Appendices (Available Electronically)

A. Methods and Assumptions Document
B. Traffic Forecast Memo
C. Existing Condition Memo
D. Future Conditions Memo
E. Build Concept
F. HCS Analysis Reports
G. Concept Evaluation Memorandum
H. Safety Memo / IHSDM Output

Appendix A - Methods and Assumptions Document

AMENDMENT #1

Methods & Assumptions Document

I-229 Exit 6 (10th Street) Interchange Study
HP5596(20) P (Interchange Study)

1. Methods and Assumptions Document

This Methods and Assumptions document was developed in preparation for the Methods and Assumptions Meeting held as part of the project start-up with representatives from the South Dakota Department of Transportation (SDDOT), Federal Highway Administration (FHWA), City of Sioux Falls, and Sioux Falls MPO. This document is intended to serve as a historical record of the process, dates, and decisions made by the study team representatives for the ***I-229 Exit 6 (10th Street) Interchange Study*** portion of the project.

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2. Stakeholder Acceptance Page

The undersigned parties concur with the Methods and Assumptions for the ***I-229 Exit 6 (10th Street) Interchange Study*** as presented in this document.

SDDOT:	FHWA:
Signature	MARK D HOINES Digitally signed by MARK D HOINES Date: 2020.09.30 06:24:00 -05'00' Signature
Planning Engineer Title	Planning/Civil Rights Specialist Title
Sept. 30, 2020 Date	09/30/2020 Date

The undersigned parties concur with AMMENDMENT #1 to the Methods and Assumptions for the ***I-229 Exit 6 (10th Street) Interchange Study*** as presented in this document in red.

SDDOT:	FHWA:
_____ Signature	_____ Signature
_____ Title	_____ Title
_____ Date	_____ Date

Notes:

(1) Participation on the Study Advisory Team and/or signing of this document does not constitute approval of the ***I-229 Exit 6 (10th Street) Interchange Study*** Final Report or conclusions.

(2) All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed-upon changes to the assumptions in this document a revision will be created, endorsed, and signed by all the signatories.

3. Introduction and Project Description

Project Background, Understanding, and Need for Study

The recently completed I-229 Major Investment Study determined that the I-229 Exit 6 (10th Street) interchange will need modification to better handle current and future traffic. That study also recommended that the I-229 mainline be expanded to 3 lanes in each direction between Exit 5 (26th Street) and Exit 6 (10th Street).

SDDOT currently intends to reconstruct the I229 mainline and Exit 6 in conjunction with City of Sioux Falls construction of 10th Street east and west of the interchange. The exact limits of the construction will be determined by this study and are currently planned to begin in ~~for~~ Federal fiscal year 2027.

Five future alternatives for the Exit 6 interchange were forwarded from the I-229 Major Investment Study. The technical feasibility of each alternative will be evaluated for consideration in the forthcoming environmental documentation. The alternatives include:

- No-Build
- Widen existing single point interchange, 4-lane divided corridor
- Widen existing single point interchange, 5-lane undivided corridor
- Convert to DDI interchange, 4-lane divided corridor
- Convert to DDI interchange, 5-lane undivided corridor

One additional interchange alternative will be evaluated, including:

- Modification of single point interchange through the addition of a second northbound to westbound left turn lane, a second northbound to eastbound right turn lane, and a second southbound to eastbound left turn lane

Three future alternatives for the I-229 mainline were forwarded from the I-229 Major Investment Study. The technical feasibility of each alternative will be evaluated for consideration in the forthcoming environmental documentation. The alternatives include:

- No Build
- Convert to a six-lane cross-section with no curve improvement
- Convert to a six-lane cross-section with curve improvement

Two additional alternatives for the I-229 mainline will be evaluated, including:

- Widen inside shoulder north of 18th Street to 10th Street
- No inside shoulder widening

Study expectations and objectives, identified in the study Request for Proposal (RFP), include:

1. Interchange Modification Study: The development of the Interchange Modification Justification Report (IMJR) for the interchange.
2. Environmental Study: The development of all environmental documentation

necessary for the construction project to modify the interchange and related crossroad improvements.
3. Topographic Survey: Conducting the survey data necessary for design.
4. Subsurface Utility Engineering and Evaluation (SUE): Collecting the subsurface utility locations.
5. Design: Complete design necessary to prepare construction plan set(s) for the project(s).

Study Schedule

Date	Task/Event
July 2020	Project Kickoff and M&A Document
August – September 2020	Data Collection
September – October 2020	Traffic Forecasts, Analysis, and Crash History Reviews
October 2020	Concept Development, Analysis, and Screening
October – November 2022 ~~2020~~	Build Options Refinement, Analysis, and Screening
December 2022 ~~2020~~	Draft IMJR
January 2023 ~~2021~~ – March 2023 ~~2021~~	IMJR Document Reviews and Revisions
April 2023 ~~2021~~	Final IMJR and Draft Environmental Scan Documents (as field conditions allow, certain studies may be delayed if dependent upon weather conditions)

Location

The I-229 Exit 6 interchange is located within east-central Sioux Falls. Details of the study area, including the I-229 mainline and adjacent intersecting arterial streets are provided in Section 4 of this document.

Facilities Affected by the Study

The study will evaluate traffic conditions on public facilities within the study area, including the I-229 and 10th Street corridors and connecting streets. Private access/driveway locations within the study area are also likely to be affected. See the Study Area discussion for a list of these facilities.

Widening on the I-229 mainline could impact the interstate overpasses at 12th Street and 18th Street, requiring reconstruction of the structures. If reconstructed, the structures need to provide pedestrian and bicycle access for both eastbound and westbound non-motorized traffic.

Modifications within the study area may also affect parallel and cross-routes around the study area through detour routes during construction and potential shifts in traffic patterns following construction.

Previous Studies

The following previous studies will be reviewed during this study:

- Go Sioux Falls MPO 2040 Long-Range Transportation Plan
  - http://siouxfallsmpo.org/files/3815/1119/5024/SiouxFalls2040LRTP-FinalNov2015wApp.pdf
- Shape Sioux Falls 2045 Comprehensive Plan ~~(currently being finalized)~~
- Coordinated Public Transit – Human Services Plan
  - http://siouxfallsmpo.org/files/3715/7410/4775/2018_Coordinated_Plan_with_Addendums.pdf
- MPO Bicycle Plan
  - http://siouxfallsmpo.org/files/1313/7766/4918/MPO_Bicycle_Plan.pdf
- I-229 Major Investment Corridor Study
  - http://www.i229study.com/
- I-229 Exit 5 (26th Street) Interchange Justification Study
  - https://dot.sd.gov/media/documents/Exit5_26thStreet_IMJR102714.pdf
- I-229 Exit 6 (10th Street) Final Report
  - https://dot.sd.gov/media/documents/I229_SS3_FINALReportAppendices_June2017.pdf
- I-229 Exit 7 (Rice Street) Final Report
  - https://dot.sd.gov/media/documents/I229_SS5_FINALReportAppendices_June2017.pdf

Study Advisory Team Members

A Study Advisory Team has been formed to guide the study through completion. The Study Advisory Team is comprised of representative parties of the SDDOT, FHWA, the City of Sioux Falls, and the Sioux Falls MPO. Members of the Study Advisory Team are:

Participant	Agency
Greg Aalberg	SDDOT – Sioux Falls Area
Shannon Ausen	City of Sioux Falls – Public Works
Jeff Brosz	SDDOT – Trans. Inv. Management
Travis Dressen	SDDOT – Mitchell Region
Stacy DuChene	SDDOT – Road Design
Jim Feeney	Sioux Falls MPO
Joel Gengler	SDDOT - ROW
Sarah Gilkerson	SDDOT – Project Development
Steve Gramm	SDDOT – Project Development

Heath Hoftiezer	City of Sioux Falls – Public Works
Joanne Hight	SDDOT – Administration
Mark Hoines	FHWA
Andrea Kramer	SDDOT – Administration
Tom Lehmkuhl	FHWA
Steve Kerr	SDDOT – Bridge Design
Scott Rabern	SDDOT – Road Design
Brian Rogness	SDDOT – Project Development
~~Brooke White~~ Joseph Sestak	SDDOT – Mitchell Region
Kelly VanDeWiele	FHWA

* Additional team members may be added as the study progresses.

4. Study Area

The I-229 Exit 6 (10th Street) Interchange Study area includes (corridors highlighted in red in Figure 1):

- 10th Street from the intersection with Jessica Avenue to the signalized Hy-Vee/Campbells entrance, approximately 0.75 miles
- 26th Street from Van Eps Avenue to Southeastern Avenue, approximately 0.75 miles
- Rice Street from Lowell Avenue to Bahnson Avenue, approximately 1.2 miles
- 6th Street from Lowell Avenue to Cleveland Avenue, approximately 0.3 miles
- 12th Street from Lowell Avenue to Cleveland Avenue, approximately 0.3 miles
- 18th Street from Southeastern Avenue to Cleveland Avenue, approximately 0.4 miles
- Southeastern Avenue from 26th Street to 18th Street, approximately 0.6 miles
- Mainline I-229 from north of I-229 Exit 4 interchange to north of the I-229 Exit 7 interchange, approximately 3.5 miles
- The ramps for the I-229 Exit 5 (26th Street) interchange
- The ramps for the I-229 Exit 6 (10th Street) interchange
- The ramps for the I-229 Exit 7 (Rice Street) interchange

The limits of the environmental study will be determined as part of the planning study but are anticipated to encompass a smaller area than the study corridors.

Refinements of the mainline, interchange and arterial alternatives will be made to address the findings of the technical analysis and will be reflected in the final study results and reported measures of effectiveness.

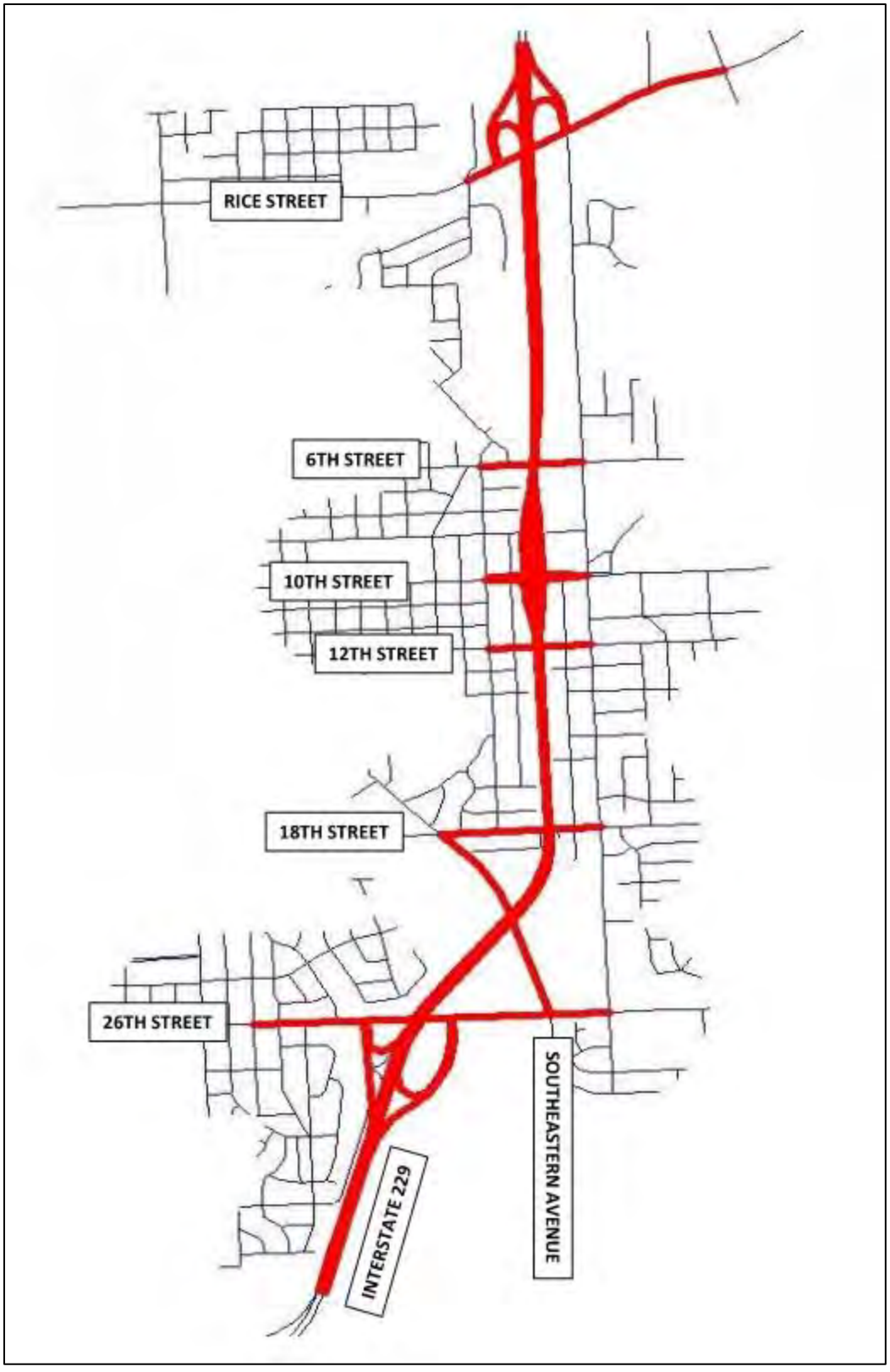

Figure 1 – Study Area Overview Map

Study intersections that will be analyzed as multi-modal intersections, either signal or stop sign controlled, include:

Ref #	Street #1	Street #2
1	10th Street	Jessica Avenue
2	10th Street	Lowell Avenue
3	10th Street	Conklin Avenue
6	10th Street	Blaine Avenue
7	10th Street	Cleveland Avenue
8	10th Street	Hy-Vee/Campbell's Entrance
9	26th Street	Van Eps Avenue
10	26th Street	Yeager Road/Frederick Drive
13	26th Street	Southeastern Avenue
14	26th Street	Cleveland Avenue
15	Rice Street	Lowell Avenue
18	Rice Street	Bahnson Avenue
19	18th Street	Southeastern Avenue
20	18th Street	Cleveland Avenue
21	12th Street	Lowell Avenue
22	12th Street	Cleveland Avenue
23	6th Street	Lowell Avenue
24	6th Street	Cleveland Avenue

Study intersections that will be analyzed as interchange ramp terminals include:

Ref #	Street #1	Street #2
4	10th Street	Single Point Ramp Terminal
11	26th Street	SB Ramp Terminal
12	26th Street	NB Ramp Terminal
16	Rice Street	SB Ramp Terminal
17	Rice Street	NB Ramp Terminal

5. Analysis Years/Periods

This study will evaluate traffic operations during the following time periods:

- Existing Conditions (Year 2021)
- Year of Project Completion (Year 2027)
- Planning Horizon Year (Year 2050)

Existing Conditions (Year 2021)

Existing conditions analyses will be conducted for year 2020 volume conditions. The raw counts will be factored to a design season and balanced between intersections. Peak hour volumes will be determined on a per intersection basis and representative of:

- AM Peak Hour
- PM Peak Hour

Future Conditions (Years 2027 and 2050)

Future/Design conditions analyses will be conducted for years 2027 Year of Project Completion and 2050 Planning Horizon Year. Traffic forecasts for these Future Conditions will be developed using methodology outlined in the 'Existing Volumes and Traffic Forecasts' section. Future Conditions peak hour timeframes will coincide with those identified in the Existing Conditions.

For 2027 Year of Project Completion and 2050 Planning Horizon Year, the following peak hours will be evaluated:

- AM Peak Hour
- PM Peak Hour

6. Data Collection

Intersection Turning Movement Count Data

Turning movement counts define actual traffic at the study intersections during a typical weekday. Turning movement counts are available for some of the study area intersections while new counts will have to be conducted at other locations. The City will provide historical turning movement counts from 2017 – 2019 and new counts will be conducted at any locations that have not been counted during this period. All counts will be factored for annual growth and seasonality to produce a balanced 2021 data set for analysis. Factoring of historical counts will be used to eliminate the effects of the COVID-19 pandemic on traffic volumes and to account for construction within the study area.

Counts at Rice Street/Bahnson Avenue and 12th Street/Lowell Avenue will be collected by the consultant team in September 2020. The new intersections at 26th Street/ Frederick Drive/Yeager Road and 26th Street/ I-229 SB ramp will be counted after 26th Street construction is completed to establish a volume baseline and validate the balanced 2021 data set. The new turning movement counts will be 12-hour duration (6:00 AM to 6:00 PM), collected to cover the AM and PM peak periods in 15-minute

intervals. Vehicle classification and pedestrian/bicycle data will also be included in these counts. Study area intersections and count status include:

Ref #	Street #1	Street #2	Year Last Collected
1	10th Street	Jessica Avenue	2017
2	10th Street	Lowell Avenue	2017
3	10th Street	Conklin Avenue	2013
4	10th Street	Single Point Ramp Terminal	2019
5	10th Street	NB Ramp Terminal	***
6	10th Street	Blaine Avenue	2013
7	10th Street	Cleveland Avenue	2019
8	10th Street	Hy-Vee/Campbell's Entrance	2019
9	26th Street	Van Eps Avenue	2018
10	26th Street	Yeager Road/Frederick Drive	2018**
11	26th Street	SB Ramp Terminal	**
12	26th Street	NB Ramp Terminal	2018**
13	26th Street	Southeastern Avenue	2018**
14	26th Street	Cleveland Avenue	2018
15	Rice Street	Lowell Avenue	2015
16	Rice Street	SB Ramp Terminal	2018
17	Rice Street	NB Ramp Terminal/Cleveland	2018
18	Rice Street	Bahnson Avenue	1998*
19	18th Street	Southeastern Avenue	2018
20	18th Street	Cleveland Avenue	2018
21	12th Street	Lowell Avenue	*
22	12th Street	Cleveland Avenue	2019
23	6th Street	Lowell Avenue	2015
24	6th Street	Cleveland Avenue	2018

*Counted by Consultant in 2020
**Currently under construction – previous count data will be factored and balanced for initial analysis and intersections 10 and 11 will be counted after construction is complete.
***Intersection does not currently exist – volumes to be forecast depending on scenario

Interchange/Interstate Count Data

The SDDOT will provide 24-hour traffic volume ramp and crossroad counts for I-229 Exits 5, 6, and 7, and I-229 mainline.

Collected data will include mainline per vehicle record, which will provide time, class, and speed for each vehicle.

Heavy Vehicle Data

Intersection heavy vehicle percentages will be determined by intersection turning movement counts. Interstate mainline heavy vehicle percentages will be determined by 24-hour mainline counts.

Traffic Data Collection Techniques

All traffic data was/will be collected using standard field practices, which may consist of video cameras at intersections and tube counters on roadway segments.

Counts will be collected on a Tuesday, Wednesday, or Thursday when school is in session during good driving/weather conditions. The City has maintained an index of traffic volumes at selected arterial street intersections throughout the COVID-19 pandemic. That index shows that recent volumes have returned to near pre-pandemic levels. Recent SDDOT count also show traffic volume trends returning to normal. The Sioux Falls index will be used to develop factors for application to new traffic counts to create consistent data sets independent of the effects of the pandemic. New counts will represent a small portion of the total traffic data set and all volumes will be balanced to reflect pre-pandemic conditions.

The percentages of Interstate traffic that enter from an interchange on ramp, remain in the auxiliary lane, and exit at the following off-ramp are available from previous studies and will be augmented with samples within the study area. The previous study data were obtained from smartphone tracking analysis provided by StreetLight Data, Inc. and represent the 2017 - 2018 period.

Additional Data Supplied by SDDOT, City of Sioux Falls, or Sioux Falls MPO

- Existing vehicular traffic data, including crash data and turning movement counts as mentioned above
- Existing structure condition data
- SDDOT Road Design Manual
- Available construction plans
- Available land survey data (topography and original DTM file)
- Available GIS data, including aerial photography, parcel information, existing land use (rooftops and commercial square footage) and crash locations
- Available data and reports from previously completed and on-going studies

Free-Flow Speeds

I-229 free-flow speeds will be based on measured speeds collected as part of the 24-hour counts, supplemented by data collected for the I-229 Major Investment Study. Additional verification will be provided through the MPM-RDS database.

Crossroad free-flow speeds will be estimated using estimation procedures documented in HCM6. Required data, such as lane widths, speed limits, and lateral clearance, will be obtained from field visits, available construction plans, and future concept geometrics.

7. Existing Volumes and Traffic Forecasts

Existing Volumes

The following process will be used to develop the study area Existing Conditions (2020) AM and PM peak period traffic volumes:

1. Identify AM and PM peak hours at each study intersection.
2. Factor counts to a design season (factor provided by SDDOT).
3. Factor counts to account for annual and COVID index variances.
4. Balance counts across study area intersections/roadway segments to five (5) vehicle increments. For low-volume movements, presented movement volume may be less than 5 vehicles.

Heavy vehicle percentages based on collected 2020 vehicle classification counts.

Traffic Forecasts

The Sioux Falls MPO Travel Demand Model will be utilized for the purposes of this study.

FHWA requirements for use of the travel demand model include documentation of the following:

1. Assemble continuous daily, directional traffic count information for comparison with Year of Project Completion model information.
2. Compare Year of Project Completion model estimated volumes to observed counts within the project study area.
3. Discuss impacted travel markets where path diversion is most likely to occur.
4. Compare model estimated and observed travel speeds on the project main line and directly impacted facilities (e.g. arterials at a new interchange).

The following methodology will be used to develop 2027 Year of Project Completion and 2050 Planning Horizon Year traffic forecasts:

1. Obtain existing traffic data for the study area freeway segments and intersections.
2. Identify AM and PM peak hour volumes for the area freeway segments and intersections.
3. Develop “K” factors for the AM and PM peak periods.
4. Obtain calibrated Year of Project Completion and future year GIS-based model output from City of Sioux Falls Staff.
5. Generate 24-hour, AM peak hour, and PM peak hour link volumes
6. Develop a growth rate based on the base year and 2050 models
    a. Project 2050 Planning Horizon Year volumes based on growth rate.
    b. Interpolate growth between base year and 2050 models to determine 2027 Year of Project Completion volumes.
    c. Make necessary post-processing adjustments.
7. Using existing turning movement percentages from collected traffic count data and model distribution, develop design turning movement volumes for the purposes of intersection evaluation.
    a. Smooth and balance forecasts to five (5) vehicle increments within the study area.
    b. For low-volume movements, presented movement volume may be less than 5 vehicles.
    c. If a location shows a decline in traffic volumes between the Existing Conditions (2020) and years 2027 and 2050 and no readily-apparent reason for this decline is identified after reviewing model input, the reported volumes will be held at 0% growth in developing the future-year volume and noted to the SAT.
8. Complete needed evaluation on design volumes calculated.

Heavy vehicle percentages based on collected 2020 vehicle classification counts.

8. Traffic Operations Analysis

Traffic Operations Analysis

1. Software
    a. Signalized Intersections
        i. Highway Capacity Software (HCS7) Release 7.9 (HCM 6th Edition (HCM6) methodology) Streets module
            1. Ramp terminal intersections meeting the interchange types defined in HCM6 Chapter 23 (Interchange Ramp Terminals) will be analyzed with the Interchanges section of the HCS7 Streets module.

b. Non-signalized intersections may include:
    i. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) Two-Way Stop-Control (TWSC) module
        1. Ramp terminal intersections with stop control will be included.
    ii. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) All-Way Stop-Control (AWSC) module
    iii. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) Roundabouts module
c. Basic Freeway, Ramp Junctions and Weave Areas
    i. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) Freeways Facility module
d. Pedestrians and Bikes may include:
    i. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) Street module
        1. For segment pedestrian and bicycle LOS scores, applies only to corridors with signalized boundary intersections.
        2. For signalized intersection pedestrian and bicycle LOS scores
    ii. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) TWSC module
        1. For TWSC intersection pedestrian LOS scores (crossing major road)
    iii. Highway Capacity Software (HCS7) Release 7.9 (HCM6 methodology) Two-Lane Highways module
        1. For segment bicycle LOS scores on two-lane highway segment

Synchro/SimTraffic software may be utilized, if necessary, for the development of signal timings and/or queue length projections.

2. Operational Analysis Results (Existing Conditions and Future No-Build Conditions)
    a. Level of Service (LOS)
        i. Ramp Terminal Intersections
            1. LOS based on HCM6 Chapter 20 (TWSC Intersection) methodology.
        ii. Crossroad Corridor Intersections
            1. LOS based on
                a. HCM6 Chapter 20 (TWSC Intersection) methodology, and

b. Weighted average intersection delay
    i. Based on total 'Intersection Delay' as reported in HCS7 TWSC module compared with AWSC LOS thresholds.
iii. Basic Freeway, Ramp Junctions and Weave Areas
    1. LOS based on HCM6 Chapter 10 Freeway Facilities Core Methodology

3. Operational Analysis Results (Future Build Conditions)
    a. Signal Warrants
        i. Signal warrant analysis will be completed for study area intersections along the corridor as determined by the SAT. Some potential interchange configurations require signals regardless of warrant.
        ii. If results of a signal warrant analysis indicates a signal may be warranted in one of the study analysis years, an approximate year in which the warrant(s) is/are met will be determined based on a straight-line interpolation of traffic volumes between the Existing Conditions (2020) and 2050 Planning Horizon Year.
    b. Level of Service (LOS)
        i. Freeway Segments
            1. Urban area minimum allowable LOS – LOS 'C'; LOS 'B' desirable.
        ii. Ramp Terminal Intersections
            1. Urban area minimum allowable LOS – ~~LOS 'C'~~ LOS 'F'; LOS will not be used. Instead:
                a. ~~Individual movements will be allowed to operate at LOS 'D' but the overall intersection LOS shall be 'C' or better.~~ 95th percentile queuing at ramp terminal intersections must be contained to the ramps, and not extend onto mainline I-229.
        iii. Signalized Non-Ramp Terminal Intersections modified by project improvements.
            1. Urban area minimum allowable LOS – LOS 'D'
                a. Individual movements cannot operate with a v/c ratio greater than 1.0.
                b. Individual movements will be allowed to operate at LOS 'E', but the overall intersection LOS shall be 'D' or better.
        iv. Other intersections modified by project improvements

1. Urban area minimum allowable LOS – LOS 'D'
    a. Individual movements will be allowed to operate at LOS 'E' or 'F', but the overall intersection LOS shall be 'D' or better.

v. Intersections not modified by project improvements
    1. Minimum allowable LOS – LOS 'D'
        a. Individual movements will be allowed to operate at LOS 'E' or 'F', but the overall intersection LOS shall be 'D' or better.

vi. TWSC Intersection LOS Reporting
    1. HCM6 Chapter 20 (TWSC Intersection) methodology, and
    2. Weighted average intersection delay
        a. Based on total 'Intersection Delay' as reported in HCS7 TWSC module compared with HCM6 AWSC LOS Thresholds.

vii. Queue Storage Ratio
    1. Queue storage ratio greater than 1.0 for any movement will result in the overall intersection being reported as LOS F.

viii. Basic Freeway, Ramp Junctions and Weave Areas
    1. Urban area minimum allowable LOS – LOS 'C'

4. Variables
    a. Peak Hour Factor (PHF)
        i. Existing Conditions (2020) analysis will use calculated PHFs from existing counts with a maximum value of 0.90.
        ii. Planning Horizon Year (2050) conditions and Year of Project Completion (2027) analysis will use 'Suggested Default Values' for PHFs as indicated in HCM6:
            1. TWSC Analysis: 0.92
            2. AWSC Analysis: 0.92
            3. Roundabout Analysis: 0.92
            4. Two-Lane Highway Analysis: 0.88
            5. Signalized Arterial and Ramp Terminal Intersections Analysis:
                a. 0.92 for ≥ 1,000 veh/h entering volume
                b. 0.90 for < 1,000 veh/h entering volume
    b. Saturation Flow Rate
        i. SDDOT Design Manual indicates the use of up to 1,900 vph ideal saturation flow rate in urban and suburban areas and up to 1,700 vph in rural areas. An ideal saturation flow rate of 1,800 vph will be used for this study to account for a mix of urban and visiting driver

behavior. This value will be used for the signalized intersections, uncontrolled movements along major route through a TWSC intersection, and freeway locations within the study area.

c. Traffic Signal Controllers
    i. Operational analysis will allow for both actuated and coordinated controllers.
d. Left-Turn Phasing
    i. Protected, Permitted/Protected or Split Phasing will be allowed at intersections.
e. Heaviest Lane Volume (HLV)
    i. Default HCS Streets values used for ramp terminal/arterial intersections.
f. Heavy Vehicle Percentage
    i. Based on sampling of existing traffic.
g. Phase Change Intervals
    i. Future No-Build (Year 2027 and 2050) Conditions
        1. Phase change intervals will be calculated for new signalized intersections using methodologies outlined in the SDDOT Road Design Manual.
h. Right Turn on Red
    i. All intersections will be evaluated with the HCM6 default of 0 unless otherwise determined by the SAT.
i. Design Input Data for HCS Analysis
    i. Existing Conditions and No-Build Conditions will use design features based on construction plans and/or available GIS roadway characteristic data.
    ii. Build Conditions will correspond to respective Build Alternative design.
    iii. Terrain: Flat
    iv. Highway Class (arterial crossroads): as recommended in HCM6.
    v. Free-Flow Speed:
        1. Arterial crossroads Existing and Build Conditions: measured speed, as available, or current posted speed limit + 5 mph
        2. I-229 Existing and Build Conditions: measured speed

9. Safety Issues

Crash data will be reviewed for the study area based on South Dakota Department of Public Safety (SDDPS) crash records for the most recent five years of available data. SDDPS's database will be the only database used in the calculation of crash rates and critical crash rates. The following information will be provided from the crash analysis:

- Segment and Intersection Crash Rates
- Segment and Intersection Critical Crash Rates (per Highway Safety Manual)
- Crash Trends
- Potential Mitigation Measures to Improve Locations Above Critical Crash Rates

A safety analysis of Build Options for 2027 Year of Project Completion and 2050 Planning Horizon Year time periods be completed utilizing FHWA's Interactive Highway Safety Design Model's (IHSDM) Crash Prediction Module in accordance with the Highway Safety Manual. SDDOT-provided calibration data, if available, will be incorporated into the model.

10. Selection of Measures of Effectiveness (MOE)

The main goals of this study are as follows:

1. Complete a traffic level of service analysis for both existing and future (2027 and 2050) conditions on the I-229 mainline, select interchanges and crossroads.
2. Complete a safety analysis of I-229 mainline, interchanges, and crossroads.
3. Identify locations on I-229 not in compliance with current level of service standards under both the current and forecasted future traffic conditions, level of service requirements of LOS 'C'.
4. Conduct interchange options feasibility study on the Exit 6 interchange as required by the scope of work.
5. Create final products for use by the SDDOT which will guide the Department in the implementation of recommended improvements that will maximize the efficiency of the system.

To satisfy the study objective, the following MOEs will be used to evaluate and compare the alternatives:

- Signalized Intersections: LEVEL OF SERVICE and INDIVIDUAL MOVEMENT DELAY
- Freeway Segments, Ramp Junctions, and Weave Areas: LEVEL OF SERVICE
- Arterial Corridor Segments: LEVEL OF SERVICE, SPEED, and DELAY
- Ramp Terminal Intersections: LEVEL OF SERVICE and INDIVIDUAL MOVEMENT DELAY plus ORIGIN-DESTINATION (OD) LOS

11. FHWA Interstate Access Modification Policy Points

An Interchange Modification Justification Report (IMJR) will be developed for the I-229 Exit 6 interchange in accordance with section 3.5.3 of FHWA's Interstate System

Access Informational Guide and the May 22, 2017, FHWA Policy on Access to the Interstate System.

12. Environmental Scan

Preliminary environmental investigation will be conducted to provide a bridge between the Interchange Justification Report and the NEPA decision document. The purpose of the scan document is to identify potential resources and alternatives early in the planning process to avoid fatal flaws and to consider sensitive environmental, community and economic resources.

In order to be efficient with environmental studies and avoid situations where re-work is necessary due to changing study findings from the traffic or concept design portions of work, the majority of environmental scan field work will be conducted after preliminary findings from the IMJR process are developed and vetted by the SAT. This should not prevent coordination with partner agencies and similar foundational components of the scan process.

The scan tasks will include:

- Determine environmental study area
- Provide public and agency coordination
- Prepare and distribute tribal consultation letters
- Coordinate landowner permission for site surveys
- Evaluation of project independent utility and termini
- Develop project purpose and need
- Document and screen alternatives
- Identify resources and the alternatives' influence on each
- Evaluate environmental justice impacts
- Evaluate wetland and waterway impacts
- Evaluate cultural resources impacts
- Evaluate bicyclist, pedestrian, and recreational impacts
- Evaluate Section 4(f) and 6(f) impacts
- Evaluate economic resources impacts
- Evaluate noise impacts
- Evaluate floodplain impacts
- Evaluate vegetation, fish, and wildlife impacts
- Evaluate threatened and endangered species impacts
- Evaluate regulated materials impacts
- Evaluate air and water quality impacts

- Evaluate impacts to social environment, visual quality and aesthetics, farmland, public facilities, invasive species, and construction.
- Evaluate indirect and cumulative impacts
- Develop potential mitigation strategies
- Coordinate with the NEPA action determination
- Prepare an environmental scan document

13. Deviations/Justifications

No deviations from standards are currently known. Deviations required will be documented through amendments to this document prior to proceeding.

14. Traffic Variables for Design

The following traffic variables for design will be determined for use in future design as part of this study:

- Average Annual Daily Traffic for the year of construction (AADT2027)
- Average Annual Daily Traffic for the future year (AADT2050)
- Design Hour Volume, 30th highest hour of the year (DHV)
- Direction Distribution in the predominate direction of travel (D)
- Truck Percentage of DHV (T DHV)
- Truck Percentage of AADT (T ADT)
- Design speed(s) (V)

These variables will be determined for the following:

- I-229 Mainline
- Exit 6 off-ramps
- Exit 6 on-ramps
- 10th Street
- Any other I-229 cross-street impacted by construction

15. Conclusion

All sections contained in this document will guide the traffic data collection and traffic assessment for this study.

Appendix B - Traffic Forecast Memo

DRAFT MEMORANDUM

TO: Steve Gramm
South Dakota Department of Transportation

FROM: Chase Cutler, HR Green, PE, PTOE

DATE: January 19, 2021

RE: I-229 Exit 6 (10th Street) Interchange Study – Traffic Forecast Memo
SD DOT Project Number: PL0194(98) P, PCN 07P7

This technical memorandum provides the future year traffic forecast methodology developed for the I-229 Exit 6 Interchange Study. The project area includes mainline I-229 between Exit 5 and Exit 7, as well as adjacent intersections along the corridors of Rice Street, 6th Street, 10th Street, 12th Street, 18th Street, Southeastern Avenue, and 26th Street in Sioux Falls, South Dakota.

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INTRODUCTION

As part of the I-229 Exit 6 (10th Street) Interchange Modification Study in the City of Sioux Falls, South Dakota, traffic forecasts were completed. The study area limits extend north/south along I-229 from Exit 5 (26th Street) to Exit 7 (Rice Street), and east/west along 10th Street from Jessica Avenue to the signalized Hy-Vee entrance. Additional corridors within the study limits include:

- 26th Street form Van Eps Avenue to Southeastern Avenue,
- 18th Street from Southeastern Avenue to Cleveland Avenue,
- 12th Street from Lowell Avenue to Cleveland Avenue,
- 6th Street from Lowell Avenue to Cleveland Avenue, and
- Rice Street from Lowell Avenue to Bahnson Avenue.

As part of the study, the Average Daily Traffic (ADT) and peak hour traffic volume projections have been prepared for the 2027 Year of Project Completion and 2050 Planning Horizon Year. Existing turning movement volumes and output from the Sioux Falls MPO Travel Demand Model (TDM) were used to estimate the peak hour traffic volumes. The existing traffic volumes, established from the most recent available data which included mainline, ramp, and intersection counts, are documented in the previously submitted Existing Conditions technical memorandum. Using straight-line growth, interim year traffic forecasts were developed for the 2027 Year of Project Completion and 2050 Planning Horizon Year traffic volume conditions. The purpose of this memorandum is to document the process used to develop the projected volumes and to present the resulting values used for the analysis and assessment of traffic conditions.

TRAVEL DEMAND MODEL

The Sioux Falls Metropolitan Planning Organization (SFMPO) maintains a computerized travel demand model (TDM), using Cube Voyager software, for estimating future year traffic. In the model, the Sioux Falls metropolitan area is divided into smaller transportation analysis zones (TAZs), each of which includes information such as existing and future population, household size, number of vehicles, employment, and other socioeconomic data. The future land use for each TAZ (which will determine the future population and employment) is based on the plans in the area. The primary model outputs used for this study were the 2018 base model and 2045 projection year model average daily traffic (ADT) for each link in the network.

Data was retrieved from the SFMPO TDM for each interstate mainline, ramp, interchange crossroads and corridors within the study area. **Figure 1** shows the project study area.

Figure 1: Study Area

FUTURE YEAR ADT FORECASTS

In order to evaluate the existing infrastructure under future traffic conditions, the estimated 2045 ADT volumes were provided by the Sioux Falls MPO Travel Demand Model. These forecasted volumes accounted for localized traffic growth, changes in traffic patterns, and any planned interchange improvements. The estimated ADT was provided for the Interstate mainline and crossroad corridors, as described earlier in this document. In order to determine the traffic growth within the study area to estimate 2050 traffic volumes, the 2018 base year ADT was also provided in the travel demand model. Growth factors were developed from the TDM data and applied to the existing traffic volume data to develop the 2050 ADT forecast.

FUTURE YEAR PEAK HOUR VOLUMES

The estimated ADT volumes for the 2050 Planning Horizon Year were used in the development of the morning (AM) and afternoon (PM) peak hour volumes. The peak hour volumes were later used for the traffic analysis to assess the level of operations for freeway sections and intersections within the study corridor.

Utilizing existing peak hour traffic data along with projected future year and base year ADT volumes, a multi-step process was used to obtain peak hour traffic counts for the planning horizon year condition. Growth factors developed from the TDM data were applied to the existing traffic volume data to develop the 2050 Planning Horizon Year peak hour traffic movement volumes. This output was compared against K factors developed for the AM and PM period at each location to verify the accuracy of growth and adjustments were made where necessary. The peak hour volumes between intersections were then smoothed and balanced to within five vehicles. The peak hour volumes between interchange ramps were smoothed and balanced to remove any vehicle flow variability. The resulting output was the 2050 Planning Horizon Year's peak hour turning volumes for the no build condition.

Table 1 and **Table 2** show the 2050 peak hour traffic forecast volumes.

INTERIM YEAR ADT FORECASTS

In order to evaluate the existing infrastructure under interim year traffic conditions, straight-line growth rates between the existing year ADT volumes and the estimated 2050 ADT volumes were calculated and the interim year traffic volumes were interpolated. The 2027 Year of Project Completion daily traffic forecast was developed and carried forward to approximate the peak hour volumes.

INTERIM YEAR PEAK HOUR VOLUMES

The estimated 2027 Year of Project Completion morning (AM) and afternoon (PM) peak hour volumes were developed by process of interpolation using straight-line growth assumptions based on the existing year and future year 2050 traffic volumes. The peak hour volumes were later used for the traffic analysis to assess the level of operations for freeway sections and intersections within the study corridor.

Table 3 and **Table 4** show the 2027 peak hour traffic forecast volumes.

SUMMARY

The traffic forecast methodology used for the I-229 Exit 6 (10th Street) Interchange Modification Study provided acceptable results for the 2050 Planning Horizon Year traffic demand. The minor adjustments were based on general knowledge of the area and the expected population and employment growth along with observed existing conditions.

The resulting 2050 No Build traffic forecast produced from the procedures described within this memorandum are depicted in **Figure 2** and **Figure 3**. The resulting 2027 No Build traffic forecast produced from straight-line growth interpolation is depicted in **Figure 4** and **Figure 5**.

Table 1: 2050 Interstate and Ramp Traffic Volume Projections

	Northbound I-229												
	I-229	Exit 5			I-229	Exit 6			I-229	Exit 7			I-229
Time	**NB4**	**5R1**	**NB55**	**5R2**	**NB5**	**6R1**	**NB66**	**6R2**	**NB6**	**7R1**	**NB77**	**7R2**	**NB7**
7:15	840	135	650	110	835	245	645	210	770	130	675	130	760
7:30	1,060	195	795	130	1,015	355	740	290	935	145	830	205	970
7:45	1,180	205	895	105	1,080	350	800	240	940	135	845	190	975
8:00	880	170	645	85	785	250	590	175	690	175	565	90	610
AM Hr	**3,960**	**705**	**2,985**	**430**	**3,715**	**1,200**	**2,775**	**915**	**3,335**	**585**	**2,915**	**615**	**3,315**
PHF	0.84	0.86	0.83	0.83	0.86	0.85	0.87	0.79	0.89	0.84	0.86	0.75	0.85
ADJ	4,250	705	3,545	430	3,975	1,200	2,775	915	3,690	585	3,105	615	3,720
16:30	1,120	300	705	35	765	390	460	195	595	185	460	100	525
16:45	960	225	650	50	730	350	455	165	565	215	410	85	465
17:00	1,080	305	660	75	785	395	475	180	595	230	425	105	500
17:15	1,120	255	765	45	840	405	525	205	660	255	480	115	560
PM Hr	**4,280**	**1,085**	**2,780**	**205**	**3,120**	**1,540**	**1,915**	**745**	**2,415**	**885**	**1,775**	**405**	**2,050**
PHF	0.96	0.89	0.91	0.68	0.93	0.95	0.91	0.91	0.91	0.87	0.92	0.88	0.92
ADJ	4,335	1,085	3,250	205	3,455	1,540	1,915	745	2,660	885	1,775	405	2,180
Daily	47,672	11,259	32,150	3,297	37,692	16,525	24,691	9,786	31,269	9,155	24,661	5,260	28,112
MPO Raw	***41,813***	***7,482***	***34,331***	***6,340***	***40,671***	***11,201***	***29,470***	***8,058***	***37,528***	***10,739***	***26,789***	***5,258***	***32,047***
ADJ	49,180	11,260	37,920	3,295	41,215	16,525	24,690	9,785	34,475	9,155	25,320	5,260	30,580

	Southbound I-229												
	I-229	Exit 7			I-229	Exit 6			I-229	Exit 5			I-229
Time	**SB7**	**7R3**	**SB77**	**7R4**	**SB6**	**6R3**	**SB66**	**6R4**	**SB5**	**5R3**	**SB55**	**5R4**	**SB4**
7:15	495	85	395	190	605	130	450	280	730	95	560	250	1,025
7:30	515	45	460	190	675	165	480	345	825	100	640	275	1,150
7:45	570	75	475	185	690	155	500	345	845	95	675	265	1,165
8:00	400	45	345	150	510	110	380	260	640	75	500	195	865
AM Hr	**1,980**	**250**	**1,675**	**715**	**2,480**	**560**	**1,810**	**1,230**	**3,040**	**365**	**2,375**	**985**	**4,205**
PHF	0.87	0.74	0.88	0.94	0.90	0.85	0.91	0.89	0.90	0.91	0.88	0.90	0.90
ADJ	1,905	250	1,655	715	2,370	560	1,810	1,230	3,040	365	2,675	985	3,660
16:30	935	110	800	160	1,015	210	765	335	1,130	120	915	195	1,275
16:45	925	140	755	130	940	215	680	340	1,040	195	685	165	990
17:00	1,045	150	865	175	1,100	225	830	460	1,310	180	985	205	1,370
17:15	950	140	775	120	955	225	685	460	1,140	235	715	170	1,030
PM Hr	**3,855**	**540**	**3,195**	**585**	**4,010**	**875**	**2,960**	**1,595**	**4,620**	**730**	**3,300**	**735**	**4,665**
PHF	0.92	0.90	0.92	0.84	0.91	0.97	0.89	0.87	0.88	0.78	0.84	0.90	0.85
ADJ	3,790	540	3,250	585	3,835	875	2,960	1,595	4,555	730	3,825	735	4,560
Daily	29,750	4,359	24,396	7,093	33,114	7,576	24,101	16,579	40,547	4,824	31,864	10,544	51,471
MPO Raw	***34,087***	***5,763***	***28,324***	***8,283***	***36,607***	***10,756***	***25,851***	***13,095***	***38,946***	***2,852***	***36,094***	***6,084***	***42,178***
ADJ	28,940	4,360	24,580	7,095	31,675	7,575	24,100	16,580	40,680	4,825	35,855	10,545	46,400

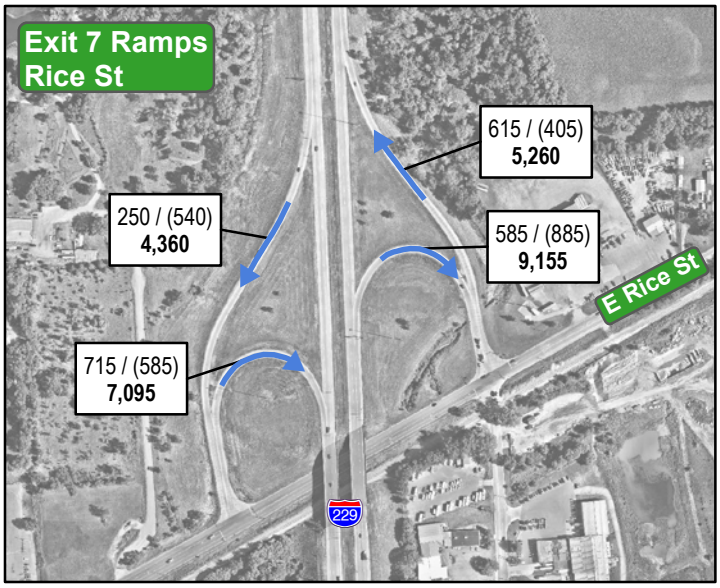
Table 2: 2050 Arterial Traffic Volume Projections

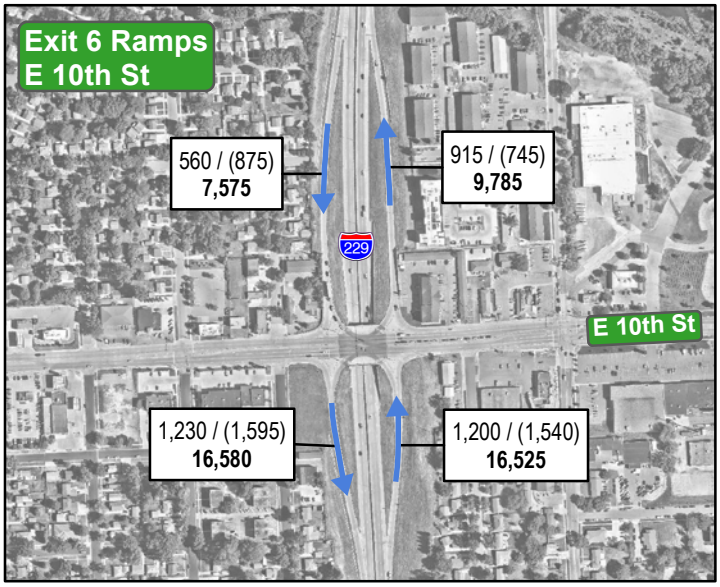
2050 AM Turning Movements

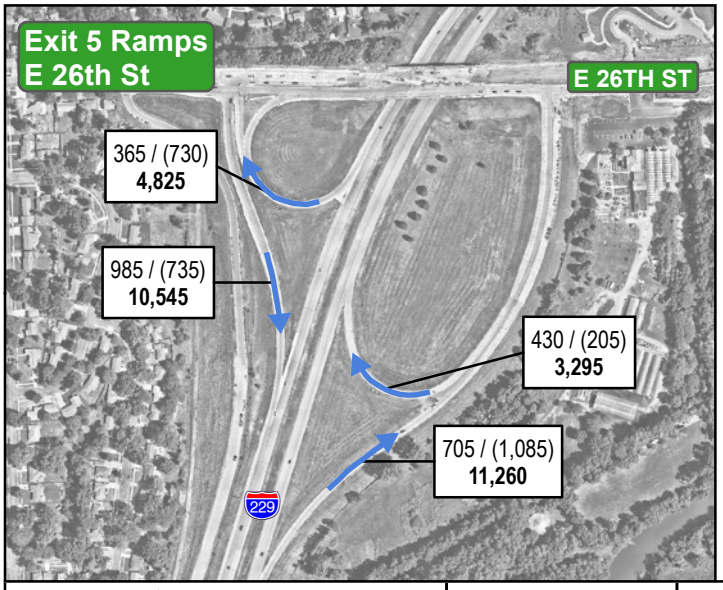
Intersection	Int. #	Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
10th St at Jessica Ave	1	7:15	155	0	50	0	0	0	0	985	60	30	1905	0	**3185**
10th St at Lowell Ave	2	7:15	15	15	55	90	20	35	15	1045	10	55	1880	50	**3285**
10th St at Conklin Ave	3	7:15	0	0	170	0	0	10	0	1180	10	0	1975	10	**3355**
10th St at I-229 SPUI	4	7:15	620	0	580	225	0	335	155	660	535	695	1030	760	**5595**
10th St at XX	5	7:15	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10th St at Blaine Ave	6	7:15	0	0	10	0	0	0	0	1415	50	0	2485	0	**3960**
10th St at Cleveland Ave	7	7:15	295	315	30	90	180	340	235	1050	140	35	1850	115	**4675**
10th St at Hyvee	8	7:15	10	5	5	30	5	65	100	1045	25	20	1925	90	**3325**
26th St at Van Eps Ave	9	7:15	5		10	25	5	15	5	450	10	20	885	10	**1440**
26th St at Yeager Rd	10	7:15	25	5	55	10	5	10	5	435	10	125	890	10	**1585**
26th St at I-229 SB Ramp	11	7:15	155	0	210	0	0	0	0	415	85	900	870	0	**2635**
26th St at I-229 NB Ramp	12	7:15	190	0	515	0	0	0	0	510	115	315	1580	0	**3225**
26th St at Southeastern Ave	13	7:15	525	1200	90	110	205	75	80	820	125	40	1295	325	**4890**
26th St at Cleveland Ave	14	7:15	45	65	30	60	10	105	55	940	25	15	1510	85	**2945**
Rice St at Lowell Ave	15	7:15	60	0	90	0	0	0	0	425	25	30	1150	0	**1780**
Rice St at I-229 SB Ramp	16	7:15	0	0	0	155	0	95	170	345	0	0	1085	545	**2395**
Rice St at I-229 NB Ramp	17	7:15	300	355	155	170	40	375	40	210	250	60	955	220	**3130**
Rice St at Bahnson Ave	18	7:15	10	0	30	5	0	35	45	485	10	20	1185	15	**1840**
18th St at Southeastern Ave	19	7:15	1375	190	40	5	85	25	15	175	210	25	395	15	**2555**
18th St at Cleveland Ave	20	7:15	55	160	5	25	115	100	40	100	25	20	310	65	**1020**
12th St at Lowell Ave	21	7:15	5	45	20	35	15	10	10	175	5	5	495	40	**860**
12th St at Cleveland Ave	22	7:15	160	415	10	35	200	35	25	120	20	25	340	75	**1460**
6th St at Lowell Ave	23	7:15	15	10	15	5	20	35	10	530	20	45	1075	5	**1785**
6th St at Cleveland Ave	24	7:15	140	195	300	160	195	110	55	435	80	380	900	270	**3220**

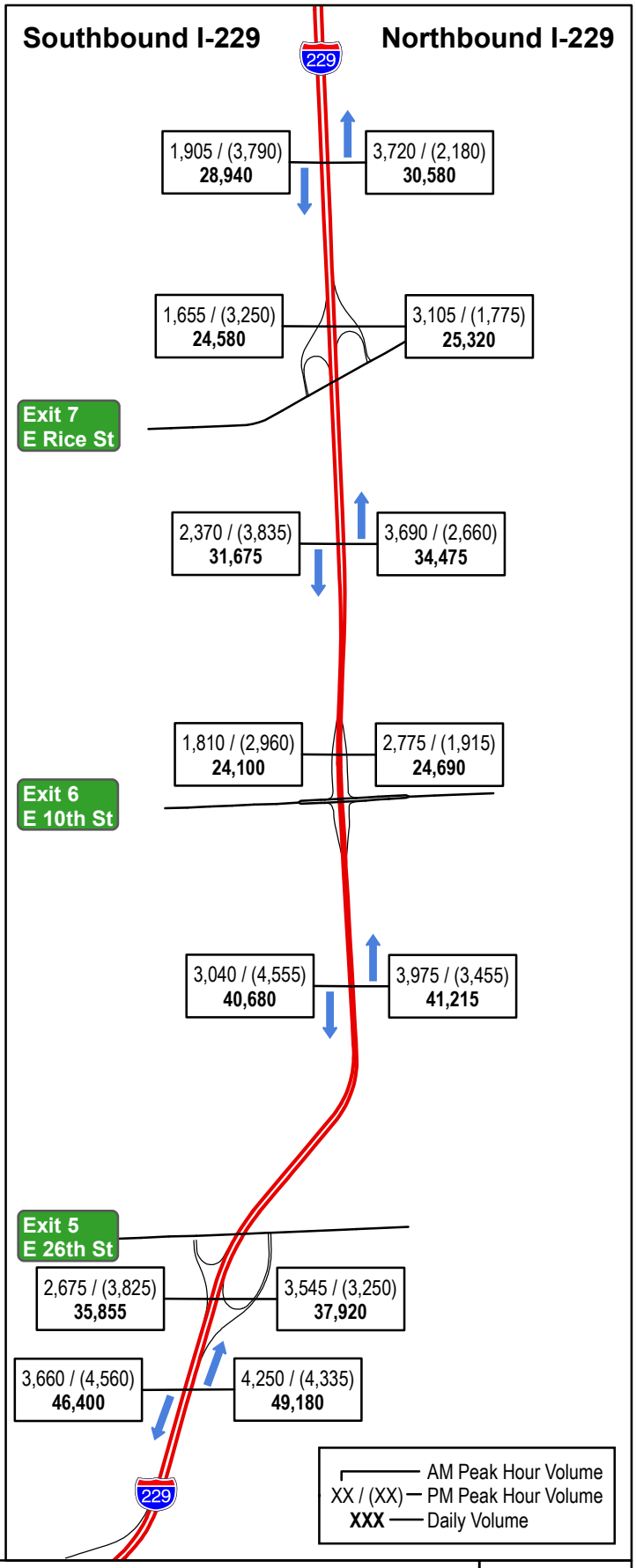
2050 PM Turning Movements

Intersection	Int. #	Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
10th St at Jessica Ave	1	16:30	65	0	60	0	0	0	0	2060	105	65	1460	0	**3815**
10th St at Lowell Ave	2	16:30	10	30	70	180	55	20	30	2115	20	180	1525	100	**4335**
10th St at Conklin Ave	3	16:30	0	0	90	0	0	25	0	2340	25	0	1780	20	**4280**
10th St at I-229 SPUI	4	16:30	535	0	1005	595	0	280	320	1245	865	730	985	425	**6985**
10th St at XX	5	16:30	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10th St at Blaine Ave	6	16:30	0	0	15	0	0	0	0	2760	85	0	2140	0	**5000**
10th St at Cleveland Ave	7	16:30	230	300	70	235	345	220	340	2045	390	40	1690	185	**6090**
10th St at Hyvee	8	16:30	30	10	20	100	5	90	185	2080	85	25	1795	80	**4505**
26th St at Van Eps Ave	9	16:30	5	5	5	10		15	10	575	5	5	605	15	**1255**
26th St at Yeager Rd	10	16:30	15	5	160	10	5	10	10	540	15	150	610	10	**1540**
26th St at I-229 SB Ramp	11	16:30	150	0	580	0	0	0	0	615	95	640	620	0	**2700**
26th St at I-229 NB Ramp	12	16:30	85	0	1000	0	0	0	0	1090	105	100	1175	0	**3555**
26th St at Southeastern Ave	13	16:30	225	490	140	375	1050	85	120	1355	615	95	965	170	**5685**
26th St at Cleveland Ave	14	16:30	35	30	25	140	100	150	170	1650	50	45	1045	105	**3545**
Rice St at Lowell Ave	15	16:30	35	0	55	5	0	5	5	1270	100	95	740	5	**2315**
Rice St at I-229 SB Ramp	16	16:30	0	0	0	445	0	95	200	1130	0	0	745	385	**3000**
Rice St at I-229 NB Ramp	17	16:30	250	150	100	625	55	205	105	690	780	105	675	150	**3890**
Rice St at Bahnson Ave	18	16:30	20	0	25	45	0	120	15	1390	10	55	790	15	**2485**
18th St at Southeastern Ave	19	16:30	485	155	150	20	105	15	65	610	1315	105	170	20	**3215**
18th St at Cleveland Ave	20	16:30	55	225	30	170	270	80	125	465	140	15	125	40	**1740**
12th St at Lowell Ave	21	16:30	5	25	30	95	65	15	10	700	10	15	290	20	**1280**
12th St at Cleveland Ave	22	16:30	90	315	40	110	465	65	95	495	210	25	190	55	**2155**
6th St at Lowell Ave	23	16:30	25	35	50	10	20	35	50	1150	45	50	715	5	**2190**
6th St at Cleveland Ave	24	16:30	205	300	505	455	480	115	115	825	245	305	450	145	**4145**









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SEH

Project: HGRSP 1565
Print Date: 1/13/2021

Map by: jdanibas
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2050 I-229 VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 2

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SEH

0 0.125 0.25 Miles

Project: HGRSP 1565
Print Date: 12/1/2020

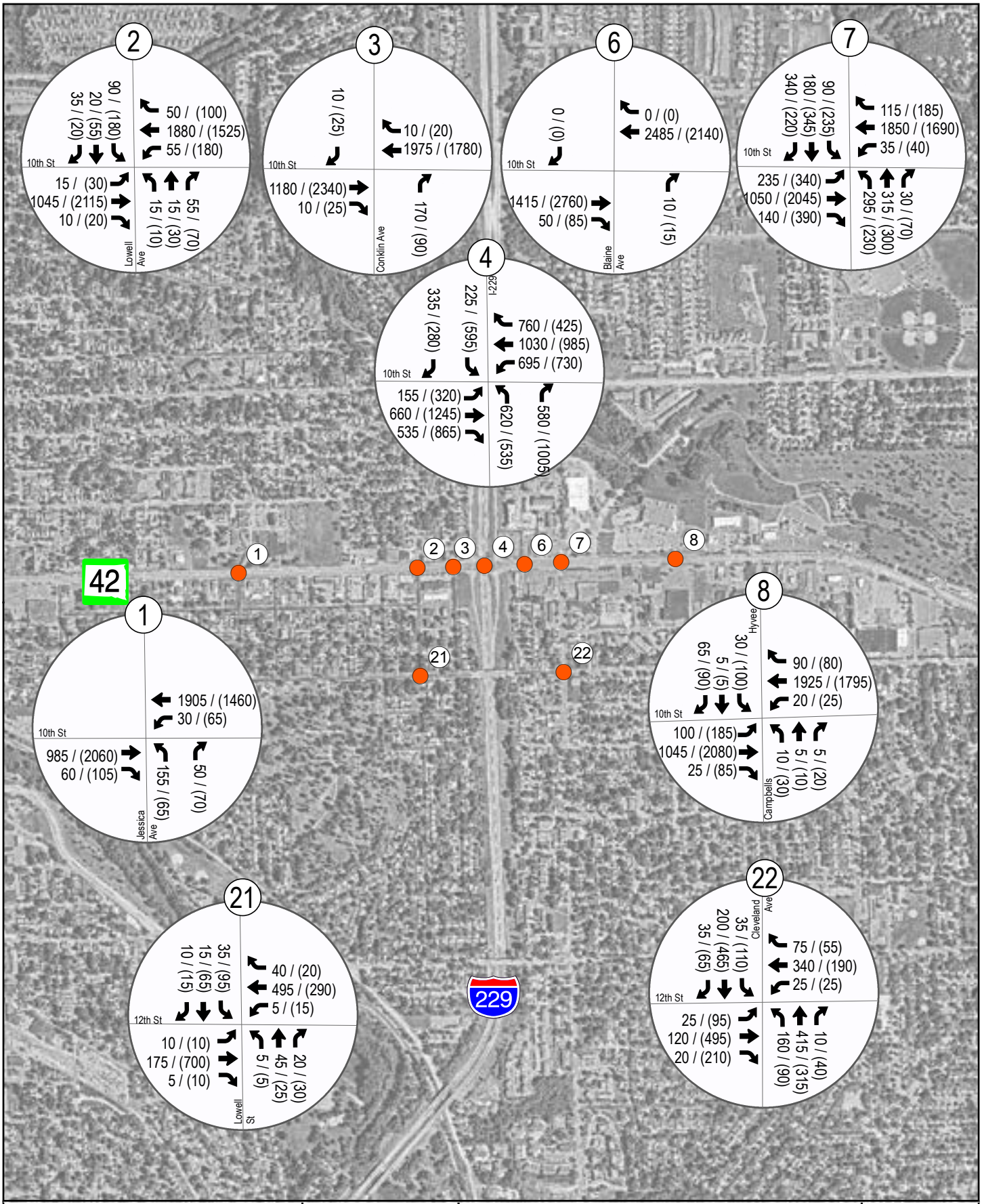
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2050 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 3



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SEH

0 0.125 0.25 Miles

Project: HGRSP 1565
Print Date: 12/2/2020

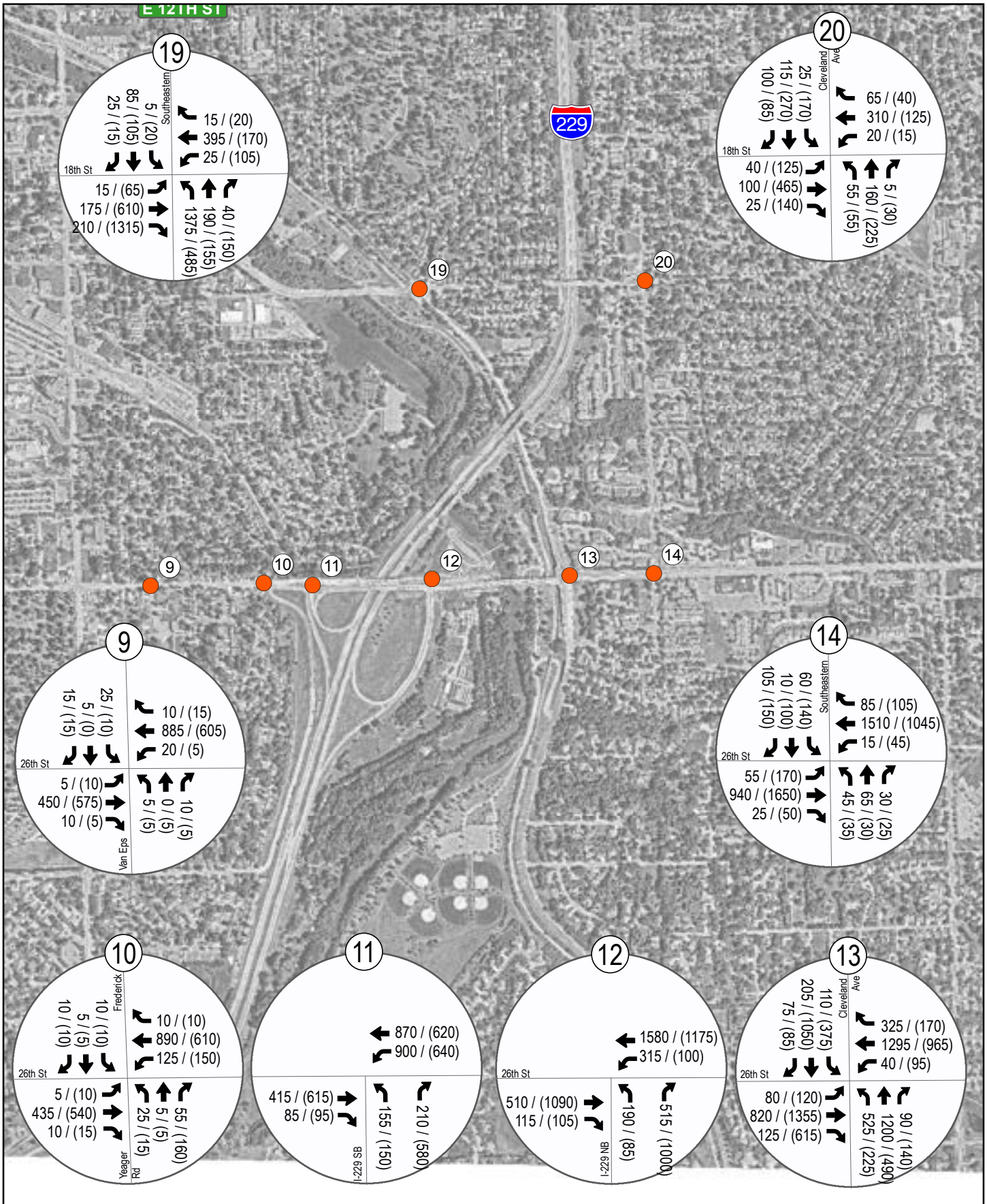
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2050 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 3



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SEH

0 0.125 0.25 Miles

Project: HGRSP 1565
Print Date: 12/2/2020

Map by: ljohnson
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2050 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 3

