US Highway 16
CORRIDOR STUDY

US16/Neck Yoke Road Intersection Build Options Report

Pennington County, South Dakota

July 14, 2021

SD DOT

U.S. Department of Transportation Federal Highway Administration

Rapid City Area Metropolitan Planning Organization

Pennington County

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Abbreviations

AASHTO	American Association of State Highway Transportation Officials
ETT	Experienced Travel Time
FHWA	Federal Highway Administration
F+I	Fatal and Injury Crashes
HCM6	6th Edition of Highway Capacity Manual
HCS	Highway Capacity Software
HSM	Highway Safety Manual
IHSDM	Interactive Highway Safety Design Module
LOS	Level of Service
MEV	Million Entering Vehicles
MVMT	Million Vehicle Miles Traveled
NEPA	National Environmental Policy Act
PDO	Property Damage Only Crash
RCAMPO	Rapid City Area Metropolitan Planning Organization
RCI	Reduced Conflict Intersection
ROW	Right-of-Way
SDDOT	South Dakota Department of Transportation
STIP	Statewide Transportation Improvement Program
US16	US Highway 16

1.0 Executive Summary

The US16/Neck Yoke Road intersection is located along US16, south of the Rapid City urban area. The intersection is located amongst several access points through the Spring Creek valley and is important to local access and network connectivity. Area traffic volumes peak during the summer tourist season due to surrounding tourist destinations and its proximity along a key connector between I-90/Rapid City and the Black Hills/Mount Rushmore area. It is anticipated that this traffic demand will continue to grow, particularly daily traffic as Rapid City and Black Hills-area development continues to expand south of Rapid City.

At the onset of the study, three overarching needs were identified to be addressed by a future project:

- High severity crash rate at the US16/Neck Yoke Road intersection.
- Multiple access points in close proximity, which leads to safety and operational issues in the area.
- Narrow median separation that leads to a degradation in operations and safety with the existing traffic control.

This intersection analysis is a sub-area analysis to a much larger US16 Corridor Study. The US16/Neck Yoke Road Intersection Build Options Report provides a technical analysis of the operational feasibility related to the proposed changes to the existing US16/Neck Yoke Road intersection and nearby access points.

The recommended alternative that best meets established transportation needs for the intersection study area is:

- Build Option 1.1d: RCI at Neck Yoke Road (west).
    - Reconstruct existing US16/Neck Yoke Road intersection to a reduced conflict intersection (RCI).
    - Shifts main US16/Neck Yoke Road intersection 250 feet west.
    - Close the following US16 intersections:
        - US16 Service Road Central Access/Reptile Gardens Central Driveway (US16/Central Driveway)
        - US16 Service Road North Access/Reptile Gardens North Driveway (US16/North Driveway)
        - Unknown Road
    - Construct new frontage road on north side of US16.

The operations and safety analysis contained within this report shows that the recommended alternative is expected to improve traffic operations and safety along US16 within the study area. SDDOT has identified a project at the US16/Neck Yoke Road intersection in the **2022-2025 STIP (**PCN 06X3).

An environmental scan for the proposed changes has been developed concurrently with this report. Recommendations carried forward from this analysis will feed into the NEPA process for a future US16/Neck Yoke Road intersection project.

2.0 Introduction

2.1 Background

The US16/Neck Yoke Road intersection analysis is a sub-area analysis to a much larger US16 Corridor Study. Recommendations carried forward from this analysis will feed into the NEPA process for a future US16/Neck Yoke Road intersection project. The purpose of this report is to document the concept development, Build Option refinement, analysis, and evaluation process to support recommendations for a future project at the US16/Neck Yoke Road intersection and nearby access points.

The US16/Neck Yoke Road intersection is located along US16, south of the Rapid City urban area. The intersection is located amongst several access points through the Spring Creek valley and is important to local access and network connectivity. It has experienced several high-severity crashes in recent years, including one fatal crash between 2014 and 2018. Area traffic volumes peak during the summer tourist season due to surrounding tourist destinations and its proximity along a key connector between I-90/Rapid City and the Black Hills/Mount Rushmore area. It is anticipated that this traffic demand will continue to grow, particularly daily traffic as Rapid City and Black Hills-area development continues to expand south of Rapid City.

2.2 Study Area

The US16/Neck Yoke Road intersection study area is shown in **Figure 1** and includes the following segments and intersections.

- Study segments
    - US16 corridor between Croell Pit West/Main Entrance and Sammis Trail
    - Neck Yoke Road between US16 and Spring Creek Road
    - US16 service road from Neck Yoke Road north
- Study intersections:
    - US16/Croell Pit West/Main Entrance (US16/Croell Pit Main Entrance)
    - US16/Neck Yoke Road/Reptile Gardens South (US16/Neck Yoke Road)
    - US16/US16 Service Road Central Access/Reptile Gardens Central Driveway (US16/Central Driveway)
    - US16/US16 Service Road North Access/Reptile Gardens North Driveway (US16/North Driveway)
    - US16/Unknown Road
    - US16/Sammis Trail
    - Neck Yoke Road/Spring Creek Road

Figure 1: US16/Neck Yoke Road Intersection Study Area

The US16/Neck Yoke Road intersection study area is a sub-area of the overall US16 Corridor Study. The US16 Corridor Study area extends approximately 16.3 miles along US16 between the US16 Alternate (Keystone Wye) and Cathedral Drive/Fairmont Boulevard in Rapid City, shown in **Figure 2.**

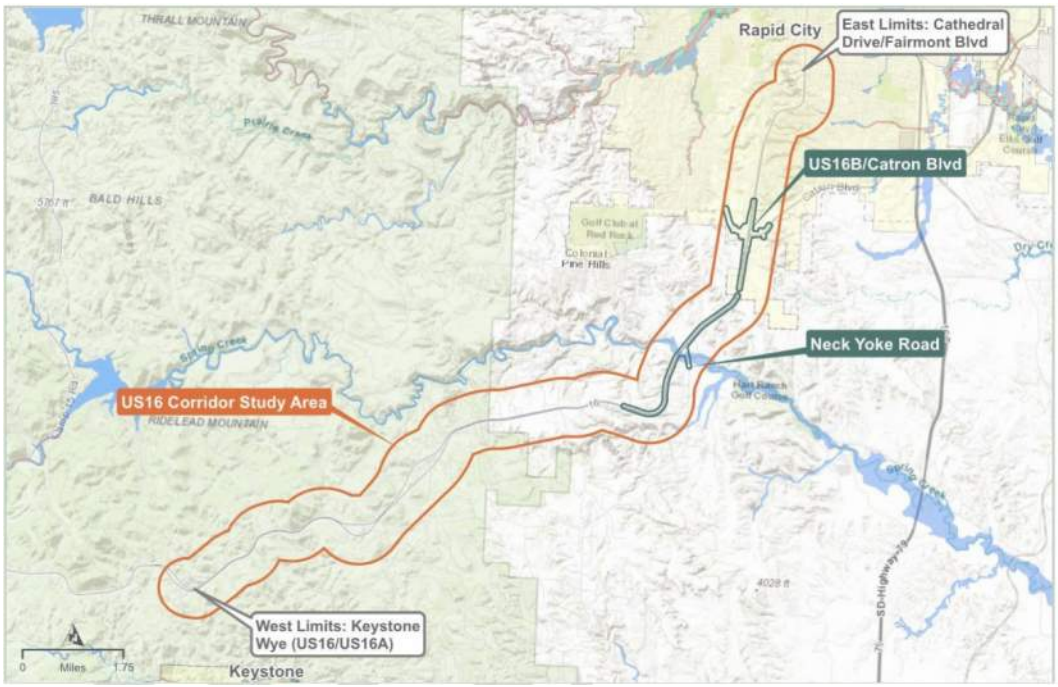
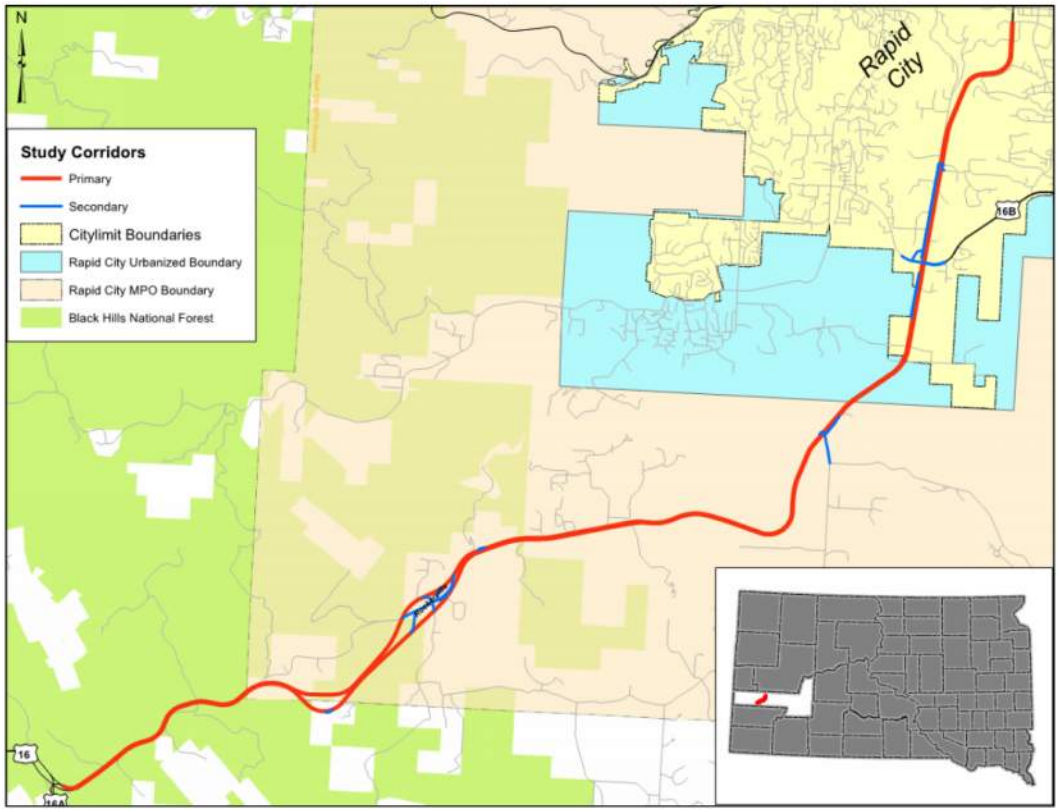


Figure 2: US16 Corridor Study Area

There are a several different planning boundaries in the area that factor into the traffic forecasting process, traffic operations analysis thresholds, and overall goals for the area that will be discussed later in the report. The current FHWA approved urban boundary through the US16 corridor designates the urbanized area as follows:

- Urban – north of section line between Sammis Trail and Neck Yoke Road
- Rural – south of section line between Sammis Trail and Neck Yoke Road

The Rapid City Area Metropolitan Planning Organization (RCAMPO) planning boundary encompasses the US16/Neck Yoke Road intersection sub-area defined for this analysis. Both areas are shown in **Figure 3**.



Source: SDDOT figure

Figure 3: Rapid City Urbanized Boundary and Rapid City Area MPO Boundary

2.3 Methods and Assumptions

A methods and assumptions document (M&A document) was prepared at the onset of this study to serve as a historical record of the study process and methodologies, dates, and decisions made by the study team representatives for the US16 Corridor Study. Section 9 in the M&A document identifies the study limits for the US16/Neck Yoke Road intersection sub-area analysis. A copy of the most recent version of the M&A document to the date of this report is provided in **Appendix A**.

2.4 Planning and Study Completed to Date

The SDDOT completed a US16 Corridor Study in 2004 which recommended the following for the US16/Neck Yoke Road intersection area:

- Consolidate the three Reptile Gardens access points to one intersection at Neck Yoke Road.
- Close the unknown road access point and relocate access to US16/Neck Yoke Road intersection.
- Consider signalizing the US16/Neck Yoke Road intersection when warranted by traffic volumes.

These recommendations were brought forward as preliminary concepts to the US16 Corridor Study and served as the foundation for the initial high-level concept intersection type screening process.

Currently, the SDDOT has identified a project at the US16/Neck Yoke Road intersection in the **2022-2025 STIP** (PCN 06X3).

3.0 Existing Conditions

3.1 Existing Road Conditions

The existing US16 corridor through the Neck Yoke Road intersection exhibits the following conditions shown in **Table 1**.

Table 1: US16/Neck Yoke Road Intersection Study Area Road Summary

	US16	US16 Service Road	Neck Yoke Road
Owner	SDDOT	SDDOT	Pennington County
Surfacing	Bituminous	Bituminous	Bituminous
Cross-Section	4-lane divided rural highway with depressed median (paved or turf)	2-lane rural, local roadway	2-lane highway
Roadway Widths	34 ft in both directions 24 ft surface width – (2-12 ft lanes in each direction 3 ft inside shoulder 6 to 7 ft (varies) outside shoulder	24 ft roadway width 24 ft surface width (1-12 ft lane in each direction) No outside shoulder	30 ft roadway width 24 ft surface width (1-12 ft lane in each direction) 3 ft outside shoulder
Median Width	26 ft	-	-
Functional Classification	Rural Other Freeway and Expressways	Rural Local Road	Major Collector
Right-of-Way Width	150 ft	w/in US16 ROW limits	66 ft
SDDOT Access Classification	Expressway	-	-
Miscellaneous	Roadway lighting at Neck Yoke Road intersection (added 2019)		

The US16 corridor through the intersection study area was originally constructed in the 1950's/1960's with the following design speeds:

- Neck Yoke Road to unknown road: 60 mph
- West of Neck Yoke Road: 70 mph
- East of unknown road: 70 mph

Existing US16 grade through the Neck Yoke Road/Reptile Gardens/US16 service road area is approximately 1.4 percent (shown in **Figure 4** as 1.443 percent). The US16 grade steepens considerably heading out of the valley to the east and west with sustained grades between 4 and 6.5 percent. A summary of grades entering and exiting existing vertical curves through the US16/Neck Yoke Road intersection area is shown in **Figure 4**.

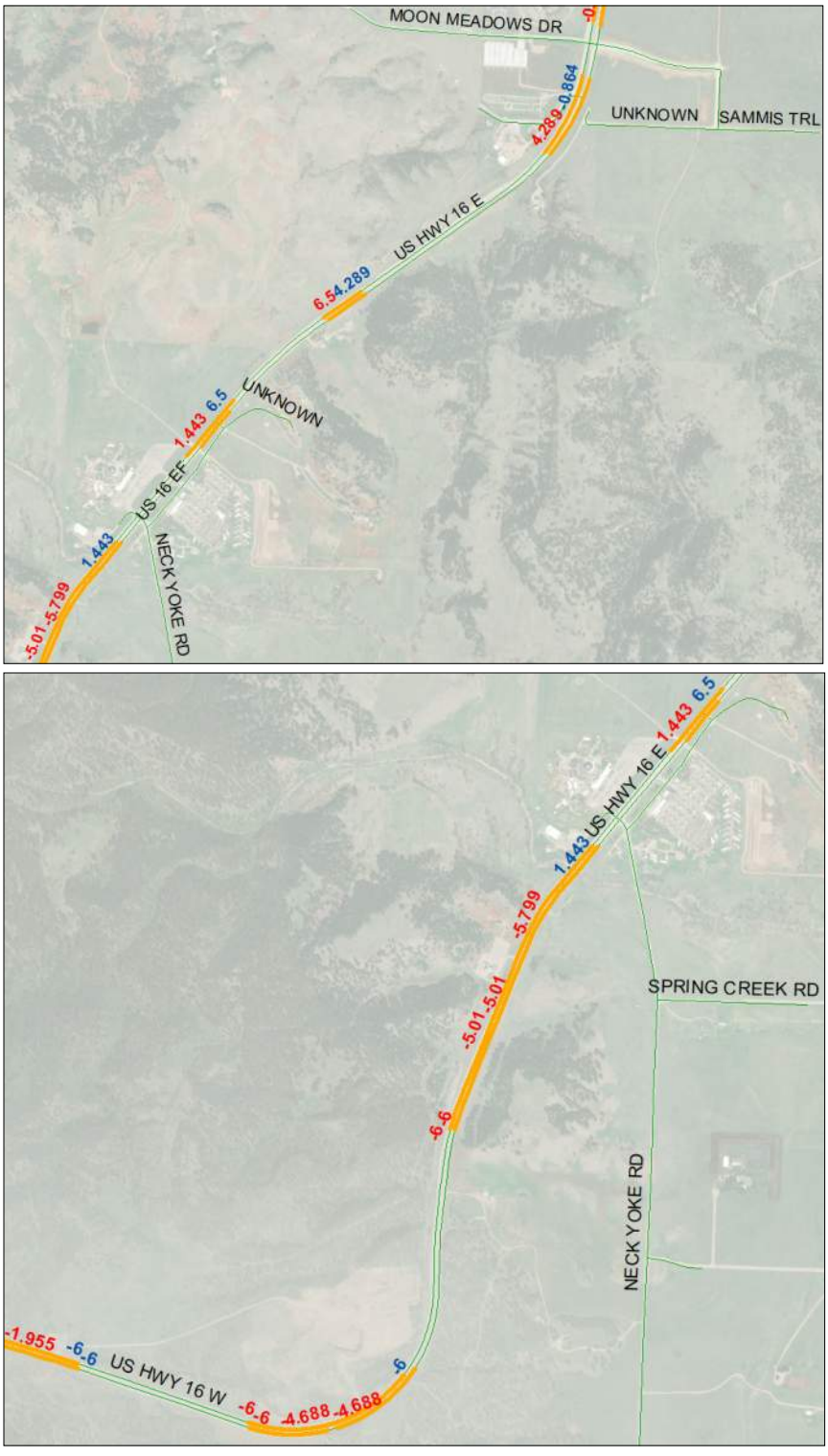
All existing sub-area analysis intersections are currently full access with lane configurations shown in **Figure 5**. Current US16 median width through the Neck Yoke Road and US16 service road/Reptile Gardens intersections is approximately 26 feet. This width is typically not wide enough to facilitate a two-stage crossing of US16 (where a vehicle can cross one direction of US16 and then stop in the median, with no overhang into US16 traffic, to wait for an opportunity to cross the other direction of US16). During high volume periods, the lack of median refuge space and the overall large intersection area can be problematic for motorists to gauge gaps in high-speed traffic from two directions of travel.

The existing turn lane lengths, or lack of turn lanes, along US16 in the proximity of the Neck Yoke Road intersection has been noted as a transportation need in the area. **Table 2** provides a summary of existing turn lane availability and length for the subject intersections. Turn lane volume warrants, identifying a specific turn lane is warranted by existing or future-year traffic volumes, are provided later in this report.

Table 2: US16 Turn Lanes at Neck Yoke Road Area Intersections

US16 Intersection	Turn Lane	Existing?	Length (ft)*	Right or Left Turn Lane Design Notes
Unknown Road	EB LT	n/a	-	
	EB RT	No	-	
	WB LT	No	-	
	WB RT	n/a	-	
North Driveway (Reptile Gardens)	EB LT	Yes	290	Warranted turn lane at 60 mph design speed: 435 ft plus storage length. Non-warranted turn lane at 60 mph design speed: 220 ft.
	EB RT	No	-	
	WB LT	No	-	
	WB RT	No	-	
Central Driveway (Reptile Gardens)	EB LT	Yes	350	
	EB RT	No	-	
	WB LT	Yes	280	
	WB RT	No	-	
Neck Yoke Road	EB LT	Yes	350	
	EB RT	No	-	
	WB LT	Yes	335	
	WB RT	No	-	

Notes:
* Turn lane length is from approximate stop location back to start of turn lane bay taper.
Recommended turn lane lengths from SDDOT Road Design Manual Table 12-5, Figure 12-11, and Figure 12-12.

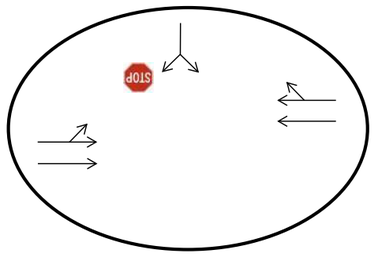


Source: SDDOT GIS existing vertical curve information
Notes: Values reflect the existing grade entering exiting vertical curves. Vertical curves are represented by the thick yellow lines. A sustained grade between vertical curves is reflected by the upstream exiting grade and entering grade at the downstream vertical curve.

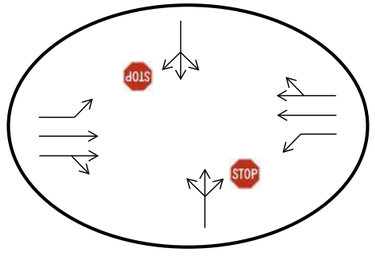
Figure 4: Existing US16 Corridor Vertical Grades

US16 Corridor

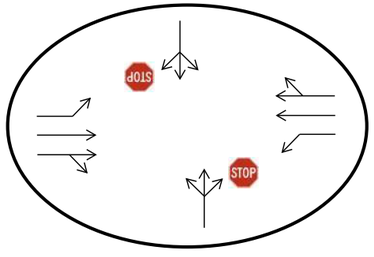
19. US16 & Croell Pit West Ent.



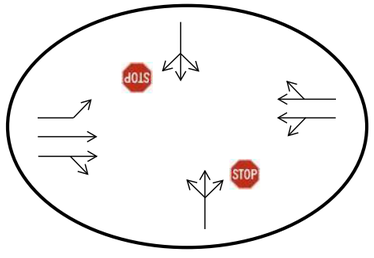
20. US16 & Neck Yoke Road



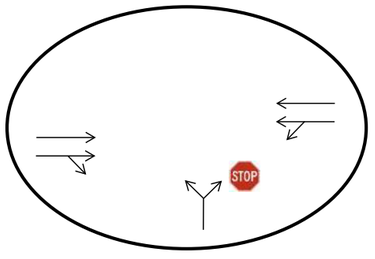
21. US16 & Reptile Gardens Cent.



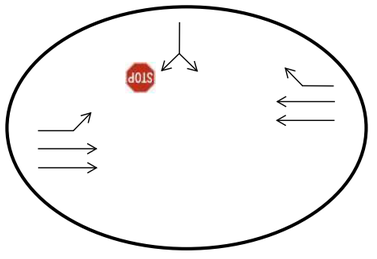
22. US16 & Reptile Gardens (N)



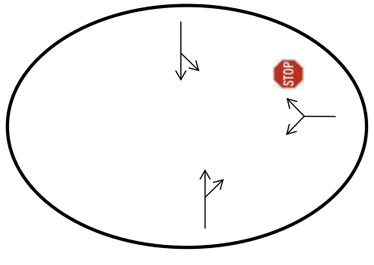
23. US16 & Unknown Road



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd



Notes
Intersection numbering is consistent with the overall US16 Corridor Study.

3.2 Existing US16 Structures

Both bridges over Spring Creek, just west of Neck Yoke Road, are continuous concrete bridges and are considered in good condition according to the 2018 inspections completed by the SDDOT. Current deficiencies listed in the inspection reports include substandard width and scour potential, but none of the inspection ratings are low enough at this time to warrant immediate replacement. The bridges were built in 1963-1964 and are nearing the end of their design life where rehabilitation or replacement will be needed.

3.3 Existing Access

The current SDDOT access classification of US16 through the intersection study area is Expressway, which is defined in the SDDOT Road Design Manual as 'high-speed divided highways serving interstate and regional travel needs.' Current access location criteria is summarized in the following table.

Table 3: SDDOT Access Classification Criteria

Access Classification	Signal Spacing Distance (mile)	Median Opening Spacing (mile)	Minimum Unsignalized Access Spacing (feet)	Access Density	Denial of Direct Access When Other Available
Interstate	N/A	N/A	N/A	N/A	Yes
Expressway	1/2	1/2 F, 1/2 D	2640	at half-mile increments	Yes
Free Flow Urban	1/2	1/2 F, 1/4 D	1320	at quarter-mile increments	Yes
Intermediate Urban	1/2	1/2 F, 1/4 D	660	1 access/block face, right in/right out preferred	Yes
Urban Developed	1/4	1/4	100	2 accesses/block face	Yes
Urban Fringe	1/4	1/4	1000	5 accesses/side/mile	Yes
Rural	N/A	N/A	1000	5 accesses/side/mile	Yes

Notes:

1. Access to the Interstate system is governed by SDDOT interchange policy. No access shall be provided on non-interstate routes within the following distance of interstate ramp terminals: 1/8 mile directional access, 1/4 mile full access
2. N/A = Not Applicable, F = Full Movement – all turns and through movements provided, D = Directional Only – certain turning and through movements not provided.
3. SDDOT may defer to stricter local standards.
4. SDDOT will seek opportunities to reduce access density wherever possible.
5. Rural class minimum unsignalized access spacing may be reduced to 660' by the Area Engineer, based on results of an engineering study as described in 70:09:01:02
6. Unsignalized access spacing also is subject to corner clearance analysis.

Source: Figure 17-4, SDDOT Road Design Manual (accessed 1/20/2020)

The series of existing access points in the US16/Neck Yoke Road area do not meet median opening and access spacing criteria for an Expressway access classification. Separation between each access point is less than 600 feet. Further, the existing access density limits the available length for each turn lane and requires that much of a turning vehicle's deceleration occur within a US16 through lane instead of in the turn lane.

