This criteria is based on maintaining proper traffic signal spacing and preventing interference with traffic operations of Veterans Parkway intersections. Maple Street falls under the arterial street type.

Table 2: Veterans Parkway (SD100) Side Street Access Spacing

STREET TYPE	SPACING CRITERIA
MAJOR COLLECTOR (18TH, 33RD, UNNAMED BETWEEN MAPLE, MADISON)	TRAFFIC SIGNAL - 1/4 MILE INTERSECTION - 450 FEET
ARTERIAL	FULL INTERSECTION - 1/4 MILE PARTIAL INTERSECTION* - 660 FEET

* partial intersection may include right in/right-out and left-in movements

Source: Table 2 in the SD100 Access and Noise Plan

Refer to the SD100 Access and Noise Plan for additional details on Veterans Parkway access, Maple Street access within the Veterans Parkway corridor no access zone, and variance requests.

Maple Street/Park Street: Veterans Parkway to Six Mile Road

Joint Jurisdiction: Minnehaha County and City of Sioux Falls

The City of Sioux Falls currently identifies Maple Street identified as a **priority 2 arterial street** with full build as a multi-lane roadway with median. Future access spacing is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: ¼-mile locations
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Crossroad – Six Mile Road
Joint Jurisdiction: Minnehaha County and City of Sioux Falls

The City of Sioux Falls currently identifies Six Mile Road as a **priority 3 arterial street**. Future access spacing is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: 660-ft. spacing
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Maple Street/Park Street: Six Mile Road to SD11/Splitrock Boulevard
Joint Jurisdiction: Minnehaha County and City of Brandon (west of Brandon city limits)
Jurisdiction: City of Brandon (within Brandon city limits)

The City of Brandon currently identifies Maple Street/Park Street as a **priority 2 arterial street**, extending the current City of Sioux Falls access classification east from Six Mile Road. Future access spacing along this segment is allowed as follows:

- Full movement access: ¼-mile locations
- Signal spacing: ¼-mile spacing
- Median opening: ¼-mile locations
- Unsignalized intersection spacing: varies. Access may be allowed at 660-ft. intervals based on a traffic study.

Crossroad – SD11/Splitrock Boulevard
Jurisdiction: SDDOT

The SDDOT currently classifies SD11/Splitrock Boulevard as **urban fringe** access through the Sioux Boulevard intersection and potential Park Street extension intersection location. Access spacing is allowed as follows:

- Access density: 5 accesses/side/mile
- Signal spacing: ¼-mile spacing
- Median opening spacing:
    - ½ mile spacing for full access
    - ¼ mile spacing for directional access
- Minimum Unsignalized intersection spacing: 1,000 feet.

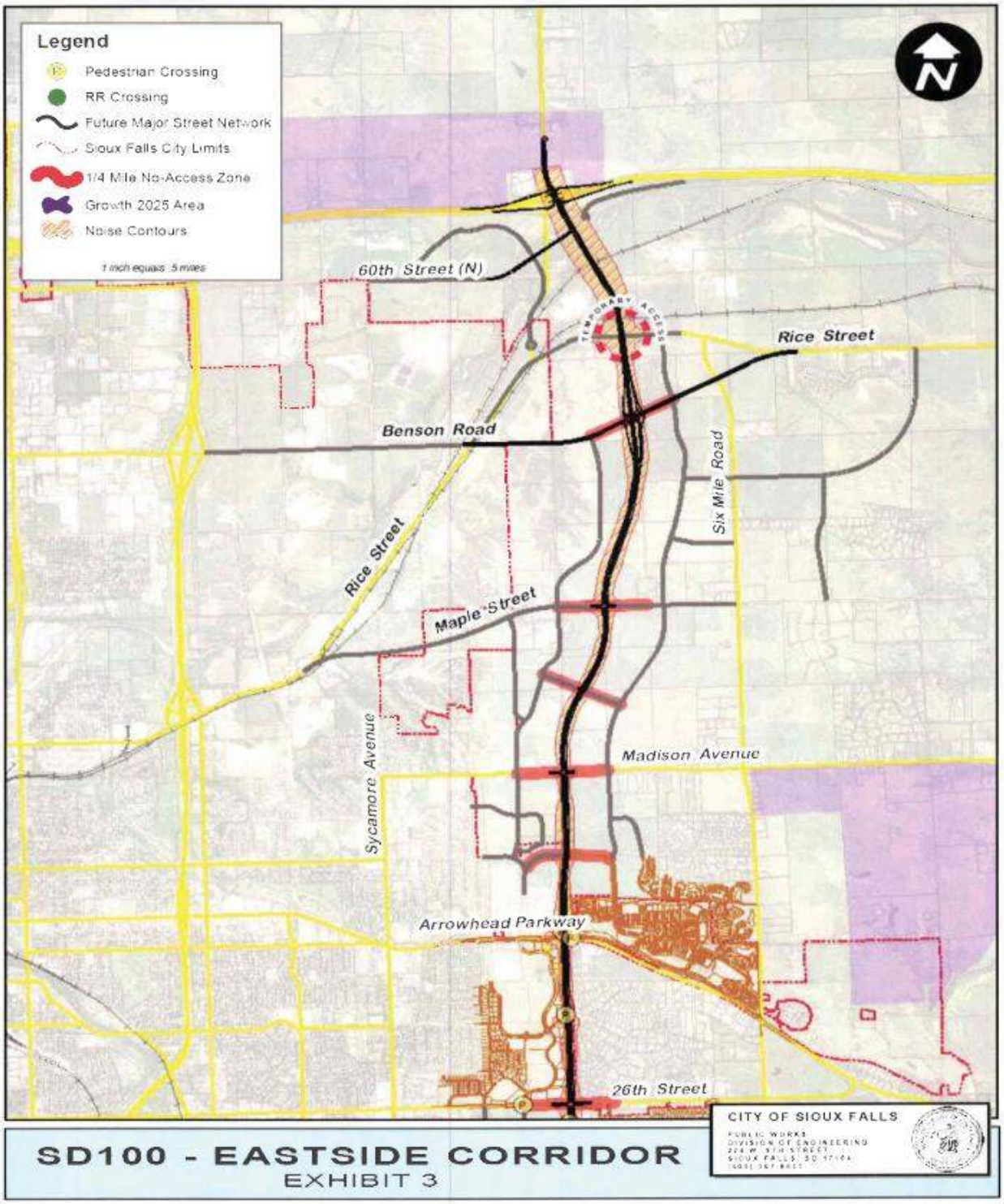


Figure 2: Maple Street/Park Street Minimum Build Conditions

Source: Table 2 in the SD100 Access and Noise Plan

Findings

The following are preliminary findings and considerations to be carried through this study.

Maple Street: Veterans Parkway to Six Mile Road

- Proposed collector as identified in the previous planning studies splits the ¼-mile marks along this segment.
- There are two clusters of access points within this middle ¼-mile segment.

Maple Street: Six Mile Road to 1 Mile East

- Access points for first ½ mile east of Six Mile Road are minimal, and predominantly existing local street and proposed collector intersections.
- For the second ½ mile east of Six Mile Road, driveway density increases.
- Terrain begins to become more of a consideration through this eastern ½ mile segment.

Maple Street/Park Street Access: 1 Mile East of Six Mile Road to Brandon City Limits

- Driveway density slightly decreases, compared to segments to the west.
- Topography challenges will be an important consideration in access location modifications.
- Many of these parcels are dependent on access to Maple Street for their egress.

Park Street and Sioux Boulevard: Brandon City Limits to SD11

- Most access locations have been established through school development. Internal traffic circulation is a key element to these access locations.
- Greatest access density of any of the study segments.
- Driveways for school drop-off/pick-up serve some of the greatest vehicular demand (and turning traffic) along the corridor.

Overall, current access spacing reflects typical rural conditions and does not meet Sioux Falls or Brandon access criteria for priority 2 arterial streets.

As traffic volumes continue to increase along the corridor, the density and location of these access points will heighten safety and operational challenges throughout the corridor. Each access point introduces points of conflict for turning and slowing vehicles, including right-angle conflict that has a propensity for high severity crashes. As volumes increase, exposure to these conflicts also increases. Accommodating fewer access points, spaced further apart, presents fewer conflict points and clearer expectations for drivers throughout the corridor.

Increased traffic volumes and high access density also creates operational challenges. The more access points along a corridor, the more difficult it is to maintain a free-flow speed due to turning vehicles both onto and off of the high volume corridor. This creates a turbulent traffic flow with frequent slowing, stopping, and accelerating that contributes to greater congestion, safety concerns, fuel consumption, and vehicle wear.

Maple Street/Park Street Corridor Access Management Plan

It is desired that the Maple Street/Park Street corridor access be modified to meet Sioux Falls and Brandon access criteria for a priority 2 arterial streets. A variety of techniques to modify existing access points and manage access through future development are pertinent to this corridor, such as:

- Removal of access
- Combining access
- Relocating access
- Restricting movements to/from access
- Adding turn lanes
- Spacing of future roadways consistent with access criteria

The access management plan for this corridor is tied to three key activities related to traffic demand and land development along the corridor:

1. Reconstruction of the Maple Street/Park Street corridor to a paved roadway (short-term).
    - Opportunities for access consolidation and relocation of driveways will be further investigated during design of an initial Maple Street/Park Street reconstruction project.
2. Redevelopment of adjacent parcels, including the construction of potential collector roads (ongoing).
    - Existing access locations that do not meet priority 2 access criteria will be removed when the parcel is redeveloped.
    - Redevelopment plan will propose and analyze proposed new access locations to Maple Street/Park Street and/or future intersecting collector roads.
3. Expansion of Maple Street/Park Street segments to add capacity when dictated by development and traffic demand (long-term).
    - Access management techniques will be reviewed during any future capacity expansion along the corridor.
    - Expansion to a 5-lane section may include a median and restriction movement access points.

The final determination of access modifications will be made by the jurisdiction with approval authority for the respective Maple Street/Park Street corridor segment and/or crossroad.

Appendix B. Crash Analysis of Existing Conditions Technical Memorandum

Technical Memo

Date:	Monday, March 4, 2019
Project:	Maple Street/Park Street Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Crash Analysis of Existing Conditions

Introduction

This memorandum documents the crash history analysis for Maple/Park Street study corridor between and including Veterans Parkway and SD Hwy 11/Splitrock Boulevard. The crash history analysis was conducted to help identify areas that may warrant consideration of safety-related improvements in future design.

Methodology

Crash data for years 2013 through 2017 was provided by the South Dakota Department of Transportation (SDDOT) through a GIS geodatabase. Crashes were reviewed to identify any historical crash trends or high frequency areas to help develop potential crash mitigation measures that will be carried into design. Analysis of the following roadway facilities was conducted:

- Intersections
- Corridor segments

Crashes surrounding intersections were vetted to determine whether the crash was due to an event or causal factor along the Maple/Park Street corridor. For crashes that were found to be related to the study corridor, crashes were identified and sorted based on whether they were intersection or segment-related.

Intersection and segment crash rates were calculated with available traffic count data provided by the City of Sioux Falls, SDDOT, City of Brandon, Minnehaha County or as collected as part of this study.

Maple/Park Street Corridor Summary

The Maple/Park Street study corridor extends for approximately 3.25 miles between, and including, the intersections with Veterans Parkway to the west and SD Hwy 11/Splitrock Boulevard to the east (via Sioux Boulevard).

Maple/Park Street is a gravel township roadway between Veterans Parkway and the Sioux River Bridge. The roadway is paved from the bridge to SD Hwy 11/Splitrock Boulevard, with a

curb and gutter section between the Brandon Valley Intermediate School driveway and Sioux Boulevard.

Because the current built-out intersection with Veterans Parkway was not completed until 2018, which is outside of the crash review window, the safety analysis extends west to the next section line road at Powder House Road. This adds 0.25 miles to the west of Veterans Parkway.

Overall, there were 18 crashes reported along the study corridor, from Powder House Road to SD Hwy 11/Splitrock Boulevard, between 2013 and 2017. These crashes are shown spatially in Figure 1.

LEGEND

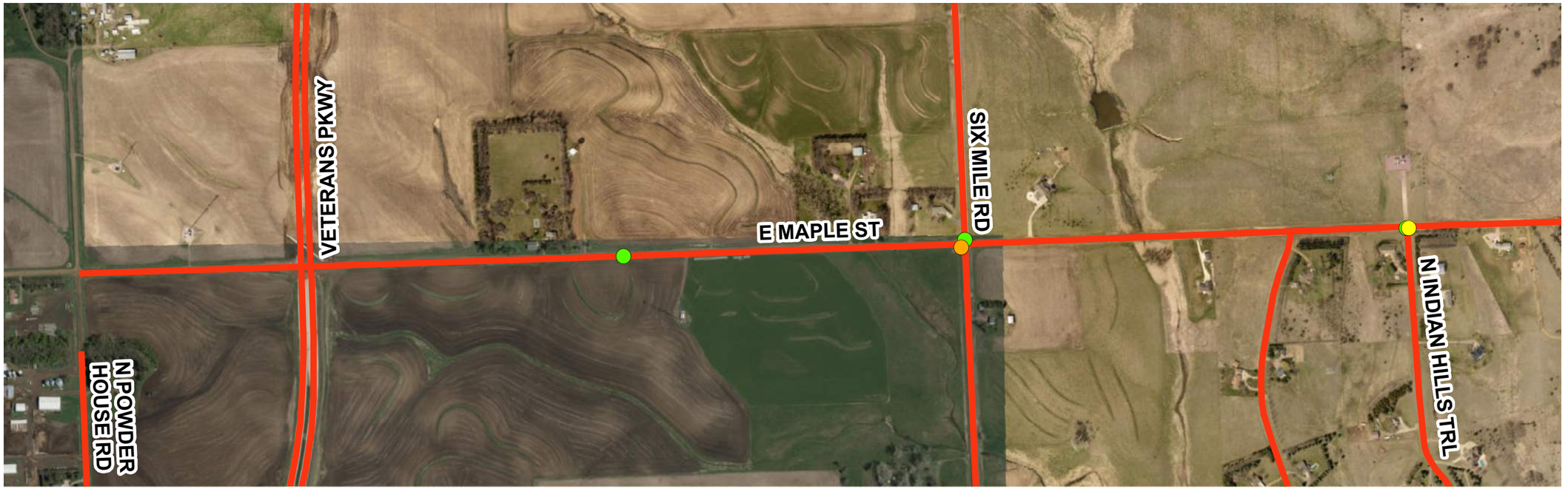
- Roadways

Injury Severity

- Incapacitating
- Non-incapacitating
- Possible
- No injury
- Wild animal hit

DATA SOURCE: SDDOT

0 Feet 750



MAPLE STREET / PARK STREET CRASH HISTORY

2013 - 2017

FIGURE 1

Maple/Park Street Intersections

Intersection crash rates and weighted crash rates are calculated in terms of crashes per million entering vehicles (crashes/MEV). Weighted crash rates were calculated using average daily traffic from the most recently collected daily traffic counts and by weighting each crash in accordance with its severity: fatal crash (12), injury crash (3), and property damage crash (1). This process differs from the calculation of an average crash rate in that the weighted crash rate accounts for injury and fatal crashes through the weighting process. An average crash rate calculation reflects total crash frequency, regardless of injury severity.

Intersection-related crashes occurring within the Maple/Park Street study area are shown in Table 1.

Table 1: Maple/Park Street Intersection Crash Rates

Intersection	Total # Crashes	Daily Entering Volume (vpd)	Crash Rate (crashes/MEV)	Weighted Crash Rate (crashes/MEV)
Veterans Parkway	0[a]	-	0	0
Six Mile Road	2	5,850	0.19	0.37
Indian Hills Trail (East) [b]	1	640	0.85	2.55
Locust Avenue [b]	2	2,275	0.48	0.96
SD Hwy 11/Splitrock Blvd	5	4,435	0.62	0.86

[a] Built-out intersection with Maple Street opened in 2018.

[b] Local street intersection, shown for informational purposes in this table. Crash(es) also included in the segment total.

The following provides a summary of the crashes at the four Maple/Park Street intersections exhibiting a crash history:

Six Mile Road intersection

- 1 incapacitating injury crash
  - Rear-end crash of northbound vehicles
  - Involved a motorcycle
- 1 no injury crash
  - Roadway departure
  - Snow road conditions

Indian Hills Trail (East) intersection

- 1 non-incapacitating injury crash
  - Roadway departure in eastbound direction
  - Icy road conditions

Locust Avenue intersection

- 1 incapacitating injury crash involving a pedalcycle
  - Glare noted as a contributing circumstance

- 1 no injury crash
    - Rear-end crash of westbound vehicles
    - Distracted driving noted as a contributing circumstance

Sioux Boulevard and SD Hwy 11/Splitrock Boulevard intersection

- 1 possible injury crash
- 3 angle crashes
    - Mix of eastbound, northbound, and southbound vehicles
- 2 rear-end crashes
    - Both involving eastbound vehicles
- Though not incorporated into the intersection crash analysis (not intersection-related crashes), there were 3 vehicle-animal crashes reported within 150 feet of the intersection

Maple/Park Street Corridor Segments

The Maple/Park Street corridor was divided into four segments based on arterial crossroad intersections, roadway cross-section, and traffic conditions due to volumes, schools, and residential development. The following segments were analyzed:

- Powder House Road to Six Mile Road
- Six Mile Road to Brandon City Limits (boundary located between Brandon Valley Intermediate School driveway and Big Sioux Recreation Area driveway)
- Brandon City Limits to Sioux Boulevard
- Sioux Boulevard to SD Hwy 11/Splitrock Boulevard

Corridor crash rates and weighted crash rates were calculated in terms of crashes per million vehicle miles traveled (crashes/MVMT). The weighting process is similar to that used in the calculation of intersection crash rates: fatal crash (12), injury crash (3), and property damage crash (1). Table 2 presents a crash summary for the four corridor segments.

Table 2: Maple/Park Street Corridor Segment Crash Rates

Segment	Total # Crashes	Segment Volume (vpd)	Segment Length (mi.)	Crash Rate (crashes/ MVMT)	Weighted Crash Rate (crashes/ MVMT)
Powder House Road to Six Mile Road	1	190	0.97	3.0	3.0
Six Mile Road to Brandon City Limit	8	615/480	1.0/0.8	4.2	6.3
Brandon City Limit to Sioux Boulevard	2	1,945	0.25	2.3	4.5
Park Street to SD Hwy 11/Splitrock Blvd	0	1,945	0.23	0	0

The following provides additional detail to crash types and contributing circumstances for Maple/Park Street corridor segment-related crashes.

Powder House Road to Six Mile Road (1 crash)

- 1 roadway departure crash
- Resulted in overturn/rollover event

Six Mile Road to Brandon City Limit (8 crashes)

- 6 roadway departure crashes
    - 2 resulted in non-incapacitating injuries
        - Driver was not wearing seatbelt in both crashes
    - 4 occurred on snowy or icy road conditions
    - 3 noted speed as a contributing factor
- 1 rear-end crash
- 1 vehicle-animal crash

Brandon City Limit to Sioux Boulevard (2 crashes)

- Local street intersection-related crashes at Locust Avenue

SD Hwy 11 Segment at Potential Park Street Intersection

Approximately 1,000 feet of SD Hwy 11/Splitrock Boulevard was also reviewed where a potential intersection with Park Street may be proposed in the future (access and specific location subject to SDDOT approval). This stretch of SD Hwy 11/Splitrock Boulevard, and the reported crashes between 2013 and 2017, is shown in Figure 2. Overall, eight crashes were reported along this segment and all eight involved vehicle-animal conflicts.

Figure 2: SD Hwy 11/Splitrock Boulevard Vehicle Animal Crashes near Potential Park Street Connection

Crash Trend Summary

Overall, there were 18 crashes reported along the study corridor between 2013 and 2017.

5 of the 18 crashes involved an injury

- 2 incapacitating injury crashes
- 2 non-incapacitating injury crashes
- 1 possible injury crash

The crashes were split between single-vehicle and multi-vehicle crashes:

- Multi-vehicle crashes
    - 3 angle crashes
    - 5 rear-end crashes
- Vehicle/pedestrian/bicycle crash
    - 1 vehicle-pedalcycle crash
- Single-vehicle crashes
    - 8 roadway departure crashes
    - 1 vehicle-animal crash

Crashes are generally dispersed across the corridor, with the following concentrations:

- 8 crashes on the township segment between Six Mile Road and the Brandon City Limits
    - Predominantly roadway departure crashes striking a variety of objects
    - Speed was noted as a contributing factor in 3 crashes
- 5 crashes at the SD Hwy 11/Splitrock Boulevard and Sioux Boulevard intersection
    - 3 angle crashes involving vehicles from all approaches
    - 2 rear-end crashes involving eastbound vehicles

Snowy or icy road conditions noted in 7 of the 18 crashes.

There is a high propensity for vehicle-animal crashes along the SD Hwy 11/Splitrock Boulevard corridor.

Potential Mitigation Measures

The overarching need for improvement along this corridor is growing traffic volumes and providing a roadway that is commensurate with how it is desired to function. Maple Street is currently a township roadway west of the Brandon City limits, in both design characteristics and jurisdiction. There were seven roadway departure crashes along Maple street west of the Brandon City limits. Potential crash mitigation measures to this segment include improving the roadway to current design standards and desired functionality, such as typical section, vertical curvature, roadway surfacing, and roadside design. These improvements may also benefit the winter weather-related crashes.

Five crashes were noted at the Sioux Boulevard and SD11/Splitrock Boulevard intersection. While difficult to discern any notable trends based on the crash population, access management improvements within the intersection may be desirable as traffic volumes continue to increase. There are currently 8 access points (both sides of SD Hwy 11/Splitrock Boulevard) within 350 feet on either side of the Sioux Boulevard intersection.

One vehicle/pedestrian/bicycle crash was noted at the Park Street and Locust Street intersection. Considerations to pedestrian/bicycle crossings of Park Street and Sioux Boulevard will be an integral part of planning along this corridor with the high demand of crossings to/from the Brandon Valley Intermediate School and Robert Bennis Elementary School south of Park Street.

While only two crashes were noted, consider intersection geometrics and traffic control needs at the Maple Street and Six Mile Road intersection with future improvements. Vehicle conflict exposure will continue to increase as traffic increases along both corridors.

Appendix A – Crash Summary Table

AccidentNl	AccidentDateTime	RoadCondDesc	MHEvnts	Motorcyle	Speed	AlcoholUs	InjurySeverity	MannerOfCollision	Junction	Distract	TravelDirection	DriverContribCircum
1707469	6/14/2017 19:03	Dry	Motor vehicle in transport	N	N	N	Possible	Angle	T- intersection	N	Northbound; Southbound	Failed to yield to vehicle; None
1400382	1/16/2014 13:10	Snow	Motor vehicle in transport	N	N	N	No injury	Angle	T- intersection	N	Eastbound; Southbound	Failed to yield to vehicle; None
1614920	11/18/2016 15:22	Snow	Motor vehicle in transport	N	Y	N	No injury	Angle	Intersection related	N	Eastbound; Southbound	Driving too fast for conditions; None
1507731	6/1/2015 17:01	Dry	Motor vehicle in transport	N	N	N	No injury	Rear-end (front to rear)	Intersection related	N	Eastbound	Followed too closely; None
1508658	8/3/2015 13:10	Dry	Motor vehicle in transport	N	N	N	No injury	Rear-end (front to rear)	Intersection related	N	Eastbound	None; Other
1309242	8/14/2013 10:48	Dry	Motor vehicle in transport	Y	N	N	Incapacitating	Rear-end (front to rear)	Intersection related	N	Northbound	Followed too closely; None
1614815	11/18/2016 11:45	Snow	Embankment	N	Y	N	No injury	No collision between 2 MV in transport	Non-junction	N	Northbound	Driving too fast for conditions; None
1404763	4/12/2014 10:47	Dry	Overturn/rollover	N	N	N	No injury	No collision between 2 MV in transport	Non-junction	N	Eastbound	None
1713692	10/23/2017 17:43	Sand, mud, dirt, gravel	Ditch	N	N	Y	No injury	No collision between 2 MV in transport	Non-junction	N	Westbound	None; Running off road
1617667	12/22/2016 12:22	Snow	Mailbox	N	N	N	No injury	No collision between 2 MV in transport	Non-junction	N	Eastbound	None; Running off road
1504999	5/14/2015 19:30	Sand, mud, dirt, gravel	Motor vehicle in transport	N	Y	N	No injury	Rear-end (front to rear)	Non-junction	N	Westbound	Exceeded posted speed limit; None; Other
1310597	9/16/2013 6:30	Dry	Fence	N	N	N	No injury	No collision between 2 MV in transport	Non-junction	N	Westbound	None; Running off road
1300300	1/5/2013 16:33	Ice	Highway traffic sign post/sign	N	N	N	Non-incapacitating	No collision between 2 MV in transport	Intersection related	N	Eastbound	None
1316000	12/22/2013	Ice	Culvert	N	Y	Y	No injury	No collision between 2 MV in transport	Non-junction	N	Eastbound	Drinking; Driving too fast for conditions
1414740	11/24/2014 11:40	Dry	Animal - wild	N	N	N	Wild animal hit		Non-junction	N	Westbound	Wild animal hit - damage only
1400736	1/25/2014 21:13	Ice	Tree/shrubbery	N	Y	N	Non-incapacitating	No collision between 2 MV in transport	Non-junction	N	Westbound	Driving too fast for conditions; Running off road
1712930	9/29/2017 7:36	Dry	Motor vehicle in transport	N	N	N	No injury	Rear-end (front to rear)	Intersection related	Y	Westbound	Distracted (list distraction in narrative); Followed too closely; None
1502532	3/13/2015 18:50	Dry	Not applicable, Pedalcycle	N	N	N	Incapacitating	No collision between 2 MV in transport	Intersection related	N	Immobile; Westbound	None; Not applicable

List revised 11/15/2018

2013 - 2017; Crash database provided by SDDOT.

Table reflects a vetted list of area crashes. Only crashes due to an event or causal factor along Maple/Park Street corridor included.

Appendix C. Traffic Forecasts Technical Memorandum

Technical Memo

Date:	Friday, February 22, 2019
Project:	Maple Street/Park Street Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Traffic Forecasts

The purpose of this memorandum is to present the 2018 Existing Conditions and 2045 No-Build Conditions volume data sets for the Maple Street/Park Street corridor between Veterans Parkway and SD11. The process used to develop these data sets is also described.

Sources of Data

The following data was obtained for the development of the 2018 Existing Conditions and 2045 No-Build Conditions volume sets.

Peak hour intersection turning movement counts:

- Collected by consultant team on Tuesday, November 13, 2018

24-hour roadway segment counts:

- Collected by City of Sioux Falls and Minnehaha County throughout 2018

Traffic forecasts were based on output from the Sioux Falls Metropolitan Planning Organization (MPO) travel demand model (TDM). The following model versions were used:

- 2013 – base year
- 2045 – planning horizon

The 2045 Planning Horizon model scenario used in the development of future-year traffic volumes reflects the constrained model with Holly Boulevard/Rice Street as a 2-lane roadway. It also includes:

- Veterans Parkway connection to I-29 (southern segment, between SD11 and I-29) was included in the model
- Maple/Park Street links in the model were assumed that the roadway is 2 lanes and paved to realize demand in the area.

Existing Volumes

2018 Existing Conditions traffic data is the basis for an assessment of current conditions and the development of both daily and intersection turning movement forecasts.

Daily (24-hour) and peak hour turning movement counts were post-processed to develop 2018 Existing Conditions volume data sets presented in this memorandum. All existing counts were factored to a design season to account for seasonal fluctuations throughout the year. Where multiple counts and/or sources overlapped, the counts were evaluated for reasonableness and the count that best reflected a typical weekday was selected.

Counts were balanced and smoothed through the study corridor. However, low-volume movements (one or two vehicles over the peak hour) are presented at the actual factored count volume to depict the low-volume nature of the specific movement.

Forecast Methodology

This study's forecast year is 2045 and reflects the planning horizon for traffic operations analysis and conceptual design. Traffic forecasts help assess future-year capacity and operational needs along the Maple Street/Park Street corridor due growth in traffic demand and/or changes in traffic patterns.

The following process was used to develop daily and peak hour intersection turning movement forecasts along the Maple Street/Park Street corridor:

1. 2045 planning horizon constrained model scenario was evaluated for reasonableness, whether it met study goals, consistency in planned future roadway network, and any gaps in future development.
2. Conceptual development plans for The Hollows were reviewed and compared to the respective TDM traffic analysis zone (TAZ) to determine whether the current model input reflected the potential trip generation for development.
    a. Trip generation was estimated for the conceptual layout and compared to the model input.
    b. The respective model TAZ was adjusted based on these findings
    c. See The Hollows Development section for additional information
3. 2045 model output was post-processed consistent with travel demand model forecast methodologies presented in NCHRP 765: Analytical Travel forecasting Approaches for Project-Level Planning and Design.
    a. Daily segment forecasts were developed based on growth factors from existing counts, 2013 base model output, and 2045 planning horizon model output.
    b. Peak hour intersection turning movement forecasts were developed through an iterative process that balances intersection turning movements
        i. Intersection volumes were balanced and smoothed across the corridor.

The Hollows Development

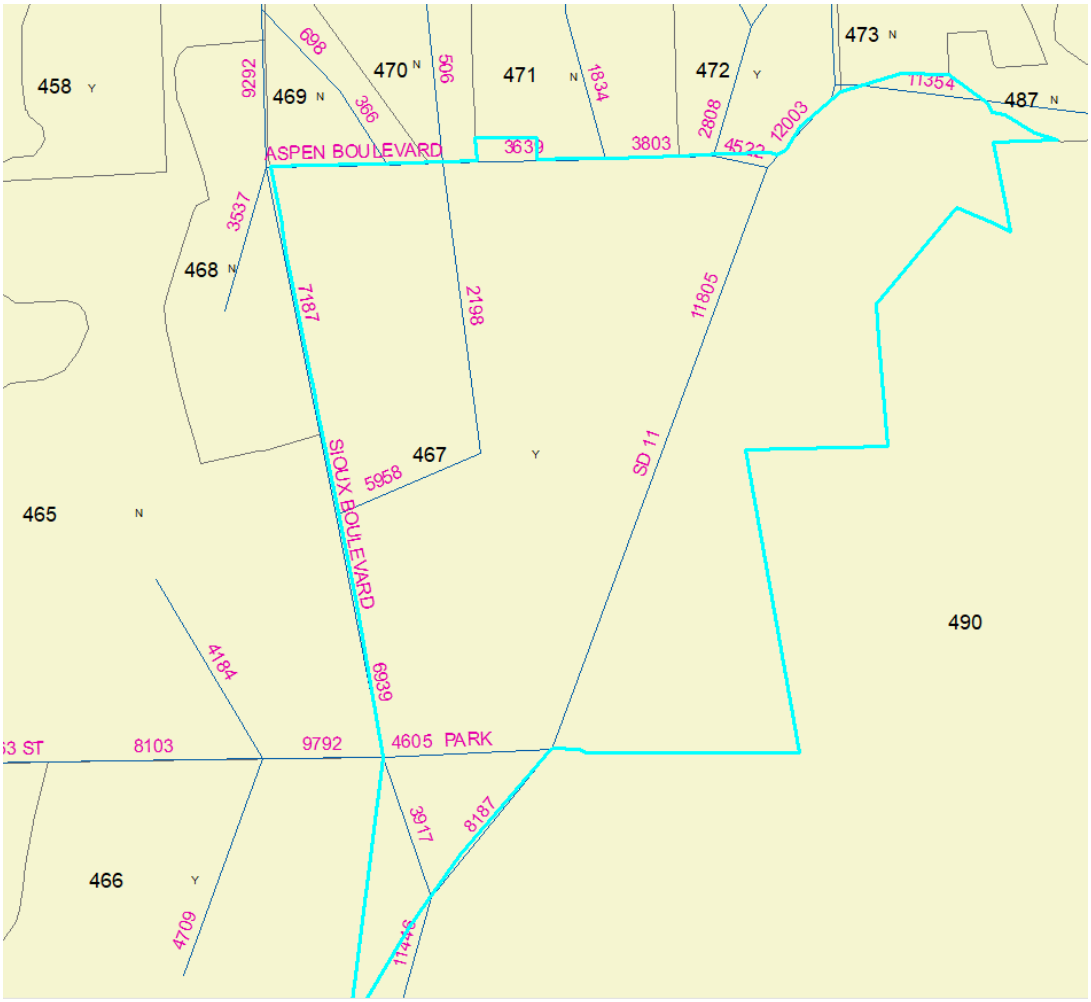
The Hollows is a proposed mixed-use development, currently in an early conceptual phase, within a triangle of undeveloped land bound by Aspen Boulevard (north), Sioux Boulevard (west), and SD11 (east) on the east end of the corridor. The property owner provided a sketch of their vision for potential development opportunities in the area to the study team for incorporation into the study. This development would be anticipated to directly affect traffic

demand along the Maple Street/Park Street corridor and traffic patterns throughout the area due to new street connections.

The proposed Hollows development falls within the model's TAZ 467, shown in **Figure 1**. This TAZ was reviewed to determine what level of development has already been included in the model and if there needs to be any update given the recently provided development concept. The constrained 2045 model included the following development within TAZ 467:

- 448 households
- 170 retail jobs
- 60 office jobs
- 109 other jobs

Figure 1: Sioux Falls Travel Demand Model TAZ 467 and Total Link Volumes



To aid in the review, the number of trips associated with the potential development sketch provided by the property owner was estimated using traffic impact study techniques and trip generation rates presented by the Institute of Transportation Engineers (ITE). Estimated trip generation numbers were then compared to model output and used to help revise TAZ land-use

(households and employment) data. The trip generation table and associated development sketch are both provided in **Appendix A**.

The estimated number of trips The Hollows development would generate are summarized as follows:

- Total daily trips: 10,000
- Total AM peak hour trips (in/out): 780 (385/395)
- Total PM peak hour trips (in/out): 735 (370/365)

These trip generation values account for applicable pass-by trips and represent a reduction of 15 percent that accounts for internal capture of the mixed-use development.

It was concluded that this concept reflects a build-out of the entire area and, without more firm plans, is speculative that the level of development would either fit or be realized by 2045. Therefore, a scaled version of this development concept was added to TAZ 467 in the form of the following additional households and employees:

- 150 households
- 200 retail employees
- 100 office employees
- 50 other employees

With the additional household and employment data added to TAZ 467, the total model volumes loaded onto the model transportation network to/from this TAZ are approximately:

- Total daily volume: 8,155
- Total AM peak hour volume: 580
- Total PM peak hour volume: 800

The No-Build Conditions volume set does not include the Park Street extension and assumes all access to this development is from Sioux Boulevard or Aspen Boulevard. The Build Conditions data set will include the Park Street extension (to SD11/Splitrock Boulevard) as part of the potential modifications, along with potentially vacating of Sioux Boulevard, as determined by the SAT. Traffic volumes will be manually distributed to include this potential Park Street connection as part of the Build Conditions traffic operations analysis.

Proposed Collector Roads

Proposed collector roads identified in the Northeast Transportation Study were added to the 2045 No-Build Conditions scenario, and include:

- North leg and south leg of future intersection mid-segment between Veterans Parkway and Six Mile Road
- South leg of future intersection between Six Mile Road and Indian Hills Trail (west)
- North leg of existing intersection at Indian Hills Trail (east)

These collector locations are also consistent with proposed Sioux Falls growth area collectors identified in the 2040 Major Streets Plan. Both of these figures are provided in **Appendix B**.

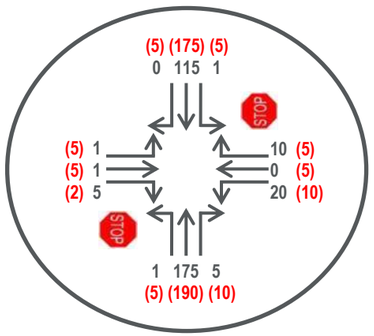
Peak hour forecasts were developed based on centroid connector volumes in the 2045 model and then distributed and assigned to the applicable proposed collectors and existing local streets.

Traffic Volumes

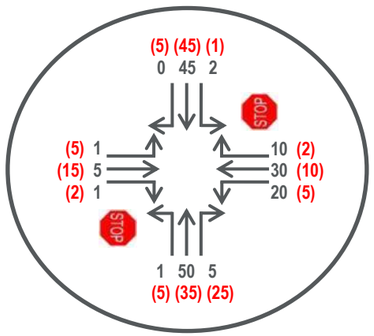
2018 Existing Conditions and 2045 No-Build Conditions volume sets are shown in the following figures:

- **Figure 2: 2018 Existing Conditions**
- **Figure 3: 2045 No-Build Conditions**

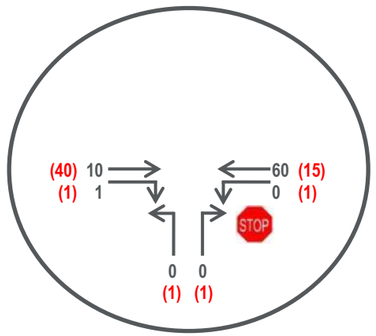
1. Maple St & Veterans Pkwy



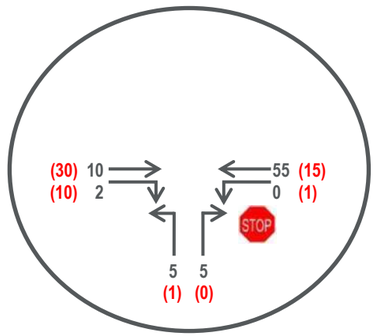
2. Maple St & Six Mile Rd



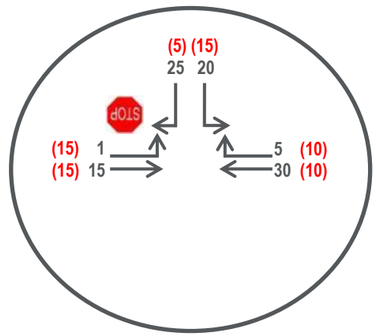
3. Maple St & Indian Hills Tr W



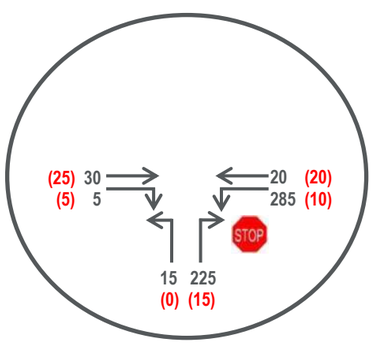
4. Maple St & Indian Hills Tr E



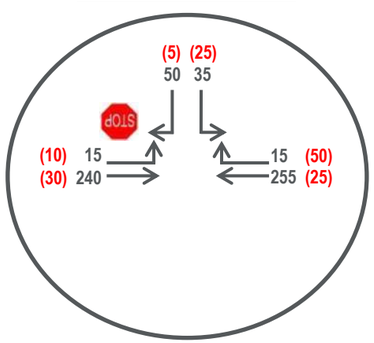
5. Maple St & Oak Rd



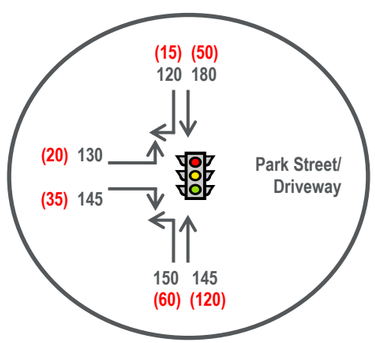
6. Park St & Intermediate School Driveway



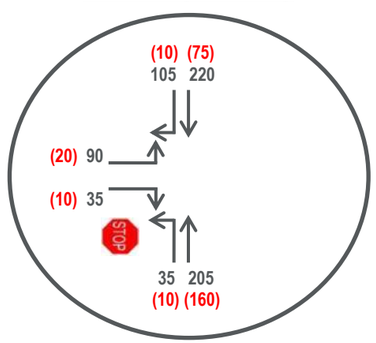
7. Park St & Locust St



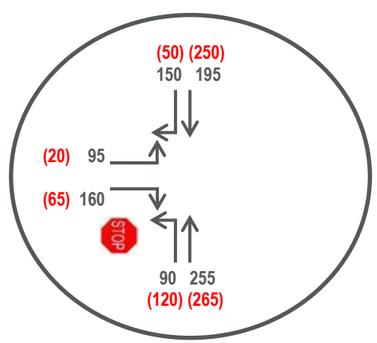
8. Park St & Sioux Blvd



9. Sioux Blvd & Robert Bennis Elementary Driveway



10. Sioux Blvd & SD11/Splitrock Blvd



2018 Existing Conditions Traffic Volumes

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

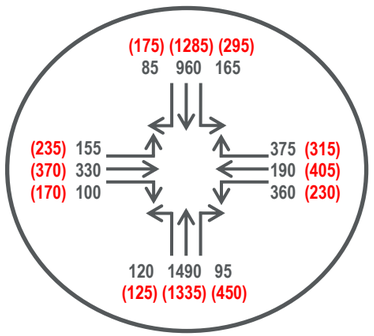
N

LEGEND

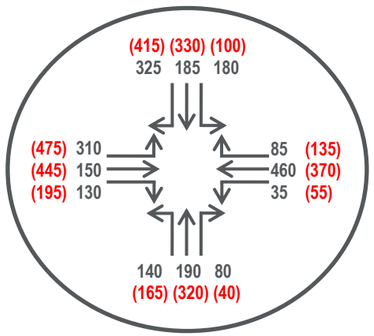
- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume
- Existing Traffic Control

FIGURE 2

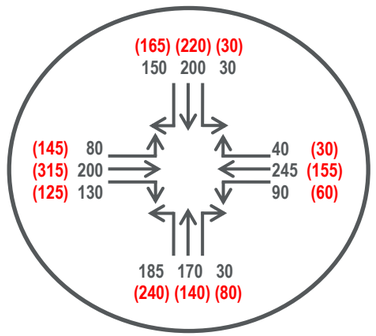
1. Maple St & Veterans Pkwy



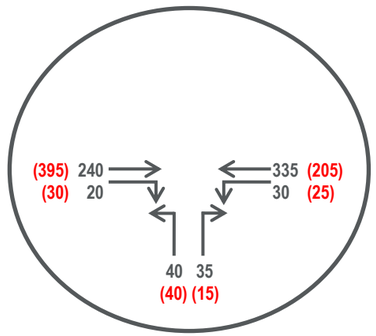
2. Maple St & Future Collector



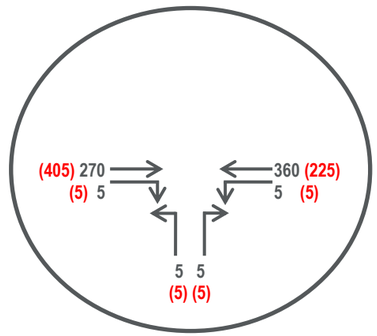
3. Maple St & Six Mile Rd



4. Maple St & Future Collector



5. Maple St & Indian Hills Tr W



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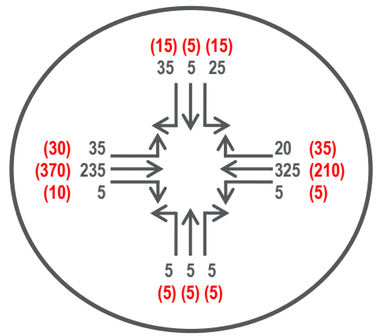
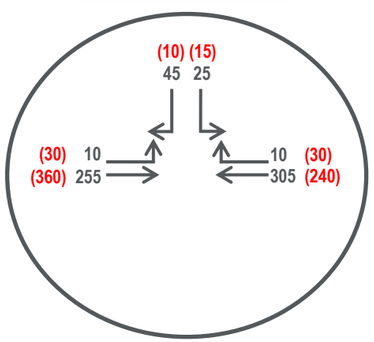
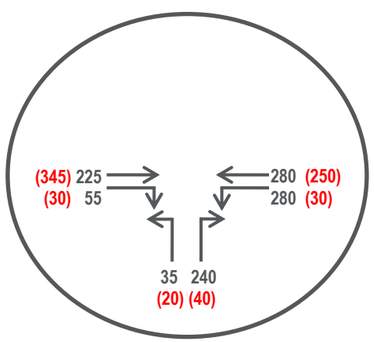


