

Technical Memo

Date: April 12, 2017

Project: I-29 Exit 77 (41st Street) Interchange Modification Justification Report,
Project # PL0100(84) 3616P, PCN 05MH

To: Study Advisory Team

From: HDR

Subject: Carolyn Avenue Alternatives Evaluation and Recommendation

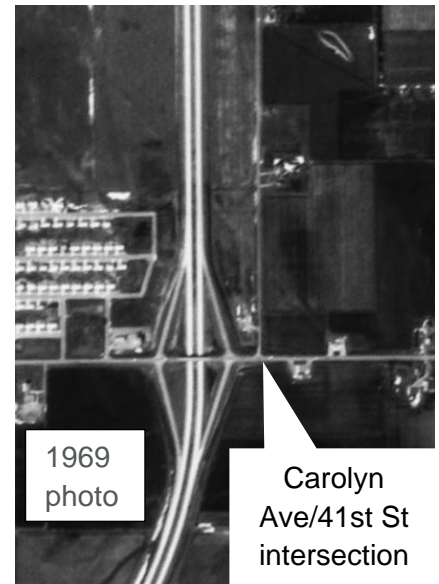
1. Background

When constructed as part of the original I-29/41st Street interchange in 1960, the Carolyn Avenue connection to 41st Street did not pose a concern for traffic at the interchange or along 41st Street. At that time traffic volumes were low and most of the surrounding property was cropland or pasture. The photo at right shows the interchange in 1969, still with minimal development on the east side of I-29.

As development and traffic increased, the close proximity of Carolyn Avenue to the I-29 ramps became more of a safety and traffic problem, especially as commercial businesses sprang up along Carolyn Avenue. Current development along Carolyn Avenue is shown in the 2014 photo at bottom right.

Today, adjacent business owners have recognized the safety concerns at the Carolyn Avenue/41st Street intersection. Studies have shown that the crashes are above the critical rate along 41st Street in the vicinity of the intersection.^{1, 2}

However, in spite of the traffic and crash problems, business owners along Carolyn Avenue have opposed any kind of reduced access at the Carolyn Avenue/41st Street intersection from what has historically been a full access "T" intersection. This opposition was documented in studies conducted 1999³ and 2012.⁴



¹ HDR, April 2017. Technical Memo 2 Crash Analysis for I-29 Exit 77

² Felsburg Holt & Ullevig, March 2010. SDDOT Decennial Interstate Corridor Study Phase 1 Report

³ Short Elliot Hendrickson, Fall 1999. 41st Street Corridor Analysis Public Involvement

⁴ HDR, June 2012. I-29 Exit 77 (41st Street) Crossroad Corridor Study

2. Purpose

As part of the current I-29 Exit 77 (41st Street) interchange study, six build alternatives for the Carolyn Avenue/41st Street intersection have been developed. These alternatives are independent from the interchange alternatives and 41st Street typical roadway section alternatives under consideration.

Attachment A to this memo provides the proposed build alternatives; a graphic depicting the existing conditions is also included. Reduced size versions of the alternatives are also provided with the discussion of each alternative.

The purpose of this memo is to provide a brief evaluation of each of the build alternatives and provide recommendations on:

- Which alternatives to carry forward for further evaluation.
- Which alternatives to eliminate from further evaluation.

3. Evaluation Criteria

The main criteria used to evaluate the Carolyn Avenue alternatives are:

3.1 Fulfillment of the Project Purpose and Need

3.1.1 *Are traffic capacity and safety along 41st Street improved?*

- A poor rating indicates that all movements at the 41st Street/Carolyn Avenue intersection are maintained from existing conditions, thereby perpetuating the unrestricted left turn movements that have been the cause of the majority of the crashes and traffic backups.
- A moderate rating indicates that left turn movements at the 41st Street/Carolyn Avenue intersection are eliminated but right turn movements are allowed. This significantly reduces the conflict points at the intersection, specifically the left-turn movements.
- A good rating indicates that right-in only or no turn movements are provided at the 41st Street/Carolyn Avenue intersection. This significantly reduces or totally eliminates the number of conflict points for vehicles.

3.1.2 *Are pedestrian facilities improved?*

- A poor rating indicates that ADA compliant pedestrian features are not provided and pedestrians must cross Carolyn Avenue without protection of a signal phase.
- A moderate rating indicates that ADA compliant pedestrian features are provided but pedestrians cross Carolyn Avenue without protection of a signal phase.
- A good rating indicates that ADA compliant pedestrian features are provided and pedestrians do not have to cross an unsignalized intersection.

3.1.3 *Is adequate spacing provided between Carolyn Avenue and the I-29 northbound on-ramp?*

- SDDOT design standards require a 100' separation between a ramp/cross-road intersection and the nearest adjacent cross-road access point. For the purposes of access spacing, SDDOT begins the 100' separation requirement at the taper end of the right-turn lane for the ramp/cross-road intersection and does not allow an access within a right-turn lane.⁵ This is either a yes or no evaluation.

3.2 Traffic Operations

3.2.1 *Is the Carolyn Avenue intersection within the 41st Street right turn lane to the I-29 northbound on-ramp?*

- The existing intersection is within the 41st Street right turn lane. However, this is not an allowable condition per SDDOT for any of the proposed alternatives. This is either a yes or no evaluation.
- It should be noted that the VISSIM traffic analysis in the 2012 Corridor Study did not indicate a need for a 41st Street right turn lane for the 2035 traffic horizon year. However, the HCS2010 traffic analysis for the current interchange study (with a 2045 traffic horizon year) indicated that a 41st Street right turn lane is necessary to provide an acceptable Level of Service at the 41st Street/ramp intersection.

3.2.2 *Will reduction of access at Carolyn Avenue re-direct and therefore increase traffic at other intersections?*

- A none rating indicates that all movements will be maintained at the 41st Street/Carolyn Avenue intersection and no traffic will be diverted to other intersections.
- A minimal rating indicates that some traffic movements at the 41st Street/Carolyn Avenue intersection would be eliminated and therefore some traffic will be diverted to other intersections.
- A moderate rating indicates that Carolyn Avenue access is closed at 41st Street so all traffic must divert to other intersections. It should be noted that this condition was analyzed from a traffic perspective and it was determined that other intersections would adequately accommodate the diverted traffic. A signal would be needed at the Shirley Avenue/38th Street intersection under year 2045 traffic conditions.⁶ Therefore the term "moderate" is reasonable.

3.2.3 *Year 2045 Level of Service and delay at the Carolyn Avenue/41st Street intersection.*

- This is a measurement of traffic conditions for each of the alternatives at the 41st Street/Carolyn Avenue intersection.

⁵ SDDOT Road Design Manual Chapter 13

⁶ HDR, April 2017. Technical Memo 3 Future Traffic Conditions for I-29 Exit 77

3.3 Property Impacts

3.3.1 *What are the property acquisitions?*

- Total and partial acquisitions have been quantified for each of the alternatives.
- Based on recent similar property purchases along 41st Street and Louise Avenue, property acquisition costs are estimated at \$30 per square foot. Future appraisals will identify the cost more precisely.
- For several of the total acquisitions there would be excess property that could be re-sold to adjacent properties or re-developed after completion of the roadway improvements. The re-sale value is estimated at \$20 per square foot.

