Noise Study Technical Report

I-29 Exit 77 (41st Street) Corridor Environmental Assessment

IM0293(A6)77 3014 N; PCN 03RA

Sioux Falls, South Dakota
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Executive Summary

The Federal Highway Administration (FHWA) regulations for mitigation of highway traffic noise in the planning and design of federally aided highway projects are contained in Title 23 of the United States Code of Federal Regulations Part 772 (23 CFR 772). These regulations state that a "Type I" traffic noise impact analysis is required when through and/or auxiliary lanes are added to a roadway. This analysis was conducted to evaluate the potential noise impacts associated with the proposed transportation improvements in the vicinity of the I-29 Exit 77 (41st Street) interchange and along 41st Street in Sioux Falls, South Dakota (the Project). The Project proposes to:

- widen the roadway and add and realign lanes along 41st Street from just west of Marion Road through the I-29 interchange
- reconfigure the I-29/41st Street interchange
- add a raised median and modify intersections along 41st Street from I-29, to just west of Louise Avenue

These proposed improvements require a noise analysis for the Project Build Alternatives.

Noise-sensitive sites are predicted to approach or exceed the FHWA Noise Abatement Criteria (NAC) as a result of the proposed Build Alternatives. For all three build alternatives (A, B, C), there are 31 residential receptors and 1 recreational receptor impacted by the Project out of a total of 135 analyzed noise receptor sites. Because noise impacts are predicted under the Build Alternatives for this Type I project, noise abatement measures must be considered, in accordance with FHWA guidelines. Noise-abatement measures were evaluated as part of this analysis and were found to be feasible but not reasonable per South Dakota Department of Transportation (SDDOT) policy. Therefore, noise mitigation is not proposed as part of the Project.

Noise Impact Summary

FHWA Activity Category/Land Use	Projected Number of Impacted Receptors by Alternative			
	Existing	Build Alt A	Build Alt B	Build Alt C
B/Residential	27	31	31	31
C/Recreational	0	1	1	1
Total	27	32	32	32

Construction activity may cause intermittent fluctuations in noise levels. During the construction phase of the project, all reasonable measures will be taken to minimize noise impact from these activities.

Figure A-1 in **Appendix A** shows the noise receptors, analyzed noise abatement locations, and the proposed roadway improvements.

1.0 Introduction

The South Dakota Department of Transportation (SDDOT) and the City of Sioux Falls (the City) are studying alternatives to improve safety and enhance traffic operations at the I-29 Exit 77 (41st Street) interchange and along 41st Street in Sioux Falls, South Dakota (SD).

The I-29/41st Street interchange in Sioux Falls is located in a fully developed urbanized area in the Sioux Falls metropolitan area. Land use at and near the interchange is comprised primarily of commercial development east of I-29 and a combination of commercial, institutional and residential properties west of I-29. Both the I-29 and 41st Street corridors serve as primary routes for commuters and local traffic.

This report presents the noise analysis conducted for the Project, including predicted impacts and analyzed abatement measures.

Appendix A includes the figure with the noise receptor locations, receptors with predicted noise impacts, and the noise abatement locations analyzed.

Appendix B includes the traffic data used in the analysis.

Appendix C includes the noise analysis results for each modeled receptor.

Appendix D contains field measurement data, photos and logs.

Appendix E contains the proposed build alternatives evaluated in the analysis.

2.0 Project Overview

This analysis was conducted to evaluate the potential noise impacts associated with the Project along 41st Street and I-29 in southwest Sioux Falls, in Minnehaha County, SD. The main components of the Project, as proposed by SDDOT and the City of Sioux Falls, are to:

- Re-construct and re-configure the I-29 Exit 77 (41st Street) interchange to improve traffic capacity and safety.
- Widen 41st Street from two through lanes to three through lanes in each direction from Marion Road to I-29 to accommodate anticipated traffic volumes. Arterial and collector street intersections with 41st Street will also be reconstructed to add traffic capacity.
- Reconstruct 41st Street from I-29 to just west of Louise Avenue. Although no additional through lanes are proposed, median treatments and additional turning lanes at intersections will reduce traffic delays. Shirley Avenue will also be re-aligned and widened at 41st Street to add traffic capacity.
- Upgrade pedestrian facilities to comply with Americans with Disabilities Act (ADA) requirements.

3.0 Methodology

The noise study for this project was prepared in accordance with the SDDOT Noise Analysis and Abatement Guidance (2011) policy. This policy describes SDDOT's implementation of the requirements of the Federal Highway Administration (FHWA) Noise Standards at 23 Code of Federal Regulations (CFR) Part 772, which became effective July 2011. This policy was developed by SDDOT and concurred with by

FHWA. The 1972 Federal-aid Highway Act required FHWA to develop a noise standard for new Federal-aid highway projects.

The noise study includes four distinct scenarios consisting of the Existing year (2016) and three design year (2045) Build Alternatives. There are three alternatives (A, B, C) for the 41st Street Corridor and two alternatives for the I-29 Exit 77 (41st Street) interchange. For the noise study, all three alternatives were modeled for the 41st Street Corridor, although the design alignment only varies slightly and does not significantly change the traffic noise in the study area. Because the interchange ramp and bridge roadways are not directly adjacent to any noise-sensitive receptors, the diverging diamond interchange alternative was modeled for all build scenarios. Figure A-1 presented in **Appendix A** shows the project area with the Alternative A. **Appendix E** contains the roadway and interchange build alternatives.

3.1 Noise Metrics

Noise can be described as unwanted or excessive sound that may interfere with communication or disturb the community. Sound becomes unwanted when it interferes with normal activities, such as sleep, work, speech, or recreation. Noise levels are measured in decibels[1] (dB), a unit used to measure the intensity or pressure level of a sound on a logarithmic scale. For traffic noise purposes the A-weighted scale is used, which provides a single number measure that weighs different frequencies in a manner similar to the sensitivity of the human ear. Thus, the A-weighted sound level in decibels, expressed in dB(A), provides a simple measure of intensity and frequency that correlates well with the human response to environmental noise.

Noise levels from highway traffic are affected by three factors: (1) the volume of traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, traffic noise increases as one or more of these three factors increase. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires.

The noise level descriptor used by SDDOT is the equivalent sound pressure level (L_{eq}). L_{eq} is defined as the continuous steady sound level that would have the same total A-weighted sound energy as the real fluctuating sound measured over a given period of time. Traffic noise levels are measured with the hourly equivalent sound pressure level, expressed as $L_{eq(h)}$. Figure 1 illustrates how traffic noise levels relate to other sound sources.

[1] The number of decibels is calculated as ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure (often frequency weighted), and the reference mean-squared sound pressure of 20 µPa, the threshold of human hearing.

Figure 1: Typical Noise Levels

Common Outdoor Activities	Noise Level dB(A)	Common Indoor Activities
	-110-	Rock Band
Jet Fly-over at 1,000 feet		
	-100-	
Gas Lawn Mower at 3 feet		
	-90-	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 1 m (3 feet)
	-80-	Garbage Disposal at 1 m (3 feet)
Noisy Urban Area (Daytime)		
Gas Lawn Mower at 100 feet	-70-	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet	-60-	
		Large Business Office
Quiet Urban Daytime	-50-	Dishwasher Next Room
Quiet Urban Nighttime	-40-	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime		
	-30-	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	-20-	
		Broadcast/Recording Studio
	-10-	
Lowest Threshold of Human Hearing	-0-	Lowest Threshold of Human Hearing

Source: California Dept. of Transportation Technical Noise Supplement, Oct. 1998, Page 18.

3.2 Federal and State Regulations

Traffic noise impact from the proposed Project was assessed in accordance with FHWA and SDDOT noise assessment regulations and guidelines. FHWA's Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 CFR 772, requires the following during the planning and design of a highway project.

- Identification of highway traffic noise impacts;
- Examination of potential abatement measures;
- Gather public input approval for reasonable and feasible abatement measures;
- Incorporation of reasonable and feasible highway traffic noise abatement measures into the highway project;
- Coordination with local officials to provide helpful information on compatible land use planning and control; and
- Identification and incorporation of necessary measures to abate construction noise

The highway traffic noise impact identification process involves a review of the existing and permitted noise-sensitive properties that parallel the highway corridor and determining existing and future noise levels within those areas. Noise-sensitive land use is identified by inspecting aerial photography and

performing site reconnaissance. Highway traffic noise analyses are also performed for undeveloped lands when they are considered permitted developments. Review of the City of Sioux Falls Building Permit Database did not find any building permits for new construction of noise-sensitive land use in the study area.

The FHWA mandates the most recent version of the Traffic Noise Model® (TNM) software be used to predict noise levels from roadway operations. Additional information is given on this software in the next section. After the existing and proposed land uses are established, the horizontal and vertical geometry of the study area is validated in the TNM through a process that compares modeled noise levels to actual measured noise levels. The noise model must predict noise levels that are within 3 dB(A) of the actual levels in order to be considered valid. Future design year traffic is applied to a model that has been validated for the existing condition to estimate design year (2045) noise levels.

The FHWA Noise Abatement Criteria (NAC) presented in 23 CFR 772 establish criteria for traffic noise impact assessment with respect to various land uses. A traffic noise impact is defined as a future noise level that approaches or exceeds the FHWA NAC or a future noise level that creates a substantial noise increase over existing noise levels. An approaching noise level is defined by SDDOT as being 1 dB(A) less than the noise level listed as the FHWA NAC for Activity Categories A through E in **Table 1**. The FHWA allows states to define a substantial noise increase as an increase of anywhere between 5 and 15 dB(A). SDDOT uses a 15 dB(A) increase between the existing and modeled design year sound levels to identify substantial increase impact.

In this study, residential (Category B), park/recreation areas (Category C), and institutional interior areas (Category D) were evaluated. If one or more receptors are affected by project-related traffic noise levels that approach or exceed the abatement criteria, or that substantially exceed existing noise levels, then abatement measures must be considered. If the abatement criteria is not approached or exceeded, or if projected traffic noise levels do not substantially exceed existing noise levels, abatement measures will not be considered. For this analysis, traffic noise was evaluated for noise-sensitive properties within 300 feet of the Project.

Table 1. Noise Abatement Criteria

[Hourly A-Weighted Sound Level – decibels (dB(A))]				
Activity Category	**Activity $L_{eq(h)}$[1]**		**Evaluation Location**	**Description of Activity Category**
	FHWA	**SDDOT**		
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67 52	66 51	Exterior Interior	Residential.
C[2]	67	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[2]	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--	--	Undeveloped lands that are not permitted.

(Based on Table 1 of 23 CFR Part 772)

[1] *The $L_{eq(h)}$ Activity Criteria values are for impact determination only, and are not design standards for noise-abatement measures.*

[2] *Includes undeveloped lands permitted for this activity category.*

3.3 FHWA Traffic Noise Model

The Existing (2016) and design year (2045) traffic noise levels were calculated for 135 noise-sensitive sites using the FHWA's latest traffic noise modeling software TNM (version 2.5). TNM is FHWA's computer program for highway traffic noise prediction and analysis. The use of the most recent TNM software is a mandatory requirement for all traffic noise related projects, under State and Federal regulations.

In accordance with 23 CFR 772.9(c), "Noise contour lines may be used for project alternative screening or for land use planning … but shall not be used for determining highway traffic noise impacts." Consequently, approximate distances to noise contours were determined and presented in Section 7.0, but are not shown on an aerial image because they were not used in the analysis. The model predicted noise levels at each receptor location, and these values are documented in this report.

Available project design plans, topographic and aerial data were used to create a three-dimensional model of the existing and future design roadway configurations and the surrounding terrain. Receptor locations were identified from both project aerials and from driving the corridor.

3.4 Traffic Data

The PM peak hour existing and design year (2045) traffic volumes to be entered into TNM were based on information prepared by HDR. The PM peak hour was determined to provide the loudest hour noise conditions for the study. Vehicle speeds were based on the roadway posted speed limits. The vehicle mix data was summarized for entry into the TNM into three vehicle classifications: automobiles (A); medium trucks (MT); and heavy trucks (HT). Medium trucks include all vehicles with two axles and six tires, generally having a gross vehicle weight greater than 9,900 lbs. Heavy trucks include all vehicles having three or more axles, generally having a gross vehicle weight greater than 26,400 lbs. The traffic parameters used in the noise model for prediction of existing and future noise levels are presented in **Appendix B**.

4.0 Traffic Noise Analysis

As stated in Section 3.0, the noise study for this project was prepared in accordance with the SDDOT Noise Analysis and Abatement Guidance (2011) policy. The noise analysis and measurement procedures described in this section follow the methods outlined in that policy.

4.1 Noise-Sensitive Sites

A receptor is a discrete or representative location of a noise-sensitive site or area for any of the land use categories listed in **Table 1**.

In determining traffic noise impacts, primary consideration is given to exterior areas where frequent human use occurs. If no exterior areas of frequent human use are present, no further analysis is required, with the exception being any Category D land uses. An individual receptor was modeled for each noise-sensitive area/property within approximately 300 feet of the design roadway edge of pavement. The location of each receptor is shown on Figure A-1 in **Appendix A**.

Existing land use within the corridor varies and includes mostly residential (Category B), recreational (Category C), and institutional interior (Category D) noise-sensitive land use west of I-29 and mostly commercial use east of I-29. No exterior areas of frequent human use were identified at the commercial properties east of I-29. No receptors were modeled and analyzed east of I-29 because noise-sensitive land use does not exist in that portion of the study area.

Category D receptors include Sunnycrest United Methodist Church and Mount Marty College south of 41st Street between S Cathy Avenue and S Gateway Boulevard. No outdoor areas of frequent human use were identified at Mount Marty College, and the outdoor areas of frequent human use at Sunnycrest (benches) were located behind the building. As such, interior noise levels were evaluated at both these sites using Table 6: Building Noise Reduction Factors from the FHWA Highway Traffic Noise: Analysis and Abatement Guidance manual and assumed masonry building construction with single-glazed windows for an outdoor to indoor noise reduction of 25 dB. There are no Activity Category A or E (commercial with exterior areas of frequent human use) land uses in the corridor. Two multi-family properties within the 300-foot noise study area did not include defined exterior areas of frequent human use and therefore were not assessed for impact.

4.2 Measured Noise Levels

SDDOT Noise Policy and Guidance states that existing noise levels should be determined by conducting field measurements. Figure A-1 in **Appendix A** contains a plan map of the study area and shows the location of the noise measurement sites.

4.2.1 Field Testing Procedure

HDR staff measured traffic noise levels at representative sites throughout the project corridor on December 1st and 2nd, 2016. Traffic noise measurements were conducted in accordance with the FHWA-PD-96-046 Measurement of Highway Related Noise (May 1996). An important purpose of gathering noise measurements in the study area is to provide a basis for validating the noise prediction computer model used to project future noise impacts. Therefore, measurements must be conducted when traffic is freely flowing on the project roadways. Simultaneous traffic counts are conducted along with the noise measurements to provide the traffic data needed for the noise model validation effort. For this study, traffic counts were performed for 10 minute intervals directly before and after each measurement, with additional traffic observations during the measurement taken into consideration. The average meteorological conditions were reported as shown in Table 2.

Table 2. Meteorological Conditions

Temperature	≅ 31-34 °F
Humidity	≅ 84–88%
Wind	≅ light/variable
Conditions	Mostly Cloudy

4.2.2 Instrumentation

Noise monitoring was conducted using a Larson Davis 824 Sound Level Meter (SLM). The meter was set at a height of approximately 5 feet for all measurements, and the microphone was covered with a windscreen. Table 3 summarizes the instruments used to collect the monitoring data for this noise analysis report.

Table 3. Noise Analysis Instrumentation Summary

Instrument	Make	Model	Serial Number
Sound Analyzer 1	Larson Davis	824	824A3204
Calibrator	Larson Davis	CAL200	3722

4.2.3 Field Measurement Methods and Locations

Ambient noise measurements were collected in the study area at four representative sites for a duration of 15 minutes. The SLM was programmed to compute the equivalent sound level (L_{eq}). The SLM was calibrated before and after monitoring, and no significant calibration drifts were detected during the study. The SLM was also programmed to collect measurements of the L_{eq} for each individual one-minute interval, so that periods including events that were not representative of the ambient noise environment or not traffic-related could be separated or excluded if needed. Minutes that included traffic not recorded during the timed counts or noise events not related to traffic were taken into consideration for each site.

The dominant source of noise at M1 was Marion Road. The dominant source of noise at M2 and M3 was 41st Street, with some additional noise provided by Terry Avenue and the Terry Avenue/41st Street intersection signal at M3. The dominant source of noise at M4 was I-29. Noise sources that were not related to traffic included some aircraft operations, pedestrians and residents, and community-related activities. The measurement results indicated that traffic was the dominant source of noise despite of the presence of other sources.

The measured short-term noise levels appear in Table 4 as equivalent sound levels (L_{eq}). As described above, the L_{eq} is a sound-energy average of the fluctuating sound level (in A-weighted decibels, dB(A) measured over a specified period of time. Table 4 describes the location of each monitoring site and shows that the measured sound levels ranged from a low of 62 dB(A) at Sunnycrest United Methodist Church (Site M3) to a high of 69 dB(A) at the Westwood Apartments multi-family building (Site M4). **Appendix C** provides more details on the noise measurement program, including field data sheets, site photographs, traffic count data and noise measurement results spreadsheets.

Table 4. Noise Measurement Location Summary

Measurement No.	Location	Date	Start Time	Duration (Min.)	Measured L_{eq} (dB(A))
M1	3201 Marion Road	1-Dec-16	15:03	15	65
M2	5005 W 40th Street	1-Dec-16	16:02	15	63
M3	4801 W 41st Street	2-Dec-16	8:31	15	62
M4	3000 S Mayfair Drive	2-Dec-16	9:26	15	69

4.2.4 Noise Monitoring Results and Model Validation

The measured noise levels for each of the monitoring sites selected along the project corridor are presented in Table 5. As noted in the FHWA guidance, the noise prediction model is validated if existing field measured traffic noise levels and predicted traffic noise levels for the existing condition are with +/- 3 dB(A). The measurements were compared to the existing noise levels calculated using TNM, and each set of predicted and measured data was found to be within the acceptable plus or minus 3 dB(A) tolerance.

Table 5. Model Validation Results

Monitoring Location	Monitoring L_{eq} (dB(A))	Modeled L_{eq} (dB(A))	Difference
M1	64.9	63.5	-1.4
M2	63.4	64.3	+0.9
M3	61.8	61.5	-0.3
M4	69.1	71.0	+1.9

4.3 Predicted Noise Levels

The results of the noise analysis are presented for each modeled receptor in **Appendix C**. The calculated traffic noise levels reflect the proposed field conditions, elevation differences, and the proposed roadway alignment in relation to the noise-sensitive sites. Computed noise levels ranged from 50 to 71 dB(A) L_{eq} (exterior) for the Existing condition and from 52 to 74 dB(A) L_{eq} (exterior) for all three build alternatives.

4.4 Noise Impact Analysis

The predicted traffic noise levels at each noise-sensitive site were compared to the FHWA NAC. As evidenced by Table 6, noise impacts are predicted as a result of the year 2045 Build Alternatives. The impacted receptors are also shown in Figure A-1 in **Appendix A**.

Table 6. Predicted Noise Impacts by Alternative

Alternative	Impact Type	# of Impacted Sites by NAC Activity Category		
		Residential (Cat. B)	Recreational (Cat. C)	Total
Existing	NAC	27	0	27
Year 2045 Alt A	NAC	31	1	32
Year 2045 Alt B	NAC	31	1	32
Year 2045 Alt C	NAC	31	1	32

No substantial noise increase impacts (defined as 15 dB(A) above existing noise levels) are predicted to occur for this project. Predicted traffic noise levels resulting from the design year (2045) Build Alternatives increase as much as 4 dB(A) over existing noise levels, as shown in the predicted noise levels presented in **Appendix C**. These increases are the result of increases in traffic volumes and changes in roadway geometry.

The predicted traffic noise impacts are the same for Build Alternatives A, B and C, with sound levels varying slightly for each alternative. Alternative B sound levels are only 0.1 dB higher than Alternative A sound levels for 3 receptors, as the geometry of the roadway design changes minimally near sensitive receptors between these 2 alternatives. Alternative C sound levels are lower for receptors south of 41st Street and the one multi-family property (Stoner's Landing) north of 41st Street at W 39th Street and S Meadow Avenue. Alternative C sound levels are up to 1 dB higher for receptors north of 41st Street near Marion Road. This is because the Alternative C design excludes lane widening in the eastbound direction and adds roadway width on the westbound side near Marion Road.

The impacts include 31 residential receptors and one recreational receptor placed at the Fire Station driveway basketball hoop[2].

For receptors (with exterior use) south of 41st Street, Alternatives A/B sound levels range from 52 to 61 dB(A) L_{eq} and 52 to 60 dB(A) L_{eq} for Alternative C, increasing by 1 to 3 dB for Alternatives A/B and 1 to 2 dB for Alternative C (existing levels range from 50 to 58 dB(A) L_{eq}). Interior use institutional receptors (Category D) sound levels range from 41 to 44 dB(A) L_{eq} for Alternative B and 40 to 44 for Alternatives A/C, increasing by 2 to 3 dB for Alternative B and 2 dB for Alternatives A/C. Noise levels were calculated at the exterior façade for these receptors and reduced by 25 dB, based on masonry building construction

[2] This basketball hoop was observed in aerial imagery, but was not observed in the field. It is likely that the basketball hoop is used seasonally by the Fire Department.

with single-glazed windows per Table 6: Building Noise Reduction Factors from the FHWA Highway Traffic Noise: Analysis and Abatement Guidance manual, for comparison to the Category D NAC.

For receptors north of 41st Street, sound levels range from 52 to 72 dB(A) L_{eq} dB(A) for all alternatives, increasing by 1 to 4 dB over existing (existing levels range from 50 to 70 dB(A) L_{eq}).

For receptors west of I-29 and north of 38th Street, sound levels range from 54 to 74 dB(A) L_{eq} for all alternatives, increasing by 3 to 4 dB over existing (existing levels range from 51 to 71 dB(A) L_{eq}). Sound levels for receptors west of I-29 and north of 38th Street do not vary between alternatives.

4.5 Noise-Abatement Measures

In accordance with the SDDOT noise policy, noise-abatement measures must be evaluated for noise receptors predicted to approach or exceed the FHWA NAC as a result of the Build Alternatives, or which are predicted to experience a substantial (15 dB(A)) noise level increase over existing noise levels. Potential traffic noise abatement measures that could be considered for the predicted impacts are listed below, along with reasons why some are considered infeasible.