Table 3: 2027 Interstate and Ramp Traffic Volume Projections

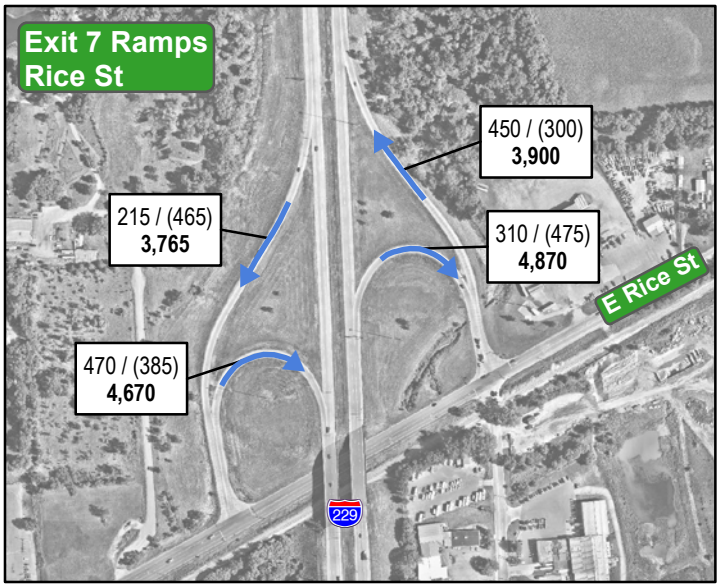
	Northbound I-229												
	I-229	Exit 5			I-229	Exit 6			I-229	Exit 7			I-229
Time	**NB4**	**5R1**	**NB55**	**5R2**	**NB5**	**6R1**	**NB66**	**6R2**	**NB6**	**7R1**	**NB77**	**7R2**	**NB7**
7:15	520	110	405	110	525	125	405	140	530	70	465	95	555
7:30	660	155	495	130	640	185	465	195	645	75	570	150	710
7:45	735	165	555	105	675	185	500	160	650	70	585	140	715
8:00	545	135	400	85	495	130	370	115	475	95	390	65	450
AM Hr	**2,460**	**565**	**1,855**	**430**	**2,335**	**625**	**1,740**	**610**	**2,300**	**310**	**2,010**	**450**	**2,430**
PHF	0.84	0.86	0.84	0.83	0.86	0.84	0.87	0.78	0.88	0.82	0.86	0.75	0.85
ADJ	2,470	565	1,905	430	2,335	625	1,710	610	2,320	310	2,010	450	2,460
16:30	695	240	440	35	480	200	290	130	410	100	315	75	385
16:45	600	180	405	50	460	180	285	110	390	115	280	65	340
17:00	670	245	410	75	490	205	295	120	410	125	295	75	365
17:15	695	205	475	45	530	210	330	135	455	135	330	85	410
PM Hr	**2,660**	**870**	**1,730**	**205**	**1,960**	**795**	**1,200**	**495**	**1,665**	**475**	**1,220**	**300**	**1,500**
PHF	0.96	0.89	0.91	0.68	0.92	0.95	0.91	0.92	0.91	0.88	0.92	0.88	0.91
ADJ	2,625	870	1,755	205	1,960	795	1,165	495	1,660	475	1,185	300	1,485
Daily	29,620	9,025	19,975	3,295	23,650	8,570	15,490	6,485	21,540	4,870	16,985	3,900	20,625
MPO Raw													
ADJ	29,380	9,025	20,355	3,295	23,650	8,570	15,080	6,485	21,565	4,870	16,695	3,900	20,595

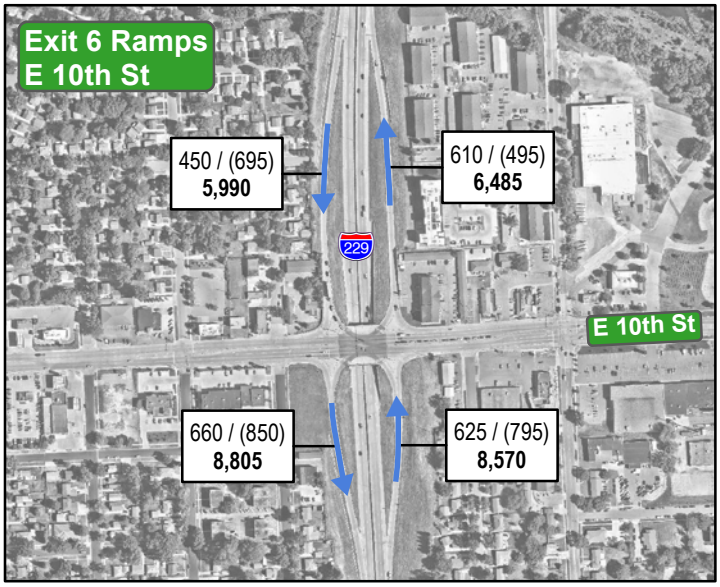
	Southbound I-229												
	I-229	Exit 7			I-229	Exit 6			I-229	Exit 5			I-229
Time	**SB7**	**7R3**	**SB77**	**7R4**	**SB6**	**6R3**	**SB66**	**6R4**	**SB5**	**5R3**	**SB55**	**5R4**	**SB4**
7:15	365	70	290	125	420	105	310	150	460	95	350	250	635
7:30	380	40	335	125	465	130	330	185	515	100	400	275	715
7:45	420	65	350	120	475	125	345	185	530	95	425	265	725
8:00	290	40	250	100	350	90	260	140	400	75	315	195	535
AM Hr	**1,455**	**215**	**1,225**	**470**	**1,710**	**450**	**1,245**	**660**	**1,905**	**365**	**1,490**	**985**	**2,610**
PHF	0.87	0.77	0.88	0.94	0.90	0.87	0.90	0.89	0.90	0.91	0.88	0.90	0.90
ADJ	1,440	215	1,225	470	1,695	450	1,245	660	1,905	365	1,540	985	2,525
16:30	685	95	585	105	700	165	525	180	710	120	575	195	795
16:45	680	120	555	85	645	170	470	180	655	195	430	165	615
17:00	765	130	635	115	755	180	570	245	820	180	615	205	850
17:15	695	120	570	80	655	180	470	245	715	235	450	170	640
PM Hr	**2,825**	**465**	**2,345**	**385**	**2,755**	**695**	**2,035**	**850**	**2,900**	**730**	**2,070**	**735**	**2,900**
PHF	0.92	0.89	0.92	0.84	0.91	0.97	0.89	0.87	0.88	0.78	0.84	0.90	0.85
ADJ	2,825	465	2,360	385	2,745	695	2,050	850	2,900	730	2,170	735	2,905
Daily	21,825	3,765	17,895	4,670	22,810	5,990	16,600	8,805	25,440	4,825	19,990	10,545	31,980
MPO Raw													
ADJ	21,720	3,765	17,955	4,670	22,625	5,990	16,635	8,805	25,440	4,825	20,615	10,545	31,160

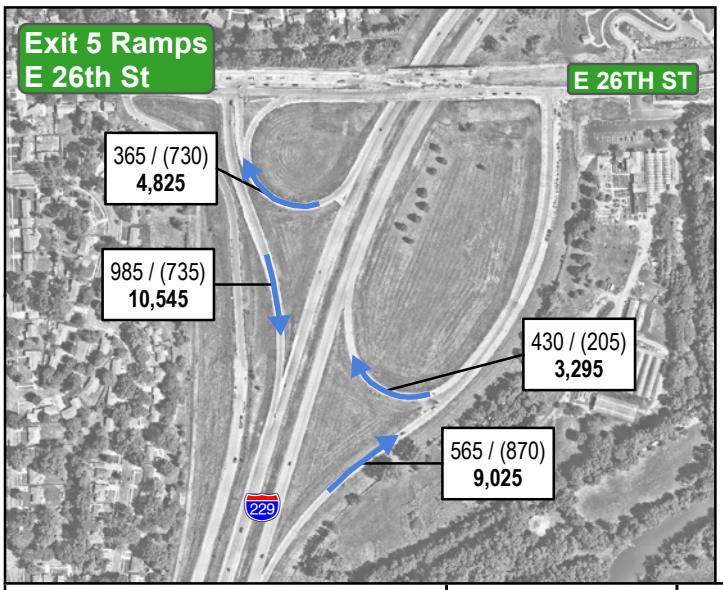
Table 4: 2027 Arterial Traffic Volume Projections

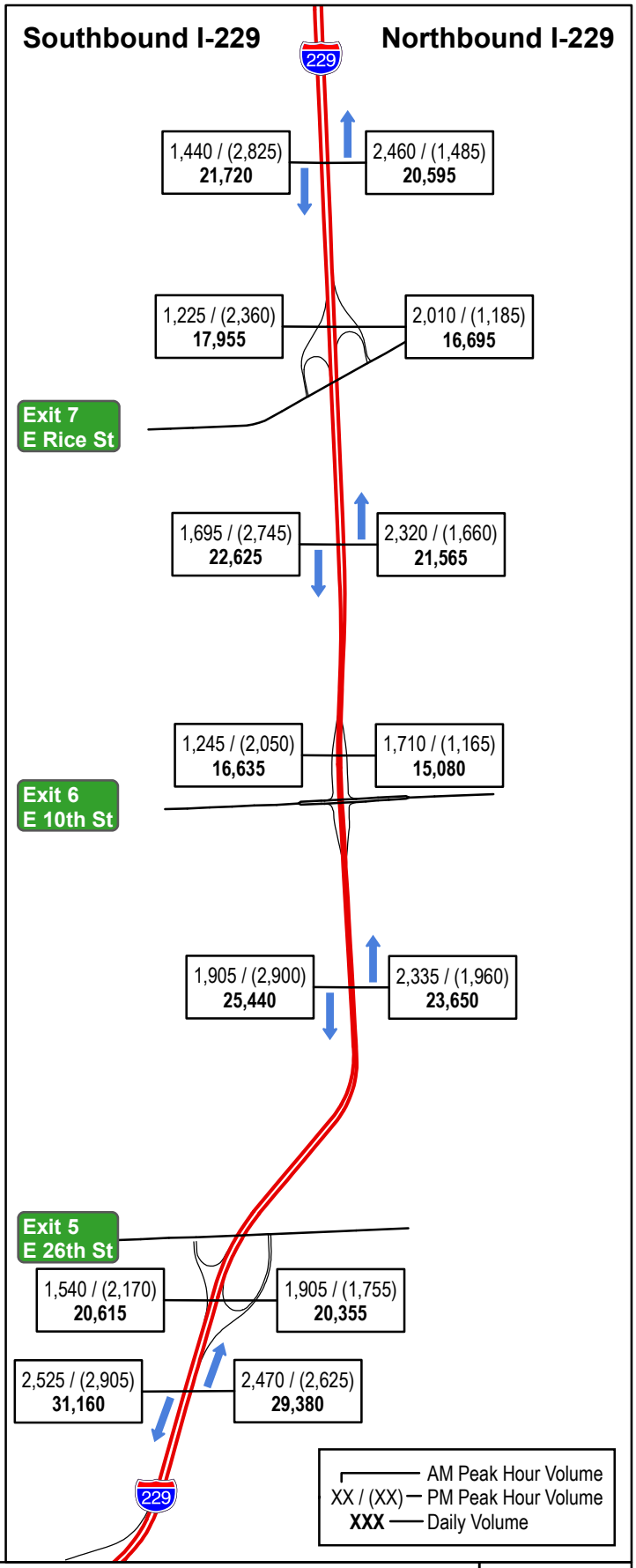
2027 AM Turning Movements															
Intersection	**Int. #**	**Time**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**TOTAL**
10th St at Jessica Ave	1	7:15	115	0	40	0	0	0	0	600	45	20	1415	0	**2235**
10th St at Lowell Ave	2	7:15	10	10	40	65	15	25	10	675	10	35	1275	30	**2200**
10th St at Conklin Ave	3	7:15	0	0	125	0	0	10	0	775	10	0	1340	5	**2265**
10th St at I-229 SPUI	4	7:15	320	0	300	180	0	270	110	490	300	350	750	495	**3565**
10th St at XX	5	7:15	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10th St at Blaine Ave	6	7:15	0	0	5	0	0	0	0	935	35	0	1600	0	**2575**
10th St at Cleveland Ave	7	7:15	205	220	20	55	110	210	160	690	95	20	1185	60	**3030**
10th St at Hyvee	8	7:15	10	5	5	30	5	65	90	655	15	10	1210	70	**2170**
26th St at Van Eps Ave	9	7:15	5	0	5	25	5	15	5	365	10	20	805	5	**1265**
26th St at Yeager Rd	10	7:15	25	5	55	10	5	10	5	400	5	120	730	5	**1375**
26th St at I-229 SB Ramp	11	7:15	155	0	210	0	0	0	0	380	85	900	700	0	**2430**
26th St at I-229 NB Ramp	12	7:15	150	0	415	0	0	0	0	475	115	315	1455	0	**2925**
26th St at Southeastern Ave	13	7:15	480	685	55	55	115	40	65	700	120	40	1250	250	**3855**
26th St at Cleveland Ave	14	7:15	45	35	30	55	10	100	50	740	20	10	1395	70	**2560**
Rice St at Lowell Ave	15	7:15	45	0	65	0	0	0	0	280	15	20	755	0	**1180**
Rice St at I-229 SB Ramp	16	7:15	0	0	0	135	0	80	110	235	0	0	695	360	**1615**
Rice St at I-229 NB Ramp	17	7:15	185	225	35	90	20	200	25	155	185	35	665	200	**2020**
Rice St at Bahnson Ave	18	7:15	10	0	30	0	0	20	25	255	5	10	850	5	**1210**
18th St at Southeastern Ave	19	7:15	970	85	15	5	20	25	10	100	120	25	390	15	**1780**
18th St at Cleveland Ave	20	7:15	55	155	5	20	95	85	35	65	20	20	305	65	**925**
12th St at Lowell Ave	21	7:15	5	35	15	30	10	10	10	140	0	5	390	35	**685**
12th St at Cleveland Ave	22	7:15	135	345	5	25	140	20	15	65	15	20	315	70	**1170**
6th St at Lowell Ave	23	7:15	10	5	10	0	15	25	10	375	15	30	685	0	**1180**
6th St at Cleveland Ave	24	7:15	85	120	190	90	100	75	40	325	60	270	620	175	**2150**

2027 PM Turning Movements															
Intersection	**Int. #**	**Time**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**TOTAL**
10th St at Jessica Ave	1	16:30	45	0	45	0	0	0	0	1620	80	50	870	0	**2710**
10th St at Lowell Ave	2	16:30	5	25	50	135	40	15	25	1400	15	135	955	70	**2870**
10th St at Conklin Ave	3	16:30	0	0	65	0	0	20	0	1565	20	0	1140	15	**2825**
10th St at I-229 SPUI	4	16:30	275	0	520	470	0	220	225	920	480	365	655	270	**4400**
10th St at XX	5	16:30	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10th St at Blaine Ave	6	16:30	0	0	10	0	0	0	0	1865	55	0	1290	0	**3220**
10th St at Cleveland Ave	7	16:30	175	210	50	145	210	160	235	1345	300	20	950	90	**3890**
10th St at Hyvee	8	16:30	30	10	20	100	5	90	160	1365	45	15	950	65	**2855**
26th St at Van Eps Ave	9	16:30	5	0	0	10	0	15	5	680	5	0	500	10	**1230**
26th St at Yeager Rd	10	16:30	15	5	150	10	5	10	10	520	10	140	480	10	**1365**
26th St at I-229 SB Ramp	11	16:30	150	0	585	0	0	0	0	590	90	640	480	0	**2535**
26th St at I-229 NB Ramp	12	16:30	65	0	805	0	0	0	0	1070	105	100	1055	0	**3200**
26th St at Southeastern Ave	13	16:30	195	240	100	270	600	50	60	1285	525	90	910	140	**4465**
26th St at Cleveland Ave	14	16:30	35	25	25	135	60	135	155	1475	30	40	975	95	**3185**
Rice St at Lowell Ave	15	16:30	25	0	40	0	0	0	0	940	75	70	430	0	**1580**
Rice St at I-229 SB Ramp	16	16:30	0	0	0	385	0	80	190	790	0	0	420	190	**2055**
Rice St at I-229 NB Ramp	17	16:30	145	115	40	335	30	110	75	515	585	60	355	105	**2470**
Rice St at Bahnson Ave	18	16:30	20	0	25	25	0	70	5	850	5	35	390	10	**1435**
18th St at Southeastern Ave	19	16:30	285	95	70	20	70	15	35	530	835	30	170	20	**2175**
18th St at Cleveland Ave	20	16:30	30	215	25	140	225	65	105	380	65	15	105	40	**1410**
12th St at Lowell Ave	21	16:30	0	20	25	75	50	10	5	600	10	15	230	15	**1055**
12th St at Cleveland Ave	22	16:30	75	265	30	80	330	45	75	395	165	20	175	50	**1705**
6th St at Lowell Ave	23	16:30	20	25	40	5	15	25	40	875	35	40	420	5	**1545**
6th St at Cleveland Ave	24	16:30	125	180	310	230	245	60	85	630	185	195	290	95	**2630**









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Project: HGRSP 1565
Print Date: 1/13/2021

Map by: jdanibas
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2027 I-229 VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 4

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SEH

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Project: HGRSP 1565
Print Date: 12/3/2020

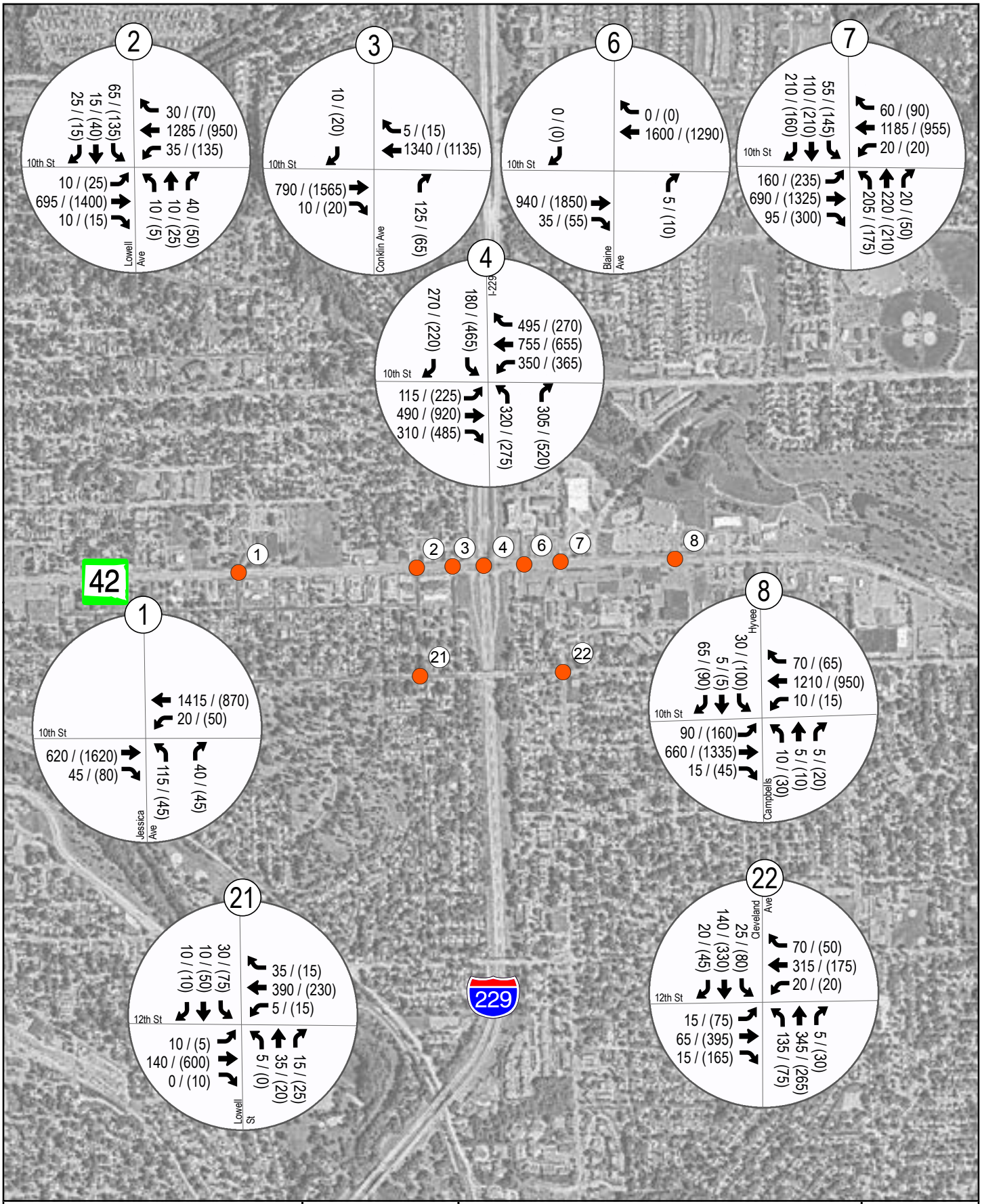
Map by: ljohnson
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2027 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 5



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Project: HGRSP 1565
Print Date: 12/2/2020

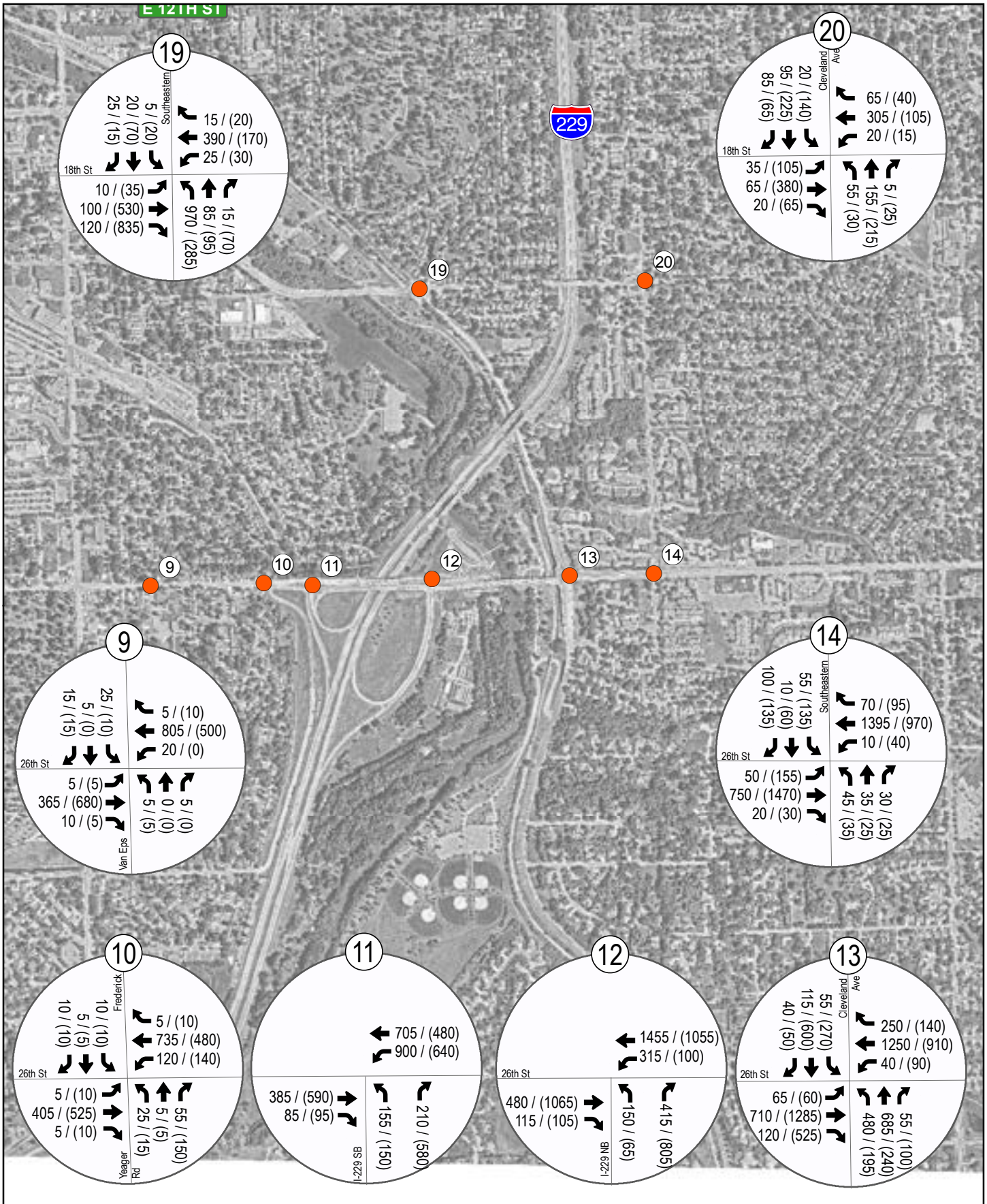
Map by: ljohnson
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2027 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 5



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SEH

0 0.125 0.25 Miles

Project: HGRSP 1565
Print Date: 12/2/2020

Map by: ljohnson
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

2027 NO BUILD VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure 5

Appendix C – Existing Conditions Memo

Building a Better World for All of Us®

DRAFT MEMORANDUM

TO: Steve Gramm
South Dakota Department of Transportation

FROM: Graham Johnson, PE (SD, MN, IA), PTOE
Justin Anibas, EIT
Chase Cutler, HR Green, PE, PTOE

DATE: October 28, 2020

RE: I-229 Exit 6 (10th Street) Interchange Project - Existing Conditions Memo
SEH No. HRGSP 156524

This technical memorandum provides the findings related to the existing conditions of the I-299 Exit 6 interchange at 10th Street. The project area includes mainline I-229 between Exit 5 and Exit 7, as well as Rice Street, 6th Street, 10th Street, 12th Street, 18th Street, Southeastern Avenue, and 26th Street in Sioux Falls, South Dakota.

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Freeway Design Criteria 20
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INTRODUCTION

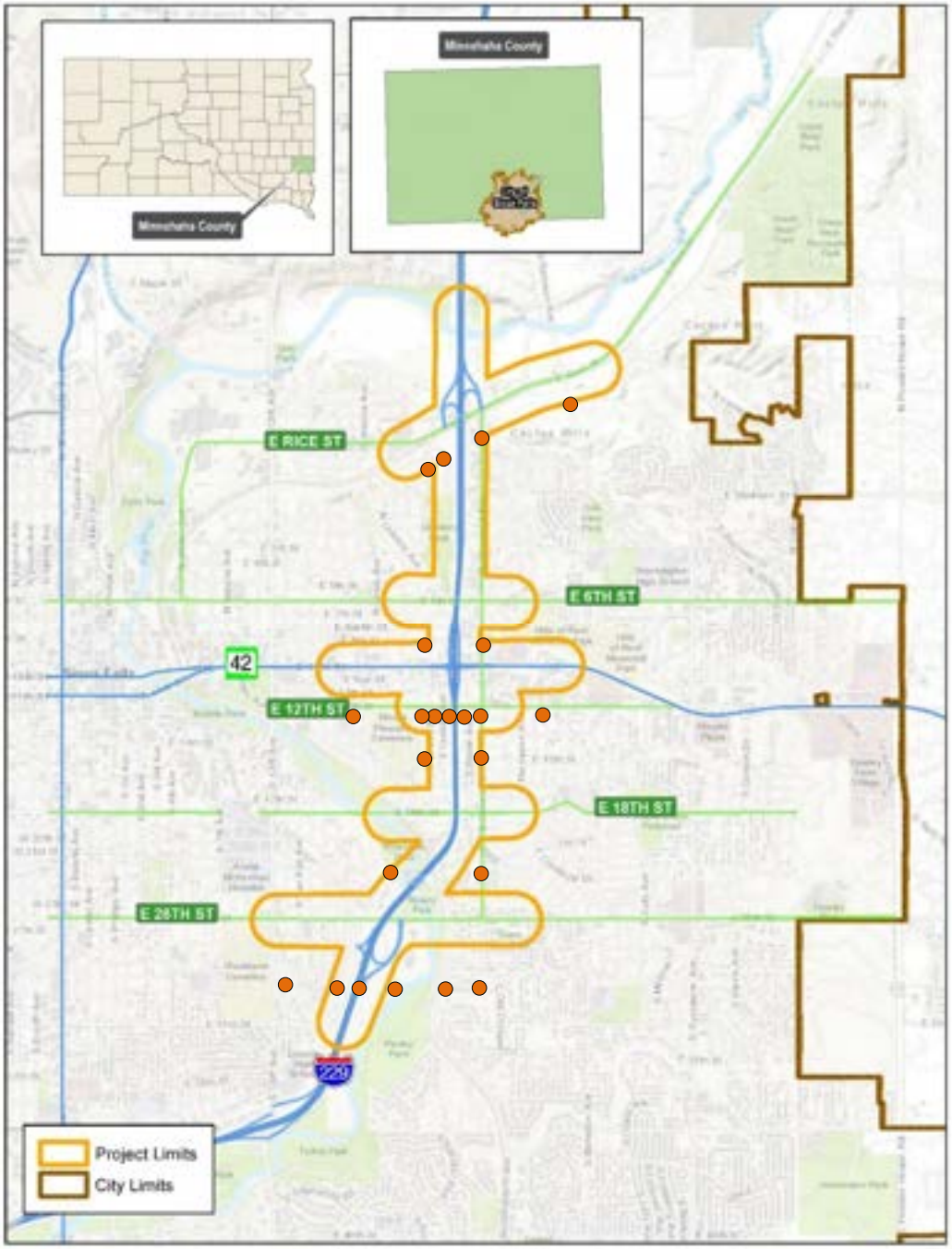
The South Dakota Department of Transportation (SDDOT) initiated an assessment of the existing interchange on Interstate 229 (I-229) at 10th Street (Exit 6) to improve the safety, operations and geometric design of the interchange area.

The subject interchange is at mileage reference marker 6 on I-229, in eastern Sioux Falls, SD. The interchange is approximately six miles east/northeast of the I-29/I-229 system interchange and four miles south of the I-229/I-90 system interchange. The adjacent interchanges along I-229 are 26th Street (Exit 5) and Rice Street (Exit 7); the interchange spacing is approximately 1-1/4 mile to either side of the subject interchange.

This location is within the Sioux Falls MPO and within the developed urban area of the city. The 10th Street corridor is a primary commuter route between downtown and the urban/suburban residential areas throughout the Sioux Falls eastern metropolitan area.

Figure 1 shows the project area and the 24 study intersection, which includes Mainline I-229, 10th Street (Exit 6 Interchange), and several other roadways that cross I-229.

Figure 1 Project Location



EXISTING ROADWAY NETWORK

The existing roadway network, represented by their Federal functional classification, surrounding the project area is shown in **Figure 2**.

The existing major roadways within the study area include:

- **I-229** – urban interstate facility, currently two continuous lanes in each direction with auxiliary lanes provided between the Exit 6 and Exit 7 interchanges.
    - 2018 Average Annual Daily Traffic (AADT) ranges between 29,800 to 37,700 vehicles in the project area.
- **Rice Street** – urban minor arterial transitioning between a 3-lane and 4-lane roadway; west of the interstate the roadway is a 4-lane undivided facility and east of the interstate the roadway is a 3-lane facility.
    - 2018 AADT ranges between 12,500 and 13,700 vehicles in the project area.
- **E. 6th Street** – urban major collector transitioning between a 3-lane and 4-lane roadway; west of the interstate the roadway is a 3-lane facility and east of the interstate the roadway is a 4-lane undivided facility.
    - 2018 AADT ranges between 10,200 and 15,100 vehicles in the project area.
- **E. 10th Street** – urban principal arterial with a 4-lane divided roadway within the interchange area; east and west of the interchange area the roadway is a 4-lane undivided with a two-way left turn lane (TWLTL, 5-lane).
    - 2018 AADT ranges between 21,200 and 31,400 vehicles in the project area.
- **E. 12th Street** – 2-lane major urban collector roadway.
    - 2018 AADT ranges between 3,400 and 4,600 vehicles in the project area.
- **E. 18th Street** – 2-lane major urban collector roadway.
    - 2018 AADT ranges between 3,800 and 5,500 vehicles in the project area.
- **E. 26th Street** – urban minor arterial varying between 3-lane and 5-lane sections. 26th Street is being reconstructed to a 4-lane divided roadway through the I-229 interchange as part of an on-going interchange project (complete in 2020).
    - 2018 AADT ranges between 12,400 and 28,500 vehicles in the project area.
- **N. Cleveland Avenue** –urban major collector roadway transitioning between a 2-lane and 3-lane facility.
    - 2018 AADT ranges between 6,400 and 7,100 vehicles in the project area.
- **S. Cleveland Avenue** – 2-lane urban major collector roadway.
    - 2018 AADT ranges between 5,400 and 6,400 vehicles in the project area.
- **S. Southeastern Avenue** – urban minor arterial transitioning between a 3-lane and 4-lane roadway.
    - 2018 AADT ranges between 8,500 and 12,700 vehicles in the project area.
    - As part of the 2020 reconstruction on 26th Street, the Southeastern Avenue approaches to 26th Street are being expanded to include dual left turn lanes, two through lanes, and a right turn lane.
- **N. Lowell Avenue** – 2-lane urban local roadway.
- **S. Lowell Avenue** – 2-lane urban local roadway.

Figure 2 Existing Federal Functional Classification

EXISTING INTERCHANGES

The following is a description and aerial photograph of the four existing interchanges within the entire project study area.

I-229 at 26th Street (Exit 5)

The interchange is wrapping up a major reconstruction project in 2020. The interchange was reconstructed to a standard folded diamond configuration as shown in **Figure 3**. The northbound I-229 ramp connections were widened near the ramp terminal intersection, but are unchanged near the ramp gores. The southbound ramp configuration was entirely reconfigured.

Yeager Road was realigned to connect to 26th Street west of its current location and will no longer be related to the interchange. A new southbound exit loop ramp will directly tie into 26th Street; this new ramp terminal intersection is essentially in the same location as the existing 26th Street/Yeager Road intersection. The first intersection to the west will be approximately 400 feet away at the new Yeager Road intersection.
26th Street was widened and additional turn lanes were provided at the ramp terminal intersections; both are controlled by traffic signals.

The 26th Street at Yeager Road intersection will be under minor street stop control. The expansion of 26th Street will extend to the east and include significant reconfiguration of the intersection with Southeastern Avenue. The first intersection to the east will be approximately 300 feet away at a business driveway, with the first major intersection approximately 1,250 feet away at Southeastern Avenue.

Figure 3 Existing I-229 at 26th Street Interchange (2020)

I-229 at 10th Street (Exit 6)

This service interchange along I-229 is a Single Point Urban Interchange (SPUI) as shown in **Figure 4**. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchange to the north. At this interchange, 10th Street travels over I-229 on a single bridge structure.

The ramp connections are a SPUI design that is currently controlled by a single traffic signal. The nearest intersection west of the interchange is approximately 275 feet at Conklin Avenue which is a Right-In/Right Out (RI/RO) access, the nearest full access intersection is approximately 600 feet away at Lowell Avenue (traffic signal control). The nearest intersection east of the interchange is approximately 375 feet at Blaine Avenue which is a Right-In/Right Out (RI/RO) access, the nearest full access intersection is approximately 700 feet away at Cleveland Avenue (traffic signal control).

Figure 4 Existing I-229 at 10th Street Interchange

I-229 at Rice Street (Exit 7)

This service interchange along I-229 is a folded diamond configuration to the north as shown in **Figure 5**. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchange to the south and north. At this interchange, I-229 travels over Rice Street on two separate bridge structures.

Both ramp terminal intersections are currently controlled by traffic signals with approximately 1,000 feet between the intersections. The south leg of the eastern ramp terminal (northbound I-229) is Cleveland Avenue. The nearest intersection west of the interchange is approximately 450 feet away at Lowell Avenue (minor street stop control), the nearest intersection to the east is approximately 2,250 feet away at Bahnson Avenue (minor stop control).

Figure 5 Existing I-229 at Rice Street Interchange

TRAFFIC DATA AND INFORMATION

The data used to create this document came from the participating agencies including the SDDOT and the City of Sioux Falls. The most recent data available was used in the analysis including traffic counts, crash data, and signal timing data.

Traffic Volumes

Due to multiple conditions in the project area, traffic volumes and turning movement volumes were not able to be collected as part of this study. The following two reasons limited the data collection at the time of this study:

- The current health pandemic (Covid 19) and associated travel reductions throughout the state.
- Construction detours corresponding to the 26th Street interchange reconstruction.

However, there have been several recent studies as well as other miscellaneous turning movement counts that were provided and utilized for this project. **Table 1** lists all the study intersections and the most recent count year provided; the SDDOT provided 2018 I-229 mainline and ramp data for the project area.

Table 1 Intersection Count Information

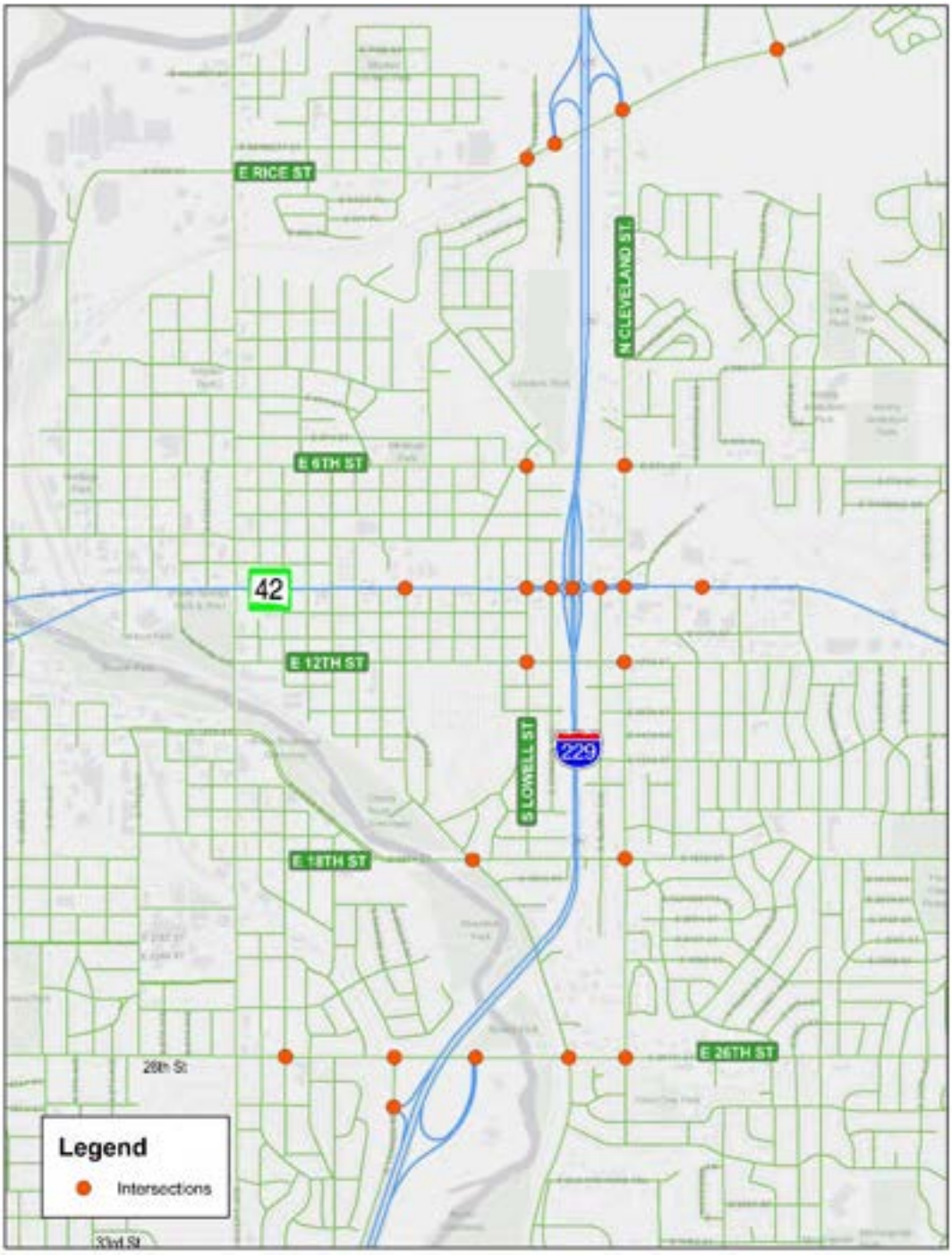
Int #	Main Street	Cross Street	Count Year(s)
1	10TH Street	Jesiica Avenuve	2017
2	10TH Street	Lowell Avenue	2017/2015
3	10TH Street	Conklin Avenue	2013
4	10TH Street	I-229 SPUI	2019/2016
6	10TH Street	Blaine Avenue	2013
7	10TH Street	Cleveland Avenue	2019/2018
8	10TH Street	HyVee Entrance	2019
9	26TH Street	Van Eps Avenue	2018
10	26TH Street	Yeager/Frederick Avenue	2018
11	26TH Street	I-229 SB Ramp Terminal	2016
12	26TH Street	I-229 NB Ramp Terminal	2018
13	26TH Street	Southeastern Avenue	2018
14	26TH Street	Cleveland Avenue	2018
15	Rice Street	Lowell Avenue	2015
16	Rice Street	I-229 SB Ramp Terminal	2018
17	Rice Street	I-229 NB Ramp Terminal	2018
18	Rice Street	Bahnson Avenue	2020
19	18TH Street	Southeastern Avenue	2018
20	18TH Street	Cleveland Avenue	2018
21	12TH Street	Lowell Avenue	2020
22	12TH Street	Cleveland Avenue	2019/2016
23	6TH Street	Lowell Avenue	2015
24	6TH Street	Cleveland Avenue	2018/2015

Notes: 2019 Data along 10th Street includes detour traffic from 26th Street construction; previous counts were reviewed to blend data.
26th St at Yeager/SB Ramp 2018 data was modified to match new conditions.

All historical traffic count data was factored up to an existing 2021 estimate based on the existing count year, historical average annual daily traffic (AADT), and balancing between study intersections.

Figure 6 represents the study intersection count locations. The existing 2021 freeway traffic counts and intersection turning movements at all study intersections can be found in the attached **Figures A1-A3**.

Figure 6 Intersection Count Locations



Origin Destination Study

An origin-destination (OD) study was previously developed for I-229 during the interchange study for Exit 3 and Exit 4. As the current Exit 5 construction is presently creating unrealistic patterns due to detouring traffic, updating the OD study was not considered feasible and therefore the previous results will be utilized and described below.

During the Exit 3 and Exit 4 study, data from a 3rd party vendor platform, StreetLight Data Incorporated was used. The platform uses global positioning system (GPS) information and location based service (LBS) information from both connected vehicles (cars and trucks) and cell phones.

A full OD study was conducted along I-229 between I-29 and I-90, including all nine service interchanges between the two system interchanges. The full results can be found in the I-229 Exits 3 & 4 Interchange Study: Origin-Destination Study memorandum, as part of the Exit 3 and Exit 4 Interstate Modification Justification Reports (IMJR).

The platform allowed for 1-year worth of data to be pulled for the entire I-229 corridor; a total of 375,000 personal LBS trips and 265,000 commercial GPS trips were captured along the corridor. The data is sorted out by day of the week and grouped by hours throughout the day. For the OD analysis, the weekday trips during the AM and PM peak periods, 6am to 9am and 3pm to 6pm, were tabulated for use in this study evaluation.

For this analysis, the information regarding the weaving percentages between the study interchanges was utilized in the operational weaving analysis. **Table 2** shows the results of the four weaving segments within this interchange project area; the percentages are of the entrance ramp volumes entering I-229.

Table 2 Origin Destination Information

Ramp Weaving Segment		Avg Weekday 24-hr Data	Avg Weekday AM Peak	Avg Weekday PM Peak
NB I-229	Exit 5 to Exit 6	22%	12%	31%
NB I-229	Exit 6 to Exit 7	17%	13%	22%
SB I-229	Exit 7 to Exit 6	23%	14%	24%
SB I-229	Exit 6 to Exit 5	11%	9%	11%

TRAFFIC OPERATIONS

A traffic operations study was conducted for the project area using the estimated 2021 traffic volumes. A total of twenty-three existing intersections and twelve ramp junctions were analyzed within the interchange study area.

Analysis techniques included evaluation of operational capacity using the Highway Capacity Manual (HCM), 6th Edition, techniques via the Highway Capacity Software (HCS) Version 7.

It should be noted that the HCM does not recommend using the merge and diverge analysis procedures when a full length auxiliary lane is provided; the methodologies were derived from acceleration and deceleration lengths of 1,500 feet or less. Page 14-30 of the HCM 6th Edition says:

- The freeway segment downstream of the on-ramp or upstream of the off-ramp is simply considered to be a basic freeway segment with an additional lane.
- The case of an on-ramp followed by an off-ramp lane drop may be a weaving segment and should be evaluated with the procedures of Chapter 13, Freeway Weaving Segments.

Therefore, for this analysis both the basic lane and weaving segment analysis were conducted on all freeway mainline segments that include full auxiliary lanes between ramp connections.

Level of Service Criteria

The freeway and arterial Level of Service (LOS) criteria presented in the following tables were used to evaluate the traffic operations in the study area; the information is from the SDDOT Road Design Manual (Chapter 15) and based on the Highway Capacity Manual (HCM).

Table 3 Freeway - LOS Criteria

Level of Service (LOS)	Description	Density (pc/mi/ln)
A	Free-flow operation	≤ 11.0
B	Reasonably free-flow operation; minimal restriction on lane changes & maneuvers	> 11.0 to 18.0
C	Near free-flow operation; noticeable restriction on lane changes & other maneuvers	> 18.0 to 26.0
D	Speed decline with increasing flows; significant restriction on lane changes & other maneuvers	> 26.0 to 35.0
E	Facility operates at capacity; very few gaps for lane changes & other maneuvers; frequent disruptions & queues	> 35.0 to 45.0
F	Unstable flow; operational breakdown	> 45.0

Source: SDDOT Road Design Manual (Table 15-1)

Table 4 Signalized Intersection Control - LOS Criteria

Level of Service (LOS)	Description	Signalized Delay (sec/veh)
A	Very minimal queueing; excellent corridor progression	≤ 10.00
B	Some queuing; good corridor progression	> 10.0 to 20.0
C	Regular queueing; not all demand may be serviced on some cycles (cycle failure)	> 20.0 to 35.0
D	Queue lengths increased; routine cycle failures	> 35.0 to 55.0
E	Majority of cycles fail	> 55.0 to 80.0
F	Volume to capacity ratio approaches 1.0; very long queues, almost all cycles fail	> 80.0

Source: SDDOT Road Design Manual (Table 15-5)

Table 5 All-Way Stop & Two Way Stop Intersection Control - LOS Criteria

Level of Service (LOS)	Description	Un-signalized Delay (sec/veh)
A	Queuing is rare	≤ 10.00
B	Occasional queueing	> 10.0 to 15.0
C	Regular queueing	> 15.0 to 25.0
D	Queue lengths increase	> 25.0 to 35.0
E	Significant queueing	> 35.0 to 50.0
F	Volume to capacity ratio approaches 1.0; very long queues	> 50.0

Source: SDDOT Road Design Manual (Table 15-6 and 15-7)

The SDDOT has established a minimum of LOS C on urban interstate highway corridors. At ramp terminal intersections the overall intersection must be at a LOS C or better; however, individual movements may operate at a LOS D.

The City of Sioux Falls has established a minimum of LOS D on arterial signalized intersections and any intersection movement at LOS E or better. Two way stop control intersections should have the minor approaches operate at a LOS D or better.

Available storage for turning vehicles plays an important role in the operations of an intersection. The HCM software does not properly handle lane blockage conditions, providing LOS results that are not reflective of actual operations. The HCM methodologies provide a “Queue Storage Ratio” (QSR) which is the maximum stacking of queued vehicles (SDDOT recommends the 95th percentile queue) divided by the available storage length provided for the movement. If the QSR is above 1.0, it represents a queue that is spilling outside of the available storage and blocking other movements at the intersection. At any intersection where the QSR is above 1.0 for a movement, it is SDDOT preference to state the intersection has failing operations, regardless of the overall delay at the intersection. The volume to capacity (v/c) ration should also be less than 1.0 for all movements.

Existing Operations

The project area includes 3 service interchanges with 12 ramp junctions and 7 mainline segments; however some of the ramps have auxiliary lanes between adjacent interchanges and therefore limit the number of merge and diverge analysis locations.

The summation of the existing traffic operations analysis show that mainline I-229 operates acceptably. All existing ramp junctions and weaving segments operate at a LOS C or better during the AM and PM peak hours. Results for the individual segments and ramp junctions of I-229 in the project area are shown in **Table 6** as well as **Figure 7**.

Table 6 Existing (2021) Freeway Operations Summary

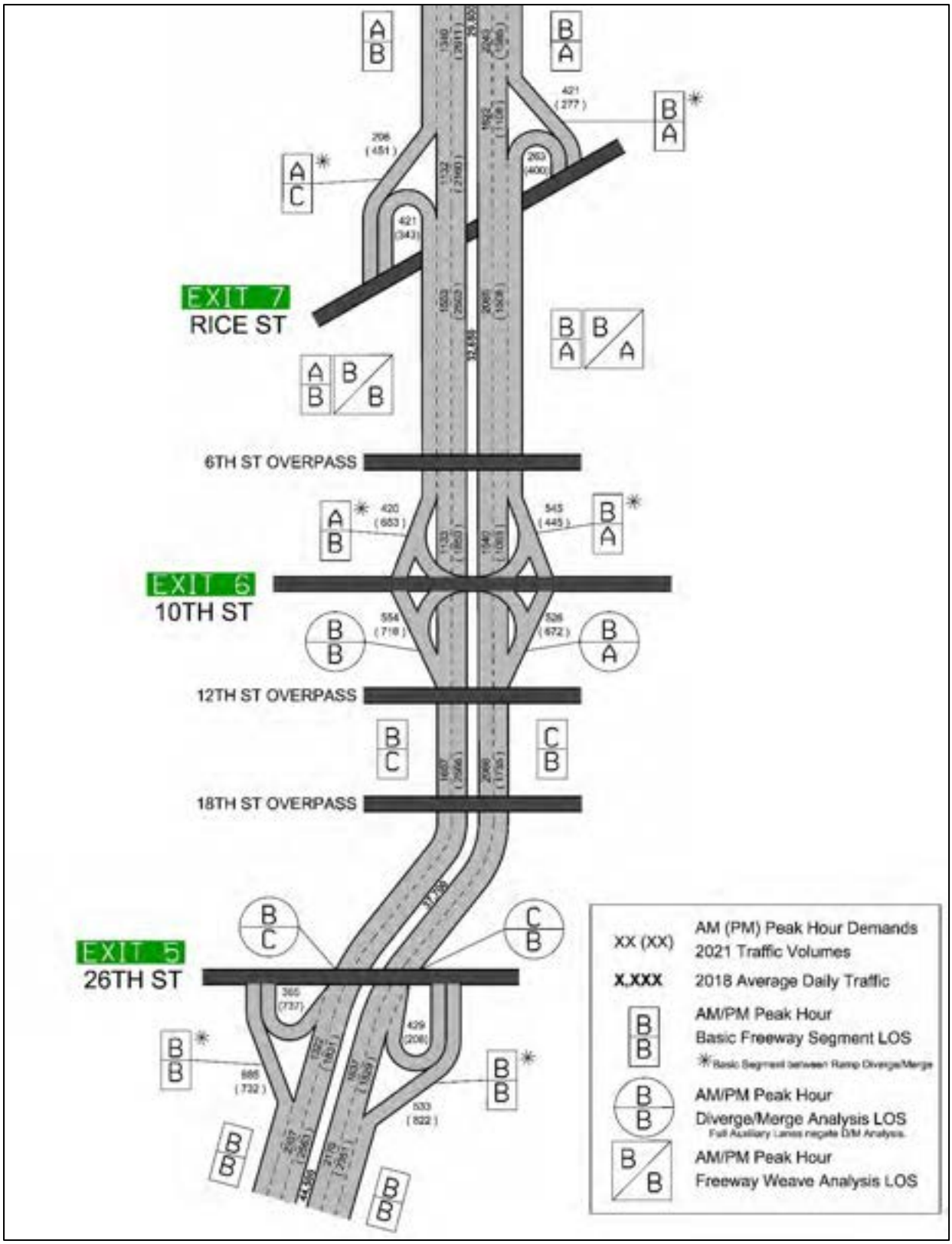
Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	B
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: between Exit 5 and Exit 6	Basic	C	B
	NB I-229: Exit 6 Exit Ramp	Diverge	B	A
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	A
	NB I-229: between Exit 6 and Exit 7	Basic	B	A
		Weave	B	A
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	B	A
	NB I-229: north of Exit 7	Basic	B	A
SB I-229	SB I-229: north of Exit 7	Basic	A	B
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	A	C
	SB I-229: between Exit 7 and Exit 6	Basic	A	B
		Weave	B	B
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	A	B
	SB I-229: Exit 6 Entrance Ramp	Merge	B	B
	SB I-229: between Exit 6 and Exit 5	Basic	B	C
	SB I-229: Exit 5 Exit Ramp	Diverge	B	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	B
	SB I-229: southwest of Exit 5	Basic	B	B

Of the five total LOS C segments or junctions, the 4-lane section of I-229 between Exit 5 and Exit 6 includes 4 of the LOS C results. Currently the basic lanes have LOS C directionally with northbound in the AM peak hour and southbound in the PM peak hour. With the basic lane approaching capacity, the northbound merge from Exit 5 and the southbound diverge to Exit 5 both currently operate at a LOS C. The ramps merge and diverge from Exit 6 are not an issue on this segment as they both have long acceleration and deceleration lanes provided.

The southbound direction between Exit 6 and Exit 5 in the PM peak hour is currently approaching the LOS C/D threshold; it is within approximately 300 vehicles or approximately 10% of the volume threshold to be LOS D.

The final LOS C is located along southbound I-229 between the Exit 7 ramps, this location is just over the density criteria for LOS B/C and should continue to operate well in the short term.

Figure 7 Existing (2021) Freeway Summary



For the arterial intersection analysis, a total of 23 study intersections were included in the analysis, this includes 16 traffic signals, 5 minor stop control intersections, and 2 right-in/right-out (RI/RO) intersections. Results for the intersection analysis in the project area are shown in **Table 7** as well as **Figure 8**.

Table 7 Existing (2021) Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	Lowell Avenue	Minor Stop	A	A	C	A	C	A	A	D	C	D
Rice Street	I-229 SB Ramp Terminal	Signal	A	A	NA	**D -**	**B -**	B	B	NA	**D -**	**C -**
Rice Street	I-229 NB Ramp Terminal	Signal	B	B	D	C	C	B	B	C	**E -***	**C -***
Rice Street	Bahnson Avenue	Minor Stop	A	A	C	C	C	A	A	**E**	D	**E**
6TH Street	Lowell Avenue	Minor Stop	A	A	C	C	C	A	B	**F**	**E**	**F**
6TH Street	Cleveland Avenue	Signal	B	B	C	C	B	D	C	C	C	C
10TH Street	Jessica Avenue	Signal	A	A	**E***	NA	**A***	A	A	**E-**	NA	**A-**
10TH Street	Lowell Avenue	Signal	A	A	D	D	A	B	**A***	D	D	**B***
10TH Street	Conklin Avenue	RI/RO	--	--	C	C	C	--	--	C	B	C
10TH Street	I-229 SPUI	Signal	**D -**	C	D	D	**D -**	**F**	**F**	C	D	**F**
10TH Street	Blaine Avenue	RI/RO	--	--	B	NA	B	--	--	C	NA	C
10TH Street	Cleveland Avenue	Signal	B	C	**D***	E	**C***	B	C	**D***	**E***	**C***
10TH Street	HyVee Entrance	Signal	A	A	D	D	A	A	A	D	**D***	**B***
12TH Street	Lowell Avenue	Minor Stop	A	A	C	C	C	A	A	C	**F**	**F**
12TH Street	Cleveland Avenue	Signal	B	B	B	B	B	C	B	B	B	B
18TH Street	Southeastern Avenue	Signal	D	D	**F**	**E**	**F**	C	B	D	**E**	D
18TH Street	Cleveland Avenue	Signal	B	B	B	B	B	B	B	B	C	B
26TH Street	Van Eps Avenue	Signal	A	A	D	D	A	A	A	**E**	**E**	A
26TH Street	Yeager/Frederick Avenue	Minor Stop	A	A	C	**E**	**E**	A	A	D	**F**	**F**
26TH Street	I-229 SB Ramp Terminal	Signal	C	**A***	C	NA	**A***	**D***	A	B	NA	**C***
26TH Street	I-229 NB Ramp Terminal	Signal	A	C	C	NA	C	C	A	C	NA	C
26TH Street	Southeastern Avenue	Signal	B	B	**D***	**E**	**C***	D	D	D	**E**	D
26TH Street	Cleveland Avenue	Signal	A	C	D	D	C	A	C	**E**	**D***	**C***

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (v/c) ration > 1.0, or queue storage issue.
- " * " Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- " – " At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

Under the existing conditions, there are fifteen intersections that currently have failing traffic operations in at least one of the peak periods; these conditions are due to volume to capacity issues, queue storage issues, or delay issues. There is an additional single intersection with an approach that is failing yet the overall intersection is acceptable. Therefore, seven intersections currently have acceptable operations in both peak periods.

Along Rice Street, both ramp terminal intersections operate at a LOS C or better; however, both intersections have at least one movement that fails. The southbound left turns at the southbound ramp operates at a LOS E, the southbound left at the northbound ramp operates at a LOS F with both QSR and V/C issues.

Along 6th Street, the Lowell Avenue minor stop controlled approach have poor LOS on both the approaches to 6th Street. 6th Street carries a high volumes of traffic during the PM peak hour that limits gaps for Lowell Avenue traffic to enter or cross 6th Street.

Along 10th Street, only the I-229 SPUI intersection operates under failing conditions. At Cleveland Avenue, the southbound approach is at a LOS E in both peak hours with QSR issues, this is created by capacity issues on this approach leg. At Jessica Avenue, the northbound approach is at a LOS E in both peak hours with the overall intersection at a LOS A, this minor approach delay is created by the signal timing which provides more time for 10th Street.

The 10th Street at I-229 SPUI intersection currently operates under significant delays in the PM peak hour; however, the AM peak is operating at a LOS D with a movement at LOS E. The single left turn lane on all four approaches of the SPUI design create significant delays and vehicles are not served within a cycle length at the intersection.

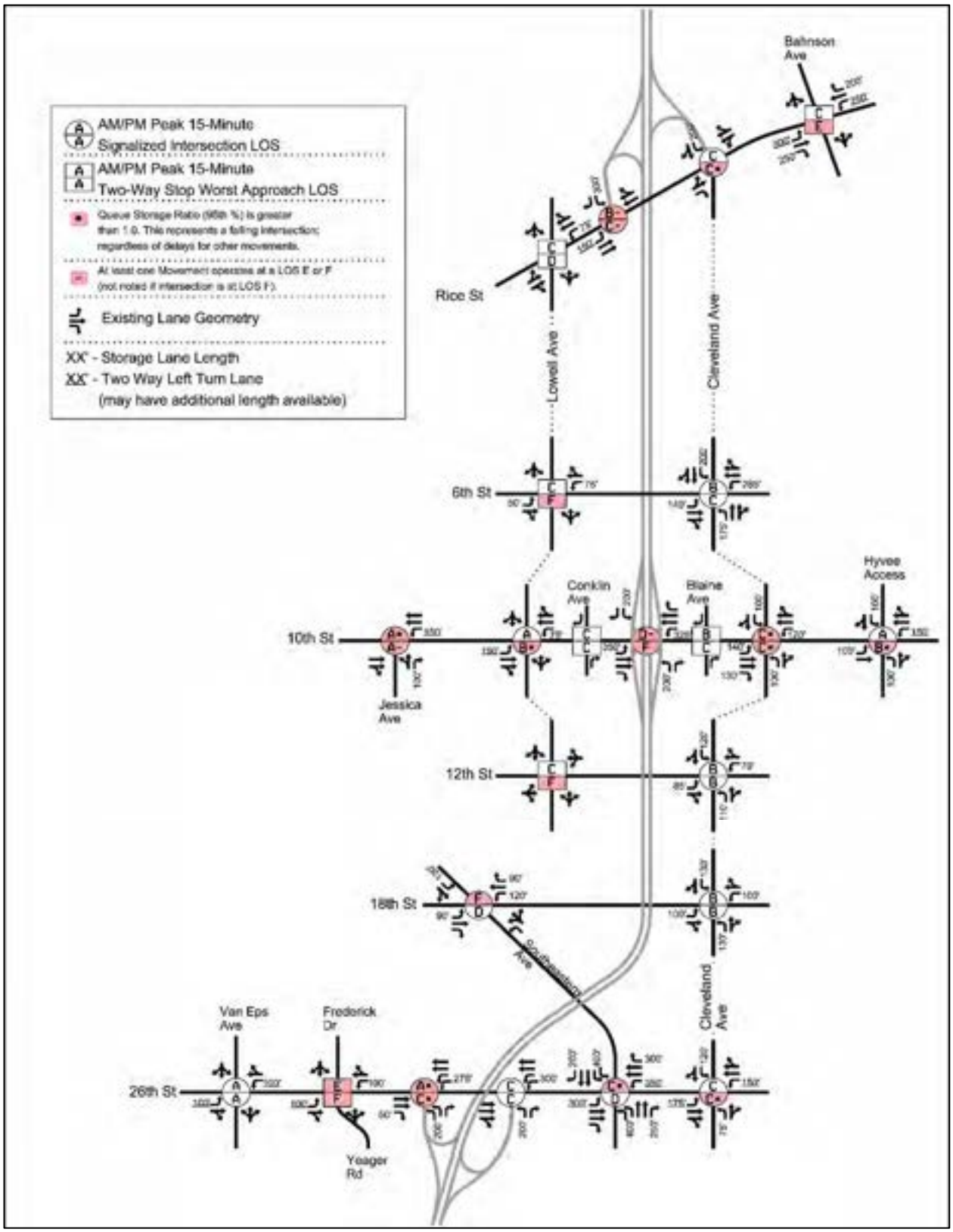
Along 12th Street, the Lowell Avenue southbound minor stop controlled approach has a poor LOS. 12th Street carries a higher volumes of traffic during the PM peak hour that limits gaps for Lowell Avenue traffic to enter or cross 12th Street.

Along 18th Street, the Southeastern Avenue intersection currently has failing operations in the AM peak hour. The northbound left turn volume is a significant constraint that requires the intersection to operate under a split phase timing; split phase signal timings typically create longer delays for all approaches. The eastbound approach carries a high volume in the PM peak hour that requires a long green phase to serve the demands, which adds delay for all approaches.

While 26th Street is currently under construction, the resulting design will still incur operational issues during both peak periods outside of the immediate interchange area. Three of the study intersections will have a poor approach LOS, but the overall intersection is acceptable; this includes Van Eps Avenue, Southeastern Avenue, and Cleveland Avenue. The new Yeager Avenue/Frederick Avenue intersection will operate under minor stop control; the high directional volumes along 26th Street will limit gaps for vehicles to cross or enter the roadway and the approach will operate at a LOS F. The southbound I-229 ramp does have queue storage issues for the eastbound right turn as the storage lane is very short.

Attached to this memorandum is an HCS analysis summary table that also includes a multi-modal analysis. Most of the intersections (analysis only includes signalized intersections) have a LOS of C or better for both the pedestrian and bicycle LOS. There are 3 locations that have a poor LOS, all of which are on the ramp connection legs of the intersections.

Figure 8 Existing (2021) Arterial Summary



Crash History

A comprehensive safety analysis was conducted for the entire project area for this study. The analysis included the most recent 5-years of crash history available from the SDDOT. This included the five calendar years of 2015 through 2019.

A detailed crash analysis was completed and documented in a separate memorandum; *I-229 Exit 6 (10th Street) Interchange Project – Safety Memo*. The crash memorandum is attached to this document, however a brief summary is provided below.

The crash records were segregated into crashes for each of the study intersections and the arterial and freeway segments. The type and severity of the crashes were reviewed and crash rates and critical rates were calculated for each.

Crash severity is comprised of 5 separate types including fatal, an incapacitating injury (Severity A), a non-incapacitating injury (Severity B), a possible injury (Severity C), or a property damage only (PD) crash; wild animal hits are coded in a separate category.

Crash rates are expressed as the number of crashes per million entering vehicles (MEV) at an intersection or along a segment. The critical crash rate is a statistical value that is unique to each intersection or segment. It is based on vehicular exposure and the average crash rate for similar intersection or segment; a crash rate higher than the critical rates indicates a sustained crash problem. A critical crash rate index is calculated by dividing the crash rate by the critical rate. Any index value above 1.0 indicates a crash rate at or exceeding the critical rate.

The average crash rate for an urban freeway system, provided by SDDOT, was 1.03 crashes per MEV. The City of Sioux Falls provided the most recent average crash data, from 2015, for the varying arterial roadway and intersection control types.

A total of 1,632 crashes occurred within the entire project area during the 5-year analysis period. A total of 400 crashes occurred along the freeway mainline or ramp connections and a total of 1,232 occurred at a study intersection or segment.

A total of 353 crashes occurred along mainline I-229, 6 segment areas that have had crash rates above the critical, these include:

- Northbound I-229 Locations:
  - Mainline segment between Exit 5 and Exit 6.
  - Exit 6 Diverge Area.
  - Exit 7 Merge Area.
- Southbound I-229 Locations:
  - Exit 7 Merge Area.
  - Exit 6 Diverge Area.
  - Exit 6 Merge Area.

A total of 47 crashes occurred on the I-229 ramp connections, there were 3 ramp connections from I-229 that had crash rates above the critical rate, these include:

- Northbound I-229 Entrance Ramp from 26th Street (Exit 5).
- Northbound I-229 Exit Ramp to Rice Street (Exit 7).
- Southbound I-229 Entrance Ramp from 10th Street (Exit 6).

A total of 1,104 crashes occurred at study intersections within the project area. The study intersections included 23 recommended study intersections; 4 additional intersections were included as they had approximately 10 crashes during the 5-year period. A total of 15 intersections have crash rates that exceed the critical rates, these include:

- Rice Street at the I-229 Northbound Ramp Terminal
- 6th Street at Cleveland Avenue
- 10th Street at Lowell Avenue
- 10th Street at I-229 SPUI
- 10th Street at Cleveland Avenue
- 12th Street at Lowell Avenue
- 12th Street at Cleveland Avenue
- 18th Street at Southeastern Avenue
- 18th Street at Blaine Avenue (non-study intersection)
- 18th Street at Cleveland Avenue
- 26th Street at Yeager Road**
- 26th Street at I-229 Northbound Ramp Terminal**
- 26th Street at Southeastern Avenue**
- 26th Street at Cleveland Avenue**
- Yeager Road at I-229 Southbound Ramp Terminal**

  **26th Street/Exit 5 is currently under construction and the new design should improve safety on the corridor.

A total of 128 crashes occurred along arterial segments between intersections, a total of 22 segments were evaluated along the 7 study corridors. Only 1 segment had a crash rate higher than the critical rate.

- 12th Street: between Lowell Avenue and Cleveland Avenue

More detailed information can be found in the attached traffic safety memorandum.

FREEWAY DESIGN CRITERIA

This section will discuss the I-229 freeway facility within the project area. The primary design principles and criteria that impact freeway operations include:

- Basic Lane Capacity
- Route Continuity
- Lane Balance
- Interchange Spacing
- Ramp Spacing

These criteria are described in the American Association of State Highway and Transportation Official's (AASHTO) Policy on Geometric Design of Highways and Streets 2011 edition. The existing design speed for I-229 is 70 mph, with a posted speed limit of 65 mph.