3.3.2 *Access impacts to business owners along Carolyn Avenue*

- A rating of none indicates that all movements at the intersection will be maintained resulting in no access impacts to businesses.
- Minor impact indicates that some movements to/from 41st Street at Carolyn Avenue will be restricted, thereby causing some traffic to divert to the Shirley Avenue via either 34th Street or 38th Street to access businesses along Carolyn Avenue.
- Moderate impact indicates that Carolyn Avenue access at 41st Street will be eliminated. However, properties will maintain access to Carolyn Avenue and will be able access 41st Street via 38th Street and 34th Street and improved and signalized 41st Street/Shirley Avenue intersection

3.3.3 *Acceptance of the landowners to the Carolyn Avenue alternatives*

- A poor rating indicates that landowners have been opposed to the alternative.
- A moderate rating indicates that landowners have not been totally supportive of the alternative but have indicated some level of acceptance.
- A good rating indicates that landowners have expressed acceptance of the alternative.
- An unknown listing indicates that the alternative has not yet been reviewed by enough landowners to determine the level of acceptance.

Notes from the 8/30/16 and 11/17/16 meetings with Carolyn Avenue landowners are provided by reference.^{7, 8}

⁷HDR, August 30, 2016. I-29 41st St Meeting Notes Carolyn Avenue Landowners

⁸ HDR, November 17, 2016. I-29 41st St Meeting Notes Carolyn Avenue Gustafson

3.4 Costs

Major cost considerations are:

- Initial ROW acquisitions
- Net ROW acquisitions assuming resale of a portion of the total take acquisitions
- Roadway construction
- Addition of these both before and after re-sale of excess property

3.5 Environmental Impacts

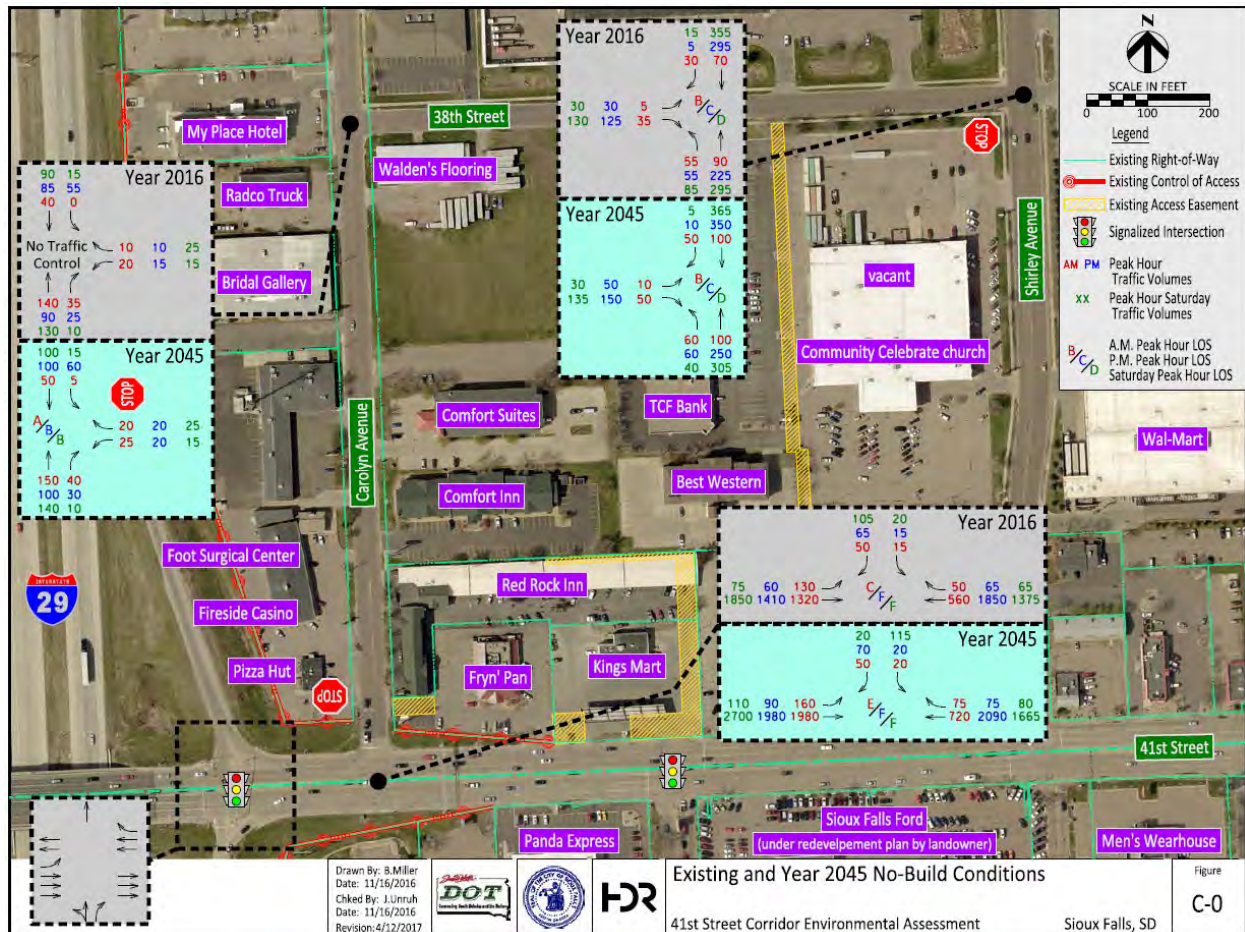
These are the environmental impacts that are applicable to the Carolyn Avenue alternatives:

- Number of impacted structures that meet the criteria for historic structures
- Number of impacted properties that meet Section 4(f) criteria; the only applicable properties for this project would be historic structures.
- Number of property acquisitions that have environmental justice implications
- Number of property acquisition where contaminated materials are known to exist
- Acres of wetland or floodplain impacts

4. No-Build Alternative

The No-Build Alternative (**Figure C-0**) will be carried forward as a base-line comparison for the build alternatives. However, as noted in the Alternatives Comparison Matrix, the No-Build Alternative does not meet the Project Purpose and Need for:

- Improving traffic and safety along 41st Street
- Improving pedestrian facilities along 41st Street
- Providing adequate separation to the I-29 northbound on-ramp
- Moving the intersection out of the 41st Street right turn lane for the I-29 northbound on-ramp.



5. Build Alternatives Evaluation

Alternative 1 – Right-in / Right-out at Existing Carolyn Avenue Alignment

Alternative 1 (**Figure C-1**) proposes keeping Carolyn Avenue on its existing alignment with the raised 41st Street center median restricting left turns at the intersection.