1. Modifying the proposed horizontal and/or vertical alignments of the roadway
   - *Impractical because the extent of realignment necessary to alleviate noise impacts would cause impacts to the fully developed properties adjacent to the entire corridor.*
   - *Alignment modifications generally involve orienting the roadway sufficient distances from noise sensitive areas so as to minimize noise impacts. This project is being built on available right-of-way, through an existing corridor, with little to no room for alignment modifications on either side.*
2. Traffic management measures (e.g. modify speed limits and restrict truck traffic)
   - *Impractical given the type of road in question; 41st Street is a categorized as an arterial roadway for the City of Sioux Falls transportation network with the design intent to accommodate through traffic, including trucks. Therefore speed limit reductions and truck traffic limitations would not be consistent with the functional classification.*
   - *Any reduction in speed would affect the roadway's ability to accommodate anticipated traffic volumes and reduce the capacity of the proposed facility. Additionally, this measure is unreasonable because motorists are unlikely to obey an unrealistic speed limit and speeds would have to be lowered a considerable amount before any significant noise reduction would be noticed.*
   - *Diverting truck traffic on I-29 or 41st Street would not be feasible since improving traffic flow in the area is a primary reason for constructing the project, and diversion of truck traffic to other roadways could increase noise levels in nearby residential areas and be restrictive to the existing commercial businesses along the corridor. Additionally, heavy truck volumes are low on 41st Street, and removal of them would have little to no impact on lowering noise levels.*
3. Construction of noise barriers along or within the ROW
   - *Possible options include barriers, berms, and vegetation. Berms and vegetation would require more space than is available. Barriers are discussed in more detail in Section 5.6.*
4. Acquisition of property rights for construction of noise barriers
   - *Not necessary because barriers from Item 3, above, can be used*
5. Acquisition of property to serve as a buffer zone
   - *Prohibitively expensive for the Project budget because full residential parcels would need to be acquired to alleviate noise impacts. In addition, this measure would remove a row of shielding from the roadway noise that could increase noise levels at other receptors.*

4.6 Noise Barriers

When a traffic noise impact is identified, noise abatement measures will be considered and evaluated for feasibility and reasonableness by comparing the cost and effect of the abatement measure against the amount of benefit. In accordance with the SDDOT 2011 noise policy, all of the following conditions must be met in order for noise abatement to be justified and incorporated into project design. Failure to achieve any single element of feasibility or reasonableness will result in the noise abatement measure being deemed not feasible or not reasonable, whichever applies.

4.6.1 Feasibility

When a traffic noise impact is identified on a project, noise abatement will be considered and evaluated for engineering and acoustical feasibility.

- **Engineering feasibility:**
  - Safety: An abatement measure will be deemed not feasible if it causes an excessive restriction of sight distance, continuous shadow resulting in icing or snow accumulation on driving lanes, or severe drainage problems associated either with the barrier or flood-prone areas.
  - Barrier height: The design of each proposed barrier will be considered on an individual basis when determining barrier height. The designed height of any proposed barrier may be adjusted based on feasibility and reasonableness considerations. Due to safety concerns, SDDOT will generally not construct barriers higher than 20 feet.
  - Topography: If the topography is such that an abatement measure cannot be built, then it will be deemed not feasible.
  - Drainage and utilities: A noise abatement measure is not feasible if access to drainage and utilities cannot be maintained.
  - Maintenance of the abatement measure, maintenance access to adjacent properties, and access to adjacent properties: A noise abatement measure is not feasible if access to the abatement measure, side streets, driveways, ramps, etc., cannot be maintained.
- **Acoustic Feasibility:** A noise abatement measure is considered acoustically feasible when a minimum of 60 percent of front-row receptors directly behind the noise barrier (noise barrier must extend entirely across receptor's property line) achieve a 5 dB(A) noise reduction.

4.6.2 Reasonableness

Reasonableness is a more subjective criterion than feasibility. It implies that common sense and good judgment were applied in arriving at a decision when noise abatement measures are considered. The following three reasonableness criteria must be collectively achieved for an abatement measure to be considered reasonable:

- **Viewpoints of the Property Owners and Residents of all Benefited Receptors (Activity Category B Land Uses)**
  When it is determined that it would be feasible to provide noise abatement for a site, and a preliminary determination has been made that abatement would be reasonable, a public informational meeting will be held as part of the process for a final determination of whether abatement would be reasonable. Benefited property owners and residents will be given an opportunity to vote on noise abatement by ballot. An informational packet and a ballot will be sent by certified mail to all benefited property owners and residents, at least 14 days before the date of the noise abatement meeting. The votes will be weighed in the following manner:
  - 3 points/ballot for benefited first row property owners
  - 1 point/ballot for all other benefited property owners
  - 1 point/ballot vote for all residents

Consideration of the noise abatement measure will continue unless more than 50 percent of all distributed points are returned that indicate the balloted voters do not want the abatement measure. If the benefited property owners and residents vote to reject construction of a noise barrier, their area will not be reconsidered for future noise abatement unless another Type 1 project is proposed for the area.

Voting by landowners is only conducted when a proposed noise abatement measure is found to be feasible.

For Activity Categories A, C, D, and E, the views of the property owner or authority having jurisdiction over the property will be considered.

- **Cost Effectiveness**
  Noise barriers that are determined to be feasible to design and construct must also be evaluated for reasonable cost. SDDOT defines cost effectiveness as dollars per benefited receptor. Based on 2010 construction cost estimates, SDDOT will use $\$44/ft^2$ for barrier costs. The abatement cost guidance will be reevaluated every 5 years, or sooner if updated costs become available. If the cost per benefited receptor is more than $21,000, the abatement measure will be considered not reasonable.

- **Noise Reduction Goal:** A minimum of 40 percent of benefited receptors must achieve a 7 dB(A) noise reduction in order for noise abatement to be reasonable.

Noise barrier abatement is not feasible for three of the impacted sites (P6, P22, and P23) along Marion Road due to their proximity to cross streets and driveway cuts, including the Fire Station recreational receptor. For the remaining NAC impacts predicted from the Project, noise barrier designs were analyzed.

4.6.3 Noise Barrier 1 (Alternatives A and B)

HDR modeled a noise barrier along the north side of 41st Street to protect impacted receptors between Marion Road and Terry Avenue where property chain and wood fences currently exist. These receptors include single family homes at P30, P31, and P36 through P41. The predicted noise levels at each of these receptors as well as the non-impacted receptors behind Barrier 1 were the same for Alternatives A and B. Results for Noise Barrier 1 with Alternatives A and B are summarized in **Table 7**. The noise barrier modeled is feasible as it was able to achieve a 5 dB(A) noise reduction at a minimum of 60% of the front row receptors directly behind the noise barrier (100% of front row impacts achieved 5 dB(A) noise reduction), but it is not cost-reasonable at a cost of $37,923 per benefited receptor. Barrier 1 would be 6 to 8 feet tall and 877 feet long. At a cost of $44 per square foot and 6,895 square feet, Barrier 1 would cost a total of $303,380. Barrier 1 would reach the noise reduction design goal of 7 dB(A) for 63% of the benefited receptors, with insertion losses ranging from 5 to 9 dB for benefited receptors. Figure A-1 in **Appendix A** shows the evaluated barrier location.

Table 7. Noise Barrier 1 (Alternative A and B) Results

Barrier	Barrier Length (ft)	Average Barrier Height (ft)	Total Number of Impacted Receptors		Number Of Benefited Receptors[1]	Number Of Receptors > 7 dB(A) Reduction	Overall Cost[2] Per Benefited Receptor	Feasible/ Reasonable[3]
			Alt A	Alt B				
1	877	7.9	8	8	8	5	$37,923	No

[1] *Receptors where the noise level reduction from the barrier is at least 5 dB(A)*
[2] *Based upon SDDOT recommended cost $44/ft^2*
[3] *Based upon SDDOT recommended cost per benefited receptor of $21,000*

4.6.4 Noise Barrier 1 (Alternative C)

Barrier 1 was also analyzed for Alternative C, as predicted noise levels vary slightly from Alternative A/B for receptors behind this barrier. These receptors include single family homes at P30, P31, and P36 through P41. Results for Noise Barrier 1 with Alternative C are summarized in **Table 8**. Barrier 1 is located along the north side of 41st Street between Marion Road and Terry Avenue where property chain and wood fences currently exist. The noise barrier modeled is feasible as it was able to achieve a 5 dB(A) noise reduction at a minimum of 60% of the front row receptors directly behind the noise barrier (100% of front row impacts achieved 5 dB(A) noise reduction), but it is not cost-reasonable at a cost of $37,923 per benefited receptor. Barrier 1 would be 6 to 8 feet tall and 877 feet long. At a cost of $44 per square foot and 6,895 square feet, Barrier 1 would cost a total of $303,380. Barrier 1 would reach the noise reduction design goal of 7 dB(A) for 63% of the benefited receptors, with insertion losses ranging from 5 to 9 dB for benefited receptors.

Table 8. Noise Barrier 1 (Alternative C) Results

Barrier	Barrier Length (ft)	Average Barrier Height (ft)	Total Number of Impacted Receptors	Number Of Benefited Receptors[1]	Number Of Receptors > 7 dB(A) Reduction	Overall Cost[2] Per Benefited Receptor	Feasible/ Reasonable[3]
			Alt C				
1	877	7.9	8	8	5	$37,923	No

[1] *Receptors where the noise level reduction from the barrier is at least 5 dB(A)*
[2] *Based on construction cost increase of $6.3M from Alternative 7a to 5a.*
[3] *Based upon SDDOT recommended cost per benefited receptor of $21,000*

4.6.5 Noise Barrier 2 (Alternatives A, B and C)

HDR modeled a noise barrier along the I-29 SB off-ramp to protect impacted receptors along the ramp and I-29 SB. These receptors include one single family home (P73) and multi-family property receptors at Westwood Apartments (P69-P72 and P118-P121) and Mayfair Place Apartments (P94, P95, P98, P99, P102, P103, P106, P107, P110, P111, P114 and P115). Predicted noise levels do not change for these receptors or the non-impacted receptors behind Barrier 2 for all alternatives. Results for Noise Barrier 2 are summarized in **Table 9**. The noise barrier modeled is feasible as it was able to achieve a 5 dB(A) noise reduction at a minimum of 60% of the front row receptors directly behind the noise barrier (100% of front row impacts achieved 5 dB(A) noise reduction), but it is not cost-reasonable at a cost of $29,564 per benefited receptor. Barrier 2 would be 14 to 16 feet tall and 1,080 feet long. At a cost of $44 per square

foot and 16,798 square feet, Barrier 2 would cost a total of $739,112. Barrier 2 would reach the noise reduction design goal of 7 dB(A) for 60% of the benefited receptors, with insertion losses ranging from 5 to 11 dB for benefited receptors. Figure A-1 in **Appendix A** shows the evaluated barrier location.

Table 9. Noise Barrier 2 (All Alternatives) Results

Barrier	Barrier Length (ft)	Average Barrier Height (ft)	Total Number of Impacted Receptors	Number Of Benefited Receptors[1]	Number Of Receptors > 7 dB(A) Reduction	Overall Cost[2] Per Benefited Receptor	Feasible/ Reasonable[3]
			All Alts				
2	1,080	15.6	21	25	15	$29,564	No

[1] *Receptors where the noise level reduction from the barrier is at least 5 dB(A)*
[2] *Based upon SDDOT recommended cost $44/ft^2*
[3] *Based upon SDDOT recommended cost per benefited receptor of $21,000*

5.0 Conclusions

Noise-sensitive sites are predicted to approach or exceed the FHWA NAC as a result of the proposed Build Alternatives. This includes 31 residential receptors and one recreational receptor. Noise-abatement measures were evaluated as part of this analysis and were found to not be feasible and/or reasonable. Noise mitigation is not proposed as part of this project.

6.0 Construction Noise and Vibration

The construction of the proposed Project would result in temporary noise and vibration increases within the Project area. The sources of construction-related noise and vibration include heavy equipment used in hauling materials and building the roadway improvements. During construction, contractors will be required to comply with the sound control requirements identified in the SDDOT Standard Specifications for Roads and Bridges, 2015 (Section 7.22). Since the Project is within the City limits, the contractor also needs to get a noise permit from the City Department of Health. Construction noise abatement will be reviewed on a case-by-case basis. Construction abatement measures will be determined by weighing the duration of the project, benefits achieved, overall adverse social, economic and environmental effects, and cost of abatement measures.

The following have been identified as being potential construction noise- and vibration-sensitive sites that exist along the project corridor: single-family residences, multi-family dwellings, recreational and institutional land use.

7.0 Information for Local Government Officials

Control of land use surrounding high traffic corridors is the most effective means of preventing impacts to residents. This control, however, is in the hands of local officials. For this reason, 23 CFR 772.17 requires the SDDOT to assist the local government by providing information that will help them recognize the incompatible land uses near the state highways.

Local officials will be provided with information on noise compatible planning techniques that can be used to prevent future highway traffic noise impacts. To assist local officials within whose jurisdiction a Type I highway project is located, SDDOT will provide information on future noise levels for each Activity Category (exterior) located along the project.

The distance between the edge of the nearest travel lane of the proposed roadway and the point at which the approaching NAC noise levels occur is provided in **Table 10** for exterior Activity Categories B, C and E[3]. These distances are approximate and highly variable depending upon nearby land uses and local noise producing activities. The distances were estimated based on contour string receptor points modeled in the build alternative models.

Table 10. Noise Contours

Roadway Segment	Activity Category	Noise Level $L_{eq(h)}$, dB(A)	Approximate Distance (ft) to NAC under 2045 Build Alternatives
I-29	B & C	66	up to 400[1]
I-29	E	71	150
41st Street	B & C	66	100
41st Street	E	71	35
Marion Road	B & C	66	75
Marion Road	E	71	>5

[1] *Contour string receptors north of 41st Street showed noise levels up to 66 dB up to 400 feet from I-29; however, contour string receptors south of 41st Street only showed noise levels up to 66 dB out to about 275 feet.*

[3] Exterior areas of frequent human use do not currently exist for Category E properties in the study area, but the contour information is provided for potential future development.

8.0 Bibliography

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U.S. Department of Transportation, Federal Highway Administration. FHWA Traffic Noise Model: User's Guide. FHWA Report Number FHWA-PD-96-009. January 1998.

U.S. Department of Transportation, Federal Highway Administration. FHWA Traffic Noise Model: User's Guide (Version 2.5 Addendum). April 2004.

U.S. Department of Transportation, Federal Highway Administration. Measurement of Highway-Related Noise. FHWA Report Number FHWA-PD-96-046. May 1996.

U.S. National Archives and Records Administration, Office of the Federal Register. Title 23, Code of Federal Regulations, Part 772. Procedures for Abatement of Highway Traffic Noise and Construction Noise.

APPENDICES

Appendix A:
Figure A-1– Noise Study Measurement Sites, Noise Impacts and Barrier Evaluations

Appendix B: Traffic Data
Figures B-1 and B-2 – Traffic Data for Noise Analysis

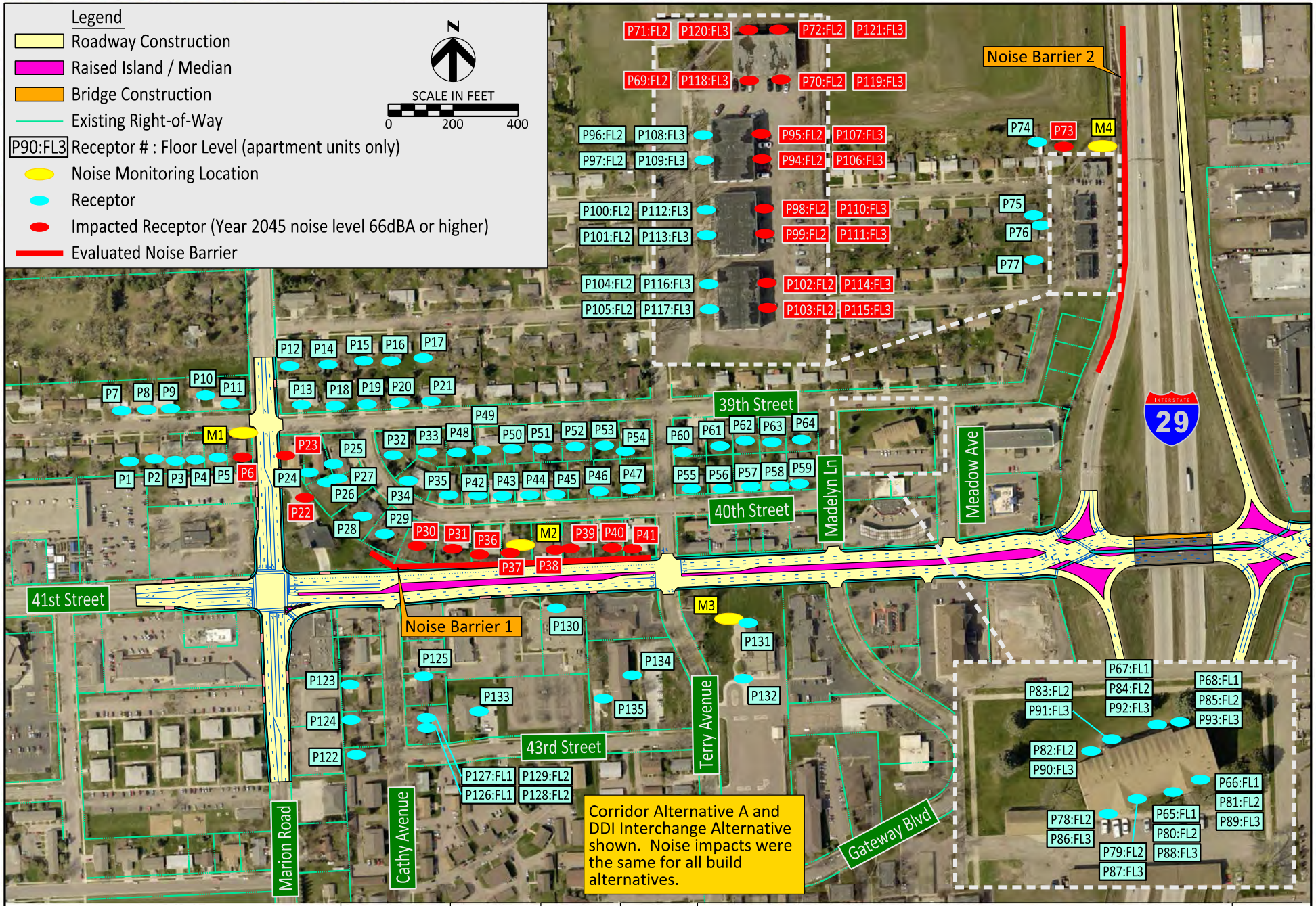
Appendix C: Noise Analysis Results

Appendix D: Noise Measurement Data
Figures D-1 to D-4 – Noise Measurement Site Photos

Appendix E: Build Alternatives Concept Layouts

Appendix A

Figures A-1 – Noise Study Measurement Sites, Noise Impacts and Barrier Evaluation



Drawn By: B.Miller
Date: 12/20/2016
Chked By: J.Unruh
Date: 12/20/2016
Revision:

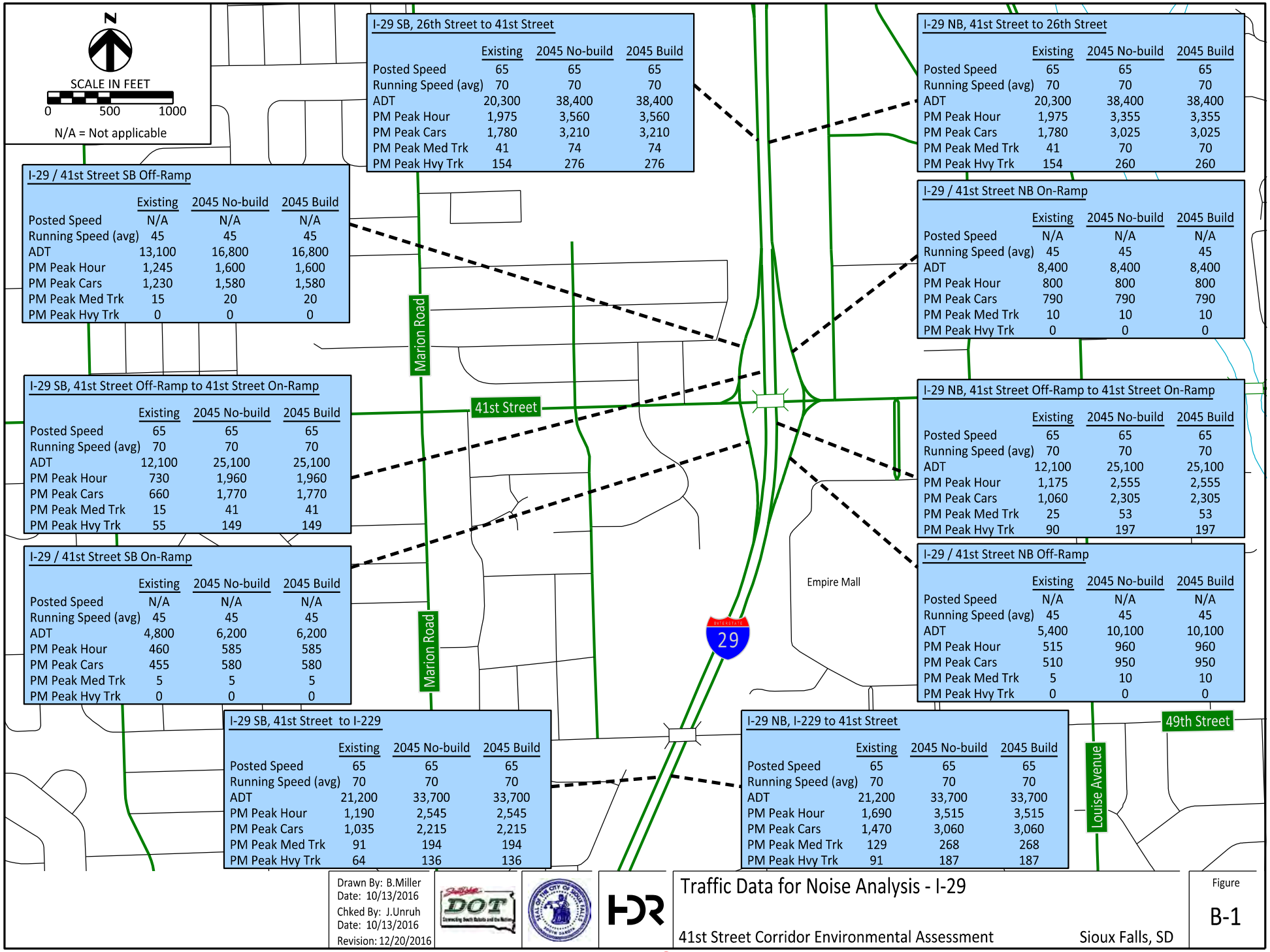
Traffic Noise Impacts and Barrier Evaluation
West of I-29