3.4 Existing Traffic Volumes

The 2019 Existing Conditions volume set was developed for the existing study area using daily and peak hour segment counts collected in 2019 as part of the overall US16 Corridor Study:

- Peak hour (morning and afternoon/evening) intersection turning movement counts
    - Collected on Thursday, May 30, 2019.
    - Counts provided peak hour intersection turning movement volumes, peak hour factors, and heavy vehicle percentages broken out by trucks, RVs, and lights pulling boats/campers/trailers.
- 24-hour roadway segment counts
    - Collected on Thursday, May 30, 2019.
    - Counts provided daily segment volumes, heavy vehicle percentages, and speeds

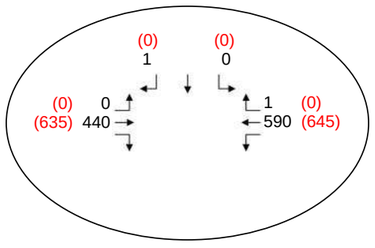
All volumes presented in this report reflect a 'peak season', which is during the summer tourist season. Seasonal adjustment factors were applied to the counts to reflect a June 'peak season'.

A summary of the 2019 Existing Conditions volume set is shown in **Figure 6**.

Further information regarding the traffic data collection and development of the 2019 Existing Conditions volume set is can be found in the *2019 Existing Conditions Traffic Operations* technical memo in **Appendix B**.

US16 Corridor

19. US16 & Croell Pit West Ent.



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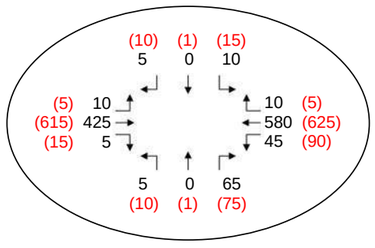

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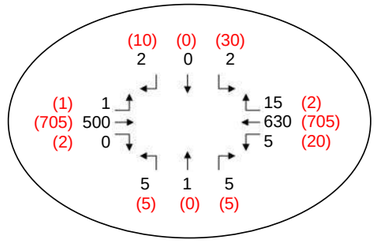
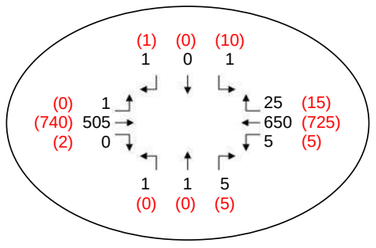


22. US16 & Reptile Gardens (N)



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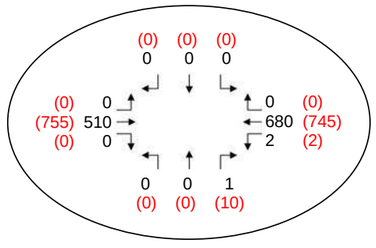

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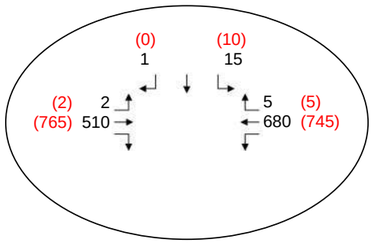

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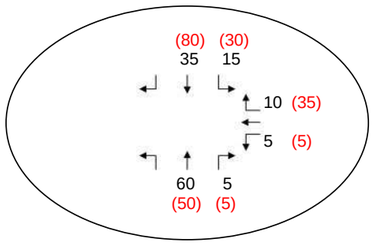


Notes
Traffic volumes obtained from the US16 Corridor Study ***Existing Conditions Traffic Operations*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

Legend

- 64 — Mileage Reference Marker (MRM)
- 1 — Study Intersection
- 14,000 — Existing Daily Traffic Volumes*
- AM (PM) — Existing Peak Hour Traffic Volumes*

Notes:
** Volumes reflect June design season*

US Highway 16 CORRIDOR STUDY

2019 EXISTING CONDITIONS TRAFFIC VOLUMES
US16 CORRIDOR STUDY - US16/NECK YOKE ROAD INTERSECTION AREA
FIGURE 6, PAGE 1 OF 1

3.5 Crash History Review

Crash data for years 2014 through 2018 was provided by the SDDOT through a GIS geodatabase. Crashes were reviewed throughout the entire US16 Corridor Study area to identify any historical crash trends or high frequency areas to help develop potential crash mitigation measures for consideration in design. All crashes were sorted based on whether they were related to a corridor intersection or roadway segment. Low-volume crossroads and private driveways were typically not considered a primary analysis intersection.

Crash rates and critical crash rates were calculated for both intersections and roadway segments. Intersection crash rates were calculated in terms of crashes per million entering vehicles (crashes/MEV). Roadway segment crash rates were calculated in terms of million vehicle miles traveled (crashes/MVMT).

Critical crash rates were calculated based on the statistical populations for each crash location (intersection or segment), using methods presented in the Highway Safety Manual (HSM, American Association of State Highway and Transportation Officials (AASHTO), 2010). A critical crash rate accounts for a desired level of confidence, vehicle exposure, and similar facility types. Intersections and segments where the crash rate exceeds the critical rate should be investigated further.

Weighted crash rates were also calculated for corridor segments by weighting each crash in accordance with its severity: fatal crash (12), injury crash (3), and property damage crash (1). Weights were assigned to each crash in accordance with methodology used by the SDDOT in determining statewide average crash rates. This method differs from the calculation of an average crash rate in that the weighted crash rate accounts for injury and fatal crashes through the weighting process. An average crash rate calculation reflects total crash frequency, regardless of injury severity.

Intersection and segment crash rates were calculated with available daily traffic count data provided by the SDDOT or collected as part of this study.

3.5.1 US16 Corridor Segments Summary

Table 4 and **Table 5** present a summary of US16 Corridor Study segment crashes by severity and crash rate for locations within the US16/Neck Yoke Road intersection study area. Critical crash rate calculations incorporate all segments within the overall US16 Corridor Study.

Table 4: US16/Neck Yoke Road Intersection Study Area Segments – Crash Severity

US16 Segment		Fatal	Injury			PDO		Total
From	To		A	B	C	Vehicle Only	Animal	
Unknown road	Sammis Trail	0	0	3	0	9	21	33
Neck Yoke Road	Unknown road	0	0	1	0	3	4	8
Horizontal Curve (east)	Neck Yoke Road	0	0	1	0	7	24	32
Horizontal Curve (west)**	Horizontal Curve (east)	1	2	3	0	6	6	18

Notes: 2014-2018 crashes.
** Point located just east of existing Croell Quarry main entrance.
Injury severity categories:
A: Incapacitating injury B: Non-incapacitating injury C: Possible injury
PDO: Property damage only (no reported injury) crashes

Table 5: US16/Neck Yoke Road Intersection Study Area Segments – Crash Rates

US16 Segment		Weighted Crash Rates (crashes per MVMT)			Critical Crash Rates (crashes per MVMT)		
From	To	Weighted Crash Rate	State Rate	Ratio	Crash Rate	Critical Rate	Ratio
Unknown road	Sammis Trail	1.37	1.71	0.80	1.20	1.92	0.63
Neck Yoke Road	Unknown road	2.27	1.45	**1.57**	1.80	2.60	0.69
Horizontal Curve (east)	Neck Yoke Road	2.41	1.45	**1.66**	2.30	2.10	**1.10**
Horizontal Curve (west)**	Horizontal Curve (east)	4.01	1.45	**2.76**	1.80	2.22	0.81

Notes: 2014-2018 crashes.
** Point located just east of existing Croell Quarry main entrance.
Ratios that exceed 1.0 noted in **Orange Bold** text.
Functional Classification and statewide weighted average crash rate (weighted rate crashes/MVMT)
Urban Freeway & Expressway: 1.71 weighted crashes/MVMT
Rural Freeway & Expressway: 1.45 weighted crashes/MVMT
Critical crash rate calculations based on all segments within overall US16 Corridor Study.

3.5.2 US16 Corridor Intersection Summary

A summary of US16 Corridor Study intersection-related crashes occurring within the US16/Neck Yoke Road intersection study area is presented in **Table 6** and **Table 7**. Study area intersections not noted in the tables did not exhibit an intersection-related crash within the 5-year review period. The crash rate rank and critical crash rates are based on all analyzed US16 two-way stop-control intersections within the overall US16 Corridor Study.

Table 6: US16/Neck Yoke Road Intersection Study Area Intersections – Crash Severity

US16 Corridor Intersection	Intersection Control	Fatal	Injury			PDO	Total
			A	B	C	Vehicle Only	
Sammis Trail	Two-Way Stop-Control	0	0	0	1	1	2
Neck Yoke Road	Two-Way Stop-Control	1	2	0	0	1	4

Notes: 2014-2018 crashes.
Injury severity categories:
A: Incapacitating injury B: Non-incapacitating injury C: Possible injury
PDO: Property damage only (no reported injury) crashes

Table 7: US16/Neck Yoke Road Intersection Study Area Intersections – Crash Rates

US16 Corridor Intersection	Intersection Control	Weighted Crash Rates (crashes per MVMT)		Critical Crash Rates (crashes per MVMT)		
		Weighted Crash Rate	Rank	Crash Rate	Critical Rate	Ratio
Sammis Trail	Two-Way Stop-Control	0.13	11	0.06	0.26	0.23
Neck Yoke Road	Two-Way Stop-Control	0.74	4	0.16	0.27	0.58

Notes: 2014-2018 crashes.
Ratios that exceed 1.0 noted in Orange Bold text.
No statewide average available for intersections.
Critical crash rate calculations based on all analyzed intersections within overall US16 Corridor Study

3.5.3 Crash Review Findings

All four US16/Neck Yoke Road intersection crashes were angle crashes, summarized in **Table 8**, resulting in one fatal crash and two incapacitating crashes. The three injury crashes involved an eastbound and westbound vehicle, with one of them turning left onto the crossroad. The fatal crash and one incapacitating crash involved a motorcycle.

Table 8: US16/Neck Yoke Road Intersection Crash Summary (2014 – 2018)

Total Crashes: 4
Crash Rate: 0.16 crashes/MEV
Weighted Crash Rate:
0.74 crashes/MEV
Intersection Control: TWSC

Injury Crash Summary
Fatal: 1
Incapacitating: 2

Manner of Collision Summary
Angle: 4

Median width is approximately 26 feet, which does not facilitate two-stage crossings of US16. A 2015 project removed a narrow raised median and shifted left-turn lanes closer to the opposing direction to create more of an offset to view oncoming traffic. However, the three injury crashes occurred after this modification was implemented.

There were eight other crashes occurring along US16 between the Neck Yoke Road intersection and the unknown road. Four of those crashes involved wild animals. Of the remaining four, all occurred in the eastbound direction, three were roadway departure crashes, and one was an angle crash not associated with an intersection. Snow/ice road conditions were associated with two of those crashes.

Outside of the anticipated US16/Neck Yoke Road intersection project area, the two horizontal curve segments to the west noted higher weighted crash rates with one segment exceeding the critical crash rate. Crashes through these segments unrelated to the US16/Neck Yoke Road area, and are more applicable to the overall US16 Corridor Study. Many of these crashes were roadway departure type crashes that occurred on a steep grade through a horizontal curve. The SDDOT implemented a high friction surface treatment project for eastbound US16 traffic in 2019 for this segment which is expected to address many of these crashes.

Additional details regarding the crash history review can be found in the *US16 Corridor Study Crash History Review* report located in **Appendix C**.

4.0 Future Land Use

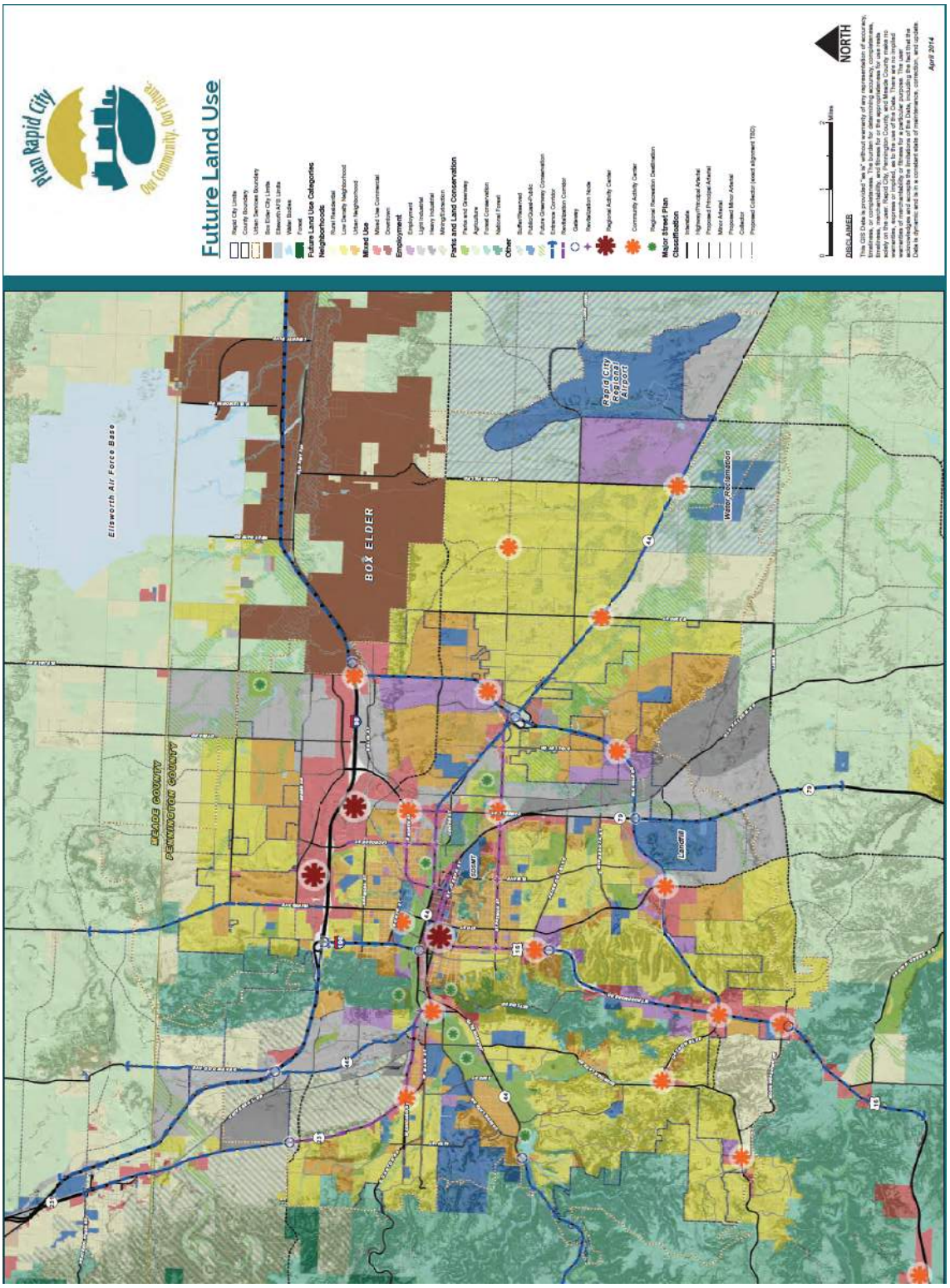
The future land use in the US16/Neck Yoke Road intersection study area was reviewed to aid in the development and assignment of traffic forecasts. It also provided insight to study and operational goals related to whether the area is expected to stay predominantly 'rural' or if high density development is expected within the 2050 Planning Horizon.

The Rapid City Comprehensive Plan[1] includes a Future Land Use Plan to guide future zoning changes, development, infrastructure improvements, investment, and reinvestment. This future land use is identified within the City of Rapid City's 3-mile platting jurisdiction and looks out over the next 10 to 20 years. The Future Land Use Plan supports the City's Urban Services Boundary and Major Street Plan, to support 'a more compact, efficient, and inter-connected pattern of development (Rapid City Comprehensive Plan page 87).

Figure 7 presents the Rapid City Comprehensive Plan Future Land Use Map, which includes both the Urban Services Boundary and Major Street Plan.

The Rapid City Comprehensive Plan subdivides Rapid City's planning area into 16 'neighborhoods'. Neighborhoods of interest to the US16/Neck Yoke Road intersection area include 'US Hwy 16' and 'Spring Creek'.

[1] Rapid City Comprehensive Plan – Plan Rapid City, adopted April 2014. https://www.rcgov.org/departments/community-planning-development/long-range-planning.html



Source: Rapid City Comprehensive Plan, April 2014. Page 89.

Figure 7: Rapid City Comprehensive Plan Future Land Use

4.1 Rapid City Comprehensive Plan – US Hwy 16 Neighborhood

The US16/Neck Yoke Road intersection is located within the US Hwy 16 neighborhood, which extends between the Cathedral Drive/Fairmont Boulevard intersection in Rapid City southward through the Neck Yoke Road area as shown in **Figure 8**.

The current urban boundary extends through this neighborhood along the section line south of Moon Meadows Drive (yellow dashed line added to **Figure 8**). The Rapid City Urban Services Boundary tracks along the urban boundary a bit to the east of US16, but primarily follows along Moon Meadows Drive west of US16. The Rapid City Comprehensive Plan identifies areas north of the Urban Services Boundary as the primary growth areas within the US Hwy 16 neighborhood through year 2040.

To the south of the Urban Service Boundary, the future land use is primarily identified as Forest Conservation with some mixed use commercial, rural residential, and parks and greenway. A large portion of this land use is already developed, such as Reptile Gardens, and Happy Holiday Resort.

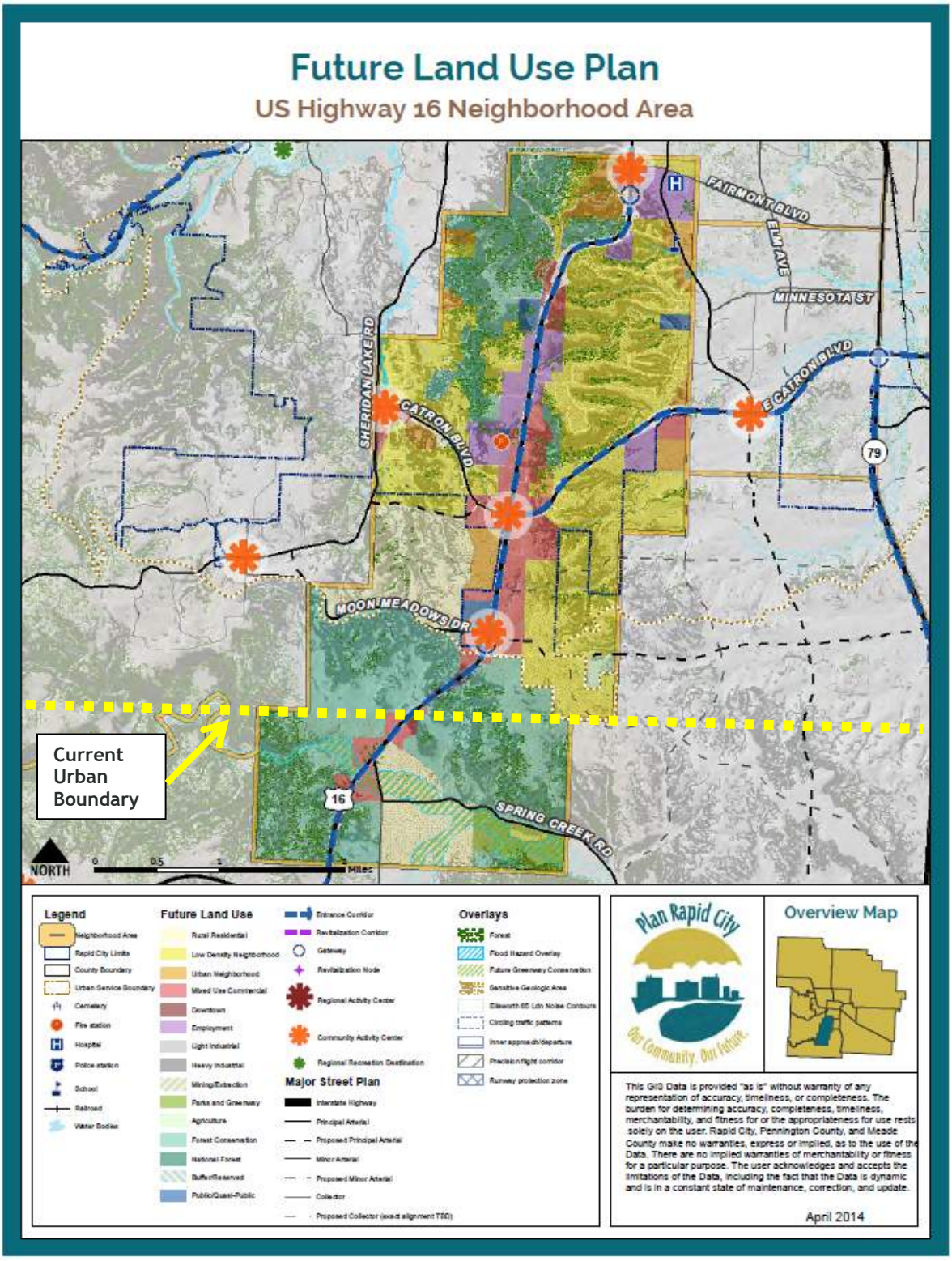
Conclusions from the future land use plan and associated neighborhood goals and policies is that future development is going to be encouraged north of Moon Meadows Drive and within the Urban Services Boundary. Land use to the south of this area is primarily low density Forest Conservation Area development, with some Rural Residential Mixed Use Commercial. However, much of the identified commercial is existing.

4.2 Rapid City Comprehensive Plan – Spring Creek Neighborhood

The Spring Creek neighborhood is located to the southwest of the current Rapid City limits and includes US16 south of the Neck Yoke Road area through the Rapid City Area MPO's planning boundary, as shown in **Figure 9**. The neighborhood also extends northward along the eastern boundary of the US Hwy 16 neighborhood.

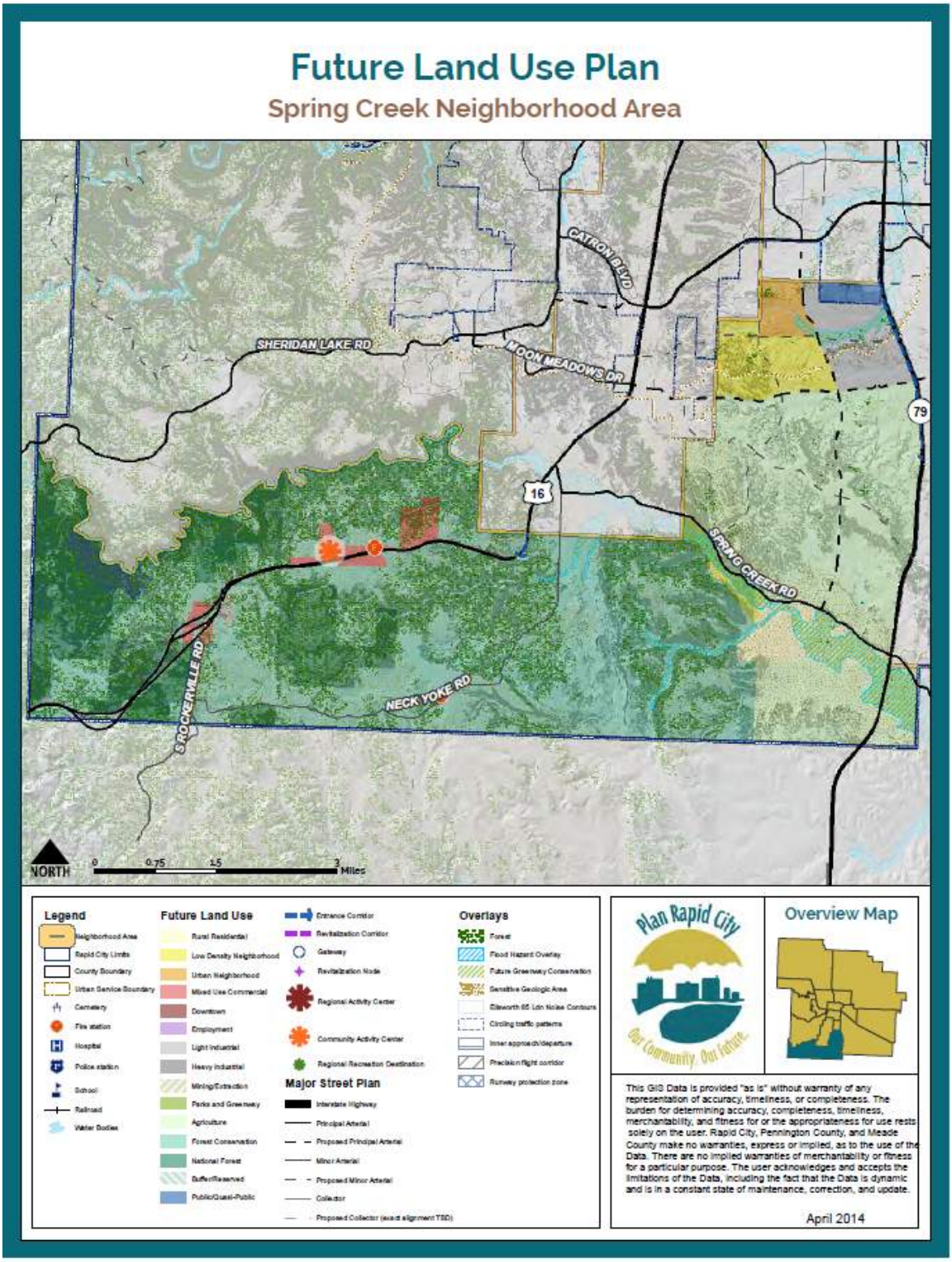
To the east of the US Hwy 16 neighborhood, between Spring Creek Road and Moon Meadows Drive, the future land use is identified as Agricultural. This notes that future development in this area is anticipated to be minimal and focus on agricultural type land uses through the Comprehensive Plan's planning horizon.