Main benefits of Alternative 1 include:

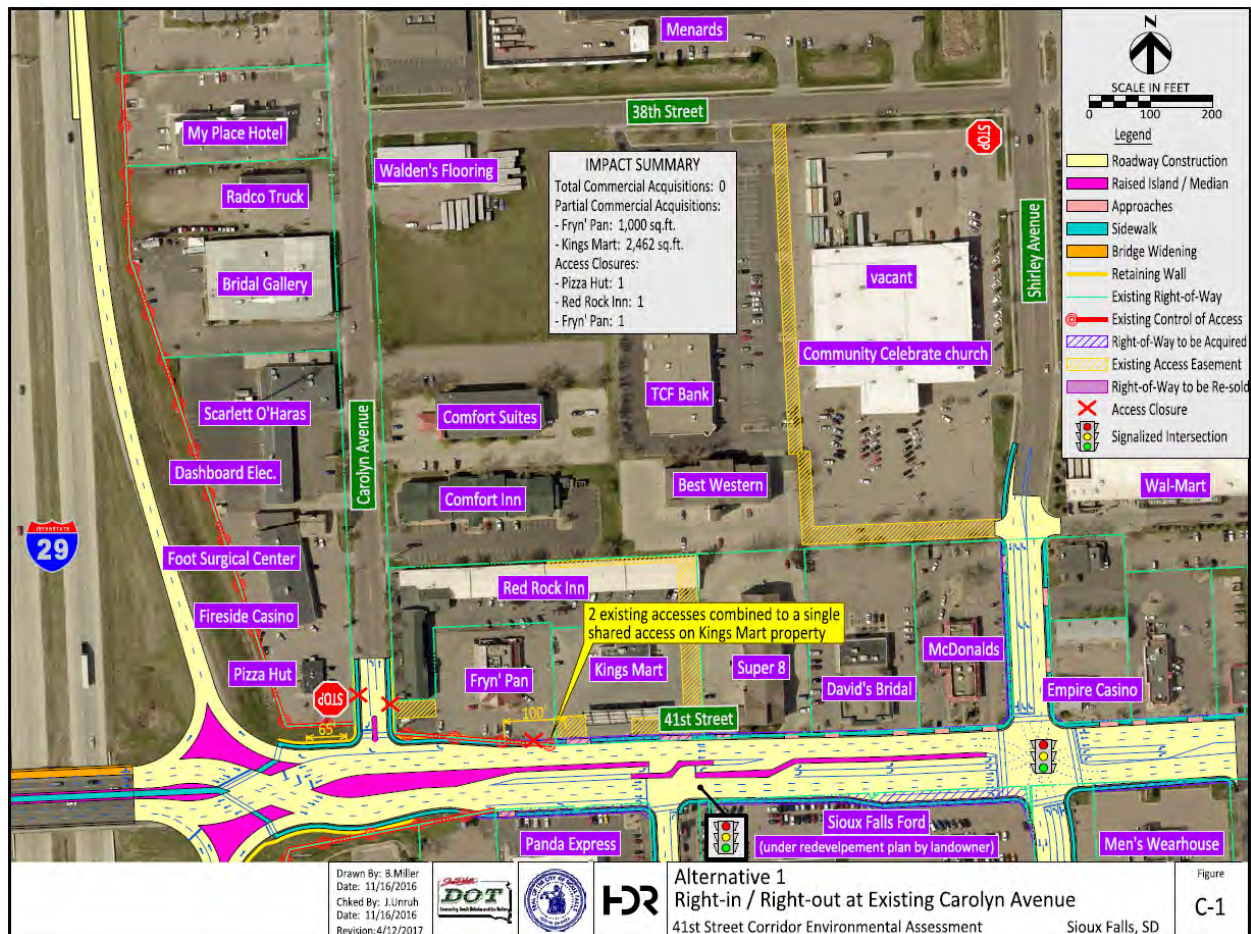
- There will be no total property acquisitions.
- Access impacts to businesses along Carolyn Avenue would be minor.
- Business owners have been supportive of this alternative.

Main drawbacks of Alternative 1 include:

- The intersection will remain in the 41st Street right turn lane to the I-29 northbound on ramp, therefore SDDOT spacing criteria will not be met.

It is recommended that Alternative 1 be dropped from further evaluation because:

- The intersection location does not meet SDDOT spacing criteria.



Alternative 2 – Right-in / Right-out at Realigned Carolyn Avenue

Alternative 2 (Figure C-2) shifts Carolyn Avenue approximately 35' east of its existing alignment. The raised 41st Street center median will restrict left turns at the intersection.

Main benefits of Alternative 2 include:

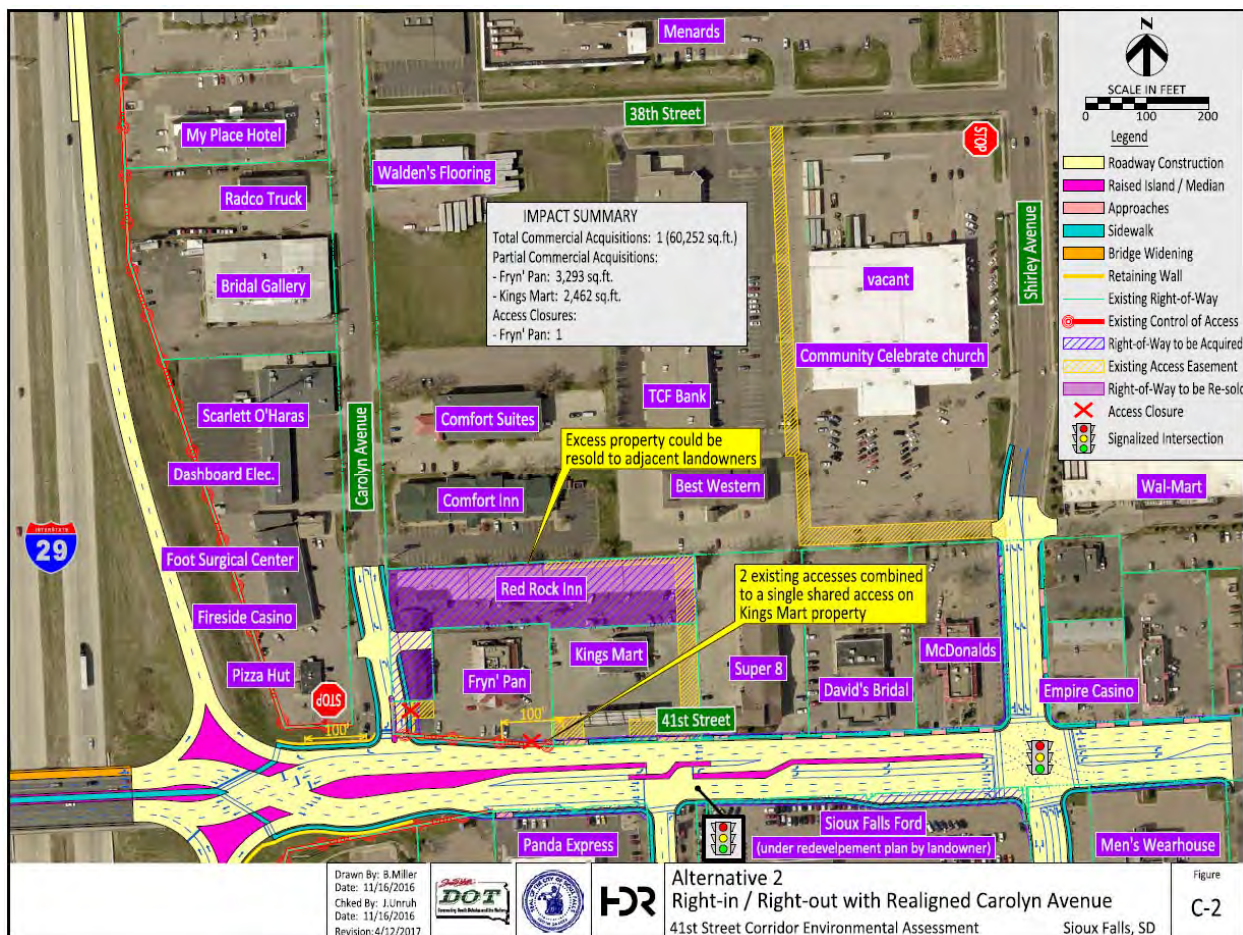
- Access impacts to businesses along Carolyn Avenue would be minor.
- Business owners have generally been supportive of the minor impacts to access associated with this alternative.