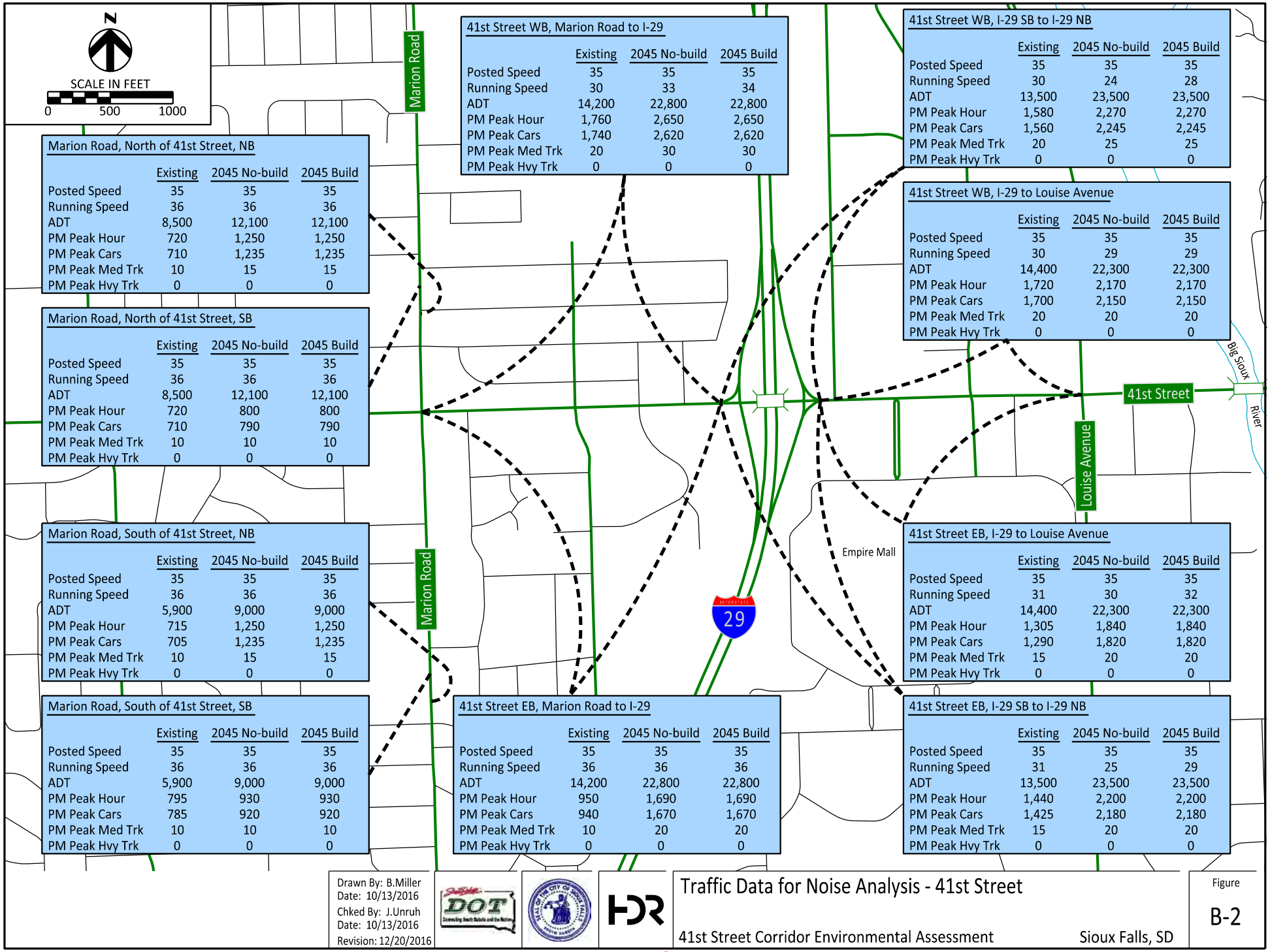
41st Street Corridor Environmental Assessment — Sioux Falls, SD

Figure A-1

Appendix B

Traffic Data


N
SCALE IN FEET
0 500 1000
N/A = Not applicable
I-29 SB, 26th Street to 41st Street
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 20,300 38,400 38,400
PM Peak Hour 1,975 3,560 3,560
PM Peak Cars 1,780 3,210 3,210
PM Peak Med Trk 41 74 74
PM Peak Hvy Trk 154 276 276
I-29 NB, 41st Street to 26th Street
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 20,300 38,400 38,400
PM Peak Hour 1,975 3,355 3,355
PM Peak Cars 1,780 3,025 3,025
PM Peak Med Trk 41 70 70
PM Peak Hvy Trk 154 260 260
I-29 / 41st Street SB Off-Ramp
Existing 2045 No-build 2045 Build
Posted Speed N/A N/A N/A
Running Speed (avg) 45 45 45
ADT 13,100 16,800 16,800
PM Peak Hour 1,245 1,600 1,600
PM Peak Cars 1,230 1,580 1,580
PM Peak Med Trk 15 20 20
PM Peak Hvy Trk 0 0 0
I-29 / 41st Street NB On-Ramp
Existing 2045 No-build 2045 Build
Posted Speed N/A N/A N/A
Running Speed (avg) 45 45 45
ADT 8,400 8,400 8,400
PM Peak Hour 800 800 800
PM Peak Cars 790 790 790
PM Peak Med Trk 10 10 10
PM Peak Hvy Trk 0 0 0
Marion Road
41st Street
I-29 SB, 41st Street Off-Ramp to 41st Street On-Ramp
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 12,100 25,100 25,100
PM Peak Hour 730 1,960 1,960
PM Peak Cars 660 1,770 1,770
PM Peak Med Trk 15 41 41
PM Peak Hvy Trk 55 149 149
I-29 NB, 41st Street Off-Ramp to 41st Street On-Ramp
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 12,100 25,100 25,100
PM Peak Hour 1,175 2,555 2,555
PM Peak Cars 1,060 2,305 2,305
PM Peak Med Trk 25 53 53
PM Peak Hvy Trk 90 197 197
I-29 / 41st Street SB On-Ramp
Existing 2045 No-build 2045 Build
Posted Speed N/A N/A N/A
Running Speed (avg) 45 45 45
ADT 4,800 6,200 6,200
PM Peak Hour 460 585 585
PM Peak Cars 455 580 580
PM Peak Med Trk 5 5 5
PM Peak Hvy Trk 0 0 0
Empire Mall
I-29 / 41st Street NB Off-Ramp
Existing 2045 No-build 2045 Build
Posted Speed N/A N/A N/A
Running Speed (avg) 45 45 45
ADT 5,400 10,100 10,100
PM Peak Hour 515 960 960
PM Peak Cars 510 950 950
PM Peak Med Trk 5 10 10
PM Peak Hvy Trk 0 0 0
Marion Road
INTERSTATE 29
49th Street
Louise Avenue
I-29 SB, 41st Street to I-229
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 21,200 33,700 33,700
PM Peak Hour 1,190 2,545 2,545
PM Peak Cars 1,035 2,215 2,215
PM Peak Med Trk 91 194 194
PM Peak Hvy Trk 64 136 136
I-29 NB, I-229 to 41st Street
Existing 2045 No-build 2045 Build
Posted Speed 65 65 65
Running Speed (avg) 70 70 70
ADT 21,200 33,700 33,700
PM Peak Hour 1,690 3,515 3,515
PM Peak Cars 1,470 3,060 3,060
PM Peak Med Trk 129 268 268
PM Peak Hvy Trk 91 187 187
Drawn By: B.Miller
Date: 10/13/2016
Chked By: J.Unruh
Date: 10/13/2016
Revision: 12/20/2016
DOT
HDR
Traffic Data for Noise Analysis - I-29
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
B-1


N
SCALE IN FEET
0
500
1000
Marion Road
41st Street
Louise Avenue
Big Sioux River
Empire Mall
29
Marion Road, North of 41st Street, NB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 36 36 36
ADT 8,500 12,100 12,100
PM Peak Hour 720 1,250 1,250
PM Peak Cars 710 1,235 1,235
PM Peak Med Trk 10 15 15
PM Peak Hvy Trk 0 0 0
Marion Road, North of 41st Street, SB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 36 36 36
ADT 8,500 12,100 12,100
PM Peak Hour 720 800 800
PM Peak Cars 710 790 790
PM Peak Med Trk 10 10 10
PM Peak Hvy Trk 0 0 0
Marion Road, South of 41st Street, NB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 36 36 36
ADT 5,900 9,000 9,000
PM Peak Hour 715 1,250 1,250
PM Peak Cars 705 1,235 1,235
PM Peak Med Trk 10 15 15
PM Peak Hvy Trk 0 0 0
Marion Road, South of 41st Street, SB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 36 36 36
ADT 5,900 9,000 9,000
PM Peak Hour 795 930 930
PM Peak Cars 785 920 920
PM Peak Med Trk 10 10 10
PM Peak Hvy Trk 0 0 0
41st Street WB, Marion Road to I-29
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 30 33 34
ADT 14,200 22,800 22,800
PM Peak Hour 1,760 2,650 2,650
PM Peak Cars 1,740 2,620 2,620
PM Peak Med Trk 20 30 30
PM Peak Hvy Trk 0 0 0
41st Street EB, Marion Road to I-29
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 36 36 36
ADT 14,200 22,800 22,800
PM Peak Hour 950 1,690 1,690
PM Peak Cars 940 1,670 1,670
PM Peak Med Trk 10 20 20
PM Peak Hvy Trk 0 0 0
41st Street WB, I-29 SB to I-29 NB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 30 24 28
ADT 13,500 23,500 23,500
PM Peak Hour 1,580 2,270 2,270
PM Peak Cars 1,560 2,245 2,245
PM Peak Med Trk 20 25 25
PM Peak Hvy Trk 0 0 0
41st Street WB, I-29 to Louise Avenue
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 30 29 29
ADT 14,400 22,300 22,300
PM Peak Hour 1,720 2,170 2,170
PM Peak Cars 1,700 2,150 2,150
PM Peak Med Trk 20 20 20
PM Peak Hvy Trk 0 0 0
41st Street EB, I-29 to Louise Avenue
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 31 30 32
ADT 14,400 22,300 22,300
PM Peak Hour 1,305 1,840 1,840
PM Peak Cars 1,290 1,820 1,820
PM Peak Med Trk 15 20 20
PM Peak Hvy Trk 0 0 0
41st Street EB, I-29 SB to I-29 NB
Existing 2045 No-build 2045 Build
Posted Speed 35 35 35
Running Speed 31 25 29
ADT 13,500 23,500 23,500
PM Peak Hour 1,440 2,200 2,200
PM Peak Cars 1,425 2,180 2,180
PM Peak Med Trk 15 20 20
PM Peak Hvy Trk 0 0 0
Drawn By: B.Miller
Date: 10/13/2016
Chked By: J.Unruh
Date: 10/13/2016
Revision: 12/20/2016
DOT
HDR
Traffic Data for Noise Analysis - 41st Street
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
B-2

EXISTING TRAFFIC DATA (Year 2016)							
LOCATION	SPEED	PM PEAK					
		TOTAL VOLUME	CARS	MEDIUM TRUCKS	HEAVY TRUCKS	BUSES	MOTORCYCLES
41st St WB, Marion Rd to I-29	35	1,760	1,740	20	0	0	0
41st St WB, I-29 SB to I-29 NB	35	1,580	1,560	20	0	0	0
41st St WB, I-29 to Louise Ave	35	1,720	1,700	20	0	0	0
41st St EB, Marion Rd to I-29	35	950	940	10	0	0	0
41st St EB, I-29 SB to I-29 NB	35	1,440	1,425	15	0	0	0
41st St EB, I-29 to Louise Ave	35	1,305	1,290	15	0	0	0
Marion Rd NB, North of 41st St	35	720	710	10	0	0	0
Marion Rd NB, South of 41st St	35	715	705	10	0	0	0
Marion Rd SB, North of 41st St	35	720	710	10	0	0	0
Marion Rd SB, South of 41st St	35	795	785	10	0	0	0
I-29 SB, 26th St to 41st S	65	1,975	1,780	41	154	0	0
I-29 NB, 26th St to 41st S	65	1,975	1,780	41	154	0	0
On-Ramp 41st to I-29 NB	45	800	790	10	0	0	0
I-29 NB, Between Interchange	65	1,175	1,060	25	90	0	0
Off-Ramp I-29 NB to 41st	45	515	510	5	0	0	0
I-29 NB, I-229 to 41st St	65	1,690	1,470	129	91	0	0
I-29 SB, I-229 to 41st St	65	1,190	1,035	91	64	0	0
On-Ramp 41st to I-29 SB	45	460	455	5	0	0	0
I-29 SB, Between Interchange	65	730	660	15	55	0	0
Off-Ramp I-29 SB to 41st	45	1,245	1,230	15	0	0	0

BUILD TRAFFIC DATA (Year 2045)							
LOCATION	SPEED	PM PEAK					
		TOTAL VOLUME	CARS	MEDIUM TRUCKS	HEAVY TRUCKS	BUSES	MOTORCYCLES
41st St WB, Marion Rd to I-29	35	2,650	2,620	30	0	0	0
41st St WB, I-29 SB to I-29 NB	35	2,270	2,245	25	0	0	0
41st St WB, I-29 to Louise Ave	35	2,170	2,150	20	0	0	0
41st St EB, Marion Rd to I-29	35	1,690	1,670	20	0	0	0
41st St EB, I-29 SB to I-29 NB	35	2,200	2,180	20	0	0	0
41st St EB, I-29 to Louise Ave	35	1,840	1,820	20	0	0	0
Marion Rd NB, North of 41st St	35	1,250	1,235	15	0	0	0
Marion Rd NB, South of 41st St	35	1,250	1,235	15	0	0	0
Marion Rd SB, North of 41st St	35	800	790	10	0	0	0
Marion Rd SB, South of 41st St	35	930	920	10	0	0	0
I-29 SB, 26th St to 41st S	65	3,560	3,210	74	276	0	0
I-29 NB, 26th St to 41st S	65	3,355	3,025	70	260	0	0
On-Ramp 41st to I-29 NB	45	800	790	10	0	0	0
I-29 NB, Between Interchange	65	2,555	2,305	53	197	0	0
Off-Ramp I-29 NB to 41st	45	960	950	10	0	0	0
I-29 NB, I-229 to 41st St	65	3,515	3,060	268	187	0	0
I-29 SB, I-229 to 41st St	65	2,545	2,215	194	136	0	0
On-Ramp 41st to I-29 SB	45	585	580	5	0	0	0
I-29 SB, Between Interchange	65	1,960	1,770	41	149	0	0
Off-Ramp I-29 SB to 41st	45	1,600	1,580	20	0	0	0

Appendix C

Noise Analysis Results

Existing (2016) and Future (2045) Traffic Noise Levels											
Receptor	FHWA Activity Category	Land Use	Units	Impact Criteria	Loudest-hour L_{eq} (dB(A))						
					Existing	Build Alt A	Build Alt B	Build Alts A/B Increase	Build Alt C	Build Alt C Increase	Impact ?
Highlighted cell indicates noise levels approaching or above NAC standards											
P1	B	SF	1	67	56	58	58	2	58	2	N
P2	B	SF	1	67	56	58	58	2	58	2	N
P3	B	SF	1	67	56	58	58	2	58	2	N
P4	B	SF	1	67	57	59	59	2	59	2	N
P5	B	SF	1	67	61	63	63	2	63	2	N
P6	B	SF	1	67	65	67	67	1	67	1	Y
P7	B	SF	1	67	53	55	55	2	55	2	N
P8	B	SF	1	67	54	56	56	2	56	2	N
P9	B	SF	1	67	56	58	58	2	58	2	N
P10	B	SF	1	67	58	60	60	2	60	2	N
P11	B	SF	1	67	62	64	64	2	64	2	N
P12	B	SF	1	67	63	65	65	2	65	2	N
P13	B	SF	1	67	61	63	63	3	63	3	N
P14	B	SF	1	67	57	58	58	1	58	1	N
P15	B	SF	1	67	53	55	55	1	55	1	N
P16	B	SF	1	67	51	53	53	2	53	2	N
P17	B	SF	1	67	50	52	52	2	52	2	N
P18	B	SF	1	67	57	59	59	2	59	2	N
P19	B	SF	1	67	54	56	56	2	56	2	N
P20	B	SF	1	67	52	54	54	2	54	2	N
P21	B	SF	1	67	51	53	53	2	53	2	N
P22	C	Rec	1	67	63	66	66	3	67	3	Y
P23	B	SF	1	67	67	70	70	3	70	3	Y
P24	B	SF	1	67	62	65	65	3	65	4	N
P25	B	MF	1	67	59	61	61	2	61	2	N
P26	B	MF	1	67	59	61	61	2	62	3	N
P27	B	SF	1	67	59	61	61	2	61	2	N

Existing (2016) and Future (2045) Traffic Noise Levels											
Receptor	FHWA Activity Category	Land Use	Units	Impact Criteria	Loudest-hour L_{eq} (dB(A))						
					Existing	Build Alt A	Build Alt B	Build Alts A/B Increase	Build Alt C	Build Alt C Increase	Impact ?
Highlighted cell indicates noise levels approaching or above NAC standards											
P28	B	SF	1	67	61	62	62	1	63	2	N
P29	B	SF	1	67	63	65	65	2	66	2	N
P30	B	SF	1	67	65	67	67	2	67	3	Y
P31	B	SF	1	67	65	68	68	2	68	3	Y
P32	B	SF	1	67	55	57	57	2	57	2	N
P33	B	SF	1	67	53	55	55	2	56	2	N
P34	B	SF	1	67	57	58	58	2	59	3	N
P35	B	SF	1	67	58	59	59	2	60	3	N
P36	B	SF	1	67	67	69	69	2	69	2	Y
P37	B	SF	1	67	68	70	70	2	70	2	Y
P38	B	SF	1	67	69	71	71	2	71	2	Y
P39	B	SF	1	67	69	71	71	2	71	2	Y
P40	B	SF	1	67	69	71	71	2	71	2	Y
P41	B	SF	1	67	70	72	72	2	72	2	Y
P42	B	SF	1	67	58	60	60	2	60	3	N
P43	B	SF	1	67	58	60	60	2	60	2	N
P44	B	SF	1	67	58	60	60	2	60	2	N
P45	B	SF	1	67	58	60	60	2	61	2	N
P46	B	SF	1	67	59	61	61	2	61	2	N
P47	B	SF	1	67	59	61	61	2	61	2	N
P48	B	SF	1	67	53	55	55	2	55	2	N
P49	B	SF	1	67	53	55	55	2	55	2	N
P50	B	SF	1	67	53	55	55	2	55	2	N
P51	B	SF	1	67	53	55	55	2	55	2	N
P52	B	SF	1	67	53	55	55	2	55	2	N
P53	B	SF	1	67	53	55	55	2	56	2	N
P54	B	SF	1	67	54	56	56	2	56	2	N
P55	B	SF	1	67	57	59	59	2	60	2	N

Existing (2016) and Future (2045) Traffic Noise Levels											
Receptor	FHWA Activity Category	Land Use	Units	Impact Criteria	Loudest-hour L_{eq} (dB(A))						
					Existing	Build Alt A	Build Alt B	Build Alts A/B Increase	Build Alt C	Build Alt C Increase	Impact ?
Highlighted cell indicates noise levels approaching or above NAC standards											
P56	B	SF	1	67	56	58	58	2	58	2	N
P57	B	SF	1	67	54	56	56	2	57	2	N
P58	B	SF	1	67	56	58	58	2	58	2	N
P59	B	SF	1	67	56	59	59	3	59	3	N
P60	B	SF	1	67	55	57	57	2	57	2	N
P61	B	SF	1	67	54	56	56	2	56	3	N
P62	B	SF	1	67	54	56	56	3	56	3	N
P63	B	SF	1	67	54	57	57	3	57	3	N
P64	B	SF	1	67	54	57	57	3	57	3	N
P65_FL1	B	MF	1	67	54	57	57	3	57	3	N
P66_FL1	B	MF	1	67	55	58	58	3	58	3	N
P67_FL1	B	MF	1	67	52	55	55	3	55	3	N
P68_FL1	B	MF	1	67	53	56	56	3	56	3	N
P69_FL2	B	MF	1	67	67	71	71	4	71	4	Y
P70_FL2	B	MF	1	67	69	73	73	4	73	4	Y
P71_FL2	B	MF	1	67	67	71	71	4	71	4	Y
P72_FL2	B	MF	1	67	69	73	73	4	73	4	Y
P73	B	SF	1	67	63	67	67	4	67	4	Y
P74	B	SF	1	67	60	64	64	4	64	4	N
P75	B	SF	1	67	57	61	61	3	61	3	N
P76	B	SF	1	67	57	60	60	3	60	3	N
P77	B	MF	2	67	58	61	61	3	61	3	N
P78_FL2	B	MF	1	67	57	60	60	3	60	3	N
P79_FL2	B	MF	1	67	57	60	60	3	60	3	N
P80_FL2	B	MF	1	67	58	61	61	3	60	3	N
P81_FL2	B	MF	1	67	58	61	61	3	61	3	N
P82_FL2	B	MF	1	67	54	57	57	3	57	3	N
P83_FL2	B	MF	1	67	54	57	57	3	57	3	N

Existing (2016) and Future (2045) Traffic Noise Levels											
Receptor	FHWA Activity Category	Land Use	Units	Impact Criteria	Loudest-hour L_{eq} (dB(A))						
					Existing	Build Alt A	Build Alt B	Build Alts A/B Increase	Build Alt C	Build Alt C Increase	Impact ?
Highlighted cell indicates noise levels approaching or above NAC standards											
P84_FL2	B	MF	1	67	55	58	58	3	58	3	N
P85_FL2	B	MF	1	67	55	58	58	3	58	3	N
P86_FL3	B	MF	1	67	59	62	62	3	62	3	N
P87_FL3	B	MF	1	67	59	62	62	3	62	3	N
P88_FL3	B	MF	1	67	60	62	62	3	62	3	N
P89_FL3	B	MF	1	67	60	63	63	3	63	3	N
P90_FL3	B	MF	1	67	56	59	59	3	59	3	N
P91_FL3	B	MF	1	67	57	60	60	3	60	3	N
P92_FL3	B	MF	1	67	57	60	60	3	60	3	N
P93_FL3	B	MF	1	67	58	61	61	3	61	3	N
P94_FL2	B	MF	1	67	70	73	73	4	73	4	Y
P95_FL2	B	MF	1	67	70	73	73	4	73	4	Y
P96_FL2	B	MF	1	67	54	57	57	3	57	3	N
P97_FL2	B	MF	1	67	52	55	55	3	55	3	N
P98_FL2	B	MF	1	67	70	73	73	3	73	3	Y
P99_FL2	B	MF	1	67	70	73	73	3	73	3	Y
P100_FL2	B	MF	1	67	51	54	54	3	54	3	N
P101_FL2	B	MF	1	67	51	54	54	3	54	3	N
P102_FL2	B	MF	1	67	70	73	73	3	73	3	Y
P103_FL2	B	MF	1	67	70	73	73	3	73	3	Y
P104_FL2	B	MF	1	67	53	56	56	3	56	3	N
P105_FL2	B	MF	1	67	55	58	58	3	58	3	N
P106_FL3	B	MF	1	67	70	74	74	3	74	3	Y
P107_FL3	B	MF	1	67	70	74	74	3	74	3	Y
P108_FL3	B	MF	1	67	58	61	61	3	61	3	N
P109_FL3	B	MF	1	67	57	60	60	3	60	3	N
P110_FL3	B	MF	1	67	71	74	74	3	74	3	Y
P111_FL3	B	MF	1	67	71	74	74	3	74	3	Y

