SIOUX FALLS DOWNTOWN TRAFFIC IMPACT STUDY

January 2024

CITY OF SIOUX FALLS

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Executive Summary

In 2022, the City of Sioux Falls initiated a study to develop the *Horizon 2035 Downtown Plan* that creates "a vision that stimulates a vibrant downtown and supports a variety of developments and amenities over the next 10 years. It will be a look forward at the next decade and it will be a guiding document in the community to implement the collective vision."[1] It was determined that a traffic analysis was needed to support the downtown plan and provide traffic-related guidance to long-range planning efforts and future projects.

The South Dakota Department of Transportation (SDDOT) has identified a future need to replace the existing 10th Street and 11th Street viaducts over the railroad tracks and Big Sioux River. These future projects reflect significant investment in the transportation network with implications to downtown area travel and travel throughout the Sioux Falls metropolitan area. This study serves as a preliminary opportunity for the City of Sioux Falls to develop and evaluate potential combinations of transportation modifications throughout the downtown area. This study was structured to consider guiding principles and goals identified in the *Go Sioux Falls Metropolitan Planning Organization (MPO) 2045 Long Range Transportation Plan (LRTP)*.

This *Downtown Traffic Impact Study* includes three phases:

1. **East-West Corridor Study:** high-level review of east/west corridors through the downtown area to better understand benefits and drawbacks of potential new connections, changes to number of lanes, and/or one-way to two-way conversions
2. **Downtown Traffic Analysis:** crash history review, traffic forecasting, and a detailed peak hour operations analysis to help guide alternatives development and evaluation
3. **10th Street/11th Street Viaduct Study:** development, refinement, and evaluation of 10th Street/11th Street (10th/11th Street) viaduct and roadway alternatives

The study area extends from Grange Avenue (west) to Cliff Avenue (east) and Russell Street / Rice Street (north) to 14th Street (south).

Phase 1: East/West Corridor Study

Phase 1 reviews east/west corridor connectivity and capacity through the downtown area to identify long-range number of lane and roadway connection needs. The Sioux Falls Metropolitan Planning Organization (MPO) travel demand model (TDM) was used for this high-level analysis and several scenarios were developed to assess the following roadway variations:

- **10th/11th Street corridor number of lanes and directionality**
  - 3 lanes or 2 lanes in each direction
  - Maintain one-way pair or convert both streets to two-way travel (one-way to two-way conversion)
- **Rice-Russell connection** between Russell Street and Rice Street
  - New direct, multilane arterial connection from Minnesota Avenue to Cliff Avenue

[1] City of Sioux Falls *Horizon 2035 Downtown Plan*. www.siouxfalls.org/planning-dev/planning/downtown/2035-downtown

- **Benson Road connection** between Sycamore Avenue and Rice Street
    - New direct, multilane arterial connection extending Benson Road to Rice Street

The study team met on December 12, 2022, to review preliminary findings and identify two TDM scenarios for consideration as part of Phase 2. 'Scenario 44' maintains the 10th/11th Street one-way pair and incorporates a 10th/11th Street road diet (2 lanes in each direction) through the downtown area. 'Scenario 45' maintains the 10th/11th Street one-way pair and 3 lanes in each direction.

Phase 2: Downtown Traffic Analysis

Phase 2 reflects a focused analysis of the downtown area to help guide development and evaluation of 10th Street and 11th Street corridor and viaduct alternatives. This phase includes reviewing crash history, developing daily and peak hour traffic forecasts, and conducting a traffic operations analysis of No Build and Build conditions.

Phase 1 traffic scenario recommendations established the foundation for all Phase 2 traffic forecasting. Phase 2 downtown traffic analysis recommendations guide the Phase 3 development, refinement, and evaluation of 10th Street/11th Street viaduct alternatives.

The traffic operations analysis focused on three viaduct alignment options.

- **Alignment Option 1: Separate Alignments**
    - Maintains the existing 10th/11th Street alignment split across the Big Sioux River
- **Alignment Option 2: North Alignment**
    - Combines 10th/11th Street bridges to a single, north alignment across the Big Sioux River
    - 2nd Avenue & 10th Street intersection includes eastbound 11th Street through traffic
- **Alignment Option 3: South Alignment**
    - Combines 10th/11th Street bridges to a single, south alignment across the Big Sioux River
    - 2nd Avenue & 11th Street intersection includes westbound 10th Street through traffic

Based on findings from the Phase 2 downtown traffic operations analysis, it is recommended that:

- Alignment Option 1 (Separate Alignments) and Alignment Option 2 (North Alignment) be carried forward to Phase 3 of the study for conceptual design and evaluation
- Alignment Option 3 (South Alignment) be eliminated from further consideration
- Scenario 45 (S45) volumes and three lanes in each direction (3-lane 10th/11th Street) be used as the basis to guide evaluation and design decisions

Phase 3: 10th Street / 11th Street Viaduct Study

Phase 3 of the *Downtown Traffic Impact Study* focuses on concept development, refinement, and evaluation of the 10th Street and 11th Street viaducts and connecting roadway network. Recommendations from Phases 1 and 2 provide guidance on 10th/11th Street corridor number of lanes, intersection lane configurations, and operational feasibility.

Four conceptual viaduct options were developed for further evaluation, shown in **Figure ES-1 through Figure ES-4**. Bridge and retaining wall constructability, developable area adjacent to and/or under the viaducts, local street connectivity maintenance of traffic environmental impacts, and cost were all reviewed.

Downtown 10th/11th Street typical sections and an 'S-curve' concept west of Minnesota Avenue were also developed.

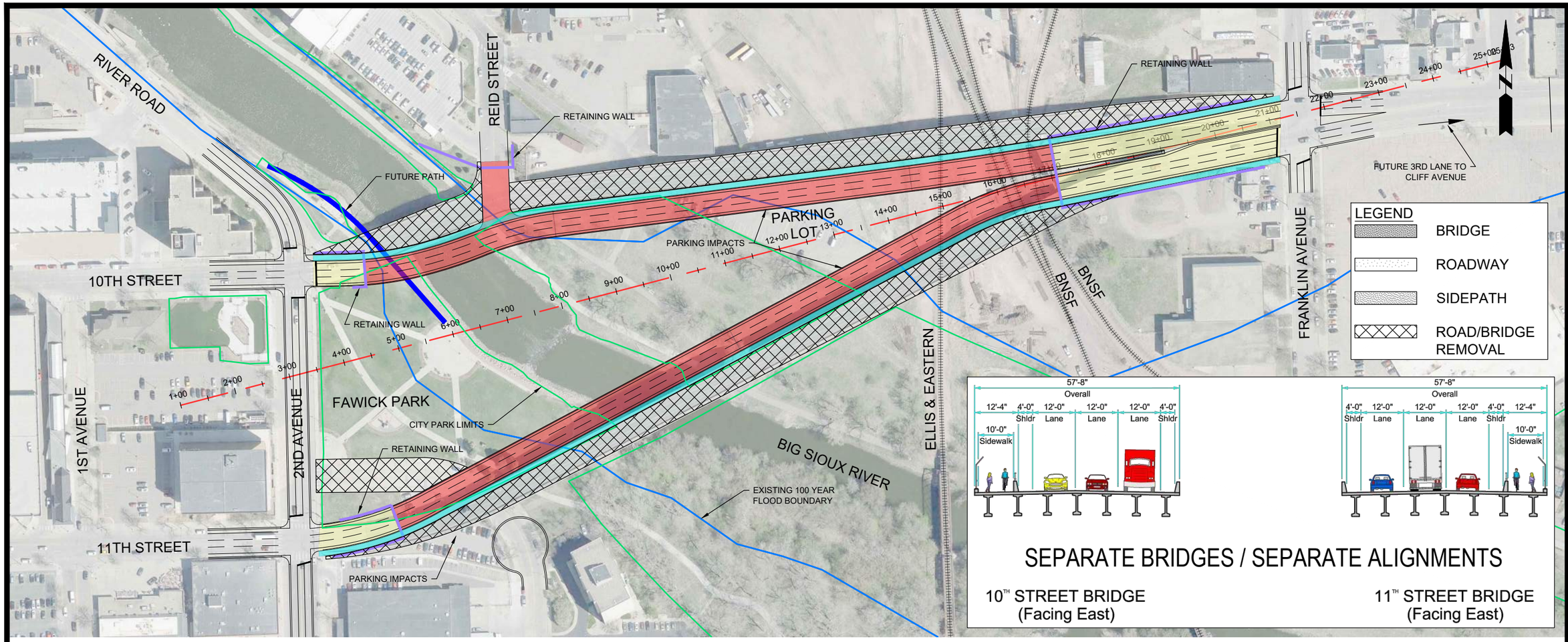
Phase 3 conclusions summarize *Downtown Traffic Impact Study* findings that correspond with the following applicable *Horizon 2035 Downtown Plan* and *Go Sioux Falls 2045 LRTP* goals and core values:

- *2045 LRTP Goal A: Operational Efficiency*
- *2045 LRTP Goal B: Connectivity and Economic Vitality*
- *2045 LRTP Goal E: Safety and Security*
- *2045 LRTP Goal C: Livability and Environmental Sustainability*
- *2045 LRTP Goal D: Multimodal Integration*
- *2045 LRTP Goal F: System Preservation*
- *Horizon 2035 Downtown Plan: Connected core value, where downtown is a place that is connected, easy to access, and navigate*

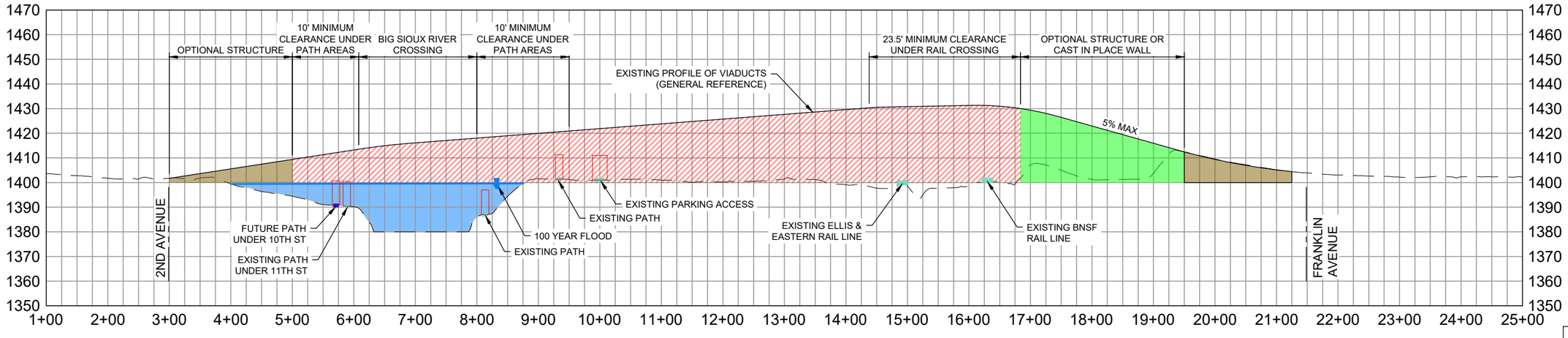
As part of the draft report review, the study team met with City of Sioux Falls leadership on October 10, 2023, to present findings, conclusions, and recommendations from the *Downtown Traffic Impact Study*.

Recommendations to be carried forward into the next study of the 10th/11th Street viaducts include:

1. Maintain and/or plan for 3 lanes in each direction
    a. Consider removing 10th Street and 11th Street on-street parking through downtown to reallocate space for pedestrian and streetscape type uses
2. Maintain one-way pair between Minnesota Avenue and east of the viaducts
    a. Consider one-way to two-way conversion west of Minnesota Avenue in a separate study
3. Further refine and evaluate Viaduct Options 1 through 4
4. Partner with area stakeholders to determine the best use of space and desired levels of mobility under and around the viaducts



Viaduct Option 1



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

DESIGNED BY: J. KJENSTAD
DRAWN BY: M. SEINER ACAD FILE: Z-01C-SP_MODEL_LINEWORK-OPTIONS.DWG
CHECKED BY: J. KJENSTAD DATE: 6/13/2023
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CITY OF SIOUX FALLS

Figure ES-1

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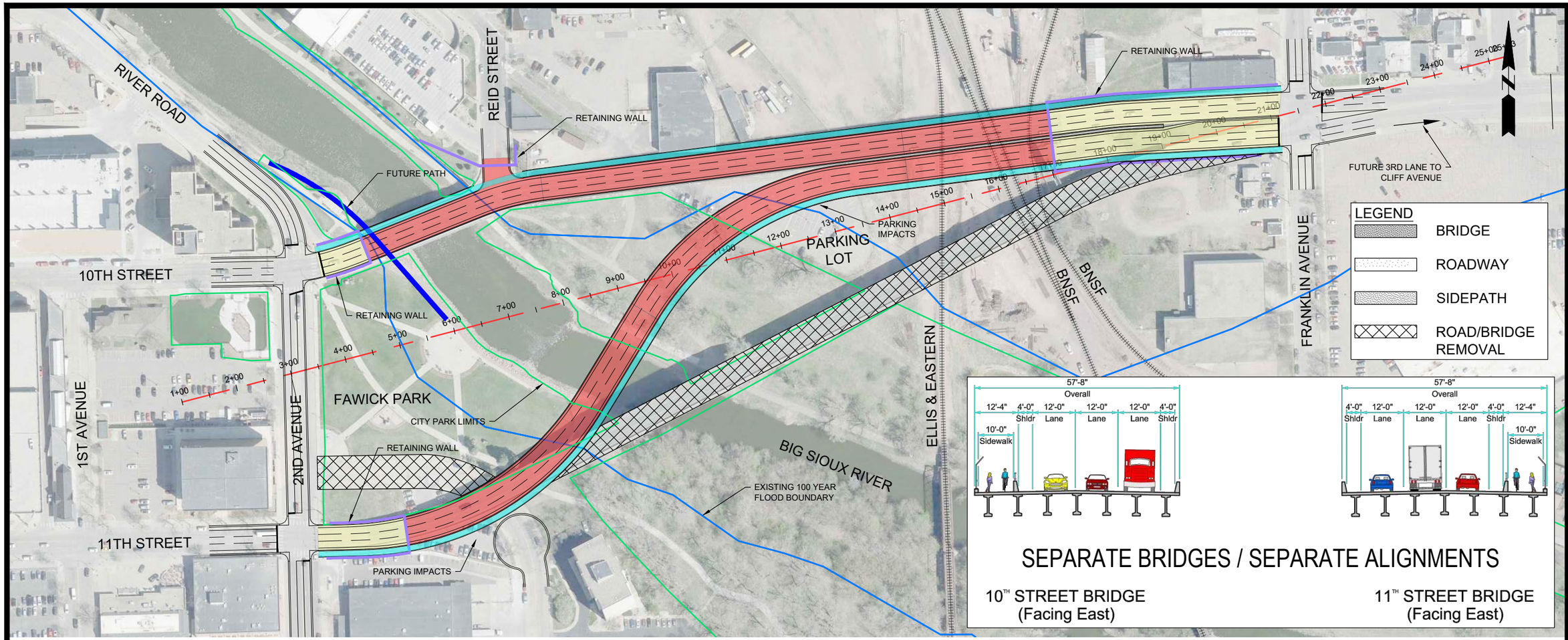

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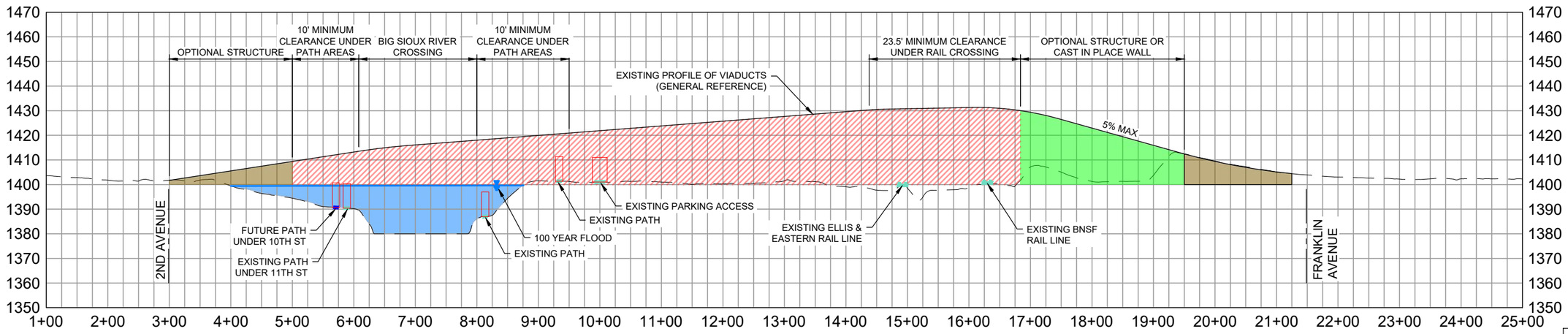

DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

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CHECKED BY: J. KJENSTAD DATE: 6/13/2023
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CITY OF SIOUX FALLS

Figure ES-2

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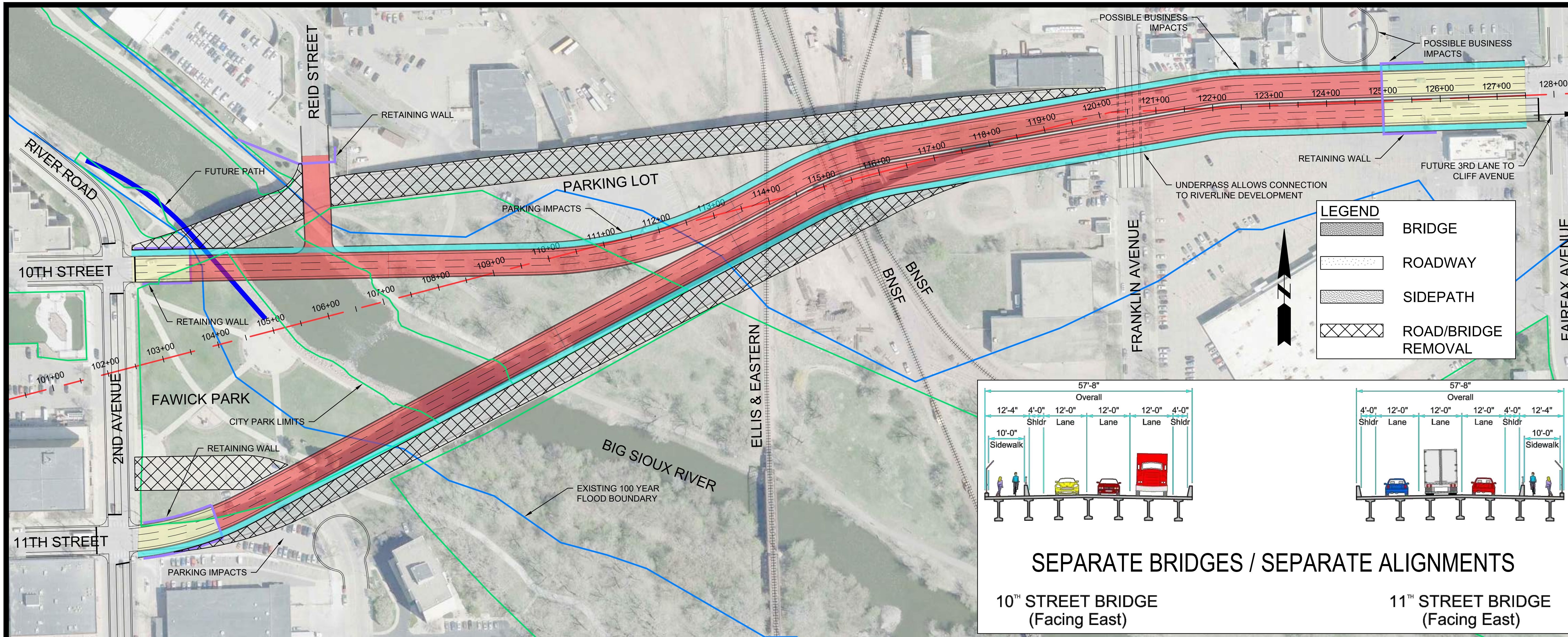
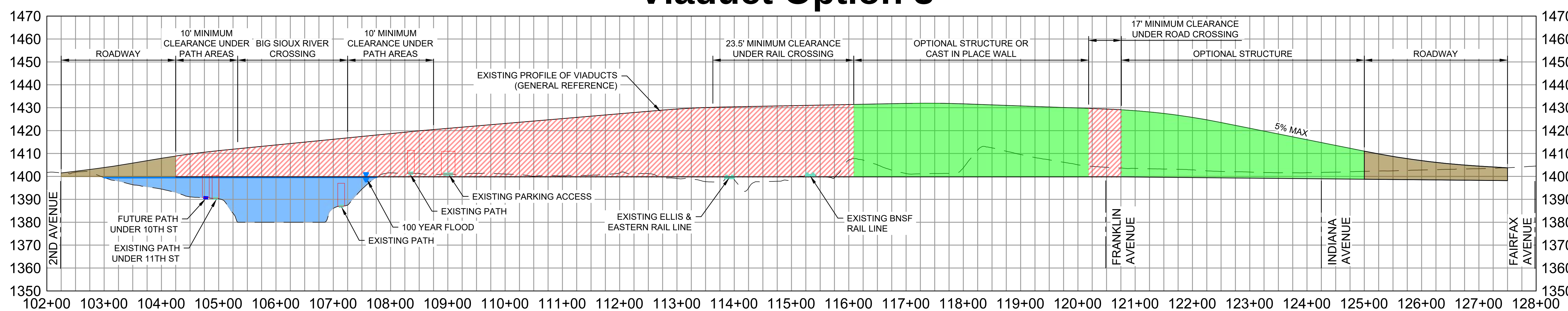