Overall, it can be concluded that the Rapid City Comprehensive Plan anticipates minimal future development throughout the Spring Creek neighborhood through year 2040. Development that has occurred and will likely continue is low density residential consistent with the Forest Conservation land use.



Source: Rapid City Comprehensive Plan, April 2014. Page 173.

Figure 8: Rapid City Comprehensive Plan – US Hwy 16 Neighborhood Area



Source: Rapid City Comprehensive Plan, April 2014. Page 169.

Figure 9: Rapid City Comprehensive Plan – Spring Creek Neighborhood Area

5.0 Traffic Forecasts

Future-year US16/Neck Yoke Road intersection study area traffic volumes were developed as part of the overall US16 Corridor Study. The study's forecast years include:

- Year 2026 – First Possible Year of Project Completion
- Year 2050 – Planning Horizon Year

Traffic forecasts help assess future-year capacity and operational needs throughout the study area due to growth in traffic demand and/or changes in traffic patterns. This study's forecast year is 2050 and reflects the planning horizon for traffic operations analysis and conceptual design. The 2026 First Possible Year of Project Completion reflects the opening day traffic operations and can reflect an interim timeframe for phased construction, if desired.

The basis for the traffic forecasts included traffic counts collected by the SDDOT and HDR in 2019 and the RCAMPO travel demand model. Future land use presented in the previous section is one of the key elements used to develop future-year trips incorporated into the model. The following model versions were used to develop forecasts for this study:

- 2013 – travel demand model base year
- 2040 – travel demand model planning horizon

The following process was used to develop daily and peak hour intersection turning movement forecasts throughout the study area for the 2050 Planning Horizon No-Build conditions:

1. The 2040 travel demand model scenario was evaluated for reasonableness, whether it met study goals, consistency in planned future roadway network, and any gaps in future development.
2. 2040 model output was post-processed consistent with travel demand model forecast methodologies presented in *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.
    a. 2050 daily segment forecasts were developed using:
        i. Seasonally adjusted existing volumes (June 2019).
        ii. 2050 growth factors were calculated from a comparison of 2013 base model and 2040 planning horizon model output.
    b. 2050 peak hour intersection turning movement forecasts were developed using:
        i. Seasonally adjusted existing volumes (June 2019).
        ii. 2050 growth factors were calculated from a comparison of 2013 base model and 2040 planning horizon model output.
        iii. The iterative directional volume estimation method as outlined in *NCHRP 765*.

Where there were gaps in the model's estimation of future development, development-generated traffic was assigned to affected intersections based on an estimation of future development occurring within the planning horizon.

Peak hour intersection turning movement volumes were smoothed and balanced throughout the study corridor.

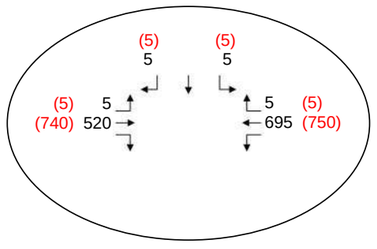
Year 2026 No-Build condition traffic volumes were developed from a straight-line interpolation between the 2019 Existing conditions volume set and the 2050 No-Build conditions volume set.

An overview of the Year 2026 and Year 2050 No Build condition traffic volumes are provided in **Figure 10** and **Figure 11**, respectively.

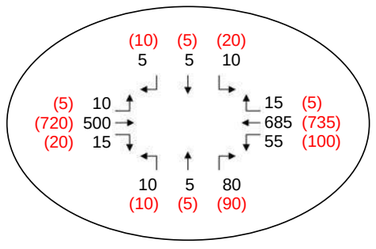
Additional information regarding the overall traffic forecasting process, a project-level review of the travel demand model, and considerations of previous studies completed to date in the area is provided in the *US16 Corridor Study Traffic Forecasts* technical memo provided in **Appendix D**.

US16 Corridor

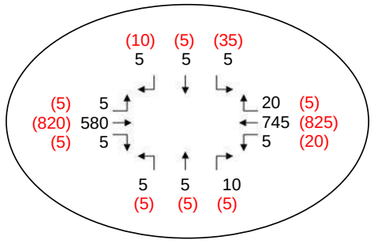
19. US16 & Croell Pit West Ent.



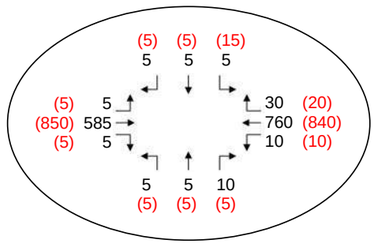
20. US16 & Neck Yoke Road



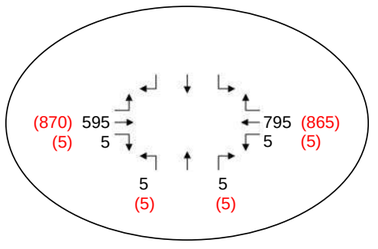
21. US16 & Reptile Gardens Cent.



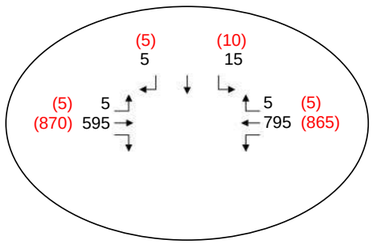
22. US16 & Reptile Gardens (N)



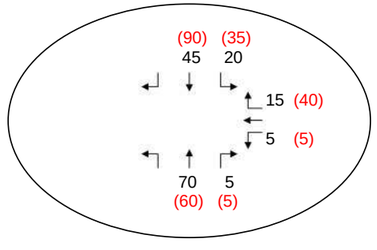
23. US16 & Unknown Road



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd



Notes
Traffic volumes obtained from the US16 Corridor Study ***2026 No-Build Conditions Traffic Operations*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

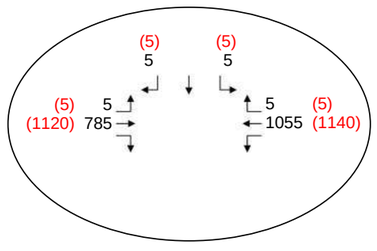
Legend

- 54 — Mileage Reference Marker (MRM)
- 1 — Study Intersection
- 14,000 — 2026 Daily Traffic Volumes*
- AM (PM) — 2026 Peak Hour Traffic Volumes*

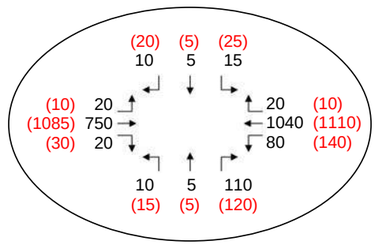
Notes:
**** Volumes reflect June design season***

US16 Corridor

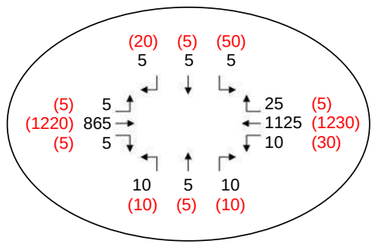
19. US16 & Croell Pit West Ent.



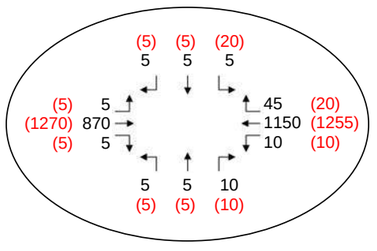
20. US16 & Neck Yoke Road



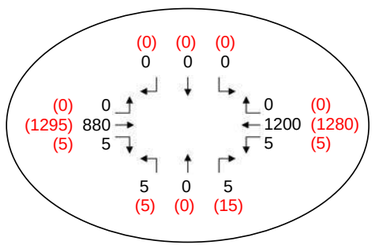
21. US16 & Reptile Gardens Cent.



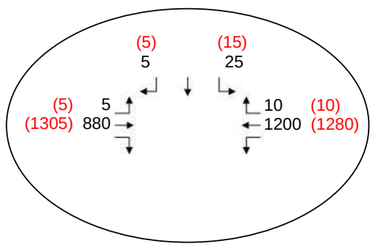
22. US16 & Reptile Gardens (N)



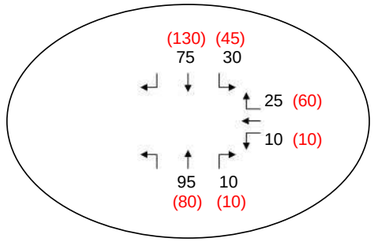
23. US16 & Unknown Road



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd



Notes
Traffic volumes obtained from the US16 Corridor Study ***Traffic Forecasts*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

Legend

- 54 — Mileage Reference Marker (MRM)
- 1 — Study Intersection
- 14,000 — 2050 Daily Traffic Volumes*
- AM (PM) — 2050 Peak Hour Traffic Volumes*

Notes:
**** Volumes reflect June design season***

US Highway 16 CORRIDOR STUDY

2050 NO-BUILD CONDITIONS TRAFFIC VOLUMES

US16 CORRIDOR STUDY - US16/NECK YOKE ROAD INTERSECTION AREA

6.0 Traffic Operations Analysis Methodology

Peak hour level of service (LOS) was calculated for study area intersections and roadway segments using Highway Capacity Software, Version 7 (HCS7) and methodology described in the 6th Edition of the Highway Capacity Manual (HCM6).

6.1 Intersection LOS

HCM6 analysis methodology measures intersection average control delay in terms of seconds of delay per vehicle (sec/veh) and applies a LOS value in accordance with thresholds presented in **Table 9**.

Table 9: Intersection Level of Service Thresholds

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

Source: Transportation Research Board, HCM6.
* Two-way stop-control LOS reflects worst-case stop-controlled approach.

Overall, or 'weighted', intersection delay was also calculated to present a second average delay measure at two-way stop-control intersections. This method accounts for the operational benefits afforded to the major, high volume through movements that are not stop or signal-controlled at intersections. HCM6 reporting in HCS7 provides an average intersection delay value that reflects the weighted average delay of all vehicles entering the intersection. A LOS measure is applied to this overall intersection delay value using HCM6 All-Way Stop-Control LOS thresholds.

6.2 Multilane Highway Segment LOS

HCM6 methodology was used to analyze multilane highway segments. The US16 corridor was segmented using break points that generally reflect changes in grade. Each segment was then analyzed based on 'level' or 'rolling' terrain for a specific grade for segments where long, steep grades were present (typically for segments longer than 0.25 miles and with grades of 3 percent or greater). Specific limits are shown in the respective operations analysis technical memo included in the **Appendix**.

HCM6 multilane analysis methods measure lane density in terms of passenger cars per mile per lane (pc/mi/ln) and applies a LOS value in accordance with thresholds presented in **Table 10**.

Table 10: Multilane Highway Segment Level of Service Thresholds

LOS	Density (pc/mi/ln)
A	≤ 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	Demand exceeds capacity; > 45

Source: Transportation Research Board, HCM6.

6.3 Alternative Intersection LOS

HCM6 classifies multiple, closely-spaced intersections that distribute/displace traffic movements as alternative intersections. These alternative intersections, such as an RCI that displaces left and through traffic from the minor approach to a downstream U-turn, are operationally independent and best analyzed as a single unit

Alternative intersection LOS methodology is slightly different from a conventional intersection in that it considers an entire origin-destination path through the multiple intersections. This path takes into account both control delay at each intersection as well as the extra distance travel time. Combined, these two measures determine the experienced travel time (ETT) for each origin-destination travel path through the intersection.

Experienced travel time LOS thresholds are provided in **Table 11**.

Table 11: Alternative Intersection Origin-Destination Level of Service Thresholds

LOS	Experienced Travel Time per Vehicle (sec/veh)
A	≤ 10
B	> 10 – 20
C	> 20 - 35
D	> 35 – 55
E	> 55 – 80
F	Demand exceeds capacity; > 80

Source: Transportation Research Board, HCM6.

HCS7 methodology also calculates overall intersection ETT to account for the benefits afforded to the high volume free through movements on the major route. The same ETT LOS thresholds that are applied to individual movement ETT can be applied to the overall intersection ETT.

6.4 Level of Service Goals

The US16/Neck Yoke Road intersection has been identified as a rural intersection for the US16 Corridor Study. This determination was made through a review of planning efforts completed to date by the City of Rapid City and the Rapid City Area MPO. Further, the existing Rapid City urban boundary is along a section line between the unknown road (north of Neck Yoke Road) and Sammis Trail and is not anticipated to shift southward into the Spring Creek valley in the near future. All intersections within the US16/Neck Yoke Road intersection study area, except the US16 & Sammis Trail intersection, fall within the rural area.

The following minimum allowable LOS thresholds in **Table 12** have been established for this study.

Table 12: Minimum Allowable Level of Service by Facility

Facility Type	Minimum Allowable LOS	Notes
	Rural Area	
Signalized Intersections	LOS B	
Two-Way Stop-Controlled Intersections	LOS B	TWSC intersection LOS will be based on weighted average intersection delay. The worst-cast stop-controlled approach delay and LOS may be lower than the minimum allowable LOS.
Multilane Highways	LOS B	

7.0 Existing and Future No Build Conditions Traffic Operations

The following summarizes intersection and multilane highway segment traffic operations for the 2019 existing, 2026 No Build, and 2050 No Build conditions through the US16/Neck Yoke Road intersection study area. Locations that do not meet LOS goals outlined for this study area are noted in **Bold Orange** text in the table. Additional information for these analyses can be found in the following reports included in the **Appendix**:

- *2019 Existing Conditions Traffic Operations* technical memo (**Appendix B**)
- *2026 No-Build Conditions Traffic Operations* technical memo (**Appendix E**)
- *2050 No-Build Conditions Traffic Operations* technical memo (**Appendix F**)

7.1 Intersections

A summary of intersection operations for the Existing, 2026 No Build and 2050 No Build conditions is provided in the following tables. All intersections within the US16/Neck Yoke Road intersection study area are two-way stop-controlled intersections from the side street (US16 through traffic has a free movement). The LOS B goal for this study at two-way stop-controlled intersections is applied to the overall, or weighted, delay measure.

Table 13: Intersection Operations – Existing Conditions

US16 Intersection	Measure	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Sammis Trail	Overall	0.1	A	-	0.0	A	-
	TWSC	*13.3*	*B*	*0.0*	*0.0*	*A*	*0.0*
Unknown Road	Overall	0.0	A	-	0.1	A	-
	TWSC	*9.9*	*A*	*0.0*	*11.1*	*B*	*0.1*
US16 Service Road / Reptile Gardens North Access	Overall	0.1	A	-	0.3	A	-
	TWSC	*14.1*	*B*	*0.0*	*29.1*	*D*	*0.2*
US16 Service Road / Reptile Gardens Central Access	Overall	0.2	A	-	1.0	A	-
	TWSC	*16.5*	*C*	*0.1*	*29.2*	*D*	*0.8*
Neck Yoke Road / Reptile Gardens South Access	Overall	1.2	A	-	1.7	A	-
	TWSC	*19.0*	*C*	*0.2*	*28.1*	*D*	*0.5*
Croell Pit West/Main Entrance	Overall	0.0	A	-	0.0	A	-
	TWSC	*10.1*	*B*	*0.0*	*5.0*	*A*	*0.0*
Non-US16 Intersection: Neck Yoke Rd & Spring Creek Rd	Overall	1.7	A	-	2.8	A	-
	TWSC	*2.3*	*A*	*0.0*	*2.1*	*A*	*0.1*

Overall intersection control delay represents the weighted average of each approach.
TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95th% queue.

Table 14: Intersection Operations – 2026 No Build Conditions

US16 Intersection	Measure	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Sammis Trail	**Overall**	0.2	A	-	0.2	A	-
	TWSC	*12.6*	*B*	*0.1*	*15.2*	*C*	*0.1*
Unknown Road	**Overall**	0.2	A	-	0.3	A	-
	TWSC	*19.6*	*C*	*0.2*	*30.9*	*D*	*0.3*
US16 Service Road / Reptile Gardens North Access	**Overall**	0.9	A	-	2.2	A	-
	TWSC	*36.2*	*E*	*0.5*	*98.6*	*F*	*1.8*
US16 Service Road / Reptile Gardens Central Access	**Overall**	1.2	A	-	5.6	A	-
	TWSC	*50.2*	*F*	*0.9*	*169.4*	*F*	*4.3*
Neck Yoke Road / Reptile Gardens South Access	**Overall**	2.1	A	-	5.6	A	-
	TWSC	*45.2*	*E*	*1.0*	*173.9*	*F*	*3.3*
Croell Pit West/Main Entrance	**Overall**	0.2	A	-	0.2	A	-
	TWSC	*19.0*	*C*	*0.1*	*23.4*	*C*	*0.2*
Non-US16 Intersection: Neck Yoke Rd & Spring Creek Rd	**Overall**	1.9	A	-	2.8	A	-
	TWSC	*7.8*	*A*	*0.1*	*8.4*	*A*	*0.2*

Overall intersection control delay represents the weighted average of each approach.
TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95th% queue.

Table 15: Intersection Operations – 2050 No Build Conditions

US16 Intersection	Measure	AM			PM		
		Control Delay (sec/veh)	LOS	95% Queue (veh)	Control Delay (sec/veh)	LOS	95% Queue (veh)
Sammis Trail	**Overall**	0.2	A	-	0.2	A	-
	TWSC	*18.4*	*C*	*0.2*	*27.4*	*D*	*0.4*
Unknown Road	**Overall**	0.6	A	-	1.9	A	-
	TWSC	*42.5*	*E*	*0.4*	*78.0*	*F*	*1.3*
US16 Service Road / Reptile Gardens North Access	**Overall**	3.1	A	-	64.0	F	-
	TWSC	*204.6*	*F*	*1.9*	*4539.5*	*F*	*6.3*
US16 Service Road / Reptile Gardens Central Access	**Overall**	11.2	B	-	134.9	F	-
	TWSC	*577.9*	*F*	*4.0*	*4259.0*	*F*	*13.1*
Neck Yoke Road / Reptile Gardens South Access	**Overall**	22.8	C	-	590.7	F	-
	TWSC	*525.4*	*F*	*10.1*	*12975.8*	*F*	*23.1*
Croell Pit West/Main Entrance	**Overall**	0.3	A	-	0.5	A	-
	TWSC	*39.3*	*E*	*0.3*	*63.4*	*F*	*0.6*
Non-US16 Intersection: Neck Yoke Rd & Spring Creek Rd	**Overall**	2.1	A	-	2.9	A	-
	TWSC	*7.9*	*A*	*0.1*	*8.5*	*A*	*0.3*

Overall intersection control delay represents the weighted average of each approach.
TWSC control delay represents the worst-cast stop-controlled approach delay and the associated 95th% queue.

7.2 Multilane Highway Segments

Multilane highway segment analysis measures through the US16/Neck Yoke Road intersection study area are shown in the following tables for Existing, 2026 No Build and 2050 No Build conditions. The segment numbering corresponds with the overall US16 Corridor Study multilane highway segmentation, with segments 27-34 occurring in this intersection sub-area. The general segmentation is as follows:

- Segments 27-31: Croell Pit West Entrance to MRM 61.50 (near Spring Creek bridges)
- Segment 32: Mileage reference marker (MRM) 61.50 (near Spring Creek bridges) to 62.00 (unknown road)
- Segments 33-34: 62.00 (unknown road) to Sammis Trail

A reference map for these locations is included in the respective traffic operations analysis technical memos in the **Appendix**.

Table 16: US16 Multilane Highway Operations – Existing Conditions

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)	Analysis Grade (%)**	AM LOS		PM LOS	
		From	To			EB	WB	EB	WB
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8	6.0	A	A	A	A
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	A	A	A	A
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0	6.5	A	A	A	A

Segment number corresponds with overall US16 Corridor Study segmentation.
** Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.
Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).
Limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.

Table 17: US16 Multilane Highway Operations – 2026 No Build Conditions

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)	Analysis Grade (%)**	AM LOS		PM LOS	
		From	To			EB	WB	EB	WB
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8	6.0	A	A	A	A
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	A	A	A	A
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0	6.5	A	A	A	A

Segment number corresponds with overall US16 Corridor Study segmentation.
** Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.
Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).
Limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.

Table 18: US16 Multilane Highway Operations – 2050 No Build Conditions

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)	Analysis Grade (%)**	AM LOS		PM LOS	
		From	To			EB	WB	EB	WB
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8	6.0	A	B	B	B
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	A	B	B	B
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0	6.5	A	B	B	B

Segment number corresponds with overall US16 Corridor Study segmentation.
** Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.
Existing profile information obtained from SDDOT profile GIS layer (current spring 2019).
Limits and length are approximate, and thus may not align due to rounding and approximation of MRM locations.

7.3 Existing and Future No Build Conditions Traffic Operations Conclusions

The following intersections did not meet LOS goals in the 2050 No Build conditions. In each instance, the overall intersection delay, or weighted average, exceeded the LOS B goal.

- US16 & US16 Service Road/Reptile Gardens North Access
    - Overall intersection LOS F in PM peak period (2050)
- US16 & US16 Service Road/Reptile Gardens Central Access
    - Overall intersection LOS F in PM peak period (2050)
- US16 & Neck Yoke Road/Reptile Gardens South Access
    - Overall intersection LOS C in AM peak period and LOS F in PM peak period (2050)

All US16 multilane segments through the study area were measured at LOS B or better, and thus meet LOS goals for this study.

8.0 Summary of US16/Neck Yoke Road Intersection Transportation Needs

The purpose of the US16/Neck Yoke Road intersection Project is to improve safety and access management in the area of Neck Yoke Road. Transportation needs addressed by the purpose are summarized in the following. Additional information regarding the project purpose and need can be found in the current version of the US16/Neck Yoke Road Purpose and Need document.

High severity crash rate

Three of the four crashes occurring at the US16/Neck Yoke Road intersection between 2014 and 2018 resulted in fatal (1 crash) or serious injuries (2 crashes). All four crashes were angle type crashes. This resulted in a weighted crash rate in the top five of all intersections analyzed as part of the overall US16 corridor study.

Multiple access points

Current US16 spacing between Neck Yoke Road and adjacent access points is less than 600 feet, which is less than recommended minimums outlined by the SDDOT expressway access classification. This spacing leads to multiple safety and operational issues in the area, such as:

- Existing turn lanes do not meet recommend lengths, requiring traffic to complete more of their deceleration in the US16 through lane instead of within the turn lane.
- Not all access points include turn lanes, which requires motorists to fully decelerate and potentially stop in a US16 through lane to complete some movements.
- Each access point provides for all movements, leading to numerous points of conflict for turning and through traffic.

9.0 US16/Neck Yoke Road Intersection Preliminary Concept Summary

The US16/Neck Yoke Road intersection was first studied in a 2004 as part of a US16 corridor study between Neck Yoke Road and Cathedral Drive/Fairmont Boulevard. That study recommended consolidating all access points in the Neck Yoke Road/Reptile Gardens area to a single access point. A traffic signal was noted for consideration when warranted by traffic signal warrants.

In the early stages of this US16 Corridor Study, seven intersection concepts were developed to evaluate different types of intersections.

- Concept 1: Neck Yoke Road Realignment Options
    - Concepts would be implemented in conjunction with an applicable intersection concept noted below.
- Concept 2: Standard Diamond Interchange South of Neck Yoke Road
- Concept 3: Tight Diamond Interchange North of Neck Yoke Road
- Concept 4: Reduced Conflict Intersection (RCI) at Neck Yoke Road
- Concept 5: RCI at Central Driveway
- Concept 6: Traffic Signal at Neck Yoke Road
- Concept 7: Traffic Signal at Central Driveway

Two intersection types across four concepts, an RCI and signalized intersection shown in Concepts 4-7, were carried forward as Build Options from a Study Advisory Team meeting held on October 28, 2019. While the larger interchange and realignment concepts were eliminated from consideration (Concepts 1-3), they will still be considered as part of the long-range planning process for the overall US16 corridor.

The intersection type concept screening process is documented in the *US16/Neck Yoke Road Intersection Concept Evaluation* report attached in **Appendix G**.

10.0 US16/Neck Yoke Road Intersection Build Options

Carrying forward the RCI and signalized intersection types from the preliminary concept evaluation phase led to the development of 13 different Build Option variations. Overall, there are three primary elements that are incorporated in various combinations to develop these Build Options:

1. Intersection control: RCI or signalized intersection.
2. Main intersection location: at Neck Yoke Road, at Neck Yoke Road shifted west, or the central driveway.
3. Number of access points: one or two.