Basic Lane Capacity

The basic number of lanes is defined as a minimum number of lanes designated and maintained over a significant length of a corridor, regardless of changes in traffic volumes and lane-balance. An assessment of basic lane needs is an indicator of minimum capacity requirements; it is not an indicator of the actual capacity. **Table 8**, below, summarizes the basic lane volumes for LOS C, LOS D and LOS E from the Highway Capacity Manual (HCM).

Table 8 Basic Lane Capacity

Free Flow Speed (mph)	Per-Lane Volume Threshold (pcphpl) / (Vehicle Density (pc/mi/ln))		
	LOS C	LOS D	LOS E
75 mph	1,750 / (26.0)	2,110 / (35.0)	2,400 / (45.0)
70 mph	1,690 / (26.0)	2,080 / (35.0)	2,400 / (45.0)
65 mph	**1,630 / (26.0)**	**2,030 / (35.0)**	**2,350 / (45.0)**
60 mph	1,560 / (26.0)	2,010 / (35.0)	2,300 / (45.0)
55 mph	1,430 / (26.0)	1,900 / (35.0)	2,250 / (45.0)

Source: Highway Capacity Manual 6th Edition, Exhibit 12-4; HCM 2010, Exhibit 11-17

While the previous **Table 6** shows the results of the operational analysis, this Basic Lane Capacity assessment still evaluated each mainline segment based on the higher of the AM or PM peak hour data. The following **Table 9** shows the results of the analysis, all segments have enough basic lane capacity to reach a LOS C or better

Table 9 I-229 Basic Lane Assessment

Description			Existing Lane	Max Hourly Volume (AM or PM)	Basic Lane LOS	# of Lanes for LOS C Conditions
	From	To				
NB I-229	NB I-229	26th Street Exit	3	2351	B	1.6
	26th Street Exit	26th Street Entrance	2	1637	B	1.1
	26th Street Entrance	10th Street Exit	2	2066	B	1.4
	10th Street Exit	10th Street Entrance	2	1540	B	1.1
	10th Street Entrance	Rice Street Exit	3	2085	B	1.4
	Rice Street Exit	Rice Street Entrance	2	1822	B	1.2
	Rice Street Entrance	NB I-229	3	2243	B	1.5
SB I-229	SB I-229	Rice Street Exit	3	2611	B	1.8
	Rice Street Exit	Rice Street Entrance	2	2160	C	1.5
	Rice Street Entrance	10th Street Exit	3	2503	B	1.7
	10th Street Exit	10th Street Entrance	2	1850	B	1.3
	10th Street Entrance	26th Street Exit	2	2568	C	1.8
	26th Street Exit	26th Street Entrance	2	1831	B	1.2
	26th Street Entrance	SB I-229	3	2563	B	1.7

Route Continuity

A route continuity evaluation is used to determine if any forced lane changes are required to continue along a specific highway. A forced lane change occurs when either an established through lane is dropped at a major fork diverge or when an auxiliary lane is added to the left side of the roadway to accommodate the design of a major fork diverge and the through traffic must change lanes in order to continue.

Route continuity is currently satisfied for I-229 in the project area; I-229 has two continuous travel lanes in both directions which connect to both the I-29 and I-90 system interchanges.

Lane Balance

The concept of lane balance is intended to smooth traffic flow through and beyond an interchange. The AASHTO definition of lane balance is as follows:

1. At entrances, the number of lanes beyond the merging of two traffic streams should not be less than the sum of all traffic lanes on the merging roadways minus one.
2. At exits, the number of approach lanes on the highway must be equal to the number of lanes on the highway beyond the exit, plus the number of lanes on the exit, minus one. Exceptions to this principle occur at cloverleaf loop-ramp exits that follow a loop-ramp entrance and at exits between closely spaced interchanges (i.e. interchanges where the distance between the end of the taper of the entrance terminal and the beginning of the taper of the exit terminal is less than 1,500 ft). In these cases, the auxiliary lane may be dropped in a single-lane exit with the number of lanes on the approach roadway being equal to the number of through lanes beyond the exit plus the lane on the exit.
3. The traveled way of the highway should be reduced by not more than one traffic lane at a time.

Lane balance is satisfied at all entrances in the project area. Lane balance is not satisfied at the exit ramp locations that are fed by a full auxiliary; to fully satisfy the criteria, escape lanes would need to be provided after the exit ramp to ensure vehicles would not become trapped in the auxiliary lane.

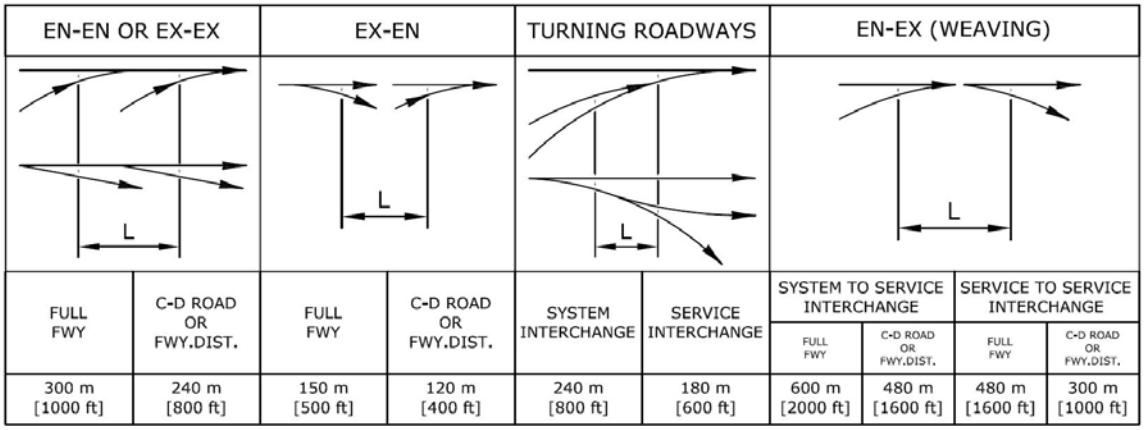
Interchange Spacing

In urban or urbanizing areas, the minimum recommended interchange spacing is 1-mile. The three existing I-229 interchanges all currently exceed the 1-mile spacing.

Ramp Spacing

The distance between freeway ramps can be one of the most important features to impact freeway operations. SDDOT has established guidelines for desired interchange ramp spacing based on AASHTO criteria and these guidelines are documented in the SDDOT Road Design Manual, Chapter 13, and are shown in **Figure 9**.

Figure 9 AASHTO / SDDOT Ramp Spacing Criteria



The primary goal for ramp spacing is “desirable” spacing; the shortest acceptable spacing is “minimum” spacing. **Table 10** summarizes the existing ramp spacing for I 229; all ramp spacing is greater than the “desirable”.

Table 10 I-229 Ramp Spacing - Existing

	Description		Ramp Type	Desirable Space (ft)	Minimum Space (ft)	Existing (ft)
	From	To				
NB I-229	NB I-229	26th Street Exit	EN-EX	2,000	1,500	2,750
	26th Street Exit	26th Street Entrance	EX-EN	750	500	1,550
	26th Street Entrance	10th Street Exit	EN-EX	2,000	1,500	6,700
	10th Street Exit	10th Street Entrance	EX-EN	750	500	2,280
	10th Street Entrance	Rice Street Exit	EN-EX	2,000	1,500	5,110
	Rice Street Exit	Rice Street Entrance	EX-EN	750	500	1,350
	Rice Street Entrance	NB I-229	EN-EX	2,000	1,500	5,280
SB I-229	SB I-229	Rice Street Exit	EN-EX	2,000	1,500	5,670
	Rice Street Exit	Rice Street Entrance	EX-EN	750	500	1,340
	Rice Street Entrance	10th Street Exit	EN-EX	2,000	1,500	4,830
	10th Street Exit	10th Street Entrance	EX-EN	750	500	2,270
	10th Street Entrance	26th Street Exit	EN-EX	2,000	1,500	6,400
	26th Street Exit	26th Street Entrance	EX-EN	750	500	1,200
	26th Street Entrance	SB I-229	EN-EX	2,000	1,500	2,520

CONCLUSIONS

The existing interchange of I-229 at 10th Street (Exit 6) currently has both safety and operational issues.

Mainline I-229

Operationally, the I-229 mainline currently performs under acceptable conditions along the study area. The 4-lane segment between Exit 5 and Exit 6 currently operate at LOS C, the southbound basic lane is currently within 10% of the LOS D criteria during the PM peak hour.

Crashes on I-229 are concentrated mainly at entrance and exit ramp locations. Three of the four Exit 6 ramp connections are currently over the critical crash rate; only the northbound entrance ramp is not over. Both of the entrance ramps from Exit 7 are also above the critical rates. The only mainline segment over the critical rate is northbound I-229 between Exit 5 and Exit 6; the two curves and the river bridge have had a high number of crashes with a high percentage of poor roadway conditions (rain, snow, ice, etc.).

I-229 Ramp Connections

All ramp connections are currently single lane connections to I-229; the ramp volumes are all significantly below the capacity of each ramp and there are no capacity issues. However, three ramp connections have had a crash history that results in a crash rate above the critical rate. In the northbound direction, the Exit 5 entrance ramp and the Exit 7 off ramp have had a crash problem; poor roadway conditions on the loop ramp areas. In the southbound direction, the Exit 6 entrance has had a crash problem.

Study Intersections

The project area includes 23 study intersections that were evaluated. Operationally, many of the study intersections currently have operational issues that would require additional capacity or traffic signal upgrades to improve.

Under the existing conditions, there are fifteen intersections that currently have failing traffic operations in at least one of the peak periods; these conditions are due to volume to capacity issues, queue storage issues, or delay issues. There is an additional single intersection with an approach that is failing yet the overall intersection is acceptable. Therefore, seven intersections currently have acceptable operations in both peak periods.

The fifteen intersections with failing operations include:

- Rice Street at I-229 Southbound Ramp Terminal
- Rice Street at I-229 Northbound Ramp Terminal
- Rice Street at Bahnson Avenue
- 6th Street at Lowell Avenue
- 10th Street at Jessica Avenue
- 10th Street at Lowell Avenue
- 10th Street at I-229 SPUI
- 10th Street at Cleveland Avenue
- 10th Street at Hyvee Entrance
- 12th Street at Lowell Avenue
- 18th Street at Southeastern Avenue
- 26th Street at Yeager/Frederick Avenue
- 26th Street at I-229 Southbound Ramp Terminal
- 26th Street at Southeastern Avenue
- 26th Street at Cleveland Avenue

Of the 23 study intersection, currently 15 intersections have crash rates that exceed the critical rates; this includes at least one intersection on each corridor. There are 4 intersections that have crash rates that are more than two times the critical rate which indicates a major safety concern:

- 10th Street at I-229 SPUI
- 10th Street at Cleveland Avenue
- 26th Street at I-229 Northbound
- 26th Street at Cleveland Avenue

The 26th Street corridor has safety issues at 5 of the 6 study intersections. The current Exit 5 construction project should improve both safety and operations at 4 of the intersections directly as they are being improved with the project. 26th Street at Cleveland Avenue is not directly part of the current project, but improvements at the Exit 5 intersections should improve the safety and operations at this intersection as traffic will flow through the interchange area more efficiently.

Design Considerations

Based on the AASHTO design guidance, the current I-229 meets many of the basic freeway criteria including the number of basic lanes, route continuity, interchange spacing and ramp spacing. Lane balance is met at all entrance ramp locations, but is not currently met at all exit ramp locations. At an exit ramp, a full auxiliary lane typically requires an escape lane along mainline to meet the criteria for lane balance.

Recommendations

Based on the existing conditions evaluation, proposed project improvements to the corridor should address the safety and operational issues described in this memorandum.

gtj
Figures A1-A3 – Existing Traffic Volumes
HCS Analysis Summary (includes Multi-Modal)

c: Shannon Ausen, City of Sioux Falls
Heath Hoftiezer, City of Sioux Falls
Ross Harris, SEH
Ben White, HR Green
Tim Thoreen, HR Green
Rick Laughlin, HR Green

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SEH

0 0.125 0.25 Miles

Project: HGRSP 156524
Print Date: 10/9/2020

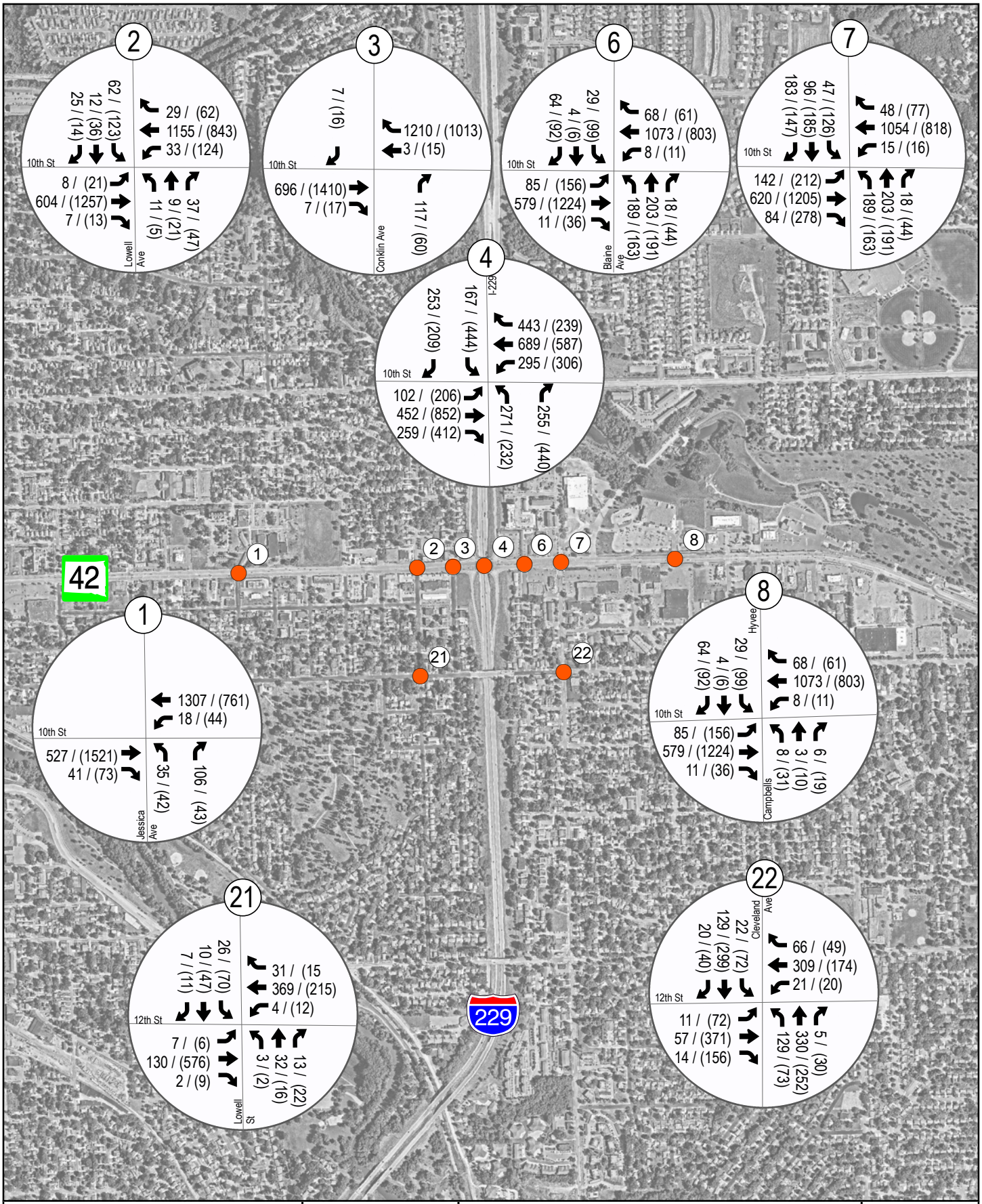
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

EXISTING VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A1



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SEH

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Project: HGRSP 156524
Print Date: 10/9/2020

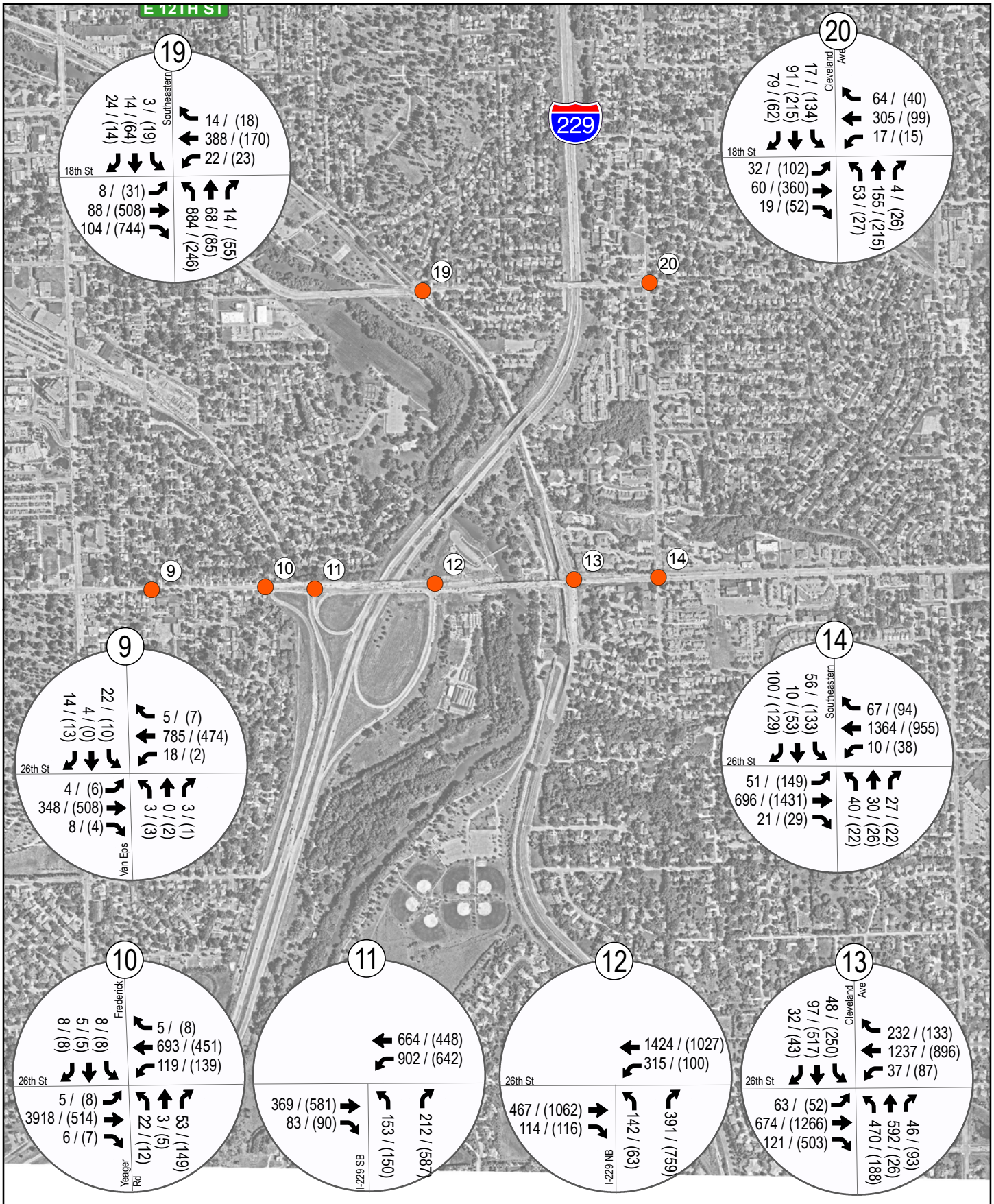
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

EXISTING VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A2



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SEH

0 0.125 0.25 Miles

Project: HGRSP 156524
Print Date: 10/8/2020

Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

EXISTING VOLUMES

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A3

HCS SUMMARY - Multi-Modal (LOS)

	Intersection Location	Traffic Control	Metric	Existing Year 2021									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
Rice Street	Rice Street & Lowell Avenue	Two-way Stop Control	*Delay (Sec.)*	0.0	0.2	15.3	0.0	**15.3**	0.0	1.7	32.3	22.5	**32.3**
			LOS	A	A	C	A	**C**	A	A	D	C	D
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	Rice Street & SB I-229	Traffic Signal	*Delay (Sec.)*	4.9	8.8	-	53.4	**14.3**	10.7	12.9	-	54.9	**21.9**
			LOS	A	A	NA	D	**B**	B	B	NA	D	**C**
			Ped LOS	A	B	B	B		A	B	B	B	
			Bicycle LOS	A	A	-	F		A	A	-	F	
	Rice Street & NB I-229	Traffic Signal	*Delay (Sec.)*	19.9	19.4	40.3	27.4	**25.1**	12.1	10.6	33.9	73.5	**25.5**
			LOS	B	B	D	C	**C**	B	B	C	E	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		B	A	A	A	
	Rice Street & Bahnson Avenue	Two-way Stop Control	*Delay (Sec.)*	1.0	0.1	16.7	17.8	**17.8**	0.1	0.8	43.2	30.0	**43.2**
			LOS	A	A	C	C	**C**	A	A	E	D	**E**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
6th Street	6th Street & Lowell Avenue	Two-way Stop Control	*Delay (Sec.)*	9.0	0.4	23.1	20.5	**23.1**	8.3	10.4	85.0	37.0	**85.0**
			LOS	A	A	C	C	**C**	A	B	F	E	**F**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	6th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	18.3	15.2	30.5	26.9	**20.0**	39.6	21.0	29.7	21.6	**29.8**
			LOS	B	B	C	C	**B**	D	C	C	C	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		A	A	A	A	
10th Street	10th Street & Jessica Avenue	Traffic Signal	*Delay (Sec.)*	3.1	2.5	58.3	-	**6.8**	4.6	3.0	59.4	-	**6.0**
			LOS	A	A	E	NA	**A**	A	A	E	NA	**A**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		B	A	F	-	
	10th Street & Lowell Avenue	Traffic Signal	*Delay (Sec.)*	6.0	1.5	49.9	54.5	**7.0**	10.9	7.2	43.5	53.5	**13.3**
			LOS	A	A	D	D	**A**	B	A	D	D	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
	10th Street & Conklin Avenue	Two-way Stop Control	*Delay (Sec.)*	-	-	15.6	17.4	**17.4**	-	-	22.6	14.8	**22.6**
			LOS			C	C	**C**			C	B	**C**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & I-229 SPUI	Traffic Signal	*Delay (Sec.)*	39.0	34.9	48.5	41.3	**37.9**	440.3	85.4	31.9	45.2	**248.2**
			LOS	D	C	D	D	**D**	F	F	C	D	**F**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		A	A	A	A	
	10th Street & Blaine Avenue	Two-way Stop Control	*Delay (Sec.)*	-	-	12.4	-	**12.4**	-	-	19.7	-	**19.7**
			LOS			B	NA	**B**			C	NA	**C**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	13.4	27.9	38.0	69.5	**31.1**	11.8	23.5	40.7	61.1	**27.4**
			LOS	B	C	D	E	**C**	B	C	D	E	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
	10th Street & Hy-Vee Access	Traffic Signal	*Delay (Sec.)*	2.5	6.1	51.6	54.5	**7.8**	3.1	6.8	50.4	52.5	**10.7**
			LOS	A	A	D	D	**A**	A	A	D	D	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
12th Street	12th Street & Lowell Avenue	Two-way Stop Control	*Delay (Sec.)*	0.5	0.1	15.5	18.3	**18.3**	0.2	0.7	21.3	93.7	**93.7**
			LOS	A	A	C	C	**C**	A	A	C	F	**F**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	12th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	12.2	17.5	16.0	12.9	**15.8**	25.6	14.3	15.4	16.0	**19.2**
			LOS	B	B	B	B	**B**	C	B	B	B	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		B	A	A	A	

HCS SUMMARY - Multi-Modal (LOS)

	Intersection Location	Traffic Control	Metric	Existing Year 2021									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
18th Street	18th Street & Southeastern Avenue	Traffic Signal	*Delay (Sec.)*	35.9	40.6	191.8	70.0	**130.5**	33.4	15.5	46.9	58.3	**35.9**
			LOS	D	D	F	E	**F**	C	B	D	E	**D**
			Ped LOS	B	B	B	B		B	B	B	C	
			Bicycle LOS	A	A	C	A		C	A	A	A	
	18th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	11.9	14.4	18.6	18.6	**16.0**	14.6	11.0	19.6	22.6	**17.4**
			LOS	B	B	B	B	**B**	B	B	B	C	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		A	A	A	A	
26th Street	26th Street & Van Eps Avenue	Traffic Signal	*Delay (Sec.)*	3.5	4.4	50.7	52.0	**5.9**	4.4	2.4	58.3	59.2	**4.7**
			LOS	A	A	D	D	**A**	A	A	E	E	**A**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
	26th Street & Frederick Drive	Two-way Stop Control	*Delay (Sec.)*	0.1	1.3	23.1	45.5	**45.5**	0.1	2.2	25.3	66.1	**66.1**
			LOS	A	A	C	E	**E**	A	A	D	F	**F**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	26th Street & SB I-229	Traffic Signal	*Delay (Sec.)*	31.4	9.6	21.4	-	**9.3**	54.1	7.0	12.7	-	**22.0**
			LOS	C	A	C	NA	**A**	D	A	B	NA	**C**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		A	B	F	-	
	26th Street & NB I-229	Traffic Signal	*Delay (Sec.)*	7.8	24.9	29.8	-	**22.6**	25.4	9.9	32.4	-	**20.4**
			LOS	A	C	C	NA	**C**	C	A	C	NA	**C**
			Ped LOS	B	A	C	B		B	A	C	B	
			Bicycle LOS	A	B	A	-		A	B	B	-	
	26th Street & Southeastern Avenue	Traffic Signal	*Delay (Sec.)*	10.1	18.1	47.4	57.3	**27.4**	35.7	35.4	53.6	59.9	**42.9**
			LOS	B	B	D	E	**C**	D	D	D	E	**D**
			Ped LOS	C	C	B	B		C	C	B	B	
			Bicycle LOS	A	B	B	A		B	B	A	A	
	26th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	8.0	21.3	53.6	45.5	**20.4**	8.0	26.6	59.2	47.5	**21.0**
			LOS	A	C	D	D	**C**	A	C	E	D	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	

HCS SUMMARY - Intersection (LOS, QSR, V/C)

	Intersection Location	Traffic Control	Metric	Existing Year 2021									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
Rice Street	Rice Street & Lowell Avenue	Two-way Stop Control	Delay (Sec.)	0.0	0.2	15.3	0.0	**15.3**	0.0	1.7	32.3	22.5	**32.3**
			LOS	A	A	C	A	**C**	A	A	D	C	**D**
			Queues (veh)	-	-	-	-		-	-	-	-	
			v/c > 1.0	-	-	-	-		-	-	-	-	
	Rice Street & SB I-229	Traffic Signal	Delay (Sec.)	4.9	8.8	-	53.4	**14.3**	10.7	12.9	-	54.9	**21.9**
			LOS	A	A	NA	D	**B**	B	B	NA	D	**C**
			QSR	-	-	-	0.64		-	-	-	***1.34***	
			v/c > 1.0	-	-	-	0.817		-	-	-	0.96	
	Rice Street & NB I-229	Traffic Signal	Delay (Sec.)	19.9	19.4	40.3	27.4	**25.1**	12.1	10.6	33.9	73.5	**25.5**
			LOS	B	B	D	C	**C**	B	B	C	E	**F**
			QSR	-	-	0.95	-		-	-	-	***1.73***	
			v/c > 1.0	-	-	0.622	-		-	-	-	***1.048***	
	Rice Street & Bahnson Avenue	Two-way Stop Control	Delay (Sec.)	1.0	0.1	16.7	17.8	**17.8**	0.1	0.8	43.2	30.0	**43.2**
			LOS	A	A	C	C	**C**	A	A	E	D	**E**
			Queues (veh)	-	-	-	-		-	-	1.7	2.0	
			v/c > 1.0	-	-	-	-		-	-	-	-	
6th Street	6th Street & Lowell Avenue	Two-way Stop Control	Delay (Sec.)	9.0	0.4	23.1	20.5	**23.1**	8.3	10.4	85.0	37.0	**85.0**
			LOS	A	A	C	C	**C**	A	B	F	E	**F**
			Queues (veh)	-	-	-	-		-	-	4.1		
			v/c > 1.0	-	-	-	-		-	-	0.72	-	
	6th Street & Cleveland Avenue	Traffic Signal	Delay (Sec.)	18.3	15.2	30.5	26.9	**20.0**	39.6	21.0	29.7	21.6	**29.8**
			LOS	B	B	C	C	**B**	D	C	C	C	**C**
			QSR	-	-	-	-		-	-			
			v/c > 1.0	-	-	-	-		-	-	-	-	
10th Street	10th Street & Jessica Avenue	Traffic Signal	Delay (Sec.)	3.1	2.5	58.3	-	**6.8**	4.6	3.0	59.4	-	**6.0**
			LOS	A	A	E	NA	**A**	A	A	E	NA	**A**
			QSR	-	-	***1.52***	-		-	-			
			v/c > 1.0	-	-	0.762	-		-	-	-	-	
	10th Street & Lowell Avenue	Traffic Signal	Delay (Sec.)	6.0	1.5	49.9	54.5	**7.0**	10.9	7.2	43.5	53.5	**13.3**
			LOS	A	A	D	D	**A**	B	A	D	D	**B**
			QSR	-	-	-	-		-	***1.12***			
			v/c > 1.0	-	-	-	-		-	0.511	-	-	
	10th Street & Conklin Avenue	Two-way Stop Control	Delay (Sec.)	-	-	15.6	17.4	**17.4**	-	-	22.6	14.8	**22.6**
			LOS			C	C	**C**			C	B	**C**
			Queues (veh)	-	-	-	-		-	-			
			v/c > 1.0	-	-	-	-		-	-	-	-	
	10th Street & I-229 SPUI	Traffic Signal	Delay (Sec.)	39.0	34.9	48.5	41.3	**37.9**	440.3	85.4	31.9	45.2	**248.2**
			LOS	D	C	D	D	**D**	F	F	C	D	**F**
			QSR	-	-	-	-		-	-	-	-	
			v/c > 1.0	-	0.512	-	-		***2.078***	***1.043***	0.421	0.817	
	10th Street & Blaine Avenue	Two-way Stop Control	Delay (Sec.)	-	-	12.4	-	**12.4**	-	-	19.7	-	**19.7**
			LOS			B	NA	**B**			C	NA	**C**
			Queues (veh)	-	-	-	-		-	-			
			v/c > 1.0	-	-	-	-		-	-	-	-	
	10th Street & Cleveland Avenue	Traffic Signal	Delay (Sec.)	13.4	27.9	38.0	69.5	**31.1**	11.8	23.5	40.7	61.1	**27.4**
			LOS	B	C	D	E	**F**	B	C	D	E	**F**
			QSR	-	-	***2.44***	-		-	-	***1.99***	***1.70***	
			v/c > 1.0	-	0.815	0.815	0.938		-	-	0.741	0.936	
	10th Street & Hy-Vee Access	Traffic Signal	Delay (Sec.)	2.5	6.1	51.6	54.5	**7.8**	3.1	6.8	50.4	52.5	**10.7**
			LOS	A	A	D	D	**A**	A	A	D	D	**B**
			QSR	-	-	-	-		-	-		***1.74***	
			v/c > 1.0	-	-	-	-		-	-	-	0.587	
12th Street	12th Street & Lowell Avenue	Two-way Stop Control	Delay (Sec.)	0.5	0.1	15.5	18.3	**18.3**	0.2	0.7	21.3	93.7	**93.7**
			LOS	A	A	C	C	**C**	A	A	C	F	**F**
			Queues (veh)	-	-	-	-		-	-		6.8	
			v/c > 1.0	-	-	-	-		-	-	-	0.90	
	12th Street & Cleveland Avenue	Traffic Signal	Delay (Sec.)	12.2	17.5	16.0	12.9	**15.8**	25.6	14.3	15.4	16.0	**19.2**
			LOS	B	B	B	B	**B**	C	B	B	B	**B**
			QSR	-	-	0.86	-		-	-			
			v/c > 1.0	-	-	-	-		-	-	-	-	

18th Street	18th Street & Southeastern Avenue	Traffic Signal	*Delay (Sec.)*	35.9	40.6	191.8	70.0	**130.5**	33.4	15.5	46.9	58.3	**35.9**
			LOS	D	D	F	E	**F**	C	B	D	E	**D**
			QSR	-	-	0.0	0.0		0.22	-	0.0	0.190	
			v/c > 1.0	-	-	***1.381***	0.126		0.907	-	0.859	0.753	
	18th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	11.9	14.4	18.6	18.6	**16.0**	14.6	11.0	19.6	22.6	**17.4**
			LOS	B	B	B	B	**B**	B	B	B	C	**B**
			QSR	-	-	-	-		-	-		0.78	
			v/c > 1.0	-	-	-	-		-	-	-	0.506	
26th Street	26th Street & Van Eps Avenue	Traffic Signal	*Delay (Sec.)*	3.5	4.4	50.7	52.0	**5.9**	4.4	2.4	58.3	59.2	**4.7**
			LOS	A	A	D	D	**A**	A	A	E	E	**A**
			QSR	-	-	-	-		-	-			
			v/c > 1.0	-	-	-	-		-	-	-	-	
	26th Street & Frederick Drive	Two-way Stop Control	*Delay (Sec.)*	0.1	1.3	23.1	45.5	**45.5**	0.1	2.2	25.3	66.1	**66.1**
			LOS	A	A	C	E	E	A	A	D	F	**F**
			Queues (veh)	-	-	-	0.7		-	-		1.1	
			v/c > 1.0	-	-	-	0.21		-	-	-	0.30	
	26th Street & SB I-229	Traffic Signal	*Delay (Sec.)*	31.4	9.6	21.4	-	**9.3**	54.1	7.0	12.7	-	**22.0**
			LOS	C	A	C	NA	**A**	D	A	B	NA	**C**
			QSR	-	***1.23***	-	-		***1.67***	-	0.93		
			v/c > 1.0	-	0.505	-	-		0.72	-	0.567	-	
	26th Street & NB I-229	Traffic Signal	*Delay (Sec.)*	7.8	24.9	29.8	-	**22.6**	25.4	9.9	32.4	-	**20.4**
			LOS	A	C	C	NA	**C**	C	A	C	NA	**C**
			QSR	-	-	-	-		-	-	0.0		
			v/c > 1.0	-	0.706	0.533	-		0.739	-	0.817	-	
	26th Street & Southeastern Avenue	Traffic Signal	*Delay (Sec.)*	10.1	18.1	47.4	57.3	**27.4**	35.7	35.4	53.6	59.9	**42.9**
			LOS	B	B	D	E	**C**	D	D	D	E	**D**
			QSR	-	-	***1.31***	-		-	-			
			v/c > 1.0	-	0.842	0.743	-		-	-	-	-	
	26th Street & Cleveland Avenue	Traffic Signal	*Delay (Sec.)*	8.0	21.3	53.6	45.5	**20.4**	8.0	26.6	59.2	47.5	**21.0**
			LOS	A	C	D	D	**C**	A	C	E	D	**C**
			QSR	-	-	-	-		-	-		***1.69***	
			v/c > 1.0	-	-	-	-		-	-	-	0.543	

Appendix D – Future Conditions Memo

DRAFT MEMORANDUM

TO: Steve Gramm
South Dakota Department of Transportation

FROM: Chase Cutler, HR Green, PE, PTOE

DATE: February 2, 2021

RE: I-229 Exit 6 (10th Street) Interchange Study – Future No Build Traffic Operations Memo
SD DOT Project Number: PL0194(98) P, PCN 07P7

This technical memorandum provides the future year traffic operations results for the I-229 Exit 6 Interchange Study. The project area includes mainline I-229 between Exit 5 and Exit 7, as well as adjacent intersections along the corridors of Rice Street, 6th Street, 10th Street, 12th Street, 18th Street, Southeastern Avenue, and 26th Street in Sioux Falls, South Dakota.

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INTRODUCTION

As part of the I-229 Exit 6 (10th Street) Interchange Modification Study in the City of Sioux Falls, South Dakota, an operational analysis of the system was conducted.

The study area limits extend north/south along I-229 from Exit 5 (26th Street) to Exit 7 (Rice Street), and east/west along 10th Street from Jessica Avenue to the signalized Hy-Vee/Campbells entrance. Additional corridors within the study limits include:

- 26th Street from Van Eps Avenue to Southeastern Avenue,
- 18th Street from Southeastern Avenue to Cleveland Avenue,
- 12th Street from Lowell Avenue to Cleveland Avenue,
- 6th Street from Lowell Avenue to Cleveland Avenue, and
- Rice Street from Lowell Avenue to Bahnson Avenue.

The purpose of this memorandum is to present the resulting values for the future No Build traffic operation analysis and assessment of traffic conditions. This information will serve as the baseline analysis for the evaluation and refinement of Build concepts at the I-229 Exit 6 interchange.

Figure 1: Study Area

TRAFFIC OPERATIONS ANALYSIS METHODOLOGY

System traffic operations for the 2027 Year of Project Completion and 2050 Planning Horizon Year forecasted traffic were evaluated by conducting a capacity analysis of freeway segments and arterial intersections to assess the quality of service within the study area. The capacity analysis methodology considers traffic volumes, geometry, signal control type, and other characteristics to determine how the system is operating.

Analysis measures and methodologies are based on those outlined in the 6th edition of the Highway Capacity Manual (HCM 6). This provides a systematic, and widely understood, method to compare operations of similar roadway segment type or intersection across various alternatives in terms of Level of Service (LOS). Along freeway segments, the primary Measure of Effectiveness (MOE) is vehicle density measured in terms of passenger cars per mile (pc/mi/ln), shown in **Table 1**. This applies to basic freeway (mainline), segments, merge/diverge segments, and weave segments. At unsignalized and signalized intersections, the primary MOE is average control delay, measured in seconds per vehicle (sec/veh), shown in **Table 2**. A weighted average approach was also used to present an alternative average delay measure at minor cross-street two-way stop-controlled intersections.

Table 1: Freeway Level of Service Thresholds

Level of Service (LOS)	Segment Density (pc/mi/ln)		
	Merging and Diverging Segment	Freeway Weaving Segment	Basic Freeway Segment
A	0 – 10	0 – 10	0 – 11
B	> 10 – 20	> 10 – 20	> 11 – 18
C	> 20 – 28	> 20 – 28	> 18 – 26
D	> 28 – 35	> 28 – 35	> 26 – 35
E	> 35	> 35	> 35 – 45
F	Demand exceeds capacity	Demand exceeds capacity	Demand exceeds capacity; > 45

Source: Transportation Research Board, Highway Capacity Manual, 6th edition.

Table 2: Intersection Level of Service Thresholds

Level of Service (LOS)	Intersection Delay per Vehicle (sec/veh)	
	Signalized Intersections	Two-Way Stop-Control*, All-Way Stop-Control, and Roundabouts
A	0 – 10	0 – 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, Highway Capacity Manual, 6th edition

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

Level of Service measures are graded in accordance with six levels of traffic service, between A and F, established by the HCM 6. Levels of service (LOS) are measures of traffic operations which consider speed, delay, traffic interruptions, safety, driver comfort, and convenience ranging from Level A "Free Flow" to Level F "Fully Saturated". LOS C, which is normally used for design, represents a roadway with volumes ranging from 70% to 80% of its capacity. LOS D is generally considered acceptable for peak periods in urban and suburban areas. LOS C is typically acceptable for newly constructed roadways in urban areas and LOS E represents full capacity. Other MOEs not directly translated to LOS thresholds, but still an important part in the assessment of quality of service and often related to LOS threshold measures include queue length and average vehicle travel speed. In addition, volume to capacity (V/C), often expressed as a ratio, is used to quantify available capacity of a roadway segment based on a given demand.

The SDDOT has established a minimum LOS C on urban interstate highway corridors. At ramp terminal intersections, the overall intersection must be at a LOS C or better; however, individual movements may operate at a LOS D. At other arterial intersections, the overall intersection must be a LOS D or better; however, individual movements may operate at a LOS E if signalized or LOS F if unsignalized. Signalized intersections that are modified by the project cannot operate with a volume to capacity ratio greater than 1 for any movement. If arterial intersections are shown to have any movements with a queue storage ratio greater than 1 than that intersection will be reported as LOS F.

The traffic operations analysis utilized Highway Capacity Software 7 (HCS 7), Version 7.9. I-229 freeway operations on basic freeway, merge/diverge, and weaving segments were analyzed using the Freeways Facility module. The crossroad corridor intersections were analyzed using the Streets module for signalized intersections and the Stop Control module for any unsignalized intersections. Synchro/SimTraffic, Version 10 was used to develop signal timings at local arterial intersections.

FUTURE YEAR 2027 AND 2050 PEAK HOUR VOLUMES

Future year AM and PM peak hour traffic volumes were developed for 2027 and 2050 No-Build Conditions using the Existing Conditions peak hour traffic volumes and the Sioux Falls Metropolitan Planning Organization 2045 travel demand model. Future year 2027 represents the Year of Project Completion and 2050 represents the Planning Year horizon for the interchange and corridor improvements. The Traffic Forecast memorandum presents more details regarding the future-year peak hour traffic model development.

2027 NO BUILD TRAFFIC OPERATIONS

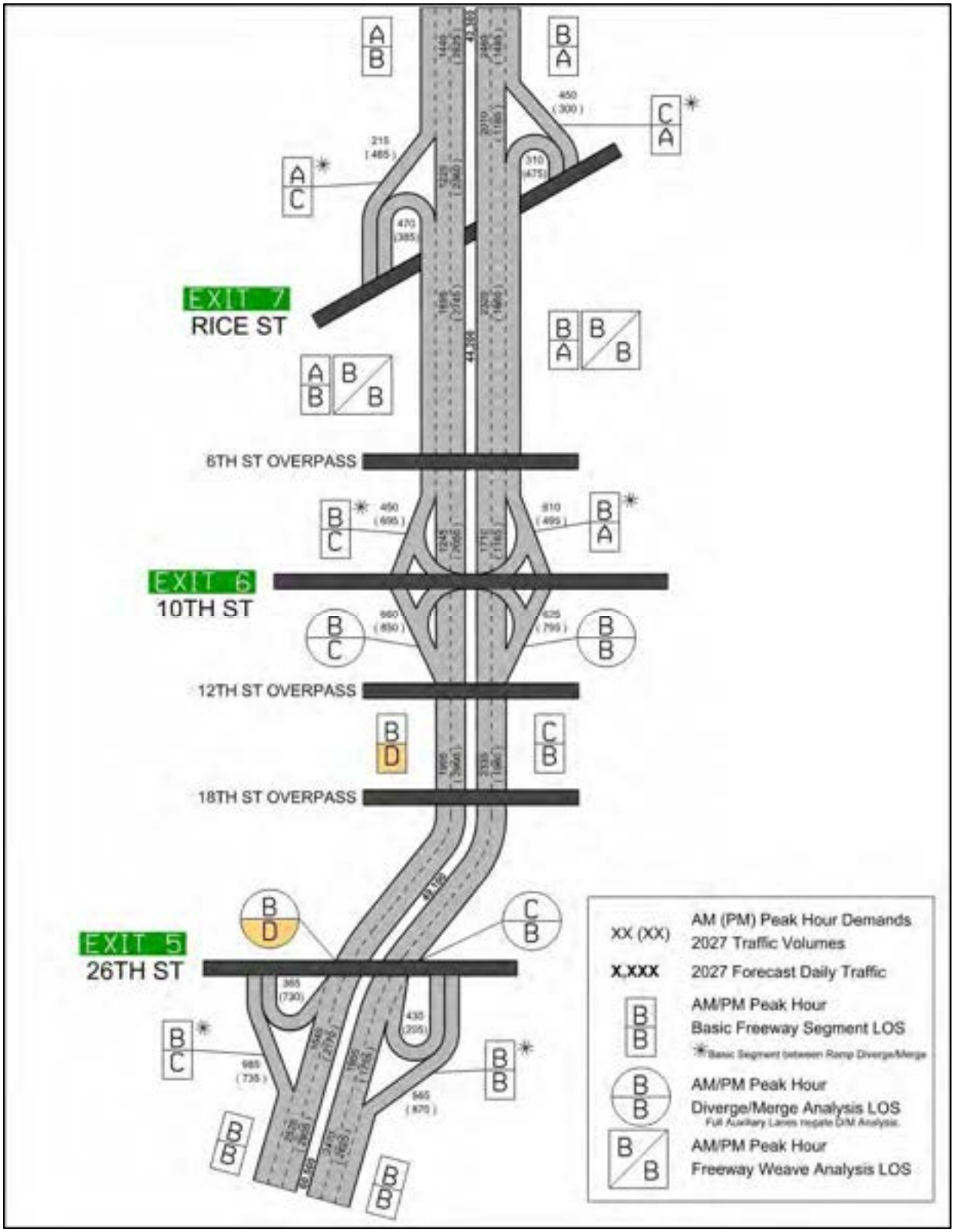
The traffic operations representing the 2027 Year of Project Completion No Build condition are provided in the following section. The project area includes 3 service interchanges with 12 ramp junctions. Results for the individual segments and ramp junctions of I-229 within the study area are shown in **Table 3** as well as **Figure 2**.

Table 3: 2027 No Build Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	B
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: between Exit 5 and Exit 6	Basic	C	B
	NB I-229: Exit 6 Exit Ramp	Diverge	B	B
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	A
	NB I-229: between Exit 6 and Exit 7	Basic	B	A
		Weave	B	B
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	C	A
	NB I-229: north of Exit 7	Basic	B	A
SB I-229	SB I-229: north of Exit 7	Basic	A	B
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	A	C
	SB I-229: between Exit 7 and Exit 6	Basic	A	B
		Weave	B	B
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	C
	SB I-229: Exit 6 Entrance Ramp	Merge	B	C
	SB I-229: between Exit 6 and Exit 5	Basic	B	**D**
	SB I-229: Exit 5 Exit Ramp	Diverge	B	**D**
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	C
	SB I-229: southwest of Exit 5	Basic	B	B

The analysis of the 2027 No Build condition demonstrated that the majority of mainline I-229 operated acceptably. However, the mainline segment of southbound I-229 between Exit 6 and Exit 5 and the ramp diverge to Exit 5 were shown to operate at LOS D during the PM peak hour. All other mainline segments operated at a LOS C or better during the AM and PM peak hours.

Figure 2: 2027 No Build Freeway Summary



A total of 23 study intersections were included in the analysis, including 16 traffic signals, 5 minor stop control intersections, and 2 right-in/right-out (RI/RO) intersections. Results for the intersection analysis in the project area are shown in **Table 4** as well as **Figure 3**.

Table 4: 2027 No Build Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	Lowell Avenue	Minor Stop	A	A	C	A	C	A	A	E	A	**E**
Rice Street	I-229 SB Ramp Terminal	Signal	A	A	NA	C	B	B	C	NA	**D***	**C***
Rice Street	I-229 NB Ramp Terminal	Signal	A	C	C	B	B	C	B	D	**E-***	**C-***
Rice Street	Bahnson Avenue	Minor Stop	A	A	C	C	C	A	A	E	D	**E**
6TH Street	Lowell Avenue	Minor Stop	A	A	D	C	D	A	A	F	E	**F**
6TH Street	Cleveland Avenue	Signal	B	B	C	C	B	D	B	**F**	**C***	**D-***
10TH Street	Jessica Avenue	Signal	A	A	**D***	NA	**A***	A	A	D	NA	A
10TH Street	Lowell Avenue	Signal	A	A	C	D	A	B	**A***	D	D	**B***
10TH Street	Conklin Avenue	RI/RO			C	C	C			C	C	C
10TH Street	I-229 SPUI	Signal	B	B	B	B	B	**D**	**C**	B	D	**D**
10TH Street	Blaine Avenue	RI/RO			B	NA	B			C	NA	C
10TH Street	Cleveland Avenue	Signal	A	B	**D***	**F**	**C-***	**B***	C	**D***	**E**	**C***
10TH Street	Hy-Vee Entrance	Signal	A	A	C	C	A	A	A	D	**D***	**A***
12TH Street	Lowell Avenue	Minor Stop	A	A	B	C	C	A	A	C	E	**E**
12TH Street	Cleveland Avenue	Signal	A	B	B	B	B	B	B	B	C	B
18TH Street	Southeastern Avenue	Signal	C	C	**F**	D	**F**	E	B	D	**F**	**E-**
18TH Street	Cleveland Avenue	Signal	B	B	A	A	B	B	B	B	B	B
26TH Street	Van Eps Avenue	Signal	A	A	D	D	A	A	A	B	B	A
26TH Street	Yeager/Frederick Avenue	Minor Stop	A	A	D	E	**E**	A	A	C	**F**	**F**
26TH Street	I-229 SB Ramp Terminal	Signal	B	A	A	NA	A	C	A	A	NA	B
26TH Street	I-229 NB Ramp Terminal	Signal	B	B	B	NA	B	B	A	**F**	NA	**D-**
26TH Street	Southeastern Avenue	Signal	B	C	**D***	D	**C***	C	C	D	E	C
26TH Street	Cleveland Avenue	Signal	B	B	D	C	B	B	C	D	**C***	**C***

Notes:
- ”n/a” denotes an approach that does not exist at the intersection. “—” denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (v/c) ration > 1.0, or queue storage issue.
- “ * ” Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- “ – “ At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

The analysis of the 2027 No Build condition determined that there were sixteen intersections that demonstrated inadequate traffic operations in at least one of the peak periods. The intersections exhibited issues with high delays, inadequate queue storage, or capacity constraints.

Along Rice Street, both ramp terminal intersections operated at a LOS C or better; however, both intersections had at least one movement that failed. The southbound ramp had a southbound left turn that operated at a LOS D with a QSR greater than 1, the northbound ramp had a southbound left turn that operated at a LOS F with both QSR and V/C issues. The other two arterial intersections along Rice Street also demonstrated poor operations with a LOS E during the PM peak hour.

Along 6th Street, the Lowell Avenue intersection operated at a LOS F with high delays on the northbound and southbound approaches. The intersection with Cleveland Avenue operated at LOS D but had a failing northbound right turn movement and a southbound left turn that demonstrated QSR issues.

Along 10th Street, the ramp terminal intersection operated at a LOS B and LOS D during the AM and PM peak hours, respectively. This intersection demonstrated V/C issues on both the eastbound and westbound approaches with significant delays attributed to the left turn movements. The other arterial intersections along 10th Street all demonstrated poor operations with the exception of the two right-in, right-out intersections with Conklin Avenue and Blaine Avenue. At Jessica Avenue, the northbound approach demonstrated QSR issues. At Lowell Avenue, the westbound approach demonstrated QSR issues. At Cleveland Avenue, the northbound and eastbound approaches demonstrated QSR issues and the southbound approach demonstrated V/C issues. At the Hy-Vee access, the southbound approach demonstrated QSR issues.

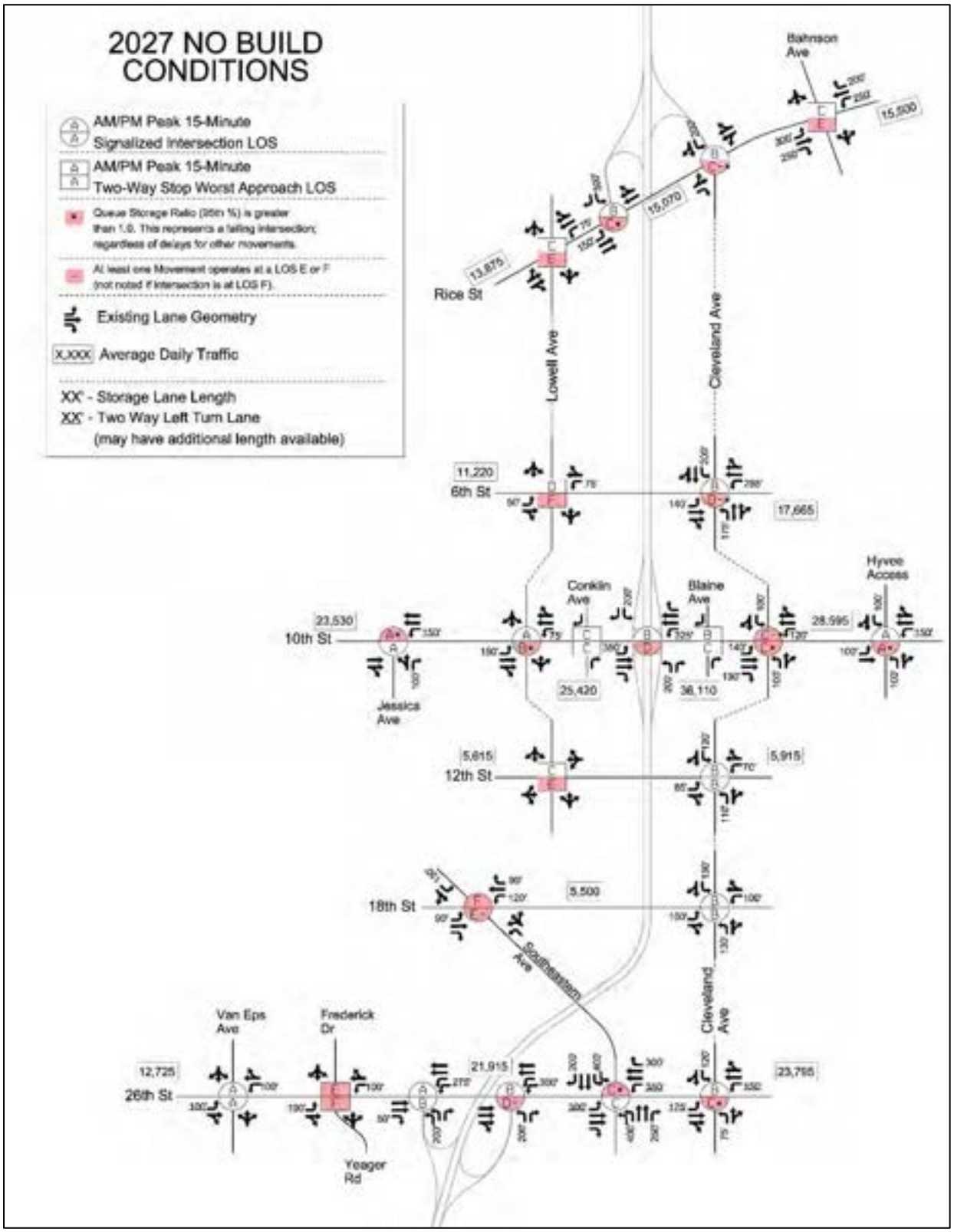
Along 12th Street, the intersection with Lowell Avenue was shown to operate at a LOS E with high delays on the southbound approach. The intersection with Cleveland was shown to operate with a LOS B.

Along 18th Street, the intersection with Southeastern Avenue was shown to operate at a LOS F and E during the AM and PM peak hour, respectively. The heavy northbound left turn volume contributed to a high delay and significant V/C issue during the AM peak hour. Similarly, the PM peak hour eastbound approach carries a high right-turning volume that contributes to V/C issues along with high delays on the southbound approach.

Along 26th Street, the southbound ramp terminal intersection operated at LOS B or better, but the northbound ramp terminal intersection was shown to operate at LOS D with the heavy northbound right turn volume contributing to high delays and V/C issues. The other arterial intersections along 26th Street demonstrated poor operations with the exception of the intersection with Van Eps Avenue. At Fredrick Avenue, the southbound approach demonstrated high delays and LOS F. At Southeastern Avenue, the overall intersection operated at a LOS C, but the northbound left turn had a QSR greater than 1. At Cleveland Avenue, the overall intersection operated at a LOS C or better, but the southbound left turn had a QSR greater than 1.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS of C or better for both the pedestrian and bicycle operations. There were 3 locations that demonstrated a poor LOS, including Rice Street & SB I-229, 10th Street 7 Jessica Avenue, and 26th Street & SB I-229. The multi-modal scores can be seen in **Appendix A**.

Figure 3: 2027 No Build Arterial Summary



2050 NO BUILD TRAFFIC OPERATIONS

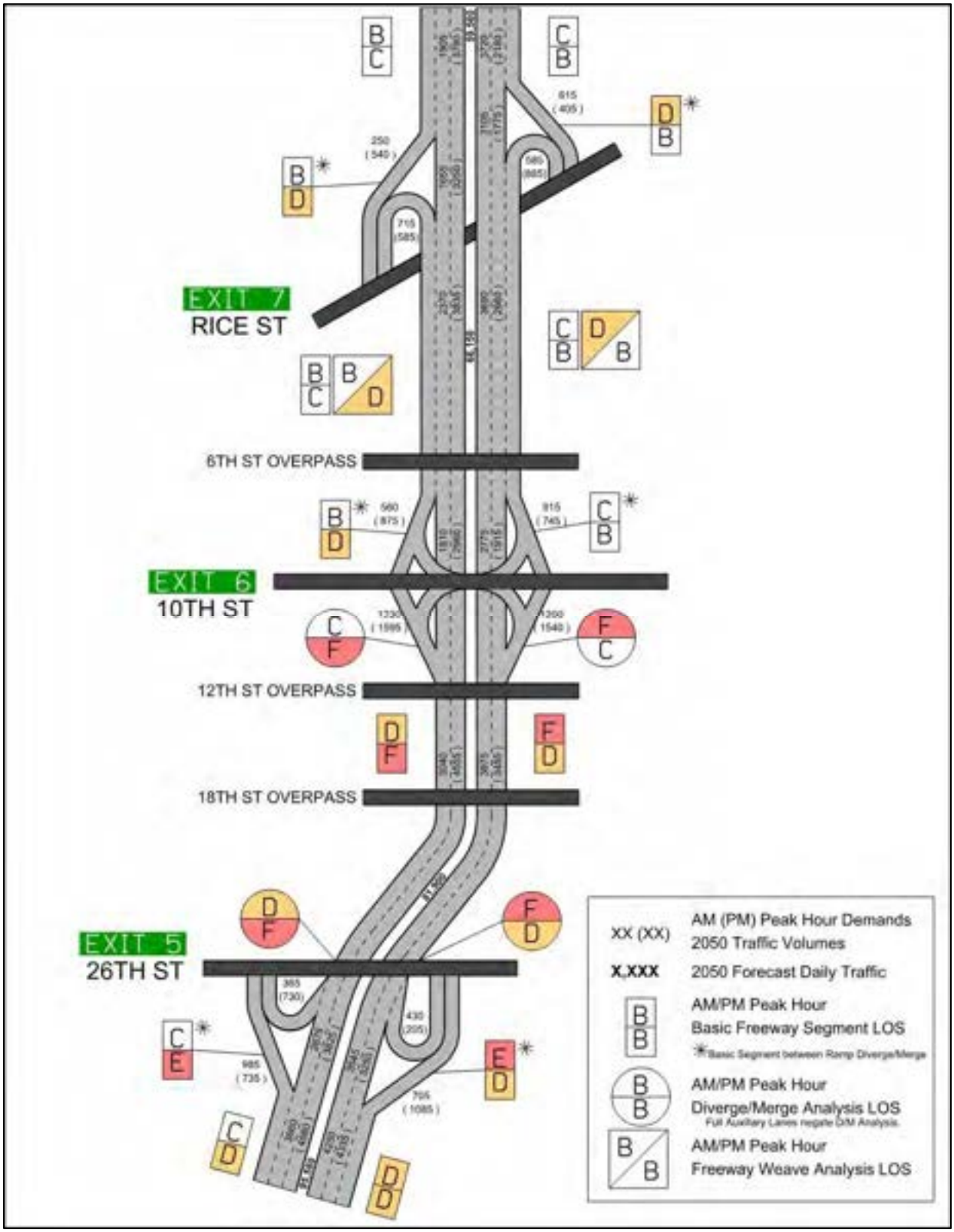
The traffic operations representing the 2050 Year of Planning No Build condition are provided in the following section. The project area includes 3 service interchanges with 12 ramp junctions. Results for the individual segments and ramp junctions of I-229 within the study area are shown in **Table 5** as well as **Figure 4**.

Table 5: 2050 No Build Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	**D**	**D**
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	**E**	**D**
	NB I-229: Exit 5 Entrance Ramp	Merge	**F**	**D**
	NB I-229: between Exit 5 and Exit 6	Basic	**F**	**D**
	NB I-229: Exit 6 Exit Ramp	Diverge	**F**	C
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	C	B
	NB I-229: between Exit 6 and Exit 7	Basic	C	B
		Weave	**D**	B
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	**D**	B
	NB I-229: north of Exit 7	Basic	C	B
SB I-229	SB I-229: north of Exit 7	Basic	B	C
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	B	**D**
	SB I-229: between Exit 7 and Exit 6	Basic	B	C
		Weave	B	**D**
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	**D**
	SB I-229: Exit 6 Entrance Ramp	Merge	C	**F**
	SB I-229: between Exit 6 and Exit 5	Basic	**D**	**F**
	SB I-229: Exit 5 Exit Ramp	Diverge	**D**	**F**
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	**E**
	SB I-229: southwest of Exit 5	Basic	C	**D**

The analysis of the 2050 No Build condition revealed capacity constraints leading to poor operating LOS throughout mainline I-229. Out of the 18 total mainline segments, 15 were shown to operate at a LOS D or worse during either the AM or PM peak hour. There were three mainline segments that operated at a LOS C or better during the AM and PM peak hours.

Figure 4: 2050 No Build Freeway Summary



A total of 23 study intersections were included in the analysis, including 16 traffic signals, 5 minor stop control intersections, and 2 right-in/right-out (RI/RO) intersections. Results for the intersection analysis in the project area are shown in **Table 6** as well as **Figure 5**.

Table 6: 2050 No Build Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	Lowell Avenue	Minor Stop	A	A	D	A	D	A	C	F	F	**F**
Rice Street	I-229 SB Ramp Terminal	Signal	**B***	B	NA	**E**	**C-***	**C***	C	NA	**D***	**C***
Rice Street	I-229 NB Ramp Terminal	Signal	**F**	**F**	**F***	**E***	**F**	**F**	D	**F***	**F***	**F**
Rice Street	Bahnson Avenue	Minor Stop	A	A	F	E	**F**	A	A	F	F	**F**
6TH Street	Lowell Avenue	Minor Stop	A	A	F	F	**F**	A	A	F	E	**F**
6TH Street	Cleveland Avenue	Signal	C	C	E	C	D	E	**E***	**F***	**F***	**F**
10TH Street	Jessica Avenue	Signal	A	A	C	NA	A	B	A	D	NA	B
10TH Street	Lowell Avenue	Signal	A	B	E	E	B	D	**C***	D	**F**	**D-***
10TH Street	Conklin Avenue	RI/RO			D	D	D			F	C	**F**
10TH Street	I-229 SPUI	Signal	**F**	D	**F**	D	**F**	**E**	**D**	**D**	**F**	**E-**
10TH Street	Blaine Avenue	RI/RO			C	NA	C			E	NA	**E**
10TH Street	Cleveland Avenue	Signal	**D***	**F**	**F***	**F**	**F**	**B***	**F**	**F***	**F***	**F**
10TH Street	Hy-Vee Entrance	Signal	**A***	B	E	**F**	**B-***	**A***	B	**E***	**E***	**B***
12TH Street	Lowell Avenue	Minor Stop	A	A	C	C	C	A	A	D	F	**F**
12TH Street	Cleveland Avenue	Signal	B	B	B	B	B	D	B	C	C	C
18TH Street	Southeastern Avenue	Signal	E	E	**F**	**F**	**F**	**F**	**C***	E	**F**	**F**
18TH Street	Cleveland Avenue	Signal	B	C	A	A	B	B	B	B	C	B
26TH Street	Van Eps Avenue	Signal	A	A	C	C	A	A	A	C	C	A
26TH Street	Yeager/Frederick Avenue	Minor Stop	A	A	D	F	**F**	A	A	D	F	**F**
26TH Street	I-229 SB Ramp Terminal	Signal	B	A	B	NA	B	C	A	B	NA	B
26TH Street	I-229 NB Ramp Terminal	Signal	C	B	B	NA	B	B	A	**F**	NA	**E-**
26TH Street	Southeastern Avenue	Signal	C	**D***	**F***	E	**E-***	C	D	E	**F***	**E-***
26TH Street	Cleveland Avenue	Signal	B	C	E	D	C	B	C	D	**D***	**C***

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (v/c) ration > 1.0, or queue storage issue.
- " * " Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- " – " At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

The analysis of the 2050 No Build condition determined that there were eighteen intersections that demonstrated inadequate traffic operations in at least one of the peak periods. The intersections exhibited issues with high delays, inadequate queue storage, or capacity constraints.

Along Rice Street, all intersections operated with LOS F or QSR and V/C issues that designate them failing. The southbound ramp terminal intersection operated at a LOS C with a QSR greater than 1, the northbound ramp terminal intersection operated at a LOS F with a QSR greater than 1 and V/C issues. The other two arterial intersections along Rice Street also demonstrated poor operations with a LOS F and V/C issues.

Along 6th Street, all intersections operated with LOS F or QSR and V/C issues that designate them failing.

Along 10th Street, the ramp terminal intersection operated at a LOS F and LOS E during the AM and PM peak hours, respectively with V/C issues. The other arterial intersections along 10th Street all demonstrated poor operations with the exception of Jessica Avenue. At Lowell Avenue, the westbound approach demonstrated QSR issues. The right-in, right-out intersections with Conklin Avenue and Blaine Avenue, were shown to operate at LOS F and LOS E, respectively. At Cleveland Avenue, the intersection experienced high delays, QSR and V/C issues. At the Hy-Vee access, the northbound and southbound approaches demonstrated QSR issues.