10TH STREET
11TH STREET
RIVER ROAD
REID STREET
2ND AVENUE
FAWICK PARK
PARKING LOT
BIG SIOUX RIVER
ELLIS & EASTERN
BNSF
BNSF
FRANKLIN AVENUE
FAIRFAX AVENUE
RETAINING WALL
FUTURE PATH
PARKING IMPACTS
RETAINING WALL
CITY PARK LIMITS
RETAINING WALL
EXISTING 100 YEAR FLOOD BOUNDARY
PARKING IMPACTS
POSSIBLE BUSINESS IMPACTS
POSSIBLE BUSINESS IMPACTS
RETAINING WALL
FUTURE 3RD LANE TO CLIFF AVENUE
UNDERPASS ALLOWS CONNECTION TO RIVERLINE DEVELOPMENT
LEGEND
BRIDGE
ROADWAY
SIDEPATH
ROAD/BRIDGE REMOVAL
57'-8" Overall
12'-4" 4'-0" Shldr 12'-0" Lane 12'-0" Lane 12'-0" Lane 4'-0" Shldr
10'-0" Sidewalk
4'-0" Shldr 12'-0" Lane 12'-0" Lane 12'-0" Lane 4'-0" Shldr 12'-4"
10'-0" Sidewalk
SEPARATE BRIDGES / SEPARATE ALIGNMENTS
10TH STREET BRIDGE (Facing East)
11TH STREET BRIDGE (Facing East)

Viaduct Option 3


ROADWAY
10' MINIMUM CLEARANCE UNDER PATH AREAS
BIG SIOUX RIVER CROSSING
10' MINIMUM CLEARANCE UNDER PATH AREAS
23.5' MINIMUM CLEARANCE UNDER RAIL CROSSING
OPTIONAL STRUCTURE OR CAST IN PLACE WALL
17' MINIMUM CLEARANCE UNDER ROAD CROSSING
OPTIONAL STRUCTURE
ROADWAY
EXISTING PROFILE OF VIADUCTS (GENERAL REFERENCE)
5% MAX
FUTURE PATH UNDER 10TH ST
EXISTING PATH UNDER 11TH ST
100 YEAR FLOOD
EXISTING PATH
EXISTING PATH
EXISTING PARKING ACCESS
EXISTING ELLIS & EASTERN RAIL LINE
EXISTING BNSF RAIL LINE
2ND AVENUE
FRANKLIN AVENUE
INDIANA AVENUE
FAIRFAX AVENUE
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DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

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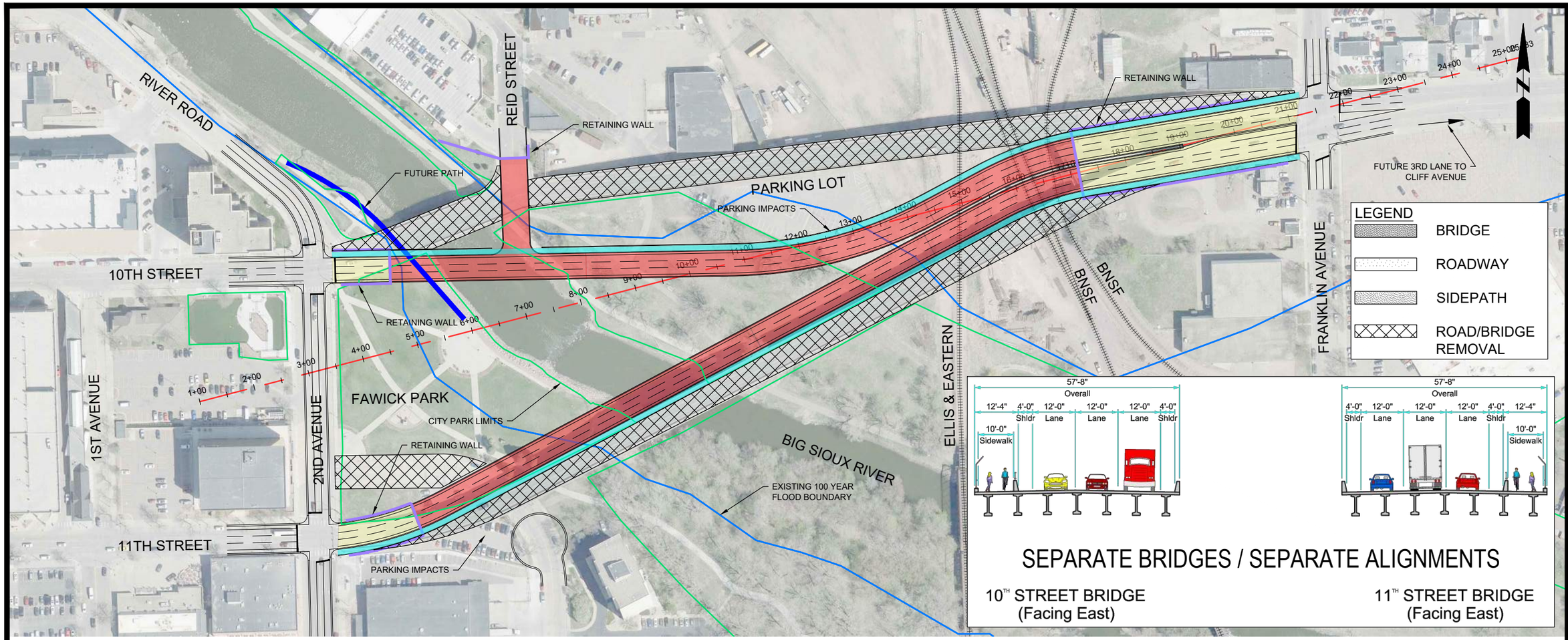
CHECKED BY: J. KJENSTAD
REVISIONS:

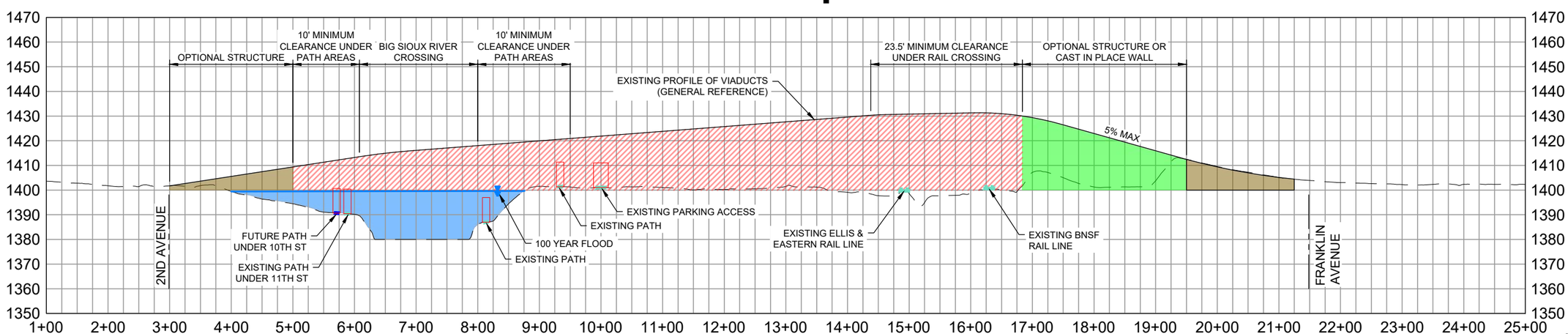
CITY OF SIOUX FALLS

HDR

Figure ES-3



Viaduct Option 4



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

DESIGNED BY: J. KJENSTAD
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REVISIONS:

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CITY OF SIOUX FALLS

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Figure ES-4

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Introduction

In 2022, the City of Sioux Falls initiated a study to develop the *Horizon 2035 Downtown Plan* that creates "a vision that stimulates a vibrant downtown and supports a variety of developments and amenities over the next 10 years. It will be a look forward at the next decade and it will be a guiding document in the community to implement the collective vision."[2] It was determined that a traffic analysis was needed to support the downtown plan and provide traffic-related guidance to long-range planning efforts and future projects.

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Study Area

The downtown Sioux Falls study area, shown in **Figure** , generally extends between:

- Grange Avenue (west) to Cliff Avenue (east)
- Russell Street / Rice Street (north) to 14th Street (south)

Phase 1 also includes consideration of a potential Benson Road extension to Rice Street and Russell Street to Rice Street (Rice-Russell) connection, both shown in **Figure 1**Figure . Phases 2 and 3 narrow the study area to the 10th/11th Street corridor, as the analysis, evaluation, and conceptual design becomes increasingly detailed.

Methods and Assumptions

A *Methods and Assumptions* document, provided in **Appendix A**, was developed to guide the traffic forecasting and analysis process.

[2] City of Sioux Falls *Horizon 2035 Downtown Plan*. www.siouxfalls.org/planning-dev/planning/downtown/2035-downtown

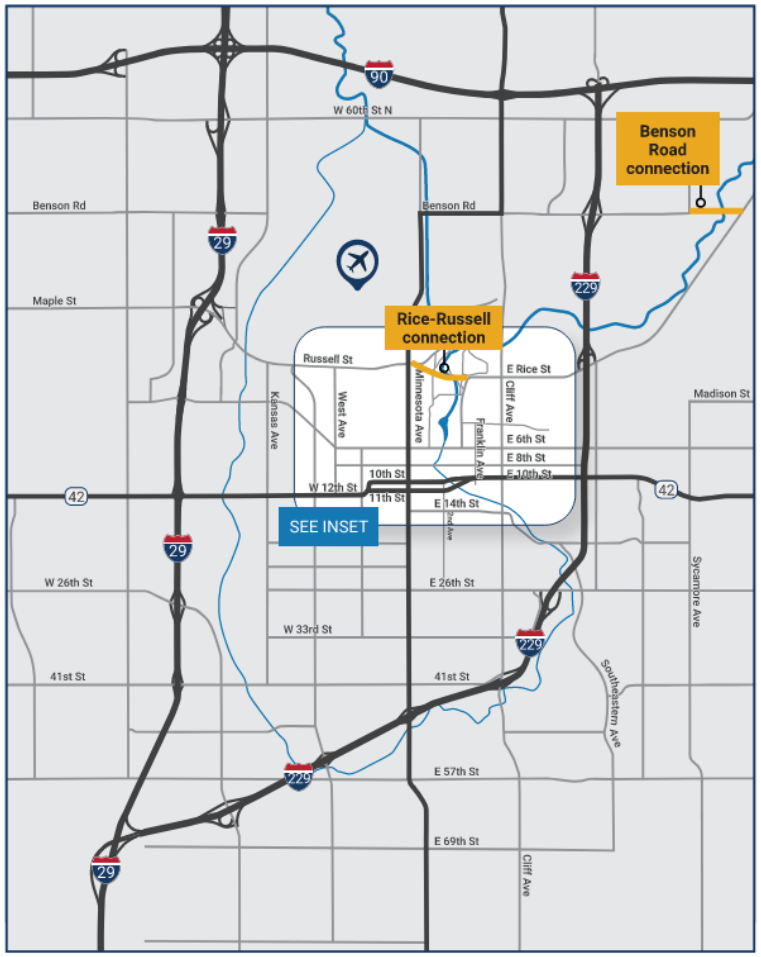


Figure 1: Study Area

Phase 1: East/West Corridor Study

The *Phase 1 East/West Corridor Review Memo* is provided in **Appendix B**.

Phase 1 reviews east/west corridor connectivity and capacity through the downtown area to identify long-range number of lane and roadway connection needs. The Sioux Falls Metropolitan Planning Organization (MPO) travel demand model (TDM) was used for this high-level analysis and several scenarios were developed to assess the following roadway variations:

- **10th/11th Street corridor number of lanes and directionality**
  - 3 lanes or 2 lanes in each direction
  - Maintain one-way pair or convert both streets to two-way travel (one-way to two-way conversion)
- **Rice-Russell connection** between Russell Street and Rice Street
  - New direct, multilane arterial connection from Minnesota Avenue to Cliff Avenue
- **Benson Road connection** between Sycamore Avenue and Rice Street
  - New direct, multilane arterial connection extending Benson Road to Rice Street

Each of the scenarios were analyzed to determine benefits and drawbacks of the various modifications, including operational measures such as roadway segment traffic volumes, vehicle miles traveled, and delay. Findings and conclusions were used by the study team to guide selection of TDM scenarios for the study's second phase.

Methodology

The current Sioux Falls MPO TDM's Planning Horizon incorporates Year 2050 land use and the 2045 'constrained' roadway network based on *Go Sioux Falls 2045 LRTP* recommendations. Daily volumes presented in Phase 1 reflect raw TDM volumes and were not adjusted with consideration to existing volumes.

Scenario Summaries

In total, 13 scenarios were developed in Phase 1 to include a 2050 Base scenario and 12 'variation' scenarios exhibiting modifications to the 2050 Base scenario.

The 2050 Base scenario (Scenario A) includes:

- Rice-Russell connection
- Benson Road connection
- No changes to existing 10th/11th Street corridor through downtown area

The other 12 scenarios reflect the following individual, or combined, modifications:

- Rice-Russell connection
- Benson Road connection
- 10th Street widening east of the downtown viaducts to a 6-lane section with 3 lanes in each direction

- 10th/11th Street one-way to two-way conversion with 11th Street prioritized for through traffic
    - 10th Street: 1 lane in each direction plus center left turn lane (local traffic)
    - 11th Street: 2 lanes in each direction plus center left turn lane (prioritized route)
- 10th/11th Street road diet that maintains the existing one-way pair, but reduces the number of lanes in each direction from 3 to 2

Findings

Phase 1 scenario summary sheets are included in **Appendix B**. Each sheet presents the respective scenario's transportation network modifications, TDM output for daily segment traffic volumes, vehicle miles traveled, delay, and key findings.

Overarching conclusions related to the potential big-picture downtown transportation network modifications include:

- **East/West route continuity:** maintaining continuous levels of capacity through the downtown area is an important consideration when gauging feasibility of different lane configurations, particularly if 10th Street is expanded to a 6-lane section east of downtown

- **10th/11th Street number of lanes:** as opportunities for east/west route travel are reduced by removing lanes and/or not constructing a direct Rice-Russell connection, east/west travel becomes constrained and leads to route diversion to other roadways not designed or intended for higher volumes and/or through traffic. Route diversion through neighborhoods would be expected, particularly during congested peak periods and special events.

- **10th/11th Street road diet:** may be feasible for further consideration with or without the Rice-Russell connection, though notably higher levels of route diversion and vehicular delay were noted in the road diet scenarios

- **10th/11th Street one-way to two-way conversion:** results in the highest levels of vehicular delay and vehicle miles traveled due to congestion along the 2-way 11th Street corridor and subsequent diversion to other downtown area roadways
    - Anticipated traffic volumes, short city blocks, and intersections accommodating all applicable turn movements create a very challenging corridor to manage traffic demand
    - 11th Street congestion diverts traffic to 6th Street and 8th Street, which increases volumes on those corridors up to or exceeding the upper limits of available capacity

- **2nd Avenue road diet:** may be feasible for further consideration

- **Benson Road connection:** results in negligible effect on downtown traffic patterns

- **Rice-Russell connection:** provides operational benefits to the area in terms of overall delay and volume reduction on other east/west corridors, but leads to higher vehicle miles traveled
    - Rice-Russell connection only reduced 10th/11th Street daily traffic volumes by 10 to 15 percent
        - This illustrates considerable demand for east/west travel in the downtown area, particularly for the 10th/11th Street corridor
        - As additional capacity is added to the downtown area (e.g., Rice-Russell connection), traffic reroutes from other Sioux Falls east/west corridors to the downtown arterial corridors because of their key location and route continuity within the heart of Sioux Falls
        - It can be concluded that the Rice-Russell connection's direct operational benefit to the 10th/11th Street corridor is not substantial. As traffic is pulled from the 10th/11th Street corridor to the Rice-Russell connection, available traffic capacity backfills with traffic from other east/west corridors.
    - Most notable direct Rice-Russell connection traffic reduction benefits occurred on Falls Park Drive, North Drive, and 6th Street

- **Rice-Russell connection:** was identified as physically feasible in the *2009 Northeast Transportation Network Feasibility Study* but presents several significant physical and regulatory challenges, including:
    - Steep slopes, railroad crossings, and a Big Sioux River crossing that require significant bridge lengths or combination of bridges and tunnels, which leads to high costs
        - A new Rice-Russell connection bridge does not replace the need for reconstructing the 10th/11th Street corridor. The Rice-Russell connection would be in addition to the required reconstruction of the 10th/11th Street viaducts.
    - Impacts to the Smithfield facility and their operations include building acquisition, bisecting their property, loss of parking, and/or extensive modification to the facility's transportation infrastructure

- **Rice-Russell connection:** based on these findings, it was concluded that the scenarios being analyzed in subsequent phases do not include the Rice-Russell connection when developing traffic forecasts.
    - This conclusion does not recommend removing the connection from future planning efforts beyond this study, rather it recognizes the complexities of constructing this connection (cost, constructability, potential impacts, etc.) and nominal reduction in traffic to the 10th/11th Street corridor. This analysis accounts for the long-range volume condition that does not require the Rice/Russell connection be constructed.

Recommended Scenarios for Downtown Traffic Study (Phase 2)

The study team met on December 12, 2022, to review preliminary findings and identify two TDM scenarios for consideration in Phase 2 of the study. Recommended TDM scenario elements are shown below in light blue text.

Rice-Russell connection:

- No direct, multilane arterial connection of Russell Street between Minnesota Avenue and Rice Street
- Maintain existing connectivity between Minnesota Avenue and Rice Street via Falls Park Drive, Phillips Avenue, and 1st Avenue
- Incorporate a direct, 2-lane collector route between Falls Park Drive and Brookings Street to enhance local connectivity with Falls Park

Benson Road connection:

- Include connection between Sycamore Avenue and Rice Street

10th Street (east of Franklin Street) and 12th Street (west of Grange Avenue):

- Include 6-lanes, 3 lanes in each direction
  - East of Franklin Street through I-229
  - West of Grange Avenue through Kiwanis Avenue
- Analyzing an expanded 10th/11th Street corridor east and west of downtown accounts for 75-year bridge design and provides a conservative look at higher traffic volumes traveling to/from the downtown area via a 6-lane 10th Street and 12th Street cross-section

10th/11th Street in downtown area (Grange Avenue to Franklin Street):

- Option 1: Maintain one-way pair, but reduce number of lanes to 2 in each direction
  - Reduces roadway width by decreasing the number of travel lanes from 3 to 2; removes parking
    - Lanes added/dropped at Grange Avenue and Franklin Street
- Option 2: Maintain 3 lanes in each direction and one-way pair
  - No change to existing 10th/11th Street number of lanes; removes parking

9th Street and 2nd Avenue in downtown area:

- Modify with a road diet to provide a 3-lane section, with 1 lane in each direction plus center left turn lane

14th Street (Minnesota Avenue to Cliff Avenue):

- Maintain 4-lane section

Scenario summary sheets for the two recommended scenarios carried forward to Phase 2 are provided in **Figure 2** and **Figure 3**. Differences between the two scenarios center on the 10th/11th Street options in the downtown area. 'Scenario 44' incorporates a 10th/11th Street road diet through the downtown area and 'Scenario 45' maintains 3 lanes in each direction. All other elements are the same between the two scenarios.