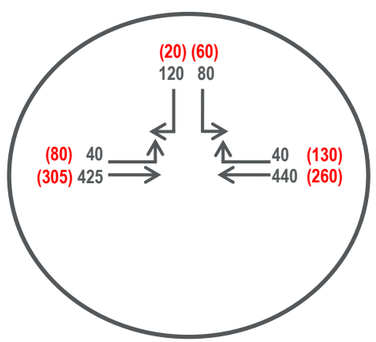
7. Maple St & Oak Rd



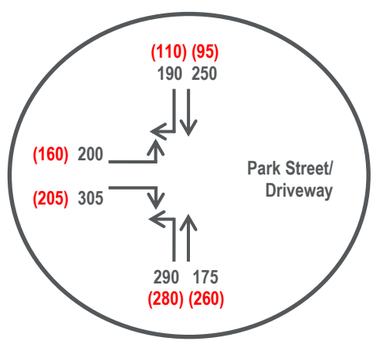
8. Park St & Intermediate School Driveway



9. Park St & Locust St



10. Park St & Sioux Blvd



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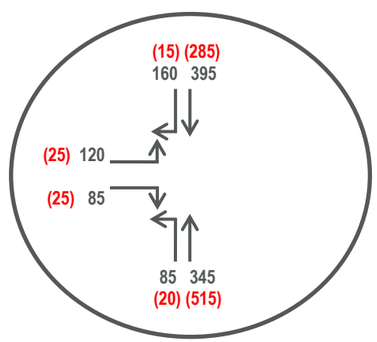

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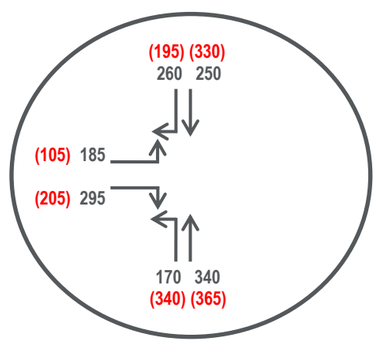


2045 Traffic Forecasts (No-Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

N

FIGURE 3

Appendix A. The Hollows Development Concept

The Hollows Development Concept

Trip Generation based on Development Concept

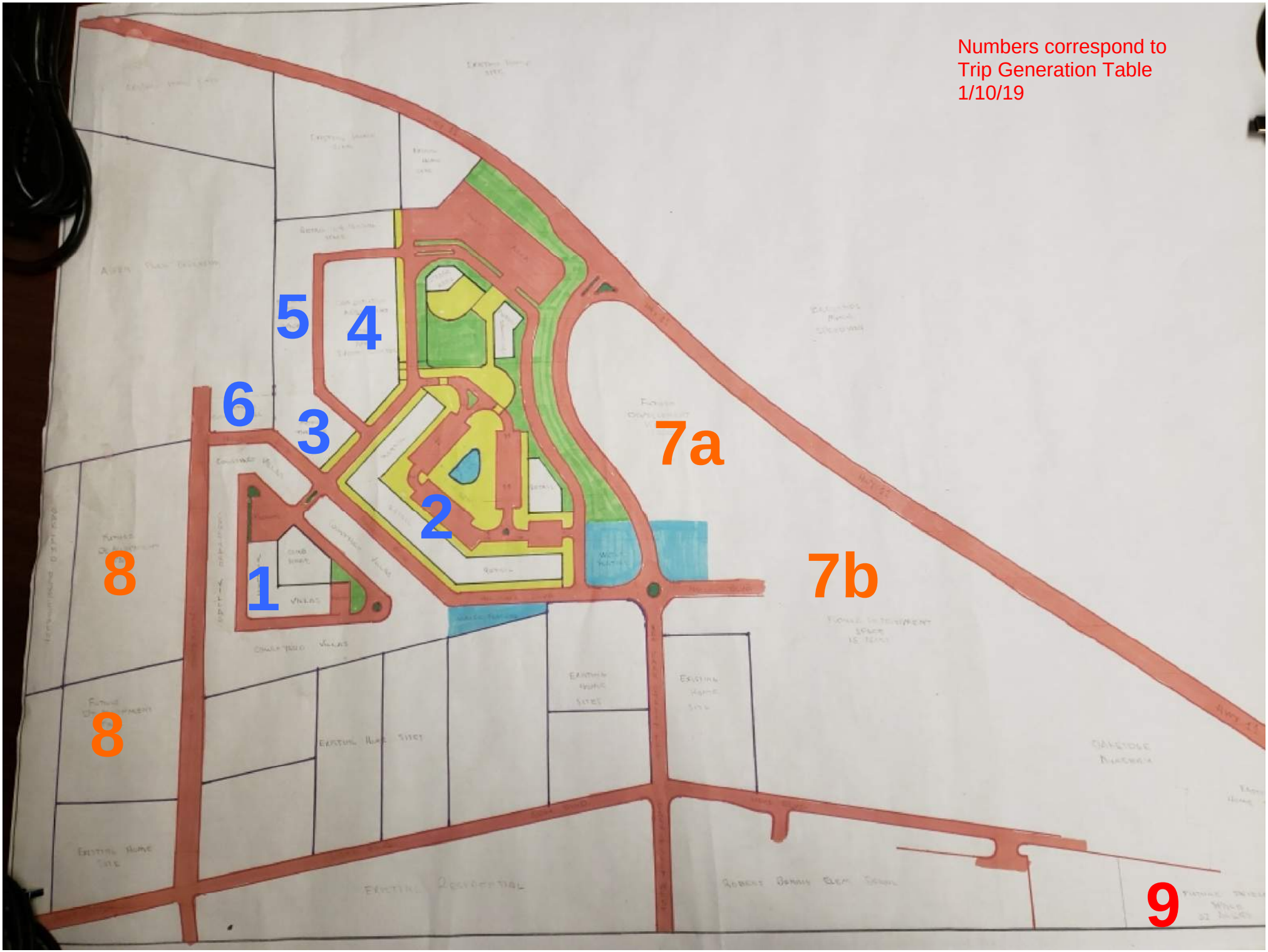

Numbers correspond to
Trip Generation Table
1/10/19
5
4
6
3
7a
2
8
1
7b
8
9

Table: Proposed Parcel Subdivisions and Land Uses (Park Street Extension/SD11)

Draft 1/10/2018

Area	Lot #	Land Use Description	ITE Code	Quantity	Unit	Trip Rates**			Total Trips			AM			PM		
						Daily	AM	PM	Daily	AM	PM	In	Out	Pass-By*	In	Out	Pass-By*
Mixed-Use	1	Residential Condominium/Townhouse	230	30	Dw. Units	5.81	0.44	0.52	174	13	16	2	11	0	10	5	0
Development	2	Specialty Retail (General Retail)	826	47.9	k-sqf	44.32	6.84	2.71	2300	355	141	170	185	0	62	79	0
	3	Movie Theater	444	5	Screens	546.86		20.22	2734	0	101	0	0	0	40	61	0
	4	Apartment/Hotel/Event Center															
	4.a	Apartment	220	60	Dw. Units	6.65	0.51	0.62	399	31	37	6	24	0	24	13	0
	4.b	Hotel	310	100	Rooms	8.17	0.53	0.6	817	53	60	31	22	0	31	29	0
	4.c	Recreational Community Center	495	10	k-sqf	33.82	2.05	2.74	338	21	27	14	7	0	13	14	0
	5	Retail/Housing															
	5.a-1	High-turnover Restaurant	932	7.8	k-sqf	127.15	10.81	9.85	992	84	77	26	22	36	26	18	33
	5.a-2	Fast-food with drive-through	934	2.9	k-sqf	496.12	45.42	32.65	1439	132	95	34	32	66	25	23	47
	5.a-3	Drive in Bank	912	8.7	k-sqf	148.15	12.08	24.3	1289	105	211	32	24	49	56	56	99
	6	Government Office Bulding	730	10	k-sqf	68.93	5.88	1.21	689	59	12	49	9	0	4	8	0
Surrounding	7a	Low-Rise Apartment	221	60.0	Dw. Units	6.59	0.46	0.58	395	28	35	6	22	0	23	12	0
Mixed-Use	7b	Single Family Detached Housing	210	9.0	Acres	26.04	2.06	2.74	86	7	9	2	5	0	6	3	0
Development	8	Single Family Detached Housing	210	7.3	Acres	26.04	2.06	2.74	69	5	7	1	4	0	5	3	0
					Total Mixed-Use and Adjacent Residential Trips:				**11721**	**893**	**828**	**373**	**367**	**151**	**325**	**324**	**179**
					Site entering/exiting trips after 15% reduction due to multi-purpose land uses:				**9963**	**759**	**704**	**317**	**312**	**128**	**276**	**275**	**152**
Outside of Area	9	Single Family Detached Housing	210	32.0	Acres	26.04	2.06	2.74	305	24	32	6	18	0	20	12	0
					Total Area Development Trips:				**10268**	**783**	**736**	**323**	**330**	**128**	**296**	**287**	**152**
Optional Land Use																	
	5.b	Residential Condominium/Townhouse	230	14	Dw. Units	5.81	0.44	0.52	81	6	7	1	5	0	5	2	0

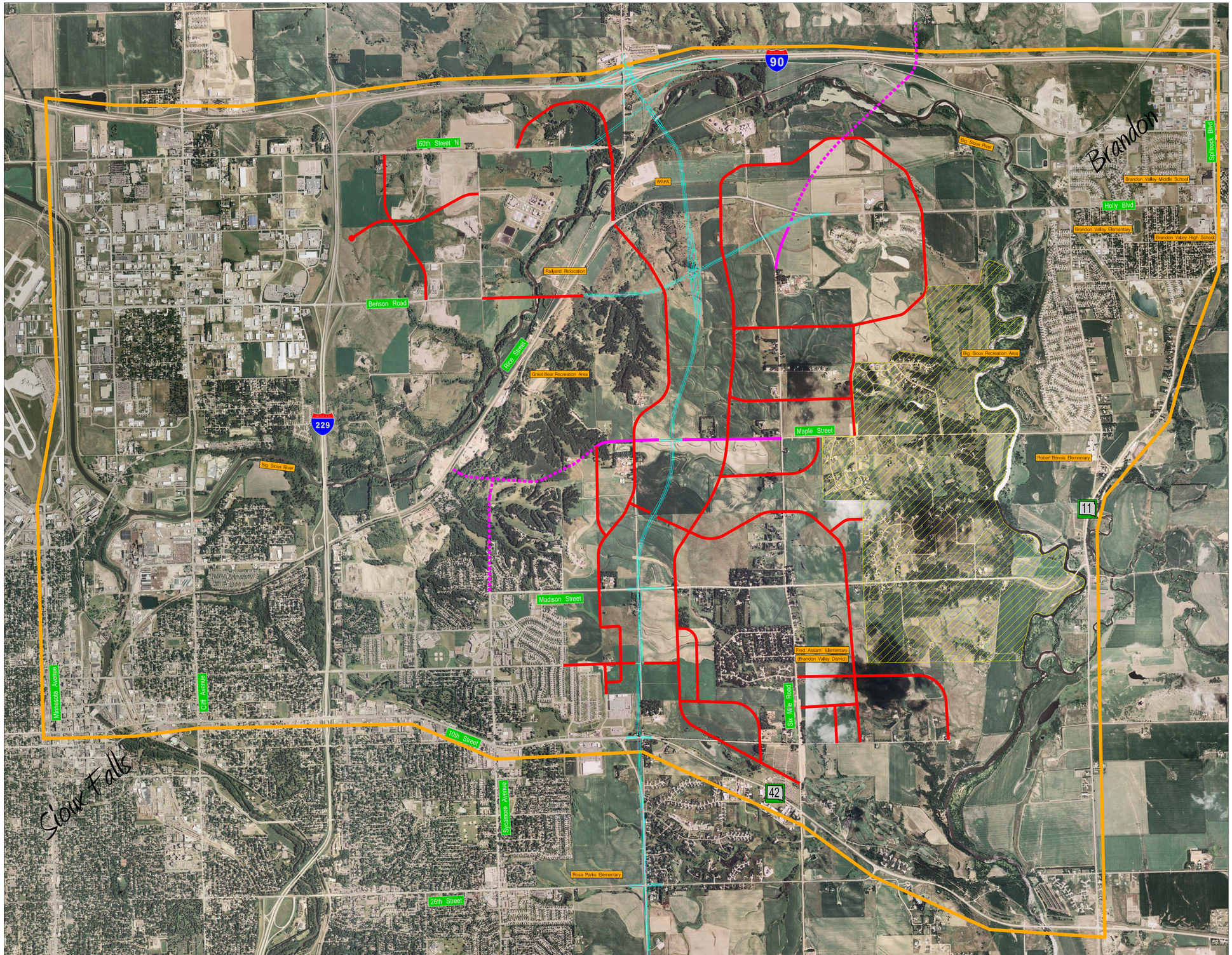
* Pass-By trips will be distributed 50% in / 50% out

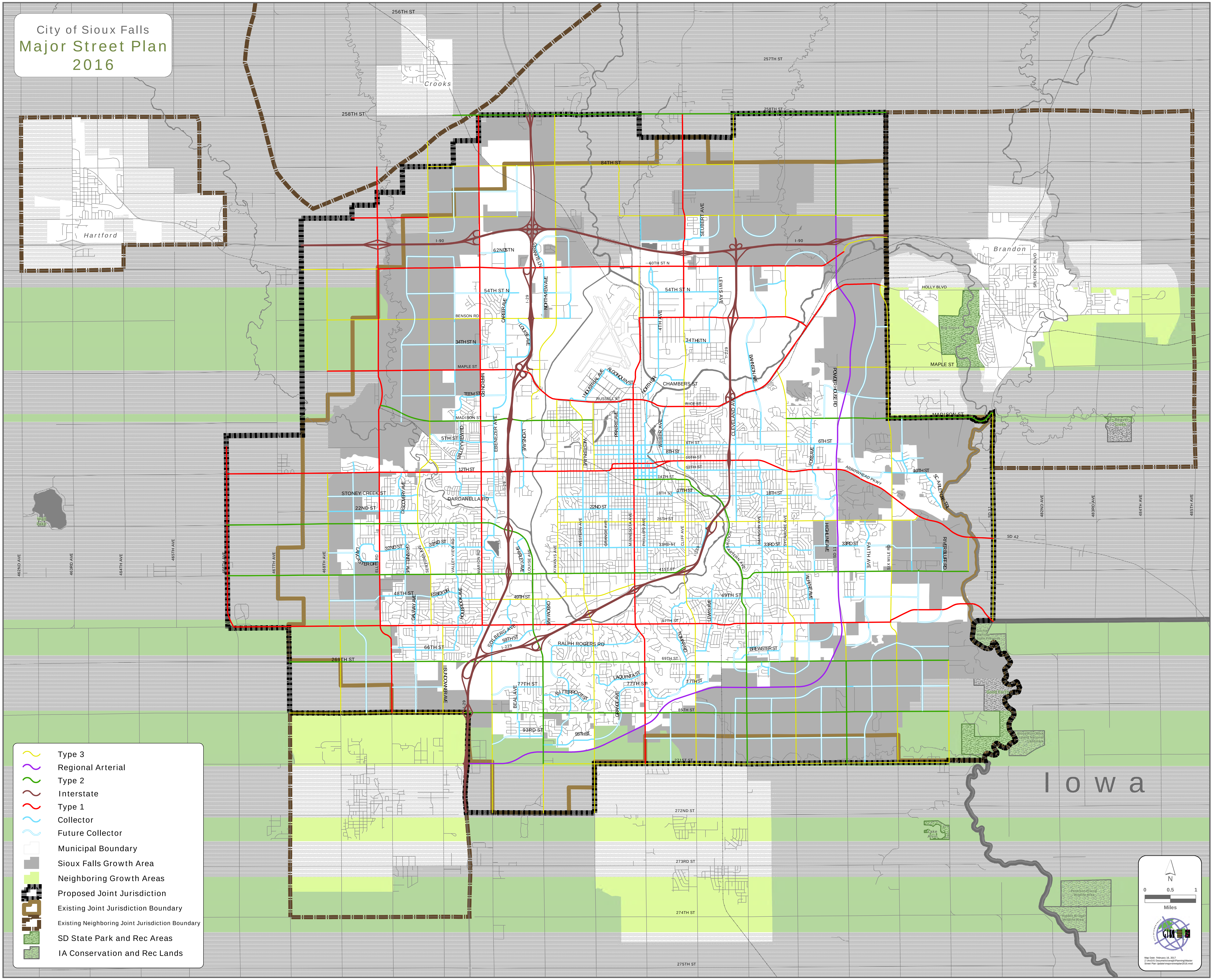
** ITE Trip Generation Rates - 9th Edition

Appendix B. Area Collector Road Planning Maps

Northeast Transportation Network Study – Collector Street Layout (2009)
http://www.siouxfalls.org/public-works/special-projects/ne-transportation-network

Sioux Falls 2040 Major Streets Plan (2018)
https://www.siouxfalls.org/planning-dev/planning/st-plan


90
60th Street N
WAPA
Railyard Relocation
Benson Road
Rice Street
Great Bear Recreation Area
229
Big Sioux River
Big Sioux River
Brandon
Spitzer Blvd
Brandon Valley Middle School
Holly Blvd
Brandon Valley Elementary
Brandon Valley High School
Big Sioux Recreation Area
Maple Street
Robert Bennis Elementary
11
Madison Street
Fred Assam Elementary
(Brandon Valley District)
Six Mile Road
Minnesota Avenue
Cliff Avenue
10th Street
Sioux Falls
Sycamore Avenue
42
Rosa Parks Elementary
26th Street
HDR
Collector Street Layout
Study Area Boundary
Proposed SD100
Proposed Collector Street
Proposed Arterial Street
Connection Being Studied
Collector Street Constraints
N
SCALE IN FEET
0
625
1250



City of Sioux Falls
Major Street Plan
2016
Type 3
Regional Arterial
Type 2
Interstate
Type 1
Collector
Future Collector
Municipal Boundary
Sioux Falls Growth Area
Neighboring Growth Areas
Proposed Joint Jurisdiction
Existing Joint Jurisdiction Boundary
Existing Neighboring Joint Jurisdiction Boundary
SD State Park and Rec Areas
IA Conservation and Rec Lands
Crooks
Hartford
Brandon
Iowa
Wall Lake
Big Sioux
Beaver Creek
Gitchie Manitou State Preserve
Good Earth
Blood Run/Rock Island National Landmark
Lake Alvin
Peterson Prairie Wildlife Area
Hidden Bridge Wildlife Area
256TH ST
257TH ST
258TH ST
84TH ST
I-90
I-29
I-229
62ND ST N
60TH ST N
54TH ST N
BENSON RD
34TH ST N
MAPLE ST
TEEM ST
MADISON ST
RUSSELL ST
RICE ST
CHAMBERS ST
HOLLY BLVD
SPLITROCK BLVD
5TH ST
6TH ST
8TH ST
10TH ST
12TH ST
14TH ST
17TH ST
18TH ST
22ND ST
26TH ST
32ND ST
33RD ST
41ST ST
48TH ST
49TH ST
57TH ST
59TH ST
66TH ST
69TH ST
77TH ST
85TH ST
93RD ST
95TH ST
269TH ST
271ST ST
272ND ST
273RD ST
274TH ST
275TH ST
STONEY CREEK ST
DARDANELLA RD
ARROWHEAD PKWY
RALPH ROGERS RD
BREWSTER ST
LAQUINTA ST
BITTERROOT ST
ESSEX DR
LANCASTER DR
SOLBERG AVE
SD 11
SD 42
462ND AVE
463RD AVE
464TH AVE
465TH AVE
466TH AVE
467TH AVE
468TH AVE
482ND AVE
483RD AVE
484TH AVE
485TH AVE
DISCOVERY AVE
GRINNELL AVE
SERTOMA AVE
ELLIS RD
GALWAY AVE
VALLEY VIEW RD
HOLBROOK AVE
SUNDOWNER AVE
MARION RD
EBENEZER AVE
CAREER AVE
LOUISE AVE
GRANITE LN
NORTHVIEW AVE
SHIRLEY AVE
LYONS AVE
KIWANIS AVE
OXBOW AVE
BEAL AVE
WESTERN AVE
GRANGE AVE
PRAIRIE AVE
INDUSTRIAL AVE
ALGONQUIN ST
NORTH DR
MINNESOTA AVE
PHILLIPS AVE
WEBER AVE
4TH AVE
SEUBERT AVE
CLIFF AVE
LEWIS AVE
TOMAR RD
CLEVELAND AVE
SOUTHEASTERN AVE
BAHNSON AVE
SYCAMORE AVE
FOSS AVE
HIGHLINE AVE
ALPINE AVE
POWDER HOUSE RD
FAITH AVE
SIX MILE RD
RIVER BLUFF RD
SCARLET OAK TRL
N
0 0.5 1
Miles
Map Date: February 16, 2017
Z:\ArcGIS Documents\enajb\Planning\Master Street Plan Update\majorstreetplan2016.mxd

Appendix D. Existing and Future No-Build Conditions Traffic Operations Technical Memorandum

Technical Memo

Date:	Friday, February 22, 2019
Project:	Maple Street/Park Street Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Existing and Future No-Build Conditions Traffic Operations

Introduction

This memorandum presents the traffic operations analysis along the Maple Street/Park Street corridor between Veterans Parkway and SD11/Splitrock Boulevard. Analysis periods include:

- Existing Conditions (Year 2018)
- 2045 Planning Horizon No-Build Conditions (2045 No-Build Conditions)

The purpose of this memorandum is to identify traffic operational needs along the study corridor. This analysis also serves as a baseline for the development and evaluation of corridor concepts that will be carried into conceptual design.

Traffic Data

Traffic data used to develop the 2018 Existing Conditions and 2045 No-Build Conditions volume sets is summarized as follows:

Peak hour intersection turning movement counts:

- Collected by consultant team on Tuesday, November 13, 2018

24-hour roadway segment counts:

- Collected by City of Sioux Falls and Minnehaha County throughout 2018

Traffic forecasts were based on output from the Sioux Falls Metropolitan Planning Organization (MPO) travel demand model. The following model versions were used:

- 2013 – base year
- 2045 – planning horizon

Heavy vehicle percentages and peak hour factors (PHF) used in the analysis were obtained from the peak hour intersection turning movement counts.

Traffic Volume Development

Daily segment volumes and AM and PM peak hour intersection volumes were developed for both the 2018 Existing Condition and 2045 Planning Horizon No-Build Conditions scenarios.

The 2018 Existing Conditions volume set was developed for the existing corridor using the 2018 segment and peak hour counts, factored to a design season to account for seasonal fluctuations. Intersection turning movement volumes were balanced and smoothed across the corridor.

Traffic forecasts for 2045 were prepared using the most current version of the Sioux Falls MPO travel demand model (year 2045) and obtained development plans. The 2045 No-Build Conditions scenario is based on the 2045 constrained travel demand model and includes:

- Holly Boulevard/Rice Street is a 2-lane roadway
- Veterans Parkway is extended to I-29 (southern segment, between SD11 and I-29) was included in the model
- Maple Street/Park Street corridor is a 2-lane, paved roadway, in order to realize demand on the corridor

Model output was post-processed to a 2045 No-Build Conditions scenario roadway network for analysis, which included:

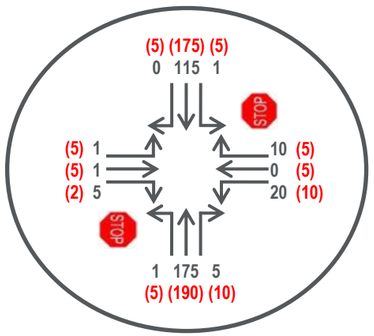
- Planned north/south collectors, as identified in the Northeast Transportation Network Study[1], were incorporated at the following locations:
    - North leg and south leg of future intersection between Veterans Parkway and Six Mile Road
    - South leg of future intersection between Six Mile Road and Indian Hills Trail (west intersection)
    - North leg of existing intersection at Indian Hills Trail (east intersection)
- A proposed extension of Park Street between Sioux Boulevard and SD11/Splitrock Boulevard was not included. This extension will be analyzed as part of a Build Conditions analysis and traffic will be distributed accordingly as part of that analysis.

Methodology used in the development of segment and intersection peak hour forecasts was consistent with NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design.

A summary of traffic volumes for the 2018 Existing Conditions and 2050 No-Build Conditions is provided in **Figures 1 and 2**. The Traffic Forecasts technical memorandum presents more details regarding the development of existing conditions and future-year peak hour traffic volumes.

[1] https://www.siouxfalls.org/public-works/special-projects/ne-transportation-network

1. Maple St & Veterans Pkwy



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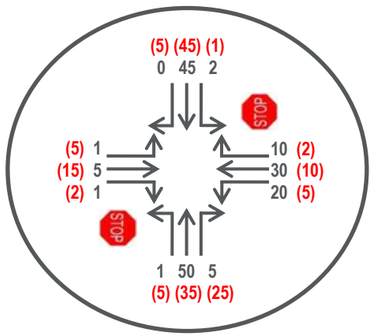
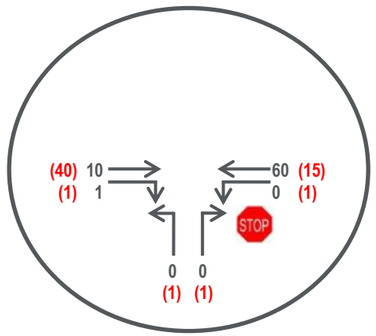


3. Maple St & Indian Hills Tr W



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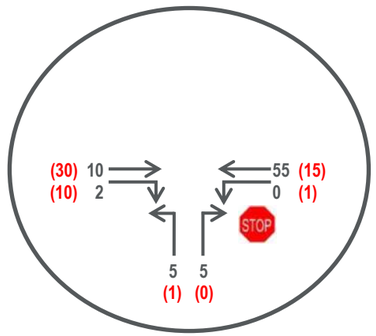

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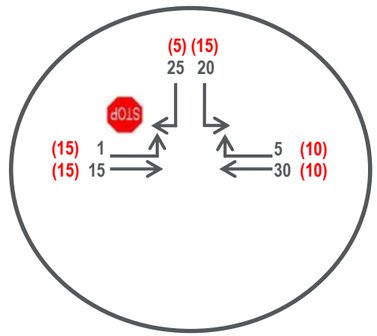

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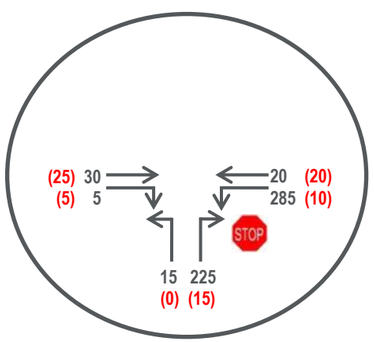

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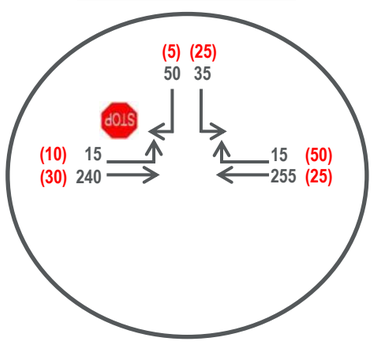

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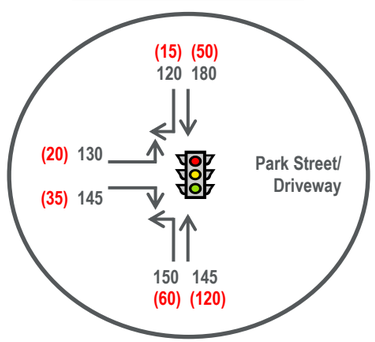

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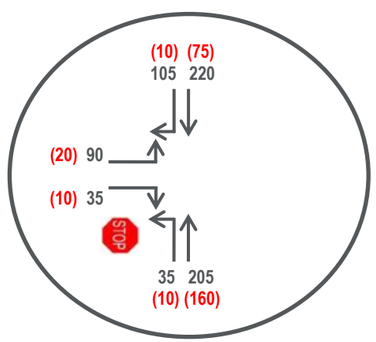

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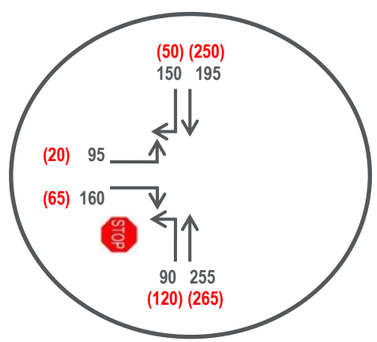


2018 Existing Conditions Traffic Volumes

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

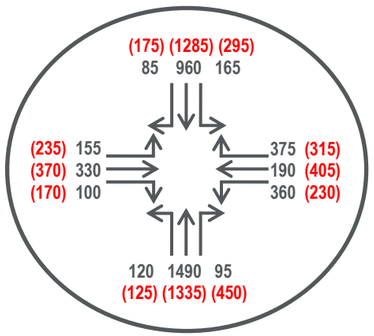
N

LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume
- Existing Traffic Control

FIGURE 1

1. Maple St & Veterans Pkwy



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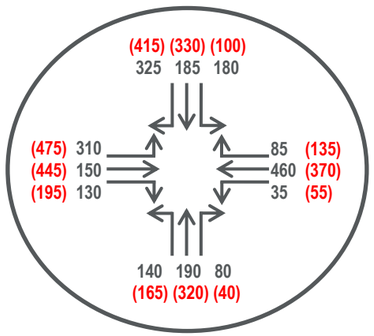

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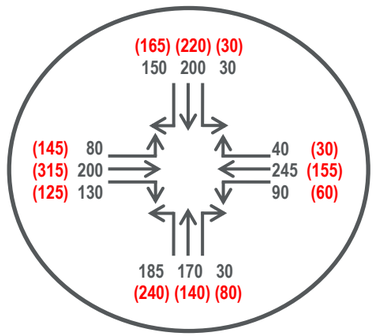

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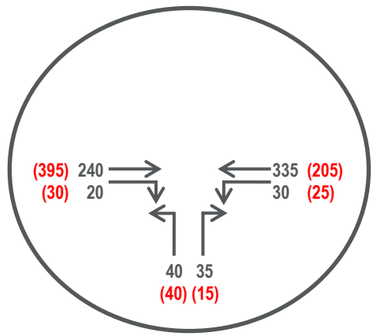

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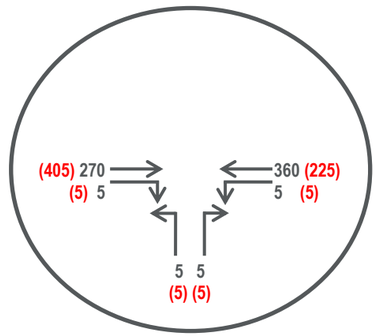

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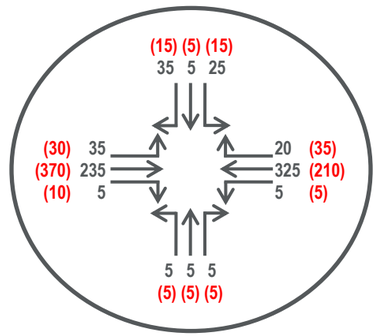

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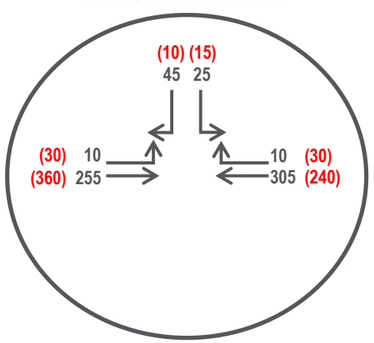

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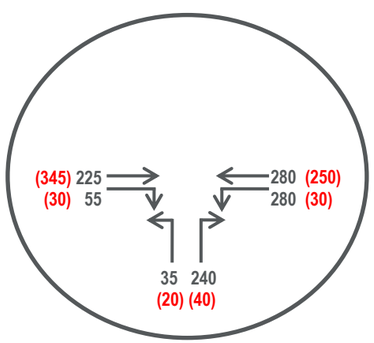

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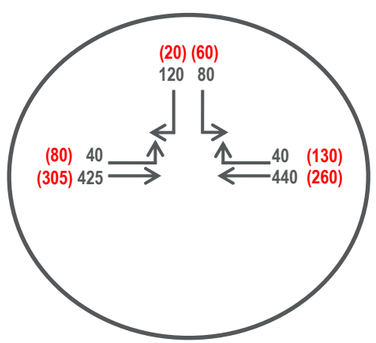
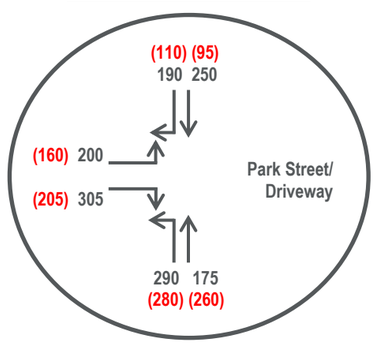
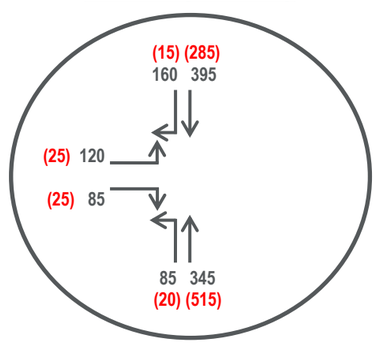


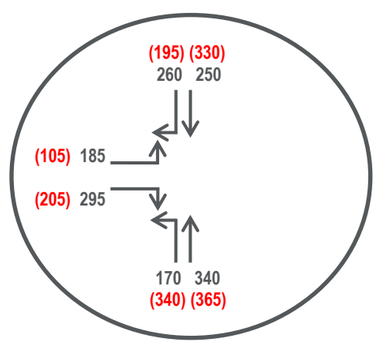
10. Park St & Sioux Blvd



11. Sioux Blvd & Robert Bennis Elementary Driveway



12. Sioux Blvd & SD11/Splitrock Blvd



2045 Traffic Forecasts (No-Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

N

FIGURE 2

Traffic Operations

Peak hour level of service (LOS) was calculated for Maple Street/Park Street analysis intersections using Synchro/SimTraffic 10 traffic analysis software and methodology described in the 6th Edition of the Highway Capacity Manual (HCM6). HCM6 analysis methods measure intersection average control delay in terms of seconds of delay per vehicle (sec/veh) and applies a LOS value in accordance with thresholds presented in **Table 1**.

Table 1: Intersection Level of Service Thresholds

LOS	Intersection Delay per Vehicle (sec/veh)	
	Signalized Intersections	**Two-Way Stop-Control*, All-Way Stop-Control, and Roundabouts**
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 - 35	> 15 - 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Transportation Research Board, HCM6.

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

Weighted intersection delay was also calculated to present a second average delay measure for Maple Street/Park Street intersections that are stop-controlled from the local (minor) street approach. This method accounts for the operational benefits afforded to the major, high volume through movements that are not stop or signal-controlled at intersections. HCM6 reporting in Synchro 10 provides an average intersection delay value that reflects the weighted average delay of all vehicles entering the intersection. A LOS measure is applied to this average intersection delay value using HCM6 All-Way Stop-Control LOS thresholds.

Level of Service Goals for Study

The following minimum allowable LOS thresholds have been established for this study:

- Signalized intersections minimum allowable LOS – LOS C
    - Individual movements LOS D or better
- Two-way stop-controlled intersections LOS – LOS C, though a lower LOS may be acceptable as it is reported on the side-street approach

These LOS thresholds will be used to identify areas of operational needs along the corridor. In future Build Conditions operational analysis memoranda, these thresholds will be used to guide the development of potential improvements and subsequent evaluation of concepts.

This study focuses on the traffic operations at the following Maple Street/Park Street corridor intersections:

- Veterans Parkway
- Six Mile Road
- Locust Avenue
- Sioux Boulevard
- SD11/Splitrock Boulevard

Existing Conditions Traffic Operations Analysis

The Existing Conditions traffic operations analysis reflects a scenario that analyzes the current network, using recently collected traffic counts (2018) and existing roadway conditions such as number of lanes, intersection traffic control, speed limits, signal timings, etc.

The 2018 Existing Conditions intersection operations are summarized in the following tables. HCM6-based Synchro analysis reports are provided in **Appendix A**.

- **Table 2**: Maple Street/Park Street Corridor Intersections – Existing Conditions
- **Table 3**: Maple Street/Park Street Corridor Intersections (Weighted Average) – Existing Conditions

Table 2: Maple Street/Park Street Corridor Intersections – Existing Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC*	10.2	B	11.4	B
Six Mile Road	TWSC*	9.8	A	9.8	A
Locust Avenue	TWSC*	15.1	C	9.4	A
Sioux Boulevard	Signal	20.3	C	9.0	A
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC*	19.9	C	12.5	B

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

Table 3: Maple Street/Park Street Corridor Intersections (Weighted Average) – Existing Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Weighted Avg. Delay (sec/veh)	LOS	Weighted Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC	1.1	A	1	A
Six Mile Road	TWSC	4	A	2.7	A
Locust Avenue	TWSC	2.3	A	2.5	A
Sioux Boulevard	Signal	n/a	n/a	n/a	n/a
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC	6.2	A	2.7	A

2045 No-Build Conditions Traffic Operations Analysis

The purpose of the 2045 No-Build Conditions analysis is to identify future-year needs and help guide the subsequent development of potential improvements within the study area. This scenario reflects the existing roadway network with the following modifications:

- Assumes the roadway is paved in the travel demand model in order to realize the full extent of traffic demand attracted to this corridor.
- Planned collector roadways are included to reflect future-year turning movements.
- Park Street and Sioux Boulevard intersection traffic signal timing was optimized to account for routine retiming as traffic demand increases over time.
- Traffic volumes are updated with 2045 forecasts.

The 2045 No-Build Conditions intersection operations are summarized in the following tables. HCM6-based Synchro analysis reports are provided in **Appendix B**.

- **Table 4**: Maple Street/Park Street Intersections – 2045 No-Build Conditions
- **Table 5**: Maple Street/Park Street Intersections (Weighted Average) – 2045 No-Build Conditions

Table 4: Maple Street/Park Street Corridor Intersections – 2045 No-Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC*	~	F	~	F
Six Mile Road	TWSC*	~	F	~	F
Locust Avenue	TWSC*	54.2	F	24.1	C
Sioux Boulevard	Signal	59.6	E	18.8	B
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC*	664.4	F	1187.6	F

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

~ Volume exceeds capacity on minor approaches and computation not defined.

Table 5: Maple Street/Park Street Corridor Intersections (Weighted Average) – 2045 No-Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Weighted Avg. Delay (sec/veh)	LOS	Weighted Avg. Delay (sec/veh)	LOS
Veterans Parkway	TWSC	~	F	~	F
Six Mile Road	TWSC	~	F	~	F
Locust Avenue	TWSC	9.8	A	3.1	A
Sioux Boulevard	Signal	n/a	n/a	n/a	n/a
Sioux Boulevard & SD11/Splitrock Boulevard	TWSC	213.7	F	241.8	F

~ Volume exceeds capacity on minor approaches and computation not defined.

Summary and Conclusions

Traffic operations in the 2018 Existing Conditions scenario all result in delay within acceptable LOS thresholds for this study.

In the 2045 No-Build Conditions scenario, traffic demand significantly increases throughout the study corridor. As expected, this creates operational needs at each of the analysis intersections if capacity is not increased or traffic control is not modified. Capacity-related improvements will be addressed as part of the Build Conditions analysis.