Existing (2016) and Future (2045) Traffic Noise Levels											
Receptor	FHWA Activity Category	Land Use	Units	Impact Criteria	Loudest-hour L_{eq} (dB(A))						
					Existing	Build Alt A	Build Alt B	Build Alts A/B Increase	Build Alt C	Build Alt C Increase	Impact ?
Highlighted cell indicates noise levels approaching or above NAC standards											
P112_FL3	B	MF	1	67	56	59	59	3	59	3	N
P113_FL3	B	MF	1	67	56	59	59	3	59	3	N
P114_FL3	B	MF	1	67	71	74	74	3	74	3	Y
P115_FL3	B	MF	1	67	71	74	74	3	74	3	Y
P116_FL3	B	MF	1	67	57	60	60	3	60	3	N
P117_FL3	B	MF	1	67	59	63	63	3	63	3	N
P118_FL3	B	MF	1	67	68	72	72	3	72	3	Y
P119_FL3	B	MF	1	67	70	73	73	3	73	3	Y
P120_FL3	B	MF	1	67	68	72	72	3	72	3	Y
P121_FL3	B	MF	1	67	70	73	73	3	73	3	Y
P122	B	MF	2	67	55	58	58	3	58	3	N
P123	B	SF	1	67	58	64	64	5	63	5	N
P124	B	SF	1	67	54	60	60	5	59	5	N
P125	B	SF	1	67	56	60	60	3	59	3	N
P126_FL1	B	MF	1	67	50	53	53	3	53	2	N
P127_FL1	B	MF	1	67	50	53	53	3	53	2	N
P128_FL2	B	MF	1	67	54	56	56	2	56	2	N
P129_FL2	B	MF	1	67	54	57	57	3	57	3	N
P130	D	Sch	1	52	42	44	44	2	44	2	N
P131	D	Ch	1	52	38	40	41	3	40	2	N
P132	C	Ch	1	67	56	59	59	3	59	2	N
P133	C	MF	1	67	52	54	54	3	54	2	N
P134	C	Rec	1	67	57	60	60	3	59	2	N
P135	C	Rec	1	67	50	53	53	3	52	2	N

Appendix D

Noise Measurement Data

Figure D-1. Site M1

Figure D-2. Site M2

Figure D-3. Site M3

Figure D-4. Site M4

Project:	41 Street Corridor Study
Job #:	10029213
Analyst:	RAM
Sites:	M1-M4
Location:	Sioux Falls, SD
Date:	12/1/16- 12/2/16

						MEASURED	PREDICTED	
Site	**Address**	**Date**	**Time Start**	**Duration**	**Total Leq, dBA**	**Traffic Only Leq, dBA**	**TNM Leq**	**Difference**
M1	3201 Marion Rd	1-Dec-16	15:03	15	65	64.9	63.5	***-1.4***
M2	5005 W 40th St	1-Dec-16	16:02	15	63	63.4	64.3	***0.9***
M3	4801 W 41st Street	2-Dec-16	8:31	15	62	61.8	61.5	***-0.3***
M4	3000 S Mayfair Dr	2-Dec-16	9:26	15	69	69.1	71.0	1.9
							Average	0.3
							Standard Deviation	1.4

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

Reading: M1

Project Description: 10029213; SDDOT 41st St Corridor

Noise Source: Marion Rd Date: 12/1/16 Personnel: RAM

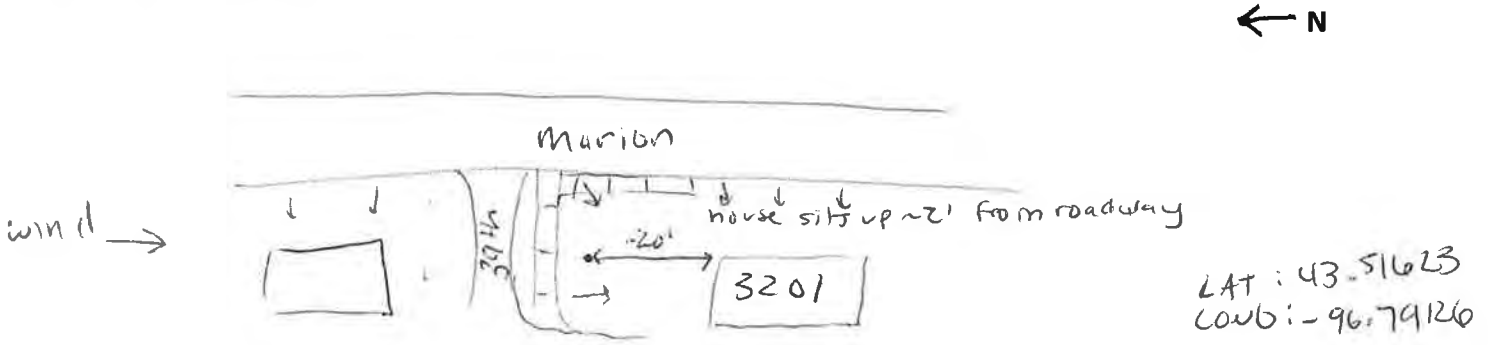
Equipment	Type	Serial #
Sound Level Meter	LD 824	824A3204
Microphone/Preamp	LD 2541/LD PRM902	4652/3380
Calibrator	LD Cal 200	3722

SLM SETTINGS (circle one) FAST (SLOW)

WEIGHTING (circle one) (A) Lin.

Location Description: SF, 3201 S Marion Rd

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:



Start Time: 15:03 AM (PM) Stop Time: 15:19 AM (PM) Duration: 16 min

Wind Speed: 0-5 mph, some gusts up to 10mph Wind Direction: ~~South~~ NNW

Temperature: 34°F Humidity: 84%

Calibration results before: ~~Chk~~ 114.0 dBA and after 113.9 dBA

Traffic Count Roadway: Marion Rd

	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
14:21 NB	32	1	0	0	0
15:24 NB	47	1	0	0	0
14:20 SB	28	0	0	#2	0
15:30 SB	42	0	0	0	0

SL: 35 mph

*Note roadway direction in table

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

PROJECT: SDDOT 41st St Corridor

JOB NO.: 10029213

SITE/READING NO.: M1 PERSONNEL: RAM

LOCATION/ADDRESS: 3201 S Marion Rd DATE: 12/1 1 16

#	1 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Other Noise Sources	COMMENTS ~~(Include Calibration Data)~~
1	~~14:45~~				
2	46				
3	~~49~~				
4	48				
5	49				
6	50				
7	~~51~~				
8	52				
9	53				
10	54				
11	~~55~~				
12	56				
13	57				
14	~~58~~				
15	~~59~~				
16	15:03	64.2			
17	04	65.6			
18	05	65.4			
19	06	64.7			
20	07	65.5			
21	08	65.6			
22	09	64.9			
23	10	63.7			
24	11	65.4		resident on 39th (car)	resident garage door
25	12	62.2			
26	13	64.7			
27	14	63.9			
28	15	64.9			
29	16	65.8		School bus	
30	17	66.3			

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

18 66.7 fast car NB

Site Number	M1
Location:	3201 Marion Rd
Date:	1-Dec-16
Start Time:	15:03
Duration	15

Minute	**Leq**	**Exclude from Traffic-Only**	**Exclude from Overall**	**Energy**	**Traffic-Only Leq**	**Overall Leq**
15:03	64.2			2630267.992	2630267.992	2630267.992
15:04	65.6			3630780.548	3630780.548	3630780.548
15:05	65.4			3467368.505	3467368.505	3467368.505
15:06	64.7			2951209.227	2951209.227	2951209.227
15:07	65.5			3548133.892	3548133.892	3548133.892
15:08	65.6			3630780.548	3630780.548	3630780.548
15:09	64.9			3090295.433	3090295.433	3090295.433
15:10	63.7			2344228.815	2344228.815	2344228.815
15:11	65.4			3467368.505	3467368.505	3467368.505
15:12	62.1			1621810.097	1621810.097	1621810.097
15:13	64.6			2884031.503	2884031.503	2884031.503
15:14	63.9			2454708.916	2454708.916	2454708.916
15:15	64.9			3090295.433	3090295.433	3090295.433
15:16	65.8			3801893.963	3801893.963	3801893.963
15:17	66.3			4265795.188	4265795.188	4265795.188
15:18	66.7	x	x	4677351.413	0	0
15:19				0	0	0
15:20				0	0	0
15:21				0	0	0
15:22				0	0	0
15:23				0	0	0
15:24				0	0	0
15:25				0	0	0
15:26				0	0	0
15:27				0	0	0
15:28				0	0	0
15:29				0	0	0
15:30				0	0	0
15:31				0	0	0
15:32				0	0	0
15:33				0	0	0
15:34				0	0	0
					Traffic-only Leq	**64.9**
					Overall Leq	**64.9**

Traffic Counts

Msmt #	Roadway	Direction	VehicleType	Total_Lookup	VehType_Lookup	Start_Time	Duration	Count	Speed
M1	Marion Rd	NB	A	M1_Marion Rd_NB	M1_Marion Rd_NB_A	14:21	5	32	35
M1	Marion Rd	NB	MT	M1_Marion Rd_NB	M1_Marion Rd_NB_MT		5	1	35
M1	Marion Rd	NB	HT	M1_Marion Rd_NB	M1_Marion Rd_NB_HT		5	0	35
M1	Marion Rd	NB	Bus	M1_Marion Rd_NB	M1_Marion Rd_NB_Bus		5	0	35
M1	Marion Rd	NB	Moto	M1_Marion Rd_NB	M1_Marion Rd_NB_Moto		5	0	35
M1	Marion Rd	SB	A	M1_Marion Rd_SB	M1_Marion Rd_SB_A	14:27	5	28	35
M1	Marion Rd	SB	MT	M1_Marion Rd_SB	M1_Marion Rd_SB_MT		5	0	35
M1	Marion Rd	SB	HT	M1_Marion Rd_SB	M1_Marion Rd_SB_HT		5	0	35
M1	Marion Rd	SB	Bus	M1_Marion Rd_SB	M1_Marion Rd_SB_Bus		5	2	35
M1	Marion Rd	SB	Moto	M1_Marion Rd_SB	M1_Marion Rd_SB_Moto		5	0	35
M1	Marion Rd	NB	A	M1_Marion Rd_NB	M1_Marion Rd_NB_A	15:24	5	47	35
M1	Marion Rd	NB	MT	M1_Marion Rd_NB	M1_Marion Rd_NB_MT		5	1	35
M1	Marion Rd	NB	HT	M1_Marion Rd_NB	M1_Marion Rd_NB_HT		5	0	35
M1	Marion Rd	NB	Bus	M1_Marion Rd_NB	M1_Marion Rd_NB_Bus		5	0	35
M1	Marion Rd	NB	Moto	M1_Marion Rd_NB	M1_Marion Rd_NB_Moto		5	0	35
M1	Marion Rd	SB	A	M1_Marion Rd_SB	M1_Marion Rd_SB_A	15:30	5	42	35
M1	Marion Rd	SB	MT	M1_Marion Rd_SB	M1_Marion Rd_SB_MT		5	0	35
M1	Marion Rd	SB	HT	M1_Marion Rd_SB	M1_Marion Rd_SB_HT		5	0	35
M1	Marion Rd	SB	Bus	M1_Marion Rd_SB	M1_Marion Rd_SB_Bus		5	0	35
M1	Marion Rd	SB	Moto	M1_Marion Rd_SB	M1_Marion Rd_SB_Moto		5	0	35

A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto
A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto

TNM Input Table

Msmt #	Roadway	Direction	VehicleType	Lookup	Lookup	Total_Duration	Total_Type_Count	Avg_Speed	**Hour_Count**	**Speed**	1/2 Count	
M1	Marion Rd	NB	A	M1_Marion Rd_NB	M1_Marion Rd_NB_A	10	79	35	474	35	237	35
M1	Marion Rd	NB	MT	M1_Marion Rd_NB	M1_Marion Rd_NB_MT	10	2	35	12	35	6	35
M1	Marion Rd	NB	HT	M1_Marion Rd_NB	M1_Marion Rd_NB_HT	10	0	35	0	0	0	0
M1	Marion Rd	NB	Bus	M1_Marion Rd_NB	M1_Marion Rd_NB_Bus	10	0	35	0	0	0	0
M1	Marion Rd	NB	Moto	M1_Marion Rd_NB	M1_Marion Rd_NB_Moto	10	0	35	0	0	0	0
M1	Marion Rd	SB	A	M1_Marion Rd_SB	M1_Marion Rd_SB_A	10	70	35	420	35	210	35
M1	Marion Rd	SB	MT	M1_Marion Rd_SB	M1_Marion Rd_SB_MT	10	0	35	0	0	0	0
M1	Marion Rd	SB	HT	M1_Marion Rd_SB	M1_Marion Rd_SB_HT	10	0	35	0	0	0	0
M1	Marion Rd	SB	Bus	M1_Marion Rd_SB	M1_Marion Rd_SB_Bus	10	2	35	12	35	6	35
M1	Marion Rd	SB	Moto	M1_Marion Rd_SB	M1_Marion Rd_SB_Moto	10	0	35	0	0	0	0
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

Reading: M2

Project Description: 10029213; SDDOT 41st St Corridor

Noise Source: 41st St Date: 12/1/16 Personnel: RAM

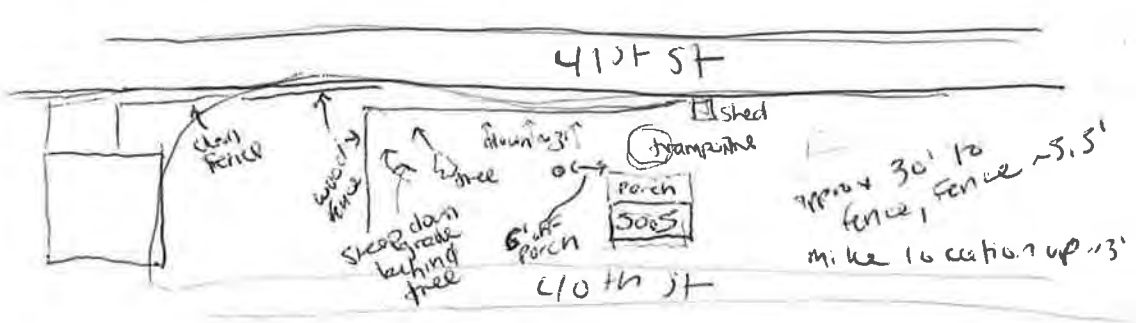
Equipment	Type	Serial #
Sound Level Meter	LD 824	824A3204
Microphone/Preamp	LD 2541/LD PRM902	4652/3380
Calibrator	LD Cal 200	3722

SLM SETTINGS (circle one) FAST (SLOW)

WEIGHTING (circle one) (A) Lin.

Location Description: SF, 5005 W 40th St

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:



N

LAT: 43.51516
LONG: -96.75913

Start Time: 16:02 AM (PM)

Stop Time: 16:19 AM (PM)

Duration: 17 min

Wind Speed: 0-5 mph

Wind Direction: NNW

Temperature: 33°F

Humidity: 88%

Calibration results before: 114.0 dBA and after 114.0 dBA

Traffic Count Roadway: 41st St

Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB 15:44 67	0	1	0	0
14:27 66	0	0	0	0
WB 15:50 112	0	0	0	0
14:33 123	0	6	0	6

SL: 35mph

*Note roadway direction in table

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

PROJECT: SDDOT 41st St Corridor

JOB NO.: 10029213

SITE/READING NO.: M2

PERSONNEL: RAM

LOCATION/ADDRESS: 5005 W 40th St

DATE: 12/1/16

#	1 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Other Noise Sources	COMMENTS (~~Include Calibration~~ Data)
1	16:02	62.5			
2	16:03	66.4			
3	04	61.4			
4	05	62.7			
5	06	62.8			
6	07	63.6			
7	08	62.4			
8	09	62.1			
9	10	65.3			
10	11	62.7			
11	12	63.3			
12	13	62.7			
13	14	64.2			
14	15	63.7			
15	16	62.4		mcl trk EB	
16	17	63.0			
17	18	63.5			
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

Site Number	M2
Location:	5005 W 40th St
Date:	1-Dec-16
Start Time:	16:02
Duration	15

Minute	Leq	Exclude from Traffic-Only	Exclude from Overall	Energy	Traffic-Only Leq	Overall Leq
16:02	62.5			1778279.41	1778279.41	1778279.41
16:03	66.4			4365158.322	4365158.322	4365158.322
16:04	61.4			1380384.265	1380384.265	1380384.265
16:05	62.7			1862087.137	1862087.137	1862087.137
16:06	62.8			1905460.718	1905460.718	1905460.718
16:07	63.6			2290867.653	2290867.653	2290867.653
16:08	62.4			1737800.829	1737800.829	1737800.829
16:09	62.1			1621810.097	1621810.097	1621810.097
16:10	65.3			3388441.561	3388441.561	3388441.561
16:11	62.7			1862087.137	1862087.137	1862087.137
16:12	63.3			2137962.09	2137962.09	2137962.09
16:13	62.7			1862087.137	1862087.137	1862087.137
16:14	64.2			2630267.992	2630267.992	2630267.992
16:15	63.7			2344228.815	2344228.815	2344228.815
16:16	62.4			1737800.829	1737800.829	1737800.829
16:17	63	x	x	1995262.315	0	0
16:18	63.5	x	x	2238721.139	0	0
16:19				0	0	0
16:20				0	0	0
16:21				0	0	0
16:22				0	0	0
16:23				0	0	0
16:24				0	0	0
16:25				0	0	0
16:26				0	0	0
16:27				0	0	0
16:28				0	0	0
16:29				0	0	0
16:30				0	0	0
16:31				0	0	0
16:32				0	0	0
16:33				0	0	0
					Traffic-only Leq	**63.4**
					Overall Leq	**63.4**

Traffic Counts

Msmt #	Roadway	Direction	VehicleType	Total_Lookup	VehType_Lookup	Start_Time	Duration	Count	Speed
M2	41st Street	EB	A	M2_41st Street_EB	M2_41st Street_EB_A	15:44	5	67	35
M2	41st Street	EB	MT	M2_41st Street_EB	M2_41st Street_EB_MT		5	1	35
M2	41st Street	EB	HT	M2_41st Street_EB	M2_41st Street_EB_HT		5	1	35
M2	41st Street	EB	Bus	M2_41st Street_EB	M2_41st Street_EB_Bus		5	0	35
M2	41st Street	EB	Moto	M2_41st Street_EB	M2_41st Street_EB_Moto		5	0	35
M2	41st Street	WB	A	M2_41st Street_WB	M2_41st Street_WB_A	15:50	5	112	35
M2	41st Street	WB	MT	M2_41st Street_WB	M2_41st Street_WB_MT		5	0	35
M2	41st Street	WB	HT	M2_41st Street_WB	M2_41st Street_WB_HT		5	0	35
M2	41st Street	WB	Bus	M2_41st Street_WB	M2_41st Street_WB_Bus		5	0	35
M2	41st Street	WB	Moto	M2_41st Street_WB	M2_41st Street_WB_Moto		5	0	35
M2	41st Street	EB	A	M2_41st Street_EB	M2_41st Street_EB_A	16:27	5	66	35
M2	41st Street	EB	MT	M2_41st Street_EB	M2_41st Street_EB_MT		5	0	35
M2	41st Street	EB	HT	M2_41st Street_EB	M2_41st Street_EB_HT		5	0	35
M2	41st Street	EB	Bus	M2_41st Street_EB	M2_41st Street_EB_Bus		5	0	35
M2	41st Street	EB	Moto	M2_41st Street_EB	M2_41st Street_EB_Moto		5	0	35
M2	41st Street	WB	A	M2_41st Street_WB	M2_41st Street_WB_A	16:33	5	123	35
M2	41st Street	WB	MT	M2_41st Street_WB	M2_41st Street_WB_MT		5	0	35
M2	41st Street	WB	HT	M2_41st Street_WB	M2_41st Street_WB_HT		5	0	35
M2	41st Street	WB	Bus	M2_41st Street_WB	M2_41st Street_WB_Bus		5	0	35
M2	41st Street	WB	Moto	M2_41st Street_WB	M2_41st Street_WB_Moto		5	0	35

A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto
A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto

TNM Input Table

Msmt #	Roadway	Direction	VehicleType	Lookup	Lookup	Total_Duration	Total_Type_Count	Avg_Speed	**Hour_Count**	**Speed**	1/2 Count	
M2	41st Street	EB	A	M2_41st Street_EB	M2_41st Street_EB_A	10	133	35	798	35	399	35
M2	41st Street	EB	MT	M2_41st Street_EB	M2_41st Street_EB_MT	10	1	35	6	35	3	35
M2	41st Street	EB	HT	M2_41st Street_EB	M2_41st Street_EB_HT	10	1	35	6	35	3	35
M2	41st Street	EB	Bus	M2_41st Street_EB	M2_41st Street_EB_Bus	10	0	35	0	0	0	0
M2	41st Street	EB	Moto	M2_41st Street_EB	M2_41st Street_EB_Moto	10	0	35	0	0	0	0
M2	41st Street	WB	A	M2_41st Street_WB	M2_41st Street_WB_A	10	235	35	1410	35	705	35
M2	41st Street	WB	MT	M2_41st Street_WB	M2_41st Street_WB_MT	10	0	35	0	0	0	0
M2	41st Street	WB	HT	M2_41st Street_WB	M2_41st Street_WB_HT	10	0	35	0	0	0	0
M2	41st Street	WB	Bus	M2_41st Street_WB	M2_41st Street_WB_Bus	10	0	35	0	0	0	0
M2	41st Street	WB	Moto	M2_41st Street_WB	M2_41st Street_WB_Moto	10	0	35	0	0	0	0
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

Reading: M3

Project Description: 10029213; SDDOT 41st St Corridor

Noise Source: 41st St Date: 12/2/16 Personnel: RAM

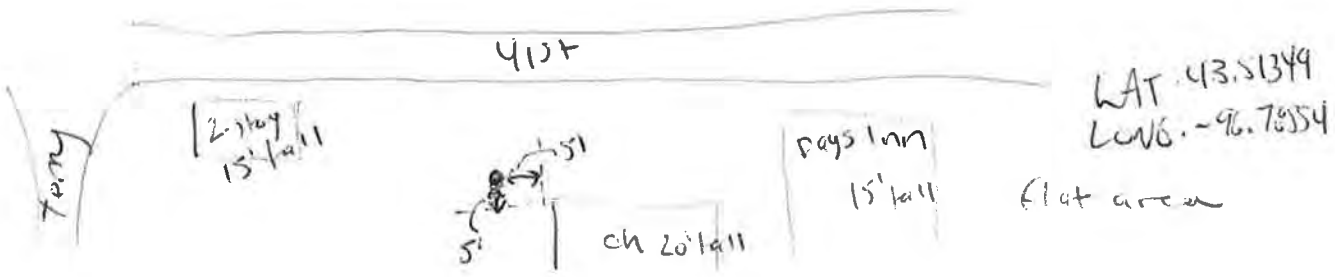
Equipment	Type	Serial #
Sound Level Meter	LD 824	824A3204
Microphone/Preamp	LD 2541/LD PRM902	4652/3380
Calibrator	LD Cal 200	3722

SLM SETTINGS (circle one) FAST (SLOW)

WEIGHTING (circle one) (A) Lin.