Build Options developed for the US16/Neck Yoke Road intersection, shown in **Figure 12** through **Figure 24**, are as follows:

- 1.1a: RCI at Neck Yoke Road
- 1.1b: RCI at Neck Yoke Road plus Northern ¾ Access

- 1.1c: RCI at Neck Yoke Road plus Northern Partial Access
- 1.1d: RCI at Neck Yoke Road (West)
- 1.1e: RCI at Neck Yoke Road (West) plus Central Partial Access
- 1.2a: RCI at Central Driveway
- 1.2b: RCI at Central Driveway plus Northern ¾ Access
- 1.3a: RCI at Central Driveway with US16 Realignment
- 1.3b: RCI at Central Driveway with US16 Realignment plus Northern ¾ Access
- 2.1a: Signalized Intersection at Neck Yoke Road
- 2.1b: Signalized Intersection at Neck Yoke Road plus Northern ¾ Access
- 2.2a: Signalized Intersection at Central Driveway
- 2.2b: Signalized Intersection at Central Driveway plus Northern ¾ Access

All Build Options incorporate some level of consolidation of the following existing US16 access points:

- Neck Yoke Road/Reptile Gardens South (US16/Neck Yoke Road)
- US16 Service Road Central Access/Reptile Gardens Central Driveway (US16/Central Driveway)
- US16 Service Road North Access/Reptile Gardens North Driveway (US16/North Driveway)
- Unknown road

Design-related considerations incorporated into the Build Options include, but are not limited to:

- Frontage connections have been incorporated to provide access to parcels dependent on a proposed modified or closed access point.
    - Full-length frontage road on west side: built eastward from the outer row of parking to not impact existing stalls and sign.
    - Partial length frontage road on west side: parking impacts anticipated to outer row of parallel parking north of existing access point to provide greater separation between US16 and first conflict point. Proposed relocation of parallel parking to the wide aisle north edge of parking lot.
    - On the west side, Build Options with full-length frontage roads build the
- Both Spring Creek bridges on US16 are shown as being replaced in all Build Options due to their age (both constructed in 1963-1964).
- With consolidation of area turning movements to a single location,
    - Unsignalized US16 left and right turn lanes will be warranted by year 2050, with the westbound left and right turn lanes currently being warranted or will be warranted by 2026. US16 left and right turn lanes are incorporated in all RCI Build Options.

    - It is anticipated that a full access intersection may meet traffic signal warrants by year 2026. A traffic signal is included in all signalized intersection Build Options.
- Unless noted, layouts reflect a design speed of:
    - US16: 65 mph
    - Neck Yoke Road: 35 mph

More information on each Build Option is provided in the *US16/Neck Yoke Road Intersection Build Option Evaluation* report provided in **Appendix H**.

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- STOP Controlled Intersection
- X Access Closure

16

STOP

100ft

Neck Yoke Road

Build Option
1.1a

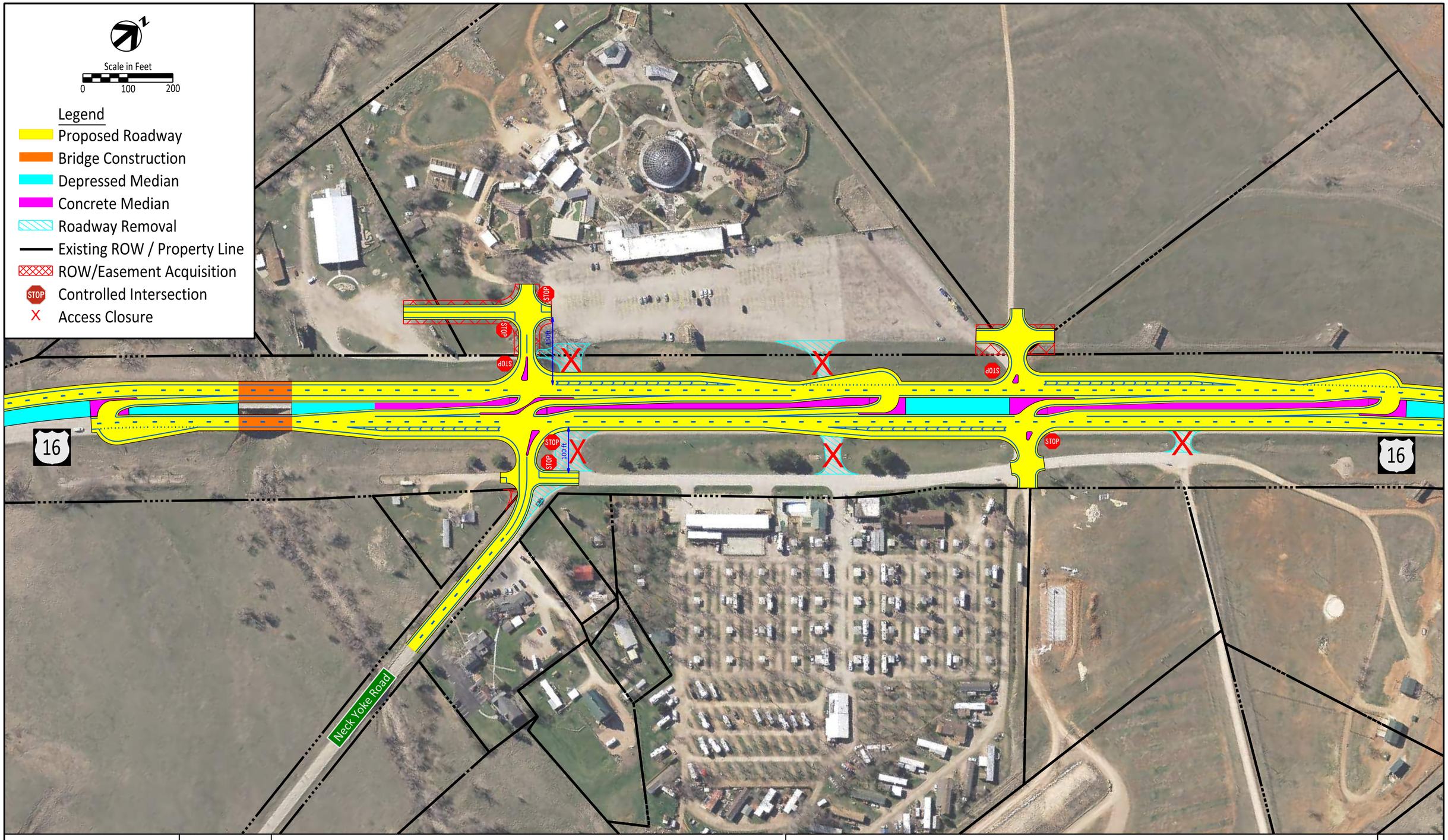
US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
12

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- Access Closure



Build Option
1.1b

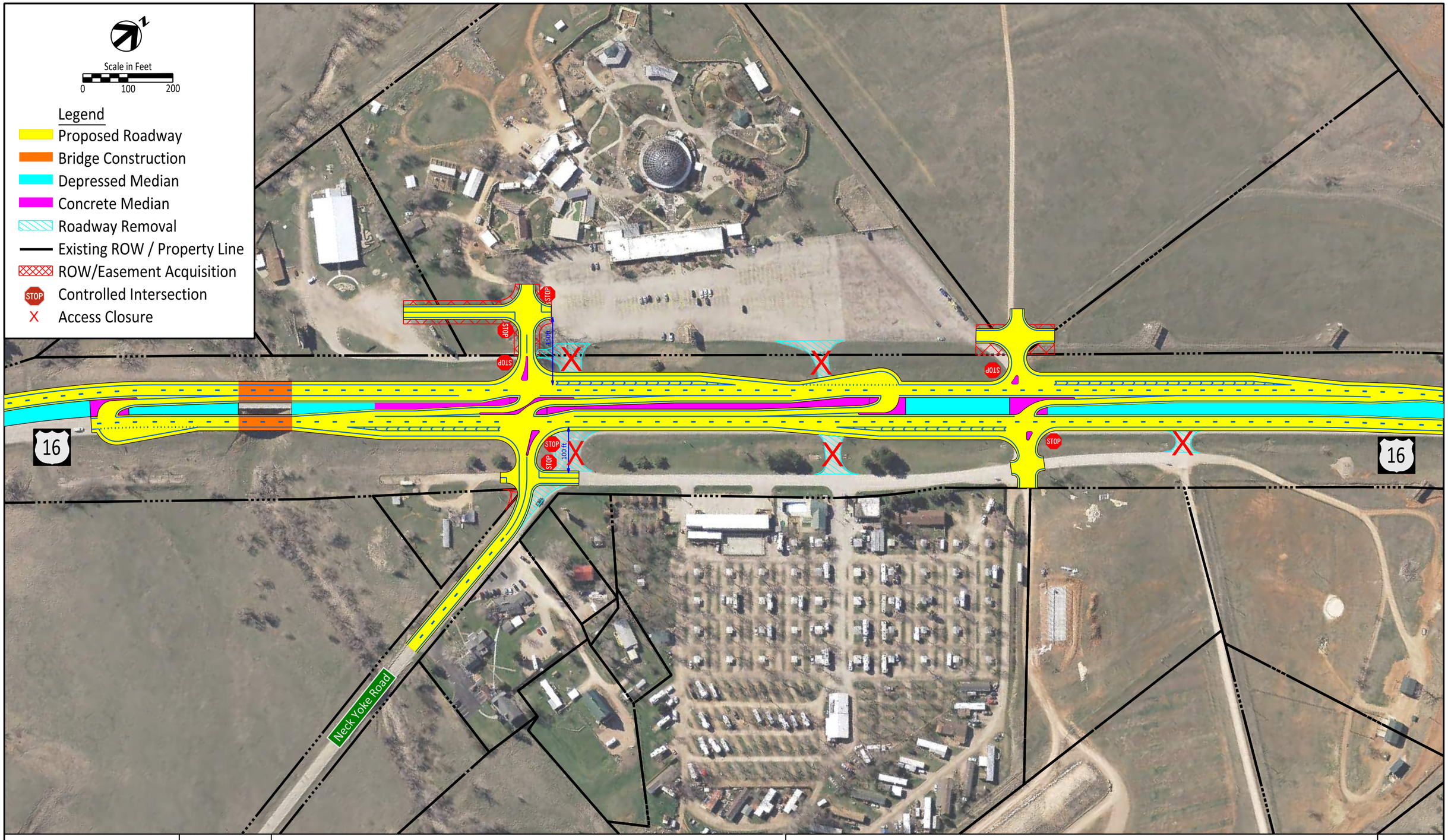
US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
13

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- Access Closure

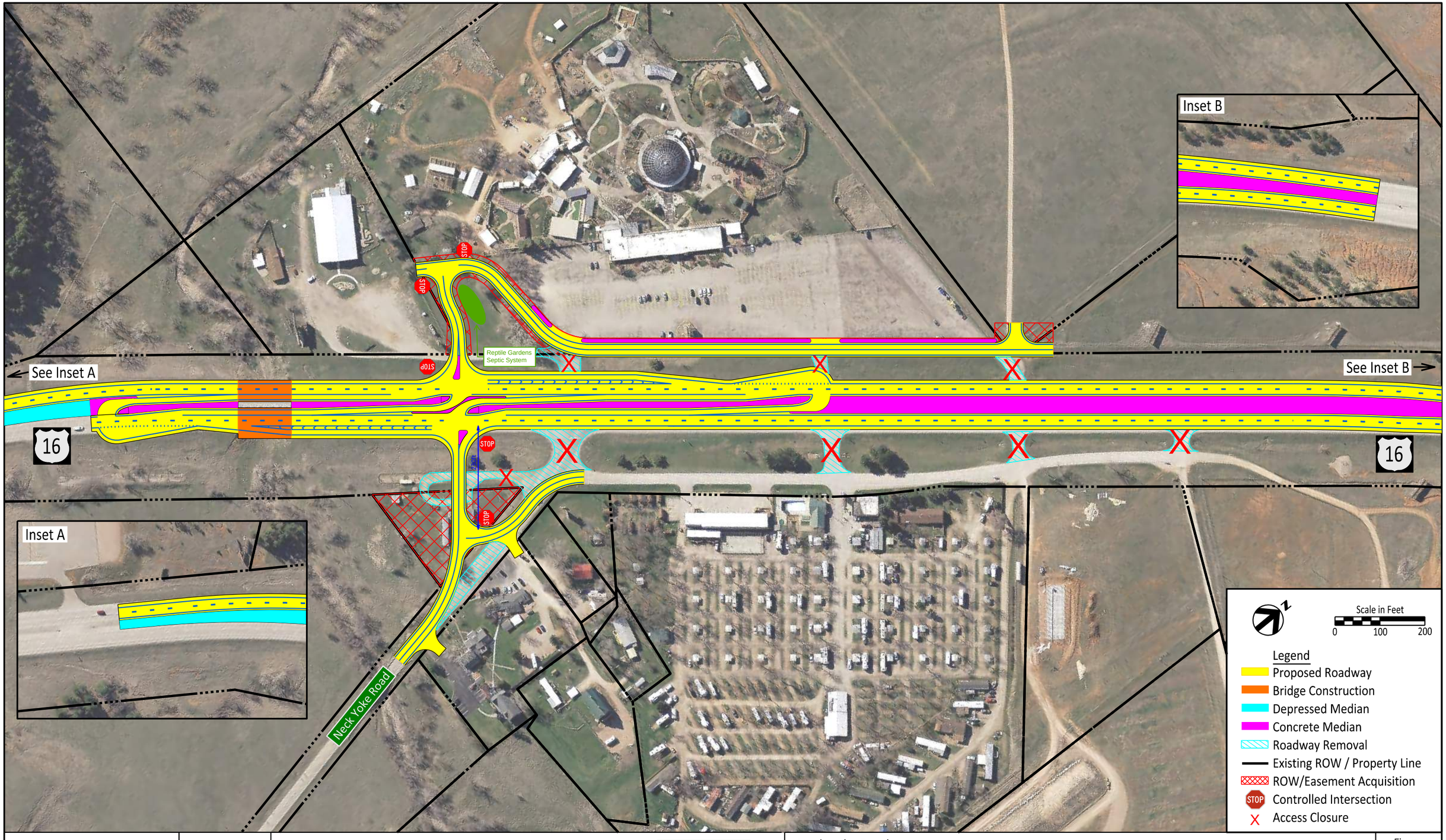


Build Option
1.1c

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
14

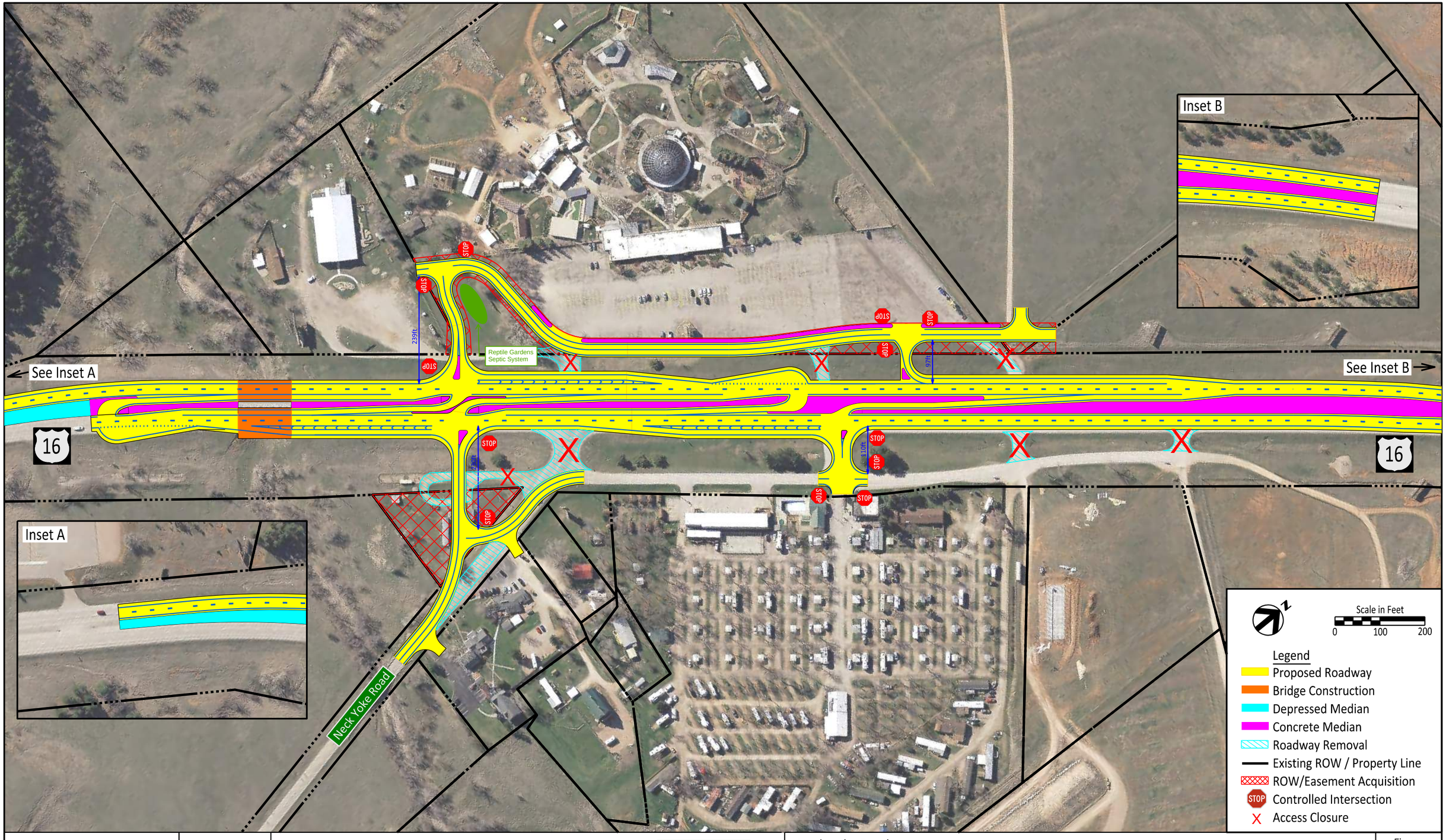


Build Option
1.1d

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
15



Build Option
1.1e

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
16

Option 1 for Northwest Access

Option 2 for Northwest Access

Option 3 for Northwest Access

Inset B

Inset A

See Inset A

See Inset B

Reptile Gardens
Septic System

Neck Yoke Road

239ft

110ft

97ft

STOP

16

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- Access Closure

Build Option
1.1e

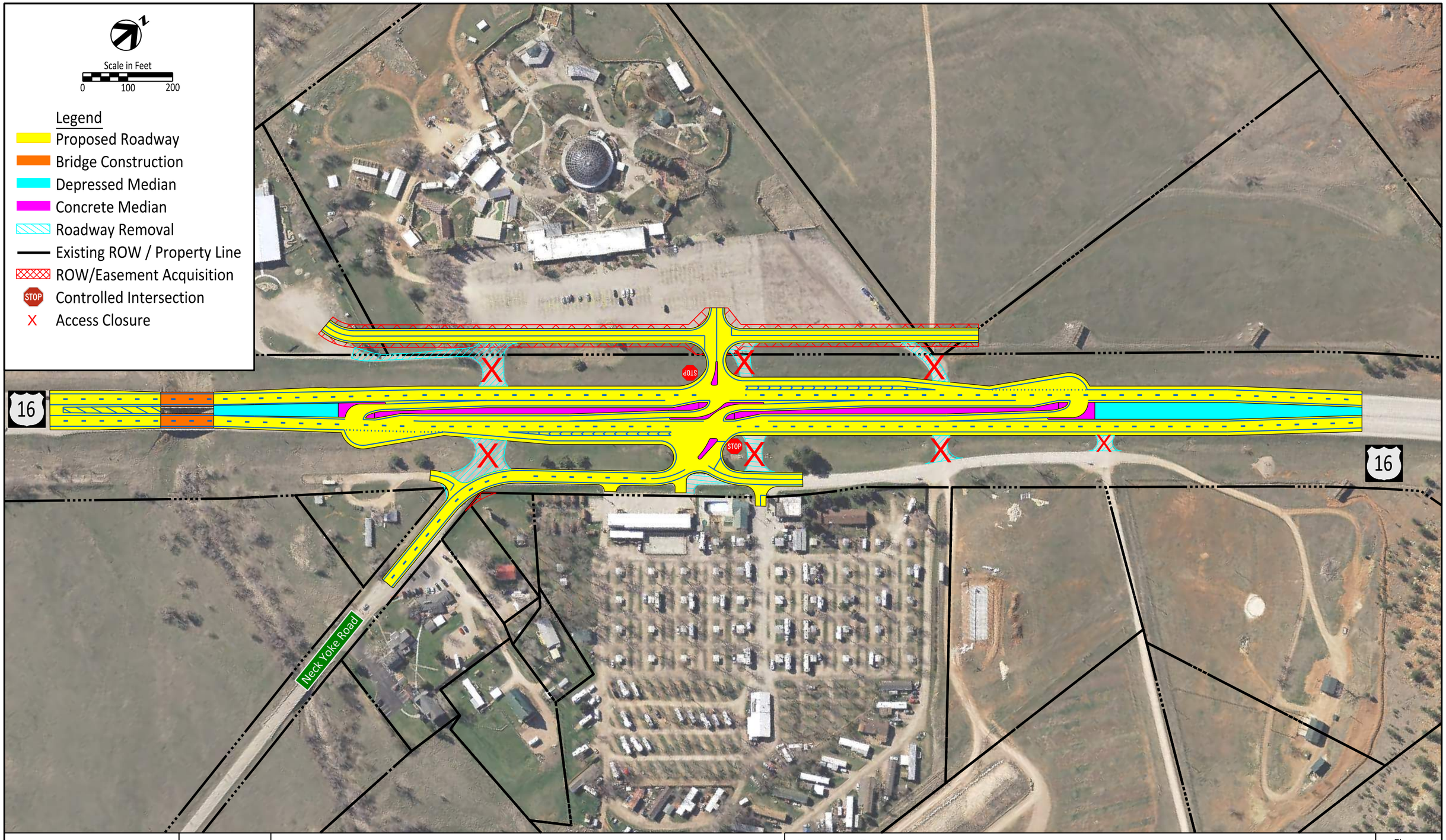
US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
16

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- STOP Controlled Intersection
- X Access Closure



Build Option
1.2a

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Central Driveway
US16 Corridor Study
Rapid City, SD

Figure
17

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- STOP Controlled Intersection
- X Access Closure

16

STOP

X

Neck Yoke Road

Build Option 1.2b			US Highway 16 CORRIDOR STUDY	Neck Yoke Road Reduced Conflict Intersection (RCI) - Central Driveway US16 Corridor Study Rapid City, SD	Figure 18

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- Access Closure

Neck Yoke Road

16

16

STOP

STOP

Build Option
1.3a

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Central Driveway with US16 Realignment
US16 Corridor Study
Rapid City, SD

Figure
19

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- STOP Controlled Intersection
- X Access Closure

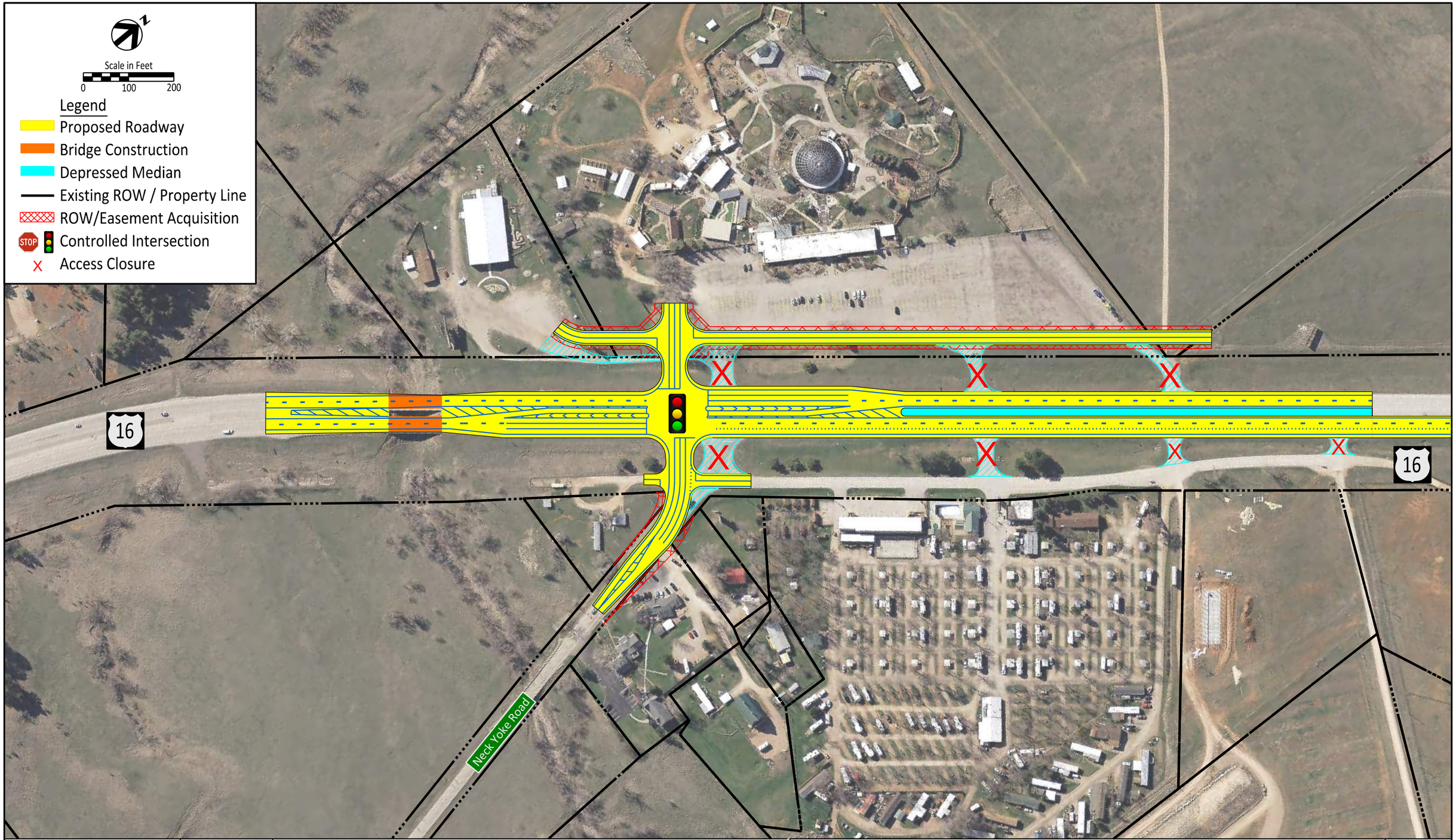
16
16
Neck Yoke Road
STOP
STOP
STOP

Build Option
1.3b

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Reduced Conflict Intersection (RCI) - Central Driveway with US16 Realignment
US16 Corridor Study
Rapid City, SD