CITY OF SIOUX FALLS

DOWNTOWN TRAFFIC IMPACT STUDY

Recommended Scenario 1: Downtown 10th/11th Street Road Diet

Figure 2

Combines Scenarios B, D, and F to:

- Widen 10th Street to three lanes in each direction from the viaduct (Franklin Street) east to I-229 (B)
- Remove Russell Street connection between Minnesota Avenue and Cliff Avenue (D)
- Maintain 10th/11th Street one-way pair but reduces the number of through lanes from three to two in each direction between Grange Avenue and Franklin Avenue (F)

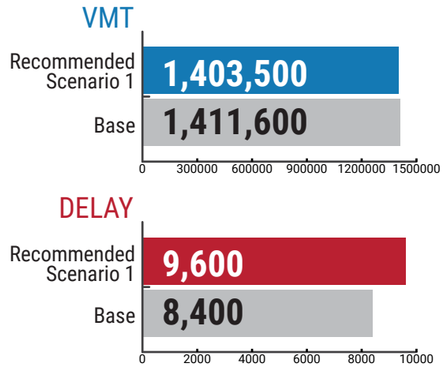
Other modifications include:

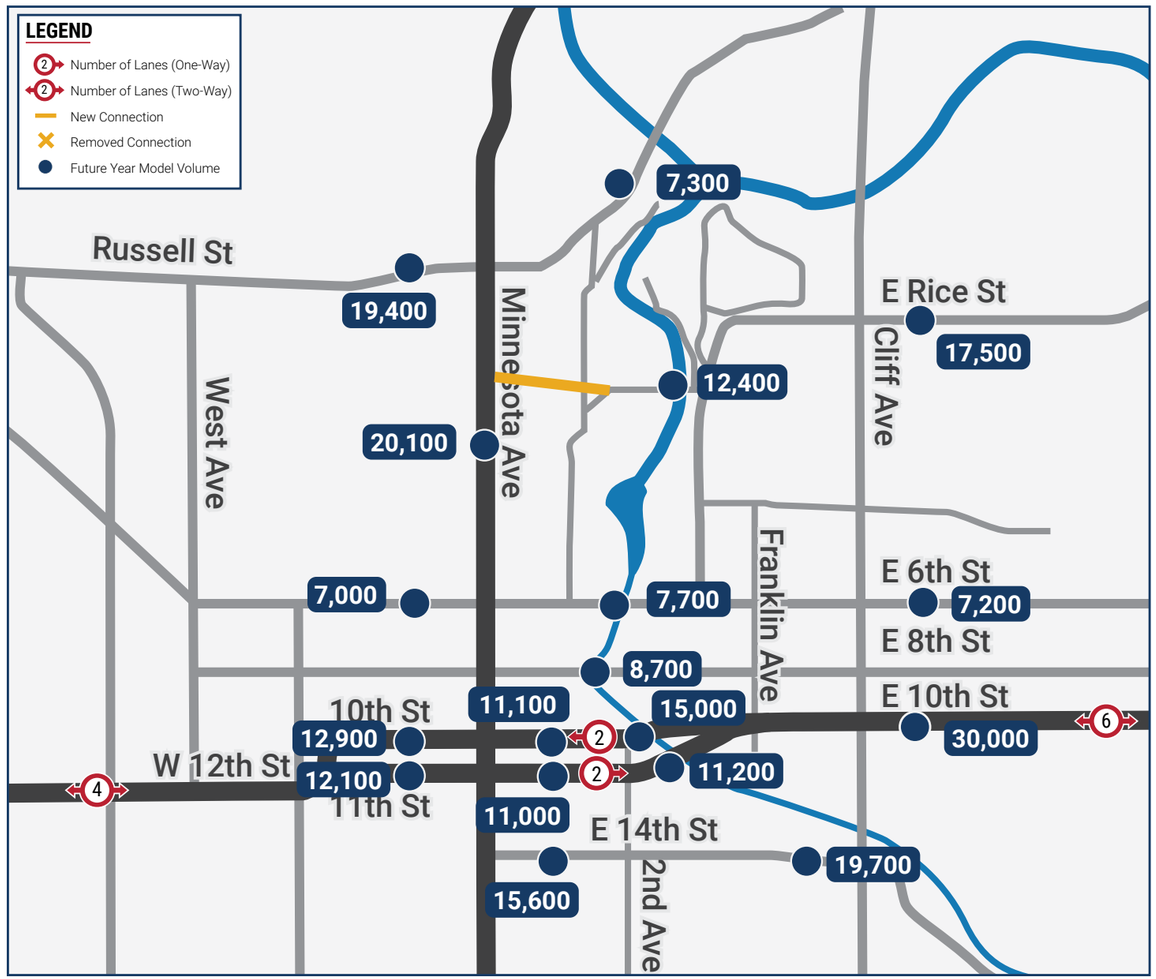
- Widen 10th Street to three lanes in each direction from Grange Avenue west to Kiwanis Avenue
- Minnesota Avenue to Falls Park Drive direct connection
- 2nd Avenue road diet

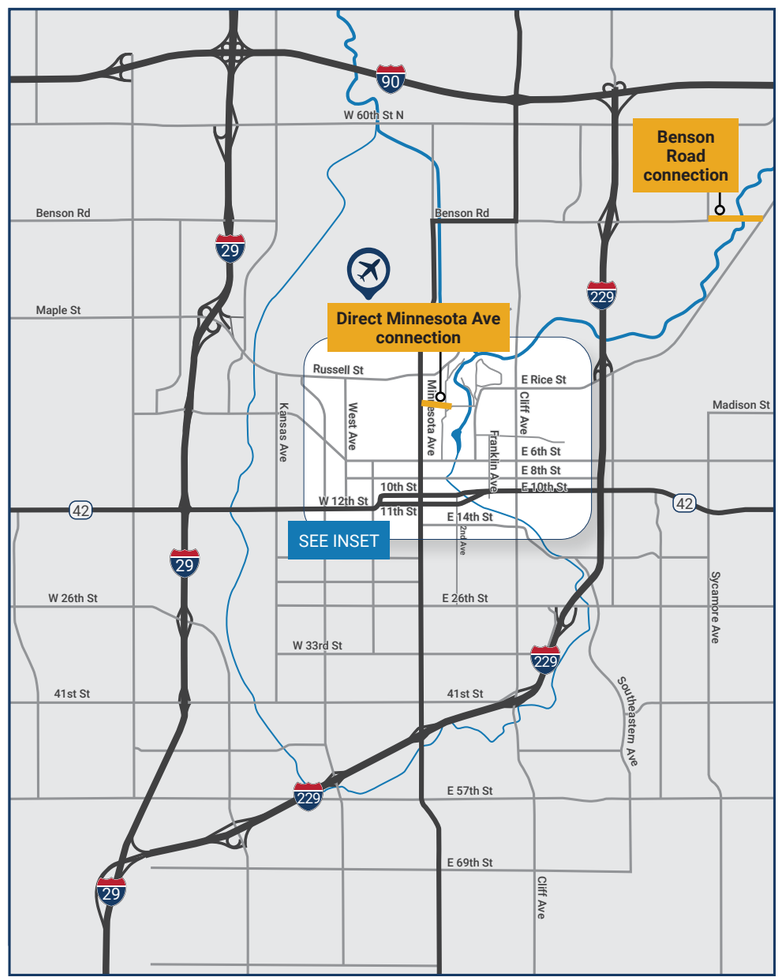
- Russell Street connection: ✗
- Benson Road connection: ✓
- 10th/11th Street corridor: **No changes**
  - 6 Lanes East of Downtown
  - 6 Lanes West of Downtown

Sub-Area Performance Measures

- **Daily Vehicle Miles Traveled (VMT):** total distance of travel by all vehicles on study area roads
- **Daily Delay:** additional time spent traveling for all vehicles in a scenario due to congested conditions, compared to ideal, uncongested conditions







TDM REFERENCE SCENARIO 44

Key Findings

- Downtown 10th/11th Street road diet volumes similar to other road diet scenarios, even with 6 lanes west and east of downtown
- Direct connection between Minnesota Avenue and Falls Park Drive attracts 12,000 vehicles
- Phillips Avenue volumes up 20% higher than Base Scenario A
- 8th Street and 14th Street volumes nearly 10% higher than Recommended Scenario 2

CITY OF SIOUX FALLS

DOWNTOWN TRAFFIC IMPACT STUDY

Recommended Scenario 2: Downtown 10th/11th Street 3-Lane in Both Directions

Figure 3

Combines Scenarios B and D to:

- Widen 10th Street to three lanes in each direction from the viaduct (Franklin Street) east to I-229 (B)
- Remove Russell Street connection between Minnesota Avenue and Cliff Avenue (D)

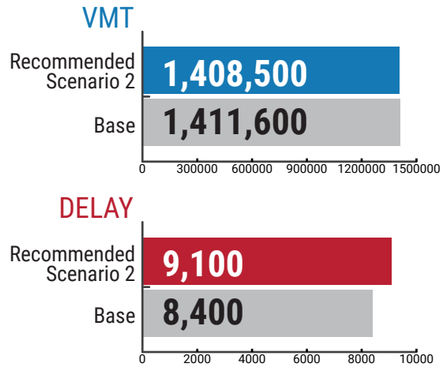
Other modifications include:

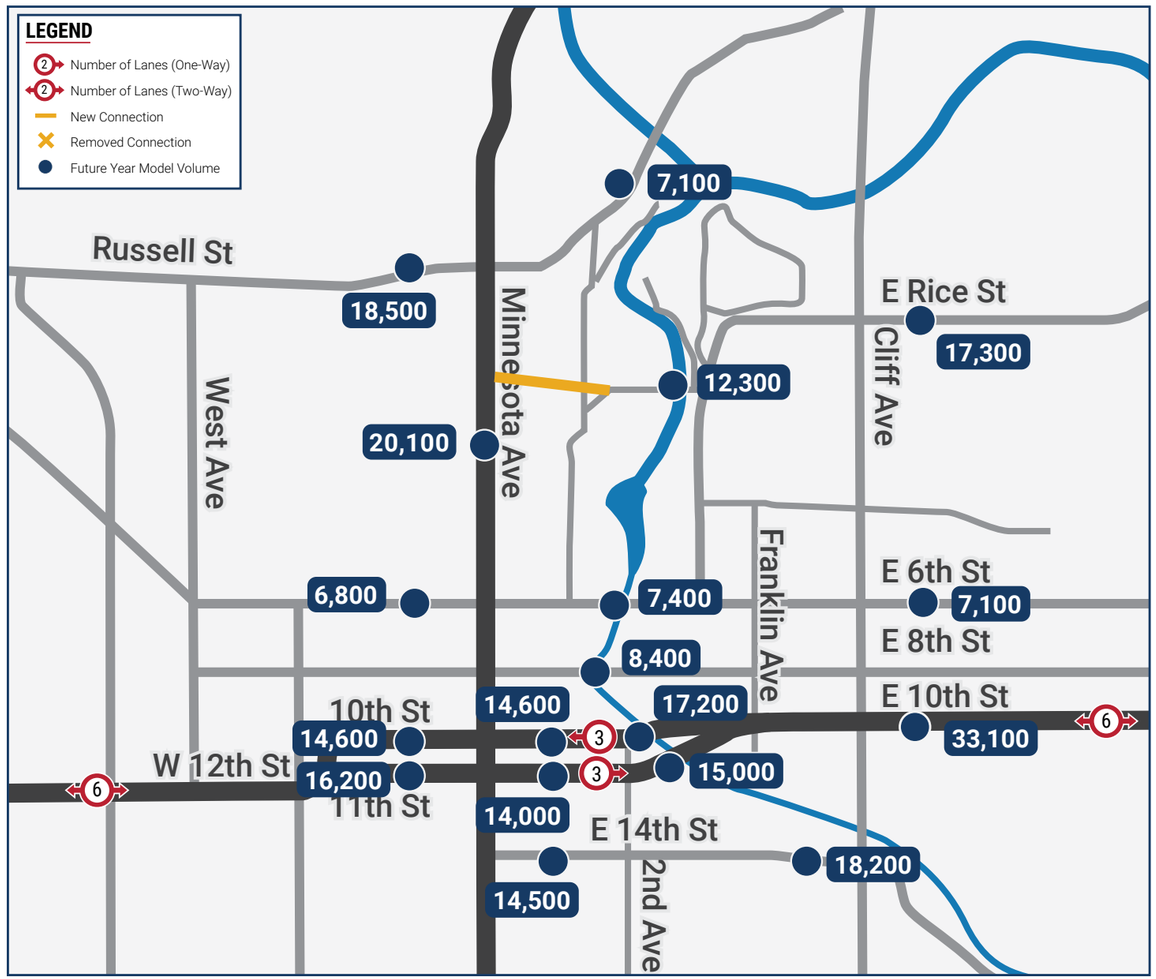
- Widen 12th Street to three lanes in each direction from Grange Avenue west to Kiwanis Avenue
- Minnesota Avenue to Falls Park Drive direct connection
- 2nd Avenue road diet

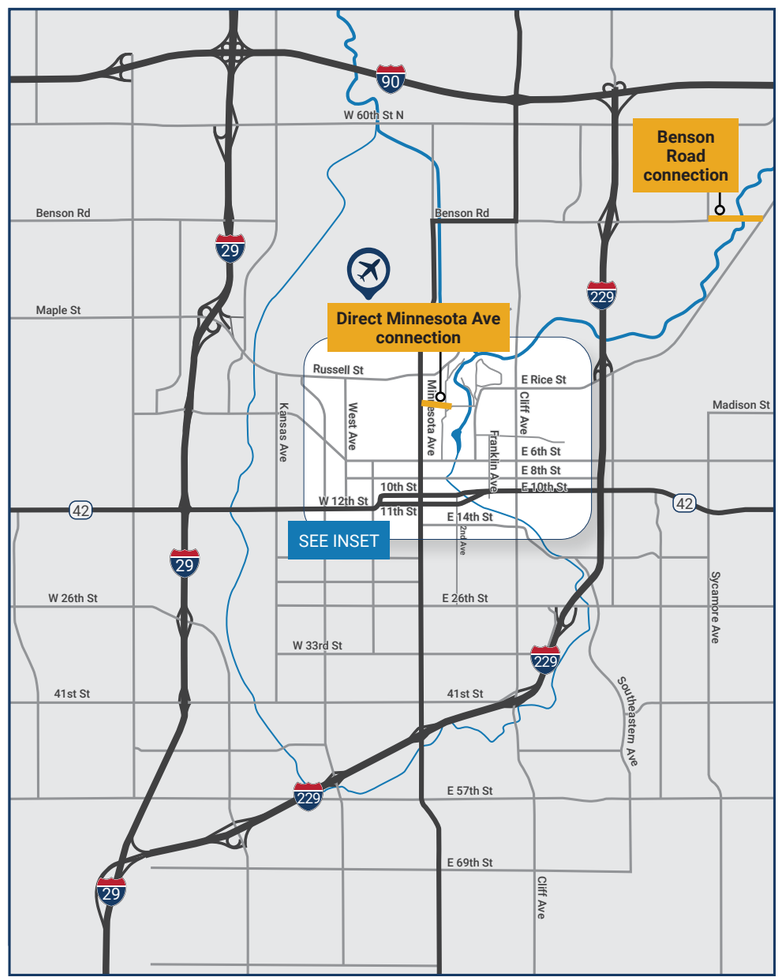
- Russell Street connection: ✗
- Benson Road connection: ✓
- 10th/11th Street corridor: **No changes**
  - 6 Lanes East of Downtown
  - 6 Lanes West of Downtown

Sub-Area Performance Measures

- **Daily Vehicle Miles Traveled (VMT):** total distance of travel by all vehicles on study area roads
- **Daily Delay:** additional time spent traveling for all vehicles in a scenario due to congested conditions, compared to ideal, uncongested conditions







Key Findings

- Highest 10th/11th/12th Street volumes of all scenarios between Kiwanis Avenue and I-229
- Viaduct volumes exceed 32,000 vehicles, with is nearly 6,000 higher than Recommended Scenario 1
- Direct connection between Minnesota Avenue and Falls Park Drive attracts 12,000 vehicles

TDM REFERENCE SCENARIO 45

Phase 2: Downtown Traffic Analysis

*The 10th/11th Street Corridor Crash History Review Memo and Phase 2 Traffic Operations Analysis Memo are provided in **Appendix C and D**, respectively. The 10th/11th Street Corridor Sensitivity Analysis Memo, which reviews traffic volumes beyond the Year 2050 Planning Horizon, is provided in **Appendix E**.*

The downtown traffic analysis reflects a focused analysis of the downtown area to help guide development and evaluation of 10th Street and 11th Street corridor and viaduct alternatives. This phase includes reviewing crash history, developing daily and peak hour traffic forecasts, and conducting a traffic operations analysis of No Build and Build conditions.

Phase 1 traffic scenario recommendations established the foundation for all Phase 2 traffic forecasting. Phase 2 downtown traffic analysis recommendations will guide the development, refinement, and evaluation of alternatives in Phase 3, the 10th Street/11th Street Viaduct Study.

10th/11th Street Crash History Review

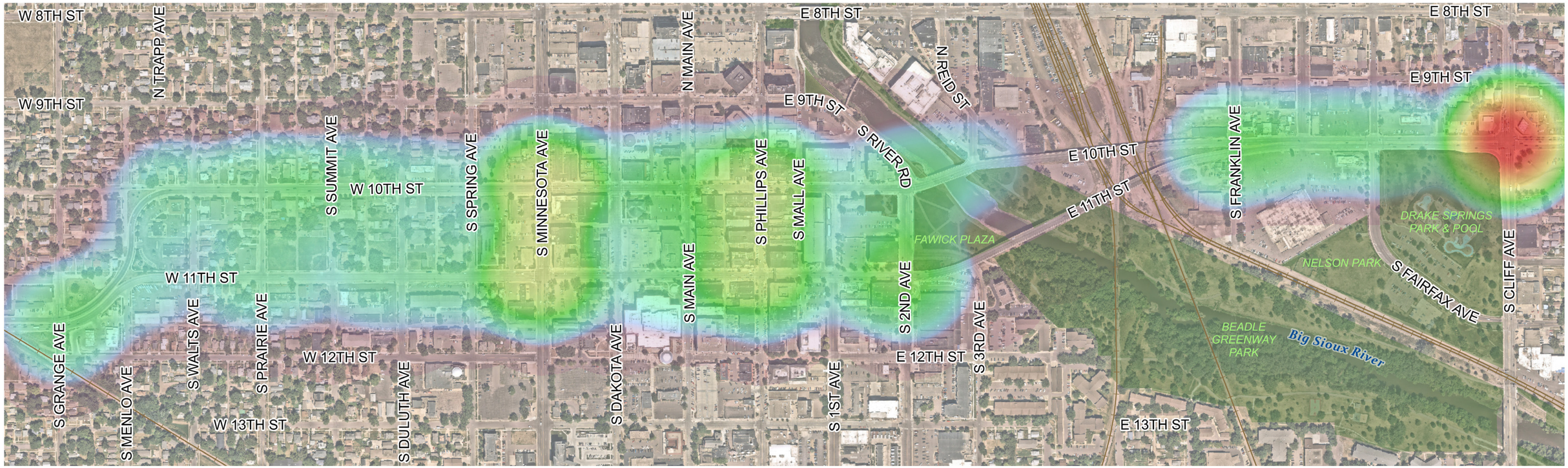
Reported crashes for years 2018 through 2022 were reviewed along the 10th/11th Street corridor, from east of Grange Avenue eastward to Cliff Avenue, to help identify crash trends and high-frequency crash locations. **Figure 4** illustrates the density of crashes, or high frequency locations, within the study area.