Location Description: Church, 4901 W 41st St

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:



Start Time: 8:31 (AM) PM

Stop Time: 8:49 (AM) PM

Duration: 18

Wind Speed: 0-5 mph Wind Direction: NNE

Temperature: 31°F Humidity: 87%

Calibration results before: 114.0 dBA and after 113.8 dBA

Traffic Count Roadway: 41st Street

	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
EB 8:14	93	0	0	0	0
8:55	64	0	0	1	0
WB 8:20	48	0	0	0	0
9:00	51	1	0	1	0

Spd Limit - 35mph

*Note roadway direction in table

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

PROJECT: SDDOT 41st St Corridor

JOB NO.: 10029213

SITE/READING NO.: M3 PERSONNEL: RAM

LOCATION/ADDRESS: 4801 W 41st St, Sunnycrest Church DATE: 12/2/16

#	1 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Other Noise Sources	COMMENTS (~~Include Calibration Data~~)
1	8:31	61.2		overflight - prop during first interval, barely audible	
2	32	62.4			trk "clang" @ gas station
3	33	63.6	?	hvy trk on Tony to 41st EB, hvy WB	
4	34	62.7		loud pickup WB	
5	35	60.2			
6	36	61.9			
7	37	61.4			rev engine on Tony audible
8	38	62.3		bus/md trk EB, bus WB	
9	39	60.7			
10	40	62.6		hvy EB	
11	41	63.7		cars turning off Tony to 41st EB	loud pickup EB
12	42	62.4		bus WB to Tony	
13	43	61.8			
14	44	60.4			
15	45	62.5			
16	46	61.5		bus on Tony, lets people off	
17	47	61.2		bus to 41st EB	
18	48	62.3		md trk WB	
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

Site Number	M3
Location:	4801 W 41st Street
Date:	2-Dec-16
Start Time:	8:31
Duration	15

Minute	Leq	Exclude from Traffic-Only	Exclude from Overall	Energy	Traffic-Only Leq	Overall Leq
8:31	61.2	x	x	1318256.739	0	0
8:32	62.4	x	x	1737800.829	0	0
8:33	63.6	x	x	2290867.653	0	0
8:34	62.7			1862087.137	1862087.137	1862087.137
8:35	60.2			1047128.548	1047128.548	1047128.548
8:36	61.9			1548816.619	1548816.619	1548816.619
8:37	61.4			1380384.265	1380384.265	1380384.265
8:38	62.3			1698243.652	1698243.652	1698243.652
8:39	60.7			1174897.555	1174897.555	1174897.555
8:40	62.6			1819700.859	1819700.859	1819700.859
8:41	63.7	x		2344228.815	0	2344228.815
8:42	62.4			1737800.829	1737800.829	1737800.829
8:43	61.8			1513561.248	1513561.248	1513561.248
8:44	60.4			1096478.196	1096478.196	1096478.196
8:45	62.5			1778279.41	1778279.41	1778279.41
8:46	61.5			1412537.545	1412537.545	1412537.545
8:47	61.2			1318256.739	1318256.739	1318256.739
8:48	62.3			1698243.652	1698243.652	1698243.652
8:49				0	0	0
8:50				0	0	0
8:51				0	0	0
8:52				0	0	0
8:53				0	0	0
8:54				0	0	0
8:55				0	0	0
8:56				0	0	0
8:57				0	0	0
8:58				0	0	0
8:59				0	0	0
9:00				0	0	0
9:01				0	0	0
9:02				0	0	0
					Traffic-only Leq	**61.8**
					Overall Leq	**61.9**

Traffic Counts

Msmt #	Roadway	Direction	VehicleType	Total_Lookup	VehType_Lookup	Start_Time	Duration	Count	Speed
M3	41st Street	EB	A	M3_41st Street_EB	M3_41st Street_EB_A	8:14	5	93	35
M3	41st Street	EB	MT	M3_41st Street_EB	M3_41st Street_EB_MT		5	1	35
M3	41st Street	EB	HT	M3_41st Street_EB	M3_41st Street_EB_HT		5	2	35
M3	41st Street	EB	Bus	M3_41st Street_EB	M3_41st Street_EB_Bus		5	0	35
M3	41st Street	EB	Moto	M3_41st Street_EB	M3_41st Street_EB_Moto		5	0	35
M3	41st Street	WB	A	M3_41st Street_WB	M3_41st Street_WB_A	8:20	5	48	35
M3	41st Street	WB	MT	M3_41st Street_WB	M3_41st Street_WB_MT		5	0	35
M3	41st Street	WB	HT	M3_41st Street_WB	M3_41st Street_WB_HT		5	1	35
M3	41st Street	WB	Bus	M3_41st Street_WB	M3_41st Street_WB_Bus		5	0	35
M3	41st Street	WB	Moto	M3_41st Street_WB	M3_41st Street_WB_Moto		5	0	35
M3	41st Street	EB	A	M3_41st Street_EB	M3_41st Street_EB_A	8:55	5	64	35
M3	41st Street	EB	MT	M3_41st Street_EB	M3_41st Street_EB_MT		5	0	35
M3	41st Street	EB	HT	M3_41st Street_EB	M3_41st Street_EB_HT		5	0	35
M3	41st Street	EB	Bus	M3_41st Street_EB	M3_41st Street_EB_Bus		5	1	35
M3	41st Street	EB	Moto	M3_41st Street_EB	M3_41st Street_EB_Moto		5	0	35
M3	41st Street	WB	A	M3_41st Street_WB	M3_41st Street_WB_A	9:00	5	51	35
M3	41st Street	WB	MT	M3_41st Street_WB	M3_41st Street_WB_MT		5	1	35
M3	41st Street	WB	HT	M3_41st Street_WB	M3_41st Street_WB_HT		5	0	35
M3	41st Street	WB	Bus	M3_41st Street_WB	M3_41st Street_WB_Bus		5	1	35
M3	41st Street	WB	Moto	M3_41st Street_WB	M3_41st Street_WB_Moto		5	0	35

A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto
A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto

TNM Input Table

Msmt #	Roadway	Direction	VehicleType	Lookup	Lookup	Total_Duration	Total_Type_Count	Avg_Speed	**Hour_Count**	**Speed**	1/2 Count	
M3	41st Street	EB	A	M3_41st Street_EB	M3_41st Street_EB_A	10	157	35	942	35	471	35
M3	41st Street	EB	MT	M3_41st Street_EB	M3_41st Street_EB_MT	10	1	35	6	35	3	35
M3	41st Street	EB	HT	M3_41st Street_EB	M3_41st Street_EB_HT	10	2	35	12	35	6	35
M3	41st Street	EB	Bus	M3_41st Street_EB	M3_41st Street_EB_Bus	10	1	35	6	35	3	35
M3	41st Street	EB	Moto	M3_41st Street_EB	M3_41st Street_EB_Moto	10	0	35	0	0	0	0
M3	41st Street	WB	A	M3_41st Street_WB	M3_41st Street_WB_A	10	99	35	594	35	297	35
M3	41st Street	WB	MT	M3_41st Street_WB	M3_41st Street_WB_MT	10	1	35	6	35	3	35
M3	41st Street	WB	HT	M3_41st Street_WB	M3_41st Street_WB_HT	10	1	35	6	35	3	35
M3	41st Street	WB	Bus	M3_41st Street_WB	M3_41st Street_WB_Bus	10	1	35	6	35	3	35
M3	41st Street	WB	Moto	M3_41st Street_WB	M3_41st Street_WB_Moto	10	0	35	0	0	0	0
			A	__	___A	0	0	0	#DIV/0!	#DIV/0!		
			MT	__	___MT	0	0	0	#DIV/0!	#DIV/0!		
			HT	__	___HT	0	0	0	#DIV/0!	#DIV/0!		
			Bus	__	___Bus	0	0	0	#DIV/0!	#DIV/0!		
			Moto	__	___Moto	0	0	0	#DIV/0!	#DIV/0!		
			A	__	___A	0	0	0	#DIV/0!	#DIV/0!		
			MT	__	___MT	0	0	0	#DIV/0!	#DIV/0!		
			HT	__	___HT	0	0	0	#DIV/0!	#DIV/0!		
			Bus	__	___Bus	0	0	0	#DIV/0!	#DIV/0!		
			Moto	__	___Moto	0	0	0	#DIV/0!	#DIV/0!		
			A	__	___A	0	0	0	#DIV/0!	#DIV/0!		
			MT	__	___MT	0	0	0	#DIV/0!	#DIV/0!		
			HT	__	___HT	0	0	0	#DIV/0!	#DIV/0!		
			Bus	__	___Bus	0	0	0	#DIV/0!	#DIV/0!		
			Moto	__	___Moto	0	0	0	#DIV/0!	#DIV/0!		
			A	__	___A	0	0	0	#DIV/0!	#DIV/0!		
			MT	__	___MT	0	0	0	#DIV/0!	#DIV/0!		
			HT	__	___HT	0	0	0	#DIV/0!	#DIV/0!		
			Bus	__	___Bus	0	0	0	#DIV/0!	#DIV/0!		
			Moto	__	___Moto	0	0	0	#DIV/0!	#DIV/0!		

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

Reading: M4

Project Description: 10029213; SDDOT 41st St Corridor

Noise Source: I-29 Date: 12/2/16 Personnel: RAM

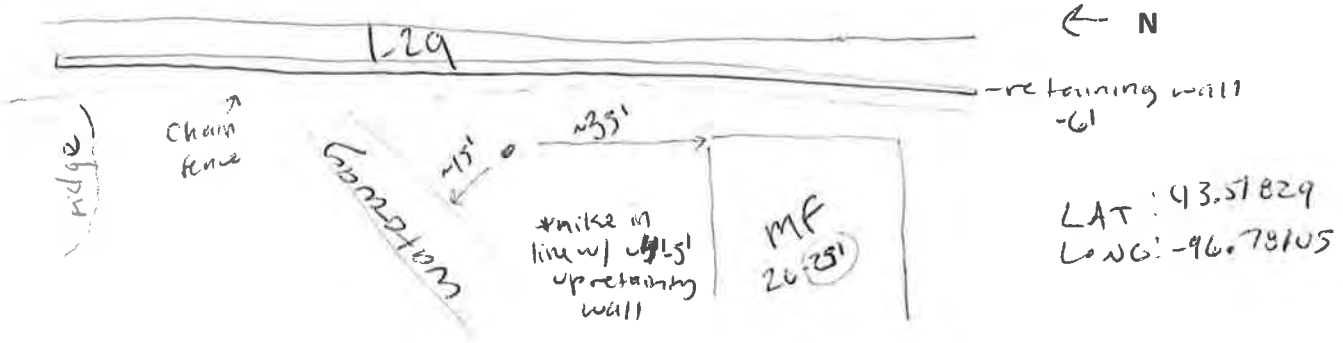
Equipment	Type	Serial #
Sound Level Meter	LD 824	824A3204
Microphone/Preamp	LD 2541/LD PRM902	4652/3380
Calibrator	LD Cal 200	3722

SLM SETTINGS (circle one) FAST (SLOW)

WEIGHTING (circle one) (A) Lin.

Location Description: MF, 3000 S May Fair Dr

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:



Start Time: 9:26 (AM) PM Stop Time: 9:42 (AM) PM Duration: 16

Wind Speed: 0-5 mph Wind Direction: NNE

Temperature: 31°F Humidity: 87%

Calibration results before: 114.0 dBA and after 113.9 dBA

Traffic Count Roadway: I-29

	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
NB 9:10	105	3	14	1 1	0
9:51	69	2	9	2	0
SB 9:10	70	2	9	0	0
9:57	100	0	8	0	0

SL: 65 mph driving 70 mph

*Note roadway direction in table

HDR

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET

PROJECT: SDDOT 41st St Corridor

JOB NO.: 10029213

SITE/READING NO.: M4 PERSONNEL: RAM

LOCATION/ADDRESS: 3000 S Mayfair Dr DATE: 12/2/16

#	1 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Other Noise Sources	COMMENTS ~~(Include Calibration Data)~~
1	9:26	69.8			
2	27	66.7			
3	28	68.2			
4	29	67.1			
5	30	67.7			
6	31	69.3			
7	32	71.2			
8	33	70.3			
9	34	70.0			
10	35	69.3		[illegible] w/ recurring wheel banging	
11	36	70.2		sound	
12	37	68.7		bus SB	
13	38	68.1			
14	39	69.6		loud muffler huy hrd, prop overflight	
15	40	67.4			
16	41	70.0			
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

Site Number	M4
Location:	3000 S Mayfair Dr
Date:	2-Dec-16
Start Time:	9:26
Duration	15

Minute	Leq	Exclude from Traffic-Only	Exclude from Overall	Energy	Traffic-Only Leq	Overall Leq
9:26	69.8	x	x	9549925.86	0	0
9:27	66.7			4677351.413	4677351.413	4677351.413
9:28	68.2			6606934.48	6606934.48	6606934.48
9:29	67.1			5128613.84	5128613.84	5128613.84
9:30	67.7			5888436.554	5888436.554	5888436.554
9:31	69.3			8511380.382	8511380.382	8511380.382
9:32	71.2			13182567.39	13182567.39	13182567.39
9:33	70.3			10715193.05	10715193.05	10715193.05
9:34	70			10000000	10000000	10000000
9:35	69.3			8511380.382	8511380.382	8511380.382
9:36	70.2			10471285.48	10471285.48	10471285.48
9:37	68.6			7244359.601	7244359.601	7244359.601
9:38	68.1			6456542.29	6456542.29	6456542.29
9:39	69.6			9120108.394	9120108.394	9120108.394
9:40	67.4			5495408.739	5495408.739	5495408.739
9:41	70			10000000	10000000	10000000
9:42				0	0	0
9:43				0	0	0
9:44				0	0	0
9:45				0	0	0
9:46				0	0	0
9:47				0	0	0
9:48				0	0	0
9:49				0	0	0
9:50				0	0	0
9:51				0	0	0
9:52				0	0	0
9:53				0	0	0
9:54				0	0	0
9:55				0	0	0
9:56				0	0	0
9:57				0	0	0
					Traffic-only Leq	**69.1**
					Overall Leq	**69.1**

Traffic Counts

Msmt #	Roadway	Direction	VehicleType	Total_Lookup	VehType_Lookup	Start_Time	Duration	Count	Speed
M4	I-29	NB	A	M4_I-29_NB	M4_I-29_NB_A	9:10	5	105	65
M4	I-29	NB	MT	M4_I-29_NB	M4_I-29_NB_MT		5	3	65
M4	I-29	NB	HT	M4_I-29_NB	M4_I-29_NB_HT		5	14	65
M4	I-29	NB	Bus	M4_I-29_NB	M4_I-29_NB_Bus		5	1	65
M4	I-29	NB	Moto	M4_I-29_NB	M4_I-29_NB_Moto		5	0	65
M4	I-29	SB	A	M4_I-29_SB	M4_I-29_SB_A	9:16	5	70	65
M4	I-29	SB	MT	M4_I-29_SB	M4_I-29_SB_MT		5	2	65
M4	I-29	SB	HT	M4_I-29_SB	M4_I-29_SB_HT		5	9	65
M4	I-29	SB	Bus	M4_I-29_SB	M4_I-29_SB_Bus		5	0	65
M4	I-29	SB	Moto	M4_I-29_SB	M4_I-29_SB_Moto		5	0	65
M4	I-29	NB	A	M4_I-29_NB	M4_I-29_NB_A	9:51	5	67	65
M4	I-29	NB	MT	M4_I-29_NB	M4_I-29_NB_MT		5	2	65
M4	I-29	NB	HT	M4_I-29_NB	M4_I-29_NB_HT		5	9	65
M4	I-29	NB	Bus	M4_I-29_NB	M4_I-29_NB_Bus		5	2	65
M4	I-29	NB	Moto	M4_I-29_NB	M4_I-29_NB_Moto		5	0	65
M4	I-29	SB	A	M4_I-29_SB	M4_I-29_SB_A	9:57	5	100	65
M4	I-29	SB	MT	M4_I-29_SB	M4_I-29_SB_MT		5	0	65
M4	I-29	SB	HT	M4_I-29_SB	M4_I-29_SB_HT		5	8	65
M4	I-29	SB	Bus	M4_I-29_SB	M4_I-29_SB_Bus		5	0	65
M4	I-29	SB	Moto	M4_I-29_SB	M4_I-29_SB_Moto		5	0	65

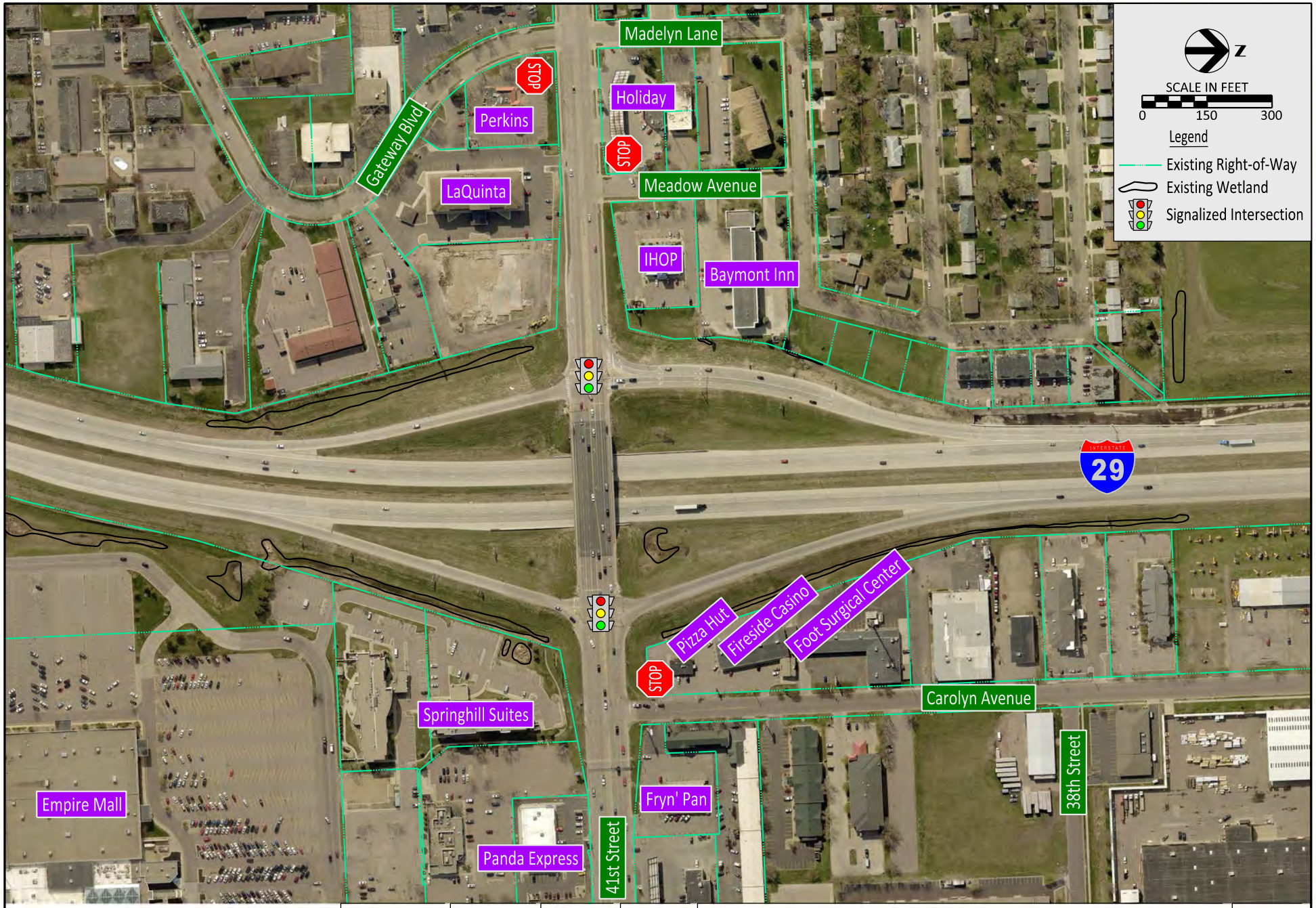
A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto
A	__	___A
MT	__	___MT
HT	__	___HT
Bus	__	___Bus
Moto	__	___Moto