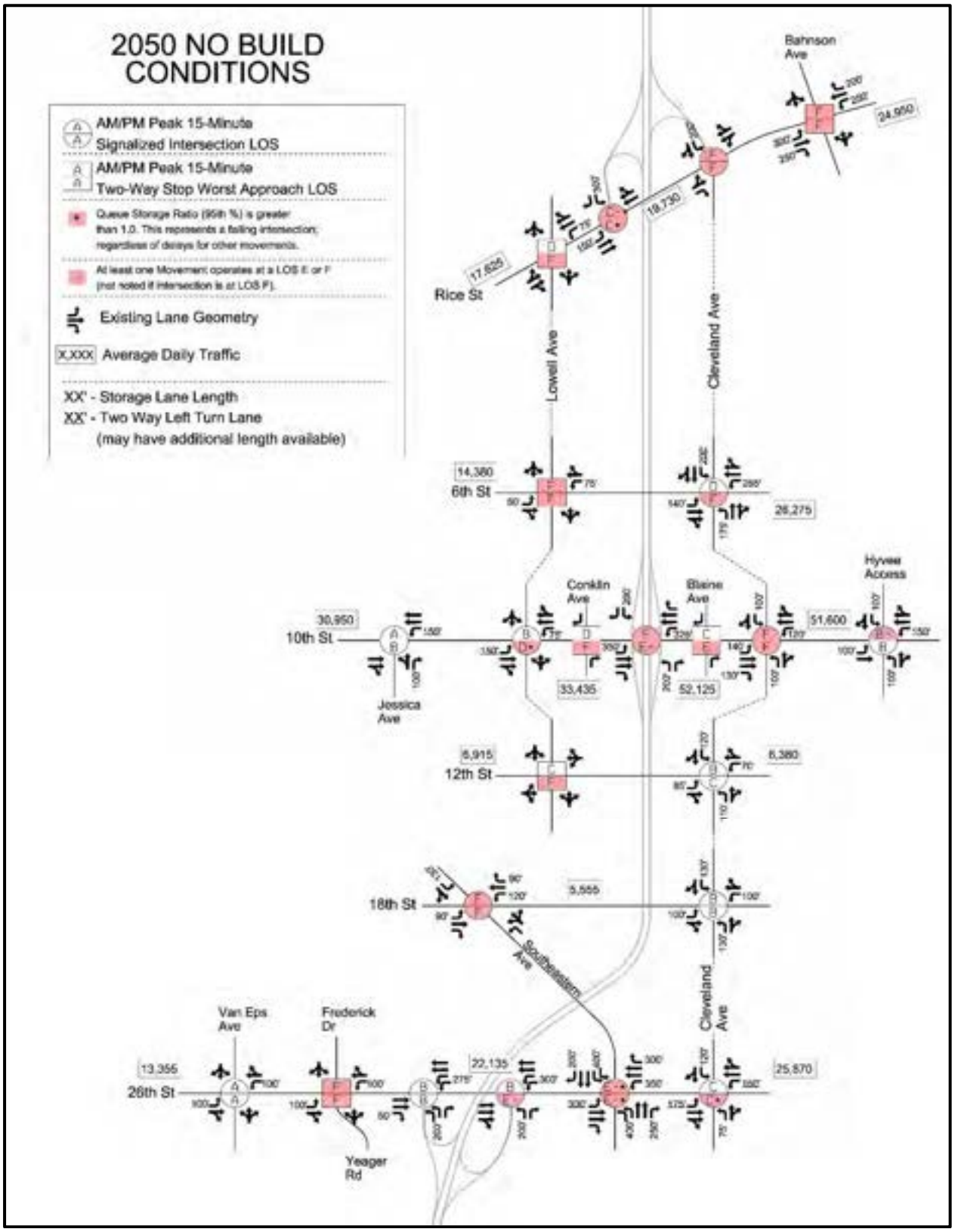
Along 12th Street, the intersection with Lowell Avenue was shown to operate at a LOS F with high delays and V/C issues on the southbound approach. The intersection with Cleveland was shown to operate with a LOS B and LOS C during the AM and PM peak hours, respectively.

Along 18th Street, the intersection with Southeastern Avenue was shown to operate at a LOS F. The heavy northbound left turn volume contributed to a high delay and significant V/C issue during the AM peak hour. Similarly, the PM peak hour carries a high eastbound right-turning volume that contributes to V/C issues along with high delays on the southbound approach and QSR issues on the westbound approach.

Along 26th Street, the southbound ramp terminal intersection operated at LOS B or better, but the northbound ramp terminal intersection was shown to operate at LOS E with the heavy northbound right turn volume contributing to high delays and V/C issues. The other arterial intersections along 26th Street demonstrated poor operations with the exception of the intersection with Van Eps Avenue. At Fredrick Avenue, the southbound approach demonstrated high delays and LOS F. At Southeastern Avenue, the intersection operated at a LOS E, with QSR and V/C issues. At Cleveland Avenue, the overall intersection operated at a LOS C or better, but the southbound left turn had a QSR greater than 1.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS of C or better for both the pedestrian and bicycle operations. There were 4 locations that demonstrated a poor LOS, including Rice Street & SB I-229, 10th Street & Jessica Avenue, 18th Street & Southeastern Avenue, and 26th Street & SB I-229. The multi-modal scores can be seen in **Appendix A**.

Figure 5: 2050 No Build Arterial Summary



SUMMARY

The No Build traffic operations analysis of the 2027 Year of Project Construction and the 2050 Planning Horizon Year provide documentation of the operational deficiencies that manifest within the study area due to traffic demand increases across this time period and capacity constraints imposed by the existing roadway infrastructure.

The 2027 No Build operations analysis demonstrated that the majority of mainline I-229 operated acceptably. However, southbound I-229 between Exit 6 and Exit 5 and the ramp diverge to Exit 5 were shown to operate at LOS D during the PM peak hour. All other mainline segments operated at a LOS C or better during the AM and PM peak hours. Under the 2027 No Build traffic volumes, there were few capacity constraints present along mainline I-229 or at the ramp junctions.

The 2027 No Build operations analysis of arterial intersections demonstrated that 16 out of the 23 intersections resulted in operations that were considered failing. The I-229 Exit 6 interchange ramp terminal intersection was determined to operate with a LOS B and LOS D during the AM and PM peak hours, respectively. The other ramp terminal intersections also demonstrated failing operations in at least one peak hour, with the exception of the southbound Exit 5 ramp terminal intersection. The arterial intersections were determined to operate poorly due to either high delays or QSR greater than 1, but there were also capacity issues documented with V/C greater than 1 at approach movements.

Along 10th Street, the arterial intersections demonstrated poor operations with the exception of the two right-in, right-out intersections with Conklin Avenue and Blaine Avenue. At Jessica Avenue, the northbound approach demonstrated QSR issues. At Lowell Avenue, the westbound approach demonstrated QSR issues. At Cleveland Avenue, the northbound and eastbound approaches demonstrated QSR issues and the southbound approach demonstrated V/C issues. At the Hy-Vee access, the southbound approach demonstrated QSR issues.

The 2050 No Build operations analysis revealed capacity constraints leading to poor operating LOS throughout mainline I-229. The majority of mainline segments were determined to have failing operations. Out of the 18 total mainline segments, 15 were shown to operate at a LOS D or worse during either the AM or PM peak hour. Under the 2050 No Build traffic volumes, the existing road network demonstrated the capacity limitations present along mainline I-229 and at the ramp junctions that should be addressed.

The 2050 No Build operations analysis of arterial intersections demonstrated that 18 out of the 23 intersections resulted in operations that were considered failing. The I-229 Exit 6 interchange ramp terminal intersection was determined to operate with a LOS F and LOS E during the AM and PM peak hours, respectively. The other ramp terminal intersections also demonstrated failing operations in at least one peak hour, with the exception of the southbound Exit 5 ramp terminal intersection. The arterial intersections were determined to operate poorly due to either high delays or QSR greater than 1, but there were also capacity issues documented with V/C greater than 1 at approach movements.

Along 10th Street, the arterial intersections demonstrated poor operations with the exception of Jessica Avenue. At Lowell Avenue, the westbound approach demonstrated QSR issues. The right-in, right-out intersections with Conklin Avenue and Blaine Avenue, were shown to operate at LOS F and LOS E, respectively. At Cleveland Avenue, the intersection experienced high delays, QSR and V/C issues. At the Hy-Vee access, the northbound and southbound approaches demonstrated QSR issues.

Throughout the I-229 corridor, the operations of the mainline segments are shown to degrade as traffic volumes increase with the majority experiencing failing operations by year 2050. Similarly, the arterial intersections showed degrading traffic operations with high delays, queue storage issues and capacity constraints at intersections increasing over time with many intersections failing by year 2050.

APPENDIX A – HCS SUMMARY

	Intersection Location	Traffic Control	Metric	Interim Year 2027									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
Rice Street	Rice Street & Lowell Avenue	Two-way Stop Control	Volume	295	775	110	0	**1180**	1015	500	65	0	**1580**
			Delay (Sec.)	0.0	0.2	15.1	0.0	**15.1**	0.0	1.6	40.7	0	**40.7**
			LOS	A	A	C	A	**C**	A	A	E	A	**E**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**1.54**	-	-	-	-	**2.18**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	Rice Street & SB I-229	Traffic Signal	Volume	345	1055	0	215	**1615**	980	610	0	475	**2065**
			Delay (Sec.)	5.4	10	-	32.7	**12.1**	13.1	20.1	-	35.9	**20.3**
			LOS	A	A	NA	C	**B**	B	C	NA	D	**C**
			Ped LOS	A	B	B	B		A	B	B	B	
			Bicycle LOS	A	A	-	F		A	A	-	F	
	Rice Street & NB I-229	Traffic Signal	Volume	370	905	445	310	**2030**	1175	520	300	475	**2470**
			Delay (Sec.)	8.5	21	29.3	17.4	**20.0**	22.6	13.6	40.4	60.4	**30.1**
			LOS	A	C	C	B	**B**	C	B	D	E	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		C	A	A	A	
	Rice Street & Bahnson Avenue	Two-way Stop Control	Volume	285	865	40	20	**1210**	860	435	45	95	**1435**
			Delay (Sec.)	0.9	0.1	17.3	16.8	**17.3**	0.0	0.8	41.2	28.6	**41.2**
			LOS	A	A	C	C	**C**	A	A	E	D	**E**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**1.13**	-	-	-	-	**3.43**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
6th Street	6th Street & Lowell Avenue	Two-way Stop Control	Volume	400	715	25	40	**1180**	950	465	85	45	**1545**
			Delay (Sec.)	0.2	0.3	26.4	21.3	**26.4**	0.4	0.9	99.0	40.9	**99.0**
			LOS	A	A	D	C	**D**	A	A	F	E	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**1.53**	-	-	-	-	**7.15**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	6th Street & Cleveland Avenue	Traffic Signal	Volume	425	1065	440	265	**2195**	900	580	615	535	**2630**
			Delay (Sec.)	17.5	15.4	30.4	21.9	**19.6**	36.0	17.8	89.1	26.9	**42.5**
			LOS	B	B	C	C	**B**	D	B	F	C	**D**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		A	A	A	A	
10th Street	10th Street & Jessica Avenue	Traffic Signal	Volume	665	1435	155	0	**2255**	1700	920	90	0	**2710**
			Delay (Sec.)	3.4	1.6	41.5	-	**5.1**	5.6	3.0	49.8	-	**6.1**
			LOS	A	A	D		**A**	A	A	D		**A**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		B	A	F	-	
	10th Street & Lowell Avenue	Traffic Signal	Volume	715	1350	60	105	**2230**	1435	1155	80	190	**2860**
			Delay (Sec.)	6.0	2.7	34.5	37.2	**6.3**	15.7	8.7	37.3	46.1	**15.5**
			LOS	A	A	C	D	**A**	B	A	D	D	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	B	A	A	
	10th Street & Conklin Avenue	Two-way Stop Control	Volume	800	1345	125	10	**2280**	1585	1150	65	20	**2820**
			Delay (Sec.)	-	-	15.2	16.9	**16.9**	-	-	24.3	15.4	**24.3**
			LOS			C	C	**C**			C	C	**C**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**0.91**	-	-	-	-	**0.67**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & I-229 SPUI	Traffic Signal	Volume	605	1105	320	180	**2210**	1145	1020	275	465	**2905**
			Delay (Sec.)	18.5	14.4	15.6	10.1	**15.0**	47.3	32.2	11.1	38.4	**35.4**
			LOS	B	B	B	B	**B**	D	C	B	D	**D**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		B	A	A	A	
	10th Street & Blaine Avenue	Two-way Stop Control	Volume	975	1600	5	0	**2580**	1905	1290	10	0	**3205**
			Delay (Sec.)	-	-	12.4	-	**12.4**	-	-	21.5	-	**21.5**
			LOS			B		**B**			C		**C**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**0.02**	-	-	-	-	**0.07**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & Cleveland Avenue	Traffic Signal	Volume	945	1265	445	375	**3030**	1860	1065	435	515	**3875**
			Delay (Sec.)	7.3	19.4	49.3	136.1	**34.9**	14.9	25.7	49.1	77.8	**30.3**
			LOS	A	B	D	F	**C**	B	C	D	E	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	

Intersection Location	Traffic Control	Metric	Interim Year 2027									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
	10th Street & Hy-Vee Access	Traffic Signal	*Volume*	765	1290	20	100	**2175**	1540	1030	60	195	**2825**
			Delay (Sec.)	5.2	9.2	33.2	34.0	**9.3**	4.2	7.6	43.0	45.2	**9.2**
			LOS	A	A	C	C	**A**	A	A	D	D	**A**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
12th Street	12th Street & Lowell Avenue	Two-way Stop Control	*Volume*	150	430	55	50	**685**	615	260	45	135	**1055**
			Delay (Sec.)	0.6	0.1	14.2	15.9	**15.9**	0.1	0.7	17.6	46.3	**46.3**
			LOS	A	A	B	C	**C**	A	A	C	E	**E**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**2.49**	-	-	-	-	**6.91**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	12th Street & Cleveland Avenue	Traffic Signal	*Volume*	95	405	485	185	**1170**	635	245	370	455	**1705**
			Delay (Sec.)	9.5	15.1	13.2	10.2	**13.1**	18.4	10.3	18.1	20.6	**17.7**
			LOS	A	B	B	B	**B**	B	B	B	C	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		B	A	A	A	
18th Street	18th Street & Southeastern Avenue	Traffic Signal	*Volume*	230	430	1070	50	**1780**	1400	220	450	105	**2175**
			Delay (Sec.)	30.1	33.6	208.6	48.0	**139.2**	65.3	15.6	44.7	102.6	**57.7**
			LOS	C	C	F	D	**F**	E	B	D	F	**E**
			Ped LOS	B	B	B	B		B	B	B	C	
			Bicycle LOS	A	A	B	A		C	A	A	A	
	18th Street & Cleveland Avenue	Traffic Signal	*Volume*	120	390	215	200	**925**	550	160	270	430	**1410**
			Delay (Sec.)	13.4	19.7	8.7	8.8	**14.0**	18.0	11.6	12.4	14.2	**15.2**
			LOS	B	B	A	A	**B**	B	B	B	B	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		A	A	A	A	
26th Street	26th Street & Van Eps Avenue	Traffic Signal	*Volume*	380	830	10	45	**1265**	690	510	5	25	**1230**
			Delay (Sec.)	2.7	4.9	40.0	41.1	**5.8**	4.5	4.0	19.5	19.8	**4.6**
			LOS	A	A	D	D	**A**	A	A	B	B	**A**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
	26th Street & Frederick Drive	Two-way Stop Control	*Volume*	415	860	85	25	**1385**	545	630	170	25	**1370**
			Delay (Sec.)	0.1	1.2	25.5	48.7	**48.7**	0.2	2.1	23.9	59.2	**59.2**
			LOS	A	A	D	E	**E**	A	A	C	F	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**3.22**	-	-	-	-	**5.09**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	26th Street & SB I-229	Traffic Signal	*Volume*	470	1605	365	0	**2440**	685	1120	730	0	**2535**
			Delay (Sec.)	16.5	4.4	9.3	-	**7.2**	33.1	5.1	8.8	-	**13.8**
			LOS	B	A	A		**A**	C	A	A		**B**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		A	A	F	-	
	26th Street & NB I-229	Traffic Signal	*Volume*	595	1770	565	0	**2930**	1170	1155	870	0	**3195**
			Delay (Sec.)	19.6	11.2	12.1	-	**12.8**	12.9	6.0	135.4	-	**41.8**
			LOS	B	B	B		**B**	B	A	F		**D**
			Ped LOS	B	A	C	B		B	A	C	B	
			Bicycle LOS	A	B	A	-		A	B	B	-	
	26th Street & Southeastern Avenue	Traffic Signal	*Volume*	895	1540	1220	210	**3865**	1870	1140	535	920	**4465**
			Delay (Sec.)	17.6	27.0	45.0	43.7	**31.8**	20.1	24.8	42.1	55.5	**32.7**
			LOS	B	C	D	D	**C**	C	C	D	E	**C**
			Ped LOS	C	C	B	B		C	C	B	B	
			Bicycle LOS	A	B	B	A		B	B	A	A	
	26th Street & Cleveland Avenue	Traffic Signal	*Volume*	820	1475	110	165	**2570**	1655	1105	85	350	**3195**
			Delay (Sec.)	10.5	18.3	41.3	34.4	**18.1**	13.8	24.2	41.7	35.0	**21.2**
			LOS	B	B	D	C	**B**	B	C	D	C	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	

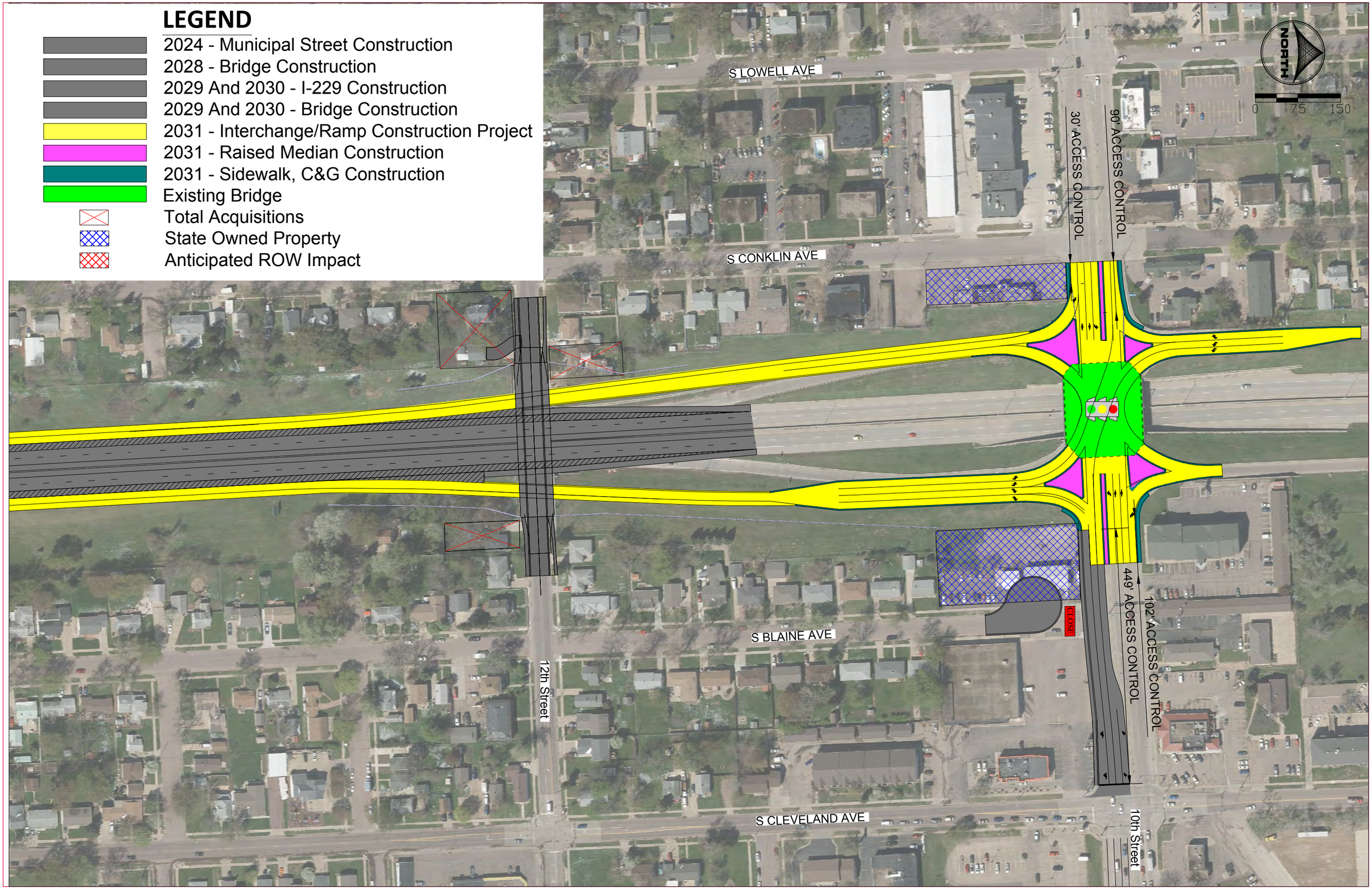
	Intersection Location	Traffic Control	Metric	Planning Year 2050									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
Rice Street	Rice Street & Lowell Avenue	Two-way Stop Control	Volume	450	1180	150	0	**1780**	1370	840	90	5	**2305**
			Delay (Sec.)	0.0	0.2	33.8	0.0	**33.8**	0.2	15.9	483.1	63.7	**483.1**
			LOS	A	A	D	A	**D**	A	C	F	F	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**2.98**	-	-	-	-	**24.91**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	Rice Street & SB I-229	Traffic Signal	Volume	495	1630	0	250	**2375**	1330	1130	0	540	**3000**
			Delay (Sec.)	15.9	13.2	-	69.7	**20.1**	20.7	25	-	52.2	**28.2**
			LOS	B	B	NA	E	**C**	C	C	NA	D	**C**
			Ped LOS	A	B	B	B		A	B	B	B	
			Bicycle LOS	A	B	-	F		B	B	-	F	
	Rice Street & NB I-229	Traffic Signal	Volume	500	1235	810	585	**3130**	1575	930	500	885	**3890**
			Delay (Sec.)	155.2	89.8	114.1	57.3	**100.5**	630.9	35.4	130.3	374.6	**365.9**
			LOS	F	F	F	E	**F**	F	D	F	F	**F**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	B	B		C	A	A	B	
	Rice Street & Bahnson Avenue	Two-way Stop Control	Volume	540	1225	40	40	**1845**	1415	860	45	165	**2485**
			Delay (Sec.)	1.1	0.1	55.2	44.8	**55.2**	0.1	1.0	1120.2	1601.5	**1601.5**
			LOS	A	A	F	E	**F**	A	A	F	F	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**2.56**	-	-	-	-	**127.03**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
6th Street	6th Street & Lowell Avenue	Two-way Stop Control	Volume	560	1125	40	60	**1785**	1245	770	105	65	**2185**
			Delay (Sec.)	0.2	0.4	156.7	83.7	**156.7**	0.4	0.8	1654.6	37.0	**1654.6**
			LOS	A	A	F	F	**F**	A	A	F	E	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**6.64**	-	-	-	-	**81.12**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	6th Street & Cleveland Avenue	Traffic Signal	Volume	570	1550	635	465	**3220**	1185	900	1010	750	**3845**
			Delay (Sec.)	22.9	32.6	79.1	29.1	**39.5**	69.9	70.3	297.7	109.0	**135.4**
			LOS	C	C	E	C	**D**	E	E	F	F	**F**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	A	A	A	
10th Street	10th Street & Jessica Avenue	Traffic Signal	Volume	1045	1935	205	0	**3185**	2165	1525	135	0	**3825**
			Delay (Sec.)	5.1	7.2	24.9	-	**7.7**	12.4	5.0	40.3	-	**10.8**
			LOS	A	A	C		**A**	B	A	D		**B**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		B	B	F	-	
	10th Street & Lowell Avenue	Traffic Signal	Volume	1070	1985	85	145	**3285**	2165	1805	110	255	**4335**
			Delay (Sec.)	8.2	15.1	60.6	70.2	**16.7**	54.0	24.0	51.4	97.0	**45.5**
			LOS	A	B	E	E	**B**	D	C	D	F	**D**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	B	A	A	
	10th Street & Conklin Avenue	Two-way Stop Control	Volume	1190	1985	170	10	**3355**	2365	1800	90	25	**4280**
			Delay (Sec.)	-	-	25.7	25.8	**25.8**	-	-	83.9	24.2	**83.9**
			LOS			D	D	**D**			F	C	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**1.38**	-	-	-	-	**1.91**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & I-229 SPUI	Traffic Signal	Volume	815	1725	620	225	**3385**	1565	1655	535	595	**4350**
			Delay (Sec.)	149.2	51.4	154.2	48.9	**100.6**	73.8	49.2	45.7	127.9	**68.2**
			LOS	F	D	F	D	**F**	E	D	D	F	**E**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	B	A		B	B	A	B	
	10th Street & Blaine Avenue	Two-way Stop Control	Volume	1465	2485	10	0	**3960**	2840	2140	15	0	**4995**
			Delay (Sec.)	-	-	16.3	-	**16.3**	-	-	46.3	-	**46.3**
			LOS			C		**C**			E		**E**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**0.04**	-	-	-	-	**0.14**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	10th Street & Cleveland Avenue	Traffic Signal	Volume	1425	2000	640	610	**4675**	2775	1915	600	800	**6090**
			Delay (Sec.)	37.3	164.0	145.0	313.6	**146.1**	17.0	181.3	174.9	300.0	**140.0**
			LOS	D	F	F	F	**F**	B	F	F	F	**F**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	B	B	B	B		C	B	B	B	

	Intersection Location	Traffic Control	Metric	Planning Year 2050									
				AM Peak Hour					PM Peak Hour				
				EB	WB	NB	SB	Overall	EB	WB	NB	SB	Overall
	10th Street & Hy-Vee Access	Traffic Signal	*Volume*	1170	2035	20	100	**3325**	2350	1900	60	195	**4505**
			Delay (Sec.)	4.7	10.1	69.6	83.4	**11.0**	6.6	12.5	66.4	71.9	**13.9**
			LOS	A	B	E	F	**B**	A	B	E	E	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	B	B	A	A		C	B	A	A	
12th Street	12th Street & Lowell Avenue	Two-way Stop Control	*Volume*	190	540	70	60	**860**	720	325	60	160	**1265**
			Delay (Sec.)	0.6	0.1	17.0	21.0	**21.0**	0.2	0.6	25.8	179.6	**179.6**
			LOS	A	A	C	C	**C**	A	A	D	F	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**3.04**	-	-	-	-	**24.21**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	12th Street & Cleveland Avenue	Traffic Signal	*Volume*	165	440	585	270	**1460**	1000	270	445	640	**2355**
			Delay (Sec.)	11.4	17.5	15.5	11.7	**14.9**	39.6	15.1	25.8	32.6	**31.6**
			LOS	B	B	B	B	**B**	D	B	C	C	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	B	A		B	A	A	B	
18th Street	18th Street & Southeastern Avenue	Traffic Signal	*Volume*	400	435	1785	115	**2735**	1990	295	790	140	**3215**
			Delay (Sec.)	64.2	60.3	273.8	146.9	**198.4**	377.1	32.2	55.8	212.3	**256.2**
			LOS	E	E	F	F	**F**	F	C	E	F	**F**
			Ped LOS	B	B	B	B		B	B	B	C	
			Bicycle LOS	A	A	C	A		D	A	B	A	
	18th Street & Cleveland Avenue	Traffic Signal	*Volume*	165	395	220	240	**1020**	730	180	310	520	**1740**
			Delay (Sec.)	14.1	20.1	8.9	9.2	**14.1**	19.3	11.5	17.6	21.4	**18.8**
			LOS	B	C	A	A	**B**	B	B	B	C	**B**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	A	A	A		B	A	A	A	
26th Street	26th Street & Van Eps Avenue	Traffic Signal	*Volume*	465	915	15	45	**1440**	590	625	15	25	**1255**
			Delay (Sec.)	3.2	7.0	29.2	29.9	**6.8**	3.1	4.3	24.6	24.9	**4.4**
			LOS	A	A	C	C	**A**	A	A	C	C	**A**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	B	A	A	
	26th Street & Frederick Drive	Two-way Stop Control	*Volume*	450	1025	85	25	**1585**	565	770	180	25	**1540**
			Delay (Sec.)	0.1	1.1	33.4	77.9	**77.9**	0.2	1.8	28.9	96.5	**96.5**
			LOS	A	A	D	F	**F**	A	A	D	F	**F**
			Weighted Intersection Delay (Sec.)	-	-	-	-	**3.76**	-	-	-	-	**5.92**
			Ped LOS	-	-	-	-		-	-	-	-	
			Bicycle LOS	-	-	-	-		-	-	-	-	
	26th Street & SB I-229	Traffic Signal	*Volume*	500	1770	365	0	**2635**	710	1260	730	0	**2700**
			Delay (Sec.)	18.5	7.5	12.0	-	**10.1**	34.2	4.2	10.9	-	**13.0**
			LOS	B	A	B		**B**	C	A	B		**B**
			Ped LOS	B	A	B	B		B	A	B	B	
			Bicycle LOS	A	B	F	-		A	B	F	-	
	26th Street & NB I-229	Traffic Signal	*Volume*	625	1895	705	0	**3225**	1195	1275	1085	0	**3555**
			Delay (Sec.)	20.7	12.3	17.3	-	**14.9**	15.4	8.3	193.6	-	**68.5**
			LOS	C	B	B		**B**	B	A	F		**E**
			Ped LOS	B	A	C	B		B	A	C	B	
			Bicycle LOS	A	B	B	-		A	B	B	-	
	26th Street & Southeastern Avenue	Traffic Signal	*Volume*	1025	1660	1815	390	**4890**	2090	1230	855	1510	**5685**
			Delay (Sec.)	32.2	52.5	80.3	66.2	**59.9**	26.6	41.8	61.1	90.6	**56.2**
			LOS	C	D	F	E	**E**	C	D	E	F	**E**
			Ped LOS	C	C	B	B		C	C	B	B	
			Bicycle LOS	A	B	B	A		B	B	A	B	
	26th Street & Cleveland Avenue	Traffic Signal	*Volume*	1020	1610	140	175	**2945**	1870	1195	90	390	**3545**
			Delay (Sec.)	11.9	21.9	57.6	48.6	**21.8**	11.4	25.5	54.1	52.3	**23.5**
			LOS	B	C	E	D	**C**	B	C	D	D	**C**
			Ped LOS	B	B	B	B		B	B	B	B	
			Bicycle LOS	A	B	A	A		B	B	A	A	

Appendix E – Build Concept

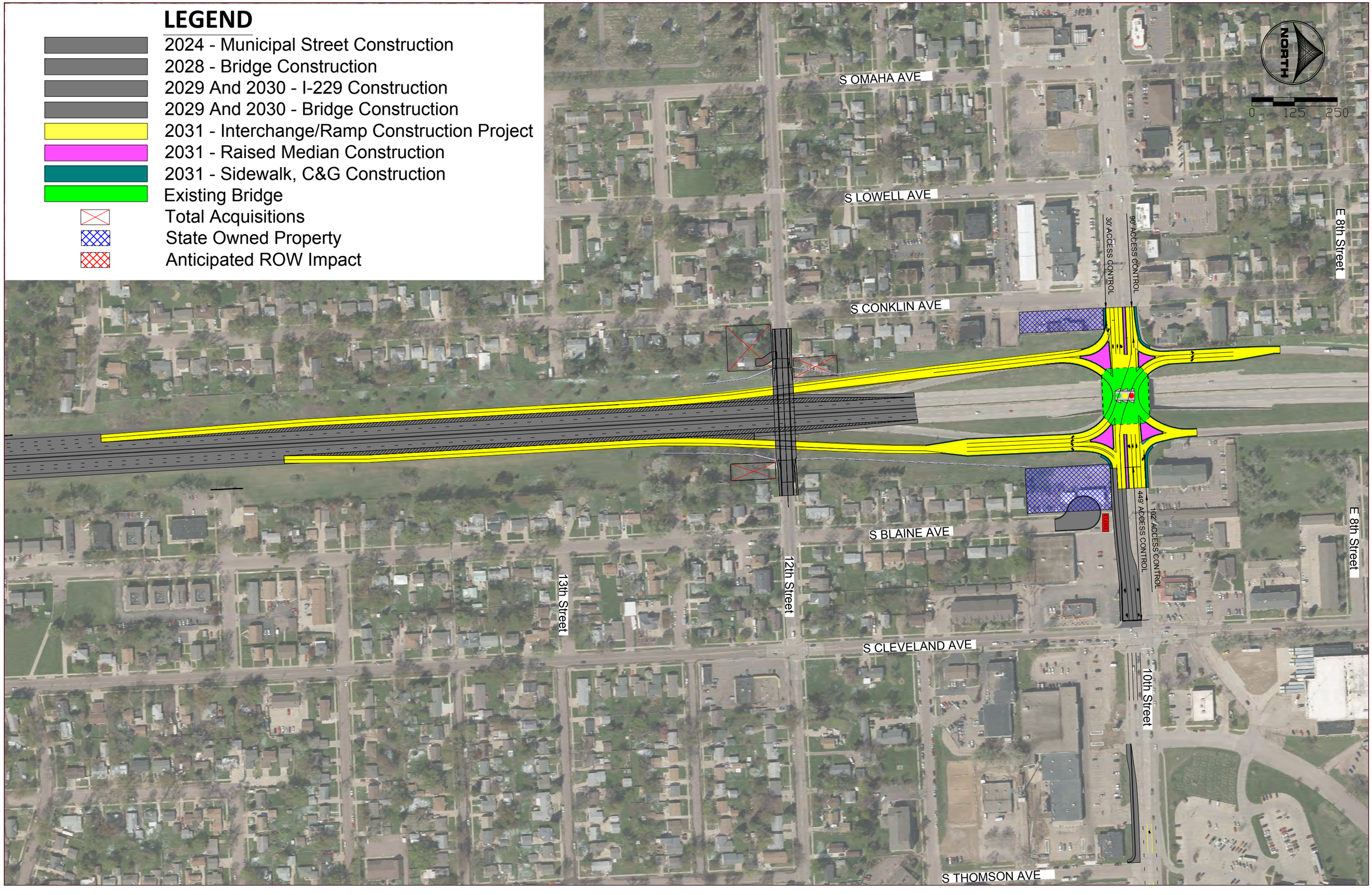
LEGEND

- 2024 - Municipal Street Construction
- 2028 - Bridge Construction
- 2029 And 2030 - I-229 Construction
- 2029 And 2030 - Bridge Construction
- 2031 - Interchange/Ramp Construction Project
- 2031 - Raised Median Construction
- 2031 - Sidewalk, C&G Construction
- Existing Bridge
- Total Acquisitions
- State Owned Property
- Anticipated ROW Impact



LEGEND

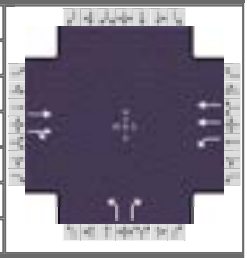
- 2024 - Municipal Street Construction
- 2028 - Bridge Construction
- 2029 And 2030 - I-229 Construction
- 2029 And 2030 - Bridge Construction
- 2031 - Interchange/Ramp Construction Project
- 2031 - Raised Median Construction
- 2031 - Sidewalk, C&G Construction
- Existing Bridge
- Total Acquisitions
- State Owned Property
- Anticipated ROW Impact



Appendix F – HCS Reports

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.85
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		527	41	18	1307		106		35			

Signal Information			
Cycle, s	116.0	Reference Phase	6
Offset, s	46	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	93.5	11.3	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

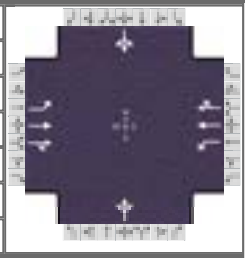
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		99.1		99.1		16.9		
Change Period, (*Y+R c*), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (*g s*), s						10.4		
Green Extension Time (*g e*), s		0.0		0.0		1.0		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		338	330	19	1376		125		41			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1713	762	1674		1688		1502			
Queue Service Time (*g s*), s		13.2	5.4	0.7	13.3		8.4		3.0			
Cycle Queue Clearance Time (*g c*), s		13.2	5.4	14.1	13.3		8.4		3.0			
Green Ratio (*g/C*)		0.81	0.81	0.81	0.81		0.10		0.10			
Capacity (*c*), veh/h		1418	1381	590	2699		164		146			
Volume-to-Capacity Ratio (*X*)		0.238	0.239	0.032	0.510		0.762		0.283			
Back of Queue (*Q*), ft/ln (95 th percentile)		71.7	68.6	6	142.1		182		53.5			
Back of Queue (*Q*), veh/ln (95 th percentile)		2.8	2.7	0.2	5.6		7.2		2.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.06	0.00		1.52		0.00			
Uniform Delay (*d 1*), s/veh		2.7	2.7	4.8	2.8		51.1		48.6			
Incremental Delay (*d 2*), s/veh		0.4	0.4	0.1	0.6		9.9		1.5			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		3.1	3.1	4.9	3.4		61.0		50.1			
Level of Service (LOS)		A	A	A	A		E		D			
Approach Delay, s/veh / LOS	3.1	A		3.5	A		58.3	E		0.0		
Intersection Delay, s/veh / LOS	7.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.83	B	0.63	A	2.32	B	2.15	B
Bicycle LOS Score / LOS	1.04	A	1.77	B		F		

HCS7 Signalized Intersection Results Summary

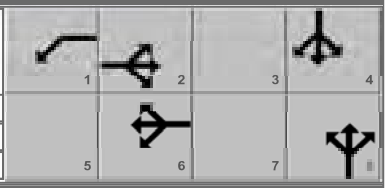
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.80
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	8	604	7	33	1155	29	11	9	37	62	12	25

Signal Information			
Cycle, s	116.0	Reference Phase	6
Offset, s	102	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	2.8	86.6	12.3	0.0	0.0	0.0	
Yellow	3.0	3.6	3.6	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		92.2	5.8	98.1		17.9		17.9
Change Period, ($Y+R_c$), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s			2.6			6.9		11.5
Green Extension Time (g_e), s		0.0	0.1	0.0		0.9		0.8
Phase Call Probability			0.71			1.00		1.00
Max Out Probability			0.00			0.00		0.02

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	9	327	326	39	694	689		71			124	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	388	1758	1751	1688	1772	1756		1598			1458	
Queue Service Time (g_s), s	0.9	7.8	7.8	0.6	8.4	8.2		0.0			4.7	
Cycle Queue Clearance Time (g_c), s	3.5	7.8	7.8	0.6	8.4	8.2		4.9			9.5	
Green Ratio (*g/C*)	0.75	0.75	0.75	0.79	0.80	0.80		0.11			0.11	
Capacity (*c*), veh/h	343	1313	1307	633	1413	1400		207			205	
Volume-to-Capacity Ratio (*X*)	0.025	0.249	0.249	0.061	0.492	0.492		0.345			0.603	
Back of Queue (*Q*), ft/ln (95 th percentile)	3.6	126.8	123.6	7.4	91.6	87.1		92			170.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.1	5.0	4.9	0.3	3.6	3.5		3.6			6.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.03	0.00	0.00	0.12	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	5.5	5.5	5.5	3.2	1.7	1.6		48.5			50.5	
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.0	0.9	1.0		1.4			4.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	5.7	6.0	6.0	3.2	2.6	2.6		49.9			54.5	
Level of Service (LOS)	A	A	A	A	A	A		D			D	
Approach Delay, s/veh / LOS	6.0	A		2.6	A		49.9	D		54.5	D	
Intersection Delay, s/veh / LOS	7.9						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.62	B	1.61	B	2.31	B	2.31	B
Bicycle LOS Score / LOS	1.13	A	1.74	B	0.61	A	0.69	A

HCS7 Two-Way Stop-Control Report

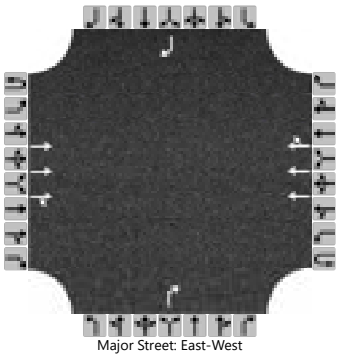
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2021
Time Analyzed	AM Peak Hour - Existing
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Conklin Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Conklin Avenue
Peak Hour Factor	0.80
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	3	0	0	0	3	0		0	0	1		0	0	1
Configuration			T	TR			T	TR				R				R
Volume (veh/h)			696	7			1210	3				117				7
Percent Heavy Vehicles (%)												2				2
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized									No				No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

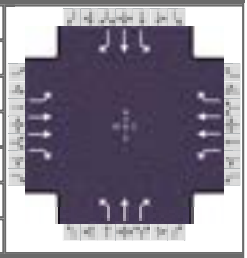
Base Critical Headway (sec)												7.1				7.1
Critical Headway (sec)												7.14				7.14
Base Follow-Up Headway (sec)												3.9				3.9
Follow-Up Headway (sec)												3.92				3.92

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												146				9
Capacity, c (veh/h)												483				300
v/c Ratio												0.30				0.03
95% Queue Length, Q_{95} (veh)												1.3				0.1
Control Delay (s/veh)												15.6				17.4
Level of Service (LOS)												C				C
Approach Delay (s/veh)									15.6				17.4			
Approach LOS									C				C			

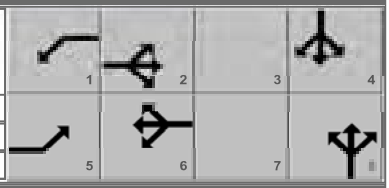
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.84
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	102	452	259	295	689	443	271	0	255	167	0	253

Signal Information					EB			WB			NB			SB		
Cycle, s	116.0	Reference Phase	6													
Offset, s	104	Reference Point	Begin	Green	5.8	1.7		47.7	29.2	0.0	0.0					
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6		3.6	3.6	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Red	4.5	4.5		4.5	3.7	0.0	0.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	13.9	55.8	23.7	65.6		36.5		36.5
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	5.8		14.3			24.4		24.6
Green Extension Time (g_e), s	0.3	0.0	1.3	0.0		4.6		4.5
Phase Call Probability	0.96		1.00			1.00		1.00
Max Out Probability	0.00		0.00			0.68		0.70

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	96	427	245	342	799	514	323	0	304	199	0	301
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1627		1674	1661		1701	1669		1674	1643	
Queue Service Time (g_s), s	3.8	8.5		12.3	18.3		20.3	0.0		11.7	0.0	
Cycle Queue Clearance Time (g_c), s	3.8	8.5		12.3	18.3		20.3	0.0		11.7	0.0	
Green Ratio (*g/C*)	0.46	0.41		0.56	0.50		0.25	0.25		0.25	0.25	
Capacity (*c*), veh/h	364	1339		610	1648		490	420		483	413	
Volume-to-Capacity Ratio (*X*)	0.265	0.319		0.561	0.485		0.659	0.000		0.412	0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	69.4	141.7		200.8	253		346.2	0		218.4	0	
Back of Queue (*Q*), veh/ln (95 th percentile)	2.7	5.6		7.8	9.9		13.7	0.0		8.5	0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d_1), s/veh	18.5	17.6		15.9	19.1		40.1	0.0		36.9	0.0	
Incremental Delay (d_2), s/veh	0.4	0.6		0.4	0.4		2.9	0.0		0.8	0.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	18.8	18.2	0.0	16.3	19.6	0.0	43.0	0.0	0.0	37.7	0.0	0.0
Level of Service (LOS)	B	B	A	B	B	A	D		A	D		A
Approach Delay, s/veh / LOS	12.5	B		12.8	B		22.2	C		15.0	B	
Intersection Delay, s/veh / LOS	14.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.11	B	2.10	B	2.45	B	2.45	B
Bicycle LOS Score / LOS	1.29	A	1.89	B	1.52	B	1.31	A

HCS7 Two-Way Stop-Control Report

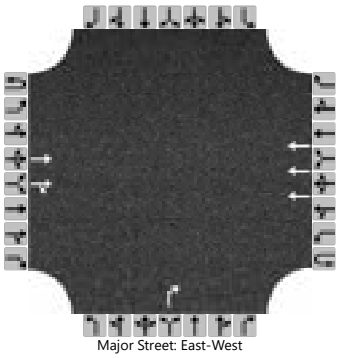
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2021
Time Analyzed	AM Peak Hour - Existing
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Blaine Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Blaine Avenue
Peak Hour Factor	0.83
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	3	0		0	0	1		0	0	0
Configuration			T	TR			T					R				
Volume (veh/h)			840	34			1426					6				
Percent Heavy Vehicles (%)												2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage	Undivided															

Critical and Follow-up Headways

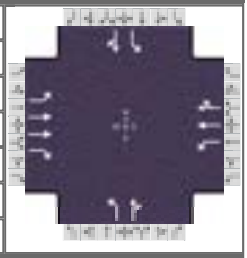
Base Critical Headway (sec)												6.9				
Critical Headway (sec)												6.94				
Base Follow-Up Headway (sec)												3.3				
Follow-Up Headway (sec)												3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												7				
Capacity, c (veh/h)												496				
v/c Ratio												0.01				
95% Queue Length, Q_{95} (veh)												0.0				
Control Delay (s/veh)												12.4				
Level of Service (LOS)												B				
Approach Delay (s/veh)										12.4						
Approach LOS										B						

HCS7 Signalized Intersection Results Summary

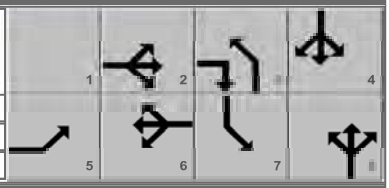
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.82
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	142	620	84	15	1054	48	189	203	18	47	96	183

Signal Information			
Cycle, s	116.0	Reference Phase	6
Offset, s	103	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.6	51.0	4.3	6.7	26.3	0.0	
Yellow	3.0	3.6	3.0	3.0	3.6	0.0	
Red	0.0	2.0	0.0	0.0	2.0	0.0	



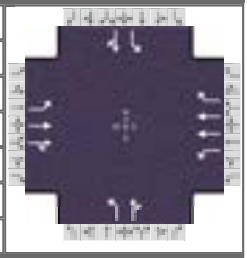
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	3.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	10.6	67.2		56.6	16.9	41.6	7.3	31.9
Change Period, ($Y+R_c$), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (g_s), s	7.5				13.7	16.6	5.0	26.3
Green Extension Time (g_e), s	0.1	0.0		0.0	0.2	2.3	0.1	0.1
Phase Call Probability	0.99				1.00	1.00	0.84	1.00
Max Out Probability	1.00				1.00	0.01	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	156	681	92	17	632	623	230	270		57	340	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1674	1490	747	1744	1717	1688	1746		1701	1597	
Queue Service Time (g_s), s	5.5	17.5	2.0	1.2	33.4	33.4	11.7	14.6		3.0	24.3	
Cycle Queue Clearance Time (g_c), s	5.5	17.5	2.0	8.2	33.4	33.4	11.7	14.6		3.0	24.3	
Green Ratio (*g/C*)	0.52	0.53	0.65	0.44	0.44	0.44	0.36	0.31		0.26	0.23	
Capacity (*c*), veh/h	238	1776	969	346	766	754	283	542		311	363	
Volume-to-Capacity Ratio (*X*)	0.656	0.384	0.095	0.049	0.825	0.826	0.815	0.497		0.184	0.938	
Back of Queue (*Q*), ft/ln (95 th percentile)	118.5	298	29.2	10.4	483.4	461	244.1	263.7		57.1	467.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	11.6	1.1	0.4	18.7	18.4	9.6	10.4		2.3	18.5	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.88	0.00	0.22	0.09	0.00	0.00	2.44	0.00		0.71	0.00	
Uniform Delay (d_1), s/veh	24.8	22.9	5.6	15.6	19.9	19.8	30.5	32.6		32.8	44.0	
Incremental Delay (d_2), s/veh	3.9	0.5	0.2	0.2	8.7	8.9	12.9	0.7		0.3	31.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	28.7	23.5	5.7	15.9	28.6	28.6	43.5	33.3		33.0	75.6	
Level of Service (LOS)	C	C	A	B	C	C	D	C		C	E	
Approach Delay, s/veh / LOS	22.6	C		28.4	C		38.0	D		69.5	E	
Intersection Delay, s/veh / LOS	33.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.91	B	2.29	B	2.45	B
Bicycle LOS Score / LOS	1.34	A	1.61	B	1.31	A	1.14	A

HCS7 Signalized Intersection Results Summary

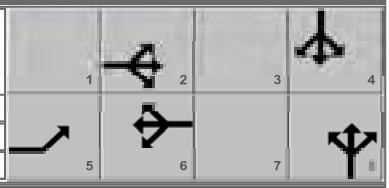
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	85	579	11	8	1073	68	8	3	6	29	4	64

Signal Information			
Cycle, s	116.0	Reference Phase	6
Offset, s	93	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.8	87.2	9.8	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



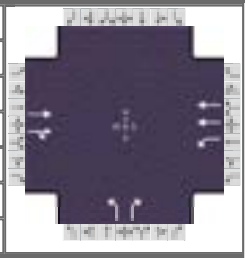
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	7.8	100.6		92.8		15.4		15.4
Change Period, ($Y+R_c$), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.8		4.8
Queue Clearance Time (g_s), s	3.3					8.3		7.5
Green Extension Time (g_e), s	0.1	0.0		0.0		0.4		0.4
Phase Call Probability	0.95					0.98		0.98
Max Out Probability	0.00					0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	96	333	331	9	1192	76	9	10		32	76	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1732	753	1647	1466	1324	1582		1416	1527	
Queue Service Time (g_s), s	1.3	3.1	3.1	0.3	16.3	1.6	0.8	0.7		2.5	5.5	
Cycle Queue Clearance Time (g_c), s	1.3	3.1	3.1	0.4	16.3	1.6	6.3	0.7		3.2	5.5	
Green Ratio (*g/C*)	0.81	0.82	0.82	0.75	0.75	0.75	0.08	0.08		0.08	0.08	
Capacity (*c*), veh/h	413	1428	1418	628	2476	1102	111	134		174	129	
Volume-to-Capacity Ratio (*X*)	0.232	0.234	0.234	0.014	0.482	0.069	0.080	0.075		0.185	0.584	
Back of Queue (*Q*), ft/ln (95 th percentile)	16.3	38.5	36.9	2.5	225.9	20.9	11.9	12.6		41.4	103.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.6	1.5	1.5	0.1	8.7	0.8	0.5	0.5		1.6	4.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.16	0.00	0.00	0.03	0.00	0.17	0.24	0.00		0.49	0.00	
Uniform Delay (d_1), s/veh	4.2	1.3	1.3	3.6	5.6	3.8	54.1	48.9		50.3	51.1	
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.0	0.7	0.1	0.3	0.2		0.6	5.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	4.3	1.7	1.7	3.7	6.3	3.9	54.4	49.1		51.0	56.1	
Level of Service (LOS)	A	A	A	A	A	A	D	D		D	E	
Approach Delay, s/veh / LOS	2.0	A		6.1	A		51.6	D		54.5	D	
Intersection Delay, s/veh / LOS	7.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.82	B	1.85	B	2.47	B	2.31	B
Bicycle LOS Score / LOS	1.11	A	1.54	B	0.52	A	0.67	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1521	73	44	761		43		42			

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	37	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	98.1	6.7	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

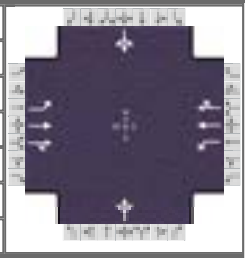
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		103.7		103.7		12.3		
Change Period, ($Y+R_c$), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (g_s), s						5.5		
Green Extension Time (g_e), s		0.0		0.0		0.4		
Phase Call Probability						0.95		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		888	883	53	909		48		47			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1729	267	1674		1688		1502			
Queue Service Time (g_s), s		38.8	18.6	11.9	5.7		3.2		3.5			
Cycle Queue Clearance Time (g_c), s		38.8	18.6	52.4	5.7		3.2		3.5			
Green Ratio (*g/C*)		0.85	0.85	0.85	0.85		0.06		0.06			
Capacity (*c*), veh/h		1487	1463	199	2831		97		86			
Volume-to-Capacity Ratio (*X*)		0.597	0.604	0.265	0.321		0.493		0.541			
Back of Queue (*Q*), ft/ln (95 th percentile)		202.8	199.7	45	53.2		68.4		68.5			
Back of Queue (*Q*), veh/ln (95 th percentile)		7.9	8.0	1.8	2.1		2.7		2.7			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.45	0.00		0.57		0.00			
Uniform Delay (d_1), s/veh		2.8	2.8	16.2	1.6		53.0		53.2			
Incremental Delay (d_2), s/veh		1.8	1.9	3.0	0.3		5.4		7.3			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		4.6	4.7	19.1	1.8		58.4		60.5			
Level of Service (LOS)		A	A	B	A		E		E			
Approach Delay, s/veh / LOS	4.6	A		2.8	A		59.4	E		0.0		
Intersection Delay, s/veh / LOS	5.8						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.81	B	0.61	A	2.32	B	2.15	B
Bicycle LOS Score / LOS	1.95	B	1.23	A		F		

HCS7 Signalized Intersection Results Summary

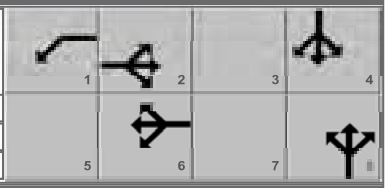
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.87
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	21	1257	13	124	843	62	5	21	47	123	36	14

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	72	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	77.8	19.0	0.0	0.0	0.0	
Yellow	3.0	3.6	3.6	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		83.4	8.0	91.4		24.6		24.6
Change Period, (*Y+R c*), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (*g s*), s			4.7			7.4		18.3
Green Extension Time (*g e*), s		0.0	0.3	0.0		1.4		0.8
Phase Call Probability			0.99			1.00		1.00
Max Out Probability			0.00			0.01		0.71

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	28	855	854	138	511	498		84			199	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	554	1758	1751	1688	1772	1729		1615			1388	
Queue Service Time (*g s*), s	1.8	30.6	30.7	2.7	17.0	16.0		0.0			10.9	
Cycle Queue Clearance Time (*g c*), s	11.1	30.6	30.7	2.7	17.0	16.0		5.4			16.3	
Green Ratio (*g/C*)	0.67	0.67	0.67	0.73	0.74	0.74		0.16			0.16	
Capacity (*c*), veh/h	390	1179	1174	251	1310	1278		298			281	
Volume-to-Capacity Ratio (*X*)	0.072	0.725	0.727	0.552	0.390	0.390		0.281			0.708	
Back of Queue (*Q*), ft/ln (95 th percentile)	11	367.3	358.1	86	279.2	250.3		100.1			256.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.4	14.3	14.3	3.4	11.0	10.0		3.9			10.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.08	0.00	0.00	1.43	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	7.2	8.4	8.4	14.2	9.2	8.3		42.8			47.4	
Incremental Delay (*d 2*), s/veh	0.3	3.1	3.1	1.5	0.7	0.7		0.7			6.1	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	7.5	11.5	11.5	15.8	9.9	9.1		43.5			53.5	
Level of Service (LOS)	A	B	B	B	A	A		D			D	
Approach Delay, s/veh / LOS	11.5	B		10.2	B		43.5	D		53.5	D	
Intersection Delay, s/veh / LOS	14.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.65	B	1.63	B	2.31	B	2.31	B
Bicycle LOS Score / LOS	1.71	B	1.46	A	0.63	A	0.82	A

HCS7 Two-Way Stop-Control Report

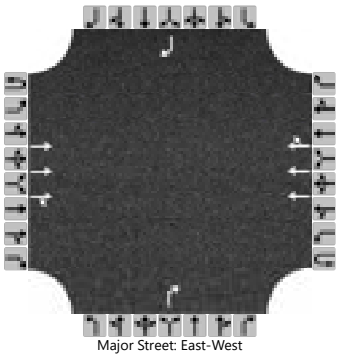
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2021
Time Analyzed	PM Peak Hour - Existing
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Conklin Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Conklin Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	3	0	0	0	3	0		0	0	1		0	0	1
Configuration			T	TR			T	TR				R				R
Volume (veh/h)			1410	17			1013	15				60				16
Percent Heavy Vehicles (%)												2				2
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized									No				No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

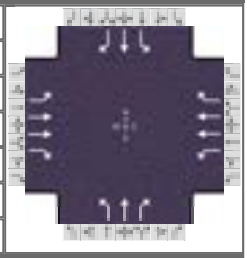
Base Critical Headway (sec)												7.1				7.1
Critical Headway (sec)												7.14				7.14
Base Follow-Up Headway (sec)												3.9				3.9
Follow-Up Headway (sec)												3.92				3.92

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												69				18
Capacity, c (veh/h)												273				386
v/c Ratio												0.25				0.05
95% Queue Length, Q_{95} (veh)												1.0				0.1
Control Delay (s/veh)												22.6				14.8
Level of Service (LOS)												C				B
Approach Delay (s/veh)									22.6				14.8			
Approach LOS									C				B			

HCS7 Signalized Intersection Results Summary

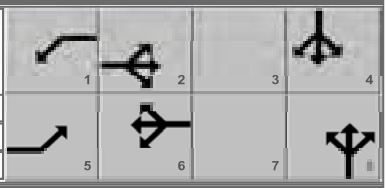
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	206	852	412	306	587	239	232	0	440	444	0	209

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	100	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.7	6.3	29.4	41.1	0.0	0.0	
Yellow	3.6	0.0	3.6	3.6	0.0	0.0	
Red	4.5	0.0	4.5	3.7	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	23.8	37.5	30.1	43.8		48.4		48.4
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	15.0		21.3			37.4		33.3
Green Extension Time (g_e), s	0.7	0.0	0.7	0.0		3.7		5.9
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.03		0.37			1.00		0.79

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	264	1093	529	343	658	268	258	0	489	493	0	232
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1714		1674	1643		1701	1669		1674	1643	
Queue Service Time (g_s), s	13.0	29.4		19.3	21.9		13.4	0.0		31.3	0.0	
Cycle Queue Clearance Time (g_c), s	13.0	29.4		19.3	21.9		13.4	0.0		31.3	0.0	
Green Ratio (*g/C*)	0.39	0.25		0.44	0.31		0.35	0.35		0.35	0.35	
Capacity (*c*), veh/h	369	869		379	1012		665	592		655	582	
Volume-to-Capacity Ratio (*X*)	0.716	1.257		0.905	0.650		0.388	0.000		0.753	0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	229.2	943.4		418.7	352.2		236.9	0		497.7	0	
Back of Queue (*Q*), veh/ln (95 th percentile)	9.0	37.1		16.4	13.8		9.4	0.0		19.4	0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d_1), s/veh	29.9	37.2		39.5	43.5		28.5	0.0		34.3	0.0	
Incremental Delay (d_2), s/veh	1.9	122.0		12.8	2.0		0.5	0.0		5.0	0.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	31.8	159.2	0.0	52.3	45.5	0.0	29.0	0.0	0.0	39.3	0.0	0.0
Level of Service (LOS)	C	F	A	D	D	A	C		A	D		A
Approach Delay, s/veh / LOS	96.7	F		37.7	D		10.0	B		26.7	C	
Intersection Delay, s/veh / LOS	55.6						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	2.12	B	2.44	B	2.44	B
Bicycle LOS Score / LOS	1.84	B	1.53	B	1.72	B	1.68	B

HCS7 Two-Way Stop-Control Report

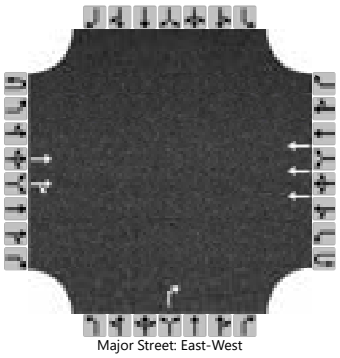
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2021
Time Analyzed	PM Peak Hour - Existing
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Blaine Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Blaine Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	3	0		0	0	1		0	0	0
Configuration			T	TR			T					R				
Volume (veh/h)			1686	50			1128					9				
Percent Heavy Vehicles (%)												2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage	Undivided															

Critical and Follow-up Headways

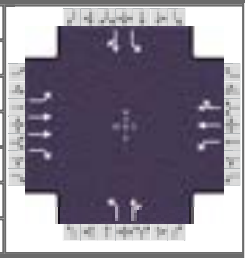
Base Critical Headway (sec)												6.9				
Critical Headway (sec)												6.94				
Base Follow-Up Headway (sec)												3.3				
Follow-Up Headway (sec)												3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												10				
Capacity, c (veh/h)												255				
v/c Ratio												0.04				
95% Queue Length, Q_{95} (veh)												0.1				
Control Delay (s/veh)												19.7				
Level of Service (LOS)												C				
Approach Delay (s/veh)										19.7						
Approach LOS										C						

HCS7 Signalized Intersection Results Summary

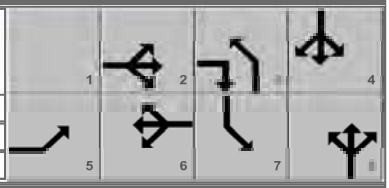
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	212	1205	278	16	818	77	163	191	44	126	185	147

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	95	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.6	49.4	9.1	2.1	27.6	0.0	
Yellow	3.0	3.6	3.0	0.0	3.6	0.0	
Red	0.0	2.0	0.0	0.0	2.0	0.0	



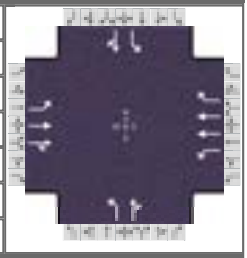
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	3.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	13.6	68.6		55.0	14.2	35.3	12.1	33.2
Change Period, ($Y+R_c$), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (g_s), s	10.2				11.2	17.5	9.1	27.4
Green Extension Time (g_e), s	0.4	0.0		0.0	0.0	2.1	0.1	0.3
Phase Call Probability	1.00				1.00	1.00	0.99	1.00
Max Out Probability	0.47				1.00	0.07	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	232	1316	304	18	513	498	181	261		140	369	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1674	1490	411	1744	1691	1688	1714		1701	1654	
Queue Service Time (g_s), s	8.2	35.2	6.5	2.9	25.1	24.7	9.2	15.5		7.1	25.4	
Cycle Queue Clearance Time (g_c), s	8.2	35.2	6.5	25.2	25.1	24.7	9.2	15.5		7.1	25.4	
Green Ratio (*g/C*)	0.53	0.54	0.64	0.43	0.43	0.43	0.34	0.26		0.32	0.24	
Capacity (*c*), veh/h	331	1818	952	161	743	720	244	439		314	394	
Volume-to-Capacity Ratio (*X*)	0.700	0.724	0.319	0.113	0.691	0.691	0.741	0.595		0.446	0.936	
Back of Queue (*Q*), ft/ln (95 th percentile)	118	392.1	52.8	18.3	390.6	362.2	199.3	279.7		135.9	490.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	15.3	2.1	0.7	15.1	14.5	7.8	11.0		5.4	19.5	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.87	0.00	0.39	0.17	0.00	0.00	1.99	0.00		1.70	0.00	
Uniform Delay (d_1), s/veh	22.4	21.2	4.8	26.3	21.1	20.5	31.4	37.9		30.7	43.3	
Incremental Delay (d_2), s/veh	0.4	0.2	0.1	1.3	4.8	5.0	10.4	2.1		1.0	29.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	22.8	21.4	4.8	27.6	25.9	25.5	41.8	39.9		31.7	72.3	
Level of Service (LOS)	C	C	A	C	C	C	D	D		C	E	
Approach Delay, s/veh / LOS	18.9	B		25.7	C		40.7	D		61.1	E	
Intersection Delay, s/veh / LOS	28.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.92	B	2.30	B	2.45	B
Bicycle LOS Score / LOS	2.04	B	1.32	A	1.22	A	1.33	A

HCS7 Signalized Intersection Results Summary

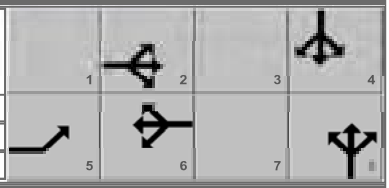
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	10TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	156	1224	36	11	803	61	31	10	19	99	6	92

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	98	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	82.8	14.1	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



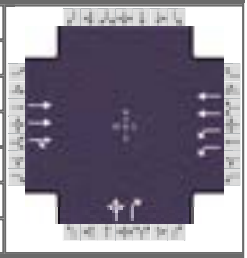
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	8.0	96.3		88.4		19.7		19.7
Change Period, (*Y+R c*), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (*g s*), s	4.8					12.8		13.0
Green Extension Time (*g e*), s	0.1	0.0		0.0		1.0		1.0
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	0.00					0.02		0.03

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	166	673	667	12	892	68	34	32		110	109	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1726	398	1647	1466	1285	1585		1388	1528	
Queue Service Time (*g s*), s	2.8	8.5	8.3	1.1	12.4	1.6	3.0	2.1		9.0	7.8	
Cycle Queue Clearance Time (*g c*), s	2.8	8.5	8.3	1.6	12.4	1.6	10.8	2.1		11.0	7.8	
Green Ratio (*g/C*)	0.77	0.78	0.78	0.71	0.71	0.71	0.12	0.12		0.12	0.12	
Capacity (*c*), veh/h	505	1364	1350	344	2349	1046	132	192		206	186	
Volume-to-Capacity Ratio (*X*)	0.328	0.493	0.494	0.035	0.380	0.065	0.261	0.167		0.535	0.587	
Back of Queue (*Q*), ft/ln (95 th percentile)	39.8	92.1	86.3	4.7	189.3	22.8	46.4	39.3		147.5	143.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	3.6	3.5	0.2	7.3	0.9	1.8	1.5		5.9	5.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00	0.00	0.05	0.00	0.18	0.93	0.00		1.74	0.00	
Uniform Delay (*d 1*), s/veh	4.7	1.8	1.7	5.1	6.5	5.0	53.3	45.7		50.6	48.2	
Incremental Delay (*d 2*), s/veh	0.1	0.8	0.9	0.2	0.5	0.1	1.0	0.4		2.6	3.5	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	4.8	2.6	2.6	5.3	7.0	5.1	54.3	46.1		53.2	51.7	
Level of Service (LOS)	A	A	A	A	A	A	D	D		D	D	
Approach Delay, s/veh / LOS	2.9	A		6.9	A		50.4	D		52.5	D	
Intersection Delay, s/veh / LOS	9.3						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	1.86	B	2.46	B	2.31	B
Bicycle LOS Score / LOS	1.79	B	1.29	A	0.60	A	0.85	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	26TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		467	114	315	1424		142	0	391			

Signal Information					EB			WB			NB		
Cycle, s	130.0	Reference Phase	6										
Offset, s	80	Reference Point	Begin	Green	17.4	58.5		39.1	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6		3.6	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.9		1.3	0.0	0.0	0.0		