This review categorized crashes into intersection or roadway segment crashes. Due to the short segments (blocks) between intersections, there were considerably fewer segment crashes as many of the crashes occurring at mid-block locations were due to intersection-related operations and queue spillback from downstream intersections. Bicycle and pedestrian crashes were also reviewed. The *10th/11th Street Corridor Crash History Review Memo* includes details of the review and is provided in **Appendix C**.

CITY OF SIOUX FALLS

10th/11th Street Corridor Crash Density (2018-2022)

Figure 4



LEGEND

Crash Density

Higher

Lower

Intersection Crashes

The following tables summarize intersection crash trends within similar 10th/11th Street corridor sub-area segments:

- **Pettigrew Heights One-Way Pair:** Walts Avenue to Spring Avenue (all unsignalized intersections)
- **Downtown One-Way Pair:** Minnesota Avenue to 2nd Avenue
- **Two-Way:** Franklin Avenue to Cliff Avenue

Table 1: Intersection Crash History (2018-2022) – Injury Summary

	Pettigrew Heights One-Way Pair	**Downtown One-Way Pair**	**Two-Way**
	Walts Ave to Spring Ave (Unsignalized intersections)	*Minnesota Ave to 2nd Ave (Primarily signalized intersections)*	*Franklin Ave to Cliff Ave (Primarily signalized intersections)*
Fatal Injury	0	0	1 (<1%)
Injury	30 (24%)	68 (18%)	44 (19%)
No Injury (Property Damage Only)	98 (76%)	300 (82%)	191 (81%)
Total Sub-Area Crashes	129	368	236

Percentage reflects the number of crashes compared to the total sub-area crashes; total may not equal 100% due to rounding

Table 2: Intersection Crash History (2018-2022) – Manner of Collision Summary

	Pettigrew Heights One-Way Pair	**Downtown One-Way Pair**	**Two-Way**
	Walts Ave to Spring Ave (Unsignalized intersections)	*Minnesota Ave to 2nd Ave (Primarily signalized intersections)*	*Franklin Ave to Cliff Ave (Primarily signalized intersections)*
Angle	65 (50%)	130 (35%)	77 (33%)
Rear End	15 (12%)	146 (40%)	98 (42%)
Sideswipe	26 (20%)	52 (14%)	50 (21%)
Single Vehicle	21 (16%)	38 (10%)	11 (5%)
Head-on	1 (<1%)	2 (<1%)	0
Total Sub-Area Crashes	129	368	236

Percentage reflects the number of crashes compared to the total sub-area crashes; total may not equal 100% due to rounding

Key area comparison findings from the intersection crash history tables include:

- **Downtown One-Way Pair:** Lowest percentage of injury crashes
  - *Contributing segment characteristics: lowest posted speed and most intersections are signalized*
- **Pettigrew Heights One-Way Pair:** Highest percentage of angle crashes
  - *Contributing segment characteristics: all intersections are unsignalized (stop-controlled from side-street approaches) and the 10th/11th Street corridor is three lanes in each direction with on-street parking*
- **Two-way East of Franklin Avenue:** Highest percentage of rear-end crashes
  - *Contributing segment characteristics: Cliff Avenue intersection queue spillback from turn lanes, YIELD-control right turn movements, and peak traffic fluctuations that can create unexpected back of queue points*
- **Downtown One-Way Pair:** Second-highest percentage of rear-end crashes
  - *Contributing segment characteristics: pretimed signals may cut off back of platoon progressing through area, congestion during peak periods, and turning vehicles stopped in through lanes waiting for pedestrians in crosswalk*
- **Pettigrew Heights One-Way Pair:** Lowest percentage of rear-end crashes, which is considerably less than the other two areas
  - *Contributing segment characteristics: free-flow travel on one-way pair and low turning volumes*
- **Two-way East of Franklin Avenue:** Highest percentage of sideswipe crashes
  - *Contributing segment characteristics: frequent lane changes due to access points and queue spillback from the Cliff Avenue intersection*
- **Pettigrew Heights One-Way Pair:** Second-highest percentage of sideswipe crashes
  - *Contributing segment characteristics: highest frequency occurs upstream of the westbound lane drop*

Downtown One-Way Pair and Two-Way East of Franklin Avenue intersections were also compared in terms of crash rate and critical crash rate to help identify locations that are experiencing higher levels of crashes when accounting for traffic volume and considering crash levels at other corridor intersections. For this study, a crash rate to critical crash rate ratio exceeding 0.8 was used to identify these locations. 10th/11th Street corridor intersections, from Minnesota Avenue east to Cliff Avenue, with a ratio greater than 0.8 include:

- 10th Street & Minnesota Avenue
- 11th Street & Minnesota Avenue
- 10th Street & Phillips Avenue
- 11th Street & Phillips Avenue
- 11th Street & 2nd Avenue
- 10th Street & Indiana Avenue
- 10th Street & Cliff Avenue

A crash rate and critical crash rate review was also conducted for roadway segments between intersections. The following three segments exhibit a ratio greater than 0.8. Each segment is

upstream of an intersection also exhibiting a ratio greater than 0.8 and thus crashes on these segments may be influenced by intersection operations and other downstream-related impacts.

- 10th Street: Dakota Avenue to Minnesota Avenue
- 10th Street: Mall Avenue to Phillips Avenue
- 11th Street: Main Avenue to Phillips Avenue

The 10th/11th Street & Minnesota Avenue intersections and 10th Street & Cliff Avenue intersection are key arterial/arterial intersections within the City of Sioux Falls. Approximately 52 percent of the 10th/11th Street corridor intersection crashes in this review occurred at these three intersections. Rear-end crashes are the predominant crash type (50 percent), which reinforces the importance of providing good levels of traffic operations to manage queue lengths and driver expectations. Further, sideswipe crashes were also prevalent at the Cliff Avenue intersection which indicate a considerable amount of lane changing conflicts within the intersection area.

The Phillips Avenue intersections are two downtown intersections that are often the first to become congested during peak periods due to single-lane Phillips Avenue approaches, high traffic volumes turning to/from Phillips Avenue, and number of conflicts (including vehicle-pedestrian conflicts). There are slightly more angle crashes at these two intersections, compared to rear-end crashes. The crash history review reinforces two key considerations at the two Phillips Avenue intersections:

- Provide adequate lanes on 10th Street and 11th Street to facilitate progression through the corridor, as cutting-off the back end of platoons due to not enough green time leads to rear-end crashes
- Size the intersection appropriately to provide safe and efficient pedestrian crossings, which helps manage vehicle-pedestrian conflicts while still providing adequate vehicular capacity to manage traffic intersection operations

Contributing factors to crashes at the 11th Street & 2nd Avenue intersection include access points within the intersection functional area, multilane 2nd Avenue with no separated southbound left turn lane, increasing travel speeds as motorists leave the downtown area, and unexpected back of queue points. This intersection could benefit with a road diet on 2nd Avenue to provide a center left turn lane, access management within the intersection functional area, and traffic calming.

The 10th Street & Indiana Avenue intersection is an unsignalized, full access intersection between signalized intersections at Franklin Avenue and Fairfax Avenue. Ten of the 15 reported crashes were angle crashes, where speed, inability to find adequate gaps, and driver expectancy-related conflicts were common contributing circumstances. One fatality was reported at this intersection due to a vehicle-pedestrian crash. Alcohol and weather conditions (rain) were noted as contributing circumstances. This intersection would benefit from further consideration as a partial access, such as a ¾ access where left turn and through movements are restricted from the side-street or a right-in right-out access.

Bicycle and Pedestrian Crashes

Reported vehicle crashes with bicycles and pedestrians were also reviewed, shown spatially in **Figure 5**. In total, there were 20 reported crashes involving bicycles and pedestrians from just east of Grange Avenue through Cliff Avenue intersections. Sixteen of these crashes occurred at intersections and the other four were at mid-segment locations. The following tables summarize these crashes by intersection location and injury.

Table 3: Bicycle and Pedestrian Crash History (2018-2022) – Intersection Summary

	Pettigrew Heights One-Way Pair	Downtown One-Way Pair	Two-Way
	Walts Ave to Spring Ave (Unsignalized intersections)	*Minnesota Ave to 2nd Ave (Primarily signalized intersections)*	*Franklin Ave to Cliff Ave (Primarily signalized intersections)*
Pedestrian	3	2	2
Bicycle	1	6	2
Total Sub-Area Crashes	4	8	4

Table 4: Bicycle and Pedestrian Crash History (2018-2022) – Injury Summary

	Pedestrian	Bicycle	Total
Fatal and Serious Injury	2	0	2 (10%)
Minor and Possible Injury	8	8	16 (80%)
No Injury	1	1	2 (10%)
Total Crashes	11	9	20

Percentage reflects the number of crashes compared to the total sub-area crashes
Table includes intersection and segment crashes

Overall, bicycle and pedestrian crashes were reported throughout the study corridor, with most occurring on 10th Street in both the one-way and two-way segments. Eighteen of the 20 reported crashes (90 percent) resulted in injury, including one fatal injury and one serious injury. This reinforces the vulnerability of pedestrians and bicyclists to injury in these types of conflicts and stresses the importance of safe multimodal facilities.

Other findings from the review include:

- 7 of the 20 crashes involved an impaired motorist
- 7 of the 20 crashes involved a vehicle turning right
    - 5 of those 7 crashes involved a bicycle

10th/11th Street Corridor Bicycle and Pedestrian Crashes (2018-2022)

LEGEND

Injury Severity

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

Traffic Volume Scenarios

Key roadway network elements within the two traffic volume scenarios selected by the study team in Phase 1 include:

Scenario 44 (S44): reduces number of 10th/11th Street lanes from 3 to 2 in each direction through downtown (Grange Avenue to Franklin Avenue)

- Maintains downtown 10th/11th Street one-way pair
- Reduces number of 10th/11th Street lanes from 3 to 2 in each direction between Grange Avenue and Franklin Avenue ("2-lane 10th/11th Street")
- 12th Street (Kiwanis Avenue to Grange Avenue): 6-lane section
    - 3 lanes in each direction plus intersection turn lanes
- 10th Street (Cliff Avenue to Sycamore Avenue): 6-lane section
    - 3 lanes in each direction plus intersection turn lanes

Scenario 45 (S45): maintains number of 10th/11th Street lanes (3 lanes) in each direction through downtown

- Maintains downtown 10th/11th Street one-way pair
- No change to number of lanes, maintains 3 lanes in each direction ("3-lane 10th/11th Street")
- 12th Street (Kiwanis Avenue to Grange Avenue): 6-lane section
    - 3 lanes in each direction plus intersection turn lanes
- 10th Street (Cliff Avenue to Sycamore Avenue): 6-lane section
    - 3 lanes in each direction plus intersection turn lanes

Both Scenarios

- No direct Rice Street – Russell Street connection
- Incorporates Falls Park Drive to Brookings Street 'collector' connection
- Includes Benson Road connection between Sycamore Avenue and Rice Street
- Incorporates 9th Street / River Road / 2nd Avenue road diet
    - Continuous 3-lane section (1 lane each direction plus center left turn lane) from Minnesota Avenue to 14th Street

Scenario 44 reduces capacity through the downtown area by decreasing the existing 3 lanes in each direction to 2 lanes in each direction on the 10th/11th Street one-way pair between Grange Avenue and Franklin Avenue. With this reduction in lanes, S44 forecasted volumes are approximately 20 percent less on the 10th/11th Street corridor than what is forecasted for S45. However, because the area's overall east/west travel demand in S44 does not diminish in conjunction with the lane reduction, the TDM redistributes the impacted traffic volumes to other corridors throughout the downtown area (e.g., 6th Street, 8th Street, 14th Street) and beyond.

Traffic Forecasts

Existing volumes were based on traffic counts collected between 2018 and 2022 as part of City of Sioux Falls, Sioux Falls MPO, and South Dakota Department of Transportation (SDDOT) count programs.

The traffic forecasting process followed methodology outlined in *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*. The Sioux Falls MPO TDM was the source of growth rates to develop 2028 Opening Year and 2050 Planning Horizon daily and peak hour volumes. 2028 Opening Year volumes were developed by interpolating straight-line growth between the 2050 Planning Horizon and Existing conditions.

The proposed Riverline District redevelopment (between the Big Sioux River, Cliff Avenue, and 10th Street) was considered in the forecasting process. However, a detailed trip generation was not conducted for this development since future land uses were not yet confirmed.

Volumes developed for this study reflect a summer average daily and peak hour traffic condition. Heavy vehicle percentages in future-year conditions were based on collected vehicle classification counts or TDM output. Pedestrian and bicycle crosswalk volumes were based on intersection counts with future-year estimates derived from vehicular traffic growth rates.

Daily roadway segment traffic volumes for Existing conditions and the 2050 Planning Horizon are summarized in **Figure 6**.

Traffic Operations Analysis

Intersection operational performance was measured in terms of Level of Service (LOS), ranging from LOS “A” (best) to “F” (worst). Intersection LOS is based on the average delay a vehicle would experience when traveling through an intersection. A description of each LOS measure and the corresponding intersection delay is shown in **Figure 7**.

The following three 10th/11th Street viaduct alignment options were analyzed as part of Phase 2. Sketches of the alignment options are presented in **Figure 8**.

Alignment Option 1: Separate Alignments

- Maintains the existing 10th/11th Street alignment split across the Big Sioux River

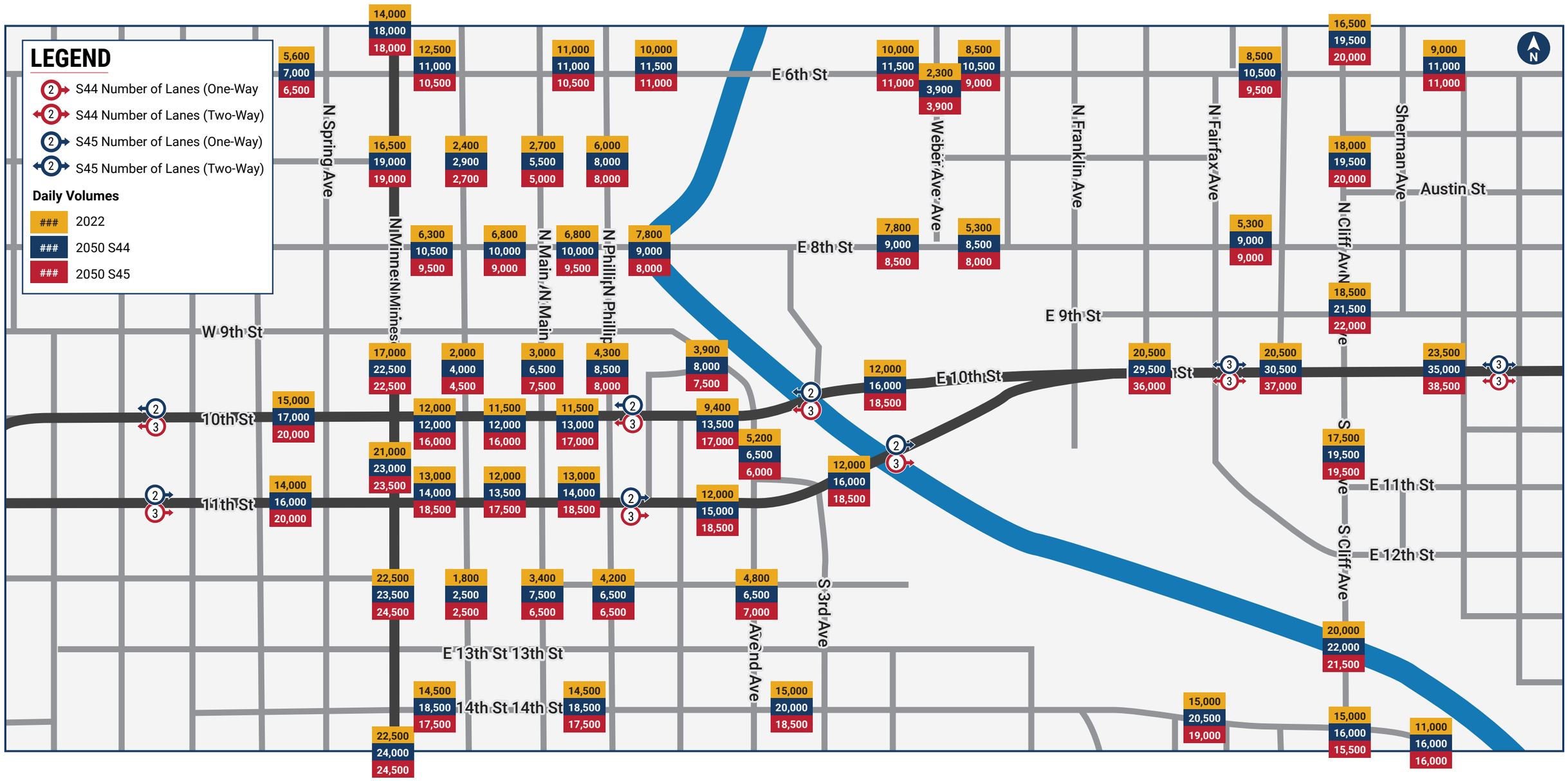
Alignment Option 2: North Alignment

- Combines 10th/11th Street bridges to a single, north alignment across the Big Sioux River
  - Supports a single bridge or two parallel bridges
- 2nd Avenue & 10th Street intersection includes eastbound 11th Street through traffic

Alignment Option 3: South Alignment

- Combines 10th/11th Street bridges to a single, south alignment across the Big Sioux River
  - Supports a single bridge or two parallel bridges
- 2nd Avenue & 11th Street intersection includes westbound 10th Street through traffic

Each alignment option was analyzed with a combination of S44 or S45 traffic volumes and a 3-lane 10th/11th Street or 2-lane 10th/11th Street roadway section (each direction). Intersection LOS results for the No Build condition and various volume and roadway section combinations are summarized in **Figure 9** through **Figure 16**. Additional information is provided in the *Phase 2 Traffic Operations Analysis Memo* in **Appendix D**.



Volume Scenarios

Scenario 44 (S44):

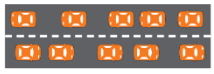
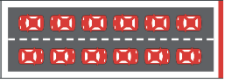
- Maintains downtown 10th/11th St one-way pair
- Reduces the number of lanes on 10th/11th St from 3 to 2 in each direction between Grange Ave and Franklin St

Scenario 45 (S45):

- Maintains downtown 10th/11th St one-way pair, with no change to number of lanes

Both Scenarios

- 12th St (Kiwanis Ave to Grange Ave): 6-lane section (3 lanes in each direction)
- 10th St (Cliff Ave to Sycamore Ave): 6-lane section (3 lanes in each direction)
- 9th St / River Rd / 2nd Ave road diet between Minnesota Avenue and 14th St

	Roadway	
A	Free-flow operation	
B	Reasonably free- flow operation; minimal restriction on lane changes and maneuvers	
C	Near free-flow operation; noticeable restriction on lane changes and other maneuvers	
D	Speed decline with increasing flows; significant restriction on lane changes and other maneuvers	
E	Facility operates at capacity; very few gaps for lane changes and other maneuvers; frequent disruptions and queues	
F	Unstable flow; operational breakdown	

Levels Designation Scale:

LOS is presented through a familiar A to F scale, where "A" means the best operating condition and "F" the worst.