TNM Input Table

Msmt #	Roadway	Direction	VehicleType	Lookup	Lookup	Total_Duration	Total_Type_Count	Avg_Speed	**Hour_Count**	**Speed**	1/2 Count	
M4	I-29	NB	A	M4_I-29_NB	M4_I-29_NB_A	10	172	65	1032	65	516	65
M4	I-29	NB	MT	M4_I-29_NB	M4_I-29_NB_MT	10	5	65	30	65	15	65
M4	I-29	NB	HT	M4_I-29_NB	M4_I-29_NB_HT	10	23	65	138	65	69	65
M4	I-29	NB	Bus	M4_I-29_NB	M4_I-29_NB_Bus	10	3	65	18	65	9	65
M4	I-29	NB	Moto	M4_I-29_NB	M4_I-29_NB_Moto	10	0	65	0	0	0	0
M4	I-29	SB	A	M4_I-29_SB	M4_I-29_SB_A	10	170	65	1020	65	510	65
M4	I-29	SB	MT	M4_I-29_SB	M4_I-29_SB_MT	10	2	65	12	65	6	65
M4	I-29	SB	HT	M4_I-29_SB	M4_I-29_SB_HT	10	17	65	102	65	51	65
M4	I-29	SB	Bus	M4_I-29_SB	M4_I-29_SB_Bus	10	0	65	0	0	0	0
M4	I-29	SB	Moto	M4_I-29_SB	M4_I-29_SB_Moto	10	0	65	0	0	0	0
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		
			A	__	___A	0	0	0	#DIV/0!	#####		
			MT	__	___MT	0	0	0	#DIV/0!	#####		
			HT	__	___HT	0	0	0	#DIV/0!	#####		
			Bus	__	___Bus	0	0	0	#DIV/0!	#####		
			Moto	__	___Moto	0	0	0	#DIV/0!	#####		

Appendix E

Build Alternatives Concept Layouts



Drawn By: B.Miller
Date: 8/30/2016
Chked By: J.Unruh
Date: 8/30/2016
Revision: 2/1/2017

Existing Conditions

41st Street Corridor Environmental Assessment — Sioux Falls, SD

Figure I-0

Drawn By: B.Miller
Date: 8/30/2016
Chked By: J.Unruh
Date: 8/30/2016
Revision: 2/1/2017

Single Point Interchange Alternative

41st Street Corridor Environmental Assessment — Sioux Falls, SD

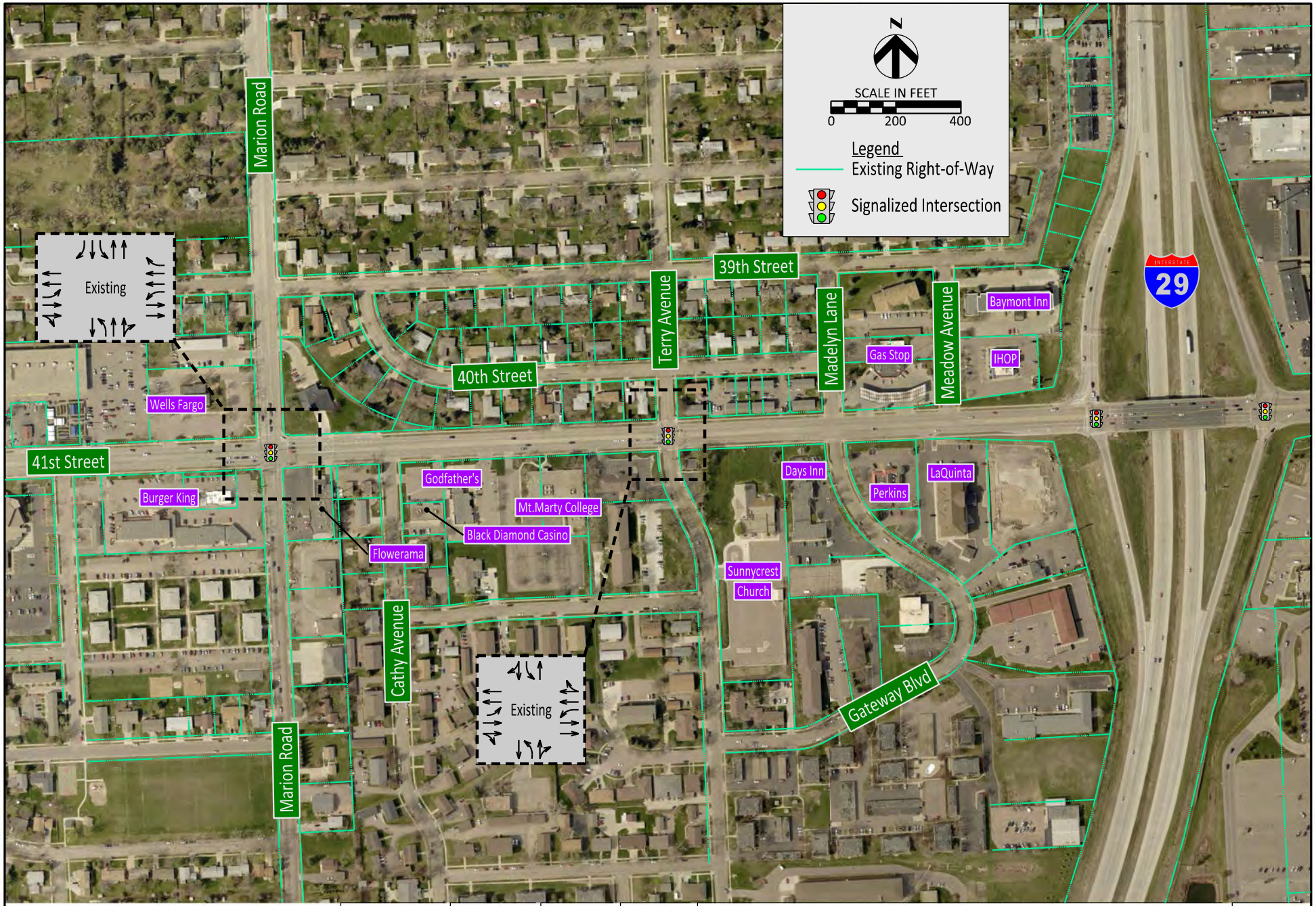
Figure I-1

Drawn By: B.Miller
Date: 8/30/2016
Chked By: J.Unruh
Date: 8/30/2016
Revision: 2/1/2017

Diverging Diamond Interchange Alternative

41st Street Corridor Environmental Assessment — Sioux Falls, SD

Figure I-2



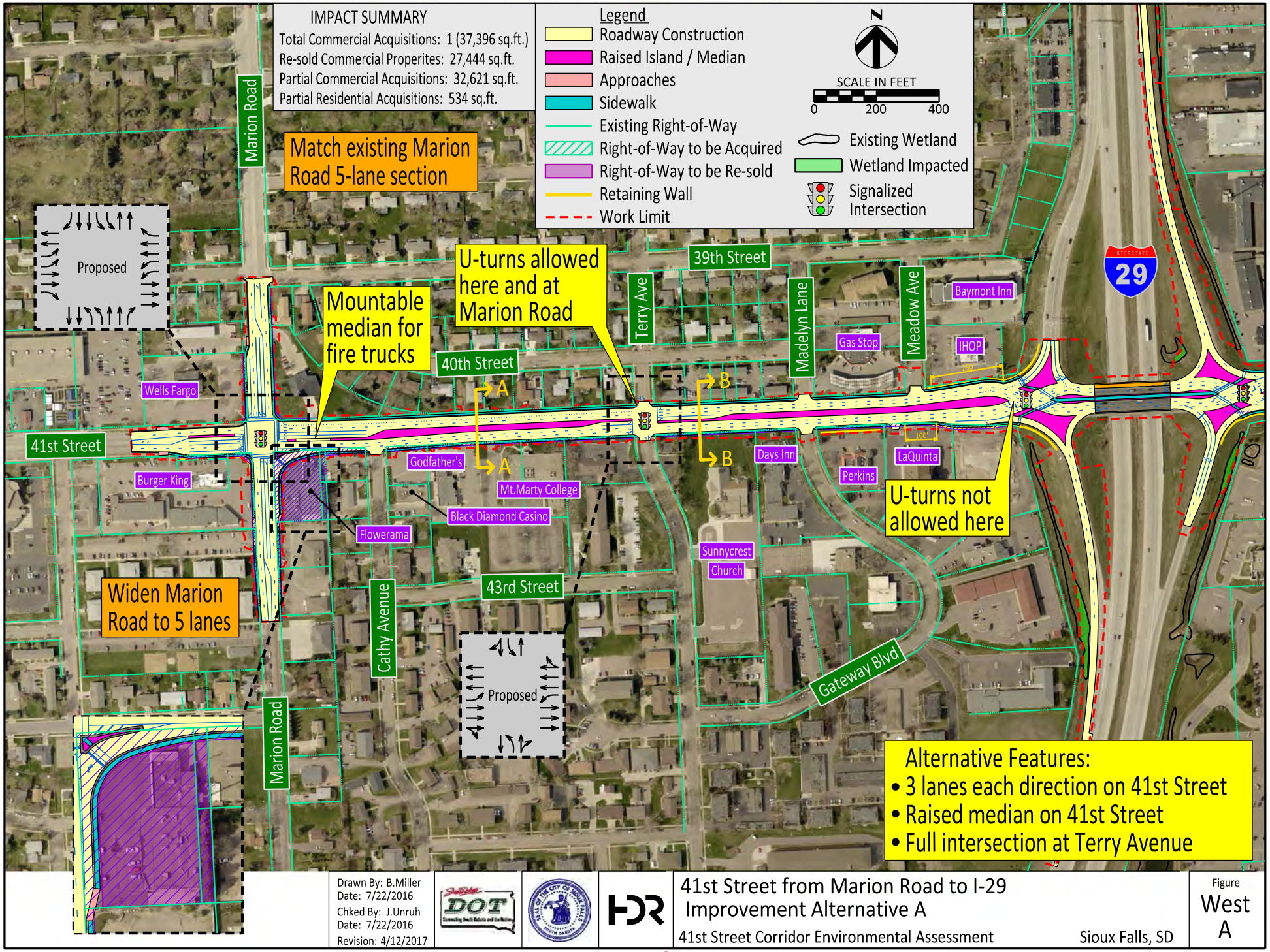
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 3/1/2017

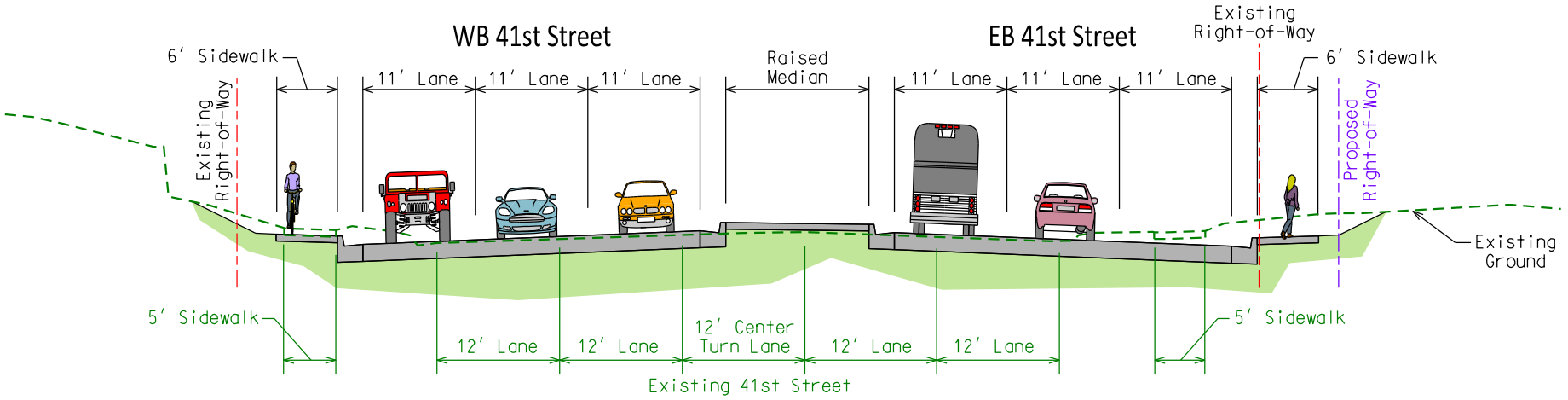
41st Street from Marion Road to I-29
Existing Conditions

41st Street Corridor Environmental Assessment

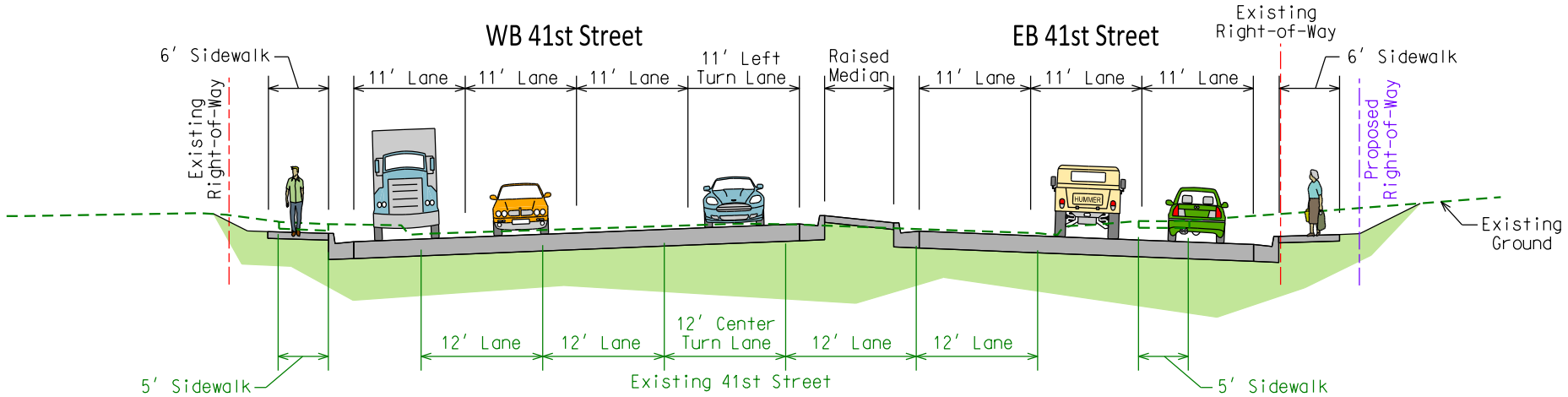
Sioux Falls, SD

Figure
West
Exist.


IMPACT SUMMARY
Total Commercial Acquisitions: 1 (37,396 sq.ft.)
Re-sold Commercial Properites: 27,444 sq.ft.
Partial Commercial Acquisitions: 32,621 sq.ft.
Partial Residential Acquisitions: 534 sq.ft.
Legend
Roadway Construction
Raised Island / Median
Approaches
Sidewalk
Existing Right-of-Way
Right-of-Way to be Acquired
Right-of-Way to be Re-sold
Retaining Wall
Work Limit
Existing Wetland
Wetland Impacted
Signalized Intersection
N
SCALE IN FEET
0
200
400
Match existing Marion Road 5-lane section
Mountable median for fire trucks
U-turns allowed here and at Marion Road
U-turns not allowed here
Widen Marion Road to 5 lanes
Proposed
Proposed
Marion Road
Marion Road
39th Street
40th Street
41st Street
43rd Street
Terry Ave
Madelyn Lane
Meadow Ave
Cathy Avenue
Gateway Blvd
INTERSTATE 29
Baymont Inn
Gas Stop
IHOP
Wells Fargo
Burger King
Godfather's
Mt.Marty College
Black Diamond Casino
Flowerama
Days Inn
Perkins
LaQuinta
Sunnycrest Church
A
A
B
B
Alternative Features:
• 3 lanes each direction on 41st Street
• Raised median on 41st Street
• Full intersection at Terry Avenue
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017
DOT
HDR
41st Street from Marion Road to I-29
Improvement Alternative A
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
West
A

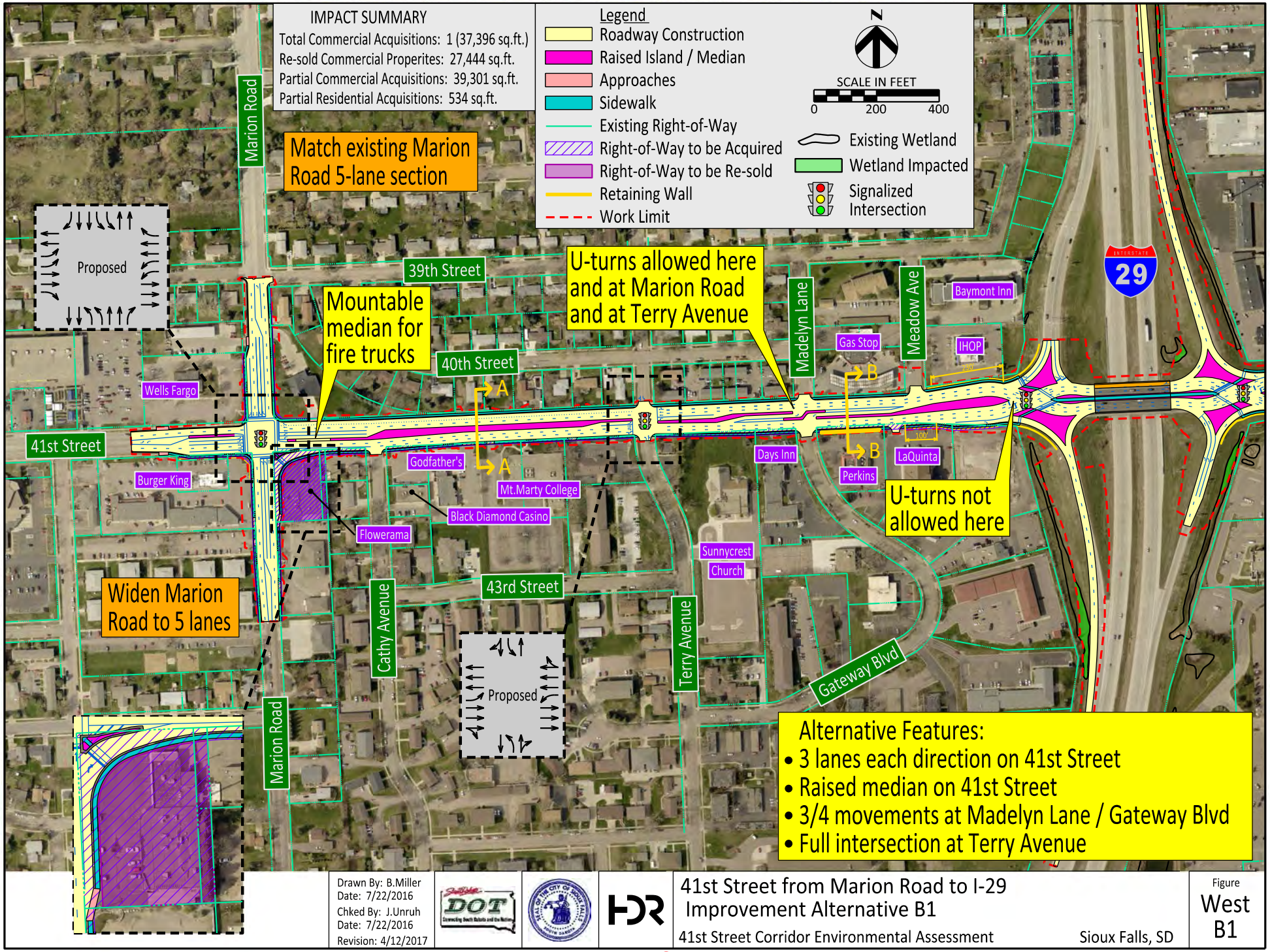


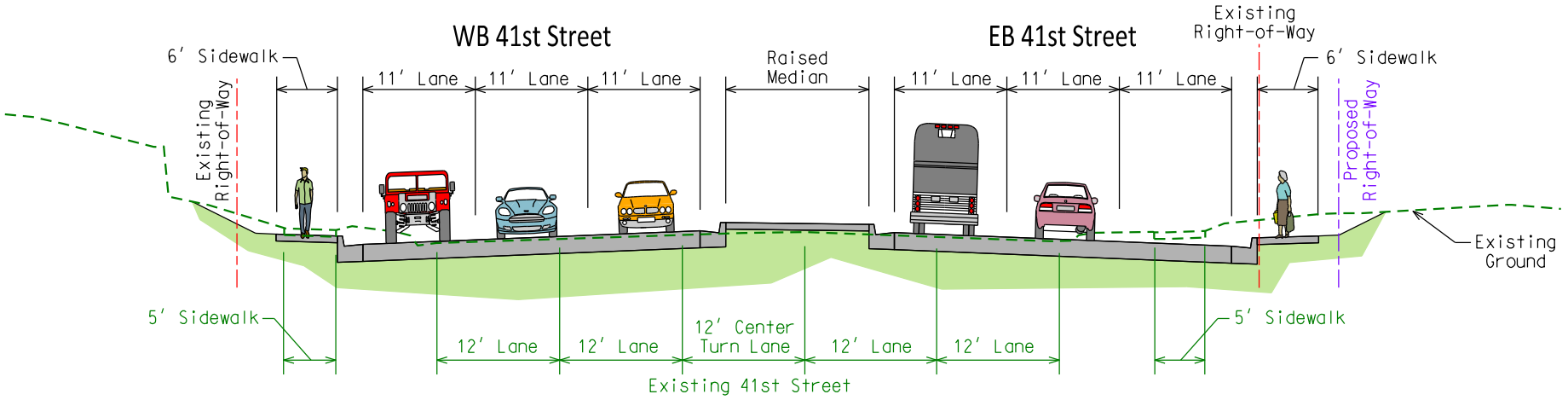
SECTION A-A
LOOKING EAST



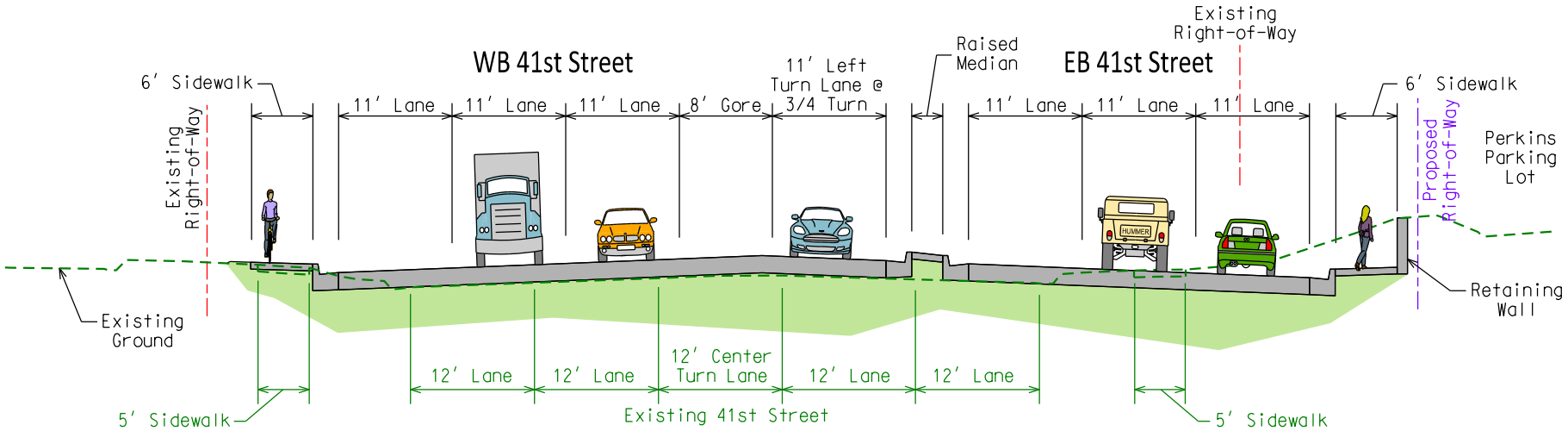
SECTION B-B
LOOKING EAST

Drawn By: B.Miller Date: 3/1/2017 Chked By: J.Unruh Date: 3/1/2017 Revision:	DOT		HDR	41st Street from Marion Road to I-29 Improvement Alternative A - Typical Sections 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure West A