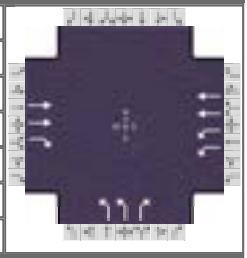
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		64.0	22.0	86.0		44.0		
Change Period, (*Y+R c*), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (*g s*), s			8.3			24.0		
Green Extension Time (*g e*), s		0.0	0.3	0.0		0.4		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		372	174	354	1600			158	348			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1708	1535	1652	1829			1714	1512			
Queue Service Time (*g s*), s		10.1	2.8	6.3	45.7			9.2	22.0			
Cycle Queue Clearance Time (*g c*), s		10.1	2.8	6.3	45.7			9.2	22.0			
Green Ratio (*g/C*)		0.34	0.34	0.60	0.62			0.30	0.43			
Capacity (*c*), veh/h		1156	691	1006	2265			516	653			
Volume-to-Capacity Ratio (*X*)		0.321	0.252	0.352	0.706			0.306	0.533			
Back of Queue (*Q*), ft/ln (95 th percentile)		61.7	39.7	102.7	664.9			175.5	315.7			
Back of Queue (*Q*), veh/ln (95 th percentile)		2.4	1.6	4.1	26.4			7.0	12.6			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.26	0.00			0.00	0.00			
Uniform Delay (*d 1*), s/veh		7.8	6.0	15.2	26.0			35.0	27.0			
Incremental Delay (*d 2*), s/veh		0.5	0.6	0.0	1.0			0.1	0.4			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		8.3	6.6	15.2	27.0			35.1	27.4			
Level of Service (LOS)		A	A	B	C			D	C			
Approach Delay, s/veh / LOS	7.8	A		24.9	C		29.8	C		0.0		
Intersection Delay, s/veh / LOS	22.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.22	B	1.37	A	2.62	C	2.33	B
Bicycle LOS Score / LOS	0.84	A	2.08	B	1.32	A		

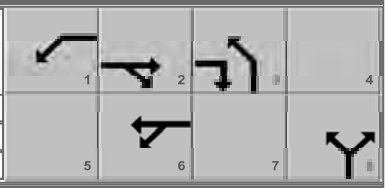
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	26TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		369	83	902	664		153		212			

Signal Information												
Cycle, s	130.0	Reference Phase	6									
Offset, s	16	Reference Point	Begin									
Uncoordinated	No	Simult. Gap E/W	On	Green	56.5	39.5	18.1	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
				Red	1.9	1.9	1.3	0.0	0.0	0.0		



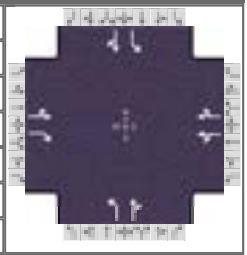
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		45.0	62.0	107.0		23.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.3		
Queue Clearance Time (*g s*), s			18.0			20.1		
Green Extension Time (*g e*), s		0.0	1.3	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		338	76	1012	745		170		236			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1622	1421	1639	1679		1626					
Queue Service Time (*g s*), s		10.1	3.9	16.0	14.1		6.2					
Cycle Queue Clearance Time (*g c*), s		10.1	3.9	16.0	14.1		6.2					
Green Ratio (*g/C*)		0.30	0.44	0.75	0.78		0.14					
Capacity (*c*), veh/h		985	630	2007	2622		453					
Volume-to-Capacity Ratio (*X*)		0.343	0.121	0.505	0.284		0.376					
Back of Queue (*Q*), ft/ln (95 th percentile)		185.5	61.8	246.1	225.7		117.1					
Back of Queue (*Q*), veh/ln (95 th percentile)		7.3	2.4	9.7	8.9		4.6					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.62	1.23	0.00		0.78					
Uniform Delay (*d 1*), s/veh		33.0	19.9	10.1	8.6		50.8					
Incremental Delay (*d 2*), s/veh		0.9	0.4	0.1	0.2		0.2					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		33.9	20.3	10.2	8.8		51.0		0.0			
Level of Service (LOS)		C	C	B	A		D		A			
Approach Delay, s/veh / LOS	31.4	C		9.6	A		21.4	C		0.0		
Intersection Delay, s/veh / LOS	15.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	0.65	A	2.48	B	2.33	B
Bicycle LOS Score / LOS	0.90	A	1.92	B		F		

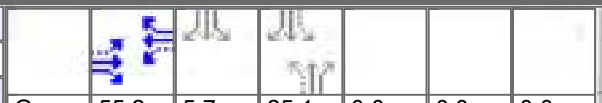
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.84
Urban Street	RICE STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	AMpeak.xus		
Project Description	AM Peak Hour				

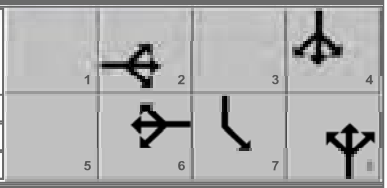


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	24	144	172	31	606	197	164	200	24	76	19	168

Signal Information			
Cycle, s	102.0	Reference Phase	6
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	55.2	5.7	25.1	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



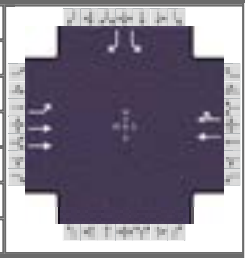
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		61.2		61.2		31.1	9.7	40.8
Change Period, ($Y+R_c$), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.7	6.0	5.7
Queue Clearance Time (g_s), s						21.9	6.2	14.9
Green Extension Time (g_e), s		0.0		0.0		3.2	0.0	5.2
Phase Call Probability						1.00	0.92	1.00
Max Out Probability						0.55	1.00	0.04

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		198	202	538		455	195	267		90	223	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1091	1384	1616		1337	1131	1642		1594	1386	
Queue Service Time (g_s), s		1.1	10.3	0.0		24.1	16.7	14.9		4.2	12.9	
Cycle Queue Clearance Time (g_c), s		25.3	10.3	23.3		24.1	19.9	14.9		4.2	12.9	
Green Ratio (*g/C*)		0.54	0.54	0.54		0.54	0.25	0.25		0.32	0.34	
Capacity (*c*), veh/h		631	749	912		724	314	404		265	473	
Volume-to-Capacity Ratio (*X*)		0.313	0.270	0.589		0.629	0.622	0.660		0.342	0.471	
Back of Queue (*Q*), ft/ln (95 th percentile)		184.4	168.5	333.1		304.4	223.4	272.7		78.1	198.2	
Back of Queue (*Q*), veh/ln (95 th percentile)		7.0	6.4	13.3		12.2	8.6	10.5		2.9	7.4	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	0.95	0.00		0.39	0.00	
Uniform Delay (d_1), s/veh		20.1	17.7	15.8		16.2	38.0	34.6		26.4	26.4	
Incremental Delay (d_2), s/veh		1.2	0.8	2.8		4.1	4.4	4.2		1.6	0.7	
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		21.3	18.6	18.6		20.3	42.3	38.8		28.1	27.1	
Level of Service (LOS)		C	B	B		C	D	D		C	C	
Approach Delay, s/veh / LOS	19.9	B		19.4	B		40.3	D		27.4	C	
Intersection Delay, s/veh / LOS	25.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.89	B	1.93	B	2.11	B
Bicycle LOS Score / LOS	1.16	A	1.31	A	1.25	A	1.00	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.85
Urban Street	RICE STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	AMpeak.xus		
Project Description	AM Peak Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	211			617	321				129		79

Signal Information			
Cycle, s	102.0	Reference Phase	6
Offset, s	75	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.2	68.2	11.6	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

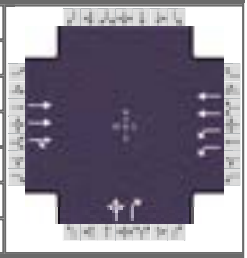
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	9.2	84.4		75.2				17.6
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	4.1							11.3
Green Extension Time (*g e*), s	0.2	0.0		0.0				0.4
Phase Call Probability	0.96							1.00
Max Out Probability	0.00							0.73

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	118	248			592	525				152		93
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1564			1722	1508				1634		1375
Queue Service Time (*g s*), s	2.1	2.1			22.0	18.3				9.3		6.6
Cycle Queue Clearance Time (*g c*), s	2.1	2.1			22.0	18.3				9.3		6.6
Green Ratio (*g/C*)	0.73	0.76			0.67	0.67				0.11		0.11
Capacity (*c*), veh/h	362	2374			1151	1008				186		156
Volume-to-Capacity Ratio (*X*)	0.325	0.105			0.514	0.520				0.817		0.594
Back of Queue (*Q*), ft/ln (95 th percentile)	29.2	24.9			193.4	226.8				204.3		110.7
Back of Queue (*Q*), veh/ln (95 th percentile)	1.1	1.0			7.3	9.1				7.8		4.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00			0.00	0.00				0.64		0.00
Uniform Delay (*d 1*), s/veh	7.7	3.2			6.2	8.8				44.2		43.0
Incremental Delay (*d 2*), s/veh	0.5	0.1			1.3	1.5				13.4		3.6
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	8.2	3.3			7.5	10.3				57.5		46.5
Level of Service (LOS)	A	A			A	B				E		D
Approach Delay, s/veh / LOS	4.9	A		8.8	A		0.0			53.4	D	
Intersection Delay, s/veh / LOS	14.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.64	A	1.87	B	2.15	B	2.32	B
Bicycle LOS Score / LOS	0.79	A	1.40	A				F

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	26TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1062	106	100	1027		63	0	759			

Signal Information					EB			WB			NB		
Cycle, s	140.0	Reference Phase	2										
Offset, s	13	Reference Point	Begin	Green	29.4	50.5		45.1	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6		3.6	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.9		1.3	0.0	0.0	0.0		

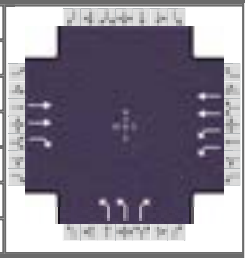
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		56.0	34.0	90.0		50.0		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (g_s), s			4.0			47.1		
Green Extension Time (g_e), s		0.0	0.1	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		567	272	111	1141			70	674			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1743	1656	1652	1767			1714	1618			
Queue Service Time (g_s), s		29.4	17.7	2.0	17.1			4.0	45.1			
Cycle Queue Clearance Time (g_c), s		29.4	17.7	2.0	17.1			4.0	45.1			
Green Ratio (*g/C*)		0.22	0.22	0.59	0.60			0.32	0.53			
Capacity (*c*), veh/h		768	597	810	2133			552	826			
Volume-to-Capacity Ratio (*X*)		0.739	0.456	0.137	0.535			0.127	0.817			
Back of Queue (*Q*), ft/ln (95 th percentile)		154	150.6	33.9	210.7			77.3	655.5			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.1	6.0	1.3	8.4			3.1	26.2			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.08	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		22.9	29.1	21.8	8.0			33.5	26.3			
Incremental Delay (d_2), s/veh		0.6	0.2	0.0	0.8			0.0	6.0			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		23.5	29.3	21.8	8.8			33.6	32.3			
Level of Service (LOS)		C	C	C	A			C	C			
Approach Delay, s/veh / LOS	25.4	C		9.9	A		32.4	C		0.0		
Intersection Delay, s/veh / LOS	20.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.34	B	1.38	A	2.62	C	2.33	B
Bicycle LOS Score / LOS	1.20	A	1.52	B	1.72	B		

HCS7 Signalized Intersection Results Summary

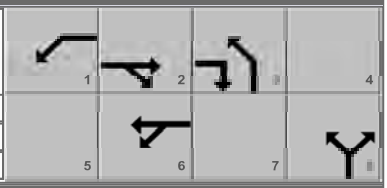
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.87
Urban Street	26TH STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		581	90	642	448		150		587			

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	107	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	70.5	40.5	13.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



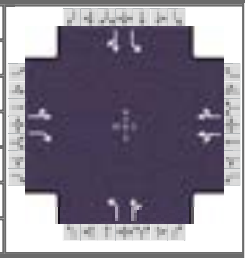
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		46.0	76.0	122.0		18.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (*g s*), s			9.6			15.1		
Green Extension Time (*g e*), s		0.0	0.8	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		700	109	713	498		172		675			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1680	1431	1639	1649		1626					
Queue Service Time (*g s*), s		27.7	8.1	7.6	7.1		7.1					
Cycle Queue Clearance Time (*g c*), s		27.7	8.1	7.6	7.1		7.1					
Green Ratio (*g/C*)		0.29	0.38	0.81	0.83		0.09					
Capacity (*c*), veh/h		972	548	1890	2744		304					
Volume-to-Capacity Ratio (*X*)		0.720	0.198	0.377	0.181		0.567					
Back of Queue (*Q*), ft/ln (95 th percentile)		460.6	167.1	147.2	99.6		138.8					
Back of Queue (*Q*), veh/ln (95 th percentile)		18.1	6.6	5.8	3.9		5.4					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	1.67	0.74	0.00		0.93					
Uniform Delay (*d 1*), s/veh		53.1	34.3	8.6	4.5		60.7					
Incremental Delay (*d 2*), s/veh		3.9	0.7	0.0	0.1		1.6					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		57.0	35.0	8.7	4.6		62.3		0.0			
Level of Service (LOS)		E	C	A	A		E		A			
Approach Delay, s/veh / LOS	54.1	D		7.0	A		12.7	B		0.0		
Intersection Delay, s/veh / LOS	22.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	0.63	A	2.48	B	2.33	B
Bicycle LOS Score / LOS	1.12	A	1.52	B		F		

HCS7 Signalized Intersection Results Summary

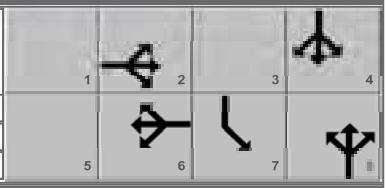
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	RICE STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	PMpeak.xus		
Project Description	PM Peak Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	480	544	53	298	98	128	109	33	283	25	92

Signal Information			
Cycle, s	76.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	41.7	6.0	12.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



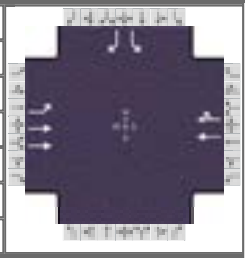
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		47.7		47.7		18.3	10.0	28.3
Change Period, ($Y+R_c$), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.7	6.0	5.7
Queue Clearance Time (g_s), s						10.3	8.0	7.6
Green Extension Time (g_e), s		0.0		0.0		2.0	0.0	2.9
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						0.36	1.00	0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		611	604	251		248	142	158		314	130	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1588	1431	1295		1306	1230	1576		1594	1388	
Queue Service Time (g_s), s		6.5	20.7	0.0		8.0	8.3	7.1		6.0	5.6	
Cycle Queue Clearance Time (g_c), s		16.9	20.7	6.3		8.0	8.3	7.1		6.0	5.6	
Green Ratio (*g/C*)		0.55	0.55	0.55		0.55	0.16	0.16		0.27	0.29	
Capacity (*c*), veh/h		925	785	769		717	294	255		300	407	
Volume-to-Capacity Ratio (*X*)		0.661	0.770	0.326		0.347	0.484	0.619		1.048	0.319	
Back of Queue (*Q*), ft/ln (95 th percentile)		193.8	203.7	96.9		100.4	121.5	138.7		345.5	81.2	
Back of Queue (*Q*), veh/ln (95 th percentile)		7.3	7.7	3.9		4.0	4.7	5.3		12.9	3.0	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	0.52	0.00		1.73	0.00	
Uniform Delay (d_1), s/veh		7.9	8.1	9.2		9.5	30.2	29.7		30.1	20.9	
Incremental Delay (d_2), s/veh		2.8	5.4	1.1		1.3	2.6	5.2		65.0	0.4	
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		10.7	13.5	10.3		10.8	32.8	34.8		95.1	21.4	
Level of Service (LOS)		B	B	B		B	C	C		F	C	
Approach Delay, s/veh / LOS	12.1	B		10.6	B		33.9	C		73.5	E	
Intersection Delay, s/veh / LOS	25.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	1.93	B	2.11	B
Bicycle LOS Score / LOS	2.49	B	0.90	A	0.98	A	1.22	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period		PHF	0.90
Urban Street	RICE STREET	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	PMpeak.xus		
Project Description	PM Peak Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	186	721			361	157				373		78

Signal Information			
Cycle, s	76.0	Reference Phase	2
Offset, s	65	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.5	30.5	20.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

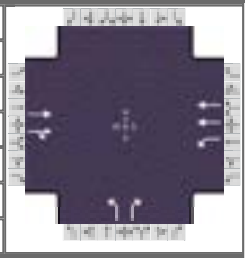
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	12.5	50.0		37.5				26.0
Change Period, ($Y+R_c$), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (g_s), s	7.2							21.0
Green Extension Time (g_e), s	0.4	0.0		0.0				0.0
Phase Call Probability	0.99							1.00
Max Out Probability	0.08							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	207	801			301	275				414		87
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1601			1638	1466				1634		1370
Queue Service Time (g_s), s	5.2	11.0			11.2	7.2				19.0		3.8
Cycle Queue Clearance Time (g_c), s	5.2	11.0			11.2	7.2				19.0		3.8
Green Ratio (*g/C*)	0.53	0.57			0.40	0.40				0.26		0.26
Capacity (*c*), veh/h	465	1811			658	589				430		361
Volume-to-Capacity Ratio (*X*)	0.444	0.442			0.457	0.466				0.964		0.240
Back of Queue (*Q*), ft/ln (95 th percentile)	79.8	160.3			132.7	96.8				429.8		55.9
Back of Queue (*Q*), veh/ln (95 th percentile)	3.1	6.2			5.0	3.9				16.4		2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.80	0.00			0.00	0.00				1.34		0.00
Uniform Delay (d_1), s/veh	11.3	9.6			11.7	9.4				27.6		22.0
Incremental Delay (d_2), s/veh	0.7	0.8			2.1	2.5				34.0		0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	11.9	10.3			13.8	11.8				61.7		22.4
Level of Service (LOS)	B	B			B	B				E		C
Approach Delay, s/veh / LOS	10.7	B		12.9	B		0.0			54.9	D	
Intersection Delay, s/veh / LOS	21.9	C										

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.68	A	1.90	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.32	A	0.96	A				F

HCS7 Signalized Intersection Results Summary

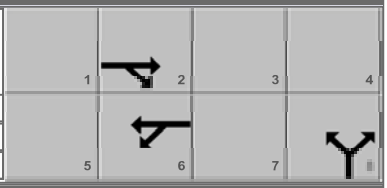
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		985	60	30	1905		155		50			

Signal Information			
Cycle, s	52.0	Reference Phase	6
Offset, s	23	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	33.4	7.5	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



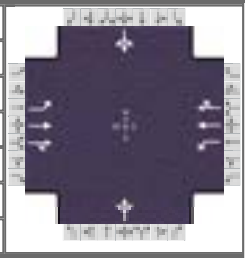
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		39.0		39.0		13.1		
Change Period, ($Y+R_c$), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		3.1		3.1		5.3		
Queue Clearance Time (g_s), s		15.7		21.8		6.9		
Green Extension Time (g_e), s		11.9		11.5		0.8		
Phase Call Probability		1.00		1.00		0.96		
Max Out Probability		0.08		0.12		0.11		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		574	562	27	1724		168		54			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1722	492	1674		1688		1502			
Queue Service Time (g_s), s		13.7	9.1	1.9	19.8		4.9		1.7			
Cycle Queue Clearance Time (g_c), s		13.7	9.1	15.4	19.8		4.9		1.7			
Green Ratio (*g/C*)		0.64	0.64	0.64	0.64		0.14		0.14			
Capacity (*c*), veh/h		1128	1105	326	2148		242		215			
Volume-to-Capacity Ratio (*X*)		0.509	0.509	0.083	0.803		0.696		0.252			
Back of Queue (*Q*), ft/ln (95 th percentile)		92.2	88.3	8.2	179.8		97.1		26.9			
Back of Queue (*Q*), veh/ln (95 th percentile)		3.6	3.5	0.3	7.0		3.8		1.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.08	0.00		0.81		0.00			
Uniform Delay (d_1), s/veh		5.0	5.0	10.6	6.9		21.2		19.8			
Incremental Delay (d_2), s/veh		0.1	0.1	0.0	0.2		5.1		0.9			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		5.1	5.1	10.6	7.1		26.3		20.7			
Level of Service (LOS)		A	A	B	A		C		C			
Approach Delay, s/veh / LOS	5.1	A		7.2	A		24.9	C		0.0		
Intersection Delay, s/veh / LOS	7.7						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.85	B	0.65	A	2.30	B	2.13	B
Bicycle LOS Score / LOS	1.42	A	2.22	B		F		

HCS7 Signalized Intersection Results Summary

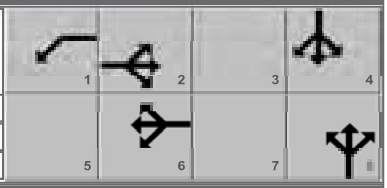
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	1045	10	55	1880	50	15	15	55	90	20	35

Signal Information			
Cycle, s	150.0	Reference Phase	6
Offset, s	148	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.5	111.7	20.6	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		117.3	6.5	123.8		26.2		26.2
Change Period, ($Y+R_c$), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s			3.0			10.0		19.7
Green Extension Time (g_e), s		0.0	0.1	0.0		1.3		0.9
Phase Call Probability			0.87			1.00		1.00
Max Out Probability			0.00			0.00		0.15

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	16	556	554	50	873	869		92			158	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	275	1758	1752	1688	1772	1756		1597			1326	
Queue Service Time (g_s), s	4.7	17.7	17.7	1.0	45.6	45.3		0.0			9.7	
Cycle Queue Clearance Time (g_c), s	43.8	17.7	17.7	1.0	45.6	45.3		8.0			17.7	
Green Ratio (*g/C*)	0.74	0.74	0.74	0.78	0.79	0.79		0.14			0.14	
Capacity (*c*), veh/h	181	1309	1305	406	1396	1383		248			221	
Volume-to-Capacity Ratio (*X*)	0.087	0.424	0.424	0.122	0.625	0.629		0.373			0.713	
Back of Queue (*Q*), ft/ln (95 th percentile)	16.2	269.1	262.1	14.9	625.6	603.1		152.5			265.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	0.6	10.5	10.5	0.6	24.6	24.1		6.0			10.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.12	0.00	0.00	0.25	0.00	0.00		0.00			0.00	
Uniform Delay (d_1), s/veh	21.2	7.1	7.1	5.2	14.6	14.1		59.3			63.8	
Incremental Delay (d_2), s/veh	0.8	0.9	0.9	0.1	1.0	1.1		1.3			6.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	22.0	8.0	8.0	5.3	15.6	15.2		60.6			70.2	
Level of Service (LOS)	C	A	A	A	B	B		E			E	
Approach Delay, s/veh / LOS	8.2	A		15.1	B		60.6	E		70.2	E	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.64	B	1.62	B	2.32	B	2.32	B
Bicycle LOS Score / LOS	1.45	A	2.27	B	0.64	A	0.75	A

HCS7 Two-Way Stop-Control Report

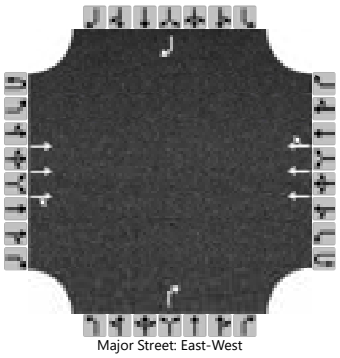
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2050
Time Analyzed	AM Peak Hour - No Build
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Conklin Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Conklin Avenue
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	3	0	0	0	3	0		0	0	1		0	0	1
Configuration			T	TR			T	TR				R				R
Volume (veh/h)			1180	10			1975	10				170				10
Percent Heavy Vehicles (%)												2				2
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized									No				No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

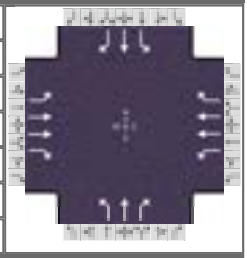
Base Critical Headway (sec)												7.1				7.1
Critical Headway (sec)												7.14				7.14
Base Follow-Up Headway (sec)												3.9				3.9
Follow-Up Headway (sec)												3.92				3.92

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												185				11
Capacity, c (veh/h)												355				184
v/c Ratio												0.52				0.06
95% Queue Length, Q_{95} (veh)												2.9				0.2
Control Delay (s/veh)												25.7				25.8
Level of Service (LOS)												D				D
Approach Delay (s/veh)									25.7				25.8			
Approach LOS									D				D			

HCS7 Signalized Intersection Results Summary

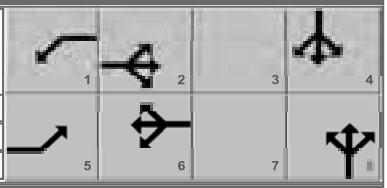
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	660	535	695	1030	760	620	0	580	225	0	335

Signal Information			
Cycle, s	150.0	Reference Phase	6
Offset, s	9	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.7	26.0	33.0	47.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	4.5	4.5	4.5	3.7	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	19.8	41.1	53.9	75.2		55.0		55.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	11.8		44.9			49.7		34.9
Green Extension Time (g_e), s	0.0	0.0	1.0	0.0		0.0		9.3
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		0.80

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	144	614	498	566	839	619	674	0	630	245	0	364
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1674	1549	1674	1699	1577	1701	1669	1606	1674	1643	1495
Queue Service Time (g_s), s	9.8	26.4	33.0	42.9	31.5	57.6	47.7	0.0	47.7	17.5	0.0	32.9
Cycle Queue Clearance Time (g_c), s	9.8	26.4	33.0	42.9	31.5	57.6	47.7	0.0	47.7	17.5	0.0	32.9
Green Ratio (*g/C*)	0.30	0.22	0.22	0.54	0.45	0.45	0.32	0.32	0.32	0.32	0.32	0.32
Capacity (*c*), veh/h	324	736	341	595	1519	705	589	531	511	580	522	476
Volume-to-Capacity Ratio (*X*)	0.445	0.834	1.461	0.952	0.552	0.878	1.144	0.000	1.234	0.421	0.000	0.766
Back of Queue (*Q*), ft/ln (95 th percentile)	200	451.9	1307.8	658.3	405	14.5	1277.5	0	1324	304.6	0	493.8
Back of Queue (*Q*), veh/ln (95 th percentile)	7.9	17.8	51.5	25.7	15.8	0.6	50.7	0.0	52.5	11.9	0.0	19.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	43.3	57.5	58.9	51.6	41.1	59.8	53.1	0.0	51.2	40.9	0.0	46.1
Incremental Delay (d_2), s/veh	0.9	9.8	221.7	3.8	0.1	1.6	83.8	0.0	121.6	0.7	0.0	7.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	44.1	67.3	280.6	55.4	41.2	61.4	136.9	0.0	172.7	41.5	0.0	53.9
Level of Service (LOS)	D	E	F	E	D	E	F		F	D		D
Approach Delay, s/veh / LOS	149.2	F		51.4	D		154.2	F		48.9	D	
Intersection Delay, s/veh / LOS	100.6						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.11	B	2.45	B	2.45	B
Bicycle LOS Score / LOS	1.70	B	2.72	C	2.64	C	1.49	A

HCS7 Two-Way Stop-Control Report

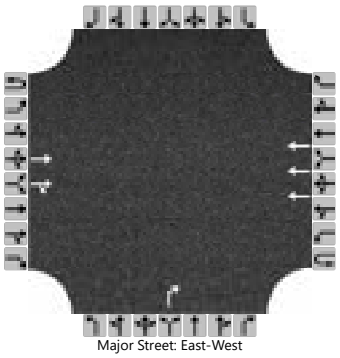
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2050
Time Analyzed	AM Peak Hour - No Build
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Blaine Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Blaine Avenue
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	3	0		0	0	1		0	0	0
Configuration			T	TR			T					R				
Volume (veh/h)			1415	50			2485					10				
Percent Heavy Vehicles (%)												2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage	Undivided															

Critical and Follow-up Headways

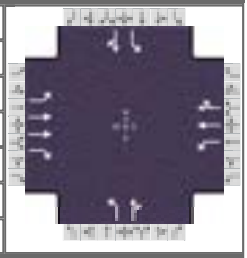
Base Critical Headway (sec)												6.9				
Critical Headway (sec)												6.94				
Base Follow-Up Headway (sec)												3.3				
Follow-Up Headway (sec)												3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												11				
Capacity, c (veh/h)												330				
v/c Ratio												0.03				
95% Queue Length, Q_{95} (veh)												0.1				
Control Delay (s/veh)												16.3				
Level of Service (LOS)												C				
Approach Delay (s/veh)										16.3						
Approach LOS										C						

HCS7 Signalized Intersection Results Summary

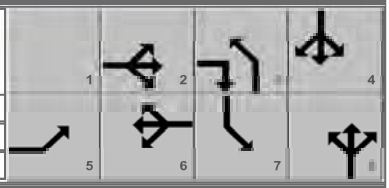
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	235	1050	140	35	1850	115	295	315	30	90	180	340

Signal Information			
Cycle, s	150.0	Reference Phase	6
Offset, s	51	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	72.4	5.0	8.0	32.4	0.0
Yellow	3.0	3.6	3.0	3.0	3.6	0.0
Red	0.0	2.0	0.0	0.0	2.0	0.0



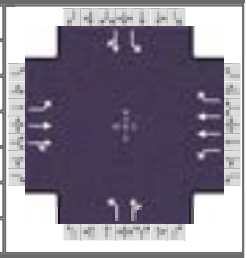
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	3.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	15.0	93.0		78.0	19.0	49.0	8.0	38.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (*g s*), s	14.0				18.0	31.2	7.0	34.4
Green Extension Time (*g e*), s	0.0	0.0		0.0	0.0	3.4	0.0	0.0
Phase Call Probability	1.00				1.00	1.00	0.98	1.00
Max Out Probability	1.00				1.00	0.22	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	226	1009	135	38	1068	1068	321	375		98	565	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1674	1490	550	1744	1708	1688	1745		1701	1598	
Queue Service Time (*g s*), s	12.0	19.2	1.2	5.3	72.4	72.4	16.0	29.2		5.0	32.4	
Cycle Queue Clearance Time (*g c*), s	12.0	19.2	1.2	9.6	72.4	72.4	16.0	29.2		5.0	32.4	
Green Ratio (*g/C*)	0.58	0.58	0.69	0.48	0.48	0.48	0.34	0.29		0.25	0.22	
Capacity (*c*), veh/h	182	1950	1027	298	842	824	228	505		187	345	
Volume-to-Capacity Ratio (*X*)	1.241	0.517	0.131	0.128	1.269	1.296	1.406	0.743		0.522	1.638	
Back of Queue (*Q*), ft/ln (95 th percentile)	463.7	204.4	16.1	34.1	2084.5	2090.9	772.6	498.8		61.3	1631.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	18.1	8.0	0.6	1.3	80.8	83.6	30.4	19.6		2.4	64.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	3.43	0.00	0.12	0.31	0.00	0.00	7.73	0.00		0.77	0.00	
Uniform Delay (*d 1*), s/veh	56.6	10.7	1.8	20.6	34.7	34.5	44.3	48.2		51.1	58.8	
Incremental Delay (*d 2*), s/veh	119.6	0.2	0.1	0.5	126.0	137.8	207.0	5.9		2.6	299.7	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	176.3	11.0	1.9	21.1	160.7	172.3	251.3	54.1		53.7	358.5	
Level of Service (LOS)	F	B	A	C	F	F	F	D		D	F	
Approach Delay, s/veh / LOS	37.3	D		164.0	F		145.0	F		313.6	F	
Intersection Delay, s/veh / LOS	146.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.92	B	2.30	B	2.46	B
Bicycle LOS Score / LOS	1.77	B	2.28	B	1.64	B	1.58	B

HCS7 Signalized Intersection Results Summary

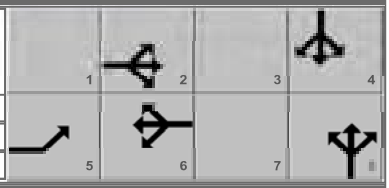
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	1045	25	20	1925	90	10	5	5	30	5	65

Signal Information			
Cycle, s	150.0	Reference Phase	6
Offset, s	2	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.9	120.5	10.4	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



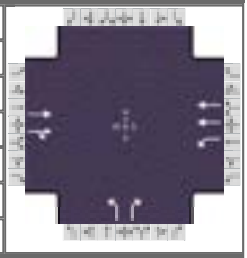
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	7.9	134.0		126.1		16.0		16.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (*g s*), s	3.4					10.5		9.3
Green Extension Time (*g e*), s	0.0	0.0		0.0		0.0		0.0
Phase Call Probability	0.98					1.00		1.00
Max Out Probability	0.00					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	97	523	519	22	2092	98	11	11		33	76	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1729	529	1647	1466	1323	1626		1415	1530	
Queue Service Time (*g s*), s	1.4	10.4	10.4	1.4	51.4	2.1	1.2	0.9		3.3	7.3	
Cycle Queue Clearance Time (*g c*), s	1.4	10.4	10.4	3.9	51.4	2.1	8.5	0.9		4.3	7.3	
Green Ratio (*g/C*)	0.85	0.86	0.86	0.80	0.80	0.80	0.07	0.07		0.07	0.07	
Capacity (*c*), veh/h	191	1493	1480	464	2646	1177	75	113		137	106	
Volume-to-Capacity Ratio (*X*)	0.509	0.351	0.351	0.047	0.791	0.083	0.144	0.096		0.238	0.717	
Back of Queue (*Q*), ft/ln (95 th percentile)	109.9	139.4	134.6	7.5	593.1	28.2	19.8	18.5		56.6	158.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.3	5.4	5.4	0.3	22.8	1.1	0.8	0.7		2.2	6.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.10	0.00	0.00	0.08	0.00	0.23	0.40	0.00		0.67	0.00	
Uniform Delay (*d 1*), s/veh	20.8	2.6	2.6	3.6	8.0	3.1	72.5	65.4		67.4	68.4	
Incremental Delay (*d 2*), s/veh	0.7	0.5	0.5	0.2	2.5	0.1	0.9	0.4		1.1	21.4	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	21.5	3.1	3.2	3.8	10.5	3.2	73.4	65.8		68.5	89.8	
Level of Service (LOS)	C	A	A	A	B	A	E	E		E	F	
Approach Delay, s/veh / LOS	4.7	A		10.1	B		69.6	E		83.4	F	
Intersection Delay, s/veh / LOS	11.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.82	B	1.84	B	2.48	B	2.32	B
Bicycle LOS Score / LOS	1.54	B	2.31	B	0.52	A	0.67	A

HCS7 Signalized Intersection Results Summary

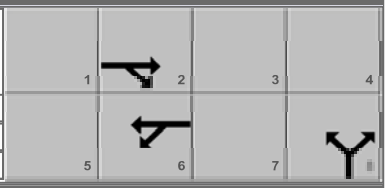
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		2060	105	65	1460		65		70			

Signal Information			
Cycle, s	79.9	Reference Phase	2
Offset, s	26	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	62.0	6.7	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	



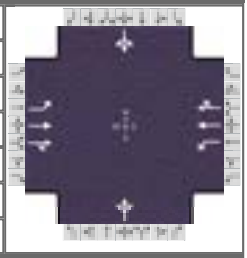
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		67.6		67.6		12.3		
Change Period, ($Y+R_c$), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		3.4		3.4		5.3		
Queue Clearance Time (g_s), s		52.2		64.0		5.9		
Green Extension Time (g_e), s		8.3		0.0		0.4		
Phase Call Probability		1.00		1.00		0.96		
Max Out Probability		0.90		1.00		0.36		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		1177	1177	59	1336		71		76			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1728	151	1674		1688		1502			
Queue Service Time (g_s), s		50.2	38.3	11.8	11.9		3.2		3.9			
Cycle Queue Clearance Time (g_c), s		50.2	38.3	62.0	11.9		3.2		3.9			
Green Ratio (*g/C*)		0.78	0.78	0.78	0.78		0.08		0.08			
Capacity (*c*), veh/h		1364	1340	112	2596		142		126			
Volume-to-Capacity Ratio (*X*)		0.863	0.878	0.530	0.515		0.497		0.602			
Back of Queue (*Q*), ft/ln (95 th percentile)		377.1	388	55.6	108.8		65.7		74.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		14.7	15.5	2.2	4.2		2.6		2.9			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.56	0.00		0.55		0.00			
Uniform Delay (d_1), s/veh		6.1	6.3	37.8	3.3		35.0		35.3			
Incremental Delay (d_2), s/veh		5.7	6.7	1.9	0.1		3.8		6.4			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		11.8	13.0	39.7	3.4		38.8		41.7			
Level of Service (LOS)		B	B	D	A		D		D			
Approach Delay, s/veh / LOS	12.4	B		5.0	A		40.3	D		0.0		
Intersection Delay, s/veh / LOS	10.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.83	B	0.63	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	2.43	B	1.86	B		F		

HCS7 Signalized Intersection Results Summary

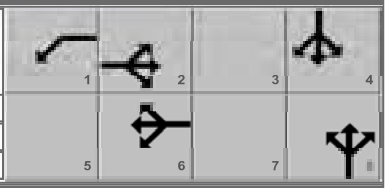
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	2115	20	180	1525	100	10	30	70	180	55	20

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	100	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	94.4	31.4	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		100.0	13.0	113.0		37.0		37.0
Change Period, (*Y+R c*), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (*g s*), s			12.0			11.6		33.4
Green Extension Time (*g e*), s		0.0	0.0	0.0		2.3		0.0
Phase Call Probability			1.00			1.00		1.00
Max Out Probability			1.00			0.01		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	32	1142	1142	161	733	721		120			277	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	363	1758	1752	1688	1772	1733		1650			1224	
Queue Service Time (*g s*), s	7.6	94.4	94.4	10.0	35.4	34.5		0.0			21.8	
Cycle Queue Clearance Time (*g c*), s	30.0	94.4	94.4	10.0	35.4	34.5		9.6			31.4	
Green Ratio (*g/C*)	0.63	0.63	0.63	0.71	0.72	0.72		0.21			0.21	
Capacity (*c*), veh/h	222	1106	1103	161	1269	1241		372			297	
Volume-to-Capacity Ratio (*X*)	0.144	1.032	1.035	1.003	0.578	0.581		0.322			0.933	
Back of Queue (*Q*), ft/ln (95 th percentile)	32	1389.4	1366.6	307.2	492.3	459		181.1			500.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.3	54.3	54.7	12.1	19.4	18.4		7.1			19.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.25	0.00	0.00	5.12	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	22.3	27.8	27.8	56.3	14.0	13.2		50.7			61.8	
Incremental Delay (*d 2*), s/veh	0.6	26.1	27.3	52.4	1.0	1.1		0.7			35.2	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	22.8	53.9	55.1	108.7	15.0	14.2		51.4			97.0	
Level of Service (LOS)	C	F	F	F	B	B		D			F	
Approach Delay, s/veh / LOS	54.0	D		24.0	C		51.4	D		97.0	F	
Intersection Delay, s/veh / LOS	45.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.64	B	2.31	B	2.31	B
Bicycle LOS Score / LOS	2.43	B	2.11	B	0.68	A	0.94	A

HCS7 Two-Way Stop-Control Report

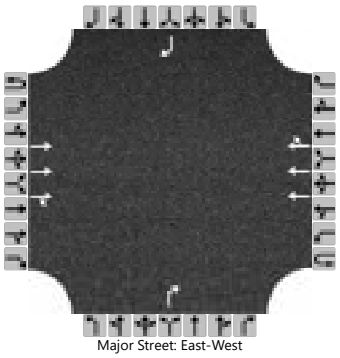
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2050
Time Analyzed	PM Peak Hour - No Build
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Conklin Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Conklin Avenue
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	3	0	0	0	3	0		0	0	1		0	0	1
Configuration			T	TR			T	TR				R				R
Volume (veh/h)			2340	25			1780	20				90				25
Percent Heavy Vehicles (%)												2				2
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized									No				No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

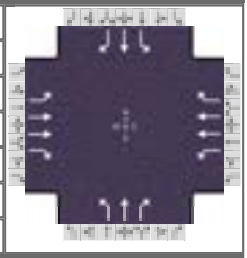
Base Critical Headway (sec)												7.1				7.1
Critical Headway (sec)												7.14				7.14
Base Follow-Up Headway (sec)												3.9				3.9
Follow-Up Headway (sec)												3.92				3.92

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												98				27
Capacity, c (veh/h)												133				214
v/c Ratio												0.73				0.13
95% Queue Length, Q_{95} (veh)												4.2				0.4
Control Delay (s/veh)												83.9				24.2
Level of Service (LOS)												F				C
Approach Delay (s/veh)									83.9				24.2			
Approach LOS									F				C			

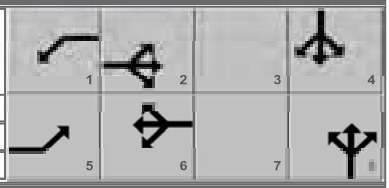
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	320	1245	865	730	985	425	535	0	1005	595	0	280

Signal Information					EB			WB			NB			SB		
Cycle, s	150.0	Reference Phase	2													
Offset, s	148	Reference Point	Begin	Green	21.6	11.2		43.9	41.7	0.0	0.0					
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6		3.6	3.6	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Red	4.5	4.5		4.5	3.7	0.0	0.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	29.7	52.0	49.0	71.3		49.0		49.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	21.3		42.9			43.7		43.7
Green Extension Time (g_e), s	0.3	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	324	1260	876	585	790	341	582	0	1092	647	0	304
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1790		1674	1690		1701	1669		1674	1643	
Queue Service Time (g_s), s	19.3	43.9		40.9	26.5		41.7	0.0		41.7	0.0	
Cycle Queue Clearance Time (g_c), s	19.3	43.9		40.9	26.5		41.7	0.0		41.7	0.0	
Green Ratio (*g/C*)	0.44	0.29		0.58	0.42		0.28	0.28		0.28	0.28	
Capacity (*c*), veh/h	450	1048		504	1424		521	464		513	457	
Volume-to-Capacity Ratio (*X*)	0.720	1.203		1.160	0.555		1.116	0.000		1.260	0.000	
Back of Queue (*Q*), ft/ln (95 th percentile)	258.7	988.8		532.5	322.9		1086.7	0		1430.4	0	
Back of Queue (*Q*), veh/ln (95 th percentile)	10.2	38.9		20.8	12.6		43.1	0.0		55.9	0.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d_1), s/veh	33.1	43.2		25.5	32.8		56.1	0.0		56.1	0.0	
Incremental Delay (d_2), s/veh	0.5	92.2		74.4	0.1		75.4	0.0		131.9	0.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	33.6	135.4	0.0	99.9	33.0	0.0	131.5	0.0	0.0	188.0	0.0	0.0
Level of Service (LOS)	C	F	A	F	C	A	F		A	F		A
Approach Delay, s/veh / LOS	73.8	E		49.2	D		45.7	D		127.9	F	
Intersection Delay, s/veh / LOS	68.2						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	2.12	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	2.67	C	2.41	B	3.25	C	2.06	B

HCS7 Two-Way Stop-Control Report

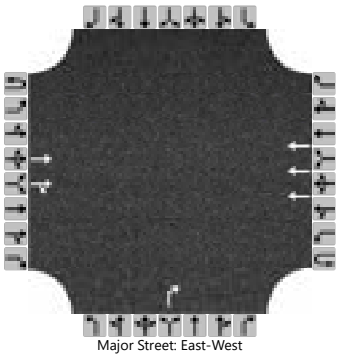
General Information

Analyst	HR Green
Agency/Co.	
Date Performed	10/2/2020
Analysis Year	2050
Time Analyzed	PM Peak Hour - No Build
Intersection Orientation	East-West
Project Description	I-229/10th Street IMJR

Site Information

Intersection	10th St & Blaine Ave
Jurisdiction	
East/West Street	10th Street
North/South Street	Blaine Avenue
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	0	3	0		0	0	1		0	0	0
Configuration			T	TR			T					R				
Volume (veh/h)			2760	85			2140					15				
Percent Heavy Vehicles (%)												2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage	Undivided															

Critical and Follow-up Headways

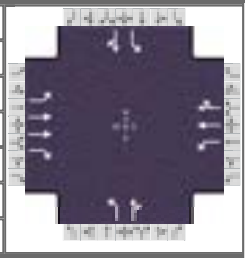
Base Critical Headway (sec)												6.9				
Critical Headway (sec)												6.94				
Base Follow-Up Headway (sec)												3.3				
Follow-Up Headway (sec)												3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)												16				
Capacity, c (veh/h)												103				
v/c Ratio												0.16				
95% Queue Length, Q_{95} (veh)												0.5				
Control Delay (s/veh)												46.3				
Level of Service (LOS)												E				
Approach Delay (s/veh)										46.3						
Approach LOS										E						

HCS7 Signalized Intersection Results Summary

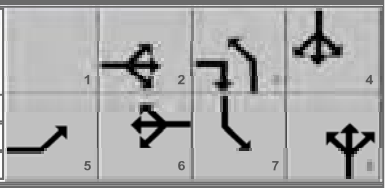
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	340	2045	390	40	1690	185	230	300	70	235	345	220

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	41	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.0	67.4	11.0	1.0	34.4	0.0	
Yellow	3.0	3.6	3.0	0.0	3.6	0.0	
Red	0.0	2.0	0.0	0.0	2.0	0.0	



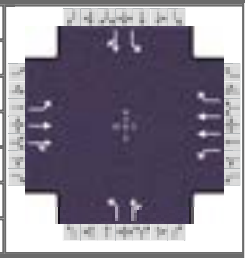
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	3.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	22.0	95.0		73.0	14.0	40.0	15.0	41.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (*g s*), s	19.2				13.0	36.4	14.0	37.4
Green Extension Time (*g e*), s	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00				1.00	1.00	1.00	1.00
Max Out Probability	1.00				1.00	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	247	1486	283	43	1019	1019	250	402		255	614	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1674	1490	349	1744	1684	1688	1714		1701	1669	
Queue Service Time (*g s*), s	17.2	38.8	12.1	11.4	67.4	67.4	11.0	34.4		12.0	35.4	
Cycle Queue Clearance Time (*g c*), s	17.2	38.8	12.1	29.5	67.4	67.4	11.0	34.4		12.0	35.4	
Green Ratio (*g/C*)	0.59	0.60	0.67	0.45	0.45	0.45	0.30	0.23		0.31	0.24	
Capacity (*c*), veh/h	260	1995	997	166	784	757	172	393		184	394	
Volume-to-Capacity Ratio (*X*)	0.950	0.745	0.284	0.262	1.300	1.347	1.456	1.023		1.388	1.559	
Back of Queue (*Q*), ft/ln (95 th percentile)	241.5	356.7	137.3	52.8	2059.3	2104.8	648.2	720.2		624.7	1688.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	9.4	13.9	5.4	2.0	79.8	84.2	25.5	28.4		24.8	67.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.79	0.00	1.02	0.48	0.00	0.00	6.48	0.00		7.81	0.00	
Uniform Delay (*d 1*), s/veh	38.5	13.0	10.7	29.7	33.9	33.5	46.3	57.8		45.1	57.3	
Incremental Delay (*d 2*), s/veh	8.0	0.2	0.1	2.1	140.6	161.0	234.3	51.5		204.3	263.8	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	46.5	13.3	10.8	31.8	174.5	194.5	280.6	109.3		249.5	321.1	
Level of Service (LOS)	D	B	B	C	F	F	F	F		F	F	
Approach Delay, s/veh / LOS	17.0	B		181.3	F		174.9	F		300.0	F	
Intersection Delay, s/veh / LOS	140.0						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.92	B	2.31	B	2.46	B
Bicycle LOS Score / LOS	2.98	C	2.20	B	1.56	B	1.92	B

HCS7 Signalized Intersection Results Summary

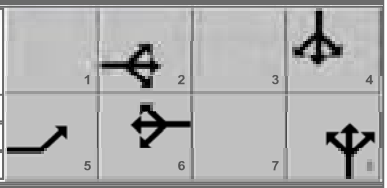
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	185	2080	85	25	1795	80	30	10	20	100	5	90

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	12	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	114.3	16.5	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



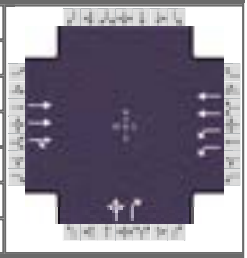
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	8.0	127.9		119.9		22.1		22.1
Change Period, (*Y+R c*), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (*g s*), s	4.5					15.4		16.4
Green Extension Time (*g e*), s	0.1	0.0		0.0		0.2		0.1
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	0.00					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	137	807	800	27	1951	87	33	33		109	103	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1719	308	1647	1466	1291	1582		1387	1526	
Queue Service Time (*g s*), s	2.5	21.4	21.7	4.8	51.9	2.3	3.7	2.8		11.6	9.7	
Cycle Queue Clearance Time (*g c*), s	2.5	21.4	21.7	18.5	51.9	2.3	13.4	2.8		14.4	9.7	
Green Ratio (*g/C*)	0.81	0.82	0.82	0.76	0.76	0.76	0.11	0.11		0.11	0.11	
Capacity (*c*), veh/h	196	1422	1402	255	2509	1117	107	174		175	168	
Volume-to-Capacity Ratio (*X*)	0.702	0.568	0.571	0.107	0.777	0.078	0.305	0.187		0.622	0.614	
Back of Queue (*Q*), ft/ln (95 th percentile)	164	224.9	218	17.9	640.7	32.5	58.6	53.1		199	185.1	
Back of Queue (*Q*), veh/ln (95 th percentile)	6.4	8.7	8.7	0.7	24.6	1.2	2.3	2.1		7.9	7.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.64	0.00	0.00	0.20	0.00	0.26	1.17	0.00		2.34	0.00	
Uniform Delay (*d 1*), s/veh	28.4	4.0	4.0	8.9	10.4	4.5	70.1	60.6		67.2	63.7	
Incremental Delay (*d 2*), s/veh	0.7	0.7	0.7	0.8	2.4	0.1	1.6	0.5		6.5	6.3	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	29.1	4.7	4.7	9.8	12.9	4.7	71.7	61.1		73.7	70.0	
Level of Service (LOS)	C	A	A	A	B	A	E	E		E	E	
Approach Delay, s/veh / LOS	6.6	A		12.5	B		66.4	E		71.9	E	
Intersection Delay, s/veh / LOS	13.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	1.86	B	2.47	B	2.32	B
Bicycle LOS Score / LOS	2.59	C	2.19	B	0.60	A	0.84	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		510	115	315	1580		190	0	515			

Signal Information			
Cycle, s	70.0	Reference Phase	6
Offset, s	48	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.4	21.5	18.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0

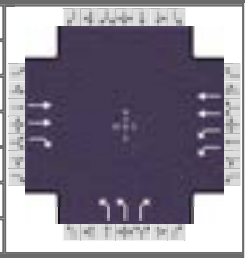
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		27.0	20.0	47.0		23.0		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (g_s), s			5.6			17.8		
Green Extension Time (g_e), s		0.0	0.3	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		430	201	342	1717			207	448			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1688	1527	1652	1719			1714	1484			
Queue Service Time (g_s), s		7.2	6.7	3.6	28.4			7.1	15.8			
Cycle Queue Clearance Time (g_c), s		7.2	6.7	3.6	28.4			7.1	15.8			
Green Ratio (*g/C*)		0.31	0.31	0.56	0.59			0.26	0.48			
Capacity (*c*), veh/h		1037	469	1259	2039			443	706			
Volume-to-Capacity Ratio (*X*)		0.415	0.428	0.272	0.842			0.466	0.635			
Back of Queue (*Q*), ft/ln (95 th percentile)		132.4	105.6	49.7	298.6			123.2	214			
Back of Queue (*Q*), veh/ln (95 th percentile)		5.2	4.2	2.0	11.8			4.9	8.6			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.12	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		20.9	16.8	8.5	11.6			21.9	13.6			
Incremental Delay (d_2), s/veh		0.8	1.8	0.0	1.5			0.3	1.4			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		21.7	18.6	8.5	13.1			22.2	15.1			
Level of Service (LOS)		C	B	A	B			C	B			
Approach Delay, s/veh / LOS	20.7	C		12.3	B		17.3	B		0.0		
Intersection Delay, s/veh / LOS	14.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.25	B	1.35	A	2.60	C	2.31	B
Bicycle LOS Score / LOS	0.86	A	2.19	B	1.57	B		

HCS7 Signalized Intersection Results Summary

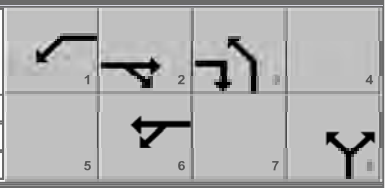
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		415	85	900	870		155		210			

Signal Information			
Cycle, s	70.0	Reference Phase	6
Offset, s	26	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	24.5	20.5	9.1	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.9	1.9	1.3	0.0	0.0	0.0	



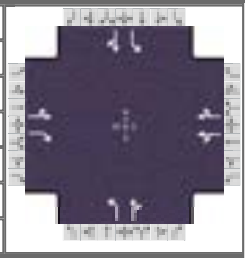
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		26.0	30.0	56.0		14.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.3		
Queue Clearance Time (*g s*), s			12.0			11.1		
Green Extension Time (*g e*), s		0.0	1.1	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		438	90	978	945		168		228			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1608	1415	1639	1645		1626					
Queue Service Time (*g s*), s		7.4	2.4	10.0	11.4		3.3					
Cycle Queue Clearance Time (*g c*), s		7.4	2.4	10.0	11.4		3.3					
Green Ratio (*g/C*)		0.29	0.42	0.67	0.72		0.13					
Capacity (*c*), veh/h		942	598	1710	2374		423					
Volume-to-Capacity Ratio (*X*)		0.465	0.150	0.572	0.398		0.399					
Back of Queue (*Q*), ft/ln (95 th percentile)		122.6	35	123	145.8		58					
Back of Queue (*Q*), veh/ln (95 th percentile)		4.8	1.4	4.8	5.7		2.3					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.35	0.61	0.00		0.39					
Uniform Delay (*d 1*), s/veh		18.4	10.8	7.7	6.8		27.9					
Incremental Delay (*d 2*), s/veh		1.6	0.5	0.1	0.2		0.2					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		19.9	11.3	7.9	7.1		28.2		0.0			
Level of Service (LOS)		B	B	A	A		C		A			
Approach Delay, s/veh / LOS	18.5	B		7.5	A		12.0	B		0.0		
Intersection Delay, s/veh / LOS	10.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.27	B	0.64	A	2.46	B	2.31	B
Bicycle LOS Score / LOS	0.94	A	2.07	B		F		

HCS7 Signalized Intersection Results Summary

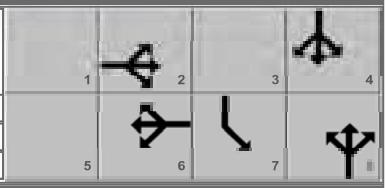
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	210	250	60	955	220	300	355	155	170	40	375

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	54.0	4.0	46.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



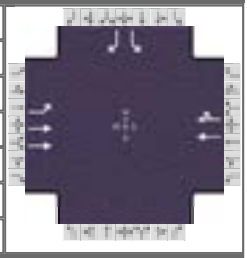
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		60.0		60.0		52.0	8.0	60.0
Change Period, (*Y+R c*), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.9	6.0	5.9
Queue Clearance Time (*g s*), s						48.0	6.0	32.0
Green Extension Time (*g e*), s		0.0		0.0		0.0	0.0	11.2
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						1.00	1.00	0.44

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		272	272	632		710	326	554		185	451	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		330	1406	1255		1453	917	1673		1594	1444	
Queue Service Time (*g s*), s		0.1	12.8	0.0		53.9	24.0	36.7		4.0	30.0	
Cycle Queue Clearance Time (*g c*), s		54.0	12.8	54.0		53.9	46.0	36.7		4.0	30.0	
Green Ratio (*g/C*)		0.45	0.45	0.45		0.45	0.38	0.38		0.43	0.45	
Capacity (*c*), veh/h		183	633	598		654	244	641		176	650	
Volume-to-Capacity Ratio (*X*)		1.484	0.430	1.057		1.086	1.339	0.864		1.050	0.694	
Back of Queue (*Q*), ft/ln (95 th percentile)		744.3	187.9	887.3		1009.2	815.3	614.6		324.4	415.9	
Back of Queue (*Q*), veh/ln (95 th percentile)		28.2	7.1	35.5		40.4	31.4	23.6		12.1	15.5	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	3.47	0.00		1.62	0.00	
Uniform Delay (*d 1*), s/veh		49.3	16.2	32.4		33.0	51.0	34.1		43.2	26.4	
Incremental Delay (*d 2*), s/veh		242.9	2.0	52.9		60.8	177.6	12.6		81.8	3.2	
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		292.1	18.2	85.3		93.8	228.5	46.8		125.1	29.6	
Level of Service (LOS)		F	B	F		F	F	D		F	C	
Approach Delay, s/veh / LOS	155.2	F		89.8	F		114.1	F		57.3	E	
Intersection Delay, s/veh / LOS	100.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.91	B	1.91	B	1.92	B	2.10	B
Bicycle LOS Score / LOS	1.38	A	1.60	B	1.94	B	1.54	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170	345			1085	545				155		95

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.2	81.5	14.3	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

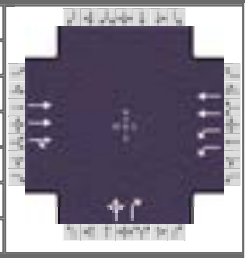
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	11.2	99.7		88.5				20.3
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	5.8							14.1
Green Extension Time (*g e*), s	0.4	0.0		0.0				0.2
Phase Call Probability	1.00							1.00
Max Out Probability	0.03							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	185	375			830	774				168		103
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1584			1819	1602				1634		1380
Queue Service Time (*g s*), s	3.8	3.7			54.0	38.0				12.1		8.5
Cycle Queue Clearance Time (*g c*), s	3.8	3.7			54.0	38.0				12.1		8.5
Green Ratio (*g/C*)	0.75	0.77			0.68	0.68				0.12		0.12
Capacity (*c*), veh/h	216	2446			1235	1088				195		165
Volume-to-Capacity Ratio (*X*)	0.857	0.153			0.672	0.712				0.863		0.626
Back of Queue (*Q*), ft/ln (95 th percentile)	206.5	46.7			376.9	364.1				274.8		150
Back of Queue (*Q*), veh/ln (95 th percentile)	7.9	1.8			14.3	14.6				10.5		5.7
Queue Storage Ratio (*RQ*) (95 th percentile)	2.06	0.00			0.00	0.00				0.86		0.00
Uniform Delay (*d 1*), s/veh	28.1	3.5			12.3	13.5				51.9		50.3
Incremental Delay (*d 2*), s/veh	12.7	0.1			0.3	0.4				26.3		5.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	40.8	3.7			12.5	13.9				78.2		55.8
Level of Service (LOS)	D	A			B	B				E		E
Approach Delay, s/veh / LOS	15.9	B		13.2	B		0.0			69.7	E	
Intersection Delay, s/veh / LOS	20.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.87	B	2.16	B	2.33	B
Bicycle LOS Score / LOS	0.95	A	1.95	B				F

HCS7 Signalized Intersection Results Summary

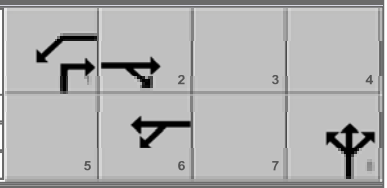
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1090	105	100	1175		85	0	1000			

Signal Information			
Cycle, s	60.4	Reference Phase	2
Offset, s	41	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.0	20.4	14.0	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.0	1.9	1.3	0.0	0.0	0.0	



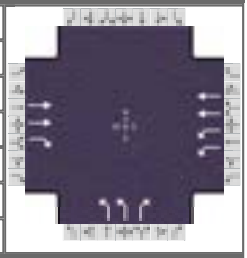
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		25.9	15.6	41.5		18.9		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		3.1	2.2	3.1		2.4		
Queue Clearance Time (g_s), s		15.3	2.9	17.1		16.0		
Green Extension Time (g_e), s		2.6	0.1	5.6		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.78	0.00	0.09		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		467	226	109	1277			92	870			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1686	1607	1652	1670			1714	1527			
Queue Service Time (g_s), s		13.3	6.5	0.9	15.1			2.6	14.0			
Cycle Queue Clearance Time (g_c), s		13.3	6.5	0.9	15.1			2.6	14.0			
Green Ratio (*g/C*)		0.34	0.34	0.55	0.60			0.23	0.41			
Capacity (*c*), veh/h		1139	543	1018	1991			397	616			
Volume-to-Capacity Ratio (*X*)		0.410	0.416	0.107	0.641			0.233	1.411			
Back of Queue (*Q*), ft/ln (95 th percentile)		75.4	72.3	11.7	164.2			44.4	1511.6			
Back of Queue (*Q*), veh/ln (95 th percentile)		3.0	2.9	0.5	6.5			1.8	60.5			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.03	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		15.4	15.4	8.3	8.0			18.8	17.5			
Incremental Delay (d_2), s/veh		0.0	0.0	0.0	0.3			0.1	194.7			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		15.4	15.4	8.3	8.3			18.9	212.2			
Level of Service (LOS)		B	B	A	A			B	F			
Approach Delay, s/veh / LOS	15.4	B		8.3	A		193.6	F		0.0		
Intersection Delay, s/veh / LOS	68.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.38	B	1.34	A	2.60	C	2.30	B
Bicycle LOS Score / LOS	1.20	A	1.63	B	2.07	B		

HCS7 Signalized Intersection Results Summary

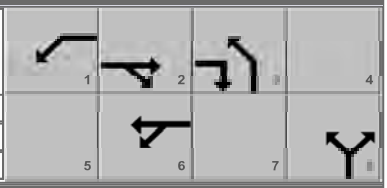
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		615	95	640	620		150		580			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	115	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	55.5	37.5	11.1	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.9	1.9	1.3	0.0	0.0	0.0	



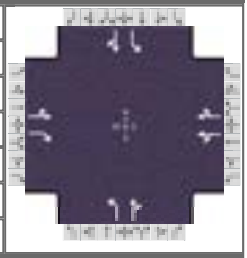
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		43.0	61.0	104.0		16.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (*g s*), s			8.7			13.1		
Green Extension Time (*g e*), s		0.0	0.8	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		555	86	696	674		163		630			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1646	1422	1639	1661		1626					
Queue Service Time (*g s*), s		16.8	4.6	6.7	5.5		5.7					
Cycle Queue Clearance Time (*g c*), s		16.8	4.6	6.7	5.5		5.7					
Green Ratio (*g/C*)		0.31	0.41	0.79	0.82		0.09					
Capacity (*c*), veh/h		1029	576	1931	2727		301					
Volume-to-Capacity Ratio (*X*)		0.540	0.149	0.360	0.247		0.542					
Back of Queue (*Q*), ft/ln (95 th percentile)		279.5	74.1	80.8	62.3		110.3					
Back of Queue (*Q*), veh/ln (95 th percentile)		11.0	2.9	3.2	2.5		4.3					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.74	0.40	0.00		0.74					
Uniform Delay (*d 1*), s/veh		34.1	22.6	5.8	2.4		52.0					
Incremental Delay (*d 2*), s/veh		1.8	0.5	0.0	0.2		1.1					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		35.9	23.1	5.8	2.6		53.1		0.0			
Level of Service (LOS)		D	C	A	A		D		A			
Approach Delay, s/veh / LOS	34.2	C		4.2	A		10.9	B		0.0		
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	0.63	A	2.48	B	2.32	B
Bicycle LOS Score / LOS	1.12	A	1.62	B		F		

HCS7 Signalized Intersection Results Summary

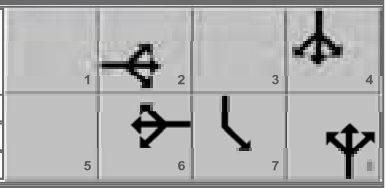
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	690	780	105	675	150	250	150	100	625	55	205

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

Green	46.0	14.0	14.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



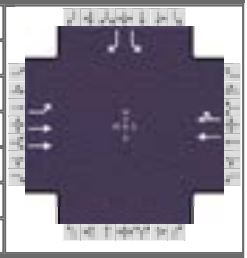
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		52.0		52.0		20.0	18.0	38.0
Change Period, (*Y+R c*), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.8	6.0	5.8
Queue Clearance Time (*g s*), s						16.0	16.0	16.5
Green Extension Time (*g e*), s		0.0		0.0		0.0	0.0	5.4
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						1.00	1.00	0.31

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		864	848	334		677	272	272		679	283	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		392	1491	807		1428	1070	1556		1594	1415	
Queue Service Time (*g s*), s		6.5	46.0	0.0		39.5	14.0	14.0		14.0	14.5	
Cycle Queue Clearance Time (*g c*), s		46.0	46.0	28.8		39.5	14.0	14.0		14.0	14.5	
Green Ratio (*g/C*)		0.51	0.51	0.51		0.51	0.16	0.16		0.33	0.36	
Capacity (*c*), veh/h		246	762	467		730	247	242		328	503	
Volume-to-Capacity Ratio (*X*)		3.515	1.112	0.715		0.927	1.102	1.123		2.071	0.562	
Back of Queue (*Q*), ft/ln (95 th percentile)		3669.6	1104.6	251.9		554.1	461.5	470.5		2094.1	218.5	
Back of Queue (*Q*), veh/ln (95 th percentile)		139.0	41.8	10.1		22.2	17.8	18.1		78.1	8.2	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	1.96	0.00		10.47	0.00	
Uniform Delay (*d 1*), s/veh		25.6	26.9	16.6		20.6	40.3	38.0		27.6	23.4	
Incremental Delay (*d 2*), s/veh		1137.6	61.4	9.0		19.6	87.5	94.8		492.5	1.4	
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		1163.1	88.4	25.7		40.3	127.7	132.8		520.2	24.8	
Level of Service (LOS)		F	F	C		D	F	F		F	C	
Approach Delay, s/veh / LOS	630.9	F		35.4	D		130.3	F		374.6	F	
Intersection Delay, s/veh / LOS	365.9						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.89	B	1.94	B	2.11	B
Bicycle LOS Score / LOS	3.31	C	1.32	A	1.38	A	2.07	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	1130			745	385				445		95

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	15	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	8.7	35.3	28.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