LOS Measures and Definitions: Highway Capacity Manual and SDDOT Road Design Manual

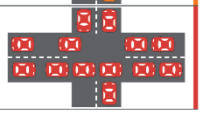
	Unsignalized Intersection	Signalized Intersection	
A	Queuing is rare **Intersection Control Delay:** ≤10 seconds/vehicle	Very minimal queuing; excellent corridor progression and/or short cycle lengths **Intersection Control Delay:** ≤10 seconds/vehicle	
B	Occasional queuing **Intersection Control Delay:** >10–15 seconds/vehicle	Some queuing; good corridor progression and/or short cycle lengths **Intersection Control Delay:** >10–20 seconds/vehicle	
C	Regular queuing **Intersection Control Delay:** >15–25 seconds/vehicle	Regular queuing; not all demand may be serviced on some cycles (cycle failure) **Intersection Control Delay:** >20–35 seconds/vehicle	
D	Queue lengths increased **Intersection Control Delay:** >25–35 seconds/vehicle	Queue lengths increased; routine cycle failures **Intersection Control Delay:** >35–55 seconds/vehicle	
E	Significant queuing **Intersection Control Delay:** >35–50 seconds/vehicle	Long queues, congested conditions; majority of cycles fail **Intersection Control Delay:** >55–80 seconds/vehicle	
F	Volume to capacity ratio approaches 1.0; very long queues **Intersection Control Delay:** >50 seconds/vehicle	Volume to capacity ratio near 1.0; very long queues, almost all cycles fail **Intersection Control Delay:** >80 seconds/vehicle	

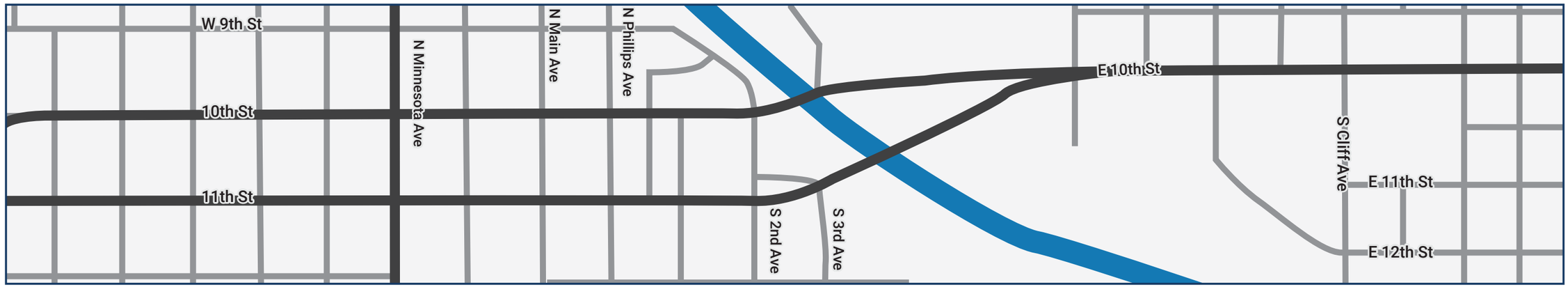
Figure 7: Level of Service (LOS) Descriptions

CITY OF SIOUX FALLS

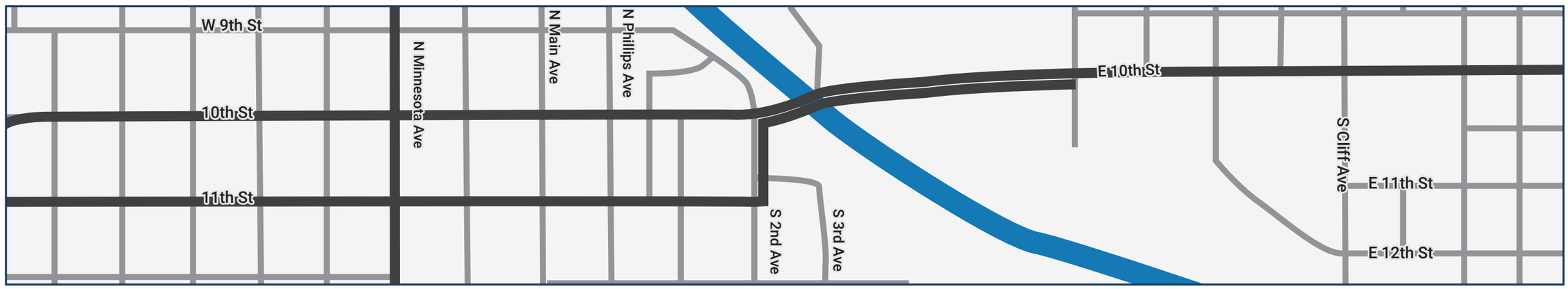
Viaduct Alignment Options

Figure 8

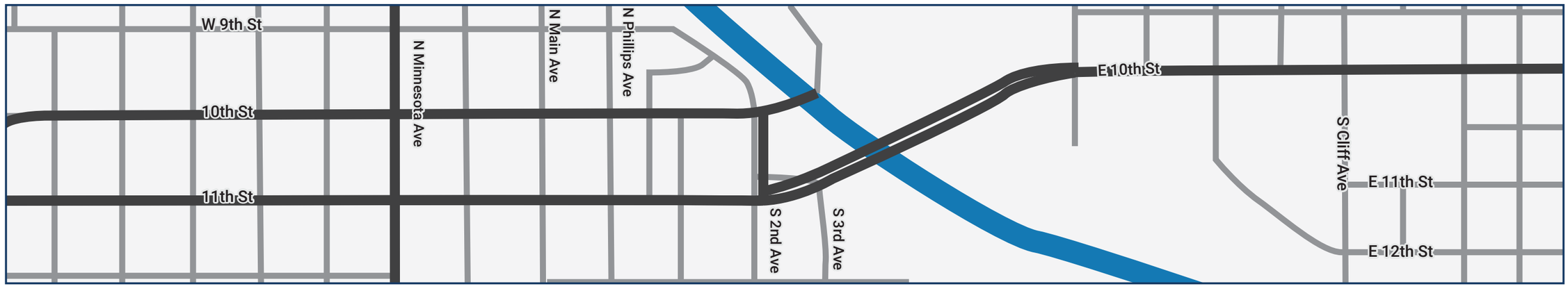
Option 1: Separate Alignments



Option 2: North Alignment



Option 3: South Alignment



CITY OF SIOUX FALLS

Year 2050 Intersection Level of Service

Figure 9
No Build: Scenario 44 (S44)

LEGEND

Daily Volumes

2050 S44

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

Lanes

2 S44 Number of Lanes (One-Way)
2 S44 Number of Lanes (Two-Way)

CITY OF SIOUX FALLS

Year 2050 Intersection Level of Service

Figure 10
No Build: Scenario 45 (S45)

LEGEND

Daily Volumes

2050 S45

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

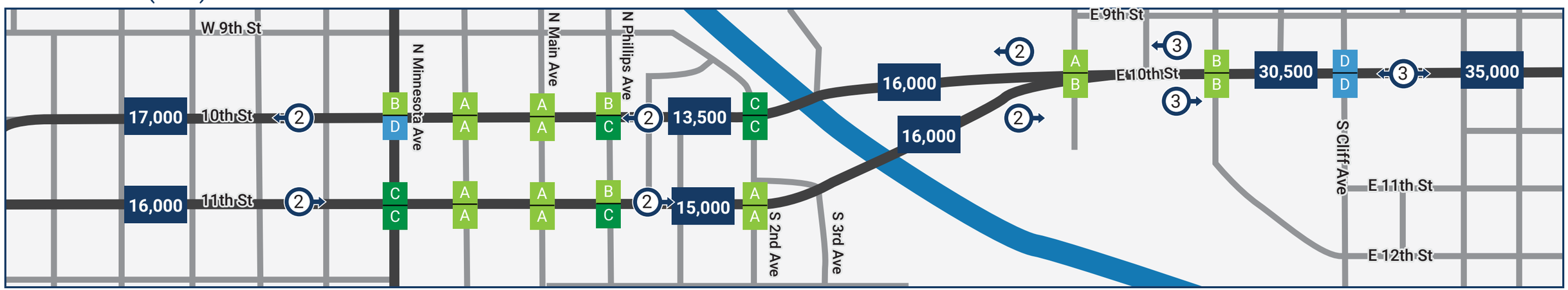
Lanes

2 S45 Number of Lanes (One-Way)
2 S45 Number of Lanes (Two-Way)

Alignment Option 1: Separate Alignments

Downtown Lanes: 2-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes



Scenario 45 (S45) Traffic Volumes - *Sensitivity Analysis*

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

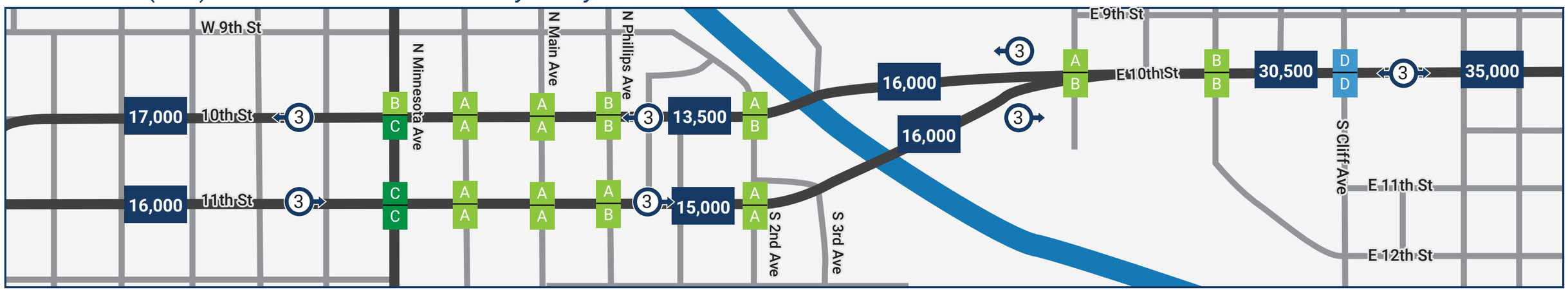
Lanes

- (2) S44 Number of Lanes (One-Way)
- (2) S44 Number of Lanes (Two-Way)
- (2) S45 Number of Lanes (One-Way)
- (2) S45 Number of Lanes (Two-Way)

Alignment Option 1: Separate Alignments

Downtown Lanes: 3-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes - *Sensitivity Analysis*



Scenario 45 (S45) Traffic Volumes

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A | B | C | D | E | F

C AM Peak Hour
C PM Peak Hour

Lanes

- (2) S44 Number of Lanes (One-Way)
- (2) S44 Number of Lanes (Two-Way)
- (2) S45 Number of Lanes (One-Way)
- (2) S45 Number of Lanes (Two-Way)

Alignment Option 2: North Alignment

Downtown Lanes: 2-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes

Scenario 45 (S45) Traffic Volumes - *Sensitivity Analysis*

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

Lanes

- (2) S44 Number of Lanes (One-Way)
- (2) S44 Number of Lanes (Two-Way)
- (2) S45 Number of Lanes (One-Way)
- (2) S45 Number of Lanes (Two-Way)

Alignment Option 2: North Alignment

Downtown Lanes: 3-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes - *Sensitivity Analysis*

Scenario 45 (S45) Traffic Volumes

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

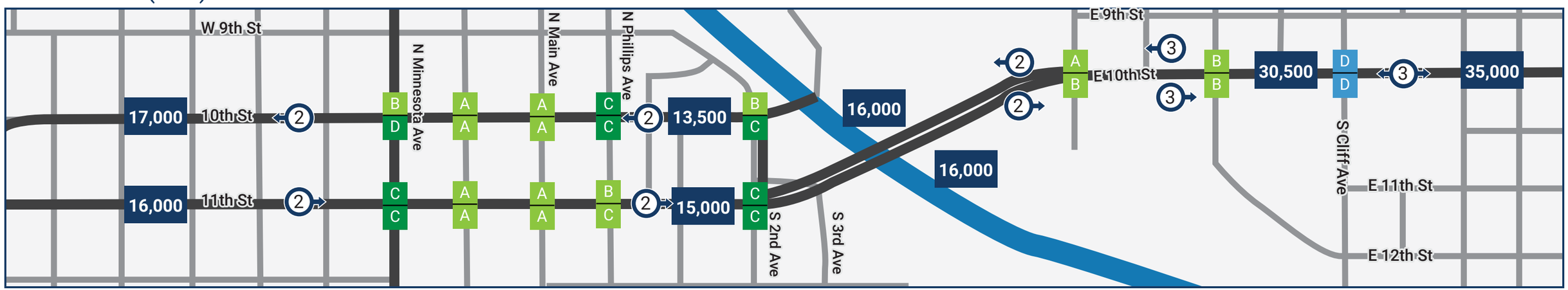
Lanes

- (2) S44 Number of Lanes (One-Way)
- (2) S44 Number of Lanes (Two-Way)
- (2) S45 Number of Lanes (One-Way)
- (2) S45 Number of Lanes (Two-Way)

Alignment Option 3: South Alignment

Downtown Lanes: 2-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes



Scenario 45 (S45) Traffic Volumes - *Sensitivity Analysis*

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A B C D E F

- C AM Peak Hour
- C PM Peak Hour

Lanes

- (2) S44 Number of Lanes (One-Way)
- (2) S44 Number of Lanes (Two-Way)
- (2) S45 Number of Lanes (One-Way)
- (2) S45 Number of Lanes (Two-Way)

Alignment Option 3: South Alignment

Downtown Lanes: 3-Lane 10th/11th Street

Scenario 44 (S44) Traffic Volumes - *Sensitivity Analysis*

Scenario 45 (S45) Traffic Volumes

LEGEND

Daily Volumes

- ### 2050 S44
- ### 2050 S45

Intersection Level of Service (LOS)

A B C D E F

C AM Peak Hour
C PM Peak Hour

Lanes

- S44 Number of Lanes (One-Way)
- S44 Number of Lanes (Two-Way)
- S45 Number of Lanes (One-Way)
- S45 Number of Lanes (Two-Way)

Overarching findings from this traffic operations analysis are summarized in the following text.

Downtown Area (General Findings)

The No Build condition analysis confirms that the existing downtown area street network generally provides adequate capacity to manage future traffic growth, outside of a few intersection modifications to incorporate turn lanes or other spot adjustments. It is expected that short periods of congestion and long queues will continue during peak hours, particularly when trains block crossings east of the Big Sioux River on 8th Street and 6th Street.

The Phillips Avenue corridor exhibits the greatest potential for expanded local street congestion due to the single lane in each direction, high pedestrian use, and relation to downtown area destinations. During the analysis, the Phillips Avenue intersections with 10th Street and 11th Street were typically the first existing intersections to fail as traffic volumes increased along the 10th/11th Street corridor.

Current downtown intersections generally operate at LOS A or B. However, in scenarios where 10th/11th Street capacity is reduced due to a reduction in lanes, intersection LOS may degrade to LOS C, D, or worse, due to longer traffic signal cycle lengths required to manage intersection operations. Longer cycle lengths translate to longer wait times for pedestrians to cross the roadway. While LOS D is often accepted at arterial/arterial intersections in Sioux Falls, it would likely be deemed unacceptable by downtown road users due to increased delay for vehicles and pedestrians, cycle lengths, vehicle idle times, queues that may extend into and block upstream intersections and crosswalks, and traffic signal cycle failure during peak periods. The difference between LOS A and LOS D delay could be upwards of 45 seconds or more waiting at the intersection during LOS D conditions.

Ultimately, intersections operating at LOS A and B can better accommodate pedestrians at downtown intersections. As intersections move towards LOS C, D, or worse, as shown when downtown lanes are reduced, the flexibility to handle bicycle and pedestrian modes of travel decreases.

Downtown 10th/11th Street Corridor Progression, Pedestrians, and Turn Lanes

Pedestrians using crosswalks were shown to have a notable impact to 10th/11th Street intersection operations and progression through the corridor in the 2-lane 10th/11th Street sections. If pedestrians in the crosswalk block both left and right turning traffic from 10th Street or 11th Street (to the crossroad), there is no sustained vehicular progression through the intersection. This impact is most prominent at the Phillips Avenue intersections where there are high pedestrian volumes. The impact was less notable with the 3-lane 10th/11th Street sections because there was always at least the middle lane for unimpeded through traffic not blocked by pedestrians in the crosswalk.

Adding turn lanes to the 2-lane section would help 10th/11th Street corridor progression by removing the blocked, turning traffic from the through lanes. However, this impacts pedestrians by increasing the number of conflict points, increasing pedestrian crossing distances to lengths greater than or equal to those in a 3-lane section, and reducing pedestrian sidewalk space on the impacted corners.

Proposed Riverline District Development

Key considerations with future traffic in the Riverline District redevelopment area include number of development access points, whether the Fairfax Avenue connection between 10th Street and Cliff Avenue is maintained, and changes in traffic demand and patterns. This area should be analyzed in greater detail when more information is known about the future development.

10th Street & Cliff Avenue Intersection

Through the operations analysis, it was determined that long-range 10th Street & Cliff Avenue intersection improvement needs include:

- Extending the 6-lane 10th Street corridor through the intersection
- Lengthening the southbound dual left turn lanes
- Maintaining eastbound and northbound right turn lanes
- Southbound and westbound right turn lanes were not shown to be needed, but are recommended if there is an opportunity to acquire additional right-of-way

10th/11th Street Number of Lanes

The analysis found that providing two lanes in each direction (2-lane 10th/11th Street) accommodates S44 traffic volumes through downtown. However, two lanes do not accommodate S45-level volumes, which reflect only a 20 percent increase from what was forecasted for S44. This is a key finding when considering the frequency of downtown special events that generate high traffic volumes, popularity of the downtown area during the high-volume summer months, and importance of east/west arterial route continuity in Sioux Falls.

New bridges are typically designed with a 75-year design life. Constructing a new 10th/11th Street viaduct that only provides two lanes in both directions would not support the anticipated long-range traffic demand traveling to and through downtown. The analysis demonstrates capacity issues with the 2-lane 10th/11th Street corridor and S45-level peak period volumes within the study's 2050 Planning Horizon, which is well short of the bridge's 75-year design life. With the magnitude and complexity of the viaduct structures, the 2-Lane 10th/11th Street capacity limitation would likely be 'permanent' through their design life.

It is recommended that 3 lanes be maintained in each direction on the 10th/11th Street corridor.

Alignment Options 1 (Separate Alignments) and 2 (North Alignment)

With the 3-lane 10th/11th Street corridor, the operations analysis confirmed Alignment Options 1 and 2 accommodate the analyzed Year 2050 S45 traffic volumes. In Alignment Option 2, the eastbound travel time and delay are generally slightly higher than Option 1 because eastbound 10th/11th Street traffic is routed on 2nd Avenue and through the 10th Street & 2nd Avenue traffic signal before joining the north viaduct alignment.

Both Alignment Options 1 and 2 are operationally feasible and recommended for further consideration in Phase 3.

Alignment Option 3 (South Alignment)

Alignment Option 3 exhibits high levels of congestion at the 2nd Avenue & 10th Street and 2nd Avenue & 11th Street intersections due to the south alignment's route for westbound 10th/11th Street traffic. Overall, this alignment option shows poor intersection operations, corridor travel time, and average corridor speed when compared to Alignment Options 1 and 2.

Alignment Option 3 is not operationally feasible and recommended to be eliminated from further consideration.

10th/11th Street Sensitivity Analysis

A sensitivity analysis was conducted for Alignment Option 1 (Separate Alignments) and Option 2 (North Alignment) to determine approximate volume levels for when additional 10th/11th Street corridor improvements may be needed beyond Year 2050. The need for the viaducts to maintain 3 lanes in each direction was confirmed in Phase 1 and Phase 2 analyses and thus this sensitivity analysis focuses on adjacent 10th/11th Street corridor intersection long-range needs. The *10th/11th Street Corridor Sensitivity Analysis Memo* is provided in **Appendix E**.