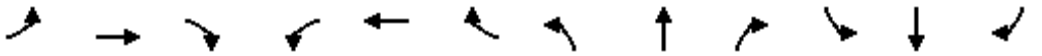
Appendix

A. Existing Conditions Synchro Reports
B. 2045 No-Build Conditions Synchro Reports

Appendix A – Existing Conditions Synchro Reports

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street/Driveway

02/22/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	0	145	1	0	0	150	145	2	0	180	120
Future Volume (veh/h)	130	0	145	1	0	0	150	145	2	0	180	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	191	0	213	1	0	0	221	213	3	0	265	176
Peak Hour Factor	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	448	0	279	208	0	0	425	923	13	144	342	227
Arrive On Green	0.20	0.00	0.20	0.20	0.00	0.00	0.11	0.57	0.57	0.00	0.37	0.37
Sat Flow, veh/h	1395	0	1396	322	0	0	1569	1620	23	1147	923	613
Grp Volume(v), veh/h	191	0	213	1	0	0	221	0	216	0	0	441
Grp Sat Flow(s),veh/h/ln	1395	0	1396	322	0	0	1569	0	1643	1147	0	1537
Q Serve(g_s), s	0.0	0.0	7.2	0.0	0.0	0.0	3.9	0.0	3.3	0.0	0.0	12.7
Cycle Q Clear(g_c), s	5.5	0.0	7.2	7.2	0.0	0.0	3.9	0.0	3.3	0.0	0.0	12.7
Prop In Lane	1.00		1.00	1.00		0.00	1.00		0.01	1.00		0.40
Lane Grp Cap(c), veh/h	448	0	279	208	0	0	425	0	936	144	0	569
V/C Ratio(X)	0.43	0.00	0.76	0.00	0.00	0.00	0.52	0.00	0.23	0.00	0.00	0.78
Avail Cap(c_a), veh/h	448	0	279	208	0	0	425	0	936	144	0	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	18.2	0.0	18.9	22.3	0.0	0.0	9.5	0.0	5.3	0.0	0.0	13.9
Incr Delay (d2), s/veh	2.9	0.0	17.8	0.0	0.0	0.0	1.1	0.0	0.6	0.0	0.0	10.0
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.2	0.0	3.4	0.0	0.0	0.0	1.1	0.0	0.9	0.0	0.0	5.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.2	0.0	36.7	22.3	0.0	0.0	10.7	0.0	5.9	0.0	0.0	23.9
LnGrp LOS	C	A	D	C	A	A	B	A	A	A	A	C
Approach Vol, veh/h		404			1			437			441	
Approach Delay, s/veh		29.3			22.3			8.3			23.9	
Approach LOS		C			C			A			C	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		34.0		16.0	10.0	24.0		16.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		28.5		10.0	5.5	18.5		10.0				
Max Q Clear Time (g_c+I1), s		0.0		0.0	5.9	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.0	0.0	0.0		0.0				

Intersection Summary												
HCM 6th Ctrl Delay			20.3									
HCM 6th LOS			C									

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	5	20	0	10	1	175	5	1	115	0
Future Vol, veh/h	1	1	5	20	0	10	1	175	5	1	115	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	535	-	535	535	-	535
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	1	1	6	23	0	11	1	199	6	1	131	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	235	340	66	269	334	100	131	0	0	205	0	0
Stage 1	133	133	-	201	201	-	-	-	-	-	-	-
Stage 2	102	207	-	68	133	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	692	574	975	654	578	927	1430	-	-	1342	-	-
Stage 1	848	778	-	773	726	-	-	-	-	-	-	-
Stage 2	884	722	-	926	778	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	683	573	975	649	577	927	1430	-	-	1342	-	-
Mov Cap-2 Maneuver	683	573	-	649	577	-	-	-	-	-	-	-
Stage 1	847	777	-	772	725	-	-	-	-	-	-	-
Stage 2	873	721	-	919	777	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	10.2	0	0.1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1430	-	-	840	721	1342	-	-
HCM Lane V/C Ratio	0.001	-	-	0.009	0.047	0.001	-	-
HCM Control Delay (s)	7.5	-	-	9.3	10.2	7.7	-	-
HCM Lane LOS	A	-	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.1	0	-	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	5	1	20	30	10	1	50	5	2	45	0
Future Vol, veh/h	1	5	1	20	30	10	1	50	5	2	45	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	6	1	25	37	12	1	62	6	2	56	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	152	130	56	131	127	65	56	0	0	68	0	0
Stage 1	60	60	-	67	67	-	-	-	-	-	-	-
Stage 2	92	70	-	64	60	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	815	761	1011	841	764	999	1549	-	-	1533	-	-
Stage 1	951	845	-	943	839	-	-	-	-	-	-	-
Stage 2	915	837	-	947	845	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	774	759	1011	833	762	999	1549	-	-	1533	-	-
Mov Cap-2 Maneuver	774	759	-	833	762	-	-	-	-	-	-	-
Stage 1	950	844	-	942	838	-	-	-	-	-	-	-
Stage 2	863	836	-	938	844	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.6	9.8	0.1	0.3
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1549	-	-	789	818	1533	-	-
HCM Lane V/C Ratio	0.001	-	-	0.011	0.091	0.002	-	-
HCM Control Delay (s)	7.3	0	-	9.6	9.8	7.4	0	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	240	255	15	35	50
Future Vol, veh/h	15	240	255	15	35	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	67	67	67	67	67	67
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	358	381	22	52	75

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	403	0	-	0	794	392
Stage 1	-	-	-	-	392	-
Stage 2	-	-	-	-	402	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1156	-	-	-	357	657
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	676	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1156	-	-	-	348	657
Mov Cap-2 Maneuver	-	-	-	-	348	-
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	676	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	15.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1156	-	-	-	481
HCM Lane V/C Ratio	0.019	-	-	-	0.264
HCM Control Delay (s)	8.2	0	-	-	15.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	1.1

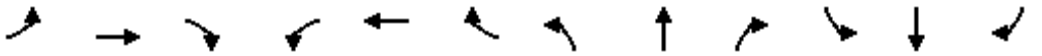
Intersection	
Int Delay, s/veh	6.2

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	95	160	90	255	195	150
Future Vol, veh/h	95	160	90	255	195	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	365	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	103	174	98	277	212	163

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	767	294	375	0	-	0
Stage 1	294	-	-	-	-	-
Stage 2	473	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	369	743	1178	-	-	-
Stage 1	754	-	-	-	-	-
Stage 2	625	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	338	743	1178	-	-	-
Mov Cap-2 Maneuver	338	-	-	-	-	-
Stage 1	691	-	-	-	-	-
Stage 2	625	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	19.9	2.2	0
HCM LOS	C		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1178	-	514	-	-
HCM Lane V/C Ratio	0.083	-	0.539	-	-
HCM Control Delay (s)	8.3	-	19.9	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0.3	-	3.2	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	0	35	0	0	0	60	120	0	0	50	15
Future Volume (veh/h)	20	0	35	0	0	0	60	120	0	0	50	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	32	0	56	0	0	0	97	194	0	0	81	24
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	458	0	279	0	329	0	722	939	0	144	495	147
Arrive On Green	0.20	0.00	0.20	0.00	0.00	0.00	0.07	0.57	0.00	0.00	0.41	0.41
Sat Flow, veh/h	1569	0	1396	0	1647	0	1569	1647	0	1170	1220	362
Grp Volume(v), veh/h	32	0	56	0	0	0	97	194	0	0	0	105
Grp Sat Flow(s),veh/h/ln	1569	0	1396	0	1647	0	1569	1647	0	1170	0	1582
Q Serve(g_s), s	0.8	0.0	1.7	0.0	0.0	0.0	1.6	2.9	0.0	0.0	0.0	2.1
Cycle Q Clear(g_c), s	0.8	0.0	1.7	0.0	0.0	0.0	1.6	2.9	0.0	0.0	0.0	2.1
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		0.23
Lane Grp Cap(c), veh/h	458	0	279	0	329	0	722	939	0	144	0	642
V/C Ratio(X)	0.07	0.00	0.20	0.00	0.00	0.00	0.13	0.21	0.00	0.00	0.00	0.16
Avail Cap(c_a), veh/h	458	0	279	0	329	0	778	939	0	144	0	642
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	16.3	0.0	16.7	0.0	0.0	0.0	6.3	5.2	0.0	0.0	0.0	9.4
Incr Delay (d2), s/veh	0.3	0.0	1.6	0.0	0.0	0.0	0.1	0.5	0.0	0.0	0.0	0.5
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.6	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.6	0.0	18.3	0.0	0.0	0.0	6.4	5.7	0.0	0.0	0.0	10.0
LnGrp LOS	B	A	B	A	A	A	A	A	A	A	A	A
Approach Vol, veh/h		88			0			291			105	
Approach Delay, s/veh		17.7			0.0			6.0			10.0	
Approach LOS		B						A			A	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		34.0		16.0	8.2	25.8		16.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		28.5		10.0	5.5	18.5		10.0				
Max Q Clear Time (g_c+I1), s		0.0		0.0	3.6	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.0	0.1	0.0		0.0				

Intersection Summary												
HCM 6th Ctrl Delay			9.0									
HCM 6th LOS			A									

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	5	2	10	5	5	5	190	10	5	175	5
Future Vol, veh/h	5	5	2	10	5	5	5	190	10	5	175	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	535	-	535	535	-	535
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	6	6	2	11	6	6	6	216	11	6	199	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	334	450	100	343	445	108	205	0	0	227	0	0
Stage 1	211	211	-	228	228	-	-	-	-	-	-	-
Stage 2	123	239	-	115	217	-	-	-	-	-	-	-
Critical Hdwy	7.56	6.56	6.96	7.56	6.56	6.96	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Follow-up Hdwy	3.53	4.03	3.33	3.53	4.03	3.33	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	593	501	933	584	504	922	1356	-	-	1331	-	-
Stage 1	769	724	-	751	712	-	-	-	-	-	-	-
Stage 2	865	704	-	875	720	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	581	496	933	573	499	922	1356	-	-	1331	-	-
Mov Cap-2 Maneuver	581	496	-	573	499	-	-	-	-	-	-	-
Stage 1	766	720	-	748	709	-	-	-	-	-	-	-
Stage 2	849	701	-	862	716	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.4	11.2	0.2	0.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1356	-	-	576	608	1331	-	-
HCM Lane V/C Ratio	0.004	-	-	0.024	0.037	0.004	-	-
HCM Control Delay (s)	7.7	-	-	11.4	11.2	7.7	-	-
HCM Lane LOS	A	-	-	B	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	15	2	5	10	2	5	35	25	1	45	5
Future Vol, veh/h	5	15	2	5	10	2	5	35	25	1	45	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	6	19	3	6	13	3	6	44	31	1	56	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	141	148	59	144	136	60	62	0	0	75	0	0
Stage 1	61	61	-	72	72	-	-	-	-	-	-	-
Stage 2	80	87	-	72	64	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	827	742	1004	823	753	1003	1535	-	-	1518	-	-
Stage 1	948	842	-	935	833	-	-	-	-	-	-	-
Stage 2	926	821	-	935	840	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	811	738	1004	802	749	1003	1535	-	-	1518	-	-
Mov Cap-2 Maneuver	811	738	-	802	749	-	-	-	-	-	-	-
Stage 1	944	841	-	931	830	-	-	-	-	-	-	-
Stage 2	906	818	-	911	839	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.8	9.7	0.6	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1535	-	-	772	788	1518	-	-
HCM Lane V/C Ratio	0.004	-	-	0.036	0.027	0.001	-	-
HCM Control Delay (s)	7.4	0	-	9.8	9.7	7.4	0	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	30	25	50	25	5
Future Vol, veh/h	10	30	25	50	25	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	72	72	72	72	72	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	42	35	69	35	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	104	0	-	0	140	70
Stage 1	-	-	-	-	70	-
Stage 2	-	-	-	-	70	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1488	-	-	-	853	993
Stage 1	-	-	-	-	953	-
Stage 2	-	-	-	-	953	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1488	-	-	-	844	993
Mov Cap-2 Maneuver	-	-	-	-	844	-
Stage 1	-	-	-	-	943	-
Stage 2	-	-	-	-	953	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1488	-	-	-	866
HCM Lane V/C Ratio	0.009	-	-	-	0.048
HCM Control Delay (s)	7.4	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	2.7

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	20	65	120	265	50	250
Future Vol, veh/h	20	65	120	265	50	250
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	365	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	24	79	146	323	61	305

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	829	214	366	0	-	0
Stage 1	214	-	-	-	-	-
Stage 2	615	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	339	823	1187	-	-	-
Stage 1	819	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	297	823	1187	-	-	-
Mov Cap-2 Maneuver	297	-	-	-	-	-
Stage 1	718	-	-	-	-	-
Stage 2	537	-	-	-	-	-

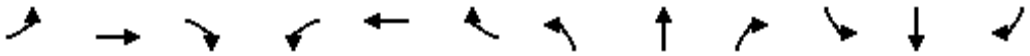
Approach	SE	NE	SW
HCM Control Delay, s	12.5	2.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1187	-	581	-	-
HCM Lane V/C Ratio	0.123	-	0.178	-	-
HCM Control Delay (s)	8.5	-	12.5	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.4	-	0.6	-	-

Appendix B – 2045 No-Build Conditions Synchro Reports

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street/Driveway

02/22/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	0	305	1	1	1	290	175	0	0	250	190
Future Volume (veh/h)	200	0	305	1	1	1	290	175	0	0	250	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	250	0	381	1	1	1	362	219	0	0	312	238
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	248	0	388	56	49	26	361	979	0	80	342	261
Arrive On Green	0.28	0.00	0.28	0.28	0.28	0.28	0.15	0.59	0.00	0.00	0.39	0.39
Sat Flow, veh/h	1393	0	1396	10	175	93	1569	1647	0	1144	867	661
Grp Volume(v), veh/h	250	0	381	3	0	0	362	219	0	0	0	550
Grp Sat Flow(s),veh/h/ln	1393	0	1396	278	0	0	1569	1647	0	1144	0	1528
Q Serve(g_s), s	0.5	0.0	24.4	0.0	0.0	0.0	13.5	5.6	0.0	0.0	0.0	30.7
Cycle Q Clear(g_c), s	25.0	0.0	24.4	24.5	0.0	0.0	13.5	5.6	0.0	0.0	0.0	30.7
Prop In Lane	1.00		1.00	0.33		0.33	1.00		0.00	1.00		0.43
Lane Grp Cap(c), veh/h	248	0	388	130	0	0	361	979	0	80	0	603
V/C Ratio(X)	1.01	0.00	0.98	0.02	0.00	0.00	1.00	0.22	0.00	0.00	0.00	0.91
Avail Cap(c_a), veh/h	248	0	388	130	0	0	361	979	0	80	0	603
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	36.8	0.0	32.3	25.8	0.0	0.0	22.0	8.5	0.0	0.0	0.0	25.8
Incr Delay (d2), s/veh	59.5	0.0	41.6	0.3	0.0	0.0	48.3	0.5	0.0	0.0	0.0	20.5
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	9.6	0.0	12.4	0.1	0.0	0.0	8.5	2.0	0.0	0.0	0.0	14.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	96.3	0.0	73.9	26.2	0.0	0.0	70.3	9.1	0.0	0.0	0.0	46.3
LnGrp LOS	F	A	E	C	A	A	F	A	A	A	A	D
Approach Vol, veh/h		631			3			581			550	
Approach Delay, s/veh		82.8			26.2			47.2			46.3	
Approach LOS		F			C			D			D	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		59.0		31.0	18.0	41.0		31.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		53.5		25.0	13.5	35.5		25.0				
Max Q Clear Time (g_c+I1), s		0.0		0.0	15.5	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.0	0.0	0.0		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	59.6
HCM 6th LOS	E

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	155	330	90	360	190	375	120	1490	95	165	960	85
Future Vol, veh/h	155	330	90	360	190	375	120	1490	95	165	960	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	535	-	535	535	-	535
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	194	413	113	450	238	469	150	1863	119	206	1200	106

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2963	3894	600	3382	3881	932	1306	0	0	1982	0	0
Stage 1	1612	1612	-	2163	2163	-	-	-	-	-	-	-
Stage 2	1351	2282	-	1219	1718	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	~ 6	~ 3	437	~ 3	~ 3	~ 262	510	-	-	276	-	-
Stage 1	~ 105	~ 157	-	~ 47	~ 82	-	-	-	-	-	-	-
Stage 2	~ 154	~ 71	-	~ 187	~ 139	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	~ 1	437	-	~ 1	~ 262	510	-	-	276	-	-
Mov Cap-2 Maneuver	-	~ 1	-	-	~ 1	-	-	-	-	-	-	-
Stage 1	~ 74	~ 40	-	~ 33	~ 58	-	-	-	-	-	-	-
Stage 2	265	~ 50	-	-	~ 35	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			1.1	6.6
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	510	-	-	-	-	276	-	-
HCM Lane V/C Ratio	0.294	-	-	-	-	0.747	-	-
HCM Control Delay (s)	15	-	-	-	-	48.5	-	-
HCM Lane LOS	B	-	-	-	-	E	-	-
HCM 95th %tile Q(veh)	1.2	-	-	-	-	5.5	-	-

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

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	80	200	130	90	245	40	185	170	30	30	200	150
Future Vol, veh/h	80	200	130	90	245	40	185	170	30	30	200	150
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	100	250	163	113	306	50	231	213	38	38	250	188

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1292	1133	344	1321	1208	232	438	0	0	251	0	0
Stage 1	420	420	-	694	694	-	-	-	-	-	-	-
Stage 2	872	713	-	627	514	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	140	~ 203	699	134	~ 183	807	1122	-	-	1314	-	-
Stage 1	611	589	-	433	444	-	-	-	-	-	-	-
Stage 2	345	435	-	471	535	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	~ 148	699	-	~ 134	807	1122	-	-	1314	-	-
Mov Cap-2 Maneuver	-	~ 148	-	-	~ 134	-	-	-	-	-	-	-
Stage 1	464	566	-	329	337	-	-	-	-	-	-	-
Stage 2	~ 22	331	-	194	514	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			4.3	0.6
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1122	-	-	-	-	1314	-	-
HCM Lane V/C Ratio	0.206	-	-	-	-	0.029	-	-
HCM Control Delay (s)	9	0	-	-	-	7.8	0	-
HCM Lane LOS	A	A	-	-	-	A	A	-
HCM 95th %tile Q(veh)	0.8	-	-	-	-	0.1	-	-

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

Intersection	
Int Delay, s/veh	9.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	40	425	440	40	80	120
Future Vol, veh/h	40	425	440	40	80	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	531	550	50	100	150

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	600	0	-	0	1206	575
Stage 1	-	-	-	-	575	-
Stage 2	-	-	-	-	631	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	977	-	-	-	203	518
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	530	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	977	-	-	-	188	518
Mov Cap-2 Maneuver	-	-	-	-	188	-
Stage 1	-	-	-	-	522	-
Stage 2	-	-	-	-	530	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	54.2
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	977	-	-	-	304
HCM Lane V/C Ratio	0.051	-	-	-	0.822
HCM Control Delay (s)	8.9	0	-	-	54.2
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0.2	-	-	-	6.9

Intersection	
Int Delay, s/veh	213.7

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	185	295	170	340	250	260
Future Vol, veh/h	185	295	170	340	250	260
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	365	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	231	369	213	425	313	325

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1327	476	638	0	-	0
Stage 1	476	-	-	-	-	-
Stage 2	851	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	~ 170	587	941	-	-	-
Stage 1	623	-	-	-	-	-
Stage 2	417	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 132	587	941	-	-	-
Mov Cap-2 Maneuver	~ 132	-	-	-	-	-
Stage 1	482	-	-	-	-	-
Stage 2	417	-	-	-	-	-

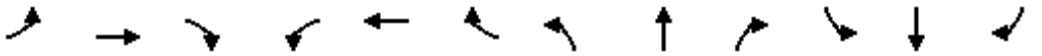
Approach	SE	NE	SW
HCM Control Delay, s	$ 664.4	3.3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	941	-	252	-	-
HCM Lane V/C Ratio	0.226	-	2.381	-	-
HCM Control Delay (s)	9.9	-	$ 664.4	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0.9	-	48.2	-	-

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

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street/Driveway

02/22/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	0	205	1	1	1	280	260	0	0	95	110
Future Volume (veh/h)	160	0	205	1	1	1	280	260	0	0	95	110
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	200	0	256	1	1	1	350	325	0	0	119	138
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	394	0	355	126	110	75	550	883	0	131	195	226
Arrive On Green	0.25	0.00	0.25	0.25	0.25	0.25	0.17	0.54	0.00	0.00	0.28	0.28
Sat Flow, veh/h	1393	0	1396	154	432	293	1569	1647	0	1038	695	806
Grp Volume(v), veh/h	200	0	256	3	0	0	350	325	0	0	0	257
Grp Sat Flow(s),veh/h/ln	1393	0	1396	879	0	0	1569	1647	0	1038	0	1502
Q Serve(g_s), s	1.9	0.0	9.2	0.0	0.0	0.0	8.0	6.3	0.0	0.0	0.0	8.2
Cycle Q Clear(g_c), s	11.1	0.0	9.2	9.2	0.0	0.0	8.0	6.3	0.0	0.0	0.0	8.2
Prop In Lane	1.00		1.00	0.33		0.33	1.00		0.00	1.00		0.54
Lane Grp Cap(c), veh/h	394	0	355	311	0	0	550	883	0	131	0	421
V/C Ratio(X)	0.51	0.00	0.72	0.01	0.00	0.00	0.64	0.37	0.00	0.00	0.00	0.61
Avail Cap(c_a), veh/h	394	0	355	311	0	0	550	883	0	131	0	421
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	19.8	0.0	18.7	15.6	0.0	0.0	10.6	7.4	0.0	0.0	0.0	17.2
Incr Delay (d2), s/veh	4.6	0.0	11.9	0.1	0.0	0.0	2.4	1.2	0.0	0.0	0.0	6.5
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.7	0.0	3.8	0.0	0.0	0.0	2.6	2.0	0.0	0.0	0.0	3.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.4	0.0	30.6	15.6	0.0	0.0	13.0	8.5	0.0	0.0	0.0	23.7
LnGrp LOS	C	A	C	B	A	A	B	A	A	A	A	C
Approach Vol, veh/h		456			3			675			257	
Approach Delay, s/veh		27.9			15.6			10.8			23.7	
Approach LOS		C			B			B			C	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		35.0		20.0	14.1	20.9		20.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		29.5		14.0	9.6	15.4		14.0				
Max Q Clear Time (g_c+I1), s		0.0		0.0	10.0	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.0	0.0	0.0		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	18.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	19.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	235	370	170	230	405	315	125	1335	450	295	1285	175
Future Vol, veh/h	235	370	170	230	405	315	125	1335	450	295	1285	175
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	535	-	535	535	-	535
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	294	463	213	288	506	394	156	1669	563	369	1606	219

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	3744	4888	803	3754	4544	835	1825	0	0	2232	0	0
Stage 1	2344	2344	-	1981	1981	-	-	-	-	-	-	-
Stage 2	1400	2544	-	1773	2563	-	-	-	-	-	-	-
Critical Hdwy	7.56	6.56	6.96	7.56	6.56	6.96	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Follow-up Hdwy	3.53	4.03	3.33	3.53	4.03	3.33	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	~ 1	~ 1	324	~ 1	~ 1	~ 309	327	-	-	~ 226	-	-
Stage 1	~ 36	~ 68	-	~ 63	~ 104	-	-	-	-	-	-	-
Stage 2	~ 146	~ 53	-	~ 85	~ 52	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	0	324	-	0	~ 309	327	-	-	~ 226	-	-
Mov Cap-2 Maneuver	-	0	-	-	0	-	-	-	-	-	-	-
Stage 1	~ 19	0	-	~ 33	~ 54	-	-	-	-	-	-	-
Stage 2	~ 175	~ 28	-	-	0	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			1.7	57.4
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	327	-	-	-	-	~ 226	-	-
HCM Lane V/C Ratio	0.478	-	-	-	-	1.632	-	-
HCM Control Delay (s)	25.7	-	-	-	-	-$ 341.6	-	-
HCM Lane LOS	D	-	-	-	-	F	-	-
HCM 95th %tile Q(veh)	2.5	-	-	-	-	23.7	-	-

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

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	145	315	125	60	155	30	240	140	80	30	220	165
Future Vol, veh/h	145	315	125	60	155	30	240	140	80	30	220	165
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	181	394	156	75	194	38	300	175	100	38	275	206

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1395	1329	378	1554	1382	225	481	0	0	275	0	0
Stage 1	454	454	-	825	825	-	-	-	-	-	-	-
Stage 2	941	875	-	729	557	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	~ 118	~ 154	667	92	~ 143	812	1076	-	-	1282	-	-
Stage 1	584	568	-	365	386	-	-	-	-	-	-	-
Stage 2	315	~ 366	-	413	511	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	~ 98	667	-	~ 91	812	1076	-	-	1282	-	-
Mov Cap-2 Maneuver	-	~ 98	-	-	~ 91	-	-	-	-	-	-	-
Stage 1	390	544	-	243	257	-	-	-	-	-	-	-
Stage 2	~ 49	~ 244	-	84	490	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			5	0.6
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1076	-	-	-	-	1282	-	-
HCM Lane V/C Ratio	0.279	-	-	-	-	0.029	-	-
HCM Control Delay (s)	9.6	0	-	-	-	7.9	0	-
HCM Lane LOS	A	A	-	-	-	A	A	-
HCM 95th %tile Q(veh)	1.1	-	-	-	-	0.1	-	-

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

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	305	260	130	60	20
Future Vol, veh/h	80	305	260	130	60	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	100	381	325	163	75	25

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	488	0	-	0	988	407
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	581	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1075	-	-	-	274	644
Stage 1	-	-	-	-	672	-
Stage 2	-	-	-	-	559	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1075	-	-	-	242	644
Mov Cap-2 Maneuver	-	-	-	-	242	-
Stage 1	-	-	-	-	593	-
Stage 2	-	-	-	-	559	-

Approach	EB	WB	SB
HCM Control Delay, s	1.8	0	24.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1075	-	-	-	287
HCM Lane V/C Ratio	0.093	-	-	-	0.348
HCM Control Delay (s)	8.7	0	-	-	24.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	1.5

Intersection	
Int Delay, s/veh	241.8

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	105	205	340	365	330	195
Future Vol, veh/h	105	205	340	365	330	195
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	365	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	131	256	425	456	413	244

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1841	535	657	0	-	0
Stage 1	535	-	-	-	-	-
Stage 2	1306	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	~ 82	543	926	-	-	-
Stage 1	585	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 44	543	926	-	-	-
Mov Cap-2 Maneuver	~ 44	-	-	-	-	-
Stage 1	316	-	-	-	-	-
Stage 2	252	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, $	1187.6	5.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	926	-	112	-	-
HCM Lane V/C Ratio	0.459	-	3.46	-	-
HCM Control Delay (s)	12.1	-	$ 1187.6	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	2.4	-	38.2	-	-

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

Appendix E. 2030 and 2045 Build Conditions Traffic Operations Technical Memorandum

Technical Memo

Date:	Wednesday, April 17, 2019
Project:	Maple Street/Park Street Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	2030 and 2045 Build Conditions Traffic Operations

Introduction

The purpose of this technical memorandum is to identify minimum build needs and present the associated Build Conditions traffic operations along the Maple Street/Park Street corridor for the following future-year scenarios:

- 2030 Interim Build Conditions
- 2045 Build Conditions

Primary components of the Build Conditions scenarios and this technical memorandum include:

- Traffic operations analysis of Build Conditions at primary intersections.
- Review of traffic signal warrants at select intersections.
- Review of turn lane warrants.
- Determination of minimum turn lane lengths.
- Recommend minimum improvements needed to meet operational goals for this study to be carried forward for conceptual design.

Study Area

The Maple Street/Park Street corridor study area is between, and including, the intersections of Veterans Parkway to the west and SD11/Splitrock Boulevard to the east. Study intersections are as noted in **Table 1**.

Table 1: Maple Street/Park Street Corridor Study Intersections

No.	Maple Street/Park Street Corridor Intersections	Intersection	Traffic Forecast Intersection	Primary Traffic Operations Analysis Intersection
1	Veterans Parkway	Existing	X	X
2	Potential Collector	Future*	X	
3	Six Mile Road	Existing	X	X
4	Potential Collector	Future*	X	
5	Indian Hills Trail (west)	Existing	X	
6	Indian Hills Trail (east) & Potential Collector	Existing/Future*	X	
7	Oak Road	Existing	X	
8	Intermediate School Drive	Existing	X	
9	Locust Street	Existing	X	X
10	Sioux Boulevard	Existing	X	X
11	Robert Bennis Elementary School Drive	Existing	X	
12	Aspen Park Road (extension)	Future**	X	
13.a	SD11/Splitrock Boulevard (via Sioux Boulevard)	Existing	X	X
13.b	SD11/Splitrock Boulevard (via Park Street extension)	Future**	X	X

** Intersection identified in Northeast Transportation Network Study*

*** Potential extension of Park Street to SD11/Splitrock Boulevard*

Build Conditions Roadway Network

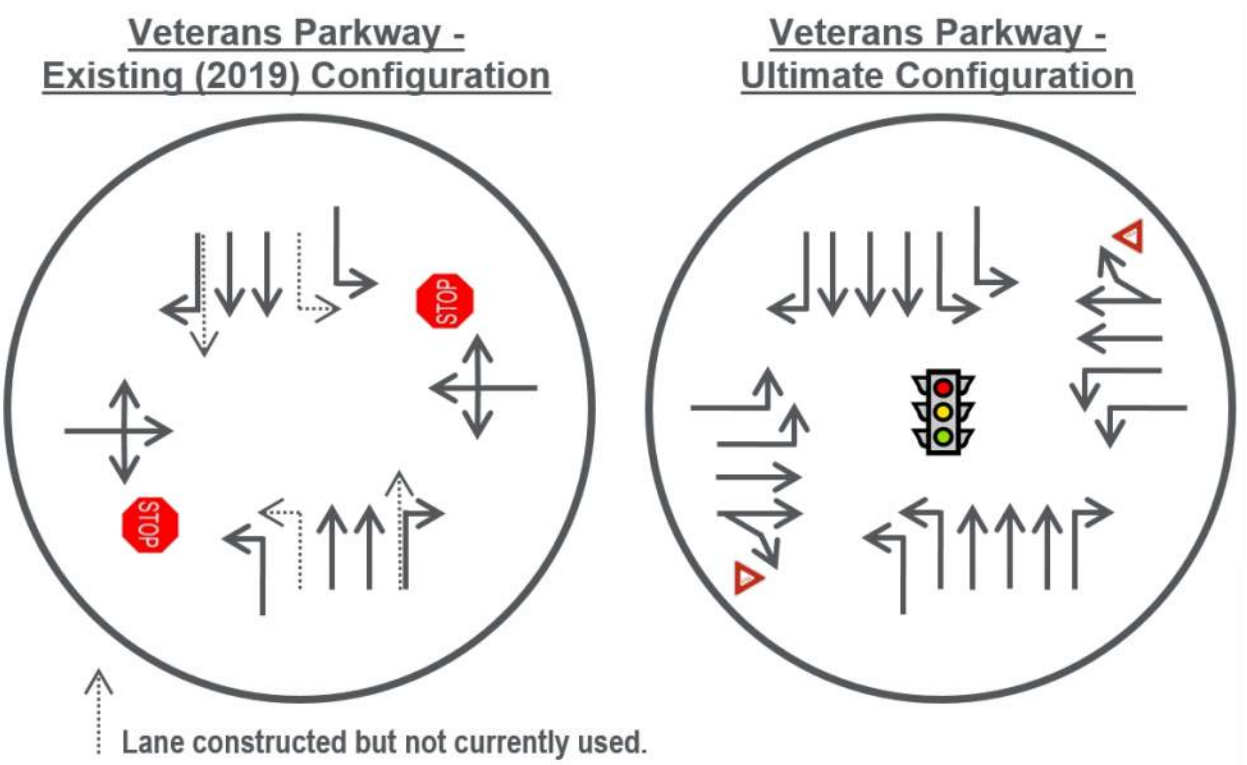
The following summarizes changes to the No-Build Conditions traffic forecasts and respective Synchro model.

Veterans Parkway and Maple Street Intersection

The Veterans Parkway and Maple Street intersection configuration developed through the Hwy100 corridor study and subsequent environmental documentation was used as the ultimate build-out for this study in the 2045 Build Conditions analysis. Findings from this study were used to both validate the Veterans Parkway build-out configuration and identify any potential modifications to the Maple Street approaches.

Currently, Veterans Parkway (formerly called SD100 or Hwy100) infrastructure is built-out on the northbound/southbound approaches but striped for less capacity as shown in **Figure 1**. The primary goal of the 2030 Interim Build Conditions is to identify what configuration is needed between the existing and ultimate build-out configurations.

Figure 1: Veterans Parkway and Maple Street Intersection Configurations



Ultimate configuration identified in the *Traffic Analysis Update – Hwy100 from Madison Street to Maple Street* technical memorandum (12/15/14)

Park Street Extension

The potential extension of Park Street to SD11/Splitrock Boulevard is incorporated in the 2045 Build Conditions and 2030 Interim Build Conditions analyses with the following modifications:

- Existing intersection of Sioux Boulevard and SD11/Splitrock Boulevard is removed.
    - Sioux Boulevard will continue southward from the elementary school to potential residential development identified in The Hollows development sketch (see the *Traffic Forecasts* technical memorandum).
- No changes to driveway access locations or purpose for Robert Bennis Elementary School or the Intermediate School.
- Aspen Park Road and Park Street intersection added within The Hollows development, east of Sioux Boulevard.

Corridor Speeds and Traffic Signals

The following Maple Street/Park Street corridor speeds were used in the Build Conditions models:

- Veterans Parkway to Six Mile Road: 40 mph
- Six Mile Road to City of Brandon limits: 45 mph
- City of Brandon limits to SD11/Splitrock Boulevard: 30 mph

The needs for traffic signals and subsequent recommendations were based on the following 2030 Interim Build and 2045 Build Conditions analyses:

- Traffic operations and LOS goals for this study
- Traffic signal warrants (with available data)

Traffic signal phase change intervals were estimated from potential build-out of intersections within the respective scenarios and corridor speeds.

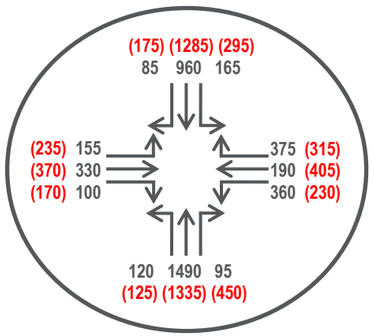
Traffic Forecasts

Daily segment volumes and AM and PM peak hour intersection volumes were developed for 2030 Interim Build Conditions and 2045 Build Conditions (study Planning Horizon) scenarios.

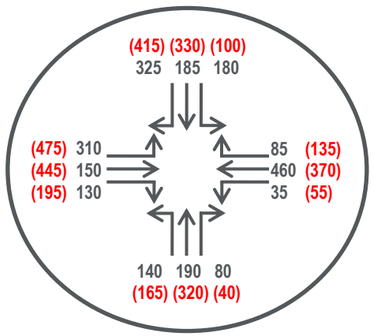
The 2045 Build Conditions traffic volumes were developed from the 2045 Sioux Falls Metropolitan Planning Organization travel demand model. These volumes are similar to the No-Build Conditions, with the primary difference being the redistribution needs required by potential modifications to the roadway network. Further explanation on methodology used to develop 2045 Planning Horizon traffic volumes is described in the *Traffic Forecasts* technical memorandum and the *Existing and Future No-Build Conditions Traffic Operations* technical memorandum.

2030 Interim Build traffic volumes were developed through a straight-line interpolation between 2018 Existing Conditions and the 2045 Planning Horizon No-Build Conditions traffic volume data sets. Volumes were then adjusted, as needed, to reflect the Build Conditions roadway network. Peak hour turning volumes are shown in **Figure 2** and **Figure 3**.

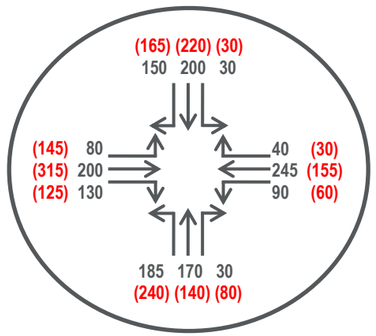
1. Maple St & Veterans Pkwy



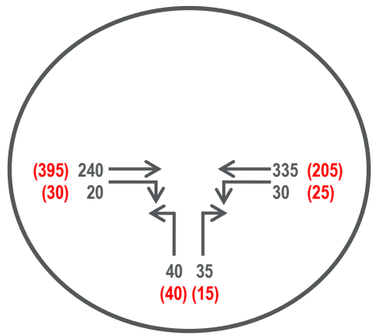
2. Maple St & Future Collector



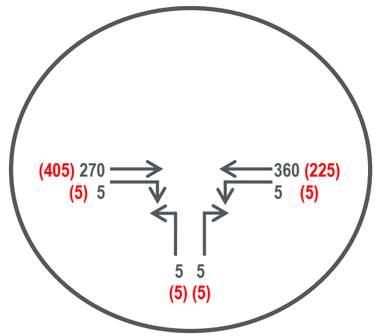
3. Maple St & Six Mile Rd



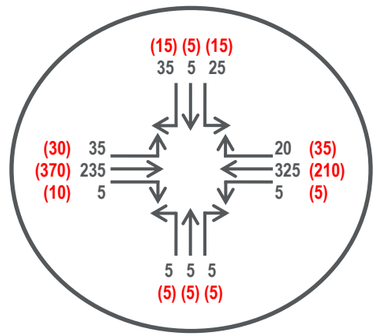
4. Maple St & Future Collector



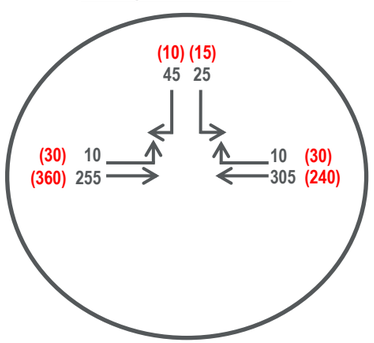
5. Maple St & Indian Hills Tr W



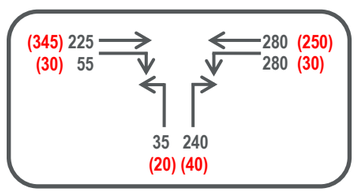
6. Maple St & Indian Hills Tr E/ Future Collector



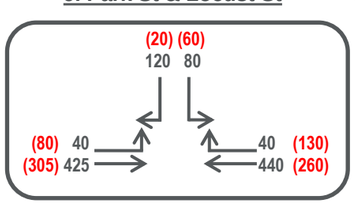
7. Maple St & Oak Rd



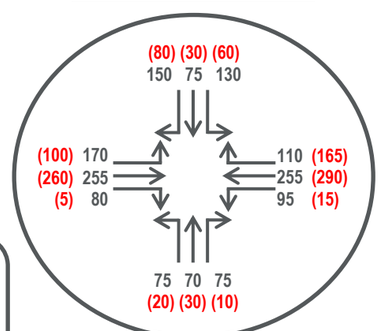
8. Park St & Intermediate School Driveway



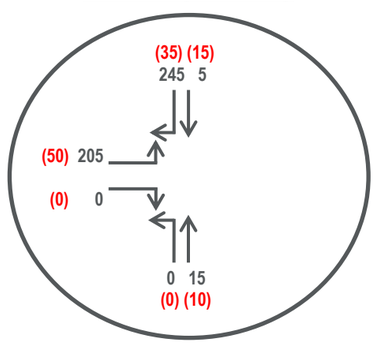
9. Park St & Locust St



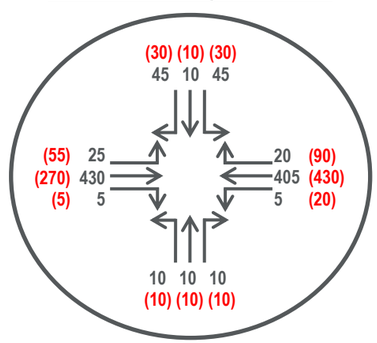
10. Park St & Sioux Blvd



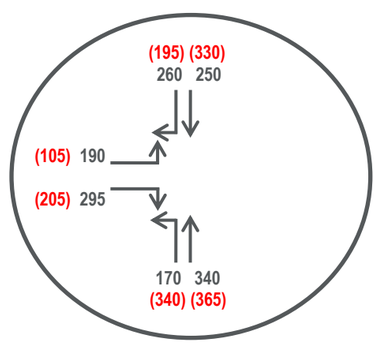
11. Sioux Blvd & Robert Bennis Elementary Driveway



12. Park St & Aspen Park Rd



13. Park St & SD11/Splitrock Blvd



2045 Traffic Forecasts (Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

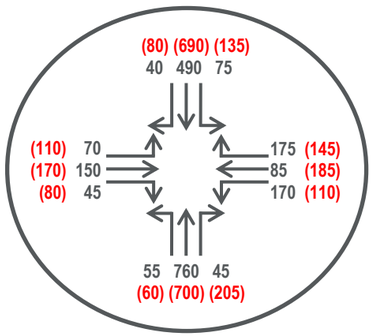
N

LEGEND

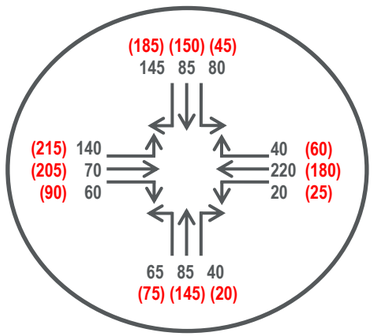
- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

FIGURE 2

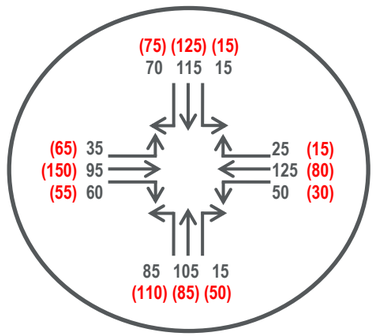
1. Maple St & Veterans Pkwy



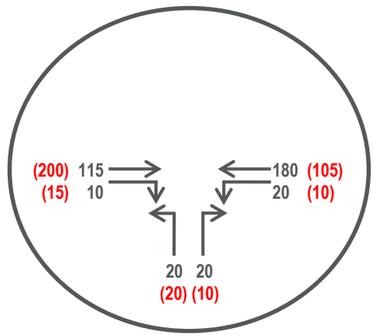
2. Maple St & Future Collector



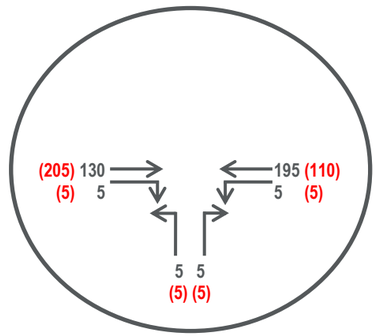
3. Maple St & Six Mile Rd



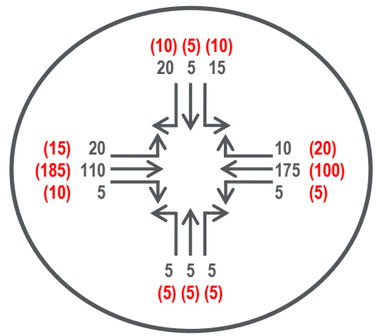
4. Maple St & Future Collector



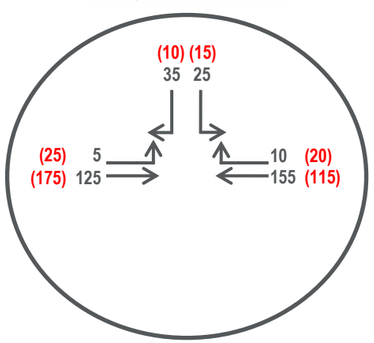
5. Maple St & Indian Hills Tr W



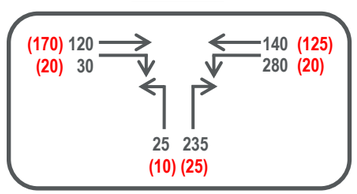
6. Maple St & Indian Hills Tr E/ Future Collector



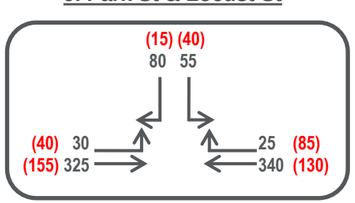
7. Maple St & Oak Rd



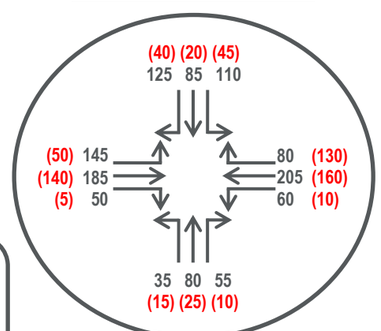
8. Park St & Intermediate School Driveway



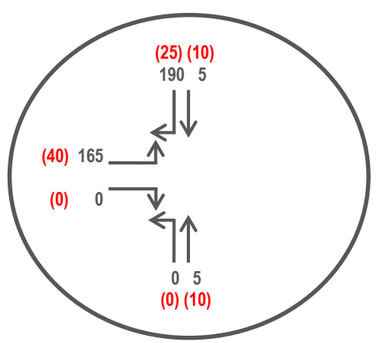
9. Park St & Locust St



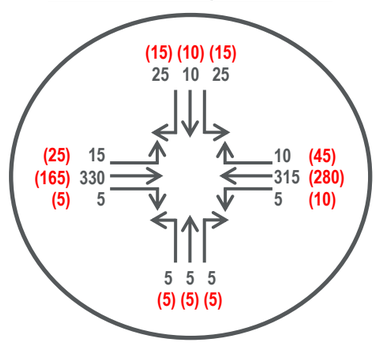
10. Park St & Sioux Blvd



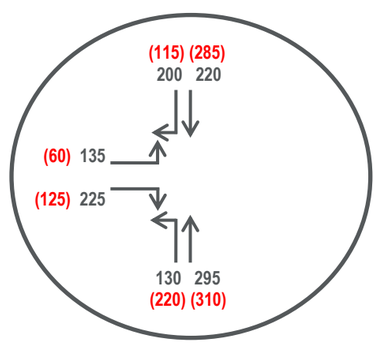
11. Sioux Blvd & Robert Bennis Elementary Driveway



12. Park St & Aspen Park Rd



13. Park St & SD11/Splitrock Blvd



2030 Traffic Forecasts (Interim Build Conditions)

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

N

LEGEND

- Study Intersection
- 1,900 — Daily Traffic Volumes
- 123 (456) — AM (PM) Peak Hour Traffic Volume

FIGURE 3

Traffic Operations Analysis Methodology

Peak hour level of service (LOS) was calculated for Maple Street/Park Street analysis intersections using Synchro/SimTraffic 10 traffic analysis software and methodology described in the 6th Edition of the Highway Capacity Manual (HCM6). HCM6 analysis methods measure intersection average control delay in terms of seconds of delay per vehicle (sec/veh) and applies a LOS value in accordance with thresholds presented in **Table 2**.