IMPACT SUMMARY
Total Commercial Acquisitions: 1 (37,396 sq.ft.)
Re-sold Commercial Properites: 27,444 sq.ft.
Partial Commercial Acquisitions: 39,301 sq.ft.
Partial Residential Acquisitions: 534 sq.ft.
Legend
Roadway Construction
Raised Island / Median
Approaches
Sidewalk
Existing Right-of-Way
Right-of-Way to be Acquired
Right-of-Way to be Re-sold
Retaining Wall
Work Limit
N
SCALE IN FEET
0 200 400
Existing Wetland
Wetland Impacted
Signalized Intersection
Match existing Marion Road 5-lane section
Marion Road
Proposed
39th Street
Mountable median for fire trucks
40th Street
U-turns allowed here and at Marion Road and at Terry Avenue
Madelyn Lane
Meadow Ave
Baymont Inn
Gas Stop
IHOP
INTERSTATE 29
Wells Fargo
41st Street
Burger King
Godfather's
Mt.Marty College
Black Diamond Casino
Flowerama
Days Inn
Perkins
LaQuinta
U-turns not allowed here
Sunnycrest Church
Widen Marion Road to 5 lanes
Cathy Avenue
43rd Street
Terry Avenue
Gateway Blvd
Proposed
Marion Road
Alternative Features:
• 3 lanes each direction on 41st Street
• Raised median on 41st Street
• 3/4 movements at Madelyn Lane / Gateway Blvd
• Full intersection at Terry Avenue
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017
DOT
HDR
41st Street from Marion Road to I-29
Improvement Alternative B1
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
West
B1

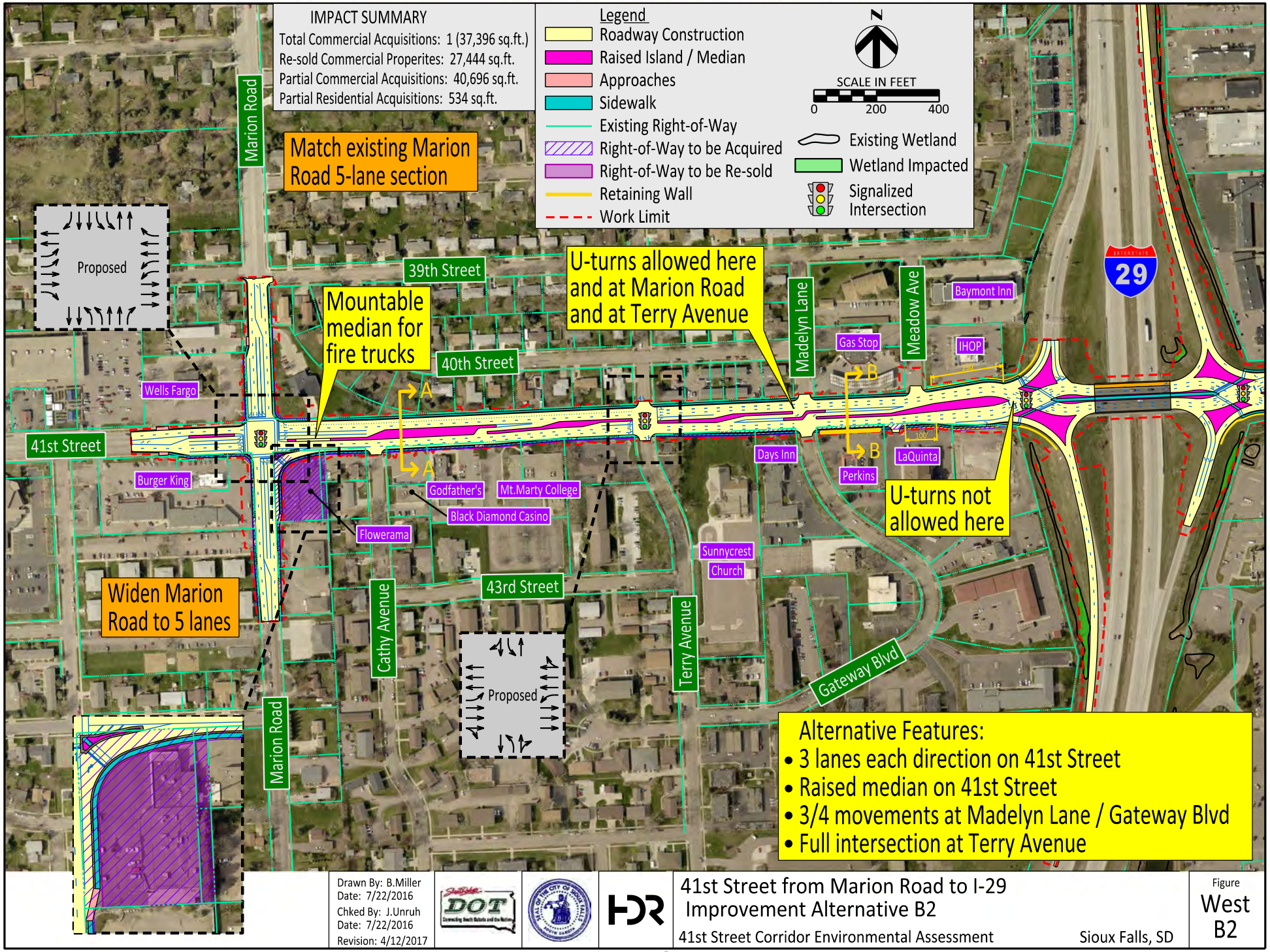


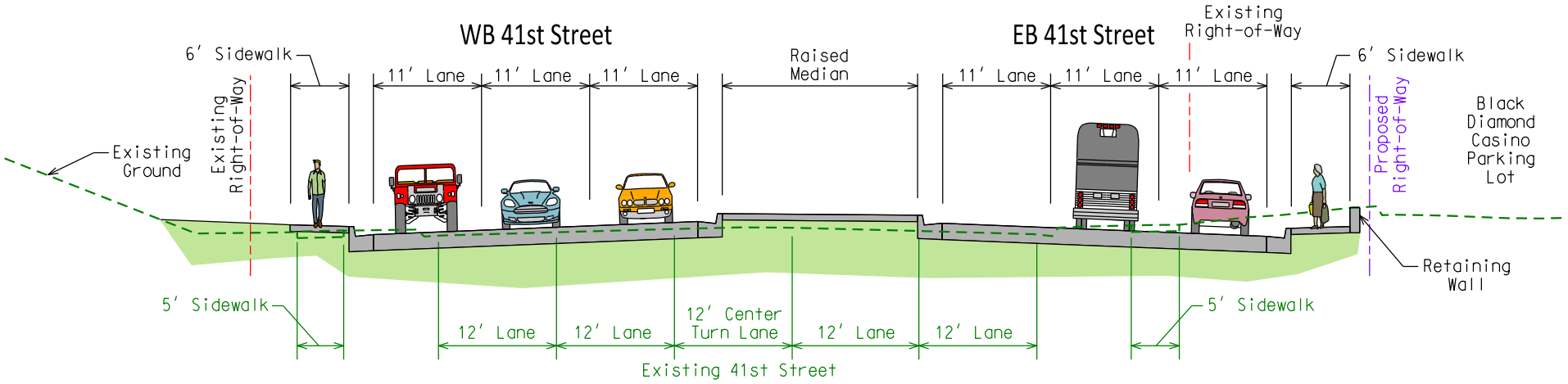
SECTION A-A
LOOKING EAST



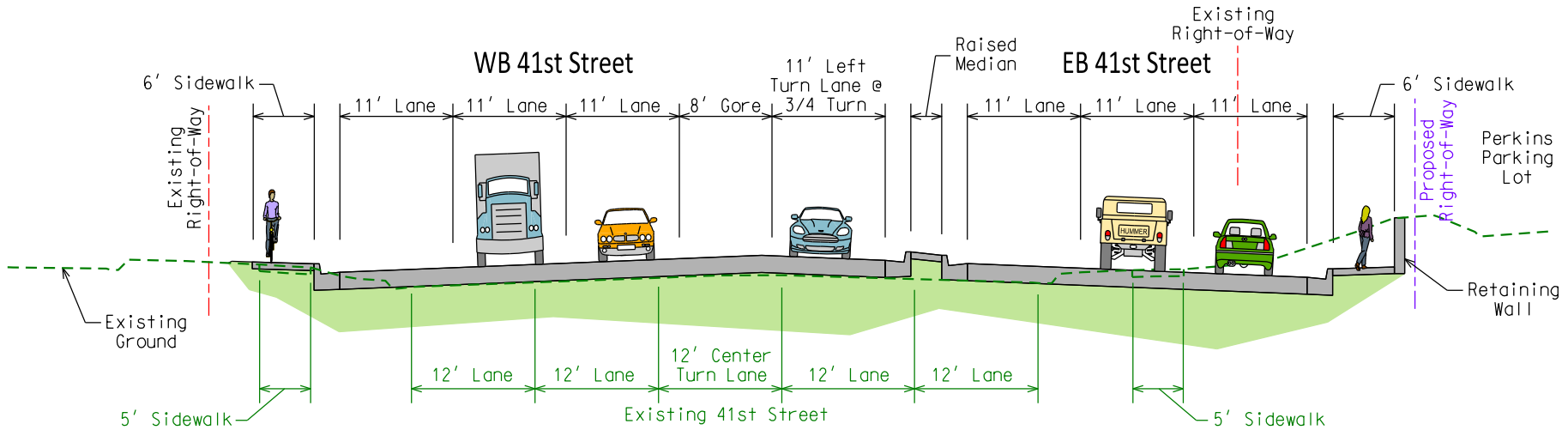
SECTION B-B
LOOKING EAST

Drawn By: B.Miller Date: 3/1/2017 Chked By: J.Unruh Date: 3/1/2017 Revision:	41st Street from Marion Road to I-29 Improvement Alternative B1 - Typical Sections 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure West B1


IMPACT SUMMARY
Total Commercial Acquisitions: 1 (37,396 sq.ft.)
Re-sold Commercial Properites: 27,444 sq.ft.
Partial Commercial Acquisitions: 40,696 sq.ft.
Partial Residential Acquisitions: 534 sq.ft.
Legend
Roadway Construction
Raised Island / Median
Approaches
Sidewalk
Existing Right-of-Way
Right-of-Way to be Acquired
Right-of-Way to be Re-sold
Retaining Wall
Work Limit
N
SCALE IN FEET
0 200 400
Existing Wetland
Wetland Impacted
Signalized Intersection
Match existing Marion Road 5-lane section
Mountable median for fire trucks
U-turns allowed here and at Marion Road and at Terry Avenue
U-turns not allowed here
Widen Marion Road to 5 lanes
Proposed
Proposed
Marion Road
39th Street
40th Street
41st Street
43rd Street
Madelyn Lane
Meadow Ave
Cathy Avenue
Terry Avenue
Gateway Blvd
INTERSTATE 29
Wells Fargo
Burger King
Godfather's
Mt.Marty College
Black Diamond Casino
Flowerama
Gas Stop
IHOP
Baymont Inn
Days Inn
LaQuinta
Perkins
Sunnycrest Church
A
A
B
B
Alternative Features:
• 3 lanes each direction on 41st Street
• Raised median on 41st Street
• 3/4 movements at Madelyn Lane / Gateway Blvd
• Full intersection at Terry Avenue
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017
DOT
HDR
41st Street from Marion Road to I-29
Improvement Alternative B2
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
West
B2



SECTION A-A
LOOKING EAST

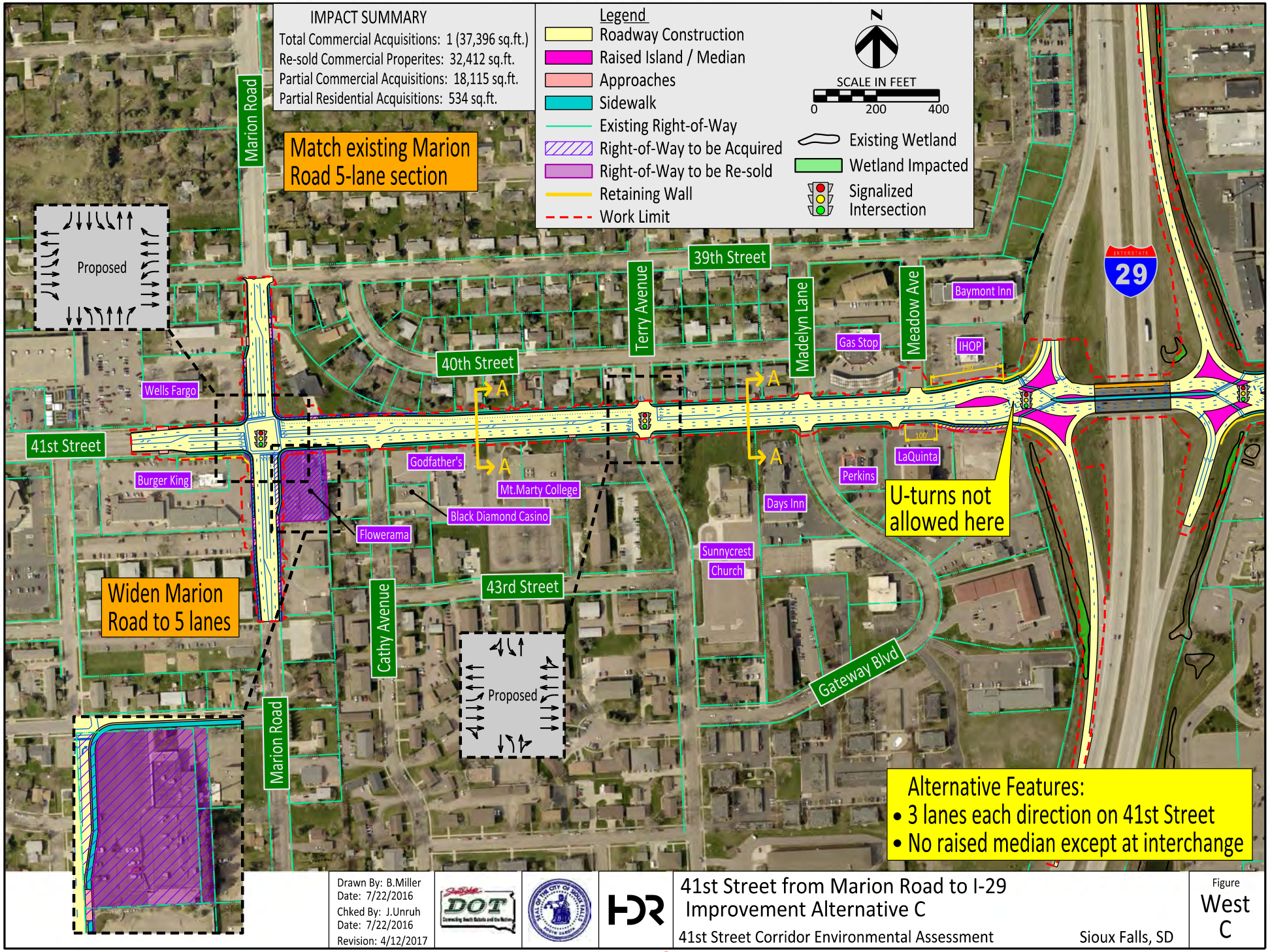


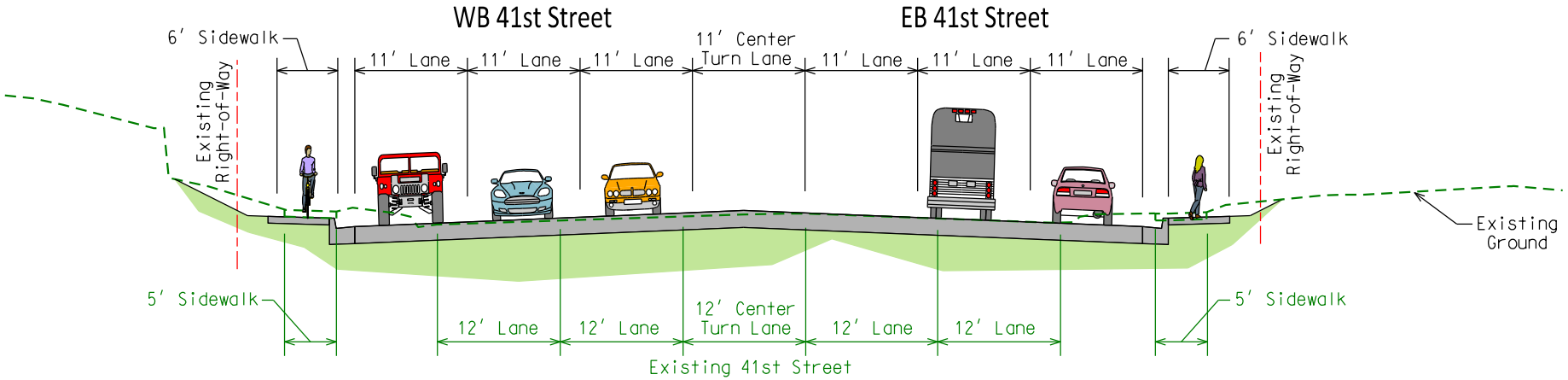
SECTION B-B
LOOKING EAST

Drawn By: B.Miller
Date: 3/1/2017
Chked By: J.Unruh
Date: 3/1/2017
Revision:

41st Street from Marion Road to I-29
Improvement Alternative B2 - Typical Sections
41st Street Corridor Environmental Assessment — Sioux Falls, SD

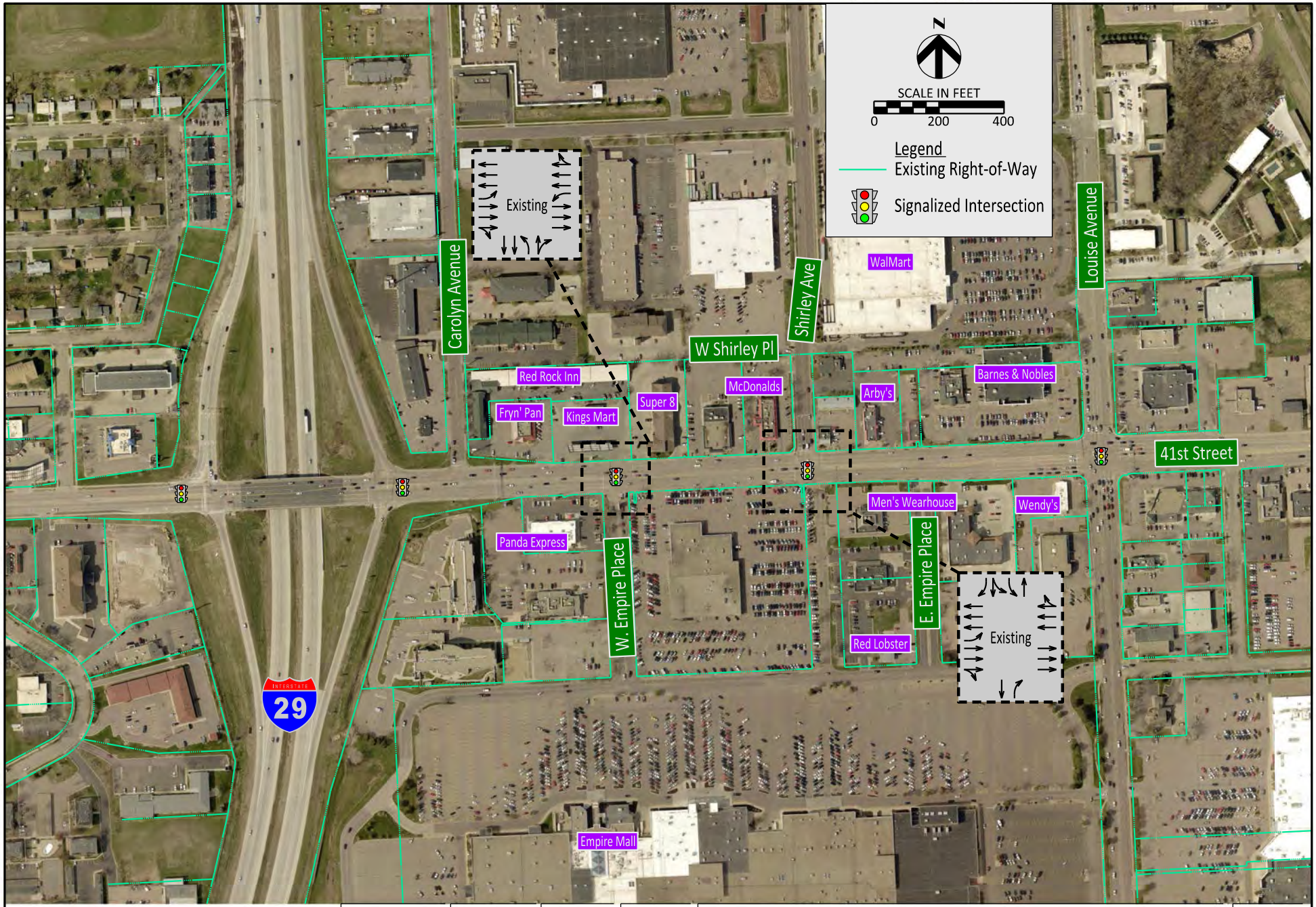
Figure
West
B2


IMPACT SUMMARY
Total Commercial Acquisitions: 1 (37,396 sq.ft.)
Re-sold Commercial Properites: 32,412 sq.ft.
Partial Commercial Acquisitions: 18,115 sq.ft.
Partial Residential Acquisitions: 534 sq.ft.
Legend
Roadway Construction
Raised Island / Median
Approaches
Sidewalk
Existing Right-of-Way
Right-of-Way to be Acquired
Right-of-Way to be Re-sold
Retaining Wall
Work Limit
N
SCALE IN FEET
0 200 400
Existing Wetland
Wetland Impacted
Signalized Intersection
Match existing Marion Road 5-lane section
Widen Marion Road to 5 lanes
U-turns not allowed here
Alternative Features:
• 3 lanes each direction on 41st Street
• No raised median except at interchange
Marion Road
39th Street
40th Street
41st Street
43rd Street
Terry Avenue
Madelyn Lane
Meadow Ave
Cathy Avenue
Gateway Blvd
Proposed
Wells Fargo
Burger King
Godfather's
Mt.Marty College
Black Diamond Casino
Flowerama
Baymont Inn
Gas Stop
IHOP
LaQuinta
Perkins
Days Inn
Sunnycrest Church
INTERSTATE 29
A
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017
41st Street from Marion Road to I-29
Improvement Alternative C
41st Street Corridor Environmental Assessment
Sioux Falls, SD
Figure
West C