As S45 traffic volumes were increased along the 10th/11th Street corridor beyond Year 2050, key findings for both Alignment Options 1 and 2 include:

- 10th Street & Minnesota Avenue and 10th Street & Cliff Avenue intersections are the first intersections to become congested
- 10th Street & Phillips Avenue and 11th Street & Phillips Avenue intersections are generally the next intersections to become congested
- Long queues were common throughout the sensitivity analysis and not always readily apparent in the intersection LOS measures as traffic progression through the corridor would likely resemble a slow, rolling queue

Key findings for Alignment Option 1:

- Alignment Option 1 performs considerably better than Alignment Option 2 at 2nd Avenue and Franklin Avenue intersections upstream/downstream of the viaducts

Key findings for Alignment Option 2:

- 10th Street & 2nd Avenue intersection begins showing congestion at only a 35 percent increase (1.35 growth factor) in eastbound/westbound 10th/11th Street corridor traffic. Contributing factors include:
    - Accommodating all intersection movements
    - Operational inefficiencies of the signalized northbound to eastbound triple right turn for 10th/11th Street eastbound through traffic

Recommended Alignment Options and Volume Scenario for 10th Street/11th Street Viaduct Study (Phase 3)

Based on findings from the Phase 2 traffic operations analysis, it is recommended that:

- Alignment Option 1 (Separate Alignments) and Alignment Option 2 (North Alignment) be carried forward to Phase 3 of the study for conceptual design and evaluation
- Alignment Option 3 (South Alignment) be eliminated from further consideration
- Scenario 45 (S45) volumes and three lanes in each direction (3-lane 10th/11th Street) be used as the basis to guide evaluation and design decisions

Phase 3: 10th Street / 11th Street Viaduct Study

High-level viaduct alignment concepts used during brainstorming discussions with the City of Sioux Falls are provided in **Appendix F**. The more detailed and refined Viaduct Option layouts, reflective of the four Viaduct Options recommended to be carried forward from this study, are presented in this section's text. The *Environmental Overview Memo* and breakdown of Viaduct Option conceptual costs are provided in **Appendix G** and **Appendix H**, respectively.

Phase 3 of the *Downtown Traffic Impact Study* focuses on concept development, refinement, and evaluation of the 10th Street and 11th Street viaducts and connecting roadway network. Recommendations from Phases 1 and 2 provide guidance on 10th/11th Street corridor number of lanes, intersection lane configurations, and operational feasibility.

Viaduct Alignment Concepts

The Phase 2 traffic operations analysis provided notable insight to operational feasibility of three overarching 10th/11th Street viaduct alignment options: 1) separate, 2) north, and 3) south. Based on that framework, several high-level alignment concepts were developed for brainstorming discussions with the study team. These discussions helped determine what elements were important, or less important, prior to full concept development. The high-level alignment concepts are provided in **Appendix F**.

Through discussions with the study team, it was determined that the following considerations help guide the screening of viaduct alignments prior to transitioning into developing viaduct options:

- Provide acceptable traffic operations, as identified in Phase 2
- Provide a common touch down point for both north and south viaducts east of the railroad tracks to provide the first full access intersection at either Franklin Avenue or Fairfax Avenue
- Minimize property impacts and provide similar or increased developable areas (open space) east of the Big Sioux River
- Minimize Section 4(f) and 6(f)
- All turn movements must meet current design standards and accommodate trucks to be able to turn side-by-side in the 3-lane section along the 10th/11th Street corridor

Through initial conceptual design, it was found that 10th Street and 11th Street through traffic needed to be maintained at separate 2nd Avenue intersections, similar to the current configuration. Intersection geometrics required to facilitate side-by-side turning movements of large trucks through triple right turns necessitated by the north and south alignment options were not feasible due to significant impacts to Fawick Park. However, the north and south alignment options exhibited viable elements east of the Big Sioux River that were integrated into the Viaduct Options.

Viaduct Options

Following the high-level brainstorming, discussion, and screening of viaduct alignment concepts, four 10th/11th Street Viaduct Options were developed for further evaluation.

Each Viaduct Option figure includes a conceptual plan, profile, and typical section view of the respective viaduct. Potential roadway alignments, intersection configurations, impacts, fill, bridge, and retaining wall locations, existing and potential shared use paths, and rail lines are also shown on the figures.

The Viaduct Options present varying degrees of space beneath the bridges and land available for development. As part of future design decisions, it will be important to establish goals for movement throughout the area as well as the desired use for the space beneath and developable areas to the north and south of the bridges.

Common Elements to All Options

Common bridge elements to all Viaduct Options include:

- **Reid Street connection to 10th Street bridge to maintain and enhance downtown development connectivity.** The Reid Street section may be constructed as a bridge or fill with retaining walls containing soil and an abutment placed at the Reid Street & 10th Street intersection.
- **Longer bridges can result in higher costs.** Overall costs may be reduced if select areas are constructed on fill and not clear spanned. Further coordination with City of Sioux Falls and SDDOT will be needed as space usage under and around the bridges will refine the desired configuration.
- **At-grade railroad crossings will need to be separated and protected from pedestrians accidentally walking into the area.** Protective fencing and possibly additional pedestrian crossings could be included. An approved catch fence will be required on the bridge over railroad right-of-way.
- **At least one lane of traffic is maintained in each direction during construction** to maintain east/west connectivity and access to downtown.
- **Bridge deck geometry includes three traffic lanes, two 4-foot shoulders, and a 10-foot shared use path on each bridge.**

- **Bridge alignments all start at 2nd Avenue on the west side** but end at either Franklin Avenue or Fairfax Avenue on the east side**.**
- **Accommodates future shared use path connection under the 10th Street bridge (west side of Big Sioux River)**, connecting Fawick Park and the existing path along River Road.
- **Provides the minimum 23.5 feet clearance between top of rail and low girder,** which allows adjacent areas under the bridge to be used as park space, if desired, similar to the 26th Street bridge over the Big Sioux River.
- **Bridge profile improvements** that soften vertical curves over the Big Sioux River, improves intersection sight distance on the east end of the viaduct, and provides an opportunity to lower the structure height.

Viaduct Option 1

Viaduct Option 1, shown in **Figure 17**, places the new bridges between the existing structures. Touch down points are between the existing 2nd Avenue and Franklin Avenue intersections. Portions of the new bridges could be constructed prior to closing one existing bridge at a time and shifting traffic to the open bridge.

Option 1 estimated bridge lengths:
10th Street: 1,250 feet
11th Street: 1,420 feet
Reid Street: 45 feet
Total bridge deck length: 2,715 feet

Due to the curvature of structures, the use of steel girders is recommended. Prestressed girders could be evaluated depending on curve radius as prestressed girders may be used in curved girder configurations if spaced properly.

Substructures would be spaced as necessary to maintain required clearance for pedestrian paths, crossroads, and railroad lines. The type of pier columns would be determined by evaluating cost and aesthetics and clear space beneath the structure would be evaluated to meet City of Sioux Falls and future development needs.

Viaduct Option 2

Viaduct Option 2, shown in **Figure 18**, places the 10th Street bridge in the same location as the existing bridge. The 11th Street bridge is realigned with a reverse curve to align with the 10th Street bridge between the Big Sioux River and railroad tracks. Travel lanes through the 11th Street bridge reverse curve will need to be wider than the typical 12-foot lanes to allow trucks to remain in their lanes through the curve. Touch down points are between 2nd Avenue and Franklin Avenue intersections.

Option 2 estimated bridge lengths:
10th Street: 1,245 feet
11th Street: 1,415 feet
Reid Street: 45 feet
Total bridge deck length: 2,705 feet

Traffic could be maintained on the existing 11th Street bridge while the 10th Street bridge is removed and reconstructed. Traffic could then shift to the new 10th Street bridge while the 11th Street bridge is removed and reconstructed.

Steel girders will be required for the 11th Street bridge due to the tight curvature through the reverse curve and likely the logical choice for the 10th Street bridge for continuity.

Substructures would be spaced as necessary to maintain required clearance for pedestrian paths, crossroads, and railroad lines. The type of pier columns would be determined by evaluating cost and aesthetics and clear space beneath the structure would be evaluated to meet City of Sioux Falls and future development needs. Moving the 11th Street bridge to the north opens a large area for development on the east bank of the Big Sioux River.

Viaduct Option 3

Viaduct Option 3, shown in **Figure 19**, places the new bridges between the existing structures. The 10th Street bridge is realigned further south of the existing bridge and a reverse curve is introduced to align the bridge with the 11th Street bridge closer to the Big Sioux River than the current configuration. Touch down points are between 2nd Avenue and Fairfax Avenue, which reflects the easternmost touch down point of the four Viaduct Options.

Option 3 estimated bridge lengths:

10th Street: 2,145 feet
11th Street: 2,210 feet
Reid Street: 170 feet
Total bridge deck length: 4,525 feet

Portions of the new bridges could be constructed while maintaining traffic on the existing bridges. Traffic could be maintained on one of the existing bridges, and then shifted to the reconstructed bridge, while the other is being removed and reconstructed.

Steel girders are recommended due to the curvature of all structures.

Substructures would be spaced as necessary to maintain required clearance for pedestrian paths, crossroads, and railroad lines. A bridge tying Reid Street into the 10th Street bridge would share a substructure unit with the 10th Street bridge. The type of pier columns would be determined by evaluating cost and aesthetics and clear space beneath the structure would be evaluated to meet City of Sioux Falls and future development needs.

Moving the 10th Street bridge to the south opens an area for development on the east bank of the Big Sioux River, north of the bridges. Extending the structures to the east eliminates the steep grades just west of the Franklin Avenue intersection and would move the first full access intersection east to Franklin Avenue. Fairfax Avenue could be maintained under the bridges through the open area or via an underpass. The area near the railroad tracks would not require retaining walls if the structures are carried the full length from 2nd Avenue to Fairfax Avenue.

Viaduct Option 4

Viaduct Option 4, shown in **Figure 20**, follows the same alignments as Viaduct Option 3 but brings the eastern touch down point westward to Franklin Avenue. This reduces the total bridge deck length when compared to Viaduct Option 3.

Option 4 estimated bridge lengths:

10th Street: 1,260 feet
11th Street: 1,330 feet
Reid Street: 170 feet
Total bridge deck length: 2,760 feet

Retaining Wall Concepts

Aesthetics will play a role in the type of wall and pattering in each area of the project. Retaining wall types other than MSE will be considered in the design process. In the event additional walls are required or desired, they will be evaluated to reduce bridge deck length and construction costs.

The west end of the project may need a sacrificial retaining wall or EPS foam fill depending on the grade difference between the new and old roadway surfaces. Both methods have been successfully used in previous City of Sioux Falls projects.

All four Viaduct Options will require a minimum of four retaining walls. However, there are differences between what is required for Viaduct Options 1,2, and 4 and Viaduct Option 3:

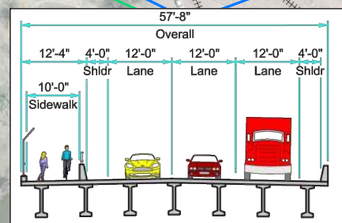
- Viaduct Options 1, 2, and 4
  - Wall height ranges from 8 feet on west end to 20 feet at east end
  - MSE walls will not be allowed within 50 feet of BNSF rail lines and thus other wall types will need to be considered in this location
- Viaduct Option 3
  - Wall height averages approximately 8 feet
  - Does not require a retaining wall in the area of the BNSF rail lines

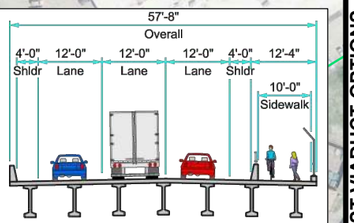
Project Phasing Considerations

Maintaining traffic on the 10th/11th Street corridor during construction was identified as a priority by the study team to maintain east/west connectivity and access to/from downtown. All Viaduct Options can maintain traffic on at least one bridge during construction but have varying levels of what can be constructed offline ahead of any traffic shifts. For peak flows on the maintained 3-lane bridge, traffic control could be modified to maintain two lanes in the peak direction with a single lane in the opposing, lower volume direction. This process would be similar to what was done for the 12th Street bridge over the Ellis and Eastern Railroad tracks west of downtown.

RIVER ROAD
REID STREET
RETAINING WALL
FUTURE PATH
PARKING LOT
PARKING IMPACTS
10TH STREET
RETAINING WALL
1ST AVENUE
2ND AVENUE
FAWICK PARK
CITY PARK LIMITS
RETAINING WALL
BIG SIOUX RIVER
EXISTING 100 YEAR FLOOD BOUNDARY
11TH STREET
PARKING IMPACTS
ELLIS & EASTERN
BNSF
BNSF
RETAINING WALL
FRANKLIN AVENUE
FUTURE 3RD LANE TO CLIFF AVENUE
1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 25+73

LEGEND
- BRIDGE
- ROADWAY
- SIDEPATH
- ROAD/BRIDGE REMOVAL



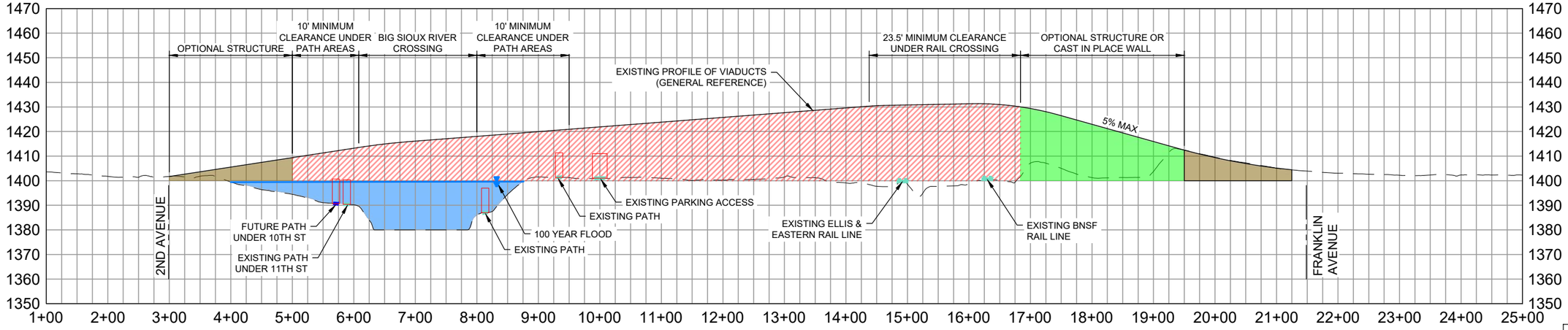


SEPARATE BRIDGES / SEPARATE ALIGNMENTS

10TH STREET BRIDGE (Facing East)

11TH STREET BRIDGE (Facing East)

Viaduct Option 1



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

DESIGNED BY: J. KJENSTAD
DRAWN BY: M. SEINER
CHECKED BY: J. KJENSTAD
REVISIONS:

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CITY OF SIOUX FALLS

Figure 17

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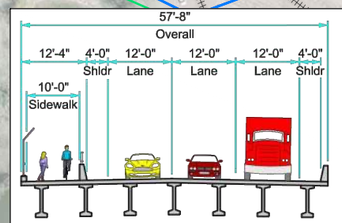
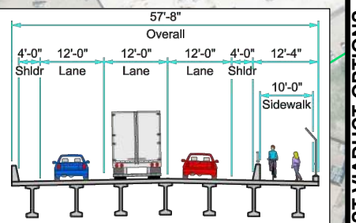
RIVER ROAD
REID STREET
RETAINING WALL
FUTURE PATH
10TH STREET
1ST AVENUE
2ND AVENUE
RETAINING WALL
FAWICK PARK
CITY PARK LIMITS
RETAINING WALL
11TH STREET
PARKING IMPACTS
PARKING LOT
PARKING IMPACTS
BIG SIOUX RIVER
EXISTING 100 YEAR FLOOD BOUNDARY
ELLIS & EASTERN
BNSF
RETAINING WALL
FRANKLIN AVENUE
FUTURE 3RD LANE TO CLIFF AVENUE
1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 25+43

LEGEND
- BRIDGE
- ROADWAY
- SIDEPATH
- ROAD/BRIDGE REMOVAL



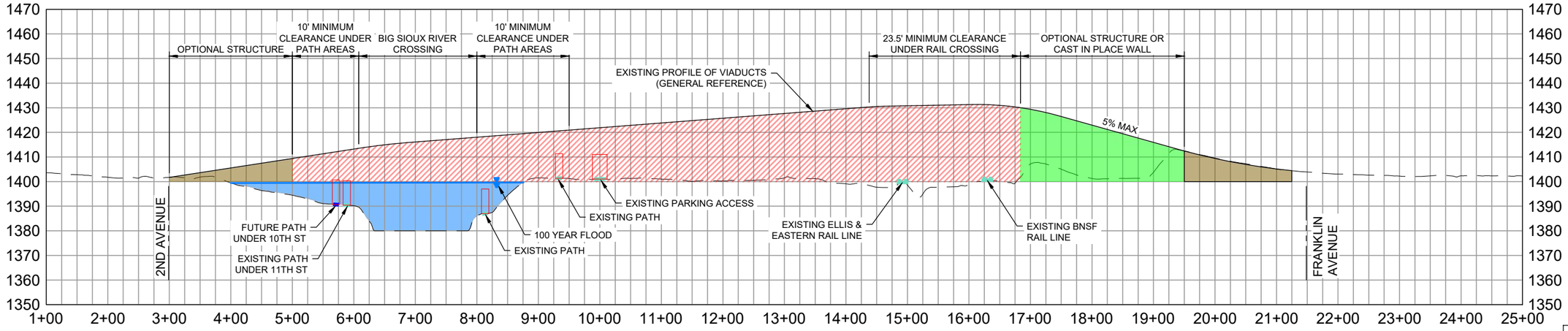


SEPARATE BRIDGES / SEPARATE ALIGNMENTS

10TH STREET BRIDGE (Facing East)

11TH STREET BRIDGE (Facing East)

Viaduct Option 2



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

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REVISIONS:

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CITY OF SIOUX FALLS

Figure 18

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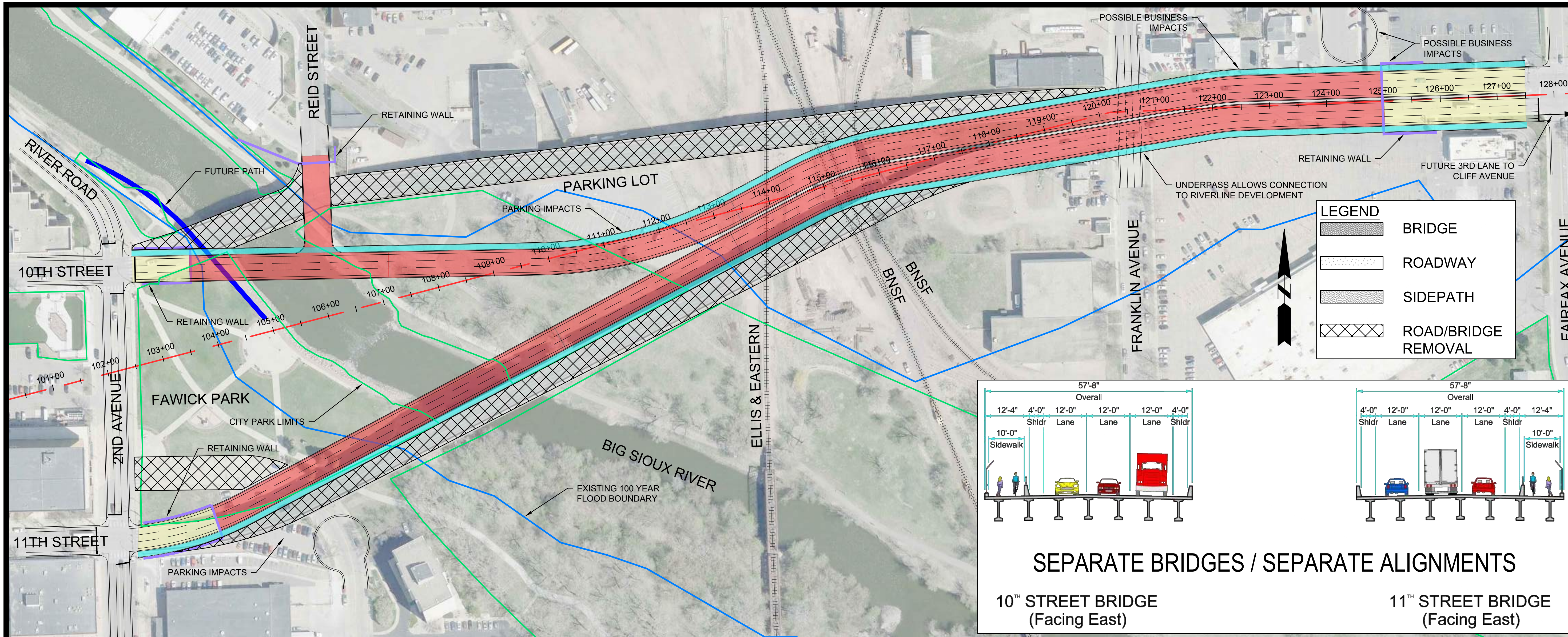
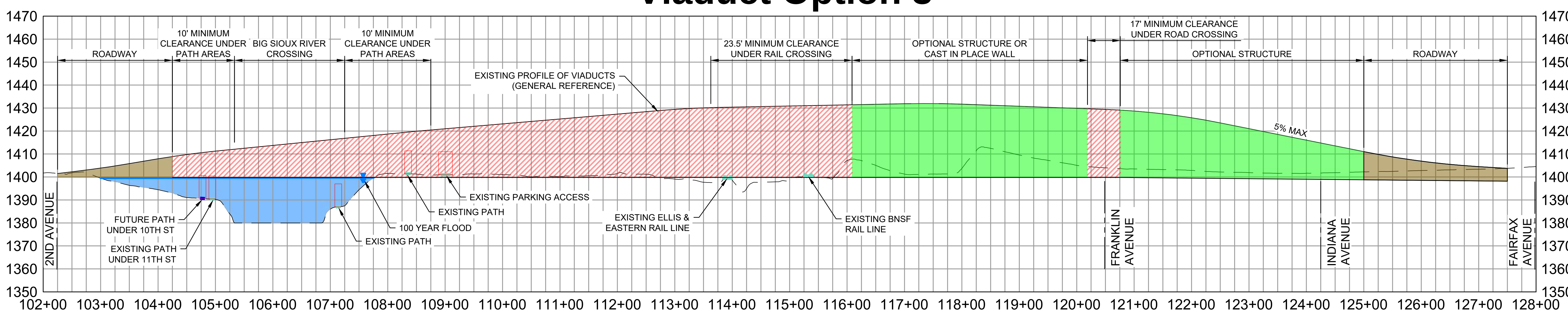