Figure
20

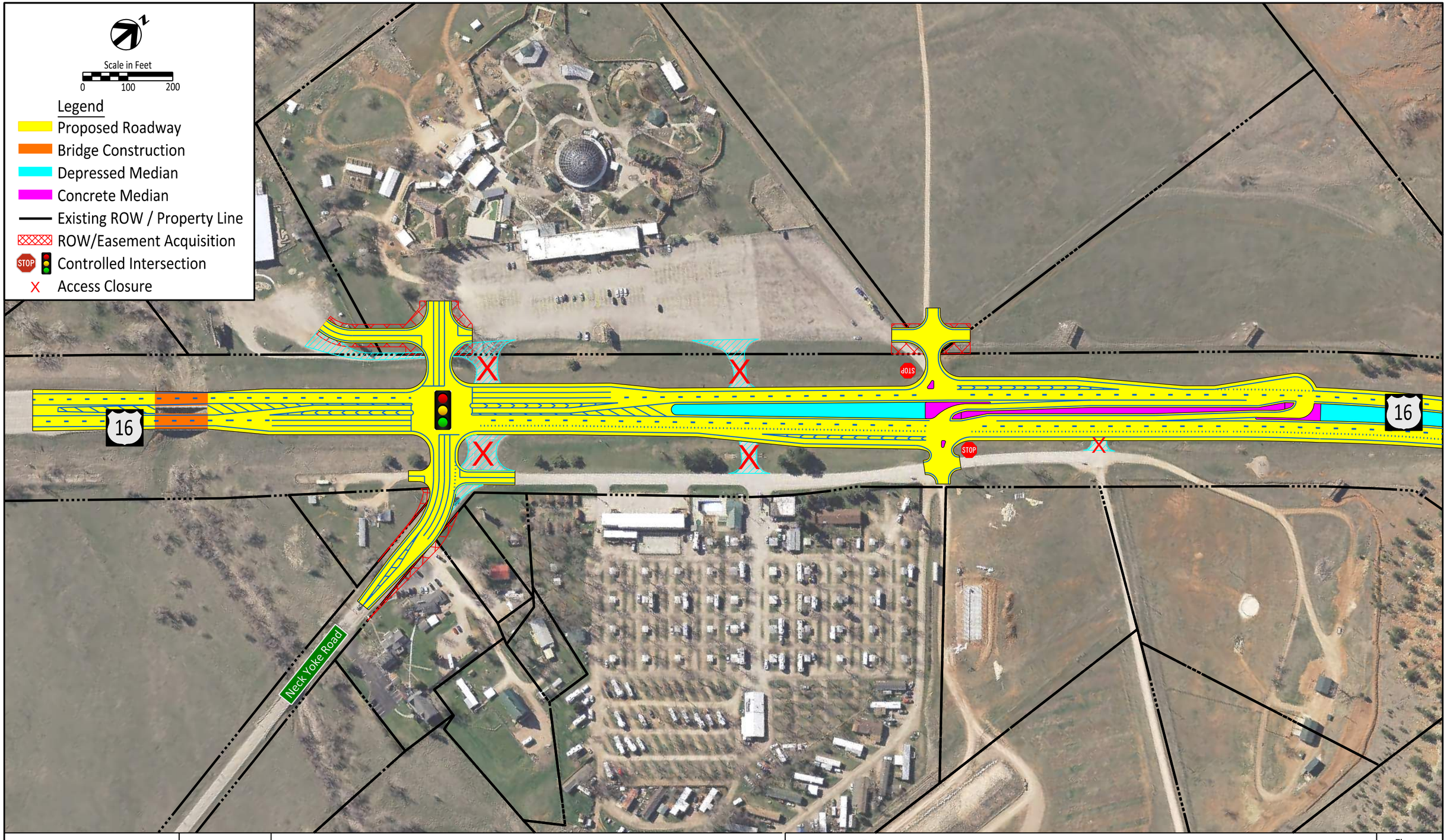


Build Option
2.1a

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Signalized Intersection - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
21



Build Option
2.1b

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Signalized Intersection - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
22

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- Access Closure

16

Neck Yoke Road

16

Build Option
2.2a

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Signalized Intersection - Central Driveway
US16 Corridor Study
Rapid City, SD

Figure
23

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Bridge Construction
- Depressed Median
- Concrete Median
- Roadway Removal
- Existing ROW / Property Line
- ROW/Easement Acquisition
- Controlled Intersection
- X Access Closure

16
16
Neck Yoke Road
STOP
STOP

Build Option
2.2b

US Highway 16
CORRIDOR STUDY

Neck Yoke Road
Signalized Intersection - Central Driveway
US16 Corridor Study
Rapid City, SD

Figure
24

11.0 US16/Neck Yoke Road Intersection Build Option Analysis

11.1 Build Condition Traffic Volume Development

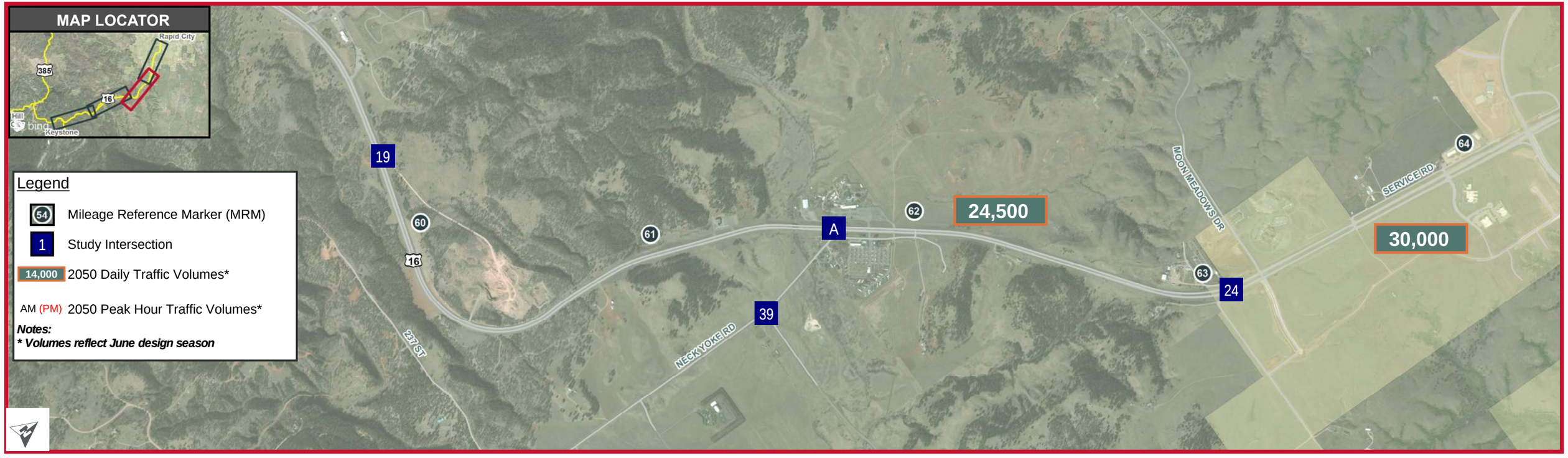
Each Build Option required redistribution, or assignment, of traffic volumes to the consolidated access points. This study assumes that all traffic volumes entering and exiting the US16/Neck Yoke Road intersection sub-area in the No Build conditions will also enter the sub-area in the Build conditions. The complete 2050 and 2026 Build condition volume sets are provided in **Figure 25** and **Figure 26**.

11.2 2050 Build Condition Traffic Operations

The following tables present 2050 Build conditions traffic operations for the 11 Build Options. The corresponding purpose of each measure in the Build Option evaluation process is also noted.

- **Table 19**, intersection delay in terms of ETT for the RCI Build Options and intersection delay for the signalized intersection Build Options.
    - Validates that each Build Option meets LOS B goal.
    - Provides a measure to compare traffic operations across all Build Options.
- **Table 20**, side-street queue lengths in terms of 95th percentile queue.
    - Validates that each Build Option reasonably manages queues.
    - Provides a measure to determine whether a Neck Yoke Road approach queue would block potential left-turning traffic onto US16 service road (i.e. a US16 to Neck Yoke Road to US16 service road movement).
- **Table 21**, US16 left-turn lane queue lengths in terms of 95th percentile queue.
    - Validate that each Build Option manages left-turn queues within available turn lane lengths.
- **Table 22**, US16 multilane highway operations in terms of density.
    - Validates multilane highway LOS will be maintained at LOS B or better with implementation of a Build Option.

HCS reports are provided in **Appendix I**.

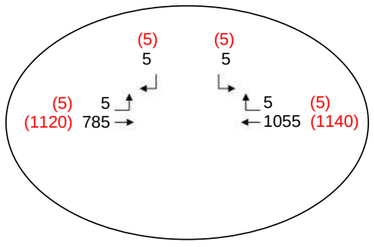


Build Options 2.1a & 2.2a

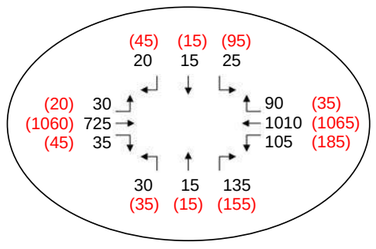
Single Full Access Intersection

US16 Corridor

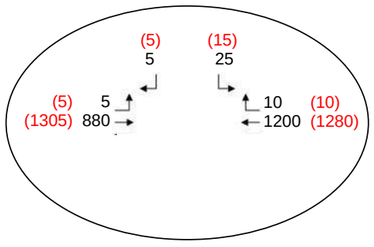
19. US16 & Croell Pit West Ent.



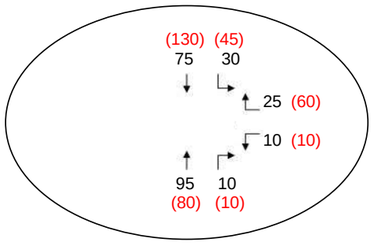
A. US16 & Neck Yoke Road



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd

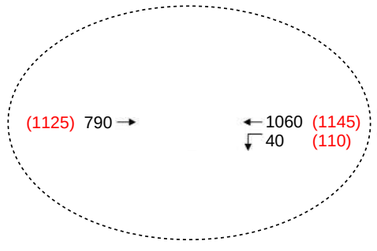


Build Options 1.1a, 1.1d, 1.2a & 1.3a

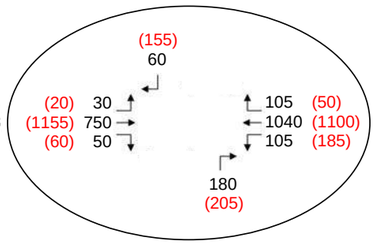
Single RCI

US16 Corridor

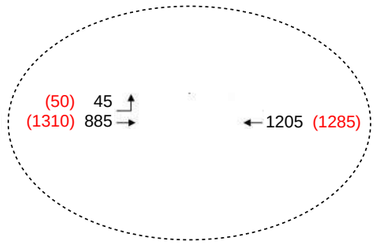
A-W. U-Turn Crossover West



A. US16 & Neck Yoke Road



A-E. U-Turn Crossover East



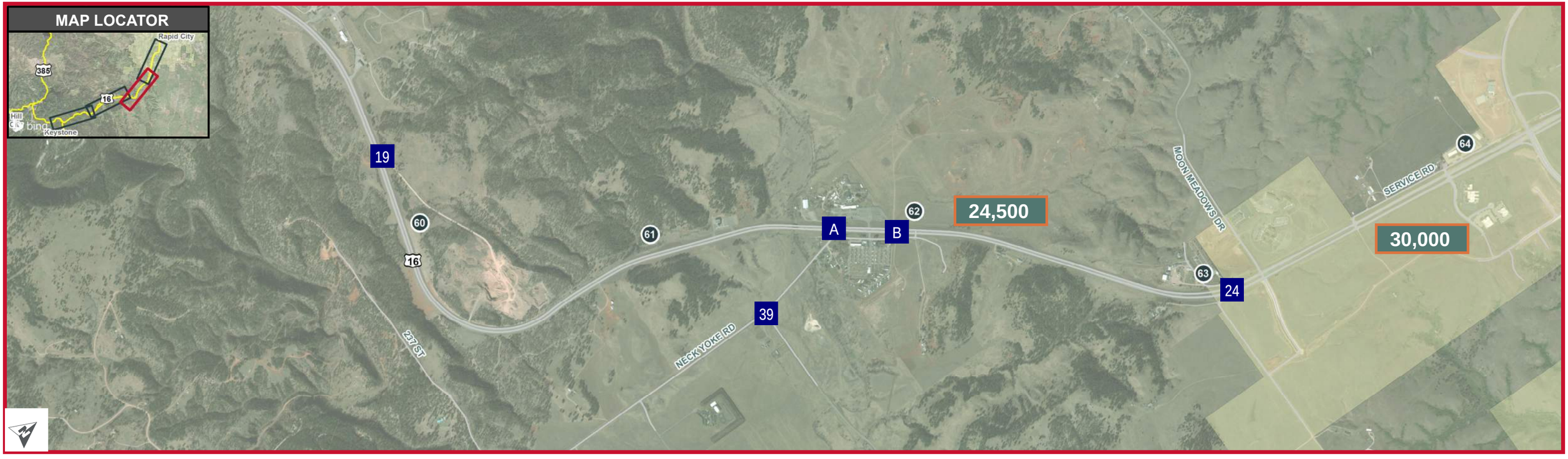
Notes

US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***Traffic Forecasts*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

Intersections 20-23 are consolidated to a single full access point 'A'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2050 No-Build Conditions forecasts.



Build Options 1.1b, 1.1c, 1.1e, 1.2b & 1.3b

RCI with North 3/4 Access Intersection

US16 Corridor

A-W. U-Turn Crossover West

(1125) 790 → ← 1060 (1145)
← 40 (110)

A. US16 & Neck Yoke Road

(130) 50 ↑
(20) 30 ↑ (1165) 760 → (50) 40 ↓
60 (30) ← 1050 (1125) ← 80 (140) ↓
135 (150) ↑

A-E. U-Turn Crossover East

(30) 25 ↑ (1285) 870 →
← 1165 (1265)

B. US16 & North 3/4 Access

(25) 10 ↑
(1275) 860 → (10) 10 ↓
45 (20) ← 1155 (1240) ← 25 (45) ↓
45 (55) ↑

B-E. U-Turn Crossover East

(20) 20 ↑ (1310) 885 →
← 1205 (1285)

US16 Corridor

19. US16 & Croell Pit West Ent.

(5) 5 ↓ (5) 5 ↓
(5) 5 ← (1120) 785 →
5 (5) ← 1055 (1140)

24. US16 & Sammis Tr

(5) 5 ↓ (15) 25 ↓
(5) 5 ← (1305) 880 →
10 (10) ← 1200 (1280)

39. Neck Yoke Rd & Spring Creek Rd

(130) 75 ↓ (45) 30 ↓
25 (60) ←
10 (10) ↓
95 (80) ↓ 10 (10) ↓

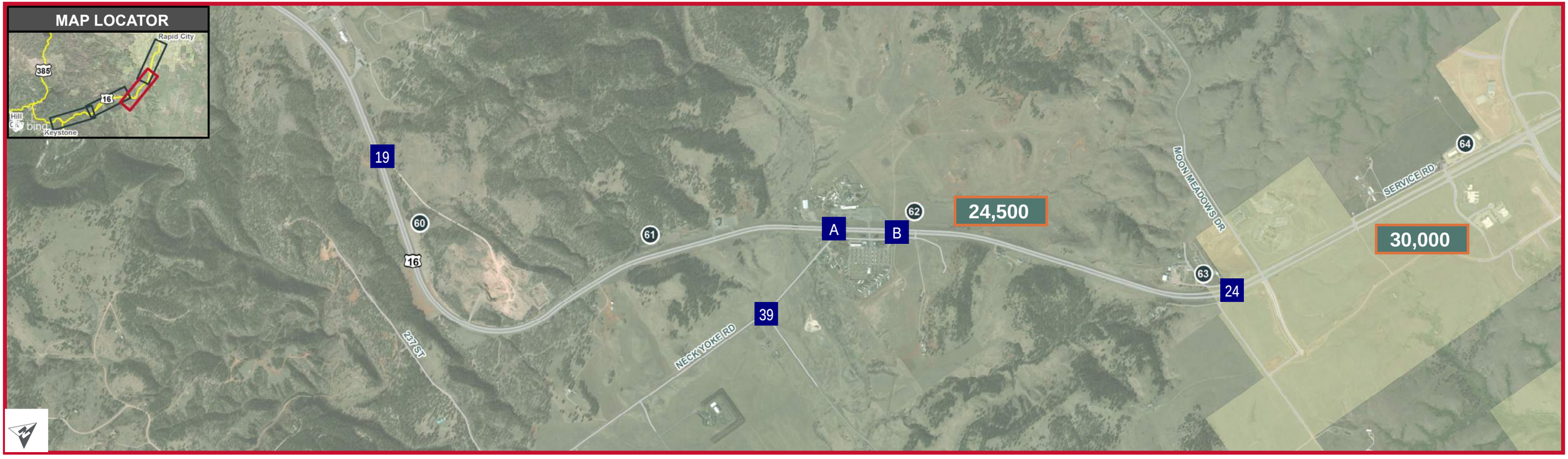
Notes

US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***Traffic Forecasts*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

This scenario consolidates intersections 20-23 into full access point 'A' and 3/4 access point 'B'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2050 No-Build Conditions forecasts.

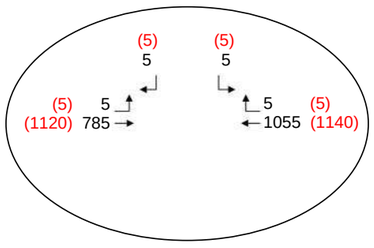


Build Options 2.1b & 2.2b

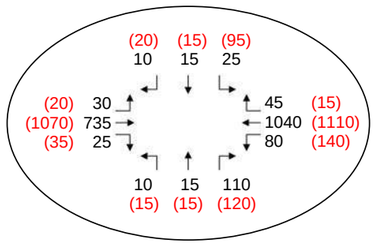
Full Access Intersection with North 3/4 Access Intersection

US16 Corridor ⟷

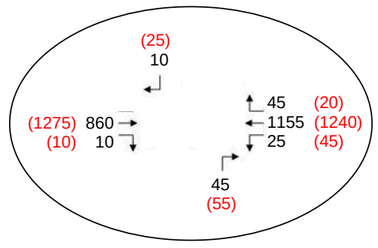
19. US16 & Croell Pit West Ent.



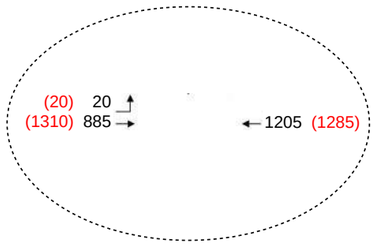
A. US16 & Neck Yoke Road



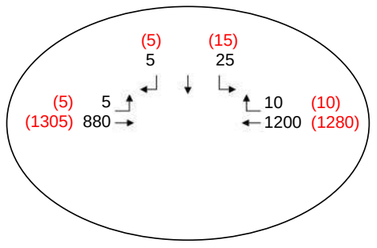
B. US16 & North Access



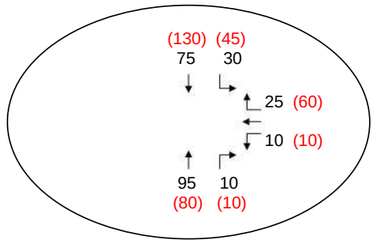
B-E. U-Turn Crossover East



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd

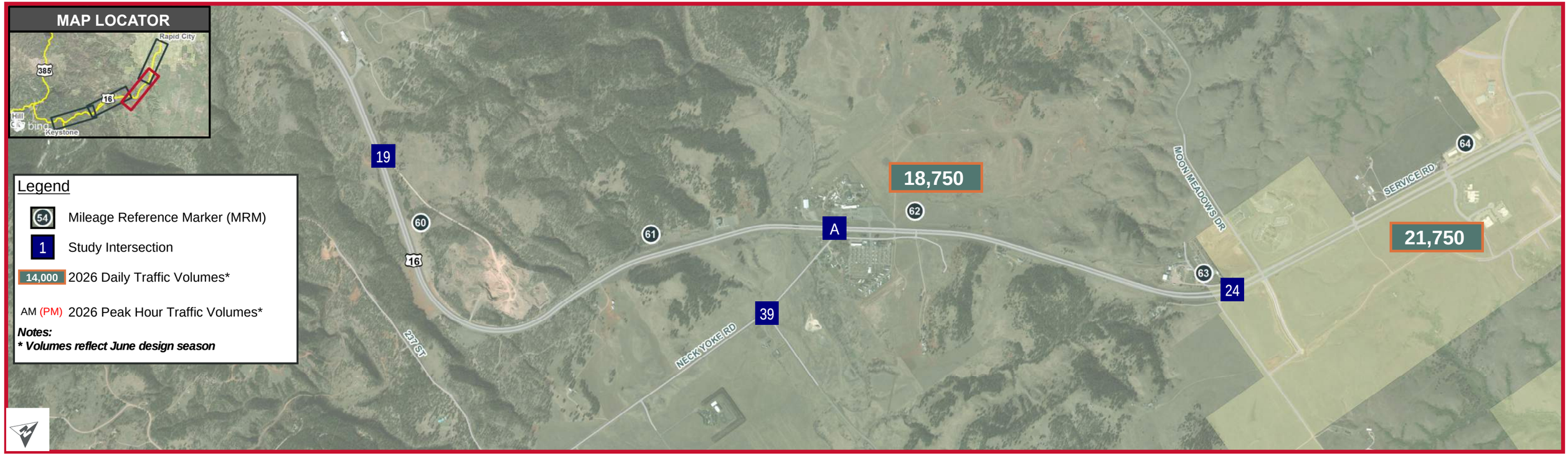


Notes
US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***Traffic Forecasts*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

This scenario consolidates intersections 20-23 into full access point 'A' and 3/4 access point 'B'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2050 No-Build Conditions forecasts.

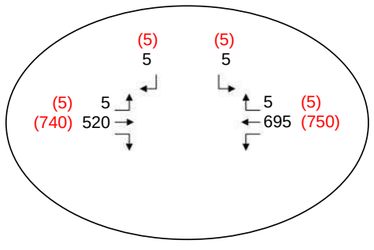


Build Options 2.1a & 2.2a

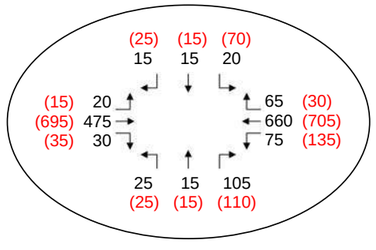
Single Full Access Intersection

US16 Corridor

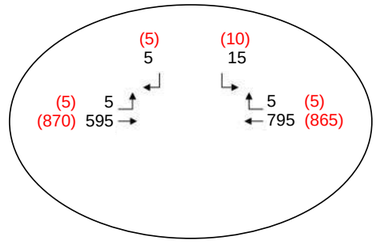
19. US16 & Croell Pit West Ent.