SECTION A-A
LOOKING EAST

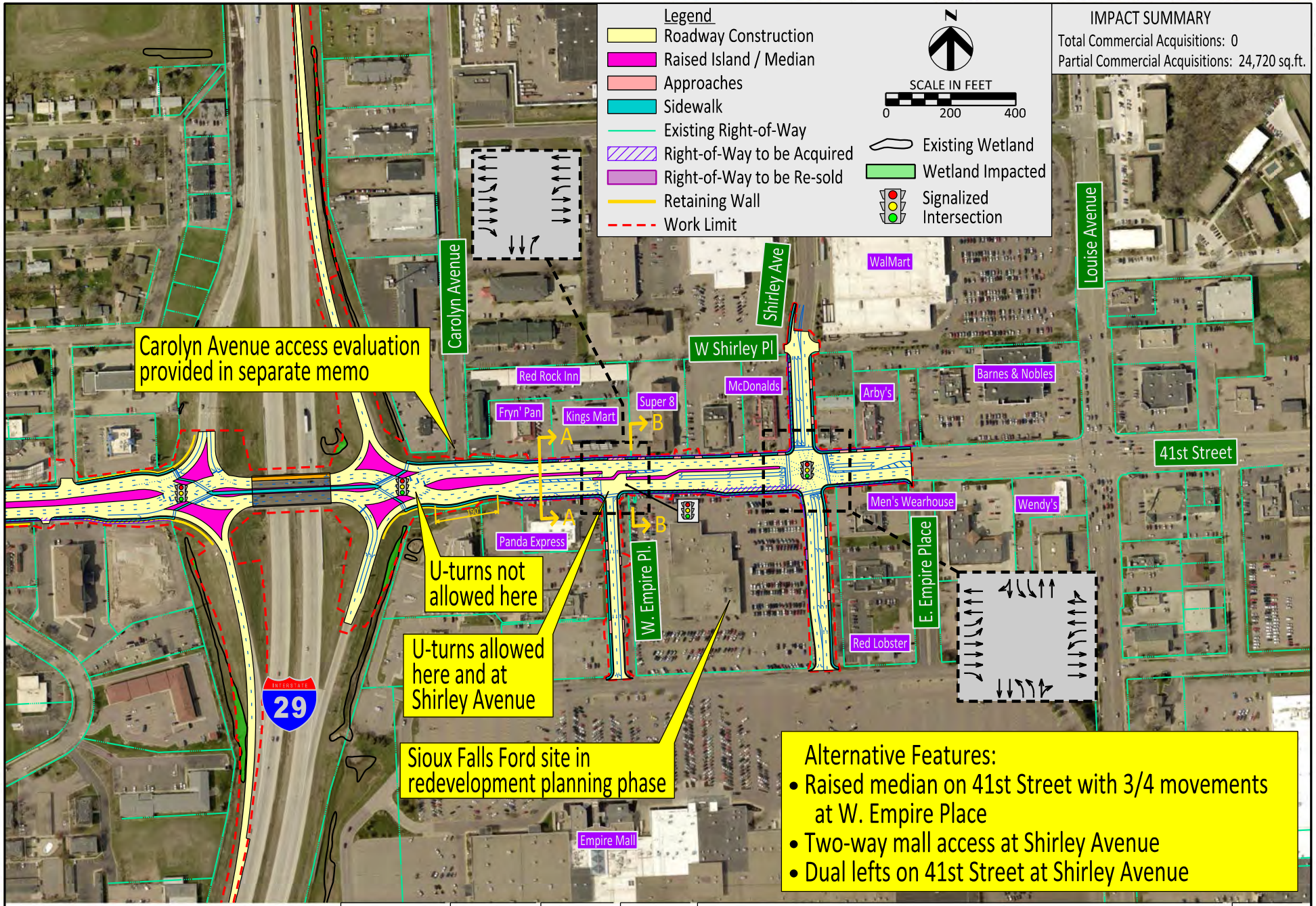
Drawn By: B.Miller Date: 3/1/2017 Chked By: J.Unruh Date: 3/1/2017 Revision:				41st Street from Marion Road to I-29 Improvement Alternative C - Typical Section 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure West C



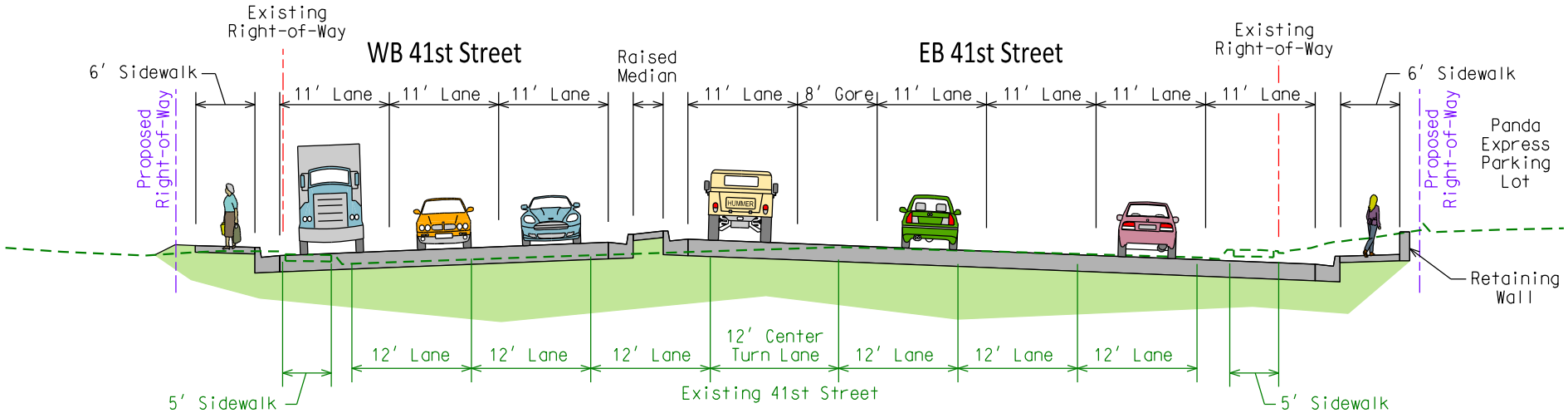
Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 3/10/2017

41st Street from I-29 to east of Shirley Avenue
Improvement Alternative A
41st Street Corridor Environmental Assessment
Sioux Falls, SD

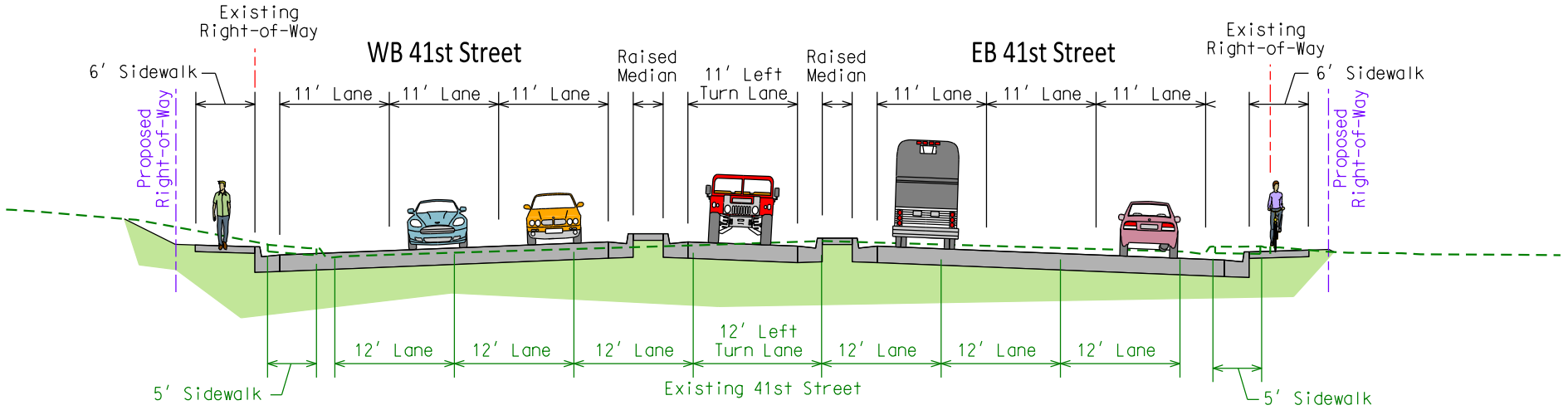
Figure
East
Exist.



Drawn By: B.Miller Date: 7/22/2016 Chked By: J.Unruh Date: 7/22/2016 Revision: 4/12/2017	DOT	HDR	41st Street from I-29 to east of Shirley Avenue Improvement Alternative A 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure East A



SECTION A-A
LOOKING EAST



SECTION B-B
LOOKING EAST

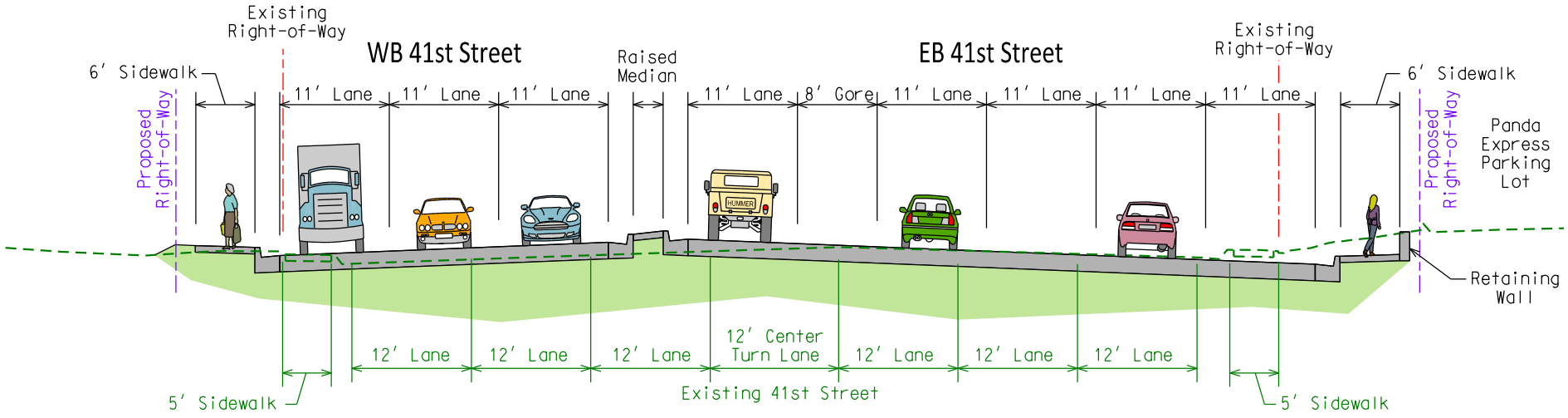
Drawn By: B.Miller Date: 3/10/2017 Chked By: J.Unruh Date: 3/10/2017 Revision:	SD DOT	City of Sioux Falls	HDR	41st Street from I-29 to east of Shirley Avenue Improvement Alternative A - Typical Sections 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure East A

Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017

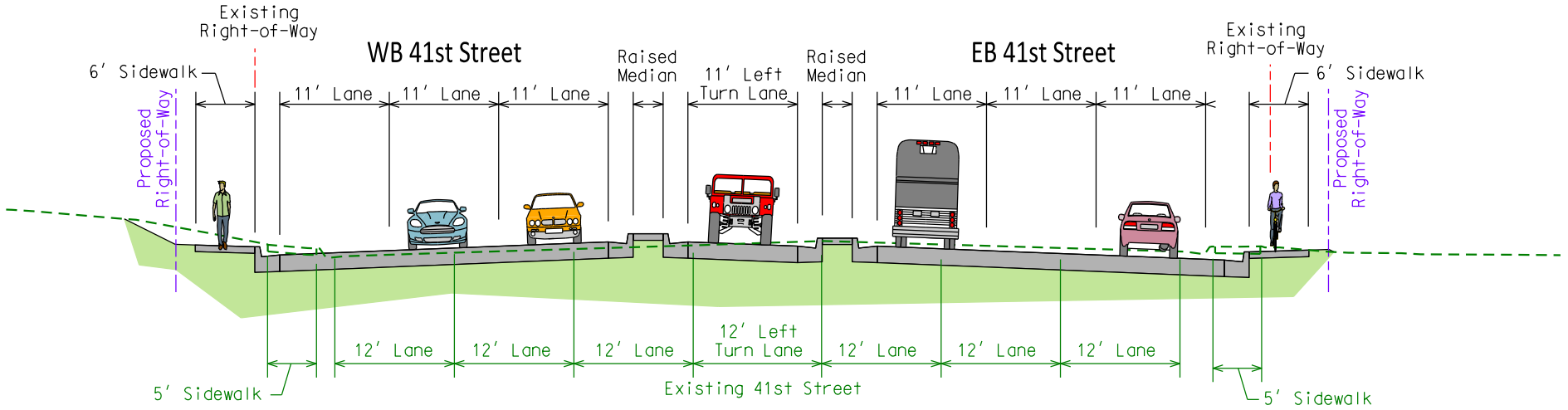
41st Street from I-29 to east of Shirley Avenue
Improvement Alternative B

41st Street Corridor Environmental Assessment — Sioux Falls, SD

Figure
East
B



SECTION A-A
LOOKING EAST

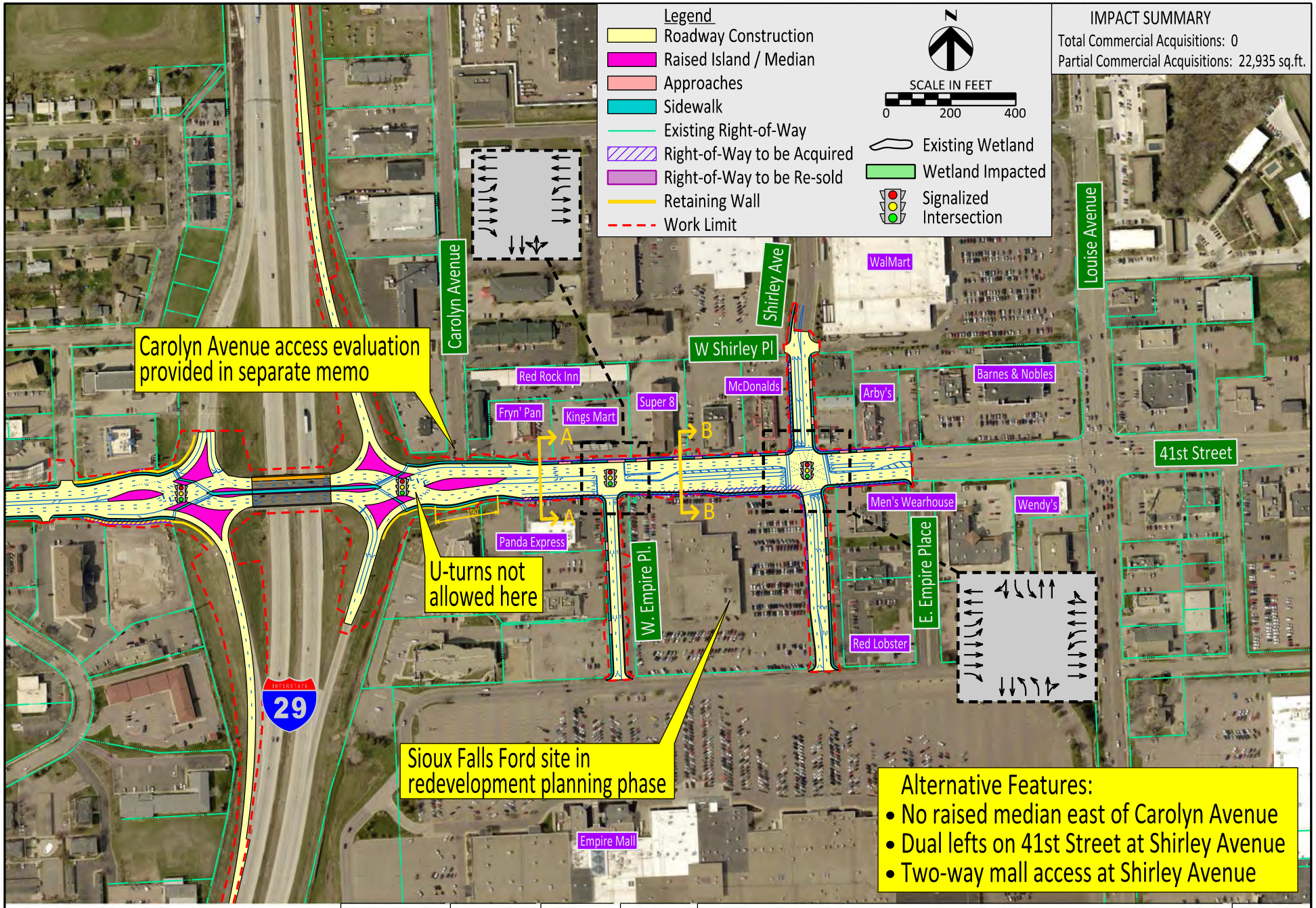


SECTION B-B
LOOKING EAST

Drawn By: B.Miller
Date: 3/10/2017
Chked By: J.Unruh
Date: 3/10/2017
Revision:

41st Street from I-29 to east of Shirley Avenue
Improvement Alternative B - Typical Sections
41st Street Corridor Environmental Assessment Sioux Falls, SD

Figure
East
B

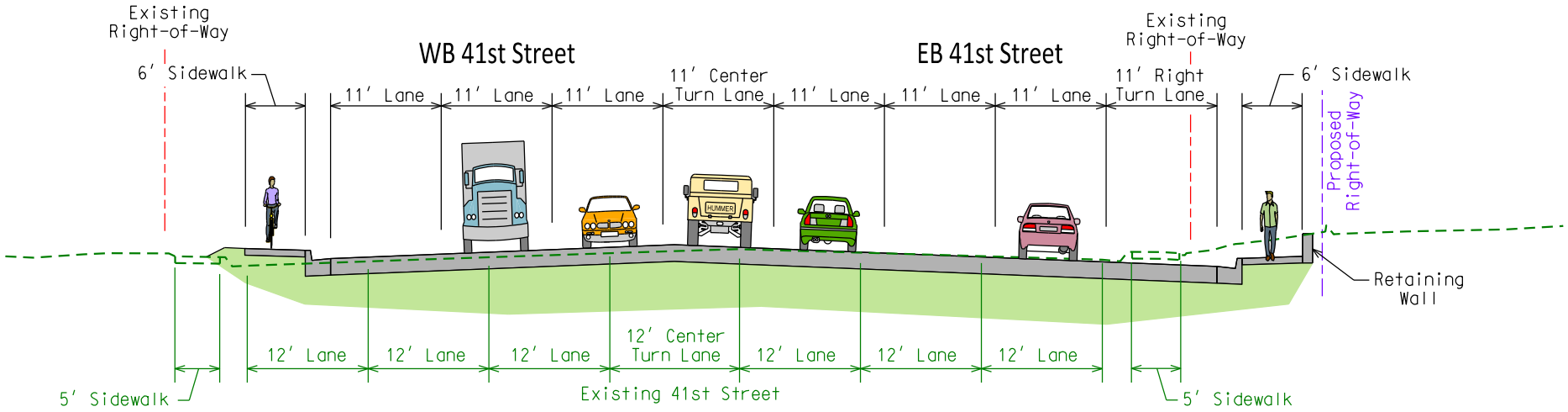


Drawn By: B.Miller
Date: 7/22/2016
Chked By: J.Unruh
Date: 7/22/2016
Revision: 4/12/2017

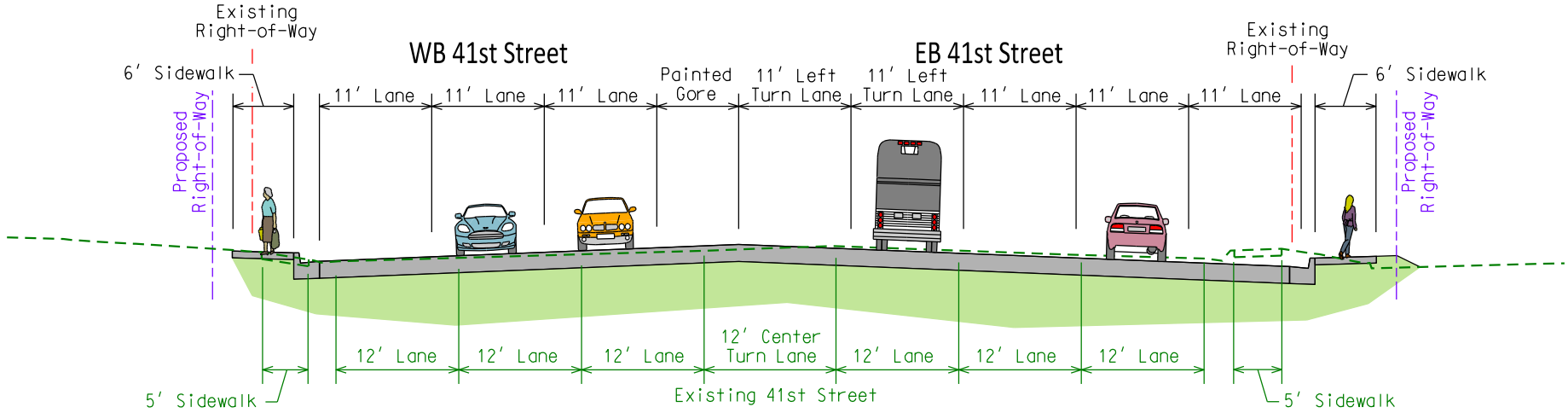
41st Street from I-29 to east of Shirley Avenue
Improvement Alternative C

41st Street Corridor Environmental Assessment — Sioux Falls, SD

Figure
East
C



SECTION A-A
LOOKING EAST



SECTION B-B
LOOKING EAST

Drawn By: B.Miller Date: 3/10/2017 Chked By: J.Unruh Date: 3/10/2017 Revision:	DOT		HDR	41st Street from I-29 to east of Shirley Avenue Improvement Alternative C - Typical Sections 41st Street Corridor Environmental Assessment — Sioux Falls, SD	Figure East C