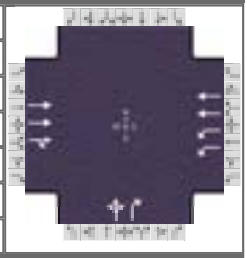
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.7	56.0		42.3				34.0
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	8.7							28.1
Green Extension Time (*g e*), s	0.0	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	217	1228			527	466				484		103
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1654			1692	1485				1634		1375
Queue Service Time (*g s*), s	6.7	24.2			32.4	22.9				26.1		5.0
Cycle Queue Clearance Time (*g c*), s	6.7	24.2			32.4	22.9				26.1		5.0
Green Ratio (*g/C*)	0.51	0.54			0.39	0.39				0.31		0.31
Capacity (*c*), veh/h	257	1801			664	583				508		428
Volume-to-Capacity Ratio (*X*)	0.846	0.682			0.794	0.800				0.951		0.241
Back of Queue (*Q*), ft/ln (95 th percentile)	178	348.5			339.1	236.1				516.4		75.9
Back of Queue (*Q*), veh/ln (95 th percentile)	6.8	13.4			12.8	9.4				19.7		2.9
Queue Storage Ratio (*RQ*) (95 th percentile)	1.78	0.00			0.00	0.00				1.61		0.00
Uniform Delay (*d 1*), s/veh	20.0	14.9			22.8	17.8				30.3		23.1
Incremental Delay (*d 2*), s/veh	21.5	2.1			4.2	4.9				28.1		0.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	41.5	17.0			27.0	22.7				58.4		23.4
Level of Service (LOS)	D	B			C	C				E		C
Approach Delay, s/veh / LOS	20.7	C		25.0	C		0.0			52.2	D	
Intersection Delay, s/veh / LOS	28.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.69	A	1.91	B	2.15	B	2.32	B
Bicycle LOS Score / LOS	1.68	B	1.50	B				F

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		510	115	315	1580		190	0	515			

Signal Information			
Cycle, s	70.0	Reference Phase	6
Offset, s	48	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.4	21.5	18.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0

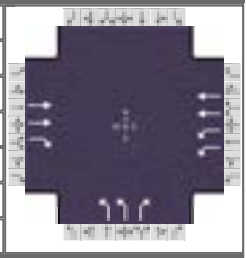
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		27.0	20.0	47.0		23.0		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (g_s), s			5.6			17.8		
Green Extension Time (g_e), s		0.0	0.3	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		430	201	342	1717			207	448			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1688	1527	1652	1719			1714	1484			
Queue Service Time (g_s), s		7.2	6.7	3.6	28.4			7.1	15.8			
Cycle Queue Clearance Time (g_c), s		7.2	6.7	3.6	28.4			7.1	15.8			
Green Ratio (*g/C*)		0.31	0.31	0.56	0.59			0.26	0.48			
Capacity (*c*), veh/h		1037	469	1259	2039			443	706			
Volume-to-Capacity Ratio (*X*)		0.415	0.428	0.272	0.842			0.466	0.635			
Back of Queue (*Q*), ft/ln (95 th percentile)		132.4	105.6	49.7	298.6			123.2	214			
Back of Queue (*Q*), veh/ln (95 th percentile)		5.2	4.2	2.0	11.8			4.9	8.6			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.12	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		20.9	16.8	8.5	11.6			21.9	13.6			
Incremental Delay (d_2), s/veh		0.8	1.8	0.0	1.5			0.3	1.4			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		21.7	18.6	8.5	13.1			22.2	15.1			
Level of Service (LOS)		C	B	A	B			C	B			
Approach Delay, s/veh / LOS	20.7	C		12.3	B		17.3	B		0.0		
Intersection Delay, s/veh / LOS	14.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.25	B	1.35	A	2.60	C	2.31	B
Bicycle LOS Score / LOS	0.86	A	2.19	B	1.57	B		

HCS7 Signalized Intersection Results Summary

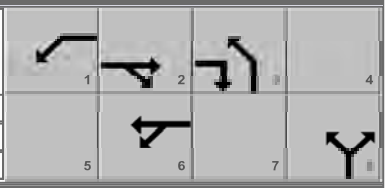
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		415	85	900	870		155		210			

Signal Information			
Cycle, s	70.0	Reference Phase	6
Offset, s	26	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	24.5	20.5	9.1	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.9	1.9	1.3	0.0	0.0	0.0	



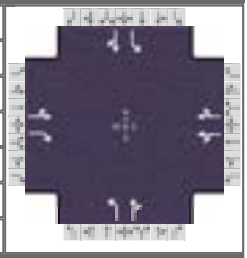
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		26.0	30.0	56.0		14.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.3		
Queue Clearance Time (*g s*), s			12.0			11.1		
Green Extension Time (*g e*), s		0.0	1.1	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		438	90	978	945		168		228			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1608	1415	1639	1645		1626					
Queue Service Time (*g s*), s		7.4	2.4	10.0	11.4		3.3					
Cycle Queue Clearance Time (*g c*), s		7.4	2.4	10.0	11.4		3.3					
Green Ratio (*g/C*)		0.29	0.42	0.67	0.72		0.13					
Capacity (*c*), veh/h		942	598	1710	2374		423					
Volume-to-Capacity Ratio (*X*)		0.465	0.150	0.572	0.398		0.399					
Back of Queue (*Q*), ft/ln (95 th percentile)		122.6	35	123	145.8		58					
Back of Queue (*Q*), veh/ln (95 th percentile)		4.8	1.4	4.8	5.7		2.3					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.35	0.61	0.00		0.39					
Uniform Delay (*d 1*), s/veh		18.4	10.8	7.7	6.8		27.9					
Incremental Delay (*d 2*), s/veh		1.6	0.5	0.1	0.2		0.2					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		19.9	11.3	7.9	7.1		28.2		0.0			
Level of Service (LOS)		B	B	A	A		C		A			
Approach Delay, s/veh / LOS	18.5	B		7.5	A		12.0	B		0.0		
Intersection Delay, s/veh / LOS	10.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.27	B	0.64	A	2.46	B	2.31	B
Bicycle LOS Score / LOS	0.94	A	2.07	B		F		

HCS7 Signalized Intersection Results Summary

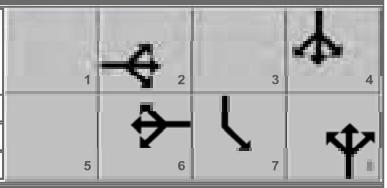
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	210	250	60	955	220	300	355	155	170	40	375

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	54.0	4.0	46.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



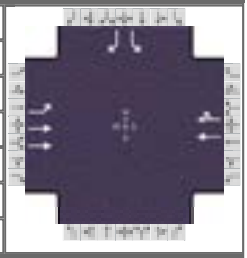
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		60.0		60.0		52.0	8.0	60.0
Change Period, (*Y+R c*), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.9	6.0	5.9
Queue Clearance Time (*g s*), s						48.0	6.0	32.0
Green Extension Time (*g e*), s		0.0		0.0		0.0	0.0	11.2
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						1.00	1.00	0.44

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		272	272	632		710	326	554		185	451	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		330	1406	1255		1453	917	1673		1594	1444	
Queue Service Time (*g s*), s		0.1	12.8	0.0		53.9	24.0	36.7		4.0	30.0	
Cycle Queue Clearance Time (*g c*), s		54.0	12.8	54.0		53.9	46.0	36.7		4.0	30.0	
Green Ratio (*g/C*)		0.45	0.45	0.45		0.45	0.38	0.38		0.43	0.45	
Capacity (*c*), veh/h		183	633	598		654	244	641		176	650	
Volume-to-Capacity Ratio (*X*)		1.484	0.430	1.057		1.086	1.339	0.864		1.050	0.694	
Back of Queue (*Q*), ft/ln (95 th percentile)		744.3	187.9	887.3		1009.2	815.3	614.6		324.4	415.9	
Back of Queue (*Q*), veh/ln (95 th percentile)		28.2	7.1	35.5		40.4	31.4	23.6		12.1	15.5	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	3.47	0.00		1.62	0.00	
Uniform Delay (*d 1*), s/veh		49.3	16.2	32.4		33.0	51.0	34.1		43.2	26.4	
Incremental Delay (*d 2*), s/veh		242.9	2.0	52.9		60.8	177.6	12.6		81.8	3.2	
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		292.1	18.2	85.3		93.8	228.5	46.8		125.1	29.6	
Level of Service (LOS)		F	B	F		F	F	D		F	C	
Approach Delay, s/veh / LOS	155.2	F		89.8	F		114.1	F		57.3	E	
Intersection Delay, s/veh / LOS	100.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.91	B	1.91	B	1.92	B	2.10	B
Bicycle LOS Score / LOS	1.38	A	1.60	B	1.94	B	1.54	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170	345			1085	545				155		95

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.2	81.5	14.3	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

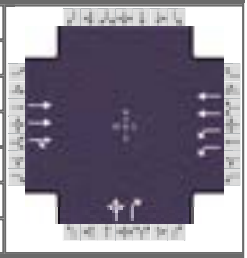
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	11.2	99.7		88.5				20.3
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	5.8							14.1
Green Extension Time (*g e*), s	0.4	0.0		0.0				0.2
Phase Call Probability	1.00							1.00
Max Out Probability	0.03							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	185	375			830	774				168		103
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1584			1819	1602				1634		1380
Queue Service Time (*g s*), s	3.8	3.7			54.0	38.0				12.1		8.5
Cycle Queue Clearance Time (*g c*), s	3.8	3.7			54.0	38.0				12.1		8.5
Green Ratio (*g/C*)	0.75	0.77			0.68	0.68				0.12		0.12
Capacity (*c*), veh/h	216	2446			1235	1088				195		165
Volume-to-Capacity Ratio (*X*)	0.857	0.153			0.672	0.712				0.863		0.626
Back of Queue (*Q*), ft/ln (95 th percentile)	206.5	46.7			376.9	364.1				274.8		150
Back of Queue (*Q*), veh/ln (95 th percentile)	7.9	1.8			14.3	14.6				10.5		5.7
Queue Storage Ratio (*RQ*) (95 th percentile)	2.06	0.00			0.00	0.00				0.86		0.00
Uniform Delay (*d 1*), s/veh	28.1	3.5			12.3	13.5				51.9		50.3
Incremental Delay (*d 2*), s/veh	12.7	0.1			0.3	0.4				26.3		5.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	40.8	3.7			12.5	13.9				78.2		55.8
Level of Service (LOS)	D	A			B	B				E		E
Approach Delay, s/veh / LOS	15.9	B		13.2	B		0.0			69.7	E	
Intersection Delay, s/veh / LOS	20.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.87	B	2.16	B	2.33	B
Bicycle LOS Score / LOS	0.95	A	1.95	B				F

HCS7 Signalized Intersection Results Summary

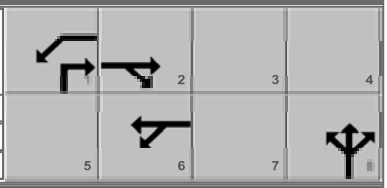
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1090	105	100	1175		85	0	1000			

Signal Information			
Cycle, s	60.4	Reference Phase	2
Offset, s	41	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.0	20.4	14.0	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.0	1.9	1.3	0.0	0.0	0.0	



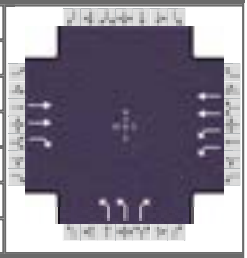
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		25.9	15.6	41.5		18.9		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		3.1	2.2	3.1		2.4		
Queue Clearance Time (g_s), s		15.3	2.9	17.1		16.0		
Green Extension Time (g_e), s		2.6	0.1	5.6		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.78	0.00	0.09		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		467	226	109	1277			92	870			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1686	1607	1652	1670			1714	1527			
Queue Service Time (g_s), s		13.3	6.5	0.9	15.1			2.6	14.0			
Cycle Queue Clearance Time (g_c), s		13.3	6.5	0.9	15.1			2.6	14.0			
Green Ratio (*g/C*)		0.34	0.34	0.55	0.60			0.23	0.41			
Capacity (*c*), veh/h		1139	543	1018	1991			397	616			
Volume-to-Capacity Ratio (*X*)		0.410	0.416	0.107	0.641			0.233	1.411			
Back of Queue (*Q*), ft/ln (95 th percentile)		75.4	72.3	11.7	164.2			44.4	1511.6			
Back of Queue (*Q*), veh/ln (95 th percentile)		3.0	2.9	0.5	6.5			1.8	60.5			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.03	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		15.4	15.4	8.3	8.0			18.8	17.5			
Incremental Delay (d_2), s/veh		0.0	0.0	0.0	0.3			0.1	194.7			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		15.4	15.4	8.3	8.3			18.9	212.2			
Level of Service (LOS)		B	B	A	A			B	F			
Approach Delay, s/veh / LOS	15.4	B		8.3	A		193.6	F		0.0		
Intersection Delay, s/veh / LOS	68.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.38	B	1.34	A	2.60	C	2.30	B
Bicycle LOS Score / LOS	1.20	A	1.63	B	2.07	B		

HCS7 Signalized Intersection Results Summary

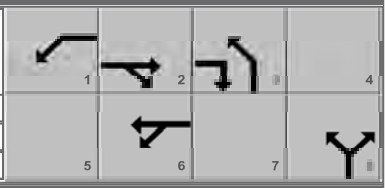
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		615	95	640	620		150		580			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	115	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	55.5	37.5	11.1	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.9	1.9	1.3	0.0	0.0	0.0	



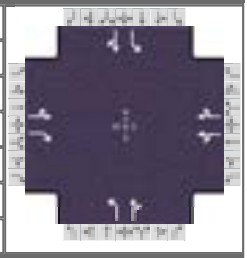
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		43.0	61.0	104.0		16.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (*g s*), s			8.7			13.1		
Green Extension Time (*g e*), s		0.0	0.8	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		555	86	696	674		163		630			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1646	1422	1639	1661		1626					
Queue Service Time (*g s*), s		16.8	4.6	6.7	5.5		5.7					
Cycle Queue Clearance Time (*g c*), s		16.8	4.6	6.7	5.5		5.7					
Green Ratio (*g/C*)		0.31	0.41	0.79	0.82		0.09					
Capacity (*c*), veh/h		1029	576	1931	2727		301					
Volume-to-Capacity Ratio (*X*)		0.540	0.149	0.360	0.247		0.542					
Back of Queue (*Q*), ft/ln (95 th percentile)		279.5	74.1	80.8	62.3		110.3					
Back of Queue (*Q*), veh/ln (95 th percentile)		11.0	2.9	3.2	2.5		4.3					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.74	0.40	0.00		0.74					
Uniform Delay (*d 1*), s/veh		34.1	22.6	5.8	2.4		52.0					
Incremental Delay (*d 2*), s/veh		1.8	0.5	0.0	0.2		1.1					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		35.9	23.1	5.8	2.6		53.1		0.0			
Level of Service (LOS)		D	C	A	A		D		A			
Approach Delay, s/veh / LOS	34.2	C		4.2	A		10.9	B		0.0		
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	0.63	A	2.48	B	2.32	B
Bicycle LOS Score / LOS	1.12	A	1.62	B		F		

HCS7 Signalized Intersection Results Summary

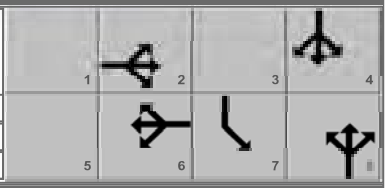
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	690	780	105	675	150	250	150	100	625	55	205

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

Green	46.0	14.0	14.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



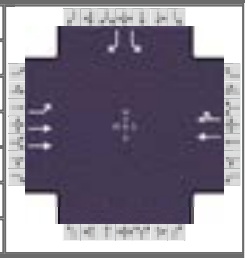
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		52.0		52.0		20.0	18.0	38.0
Change Period, (*Y+R c*), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.8	6.0	5.8
Queue Clearance Time (*g s*), s						16.0	16.0	16.5
Green Extension Time (*g e*), s		0.0		0.0		0.0	0.0	5.4
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						1.00	1.00	0.31

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		864	848	334		677	272	272		679	283	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		392	1491	807		1428	1070	1556		1594	1415	
Queue Service Time (*g s*), s		6.5	46.0	0.0		39.5	14.0	14.0		14.0	14.5	
Cycle Queue Clearance Time (*g c*), s		46.0	46.0	28.8		39.5	14.0	14.0		14.0	14.5	
Green Ratio (*g/C*)		0.51	0.51	0.51		0.51	0.16	0.16		0.33	0.36	
Capacity (*c*), veh/h		246	762	467		730	247	242		328	503	
Volume-to-Capacity Ratio (*X*)		3.515	1.112	0.715		0.927	1.102	1.123		2.071	0.562	
Back of Queue (*Q*), ft/ln (95 th percentile)		3669.6	1104.6	251.9		554.1	461.5	470.5		2094.1	218.5	
Back of Queue (*Q*), veh/ln (95 th percentile)		139.0	41.8	10.1		22.2	17.8	18.1		78.1	8.2	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	1.96	0.00		10.47	0.00	
Uniform Delay (*d 1*), s/veh		25.6	26.9	16.6		20.6	40.3	38.0		27.6	23.4	
Incremental Delay (*d 2*), s/veh		1137.6	61.4	9.0		19.6	87.5	94.8		492.5	1.4	
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		1163.1	88.4	25.7		40.3	127.7	132.8		520.2	24.8	
Level of Service (LOS)		F	F	C		D	F	F		F	C	
Approach Delay, s/veh / LOS	630.9	F		35.4	D		130.3	F		374.6	F	
Intersection Delay, s/veh / LOS	365.9						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.89	B	1.94	B	2.11	B
Bicycle LOS Score / LOS	3.31	C	1.32	A	1.38	A	2.07	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2050 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	1130			745	385				445		95

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	15	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	8.7	35.3	28.0	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

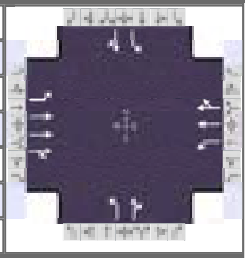
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.7	56.0		42.3				34.0
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	8.7							28.1
Green Extension Time (*g e*), s	0.0	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	217	1228			527	466				484		103
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1654			1692	1485				1634		1375
Queue Service Time (*g s*), s	6.7	24.2			32.4	22.9				26.1		5.0
Cycle Queue Clearance Time (*g c*), s	6.7	24.2			32.4	22.9				26.1		5.0
Green Ratio (*g/C*)	0.51	0.54			0.39	0.39				0.31		0.31
Capacity (*c*), veh/h	257	1801			664	583				508		428
Volume-to-Capacity Ratio (*X*)	0.846	0.682			0.794	0.800				0.951		0.241
Back of Queue (*Q*), ft/ln (95 th percentile)	178	348.5			339.1	236.1				516.4		75.9
Back of Queue (*Q*), veh/ln (95 th percentile)	6.8	13.4			12.8	9.4				19.7		2.9
Queue Storage Ratio (*RQ*) (95 th percentile)	1.78	0.00			0.00	0.00				1.61		0.00
Uniform Delay (*d 1*), s/veh	20.0	14.9			22.8	17.8				30.3		23.1
Incremental Delay (*d 2*), s/veh	21.5	2.1			4.2	4.9				28.1		0.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	41.5	17.0			27.0	22.7				58.4		23.4
Level of Service (LOS)	D	B			C	C				E		C
Approach Delay, s/veh / LOS	20.7	C		25.0	C		0.0			52.2	D	
Intersection Delay, s/veh / LOS	28.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.69	A	1.91	B	2.15	B	2.32	B
Bicycle LOS Score / LOS	1.68	B	1.50	B				F

HCS Signalized Intersection Results Summary

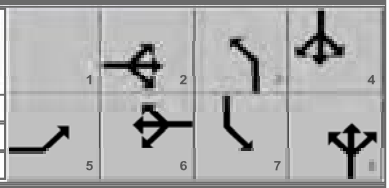
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2050 AMpeak Build IMJR- 2 EB Clev.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	235	1050	140	35	1850	115	295	315	30	90	180	340

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	83	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	62.4	5.0	5.0	27.4	0.0	
Yellow	3.0	3.6	3.0	3.0	3.6	0.0	
Red	0.0	2.0	0.0	0.0	2.0	0.0	



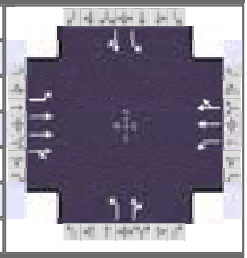
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	4.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	13.0	81.0		68.0	16.0	41.0	8.0	33.0
Change Period, ($Y+R_c$), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (g_s), s	12.0				15.0	27.9	7.0	29.4
Green Extension Time (g_e), s	0.0	0.0		0.0	0.0	2.6	0.0	0.0
Phase Call Probability	1.00				1.00	1.00	0.97	1.00
Max Out Probability	1.00				1.00	0.54	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	246	846	397	38	1068	1068	321	375		98	565	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1758	1649	440	1744	1708	1688	1745		1701	1598	
Queue Service Time (g_s), s	10.0	13.6	11.0	5.8	62.4	62.4	13.0	25.9		5.0	27.4	
Cycle Queue Clearance Time (g_c), s	10.0	13.6	11.0	6.4	62.4	62.4	13.0	25.9		5.0	27.4	
Green Ratio (*g/C*)	0.57	0.58	0.58	0.48	0.48	0.48	0.33	0.27		0.25	0.21	
Capacity (*c*), veh/h	184	2039	956	265	837	820	224	475		179	337	
Volume-to-Capacity Ratio (*X*)	1.334	0.415	0.416	0.144	1.276	1.303	1.431	0.789		0.545	1.678	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	22.3	8.2	6.4	1.1	75.4	78.3	29.7	18.1		1.7	63.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	4.23	0.00	0.00	0.27	0.00	0.00	7.55	0.00		0.53	0.00	
Uniform Delay (d_1), s/veh	35.0	10.6	7.9	17.3	31.0	30.9	38.0	43.8		43.3	51.3	
Incremental Delay (d_2), s/veh	178.7	0.5	1.2	0.6	128.8	140.7	217.5	8.7		3.4	317.9	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	213.7	11.2	9.0	17.8	159.8	171.5	255.5	52.6		46.7	369.2	
Level of Service (LOS)	F	B	A	B	F	F	F	D		D	F	
Approach Delay, s/veh / LOS	44.0	D		163.1	F		146.1	F		321.6	F	
Intersection Delay, s/veh / LOS	146.3						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.91	B	2.45	B	2.46	B
Bicycle LOS Score / LOS	1.34	A	2.28	B	1.64	B	1.58	B

HCS Signalized Intersection Results Summary

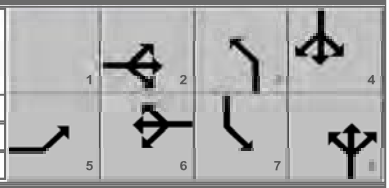
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2050 PMpeak Build IMJR- 2 EB Clev.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	340	2045	390	40	1690	185	230	300	70	235	345	220

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	82	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.0	66.4	12.0	35.4	0.0	0.0	
Yellow	3.0	3.6	3.0	3.6	0.0	0.0	
Red	0.0	2.0	0.0	2.0	0.0	0.0	



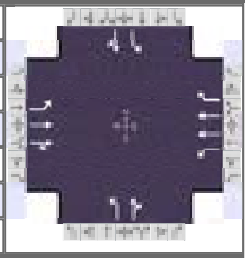
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	4.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	22.0	94.0		72.0	15.0	41.0	15.0	41.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (*g s*), s	21.0				14.0	37.1	14.0	37.4
Green Extension Time (*g e*), s	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00				1.00	1.00	1.00	1.00
Max Out Probability	1.00				1.00	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	361	1745	843	43	1019	1019	250	402		255	614	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1758	1615	118	1744	1684	1688	1714		1701	1669	
Queue Service Time (*g s*), s	19.0	56.6	67.6	20.8	66.4	66.4	12.0	35.1		12.0	35.4	
Cycle Queue Clearance Time (*g c*), s	19.0	56.6	67.6	66.4	66.4	66.4	12.0	35.1		12.0	35.4	
Green Ratio (*g/C*)	0.58	0.59	0.59	0.44	0.44	0.44	0.32	0.24		0.32	0.24	
Capacity (*c*), veh/h	260	2072	952	64	772	745	183	404		184	394	
Volume-to-Capacity Ratio (*X*)	1.390	0.842	0.886	0.675	1.320	1.367	1.366	0.994		1.388	1.559	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	30.7	25.5	30.9	3.8	80.6	85.0	23.9	27.4		24.7	67.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	5.83	0.00	0.00	0.89	0.00	0.00	6.07	0.00		7.78	0.00	
Uniform Delay (*d 1*), s/veh	47.5	19.7	27.2	59.8	32.4	31.9	44.5	57.2		44.4	57.3	
Incremental Delay (*d 2*), s/veh	181.8	1.2	3.7	26.2	149.0	169.8	195.6	43.2		204.3	263.8	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	229.3	21.0	30.9	86.0	181.4	201.7	240.1	100.4		248.7	321.1	
Level of Service (LOS)	F	C	C	F	F	F	F	F		F	F	
Approach Delay, s/veh / LOS	49.3	D		189.4	F		154.0	F		299.8	F	
Intersection Delay, s/veh / LOS	137.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.92	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	2.15	B	2.20	B	1.56	B	1.92	B

HCS Signalized Intersection Results Summary

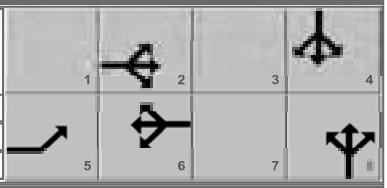
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2050 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	1045	25	20	1925	90	10	5	5	30	5	65

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	29	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.9	101.0	9.9	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



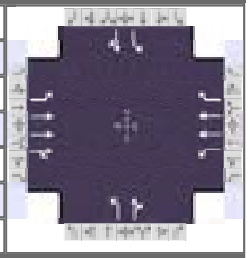
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	7.9	114.5		106.6		15.5		15.5
Change Period, ($Y+R_c$), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (g_s), s	3.5					9.3		8.3
Green Extension Time (g_e), s	0.0	0.0		0.0		0.0		0.1
Phase Call Probability	0.98					0.99		0.99
Max Out Probability	0.00					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	105	564	559	22	2092	98	11	11		33	76	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1729	490	1647	1466	1323	1626		1415	1530	
Queue Service Time (g_s), s	1.5	10.5	10.5	1.5	50.5	2.1	1.0	0.8		2.9	6.3	
Cycle Queue Clearance Time (g_c), s	1.5	10.5	10.5	4.1	50.5	2.1	7.3	0.8		3.7	6.3	
Green Ratio (*g/C*)	0.83	0.84	0.84	0.78	0.78	0.78	0.08	0.08		0.08	0.08	
Capacity (*c*), veh/h	193	1461	1448	426	2559	1139	92	124		154	117	
Volume-to-Capacity Ratio (*X*)	0.544	0.386	0.386	0.051	0.818	0.086	0.118	0.088		0.211	0.652	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	4.8	5.3	5.3	0.3	22.4	1.1	0.7	0.6		1.9	5.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.25	0.00	0.00	0.08	0.00	0.22	0.34	0.00		0.57	0.00	
Uniform Delay (d_1), s/veh	24.4	2.7	2.7	4.0	8.9	3.5	61.9	55.8		57.5	58.4	
Incremental Delay (d_2), s/veh	0.8	0.7	0.7	0.2	3.0	0.1	0.6	0.3		0.8	12.8	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	25.3	3.4	3.4	4.3	11.9	3.6	62.5	56.1		58.4	71.1	
Level of Service (LOS)	C	A	A	A	B	A	E	E		E	E	
Approach Delay, s/veh / LOS	5.3	A		11.5	B		59.3	E		67.3	E	
Intersection Delay, s/veh / LOS	11.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.82	B	1.84	B	2.47	B	2.32	B
Bicycle LOS Score / LOS	1.54	B	2.31	B	0.52	A	0.67	A

HCS Signalized Intersection Results Summary

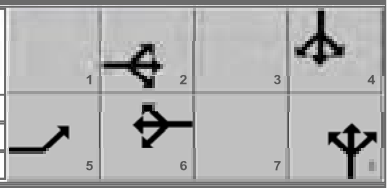
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2050 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	185	2080	85	25	1795	80	30	10	20	100	5	90

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	52	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.6	111.7	16.5	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



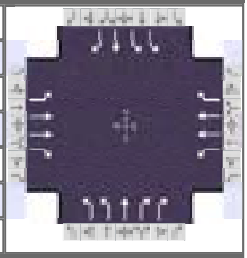
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	10.6	127.9		117.3		22.1		22.1
Change Period, (*Y+R c*), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (*g s*), s	7.5					15.4		16.4
Green Extension Time (*g e*), s	0.1	0.0		0.0		0.2		0.1
Phase Call Probability	1.00					1.00		1.00
Max Out Probability	0.00					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	191	1501	739	27	1951	87	33	33		109	103	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1707	166	1647	1466	1291	1582		1387	1526	
Queue Service Time (*g s*), s	5.5	17.5	17.7	8.9	55.8	2.4	3.7	2.8		11.6	9.7	
Cycle Queue Clearance Time (*g c*), s	5.5	17.5	17.7	15.9	55.8	2.4	13.4	2.8		14.4	9.7	
Green Ratio (*g/C*)	0.81	0.82	0.82	0.74	0.74	0.74	0.11	0.11		0.11	0.11	
Capacity (*c*), veh/h	215	2843	1392	164	2451	1091	107	174		175	168	
Volume-to-Capacity Ratio (*X*)	0.890	0.528	0.531	0.166	0.796	0.080	0.305	0.187		0.622	0.614	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	11.0	6.9	7.0	0.7	26.8	1.4	2.3	2.1		7.9	7.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	2.84	0.00	0.00	0.22	0.00	0.28	1.17	0.00		2.34	0.00	
Uniform Delay (*d 1*), s/veh	40.0	3.4	3.4	8.2	12.0	5.2	70.1	60.6		67.2	63.7	
Incremental Delay (*d 2*), s/veh	6.1	0.3	0.6	2.2	2.8	0.1	1.6	0.5		6.5	6.3	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	46.1	3.7	4.0	10.4	14.8	5.4	71.7	61.1		73.7	70.0	
Level of Service (LOS)	D	A	A	B	B	A	E	E		E	E	
Approach Delay, s/veh / LOS	7.1	A		14.4	B		66.4	E		71.9	E	
Intersection Delay, s/veh / LOS	13.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	1.86	B	2.61	C	2.47	B
Bicycle LOS Score / LOS	1.89	B	2.19	B	0.60	A	0.84	A

HCS Signalized Intersection Results Summary

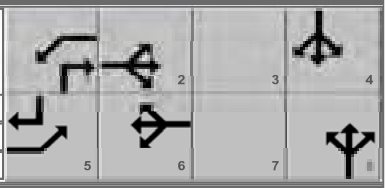
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229	File Name	2050 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	660	535	695	1030	760	620	0	580	225	0	335

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	8.8	13.4	49.5	26.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	4.5	4.5	4.5	3.7	0.0	0.0



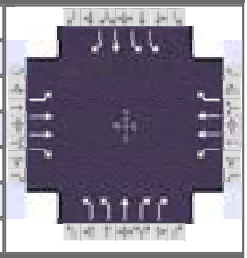
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	16.9	57.6	38.4	79.1		34.0		34.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	8.7		27.9			27.5		28.7
Green Extension Time (g_e), s	0.1	0.0	2.4	0.0		0.0		0.0
Phase Call Probability	0.99		1.00			1.00		1.00
Max Out Probability	1.00		0.00			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	144	614	498	561	831	613	674	0	630	245	0	364
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1660		1674	1678		1652	1669	1320	1626	1643	1481
Queue Service Time (g_s), s	6.7	20.7		25.9	24.5		25.5	0.0	22.9	8.1	0.0	26.7
Cycle Queue Clearance Time (g_c), s	6.7	20.7		25.9	24.5		25.5	0.0	22.9	8.1	0.0	26.7
Green Ratio (*g/C*)	0.45	0.38		0.63	0.55		0.21	0.21	0.44	0.21	0.21	0.27
Capacity (*c*), veh/h	395	1265		623	1834		789	343	1173	779	337	401
Volume-to-Capacity Ratio (*X*)	0.365	0.485		0.900	0.453		0.854	0.000	0.537	0.314	0.000	0.909
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	5.0	13.8		9.9	12.1		17.5	0.0	11.7	6.2	0.0	20.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.37	0.00		0.80	0.00		1.77	0.00	0.69	0.88	0.00	0.40
Uniform Delay (d_1), s/veh	21.9	38.4		17.3	26.6		51.2	0.0	27.0	44.3	0.0	45.6
Incremental Delay (d_2), s/veh	0.5	1.2		1.0	0.1		9.3	0.0	0.6	0.3	0.0	24.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	22.4	39.6	0.0	18.3	26.7	0.0	60.5	0.0	27.6	44.6	0.0	70.1
Level of Service (LOS)	C	D	A	B	C	A	E		C	D		E
Approach Delay, s/veh / LOS	21.9	C		16.2	B		44.6	D		59.9	E	
Intersection Delay, s/veh / LOS	29.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.26	B	2.46	B	2.46	B
Bicycle LOS Score / LOS	1.70	B	2.72	C	2.64	C	1.49	A

HCS Signalized Intersection Results Summary

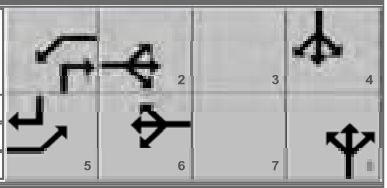
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	I-229	File Name	2050 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	320	1245	865	730	985	425	535	0	1005	595	0	280

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	31	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	19.3	19.4	55.0	24.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	4.5	4.5	4.5	3.7	0.0	0.0



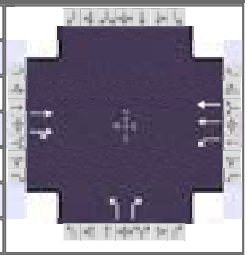
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	27.4	63.1	54.9	90.6		32.0		32.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	18.3		45.8			26.7		26.7
Green Extension Time (g_e), s	1.0	0.0	1.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		1.00			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	314	1223	849	582	786	339	582	0	1092	647	0	304
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1783		1674	1690		1652	1669	1396	1626	1643	1477
Queue Service Time (g_s), s	16.3	47.9		43.8	17.9		24.7	0.0	24.7	24.7	0.0	24.7
Cycle Queue Clearance Time (g_c), s	16.3	47.9		43.8	17.9		24.7	0.0	24.7	24.7	0.0	24.7
Green Ratio (*g/C*)	0.50	0.37		0.69	0.55		0.16	0.16	0.48	0.16	0.16	0.29
Capacity (*c*), veh/h	517	1306		592	1858		640	275	1307	631	271	439
Volume-to-Capacity Ratio (*X*)	0.608	0.936		0.983	0.423		0.909	0.000	0.836	1.024	0.000	0.693
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	8.9	20.9		14.3	8.0		18.6	0.0	25.0	22.8	0.0	16.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.66	0.00		1.14	0.00		1.87	0.00	1.46	2.33	0.00	0.32
Uniform Delay (d_1), s/veh	26.3	32.9		18.4	16.2		63.1	0.0	33.9	64.2	0.0	47.1
Incremental Delay (d_2), s/veh	0.1	1.7		7.2	0.1		17.2	0.0	5.1	42.1	0.0	5.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.4	34.6	0.0	25.6	16.2	0.0	80.3	0.0	38.9	106.4	0.0	52.3
Level of Service (LOS)	C	C	A	C	B	A	F		D	F		D
Approach Delay, s/veh / LOS	21.2	C		16.2	B		53.3	D		89.0	F	
Intersection Delay, s/veh / LOS	37.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.45	B	2.27	B	2.47	B	2.47	B
Bicycle LOS Score / LOS	2.67	C	2.41	B	3.25	C	2.06	B

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2050 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		985	60	30	1905		155		50			

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	124	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	103.5	15.3	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

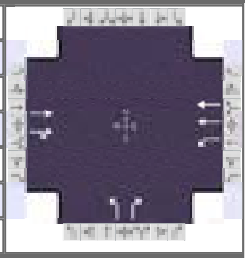
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		109.1		109.1		20.9		
Change Period, (*Y+R c*), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (*g s*), s						14.7		
Green Extension Time (*g e*), s		0.0		0.0		0.6		
Phase Call Probability						1.00		
Max Out Probability						0.51		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		574	562	28	1796		168		54			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1722	492	1674		1688		1502			
Queue Service Time (*g s*), s		15.8	12.9	0.7	10.4		12.7		4.3			
Cycle Queue Clearance Time (*g c*), s		15.8	12.9	17.4	10.4		12.7		4.3			
Green Ratio (*g/C*)		0.80	0.80	0.80	0.80		0.12		0.12			
Capacity (*c*), veh/h		1399	1371	387	2664		199		177			
Volume-to-Capacity Ratio (*X*)		0.410	0.410	0.073	0.674		0.847		0.307			
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)		7.5	7.4	0.2	2.9		10.6		3.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.06	0.00		2.24		0.00			
Uniform Delay (*d 1*), s/veh		4.0	4.0	2.8	1.0		56.2		52.5			
Incremental Delay (*d 2*), s/veh		0.9	0.9	0.3	1.0		18.1		1.4			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		4.9	4.9	3.1	2.0		74.3		53.9			
Level of Service (LOS)		A	A	A	A		E		D			
Approach Delay, s/veh / LOS	4.9	A		2.0	A		69.3	E		0.0		
Intersection Delay, s/veh / LOS	7.7						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	0.64	A	2.32	B	2.16	B
Bicycle LOS Score / LOS	1.42	A	2.22	B		F		

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2050 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		2060	105	65	1460		65		70			

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	10	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	130.4	8.4	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

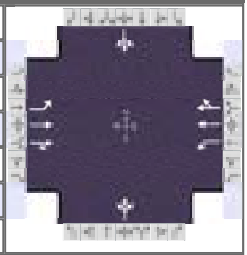
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		136.0		136.0		14.0		
Change Period, ($Y+R_c$), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (g_s), s						9.6		
Green Extension Time (g_e), s		0.0		0.0		0.0		
Phase Call Probability						1.00		
Max Out Probability						1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		1177	1177	61	1380		71		76			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1728	151	1674		1688		1502			
Queue Service Time (g_s), s		40.7	41.8	0.4	0.7		6.2		7.6			
Cycle Queue Clearance Time (g_c), s		40.7	41.8	78.8	0.7		6.2		7.6			
Green Ratio (*g/C*)		0.87	0.87	0.87	0.87		0.06		0.06			
Capacity (*c*), veh/h		1528	1502	137	2910		95		84			
Volume-to-Capacity Ratio (*X*)		0.770	0.783	0.448	0.474		0.748		0.905			
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)		16.1	16.6	2.5	0.4		6.2		8.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.65	0.00		1.32		0.00			
Uniform Delay (d_1), s/veh		3.9	4.0	12.7	0.1		69.8		70.4			
Incremental Delay (d_2), s/veh		3.8	4.2	6.3	0.3		29.2		68.2			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		7.7	8.2	19.0	0.4		99.0		138.6			
Level of Service (LOS)		A	A	B	A		F		F			
Approach Delay, s/veh / LOS	7.9	A		1.2	A		119.5	F		0.0		
Intersection Delay, s/veh / LOS	9.6						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.81	B	0.61	A	2.33	B	2.16	B
Bicycle LOS Score / LOS	2.43	B	1.86	B		F		

HCS Signalized Intersection Results Summary

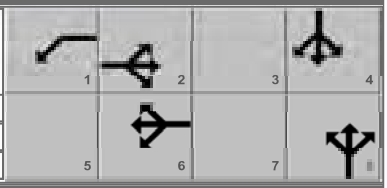
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2050 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	1045	10	55	1880	50	15	15	55	90	20	35

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	99	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.4	95.1	17.3	0.0	0.0	0.0	
Yellow	3.0	3.6	3.6	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



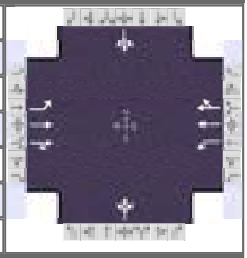
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		100.7	6.4	107.1		22.9		22.9
Change Period, (*Y+R c*), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		4.3		4.3
Queue Clearance Time (*g s*), s			2.9			9.0		16.8
Green Extension Time (*g e*), s		0.0	0.1	0.0		0.8		0.5
Phase Call Probability			0.85			1.00		1.00
Max Out Probability			0.00			0.00		0.26

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	16	556	554	52	910	908		92			158	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	255	1758	1752	1688	1772	1756		1606			1367	
Queue Service Time (*g s*), s	4.7	18.6	18.6	0.9	29.1	30.2		0.0			7.8	
Cycle Queue Clearance Time (*g c*), s	28.1	18.6	18.6	0.9	29.1	30.2		7.0			14.8	
Green Ratio (*g/C*)	0.73	0.73	0.73	0.77	0.78	0.78		0.13			0.13	
Capacity (*c*), veh/h	195	1286	1282	398	1384	1371		246			227	
Volume-to-Capacity Ratio (*X*)	0.081	0.432	0.432	0.130	0.657	0.662		0.375			0.696	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	11.6	11.6	0.5	13.6	14.1		5.1			9.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00	0.00	0.23	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	16.7	8.6	8.6	5.3	6.0	6.3		51.9			55.4	
Incremental Delay (*d 2*), s/veh	0.7	1.0	1.0	0.1	1.6	1.7		0.9			4.8	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	17.5	9.5	9.6	5.4	7.7	8.0		52.8			60.2	
Level of Service (LOS)	B	A	A	A	A	A		D			E	
Approach Delay, s/veh / LOS	9.7	A		7.8	A		52.8	D		60.2	E	
Intersection Delay, s/veh / LOS	12.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.63	B	1.62	B	2.31	B	2.31	B
Bicycle LOS Score / LOS	1.45	A	2.27	B	0.64	A	0.75	A

HCS Signalized Intersection Results Summary

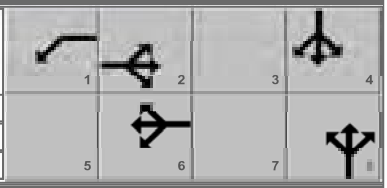
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2050	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2050 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	2115	20	180	1525	100	10	30	70	180	55	20

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	145	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	9.6	91.4	32.5	0.0	0.0	0.0
Yellow	3.5	3.5	3.5	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



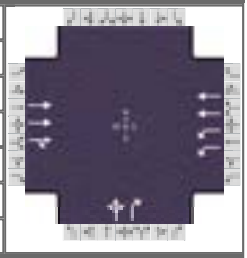
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		96.9	15.1	112.0		38.0		38.0
Change Period, (*Y+R c*), s		5.5	5.5	5.5		5.5		5.5
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		4.3		4.3
Queue Clearance Time (*g s*), s			11.7			11.6		34.5
Green Extension Time (*g e*), s		0.0	0.0	0.0		1.4		0.0
Phase Call Probability			1.00			1.00		1.00
Max Out Probability			1.00			0.01		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	32	1142	1142	167	758	747		120			277	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	346	1758	1752	1688	1772	1733		1650			1229	
Queue Service Time (*g s*), s	10.3	91.3	91.3	9.7	47.1	46.3		0.0			22.8	
Cycle Queue Clearance Time (*g c*), s	41.4	91.3	91.3	9.7	47.1	46.3		9.6			32.5	
Green Ratio (*g/C*)	0.61	0.61	0.61	0.69	0.71	0.71		0.22			0.22	
Capacity (*c*), veh/h	185	1070	1067	157	1258	1231		383			307	
Volume-to-Capacity Ratio (*X*)	0.173	1.066	1.070	1.061	0.603	0.607		0.312			0.903	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	1.6	61.9	62.3	14.4	28.2	27.0		7.0			19.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00	0.00	6.10	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	32.9	32.1	32.1	57.4	23.7	22.4		49.8			60.8	
Incremental Delay (*d 2*), s/veh	1.1	40.5	41.8	78.0	1.6	1.6		0.5			28.1	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	34.0	72.6	74.0	135.4	25.2	24.0		50.2			88.9	
Level of Service (LOS)	C	F	F	F	C	C		D			F	
Approach Delay, s/veh / LOS	72.8	E		35.7	D		50.2	D		88.9	F	
Intersection Delay, s/veh / LOS	59.0						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.65	B	2.31	B	2.31	B
Bicycle LOS Score / LOS	2.43	B	2.11	B	0.68	A	0.94	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2027 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		480	115	315	1455		150	0	415			

Signal Information			
Cycle, s	50.0	Reference Phase	6
Offset, s	4	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.4	12.5	12.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0

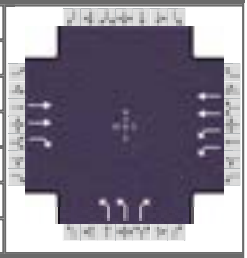
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		18.0	15.0	33.0		17.0		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (g_s), s			4.9			10.3		
Green Extension Time (g_e), s		0.0	0.2	0.0		0.1		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.01			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		342	161	342	1582			163	339			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1674	1509	1652	1672			1714	1457			
Queue Service Time (g_s), s		5.3	4.8	2.9	20.2			4.0	8.3			
Cycle Queue Clearance Time (g_c), s		5.3	4.8	2.9	20.2			4.0	8.3			
Green Ratio (*g/C*)		0.25	0.25	0.50	0.55			0.24	0.45			
Capacity (*c*), veh/h		837	377	1235	1840			415	653			
Volume-to-Capacity Ratio (*X*)		0.409	0.427	0.277	0.860			0.393	0.519			
Back of Queue (*Q*), ft/ln (95 th percentile)		82.6	75.8	35.5	205.1			62.9	96.9			
Back of Queue (*Q*), veh/ln (95 th percentile)		3.3	3.0	1.4	8.1			2.5	3.9			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.09	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		19.2	17.8	7.7	9.6			15.9	9.9			
Incremental Delay (d_2), s/veh		0.6	1.4	0.0	2.4			0.2	0.3			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		19.8	19.2	7.7	12.0			16.1	10.2			
Level of Service (LOS)		B	B	A	B			B	B			
Approach Delay, s/veh / LOS	19.6	B		11.2	B		12.1	B		0.0		
Intersection Delay, s/veh / LOS	12.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.24	B	1.35	A	2.59	C	2.29	B
Bicycle LOS Score / LOS	0.84	A	2.07	B	1.32	A		

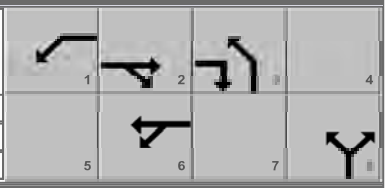
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2027 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		385	85	900	705		155		210			

Signal Information			
Cycle, s	50.0	Reference Phase	6
Offset, s	36	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	16.5	12.5	5.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0

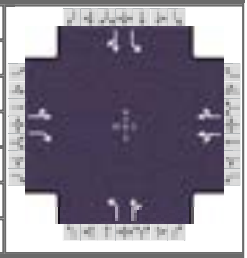
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		18.0	22.0	40.0		10.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.3		
Queue Clearance Time (*g s*), s			9.7			7.1		
Green Extension Time (*g e*), s		0.0	0.9	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.04			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		352	78	978	766		168		228			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1594	1410	1639	1616		1626					
Queue Service Time (*g s*), s		4.6	1.9	7.7	5.8		2.5					
Cycle Queue Clearance Time (*g c*), s		4.6	1.9	7.7	5.8		2.5					
Green Ratio (*g/C*)		0.25	0.35	0.62	0.69		0.10					
Capacity (*c*), veh/h		797	497	1693	2229		332					
Volume-to-Capacity Ratio (*X*)		0.441	0.156	0.578	0.344		0.508					
Back of Queue (*Q*), ft/ln (95 th percentile)		76.6	27	52.7	46.5		40.3					
Back of Queue (*Q*), veh/ln (95 th percentile)		3.0	1.1	2.1	1.8		1.6					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.27	0.26	0.00		0.27					
Uniform Delay (*d 1*), s/veh		15.8	11.1	4.4	4.1		21.3					
Incremental Delay (*d 2*), s/veh		1.7	0.7	0.2	0.2		0.5					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		17.5	11.8	4.5	4.3		21.8		0.0			
Level of Service (LOS)		B	B	A	A		C		A			
Approach Delay, s/veh / LOS	16.5	B		4.4	A		9.3	A		0.0		
Intersection Delay, s/veh / LOS	7.2						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.26	B	0.63	A	2.45	B	2.29	B
Bicycle LOS Score / LOS	0.91	A	1.93	B		F		

HCS7 Signalized Intersection Results Summary

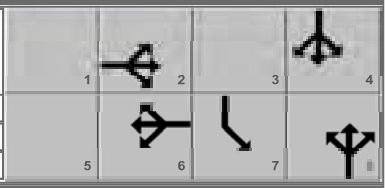
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2027 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	25	160	185	35	670	200	185	225	35	90	20	200

Signal Information			
Cycle, s	65.0	Reference Phase	6
Offset, s	64	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	29.7	4.0	15.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



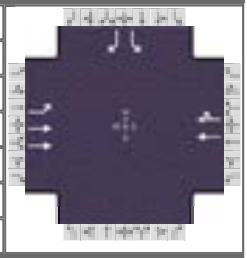
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		35.7		35.7		21.3	8.0	29.3
Change Period, ($Y+R_c$), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.7	6.0	5.7
Queue Clearance Time (g_s), s						13.9	4.9	10.8
Green Extension Time (g_e), s		0.0		0.0		1.4	0.0	4.3
Phase Call Probability						1.00	0.83	1.00
Max Out Probability						1.00	1.00	0.28

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		201	201	530		453	201	283		98	239	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1135	1370	1569		1315	1114	1616		1594	1371	
Queue Service Time (g_s), s		2.3	4.5	0.0		18.6	11.1	10.5		2.9	8.8	
Cycle Queue Clearance Time (g_c), s		20.7	4.5	17.7		18.6	11.9	10.5		2.9	8.8	
Green Ratio (*g/C*)		0.46	0.46	0.46		0.46	0.24	0.24		0.33	0.36	
Capacity (*c*), veh/h		581	625	775		600	360	382		286	493	
Volume-to-Capacity Ratio (*X*)		0.346	0.322	0.684		0.756	0.558	0.741		0.342	0.485	
Back of Queue (*Q*), ft/ln (95 th percentile)		49.8	60.7	262.5		253.2	141.9	210.9		48.8	117.1	
Back of Queue (*Q*), veh/ln (95 th percentile)		1.9	2.3	10.5		10.1	5.5	8.1		1.8	4.4	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	0.60	0.00		0.24	0.00	
Uniform Delay (d_1), s/veh		6.6	7.6	14.4		14.4	23.9	23.0		16.9	16.2	
Incremental Delay (d_2), s/veh		1.5	1.3	4.9		8.6	3.0	8.1		1.5	0.7	
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		8.1	8.9	19.2		23.1	26.9	31.1		18.5	16.9	
Level of Service (LOS)		A	A	B		C	C	C		B	B	
Approach Delay, s/veh / LOS	8.5	A		21.0	C		29.3	C		17.4	B	
Intersection Delay, s/veh / LOS	20.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.89	B	1.92	B	2.09	B
Bicycle LOS Score / LOS	1.15	A	1.30	A	1.29	A	1.04	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2027 AMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	235			695	360				135		80

Signal Information			
Cycle, s	65.0	Reference Phase	6
Offset, s	12	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.5	35.7	7.8	0.0	0.0	0.0
Yellow	3.0	5.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

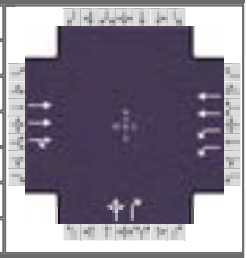
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	8.5	51.2		42.7				13.8
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	3.9							7.6
Green Extension Time (*g e*), s	0.1	0.0		0.0				0.3
Phase Call Probability	0.88							0.99
Max Out Probability	1.00							1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	120	255			565	500				147		87
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1555			1668	1467				1634		1369
Queue Service Time (*g s*), s	1.9	1.9			17.5	16.0				5.6		3.9
Cycle Queue Clearance Time (*g c*), s	1.9	1.9			17.5	16.0				5.6		3.9
Green Ratio (*g/C*)	0.63	0.68			0.55	0.55				0.12		0.12
Capacity (*c*), veh/h	345	2116			915	805				196		164
Volume-to-Capacity Ratio (*X*)	0.346	0.121			0.617	0.621				0.750		0.531
Back of Queue (*Q*), ft/ln (95 th percentile)	23.5	18.9			116.7	138.5				114.9		61.6
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	0.7			4.4	5.5				4.4		2.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00			0.00	0.00				0.36		0.00
Uniform Delay (*d 1*), s/veh	8.5	3.6			8.3	11.2				27.7		26.9
Incremental Delay (*d 2*), s/veh	0.6	0.1			0.3	0.3				6.9		2.6
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	9.1	3.7			8.6	11.6				34.5		29.5
Level of Service (LOS)	A	A			A	B				C		C
Approach Delay, s/veh / LOS	5.4	A		10.0	A		0.0			32.7	C	
Intersection Delay, s/veh / LOS	12.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.87	B	2.13	B	2.30	B
Bicycle LOS Score / LOS	0.80	A	1.43	A				F

HCS7 Signalized Intersection Results Summary

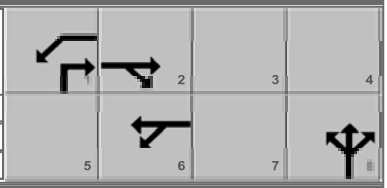
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2027 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1065	105	100	1055		65	0	805			

Signal Information			
Cycle, s	50.4	Reference Phase	2
Offset, s	48	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	9.0	17.4	9.0	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



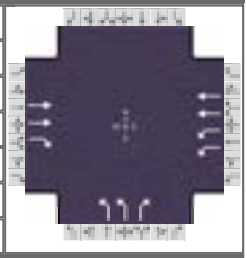
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		8.3	1.0	4.0		11.0		
Phase Duration, s		22.9	13.6	36.5		13.9		
Change Period, ($Y+R_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		3.1	2.2	3.1		2.4		
Queue Clearance Time (g_s), s		13.0	2.7	12.3		11.0		
Green Extension Time (g_e), s		1.8	0.0	5.3		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		1.00	0.00	0.08		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		538	259	109	1147			71	658			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1685	1604	1652	1649			1714	1488			
Queue Service Time (g_s), s		11.0	6.3	0.7	10.3			1.8	9.0			
Cycle Queue Clearance Time (g_c), s		11.0	6.3	0.7	10.3			1.8	9.0			
Green Ratio (*g/C*)		0.35	0.35	0.56	0.62			0.18	0.36			
Capacity (*c*), veh/h		1163	554	1050	2029			306	522			
Volume-to-Capacity Ratio (*X*)		0.462	0.467	0.103	0.565			0.231	1.260			
Back of Queue (*Q*), ft/ln (95 th percentile)		69	65.7	8.2	102.5			29.1	895.6			
Back of Queue (*Q*), veh/ln (95 th percentile)		2.7	2.6	0.3	4.1			1.2	35.8			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.02	0.00			0.00	0.00			
Uniform Delay (d_1), s/veh		12.9	12.9	6.8	5.7			17.7	16.1			
Incremental Delay (d_2), s/veh		0.0	0.0	0.0	0.2			0.1	131.9			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0	0.0			
Control Delay (*d*), s/veh		12.9	12.9	6.8	5.9			17.9	148.0			
Level of Service (LOS)		B	B	A	A			B	F			
Approach Delay, s/veh / LOS	12.9	B		6.0	A		135.4	F		0.0		
Intersection Delay, s/veh / LOS	41.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.37	B	1.33	A	2.59	C	2.29	B
Bicycle LOS Score / LOS	1.19	A	1.52	B	1.69	B		

HCS7 Signalized Intersection Results Summary

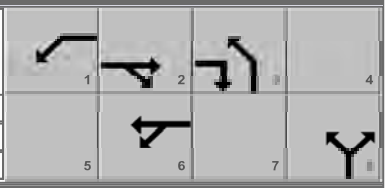
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Jul 29, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	26TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2027 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		590	95	640	480		150		580			

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	97	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	45.5	28.5	10.1	0.0	0.0	0.0	
Yellow	3.6	3.6	3.6	0.0	0.0	0.0	
Red	1.9	1.9	1.3	0.0	0.0	0.0	



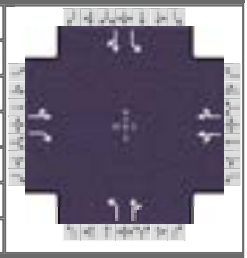
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		34.0	51.0	85.0		15.0		
Change Period, (*Y+R c*), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	2.2	0.0		2.4		
Queue Clearance Time (*g s*), s			8.5			12.1		
Green Extension Time (*g e*), s		0.0	0.8	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.00			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		646	104	696	522		163		630			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1643	1422	1639	1630		1626					
Queue Service Time (*g s*), s		17.5	4.8	6.5	3.9		4.7					
Cycle Queue Clearance Time (*g c*), s		17.5	4.8	6.5	3.9		4.7					
Green Ratio (*g/C*)		0.28	0.39	0.76	0.80		0.10					
Capacity (*c*), veh/h		937	549	1808	2592		328					
Volume-to-Capacity Ratio (*X*)		0.690	0.189	0.385	0.201		0.497					
Back of Queue (*Q*), ft/ln (95 th percentile)		282.5	76.7	76	42.1		88.1					
Back of Queue (*Q*), veh/ln (95 th percentile)		11.1	3.0	3.0	1.7		3.4					
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.77	0.38	0.00		0.59					
Uniform Delay (*d 1*), s/veh		31.8	20.3	6.9	2.5		42.5					
Incremental Delay (*d 2*), s/veh		3.2	0.6	0.0	0.1		0.4					
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0					
Control Delay (*d*), s/veh		35.0	20.9	7.0	2.6		43.0		0.0			
Level of Service (LOS)		D	C	A	A		D		A			
Approach Delay, s/veh / LOS	33.1	C		5.1	A		8.8	A		0.0		
Intersection Delay, s/veh / LOS	13.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	0.63	A	2.47	B	2.32	B
Bicycle LOS Score / LOS	1.10	A	1.49	A		F		

HCS7 Signalized Intersection Results Summary

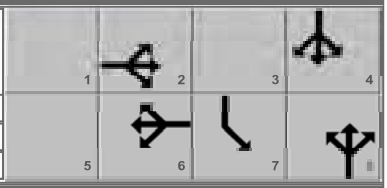
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 NB	File Name	2027 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75	515	585	60	355	105	145	115	40	335	30	110

Signal Information			
Cycle, s	75.0	Reference Phase	2
Offset, s	72	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	38.0	10.0	11.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	0.0	2.0	0.0	0.0	0.0



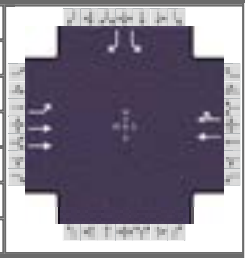
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8	7	4
Case Number		7.0		8.0		6.3	1.0	4.0
Phase Duration, s		44.0		44.0		17.0	14.0	31.0
Change Period, (*Y+R c*), s		6.0		6.0		6.0	4.0	6.0
Max Allow Headway (*MAH*), s		0.0		0.0		5.7	6.0	5.7
Queue Clearance Time (*g s*), s						11.6	12.0	8.1
Green Extension Time (*g e*), s		0.0		0.0		0.0	0.0	3.0
Phase Call Probability						1.00	1.00	1.00
Max Out Probability						1.00	1.00	0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h		641	636	256		310	158	168		364	152	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1464	1434	1072		1329	1206	1570		1594	1390	
Queue Service Time (*g s*), s		16.4	29.2	0.0		11.2	9.6	7.7		10.0	6.1	
Cycle Queue Clearance Time (*g c*), s		28.5	29.2	8.8		11.2	9.6	7.7		10.0	6.1	
Green Ratio (*g/C*)		0.51	0.51	0.51		0.51	0.15	0.15		0.31	0.33	
Capacity (*c*), veh/h		796	727	604		673	273	230		359	463	
Volume-to-Capacity Ratio (*X*)		0.806	0.875	0.423		0.460	0.578	0.732		1.014	0.328	
Back of Queue (*Q*), ft/ln (95 th percentile)		299.5	377.8	114.7		149.1	143.5	172.2		301	87.4	
Back of Queue (*Q*), veh/ln (95 th percentile)		11.3	14.3	4.6		6.0	5.5	6.6		11.2	3.3	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00		0.00	0.61	0.00		1.50	0.00	
Uniform Delay (*d 1*), s/veh		12.3	15.7	11.0		11.8	31.4	30.6		26.6	18.7	
Incremental Delay (*d 2*), s/veh		6.5	10.8	2.2		2.3	4.8	13.6		51.0	0.4	
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh		18.7	26.4	13.2		14.0	36.2	44.2		77.6	19.1	
Level of Service (LOS)		B	C	B		B	D	D		F	B	
Approach Delay, s/veh / LOS	22.6	C		13.6	B		40.4	D		60.4	E	
Intersection Delay, s/veh / LOS	30.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.89	B	1.93	B	2.10	B
Bicycle LOS Score / LOS	2.59	C	0.95	A	1.03	A	1.34	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	RL	Analysis Date	Nov 30, 2020	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	RICE STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229 SB	File Name	2027 PMpeak.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	190	790			420	190				385		80

Signal Information					Green	Yellow	Red
Cycle, s	75.0	Reference Phase	2		7.7	3.0	2.0
Offset, s	11	Reference Point	Begin		27.8	5.0	2.0
Uncoordinated	No	Simult. Gap E/W	On		21.5	4.0	2.0
Force Mode	Fixed	Simult. Gap N/S	On		0.0	0.0	0.0
					0.0	0.0	0.0
					0.0	0.0	0.0

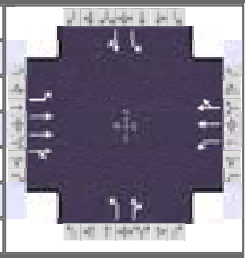
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	12.7	47.5		34.8				27.5
Change Period, (*Y+R c*), s	5.0	7.0		7.0				6.0
Max Allow Headway (*MAH*), s	4.1	0.0		0.0				4.2
Queue Clearance Time (*g s*), s	7.4							20.4
Green Extension Time (*g e*), s	0.4	0.0		0.0				1.1
Phase Call Probability	0.99							1.00
Max Out Probability	0.07							0.40

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	207	859			519	464				418		87
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1647	1604			1673	1487				1634		1370
Queue Service Time (*g s*), s	5.4	12.6			13.8	21.0				18.4		3.6
Cycle Queue Clearance Time (*g c*), s	5.4	12.6			13.8	21.0				18.4		3.6
Green Ratio (*g/C*)	0.50	0.54			0.37	0.37				0.29		0.29
Capacity (*c*), veh/h	315	1730			619	550				470		394
Volume-to-Capacity Ratio (*X*)	0.655	0.496			0.839	0.843				0.891		0.221
Back of Queue (*Q*), ft/ln (95 th percentile)	90	189.5			197	189.2				343.3		52.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.5	7.3			7.5	7.6				13.1		2.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.90	0.00			0.00	0.00				1.07		0.00
Uniform Delay (*d 1*), s/veh	15.8	10.9			17.7	19.6				25.6		20.3
Incremental Delay (*d 2*), s/veh	2.3	1.0			1.3	1.5				13.5		0.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	18.1	11.9			19.1	21.2				39.1		20.6
Level of Service (LOS)	B	B			B	C				D		C
Approach Delay, s/veh / LOS	13.1	B		20.1	C		0.0			35.9	D	
Intersection Delay, s/veh / LOS	20.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.68	A	1.91	B	2.14	B	2.31	B
Bicycle LOS Score / LOS	1.37	A	1.03	A				F

HCS Signalized Intersection Results Summary

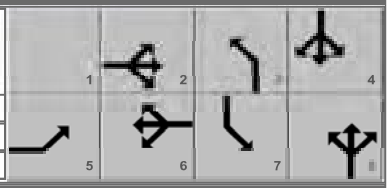
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2027 AMpeak Build IMJR - 2 EB Clev.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	690	95	20	1185	60	205	220	20	55	110	210

Signal Information			
Cycle, s	80.0	Reference Phase	6
Offset, s	9	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	36.2	3.7	0.3	14.6	0.0	
Yellow	3.0	3.6	3.0	3.0	3.6	0.0	
Red	0.0	2.0	0.0	0.0	2.0	0.0	



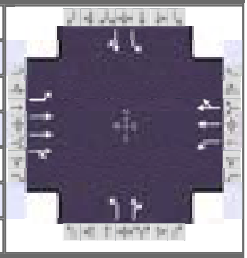
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	4.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	8.0	49.8		41.8	10.0	23.5	6.7	20.2
Change Period, ($Y+R_c$), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (g_s), s	6.4				9.0	12.9	4.2	16.6
Green Extension Time (g_e), s	0.0	0.0		0.0	0.0	1.2	0.0	0.0
Phase Call Probability	0.97				0.99	1.00	0.74	1.00
Max Out Probability	1.00				1.00	0.78	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	163	542	257	22	692	682	223	261		60	348	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1758	1646	670	1744	1714	1688	1746		1701	1597	
Queue Service Time (g_s), s	4.4	2.6	2.2	0.8	24.7	24.8	7.0	10.9		2.2	14.6	
Cycle Queue Clearance Time (g_c), s	4.4	2.6	2.2	0.8	24.7	24.8	7.0	10.9		2.2	14.6	
Green Ratio (*g/C*)	0.54	0.55	0.55	0.45	0.45	0.45	0.29	0.22		0.23	0.18	
Capacity (*c*), veh/h	250	1942	910	393	789	776	238	391		239	292	
Volume-to-Capacity Ratio (*X*)	0.650	0.279	0.283	0.056	0.877	0.880	0.938	0.667		0.250	1.193	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	1.5	1.3	0.2	10.6	10.5	10.0	8.5		1.6	22.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.50	0.00	0.00	0.05	0.00	0.00	2.55	0.00		0.52	0.00	
Uniform Delay (d_1), s/veh	13.9	3.1	2.5	6.2	10.3	10.2	26.7	28.3		25.3	32.7	
Incremental Delay (d_2), s/veh	5.2	0.3	0.7	0.2	10.5	10.9	41.5	4.3		0.5	115.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	19.1	3.5	3.2	6.4	20.8	21.0	68.1	32.6		25.8	148.3	
Level of Service (LOS)	B	A	A	A	C	C	E	C		C	F	
Approach Delay, s/veh / LOS	6.0	A		20.7	C		49.0	D		130.3	F	
Intersection Delay, s/veh / LOS	34.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.90	B	2.44	B	2.44	B
Bicycle LOS Score / LOS	1.05	A	1.62	B	1.29	A	1.16	A