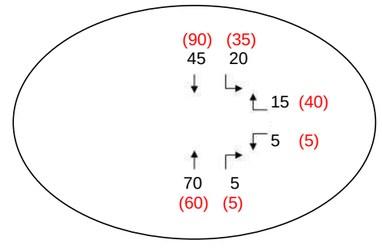
A. US16 & Neck Yoke Road



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd

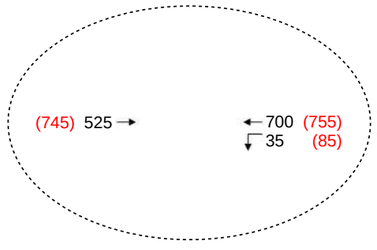


Build Options 1.1a, 1.1d, 1.2a & 1.3a

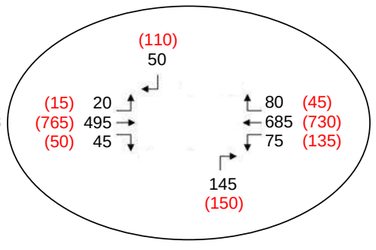
Single RCI

US16 Corridor

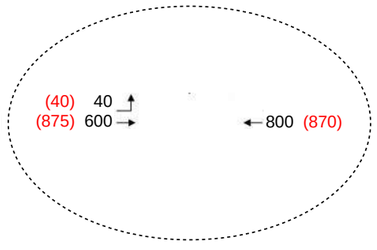
A-W. U-Turn Crossover West



A. US16 & Neck Yoke Road



A-E. U-Turn Crossover East



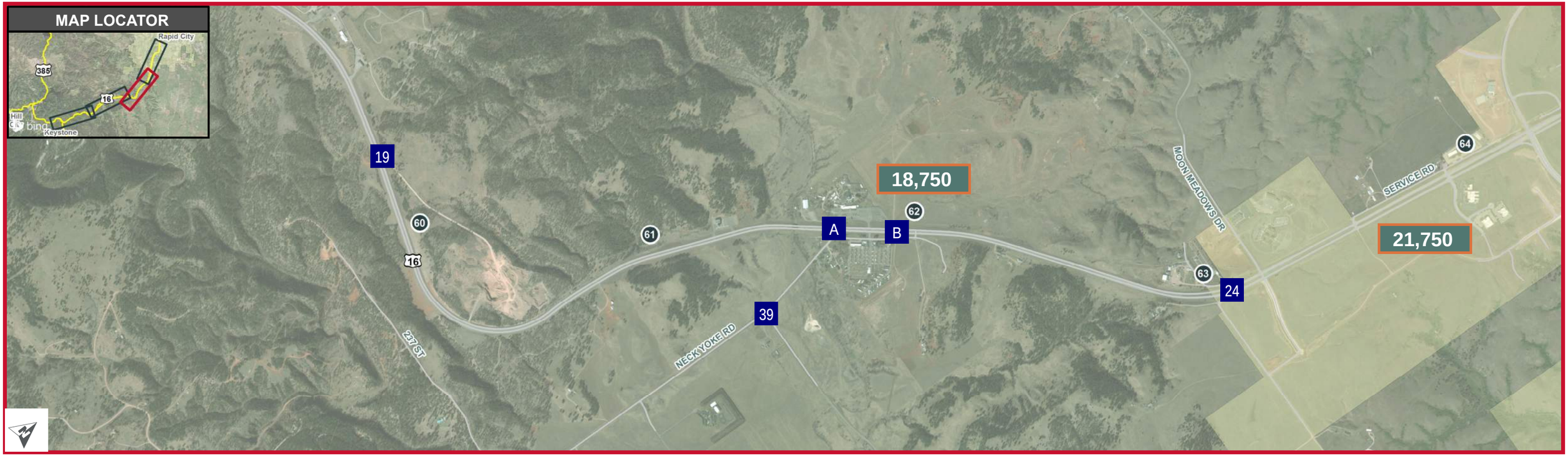
Notes

US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***Traffic 2026 No-Build Conditions Traffic Operations*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

Intersections 20-23 are consolidated to a single full access point 'A'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2026 No-Build Conditions forecasts.



Build Options 1.1b, 1.1c, 1.1e, 1.2b & 1.3b

RCI with North 3/4 Access Intersection

US16 Corridor

A-W. U-Turn Crossover West

(745) 525 →

← 700 (755)
35 (85)

A. US16 & Neck Yoke Road

(95)
40

(15) 20
(775) 510 →
(40) 30

30 (30)
← 695 (745)
55 (100)

105
(115)

A-E. U-Turn Crossover East

(25) 25
(865) 590 →

← 755 (850)

B. US16 & North 3/4 Access

(15)
10

(855) 575 →
(10) 15

50 (15)
← 745 (835)
20 (35)

40
(35)

B-E. U-Turn Crossover East

(15) 15
(875) 600 →

← 800 (870)

US16 Corridor

19. US16 & Croell Pit West Ent.

(5) 5
(5) 5

(5) 5
(740) 520 →

5 (5)
← 695 (750)

24. US16 & Sammis Tr

(5) 5
(10) 15

(5) 5
(870) 595 →

5 (5)
← 795 (865)

39. Neck Yoke Rd & Spring Creek Rd

(90) (35)
45 20

15 (40)

5 (5)

70 5
(60) (5)

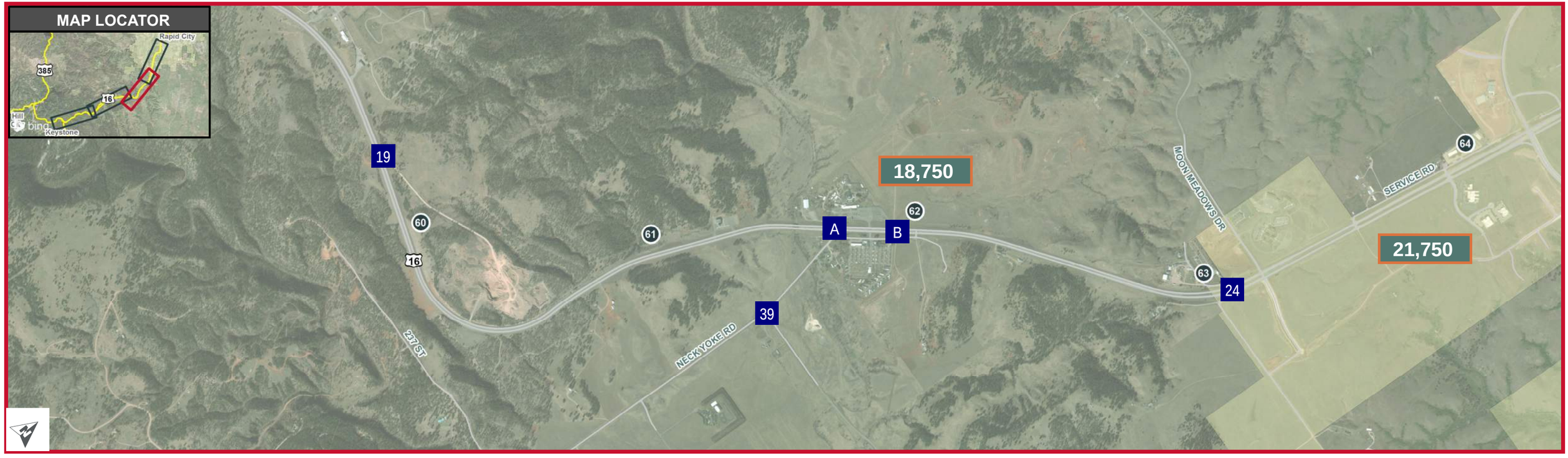
Notes

US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***Traffic 2026 No-Build Conditions Traffic Operations*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

This scenario consolidates intersections 20-23 into full access point 'A' and 3/4 access point 'B'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2026 No-Build Conditions forecasts.

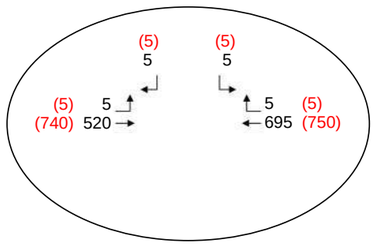


Build Options 2.1b & 2.2b

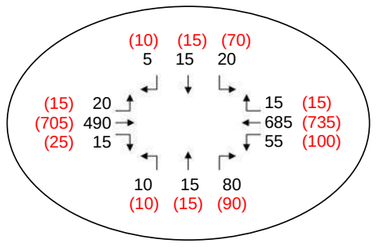
Full Access Intersection with North 3/4 Access Intersection

US16 Corridor ⟷

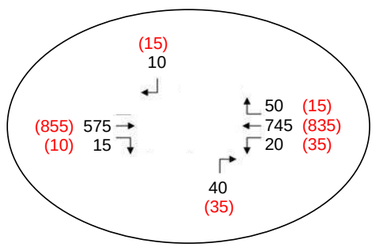
19. US16 & Croell Pit West Ent.



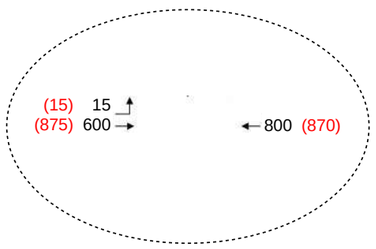
A. US16 & Neck Yoke Road



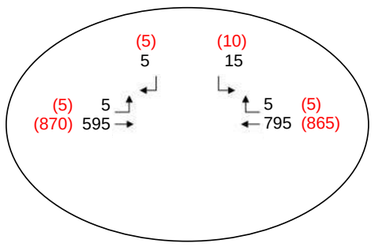
B. US16 & North 3/4 Access



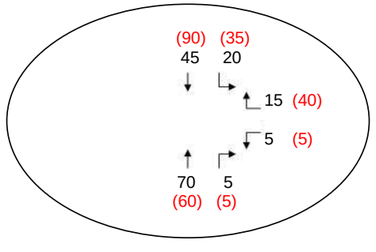
B-E. U-Turn Crossover East



24. US16 & Sammis Tr



39. Neck Yoke Rd & Spring Creek Rd



Notes

US16/Neck Yoke Road subarea traffic volumes are based on No-Build Conditions forecasts presented in the US16 Corridor Study ***2026 No-Build Conditions Traffic Operations*** technical memorandum.

Intersection numbering is consistent with the overall US16 Corridor Study.

This scenario consolidates intersections 20-23 into full access point 'A' and 3/4 access point 'B'. Volumes affected by the closures have been relocated to this intersection.

There is no change to overall volumes entering/exiting this subarea from the 2026 No-Build Conditions forecasts.

11.2.1 Intersection Delay

The following table presents measured intersection delay and LOS for each Build Option.

Table 19: US16/Neck Yoke Road Intersection Operations – 2050 Build Conditions

Build Option	Description	Overall Intersection LOS Measure	Intersection	AM	PM
				Measure / LOS	Measure / LOS
1.1a **1.1d** **1.2a** **1.3a**	Single RCI	ETT	RCI:	3.8 / A	8.1 / A
1.1b **1.2b** **1.3b**	RCI + Northern ¾ Access	ETT	Main RCI: North ¾ Access:	3.3 / A 0.8 / A	5.7 / A 1.1 / A
1.1c **1.1e**	RCI + Northern or Central Partial Access	ETT	Main RCI: Partial Access:	3.8 / A 0.4 / A	6.1 / A 0.7 / A
2.1a **2.2a**	Single Signalized Intersection	Intersection delay	Signalized Intersection:	16.6 / B	19.8 / B
2.1b **2.2b**	Signalized Intersection + Northern ¾ Access	Intersection delay (signal); ETT (3/4 access)	Main Signal: North ¾ Access:	14.5 / B 0.8 / A	17.2 / B 1.1 / A

ETT: Experienced Travel Time

All Build Options provide a significant improvement to intersection delay, compared to the No Build condition, meet LOS B goals, and removes the requirement of two-stage gap acceptance for movements from the side-street.

The RCI Build Options demonstrate the operational benefits this type of intersection configuration has on the high volume US16 through movement. Unlike a signalized intersection, US16 through traffic does not need to stop in an RCI and thus results in zero seconds of delay. Even with the extra travel distance of an RCI, accounted for in the ETT measure, overall intersection delay is considerably lower than a signalized intersection.

The RCI plus a northern (3/4 or partial) access Build Options (1.1b, 1.1c, 1.1e, 1.2b, and 1.3b) all result in the least amount of main intersection delay. The single RCI Build Options (1.1a, 1.1d, 1.2a, and 1.3a) also provides LOS A operations with only slightly greater delay than those with multiple access points.

The signalized intersection Build Options (2.1a, 2.2a, 2.1b, and 2.2b) all result in measured intersection delay that ranges from two to four times greater than measured delay in the RCI Build Options. This is in part to the high volume US16 through traffic needing to stop when the side-streets have the green phase.

A supplemental analysis that looked at truck lane utilization impacts of a signalized intersection recommends inclusion of a third eastbound lane through the intersection and up to Moon Meadows Drive. It was found that even with a slight lane utilization shift, where trucks queue in the right lane at the signal and passenger cars tend to move to the left passing lane to get around the slow moving trucks that stopped for a signal at the bottom of the valley. As a result, queues were not being cleared each signal cycle and the overall signalized intersection was not meeting LOS B goals with just two eastbound lanes. Thus, all

signalized intersection Build Options incorporate a third eastbound lane. Additional information on this analysis can be found in **Appendix J**.

11.2.2 Intersection Queue Lengths

Measured 95th percentile queue lengths were reviewed for Build Option intersections to assess potential queue impacts, individual intersection movement and overall intersection operations, and whether queues can be accommodated within each Build Option layouts.

11.2.3 Neck Yoke Road and Service Road Approach Queues

The first review focuses on side-street queues and how long that queue will spill back from the stop location. This is of particular interest for the northbound main Neck Yoke Road intersection approach where longer queues have the potential of blocking a southbound left-turn onto the US16 service road. If this turn opportunity is blocked, there is the risk of potential spillback of vehicles onto the high speed US16 mainline. This risk is the greatest in situations where there is only one option available to turn between US16 and the US16 service road. An example of this distance and potential conflict area at the Neck Yoke Road intersection is shown in **Figure 27**.

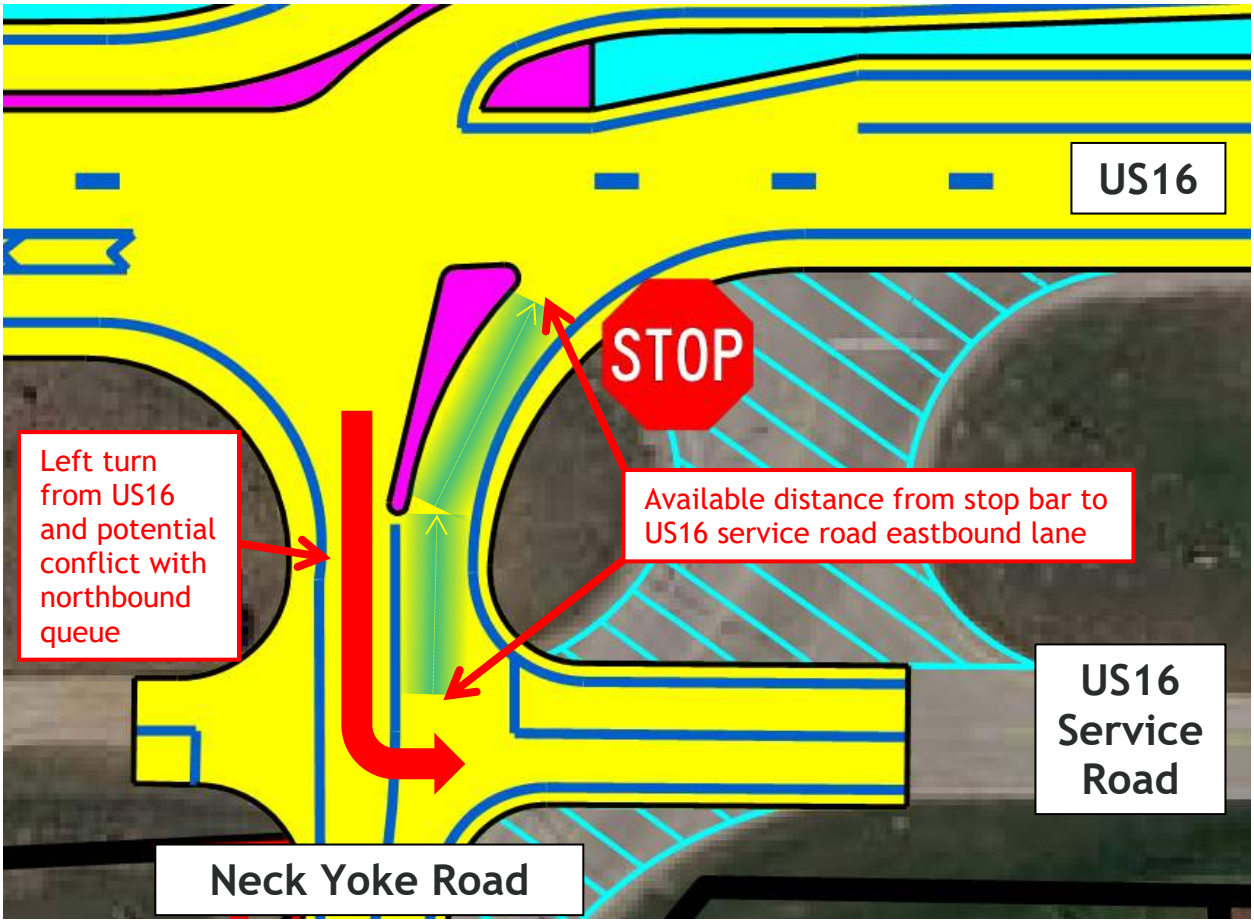


Figure 27: Example Left-Turn Queue Impacts for Southbound Left Turns onto US16 Service Road (Build Option 1.1a shown)

Available northbound Neck Yoke Road queue storage between the stop bar and the US16 service road eastbound lane for each Build Option is as follows:

- 1.1a, 1.1b, 1.1c: 100 ft.
- 1.1d and 1.1e: 230 ft.
- 1.2a and 1.2b: 80 ft.
- 1.3a and 1.3b: 105 ft.
- 2.1a and 2.1b: 95 ft.
- 2.2a and 2.2b: 90 ft.

Table 20 summarizes measured 95th percentile queue lengths for the side-street approaches to US16 in each of the Build Options. Northbound Neck Yoke Road or central driveway queues that exceed the available distance between the stop bar and US16 service road eastbound lane are noted in **Bold Orange** text.

Table 20: US16/Neck Yoke Road Intersection Side Street Queues – 2050 Build Conditions

Build Option	Description	Intersection	Northbound - 95% Queue (ft)		Southbound - 95% Queue (ft)	
			AM	PM	AM	PM
1.1a 1.1d 1.2a 1.3a	Single RCI	RCI:	53	140	18	65
1.1b 1.2b 1.3b	RCI + Northern ¾ Access	Main RCI: North ¾ Access:	35 10	78 20	15 3	50 8
1.1c 1.1e	RCI + Northern or Central Partial Access	Main RCI: Partial Access:	43 5	98 13	15 3	50 8
2.1a 2.2a	Single Signalized Intersection	Signalized Intersection:	157	217	28	113
2.1b 2.2b	Signalized Intersection + Northern ¾ Access	Main Signal: North ¾ Access:	124 10	146 20	28 3	101 8

Northbound Neck Yoke Road queues that exceed the following values are noted in **Bold Orange** text:
1.1a, 1.1b, 1.1c: 100 ft.
1.1d and 1.1e: 230 ft.
1.2a and 1.2b: 80 ft.
1.3a and 1.3b: 105 ft.
2.1a and 2.1b: 95 ft.
2.2a and 2.2b: 90 ft.

The RCI Build Options with multiple access points (1.1b, 1.1c, 1.1e, 1.2b, and 1.3b) and RCI Build Options with the US16 Service Road realigned further south to increase separation (1.1d and 1.1e) all provide acceptable separation between US16 and the US16 service road. All other Build Options exhibit a measured queue that exceeds available storage and reflect a higher risk for potential intersection blockage.

Additional considerations not captured in an HCS analysis pertinent to this review include:

- RCI 1.1d and 1.1e provide the greatest separation between US16 and US16 service road at 230 feet, representing the lowest risk of potential queue spillback impacts.
- With multiple access points,
    - Motorists have the opportunity to gauge levels of congestion at the intersections and choose their access, which brings both benefits and drawbacks.
    - Destinations may be signed on US16 to direct motorists to the most operationally beneficial access to complete a turn.
        - For example, motorists destined for the hotel and campground access can be directed to the northern access where they would have a right-turn from US16 to the US16 service road, instead of a left-turn across traffic at the southern access.
    - Clear signage is needed to guide drivers to the appropriate intersection for traffic leaving the surrounding development.

11.2.4 US16 Left Turn Queues

A second review of measured queues focuses on US16 traffic turning left onto the side streets. **Table 21** summarizes US16 left turn queues for each of the Build Options.

Table 21: US16 Left-Turn Queues – 2050 Build Conditions

Build Option	Description	Intersection	Eastbound - 95% Queue (ft)		Westbound - 95% Queue (ft)	
			AM	PM	AM	PM
1.1a **1.1d** **1.2a** **1.3a**	Single RCI	RCI Main West U-Turn: RCI Main: RCI Main East U-Turn:	- 8 15	- 5 20	8 18 -	38 80 -
1.1b **1.2b** **1.3b**	RCI + Northern ¾ Access	RCI Main West U-Turn: RCI Main: RCI Main East U-Turn: *North ¾ Access Main:* *North ¾ Access U-Turn:*	- 5 8 - *5*	- 5 10 - *8*	8 13 - *5* -	38 50 - *13* -
1.1c **1.1e**	RCI + Northern or Central Partial Access	RCI Main West U-Turn: RCI Main: RCI Main East U-Turn: *Partial Access Main:*	- 5 13 -	- 5 18 -	13 13 - *5*	38 50 - *13*
2.1a **2.2a**	Single Signalized Intersection	Signalized Intersection:	10	9	32	73
2.1b **2.2b**	Signalized Intersection + Northern ¾ Access	Signalized Intersection: *North ¾ Access Main:* *North ¾ Access U-Turn:*	9 - *5*	7 - *8*	21 *5* -	43 *13* -

Overall, US16 left-turn lane queues are well managed in all Build Options. The longest measured queues occur in the westbound left-turn lane at the main intersection (RCI or signalized intersection) in the PM peak period. Queues typically exhibit approximately 3 vehicles (75 feet) or less.

A secondary access shows some benefit to reducing queue lengths, generally reducing the same westbound left-turn movement at the main intersection by around 25 feet (or one passenger car).

11.2.5 Multilane Highway Operations

Primary multilane highway analysis-related differences from the No Build conditions analysis is a reduction in full access points through segment 32 (approximately from Spring Creek bridges/Neck Yoke Road to the unknown road) in all Build Options and a signalized intersection plus the additional eastbound lane in the signalized intersection Build Options. Incorporating these differences, the multilane highway operations are summarized in the following table.

Table 22: US16 Multilane Highway Operations – 2050 Build Conditions

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)	Analysis Grade (%)**	Build Option	AM LOS		PM LOS	
		From	To				EB	WB	EB	WB
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8	6.0	RCI: Signal*:	A A	B B	B B	B B
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	RCI: Signal*:	A A	B B	B A	B B
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0	6.5	RCI: Signal*:	A A	B B	B A	B B

Segment number corresponds with overall US16 Corridor Study segmentation.
* Effects of the traffic signal are analyzed through the intersection analysis.
** Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

For the RCI Build options, there was negligible difference in the overall density measures from the 2050 No Build conditions. All segments maintain the LOS B or better goal.

In the signalized intersection Build Options, density was decreased in the eastbound direction because of the third through lane. However, one of the drawbacks to multilane highway methodology is that it doesn't account for signalized intersections and stopped traffic at the bottom of a hill. Therefore, while the resulting eastbound direction improves to a LOS A from the signalized intersection eastward, the measure does not account for the likely speed differential caused by traffic signal.

11.3 2026 Build Condition Traffic Operations

The operational measures from the 2026 Build conditions analysis is shown in the following tables. The purpose of this analysis is to present expected traffic operations at the time of a potential construction project being complete and open for traffic. It is anticipated that all improvements identified in the Build Options would be constructed and open for year 2026 (i.e. no phased construction). As shown in the tables, all US16/Neck Yoke Road intersection analysis intersections and roadway segments are anticipated to meet LOS goals established for this study in the year 2026. HCS reports are provided in **Appendix K**.

Table 23: US16/Neck Yoke Road Intersection Operations – 2026 Build Conditions

Build Option	Description	Overall Intersection LOS Measure	Intersection	AM	PM
				Measure / LOS	Measure / LOS
1.1a **1.1d** **1.2a** **1.3a**	Single RCI	ETT	RCI:	3.7 / A	5.2 / A
1.1b **1.2b** **1.3b**	RCI + Northern ¾ Access	ETT	Main RCI: North ¾ Access:	3.0 / A 0.8 / A	4.4 / A 0.9 / A
1.1c **1.1e**	RCI + Northern or Central Partial Access	ETT	Main RCI: Partial Access:	3.6 / A 0.4 / A	4.8 / A 0.5 / A
2.1a **2.2a**	Single Signalized Intersection	Intersection delay	Signalized Intersection:	16.1 / B	17.6 / B
2.1b **2.2b**	Signalized Intersection + Northern ¾ Access	Intersection delay (signal); ETT (3/4 access)	Main Signal: North ¾ Access:	14.7 / B 0.8 / A	16.2 / B 0.9 / A

ETT: Experienced Travel Time

Table 24: US16 Multilane Highway Operations – 2026 Build Conditions

Seg. #	Mainline	Approximate Limits		Approx. Length (miles)	Analysis Grade (%)**	Build Option	AM LOS		PM LOS	
		From	To				EB	WB	EB	WB
27 - 31	US 16	Croell Pit West Entrance	MRM 61.50	1.8	6.0	RCI: Signal*:	A A	A A	A A	A A
32	US 16	MRM 61.50	MRM 62.00	0.4	Level	RCI: Signal*:	A A	A A	A A	A A
33 - 34	US 16	MRM 62.00	MRM 63.00	1.0	6.5	RCI: Signal*:	A A	A A	A A	A A

Segment number corresponds with overall US16 Corridor Study segmentation.
* Effects of the traffic signal are analyzed through the intersection analysis.
** Analysis grade reflects level, rolling or specific grade (segment upgrade typically shown for segments representing two directions of travel), per HCM6 methodology.

11.4 Predictive Safety Analysis

A predictive safety analysis was completed for the No Build and Build Option conditions using the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) method to evaluate the expected safety of proposed intersection and roadway modifications. As stated in the HSM, "*The predictive method provides a quantitative measure of expected crash frequency under both existing conditions and conditions which have not yet occurred. This allows proposed roadway conditions to be quantitatively assessed…*" (HSM, 2010 version).