Main drawbacks of Alternative 2 include:

- The Red Rock Inn would need to be acquired. This property was purchased by a minority businessman in December 2011; additional analysis is needed to determine if this acquisition would have environmental justice implications.
- The intersection will remain in the 41st Street right turn lane to the I-29 northbound on ramp, therefore SDDOT spacing criteria will not be met.

It is recommended that Alternative 2 be dropped from further evaluation because:

- The intersection location does not meet SDDOT spacing criteria.



Alternative 3 – Right-in Only at Existing Carolyn Avenue Alignment

Alternative 3 (**Figure C-3**) keeps Carolyn Avenue on its existing alignment but only allows right-in traffic from 41st Street. A cul-de-sac along the west side of Carolyn Avenue would restrict southbound drivers from access to 41st Street.

Main benefits of Alternative 3 include:

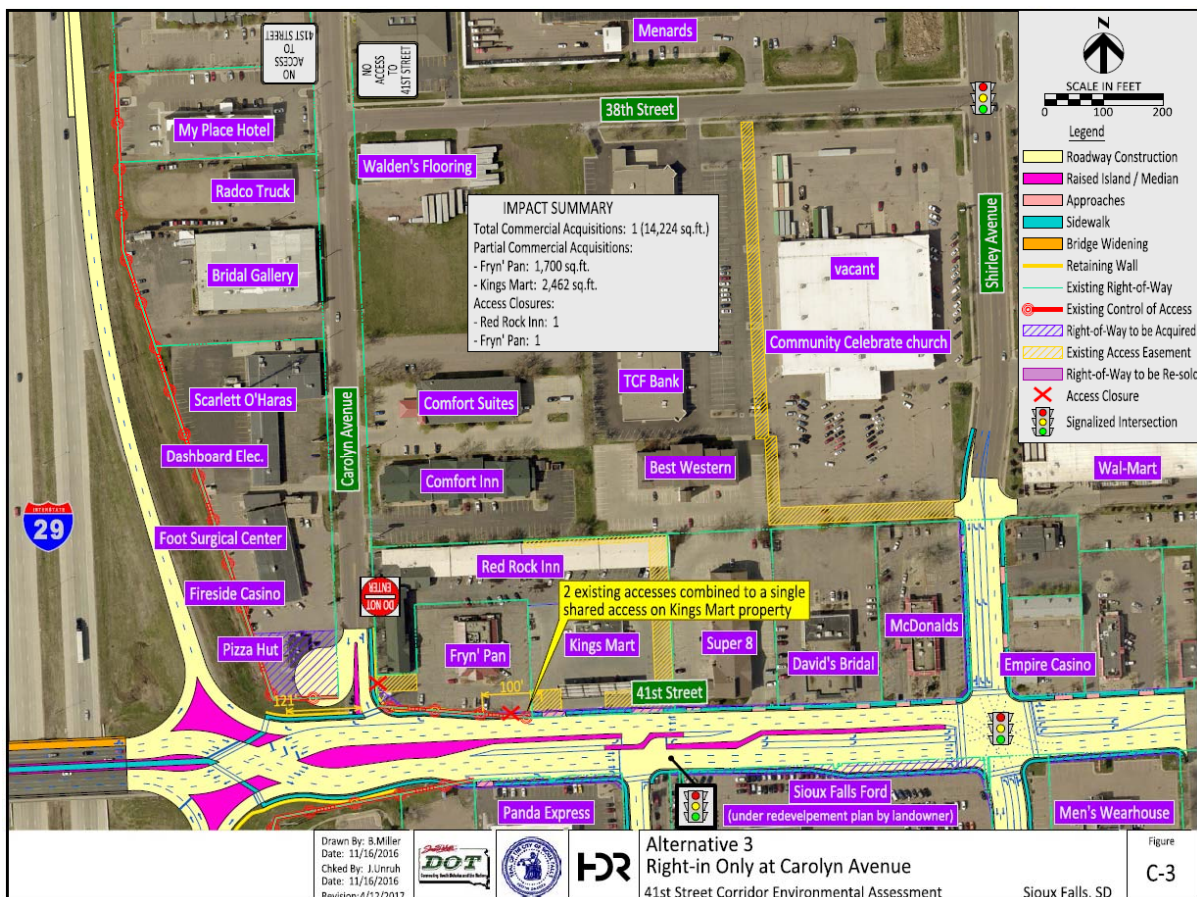
- Direct access from 41st Street to Carolyn Avenue would be maintained.
- Business owners have previously expressed some level of support for this alternative.

Main drawbacks of Alternative 3 include:

- The intersection will remain in the 41st Street right turn lane to the I-29 northbound on ramp, therefore SDDOT spacing criteria will not be met.
- Regardless of the extent of traffic signs, southbound drivers on Carolyn Avenue may be confused when approaching 41st Street and ending up re-directed via the cul-de-sac.
- There will be a total acquisition of the Pizza Hut property.
- Access to Red Rock Inn from Carolyn Avenue is eliminated because of close proximity to 41st Street.

It is recommended that Alternative 3 be dropped from further evaluation because:

- The intersection location does not meet SDDOT spacing criteria.



Alternative 4 – West Side Carolyn Avenue Cul-de-sac

Alternative 4 (**Figure C-4**) eliminates Carolyn Avenue access to 41st Street with a cul-de-sac on the west side of Carolyn Avenue.

Main benefits of Alternative 4 include:

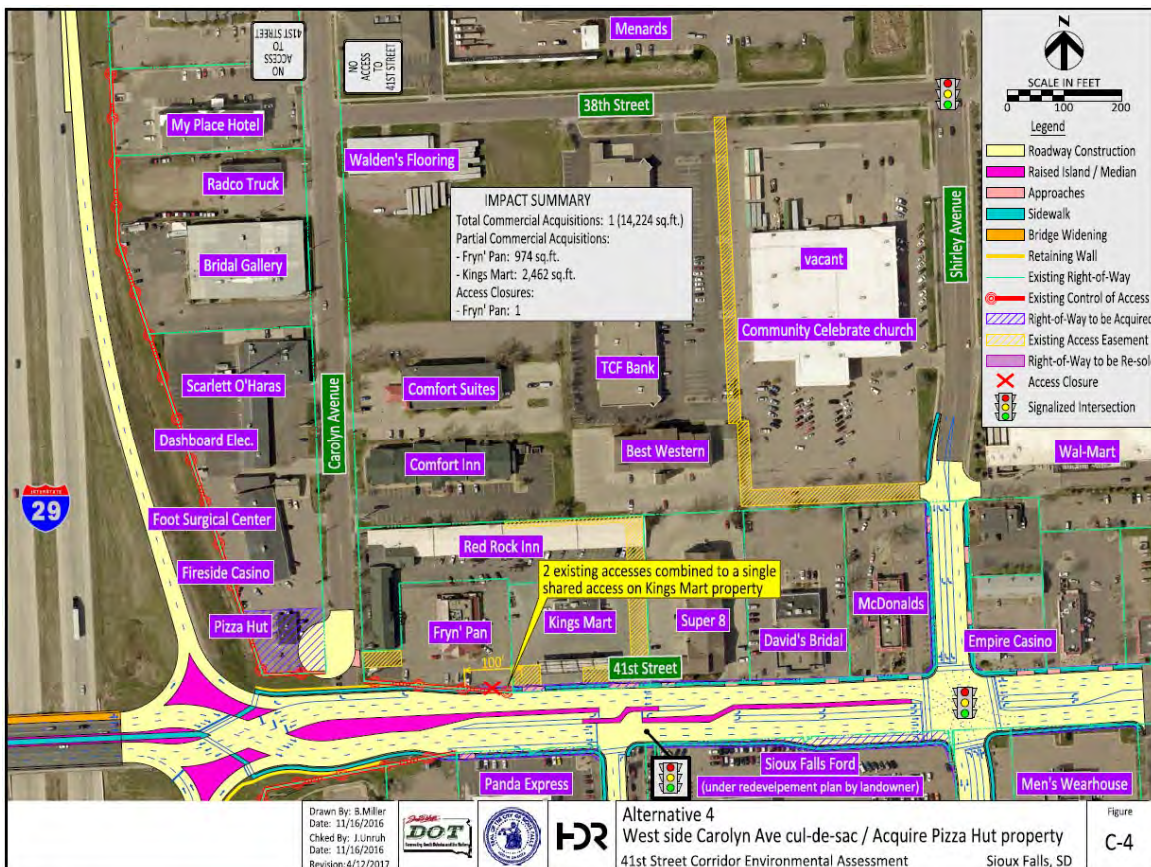
- SDDOT spacing criteria between an interchange ramp and nearest access is met.
- Without any connection between 41st Street and Carolyn Avenue, safety concerns are significantly reduced.

Main drawbacks of Alternative 4 include:

- There may be an increase in “cut-through” traffic from the Fryn’ Pan/Kings Mart driveway to the Carolyn Avenue cul-de-sac.
- Carolyn Avenue business owners have been opposed to total elimination of the Carolyn Avenue/41st Street connection.
- There will be a total acquisition of the Pizza Hut property.

It is recommended that Alternative 4 be carried forward for further evaluation because:

- SDDOT spacing criteria is met with the resultant safety benefits.
- Carolyn Avenue businesses maintain their access to Carolyn Avenue.
- Reasonable and safer 41st Street access to/from Carolyn Avenue properties is provided by 34th Street and 38th Street and an improved 41st Street/Shirley Avenue intersection.



Alternative 5 – East Side Carolyn Avenue Cul-de-sac

Alternative 5 (**Figure C-5**) eliminates Carolyn Avenue access to 41st Street with a cul-de-sac on the east side of Carolyn Avenue.

Main benefits of Alternative 5 include:

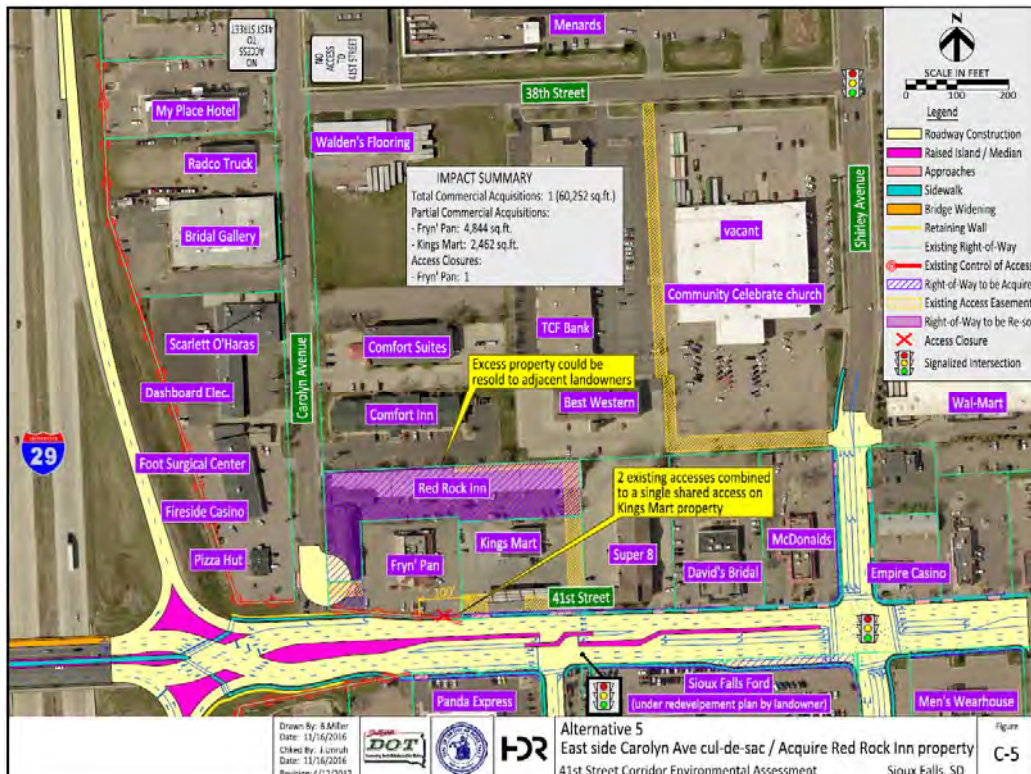
- SDDOT spacing criteria between an interchange ramp and nearest access is met.
- Without any connection between 41st Street and Carolyn Avenue, safety concerns are significantly reduced.

Main drawbacks of Alternative 5 include:

- There may be an increase in “cut-through” traffic from the Fryn’ Pan/Kings Mart driveway to the Carolyn Avenue cul-de-sac.
- Carolyn Avenue business owners have been opposed to total elimination of the Carolyn Avenue/41st Street connection.
- There will be a total acquisition of the Red Rock Inn property. This property was purchased by a minority businessman in December 2011; additional analysis is needed to determine if this acquisition would have environmental justice implications.

It is recommended that Alternative 5 be carried forward for further evaluation because:

- SDDOT spacing criteria is met with the resultant safety benefits.
- Carolyn Avenue businesses maintain their access to Carolyn Avenue.
- Reasonable and safer 41st Street access to/from Carolyn Avenue properties is provided by 34th Street and 38th Street and an improved 41st Street/Shirley Avenue intersection.



Alternative 6 – Realigned Carolyn Avenue to the Empire Mall Entrance

Alternative 6 (**Figure C-6**) realigns Carolyn Avenue through the Red Rock Inn, Fryn' Pan, and Kings Mart properties. Carolyn Avenue then lines up with the Empire Mall entrance.

Main benefits of Alternative 6 include:

- SDDOT spacing criteria between an interchange ramp and nearest access is met.
- Reasonable 41st Street access is maintained to/from Carolyn Avenue businesses.

Main drawbacks of Alternative 6 include:

- Acquisition of three properties adds cost to the project; some of the excess property can be re-sold to adjacent property owners or sold for re-development. See discussion for Alternatives 2 and 5 regarding the Red Rock Inn property.