HCS Signalized Intersection Results Summary

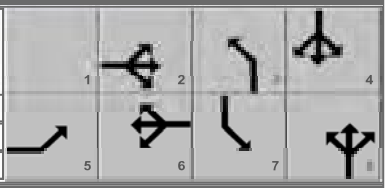
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	CLEVELAND AVENUE	File Name	2027 PMpeak Build IMJR - 2 EB Clev.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	235	1325	300	20	955	90	175	210	50	145	210	160

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	9	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.9	39.5	5.0	1.0	23.4	0.0
Yellow	3.0	3.6	3.0	3.0	3.6	0.0
Red	0.0	2.0	0.0	0.0	2.0	0.0



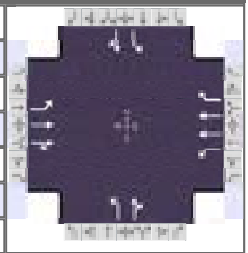
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6	3	8	7	4
Case Number	1.0	4.0		6.3	1.1	4.0	1.1	4.0
Phase Duration, s	13.9	59.0		45.1	12.0	33.0	8.0	29.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6	3.0	5.6	3.0	5.6
Max Allow Headway (*MAH*), s	4.2	0.0		0.0	4.2	4.2	4.2	4.2
Queue Clearance Time (*g s*), s	10.8				10.3	16.3	7.0	25.4
Green Extension Time (*g e*), s	0.1	0.0		0.0	0.0	2.2	0.0	0.0
Phase Call Probability	1.00				0.99	1.00	0.99	1.00
Max Out Probability	1.00				1.00	0.15	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	265	1260	573	22	579	562	190	283		158	402	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1758	1589	250	1744	1691	1688	1713		1701	1657	
Queue Service Time (*g s*), s	8.8	24.0	28.5	5.4	28.3	28.2	8.3	14.3		5.0	23.4	
Cycle Queue Clearance Time (*g c*), s	8.8	24.0	28.5	21.0	28.3	28.2	8.3	14.3		5.0	23.4	
Green Ratio (*g/C*)	0.52	0.53	0.53	0.39	0.39	0.39	0.34	0.27		0.28	0.23	
Capacity (*c*), veh/h	309	1877	849	134	689	668	224	469		279	388	
Volume-to-Capacity Ratio (*X*)	0.857	0.671	0.675	0.163	0.841	0.842	0.850	0.602		0.564	1.037	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	6.1	11.5	14.3	0.8	17.1	16.6	8.5	10.2		2.6	22.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.16	0.00	0.00	0.18	0.00	0.00	2.15	0.00		0.83	0.00	
Uniform Delay (*d 1*), s/veh	21.7	14.1	20.6	23.1	21.2	20.8	27.5	31.6		32.6	38.3	
Incremental Delay (*d 2*), s/veh	8.2	0.7	1.7	2.3	10.7	11.0	25.3	2.2		2.6	55.7	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	29.9	14.9	22.3	25.4	31.9	31.8	52.8	33.7		35.2	94.0	
Level of Service (LOS)	C	B	C	C	C	C	D	C		D	F	
Approach Delay, s/veh / LOS	18.8	B		31.8	C		41.4	D		77.4	E	
Intersection Delay, s/veh / LOS	32.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.91	B	2.44	B	2.45	B
Bicycle LOS Score / LOS	1.60	B	1.44	A	1.27	A	1.41	A

HCS Signalized Intersection Results Summary

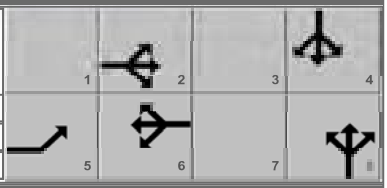
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2027 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	660	15	10	1210	70	10	5	5	30	5	65

Signal Information			
Cycle, s	80.0	Reference Phase	6
Offset, s	68	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.4	52.0	9.4	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



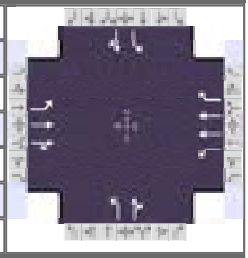
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	7.4	65.0		57.6		15.0		15.0
Change Period, (*Y+R c*), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (*g s*), s	3.3					6.3		5.7
Green Extension Time (*g e*), s	0.0	0.0		0.0		0.2		0.2
Phase Call Probability	0.87					0.94		0.94
Max Out Probability	0.05					1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	92	347	344	11	1315	76	11	11		33	76	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1730	734	1647	1466	1323	1626		1415	1530	
Queue Service Time (*g s*), s	1.3	7.0	7.0	0.4	18.6	1.5	0.6	0.5		1.7	3.7	
Cycle Queue Clearance Time (*g c*), s	1.3	7.0	7.0	0.4	18.6	1.5	4.3	0.5		2.2	3.7	
Green Ratio (*g/C*)	0.73	0.74	0.74	0.65	0.65	0.65	0.12	0.12		0.12	0.12	
Capacity (*c*), veh/h	352	1294	1283	567	2141	953	185	192		249	181	
Volume-to-Capacity Ratio (*X*)	0.262	0.268	0.268	0.019	0.614	0.080	0.059	0.057		0.131	0.421	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	0.6	3.8	3.8	0.1	9.7	0.8	0.4	0.3		1.0	2.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.16	0.00	0.00	0.03	0.00	0.16	0.18	0.00		0.31	0.00	
Uniform Delay (*d 1*), s/veh	6.4	5.0	5.0	5.0	8.2	5.2	34.7	31.3		32.3	32.7	
Incremental Delay (*d 2*), s/veh	0.1	0.5	0.5	0.1	1.3	0.2	0.1	0.1		0.3	1.9	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	6.5	5.5	5.5	5.0	9.5	5.3	34.9	31.4		32.6	34.6	
Level of Service (LOS)	A	A	A	A	A	A	C	C		C	C	
Approach Delay, s/veh / LOS	5.6	A		9.2	A		33.2	C		34.0	C	
Intersection Delay, s/veh / LOS	9.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	1.86	B	2.45	B	2.30	B
Bicycle LOS Score / LOS	1.17	A	1.64	B	0.52	A	0.67	A

HCS Signalized Intersection Results Summary

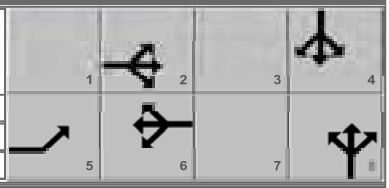
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	HY-VEE DRIVEWAY	File Name	2027 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	1335	45	15	950	65	30	10	20	100	5	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	11	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	68.6	12.2	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



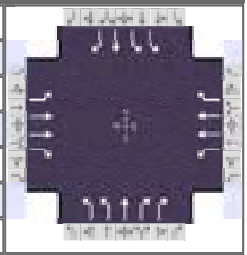
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		6.0		6.0
Phase Duration, s	8.0	82.2		74.2		17.8		17.8
Change Period, ($Y+R_c$), s	3.0	5.6		5.6		5.6		5.6
Max Allow Headway (*MAH*), s	2.2	0.0		0.0		4.7		4.7
Queue Clearance Time (g_s), s	4.8					10.8		11.4
Green Extension Time (g_e), s	0.1	0.0		0.0		0.8		0.7
Phase Call Probability	0.99					1.00		1.00
Max Out Probability	0.00					0.15		0.20

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	177	767	761	16	1033	71	33	33		109	103	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1661	1744	1724	332	1647	1466	1291	1582		1387	1526	
Queue Service Time (g_s), s	2.8	9.9	9.8	1.7	14.3	1.6	2.4	1.8		7.6	6.4	
Cycle Queue Clearance Time (g_c), s	2.8	9.9	9.8	3.7	14.3	1.6	8.8	1.8		9.4	6.4	
Green Ratio (*g/C*)	0.76	0.77	0.77	0.69	0.69	0.69	0.12	0.12		0.12	0.12	
Capacity (*c*), veh/h	446	1336	1320	293	2260	1006	148	193		216	186	
Volume-to-Capacity Ratio (*X*)	0.397	0.575	0.577	0.056	0.457	0.070	0.221	0.169		0.503	0.554	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	3.6	3.5	0.2	8.1	0.8	1.5	1.3		4.9	4.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.38	0.00	0.00	0.07	0.00	0.18	0.74	0.00		1.46	0.00	
Uniform Delay (d_1), s/veh	5.6	1.8	1.8	5.8	7.2	5.2	45.5	39.3		43.6	41.3	
Incremental Delay (d_2), s/veh	0.1	0.9	0.9	0.4	0.7	0.1	0.7	0.4		2.2	3.1	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	5.7	2.7	2.7	6.2	7.8	5.3	46.2	39.8		45.7	44.4	
Level of Service (LOS)	A	A	A	A	A	A	D	D		D	D	
Approach Delay, s/veh / LOS	3.0	A		7.7	A		43.0	D		45.1	D	
Intersection Delay, s/veh / LOS	8.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.84	B	1.86	B	2.46	B	2.30	B
Bicycle LOS Score / LOS	1.87	B	1.41	A	0.60	A	0.84	A

HCS Signalized Intersection Results Summary

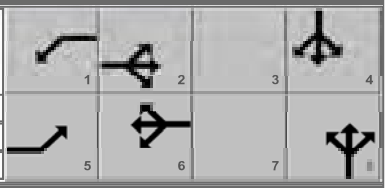
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229	File Name	2027 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115	490	310	350	755	495	320	0	305	180	0	270

Signal Information			
Cycle, s	80.0	Reference Phase	6
Offset, s	58	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.6	1.5	26.6	15.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	4.5	4.5	4.5	3.7	0.0	0.0



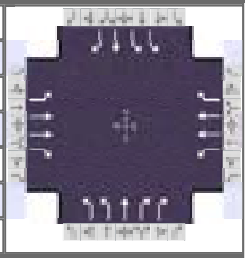
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	12.7	34.7	22.3	44.3		23.0		23.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	5.1		13.6			11.6		17.7
Green Extension Time (g_e), s	0.0	0.0	0.6	0.0		2.6		0.0
Phase Call Probability	0.90		1.00			1.00		1.00
Max Out Probability	1.00		0.96			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	102	435	275	377	813	533	348	0	332	196	0	293
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1612		1674	1631		1652	1669	1273	1626	1643	1435
Queue Service Time (g_s), s	3.1	8.4		11.6	15.8		7.3	0.0	9.6	4.0	0.0	15.7
Cycle Queue Clearance Time (g_c), s	3.1	8.4		11.6	15.8		7.3	0.0	9.6	4.0	0.0	15.7
Green Ratio (*g/C*)	0.39	0.33		0.54	0.45		0.20	0.20	0.20	0.20	0.20	0.20
Capacity (*c*), veh/h	342	1071		602	1475		828	328	500	818	322	282
Volume-to-Capacity Ratio (*X*)	0.298	0.406		0.626	0.551		0.420	0.000	0.663	0.239	0.000	1.042
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	2.1	5.8		4.3	8.1		5.3	0.0	5.6	2.8	0.0	15.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.16	0.00		0.35	0.00		0.54	0.00	0.33	0.40	0.00	0.32
Uniform Delay (d_1), s/veh	15.8	21.0		10.3	18.8		28.8	0.0	29.7	27.4	0.0	32.2
Incremental Delay (d_2), s/veh	0.5	1.1		0.4	0.4		0.5	0.0	3.7	0.2	0.0	65.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.3	22.1	0.0	10.6	19.2	0.0	29.3	0.0	33.4	27.7	0.0	97.2
Level of Service (LOS)	B	C	A	B	B	A	C		C	C		F
Approach Delay, s/veh / LOS	13.9	B		11.4	B		31.3	C		69.4	E	
Intersection Delay, s/veh / LOS	23.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.26	B	2.44	B	2.44	B
Bicycle LOS Score / LOS	1.31	A	1.92	B	1.61	B	1.29	A

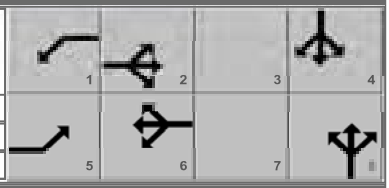
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	I-229	File Name	2027 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	225	920	485	365	655	270	275	0	520	465	0	220

Signal Information										
Cycle, s	100.0	Reference Phase	2							
Offset, s	64	Reference Point	Begin							
Uncoordinated	No	Simult. Gap E/W	On	Green	11.0	6.2	40.6	18.7	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.6	0.0	3.6	3.6	0.0	0.0
				Red	4.5	0.0	4.5	3.7	0.0	0.0



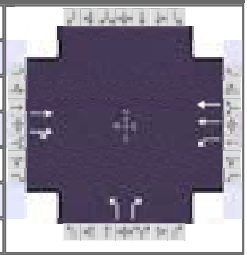
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	1.1	3.0	1.1	3.0		5.0		5.0
Phase Duration, s	19.1	48.7	25.3	54.9		26.0		26.0
Change Period, ($Y+R_c$), s	8.1	8.1	8.1	8.1		7.3		7.3
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (g_s), s	10.7		16.4			20.7		18.2
Green Extension Time (g_e), s	0.3	0.0	0.8	0.0		0.0		0.4
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		0.56			1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	271	1107	583	396	711	293	299	0	565	505	0	239
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1688	1695		1674	1637		1652	1669	1298	1626	1643	1436
Queue Service Time (g_s), s	8.7	25.5		14.4	12.6		7.8	0.0	18.7	14.5	0.0	16.2
Cycle Queue Clearance Time (g_c), s	8.7	25.5		14.4	12.6		7.8	0.0	18.7	14.5	0.0	16.2
Green Ratio (*g/C*)	0.52	0.41		0.58	0.47		0.19	0.19	0.19	0.19	0.19	0.19
Capacity (*c*), veh/h	496	1377		436	1532		762	312	485	752	307	268
Volume-to-Capacity Ratio (*X*)	0.546	0.804		0.909	0.464		0.392	0.000	1.164	0.672	0.000	0.891
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	6.4	11.6		6.8	6.2		5.9	0.0	19.3	10.2	0.0	12.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.48	0.00		0.55	0.00		0.60	0.00	1.13	1.45	0.00	0.25
Uniform Delay (d_1), s/veh	16.2	17.5		15.6	13.9		36.2	0.0	40.7	38.9	0.0	39.7
Incremental Delay (d_2), s/veh	0.5	2.9		8.3	0.4		0.5	0.0	94.5	2.6	0.0	29.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.7	20.3	0.0	23.8	14.3	0.0	36.7	0.0	135.1	41.6	0.0	68.8
Level of Service (LOS)	B	C	A	C	B	A	D		F	D		E
Approach Delay, s/veh / LOS	13.8	B		14.0	B		101.1	F		50.3	D	
Intersection Delay, s/veh / LOS	34.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.26	B	2.45	B	2.45	B
Bicycle LOS Score / LOS	1.95	B	1.64	B	1.91	B	1.72	B

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2027 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		620	45	20	1415		115		40			

Signal Information			
Cycle, s	80.0	Reference Phase	6
Offset, s	71	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	60.8	8.0	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

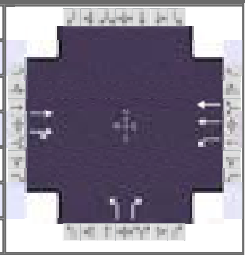
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		66.4		66.4		13.6		
Change Period, (*Y+R c*), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (*g s*), s						7.8		
Green Extension Time (*g e*), s		0.0		0.0		0.4		
Phase Call Probability						0.98		
Max Out Probability						0.47		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		366	357	20	1391		125		43			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1716	725	1674		1688		1502			
Queue Service Time (*g s*), s		6.7	5.0	0.6	11.4		5.8		2.1			
Cycle Queue Clearance Time (*g c*), s		6.7	5.0	7.3	11.4		5.8		2.1			
Green Ratio (*g/C*)		0.76	0.76	0.76	0.76		0.10		0.10			
Capacity (*c*), veh/h		1336	1304	580	2544		168		150			
Volume-to-Capacity Ratio (*X*)		0.274	0.274	0.034	0.547		0.742		0.290			
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)		2.4	2.3	0.1	4.1		4.9		1.5			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.04	0.00		1.04		0.00			
Uniform Delay (*d 1*), s/veh		2.9	2.9	3.5	2.9		35.0		33.4			
Incremental Delay (*d 2*), s/veh		0.5	0.5	0.1	0.7		8.8		1.5			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		3.4	3.4	3.6	3.6		43.8		34.9			
Level of Service (LOS)		A	A	A	A		D		C			
Approach Delay, s/veh / LOS	3.4	A		3.6	A		41.5	D		0.0		
Intersection Delay, s/veh / LOS	6.3						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.83	B	0.63	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	1.08	A	1.77	B		F		

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	JESSICA AVENUE	File Name	2027 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1620	80	50	870		45		45			

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	4	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	82.3	6.5	0.0	0.0	0.0	0.0	
Yellow	3.6	3.6	0.0	0.0	0.0	0.0	
Red	2.0	2.0	0.0	0.0	0.0	0.0	

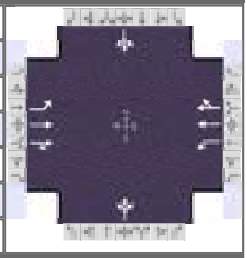
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		87.9		87.9		12.1		
Change Period, ($Y+R_c$), s		5.6		5.6		5.6		
Max Allow Headway (*MAH*), s		0.0		0.0		5.3		
Queue Clearance Time (g_s), s						5.1		
Green Extension Time (g_e), s		0.0		0.0		0.1		
Phase Call Probability						0.93		
Max Out Probability						1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		925	922	57	992		49		49			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1758	1729	248	1590		1688		1502			
Queue Service Time (g_s), s		21.2	20.3	13.7	9.4		2.8		3.1			
Cycle Queue Clearance Time (g_c), s		21.2	20.3	33.4	9.4		2.8		3.1			
Green Ratio (*g/C*)		0.82	0.82	0.82	0.82		0.07		0.07			
Capacity (*c*), veh/h		1446	1422	223	2616		110		98			
Volume-to-Capacity Ratio (*X*)		0.640	0.649	0.255	0.379		0.443		0.498			
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)		8.5	8.6	1.4	3.7		2.3		2.4			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.37	0.00		0.49		0.00			
Uniform Delay (d_1), s/veh		3.3	3.4	11.1	2.9		45.0		45.1			
Incremental Delay (d_2), s/veh		2.2	2.3	2.5	0.4		3.9		5.5			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		5.5	5.7	13.5	3.2		48.9		50.6			
Level of Service (LOS)		A	A	B	A		D		D			
Approach Delay, s/veh / LOS	5.6	A		3.8	A		49.8	D		0.0		
Intersection Delay, s/veh / LOS	6.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.82	B	0.62	A	2.31	B	2.15	B
Bicycle LOS Score / LOS	2.01	B	1.31	A		F		

HCS Signalized Intersection Results Summary

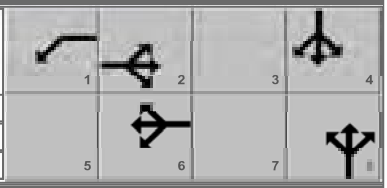
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	AM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2027 AMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	695	10	35	1285	30	10	10	40	65	15	25

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	48	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	2.3	55.1	8.5	0.0	0.0	0.0
Yellow	3.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0



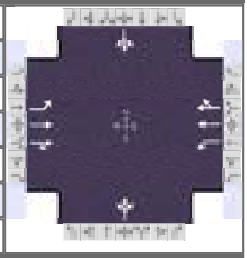
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		60.7	5.3	65.9		14.1		14.1
Change Period, (*Y+R c*), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (*g s*), s			2.5			5.1		8.0
Green Extension Time (*g e*), s		0.0	0.1	0.0		0.8		0.7
Phase Call Probability			0.56			0.98		0.98
Max Out Probability			0.00			0.01		0.04

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	10	355	353	37	705	700		65			114	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	380	1758	1749	1688	1772	1757		1587			1469	
Queue Service Time (*g s*), s	0.7	5.5	5.5	0.5	7.8	7.9		0.0			2.9	
Cycle Queue Clearance Time (*g c*), s	3.4	5.5	5.5	0.5	7.8	7.9		3.1			6.0	
Green Ratio (*g/C*)	0.69	0.69	0.69	0.74	0.75	0.75		0.11			0.11	
Capacity (*c*), veh/h	339	1210	1204	596	1336	1326		220			228	
Volume-to-Capacity Ratio (*X*)	0.030	0.293	0.293	0.063	0.527	0.528		0.296			0.500	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	0.1	3.1	3.1	0.2	3.0	3.0		2.2			4.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.02	0.00	0.00	0.09	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	4.3	4.1	4.1	3.2	1.8	1.9		33.4			34.6	
Incremental Delay (*d 2*), s/veh	0.2	0.6	0.6	0.0	1.1	1.1		1.1			2.4	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	4.5	4.7	4.7	3.2	2.9	3.0		34.4			37.0	
Level of Service (LOS)	A	A	A	A	A	A		C			D	
Approach Delay, s/veh / LOS	4.7	A		3.0	A		34.4	C		37.0	D	
Intersection Delay, s/veh / LOS	6.0						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.63	B	1.61	B	2.30	B	2.30	B
Bicycle LOS Score / LOS	1.13	A	1.70	B	0.60	A	0.68	A

HCS Signalized Intersection Results Summary

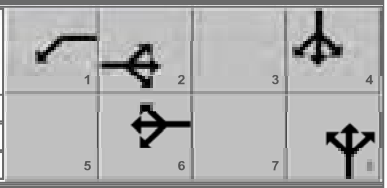
General Information				Intersection Information	
Agency	HRG			Duration, h	0.250
Analyst	MJV	Analysis Date	Dec 21, 2022	Area Type	Other
Jurisdiction	SIOUX FALLS	Time Period	PM Peak Hour	PHF	0.92
Urban Street	10TH STREET	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	LOWELL AVENUE	File Name	2027 PMpeak Build IMJR.xus		
Project Description	I-229/10TH ST IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	25	1400	15	135	950	70	5	25	50	135	40	15

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	63.9	16.9	0.0	0.0	0.0	
Yellow	3.0	3.6	3.6	0.0	0.0	0.0	
Red	0.0	2.0	2.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		4
Case Number		6.3	1.0	4.0		8.0		8.0
Phase Duration, s		69.5	8.0	77.5		22.5		22.5
Change Period, (*Y+R c*), s		5.6	3.0	5.6		5.6		5.6
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		5.3		5.3
Queue Clearance Time (*g s*), s			4.8			6.8		16.2
Green Extension Time (*g e*), s		0.0	0.3	0.0		1.4		0.7
Phase Call Probability			0.98			1.00		1.00
Max Out Probability			0.01			0.03		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	31	890	889	146	558	545		87			207	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	507	1758	1751	1688	1772	1729		1615			1413	
Queue Service Time (*g s*), s	2.0	34.4	34.6	2.8	8.4	8.7		0.0			9.4	
Cycle Queue Clearance Time (*g c*), s	2.7	34.4	34.6	2.8	8.4	8.7		4.8			14.2	
Green Ratio (*g/C*)	0.64	0.64	0.64	0.71	0.72	0.72		0.17			0.17	
Capacity (*c*), veh/h	392	1123	1119	235	1274	1243		312			301	
Volume-to-Capacity Ratio (*X*)	0.080	0.792	0.794	0.623	0.438	0.439		0.279			0.687	
Back of Queue (*Q*), ft/ln (95 th percentile)												
Back of Queue (*Q*), veh/ln (95 th percentile)	0.4	16.8	16.9	4.3	4.3	4.4		3.4			9.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.08	0.00	0.00	1.80	0.00	0.00		0.00			0.00	
Uniform Delay (*d 1*), s/veh	5.9	10.8	10.8	18.1	3.1	3.2		36.5			40.4	
Incremental Delay (*d 2*), s/veh	0.3	4.3	4.3	2.3	0.9	0.9		0.7			5.1	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Control Delay (*d*), s/veh	6.2	15.1	15.2	20.4	4.0	4.2		37.2			45.5	
Level of Service (LOS)	A	B	B	C	A	A		D			D	
Approach Delay, s/veh / LOS	15.0	B		6.0	A		37.2	D		45.5	D	
Intersection Delay, s/veh / LOS	14.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.65	B	1.63	B	2.30	B	2.30	B
Bicycle LOS Score / LOS	1.78	B	1.52	B	0.63	A	0.83	A

Appendix G – Concept Evaluation Memo

MEMO

TO: Steve Gramm
South Dakota Department of Transportation

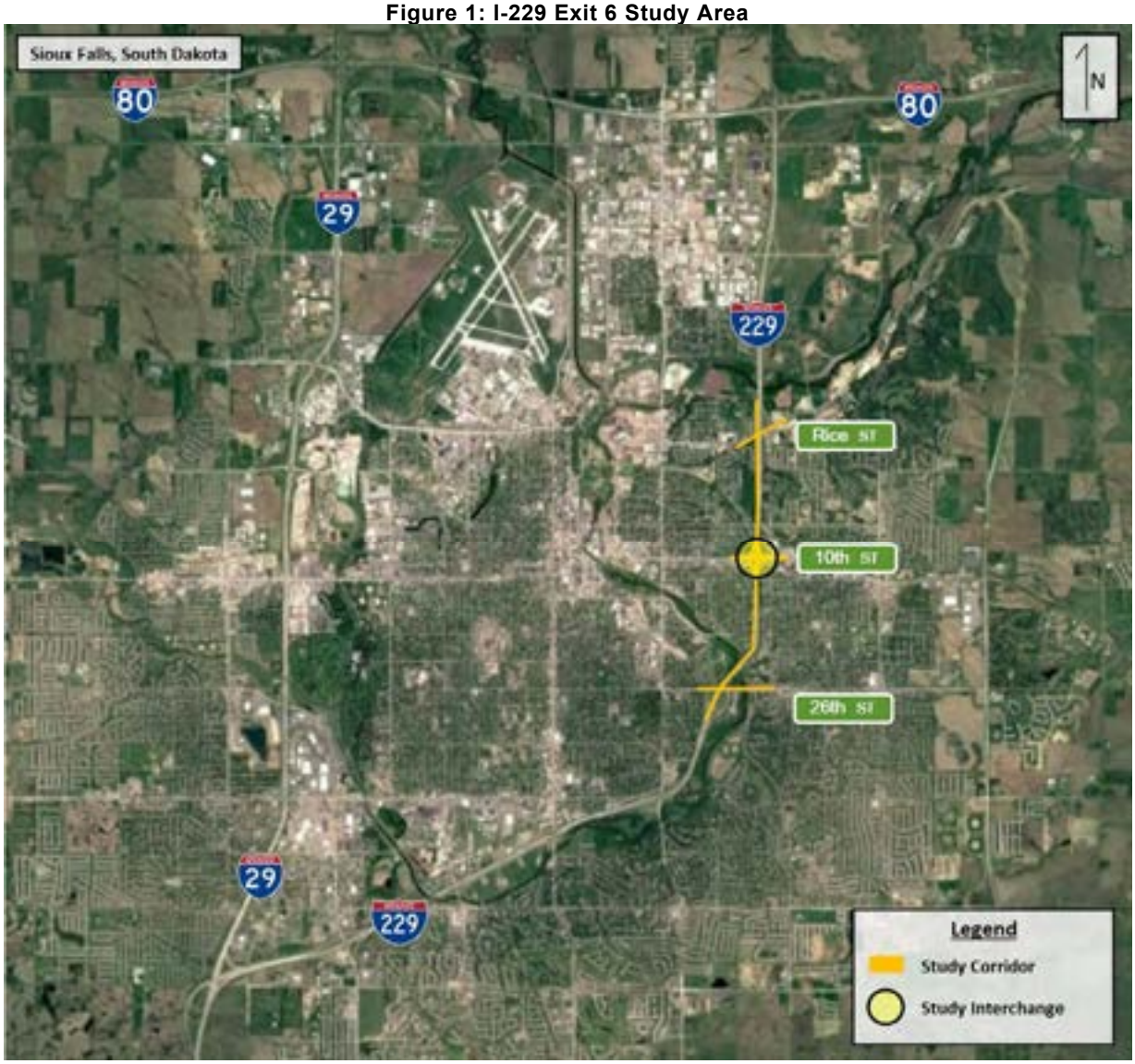
FROM: Ben White, HR Green, PE
Chase Cutler, HR Green, PE, PTOE

DATE: April 9, 2021

RE: I-229 Exit 6 (10th Street) Interchange Study – Build Concepts
SD DOT Project Number: PL0194(98) P, PCN 07P7

This technical memo serves to document the evaluation and refinement of Build concepts at the I-229 Exit 6 interchange with 10th Street in the City of Sioux Falls, South Dakota. The location of the study intersections and features of the surrounding area can be seen in the following figure.

Figure 1: I-229 Exit 6 Study Area



I-229 & 10th Street (Exit 6)

The existing 10th Street corridor is an urban principal arterial with a 4-lane divided roadway within the interchange area. The existing service interchange at I-229 & 10th Street is a Single Point Urban Interchange (SPUI) that operates under traffic signal control. The nearest intersection west of the interchange is approximately 275 feet at Conklin Avenue which is a Right-In/Right Out (RI/RO) access, the nearest full access intersection is approximately 600 feet away at Lowell Avenue (traffic signal control). The nearest intersection east of the interchange is approximately 375 feet at Blaine Avenue which is a RI/RO access, the nearest full access intersection is approximately 700 feet away at Cleveland Avenue (traffic signal control). The study intersections can be seen in the figure below.

Figure 2: 10th Street Corridor/Interchange

Build Concepts

The two Build Concepts carried forward from the previously completed I-229 Major Improvement Study (MIS) were evaluated and refined to fulfill the SDDOT traffic operations criteria. Build Concepts included a Diverging Diamond Interchange (DDI) and a SPUI. The 2050 future year traffic volumes were applied to these Build Concepts and an iterative process of traffic operations analysis and redesign was performed to adapt the concepts to the traffic needs. This process is described in greater detail in the following section.

Operations Analysis Results

Traffic analyses were conducted for 2050 Future Year conditions under scenarios for No-Build and for each Build Concept. Traffic analysis for the study area intersections was performed using Highway Capacity Software version 7.9 (HCS7) which executes methodology outlined in the 6th edition of the Highway Capacity Manual (HCM6).

The SDDOT has established a minimum LOS C on urban interstate highway corridors. At ramp terminal intersections, the overall intersection must be at a LOS C or better; however, individual movements may operate at a LOS D. At other arterial intersections, the overall intersection must be a LOS D or better; however, individual movements may operate at a LOS E if signalized or LOS F if unsignalized. Signalized intersections that were modified by the project cannot operate with a volume to capacity ratio greater than 1.0 for any movement. If arterial intersections were shown to have any movements with a queue storage ratio greater than 1.0 than that intersection will be reported as LOS F.

No-Build Condition

The No-Build Condition intersection capacity analysis considered forecasted year traffic volumes, and the existing lane configurations and intersection traffic control. The following table shows the intersection LOS, delay, and expected volume to capacity (v/c) for the critical movement at each intersection during the AM and PM peak hours. The v/c ratios are representative of the worst-case turning movement at each approach.

Table 1: No-Build Condition Operations

Intersection	Control Type	Intersection LOS / Delay (sec/veh)		EB Leg		WB Leg		NB Leg		SB Leg	
				LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
10th Street & Lowell Avenue	Signal	AM	B 16.7	A	0.42	B	0.63	E	0.37	E	0.71
		PM	D 45.5	D	1.04	C	1.01	D	0.32	F	0.93
10th Street & Conklin Avenue	TWSC	AM	D 25.8	-	-	-	-	D	0.52	D	0.06
		PM	F 83.9	-	-	-	-	F	0.73	C	0.13
10th Street & I-229	Signal	AM	F 100.6	F	1.46	D	0.95	F	1.23	D	0.79
		PM	E 68.2	E	1.20	D	1.16	D	1.12	F	1.26
10th Street & Blaine Avenue	TWSC	AM	C 16.3	-	-	-	-	C		NA	
		PM	E 46.3	-	-	-	-	E		NA	
10th Street & Cleveland Avenue	Signal	AM	F 146.1	D	1.24	F	1.27	F	1.41	F	1.64
		PM	F 140.0	B	0.95	F	1.35	F	1.46	F	1.56

** RED = Inadequate LOS or V/C > 1.0

** ORANGE = V/C over 0.90

The results of the No-Build Condition analysis show that there were undesirable traffic delays expected at all intersections within the study area. The majority of the study intersections operated at a Level of Service E or worse during at least one of the peak hour time periods with all intersections failing due to vehicle delay or v/c ratio criteria. The intersection of 10th Street & I-229 experienced LOS F and LOS E during both the AM and PM peak hours, respectively.

DDI Condition

The DDI Concept Condition intersection capacity analysis considered forecasted future year traffic volumes, and the modified concept condition lane configurations and intersection traffic control. The following table shows the

intersection LOS, delay, and expected volume to capacity (v/c) for the critical movement at each intersection during the AM and PM peak hours. The v/c ratios are representative of the worst-case turning movement at each approach. The intersection approaches with movements that were nearing a v/c ratio of 1.0 (highlighted in orange) indicate that it was near capacity.

Table 2: DDI Concept Operations

Intersection	Control Type	Intersection LOS / Delay (sec/veh)			EB Leg		WB Leg		NB Leg		SB Leg	
					LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
10th Street & Lowell Avenue	**Signal**	**AM**	B	19.2	B	0.37	B	0.66	D	0.21	D	0.34
		PM	C	30.7	D	0.89	B	0.51	D	0.78	E	0.48
10th Street & Conklin Avenue	**TWSC**	**AM**	-	-	-	-	-	-	-	-	-	-
		PM	-	-	-	-	-	-	-	-	-	-
10th Street & SB I-229	**SB DDI Signal**	**AM**	B	12.2	B	0.64	A	0.76	-	-	B	0.76
		PM	B	18.5	B	**0.98**	B	0.89	-	-	B	0.79
10th Street & NB I-229	**NB DDI Signal**	**AM**	B	17.9	A	0.37	C	**0.99**	B	0.78	-	-
		PM	C	23.6	C	**0.90**	C	**0.98**	B	0.76	-	-
10th Street & Blaine Avenue	**TWSC**	**AM**	-	-	-	-	-	-	-	-	-	-
		PM	-	-	-	-	-	-	-	-	-	-
10th Street & Cleveland Avenue	**Signal**	**AM**	D	42.4	C	0.51	D	**0.93**	E	0.78	D	0.48
		PM	D	46.2	C	0.87	E	**0.99**	E	0.81	E	0.84

** RED = Inadequate LOS or V/C > 1.0

** ORANGE = V/C over 0.90

The results of the DDI Concept Condition analysis show that acceptable traffic delays at intersections within the study area can be obtained with the DDI Concept. The operational results depicted were the result of multiple iterations of roadway lane assignment and intersection signal timing plan evaluations in an effort to minimize the roadway cross-section needs while fulfilling the capacity demands.

The number of lanes within the DDI that were determined necessary to accommodate the anticipated traffic demand and obtain sufficient traffic operations resulted in 4 eastbound through lanes and 3 westbound through lanes at the west DDI crossover intersection and 4 eastbound through lanes and 4 westbound through lanes at the east DDI crossover intersection. The roadway cross section and intersection turn lanes necessary to provide adequate capacity under the DDI concept can be seen in **Table 3** and depicted graphically in **Appendix A**.

Table 3: DDI Concept Design Requirements

Intersection	Control Type	Intersection Movement	EB Leg	WB Leg	NB Leg	SB Leg
			Lanes Required	Lanes Required	Lanes Required	Lanes Required
10th Street & SB I-229	**SB DDI Signal**	LT	-	1	-	2
		TH	4	3	-	-
		RT	1	-	-	1
10th Street & NB I-229	**NB DDI Signal**	LT	Shared	-	2	-
		TH	4	4	-	-
		RT	-	Shared	2	-

SPUI Condition

The SPUI Concept Condition intersection capacity analysis considered forecasted future year traffic volumes, and the modified concept condition lane configurations and intersection traffic control. The following table shows the intersection LOS, delay, and expected volume to capacity (v/c) for the critical movement at each intersection during the AM and PM peak hours. The v/c ratios are representative of the worst-case turning movement at each approach. The intersection approaches with movements that were nearing a v/c ratio of 1.0 (highlighted in orange) indicate that it was near capacity.

Table 4: SPUI Concept Operations

Intersection	Control Type	Intersection LOS / Delay (sec/veh)		EB Leg		WB Leg		NB Leg		SB Leg	
				LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
10th Street & Lowell Avenue	**Signal**	**AM**	B 10.6	A	0.52	A	0.60	D	0.39	D	0.37
		PM	B 17.4	B	0.70	B	0.83	D	0.39	D	0.72
10th Street & Conklin Avenue	**TWSC**	**AM**	- -	-	-	-	-	-	-	-	-
		PM	- -	-	-	-	-	-	-	-	-
10th Street & I-229	**SPUI Signal**	**AM**	B 18.0	C	0.68	B	**0.93**	B	0.73	B	0.27
		PM	C 22.6	C	0.85	C	**0.93**	B	0.74	C	0.83
10th Street & Blaine Avenue	**TWSC**	**AM**	- -	-	-	-	-	-	-	-	-
		PM	- -	-	-	-	-	-	-	-	-
10th Street & Cleveland Avenue	**Signal**	**AM**	C 20.7	A	0.57	C	0.85	C	0.52	C	0.62
		PM	C 21.1	B	0.69	B	0.75	D	0.78	D	0.74

** RED = Inadequate LOS or V/C > 1.0

** ORANGE = V/C over 0.90

The results of the SPUI Concept Condition analysis show that acceptable traffic delays at intersections within the study area can be obtained with the SPUI Concept. The operational results depicted were the result of multiple iterations of roadway lane assignment and intersection signal timing plan evaluations in an effort to minimize the roadway cross-section needs while fulfilling the capacity demands.

The number of lanes at the SPUI that were necessary to accommodate the anticipated traffic demand and obtain sufficient traffic operations resulted in 3 eastbound through lanes and 3 westbound through lanes with dual left-turn lanes needed. The roadway cross section and intersection turn lanes necessary to provide adequate capacity under the SPUI concept can be seen in **Table 5** and depicted graphically in **Appendix A**.

Table 5: SPUI Concept Design Requirements

Intersection	Control Type	Intersection Movement	EB Leg	WB Leg	NB Leg	SB Leg
			Lanes Required	Lanes Required	Lanes Required	Lanes Required
10th Street & I-229	**SPUI Signal**	LT TH RT	2 3 1	2 3 1	2 - 2	2 - 1

Summary

The traffic operations analysis was used as a tool to assist in the refinement of the DDI and SPUI concepts that were retained from a previous study. The traffic operations analysis provided feedback to the design team informing the number of lanes necessary to provide capacity as well as the number of turn lanes and length of storage required at turn bays.

The traffic operations analysis has shown the expected delays from each of the revised Build Concept conditions. Overall, it can be said that both of the Build Concepts provide reduced delays at intersections within the study area when compared to the No-Build condition.

When comparing the two Build Concepts, it can be seen that the SPUI concept was able to provide reduced delays compared to the DDI Concept. The difference in traffic operations between concepts can be attributed to the conflicting traffic volumes at the interchange, the intersection spacing, and the available traffic signal cycle lengths. The DDI concept has a higher conflicting volume of traffic than the SPUI concept, has more closely spaced signalized intersections than the SPUI, and cannot operate under the same cycle length as adjacent intersections. The combination of these elements contributed to the need for additional travel lanes at each of the crossover intersections to accommodate the traffic demand.

A secondary analysis was conducted to evaluate whether allowing a relaxed interchange ramp delay standard of achieving LOS D or better at the interchange ramp intersections would reduce the number of required travel lanes. It was determined that the controlling traffic operations metric that most influenced design was the v/c ratio and reducing the delay criteria did not provide opportunity to eliminate any travel lanes.

The refined preliminary design for each Build concept can be seen in the **Appendix A**.

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APPENDIX A: Build Concepts

LEGEND

- Interstate/Ramp Construction
- Municipal Street Construction
- Raised Median Construction
- Bridge Construction
- Pavement Replacement
- Anticipated ROW Impact
- Sidewalk / Trail Construction
- Retaining Wall Construction
- Existing ROW/Property (survey)
- Existing ROW/Property (GIS)
- Existing Wetlands
- Existing Floodway
- Existing Floodplain
- A Access Closure

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

N CLEVELAND AVE
E 8TH ST
N LOWELL AVE
E 10TH ST
S LOWELL AVE
E 12TH ST
229
S CLEVELAND AVE

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

156524 DATE: 4/9/2021	SEH I-229 / EXIT 6 SPUI ALT 1	FIGURE No. 1

9:27:14 AM 4/9/2021 shotchkin
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LEGEND

- Interstate/Ramp Construction
- Municipal Street Construction
- Raised Median Construction
- Bridge Construction
- Pavement Replacement
- Anticipated ROW Impact
- Sidewalk / Trail Construction
- Retaining Wall Construction
- Existing ROW/Property (survey)
- Existing ROW/Property (GIS)
- Existing Wetlands
- Existing Floodway
- Existing Floodplain
- A Access Closure

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

N CLEVELAND AVE
E 8TH ST
N LOWELL AVE
E 10TH ST
S LOWELL AVE
E 12TH ST
S CLEVELAND AVE
229

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

156524 DATE: 4/9/2021	SEH I-229 / EXIT 6 SPUI ALT 1B	FIGURE No. 2

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LEGEND

- Interstate/Ramp Construction
- Municipal Street Construction
- Raised Median Construction
- Bridge Construction
- Pavement Replacement
- Anticipated ROW Impact
- Sidewalk / Trail Construction
- Retaining Wall Construction
- Existing ROW/Property (survey)
- Existing ROW/Property (GIS)
- Existing Wetlands
- Existing Floodway
- Existing Floodplain
- A Access Closure

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

N CLEVELAND AVE
E 8TH ST
N LOWELL AVE
E 10TH ST
S LOWELL AVE
E 12TH ST
S CLEVELAND AVE
229

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

156524 DATE: 4/9/2021	SEH I-229 / EXIT 6 DDI ALT 1	FIGURE No. 3

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LEGEND

- Interstate/Ramp Construction
- Municipal Street Construction
- Raised Median Construction
- Bridge Construction
- Pavement Replacement
- Anticipated ROW Impact
- Sidewalk / Trail Construction
- Retaining Wall Construction
- Existing ROW/Property (survey)
- Existing ROW/Property (GIS)
- Existing Wetlands
- Existing Floodway
- Existing Floodplain
- A Access Closure

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

N CLEVELAND AVE
E 8TH ST
N LOWELL AVE
E 10TH ST
S OMAHA AVE
S LOWELL AVE
229
E 12TH ST
S CLEVELAND AVE

PRELIMINARY
SUBJECT TO CHANGE
4/9/2021

156524 DATE: 4/9/2021	SEH I-229 / EXIT 6 DDI ALT 1B	FIGURE No. 4

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Appendix H – Safety Memo

Building a Better World for All of Us®

DRAFT MEMORANDUM

TO: Steve Gramm
South Dakota Department of Transportation

FROM: Graham Johnson, PE (SD, MN, IA), PTOE
Justin Anibas, EIT

DATE: November 18, 2020

RE: I-229 Exit 6 (10th Street) Interchange Project - Safety Memo
SEH No. HRGSP 156524

This technical memorandum provides the findings related to the analysis of the crash history for the I-229 Exit 6 Interchange project. The project area includes mainline I-229 as well as Rice Street, 6th Street, 10th Street, 12th Street, 18th Street, Southeastern Avenue, and 26th Street in Sioux Falls, South Dakota. This includes I-229 at the Exit 5, Exit 6, and Exit 7 interchange area connections. The purpose is to highlight areas with existing safety concerns in the project area.

Figure 1 shows the project area, which includes Mainline I-229, 10th Street (Exit 6 Interchange), and several other roadways that cross I-229.

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Intersection Crashes 9
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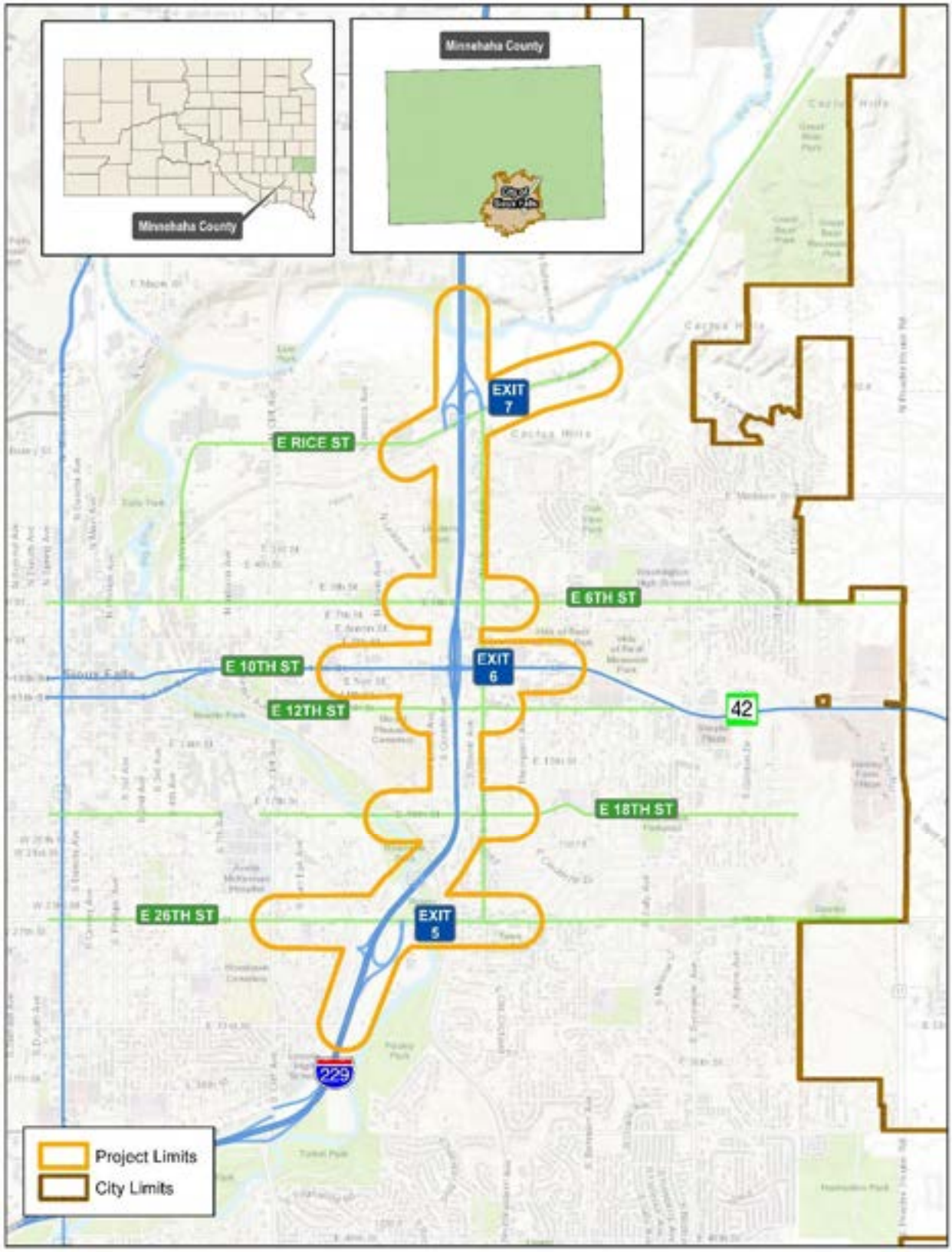
Figure 1 Project Location



CRASH DATA

Crash data from January 1, 2015 through December 31, 2019 was provided by the South Dakota Department of Transportation (SDDOT). The type and severity of crashes were reviewed, and crash rates were calculated for each study intersection. There were a total of 1,632 crashes within the project area that included 353 Mainline I-229, 47 crashes along the freeway ramps, and 1,232 crashes along the project roadways and intersections.

Crash severity is separated into six categories based on injuries sustained during the crash.

- Fatal – Crash that results in death.
- Severity A – Crash that results in an incapacitating injury.
- Severity B – Crash that results in a non-incapacitating injury.
- Severity C – Crash that results in possible injury.
- Property Damage – Crash that results in property damage only, with no injuries.
- Wild Animal Hit – Crash where a wild animal was hit; with no injuries to vehicle drivers/passengers.

The crash rate at each intersection or segment is expressed as a number of crashes per million entering vehicles (MEV). A critical crash rate is a statistical rate that is unique to each intersection or segment and is based on vehicular exposure and the average crash rate for similar facility; the critical crash rate provides a statistical threshold for screening intersections and segment safety concerns.

The critical index is the crash rate divided by the critical crash rate, a ratio of the observed crash rate to the critical crash rate. An intersection or segment with a crash rate higher than the critical rate (critical index > 1) can indicate a safety concern and the site should be further reviewed; a site with a critical index below 1.0 implies that the site does not deviate significantly from the statewide trends.

The following sections provide a summary of the mainline I-229 crashes, I-229 ramp crashes, intersection crashes, and arterial segment crashes.

The attached **Tables A1a through A2b** summarize the crashes along Mainline I-229 and the I-229 ramps by crash severity and general crash diagram. The attached **Tables B1a through B2b** summarize the crashes at each intersection and along each roadway segment by crash severity and general crash diagram.

The attached **Figures A1-A3** represents the locations of all the crashes in the project area.

MAINLINE I-229

There were a total of 353 crashes along Mainline I-229 from south of Exit 5 to north of Exit 7 in the 5-year period; directionally it is virtually split with 178 northbound crashes and 175 southbound crashes.

For this analysis, merge/diverge segments were considered to be either the taper area of the exit/entrance ramp or within 750 feet of the ramp gore if the ramp is a lane drop or lane add. The 750 feet assumption was based on the observation that many of the crashes occurred within 750 feet of ramp entrance or exit area. The only exception are the southern ramps of Exit 6 which have approximately 1,400' acceleration and deceleration lanes.

Table 1 summarizes the crashes by severity for each I-229 segment. A brief summary of the crash trends found in the crash information follows. This includes a summary of any mainline I-229 segments with a crash rate that exceeds the calculated critical rate or that had a fatal/severity A crash during the 5-year analysis period.

Table 1 Mainline I-229 Crashes

	Description	Crash Severity							Crash Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Northbound I-229	Between Exits 4 & 5*	0	0	1	0	3	0	4	0.42	1.93	0.22
	Exit 5 Diverge	0	0	0	1	9	1	11	1.91	2.21	0.87
	Exit 5 between Ramps	0	0	0	0	5	3	8	0.90	1.97	0.46
	Exit 5 Merge	0	0	0	0	5	2	7	1.17	2.18	0.54
	Between Exits 5 & 6	1	2	3	2	33	4	45	**1.58**	**1.54**	**1.03**
	Exit 6 Diverge	0	1	1	3	18	1	24	**2.63**	**1.95**	**1.35**
	Exit 6 between Ramps	0	0	0	0	8	0	8	0.83	1.92	0.43
	Exit 6 Merge	0	0	1	1	4	0	6	1.42	2.42	0.59
	Between Exits 6 & 7	0	0	1	3	9	9	22	1.08	1.63	0.66
	Exit 7 Diverge	0	1	0	0	3	6	10	2.36	2.42	0.98
	Exit 7 between Ramps	0	0	0	0	3	4	7	1.10	2.15	0.51
	Exit 7 Merge	0	0	1	0	19	6	26	**6.73**	**2.49**	**2.70**
Southbound I-229	Exit 7 Diverge	0	0	0	1	5	2	8	2.07	2.49	0.83
	Exit 7 between Ramps	0	0	0	0	4	3	7	1.22	2.21	0.55
	Exit 7 Merge	0	0	2	1	18	1	22	**5.19**	**2.42**	**2.15**
	Between Exits 7 & 6	0	0	1	2	9	13	25	1.33	1.66	0.80
	Exit 6 Diverge	0	0	1	1	12	1	15	**3.54**	**2.42**	**1.46**
	Exit 6 between Ramps	0	0	2	2	10	1	15	1.77	1.99	0.89
	Exit 6 Merge	0	0	0	0	18	0	18	1.53	1.84	0.83
	Between Exits 6 & 5	1	0	2	4	30	0	37	1.36	1.55	0.88
	Exit 5 Diverge	0	0	0	0	3	1	4	1.48	2.80	0.53
	Exit 5 between Ramps	0	0	0	0	2	1	3	0.51	2.20	0.23
	Exit 5 Merge	0	0	0	0	7	3	10	1.73	2.21	0.78
	Between Exits 5 & 4*	0	0	1	0	6	4	11	1.21	1.95	0.62
	TOTAL	**2**	**4**	**17**	**21**	**243**	**66**	**353**	n/a	n/a	n/a

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.03.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.
- * Does not include northbound Merge or southbound Diverge crashes at Exit 4.

Mainline I-229 Crash Trends

- Approximately 64% of the Mainline I-229 crashes were single vehicle (ran off road, spin outs, etc.) or wild animal hit crashes, which means only 36% of crashes along Mainline I-229 involve two vehicles colliding with one another.
- Approximately 63% of the crashes on Mainline I-229 occurred during daylight conditions, with the remaining 37% occurring when it was dark.
- Approximately 54% of the crashes on Mainline I-229 occurred when the roadway surface was dry, with the remaining 46% occurring when the roadway was wet (12%) or snowy/icy (34%).
- Approximately 48% of the crashes on Mainline I-229 occurred during the AM peak period (6-9 AM) and the PM peak period (3-6 PM).
- Approximately 47% of crashes occurred between four months of November through February, during the typical winter months.
- There were a total of 2 fatal and 4 severity A crashes along Mainline I-229 between 2015 through 2019.

Northbound I-229 Crashes

- **Northbound I-229 between Exits 5 & 6 – Mainline Segment**

  Total Crashes – 45 Crash Rate – 1.58 Critical Crash Rate – 1.54 Critical Index – 1.03

  - 45 crashes occurred along this 0.83-mile segment of I-229 over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - A majority (54%) of the crashes along this segment of I-229 were concentrated at the 2 bridges over the Big Sioux River and Southeastern Avenue as well as the two curves in the roadway.
  - 33 of the 45 crashes were single vehicle crashes (ran off road, spin outs, etc.)
  - 31 of the 45 crashes occurred when the roadway was either wet, snowy, or icy, which indicates weather is likely a significant factor in crashes along this segment of I-229.
  - There was 1 fatal crash along this segment of I-229; this crash involved a vehicle running off the roadway and rolling over when the roadway was icy.
  - There were 3 incapacitating injury (severity A) crashes along this segment of I-229. Weather was a factor in all three of the incapacitating injury crashes. One was a single vehicle crash, one was an angle/sideswipe crash, and one was a rear end crash.

- **Northbound I-229 Exit 6 Diverge – Diverge Segment**

  Total Crashes – 24 Crash Rate – 2.63 Critical Crash Rate – 1.95 Critical Index – 1.35

  - 24 crashes occurred near the exit ramp area along this 1,400-foot segment of I-229 over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 10 of the 24 crashes along this segment of I-229 were rear end crashes, likely due to vehicles slowing for congestion either on the mainline or on the exit ramp. Following too closely was the most common contributing factor for these crashes.
  - Weather was a factor in 9 of the 24 crashes along this segment of I-229

- **Northbound I-229 Exit 7 Diverge – Diverge Segment**

  Total Crashes – 10 Crash Rate – 2.36 Critical Crash Rate – 2.42 Critical Index – 0.98

  - All 10 of the crashes along this segment were single vehicle (ran off road, spin outs, etc.) or wild animal hit crashes.
  - There was 1 incapacitating injury (severity A) crash along this segment of I-229. This crash involved a vehicle running off the roadway and colliding with the guard rail/bridge.

- **Northbound I-229 Exit 7 Merge – Merge Segment**

  Total Crashes – 26 Crash Rate – 6.73 Critical Crash Rate – 2.49 Critical Index – 2.70

  - 26 crashes occurred in the entrance ramp area along this 750-foot segment of I-229 over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - A majority (69%) of the crashes along this segment of I-229 were concentrated near the Big Sioux River bridge.
  - 15 of the 26 crashes were single vehicle crashes (ran off road, spin outs, etc.)
  - 17 of the 26 crashes occurred when the roadway was either snowy or icy, which indicates weather is likely a significant factor in crashes along this segment of I-229.

Southbound I-229 Crashes

- **Southbound I-229 Exit 7 Merge – Merge Segment**

  Total Crashes – 22 Crash Rate – 5.19 Critical Crash Rate – 2.42 Critical Index – 2.15

  - 22 crashes occurred in the entrance ramp area along this 750-foot segment of I-229 over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 8 of the 22 crashes were sideswipe crashes, likely involving vehicles merging or changing lanes.
  - 7 of the 22 crashes were single vehicle crashes (ran off road, spin outs, etc.).
  - 10 of the 22 crashes occurred when the roadway was either wet, snowy, or icy. This segment of roadway includes a bridge over Rice Street, which could become slippery during adverse weather conditions.

- **Southbound I-229 Exit 6 Diverge – Diverge Segment**

  Total Crashes – 15 Crash Rate – 3.54 Critical Crash Rate – 2.42 Critical Index – 1.46

  - 15 crashes occurred near the exit ramp area along this 750-foot segment of I-229 over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 12 of the 15 crashes were single vehicle crashes (ran off road, spin outs, etc.).
  - 7 of the 15 crashes occurred when the roadway was either wet, snowy, or icy.

- **Southbound I-229 between Exits 6 & 5 – Mainline Segment**

  Total Crashes – 37 Crash Rate – 1.36 Critical Crash Rate – 1.55 Critical Index – 0.88

  - 23 of the 37 crashes were single vehicle crashes (ran off road, spin outs, etc.).
  - 11 of the 37 crashes were rear end crashes.
  - 19 of the 37 crashes occurred when the roadway was either wet, snowy, or icy.
  - There was 1 fatal crash along this segment of I-229. This crash involved a vehicle running off the roadway and hitting a guardrail.

While there are five areas above the critical crash rates, described above, there are also four additional areas that are within 15% of the critical rate. While not over the statistical critical rate, it does relate to additional areas having had safety concerns. These include:

- Northbound I-229 at Exit 5 Diverge
- Northbound I-229 at Exit 7 Diverge
- Southbound I-229 between Exit 6 Entrance and Exit Ramps
- Southbound I-229 between Exit 6 and Exit 5

I-229 RAMPS

There were a total of 47 crashes on the I-229 Exit 5, Exit 6, and Exit 7 ramp connections during the 5-year period. Below is a brief summary of the trends seen in these crashes as well as a summary of any I-229 Ramps with a crash rate that exceeds calculated critical rate or had a severe crash during the 5-year analysis period. **Table 2** summarizes the crashes by severity for each ramp along I-229.

For this analysis, ramp crashes did not include crashes that occurred at the intersections of the ramp terminals or along mainline I-229.

Table 2 I-229 Ramp Crashes

	Description	Crash Severity							Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
NB I-229 Ramps	Exit 5 Off Ramp	0	0	0	0	4	0	4	0.83	2.33	0.36
	Exit 5 On Ramp	0	0	1	1	11	0	13	**7.67**	**3.33**	**2.30**
	Exit 6 Off Ramp	0	0	0	0	2	0	2	0.57	2.57	0.22
	Exit 6 On Ramp	0	0	0	1	2	0	3	1.15	2.84	0.40
	Exit 7 Off Ramp	0	0	0	1	7	0	8	**8.09**	**4.17**	**1.94**
	Exit 7 On Ramp	0	1	0	0	1	0	2	1.51	3.68	0.41
SB I-229 Ramps	Exit 7 Off Ramp	0	0	0	0	0	0	0	0.00	3.54	0.00
	Exit 7 On Ramp	0	0	1	0	2	0	3	3.08	4.20	0.73
	Exit 6 Off Ramp	0	0	0	0	0	0	0	0.00	2.80	0.00
	Exit 6 On Ramp	0	0	0	1	8	0	9	**4.92**	**3.24**	**1.52**
	Exit 5 Off Ramp	0	0	0	0	1	0	1	1.63	5.19	0.31
	Exit 5 On Ramp	0	0	0	1	1	0	2	2.10	4.23	0.50
	TOTAL	**0**	**1**	**2**	**5**	**39**	**0**	**47**			

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.03.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.

I-229 Ramp Crash Trends

- Approximately 74% of the I-229 ramp crashes were single vehicle (ran off road, spin outs, etc.), which means only 26% of crashes on the I-229 ramps involve two vehicles colliding with one another.
- Approximately 68% of the crashes on the I-229 ramps occurred during daylight conditions, with the remaining 32% occurring when it was dark.
- Approximately 55% of the crashes on the I-229 ramps occurred when the roadway surface was dry, with the remaining 45% occurring when the roadway was wet (9%) or snowy/icy (36%).
- Approximately 40% of the crashes on the I-229 Ramps occurred during the AM peak period (6-9 AM) and PM peak period (3-6 PM).
- Approximately 55% of crashes occurred between the four months of November through February, during the typical winter months.
- There was 1 severity A crash on the I-229 Ramps from 2015 through 2019.

Northbound I-229 Ramp Crashes

- **Northbound I-229 Exit 5 On Ramp**

  Total Crashes – 13 Crash Rate – 7.67 Critical Crash Rate – 3.33 Critical Index – 2.30

  - 13 crashes occurred along this ramp over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - A majority of the crashes on this ramp occurred on the loop section.
  - 12 of the 13 crashes were single vehicle crashes (ran off road, spin outs, etc.).
  - 7 of the 13 crashes occurred when the roadway was either wet, snowy, or icy.

- **Northbound I-229 Exit 7 Off Ramp**

  Total Crashes – 8 Crash Rate – 8.09 Critical Crash Rate – 4.17 Critical Index – 1.94

  - 8 crashes occurred along this ramp over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - All 8 of the crashes on this ramp occurred on the loop section and were single vehicle crashes (ran off road, spin outs, etc.).
  - 4 of the 8 crashes occurred when the roadway was either snowy or icy.

- **Northbound I-229 Exit 7 On Ramp**

  Total Crashes – 2 Crash Rate – 1.51 Critical Crash Rate – 3.68 Critical Index – 0.41

  - Both of the crashes on this ramp were single vehicle crashes (ran off road, spin outs, etc.) and occurred when the roadway was dry.
  - There was 1 incapacitating injury (severity A) crash on this ramp. This crash involved an intoxicated driver running off the roadway and rolling over.

Southbound I-229 Ramp Crashes

- **Southbound I-229 Exit 6 On Ramp**

  Total Crashes – 9 Crash Rate – 4.92 Critical Crash Rate – 3.24 Critical Index – 1.52

  - 9 crashes occurred along this ramp over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 6 of the 9 crashes were rear end crashes, which indicates there may be congestion on this ramp.
  - 3 of the 9 crashes were single vehicle crashes (ran off road, spin outs, etc.).
  - 4 of the 9 crashes occurred when the roadway was either wet, snowy, or icy.

INTERSECTION CRASHES

There were a total of 1,104 crashes at the 27 intersections (23 study intersections, 4 other intersections) analyzed as part of this project between 2015 and 2019. Non-study intersections with approximately 10 crashes in the 5-year history were included in the intersection analysis. **Table 3** summarizes the crashes by severity for each intersection.

Table 3 Intersection Crashes

Intersection		Crash Severity							Rate Information		
		Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Rice St	Rice St at Lowell Ave	0	0	1	1	7	0	9	0.38	0.56	0.67
	Rice St at I-229 SB Ramp Terminal**	0	1	1	3	9	0	14	0.51	0.99	0.52
	Rice St at I-229 NB Ramp Terminal**	0	0	2	10	39	0	51	**1.53**	**0.95**	**1.61**
	Rice St at Bahnson Ave	0	0	0	1	1	0	2	0.10	0.60	0.17
6th St	6th St at Lowell Ave	0	0	1	2	5	0	8	0.38	0.59	0.65
	6th St at Leadale Ave (2)	0	0	0	0	8	0	8	0.41	0.60	0.69
	6th St at N Cleveland Ave**	0	0	8	14	66	0	88	**2.26**	**1.35**	**1.67**
10th St	10th St at Jessica Ave**	0	0	0	3	9	0	12	0.28	0.90	0.31
	10th St at St. Paul Ave (2)	0	0	4	1	9	0	14	0.32	0.48	0.66
	10th St at Lowell Ave**	0	1	5	12	34	0	52	**1.11**	**0.89**	**1.25**
	10th St at Conklin Ave	0	0	1	1	4	0	6	0.14	1.41	0.10
	10th St at Single Point Terminal**	0	3	3	24	120	0	150	**2.47**	**0.85**	**2.90**
	10th St at Blaine Ave	0	0	0	0	5	0	5	0.09	1.35	0.07
	10th St at Cleveland Ave**	0	1	14	25	124	0	164	**2.56**	**1.26**	**2.03**
	10th St at Chapel Hill Rd (2)	0	0	2	0	7	0	9	0.22	0.49	0.45
	10th St at Hy-Vee Access**	0	0	0	6	19	0	25	0.61	0.91	0.67
12th	12th St at Lowell Ave	0	0	1	2	4	0	7	**1.10**	**0.88**	**1.25**
	12th St at Cleveland Ave**	0	0	1	7	26	0	34	**1.73**	**1.05**	**1.65**
18th St	18th St at Southeastern Ave**	0	0	2	2	28	0	32	**1.80**	**1.07**	**1.68**
	18th St at Blaine Ave (2)	0	0	1	0	9	0	10	**0.84**	**0.70**	**1.20**
	18th St at Cleveland Ave**	0	0	1	4	24	0	29	**1.51**	**1.05**	**1.43**
26th Str	26th St at Van Eps Ave**	0	0	2	2	12	0	16	0.67	1.02	0.66
	26th St at Yeager Rd**	0	0	4	12	33	0	49	**1.16**	**0.91**	**1.28**
	Yeager Rd at SB Ramp Terminal	0	1	0	3	12	0	16	**1.01**	**0.65**	**1.54**
	26th St at NB Ramp Terminal**	0	0	10	17	72	0	99	**1.93**	**0.88**	**2.20**
	26th St at Southeastern Ave**	0	0	4	13	90	0	107	**1.58**	**1.25**	**1.26**
	26th St at Cleveland Ave**	0	1	6	20	61	0	88	**1.82**	**0.89**	**2.06**
TOTAL		**0**	**8**	**74**	**185**	**837**	**0**	**1104**	n/a	n/a	n/a

- **Signalized Intersection
- **Bold/Red Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.
- (2) Notes non-study intersections included.