FHWA's Interactive Highway Safety Design Model (IHSDM) was the tool used to evaluate safety in the No-Build and Build Option conditions. Output from this tool includes the predicted average annual crash frequency and total crashes over the analyzed timeframe (2026 – 2050).

Crashes are categorized as fatal and injury crashes (F+I) and property damage only (PDO) crashes for both intersections and roadway segments.

The 11 Build Options were consolidated into four safety analysis groups as shown in **Table 25**.

Table 25: Predictive Safety Build Option Analysis Groups

Predictive Safety Analysis Scenario	Applicable Build Options
Single RCI	1.1a, 1.2a, 1.3a
Single RCI (West)	1.1d
Single Signalized Intersection	2.1a, 2.2a
RCI + Northern ¾ or Partial Access	1.1b, 1.1c, 1.2b, 1.3b
RCI (West) + Central Partial Access	1.1e
Signalized Intersection + Northern ¾ Access	2.1b, 2.2b

It was found that all Build Options demonstrate safety improvements to the US16/Neck Yoke Road intersection area when compared to the No Build condition. A summary of predicted average annual crash frequencies between years 2026 and 2050 is shown in **Figure 28**.

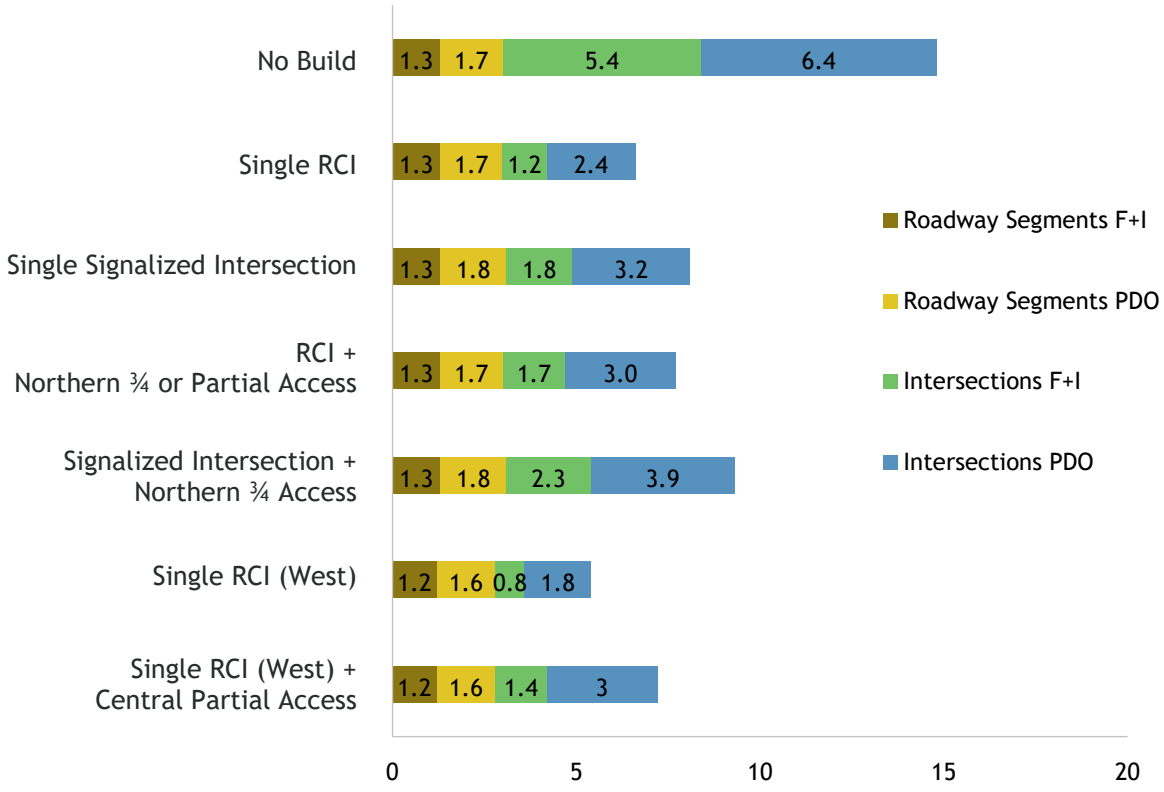


Figure 28: Predicted Average Annual Crash Frequencies (2026-2050)

The access management proposed in all Build Options results in a notable decrease in predicted crashes in all Build Options. From there, the RCI intersection treatment separates itself from a signalized intersection. This is particularly apparent in the reduction in F+I

crashes where the RCI Build Options show nearly a full F+I crash reduction annually compared to the signalized intersection.

A quantitative comparison in terms of total number of predicted crashes between 2026 and 2050 is shown in **Table 26**.

Table 26: Predicted Build Option Crash Reduction (2026-2050)

Build Options	Description	Fatal and Injury (F+I) Crashes	Property Damage Only (PDO) Crashes	Total Crashes
		+ increase -decrease from No Build	*+ increase -decrease from No Build*	*+ increase -decrease from No Build*
1.1a 1.2a 1.3a	Single RCI	-105	-100	-207
1.1d	Single RCI (West)	-118	-118	-235
2.1a 2.2a	Single Signalized Intersection	-90	-78	-170
1.1b 1.1c 1.2b 1.3b	RCI + Northern ¾ or Partial Access	-93	-85	-180
1.1e	RCI (West) + Central Partial Access	-103	-88	-190
2.1b 2.2b	Signalized Intersection + Northern ¾ Access	-78	-60	-137
No Build	No Build Condition	168 (baseline)	203 (baseline)	370 (baseline)

F+I plus PDO may not equal total crashes due to internal rounding.

The safety analysis demonstrates the safety benefits provided by the single RCI Build Options when compared to options with multiple access points or signalized intersections. RCI 1.1d, Single RCI (West), is expected to reduce F&I crashes by 70 percent and total crashes by 64 percent when compared to the No Build condition from 2026 to 2050.

A single RCI at existing Neck Yoke Road intersection, RCI 1.1a, 1.2a, and 1.3a, provides the next greatest reduction in crashes at 63 percent reduction in F&I crashes and 56 percent reduction in total crashes. While a notable improvement compared to the No Build condition, the reduction is 10 to 15 percent less than what is provided in RCI 1.1d.

RCI 1.1e incorporates the safety benefits exhibited by the RCI 1.1d design and adds a central partial access to provide additional access opportunities. The expected reduction in F&I crashes was similar to RCI 1.1a, 1.2a, and 1.3a at 61 percent and the total crash reduction was slightly less at 51 percent. Overall, the expected reduction is approximately 15 to 20 percent less than RCI 1.1d due to the additional access location.

The remaining RCI and signalized intersection Build Options result in notably less safety benefit when compared to the aforementioned RCI Build Options. The signalized intersections, 2.1b and 2.1b in particular, result in the least reduction in crashes and illustrate the safety drawbacks of installing a signalized intersection at an isolated, rural intersection at the bottom of steep grades when compared to an RCI.

The *Predictive Safety Analysis for Neck Yoke Road Study Area* technical memo in **Appendix L** provides additional details regarding the predictive safety evaluation methodology and discussion of findings.

11.5 Constructability Review

The 11 Build Options were reviewed to assess whether they were biddable and buildable as a future project and if there are any key differentiators from a constructability standpoint. Conceptual US16 corridor profiles and earthwork quantities associated with the Build options are provided in a *Roadway Profiles, Earthwork, and Utility Coordination* memo in **Appendix M**. The memo also provides a summary of comments received from local utility companies as part of the preliminary utility coordination.

11.5.1 Maintenance of Traffic

The following two goals for maintaining traffic during construction were established due to the importance of this route during the summer tourist season:

- Maintain at least one lane of US16 in both directions.
- Maintain access throughout construction, with temporary pavement and/or access being an option.

It was concluded that construction phasing for all Build Options could follow traditional, and familiar, methods for multilane highway reconstruction.

1. Reconstruct westbound US16.
    a. Construct WB lanes, WB bridge and median
    b. Maintain head-to-head traffic on EB lanes
    c. Temporary access to/from Reptile Gardens and other properties on west side of US16
2. Reconstruct eastbound US16.
    a. Construct EB lanes and EB bridge
    b. Maintain head-to-head traffic on WB lanes
3. Construct median splitter islands, as needed.

Generally, any needed widening or increased median separation was applied to the westbound lanes in each Build Option. The eastbound lanes were typically held on existing alignment.

One of the benefits unique to the RCI Build Options 1.1d and 1.1e is that the Neck Yoke Road intersection approach would be constructed off the existing Neck Yoke Road alignment and would provide greater flexibly in maintaining local traffic during construction.

There is expected to be minor impact Reptile Gardens' parking lot at the driveways and along the east side of the parking lot during construction. For Build Options with a frontage road, the layout reflects building eastward from the outer row of parking to maintain the same number of stalls after construction and not impact the sign. Phasing to minimize loss of stalls during the summer tourist season is encouraged.

11.5.2 US16 Spring Creek Bridges

The bridges were built in 1963–1964 and are at about the end of their design life. Therefore the initial assumption for these bridges has been replacement. Due to the shallow depth of the existing structures it is assumed that they would be replaced in kind with Continuous Concrete Bridges.

The possibility of structure rehabilitation and widening as necessary is a consideration for final design. Rehabilitation would have a have a lower initial cost than full replacement. The westbound structure could be widened as needed to the outside (shoulder side). The drawback to rehabilitation, however, is that the associated design life of the new structures will be two times the remaining life of the rehabilitated structures.

Approximate construction durations for various combinations of bridge work are:

- Option 1: Rehabilitate both bridges no widening
    - Four months
- Option 2: Rehabilitate one bridge; widen and rehabilitate the other bridge
    - Seven months
- Option 3: Rehabilitate one bridge; replace the other bridge
    - Eight months
- Replace both bridges.
    - 10 month construction time

For all options, both bridges could remain open to one lane of traffic during construction or traffic could be shifted head to head across one structure at a time.

11.6 Cost Summary

Comparative right of way impacts and construction cost summary is provided in **Table 27**.

Table 27: Total Right of Way Impacts and Costs

Build Option	Description	Displacements (# parcels)	Right of Way Impacts (acres)	Total Costs ($mil)
1.1a	RCI at Neck Yoke Road	0	1.8	8.7
1.1b	RCI at Neck Yoke Road + Northern ¾ Access	0	0.8	9.4
1.1c	RCI at Neck Yoke Road + Northern Partial Access	0	0.8	9.4
1.1d	RCI at Neck Yoke Road (West)	1	2.7	10.8
1.1e	RCI at Neck Yoke Road (West) + Central Partial Access	1	2.3	10.8
1.2a	RCI at Central Driveway	0	1.8	8.4
1.2b	RCI at Central Driveway + Northern ¾ Access	0	1.8	9.1
1.3a	RCI at Central Driveway with US16 Realignment	0	1.8	10.0

Build Option	Description	Displacements (# parcels)	Right of Way Impacts (acres)	Total Costs ($mil)
1.3b	RCI at Central Driveway with US16 Realignment + Northern ¾ Access	0	1.6	10.2
2.1a	Signalized Intersection at Neck Yoke Road	0	2.0	10.8
2.1b	Signalized Intersection at Neck Yoke Road + Northern ¾ Access	0	1.0	11.4
2.2a	Signalized Intersection at Central Driveway	0	1.9	10.8
2.2b	Signalized Intersection at Central Driveway + Northern ¾ Access	0	1.8	11.9

Right of way impacts account for both acquisition and easement needs. The total cost includes construction costs, right of way costs, and a 30 percent contingency. All Build Options assume full reconstruction of both Spring Creek bridge structures.

12.0 Public Involvement Summary

Two sets of public and stakeholder meetings were held as part of the concept and Build Option development phases of this study. Each set of meetings included three stakeholder meetings during the day and a public meeting that evening. Stakeholder groups included:

- US16/US16B/Catron Boulevard intersection stakeholder group.
- US16/Neck Yoke Road intersection stakeholder group.
- US16 corridor south of Neck Yoke Road stakeholder group.

Invitations were sent out to adjacent businesses and property owners and other interested groups or representatives with respect to the focus of each stakeholder group. With regard to the US16/Neck Yoke Road stakeholder group, surrounding businesses and property owners as well as emergency responders and other interested groups were invited to the information meetings.

The first set of public and stakeholder meetings were held on July 23, 2019. For the US16/Neck Yoke Road intersection, the purpose of these meetings was to solicit and discuss transportation-related needs in the area. Feedback from these meetings aided the development of the study purpose and need statement as well as the development and evaluation of intersection concepts.

The second set of public and stakeholder meetings for the overall US16 Corridor Study focused on presenting Build Options for the US16/Neck Yoke Road intersection and the US16/US16B/Catron Boulevard intersection. At these December 10, 2019, meetings, the initial set of Build Options were presented to stakeholders and the public for their feedback with the following information:

- Preliminary Build Option layouts
- Traffic operations results
- Predictive safety results
- Construction costs

Notable feedback and comments from the stakeholders and public regarding the US16/Neck Yoke Road intersection area includes:

- Traffic signals were generally not desired due to the operational and safety concerns of a signal at the bottom of steep grades.
- South Dakota trucking representatives were opposed to all options that would require US16 through movement trucks to stop at the bottom of the hill.
- Stakeholders noted many of them already turn right out of an access point and make a U-turn at a downstream median break.
- Reptile Gardens and other stakeholders supported a secondary partial access to the north.
- Stakeholders on the west side supported concepts that minimized parking lot impacts.
- There was concern noted about conflicts turning between US16 and US16 service road due to high tourist demand and large vehicles. Generally supported a second access to help alleviate this concern.

Additional one-on-one meetings were held with businesses and land owners potentially impacted by Build Options to gather additional on refined Build Options. Common comments included:

- Support for all southbound turn lanes to be located on the flatter grade of the valley and not on the 6.5 percent downgrade.
- Support for a second partial access be located at the central driveway access.
- Discussion of potential impacts such as daily operations crossing US16, underground services, signing, and displacements.

Further information, submitted comments, and stakeholder meeting notes for these public and stakeholder meetings are provided in the respective public involvement summary reports.

13.0 Build Option Evaluation Summary

This section summarizes the Build Option evaluation process that led to the development of a future project recommendation. A more detailed discussion of the Build Option evaluation process is provided in the *US16/Neck Yoke Road Intersection Build Option Evaluation* report attached in **Appendix H**.

13.1 Evaluation Methodology

The following methodology was used to compare Build Options and determine the feasibility, benefits, and drawbacks of each.

13.1.1 Evaluation Categories

Meets Purpose and Need

Each Build Option was evaluated on whether it meets the US16/Neck Yoke Road project purpose and need.

Year 2050 Intersection Traffic Operations

This category uses HCM6 traffic operations methodology measures of average intersection delay (seconds per vehicle) and associated level of service (LOS). The 2050 Planning Horizon US16/Neck Yoke Road intersection LOS goal for this study is LOS B.

This category also asks the question to whether 'US16 through traffic needs to stop at the intersection?' The proposed intersection is located at the bottom of the Spring Creek valley with steep, sustained grades heading either direction out of the valley. Stopping the high volume, high truck percent movements on US16 leads to both operational and safety issues at the intersection and segments extending to and from the intersection.

Traffic Safety

This measure demonstrates a Build Options' predicted improvement over the No Build condition as well as establishes a comparative framework for gauging predicted safety improvements between each Build Option. IHSDM output reflecting the expected decrease or increase in crashes between years 2026 and 2050 for each Build Option is summarized in terms of:

- 'Total Crashes' consists of all crash types (property damage only, injury, and fatal).
- 'Fatal and Injury Crashes' reflects the higher severity type crashes.

Local Network

The local network category considers potential operational and safety issues with traffic movements between US16 and the US16 service road, adjacent businesses and their parking lots, and other local network connections.

Neck Yoke Road or central driveway approach queues:

- Queue storage between US16 and US16 service road is limited due to existing development and US16 service road access points. Depending on the Build Option, there is between 80 and 105 feet of available storage between the northbound approach stop bar to US16 and the US16 service road eastbound lane.
- Queues extending beyond this distance could potentially block southbound Neck Yoke Road or central driveway traffic from US16 trying to turn left across this queue onto the US16 service road. This could create operational and safety issues back onto the US16 mainline, particularly in situations where there are multiple cars or RVs that follow each other trying to complete this movement.
- This category identifies which Build Options exhibit measured queues that extend beyond the available storage length. Movements, and associated peak period, that exceed the available storage are identified.

Intersection geometry and driver expectancy considerations:

- Does traffic between US16 and US16 service road need to turn left across turn lanes?
- Is the main intersection large, with multiple access points coming into the intersection? Will it be easy to navigate and meet driver expectancy navigating between US16 and US16 service road?
- Ability to sign in relation to the high tourist traffic/unfamiliar drivers in the area.
- A rating of 5 to 1 was applied to each Build Option that summarizes answers to these questions, with 5 being the most favorable and 1 being the least favorable.

Right of Way Needs and Total Costs

Build Option right of way and total cost components include:

- Right of way and easement acquisition (total acres)
- Total cost (construction cost + ROW cost + contingency)

Constructability

Constructability is measured by considerations such as:

- Overall timeline for construction and construction limits
- Maintenance of traffic along US16 and access to adjacent businesses
- Exposure of workers to traffic

A rating of 5 to 1 was applied to each Build Option based on the above considerations, where a 5 is the most favorable and 1 is the least favorable.

Public Input

This measure accounts for input provided by the public and project stakeholders during the December 10, 2019, and February 2021 stakeholder and public meetings. Much of the feedback the study team received focused on the following:

- Intersection location
- Number of access points
- Does US16 through traffic need to stop?
- Parking lot impacts (extent of new frontage roads)
- Ease of mobility and safety between US16 and businesses, US16 service road, and Neck Yoke Road. This includes considerations for longer vehicles such as RVs.
- US16 grade along turn lanes

The measure is based on support provided by the public and stakeholders in the form of written comments and verbal comments at the meetings. A rating of 5 to 1 was applied to each Build Option that summarizes the overall support for each Build Option based on the considerations noted above. A 5 is the most favorable and 1 is the least favorable.

Potential Environmental Impacts

Two resource categories were used to qualitatively evaluate potential impacts of the Build Options:

- Wetlands/floodplains
- Socioeconomics
- Displacements

13.1.2 Evaluation Measures

Each Build Option was evaluated on how they compare with other Build Options in a given category and/or whether they meet study goals. This evaluation is summarized through the following color coding in the evaluation matrix.

- **Bold Green** text indicates a Build Option measure was favorable compared to the other Build Options in a category
- Black text indicates a Build Option measure was in the middle compared to other Build Options in a category
- **Bold Red** text indicates a Build Option measure was unfavorable compared to the other Build Options in a category or the measure does not meet study goals.

13.2 No Build Condition

The No Build option is carried throughout the technical and environmental analysis for consideration as an option and as a baseline comparison for the Build Options. However, as noted in the evaluation matrix, the No Build option does not:

- Meet project purpose and need.
- Achieve LOS goals at the US16/Neck Yoke Road intersection in the 2050 Planning Horizon.
- The existing traffic control at Neck Yoke Road (stop signs on the side-street, free movement for US16 through traffic) leads to significant delay on the side street during peak hours.
- Improve intersection safety.

13.3 Build Option Evaluation

Each of the 11 Build Options were evaluated and compared using the aforementioned evaluation measures. A summary of these measures is provided in the Build Option evaluation matrix shown in **Table 36** and further discussed below. Tables in this discussion are color-coded to align with the evaluation matrix.

Meets Purpose and Need

All Build Options meet the study purpose and need.

Year 2050 Intersection Traffic Operations

The following table ranks the Build Options from least main intersection delay to greatest main intersection delay.

Table 28: Build Option Traffic Operations Rankings – 2050 Build Conditions

Rank	Build Option	Description	Overall Intersection LOS Measure	Intersection	AM	PM
					Measure / LOS	Measure / LOS
1	1.1b 1.2b 1.3b	RCI + Northern ¾ Access	ETT	Main RCI: North ¾ Access:	**3.3 / A** **0.8 / A**	**5.7 / A** **1.1 / A**
2	1.1c 1.1e	RCI + Northern or Central Partial Access	ETT	Main RCI: Partial Access:	**3.8 / A** **0.4 / A**	**6.1 / A** **0.7 / A**
3	1.1a 1.1d 1.2a 1.3a	Single RCI	ETT	RCI:	**3.8 / A**	**8.1 / A**
4	2.1b 2.2b	Signalized Intersection + Northern ¾ Access	Intersection delay (signal); ETT (3/4 access)	Main Signal: North ¾ Access:	14.5 / B 0.8 / A	17.2 / B 1.1 / A
5	2.1a 2.2a	Single Signalized Intersection	Intersection delay	Signalized Intersection:	16.6 / B	19.8 / B

ETT: Experienced Travel Time

Key takeaways from the traffic operations analysis includes:

- RCI Build Options all achieve LOS A.
- Signalized intersection Build Options measure LOS B.
    - Signalized intersection delay ranges between two and four times greater than a comparable RCI Build Option.
- RCI main intersection delay is very similar between the single RCI Build Options and RCI Build Options with multiple access points, with a difference of only 0.4-0.5 seconds per vehicle.
- Signalized intersection Build Options require US16 through traffic to stop and thus results in nearly 11-13 seconds of additional intersection delay.

Traffic Safety

All Build Options are expected to improve safety compared to the No Build condition. The combination of access closures and intersection type are the primary contributors to the level of crash reduction. The following table ranks Build Options in terms of expected crash reduction from the No Build condition.

Table 29: Build Option Crash Reduction Rankings

Rank	Build Option	Description	Total Crashes	Fatal and Injury Crashes
			- decrease in # of crashes from No Build (%)	- decrease in # of crashes from No Build (%)
1	1.1d	Single RCI (West)	**-235 (-64%)**	**-118 (-70%)**
2	1.1a 1.2a 1.3a	Single RCI	**-207 (-56%)**	**-105 (-63%)**

Rank	Build Option	Description	Total Crashes	Fatal and Injury Crashes
			- decrease in # of crashes from No Build (%)	- decrease in # of crashes from No Build (%)
3	1.1e	Single RCI (West) + Central Partial Access	-190 (-51%)	-103 (-61%)
4	1.1b 1.2b 1.3b	RCI + Northern ¾ Access	-180 (-49%)	-93 (-55%)
5	1.1c	RCI + Northern Partial Access	-180 (-49%)	-93 (-55%)
6	2.1a 2.2a	Single Signalized Intersection	-170 (-46%)	-90 (-54%)
7	2.1b 2.2b	Signalized Intersection + Northern ¾ Access	-137 (-37%)	-78 (-46%)
Baseline	No Build	No Build	370 (baseline, total crashes)	168 (baseline, total crashes)

Predicted reduction in crashes from 2026 to 2050.

Key takeaways from the traffic safety review include:

- RCI 1.1d, single RCI (west), provided the greatest expected reduction in crashes of all Build Options.
    - Approximately 0.5 F&I and 1.0 total fewer crashes annually compared to the over Build Options.
- The other single RCI Build Options, 1.1a, 1.2a, 1.3a, provided the next best reduction in crashes.
- RCI 1.1e provided the greatest reduction of crashes of Build Options with multiple access points. The F&I crash reduction was similar to RCI 1.1a, 1.2a, and 1.3a.
- The signalized intersection Build Options result in the least reduction in crashes with Build Options 2.1b and 2.2b resulting in the least reduction of all Build Options.

Local Network

The local network measure brings together several quantitative and subjective measures to summarize how well each Build Option facilitates travel between US16 and the US16 service road or adjacent parcels. This measure includes potential impacts to US16 traffic, such as queue spillback or speed differential due to violations to driver expectancy.

Neck Yoke Road Intersection Queue Impacts

The following table identifies Build Options that provide spacing between US16 and the US16 service road greater than the analysis-measured 95th percentile queues. Locations where the measured queue exceeds the available space represents a condition of elevated risk for blocking left turns onto the US16 service road and subsequent spillback onto US16.

Table 30: Build Option Potential Northbound Neck Yoke Road Queue Impacts

Build Option	Description	Available Distance between US16 and US16 Service Road	Northbound - 95% Queue (ft)	
			AM	PM
1.1e	RCI at Neck Yoke Road (West) + Central Partial Access	230	43	98
1.1d	Single RCI (West)	230	53	140
1.1b	RCI at Neck Yoke Road + Northern ¾ Access	100	35	78
1.3b	RCI at Central Driveway with US16 Realignment + Northern ¾ Access	105	35	78
1.2b	RCI at Central Driveway + Northern ¾ Access	80	35	78
1.1c	RCI at Neck Yoke Road + Northern Partial Access	100	43	98
1.1a	RCI at Neck Yoke Road	100	53	140
1.2a	RCI at Central Driveway	80	53	140
1.3a	RCI at Central Driveway with US16 Realignment	105	53	140
2.1b	Signalized Intersection at Neck Yoke Road + Northern ¾ Access	95	124	146
2.2b	Signalized Intersection at Central Driveway + Northern ¾ Access	90	124	146
2.1a	Signalized Intersection at Neck Yoke Road	95	157	217
2.2a	Signalized Intersection at Central Driveway	90	157	217

Key takeaways from the potential impact to northbound Neck Yoke Road or central driveway queues to US16 include:

- RCI 1.1e and 1.1d provides the greatest distance between US16 and US16 service road (230 feet).
    - Provides greatest amount of excess distance beyond measured queues.
    - Represents the least risk of potential blocking of Neck Yoke Road left turns onto US16 service road.
- RCI 1.1b, 1.3b, 1.2b, and 1.1c also exhibit adequate spacing, but queue lengths are reaching the extent of available distance and represent an increased risk of potential blocking.
- The signalized intersection Build Option queues all exceeded available storage space.