Viaduct Option 3



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

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CITY OF SIOUX FALLS

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Figure 19

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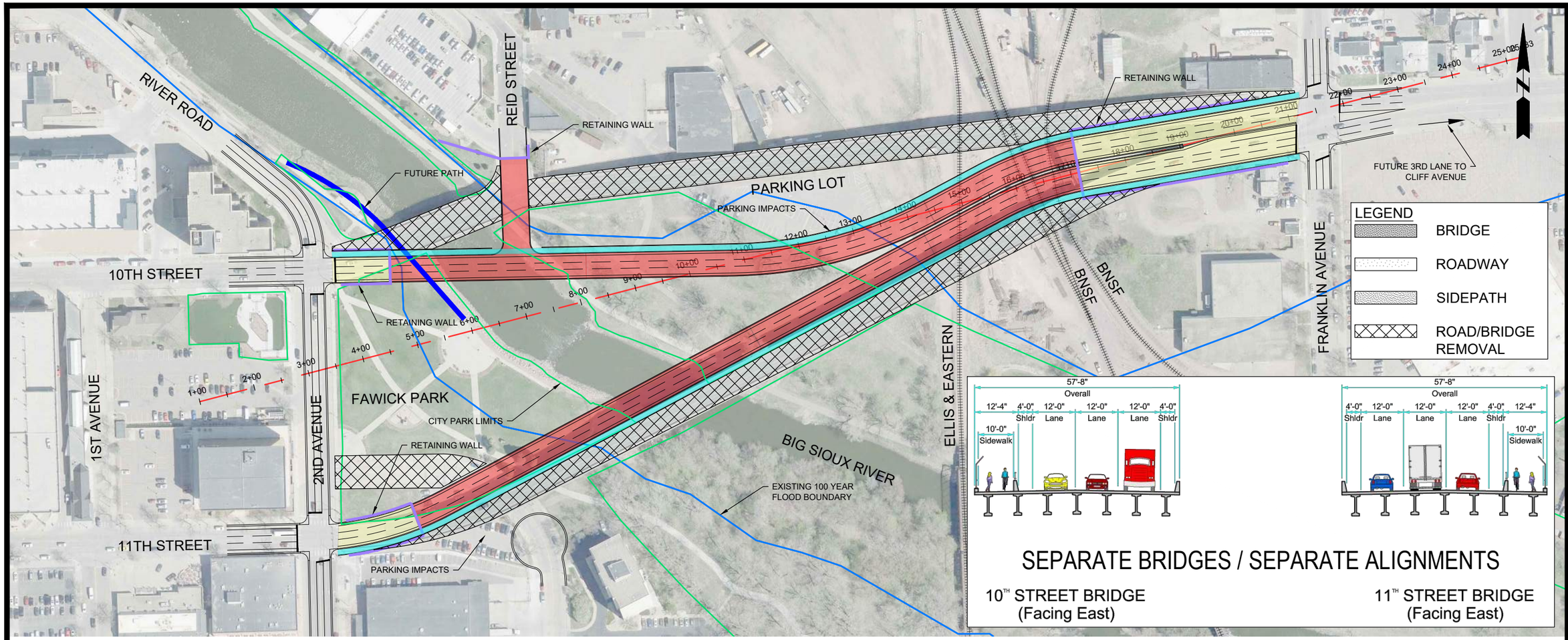
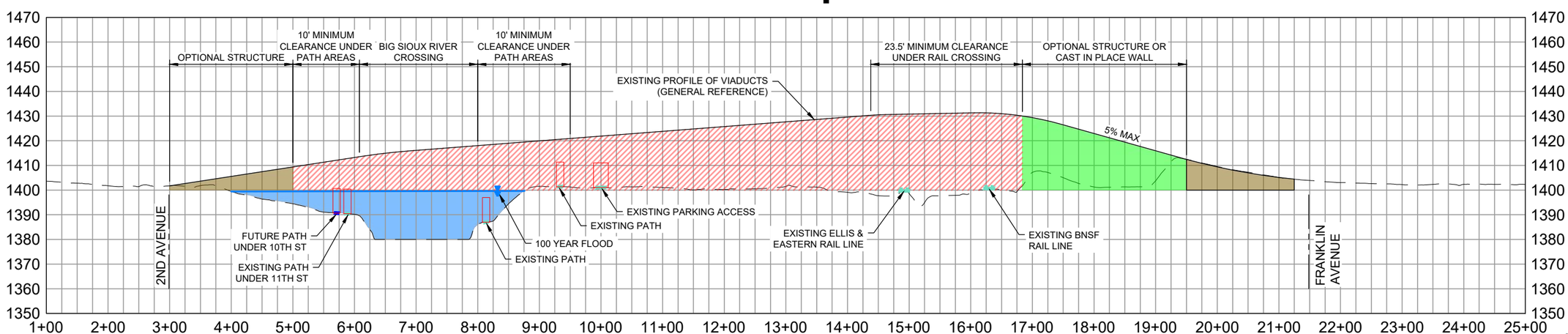


Viaduct Option 4



DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

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CITY OF SIOUX FALLS

Figure 20

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Environmental Review

An environmental overview of the study area was conducted to identify environmental resources, potential for impacts, and future actions needed as part of the project. The *Environmental Overview Memo*, included in **Appendix G**, documents findings from the review. Resources likely to be impacted by the project and require further review are summarized below.

Threatened and Endangered Species

Trees that serve as habitat for the endangered northern long-eared bat and proposed endangered tricolored bat is present within the study area. A field habitat review will need to be completed and consultation with the U.S. Fish and Wildlife Service should be conducted.

Archaeological/Historical Properties

Several historic properties eligible for the National Register of Historic Places (NRHP) exist within the study area. The records inside the study area include:

- 1 site
- 2 bridges: 1 unevaluated and 1 National Register (NR) eligible
- 109 structures: 81 NR listed, 6 not eligible, 21 unevaluated, and 1 removed
- 1 historic district (Downtown Historic District)

A field survey was not conducted for archaeological/historical properties within the study area. A survey should be conducted to determine if there are any unidentified archaeological/historic properties within the area. Consultation with SD State Historic Preservation Office should occur once impacts to these properties are known.

Section 4(f)/6(f)

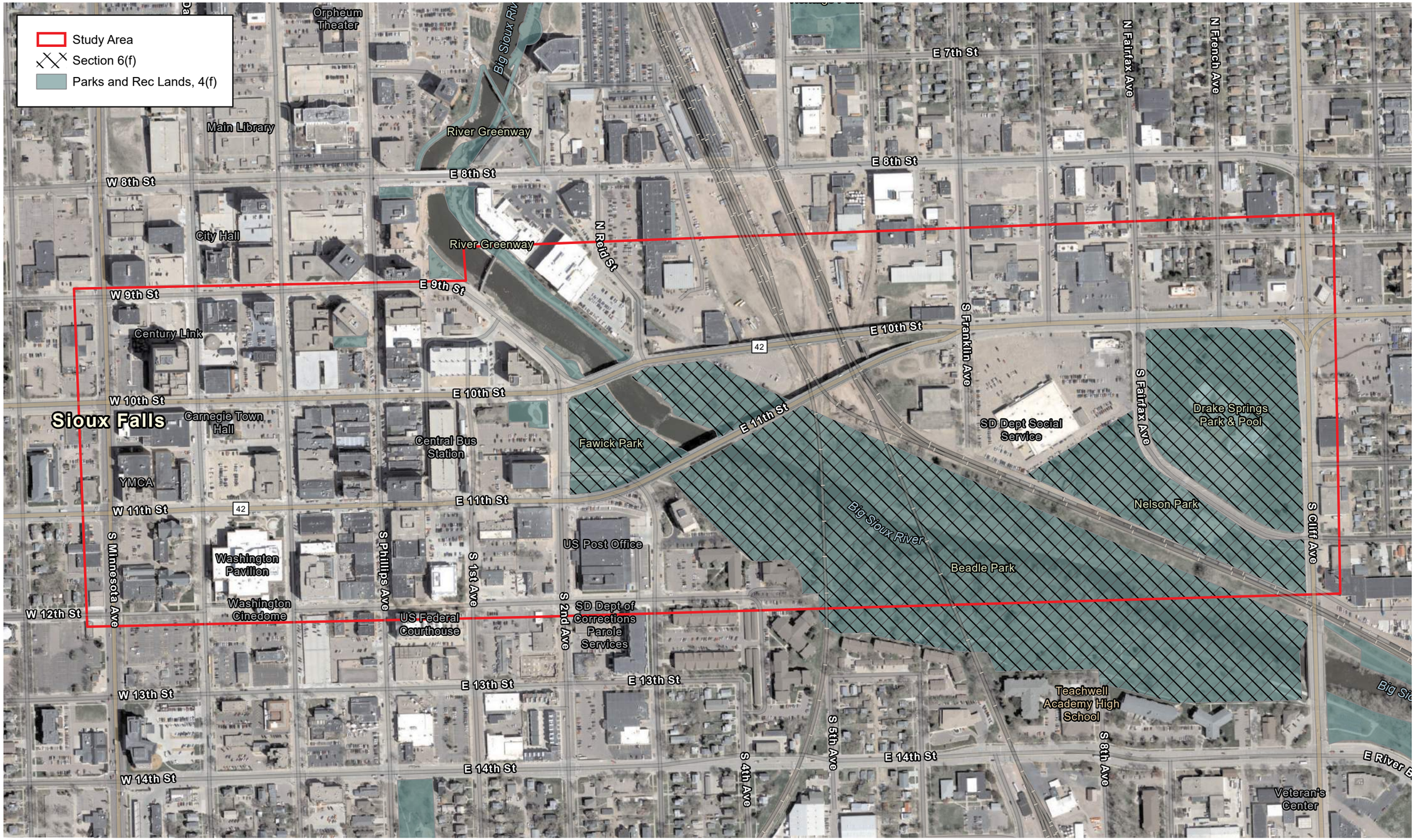
Both Section 4(f) and Section 6(f) properties are located within the study area as shown in **Figure 21**. Planned trail systems through the area identified as a future need by the City of Sioux Falls are considered planned recreation areas and would be considered 4(f) resources along with the existing trails. Historic properties eligible for listing on the NRHP are also considered Section 4(f) properties. Impacts to Section 4(f) properties will require coordination with the 4(f) property's official with jurisdiction to help determine extent of impacts and minimization measures. A public notification and opportunity to comment may be required.

The 6(f) locations within the study area include the following parks: Fawick, Beadle, Nelson, and Drake Springs. Impacts to section 6(f) resources will require coordination with SD GFP and may include National Park Service (NPS) involvement, depending on the extent of impact. Conversion of 6(f) properties for non-recreational use can require extensive coordination with agencies, particularly NPS. Impacts should be identified early and if needed, coordination initiated early in the planning process.

CITY OF SIOUX FALLS

Section 4(f) and Section 6(f) Lands

Figure 21



Floodplain

A total of 55.37-acres of FEMA floodplain exist within the study area. Once alternatives for this project have been developed, a qualified hydraulic staff should review the plan sets to determine if impacts to the floodplain would occur. Additional coordination with the floodplain administrator or FEMA may be required.

Wetlands and Other Waters of the U.S.

The desktop delineation found 2 wetlands within the study area, totaling 0.24 acres. Impacts are unlikely; however, field delineations should be completed to determine full extent of all wetlands and their boundaries once further project details are known. If impacts occur to wetlands, a U.S. Army Corps of Engineers (USACE) Section 404 Permit may be required.

The only other water of the U.S within the study area is the Big Sioux River. Approximately 9.43 acres of the river is located within the study area. A USACE permit may be required for work within the stream. Coordination with the USACE should be completed early in the planning process to determine if they may have any special requirements or concerns for bridge removal.

Socioeconomics

Socioeconomics impacts were reviewed for each of the scenarios, focusing on elements such as potential displacement, loss of direct access, alterations to property, and changes in area traffic patterns. Project impacts should not cause a more significant or longer lasting burden to minority owned or minority/low income-serving businesses and facilities than other properties or businesses within the area. Efforts should be made to not disproportionately impact environmental justice populations. Given that the area has a higher percentage of low income and minority residents than most of the City of Sioux Falls, future projects should consider additional steps to engage these communities during the public involve process.

Hazardous Materials

A review of the Spills, Tanks, and Environmental Hazards map revealed several previous records within the study area. Most have been closed or declared no further actions necessary. During agency coordination, the SD Department of Agriculture and Natural Resources (SDANR) noted some larger/more significant records in the area. They also provided recommendations on how to properly dispose of contaminated soils and what must happen if additional contamination is encountered.

Further coordination with SDDANR may be required for construction in known contaminated areas. Construction within the Big Sioux River in the area beneath the viaduct bridges should be avoided to the extent possible, as not to cause contaminated soils to be released into aquatic resources. Additional hazardous materials may be encountered within the study area. Excavated soils in known contamination areas should be tested for contamination. Soils found within the railyard to the north of the 10th Street bridge have been found to be contaminated during past projects in the area. If contamination in this particular area is found, the soils may be reused on site in “non-critical areas” such as backfill or under paved parking with the approval of an environmental engineer or geotechnical engineer. If soils will not be used on site, they must be disposed of at a Subtitle D landfill and the landfill must approve this ahead of time. Reused

soils should only be used in subsurface areas due to the potential risk of high lead concentrations.

Noise

When project design recommendations are made, they should be reviewed to determine if the project would be considered a Type 1 project, and if so, a noise study would be required.

Viaduct Options and Environmental Impacts

It was found that there is minimal difference in environmental impacts between the four Viaduct Options. All options follow or are to the inside of the existing bridge alignments. All Viaduct Options will impact the 4(f) and 6(f) land and the Big Sioux River, but they also exhibit the opportunity to give back park land when existing roadways and bridges are removed. Therefore, the same evaluation and environmental recommendations are applicable to all four Viaduct Options.

Viaduct Option Conceptual Costs

Conceptual preliminary engineering, construction, and construction engineering costs for the four Viaduct Options are presented in **Table 5**. A more detailed breakdown of costs is provided in **Appendix H**. The notably longer bridge length in Viaduct Option 3 is the primary contributing factor to that option's costs.

Table 5: Viaduct Option Conceptual Costs ($M)

	Viaduct Option 1	Viaduct Option 2	Viaduct Option 3	Viaduct Option 4
Preliminary Engineering	**$12.5**	**$13.5**	**$20**	**$12.5**
Construction*	**$83.5**	**$91**	**$130.5**	**$84**
Bridges (3)	*$51*	*$55.5*	*$84.5*	*$51.5*
Walls (4)	*$2.5*	*$3*	*$1.5*	*$2.5*
Construction Engineering	**$12.5**	**$13.5**	**$20**	**$12.5**
Project Total	**$108.5**	**$118**	**$170.5**	**$109**

** Construction cost includes 30% for contingency and bridge complexity*
Right-of-way costs in addition to Project Total
All costs reflect Year 2023 dollars

Viaduct Option Summary Matrix

A summary of similar and differentiating elements across the four Viaduct Options is provided in **Table 6**. It should be noted that the process used in this study screened out infeasible options ahead of detailed concept review and provided ample opportunity for refinement through study team discussion and feedback to arrive at the four Viaduct Options presented. Therefore, there are many similarities across the four options with the primary differences related to bridge lengths and bridge treatments on the east end.

Table 6: Viaduct Option Summary Matrix

	Viaduct Option 1	Viaduct Option 2	Viaduct Option 3	Viaduct Option 4
Touch Down Points *First at-grade, full access intersection*	2nd Avenue (west) Franklin Avenue (east)	2nd Avenue (west) Franklin Avenue (east)	2nd Avenue (west) Fairfax Avenue (east)	2nd Avenue (west) Franklin Avenue (east)
Traffic Operations	• All Viaduct Options incorporates recommendations from Phase 1 and Phase 2 traffic analyses to best manage long-range traffic growth and peak traffic fluctuations within and through the downtown area • Maintain one-way pair through separate 2nd Avenue intersections • Provide three lanes in each direction			
Bridge				
Number of Bridges	3	3	3	3
Total Bridge Length	2,715 feet	2,705 feet	4,525 feet	2,760 feet
Probable Girder Type	Steel (due to curvature) Prestressed if spaced properly	Steel (due to curvature)	Steel (due to curvature)	Steel (due to curvature)
Walls				
Number of Walls	4 (minimum)	4 (minimum)	4 (minimum)	4 (minimum)
Average Wall Height	8 to 20 feet	8 to 20 feet	8 feet	8 to 20 feet
Total Wall Area	13,500 SF	14,700 SF	7,700 SF	13,500 SF
Wall near BNSF Rail?	Yes, MSE walls not allowed	Yes, MSE walls not allowed	No	Yes, MSE walls not allowed
'New' Developable Space	Slight addition north and south of future bridges	South of future bridges	North of future bridges	North of future bridges
Franklin Avenue	At-grade intersection w/10th Street	At-grade intersection w/10th Street	Underpass or roadway through open area	At-grade intersection w/10th Street
Maintenance of Traffic	• All Viaduct Options developed to maintain traffic on at least one bridge during construction • Viaduct Option 2 is the only option that reconstructs one of the bridges entirely on existing alignment (10th Street)			
Environmental Impacts	• All Viaduct Options will impact 4(f) and 6(f) land and the Big Sioux River, but also exhibit the opportunity to give back park land when existing roadways are removed • All Viaduct Options exhibit considerably less impact than the viaduct alignment concepts that routed a combined the 10th/11th Street corridor through a single 2nd Avenue intersection			
Total Project Cost ($M)	$108.5	$118	$170.5	$109

10th Street / 11th Street Typical Sections

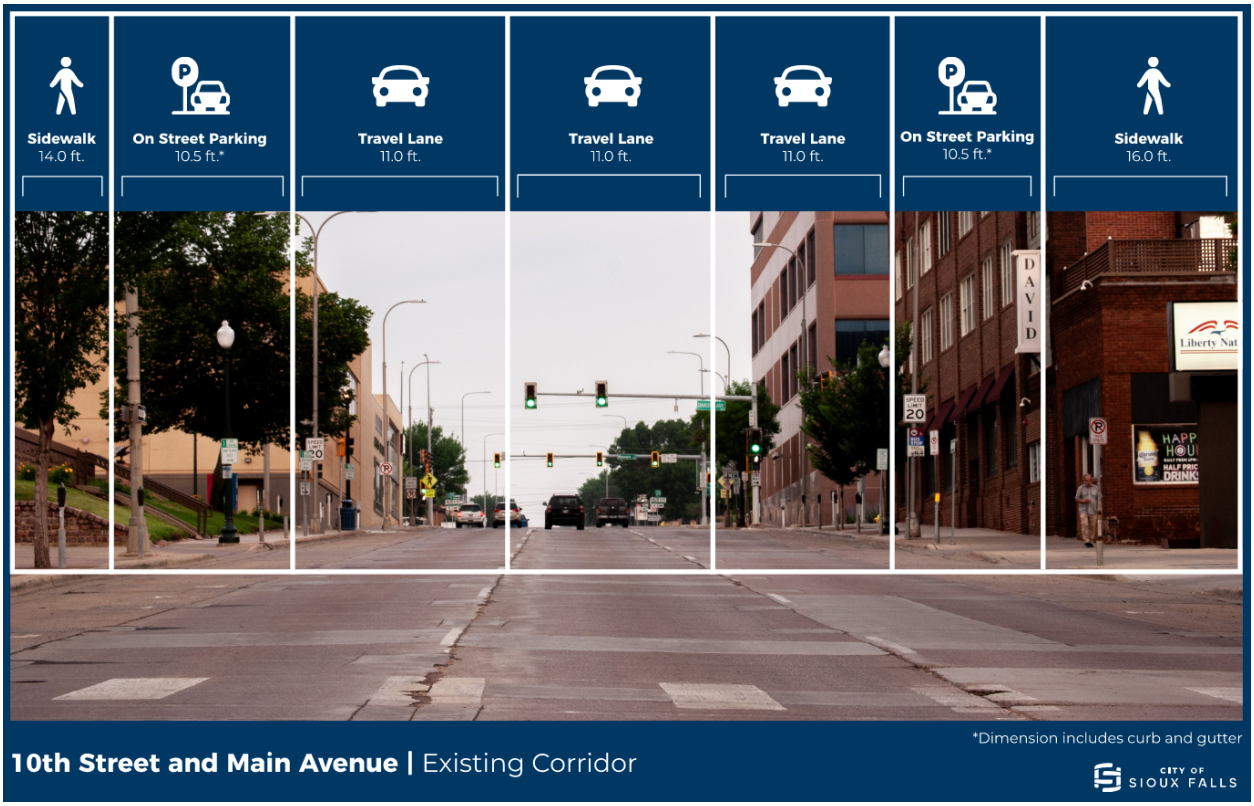
The recommended 10th/11th Street corridor typical sections through the downtown area includes 3 through lanes in each direction through the downtown area. Maintaining three continuous through lanes in the downtown area supports arterial connectivity and lane continuity and best addresses future traffic demand identified in Phase 2. Parking is proposed to be removed from the downtown area and reallocated as pedestrian space for landscaping, street furniture, expanded seating areas, and wider walkways.