Table 2: Intersection Level of Service Thresholds

LOS	Intersection Delay per Vehicle (sec/veh)	
	Signalized Intersections	**Two-Way Stop-Control*, All-Way Stop-Control, and Roundabouts**
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 - 35	> 15 - 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Transportation Research Board, HCM6.

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

Weighted intersection delay was also calculated to present a second average delay measure for Maple Street/Park Street intersections that are stop-controlled from the local (minor) street approach. This method accounts for the operational benefits afforded to the major, high volume through movements that are not stop or signal-controlled at intersections. HCM6 reporting in Synchro 10 provides an average intersection delay value that reflects the weighted average delay of all vehicles entering the intersection. A LOS measure is applied to this average intersection delay value using HCM6 All-Way Stop-Control LOS thresholds.

The following minimum allowable LOS thresholds have been established for this study.

Signalized Intersections

- Minimum allowable LOS – LOS C
- Individual movements LOS D or better

Two-Way Stop-Controlled (TWSC) Intersections

- Minimum allowable LOS – LOS C
- Lower LOS may be acceptable as it is reported on the side-street approach

Build Conditions Traffic Operations Analysis

2045 Build Conditions

A summary of 2045 Build Conditions traffic operations analysis at the primary corridor intersections is provided in **Table 3**. Each intersection and adjoining corridor segment were built-out in the Synchro traffic model to achieve LOS goals for this study. The required, minimum intersection lane configurations are shown in **Figure 4**. The HCM6-based Synchro output sheets are provided in **Appendix A**.

Table 3: Maple Street/Park Street Corridor Intersections – 2045 Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	Signal	33.2	C	35.0	C
Six Mile Road	Signal	18.2	C	23.6	C
Locust Avenue	TWSC* (Weighted)	47.3 (8.6)	E (A)	20.7 (2.7)	C (A)
Sioux Boulevard	Signal	29.2	C	19.4	B
SD11/Splitrock Boulevard	Signal	16.3	B	15.0	B

* Two-way stop-control LOS reflects worst-case stop-controlled approach.
(Weighted) reflects the weighted average intersection delay and LOS.

Year 2045 corridor cross-section needs are summarized as follows:

- 5-lane section (2 through lanes in each direction): Veterans Parkway to Six Mile Road
- 3-lane section or 2-lane section with turn lanes (1 through lane in each direction): Six Mile Road to SD11/Splitrock Boulevard

The cross-section between Veterans Parkway and Six Mile Road could be narrowed between the primary, high-volume development access point(s) and Six Mile Road. In this analysis, a future north/south collector roadway was included between Veterans Parkway and Six Mile Road to load traffic onto the Maple Street/Park Street corridor. Volumes at this intersection demonstrate the magnitude of traffic accessing this development via Maple Street. However, it should be understood that there will likely be additional access points (in accordance with access management guidelines) that will spread this demand beyond a single access.

The current travel demand model shows office park type development around all four quadrants of the Veterans Parkway and Maple Park Street intersection. The bulk of the traffic accessing this office park is traveling on Veterans Parkway, thus volumes along Maple Street drop significantly east of the primary access points into/out of this development. Much of this development is not anticipated for several years, and thus the specific development density and traffic impacts are unknown beyond the planning level incorporated in the model. Therefore, it

is recommended that a 5-lane section be planned through this entire segment between Veterans Parkway and Six Mile Road.

Primary intersection build-out needs to meet study LOS goals in year 2045 are summarized as follows:

- Veterans Parkway
    - Full build-out needed to meet LOS goals
    - Signalize
- Six Mile Road
    - Left-turn lanes in all directions
    - SB and EB right-turn lanes
    - Signalize
- Locust Street
    - EB left-turn and WB left-turn lanes
    - Stop-control from Locust Street approach
    - Option to split out southbound left and right-turn movements.
        - In the high volume AM peak period, only a slight improvement in side-street delay was realized by splitting out left and right-turn movements (40.1 seconds with SB movements split vs. 47.3 from a shared lane)
- Sioux Boulevard
    - Left-turn lanes in all directions
    - Signalize
- SD11/Splitrock Boulevard
    - Split left and right-turn traffic on Park Street
    - NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
    - Signalize

2030 Interim Build Conditions

A summary of 2030 Interim Build Conditions traffic operations analysis at the primary corridor intersections is provided in **Table 4**. Each intersection and adjoining corridor segment were built-out in the Synchro traffic model to achieve LOS goals for this study. The required, minimum intersection lane configurations are shown in **Figure 4**. The HCM6-based Synchro output sheets are provided in **Appendix B**.

Table 4: Maple Street/Park Street Corridor Intersections – 2030 Interim Build Conditions

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Veterans Parkway	Signal	25.5	C	28.0	C
Six Mile Road	Signal AWSC	13.8 12.0	B B	16.0 12.9	B B
Locust Avenue	TWSC* (Weighted)	18.6 (3.2)	C (A)	11.7 (2.1)	B (A)
Sioux Boulevard	Signal	21.4	C	15.5	B
SD11/Splitrock Boulevard	Signal	11.7	B	11.7	B

* Two-way stop-control LOS reflects worst-case stop-controlled approach.
(Weighted) reflects the weighted average intersection delay and LOS.

Year 2030 corridor cross-section needs are summarized as follows:

- 3-lane section or 2-lane section with turn lanes (1 through lane in each direction): Veterans Parkway to SD11/Splitrock Boulevard

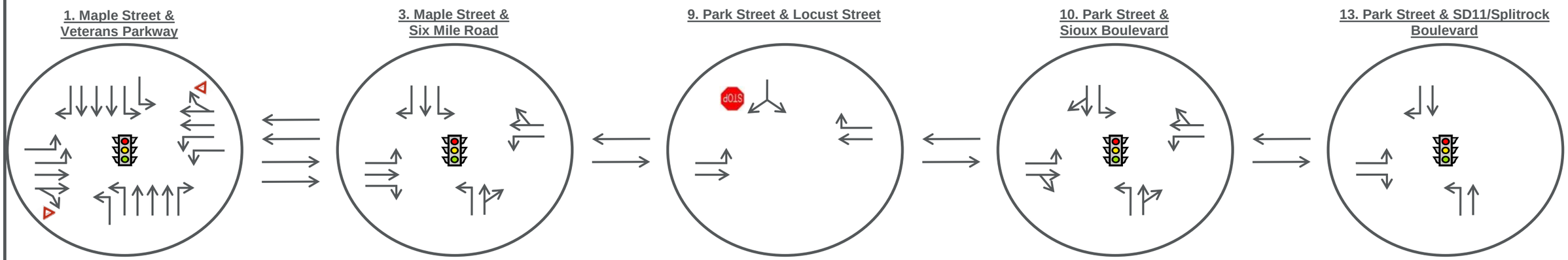
Primary intersection build-out needs to meet study LOS goals in year 2030 are summarized as follows:

- Veterans Parkway
  - Existing configuration for Veterans Parkway approaches
  - Left-turn lanes on Maple Street approaches
  - Signalize
- Six Mile Road
  - Left-turn lanes in all directions
  - Signalize or all-way stop-control
- Locust Street
  - EB left-turn and WB right-turn lanes
  - Stop-control from Locust Street approach
- Sioux Boulevard
  - Left-turn lanes in all directions
  - Signalize
- SD11/Splitrock Boulevard –
  - Split left and right-turn traffic on Park Street
  - NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
  - Signalize

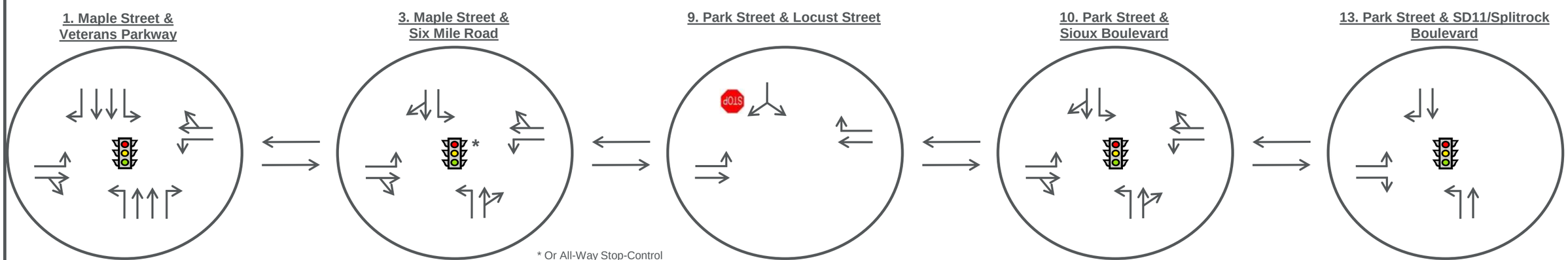
Providing a traffic signal or all-way stop-control at the Six Mile Road intersection is needed to meet 2030 Interim Build operational goals at this intersection. The all-way stop-control intersection was analyzed with the same configuration as the signalized intersection, as it would provide a smooth transition to signalization without the need for reconstruction to add left-turn lanes.

The SD11/Splitrock Boulevard intersection Build configuration was also analyzed as a TWSC intersection, stop-controlled from the Park Street approach. Resulting delay was 51.1 seconds and 63.2 seconds for the AM and PM peak period, respectively. Both of these values result in LOS F and do not meet LOS goals for this study.

2045 Minimum Build Conditions



2030 Minimum Interim Build Conditions



* Or All-Way Stop-Control

Minimum Build Conditions - Primary Intersections and Corridor Through Lanes

Maple Street/Park Street Corridor - Veterans Parkway to SD11/Splitrock Boulevard

Maple Street/Park Street Corridor Study

N

LEGEND

Intersection Approach Lane Configuration

Segment Through Lane Configuration

FIGURE 4

Sioux Boulevard Intersection Review without a Park Street Extension

The future Build Conditions were analyzed with an extension of Park Street to SD11/Splitrock Boulevard. This extension has a notable impact on traffic patterns along the eastern end of the study corridor, particularly along the Sioux Boulevard segment and at boundary intersections between Park Street and SD11/Splitrock Boulevard. The following summarizes future improvement needs if Park Street is not extended to SD11/Splitrock Boulevard and the Sioux Boulevard intersection with SD11/Splitrock Boulevard continues to serve as the primary access to/from the highway in the area.

The traffic volumes reflect those presented in the 2045 and 2030 No-Build Conditions, with 2045 volumes shown in **Figure 5**. These volumes include future development between Sioux Boulevard and SD11/Splitrock Boulevard, but assumes the majority of this traffic will enter/exit the roadway network via Sioux Boulevard and Aspen Boulevard. Volumes at and to the west of Locust Street intersection are consistent with the future traffic volumes presented in the preceding Build Conditions scenarios.

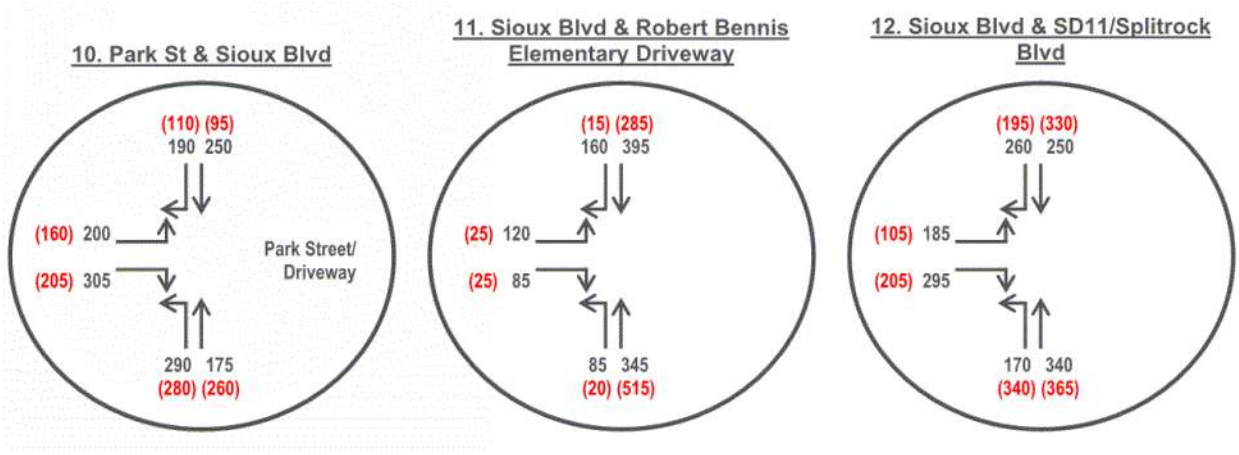


Figure 5: 2045 Peak Hour Traffic Volumes with No Park Street Extension

(As presented in the *Existing and Future No-Build Conditions Traffic Operations* technical memorandum)

A summary of the traffic operations analysis at the Park Street/Sioux Boulevard, and Sioux Boulevard/SD11/Splitrock Boulevard intersections are provided in **Table 5**. The HCM6-based Synchro output sheets are provided in **Appendix A**.

Table 5: Maple Street/Park Street Corridor Intersections – 2045 Build Conditions with No Park Street Extension

Maple Street/ Park Street Corridor Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Sioux Boulevard	Signal	29.2	C	14.7	B
SD11/Splitrock Boulevard	Signal	16.3	B	15.0	B

Without a Park Street extension to SD11/Splitrock Boulevard, the Sioux Boulevard segment south of Park Street experiences much greater demand. This leads to larger turning volumes onto Sioux Boulevard at both the Park Street and SD11/Splitrock Boulevard intersections.

At Park Street, the 2045 No-Build Conditions AM peak period operates at a LOS E. This is primarily due to the potential for a through vehicle blocking a high-volume right-turn movement. Providing a future right-turn lane and/or overlap for either the southbound or eastbound right-turn movement will address operational issues when necessitated by increased traffic demand. Timing of this need is dependent on future growth along the corridor and future access locations to development between Sioux Boulevard and SD11/Splitrock Boulevard, particularly if Park Street is a primary access to this development.

The operational results in the table for the Park Street and Sioux Boulevard intersections reflects an eastbound right-turn lane with right-turn overlap. This modification considers the potential for future traffic demand on the eastern Park Street approach. Similar operational benefits would be realized if a southbound right-turn lane were constructed.

At the Sioux Boulevard and SD11/Splitrock Boulevard intersection, the forecasted volumes and needed build-out to meet operational goals reflects what is identified for the Park Street and SD11/Splitrock Boulevard intersection:

- Split left and right-turn traffic on Sioux Boulevard
- NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
- Signalize

Intersection Traffic Signal Warrants

Traffic control signal warrants were reviewed at the following intersections based on findings from the future-year conditions operations analysis and/or other considerations as part of this study:

- Six Mile Road and Maple Street – future-year traffic operations
- Locust Street and Park Street – proximity to school and pedestrian crossings
- SD11/Splitrock Boulevard and Future Park Street – future-year traffic operations

This warrant analysis looks at future-year hourly traffic volumes reflective of the 2030 Interim Build Conditions and 2045 Build Conditions. Volumes were developed from existing counts collected in November 2018, which included:

- Four-hour counts at Six Mile Road and Locust Street intersections
- Eight-hour counts at SD11/Splitrock Boulevard

Growth factors based on straight-line growth between the 2018 Existing Conditions and 2045 Build Conditions peak hour volumes were applied to these counts. Separate growth factors were calculated for the morning and afternoon hours and applied to the traffic counts to develop future-year hourly volumes.

Methodology used in the review of future-conditions intersection traffic control is based on Chapter 4C of 2009 Manual on Uniform Traffic Control Devices (MUTCD). With available data, the traffic signal warrant review conducted using Highway Capacity Software version 7 (HCS7) focused on the following:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour

The following table summarizes findings at each evaluated intersection. More detailed output is provided in **Appendix C**.

Table 6: Traffic Signal Warrant Analysis Summary – Warrants 1-3

Maple Street/Park Street Intersection	2030			2045			Analysis Year Warrant Met
	Warrant 1 *8-Hour*	**Warrant 2** *4-Hour*	**Warrant 3** *Peak Hour*	**Warrant 1** *8-Hour*	**Warrant 2** *4-Hour*	**Warrant 3** *Peak Hour*	
Six Mile Road	n/a	-	-	n/a	**X**	**X**	**2045**
Locust Street	n/a	-	-	n/a	-	-	**Not met**
SD11/Splitrock Boulevard	-	**X**	**X**	-	**X**	**X**	**2030**

X indicates warrant met

No intersection meets Warrant 1, Eight-Hour Vehicular Volume.

Warrant 2, Four-Hour Vehicular Volume is met in year 2030 for the SD11/Splitrock Boulevard intersection and 2045 Six Mile Road intersection.

Warrant 3, Peak Hour volumes is met in year 2030 for the SD11/Splitrock Boulevard intersection and 2045 Six Mile Road intersection. However, Warrant 3 as a determining factor should be used with caution along this corridor. Other than the Locust Street intersection near the school, no intersections are considered an unusual case that attracts or discharges large number of vehicles over a short time as required for Warrant 3.

The Locust Street intersection was also reviewed for pedestrian volumes (Warrant 4) and proximity to a school and school crossings (Warrant 5).

- Warrant 4, Pedestrian Volumes
    - Counted pedestrian volumes do not meet conditions required to satisfy Warrant 4.
- Warrant 5, School Crossing
    - Available gaps in traffic and student volumes must meet conditions to satisfy Warrant 5.
        - Student volumes exceed the minimum of 20 students in the peak hour required. However, available gaps in traffic were not measured as part of this study.
        - Therefore, Warrant 5 was not met based on available data.

Guidance in the MUTCD does state that "*Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing"* (Section 4C.06.03). Current conditions satisfy three of the considerations noted in the MUTCD, with warning signs and flashers (pedestrian-activated flashing beacons), school speed zone, and a school crossing guard (school staff member at the intersection). Based on these findings and measures already in place, it is recommended this intersection continue to be monitored.

The remaining warrants were either not met or not applicable at the intersections and are summarized as follows:

- Warrant 6, Coordinated Signal System – none of the intersections are within a coordinated system.
- Warrant 7, Crash Experience – none of these intersections have experienced five or more reported crashes within a 12-month period over the last five years (see *Crash History* technical memorandum).
- Warrant 8, Roadway Network – intersection is not part of two major routes.
- Warrant 9, Grade Crossing – none of these intersections are near a grade crossing.

Pedestrian Hybrid Beacon Warrant

Warrants for a pedestrian hybrid beacon, often referred to as a HAWK system, were reviewed for a Park Street crossing near Locust Street. Chapter 4F of the 2009 MUTCD outlines procedures for the application, design, and operation of pedestrian hybrid beacons. In Section 4F.01, the MUTCD states: *"A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C), or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal."*

Guidelines for installation of a pedestrian hybrid beacon for a roadway with speeds of 35 mph or less is based on Figure 4F-1 in the MUTCD. A point is plotted on the figure that corresponds to vehicles per hour on the major street and pedestrian crossing volume of an average day.

Counts were taken at the Locust Street intersection on both September 11, 2018, and November 18, 2018. The September pedestrian volumes represent a typical crossing volume during good weather. The following summarize morning (AM) peak hour pedestrian crossing volumes (pedestrians per hour, pph) and vehicular volumes (vehicles per hour, vph) during on a typical day during good weather conducive to children walking to/from school.

Park Street Pedestrian Peak Hour Crossing Volume (2018 counts)

- West Leg: 56 pph
- East Leg: 17 pph
- Total/Consolidated North/South Park Street Crossings: 73 pph

Park Street 2-Way Vehicular Peak Hour Volume (2018 counts)

- West Leg: 539 vph
- East Leg: 547 vph

Park Street 2-Way Vehicular Peak Hour Volume (2030 Build Conditions forecast)

- West Leg: 1025 vph
- East Leg: 985 vph

For this review, the highest-volume cases were plotted on **Figure 6**, which includes:

- Pedestrian Peak Hour (AM) Crossing Volume: 73
    - Assumes a consolidated crossing point on the east or west side of Locust Street intersection.
- 2018 Peak Hour (AM) Vehicular Volume: 547 vph
- 2030 Peak Hour (AM) Vehicular Forecast Volume: 1025 vph
- Crossing Distance: approximately 45 feet (map measured)

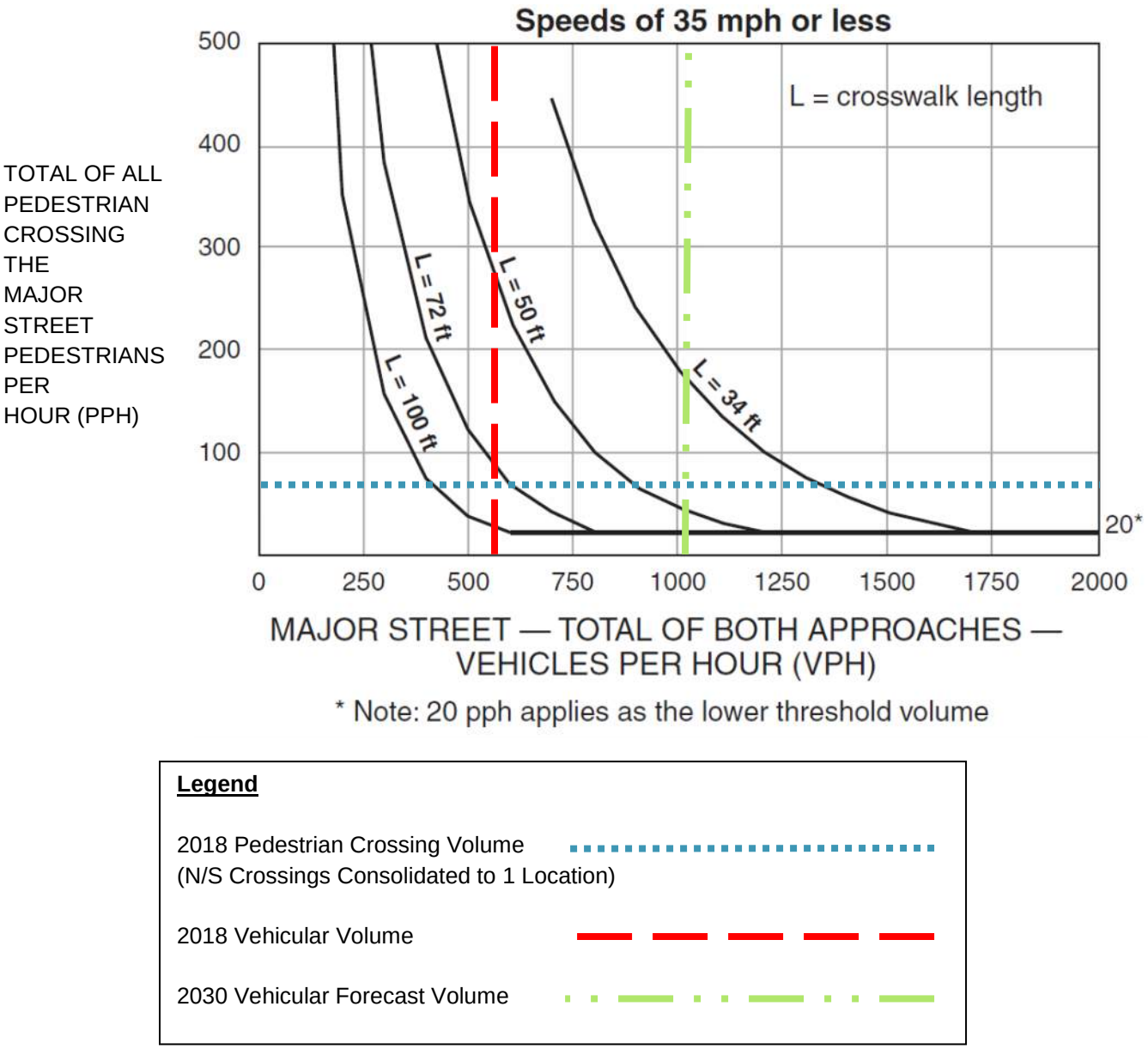


Figure 6: Park Street Crossing (at Locust Street) Pedestrian Hybrid Beacon Warrant Review
(Figure 4F-1, 2009 MUTCD)

As shown in **Figure 6**, the current pedestrian volumes and vehicular volumes do not meet guidelines for installation of a pedestrian hybrid beacon at this location. Given the anticipated growth along this corridor with the potential reconstruction of Maple Street to the west, volumes are expected to continue to increase towards a point where the warrant may be met. Based on a 45-foot crossing distance and 75 pedestrian crossings per hour, the vehicular volume where the warrant would be met is approximately 1,050 vph. It is recommended that as pedestrian crossing and vehicular volumes increase, the crossing be monitored and periodically reviewed.

Turn Lanes

A turn lane warrant analysis was conducted for study intersections and driveways along the Maple Street/Park Street corridor using 2030 Interim Build and 2045 Build Conditions traffic forecasts.

This evaluation serves as a tool to aid the study team in identifying intersection-related turn lane needs for incorporation in conceptual design. It does not require installation, or no installation, of a turn lane. However, turn lanes at high volume intersections and driveways will often provide operational and safety benefits to arterial roadway by minimizing through traffic hazards and interference.

Engineering judgment and other factors such as lane balance, access density, route continuity, or sight distance, contribute to the ultimate determination whether a turn lane is constructed. Additionally, future development intensity, timeframe, and desired access play a role in the level of demand at these future minor street intersections and driveways.

Primary Study Intersection Turn Lanes

Major street intersection turn lane needs were determined by operational analysis in the previous section. Minimum build configurations reflect the minimum turn lane needs at these primary study intersections.

Turn lanes beyond those needed to achieve study LOS goals provide operational benefits by reducing delay at signalized intersections. The following table summarizes the potential reduction in delay at the Maple Street/Park Street intersections with Six Mile Road and Sioux Boulevard.

Table 7: Maple Street/Park Street Intersections – 2045 Build Conditions Delay Comparison with Additional Right-Turn Lanes

Maple Street/ Park Street Intersection	Minimum Required Right-Turn Lanes[1]	Added Right-Turn Lanes[2]	AM Peak Period Avg. Delay (sec/veh)		PM Peak Period Avg. Delay (sec/veh)	
			Minimum Required Configuration	*W/ Additional RT Lanes*	*Minimum Required Configuration*	*W/ Additional RT Lanes*
Six Mile Road	EB, SB	NB, WB	18.2	17.1	23.6	21.0
Sioux Boulevard	None	EB, WB, NB, SB	29.2	17.9	19.4	15.2

[1] Configuration with minimum required turn lanes to meet study LOS goals, as presented in Table 3 and Figure 4.

[2] Configuration with right-turn lanes on all four intersection quadrants.

Sioux Boulevard analysis assumes extension of Park Street to SD11/Splitrock Boulevard.

Delay is reduced with the inclusion of additional right-turn lanes at both intersections. The reduction is most pronounced at the Sioux Boulevard intersection, as there were no right-turn lanes required to meet LOS goals for this study. Delay reduction at Six Mile Road was

significantly less as right-turn lanes were required, and thus already included, for the two movements with the greatest right-turn demand.

A summary of 2030 Interim Build Conditions is presented in **Table 8**.

Table 8: Maple Street/Park Street Intersections – 2030 Interim Build Conditions Delay Comparison with Additional Right-Turn Lanes

Maple Street/ Park Street Intersection	Minimum Required Right-Turn Lanes[1]	Added Right-Turn Lanes[2]	AM Peak Period Avg. Delay (sec/veh)		PM Peak Period Avg. Delay (sec/veh)	
			Minimum Required Configuration	*W/ Additional RT Lanes*	*Minimum Required Configuration*	*W/ Additional RT Lanes*
Six Mile Road	None	EB, WB, NB, SB	13.8	12.6	16.0	14.2
Sioux Boulevard	None	EB, WB, NB, SB	21.4	16.4	15.5	13.7

[1] Configuration with minimum required turn lanes to meet study LOS goals, as presented in Table 4 and Figure 4**.**

[2] Configuration with right-turn lanes on all four intersection quadrants.

Six Mile Road is signalized for this comparison.

Sioux Boulevard analysis assumes extension of Park Street to SD11/Splitrock Boulevard.

Minor Street Intersection/Driveway Access Turn Lane Review

Maple Street/Park Street approaches were evaluated at the following minor street or driveway access intersections:

- Future collector roadway (between Veterans Parkway to Six Mile Road)
- Future collector road (between Six Mile Road and Indian Hills Trail west)
- Indian Hills Trail west
- Indian Hills Trail east and future collector road
- Oak Road
- Intermediate School Drive
- Locust Street
- Robert Bennis Elementary School Drive
- Future Aspen Park Road

Turn lane warrant criteria used in this analysis is based on standards for turn lanes presented in the City of Sioux Falls Design Standards and City of Brandon Design Standards. These standards consider the relationship between traffic volumes, posted (or future) speed limits, and the number of lanes on the facility in the determination of whether a turn lane is warranted. Analysis conditions reflect those established in the 2030 Interim Build Conditions and 2045 Build Conditions scenarios, respectively.

The following table summarizes Maple Street/Park Street intersection approach locations that meet turn lane warrant criteria. Additional details of this evaluation are provided in **Appendix D**.

Table 9: Maple Street/Park Street Corridor Minor Street/Driveway Access Intersections – Turn Lane Volume Warrant Review

Minor Intersection or Access Driveway	Turn Movement	2030 Turn Lane Volume Warrant Satisfied?	2045 Turn Lane Volume Warrant Satisfied?
Future Collector Road (between Veterans Parkway and Six Mile Road)	EB LT	Yes	Yes
	EB RT	Yes	Yes
	WB LT	Yes	Yes
	WB RT	Yes	Yes
Future Collector Road (between Six Mile Road and IHT west)	EB RT	Yes	Yes
	WB LT	Yes	Yes
Indian Hills Trail (west)	EB RT	No	No
	WB LT	No	No
Indian Hills Trail (east) and Future Collector Road	EB LT	Yes	Yes
	EB RT	No	No
	WB LT	No	No
	WB RT	Yes	Yes
Oak Road	EB LT	Yes	Yes
	WB RT	Yes	Yes
Intermediate School Drive	EB RT	No	No
	WB LT	Yes	Yes
Locust Street	EB LT	Yes	Yes
	WB RT	Yes	Yes
Robert Bennis Elementary School Drive**	NB LT	Yes	Yes
	SB RT	Yes	Yes
Future Aspen Park Road**	EB LT	No	Yes
	EB RT	No	No
	WB LT	No	No
	WB RT	No	Yes

** Volumes for these two intersections reflect the highest volume condition from a potential Park Street extension. Robert Bennis Elementary School Drive shows conditions without the Park Street extension and Aspen Park Road is shown with the Park Street extension.

Overall, turn lanes along Maple Street/Park Street at minor street/driveway access intersections are typically warranted throughout the corridor. Indian Hills Trail intersections exhibit the greatest propensity for turning volumes to not meet warrants. However, there are several existing or planned access locations in this area (Indian Hills Trail east and west, Oak Road, and proposed collector roads) and future development in this area is anticipated. It is

recommended that turn lanes be planned through this location to not constrain inclusion when addressing future needs.

Turn Lane Design

Turn lane design guidelines along Maple Street/Park Street and local cross-streets are based on City of Sioux Falls Design Standards and City of Brandon Design Standards. Turn lane design guidelines on Veterans Parkway and SD11/Splitrock Boulevard are based on design guidelines presented in the South Dakota Department of Transportation (SDDOT) Road Design Manual. Recommended minimum turn lane lengths are provided in **Appendix E**.

Recommendations

The following summarizes minimum build recommendations for the Maple Street/Park Street corridor for years 2030 and 2045.

2045 Build Conditions

Maple Street/Park Street Corridor Cross-Section

- Veterans Parkway to Six Mile Road: minimum of two through lanes in each direction
    - 5-lane section (includes center left-turn lane)
- Six Mile Road to SD11/Splitrock Boulevard: minimum of one through lane in each direction
    - 3-lane section (includes center left-turn lane or 2-lane section with left-turn lane

Primary Intersection Configurations and Traffic Control

- Veterans Parkway
    - Full build-out needed to meet LOS goals
    - Signalize
- Six Mile Road
    - Left-turn lanes in all directions
    - SB and EB right-turn lanes
    - Signalize
- Locust Street
    - EB left-turn and WB left-turn lanes
    - Stop-control from Locust Street approach
- Sioux Boulevard
    - Left-turn lanes in all directions
    - Signalize
- SD11/Splitrock Boulevard
    - Split left and right-turn traffic on Park Street
    - NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
    - Signalize

Minor Street/Driveway Intersections

All other intersections are recommended to be stop-controlled from the minor-street approach with turn lanes as identified in **Table 9**.

Additional Considerations

It is recommended that turn lanes be considered at all locations along the Maple Street/Park Street corridor where warrants were not met or traffic operations did not require installation to meet study LOS goals. The inclusion of turn lanes at these locations provides operational and safety benefits to traffic traversing the corridor by removing turning traffic from the through lanes.

Consideration should be given to a future 5-lane cross-section needs throughout the corridor beyond year 2045. As a primary east/west corridor in the northeast part of the Sioux Falls metropolitan area, it is anticipated that future traffic volumes will continue to rise. A long range plan of potentially extending Park Street across the Big Sioux River would provide direct access to the Maple Street/Park Street corridor for another part of Brandon. To the west, a possible extension of Maple Street over to Rice Street provides another east/west connection that would be of interest to many motorists.

If Park Street is not extended to SD11/Splitrock Boulevard, right-turn lanes with right-turn overlap signal phasing should be considered as traffic volumes increase at the Park Street and Sioux Boulevard intersection. The extent and timeframe of this modification is dependent upon whether future development between Sioux Boulevard and SD11/Splitrock Boulevard will use Park Street as a primary access point.

2030 Interim Build

Maple Street/Park Street Corridor Cross-Section

- Veterans Parkway to Six Mile Road: minimum of one through lane in each direction
    - 3-lane section or 2-lane section with left-turn lane
    - Layout should consider future expansion to 5-lane section
- Six Mile Road to SD11/Splitrock Boulevard: minimum of one through lane in each direction
    - 3-lane section or 2-lane section with left-turn lane

Primary Intersection Configurations and Traffic Control

- Veterans Parkway
    - Existing configuration for Veterans Parkway approaches
    - Left-turn lanes on Maple Street approaches
    - Signalize
- Six Mile Road
    - Left-turn lanes in all directions
    - Signalize or all-way stop-control
- Locust Street

  - EB left-turn and WB right-turn lanes
  - Stop-control from Locust Street approach
- Sioux Boulevard
  - Left-turn lanes in all directions
  - Signalize
- SD11/Splitrock Boulevard
  - Split left and right-turn traffic on Park Street
  - NB left-turn lane and SB right-turn lane on SD11/Splitrock Boulevard
  - Signalize

Minor Street/Driveway Intersections

Similar to the year 2045 minimum build recommendations, all other intersections are recommended to be stop-controlled from the minor-street approach with turn lanes as identified in **Table 9**.

Additional Considerations

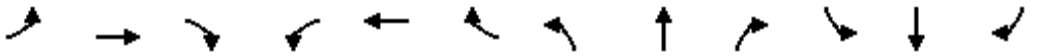
It is recommended that turn lanes be considered at all locations where warrants were not met due to the operational and safety benefits they provide to traffic along the Maple Street/Park Street corridor.

It is also recommended that the development of 2030 improvements consider needs identified in the 2045 Build Conditions, such as future cross-sectional needs, turn lanes, and intersection traffic control. In many instances, inclusion of these turn lane and traffic control improvements in year 2030 will provide operational and safety benefits to traffic traversing the corridor.

Appendix

A. 2045 Build Conditions Synchro (HCM6) Reports
B. 2030 Interim Build Conditions Synchro (HCM6) Reports
C. HCS7 Signal Warrant Analysis Reports
D. Minor Street/Driveway Access Intersection Turn Lane Warrant Review
E. Turn Lane Design Spreadsheets and SimTraffic Output

Appendix A. 2045 Build Conditions Synchro (HCM6) and SimTraffic Reports



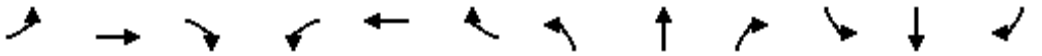
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	255	80	95	255	110	75	70	75	130	75	150
Future Volume (veh/h)	170	255	80	95	255	110	75	70	75	130	75	150
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	212	319	100	119	319	138	94	88	94	162	94	188
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	310	450	141	323	357	155	230	158	169	318	110	219
Arrive On Green	0.11	0.37	0.37	0.07	0.33	0.33	0.06	0.22	0.22	0.07	0.22	0.22
Sat Flow, veh/h	1569	1202	377	1569	1090	472	1569	729	778	1569	490	980
Grp Volume(v), veh/h	212	0	419	119	0	457	94	0	182	162	0	282
Grp Sat Flow(s),veh/h/ln	1569	0	1579	1569	0	1562	1569	0	1507	1569	0	1471
Q Serve(g_s), s	6.6	0.0	17.3	3.8	0.0	21.3	3.5	0.0	8.2	5.3	0.0	14.1
Cycle Q Clear(g_c), s	6.6	0.0	17.3	3.8	0.0	21.3	3.5	0.0	8.2	5.3	0.0	14.1
Prop In Lane	1.00		0.24	1.00		0.30	1.00		0.52	1.00		0.67
Lane Grp Cap(c), veh/h	310	0	591	323	0	512	230	0	327	318	0	329
V/C Ratio(X)	0.68	0.00	0.71	0.37	0.00	0.89	0.41	0.00	0.56	0.51	0.00	0.86
Avail Cap(c_a), veh/h	320	0	723	323	0	633	237	0	467	318	0	460
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.5	0.0	20.4	16.7	0.0	24.4	22.5	0.0	26.7	23.4	0.0	28.5
Incr Delay (d2), s/veh	5.7	0.0	2.5	0.7	0.0	13.0	1.2	0.0	1.5	1.3	0.0	11.1
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.7	0.0	6.3	1.3	0.0	9.2	1.3	0.0	3.0	2.3	0.0	5.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.2	0.0	22.9	17.4	0.0	37.5	23.6	0.0	28.2	24.7	0.0	39.6
LnGrp LOS	C	A	C	B	A	D	C	A	C	C	A	D
Approach Vol, veh/h		631			576			276			444	
Approach Delay, s/veh		23.0			33.3			26.6			34.1	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.8	22.1	10.0	34.6	9.3	22.6	13.5	31.1
Change Period (Y+Rc), s	4.5	5.5	5.0	6.0	4.5	5.5	5.0	6.0
Max Green Setting (Gmax), s	5.3	23.7	5.0	35.0	5.1	23.9	9.0	31.0
Max Q Clear Time (g_c+I1), s	7.3	10.2	5.8	19.3	5.5	16.1	8.6	23.3
Green Ext Time (p_c), s	0.0	0.8	0.0	2.4	0.0	1.0	0.0	1.8

Intersection Summary	
HCM 6th Ctrl Delay	29.2
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.