Additional note – This is the only alternative that impacts a previous or current potential hazardous material site, the current Kings Mart convenience store. The Phase 1 Environmental Site Assessment indicated that past spills have been reported on this site but all contaminated materials have been cleaned up. Kings Mart should be considered a recognized environmental concern due to the extended time it has been a gas station and the likelihood for residual soil or groundwater contamination. If subsurface work is proposed in this area, a Phase II Environmental Site Assessment is recommended to identify concentration levels and determine if special handling or disposal would be required during construction.⁹

It is recommended that Alternative 6 be dropped from further consideration because of the need to purchase three commercial properties.



⁹ HDR, February 2017. Phase 1 Environmental Site Assessment I-29 Exit 77
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6. Build Alternatives Evaluation Summary

Alternatives recommended to be carried forward for further consideration:

Alternative	Description	Main reason(s) for carrying forward
4	West Side Carolyn Avenue Cul-de-sac	<ul style="list-style-type: none">• Meets traffic, safety, and design criteria
5	East Side Carolyn Avenue Cul-de-sac	<ul style="list-style-type: none">• Meets traffic, safety, and design criteria

Alternatives recommended to be eliminated from further consideration:

Alternative	Description	Main reason(s) for elimination
1	Right-in / Right-out at Existing Carolyn Avenue Alignment	<ul style="list-style-type: none">• Intersection will remain within the 41st Street right turn lane therefore SDDOT spacing criteria is not met.
2	Right-in / Right-out at Realigned Carolyn Avenue	<ul style="list-style-type: none">• Intersection will remain within the 41st Street right turn lane therefore SDDOT spacing criteria is not met.
3	Right-in Only at Existing Carolyn Avenue Alignment	<ul style="list-style-type: none">• Intersection will remain within the 41st Street right turn lane therefore SDDOT spacing criteria is not met.
6	Realigned Carolyn Avenue to Empire Mall Entrance	<ul style="list-style-type: none">• Requires purchase of three commercial properties

Comparison Matrix
Carolyn Avenue Alternatives

I-29 Exit 77 (41st Street) Interchange Study
Project # PL0100(84) 3616P, PCN 05MH