Example typical sections within the downtown area are shown in **Figure 22** and **Figure 23**. Both figures show the existing section and a 3-lane corridor option. Primary difference is the reallocation of parking area to pedestrian space. Pedestrian space measurements are approximate and meant to illustrate the changes.

A comparative look at existing sections, a 2-lane sections (considered, but eliminated in Phase 2), and the recommended 3-lane sections along the 10th Street and 11th Street one-way pair is provided in **Appendix I**.

Other Concepts

Through discussions with the study team, a concept that brings the 10th Street / 11th Street one-way pair west of Minnesota Avenue was requested to help visualize potential impacts of the required ‘S-curve’. A conceptual layout of what this ‘S-curve’ may entail is shown in **Figure 24**.



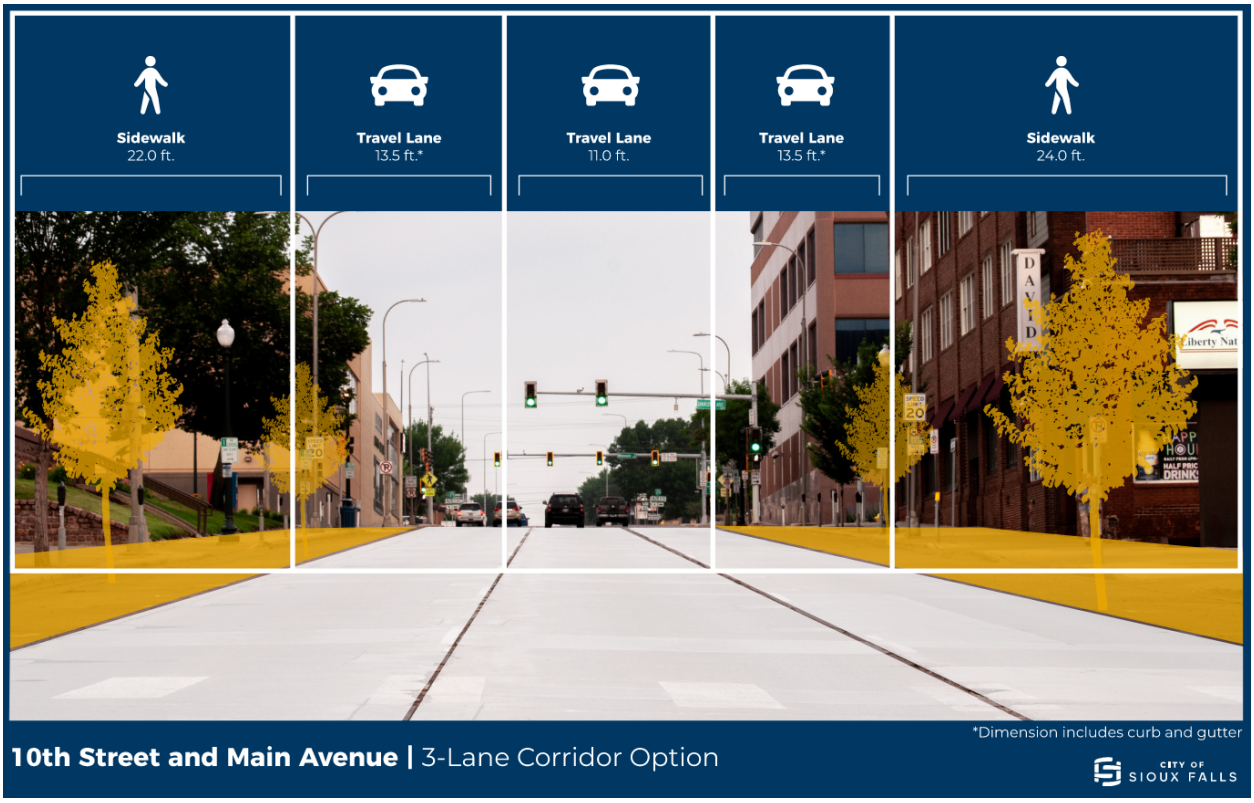
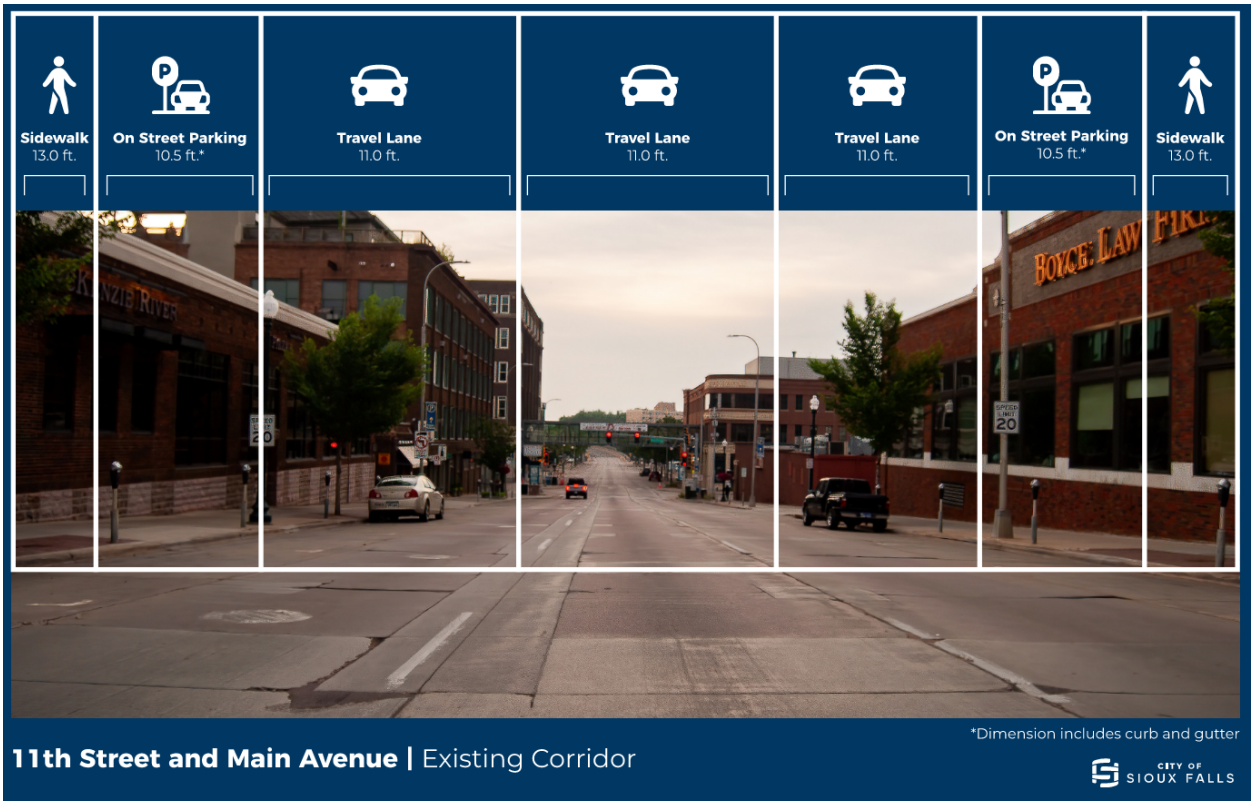


Figure 22: 11th Street Typical Section Example (Existing and 3-Lane Corridor Option)



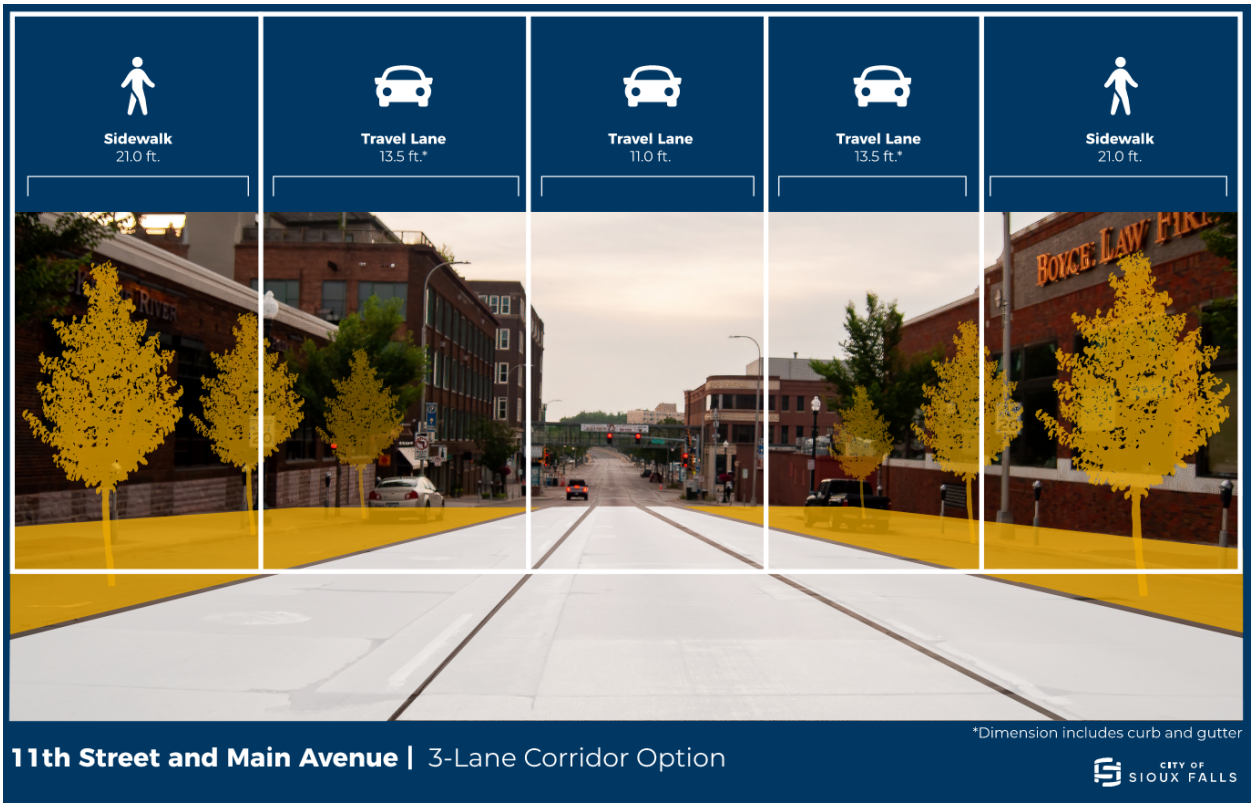


Figure 23: 11th Street Typical Section Example (Existing and 3-Lane Corridor Option)

10th Street 'S-Curve' Concept (West of Minnesota Avenue)

GRANGE AVENUE
MENLO AVENUE
WALTZ AVENUE
PRAIRIE AVENUE
SUMMIT AVENUE
DULUTH AVENUE
SPRING AVENUE
10TH STREET
11TH STREET

DOWNTOWN SIOUX FALLS TRAFFIC STUDY

SIOUX FALLS, SOUTH DAKOTA

10TH ST & 11TH ST VIADUCT OPTIONS

DESIGNED BY: J. KUENSTAD
DRAWN BY: M. SEINER ACAD FILE: 10TH TO 11TH LOOP MODIFICATIONS.DWG
CHECKED BY: J. KUENSTAD DATE: 5/15/2023
REVISIONS: BY: DATE:
BY: DATE:

CITY OF SIOUX FALLS

Figure
24

C:\pw\working\central\01\d34874\d01\10th to 11th Loop Modifications.dwg
PLOT DATE: 5/15/2023 3:44 PM Petersen, Jake

Conclusions

The *Horizon 2035 Downtown Plan* and *Go Sioux Falls 2045 LRTP* provided guidance throughout the study process. The following summarizes findings and conclusions that correspond with applicable goals from both documents. The *Horizon 2035 Downtown Plan Goals* center around the 'CONNECTED' core value, where downtown is a place that is connected, easy to access, and navigate.

LRTP Goal A: Operational Efficiency

LRTP Goal B: Connectivity and Economic Vitality

LRTP Goal E: Safety and Security

One of the most frequent comments provided by the public and stakeholders during the Sioux Falls MPO's LRTP development process is to improve east/west arterial route connectivity in the Sioux Falls area. The 10th/11th/12th Street corridor is one of the key east/west arterial roadways through the heart of Sioux Falls, bringing thousands of vehicles to and through the downtown area daily. This route also provides key connections to north/south arterials and supports emergency services.

> ***Horizon 2035 Downtown Plan***
> **CONNECTED Goal:**
> - Maintain a safe level of vehicular circulation to, from, and within downtown for all mobility types

The Phase 1 analysis highlighted diversion routes if capacity is not maintained on 10th/11th Street corridor through downtown. There would still be travel demand to and through the downtown area, but that traffic would be diverted to lower capacity east/west local and collector streets such as Falls Park Drive, 6th Street, 8th Street, and 14th Street would all be expected to see increased traffic volumes. Some level of diversion to neighborhood local streets would be expected.

This study's recommendations support Go *Sioux Falls 2045 LRTP* goals A, B, and E and the *Horizon 2035 Downtown Plan* CONNECTED goal by providing three lanes in each direction, through a one-way pair in the downtown area. This configuration provides the best long-range traffic operations through the downtown area, east/west arterial connectivity in the Sioux Falls area, and continuity of route capacity. Maintaining the 3-lane one-way pair also best manages peak traffic fluctuations, such as during the high-demand summer months and downtown events.

It was found that altering the one-way configuration by either combining the 10th/11th Street corridor to a 2-way street through the downtown area (5-lane section with 2 lanes in each direction plus center left turn lane) or combining the one-way at one of the 2nd Avenue intersections resulted in congestion issues that would impact vehicular, bicycle, and pedestrian operations and safety. Reducing the number of lanes on the existing one-way pair (from 3 to 2 in each direction) also resulted in undesirable operational and safety conditions along the 10th/11th Street corridor and downtown crossroads.

2045 LRTP Goal C: Livability and Environmental Sustainability

2045 LRTP Goal D: Multimodal Integration

The recommended Viaduct Options provide opportunities for agencies to collaborate with and support area development regarding future bridge alignments and determining the best use of available space. Open space and flow of multimodal travel below the bridges are also key considerations and each of the four Viaduct Options allow for clear-span spaces to facilitate this free movement.

All four Viaduct Options were developed and refined to minimize impact to Section 4(f) and Section 6(f) lands. While impacts are anticipated, there will also be opportunities to give back park land with the removal of existing roadways. All four Viaduct Options also provide enhanced connectivity for bicyclists and pedestrians with a shared use path on both viaducts, a shared use path connection with Fawick Park under the 10th Street viaduct, and clear space on the east side of the Big Sioux River for bike trail continuity and connections to adjacent parks and development.

***Horizon 2035 Downtown Plan* CONNECTED Goals:**

- Promote and improve the pedestrian environment by supporting walkable environments with density and connectivity
- Increase bicycle connectivity to and from downtown

Maintaining 3 lanes in each direction through the downtown area best manages multimodal traffic operations, which provides operational and safety benefits for motorists, pedestrians and bicyclists. Intersection capacity is maintained and allows greater flexibility to incorporate traffic signal measures that control vehicle-pedestrian conflicts, manages queues from extending into upstream intersections and crosswalks, and supports emergency service accessibility. The study also recommends consideration of removing 10th Street and 11th Street parking and reallocating that space to pedestrian uses, such as wider walkways, landscaping, street furniture, and expanded seating areas.

2045 LRTP Goal F: System Preservation

The need has been established to reconstruct the existing 10th/11th Street viaducts in the future. The findings and recommendations within this study utilize and repurpose existing infrastructure while providing the framework to integrate improvements supporting the other goals through new viaduct alignments. Sub-options are also available within each of the Viaduct Options to manage fill vs. clear span, retaining wall needs, and cost based on the next study's goals and objectives.

City of Sioux Falls Leadership Meeting

The study team met with City of Sioux Falls leadership on October 10, 2023, to present findings, conclusions, and recommendations from the *Downtown Traffic Impact Study* draft report. Meeting attendance and discussion topics are summarized in the meeting minutes provided in **Appendix J**.

Recommendations

Recommendations to be carried forward into the next study of the 10th/11th Street viaducts include:

1. Maintain and/or plan for 3 lanes in each direction
    a. Consider removing 10th Street and 11th Street on-street parking through downtown to reallocate space for pedestrian and streetscape type uses
2. Maintain one-way pair between Minnesota Avenue and east of the viaducts
    a. Consider one-way to two-way conversion west of Minnesota Avenue in a separate study
3. Further refine and evaluate Viaduct Options 1 through 4
4. Partner with area stakeholders to determine the best use of space and desired levels of mobility under and around the viaducts

Appendix

Appendix A: Methods and Assumptions Document

Appendix B: Phase 1 East/West Corridor Review Memo

Appendix C: 10th/11th Street Corridor Crash History Review Memo

Appendix D: Phase 2 Traffic Operations Analysis Memo

Appendix E: 10th/11th Street Corridor Sensitivity Analysis Memo

Appendix F: Viaduct Alignment Concepts (High-Level)

Appendix G: Environmental Overview Memo

Appendix H: Viaduct Option Conceptual Costs

Appendix I: 10th Street / 11th Street Typical Sections

Locations:

- 10th Street, West of Phillips Avenue
- 10th Street, West of Main Avenue
- 11th Street, East of Main Avenue
- 11th Street, East of Phillips Avenue

Each location illustrates:

- Existing section
- 2-lane option (eliminated from consideration in Phase 2)
- 3-lane option

Appendix J: October 10, 2023, City of Sioux Falls Leadership Meeting Minutes