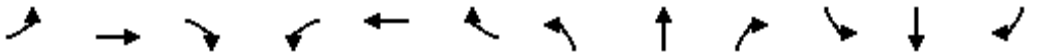
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	405	130	295	225	405	25	1515	100	85	1000	65
Future Volume (veh/h)	110	405	130	295	225	405	25	1515	100	85	1000	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778
Adj Flow Rate, veh/h	122	450	0	328	250	0	28	1683	111	94	1111	72
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	185	547		391	759		74	1813	742	149	1924	682
Arrive On Green	0.06	0.16	0.00	0.12	0.22	0.00	0.02	0.37	0.37	0.05	0.40	0.40
Sat Flow, veh/h	3285	3467	0	3285	3467	0	3285	4854	1507	3285	4854	1507
Grp Volume(v), veh/h	122	450	0	328	250	0	28	1683	111	94	1111	72
Grp Sat Flow(s),veh/h/ln	1642	1689	0	1642	1689	0	1642	1618	1507	1642	1618	1507
Q Serve(g_s), s	3.2	11.4	0.0	8.6	5.5	0.0	0.7	29.4	3.6	2.5	15.8	2.4
Cycle Q Clear(g_c), s	3.2	11.4	0.0	8.6	5.5	0.0	0.7	29.4	3.6	2.5	15.8	2.4
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	185	547		391	759		74	1813	742	149	1924	682
V/C Ratio(X)	0.66	0.82		0.84	0.33		0.38	0.93	0.15	0.63	0.58	0.11
Avail Cap(c_a), veh/h	205	651		391	811		149	1831	748	149	1924	682
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.8	35.8	0.0	38.1	28.6	0.0	42.5	26.5	12.3	41.4	20.9	13.9
Incr Delay (d2), s/veh	6.7	7.2	0.0	14.9	0.3	0.0	3.2	8.8	0.1	8.3	0.4	0.1
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.4	5.0	0.0	4.1	2.1	0.0	0.3	11.2	1.1	1.1	5.3	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.5	43.0	0.0	53.0	28.9	0.0	45.7	35.3	12.4	49.7	21.3	14.0
LnGrp LOS	D	D		D	C		D	D	B	D	C	B
Approach Vol, veh/h		572	A		578	A		1822			1277	
Approach Delay, s/veh		44.0			42.6			34.1			23.0	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	39.5	17.0	19.8	10.0	41.5	11.5	25.3
Change Period (Y+Rc), s	8.0	6.5	6.5	5.5	8.0	6.5	6.5	5.5
Max Green Setting (Gmax), s	4.0	33.3	10.5	17.0	4.0	33.3	5.5	21.2
Max Q Clear Time (g_c+I1), s	4.5	31.4	10.6	13.4	2.7	17.8	5.2	7.5
Green Ext Time (p_c), s	0.0	1.6	0.0	0.9	0.0	6.3	0.0	1.1

Intersection Summary	
HCM 6th Ctrl Delay	33.2
HCM 6th LOS	C

Notes

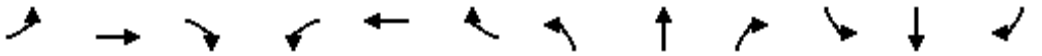
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	200	130	90	245	40	185	170	30	30	200	150
Future Volume (veh/h)	80	200	130	90	245	40	185	170	30	30	200	150
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Adj Flow Rate, veh/h	100	250	162	112	306	50	231	212	38	38	250	188
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	277	585	696	328	491	80	400	430	77	362	338	286
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.14	0.31	0.31	0.03	0.20	0.20
Sat Flow, veh/h	917	1673	1418	871	1403	229	1594	1381	248	1594	1673	1418
Grp Volume(v), veh/h	100	250	162	112	0	356	231	0	250	38	250	188
Grp Sat Flow(s),veh/h/ln	917	1673	1418	871	0	1632	1594	0	1629	1594	1673	1418
Q Serve(g_s), s	6.0	6.7	3.8	6.6	0.0	10.6	6.2	0.0	7.3	1.1	8.2	7.1
Cycle Q Clear(g_c), s	16.6	6.7	3.8	13.3	0.0	10.6	6.2	0.0	7.3	1.1	8.2	7.1
Prop In Lane	1.00		1.00	1.00		0.14	1.00		0.15	1.00		1.00
Lane Grp Cap(c), veh/h	277	585	696	328	0	571	400	0	507	362	338	286
V/C Ratio(X)	0.36	0.43	0.23	0.34	0.00	0.62	0.58	0.00	0.49	0.11	0.74	0.66
Avail Cap(c_a), veh/h	427	858	927	470	0	837	530	0	919	420	686	582
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.7	14.5	8.6	19.6	0.0	15.8	14.5	0.0	16.4	17.6	21.9	21.5
Incr Delay (d2), s/veh	0.8	0.5	0.2	0.6	0.0	1.1	1.3	0.0	0.7	0.1	3.2	2.6
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.2	2.2	0.9	1.2	0.0	3.4	1.9	0.0	2.3	0.4	3.1	2.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.5	15.0	8.7	20.2	0.0	16.9	15.8	0.0	17.1	17.8	25.1	24.1
LnGrp LOS	C	B	A	C	A	B	B	A	B	B	C	C
Approach Vol, veh/h		512			468			481			476	
Approach Delay, s/veh		14.7			17.7			16.5			24.1	
Approach LOS		B			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	24.2		26.5	14.2	17.8		26.5				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	4.0	33.0		30.0	13.0	24.0		30.0				
Max Q Clear Time (g_c+I1), s	3.1	9.3		18.6	8.2	10.2		15.3				
Green Ext Time (p_c), s	0.0	1.3		1.9	0.3	1.6		2.2				

Intersection Summary			
HCM 6th Ctrl Delay		18.2	
HCM 6th LOS		B	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	310	150	130	35	460	85	140	190	80	180	185	325
Future Volume (veh/h)	310	150	130	35	460	85	140	190	80	180	185	325
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Adj Flow Rate, veh/h	388	188	162	44	575	106	175	238	100	225	231	406
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	465	581	492	353	725	324	324	339	332	366	403	555
Arrive On Green	0.15	0.35	0.35	0.03	0.23	0.23	0.09	0.20	0.20	0.13	0.24	0.24
Sat Flow, veh/h	3092	1673	1418	1594	3180	1418	1594	1673	1418	1594	1673	1418
Grp Volume(v), veh/h	388	188	162	44	575	106	175	238	100	225	231	406
Grp Sat Flow(s),veh/h/ln	1546	1673	1418	1594	1590	1418	1594	1673	1418	1594	1673	1418
Q Serve(g_s), s	9.5	6.4	6.6	1.6	13.3	4.9	6.8	10.3	4.5	8.6	9.5	18.8
Cycle Q Clear(g_c), s	9.5	6.4	6.6	1.6	13.3	4.9	6.8	10.3	4.5	8.6	9.5	18.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	465	581	492	353	725	324	324	339	332	366	403	555
V/C Ratio(X)	0.83	0.32	0.33	0.12	0.79	0.33	0.54	0.70	0.30	0.61	0.57	0.73
Avail Cap(c_a), veh/h	515	654	554	425	957	427	324	339	332	366	403	555
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.2	18.7	18.8	22.0	28.4	25.1	22.2	28.9	24.6	21.1	26.1	20.3
Incr Delay (d2), s/veh	10.5	0.3	0.4	0.2	3.4	0.6	1.8	6.4	0.5	3.1	2.0	4.9
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	4.0	2.3	0.1	0.6	5.0	1.6	2.6	4.6	1.5	3.3	3.9	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.7	19.1	19.2	22.2	31.8	25.7	24.0	35.3	25.1	24.2	28.1	25.2
LnGrp LOS	D	B	B	C	C	C	C	D	C	C	C	C
Approach Vol, veh/h		738			725			513			862	
Approach Delay, s/veh		31.5			30.3			29.5			25.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	32.6	13.2	23.8	17.7	23.3	16.2	20.8
Change Period (Y+Rc), s	6.0	5.5	6.0	5.0	6.0	5.5	6.0	5.0
Max Green Setting (Gmax), s	6.0	30.5	7.2	18.8	13.0	23.5	10.2	15.8
Max Q Clear Time (g_c+I1), s	3.6	8.6	8.8	20.8	11.5	15.3	10.6	12.3
Green Ext Time (p_c), s	0.0	1.5	0.0	0.0	0.2	2.5	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	29.1
HCM 6th LOS	C

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	190	295	170	340	250	260
Future Volume (veh/h)	190	295	170	340	250	260
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	238	369	212	425	312	325
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	489	435	378	825	419	790
Arrive On Green	0.31	0.31	0.13	0.50	0.25	0.25
Sat Flow, veh/h	1581	1407	1581	1660	1660	1407
Grp Volume(v), veh/h	238	369	212	425	312	325
Grp Sat Flow(s),veh/h/ln	1581	1407	1581	1660	1660	1407
Q Serve(g_s), s	7.3	14.6	5.4	10.3	10.3	7.8
Cycle Q Clear(g_c), s	7.3	14.6	5.4	10.3	10.3	7.8
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	489	435	378	825	419	790
V/C Ratio(X)	0.49	0.85	0.56	0.51	0.74	0.41
Avail Cap(c_a), veh/h	798	710	655	1354	656	991
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.7	19.2	13.6	10.1	20.5	7.4
Incr Delay (d2), s/veh	0.8	5.3	1.3	0.5	2.7	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	10.9	1.5	2.6	3.5	3.6
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.4	24.5	14.9	10.6	23.1	7.8
LnGrp LOS	B	C	B	B	C	A
Approach Vol, veh/h	607			637	637	
Approach Delay, s/veh	21.7			12.1	15.3	
Approach LOS	C			B	B	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		36.1		23.4	14.6	21.5
Change Period (Y+Rc), s		6.5		5.0	7.0	6.5
Max Green Setting (Gmax), s		48.5		30.0	18.0	23.5
Max Q Clear Time (g_c+I1), s		12.3		16.6	7.4	12.3
Green Ext Time (p_c), s		2.3		1.8	0.4	2.1

Intersection Summary		
HCM 6th Ctrl Delay	16.3	
HCM 6th LOS	B	

Intersection	
Int Delay, s/veh	8.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	40	425	440	40	80	120
Future Vol, veh/h	40	425	440	40	80	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	250	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	531	550	50	100	150

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	600	0	-	0	1181	550
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	631	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	977	-	-	-	210	535
Stage 1	-	-	-	-	578	-
Stage 2	-	-	-	-	530	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	977	-	-	-	199	535
Mov Cap-2 Maneuver	-	-	-	-	199	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	530	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	47.3
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	977	-	-	-	319
HCM Lane V/C Ratio	0.051	-	-	-	0.784
HCM Control Delay (s)	8.9	-	-	-	47.3
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0.2	-	-	-	6.3

Intersection: 2: Sioux Boulevard & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	177	226	202	312	86	179	153	236
Average Queue (ft)	72	124	47	158	41	84	61	111
95th Queue (ft)	132	212	111	257	78	148	120	187
Link Distance (ft)		1003		595		273		1519
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	250		250		200		250	
Storage Blk Time (%)		0		1		0		0
Queuing Penalty (veh)		0		1		0		0

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	TR	L	L	T	TR	L	L	T	T
Maximum Queue (ft)	88	138	246	237	160	177	174	281	37	69	304	306
Average Queue (ft)	20	62	154	132	80	96	72	154	5	23	204	209
95th Queue (ft)	61	113	226	218	133	149	138	264	24	56	274	283
Link Distance (ft)			1327	1327			1874	1874			3184	3184
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350	350			350	350			535	535		
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	T	R	L	L	T	T	T	R
Maximum Queue (ft)	291	95	108	82	222	208	190	73
Average Queue (ft)	176	34	42	30	139	130	89	19
95th Queue (ft)	259	79	84	68	202	195	172	51
Link Distance (ft)	3184				2560	2560	2560	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		535	535	535				535
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 6: Six Mile Road & Maple/Park Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	TR	L	TR	L	T	R
Maximum Queue (ft)	107	136	84	118	223	139	139	48	156	129
Average Queue (ft)	41	60	30	50	93	62	57	15	76	67
95th Queue (ft)	86	116	67	98	163	111	111	40	136	119
Link Distance (ft)		1814			1043		3030		2476	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	350		350	350		350		350		350
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 10: Indian Hills Trail (E)/Future Collector N (IHT North) & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	44	10	23	69
Average Queue (ft)	9	0	9	25
95th Queue (ft)	32	6	27	51
Link Distance (ft)			1126	1325
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	350	350		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: Indian Hills Trail (W) & Maple/Park Street

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	22	39
Average Queue (ft)	1	8
95th Queue (ft)	10	31
Link Distance (ft)	650	1413
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Maple/Park Street & Oak Road

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	29	56
Average Queue (ft)	3	25
95th Queue (ft)	15	48
Link Distance (ft)		1435
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 16: Intermediate School Drive & Maple/Park Street

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	17	97	43	197
Average Queue (ft)	1	48	1	76
95th Queue (ft)	8	88	30	140
Link Distance (ft)	4292		215	546
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)		100		
Storage Blk Time (%)		0		
Queuing Penalty (veh)		1		

Intersection: 18: Maple/Park Street & Locust Street

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	50	4	132
Average Queue (ft)	16	0	61
95th Queue (ft)	44	3	107
Link Distance (ft)		1003	324
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	100		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Sioux Boulevard & Robert Bennis Driveway

Movement	EB	SB
Directions Served	L	R
Maximum Queue (ft)	72	15
Average Queue (ft)	37	0
95th Queue (ft)	59	11
Link Distance (ft)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	85	75
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 21: SD11/Splitrock Boulevard & Sioux Boulevard

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Aspen Park Road & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	71	85	31	68
Average Queue (ft)	15	15	6	19
95th Queue (ft)	53	54	26	52
Link Distance (ft)	595	820	390	470
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	125	155	163	128	60	177	160	112	132	202	113	142
Average Queue (ft)	70	84	54	45	17	101	96	46	63	95	38	76
95th Queue (ft)	117	132	123	101	46	154	148	92	108	165	86	126
Link Distance (ft)			1874	1874		1814	1814			1097		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350	350			350			350	350		350	350
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	194	220
Average Queue (ft)	92	105
95th Queue (ft)	164	184
Link Distance (ft)	1108	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		350
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 29: Future Collector South (6 Mile - IHT) & Maple/Park Street

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	34	74
Average Queue (ft)	6	27
95th Queue (ft)	25	51
Link Distance (ft)		1001
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 32: SD11/Splitrock Boulevard

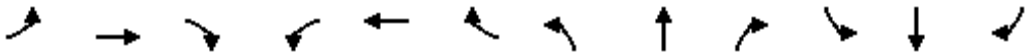
Movement	EB	EB	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	164	223	130	158	237	118
Average Queue (ft)	77	114	64	72	98	51
95th Queue (ft)	138	185	111	133	180	99
Link Distance (ft)		820			1846	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	350		350			350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 2

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street

03/08/2019



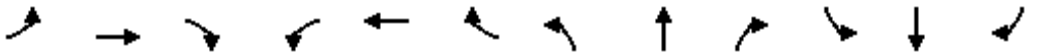
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	260	5	15	290	165	20	30	10	60	30	80
Future Volume (veh/h)	100	260	5	15	290	165	20	30	10	60	30	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	125	325	6	19	362	206	25	38	12	75	38	100
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	302	762	14	502	418	238	221	131	41	314	56	147
Arrive On Green	0.07	0.47	0.47	0.02	0.42	0.42	0.03	0.11	0.11	0.06	0.14	0.14
Sat Flow, veh/h	1569	1612	30	1569	985	561	1569	1200	379	1569	401	1056
Grp Volume(v), veh/h	125	0	331	19	0	568	25	0	50	75	0	138
Grp Sat Flow(s),veh/h/ln	1569	0	1642	1569	0	1546	1569	0	1579	1569	0	1457
Q Serve(g_s), s	2.7	0.0	8.3	0.4	0.0	20.8	0.9	0.0	1.8	2.6	0.0	5.6
Cycle Q Clear(g_c), s	2.7	0.0	8.3	0.4	0.0	20.8	0.9	0.0	1.8	2.6	0.0	5.6
Prop In Lane	1.00		0.02	1.00		0.36	1.00		0.24	1.00		0.72
Lane Grp Cap(c), veh/h	302	0	776	502	0	656	221	0	173	314	0	203
V/C Ratio(X)	0.41	0.00	0.43	0.04	0.00	0.87	0.11	0.00	0.29	0.24	0.00	0.68
Avail Cap(c_a), veh/h	316	0	1027	592	0	967	302	0	347	381	0	351
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.7	0.0	10.8	9.9	0.0	16.3	23.7	0.0	25.5	22.7	0.0	25.5
Incr Delay (d2), s/veh	0.9	0.0	0.4	0.0	0.0	5.7	0.2	0.0	0.9	0.4	0.0	3.9
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	0.9	0.0	2.7	0.1	0.0	7.4	0.3	0.0	0.7	0.9	0.0	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.6	0.0	11.2	9.9	0.0	22.0	23.9	0.0	26.4	23.1	0.0	29.4
LnGrp LOS	B	A	B	A	A	C	C	A	C	C	A	C
Approach Vol, veh/h		456			587			75			213	
Approach Delay, s/veh		11.9			21.6			25.6			27.2	
Approach LOS		B			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	12.3	6.4	35.5	6.3	14.2	9.4	32.5
Change Period (Y+Rc), s	4.5	5.5	5.0	6.0	4.5	5.5	5.0	6.0
Max Green Setting (Gmax), s	6.3	13.7	5.0	39.0	5.0	15.0	5.0	39.0
Max Q Clear Time (g_c+I1), s	4.6	3.8	2.4	10.3	2.9	7.6	4.7	22.8
Green Ext Time (p_c), s	0.0	0.1	0.0	2.1	0.0	0.4	0.0	3.6

Intersection Summary	
HCM 6th Ctrl Delay	19.4
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.



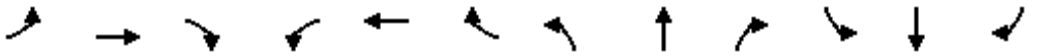
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	370	170	230	405	315	125	1335	450	295	1285	175
Future Volume (veh/h)	235	370	170	230	405	315	125	1335	450	295	1285	175
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807
Adj Flow Rate, veh/h	261	411	0	256	450	0	139	1483	500	328	1428	194
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	329	582		332	585		202	1680	674	406	1981	766
Arrive On Green	0.10	0.17	0.00	0.10	0.17	0.00	0.06	0.34	0.34	0.12	0.40	0.40
Sat Flow, veh/h	3338	3523	0	3338	3523	0	3338	4932	1531	3338	4932	1531
Grp Volume(v), veh/h	261	411	0	256	450	0	139	1483	500	328	1428	194
Grp Sat Flow(s),veh/h/ln	1669	1716	0	1669	1716	0	1669	1644	1531	1669	1644	1531
Q Serve(g_s), s	7.5	11.1	0.0	7.4	12.3	0.0	4.0	27.9	26.8	9.4	24.0	7.1
Cycle Q Clear(g_c), s	7.5	11.1	0.0	7.4	12.3	0.0	4.0	27.9	26.8	9.4	24.0	7.1
Prop In Lane	1.00		0.00	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	329	582		332	585		202	1680	674	406	1981	766
V/C Ratio(X)	0.79	0.71		0.77	0.77		0.69	0.88	0.74	0.81	0.72	0.25
Avail Cap(c_a), veh/h	390	923		525	1062		271	1727	688	576	2177	827
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.4	38.6	0.0	43.3	39.0	0.0	45.4	30.6	22.9	42.2	24.8	14.1
Incr Delay (d2), s/veh	9.3	1.6	0.0	3.8	2.2	0.0	4.5	5.7	4.2	5.7	1.1	0.2
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	3.4	4.7	0.0	3.1	5.2	0.0	1.7	10.8	9.7	4.0	8.5	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	52.7	40.2	0.0	47.1	41.2	0.0	49.9	36.3	27.2	47.9	25.9	14.3
LnGrp LOS	D	D		D	D		D	D	C	D	C	B
Approach Vol, veh/h		672	A		706	A		2122			1950	
Approach Delay, s/veh		45.1			43.3			35.0			28.4	
Approach LOS		D			D			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.0	40.1	16.3	22.2	14.0	46.1	16.2	22.3
Change Period (Y+Rc), s	8.0	6.5	6.5	5.5	8.0	6.5	6.5	5.5
Max Green Setting (Gmax), s	17.0	34.5	15.5	26.5	8.0	43.5	11.5	30.5
Max Q Clear Time (g_c+I1), s	11.4	29.9	9.4	13.1	6.0	26.0	9.5	14.3
Green Ext Time (p_c), s	0.5	3.6	0.4	2.0	0.1	9.1	0.2	2.5

Intersection Summary	
HCM 6th Ctrl Delay	35.0
HCM 6th LOS	C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	315	125	60	155	30	240	140	80	30	220	165
Future Volume (veh/h)	145	315	125	60	155	30	240	140	80	30	220	165
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	181	394	156	75	194	38	300	175	100	38	275	206
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	325	611	755	249	237	46	413	456	261	328	342	290
Arrive On Green	0.11	0.37	0.37	0.18	0.18	0.18	0.17	0.46	0.46	0.21	0.21	0.21
Sat Flow, veh/h	1581	1660	1407	851	1349	264	1581	992	567	1095	1660	1407
Grp Volume(v), veh/h	181	394	156	75	0	232	300	0	275	38	275	206
Grp Sat Flow(s),veh/h/ln	1581	1660	1407	851	0	1613	1581	0	1558	1095	1660	1407
Q Serve(g_s), s	6.2	13.7	4.0	5.6	0.0	9.7	9.8	0.0	8.1	2.0	11.0	9.5
Cycle Q Clear(g_c), s	6.2	13.7	4.0	5.9	0.0	9.7	9.8	0.0	8.1	2.0	11.0	9.5
Prop In Lane	1.00		1.00	1.00		0.16	1.00		0.36	1.00		1.00
Lane Grp Cap(c), veh/h	325	611	755	249	0	284	413	0	717	328	342	290
V/C Ratio(X)	0.56	0.64	0.21	0.30	0.00	0.82	0.73	0.00	0.38	0.12	0.80	0.71
Avail Cap(c_a), veh/h	338	713	841	294	0	369	418	0	848	417	475	403
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.5	18.3	8.4	26.3	0.0	27.7	17.1	0.0	12.4	22.8	26.4	25.8
Incr Delay (d2), s/veh	1.9	1.6	0.1	0.7	0.0	10.5	6.1	0.0	0.3	0.2	6.8	3.5
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.2	4.9	1.0	1.1	0.0	4.2	3.7	0.0	2.4	0.5	4.5	3.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.4	19.9	8.6	27.0	0.0	38.2	23.2	0.0	12.7	23.0	33.3	29.3
LnGrp LOS	C	B	A	C	A	D	C	A	B	C	C	C
Approach Vol, veh/h		731			307			575			519	
Approach Delay, s/veh		17.8			35.5			18.2			30.9	
Approach LOS		B			D			B			C	

Timer - Assigned Phs		2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s		38.1		31.7	17.8	20.4	13.4	18.3				
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0	5.5	6.0				
Max Green Setting (Gmax), s		38.0		30.0	12.0	20.0	8.5	16.0				
Max Q Clear Time (g_c+I1), s		10.1		15.7	11.8	13.0	8.2	11.7				
Green Ext Time (p_c), s		1.5		2.4	0.0	1.4	0.0	0.6				

Intersection Summary												
HCM 6th Ctrl Delay			23.6									
HCM 6th LOS			C									

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	105	205	340	365	330	200
Future Volume (veh/h)	105	205	340	365	330	200
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	131	256	425	456	412	250
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	276	541	512	1052	509	677
Arrive On Green	0.17	0.17	0.21	0.63	0.31	0.31
Sat Flow, veh/h	1581	1407	1581	1660	1660	1407
Grp Volume(v), veh/h	131	256	425	456	412	250
Grp Sat Flow(s),veh/h/ln	1581	1407	1581	1660	1660	1407
Q Serve(g_s), s	4.5	8.2	9.9	8.3	13.7	6.7
Cycle Q Clear(g_c), s	4.5	8.2	9.9	8.3	13.7	6.7
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	276	541	512	1052	509	677
V/C Ratio(X)	0.48	0.47	0.83	0.43	0.81	0.37
Avail Cap(c_a), veh/h	316	577	655	1564	872	984
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.3	13.9	11.4	5.5	19.2	9.8
Incr Delay (d2), s/veh	1.3	0.6	7.0	0.3	3.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	7.0	3.0	1.4	4.6	2.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	23.6	14.5	18.5	5.8	22.3	10.1
LnGrp LOS	C	B	B	A	C	B
Approach Vol, veh/h	387			881	662	
Approach Delay, s/veh	17.6			11.9	17.7	
Approach LOS	B			B	B	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		44.5		15.5	19.6	24.9
Change Period (Y+Rc), s		6.5		5.0	7.0	6.5
Max Green Setting (Gmax), s		56.5		12.0	18.0	31.5
Max Q Clear Time (g_c+I1), s		10.3		10.2	11.9	15.7
Green Ext Time (p_c), s		2.6		0.3	0.7	2.7

Intersection Summary		
HCM 6th Ctrl Delay		15.0
HCM 6th LOS		B

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	305	260	130	60	20
Future Vol, veh/h	80	305	260	130	60	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	250	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	100	381	325	163	75	25

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	488	0	-	0	906	325
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	581	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1075	-	-	-	307	716
Stage 1	-	-	-	-	732	-
Stage 2	-	-	-	-	559	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1075	-	-	-	278	716
Mov Cap-2 Maneuver	-	-	-	-	278	-
Stage 1	-	-	-	-	664	-
Stage 2	-	-	-	-	559	-

Approach	EB	WB	SB
HCM Control Delay, s	1.8	0	20.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1075	-	-	-	328
HCM Lane V/C Ratio	0.093	-	-	-	0.305
HCM Control Delay (s)	8.7	-	-	-	20.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	1.3

Intersection: 2: Sioux Boulevard & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	102	134	34	260	63	73	93	128
Average Queue (ft)	45	59	9	126	16	30	33	52
95th Queue (ft)	81	113	31	213	46	64	69	102
Link Distance (ft)		1003		517		274		1519
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	250		250		200		250	
Storage Blk Time (%)				0				
Queuing Penalty (veh)				0				

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	TR	L	L	T	TR	L	L	T	T
Maximum Queue (ft)	188	203	257	263	165	175	316	368	106	134	390	393
Average Queue (ft)	84	132	153	148	78	91	158	222	42	67	271	274
95th Queue (ft)	175	191	237	240	133	145	256	330	82	111	357	365
Link Distance (ft)			1327	1327			1862	1862			3184	3184
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350	350			350	350			535	535		
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	T	R	L	L	T	T	T	R
Maximum Queue (ft)	380	362	209	192	336	349	330	164
Average Queue (ft)	253	204	125	99	224	222	195	70
95th Queue (ft)	347	319	191	174	307	303	280	135
Link Distance (ft)	3184				2560	2560	2560	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		535	535	535				535
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 6: Six Mile Road & Maple/Park Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	TR	L	TR	L	T	R
Maximum Queue (ft)	142	195	105	114	200	181	150	65	190	155
Average Queue (ft)	59	106	28	41	91	84	60	20	96	77
95th Queue (ft)	112	177	73	84	161	146	118	53	161	138
Link Distance (ft)		1802			1043		3030		2476	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	350		350	350		350		350		350
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 10: Indian Hills Trail (E)/Future Collector N (IHT North) & Maple/Park Street

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	R	LTR	LTR
Maximum Queue (ft)	38	21	8	23	34
Average Queue (ft)	5	1	0	9	17
95th Queue (ft)	24	11	6	28	33
Link Distance (ft)				1126	1325
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	350	350	350		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Indian Hills Trail (W) & Maple/Park Street

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	56	30
Average Queue (ft)	4	9
95th Queue (ft)	27	31
Link Distance (ft)	650	1413
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Maple/Park Street & Oak Road

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	39	41
Average Queue (ft)	6	15
95th Queue (ft)	27	37
Link Distance (ft)		1435
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 16: Intermediate School Drive & Maple/Park Street

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	36	64
Average Queue (ft)	10	31
95th Queue (ft)	34	54
Link Distance (ft)		546
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: Maple/Park Street & Locust Street

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (ft)	61	25	55
Average Queue (ft)	20	1	28
95th Queue (ft)	50	10	49
Link Distance (ft)			324
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	100	250	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Sioux Boulevard & Robert Bennis Driveway

Movement	EB
Directions Served	L
Maximum Queue (ft)	47
Average Queue (ft)	25
95th Queue (ft)	44
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	85
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: SD11/Splitrock Boulevard & Sioux Boulevard

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Aspen Park Road & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	71	94	40	60
Average Queue (ft)	15	22	7	15
95th Queue (ft)	52	67	30	46
Link Distance (ft)	517	934	443	374
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	180	183	268	140	69	141	154	123	144	145	131	54
Average Queue (ft)	97	114	128	57	29	82	81	63	72	73	49	14
95th Queue (ft)	154	164	223	117	58	128	133	110	125	124	99	41
Link Distance (ft)			1862	1862		1802	1802			1097	1097	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350	350			350			350	350			350
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	132	158	133	256
Average Queue (ft)	57	88	58	130
95th Queue (ft)	102	141	108	218
Link Distance (ft)		1108	1108	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	350			350
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 29: Future Collector South (6 Mile - IHT) & Maple/Park Street

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	31	57
Average Queue (ft)	7	22
95th Queue (ft)	27	44
Link Distance (ft)		1001
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 32: SD11/Splitrock Boulevard & Maple/Park Street

Movement	EB	EB	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	117	159	170	131	212	106
Average Queue (ft)	53	71	87	47	111	53
95th Queue (ft)	95	126	149	106	187	95
Link Distance (ft)		934			1714	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	350		350			350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 0

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street/Driveway

04/08/2019

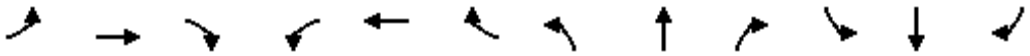
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	0	305	1	1	1	290	175	0	0	250	190
Future Volume (veh/h)	200	0	305	1	1	1	290	175	0	0	250	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	250	0	381	1	1	1	362	219	0	0	312	238
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	390	366	510	130	122	99	432	1071	0	80	396	302
Arrive On Green	0.22	0.00	0.22	0.22	0.22	0.22	0.14	0.65	0.00	0.00	0.46	0.46
Sat Flow, veh/h	1393	1647	1396	344	547	445	1569	1647	0	1144	867	661
Grp Volume(v), veh/h	250	0	381	3	0	0	362	219	0	0	0	550
Grp Sat Flow(s),veh/h/ln	1393	1647	1396	1336	0	0	1569	1647	0	1144	0	1528
Q Serve(g_s), s	15.2	0.0	20.0	0.0	0.0	0.0	10.2	4.8	0.0	0.0	0.0	27.5
Cycle Q Clear(g_c), s	15.3	0.0	20.0	0.1	0.0	0.0	10.2	4.8	0.0	0.0	0.0	27.5
Prop In Lane	1.00		1.00	0.33		0.33	1.00		0.00	1.00		0.43
Lane Grp Cap(c), veh/h	390	366	510	350	0	0	432	1071	0	80	0	698
V/C Ratio(X)	0.64	0.00	0.75	0.01	0.00	0.00	0.84	0.20	0.00	0.00	0.00	0.79
Avail Cap(c_a), veh/h	390	366	510	350	0	0	460	1071	0	80	0	698
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	33.2	0.0	24.9	27.3	0.0	0.0	16.3	6.4	0.0	0.0	0.0	20.7
Incr Delay (d2), s/veh	7.9	0.0	9.6	0.0	0.0	0.0	12.2	0.4	0.0	0.0	0.0	8.8
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	5.9	0.0	8.3	0.1	0.0	0.0	4.8	1.6	0.0	0.0	0.0	10.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.0	0.0	34.5	27.3	0.0	0.0	28.5	6.8	0.0	0.0	0.0	29.5
LnGrp LOS	D	A	C	C	A	A	C	A	A	A	A	C
Approach Vol, veh/h		631			3			581			550	
Approach Delay, s/veh		37.1			27.3			20.3			29.5	
Approach LOS		D			C			C			C	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		64.0		26.0	17.4	46.6		26.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		58.5		20.0	14.5	39.5		20.0				
Max Q Clear Time (g_c+I1), s		0.0		22.0	12.2	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.0	0.7	0.0		0.0				

Intersection Summary		
HCM 6th Ctrl Delay	29.2	
HCM 6th LOS	C	

Notes

User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	0	205	1	1	1	280	260	0	0	95	110
Future Volume (veh/h)	160	0	205	1	1	1	280	260	0	0	95	110
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	200	0	256	1	1	1	350	325	0	0	119	138
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	445	384	575	157	142	109	600	947	0	120	224	259
Arrive On Green	0.23	0.00	0.23	0.23	0.23	0.23	0.18	0.57	0.00	0.00	0.32	0.32
Sat Flow, veh/h	1393	1647	1396	328	607	467	1569	1647	0	1038	695	806
Grp Volume(v), veh/h	200	0	256	3	0	0	350	325	0	0	0	257
Grp Sat Flow(s),veh/h/ln	1393	1647	1396	1402	0	0	1569	1647	0	1038	0	1502
Q Serve(g_s), s	7.6	0.0	7.9	0.0	0.0	0.0	8.0	6.3	0.0	0.0	0.0	8.4
Cycle Q Clear(g_c), s	7.7	0.0	7.9	0.1	0.0	0.0	8.0	6.3	0.0	0.0	0.0	8.4
Prop In Lane	1.00		1.00	0.33		0.33	1.00		0.00	1.00		0.54
Lane Grp Cap(c), veh/h	445	384	575	407	0	0	600	947	0	120	0	483
V/C Ratio(X)	0.45	0.00	0.45	0.01	0.00	0.00	0.58	0.34	0.00	0.00	0.00	0.53
Avail Cap(c_a), veh/h	445	384	575	407	0	0	647	947	0	120	0	483
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	20.6	0.0	12.7	17.7	0.0	0.0	9.7	6.8	0.0	0.0	0.0	16.7
Incr Delay (d2), s/veh	3.3	0.0	2.5	0.0	0.0	0.0	1.2	1.0	0.0	0.0	0.0	4.2
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.7	0.0	2.6	0.0	0.0	0.0	2.4	2.0	0.0	0.0	0.0	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.8	0.0	15.2	17.7	0.0	0.0	10.9	7.7	0.0	0.0	0.0	20.8
LnGrp LOS	C	A	B	B	A	A	B	A	A	A	A	C
Approach Vol, veh/h		456			3			675			257	
Approach Delay, s/veh		19.0			17.7			9.4			20.8	
Approach LOS		B			B			A			C	

Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		40.0		20.0	15.2	24.8		20.0				
Change Period (Y+Rc), s		5.5		6.0	4.5	5.5		6.0				
Max Green Setting (Gmax), s		34.5		14.0	12.5	17.5		14.0				
Max Q Clear Time (g_c+I1), s		0.0		9.9	10.0	0.0		0.0				
Green Ext Time (p_c), s		0.0		0.2	0.7	0.0		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		14.7
HCM 6th LOS		B

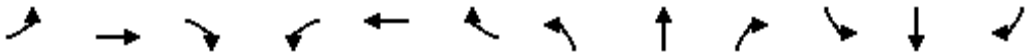
Notes

User approved pedestrian interval to be less than phase max green.

Appendix B. 2030 Interim Build Conditions Synchro (HCM6) and SimTraffic Reports

HCM 6th Signalized Intersection Summary
2: Sioux Boulevard & Maple/Park Street

03/08/2019



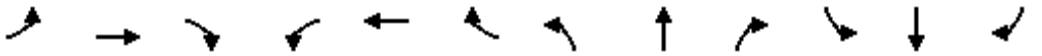
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	185	50	60	205	80	35	80	55	110	85	125
Future Volume (veh/h)	145	185	50	60	205	80	35	80	55	110	85	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	181	231	62	75	256	100	44	100	69	138	106	156
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	339	396	106	372	309	121	245	155	107	343	133	195
Arrive On Green	0.10	0.32	0.32	0.06	0.27	0.27	0.04	0.17	0.17	0.09	0.22	0.22
Sat Flow, veh/h	1569	1251	336	1569	1127	440	1569	908	626	1569	602	886
Grp Volume(v), veh/h	181	0	293	75	0	356	44	0	169	138	0	262
Grp Sat Flow(s),veh/h/ln	1569	0	1587	1569	0	1568	1569	0	1534	1569	0	1488
Q Serve(g_s), s	4.8	0.0	9.1	2.0	0.0	12.5	1.3	0.0	6.0	4.1	0.0	9.8
Cycle Q Clear(g_c), s	4.8	0.0	9.1	2.0	0.0	12.5	1.3	0.0	6.0	4.1	0.0	9.8
Prop In Lane	1.00		0.21	1.00		0.28	1.00		0.41	1.00		0.60
Lane Grp Cap(c), veh/h	339	0	503	372	0	430	245	0	262	343	0	328
V/C Ratio(X)	0.53	0.00	0.58	0.20	0.00	0.83	0.18	0.00	0.65	0.40	0.00	0.80
Avail Cap(c_a), veh/h	339	0	705	412	0	670	310	0	548	386	0	584
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.5	0.0	16.8	14.0	0.0	19.9	19.0	0.0	22.6	17.4	0.0	21.6
Incr Delay (d2), s/veh	1.6	0.0	1.1	0.3	0.0	5.0	0.3	0.0	2.7	0.8	0.0	4.5
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.6	0.0	3.1	0.7	0.0	4.7	0.5	0.0	2.2	1.4	0.0	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.1	0.0	17.8	14.3	0.0	24.9	19.4	0.0	25.3	18.2	0.0	26.0
LnGrp LOS	B	A	B	B	A	C	B	A	C	B	A	C
Approach Vol, veh/h		474			431			213			400	
Approach Delay, s/veh		17.2			23.1			24.1			23.3	
Approach LOS		B			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	15.5	8.5	24.5	7.1	18.4	11.0	22.1
Change Period (Y+Rc), s	4.5	5.5	5.0	6.0	4.5	5.5	5.0	6.0
Max Green Setting (Gmax), s	7.1	20.9	5.0	26.0	5.0	23.0	6.0	25.0
Max Q Clear Time (g_c+I1), s	6.1	8.0	4.0	11.1	3.3	11.8	6.8	14.5
Green Ext Time (p_c), s	0.0	0.7	0.0	1.5	0.0	1.2	0.0	1.6

Intersection Summary	
HCM 6th Ctrl Delay	21.4
HCM 6th LOS	C

Notes

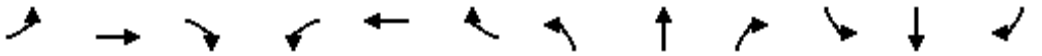
User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	150	45	170	85	175	55	760	45	75	490	40
Future Volume (veh/h)	70	150	45	170	85	175	55	760	45	75	490	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778
Adj Flow Rate, veh/h	78	167	50	189	94	194	61	844	50	83	544	44
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	232	219	66	321	111	229	314	1028	608	230	1061	551
Arrive On Green	0.05	0.17	0.17	0.10	0.21	0.21	0.04	0.30	0.30	0.05	0.31	0.31
Sat Flow, veh/h	1693	1314	393	1693	518	1068	1693	3378	1507	1693	3378	1507
Grp Volume(v), veh/h	78	0	217	189	0	288	61	844	50	83	544	44
Grp Sat Flow(s),veh/h/ln	1693	0	1707	1693	0	1586	1693	1689	1507	1693	1689	1507
Q Serve(g_s), s	2.6	0.0	8.5	6.4	0.0	12.2	1.7	16.1	1.4	2.3	9.2	1.3
Cycle Q Clear(g_c), s	2.6	0.0	8.5	6.4	0.0	12.2	1.7	16.1	1.4	2.3	9.2	1.3
Prop In Lane	1.00		0.23	1.00		0.67	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	232	0	285	321	0	340	314	1028	608	230	1061	551
V/C Ratio(X)	0.34	0.00	0.76	0.59	0.00	0.85	0.19	0.82	0.08	0.36	0.51	0.08
Avail Cap(c_a), veh/h	244	0	416	321	0	451	344	1241	703	243	1241	631
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.9	0.0	27.7	21.8	0.0	26.3	16.1	22.5	12.8	17.5	19.5	14.4
Incr Delay (d2), s/veh	0.8	0.0	4.8	2.8	0.0	11.1	0.3	3.8	0.1	0.9	0.4	0.1
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.0	0.0	3.6	2.6	0.0	5.2	0.6	5.9	0.4	0.8	3.1	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.8	0.0	32.5	24.5	0.0	37.4	16.4	26.3	12.9	18.4	19.9	14.5
LnGrp LOS	C	A	C	C	A	D	B	C	B	B	B	B
Approach Vol, veh/h		295			477			955			671	
Approach Delay, s/veh		30.2			32.3			25.0			19.4	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.5	27.7	13.4	17.1	10.8	28.4	10.1	20.4
Change Period (Y+Rc), s	8.0	6.5	6.5	5.5	8.0	6.5	6.5	5.5
Max Green Setting (Gmax), s	4.0	25.6	6.9	17.0	4.0	25.6	4.1	19.8
Max Q Clear Time (g_c+I1), s	4.3	18.1	8.4	10.5	3.7	11.2	4.6	14.2
Green Ext Time (p_c), s	0.0	3.1	0.0	0.6	0.0	2.8	0.0	0.8

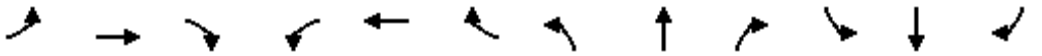
Intersection Summary	
HCM 6th Ctrl Delay	25.5
HCM 6th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	95	60	50	125	25	85	105	15	15	115	70
Future Volume (veh/h)	35	95	60	50	125	25	85	105	15	15	115	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Adj Flow Rate, veh/h	44	119	75	62	156	31	106	131	19	19	144	88
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	334	235	148	324	332	66	402	419	61	453	237	145
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.07	0.29	0.29	0.02	0.24	0.24
Sat Flow, veh/h	1071	960	605	1064	1356	269	1594	1429	207	1594	972	594
Grp Volume(v), veh/h	44	0	194	62	0	187	106	0	150	19	0	232
Grp Sat Flow(s),veh/h/ln	1071	0	1565	1064	0	1625	1594	0	1636	1594	0	1567
Q Serve(g_s), s	1.5	0.0	4.3	2.2	0.0	4.0	2.0	0.0	2.9	0.4	0.0	5.3
Cycle Q Clear(g_c), s	5.5	0.0	4.3	6.5	0.0	4.0	2.0	0.0	2.9	0.4	0.0	5.3
Prop In Lane	1.00		0.39	1.00		0.17	1.00		0.13	1.00		0.38
Lane Grp Cap(c), veh/h	334	0	383	324	0	398	402	0	480	453	0	381
V/C Ratio(X)	0.13	0.00	0.51	0.19	0.00	0.47	0.26	0.00	0.31	0.04	0.00	0.61
Avail Cap(c_a), veh/h	519	0	654	508	0	679	527	0	845	580	0	732
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.4	0.0	13.2	16.0	0.0	13.1	10.7	0.0	11.2	11.2	0.0	13.7
Incr Delay (d2), s/veh	0.2	0.0	1.0	0.3	0.0	0.9	0.3	0.0	0.4	0.0	0.0	1.6
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	0.3	0.0	1.3	0.4	0.0	1.1	0.5	0.0	0.8	0.1	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.6	0.0	14.3	16.3	0.0	14.0	11.0	0.0	11.5	11.2	0.0	15.2
LnGrp LOS	B	A	B	B	A	B	B	A	B	B	A	B
Approach Vol, veh/h		238			249			256			251	
Approach Delay, s/veh		14.5			14.6			11.3			14.9	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.8	17.9		16.0	8.8	15.9		16.0				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	4.0	21.0		17.0	6.0	19.0		17.0				
Max Q Clear Time (g_c+I1), s	2.4	4.9		7.5	4.0	7.3		8.5				
Green Ext Time (p_c), s	0.0	0.6		0.8	0.0	0.9		0.7				

Intersection Summary												
HCM 6th Ctrl Delay			13.8									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	70	60	20	220	40	65	85	40	80	85	145
Future Volume (veh/h)	140	70	60	20	220	40	65	85	40	80	85	145
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Adj Flow Rate, veh/h	175	88	75	25	275	50	81	106	50	100	106	181
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	425	598	507	470	460	390	313	228	226	330	251	362
Arrive On Green	0.11	0.36	0.36	0.02	0.28	0.28	0.06	0.14	0.14	0.07	0.15	0.15
Sat Flow, veh/h	1594	1673	1418	1594	1673	1418	1594	1673	1418	1594	1673	1418
Grp Volume(v), veh/h	175	88	75	25	275	50	81	106	50	100	106	181
Grp Sat Flow(s),veh/h/ln	1594	1673	1418	1594	1673	1418	1594	1673	1418	1594	1673	1418
Q Serve(g_s), s	4.1	1.9	2.0	0.6	7.8	1.4	2.4	3.2	1.7	2.9	3.1	5.9
Cycle Q Clear(g_c), s	4.1	1.9	2.0	0.6	7.8	1.4	2.4	3.2	1.7	2.9	3.1	5.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	425	598	507	470	460	390	313	228	226	330	251	362
V/C Ratio(X)	0.41	0.15	0.15	0.05	0.60	0.13	0.26	0.46	0.22	0.30	0.42	0.50
Avail Cap(c_a), veh/h	491	844	715	550	721	611	398	307	293	393	307	410
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.2	11.9	11.9	13.6	17.1	14.9	18.8	21.7	20.0	18.4	21.0	17.3
Incr Delay (d2), s/veh	0.6	0.1	0.1	0.0	1.2	0.1	0.4	1.5	0.5	0.5	1.1	1.1
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.2	0.6	0.6	0.2	2.7	0.4	0.8	1.2	0.5	1.0	1.2	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.8	12.0	12.0	13.7	18.4	15.0	19.2	23.2	20.4	18.9	22.2	18.4
LnGrp LOS	B	B	B	B	B	B	B	C	C	B	C	B
Approach Vol, veh/h		338			350			237			387	
Approach Delay, s/veh		12.4			17.6			21.2			19.6	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.3	25.0	9.1	13.2	11.8	20.5	9.8	12.4
Change Period (Y+Rc), s	6.0	5.5	6.0	5.0	6.0	5.5	6.0	5.0
Max Green Setting (Gmax), s	4.0	27.5	6.0	10.0	8.0	23.5	6.0	10.0
Max Q Clear Time (g_c+I1), s	2.6	4.0	4.4	7.9	6.1	9.8	4.9	5.2
Green Ext Time (p_c), s	0.0	0.6	0.0	0.2	0.1	1.3	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	17.5
HCM 6th LOS	B