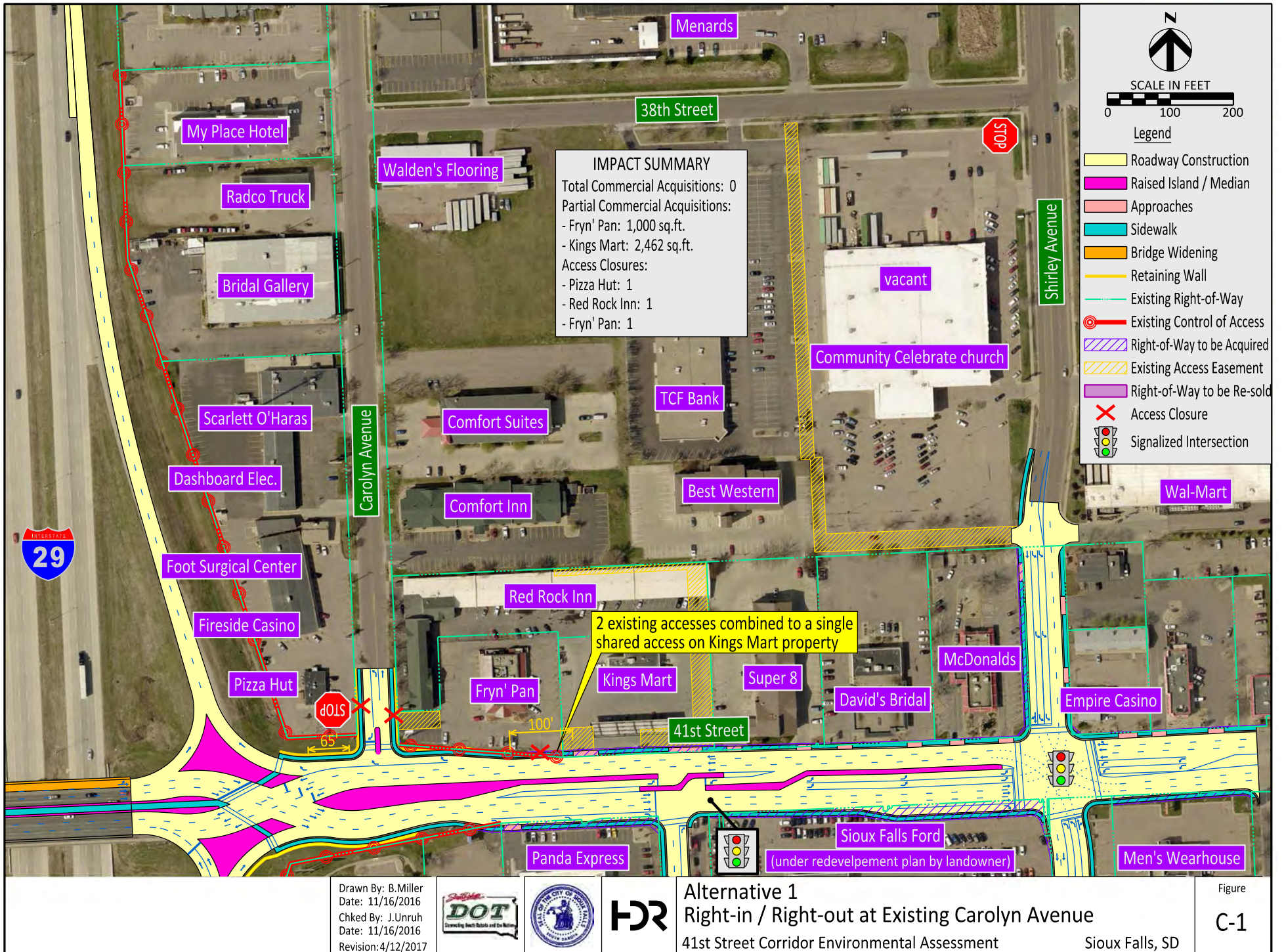
4/12/17

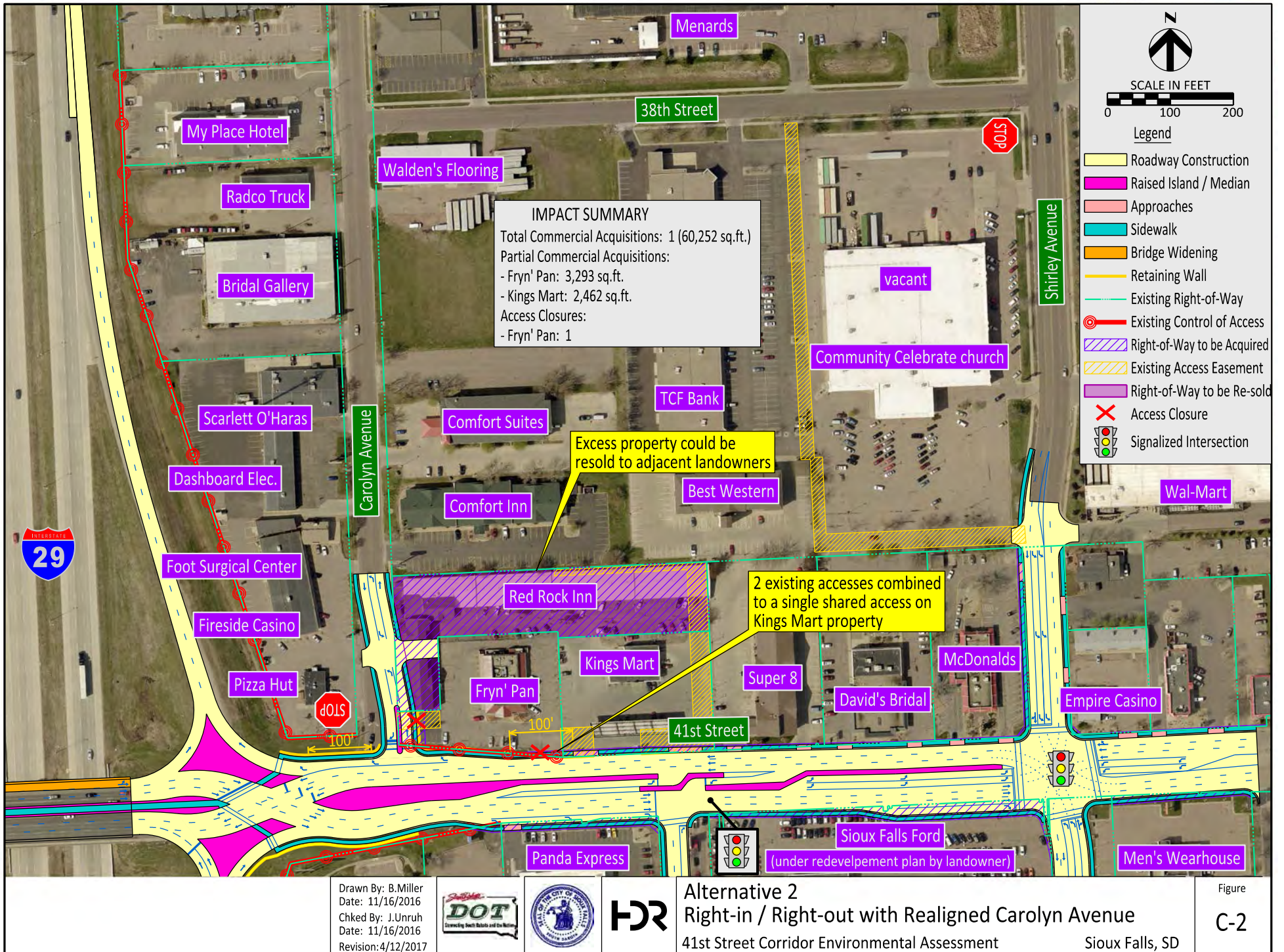
Alternative	Description	Purpose and Need				Traffic Operations		Property Impacts							Costs					Applicable Environmental Impacts					
		41 st St Capacity Improvement	Safety Improvement	Pedestrian Facilities Improvement	Adequate Separation from I-29 ramp (1)	Increase Traffic to Other Intersections	Year 2045 41st St/Carolyn Ave Intersection LOS AM/PM	Total commercial acquisitions #	Total Commercial Acquisitions sq ft	Partial commercial acquisitions sq ft	Re-sale commercial properties sq ft	Net Commercial Acquisition sq ft	Access impacts	Affected Business / Landowner Acceptance	Initial ROW Acquisition M \$	Net ROW Acquisition M \$	Construction M \$	Initial Total M \$	Final Total (after property re-sale) M \$	Historic Structures #	Section 4(f) Properties #	Environmental Justice #	Contaminated Materials #	Wetlands ac	Floodplain ac
1	Right-in / Right-out at Existing Carolyn Avenue	moderate	moderate	moderate	no	minimal	F/F	0	0	3,462	0	3,462	minor	good	0.2	0.2	0.6	0.8	0.8	0	0	0	0	0	0
2	Right-in / Right-out with Realigned Carolyn Avenue	moderate	moderate	moderate	no	minimal	F/F	1	60,252	5,755	57,353	8,654	minor	good	2.1	0.9	0.7	2.8	1.6	0	0	(5)	0	0	0
3	Right-in Only at Carolyn Avenue	moderate	moderate	moderate	no	minimal	NA	1	14,224	4,162	0	18,386	moderate	moderate	0.7	0.7	0.8	1.5	1.5	0	0	0	0	0	0
4	West side Carolyn Avenue Cul-de-sac	good	good	good	yes	moderate (2)	NA	1	14,224	3,436	0	17,660	moderate (3)	poor	0.7	0.7	0.9	1.6	1.6	0	0	0	0	0	0
5	East side Carolyn Avenue Cul-de-sac	good	good	good	yes	moderate (2)	NA	1	60,252	7,306	57,614	9,944	moderate (3)	poor	2.2	1.0	0.9	3.1	1.9	0	0	(5)	0	0	0
6	Realigned Carolyn Avenue to Mall Entrance	good	good	good	yes	minimal	A/A	3	145,744	0	103,171	42,573	minor	unknown (4)	4.4	2.3	1.1	5.5	3.4	0	0	(5)	(6)	0	0
NB	No-Build	poor	poor	poor	no	none	F/F	0	0	0	0	0	none	good	NA	NA	NA	NA	NA	0	0	0	0	0	0
NA: Not Applicable (1) SDDOT design criteria requires a minimum 100' separation from an interstate ramp junction/turn lane to the nearest access point. (2) Requires future signalization of 38 th Street/Shirley Ave intersection. Cost estimates include this signal. (3) Properties maintain access to Carolyn Avenue with these alternatives. (4) This alternative has not been presented to a sizable group of affected business/landowners. (5) Environmental justice impact not evaluated; see discussion for Alternatives 2, 5, and 6 evaluation. (6) Kings Mart convenience store has been evaluated for Phase I Environmental Site Assessment due to past use as gas station; see discussion for Alternative 6 evaluation. Options recommended for elimination from further evaluation																									