Below is a brief summary of the trends seen in these crashes as well as a summary of all intersections and highlights locations where the crash rate exceeds the calculated critical rate.

Intersection Trends

- Approximately 58% of the intersection crashes (638 out of 1,104) were rear end crashes. 97% of the rear end crashes occurred at the 16 signalized intersections analyzed. These crashes are likely the result of slowing traffic or congestion at the signalized intersections.
- Approximately 68% of all rear end crashes occurred in the eastbound/westbound direction, while the remaining 32% were in the northbound/southbound direction.
- Approximately 30% of the intersection crashes (332 out of 1,148) were right-angle crashes.
- Approximately 73% of the intersection crashes occurred during daylight conditions, with the remaining 27% occurring under dark conditions.
- Approximately 69% of the crashes occurred when the roadway surface was dry, with the remaining 31% occurring when the roadway was wet (16%) or snowy/icy (15%).
- Approximately 46% of the crashes occurred during the AM peak (6-9 AM) and PM peak (3-6 PM) periods with 31% of all crashes occurring during the PM peak period.
- The winter months (November through February) had generally the highest number of crashes, but overall there was not a significant difference in crashes by month.
- There were a total of 8 severity A crashes and no fatal crashes from 2015 through 2019.
- There were a total of 7 crashes involving pedestrian or bicyclists at the 27 intersections analyzed as part of this study.

Rice Street Crashes (4 Intersections)

- **Rice Street at Lowell Avenue (Minor Street Stop Control)**

  Total Crashes – 9 Crash Rate – 0.38 Critical Crash Rate – 0.56 Critical Index – 0.67

  - 6 of the 9 crashes were right-angle crashes. 5 of the right-angle crashes involved northbound left turning vehicles and eastbound through vehicles.

- **Rice Street at I-229 Southbound Ramp Terminal (Traffic Signal)**

  Total Crashes – 14 Crash Rate – 0.51 Critical Crash Rate – 0.99 Critical Index – 0.52

  - 8 of the 14 crashes were rear end crashes, likely the result of backups at the intersection. 4 of the rear end crashes were in the eastbound direction and 4 were in the southbound direction.
  - There was 1 incapacitating injury (severity A) crash at this intersection. This crash involved an eastbound left turning vehicle failing to yield to a westbound vehicle.

- **Rice Street at I-229 Northbound Ramp Terminal/Cleveland Avenue (Traffic Signal)**

  Total Crashes – 51 Crash Rate – 1.53 Critical Crash Rate – 0.95 Critical Index – 1.61

  - 51 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 24 of the 51 crashes were right-angle crashes. 18 involved vehicles taking a left turn with 8 involving eastbound and westbound vehicles together (no protected left phase).
  - 19 of the 51 crashes were rear end crashes, likely the result of backups at the intersection. 11 of the rear end crashes were in the northbound direction and 4 were in the southbound direction (2 eastbound, 2 westbound). This could indicate that backups are worse for northbound vehicles, although the railroad crossing on the south leg could also result in some rear end crashes for vehicles stopping for a train.

- **Rice Street at Bahnson Avenue (Minor Street Stop Control)**

  Total Crashes – 2 Crash Rate – 0.10 Critical Crash Rate – 0.58 Critical Index – 0.09

  - With only 2 crashes over the last 5 years at this intersection, no crash trends exist.

6th Street Crashes (3 Intersections)

- **6th Street at Lowell Avenue (Minor Street Stop Control)**

  Total Crashes – 8 Crash Rate – 0.38 Critical Crash Rate – 0.59 Critical Index – 0.65

  - 5 of the 8 crashes were right-angle crashes. 4 out of 5 of the right-angle crashes involved a westbound vehicle and a vehicle from one of the minor streets.

- **6th Street at Leadale Avenue (Minor Street Stop Control)**

  Total Crashes – 8 Crash Rate – 0.41 Critical Crash Rate – 0.60 Critical Index – 0.69

  - 3 of the 8 crashes were right-angle crashes and 2 were side-swipe crashes. 7 of the 8 crashes involved a westbound vehicle.

- **6th Street at Cleveland Avenue (Traffic Signal)**

  Total Crashes – 88 Crash Rate – 2.26 Critical Crash Rate – 1.35 Critical Index – 1.67

  - 88 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 43 of the 88 crashes were rear end crashes, likely the result of backups at the intersection. 18 of the rear end crashes were in the westbound direction and 9 were in the eastbound direction (11 northbound, 5 southbound).
  - 31 of the 88 crashes were right-angle crashes. 14 involved vehicles taking a left turn.
  - There were 2 pedestrian crashes and 1 bicycle crash at this intersection.
    1. A northbound bicycle failed to yield to a westbound right turning vehicle (Severity B)
    2. A northbound left turning vehicle failed to yield to a pedestrian (Severity B)
    3. A pedestrian disregarded the traffic control and was struck by an eastbound vehicle (Severity C).

10th Street Crashes (9 Intersections)

- **10th Street at Jessica Avenue (Traffic Signal)**

  Total Crashes – 12 Crash Rate – 0.28 Critical Crash Rate – 0.90 Critical Index – 0.31

  - 9 of the 12 crashes were rear end crashes, likely due to backups at the intersection. 7 of the rear end crashes were in the eastbound direction and 2 were in the westbound direction.

- **10th Street at St Paul Avenue (Minor Street Stop Control)**

  Total Crashes – 14 Crash Rate – 0.32 Critical Crash Rate – 0.48 Critical Index – 0.66

  - 11 of the 14 crashes were right-angle crashes, 8 involved a southbound vehicle failing to yield to a westbound vehicle.

- **10th Street at Lowell Avenue (Traffic Signal)**

  Total Crashes – 52 Crash Rate – 1.11 Critical Crash Rate – 0.89 Critical Index – 1.25

  - 52 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 36 of the 52 crashes were rear end crashes, likely due to backups at the intersection. 28 of the rear end crashes were in the eastbound direction and 6 were in the westbound direction (2 southbound). This could indicate that backups are much worse for eastbound traffic than westbound traffic.
  - 15 of the 52 crashes were right-angle crashes. 9 of the right-angle crashes involved vehicles taking a left turn, all 9 involved an eastbound vehicle.
  - There was 1 incapacitating injury (severity A) crash at this intersection. This crash was an eastbound rear end crash.

- **10th Street at Conklin Avenue (Right-In/Right-Out Access)**

  Total Crashes – 6 Crash Rate – 0.14 Critical Crash Rate – 1.41 Critical Index – 0.10

  - 2 of the 6 crashes involved vehicles turning right off of Conklin Avenue onto 10th Street.
  - 2 of 6 crashes involved westbound vehicles changing lanes to either turn onto Conklin Avenue or to avoid a vehicle that was slowing to do so.

- **10th Street at I-229 Single Point Ramp Terminal (Traffic Signal)**

  Total Crashes – 150 Crash Rate – 2.47 Critical Crash Rate – 0.85 Critical Index – 2.90

  - 150 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern. Considering the crash rate is nearly triple the critical crash rate at this intersection, any design considerations should include improvements to reduce crashes at this intersection.
  - 129 of the 150 crashes were rear end crashes, likely the result of backups at the intersection and signal timing issues. 45 of the rear end crashes were in the westbound direction and 26 were in the eastbound direction (43 northbound, 15 southbound).
  - There were 3 incapacitating (severity A) crashes at this intersection.
    1. A northbound vehicle stuck the bridge rail and a traffic sign
    2. Two westbound rear end crashes

- **10th Street at Blaine Avenue (Right-In/Right-Out Access)**

  Total Crashes – 5 Crash Rate – 0.09 Critical Crash Rate – 1.35 Critical Index – 0.07

  - All 5 of these crashes involved vehicles either slowing down to take a right turn or changing lanes to avoid vehicles slowing down to do so.

- **10th Street at Cleveland Avenue (Traffic Signal)**

  Total Crashes – 164 Crash Rate – 2.56 Critical Crash Rate – 1.26 Critical Index – 2.03

  - 164 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern. Considering the crash rate is over double the critical crash rate at this intersection, any design considerations should include improvements to reduce crashes at this intersection.
  - 94 of the 164 crashes were rear end crashes, likely due to backups at the intersection. 43 of the rear ends were in the westbound direction and 20 were in the eastbound direction (17 northbound, 14 southbound). This could indicate that backups are much worse for westbound traffic than eastbound traffic. 22 of the 43 westbound rear end crashes occurred during the PM peak period (3 to 6 PM).
  - 55 of the 164 crashes were right-angle crashes. 28 of the right-angle crashes involved vehicles taking a left turn, with 18 involving eastbound and westbound vehicles together (no westbound protected left phase).
  - There was 1 incapacitating injury (severity A) crash at this intersection. This crash was a westbound rear end crash.

- **10th Street at Chapel Hill Road (Minor Street Stop Control)**

  Total Crashes – 9 Crash Rate – 0.22 Critical Crash Rate – 0.49 Critical Index – 0.49

  - 6 of the 9 crashes were right-angle crashes, all involved westbound vehicles.

- **10th Street at Hy-Vee Access (Traffic Signal)**

  Total Crashes – 25 Crash Rate – 0.61 Critical Crash Rate – 0.91 Critical Index – 0.67

  - 17 of the 25 crashes were rear end crashes, likely due to backups at the intersection. 12 of the rear ends were in the westbound direction and 5 were in the eastbound direction.
  - There were 1 pedestrian and 1 bicycle crash at this intersection.
    1. A bicycle failed to yield to a southbound left turning vehicle (Severity C)
    2. A southbound left turning vehicle failed to yield to a pedestrian (Severity C)

12th Street Crashes (2 Intersections)

- **12th Street at Lowell Avenue (Minor Street Stop Control)**

  Total Crashes – 7 Crash Rate – 1.10 Critical Crash Rate – 0.88 Critical Index – 1.25

  - 7 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 5 of the 7 crashes were right-angle crashes. All 5 crashes involved one vehicle from 12th Street and one from Lowell Avenue. 4 of the 5 crashes involved a northbound vehicle.

- **12th Street at Cleveland Avenue (Traffic Signal)**

  Total Crashes – 34 Crash Rate – 1.73 Critical Crash Rate – 1.05 Critical Index – 1.65

  - 34 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 22 of the 34 crashes were right-angle crashes. 12 of the right-angle crashes involved vehicles disregarding the traffic signal.
  - There was 1 bicycle crash at this intersection. This crash involved a bicyclist failing to yield to a southbound through vehicle.

18th Street Crashes (3 Intersections)

- **18th Street at Southeastern Avenue (Traffic Signal)**

  Total Crashes – 32 Crash Rate – 1.80 Critical Crash Rate – 1.07 Critical Index – 1.68

  - 32 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 13 of the 32 crashes were rear end crashes, likely due to backups at the intersection. 8 of the rear ends were in the eastbound direction and 2 were in the westbound direction (2 northbound, 1 southbound).
  - 11 of the 32 crashes right-angle crashes. 9 of the right-angle crashes involved vehicles taking a left turn.

- **18th Street at Blaine Avenue (Minor Street Stop Control)**

  Total Crashes – 10 Crash Rate – 0.84 Critical Crash Rate – 0.70 Critical Index – 1.20

  - 10 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 5 of the 10 crashes were right-angle crashes. 4 of the 5 crashes involved a northbound and a westbound vehicle.

- **18th Street at Cleveland Avenue (Traffic Signal)**

  Total Crashes – 29 Crash Rate – 1.51 Critical Crash Rate – 1.05 Critical Index – 1.43

  - 29 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 15 of the 29 crashes were right-angle crashes.

26th Street Crashes (6 Intersections)

It should be noted that the 26th Street interchange area is currently in the process of being reconstructed and should be completed in the fall of 2020. Therefore, any safety concerns or crash trends may change significantly with a new interchange and roadway design.

- **26th Street at Van Eps Avenue (Traffic Signal)**

  Total Crashes – 16 Crash Rate – 0.67 Critical Crash Rate – 1.02 Critical Index – 0.66

  - All 16 of the crashes were rear end crashes, likely due to backups at the intersection. 9 of the rear ends were in the westbound direction and 6 were in the eastbound direction (1 northbound).

- **26th Street at Yeager Road (Traffic Signal)**

  Total Crashes – 49 Crash Rate – 1.16 Critical Crash Rate – 0.91 Critical Index – 1.28

  - Yeager will be realigned and no longer carry I-229 traffic as part of Exit 5 Interchange Project.
  - 49 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 39 of the 49 crashes were rear end crashes, likely due to backups at the intersection. 25 of the rear ends were in the westbound direction and 7 were in the eastbound direction (1 northbound). This could indicate that backups are worse for westbound vehicles.

- **Yeager Road at I-229 Southbound Ramp Terminal (Minor Street Stop Control)**

  Total Crashes – 16 Crash Rate – 1.01 Critical Crash Rate – 0.65 Critical Index – 1.54

  - As part of the reconstruction of the Exit 5, this intersection will be eliminated and the southbound I-229 ramps will have access directly to 26th Street, creating a new intersection with traffic signal control.
  - 16 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 10 of the 16 crashes were right-angle crashes. 7 of the right-angle crashes involved a southbound left turning vehicle failing to yield to a northbound vehicle.
  - There was 1 incapacitating injury (severity A) crash at this intersection. This crash involved a westbound left turning vehicle failing to yield to a northbound vehicle.

- **26th Street at I-229 Northbound Ramp Terminal (Traffic Signal)**

  Total Crashes – 99 Crash Rate – 1.93 Critical Crash Rate – 0.88 Critical Index – 2.20

  - 99 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 70 of the 99 crashes were rear end crashes, likely due to backups at the intersection. 31 of the rear ends were in the northbound direction, 15 were in the eastbound direction, and 24 were in the westbound direction.

- **26th Street at Southeastern Avenue (Traffic Signal)**

  Total Crashes – 107 Crash Rate – 1.58 Critical Crash Rate – 1.25 Critical Index – 1.26

  - 107 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 58 of the 107 crashes were rear end crashes, likely due to backups at the intersection. 28 of the rear ends were in the westbound direction and 15 were in the eastbound direction (9 northbound, 6 southbound).
  - 38 of the 107 crashes were right-angle crashes. 16 of the right-angle crashes involved left turning vehicles.

- **26th Street at Cleveland Avenue (Traffic Signal)**

  Total Crashes – 88 Crash Rate – 1.82 Critical Crash Rate – 0.89 Critical Index – 2.06

  - 88 crashes occurred over the last 5 years, this intersection has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 54 of the 88 crashes were rear end crashes, likely due to backups at the intersection. 36 of the rear ends were in the westbound direction and 14 were in the eastbound direction (4 northbound). This could indicate backups are worse for westbound vehicles.
  - 24 of the 88 crashes were right-angle crashes. 10 of the right-angle crashes involved left turning vehicles.
  - There was 1 incapacitating injury (severity A) crash at this intersection. This crash involved a drunk driver disregarding the traffic control.

SEGMENT CRASHES

There were a total of 128 crashes along the roadway segments analyzed as part of this project between 2015 and 2019. The segments included any crashes between the 27 intersections analyzed that was not assigned as an intersection crash.

Crashes at any business or residential access would be considered segment crashes for the purposes of this analysis. **Table 4** summarizes the crashes by severity for each segment.

Table 4 Segment Crashes

Roadway Description		Crash Severity							Rate Information		
	From / To	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Rice St	Lowell Ave / I-229 SB Ramp	0	0	0	0	0	5	5	2.63	7.11	0.37
	I-229 SB Ramp / I-229 NB Ramp	0	0	0	0	0	4	4	0.76	5.47	0.14
	I-229 NB Ramp / Bahnson Ave	0	0	1	0	2	6	9	1.01	7.18	0.14
6th St	Lowell Ave / Leadale Ave	0	0	1	0	2	0	3	2.36	10.20	0.23
	Leadale Ave / N Cleveland Ave	0	0	0	2	6	0	8	2.36	6.11	0.39
10th St	Jessica Ave / St. Paul Ave	0	0	3	0	6	0	9	1.10	5.01	0.22
	St. Paul Ave / Lowell Ave	0	0	0	1	8	0	9	1.66	5.26	0.32
	Lowell Ave / Conklin Ave	0	0	0	0	0	0	0	0.00	4.72	0.00
	Conklin Ave / Single Point Ramp	0	0	0	0	0	0	0	0.00	5.00	0.00
	Single Point Ramp / Blaine Ave	0	0	1	0	2	0	3	0.75	4.20	0.18
	Blaine Ave / Cleveland Ave	0	0	0	1	2	0	3	0.81	4.26	0.19
	Cleveland Ave / Chapel Hill Rd	0	0	0	0	0	0	0	0.00	4.93	0.00
	Chapel Hill Rd / Hy-Vee Access	0	0	0	0	4	0	4	0.72	5.42	0.13
12th	Lowell Ave / Cleveland Ave	0	0	3	6	8	0	17	**10.95**	**3.31**	**3.31**
	Southeastern Ave / Blaine Ave	0	0	2	2	10	0	14	4.18	7.70	0.54
18th	Blaine Ave / Cleveland Ave	0	0	2	0	1	0	3	4.78	11.96	0.40
SE	18th St / 26th St (Southeastern Ave)	0	0	0	0	6	1	7	0.81	2.32	0.35
26th St	Van Eps Ave / Yeager Rd	0	0	1	1	9	0	11	1.74	6.96	0.25
	Yeager Rd / NB Ramp	0	0	1	0	2	0	3	0.36	5.02	0.07
	I-229 NB Ramp / Southeastern Ave	0	0	2	3	9	2	16	1.27	4.64	0.27
	Southeastern Ave / Cleveland Ave	0	0	0	0	0	0	0	0.00	5.34	0.00
	26th St / SB Ramp (Yeager Rd)	0	0	0	0	0	0	0	0.00	13.64	0.00
	TOTAL	**0**	**0**	**17**	**16**	**77**	**18**	**128**	n/a	n/a	n/a

- **Bold/Red shaded** indicates a calculated crash rate that is at or exceeding the critical rate.

Below is a brief summary of the trends seen in these crashes as well as a summary of the roadway segment location with a crash rate that exceeds the calculated critical rate.

Segment Trends

- Approximately 38% of the segment crashes (48 out of 128) were single vehicle (ran off road, spin outs, etc.) or wild animal hit crashes.
- Approximately 66% of the segment crashes occurred during daylight conditions, with the remaining 34% occurring when it was dark.
- Approximately 73% of the segment crashes occurred when the roadway surface was dry, with the remaining 27% occurring when the roadway was wet (16%) or snowy/icy (11%).
- Approximately 48% of the segment crashes occurred during the AM peak (6-9 AM) and PM peak (3-6 PM) periods.
- There were 3 crashes involving a pedestrian or bicyclist on the roadway segments between 2015 and 2019.
  - A bicycle crash occurred on 6th Street between Leadale Avenue and Cleveland Avenue and involved a vehicle taking a right turn into the gas station parking lot hitting a bicyclist.
  - A pedestrian crash occurred on 10th Street at Omaha Avenue and involved an eastbound vehicle making a right turn into a pedestrian.
  - A pedestrian crash occurred on 12th Street at Conklin Avenue and involved a pedestrian crossing the roadway, failing to yield.

12th Street

- **12th Street between Lowell Avenue and Cleveland Avenue**

  Total Crashes – 17 Crash Rate – 10.95 Critical Crash Rate – 3.13 Critical Index – 3.31
  - 17 crashes occurred along this 1,330-foot segment over the last 5 years, this segment has a crash rate that exceeds the calculated critical rate, indicating a safety concern.
  - 7 crashes involved single vehicles, including 4 driving while intoxicated.
  - There are two intersections, Conklin Avenue and Blaine Avenue, along this segment that each had about 5 crashes.

Other Study Corridors

No segments with crash rates that exceed the critical rate were found along Rice Street, 6th Street, 10th Street, 18th Street, Southeastern Avenue, or 26th Street.

RESULTS

The most recent 5-years of crash data, 2015 through 2019, was reviewed as part of the I-229 Exit 6 Interchange Project. A total of 1,632 crashes occurred within the study area during the 5-year period. Crash rates were calculated for all segments and intersections and compared to the critical crash rates; a crash rate higher than the critical indicates a safety concern.

Mainline I-229 has 6 segment areas that have had crash rates above the critical, these include:

- Northbound I-229 Locations:
  - Mainline segment between Exit 5 and Exit 6.
  - Exit 6 Diverge Area.
  - Exit 7 Merge Area.
- Southbound I-229 Locations:
  - Exit 7 Merge Area.
  - Exit 6 Diverge Area.
  - Exit 6 Merge Area.

There were 3 ramp connections from I-229 that had crash rates above the critical rate, these include:

- Northbound I-229 Entrance Ramp from 26th Street (Exit 5).
- Northbound I-229 Exit Ramp to Rice Street (Exit 7).
- Southbound I-229 Entrance Ramp from 10th Street (Exit 6).

The study intersections included 23 recommended study locations; 4 additional intersection were included as they had approximately 10 crashes during the 5-year period. A total of 15 intersections have crash rates that exceed the critical rates, these include:

- Rice Street at the I-229 Northbound Ramp Terminal
- 6th Street at Cleveland Avenue
- 10th Street at Lowell Avenue
- 10th Street at I-229 SPUI
- 10th Street at Cleveland Avenue
- 12th Street at Lowell Avenue
- 12th Street at Cleveland Avenue
- 18th Street at Southeastern Avenue
- 18th Street at Blaine Avenue
- 18th Street at Cleveland Avenue
- 26th Street at Yeager Road**
- 26th Street at I-229 Northbound Ramp Terminal**
- 26th Street at Southeastern Avenue**
- 26th Street at Cleveland Avenue**
- Yeager Road at I-229 Southbound Ramp Terminal**

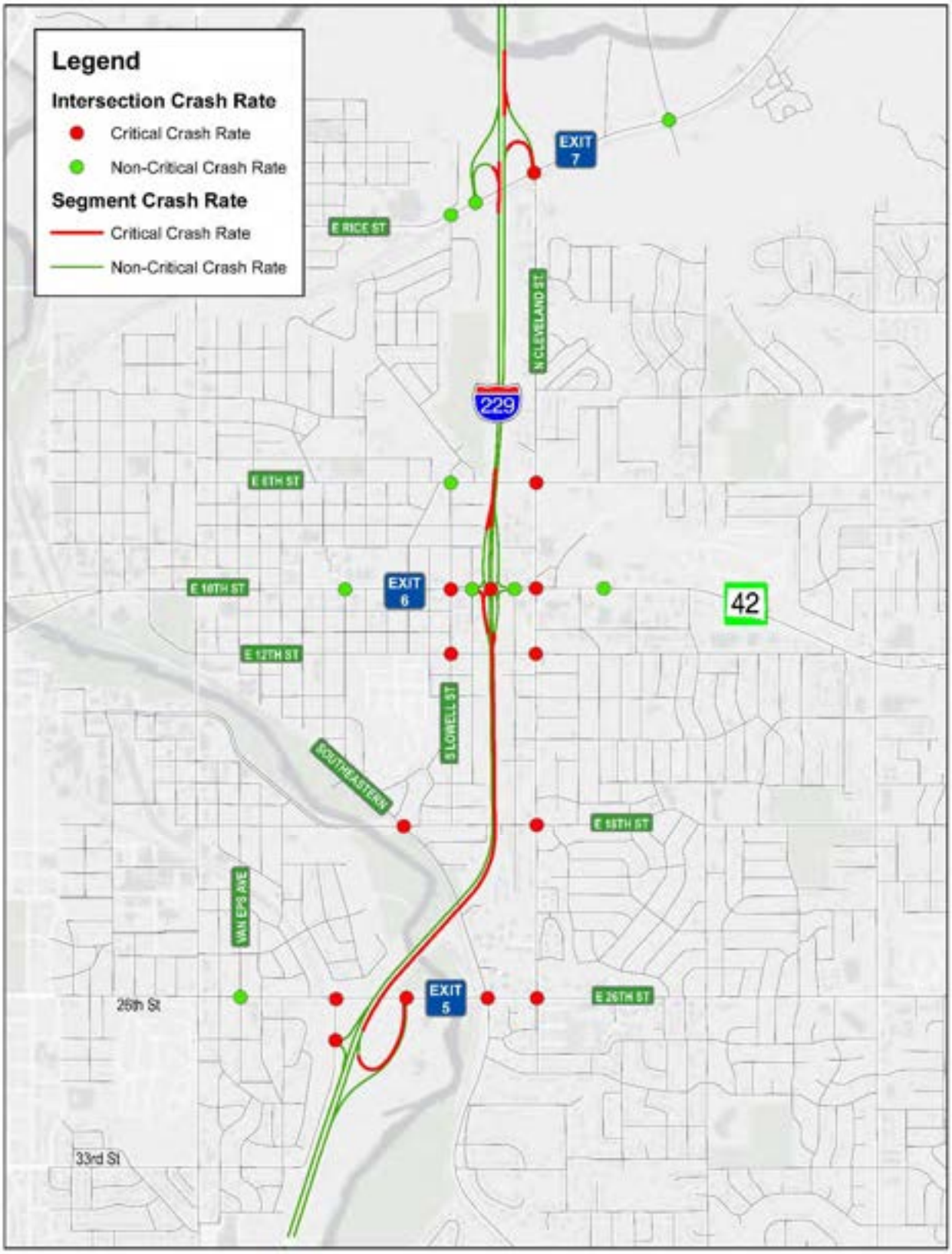
  **26th Street/Exit 5 is currently under construction and the new design should improve safety on the corridor.

Arterial segments were divided between intersections, a total of 22 segments were evaluated along the 7 roadways. Only 1 segment had a crash rate higher than the critical rate.

- 12th Street: between Lowell Avenue and Cleveland Avenue

Figure 2 highlights the mainline, ramp connection segments, and intersections that have crash rates that are above the critical rate.

Figure 2 Crash Rate Summary



It should be noted that the current construction project at the I-229 Exit 5 (26th Street) interchange will provide safety improvements to the intersections being reconstructed between Yeager Road and Southeastern Avenue. While the 26th Street at Cleveland intersection is not within the construction limits, over 40% of the existing crashes at that intersection are westbound rear end crashes; therefore, improvements downstream should reduce congestion and improve the safety of this intersection. The crashes on the northbound I-229 entrance ramp from 26th Street may not be improved as part current construction project; the existing crashes mainly occurred on the curved, loop ramp portion of the existing entrance ramp which is not fully part of the ongoing construction project.

This analysis is intended to show existing safety issues within the project area. Design changes for the study interchange, intersections, and surrounding project area should consider safety improvements for the intersections and segments that have a history of an existing safety problem.

To address the existing safety concerns throughout the project area, the following is a partial list of potential safety improvements that could be considered during the overall study recommendations:

- High Friction Surface Treatments (HFST) – improved traction for road curves in all weather conditions.
- Intelligent Transportation Systems (ITS) – improved warning information for changes in roadway conditions.
- Apply current design standards – this applies to both freeway and arterial corridors.
- Added capacity improvements to improve the traffic operations flow and efficiency.
- Signal Timing and Phasing updates –including left turn phases and improved traffic flow.

Attachments:
Tables A1a through A2b – Crash Summary Tables – Mainline I-229 and I-229 Ramps
Tables B1a through B2b – Crash Summary Tables – Intersection and Segment Crashes
Figures A1 through A3 – Crash Location Figures

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SEH

0 0.075 0.15 Miles

Project: HGRSP 156524
Print Date: 10/8/2020

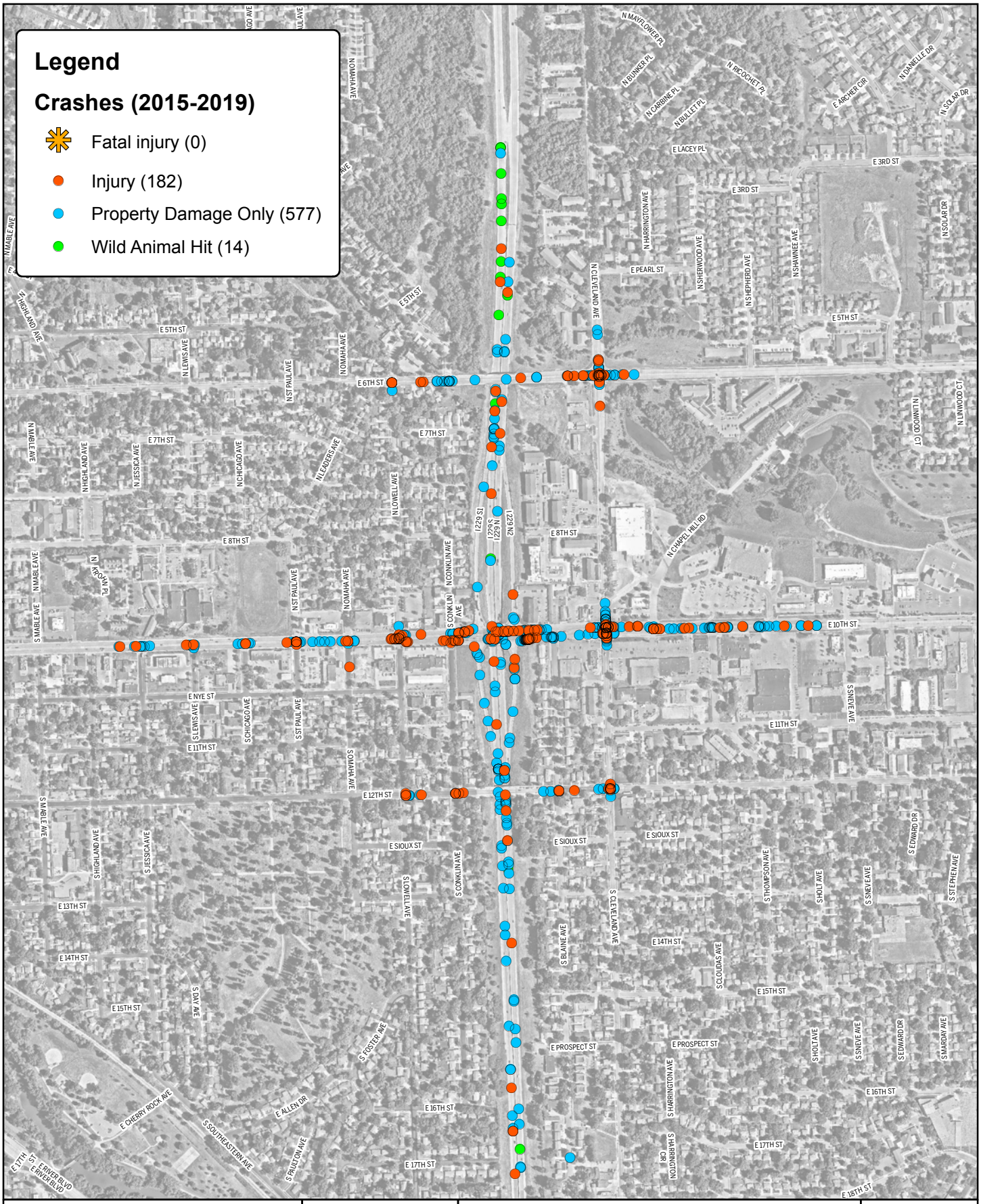
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

CRASH HISTORY (2015-2019)

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A1



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Project: HGRSP 156524
Print Date: 10/8/2020

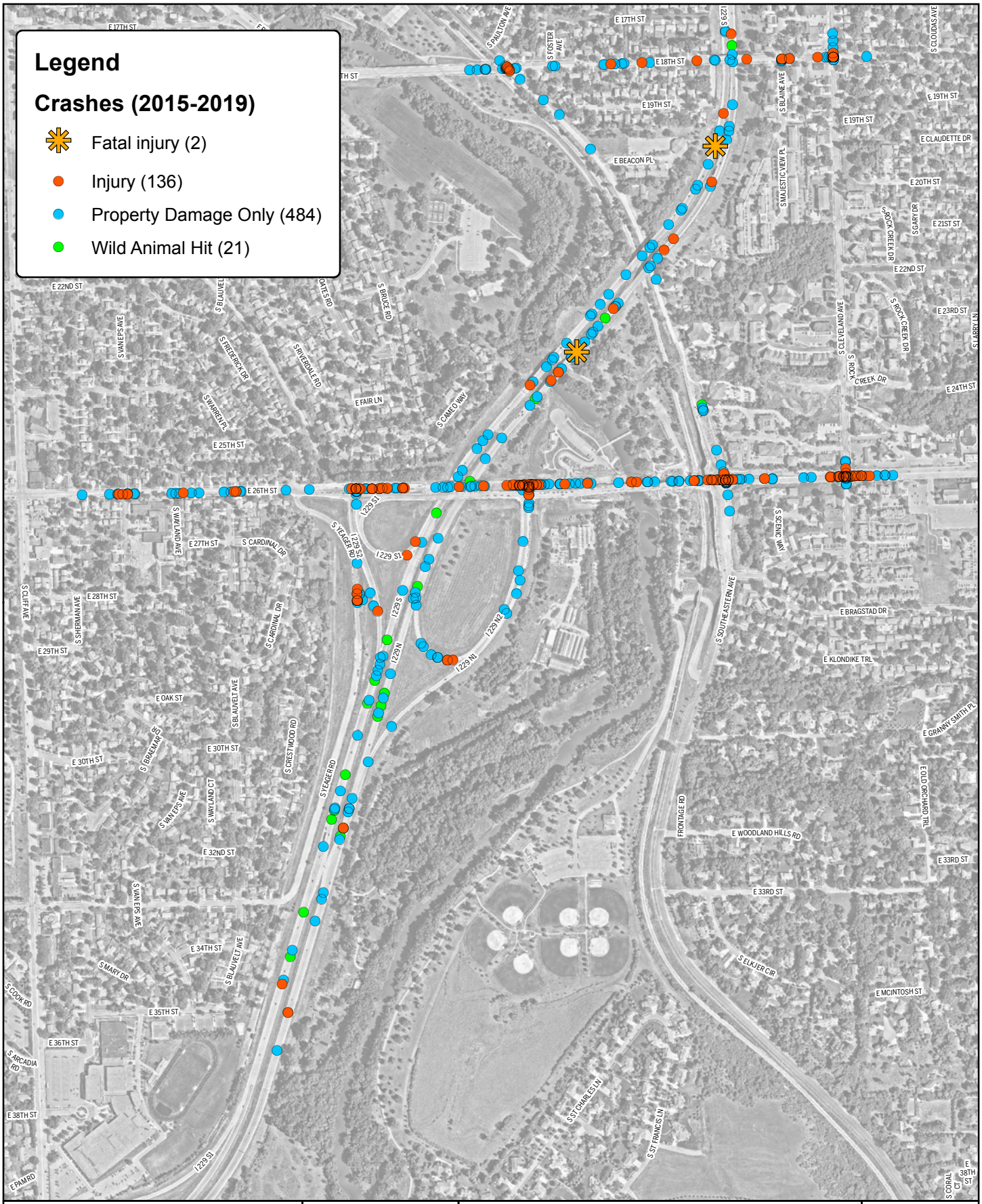
Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

CRASH HISTORY (2015-2019)

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A2



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SEH

0 0.075 0.15 Miles

Project: HGRSP 156524
Print Date: 10/8/2020

Map by: msteuernagel
Projection:UTM Zone 14N
Source: SEH, ESRI, SDDOT

CRASH HISTORY (2015-2019)

I-229 Exit 6 (10th St) Interchange Project

Sioux Falls, SD

Figure A3

Table A1a
I-229 Exit 6 Interchange Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

	Mainline Segments		Segment		Crash Severity							SEGMENT CRASH RATE INFORMATION			
												Crash Rate	Critical Rates	Critical Index	SDDOT Average
	FROM	Road Section	Length (Miles)	Segment ADT	Fatal	A	B	C	Property	Wild Animal Hits	Total	Crash Rate	Crash Rate	Critical Index	Crash Rate
Northbound I-229	Between Exits 4 & 5	Urban Interstate	0.24	22,250	0	0	1	0	3	0	4	0.42	1.93	0.22	1.03
	Exit 5 Diverge	Urban Interstate	0.14	22,250	0	0	0	1	9	1	11	1.91	2.21	0.87	**1.03**
	Exit 5 between Ramps	Urban Interstate	0.30	16,420	0	0	0	0	5	3	8	0.90	1.97	0.46	1.03
	Exit 5 Merge	Urban Interstate	0.17	18,855	0	0	0	0	5	2	7	1.17	2.18	0.54	**1.03**
	Between Exits 5 & 6	Urban Interstate	0.83	18,855	1	2	3	2	33	4	45	**1.58**	**1.54**	**1.03**	**1.03**
	Exit 6 Diverge	Urban Interstate	0.27	18,855	0	1	1	3	18	1	24	**2.63**	**1.95**	**1.35**	**1.03**
	Exit 6 between Ramps	Urban Interstate	0.43	12,285	0	0	0	0	8	0	8	0.83	1.92	0.43	1.03
	Exit 6 Merge	Urban Interstate	0.14	16,325	0	0	1	1	4	0	6	1.42	2.42	0.59	**1.03**
	Between Exits 6 & 7	Urban Interstate	0.69	16,325	0	0	1	3	9	9	22	1.08	1.63	0.66	**1.03**
	Exit 7 Diverge	Urban Interstate	0.14	16,325	0	1	0	0	3	6	10	2.36	2.42	0.98	**1.03**
	Exit 7 between Ramps	Urban Interstate	0.26	13,495	0	0	0	0	3	4	7	1.10	2.15	0.51	**1.03**
	Exit 7 Merge	Urban Interstate	0.14	14,900	0	0	1	0	19	6	26	**6.73**	**2.49**	**2.70**	**1.03**
Southbound I-229	Exit 7 Diverge	Urban Interstate	0.14	14,900	0	0	0	1	5	2	8	2.07	2.49	0.83	**1.03**
	Exit 7 between Ramps	Urban Interstate	0.25	12,400	0	0	0	0	4	3	7	1.22	2.21	0.55	**1.03**
	Exit 7 Merge	Urban Interstate	0.14	16,325	0	0	2	1	18	1	22	**5.19**	**2.42**	**2.15**	**1.03**
	Between Exits 7 & 6	Urban Interstate	0.63	16,325	0	0	1	2	9	13	25	1.33	1.66	0.80	**1.03**
	Exit 6 Diverge	Urban Interstate	0.14	16,325	0	0	1	1	12	1	15	**3.54**	**2.42**	**1.46**	**1.03**
	Exit 6 between Ramps	Urban Interstate	0.43	10,725	0	0	2	2	10	1	15	1.77	1.99	0.89	**1.03**
	Exit 6 Merge	Urban Interstate	0.34	18,855	0	0	0	0	18	0	18	1.53	1.84	0.83	**1.03**
	Between Exits 6 & 5	Urban Interstate	0.79	18,855	1	0	2	4	30	0	37	1.36	1.55	0.88	**1.03**
	Exit 5 Diverge	Urban Interstate	0.08	18,855	0	0	0	0	3	1	4	1.48	2.80	0.53	**1.03**
	Exit 5 between Ramps	Urban Interstate	0.20	16,215	0	0	0	0	2	1	3	0.51	2.20	0.23	1.03
	Exit 5 Merge	Urban Interstate	0.14	22,250	0	0	0	0	7	3	10	1.73	2.21	0.78	**1.03**
	Between Exits 5 & 4	Urban Interstate	0.22	22,250	0	0	1	0	6	4	11	1.21	1.95	0.62	**1.03**
	TOTAL				**2**	**4**	**17**	**21**	**243**	**66**	**353**				
					1%	**1%**	**5%**	**6%**	**69%**	**19%**					

Critical Rate Exceeded	Critical Index ≥ 1	Average Rate Exceeded

Table A1b
I-229 Exit 6 Interchange Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

	Mainline Segments		Diagram - Crash Type								Light Condition		Surface Condition		
	FROM	Road Section	Rear End	Right Angle	Side Swipe	Head On	One-Vehicle	Wild Animal	Ped/Bike	Total	Day	Dark	Dry	Wet	Snow/Ice
Northbound I-229	Between Exits 4 & 5	Urban Interstate	1	0	1	0	2	0	0	**4**	3	1	3	1	0
	Exit 5 Diverge	Urban Interstate	7	0	2	0	1	1	0	**11**	5	6	7	2	2
	Exit 5 between Ramps	Urban Interstate	0	0	1	0	4	3	0	**8**	4	4	6	0	2
	Exit 5 Merge	Urban Interstate	0	0	1	0	4	2	0	**7**	3	4	3	1	3
	Between Exits 5 & 6	Urban Interstate	4	2	3	0	32	4	0	**45**	28	17	16	1	28
	Exit 6 Diverge	Urban Interstate	11	1	3	0	8	1	0	**24**	13	11	13	7	4
	Exit 6 between Ramps	Urban Interstate	0	1	4	0	3	0	0	**8**	6	2	5	1	2
	Exit 6 Merge	Urban Interstate	2	0	3	0	1	0	0	**6**	6	0	6	0	0
	Between Exits 6 & 7	Urban Interstate	3	3	1	0	6	9	0	**22**	11	11	10	4	8
	Exit 7 Diverge	Urban Interstate	0	0	1	0	3	6	0	**10**	4	6	8	2	0
	Exit 7 between Ramps	Urban Interstate	0	1	0	0	2	4	0	**7**	2	5	4	1	2
	Exit 7 Merge	Urban Interstate	2	1	2	0	15	6	0	**26**	20	6	9	0	17
Southbound I-229	Exit 7 Diverge	Urban Interstate	0	0	1	0	5	2	0	**8**	1	7	5	2	1
	Exit 7 between Ramps	Urban Interstate	0	0	0	0	4	3	0	**7**	5	2	2	1	4
	Exit 7 Merge	Urban Interstate	2	4	8	0	7	1	0	**22**	16	6	12	4	6
	Between Exits 7 & 6	Urban Interstate	4	0	0	0	8	13	0	**25**	12	13	19	1	5
	Exit 6 Diverge	Urban Interstate	1	0	1	0	12	1	0	**15**	11	4	8	4	3
	Exit 6 between Ramps	Urban Interstate	2	0	2	0	10	1	0	**15**	11	4	5	3	7
	Exit 6 Merge	Urban Interstate	4	1	7	0	6	0	0	**18**	14	4	12	3	3
	Between Exits 6 & 5	Urban Interstate	9	2	3	0	23	0	0	**37**	30	7	18	1	18
	Exit 5 Diverge	Urban Interstate	1	0	0	0	2	1	0	**4**	1	3	2	1	1
	Exit 5 between Ramps	Urban Interstate	1	1	0	0	0	1	0	**3**	3	0	3	0	0
	Exit 5 Merge	Urban Interstate	1	1	4	0	1	3	0	**10**	7	3	9	0	1
	Between Exits 5 & 4	Urban Interstate	2	2	1	0	2	4	0	**11**	7	4	6	3	2
	TOTAL	**TOTAL**	**57**	**20**	**49**	**0**	**161**	**66**	**0**	**353**	**223**	**130**	**191**	**43**	**119**
			16%	**6%**	**14%**	**0%**	**46%**	**19%**	**0%**		**63%**	**37%**	**54%**	**12%**	**34%**

NOTES:

Crash Rates - Number of crashes per million entering vehicles

Exceeding the Calculated Critical Rates indicated a sustained crash problem.

SDDOT Statewide Averages	
Segement Type	Crash Rate
Urban Interstate	1.03

Table A2a
I-229 Exit 6 Interchange Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

	Ramp Segments		Segment		Crash Severity							SEGMENT CRASH RATE INFORMATION			
												Crash Rate	Critical Rates	Critical Index	SDDOT Average
	FROM	Road Section	Length (Miles)	Segment ADT	Fatal	A	B	C	Property	Wild Animal Hits	Total	Crash Rate	Crash Rate	Critical Index	Crash Rate
Northbound Ramps	Exit 5 Off Ramp	Urban Interstate	0.45	5,830	0	0	0	0	4	0	4	0.83	2.33	0.36	1.03
	Exit 5 On Ramp	Urban Interstate	0.38	2,450	0	0	1	1	11	0	13	**7.67**	**3.33**	**2.30**	**1.03**
	Exit 6 Off Ramp	Urban Interstate	0.29	6,570	0	0	0	0	2	0	2	0.57	2.57	0.22	1.03
	Exit 6 On Ramp	Urban Interstate	0.26	5,500	0	0	0	1	2	0	3	1.15	2.84	0.40	**1.03**
	Exit 7 Off Ramp	Urban Interstate	0.19	2,830	0	0	0	1	7	0	8	**8.09**	**4.17**	**1.94**	**1.03**
	Exit 7 On Ramp	Urban Interstate	0.28	2,615	0	1	0	0	1	0	2	1.51	3.68	0.41	**1.03**
Southbound Ramps	Exit 7 Off Ramp	Urban Interstate	0.32	2,500	0	0	0	0	0	0	0	0.00	3.54	0.00	1.03
	Exit 7 On Ramp	Urban Interstate	0.20	2,730	0	0	1	0	2	0	3	3.08	4.20	0.73	**1.03**
	Exit 6 Off Ramp	Urban Interstate	0.27	5,600	0	0	0	0	0	0	0	0.00	2.80	0.00	1.03
	Exit 6 On Ramp	Urban Interstate	0.15	6,775	0	0	0	1	8	0	9	**4.92**	**3.24**	**1.52**	**1.03**
	Exit 5 Off Ramp	Urban Interstate	0.13	2,640	0	0	0	0	1	0	1	1.63	5.19	0.31	**1.03**
	Exit 5 On Ramp	Urban Interstate	0.09	5,620	0	0	0	1	1	0	2	2.10	4.23	0.50	**1.03**
	TOTAL				**0**	**1**	**2**	**5**	**39**	**0**	**47**				
					0%	**2%**	**4%**	**11%**	**83%**	**0%**					

Critical Rate Exceeded	Critical Index ≥ 1	Average Rate Exceeded

Table A2b
I-229 Exit 6 Interchange Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

	Ramp Segments		Diagram - Crash Type								Light Condition		Surface Condition		
	FROM	Road Section	Rear End	Right Angle	Side Swipe	Head On	One-Vehicle	Wild Animal	Ped/Bike	Total	Day	Dark	Dry	Wet	Snow/Ice
Northbound Ramps	Exit 5 Off Ramp	Urban Interstate	0	0	0	0	4	0	0	**4**	3	1	3	0	1
	Exit 5 On Ramp	Urban Interstate	1	0	0	0	12	0	0	**13**	10	3	6	2	5
	Exit 6 Off Ramp	Urban Interstate	0	0	0	0	2	0	0	**2**	0	2	1	0	1
	Exit 6 On Ramp	Urban Interstate	1	1	0	0	1	0	0	**3**	1	2	2	0	1
	Exit 7 Off Ramp	Urban Interstate	0	0	0	0	8	0	0	**8**	7	1	4	0	4
	Exit 7 On Ramp	Urban Interstate	0	0	0	0	2	0	0	**2**	1	1	2	0	0
Southbound Ramps	Exit 7 Off Ramp	Urban Interstate	0	0	0	0	0	0	0	**0**	0	0	0	0	0
	Exit 7 On Ramp	Urban Interstate	1	0	0	0	2	0	0	**3**	3	0	3	0	0
	Exit 6 Off Ramp	Urban Interstate	0	0	0	0	0	0	0	**0**	0	0	0	0	0
	Exit 6 On Ramp	Urban Interstate	6	0	0	0	3	0	0	**9**	5	4	5	2	2
	Exit 5 Off Ramp	Urban Interstate	0	0	0	0	1	0	0	**1**	0	1	0	0	1
	Exit 5 On Ramp	Urban Interstate	2	0	0	0	0	0	0	**2**	2	0	0	0	2
	TOTAL	**TOTAL**	**11**	**1**	**0**	**0**	**35**	**0**	**0**	**47**	**32**	**15**	**26**	**4**	**17**
			23%	**2%**	**0%**	**0%**	**74%**	**0%**	**0%**		**68%**	**32%**	**55%**	**9%**	**36%**

NOTES:

Crash Rates - Number of crashes per million entering vehicles

Exceeding the Calculated Critical Rates indicated a sustained crash problem.

SDDOT Statewide Averages	
Segement Type	Crash Rate
Urban Interstate	1.03

Table B1a
I-229 Exit 6 Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

Study Intersections			Crash Severity							INTERSECTION CRASH RATE INFORMATION			
										Crash Rate	Critical Rates	Critical Index	Sioux Falls Average
Intersection	Control Type	Entering ADT	Fatal	A	B	C	Property	Wild Animal Hits	Total	Crash Rate	Crash Rate	Critical Index	Crash Rate
Rice St at Lowell Ave	Unsignalized-one road above ADT 4,000	13,100	0	0	1	1	7	0	9	0.38	0.56	0.67	**0.27**
Rice St at I-229 SB Ramp Terminal**	Signal-one road above ADT 10,000	14,900	0	1	1	3	9	0	14	0.51	0.99	0.52	0.59
Rice St at I-229 NB Ramp Terminal**	Signal-one road above ADT 10,000	18,270	0	0	2	10	39	0	51	**1.53**	**0.95**	**1.61**	**0.59**
Rice St at Bahnson Ave	Unsignalized-one road above ADT 4,000	10,810	0	0	0	1	1	0	2	0.10	0.60	0.17	0.27
6th St at Lowell Ave	Unsignalized-one road above ADT 4,000	11,530	0	0	1	2	5	0	8	0.38	0.59	0.65	**0.27**
6th St at Leadale Ave	Unsignalized-one road above ADT 4,000	10,700	0	0	0	0	8	0	8	0.41	0.60	0.69	**0.27**
6th St at N Cleveland Ave**	Signal-both roads above ADT 10,000	21,350	0	0	8	14	66	0	88	**2.26**	**1.35**	**1.67**	**0.94**
10th St at Jessica Ave**	Signal-one road above ADT 10,000	23,400	0	0	0	3	9	0	12	0.28	0.90	0.31	0.59
10th St at St. Paul Ave	Unsignalized-one road above ADT 4,000	24,050	0	0	4	1	9	0	14	0.32	0.48	0.66	**0.27**
10th St at Lowell Ave**	Signal-one road above ADT 10,000	25,550	0	1	5	12	34	0	52	**1.11**	**0.89**	**1.25**	**0.59**
10th St at Conklin Ave	Other	23,400	0	0	1	1	4	0	6	0.14	1.41	0.10	1.00
10th St at Single Point Ramp Terminal**	Signal-one road above ADT 10,000	33,240	0	3	3	24	120	0	150	**2.47**	**0.85**	**2.90**	**0.59**
10th St at Blaine Ave	Other	31,900	0	0	0	0	5	0	5	0.09	1.35	0.07	1.00
10th St at Cleveland Ave**	Signal-both roads above ADT 10,000	35,100	0	1	14	25	124	0	164	**2.56**	**1.26**	**2.03**	**0.94**
10th St at Chapel Hill Rd	Unsignalized-one road above ADT 4,000	22,500	0	0	2	0	7	0	9	0.22	0.49	0.45	0.27
10th St at Hy-Vee Access**	Signal-one road above ADT 10,000	22,500	0	0	0	6	19	0	25	0.61	0.91	0.67	**0.59**
12th St at Lowell Ave	Unsignalized-one road above ADT 4,000	3,500	0	0	1	2	4	0	7	**1.10**	**0.88**	**1.25**	**0.27**
12th St at Cleveland Ave**	Signal-both roads under ADT 10,000	10,750	0	0	1	7	26	0	34	**1.73**	**1.05**	**1.65**	**0.58**
18th St at Southeastern Ave**	Signal-both roads under ADT 10,000	9,750	0	0	2	2	28	0	32	**1.80**	**1.07**	**1.68**	**0.58**
18th St at Blaine Ave	Unsignalized-one road above ADT 4,000	6,500	0	0	1	0	9	0	10	**0.84**	**0.70**	**1.20**	**0.27**
18th St at Cleveland Ave**	Signal-both roads under ADT 10,000	10,550	0	0	1	4	24	0	29	**1.51**	**1.05**	**1.43**	**0.58**
26th St at Van Eps Ave**	Signal-one road above ADT 10,000	13,000	0	0	2	2	12	0	16	0.67	1.02	0.66	**0.59**
26th St at Yeager Rd**	Signal-one road above ADT 10,000	23,050	0	0	4	12	33	0	49	**1.16**	**0.91**	**1.28**	**0.59**
Yeager Rd at SB Ramp Terminal	Unsignalized-one road above ADT 1,000	8,670	0	1	0	3	12	0	16	**1.01**	**0.65**	**1.54**	**0.28**
26th St at NB Ramp Terminal**	Signal-one road above ADT 10,000	28,020	0	0	10	17	72	0	99	**1.93**	**0.88**	**2.20**	**0.59**
26th St at Southeastern Ave**	Signal-both roads above ADT 10,000	37,050	0	0	4	13	90	0	107	**1.58**	**1.25**	**1.26**	**0.94**
26th St at Cleveland Ave**	Signal-one road above ADT 10,000	26,450	0	1	6	20	61	0	88	**1.82**	**0.89**	**2.06**	**0.59**
TOTAL			**0**	**8**	**74**	**185**	**837**	**0**	**1,104**				
			0%	**1%**	**7%**	**17%**	**76%**	**0%**	**100%**				

**Signalized Intersections

Critical Rate Exceeded	Critical Index ≥ 1	Average Rate Exceeded

Table B1b
I-229 Exits 3 & 4 Project
2013 to 2017 Crash Data
SDDOT Crash Geodatabase Data

Study Intersections		Diagram - Crash Type							
Intersection	Control Type	Rear End	Right Angle	Side Swipe	Head On	One-Vehicle	Wild Animal	Pedestrian Crashes	Total
Rice St at Lowell Ave	Unsignalized-one road above ADT 4,000	2	6	1	0	0	0	0	9
Rice St at I-229 SB Ramp Terminal**	Signal-one road above ADT 10,000	8	5	1	0	0	0	0	14
Rice St at I-229 NB Ramp Terminal**	Signal-one road above ADT 10,000	19	24	3	0	5	0	0	51
Rice St at Bahnson Ave	Unsignalized-one road above ADT 4,000	0	1	0	0	1	0	0	2
6th St at Lowell Ave	Unsignalized-one road above ADT 4,000	3	5	0	0	0	0	0	8
6th St at Leadale Ave	Unsignalized-one road above ADT 4,000	1	3	2	0	2	0	0	8
6th St at N Cleveland Ave**	Signal-both roads above ADT 10,000	43	31	8	2	1	0	3	88
10th St at Jessica Ave**	Signal-one road above ADT 10,000	9	2	1	0	0	0	0	12
10th St at St. Paul Ave	Unsignalized-one road above ADT 4,000	2	11	0	1	0	0	0	14
10th St at Lowell Ave**	Signal-one road above ADT 10,000	36	15	0	0	1	0	0	52
10th St at Conklin Ave	Other	1	2	2	0	1	0	0	6
10th St at Single Point Ramp Terminal**	Signal-one road above ADT 10,000	129	11	4	0	6	0	0	150
10th St at Blaine Ave	Other	0	0	4	0	1	0	0	5
10th St at Cleveland Ave**	Signal-both roads above ADT 10,000	94	55	9	0	5	0	1	164
10th St at Chapel Hill Rd	Unsignalized-one road above ADT 4,000	1	6	2	0	0	0	0	9
10th St at Hy-Vee Access**	Signal-one road above ADT 10,000	17	5	1	0	0	0	2	25
12th St at Lowell Ave	Unsignalized-one road above ADT 4,000	0	5	0	0	2	0	0	7
12th St at Cleveland Ave**	Signal-both roads under ADT 10,000	7	22	2	0	2	0	1	34
18th St at Southeastern Ave**	Signal-both roads under ADT 10,000	13	11	3	0	5	0	0	32
18th St at Blaine Ave	Unsignalized-one road above ADT 4,000	4	5	1	0	0	0	0	10
18th St at Cleveland Ave**	Signal-both roads under ADT 10,000	10	15	1	0	3	0	0	29
26th St at Van Eps Ave**	Signal-one road above ADT 10,000	16	0	0	0	0	0	0	16
26th St at Yeager Rd**	Signal-one road above ADT 10,000	39	9	0	1	0	0	0	49
Yeager Rd at SB Ramp Terminal	Unsignalized-one road above ADT 1,000	2	10	1	0	3	0	0	16
26th St at NB Ramp Terminal**	Signal-one road above ADT 10,000	70	11	13	1	4	0	0	99
26th St at Southeastern Ave**	Signal-both roads above ADT 10,000	58	38	9	0	2	0	0	107
26th St at Cleveland Ave**	Signal-one road above ADT 10,000	54	24	2	0	8	0	0	88
TOTAL		**638**	**332**	**70**	**5**	**52**	**0**	**7**	**1,104**
		58%	**30%**	**6%**	**0%**	**5%**	**0%**	**1%**	

Sioux Falls Average Rates	
Intersection Type	Crash Rate
Signal-both roads above ADT 10,000	0.94
Signal-one road above ADT 10,000	0.59
Signal-both roads under ADT 10,000	0.58
Unsignalized-both roads above ADT 4,000	0.28
Unsignalized-one road above ADT 4,000	0.27
Unsignalized-one road above ADT 1,000	0.28
Unsignalized-both roads under ADT 1,000	0.42
Other	1.00

NOTES:

Crash Rates - Number of crashes per million entering vehicles

Exceeding the Calculated Critical Rates indicated a sustained crash proble

Table B2a
I-229 Exit 6 Project
2015 to 2019 Crash Data
SDDOT Crash Geodatabase Data

	Roadway Segments			Segment		Crash Severity							SEGMENT CRASH RATE INFORMATION			
													Crash Rate	Critical Rates	Critical Index	Sioux Falls
	FROM	TO	Road Section	Length (Miles)	Segment ADT	Fatal	A	B	C	Property	Wild Animal Hits	Total	Crash Rate	Crash Rate	Critical Index	Crash Rate
Rice St	Lowell Ave	I-229 SB Ramp Terminal	4-Lane - Turn Lanes (TWLTL)	0.09	12,200	0	0	0	0	0	5	5	2.63	7.11	0.37	3.40
	I-229 SB Ramp Terminal	I-229 NB Ramp Terminal	4-Lane - No Turn Lanes	0.19	15,100	0	0	0	0	0	4	4	0.76	5.47	0.14	3.33
	I-229 NB Ramp Terminal	Bahnson Ave	2-Lane - Turn Lanes (TWLTL)	0.43	11,500	0	0	1	0	2	6	9	1.01	7.18	0.14	5.17
6th St	Lowell Ave	Leadale Ave	2-Lane - Turn Lanes (TWLTL)	0.07	10,200	0	0	1	0	2	0	3	2.36	10.20	0.23	4.79
	Leadale Ave	N Cleveland Ave	4-Lane - Turn Lanes (TWLTL)	0.18	10,200	0	0	0	2	6	0	8	2.36	6.11	0.39	3.38
10th St	Jessica Ave	St. Paul Ave	4-Lane - Turn Lanes (TWLTL)	0.19	23,800	0	0	3	0	6	0	9	1.10	5.01	0.22	3.31
	St. Paul Ave	Lowell Ave	4-Lane - Turn Lanes (TWLTL)	0.13	23,800	0	0	0	1	8	0	9	1.66	5.26	0.32	3.19
	Lowell Ave	Conklin Ave	4-Lane - Median	0.06	22,900	0	0	0	0	0	0	0	0.00	4.72	0.00	2.18
	Conklin Ave	Single Point Ramp Terminal	4-Lane - Median	0.05	22,900	0	0	0	0	0	0	0	0.00	5.00	0.00	2.22
	Single Point Ramp Terminal	Blaine Ave	4-Lane - Median	0.07	31,400	0	0	1	0	2	0	3	0.75	4.20	0.18	2.18
	Blaine Ave	Cleveland Ave	4-Lane - Median	0.06	31,400	0	0	0	1	2	0	3	0.81	4.26	0.19	2.16
	Cleveland Ave	Chapel Hill Rd	4-Lane - Median	0.06	21,500	0	0	0	0	0	0	0	0.00	4.93	0.00	2.20
	Chapel Hill Rd	Hy-Vee Access	4-Lane - Turn Lanes (TWLTL)	0.14	21,500	0	0	0	0	4	0	4	0.72	5.42	0.13	3.34
12th St	Lowell Ave	Cleveland Ave	2-Lane - No Turn Lanes	0.25	3,400	0	0	3	6	8	0	17	**10.95**	**3.31**	**3.31**	**0.96**
18th St	Southeastern Ave	Blaine Ave	2-Lane - Turn Lanes (TWLTL)	0.33	5,500	0	0	2	2	10	0	14	4.18	7.70	0.54	4.54
	Blaine Ave	Cleveland Ave	2-Lane - Turn Lanes (TWLTL)	0.06	5,500	0	0	2	0	1	0	3	4.78	11.96	0.40	**4.37**
Southeastern	18th St	26th St	2-Lane - No Turn Lanes	0.56	8,500	0	0	0	0	6	1	7	0.81	2.32	0.35	1.28
26th St	Van Eps Ave	Yeager Rd	2-Lane - Turn Lanes (TWLTL)	0.28	12,400	0	0	1	1	9	0	11	1.74	6.96	0.25	4.66
	Yeager Rd	NB Ramp Terminal	4-Lane - No Turn Lanes	0.21	21,700	0	0	1	0	2	0	3	0.36	5.02	0.07	3.33
	NB Ramp Terminal	Southeastern Ave	4-Lane - No Turn Lanes	0.24	28,500	0	0	2	3	9	2	16	1.27	4.64	0.27	3.28
	Southeastern Ave	Cleveland Ave	4-Lane - Turn Lanes (TWLTL)	0.15	24,400	0	0	0	0	0	0	0	0.00	5.34	0.00	3.40
Yeager St	26th St	SB Ramp Terminal	2-Lane - Turn Lanes (TWLTL)	0.13	2,640	0	0	0	0	0	0	0	0.00	13.64	0.00	5.26
	TOTAL					**0**	**0**	**17**	**16**	**77**	**18**	**128**				
						0%	**0%**	**13%**	**13%**	**60%**	**14%**					

Critical Rate Exceeded	Critical Index ≥ 1	Average Rate Exceeded

Table B2b
I-229 Exits 3 & 4 Project
2013 to 2017 Crash Data
SDDOT Crash Geodatabase Data

	Roadway Segments			Diagram - Crash Type							
	FROM	TO	Road Section	Rear End	Right Angle	Side Swipe	Head On	One-Vehicle	Wild Animal	Pedestrian Crashes	Total
Rice St	Lowell Ave	I-229 SB Ramp Terminal	4-Lane - Turn Lanes (TWLTL)	0	0	0	0	0	5	0	5
	I-229 SB Ramp Terminal	I-229 NB Ramp Terminal	4-Lane - No Turn Lanes	0	0	0	0	0	4	0	4
	I-229 NB Ramp Terminal	Bahnson Ave	2-Lane - Turn Lanes (TWLTL)	2	0	0	0	1	6	0	9
6th St	Lowell Ave	Leadale Ave	2-Lane - Turn Lanes (TWLTL)	1	1	0	0	1	0	0	3
	Leadale Ave	N Cleveland Ave	4-Lane - Turn Lanes (TWLTL)	1	3	2	0	1	0	1	8
10th St	Jessica Ave	St. Paul Ave	4-Lane - Turn Lanes (TWLTL)	5	2	2	0	0	0	0	9
	St. Paul Ave	Lowell Ave	4-Lane - Turn Lanes (TWLTL)	1	6	1	0	0	0	1	9
	Lowell Ave	Conklin Ave	4-Lane - Median	0	0	0	0	0	0	0	0
	Conklin Ave	Single Point Ramp Terminal	4-Lane - Median	0	0	0	0	0	0	0	0
	Single Point Ramp Terminal	Blaine Ave	4-Lane - Median	0	3	0	0	0	0	0	3
	Blaine Ave	Cleveland Ave	4-Lane - Median	1	1	0	0	1	0	0	3
	Cleveland Ave	Chapel Hill Rd	4-Lane - Median	0	0	0	0	0	0	0	0
	Chapel Hill Rd	Hy-Vee Access	4-Lane - Turn Lanes (TWLTL)	2	1	0	0	1	0	0	4
12th St	Lowell Ave	Cleveland Ave	2-Lane - No Turn Lanes	2	8	0	0	6	0	1	17
18th St	Southeastern Ave	Blaine Ave	2-Lane - Turn Lanes (TWLTL)	3	0	2	0	9	0	0	14
	Blaine Ave	Cleveland Ave	2-Lane - Turn Lanes (TWLTL)	0	1	0	0	2	0	0	3
Southeastern	18th St	26th St	2-Lane - No Turn Lanes	2	1	0	0	3	1	0	7
26th St	Van Eps Ave	Yeager Rd	2-Lane - Turn Lanes (TWLTL)	6	4	0	0	1	0	0	11
	Yeager Rd	NB Ramp Terminal	4-Lane - No Turn Lanes	0	0	1	0	2	0	0	3
	NB Ramp Terminal	Southeastern Ave	4-Lane - No Turn Lanes	5	6	1	0	2	2	0	16
	Southeastern Ave	Cleveland Ave	4-Lane - Turn Lanes (TWLTL)	0	0	0	0	0	0	0	0
Yeager St	26th St	SB Ramp Terminal	2-Lane - Turn Lanes (TWLTL)	0	0	0	0	0	0	0	0
	TOTAL			**31**	**37**	**9**	**0**	**30**	**18**	**3**	**128**
				25%	**30%**	**7%**	**0%**	**24%**	**14%**		

SDDOT Statewide Averages	Crash Rate (x = Accesses/Mile)
Segment Type	
2-Lane - No Turn Lanes	CR = -0.0065x+1.4033
2-Lane - Turn Lanes (TWLTL)	CR = -0.008x+5.2641
4-Lane - No Turn Lanes	CR = -0.0026x+3.3277
4-Lane - Turn Lanes (TWLTL)	CR = -0.0029x+3.4004
6-Lane - Turn Lanes (TWLTL)	CR = -0.0216x+12.142
4-Lane - Median	CR = -0.0013x+2.2188
6-Lane - Median	CR = -0.0046x+3.6133

NOTES:

Crash Rates - Number of crashes per million entering vehicles

Exceeding the Calculated Critical Rates indicated a sustained crash problem.