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	135	225	130	295	220	200
Future Volume (veh/h)	135	225	130	295	220	200
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	169	281	162	369	275	250
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	347	447	432	907	507	739
Arrive On Green	0.22	0.22	0.10	0.55	0.31	0.31
Sat Flow, veh/h	1581	1407	1581	1660	1660	1407
Grp Volume(v), veh/h	169	281	162	369	275	250
Grp Sat Flow(s),veh/h/ln	1581	1407	1581	1660	1660	1407
Q Serve(g_s), s	4.6	8.4	3.1	6.4	6.8	5.0
Cycle Q Clear(g_c), s	4.6	8.4	3.1	6.4	6.8	5.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	347	447	432	907	507	739
V/C Ratio(X)	0.49	0.63	0.37	0.41	0.54	0.34
Avail Cap(c_a), veh/h	419	511	857	1538	693	896
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.7	14.3	9.4	6.5	14.2	6.7
Incr Delay (d2), s/veh	1.1	2.0	0.5	0.3	0.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.2	0.7	1.1	1.9	1.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.8	16.3	10.0	6.8	15.1	7.0
LnGrp LOS	B	B	A	A	B	A
Approach Vol, veh/h	450			531	525	
Approach Delay, s/veh	16.8			7.8	11.2	
Approach LOS	B			A	B	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		33.3		15.8	11.8	21.5
Change Period (Y+Rc), s		6.5		5.0	7.0	6.5
Max Green Setting (Gmax), s		45.5		13.0	18.0	20.5
Max Q Clear Time (g_c+I1), s		8.4		10.4	5.1	8.8
Green Ext Time (p_c), s		2.0		0.4	0.3	1.7

Intersection Summary	
HCM 6th Ctrl Delay	11.7
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	325	340	25	55	80
Future Vol, veh/h	30	325	340	25	55	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	250	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	38	406	425	31	69	100

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	456	0	-	0	907	425
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	482	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1105	-	-	-	306	629
Stage 1	-	-	-	-	659	-
Stage 2	-	-	-	-	621	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1105	-	-	-	296	629
Mov Cap-2 Maneuver	-	-	-	-	296	-
Stage 1	-	-	-	-	637	-
Stage 2	-	-	-	-	621	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	18.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1105	-	-	-	431
HCM Lane V/C Ratio	0.034	-	-	-	0.392
HCM Control Delay (s)	8.4	-	-	-	18.6
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	1.8

Intersection: 2: Sioux Boulevard & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	136	163	78	196	78	154	105	167
Average Queue (ft)	61	77	34	105	27	67	47	82
95th Queue (ft)	108	140	66	173	69	123	87	138
Link Distance (ft)		1003		603		274		1519
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	250		250		60		250	
Storage Blk Time (%)				0	0	11		
Queuing Penalty (veh)				0	0	4		

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	100	225	158	217	69	227	228	60	98	170	154	67
Average Queue (ft)	37	97	72	115	28	124	125	17	40	90	79	17
95th Queue (ft)	78	175	129	184	59	189	194	48	77	146	134	51
Link Distance (ft)		1344		1891		3202	3202			2578	2578	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350		350		535			535	535			535
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 6: Six Mile Road & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	73	96	83	114	90	91	42	143
Average Queue (ft)	21	47	28	49	37	34	11	66
95th Queue (ft)	55	87	61	96	72	73	34	116
Link Distance (ft)		1826		1043		3042		2488
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	350		350		350		350	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 10: Indian Hills Trail (E)/Future Collector N (IHT North) & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	21	10	23	36
Average Queue (ft)	3	0	10	17
95th Queue (ft)	15	5	28	33
Link Distance (ft)			1126	1325
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	350	350		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: Indian Hills Trail (W) & Maple/Park Street

Movement	NB
Directions Served	LR
Maximum Queue (ft)	35
Average Queue (ft)	8
95th Queue (ft)	31
Link Distance (ft)	1413
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: Maple/Park Street & Oak Road

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	5	61
Average Queue (ft)	0	24
95th Queue (ft)	4	45
Link Distance (ft)		1435
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 16: Intermediate School Drive & Maple/Park Street

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (ft)	4	79	103
Average Queue (ft)	0	32	58
95th Queue (ft)	3	69	92
Link Distance (ft)	4292		546
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 18: Maple/Park Street & Locust Street

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	31	4	101
Average Queue (ft)	8	0	40
95th Queue (ft)	29	3	74
Link Distance (ft)		1003	324
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	100		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Sioux Boulevard & Robert Bennis Driveway

Movement	EB	SB
Directions Served	L	R
Maximum Queue (ft)	62	30
Average Queue (ft)	33	1
95th Queue (ft)	50	15
Link Distance (ft)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	85	75
Storage Blk Time (%)	0	0
Queuing Penalty (veh)	0	0

Intersection: 21: SD11/Splitrock Boulevard & Sioux Boulevard

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Aspen Park Road & Maple/Park Street/Park Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	60	59	25	47
Average Queue (ft)	6	7	2	12
95th Queue (ft)	32	34	15	39
Link Distance (ft)	603	795	422	448
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	105	74	71	31	150	62	75	92	56	87	94	101
Average Queue (ft)	46	19	17	10	70	16	35	39	19	37	37	46
95th Queue (ft)	86	51	48	30	131	43	64	78	45	73	77	86
Link Distance (ft)		1891			1826			1103			1126	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350		350	350		350	350		350	350		350
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 29: Future Collector South (6 Mile - IHT) & Maple/Park Street

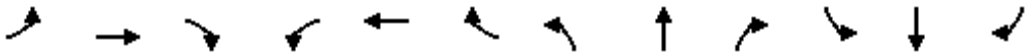
Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	28	41
Average Queue (ft)	2	18
95th Queue (ft)	15	37
Link Distance (ft)		1001
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 32: SD11/Splitrock Boulevard & Park Street

Movement	EB	EB	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	122	153	98	97	146	105
Average Queue (ft)	60	68	41	39	70	46
95th Queue (ft)	105	122	76	82	119	86
Link Distance (ft)		795			1847	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	350		350			350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 4



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	140	5	10	160	130	15	25	10	45	20	40
Future Volume (veh/h)	50	140	5	10	160	130	15	25	10	45	20	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
Adj Flow Rate, veh/h	62	175	6	12	200	162	19	31	12	56	25	50
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	338	552	19	497	257	208	339	142	55	378	77	154
Arrive On Green	0.06	0.35	0.35	0.02	0.30	0.30	0.02	0.13	0.13	0.06	0.16	0.16
Sat Flow, veh/h	1569	1583	54	1569	842	682	1569	1131	438	1569	490	980
Grp Volume(v), veh/h	62	0	181	12	0	362	19	0	43	56	0	75
Grp Sat Flow(s),veh/h/ln	1569	0	1637	1569	0	1524	1569	0	1568	1569	0	1471
Q Serve(g_s), s	1.2	0.0	3.7	0.2	0.0	10.0	0.5	0.0	1.1	1.4	0.0	2.1
Cycle Q Clear(g_c), s	1.2	0.0	3.7	0.2	0.0	10.0	0.5	0.0	1.1	1.4	0.0	2.1
Prop In Lane	1.00		0.03	1.00		0.45	1.00		0.28	1.00		0.67
Lane Grp Cap(c), veh/h	338	0	571	497	0	465	339	0	197	378	0	232
V/C Ratio(X)	0.18	0.00	0.32	0.02	0.00	0.78	0.06	0.00	0.22	0.15	0.00	0.32
Avail Cap(c_a), veh/h	415	0	993	643	0	941	472	0	357	478	0	350
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.9	0.0	11.0	10.8	0.0	14.6	16.9	0.0	18.2	16.1	0.0	17.3
Incr Delay (d2), s/veh	0.3	0.0	0.3	0.0	0.0	2.9	0.1	0.0	0.6	0.2	0.0	0.8
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	0.4	0.0	1.2	0.1	0.0	3.2	0.2	0.0	0.4	0.5	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.1	0.0	11.3	10.8	0.0	17.5	17.0	0.0	18.7	16.3	0.0	18.1
LnGrp LOS	B	A	B	B	A	B	B	A	B	B	A	B
Approach Vol, veh/h		243			374			62			131	
Approach Delay, s/veh		11.3			17.3			18.2			17.3	
Approach LOS		B			B			B			B	

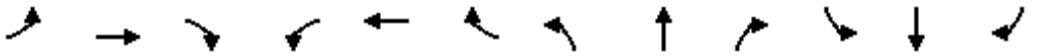
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	11.3	5.7	22.1	5.6	12.8	7.7	20.1
Change Period (Y+Rc), s	4.5	5.5	5.0	6.0	4.5	5.5	5.0	* 6
Max Green Setting (Gmax), s	5.5	10.5	5.0	28.0	5.0	11.0	5.0	* 29
Max Q Clear Time (g_c+I1), s	3.4	3.1	2.2	5.7	2.5	4.1	3.2	12.0
Green Ext Time (p_c), s	0.0	0.1	0.0	1.0	0.0	0.1	0.0	2.1

Intersection Summary	
HCM 6th Ctrl Delay	15.5
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

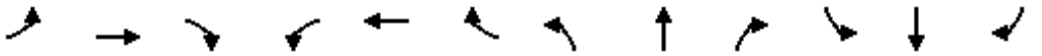
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	170	80	110	185	145	60	700	205	135	690	80
Future Volume (veh/h)	110	170	80	110	185	145	60	700	205	135	690	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807	1807
Adj Flow Rate, veh/h	122	189	89	122	206	161	67	778	228	150	767	89
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	240	286	135	322	235	184	242	959	528	262	1079	575
Arrive On Green	0.06	0.25	0.25	0.07	0.25	0.25	0.04	0.28	0.28	0.08	0.31	0.31
Sat Flow, veh/h	1721	1161	547	1721	940	735	1721	3433	1531	1721	3433	1531
Grp Volume(v), veh/h	122	0	278	122	0	367	67	778	228	150	767	89
Grp Sat Flow(s),veh/h/ln	1721	0	1708	1721	0	1674	1721	1716	1531	1721	1716	1531
Q Serve(g_s), s	4.2	0.0	11.6	4.2	0.0	16.7	2.2	16.8	9.1	4.9	15.7	3.1
Cycle Q Clear(g_c), s	4.2	0.0	11.6	4.2	0.0	16.7	2.2	16.8	9.1	4.9	15.7	3.1
Prop In Lane	1.00		0.32	1.00		0.44	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	240	0	421	322	0	419	242	959	528	262	1079	575
V/C Ratio(X)	0.51	0.00	0.66	0.38	0.00	0.88	0.28	0.81	0.43	0.57	0.71	0.15
Avail Cap(c_a), veh/h	240	0	541	322	0	537	258	1170	622	262	1256	655
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.4	0.0	27.0	21.2	0.0	28.6	20.3	26.7	20.1	20.5	24.1	16.5
Incr Delay (d2), s/veh	1.8	0.0	1.9	0.7	0.0	12.5	0.6	3.7	0.6	3.0	1.6	0.1
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	1.7	0.0	4.6	1.6	0.0	7.7	0.8	6.5	3.1	1.9	5.7	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.2	0.0	28.9	21.9	0.0	41.1	20.9	30.4	20.6	23.5	25.7	16.6
LnGrp LOS	C	A	C	C	A	D	C	C	C	C	C	B
Approach Vol, veh/h		400			489			1073			1006	
Approach Delay, s/veh		27.5			36.3			27.7			24.5	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	28.7	11.7	25.1	11.2	31.5	11.4	25.4
Change Period (Y+Rc), s	8.0	6.5	6.5	5.5	8.0	6.5	6.5	5.5
Max Green Setting (Gmax), s	6.0	27.1	5.2	25.2	4.0	29.1	4.9	25.5
Max Q Clear Time (g_c+I1), s	6.9	18.8	6.2	13.6	4.2	17.7	6.2	18.7
Green Ext Time (p_c), s	0.0	3.4	0.0	1.1	0.0	3.7	0.0	1.2

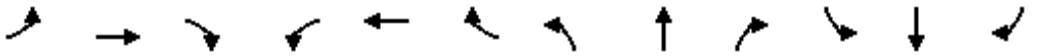
Intersection Summary	
HCM 6th Ctrl Delay	28.0
HCM 6th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	150	55	30	80	15	110	85	50	15	125	75
Future Volume (veh/h)	65	150	55	30	80	15	110	85	50	15	125	75
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	81	188	69	38	100	19	138	106	62	19	156	94
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	394	416	153	361	267	51	329	397	232	392	201	121
Arrive On Green	0.05	0.36	0.36	0.20	0.20	0.20	0.08	0.40	0.40	0.21	0.21	0.21
Sat Flow, veh/h	1581	1158	425	1114	1356	258	1581	982	575	1208	970	585
Grp Volume(v), veh/h	81	0	257	38	0	119	138	0	168	19	0	250
Grp Sat Flow(s),veh/h/ln	1581	0	1584	1114	0	1614	1581	0	1557	1208	0	1555
Q Serve(g_s), s	1.9	0.0	6.3	1.4	0.0	3.2	3.3	0.0	3.7	0.6	0.0	7.7
Cycle Q Clear(g_c), s	1.9	0.0	6.3	1.4	0.0	3.2	3.3	0.0	3.7	0.6	0.0	7.7
Prop In Lane	1.00		0.27	1.00		0.16	1.00		0.37	1.00		0.38
Lane Grp Cap(c), veh/h	394	0	568	361	0	317	329	0	630	392	0	322
V/C Ratio(X)	0.21	0.00	0.45	0.11	0.00	0.38	0.42	0.00	0.27	0.05	0.00	0.78
Avail Cap(c_a), veh/h	450	0	625	362	0	318	329	0	860	571	0	552
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.8	0.0	12.4	16.9	0.0	17.7	13.7	0.0	10.1	16.2	0.0	19.0
Incr Delay (d2), s/veh	0.3	0.0	0.6	0.1	0.0	0.7	0.9	0.0	0.2	0.1	0.0	4.0
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	0.6	0.0	1.8	0.3	0.0	1.1	1.0	0.0	0.9	0.2	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.0	0.0	13.0	17.1	0.0	18.4	14.5	0.0	10.3	16.2	0.0	23.0
LnGrp LOS	B	A	B	B	A	B	B	A	B	B	A	C
Approach Vol, veh/h		338			157			306			269	
Approach Delay, s/veh		13.3			18.1			12.2			22.5	
Approach LOS		B			B			B			C	

Timer - Assigned Phs		2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s		26.5		24.2	10.0	16.5	8.2	16.0				
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0	5.5	6.0				
Max Green Setting (Gmax), s		28.0		20.0	4.0	18.0	4.5	10.0				
Max Q Clear Time (g_c+I1), s		5.7		8.3	5.3	9.7	3.9	5.2				
Green Ext Time (p_c), s		0.8		1.0	0.0	0.8	0.0	0.2				

Intersection Summary			
HCM 6th Ctrl Delay		16.0	
HCM 6th LOS		B	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	205	90	25	180	60	75	145	20	45	150	185
Future Volume (veh/h)	215	205	90	25	180	60	75	145	20	45	150	185
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673	1673
Adj Flow Rate, veh/h	269	256	112	31	225	75	94	181	25	56	188	231
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	425	514	436	338	289	245	375	654	592	414	418	584
Arrive On Green	0.16	0.31	0.31	0.03	0.17	0.17	0.07	0.39	0.39	0.25	0.25	0.25
Sat Flow, veh/h	1594	1673	1418	1594	1673	1418	1594	1673	1418	1176	1673	1418
Grp Volume(v), veh/h	269	256	112	31	225	75	94	181	25	56	188	231
Grp Sat Flow(s),veh/h/ln	1594	1673	1418	1594	1673	1418	1594	1673	1418	1176	1673	1418
Q Serve(g_s), s	7.7	7.5	3.6	1.0	7.7	2.8	2.4	4.4	0.6	2.3	5.7	6.9
Cycle Q Clear(g_c), s	7.7	7.5	3.6	1.0	7.7	2.8	2.4	4.4	0.6	2.3	5.7	6.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	425	514	436	338	289	245	375	654	592	414	418	584
V/C Ratio(X)	0.63	0.50	0.26	0.09	0.78	0.31	0.25	0.28	0.04	0.14	0.45	0.40
Avail Cap(c_a), veh/h	459	613	520	401	418	354	416	767	688	463	488	643
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.5	17.0	15.6	19.6	23.7	21.7	14.1	12.5	10.4	17.7	19.0	12.4
Incr Delay (d2), s/veh	2.5	0.7	0.3	0.1	5.7	0.7	0.3	0.2	0.0	0.1	0.8	0.4
Initial Q Delay(d3),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
%ile BackOfQ(50%),veh/ln	2.6	2.6	1.0	0.3	3.2	0.9	0.8	1.5	0.2	0.6	2.1	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.0	17.7	15.9	19.7	29.5	22.4	14.4	12.7	10.4	17.9	19.8	12.8
LnGrp LOS	B	B	B	B	C	C	B	B	B	B	B	B
Approach Vol, veh/h		637			331			300			475	
Approach Delay, s/veh		17.5			27.0			13.0			16.2	
Approach LOS		B			C			B			B	

Timer - Assigned Phs		2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s		29.0	7.6	23.4	8.5	20.5	15.7	15.3				
Change Period (Y+Rc), s		5.5	6.0	5.0	4.5	5.5	6.0	5.0				
Max Green Setting (Gmax), s		27.5	4.0	22.0	5.5	17.5	11.0	15.0				
Max Q Clear Time (g_c+I1), s		6.4	3.0	9.5	4.4	8.9	9.7	9.7				
Green Ext Time (p_c), s		1.0	0.0	1.4	0.0	1.4	0.1	0.6				

Intersection Summary	
HCM 6th Ctrl Delay	18.2
HCM 6th LOS	B

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	60	125	220	310	285	115
Future Volume (veh/h)	60	125	220	310	285	115
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1660	1660	1660	1660	1660	1660
Adj Flow Rate, veh/h	75	156	275	388	356	144
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	300	475	469	967	492	685
Arrive On Green	0.19	0.19	0.15	0.58	0.30	0.30
Sat Flow, veh/h	1581	1407	1581	1660	1660	1407
Grp Volume(v), veh/h	75	156	275	388	356	144
Grp Sat Flow(s),veh/h/ln	1581	1407	1581	1660	1660	1407
Q Serve(g_s), s	2.0	4.2	5.5	6.4	9.7	3.0
Cycle Q Clear(g_c), s	2.0	4.2	5.5	6.4	9.7	3.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	300	475	469	967	492	685
V/C Ratio(X)	0.25	0.33	0.59	0.40	0.72	0.21
Avail Cap(c_a), veh/h	344	514	517	1231	706	866
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.4	12.5	10.1	5.7	15.9	7.4
Incr Delay (d2), s/veh	0.4	0.4	1.4	0.3	2.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.7	1.3	1.0	2.9	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.8	12.9	11.6	6.0	18.0	7.6
LnGrp LOS	B	B	B	A	B	A
Approach Vol, veh/h	231			663	500	
Approach Delay, s/veh	14.5			8.3	15.0	
Approach LOS	B			A	B	

Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		36.0		14.6	14.5	21.5
Change Period (Y+Rc), s		6.5		5.0	7.0	6.5
Max Green Setting (Gmax), s		37.5		11.0	9.0	21.5
Max Q Clear Time (g_c+I1), s		8.4		6.2	7.5	11.7
Green Ext Time (p_c), s		2.0		0.3	0.1	1.6

Intersection Summary	
HCM 6th Ctrl Delay	11.7
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	40	155	130	85	40	15
Future Vol, veh/h	40	155	130	85	40	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	250	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	194	163	106	50	19

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	269	0	-	0	457	163
Stage 1	-	-	-	-	163	-
Stage 2	-	-	-	-	294	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1295	-	-	-	562	882
Stage 1	-	-	-	-	866	-
Stage 2	-	-	-	-	756	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1295	-	-	-	540	882
Mov Cap-2 Maneuver	-	-	-	-	540	-
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	756	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1295	-	-	-	604
HCM Lane V/C Ratio	0.039	-	-	-	0.114
HCM Control Delay (s)	7.9	-	-	-	11.7
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4

Intersection: 2: Sioux Boulevard & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	58	86	34	147	41	65	58	62
Average Queue (ft)	24	29	4	70	9	23	26	29
95th Queue (ft)	51	68	21	122	33	55	54	61
Link Distance (ft)		1003		521		274		1519
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	250		250		60		250	
Storage Blk Time (%)					0	1		
Queuing Penalty (veh)					0	0		

Intersection: 3: Veterans Parkway & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	115	218	121	273	75	229	257	168	126	208	201	89
Average Queue (ft)	54	112	50	146	34	137	141	80	63	123	114	30
95th Queue (ft)	102	188	97	246	67	205	217	140	110	182	179	72
Link Distance (ft)		1344		1891		3202	3202			2578	2578	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350		350		535			535	535			535
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 6: Six Mile Road & Maple/Park Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	86	168	81	107	103	87	35	138
Average Queue (ft)	32	69	23	42	46	39	11	73
95th Queue (ft)	67	127	58	85	82	77	33	123
Link Distance (ft)		1826		1043		3042		2488
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	350		350		350		350	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 10: Indian Hills Trail (E)/Future Collector N (IHT North) & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	28	10	24	31
Average Queue (ft)	2	0	9	13
95th Queue (ft)	12	5	28	32
Link Distance (ft)			1126	1325
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	350	350		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: Indian Hills Trail (W) & Maple/Park Street

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	5	30
Average Queue (ft)	0	10
95th Queue (ft)	4	33
Link Distance (ft)	650	1413
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: Maple/Park Street & Oak Road

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	26	41
Average Queue (ft)	2	14
95th Queue (ft)	16	34
Link Distance (ft)		1435
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 16: Intermediate School Drive & Maple/Park Street

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	40	47
Average Queue (ft)	4	22
95th Queue (ft)	21	47
Link Distance (ft)		546
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: Maple/Park Street & Locust Street

Movement	EB	WB	SB
Directions Served	L	R	LR
Maximum Queue (ft)	47	4	54
Average Queue (ft)	8	0	22
95th Queue (ft)	32	3	45
Link Distance (ft)			324
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	100	250	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Sioux Boulevard & Robert Bennis Driveway

Movement	EB
Directions Served	L
Maximum Queue (ft)	44
Average Queue (ft)	21
95th Queue (ft)	43
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	85
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: SD11/Splitrock Boulevard & Sioux Boulevard

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Aspen Park Road & Maple/Park Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	51	62	18	39
Average Queue (ft)	5	8	1	6
95th Queue (ft)	27	36	11	26
Link Distance (ft)	521	897	472	498
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 26: Future Collector (VP-6 Mile) & Maple/Park Street

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	142	141	90	48	133	70	82	128	30	62	137	114
Average Queue (ft)	66	50	29	14	69	26	36	50	8	24	58	44
95th Queue (ft)	114	103	71	38	119	58	71	98	26	55	108	89
Link Distance (ft)		1891			1826			1103			1126	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350		350	350		350	350		350	350		350
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 29: Future Collector South (6 Mile - IHT) & Maple/Park Street

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	27	33
Average Queue (ft)	2	15
95th Queue (ft)	15	34
Link Distance (ft)		1001
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	350	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 32: SD11/Splitrock Boulevard & Maple/Park Street

Movement	EB	EB	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	86	114	111	98	202	73
Average Queue (ft)	34	44	55	37	91	32
95th Queue (ft)	69	86	93	79	164	66
Link Distance (ft)		897			1714	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	350		350			350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 0

Appendix C. HCS7 Signal Warrant Analysis Reports

Input Variables and Assumptions

- Population less than 10,000 for all 2030 Interim Build Conditions intersections
- Population less than 10,000 for 2045 Build Conditions at Six Mile Road intersection
- Speeds align with study speeds established for the Build Conditions analyses
- Lane configuration based on 2030 Interim Build Conditions and 2045 Build Conditions, respectively
- Locust Street intersection was noted to be on a school route
- No intersections are part of two major routes

Output Files:

- Six Mile Road
    - 2030 Interim Build Conditions – 4-hour warrant analysis
    - 2030 Interim Build Conditions – Peak hour warrant analysis
    - 2045 Build Conditions – 4-hour warrant analysis
    - 2045 Build Conditions – Peak hour warrant analysis

- Locust Street
    - 2030 Interim Build Conditions – 4-hour warrant analysis
    - 2030 Interim Build Conditions – Peak hour warrant analysis
    - 2045 Build Conditions – 4-hour warrant analysis
    - 2045 Build Conditions – Peak hour warrant analysis

- Locust Street
    - 2030 Interim Build Conditions – 4-hour warrant analysis
    - 2030 Interim Build Conditions – Peak hour warrant analysis
    - 2045 Build Conditions – Not conducted because warrant met in 2030 Interim Build Conditions
    - 2045 Build Conditions – Not conducted because warrant met in 2030 Interim Build Conditions

A separate evaluation using peak hour volumes was conducted at each intersection, as the intersection peak hour typically crossed over the count hours.

HCS7 Warrants Report

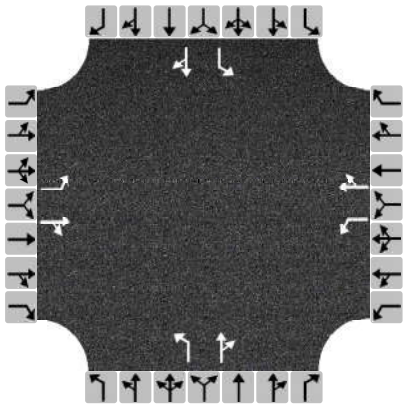
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2030 Build
Jurisdiction	Six Mile (N/S) & Maple (E/W)	Time Period Analyzed	4-hr
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	45	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	3900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	1	1	0	1	1	0	1	1	0
Lane Usage	L	TR		L	TR		L	TR		L	TR	
Vehicle Volumes Averages (veh/h)	17	21	16	12	22	4	21	32	8	12	32	19
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	260	180	579	0	0	No	No	No	No	No	No	No	No	No
08 - 09	357	193	727	0	0	No	Yes	No	No	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	190	267	631	0	0	No	No	No	No	No	No	No	No	No
17 - 18	341	199	729	0	0	No	Yes	No	No	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	1148	839	2666	0	0	0	2	0	0	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

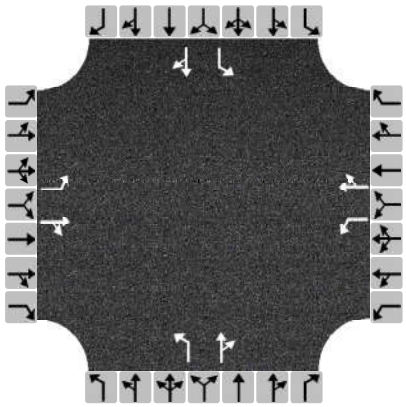
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2030 Build
Jurisdiction	Six Mile (N/S) & Maple (E/W)	Time Period Analyzed	Peak Hour
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	45	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	3900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	1	1	0	1	1	0	1	1	0
Lane Usage	L	TR		L	TR		L	TR		L	TR	
Vehicle Volumes Averages (veh/h)	8	20	9	6	16	3	16	15	5	2	19	12
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	386	202	784	0	0	No	Yes	No	No	No	No	No	No	No
08 - 09	0	0	0	0	0	No	No	No	No	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	389	240	842	0	0	No	Yes	No	No	No	No	No	No	No
17 - 18	0	0	0	0	0	No	No	No	No	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	775	442	1626	0	0	0	2	0	0	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

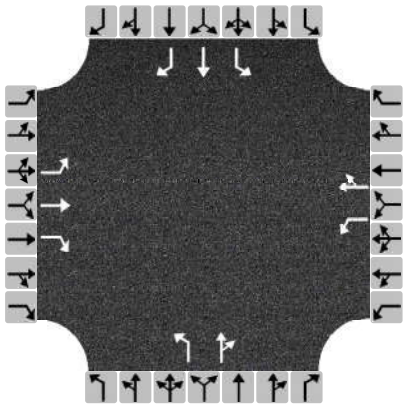
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2045 Build
Jurisdiction	Six Mile (N/S) & Maple (E/W)	Time Period Analyzed	4-hr
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	45	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	3900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	1	1	1	0	1	1	0	1	1	1
Lane Usage	L	T	R	L	TR		L	TR		L	T	R
Vehicle Volumes Averages (veh/h)	32	44	37	24	45	9	46	53	14	27	57	41
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	534	345	1158	0	0	Yes	Yes	No	Yes	Yes	No	No	No	No
08 - 09	657	372	1375	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	403	540	1248	0	0	No	Yes	No	No	Yes	No	Yes	No	No
17 - 18	721	366	1445	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	2315	1623	5226	0	0	3	4	2	3	4	0	3	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	✔
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	✓
Warrant 3: Peak Hour	✔
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	✓
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

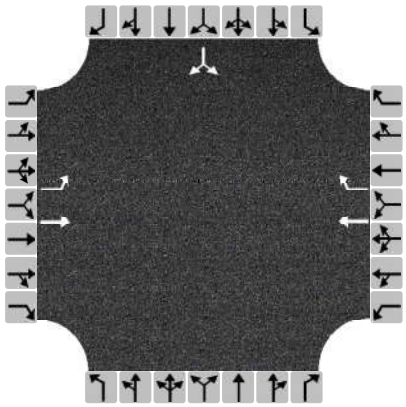
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2030 Build
Jurisdiction	Park (E/W) & Locust (N/S)	Time Period Analyzed	4-hr
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	1090		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	0	1	1	0	0	0	0	0	0
Lane Usage	L	T			T	R					LR	
Vehicle Volumes Averages (veh/h)	8	61	0	0	48	13	0	0	0	15	0	9
Pedestrian Averages (peds/h)	0			2			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	37	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	158	88	246	7	0	No	No	No	No	No	No	No	No	No
08 - 09	621	120	741	37	0	Yes	Yes	No	Yes	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	387	37	424	0	1	No	No	No	No	No	No	No	No	No
17 - 18	408	49	457	0	2	No	No	No	No	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	1574	294	1868	44	3	1	1	0	1	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	✓
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

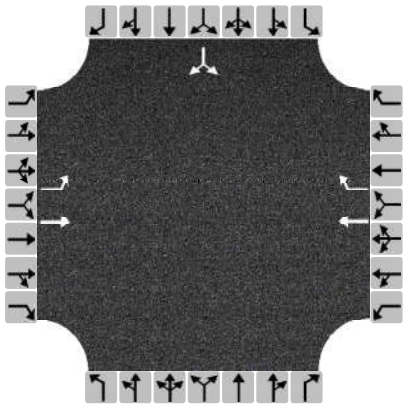
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2030 Build
Jurisdiction	Park (E/W) & Locust (N/S)	Time Period Analyzed	Peak Hour
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	1090		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	0	1	1	0	0	0	0	0	0
Lane Usage	L	T			T	R					LR	
Vehicle Volumes Averages (veh/h)	5	39	0	0	38	9	0	0	0	8	0	7
Pedestrian Averages (peds/h)	0			2			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	37	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	711	136	847	7	0	Yes	Yes	Yes	Yes	Yes	No	No	No	No
08 - 09	0	0	0	37	0	No	No	No	No	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	0	0	0	0	1	No	No	No	No	No	No	No	No	No
17 - 18	408	53	461	0	2	No	No	No	No	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	1119	189	1308	44	3	1	1	1	1	1	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	✓
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

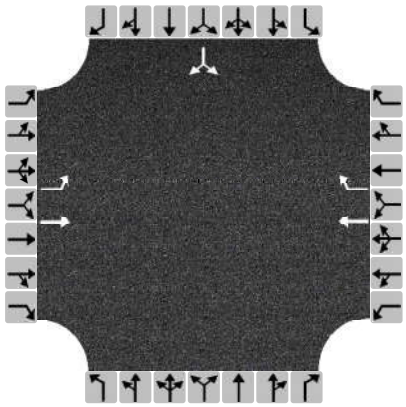
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2045 Build
Jurisdiction	Park (E/W) & Locust (N/S)	Time Period Analyzed	4-hr
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	No
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	1090		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	0	1	1	0	0	0	0	0	0
Lane Usage	L	T			T	R					LR	
Vehicle Volumes Averages (veh/h)	14	102	0	0	76	20	0	0	0	22	0	13
Pedestrian Averages (peds/h)	0			2			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	37	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (100%)	1A (80%)	1B (100%)	1B (80%)	2 (100%)	3A (100%)	3B (100%)	4A (100%)	4B (100%)
07 - 08	212	129	341	7	0	No	No	No	No	No	No	No	No	No
08 - 09	834	176	1010	37	0	Yes	Yes	No	Yes	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	753	57	810	0	1	No	No	No	No	No	No	No	No	No
17 - 18	773	73	846	0	2	No	No	No	Yes	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	2572	435	3007	44	3	1	1	0	2	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	✓
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 80% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

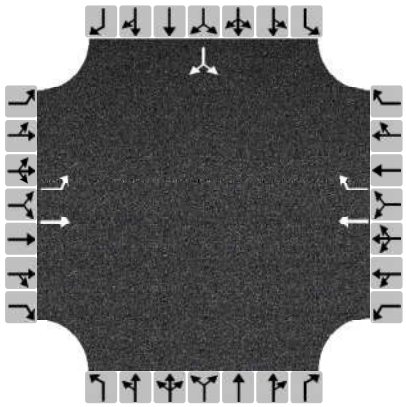
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2045 Build
Jurisdiction	Park (E/W) & Locust (N/S)	Time Period Analyzed	Peak Hour
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	East-West	Population < 10,000	No
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	1090		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	1	0	0	1	1	0	0	0	0	0	0
Lane Usage	L	T			T	R					LR	
Vehicle Volumes Averages (veh/h)	9	56	0	0	56	13	0	0	0	12	0	13
Pedestrian Averages (peds/h)	0			2			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	37	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (100%)	1A (80%)	1B (100%)	1B (80%)	2 (100%)	3A (100%)	3B (100%)	4A (100%)	4B (100%)
07 - 08	887	222	1109	7	0	Yes	Yes	No	Yes	Yes	No	No	No	No
08 - 09	0	0	0	37	0	No	No	No	No	No	No	No	No	No
09 - 10	0	0	0	0	0	No	No	No	No	No	No	No	No	No
10 - 11	0	0	0	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	0	0	0	0	0	No	No	No	No	No	No	No	No	No
15 - 16	0	0	0	0	0	No	No	No	No	No	No	No	No	No
16 - 17	0	0	0	0	1	No	No	No	No	No	No	No	No	No
17 - 18	741	84	825	0	2	No	No	No	Yes	No	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	1628	306	1934	44	3	1	1	0	2	1	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	✓
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 80% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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HCS7 Warrants Report

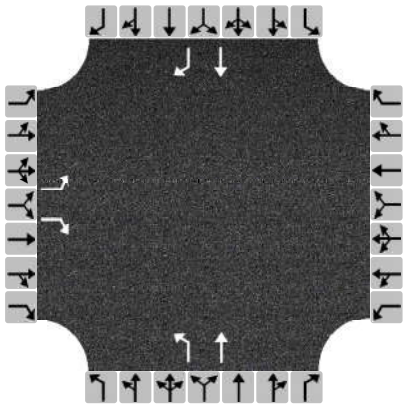
Project Information

Analyst	HDR	Date	2/27/2019
Agency	HDR	Analysis Year	2030 Build
Jurisdiction	SD11 (N/S) & Park (E/W)	Time Period Analyzed	4-hr
Project Description	Maple Street/Park Street Corridor Study		

General

Major Street Direction	North-South	Population < 10,000	Yes
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	55	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	3900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	1	0	1	0	0	0	1	1	0	0	1	1
Lane Usage	L		R				L	T			T	R
Vehicle Volumes Averages (veh/h)	50	0	81	0	0	0	73	135	0	0	132	59
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	10

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HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	425	181	606	0	0	Yes	Yes	No	No	No	No	No	No	No
08 - 09	741	324	1065	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
09 - 10	289	84	373	0	0	No	No	No	No	No	No	No	No	No
10 - 11	311	57	368	0	0	No	No	No	No	No	No	No	No	No
11 - 12	0	0	0	0	0	No	No	No	No	No	No	No	No	No
12 - 13	0	0	0	0	0	No	No	No	No	No	No	No	No	No
13 - 14	0	0	0	0	0	No	No	No	No	No	No	No	No	No
14 - 15	786	322	1108	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
15 - 16	629	260	889	0	0	Yes	Yes	No	Yes	Yes	No	No	No	No
16 - 17	909	180	1089	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
17 - 18	714	169	883	0	0	Yes	Yes	Yes	Yes	Yes	No	No	No	No
18 - 19	0	0	0	0	0	No	No	No	No	No	No	No	No	No
Total	4804	1577	6381	0	0	6	6	4	5	5	0	3	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	✔
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	✓
Warrant 3: Peak Hour	✔
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	✓
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

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Appendix D. Minor Street/Driveway Access Intersection Turn Lane Warrant Review

The following conditions were used for this evaluation:

2030 Interim Build Conditions

- 2030 Interim Build Conditions traffic volumes
- 2-lane Maple Street/Park Street corridor (1 lane in each direction)
- Posted speed limits:
    - 45 mph between Veterans Parkway and City of Brandon city limits
    - 30 mph between City of Brandon city limits and SD11/Splitrock Boulevard

2045 Build Conditions

- 2045 Build Conditions traffic volumes
- 2-lane Maple Street/Park Street segment (1 lane in each direction)
    - Six Mile Road to SD11/Splitrock Boulevard
- 4-lane Maple Street segment (2 lanes in each direction)
    - Veterans Parkway to Six Mile Road
- Posted speed limits:
    - 45 mph between Veterans Parkway and City of Brandon city limits
    - 30 mph between City of Brandon city limits and SD11/Splitrock Boulevard

MINOR STREET/DRIVEWAY ACCESS INTERSECTION TURN LANE WARRANT REVIEW - 2030 INTERIM BUILD CONDITIONS

Maple Street/Park Street Corridor Study

3/7/2019

MAPLE STREET/PARK STREET INTERSECTION	TURN	POSTED SPEED	NO. OF LANES	AM PEAK HOUR VOL OF HIGHWAY	AM PEAK HOUR VOL OF ACCESS	PM PEAK HOUR VOL OF HIGHWAY	PM PEAK HOUR VOL OF ACCESS	WARRANT VOLUME HIGHWAY	WARRANT VOLUME ACCESS	WARRANT SATISFIED?
Future Collector Road (Veterans Pkwy - 6 Mile Rd)	EB LT	45	2	550	140	775	215	200	20	Yes - AM/PM
	EB RT	45	2	270	60	510	90	200	20	Yes - AM/PM
	WB LT	45	2	550	20	775	25	200	20	Yes - AM/PM
	WB RT	45	2	280	40	265	60	200	20	Yes - AM/PM
Future Collector Road (6 Mile Rd - IHT west)	EB RT	45	2	125	10	215	15	200	20	No
	WB LT	45	2	325	20	330	10	200	20	Yes - AM
Indian Hills Trail (west)	EB RT	45	2	135	5	210	5	200	20	No
	WB LT	45	2	240	5	325	5	200	20	No
Indian Hills Trail (east) & Future Collector	EB LT	45	2	325	20	335	15	200	20	Yes - AM
	EB RT	45	2	135	5	210	10	200	20	No
	WB LT	45	2	325	5	235	5	200	20	No
	WB RT	45	2	190	10	125	20	200	20	No
Oak Road	EB LT	45	2	295	5	335	25	200	20	Yes - PM
	WB RT	45	2	165	10	135	20	200	20	No
Intermediate School Drive	EB RT	30	2	150	30	190	20	400	40	No
	WB LT	30	2	570	280	335	20	400	40	Yes - AM
Locust Street	EB LT	30	2	720	30	410	40	400	40	Yes - PM
	WB RT	30	2	365	25	215	85	400	40	No
Robert Bennis Elementary School Drive*	NB LT	30	2	660	60	515	15	400	40	Yes - AM
	SB RT	30	2	430	130	185	15	400	40	Yes - AM
Aspen Park Road*	EB LT	30	2	680	15	530	25	400	40	No
	EB RT	30	2	350	5	195	5	400	40	No
	WB LT	30	2	680	5	530	10	400	40	No
	WB RT	30	2	330	10	335	45	400	40	No

Notes:

Maple Street/Park Street speeds based on anticipated design speeds. Final design speeds will be evaluated during design.

** Build Conditions includes extension of Park Street to SD11/Splitrock Boulevard and closure of the Sioux Boulevard and SD11/Splitrock Boulevard intersection.*

Volumes shown here reflect the highest volume conditions, depending on whether Park Street is or is not extended:

- Robert Bennis Elementary School Drive volumes based on no extension of Park Street

- Aspen Park Road based on extension of Park Street and closure of Sioux Boulevard and SD11/Splitrock Boulevard intersection.

Turn lane 'No' warrants subject to change based on future development intensity, timeframe, and access. A traffic impact study should be conducted with future development. Locations not shown to meet warrants does not preclude inclusion of a turn lane with future improvements. Turn lanes at minor road intersections and driveways provide operational and safety benefits to arterial roadways by minimizing through movement traffic hazards and interference.

MINOR STREET/DRIVEWAY ACCESS INTERSECTION TURN LANE WARRANT REVIEW - 2045 BUILD CONDITIONS

Maple Street/Park Street Corridor Study

3/7/2019

MAPLE STREET/PARK STREET INTERSECTION	TURN	POSTED SPEED	NO. OF LANES	AM PEAK HOUR		PM PEAK HOUR		WARRANT VOLUME		WARRANT SATISFIED?
				VOL OF HIGHWAY	VOL OF ACCESS	VOL OF HIGHWAY	VOL OF ACCESS	HIGHWAY	ACCESS	
Future Collector Road (Veterans Pkwy - 6 Mile Rd)	EB LT	45	4	590	310	1115	475	600	40	Yes - AM
	EB RT	45	4	590	130	1115	195	800	40	Yes - AM
	WB LT	45	4	580	35	560	55	600	40	No
	WB RT	45	4	580	85	560	135	800	40	No
Future Collector Road (6 Mile Rd - IHT west)	EB RT	45	2	260	20	425	30	200	20	Yes - AM/PM
	WB LT	45	2	625	30	655	25	200	20	Yes - AM/PM
Indian Hills Trail (west)	EB RT	45	2	275	5	410	5	200	20	No
	WB LT	45	2	640	5	640	5	200	20	No
Indian Hills Trail (east) & Future Collector	EB LT	45	2	625	35	660	30	200	20	Yes - AM/PM
	EB RT	45	2	275	5	410	10	200	20	No
	WB LT	45	2	625	5	660	5	200	20	No
	WB RT	45	2	350	20	250	35	200	20	Yes - PM
Oak Road	EB LT	45	2	580	10	660	30	200	20	Yes - PM
	WB RT	45	2	315	10	270	30	200	20	Yes - PM
Intermediate School Drive	EB RT	30	2	280	55	375	30	400	40	No
	WB LT	30	2	840	280	655	30	400	40	Yes - AM
Locust Street	EB LT	30	2	945	40	775	80	400	40	Yes - AM/PM
	WB RT	30	2	480	40	390	130	400	40	Yes - AM
Robert Bennis Elementary School Drive*	NB LT	30	2	985	85	835	20	400	40	Yes - PM
	SB RT	30	2	555	160	300	15	400	40	Yes - AM
Aspen Park Road*	EB LT	30	2	890	25	870	55	400	40	Yes - PM
	EB RT	30	2	460	5	330	5	400	40	No
	WB LT	30	2	890	5	870	20	400	40	No
	WB RT	30	2	430	20	540	90	400	40	Yes - PM

Notes:

Maple Street/Park Street speeds based on anticipated design speeds. Final design speeds will be evaluated during design.