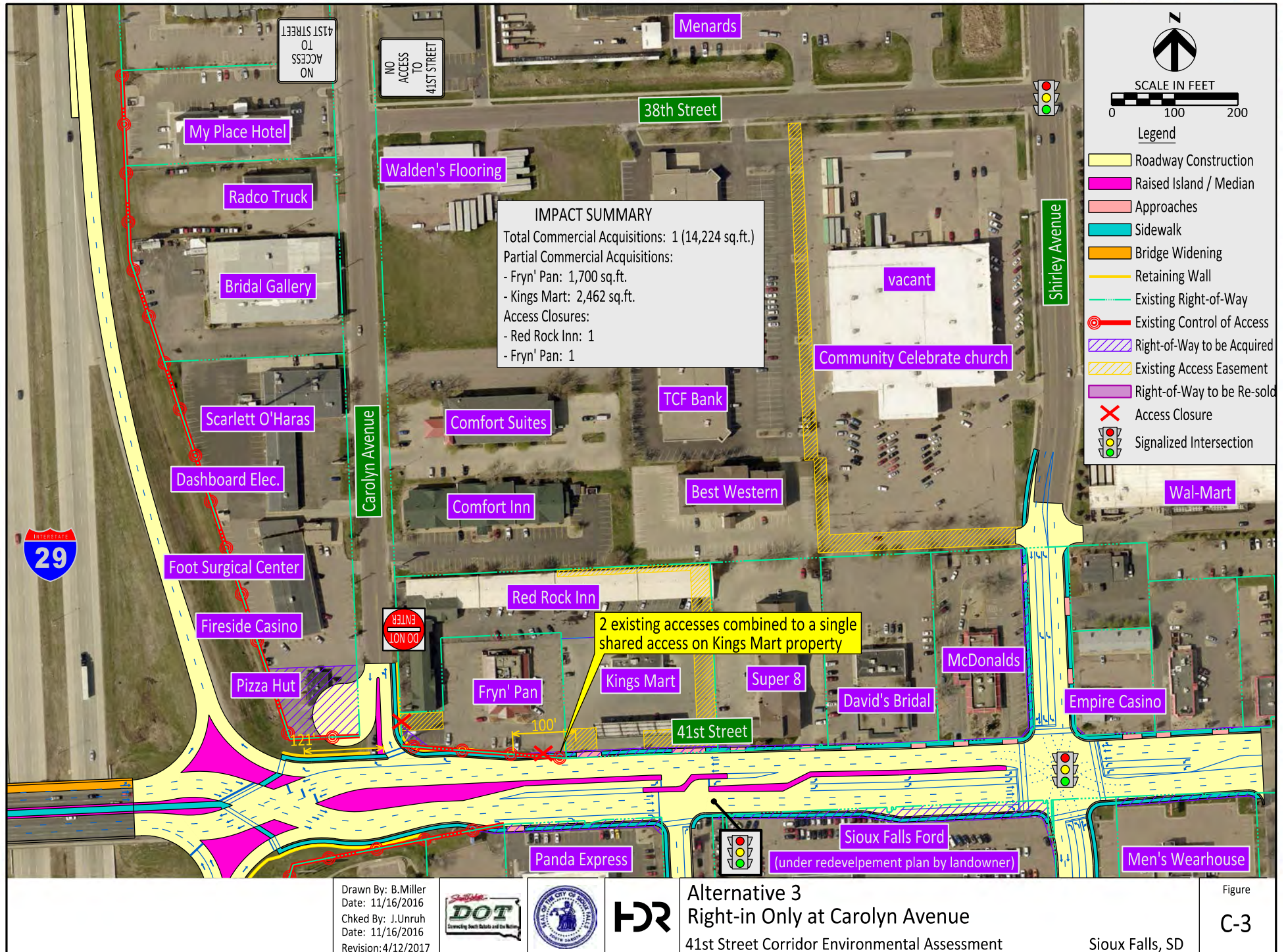


Attachment A

Carolyn Avenue Alternatives – Figures C-0 to C-6





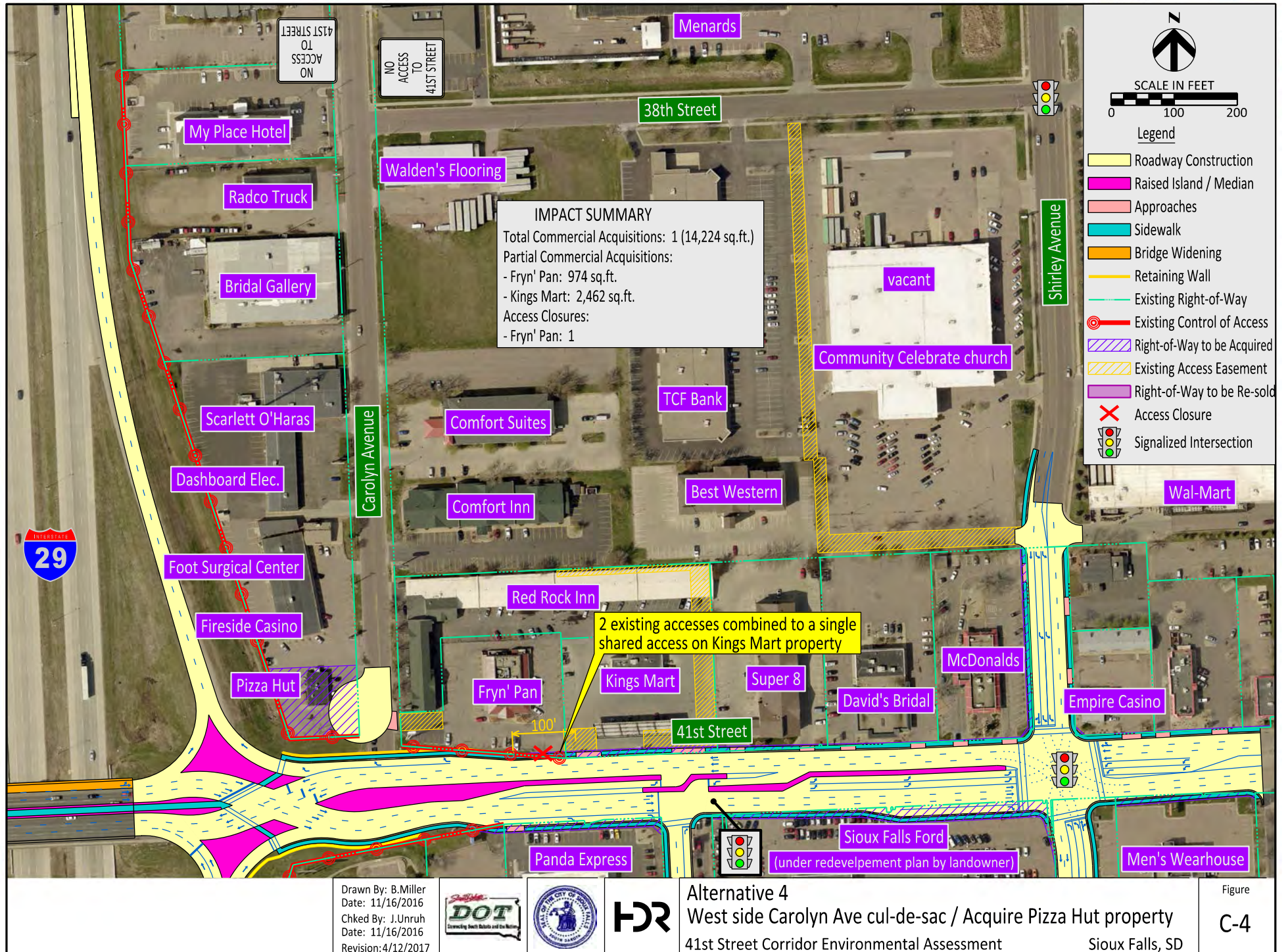


Drawn By: B. Miller
 Date: 11/16/2016
 Chkd By: J. Unruh
 Date: 11/16/2016
 Revision: 4/12/2017



Alternative 3
Right-in Only at Carolyn Avenue
 41st Street Corridor Environmental Assessment

Figure
C-3
 Sioux Falls, SD



Drawn By: B. Miller
 Date: 11/16/2016
 Chkd By: J. Unruh
 Date: 11/16/2016
 Revision: 4/12/2017



Alternative 4
 West side Carolyn Ave cul-de-sac / Acquire Pizza Hut property
 41st Street Corridor Environmental Assessment
 Sioux Falls, SD

Figure
C-4