** Build Conditions includes extension of Park Street to SD11/Splitrock Boulevard and closure of the Sioux Boulevard and SD11/Splitrock Boulevard intersection.*

Volumes shown here reflect the highest volume conditions, depending on whether Park Street is or is not extended:

- *Robert Bennis Elementary School Drive volumes based on no extension of Park Street*
- *Aspen Park Road based on extension of Park Street and closure of Sioux Boulevard and SD11/Splitrock Boulevard intersection.*

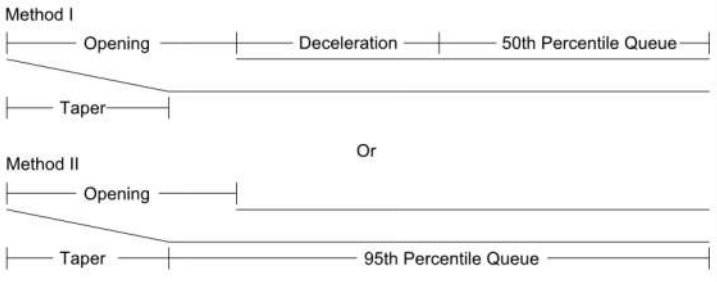
Turn lane 'No' warrants subject to change based on future development intensity, timeframe, and access. A traffic impact study should be conducted with future development. Locations not shown to meet warrants does not preclude inclusion of a turn lane with future improvements. Turn lanes at minor road intersections and driveways provide operational and safety benefits to arterial roadways by minimizing through movement traffic hazards and interference.

Appendix E. Turn Lane Design Spreadsheets and SimTraffic Output

City of Sioux Falls Engineering Design Standards, Chapter 8: Street Design and Pavement Thickness (accessed 3/4/19)

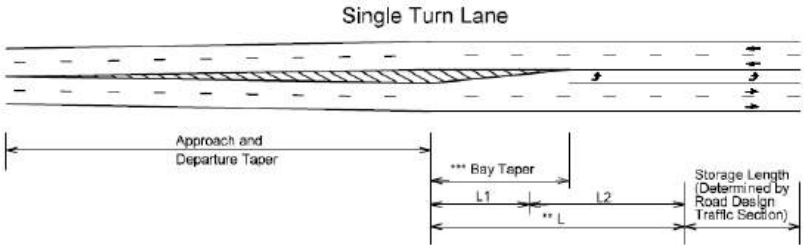
Table 8.5: Turn Lane Lengths

Posted Speed	Taper	Opening	Deceleration	50th Percentile Queue	95th Percentile Queue
30 mph	60'	60'	75'	Values determined by software analysis	
35 mph	60'	85'	75'		
40 mph	90'	120'	100'		
45 mph	120'	150'	125'		



Use the larger of the two design methods for each turn lane

South Dakota Road Design Manual, Chapter 12: Intersections (accessed 3/4/19, Figure 12-12 modified)



* Speeds from Florida study

** For steep grades consider adjusting deceleration lengths as shown in Table 13-3.

*** For recommended bay taper lengths refer to Table 12-5.

Design Speed (mph)	Entry Speed (mph)	Clearance Distance L1	Brake to Stop Distance L2	Total Deceleration Distance **L
30	*20	60	45	105
35	*25	75	70	145
40	*30	80	105	185
45	*35	85	135	220
50	44	105	215	320
55	48	125	260	385
60	52	145	310	455
65	55	170	350	520
70	58	195	395	590

Figure 12-12 Right or Left Turn Lane Design (Warranted)

TURNING LANE LENGTHS - 2030 INTERIM BUILD CONDITIONS

Maple Street/Park Street Corridor Study

3/7/2019

TURN LANE CALCULATION (FT)															
MAPLE STREET/PARK STREET CORRIDOR INTERSECTION	APPROACH	POSTED SPEED	BAY TAPER	OPENING (L1)	DECEL. (L2)	AM QUEUES				PM QUEUES				RECOMMENDED MINIMUM TURN LANE LENGTH	NOTES
						50TH QUEUE	95TH QUEUE	METHOD 1 TOTAL	METHOD 2 TOTAL	50TH QUEUE	95TH QUEUE	METHOD 1 TOTAL	METHOD 2 TOTAL		
Veterans Parkway	EB LT	40	90	120	100	37	78	257	168	54	102	274	192	**275**	
	WB LT	40	90	120	100	72	129	292	219	50	97	270	187	**300**	
	NB LT	55			455	28	59	514		34	67	522		**525**	SDDOT Design Guidelines Built: 650' (approx)
	NB RT	55			455	17	48	503		80	140	595		**600**	SDDOT Design Guidelines
	SB LT	55			455	40	77	532		63	110	565		**575**	SDDOT Design Guidelines Built: 650' (approx)
	SB RT	55			455	17	51	506		30	72	527		**550**	SDDOT Design Guidelines
Future Collector (between Veterans Parkway and Six Mile Road)	EB LT	40	90	120	100	46	86	266	176	66	114	286	204	**300**	Dual left-turn lanes
	EB RT	40	90	120	100	17	48	237	138	29	71	249	161	**250**	
	WB LT	40	90	120	100	10	30	230	120	14	38	234	128	**250**	
	WB RT	40	90	120	100	16	43	236	133	26	58	246	148	**250**	
	NB LT	30	60	60	75	35	64	170	124	36	71	171	131	**175**	
	NB RT	30	60	60	75	19	45	154	105	8	26	143	86	**175**	
	SB LT	30	60	60	75	37	73	172	133	24	55	159	115	**175**	
	SB RT	30	60	60	75	46	86	181	146	44	89	179	149	**200**	
Six Mile Road	EB LT	40	90	120	100	21	55	241	145	32	67	252	157	**275**	Based on signalized intersection.
	WB LT	45	120	150	125	28	61	303	181	23	58	298	178	**325**	
	NB LT	45	120	150	125	37	72	312	192	46	82	321	202	**325**	
	SB LT	45	120	150	125	11	34	286	154	11	33	286	153	**300**	
Six Mile Road (with right-turn lanes on all approaches)	EB LT	40	90	120	100	21	49	241	139	27	57	247	147	**250**	Based on signalized intersection.
	EB RT	40	90	120	100	18	47	238	137	14	40	234	130	**250**	
	WB LT	45	120	150	125	25	58	300	178	19	49	294	169	**300**	
	WB RT	45	120	150	125	7	23	282	143	5	20	280	140	**300**	
	NB LT	45	120	150	125	32	62	307	182	37	69	312	189	**325**	
	NB RT	45	120	150	125	4	16	279	136	13	38	288	158	**300**	
	SB LT	45	120	150	125	7	26	282	146	8	29	283	149	**300**	
	SB RT	45	120	150	125	23	53	298	173	28	62	303	182	**325**	
Future Collector (east of Six Mile Road)	EB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB LT	45	120	150	125	2	15	277	135	2	15	277	135	**300**	
Indian Hills Trail (west)	EB LT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
Indian Hills Trail (east) and Future Collector	EB LT	45	120	150	125	3	15	278	135	2	12	277	132	**300**	
	EB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB LT	45	120	150	125	0	5	275	125	0	5	275	125	**275**	
	WB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
Oak Road	EB LT	45	120	150	125	0	4	275	124	2	16	277	136	**300**	
	WB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
Intermediate School	EB RT	30	60	60	75	*0*	*0*	135	60	*0*	*0*	135	60	**150**	
	WB LT	30	60	60	75	32	69	167	129	4	21	139	81	**175**	Approx. 185' available between driveway and Locust Street.
Locust Street	EB LT	30	60	60	75	8	29	143	89	8	32	143	92	**150**	Approx. 185' available between driveway and Locust Street.
	WB RT	30	60	60	75	*0*	*0*	135	60	0	3	135	63	**150**	
Sioux Boulevard	EB LT	30	60	60	75	61	108	196	168	24	51	159	111	**200**	
	WB LT	30	60	60	75	34	66	169	126	4	21	139	81	**175**	
	NB LT	30	60	60	75	27	69	162	129	9	33	144	93	**175**	
	SB LT	30	60	60	75	47	87	182	147	26	54	161	114	**200**	
Sioux Boulevard (with right-turn lanes on all approaches)	EB LT	30	60	60	75	57	104	192	164	23	52	158	112	**200**	
	EB RT	30	60	60	75	17	46	152	106	2	12	137	72	**175**	
	WB LT	30	60	60	75	27	64	162	124	3	16	138	76	**175**	
	WB RT	30	60	60	75	20	49	155	109	25	56	160	116	**175**	
	NB LT	30	60	60	75	21	51	156	111	11	35	146	95	**175**	
	NB RT	30	60	60	75	24	56	159	116	7	24	142	84	**175**	
	SB LT	30	60	60	75	51	90	186	150	22	49	157	109	**200**	
	SB RT	30	60	60	75	42	83	177	143	19	55	154	115	**200**	
Aspen Park Road															Analyzed as a single-lane roundabout without turn lanes
Robert Bennis School (w/Park Street Extension)	NB LT	30	60	60	75	*0*	*0*	135	60	*0*	*0*	135	60	**150**	
	SB RT	30	60	60	75	1	15	136	75	*0*	*0*	135	60	**150**	
Robert Bennis School (no Park Street extension)	NB LT	30	60	60	75	25	55	160	115	16	40	151	100	**175**	Match 2045 needs
	SB RT	30	60	60	75	3	18	138	78	*0*	*0*	135	60	**150**	Match 2045 needs
SD11/Splitrock Boulevard	EB LT	30	60	60	75	60	105	195	165	34	69	169	129	**200**	
	EB RT	30	60	60	75	68	122	203	182	44	86	179	146	**225**	
	NB LT	55			455	41	76	531		55	93	548		**550**	SDDOT Design Guidelines
	SB RT	55			455	46	86	541		32	66	521		**550**	SDDOT Design Guidelines

Notes:

- 50th and 95th percentile queues obtained from SimTraffic.

- 0 (light grey zero) reflects unsignalized intersections where either no measured queue or turn lane not included in model. Recommended minimum turn lane length includes deceleration plus opening lengths.

- City of Sioux Falls turn lane lengths: Table 8.5 of Engineering Design Standards, Chapter 8: Street Design and Pavement Thickness (referenced 2/26/19).

- SDDOT turn lane lengths: Figure 12-12 of Road Design Manual, Chapter 12: Intersections (referenced 2/26/19).

TURNING LANE LENGTHS - 2045 BUILD CONDITIONS

Maple Street/Park Street Corridor Study

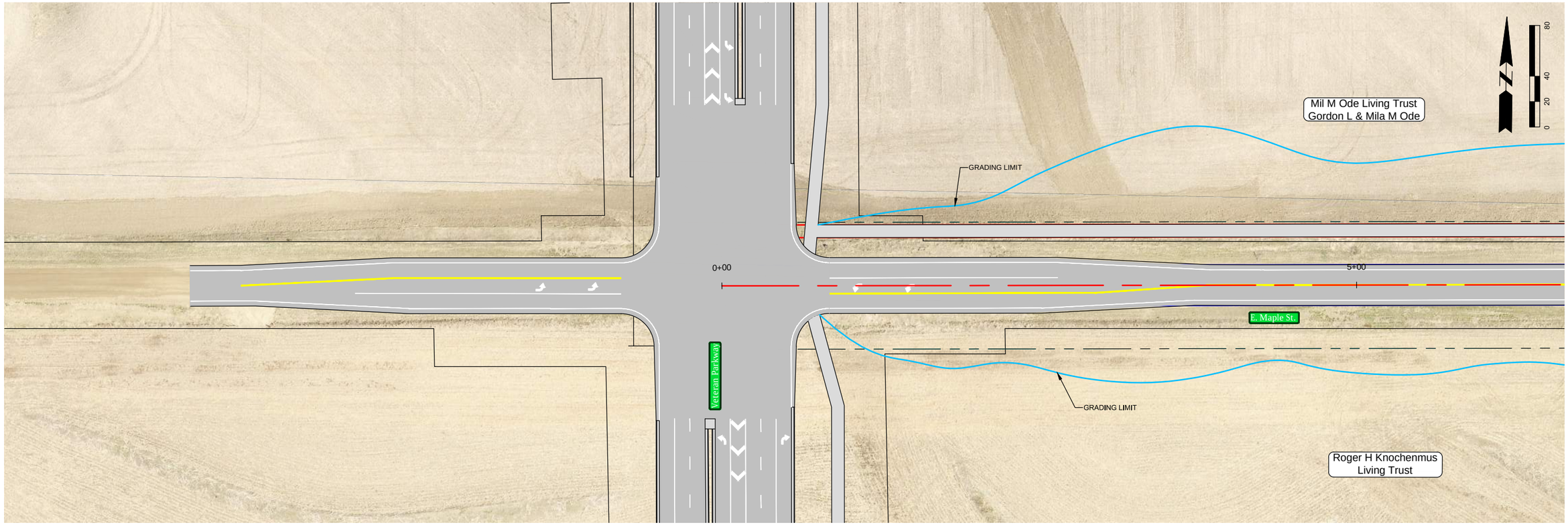
3/7/2019

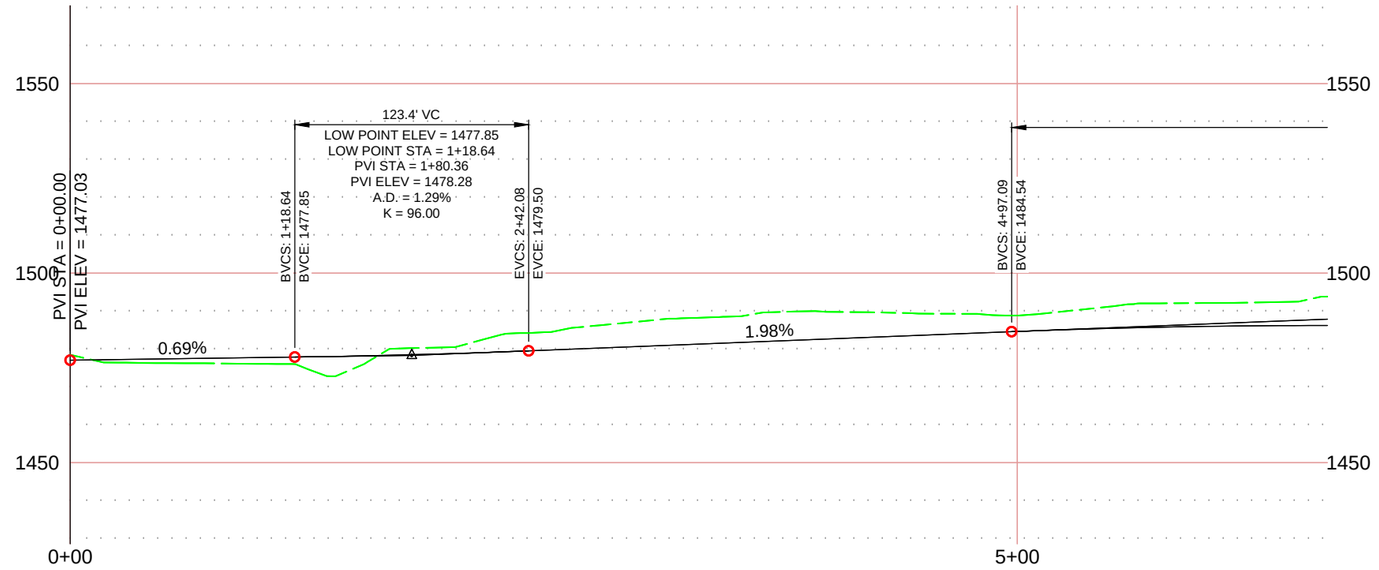
TURN LANE CALCULATION (FT)															
MAPLE STREET/PARK STREET CORRIDOR INTERSECTION	APPROACH	POSTED SPEED	BAY TAPER	OPENING (L1)	DECEL. (L2)	AM QUEUES				PM QUEUES				RECOMMENDED MINIMUM TURN LANE LENGTH	NOTES
						50TH QUEUE	95TH QUEUE	METHOD 1 TOTAL	METHOD 2 TOTAL	50TH QUEUE	95TH QUEUE	METHOD 1 TOTAL	METHOD 2 TOTAL		
Veterans Parkway	EB LT	40	90	120	100	138	62	358	152	132	191	352	281	**375**	
	EB RT	40	90	120	100	*0*	*0*	220	90	*0*	*0*	220	90	**225**	Yield-control, channelized right-turn
	WB LT	40	90	120	100	96	149	316	239	91	145	311	235	**325**	
	WB RT	40	90	120	100	*0*	*0*	220	90	*0*	*0*	220	90	**225**	Yield-control, channelized right-turn
	NB LT	55			455	23	56	511		67	111	566		**575**	SDDOT Design Guidelines Built: 650' (approx)
	NB RT	55			455	34	79	534		204	319	774		**775**	SDDOT Design Guidelines
	SB LT	55			455	42	84	539		125	191	646		**650**	SDDOT Design Guidelines Built: 650' (approx)
	SB RT	55			455	19	51	506		70	135	590		**600**	SDDOT Design Guidelines
Future Collector (between Veterans Parkway and Six Mile Road)	EB LT	40	90	120	100	84	132	304	222	114	164	334	254	**350**	Dual left-turn lanes
	EB RT	40	90	120	100	45	101	265	191	57	117	277	207	**300**	
	WB LT	40	90	120	100	17	46	237	136	29	58	249	148	**250**	
	WB RT	40	90	120	100	46	92	266	182	63	110	283	200	**300**	
	NB LT	30	60	60	75	63	108	198	168	72	125	207	185	**225**	
	NB RT	30	60	60	75	38	86	173	146	14	41	149	101	**175**	
	SB LT	30	60	60	75	76	126	211	186	57	102	192	162	**225**	
	SB RT	30	60	60	75	105	184	240	244	130	218	265	278	**300**	
Six Mile Road	EB LT	40	90	120	100	41	86	261	176	59	112	279	202	**300**	
	EB RT	40	90	120	100	64	98	284	188	28	73	248	163	**300**	
	WB LT	45	120	150	125	50	98	325	218	41	84	316	204	**325**	
	NB LT	45	120	150	125	62	111	337	231	84	146	359	266	**375**	
	SB LT	45	120	150	125	15	40	290	160	20	53	295	173	**300**	
	SB RT	45	120	150	125	67	119	342	239	77	138	352	258	**375**	
Six Mile Road (with right-turn lanes on all approaches)	EB LT	40	90	120	100	39	85	259	175	54	94	274	184	**275**	
	EB RT	40	90	120	100	27	60	247	150	25	58	245	148	**250**	
	WB LT	45	120	150	125	44	88	319	208	37	73	312	193	**325**	
	WB RT	45	120	150	125	14	41	289	161	15	44	290	164	**300**	
	NB LT	45	120	150	125	61	110	336	230	91	155	366	275	**375**	
	NB RT	45	120	150	125	10	34	285	154	22	52	297	172	**300**	
	SB LT	45	120	150	125	17	47	292	167	21	54	296	174	**300**	
	SB RT	45	120	150	125	70	117	345	237	63	115	338	235	**350**	
Future Collector (east of Six Mile Road)	EB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB LT	45	120	150	125	6	25	281	145	7	27	282	147	**300**	
Indian Hills Trail (west)	EB LT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
Indian Hills Trail (east) and Future Collector	EB LT	45	120	150	125	9	32	284	152	5	24	280	144	**300**	
	EB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
	WB LT	45	120	150	125	0	6	275	126	1	11	276	131	**300**	
	WB RT	45	120	150	125	*0*	*0*	275	120	0	6	275	126	**275**	
Oak Road	EB LT	45	120	150	125	3	15	278	135	6	27	281	147	**300**	
	WB RT	45	120	150	125	*0*	*0*	275	120	*0*	*0*	275	120	**275**	
Intermediate School	EB RT	30	60	60	75	*0*	*0*	135	60	*0*	*0*	135	60	**150**	
	WB LT	30	60	60	75	48	88	183	148	10	34	145	94	**200**	Approx. 185' available between driveway and Locust Street.
Locust Street	EB LT	30	60	60	75	16	44	151	104	20	50	155	110	**175**	Approx. 185' available between driveway and Locust Street.
	WB RT	30	60	60	75	*0*	*0*	135	60	1	10	136	70	**150**	
Sioux Boulevard	EB LT	30	60	60	75	72	132	207	192	45	81	180	141	**225**	
	WB LT	30	60	60	75	47	111	182	171	9	31	144	91	**200**	
	NB LT	30	60	60	75	41	78	176	138	16	46	151	106	**200**	
	SB LT	30	60	60	75	61	120	196	180	33	69	168	129	**200**	
Sioux Boulevard (with right-turn lanes on all approaches)	EB LT	30	60	60	75	60	106	195	166	40	73	175	133	**200**	
	EB RT	30	60	60	75	25	56	160	116	1	10	136	70	**175**	
	WB LT	30	60	60	75	38	72	173	132	8	28	143	88	**175**	
	WB RT	30	60	60	75	28	68	163	128	32	69	167	129	**175**	
	NB LT	30	60	60	75	38	76	173	136	15	43	150	103	**175**	
	NB RT	30	60	60	75	35	79	170	139	6	22	141	82	**175**	
	SB LT	30	60	60	75	56	95	191	155	32	63	167	123	**200**	
	SB RT	30	60	60	75	56	104	191	164	33	69	168	129	**200**	
Aspen Park Road		30													Analyzed as a single-lane roundabout without turn lanes
Robert Bennis School (w/Park Street Extension)	NB LT	30	60	60	75	*0*	*0*	135	60	*0*	*0*	135	60	**150**	
	SB RT	30	60	60	75	0	11	135	71	*0*	*0*	135	60	**150**	
Robert Bennis School (no Park Street extension)	NB LT	30	60	60	75	25	55	160	115	16	40	151	100	**175**	
	SB RT	30	60	60	75	3	18	138	78	*0*	*0*	135	60	**150**	
SD11/Splitrock Boulevard	EB LT	30	60	60	75	77	138	212	198	53	95	188	155	**225**	
	EB RT	30	60	60	75	114	185	249	245	71	126	206	186	**250**	
	NB LT	55			455	64	111	566		87	149	604		**625**	SDDOT Design Guidelines
	SB RT	55			455	51	99	554		53	95	550		**575**	SDDOT Design Guidelines

Notes:

- *50th and 95th percentile queues obtained from SimTraffic.*
- *0 (light grey zero) reflects unsignalized intersections where either no measured queue or turn lane not included in model. Recommended minimum turn lane length includes deceleration plus opening lengths.*
- *City of Sioux Falls turn lane lengths: Table 8.5 of Engineering Design Standards, Chapter 8: Street Design and Pavement Thickness (referenced 2/26/19).*
- *SDDOT turn lane lengths: Figure 12-12 of Road Design Manual, Chapter 12: Intersections (referenced 2/26/19).*

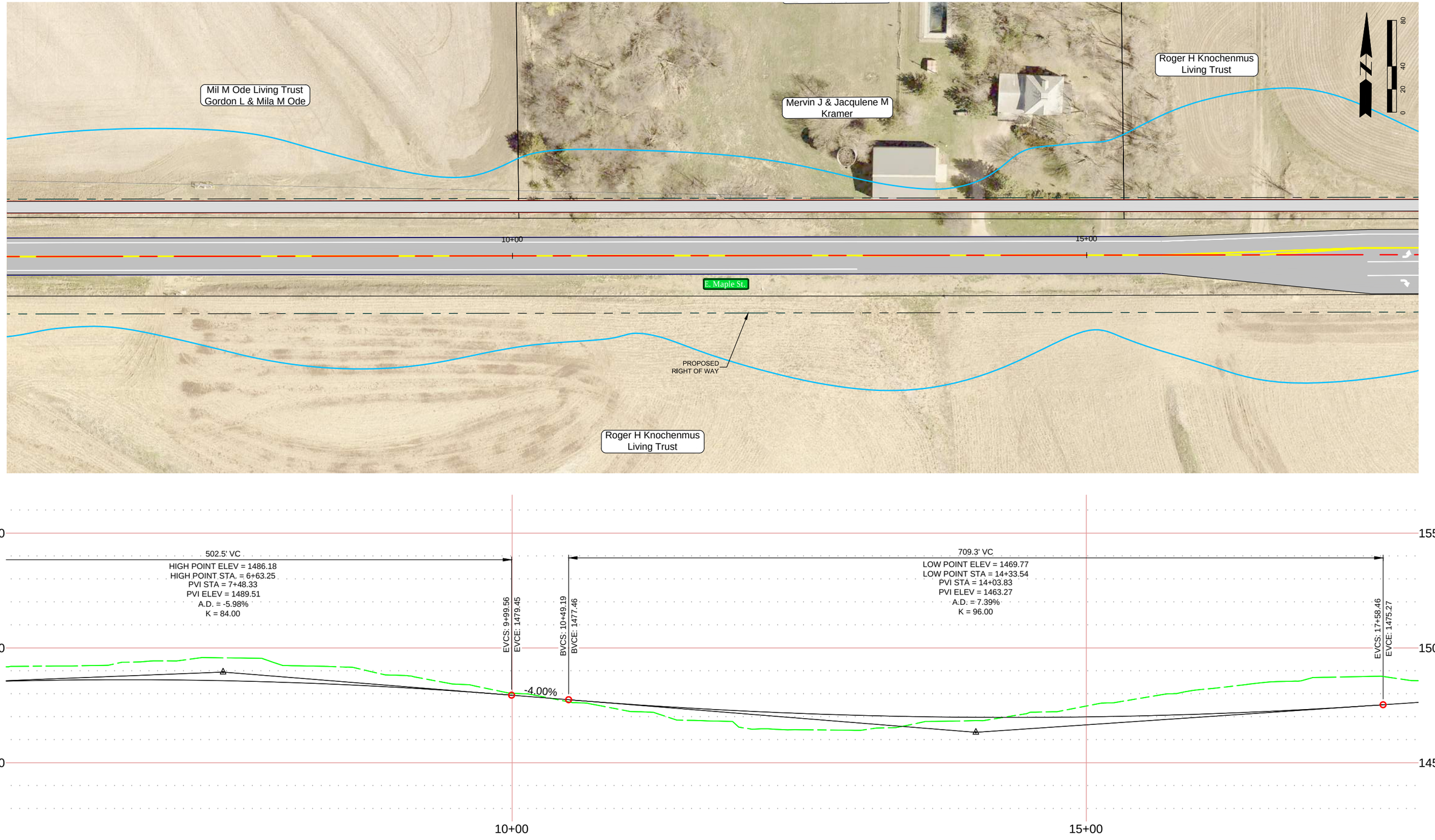
Appendix F. Maple Street/Park Street Corridor Conceptual Plan and Profile





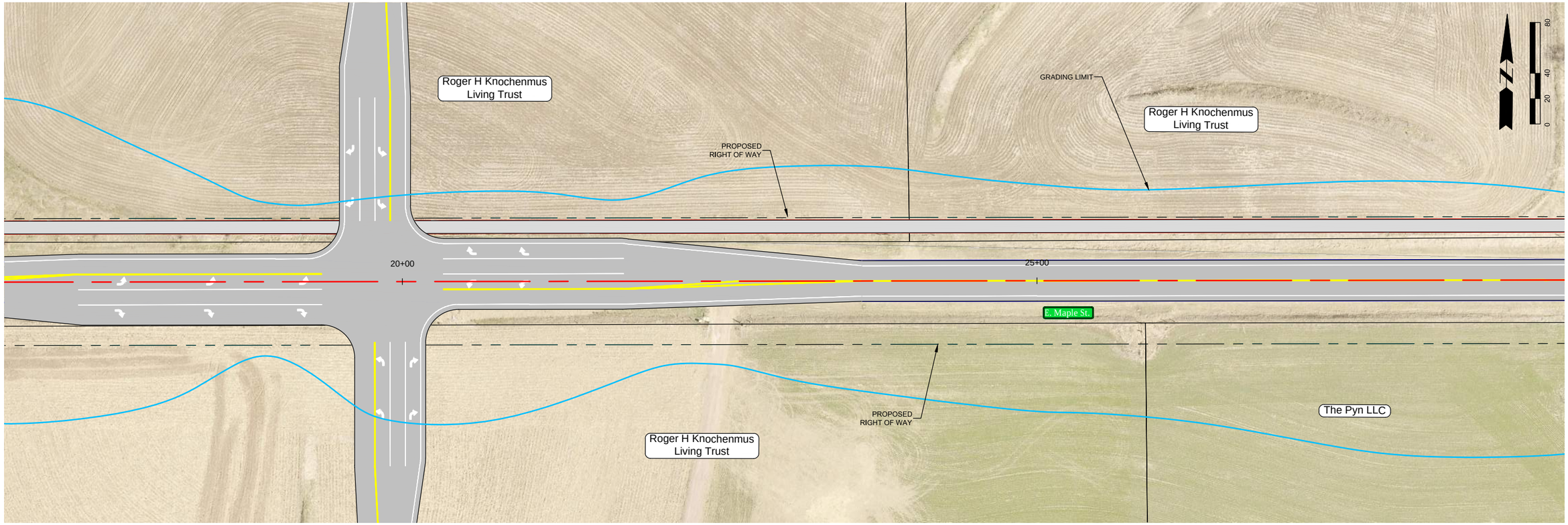
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

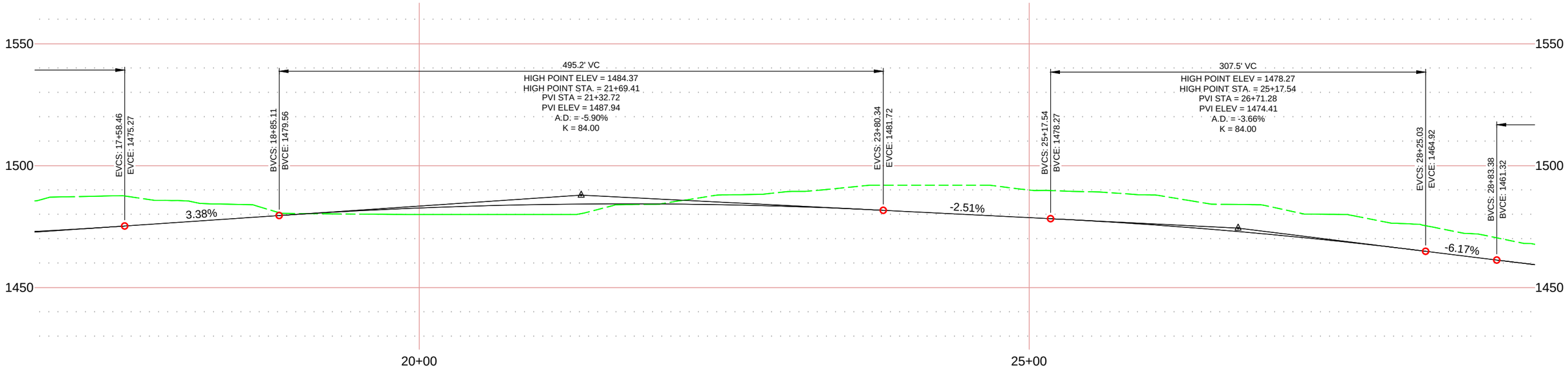
2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

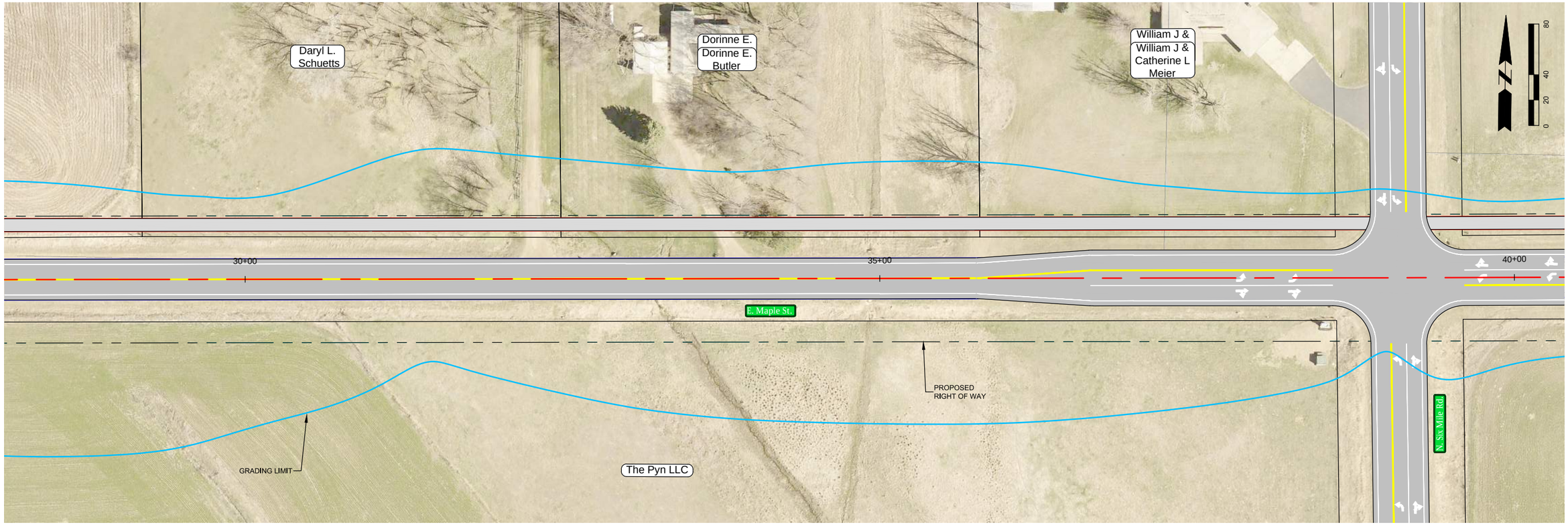
2018 / 2019

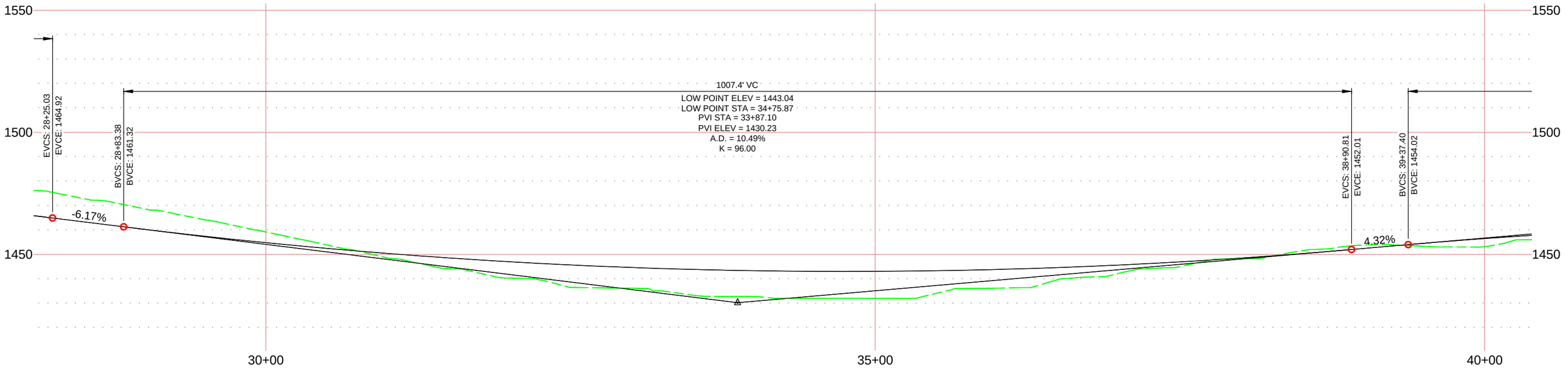




MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

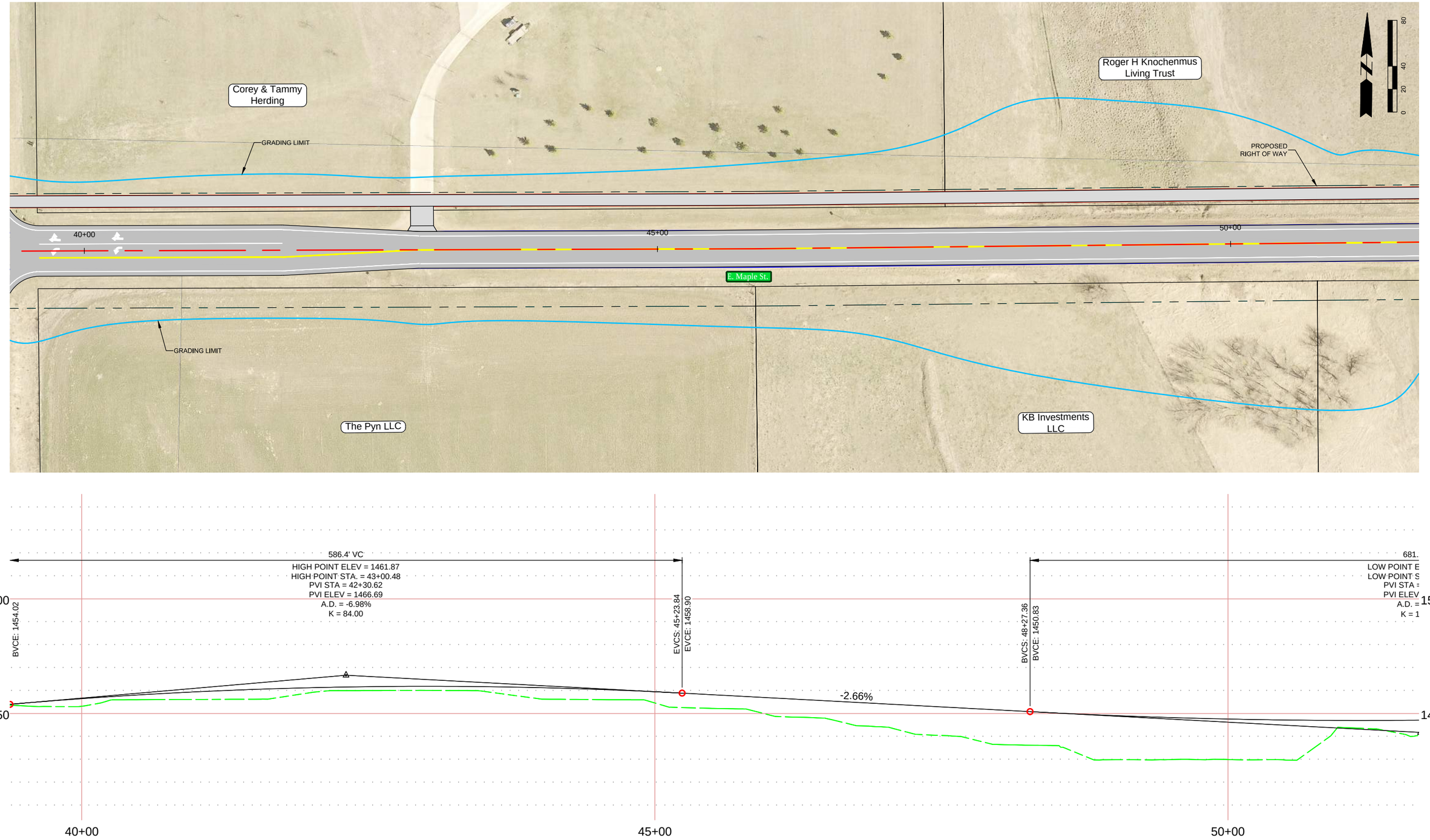
2018 / 2019





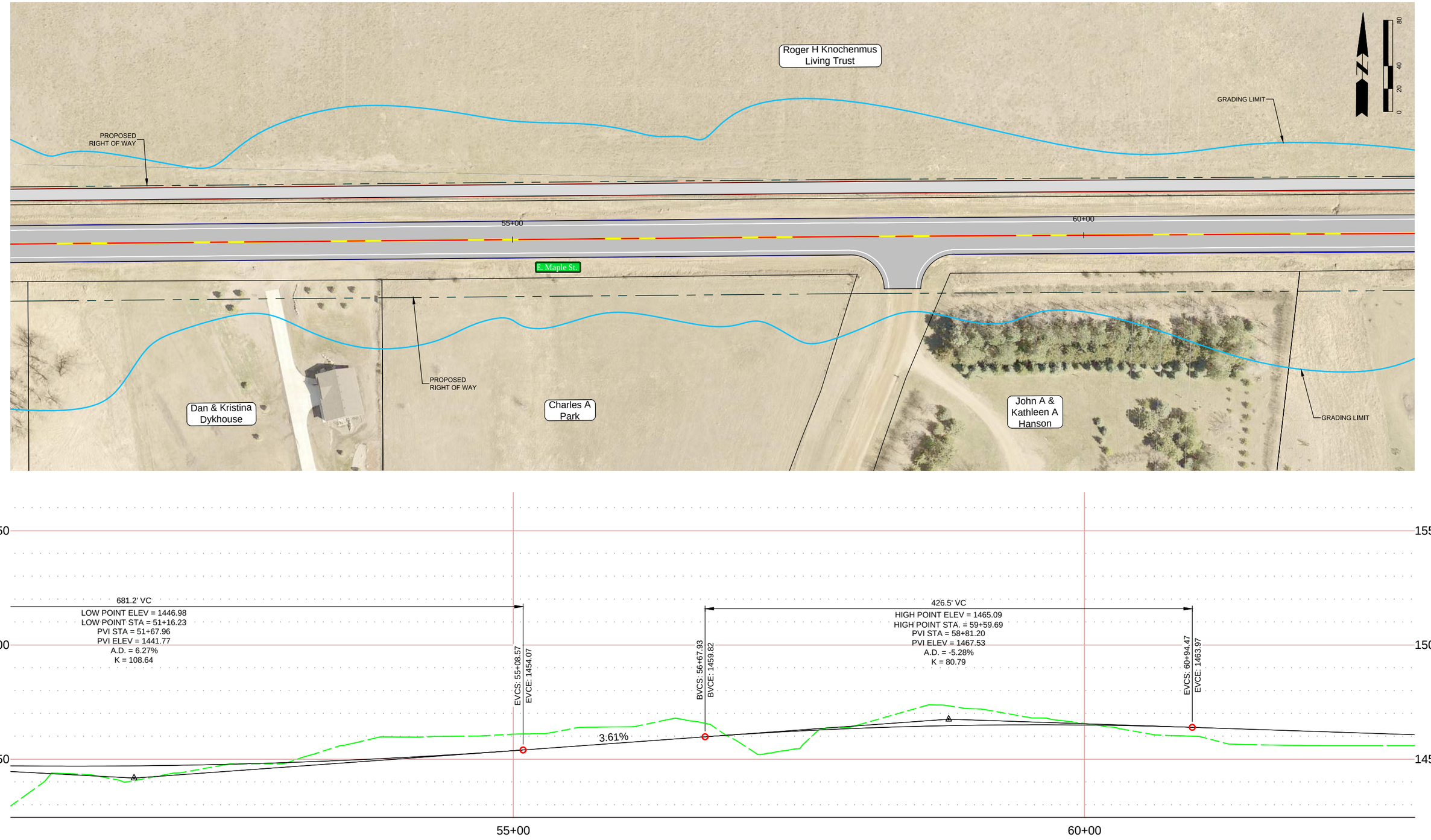
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019

East River Electric Power

Wayne F Rasmussen

GRADING LIMIT

PROPOSED RIGHT OF WAY

65+00

70+00

E. Maple St.

GRADING LIMIT

GRADING LIMIT

Jimmie L & Angeline K Brown

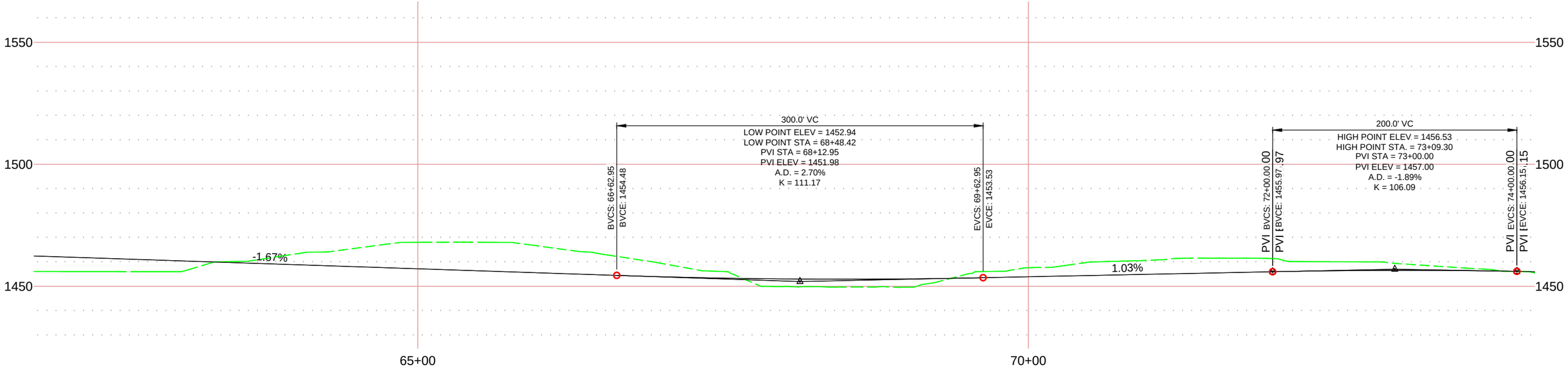
Allan D & Patricia Hall

Tim & Barb Risty

Thomas P Montoya Living Trust

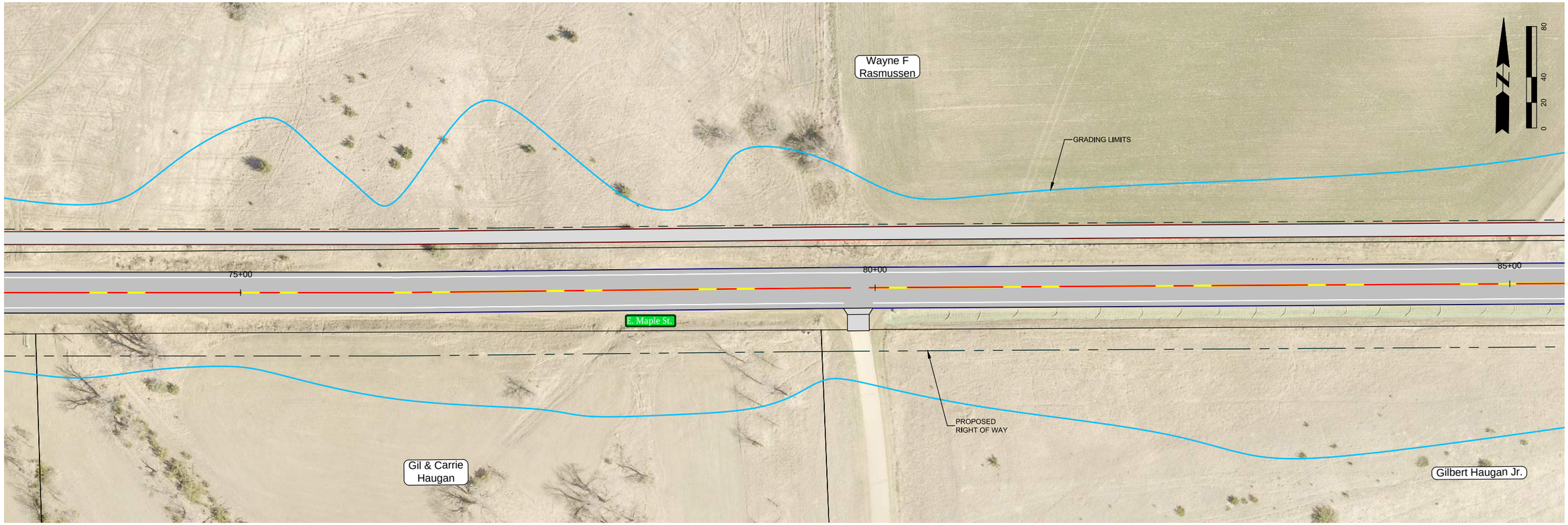
Thomas & Sherry Montoya

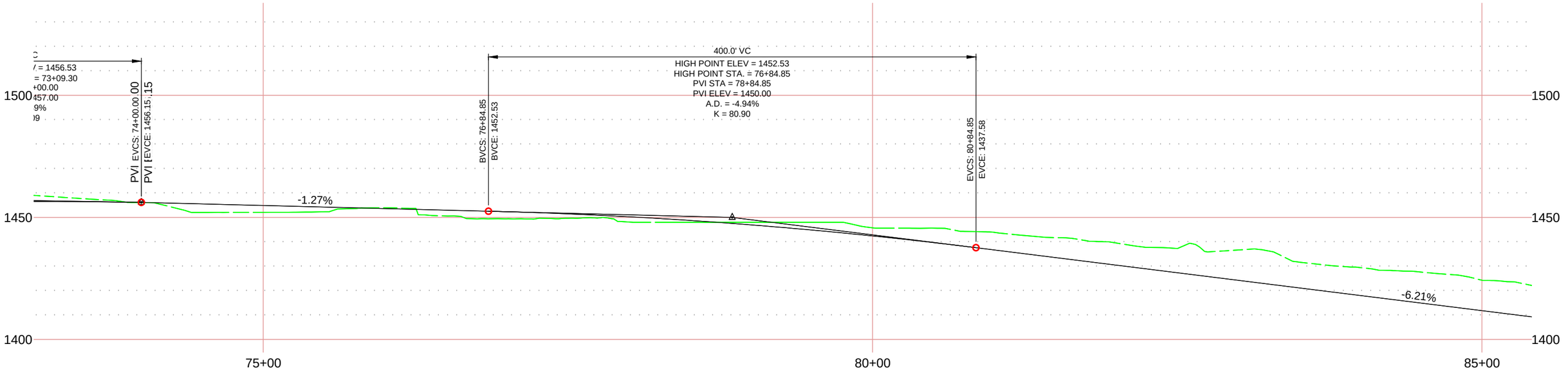
0 20 40 80



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

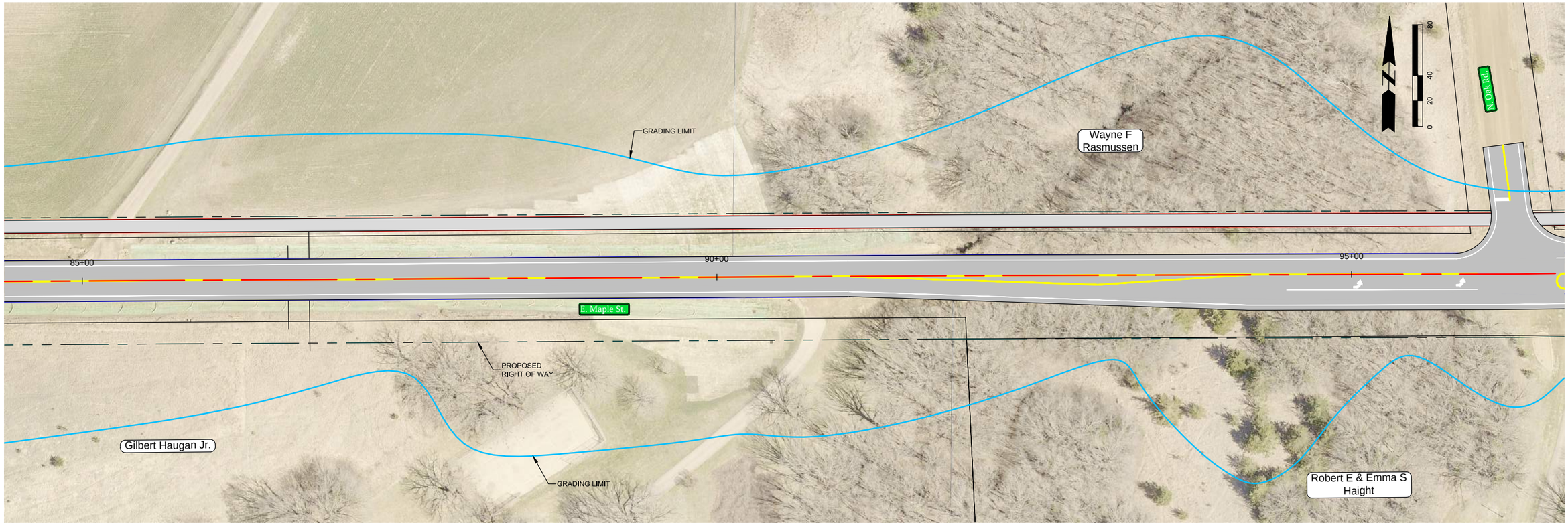
2018 / 2019

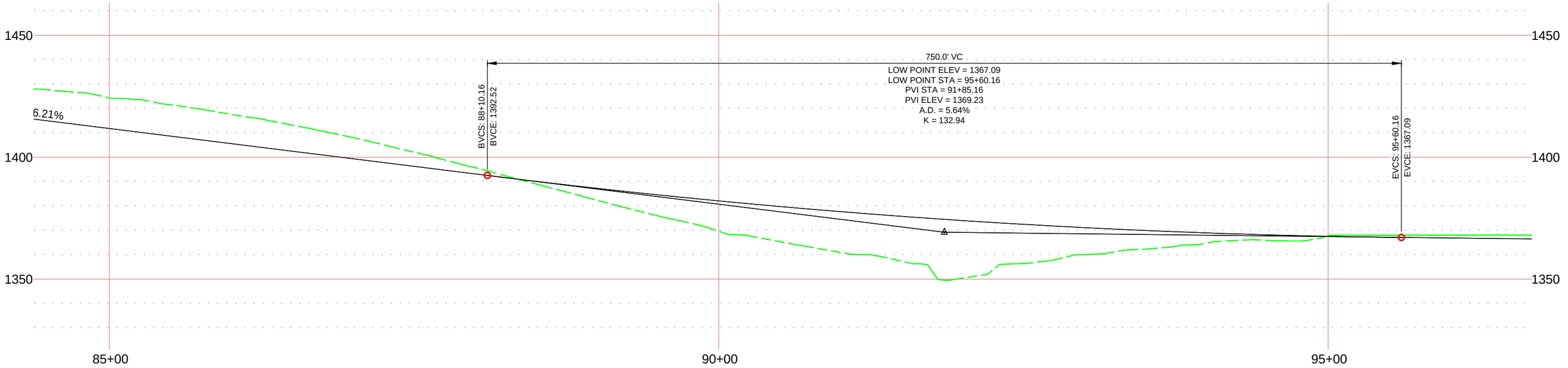




MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

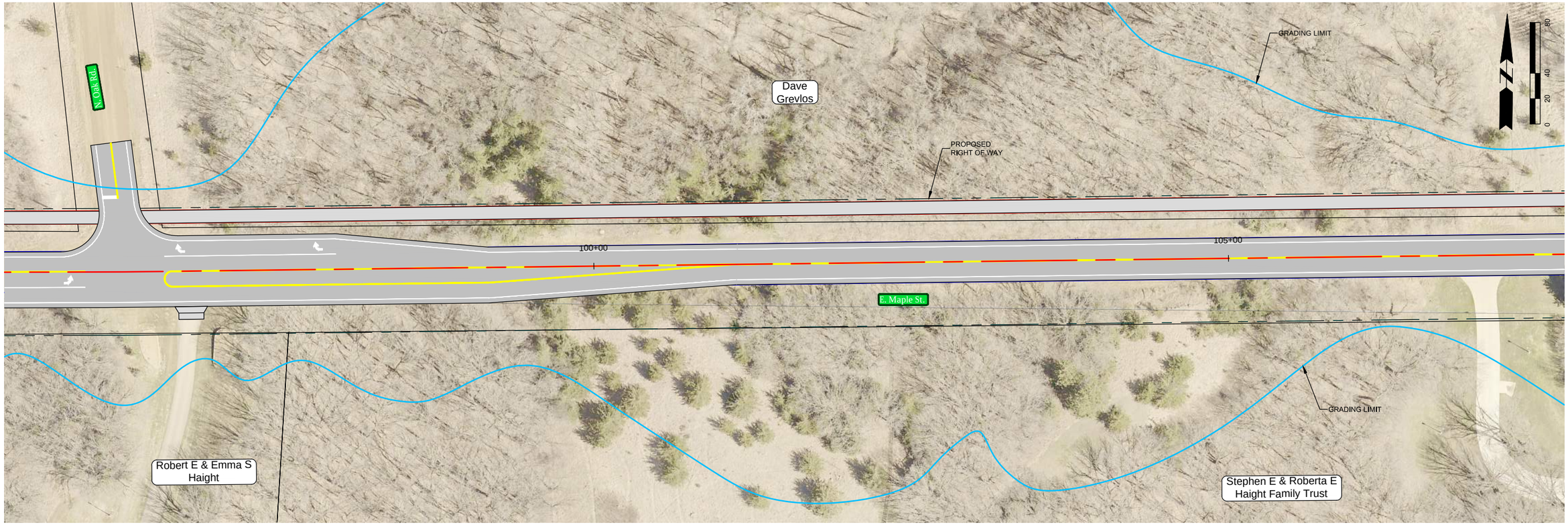
2018 / 2019

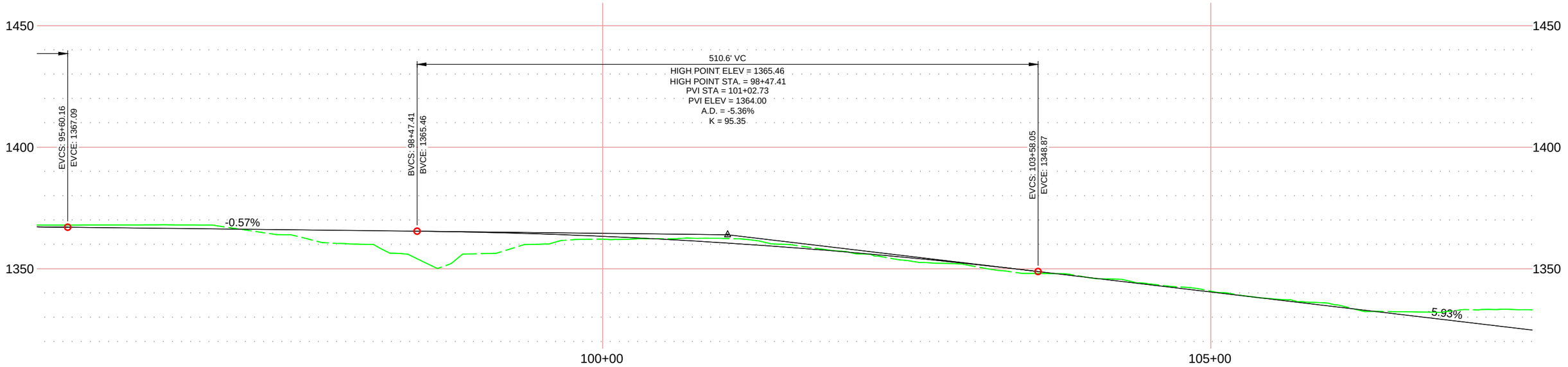




MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

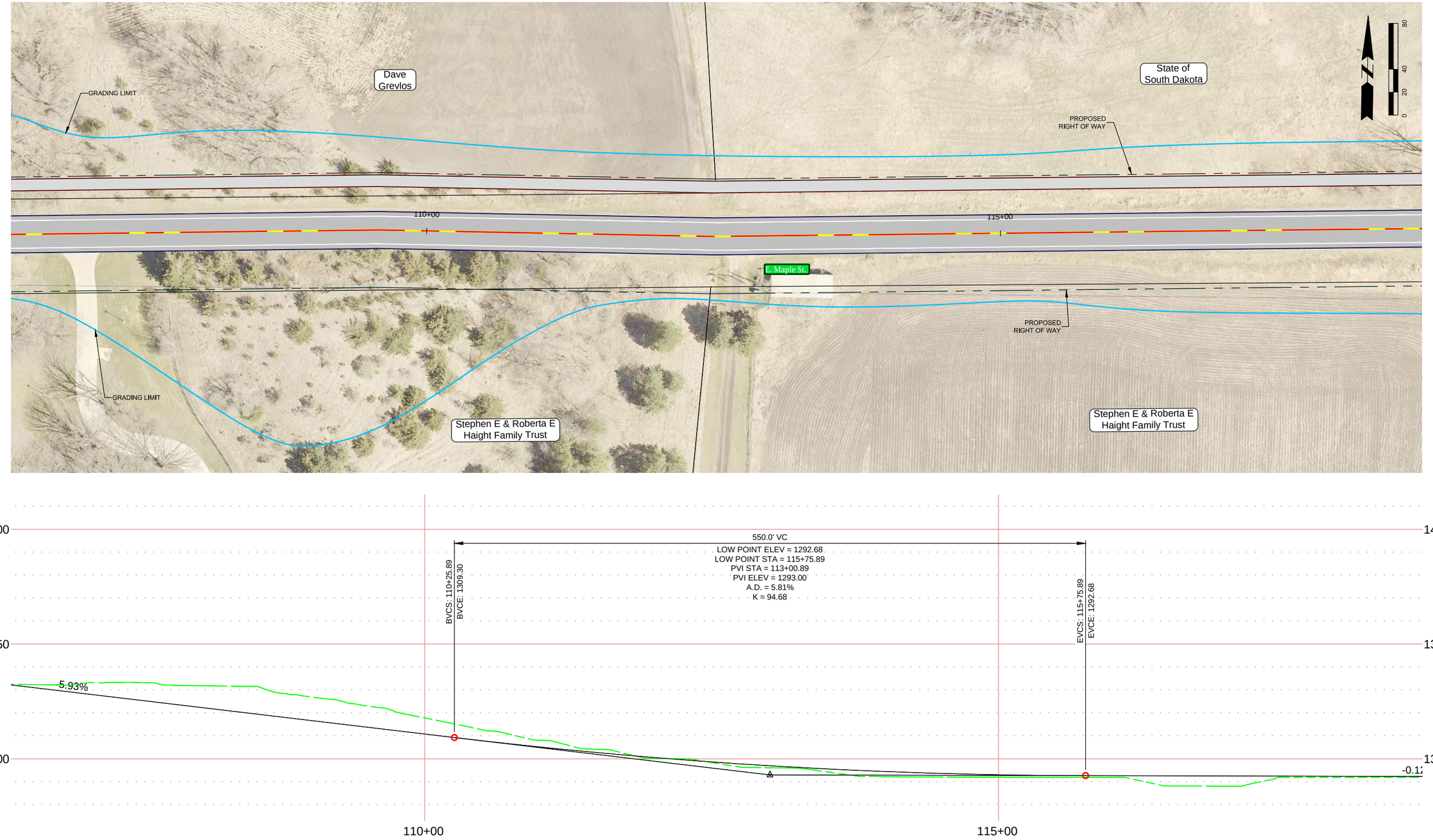
2018 / 2019





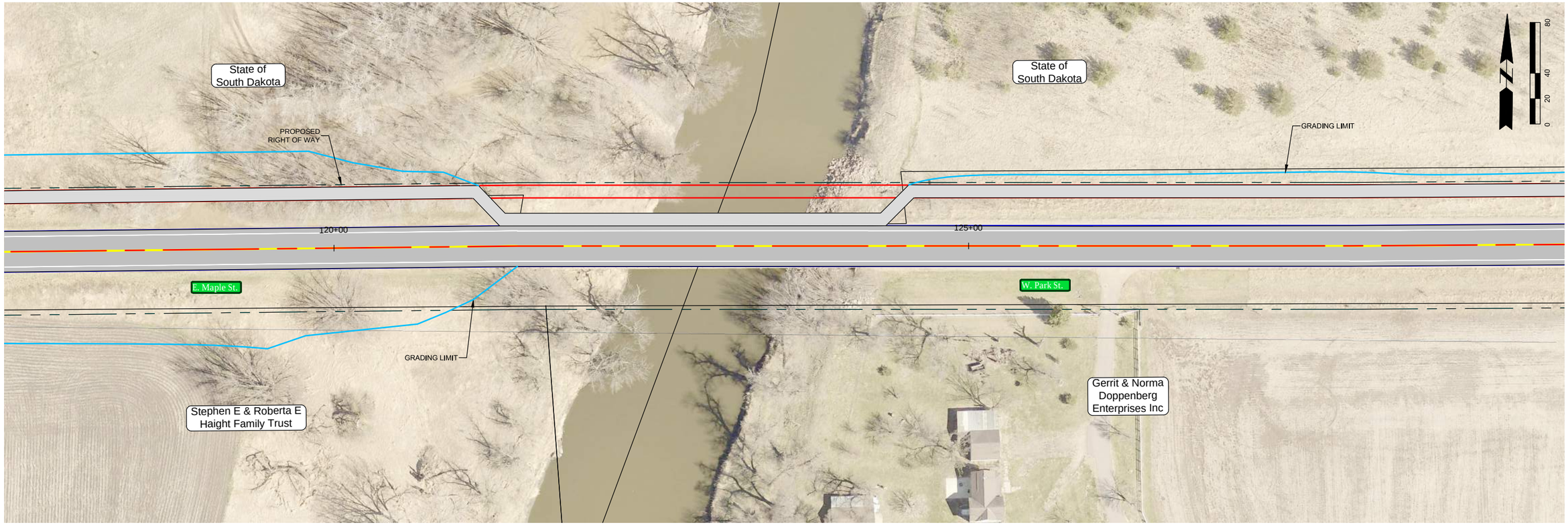
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

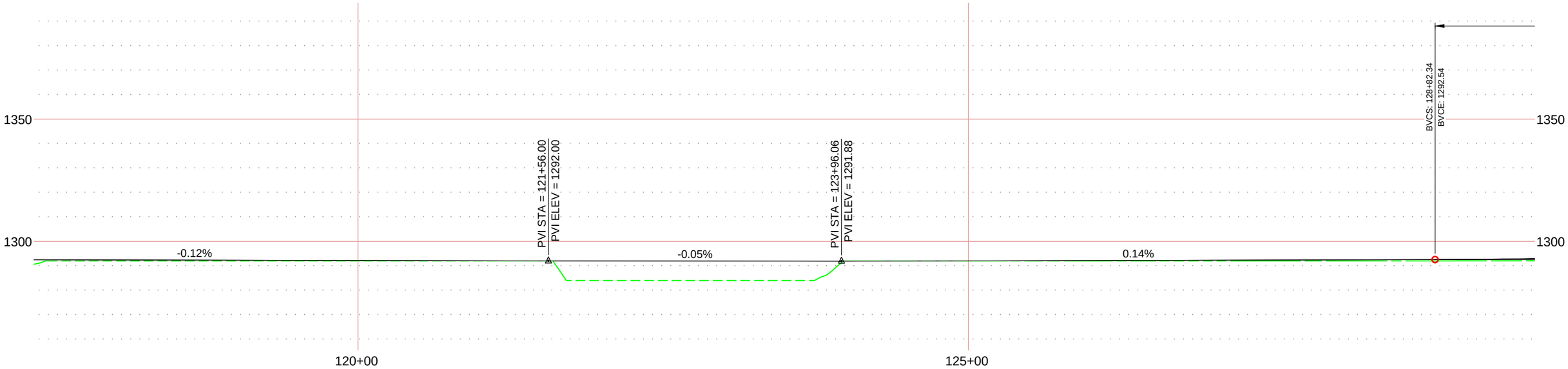
2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

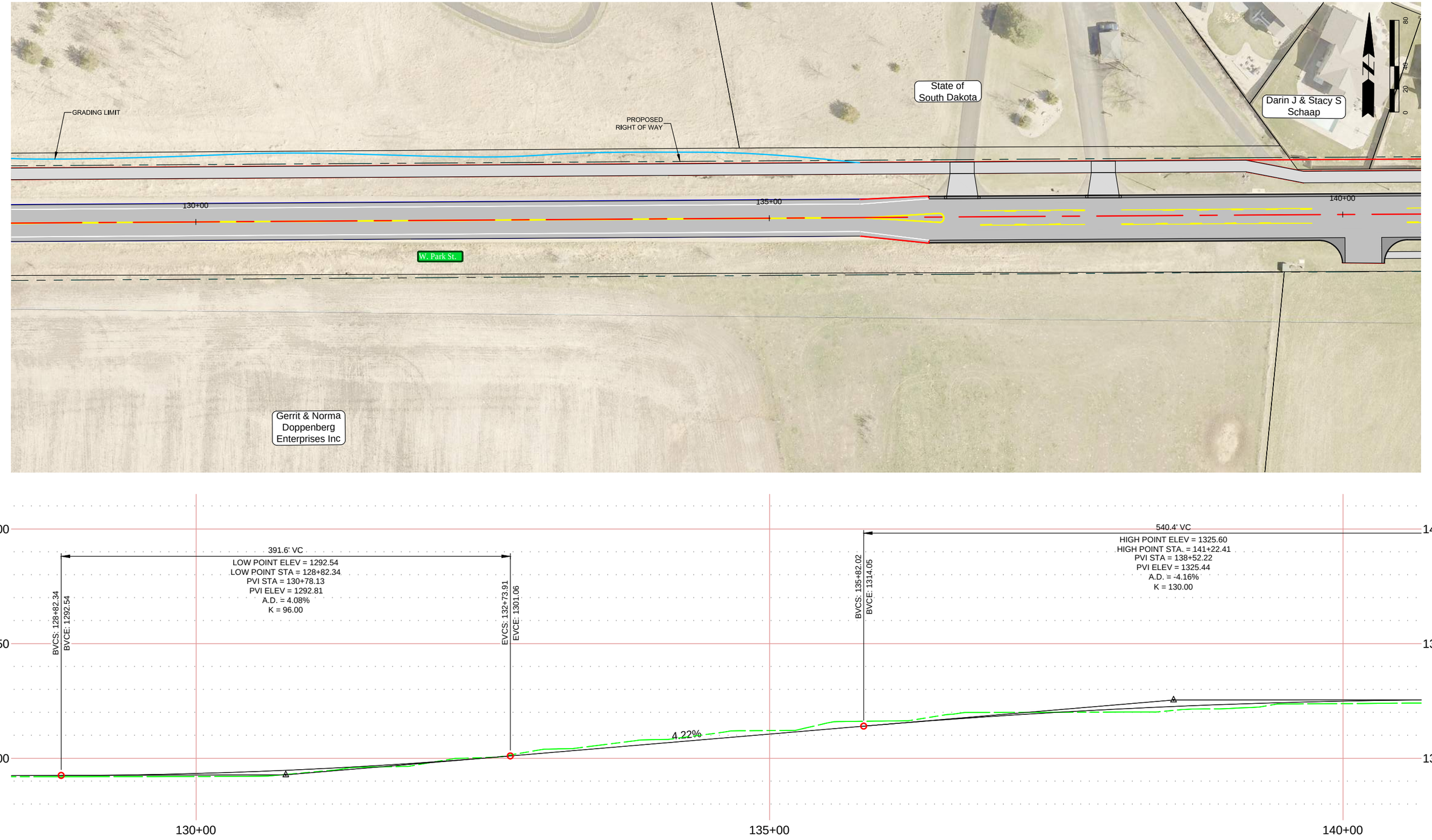
2018 / 2019





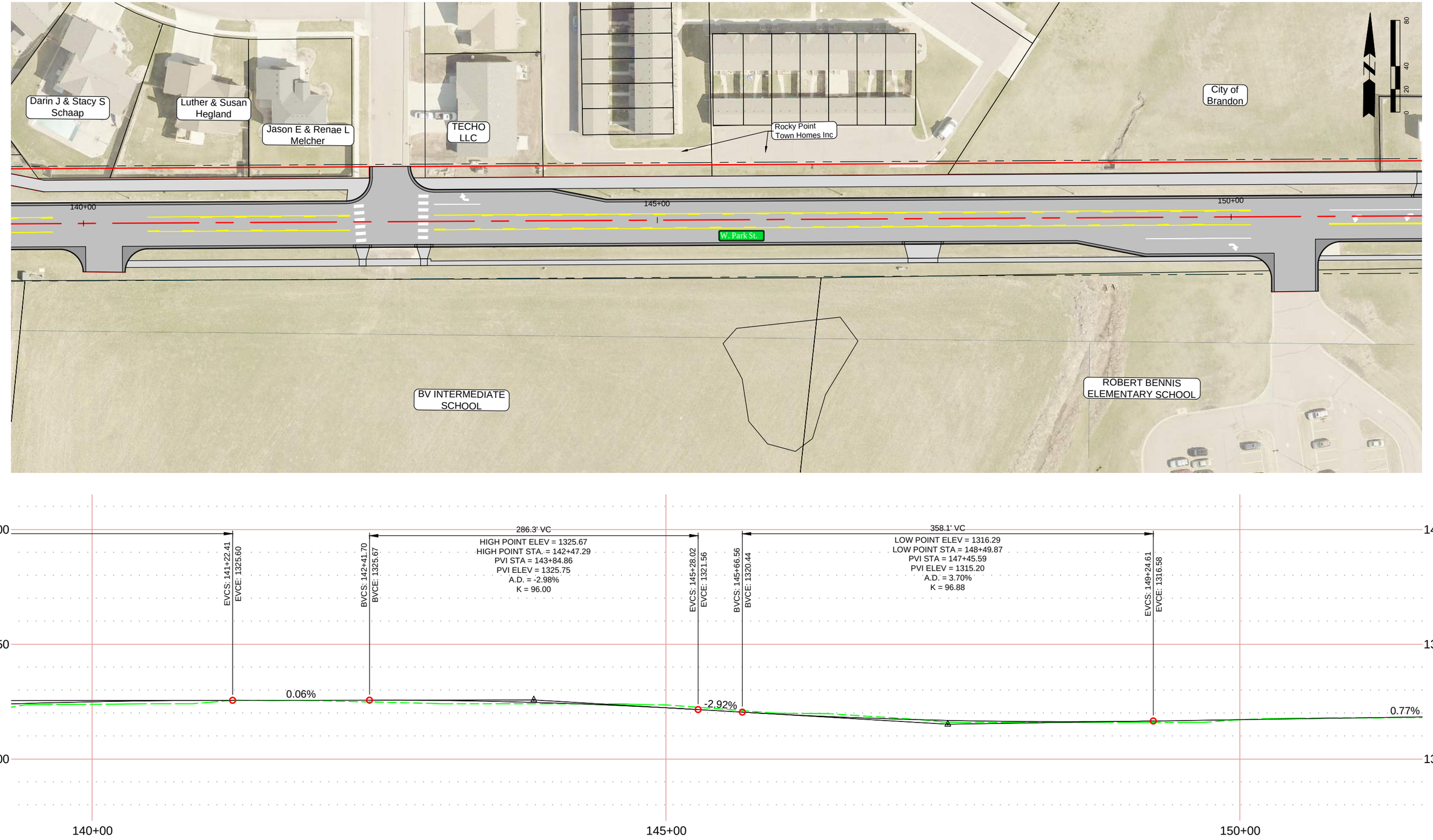
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019



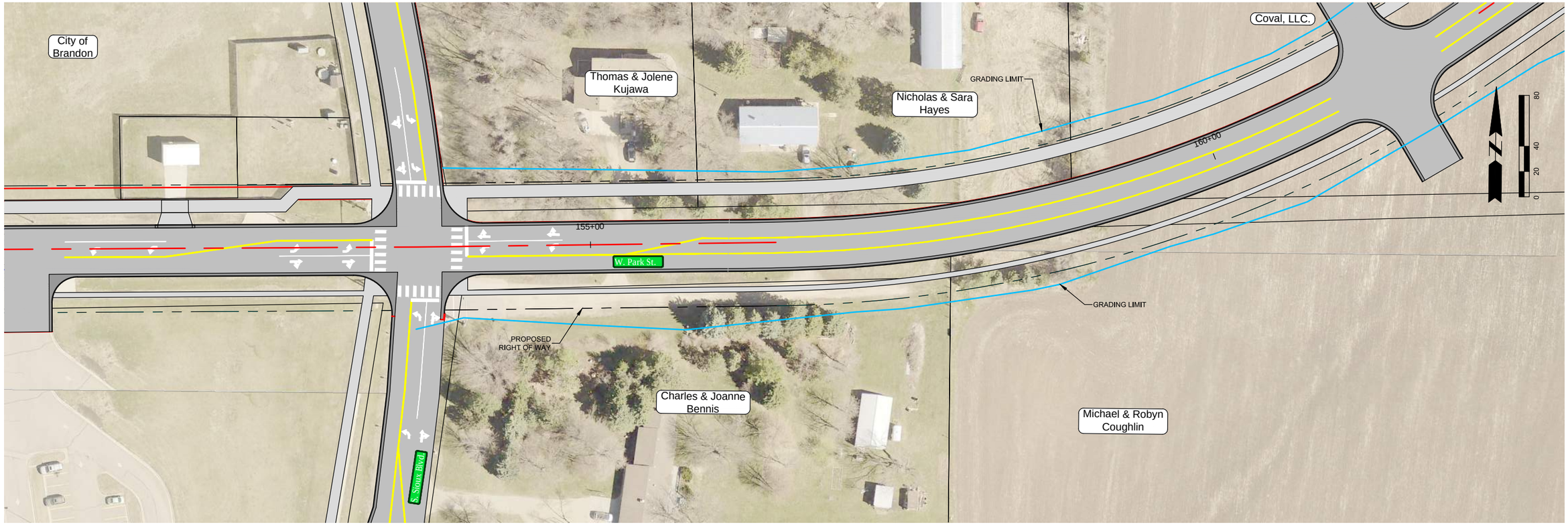
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

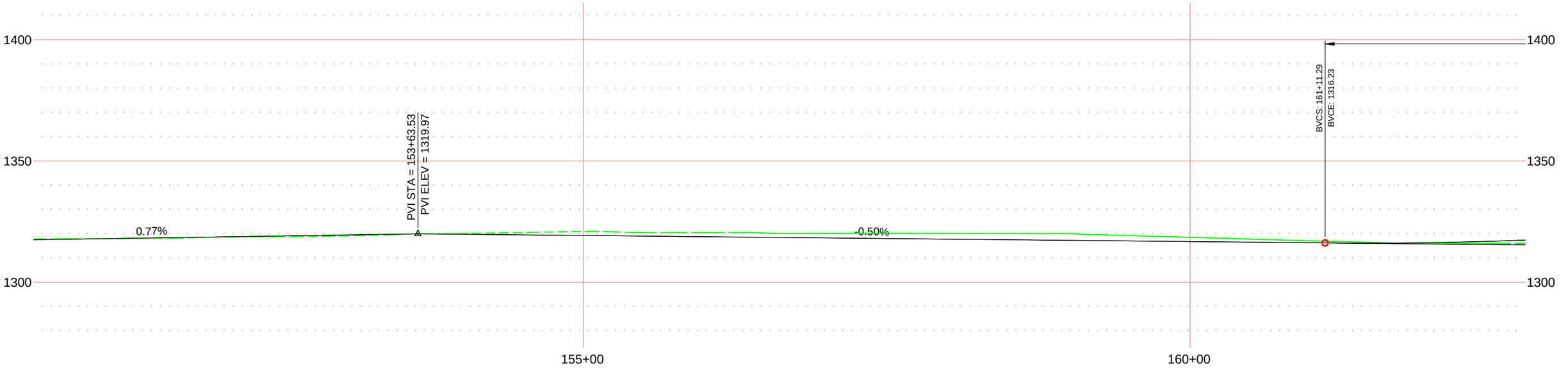
2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

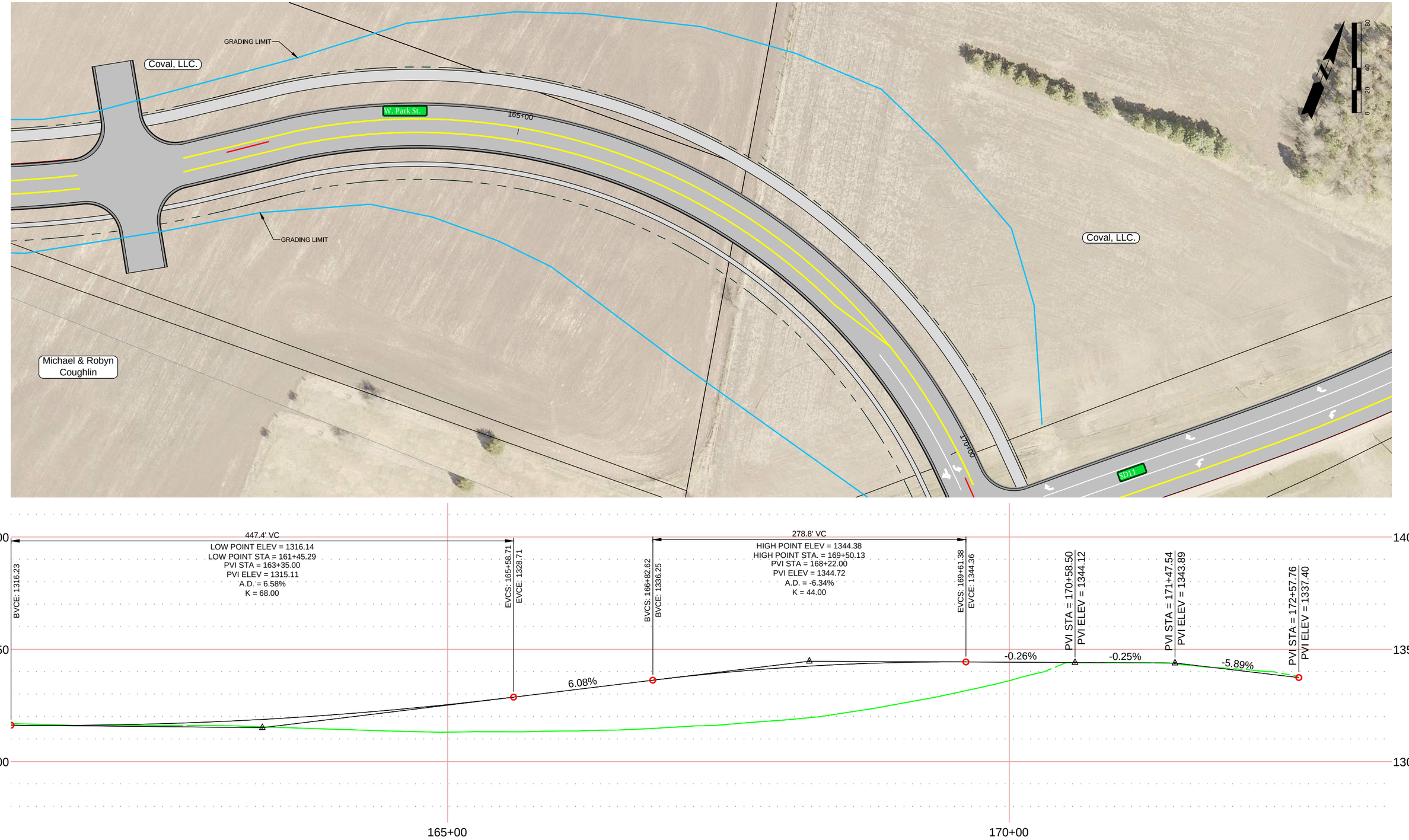
2018 / 2019





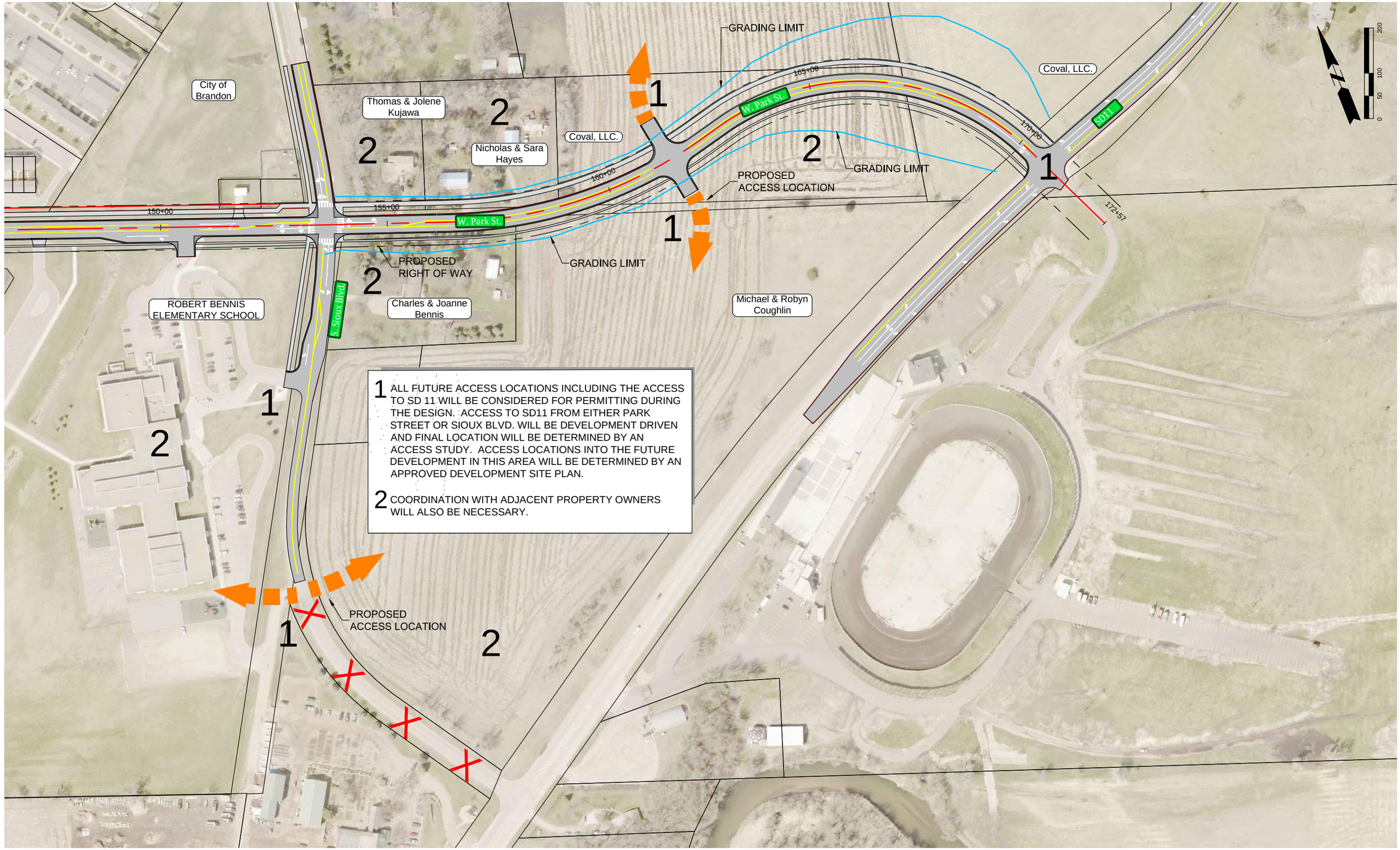
MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019



MAPLE STREET / PARK STREET CORRIDOR STUDY
FROM VETERANS PARKWAY TO SD11

2018 / 2019



MAPLE STREET / PARK STREET ACCESS OPTION FROM VETERANS PARKWAY TO SD11

2018 / 2019