Intersection Geometry and Driver Expectancy

The second measure in this category reviews intersection geometry and driver expectancy. The following table provides a rating and benefit/drawback summary for each of the Build Options.

Table 31: Build Option Intersection Geometry and Driver Expectancy Summary

Description	Benefits	Drawbacks
US16 grade	All turn lanes are off 6.5% downgrade. **1.1d, 1.1e**	At least one turn lane on 6.5% downgrade. 1.1a, 1.1b, 1.1c, 1.2a, 1.2b, 1.3a, 1.3b 2.1a, 2.1b, 2.2a, 2.2b, 2.3a, 2.3b
Spacing between US16 and US16 service road – Neck Yoke Road	Spacing greater than SDDOT minimum 150'. **1.1d, 1.1e**	Spacing less than SDDOT minimum 150'. 1.1a, 1.1b, 1.1c, 1.2a, 1.2b, 1.3a, 1.3b 2.1a, 2.1b, 2.2a, 2.2b, 2.3a, 2.3b
Spacing between US16 and US16 service road – central driveway	No access – or- smaller, simpler intersection with fewer movements and conflicts for drivers to process. Adequate separation between US16 and US16 service road intersections to provide two distinct intersections. **1.1a, 1.1b, 1.1c, 1.1d, 1.1e** **2.1a, 2.1b**	Main intersection at central driveway does not provide enough separation with US16 service road to provide two separate and distinct intersections. Both intersections blend together and expansive area of pavement creates a potentially confusing scenario for turning traffic. **1.2a, 1.2b, 1.3a, 1.3b** **2.2a, 2.2b, 2.3a, 2.3b**
US16 corridor driver expectancy	Single intersection accommodates all movements. **1.1a,, 1.1d, 1.2a, 1.3a** **2.1a, 2.2a**	Multiple access points and conflict points. Secondary access does not accommodate all movements and would need to be signed accordingly. 1.1b, 1.1c*, 1.1e*, 1.2b, 1.3b 2.1b, 2.2b
Flexibility afforded to traffic operations with multiple access points	Flexibility in directing traffic to best access point, can split local Neck Yoke Road traffic from tourist and large vehicle traffic. Can reduce delay and spread spikes in traffic volumes. **1.1b, 1.2b, 1.3b, 1.1c, 1.1e** **2.1b, 2.2b**	All traffic uses one access point. Spikes in traffic and/or large vehicles must be accommodated at a single location. 1.1a, 1.1d, 1.2a, 1.3a 2.1a, 2.2a
Notes	* Fewer conflict points than other multi-access RCIs.	

Based on these findings, a most favorable (5) to least favorable (1) rating was assigned to each of the Build Options that reflects benefits and drawbacks each represents in this category.

Right of Way Needs and Total Costs

The following table summarizes right of way needs and total costs. Build Options are ranked in terms of total cost.

Table 32: Total Right of Way Impacts and Costs

Rank	Build Option	Description	Right of Way Impacts (acres)	Total Costs ($mil)
1	1.2a	RCI at Central Driveway	1.8	8.4
2	1.1a	RCI at Neck Yoke Road	1.8	8.7
3	1.2b	RCI at Central Driveway + Northern ¾ Access	1.8	9.1
4	1.1c	RCI at Neck Yoke Road + Northern Partial Access	0.8	9.4
5	1.1b	RCI at Neck Yoke Road + Northern ¾ Access	0.8	9.4
6	1.3a	RCI at Central Driveway with US16 Realignment	1.8	10.0
7	1.3b	RCI at Central Driveway with US16 Realignment + Northern ¾ Access	1.6	10.2
8	1.1e	RCI at Neck Yoke Road (West) + Central Partial Access	2.3	10.8
	1.1d	Single RCI (West)	2.7	10.8
	2.1a	Signalized Intersection at Neck Yoke Road	2.0	10.8
	2.2a	Signalized Intersection at Central Driveway	1.9	10.8
12	2.1b	Signalized Intersection at Neck Yoke Road + Northern ¾ Access	1.0	11.4
13	2.2b	Signalized Intersection at Central Driveway + Northern ¾ Access	1.8	11.9

Constructability

It was found that none of the Build Options present significant constructability challenges and exhibit several similarities. Construction techniques, phasing, and maintenance of traffic will likely follow traditional methods. The following summarizes potential drawbacks identified in the constructability review that were incorporated into the rating of each Build Option:

- The third eastbound lane in all signalized intersection Build Options requires a longer overall construction schedule with additional earthwork and paving (2.1a, 2.1b, 2.2a, and 2.3b).
- The RCI Build Options with shifted alignments (1.3a and 1.3b) would not be able to take advantage of benefits afforded to Build Options construction on, or partially on, existing alignment. The new alignment may also result in greater drainage and utility impacts.
- Build Options 1.1b, 1.1c, 1.1e, and 2.1b require less frontage road construction, which is less construction impact to Reptile Gardens.

- Westbound Spring Creek bridge requires widening in the RCI Build Options with the main intersection at Neck Yoke Road (1.1a, 1.1b, 1.1c).
- RCI 1.1d and 1.1e constructs Neck Yoke Road on new alignment and thus provides greater flexibility in maintaining local traffic.

Based on these findings, a most favorable (5) to least favorable (1) rating was assigned to each of the Build Options that reflects the impact each potential drawback may have on the constructability of the Build Option.

Public Input

Public and stakeholder feedback from public meetings held December 10, 2019, and February 2021 and follow-up meetings with individual stakeholders in October 2020 and February 2021 is summarized in this category. There were several focal points of support or opposition related to the Build Options. Because some of these are defined quantitatively in other categories, this category is strictly related to feedback the Study Advisory Team heard from the public and stakeholders.

Table 33: Build Option Public Input Summary

Description	Support of Build Options	Opposition to Build Options
Intersection location.	Stakeholders supported Build Options where the main intersection was at Neck Yoke Road due to the smaller intersection and fewer conflicts. **1.1a, 1.1b, 1.1c, 1.1d, 1.1e** **2.1a, 2.1b**	Stakeholders were generally opposed to Build Options where the main intersection was at the central driveway do to the larger, more complex intersection that blended several turning movements into a single intersection. **1.2a, 1.2b, 1.3a, 1.3b** **2.2a, 2.2b**
Number of access points and ease of mobility and safety between US16 and businesses, US16 service road, and Neck Yoke Road. Includes longer vehicles such as RVs.	Stakeholders generally noted support for two access points instead of one to better accommodate large vehicles, tourist traffic, and local traffic. **1.1b, 1.1c, 1.1e, 1.2b, 1.3b** **2.1b, 2.2b**	Generally, less stakeholder support for Build Options with one access point 1.1a, 1.1d, 1.2a, 1.3a 2.1a, 2.2a
Does US16 through traffic need to stop?	Stakeholders generally noted support for Build Options where US16 through traffic does not need to stop at the bottom of the valley. **1.1a, 1.1b, 1.1c, 1.1d, 1.1e, 1.2a, 1.2b, 1.3a, 1.3b**	Stakeholders generally opposed Build Options where US16 through traffic would need to stop at the bottom of the valley do to both operational and safety concerns. **2.1a, 2.1b, 2.2a, 2.2b**

Key findings from the stakeholder and public comment included:

- Support for RCI Build Options over signalized intersection Build Options.
    - Strong opposition for signalized intersections from stakeholders representing long/large truck operations.

- Support for Build Options with the main intersection at Neck Yoke Road (on alignment or shifted west).
- Stakeholders expressed support for Build Options that minimized impacts to their parking lots. Layouts were revised to minimize parking lot impacts during construction and post-construction in terms loss of stalls. It is anticipated that each Build Option will need to work up to the parking lot and there will be some impact during construction.
- Support for Build Options with two access points instead of one.
- Support for locating all westbound turn lanes off the 6.5 percent downgrade north of the northern driveway access point.
- Support for providing a southbound left turn lane at the central access point instead of to the north (on the steeper grade).

Potential Environmental Impacts

Potential environmental impacts are similar across the various Build Options. There is potential impact to the floodplain and wetlands along Spring Creek resulting from bridge work with each Build Option. The greatest potential impacts are socioeconomic due to access modifications, changes in traffic patterns and direct access, parking lot impacts, and potential relocations. All Build Options would likely result in access modifications, changes to traffic patterns, and parking Build Options that consolidate all access points to a single main intersection are anticipated to result in the greatest need for Reptile Gardens parking alternations due to frontage road on the west side of US16. Build Options with second northern access would maintain direct agricultural access. Build Options 1.1d and 1.1e would also result in a residential displacement.

13.4 Build Option Screening Summary

The screening process followed a 3-step process to compare and eliminate Build Options from further consideration:

- Intersection type: RCI Build Options vs. signalized intersection Build Options
- Main intersection location: Neck Yoke Road vs. central driveway
- Number of access points: one main intersection or one main intersection plus a partial northern access

Further discussion of primary drawbacks to the Build Options eliminated from further consideration is provided in the *US16/Neck Yoke Road Intersection Build Option Evaluation* report attached in **Appendix H**.

13.4.1 Step 1: Intersection Type

Overall, the signalized intersection Build Options did not perform well in comparison to the RCI across most categories. The most notable being the traffic operations and predicted safety. Therefore, all signalized intersection Build Options were eliminated from consideration when comparing intersection types (RCI vs. signalized intersection).

13.4.2 Step 2: Main Intersection Location

The second step of the screening process involved a comparison of RCI Build Options regarding main intersection location. RCI Build Options at the central driveway resulted in an undesirable configuration on the east side of US16 due to limited space and several access points. Ultimately, the US16 intersection blended into a large intersection with the US16 service road that led to concerns for traffic operations and safety within the intersection area. Because there was a corresponding RCI Build Option with the main intersection at Neck Yoke Road, a head to head comparison of a Neck Yoke Road RCI vs. a central driveway RCI favored the Neck Yoke Road RCIs. Thus, all RCI Build Options with the main RCI at the central driveway were eliminated from further consideration.

13.4.3 Step 3: Number of Access Points

Build Options carried forward into the third step include two single RCI Build Options, 1.1a and 1.1d, and three multiple access RCI Build Options, 1.1b, 1.1c, and 1.1e. These Build Options provided the best traffic operations, showed notable safety benefits, and were supported by the public and stakeholders.

In comparison of the two single RCI Build Options, 1.1a vs. 1.1d, 1.1d was carried forward as a finalist Build Option due to:

- Greatest predicted reduction in crashes of all Build Options
    - 1.1d reflected nearly 15 percent greater reduction in F&I crashes when compared to 1.1b.
- 230 feet separation on Neck Yoke Road between US16 mainline and US16 service road
    - 1.1a did not improve separation between intersections and exhibited measured queue spillback impacts by Year 2050.

In comparison of the three multi-access RCI configurations, it was determined that 1.1e be carried forward as a finalist Build Options due to:

- Further reduction in overall number of conflict points in comparison to 1.1b
    - 1.1c and 1.1e provided the same key movement supported by stakeholders as 1.1b, but both reduced the number of conflict points by eliminating a redundant eastbound to westbound U-turn movement that provides little benefit to main intersection operations.
- 1.1e incorporates all turn lanes on the flatter grade, while 1.1c starts turn lanes on the steep downgrade.
- 1.1e provides a ¾ access into the central access, which was favored by local stakeholders.

The two finalist RCIs in step three include 1.1d, and 1.1e. A summary of key differentiating technical considerations is provided in the following tables.

Table 34: Finalist RCI Build Option Comparison Summary

Measure	1.1d	1.1e
No. of Access Points	1	2
Safety *Reduction in F&I crashes from No Build*	-118 (-70%)	-103 (-61%)
Traffic Operations	LOS A 1 intersection	LOS A Provides 2nd option for peaks
Intersection Spacing *Distance along Neck Yoke Road between US16 mainline and US16 service road at main RCI*	230'	230'
US16 Grade within Southbound Turn Lanes	Main RCI: -1.5%	Main RCI: -1.5% North access: -1.5%
Environmental *No. of full acquisitions*	1	1
B/C ratio	4.5	4.1
Total Cost *Construction + ROW + Contingency*	$10.8M	$10.8M $11.2M w/ frontage road

Table 35: Finalist RCI Build Option Main Intersection Traffic Operations Comparison

Measure	1.1d AM / PM	1.1e AM / PM
NB RT Delay (sec/veh)	16.7 / 38.9	15.8 / 30.6
NB to WB ETT (sec/veh)	52.1 / 77.1	50.5 / 67.9
NB Approach ETT (sec/veh)	25.6 / 48.3	30.4 / 37.3
SB RT Delay (sec/veh)	17.0 / 22.7	16.9 / 21.0
SB to EB ETT (sec/veh)	50.1 / 61.4	50.1 / 59.7
SB Approach ETT (sec/veh)	39.1 / 50.2	43.2 / 53.8

NB to WB ETT: NB LT traditional intersection movement
- NB RT to downstream U-turn to WB T and back through intersection
- Example: Neck Yoke Road to Black Hills movement

SB to EB ETT: NB LT traditional intersection movement
- SB RT to downstream U-turn to EB T and back through intersection
- Example: Reptile Gardens to Rapid City movement

Overall, the side-street operations are generally better for the multiple access RCI Build Options when comparing right turn delay and ETT of a left turn-equivalent movement. RCI 1.1e shows less delay and ETT in the range of approximately 1-10 seconds per vehicle. The lone exception is with the overall approach delay measure, where the inclusion of a higher proportion of lower ETT right turn traffic in a single access RCI 1.1d lowers the overall approach delay. In RCI 1.1e, several right turn vehicles use the RIRO access and the main RCI intersection primarily accommodates the higher ETT left turn and through-equivalent movement traffic.

Table 36: US16/Neck Yoke Road Intersection Build Option Evaluation Matri

		Meets Purpose and Need		2050 Planning Horizon Traffic Operations			Safety (2026 Year of Opening to 2050 Planning Horizon)		Local Network		ROW Needs	Total Costs		Public Input	Potential Environmental Impacts	
Build Option	Description	Improves Safety	Improves Access Management	US16 Main Intersection LOS	US16 Main Intersection Delay (**ETT)	Does US16 Through Traffic Need to Stop at Intersection?	Total Crashes	Fatal and Injury Crashes	Do Analysis Side Street Queues Block Access to US16 Service Road?	Intersection Geometry and Driver Expectancy	ROW Acquisition	Construction + ROW Costs + Contingency	Constructability	Build Option Support based on Stakeholder & Public Feedback	Wetlands / Floodplains	Socioeconomics
				AM/PM	AM/PM		+ increase - decrease from No Build	+ increase - decrease from No Build	Yes/No	5 - Best 3 - Middle 1 - Poor	Acre	$ mil	5 - Best 3 - Middle 1 - Poor	5 - Greatest 3 - Middle 1 - Least	Wetlands and 100-yr floodplain along Spring Creek	
1.1a	**RCI at Neck Yoke Road**	Yes	Yes	A / A	3.8 / 8.1	No	-207	-105	Yes	3	1.8	8.7	4	3	Potential impact to Spring Creek	Loss of direct access for business and residential/agricultural use. Parking alterations for Reptile Gardens
1.1b	**RCI at Neck Yoke Road** + Northern ¾ Access	Yes	Yes	A / A	3.3 / 5.7	No	-180	-93	No	3	0.8	9.4	4	3	Potential impact to Spring Creek	Loss of direct access for business but northern access for residential/agricultural use retained.
1.1c	**RCI at Neck Yoke Road** + Northern Partial Access	Yes	Yes	A / A	3.8 / 6.1	No	-180	-93	No	3	0.8	9.4	4	3	Potential impact to Spring Creek	Loss of direct access for business but northern access for residential/agricultural use retained.
1.1d	**RCI at Neck Yoke Road** (West)	Yes	Yes	A / A	3.8 / 8.1	No	-235	-118	No	4	2.7	10.8	4	3	Potential impact to Spring Creek	Displacement of one parcel. Loss of direct access for business and residential/agricultural use. Parking alterations for Reptile Gardens
1.1e	**RCI at Neck Yoke Road** (West) + Central Partial Access	Yes	Yes	A / A	3.8 / 6.1	No	-190	-103	No	4	2.3	10.8	4	5	Potential impact to Spring Creek	Displacement of one parcel. Loss of direct access for business but northern access for agricultural use on west side of US16 retained. Retain direct access for business but loss of direct access for residential/agricultural use on east side of US16.
1.2a	**RCI at Central Driveway**	Yes	Yes	A / A	3.8 / 8.1	No	-207	-105	Yes	2	1.8	8.4	4	2	Potential impact to Spring Creek	Loss of multiple accesses for business and residential but maintain direct access for Happy Holidays. Loss of parking for Reptile Gardens.
1.2b	**RCI at Central Driveway** + Northern ¾ Access	Yes	Yes	A / A	3.3 / 5.7	No	-180	-93	No	2	1.8	9.1	4	3	Potential impact to Spring Creek	Loss of multiple accesses for business and residential but maintains direct access for Happy Holidays. Parking alternations for Reptile Gardens. Northern access for agricultural use.
1.3a	**RCI at Central Driveway** with US16 Realignment	Yes	Yes	A / A	3.8 / 8.1	No	-207	-105	Yes	2	1.8	10.0	3	2	Potential impact to Spring Creek	Loss of multiple accesses for business but maintains direct access for Happy Holidays. Loss of parking for Reptile Gardens.
1.3b	**RCI at Central Driveway with US16 Realignment** + Northern ¾ Access	Yes	Yes	A / A	3.3 / 5.5	No	-180	-93	No	3	1.6	10.2	3	3	Potential impact to Spring Creek	Loss of multiple accesses for business but maintains direct access for Happy Holidays. Parking alternations for Reptile Gardens. Northern access for agricultural use.
2.1a	**Signalized Intersection at Neck Yoke Road**	Yes	Yes	B / B	16.6 / 19.8	Yes	-170	-90	Yes	2	2.0	10.8	2	1	Potential impact to Spring Creek	Loss of direct access for business and residential/agricultural use. Loss of parking for Reptile Gardens
2.1b	**Signalized Intersection at Neck Yoke Road** + Northern ¾ Access	Yes	Yes	B / B	14.5 / 17.2	Yes	-137	-78	Yes	2	1.0	11.4	2	2	Potential impact to Spring Creek	Loss of direct access for business but northern access for residential/agricultural use. Least amount of parking impacts to Reptile Gardens
2.2a	**Signalized Intersection at Central Driveway**	Yes	Yes	B / B	16.6 / 19.8	Yes	-170	-90	Yes	1	1.9	10.8	2	1	Potential impact to Spring Creek	Loss of multiple access for business and residential but maintains direct access for Happy Holidays. Loss of parking for Reptile Gardens.
2.2b	**Signalized Intersection at Central Driveway** + Northern ¾ Access	Yes	Yes	B / B	14.5 / 17.2	Yes	-137	-78	Yes	1	1.8	11.9	2	2	Potential impact to Spring Creek	Loss of multiple access for business and residential but maintains direct access for Happy Holidays. Parking alternations for Reptile Gardens. Northern access for agricultural use.
No Build	**No Build**	No	No	C / F	22.8 / 590.7	No	370 (baseline)	168 (baseline)	Yes	1	0	0	n/a	1	No Impacts	Access remains

14.0 Recommendations

14.1 Recommended Build Option

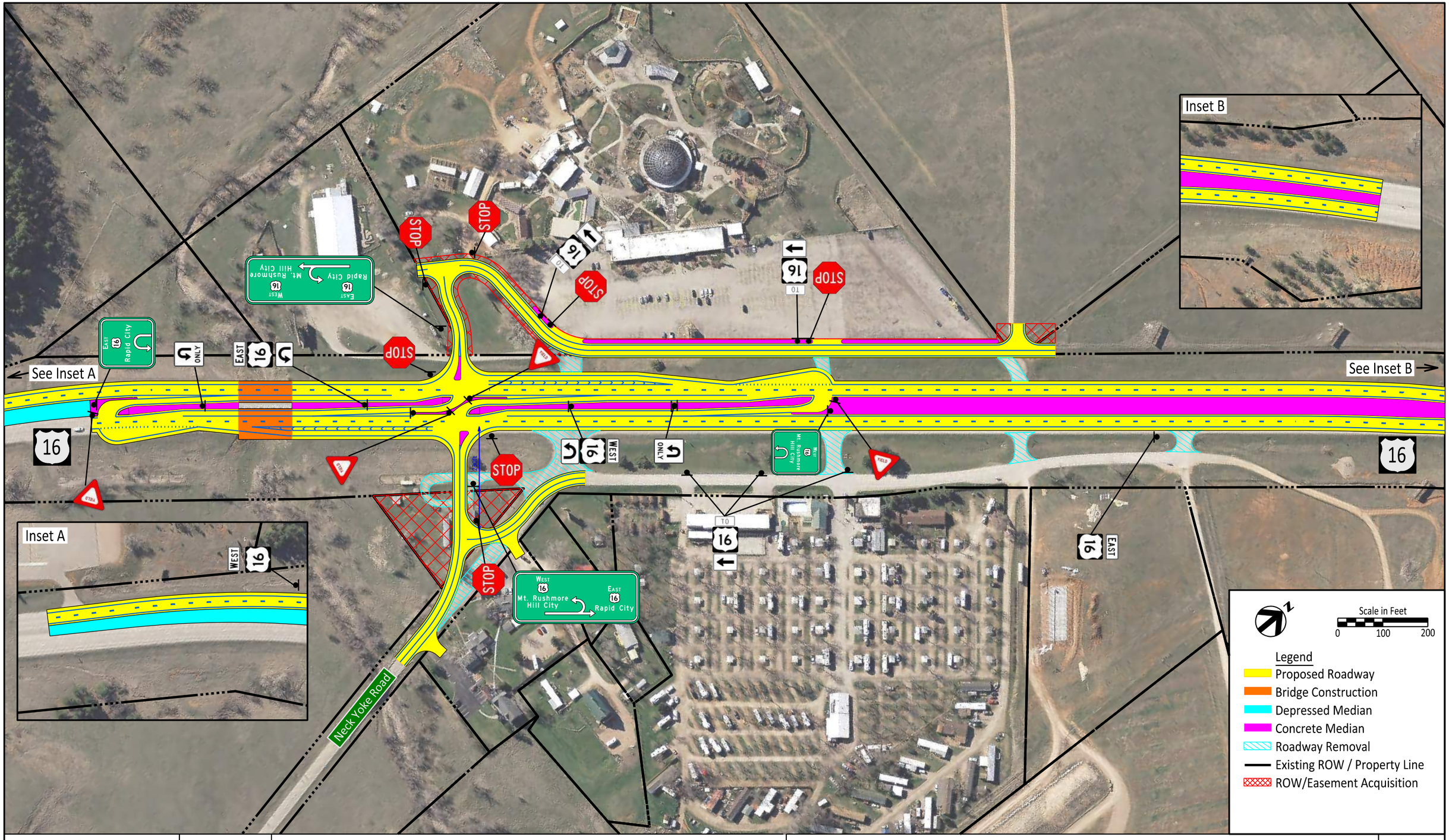
Based on the analysis contained within this report, HDR's consultant recommended technically feasible alternative that best meets the established transportation needs of the US16/Neck Yoke Road intersection is Build Option 1.1d, RCI at Neck Yoke Road (west). Key elements of this Build Option include:

- US16 through traffic does not need to stop through the intersection (free movement).
- Safety benefits:
    - 70 percent reduction in fatal and injury crashes compared to No Build condition.
    - 64 percent reduction in total crashes compared to No Build condition.
- Overall intersection operations of LOS A in Year 2050.
- Increases Neck Yoke Road intersection spacing between US16 and US16 service road to 230 feet.
    - Measured 95th percentile queue 140 feet in Year 2050 AM peak hour, 90 feet less than the available 230 feet.
- Frontage roads on west and east side distributes local traffic to access points and provides local connectivity for area parcels.
- Public/stakeholder support for Build Options:
    - Improved local network access via frontage roads, better intersection spacing, and internal connectivity
    - US16 through traffic does not need to stop at the bottom of the valley.
    - All turn lanes located entirely on the flatter 1.5 percent grade
- Benefit-cost ratio of 4.5, the greatest of all RCI finalist Build Options.

HDR understands the success of any project is often predicated on the support of proposed improvements by local stakeholders, elected officials, and the traveling public. Based on feedback received during the second and third public meetings, it was evident that local stakeholders and elected officials support the multiple access points in RCI 1.1e over the single access point in RCI 1.1d. As shown in this technical analysis, RCI 1.1e also provides notable benefit to the area with a benefit-cost ratio of 4.1. The tradeoff with multiple access points centers on the predicted increase in crashes versus a higher level of access and less delay at each individual intersection. Both Build Options satisfy the purpose and need and are considerably better than the No Build option.

The State of South Dakota access policy provides for opportunities to weigh benefits and drawbacks on the merits of each individual access. This technical report presents those benefits and drawbacks for further consideration as part of the NEPA, preliminary design, and final design processes.

Conceptual signing plans for RCI 1.1d and 1.1e are provided in **Figure 29** and **Figure 30**.



Build Option
1.1d

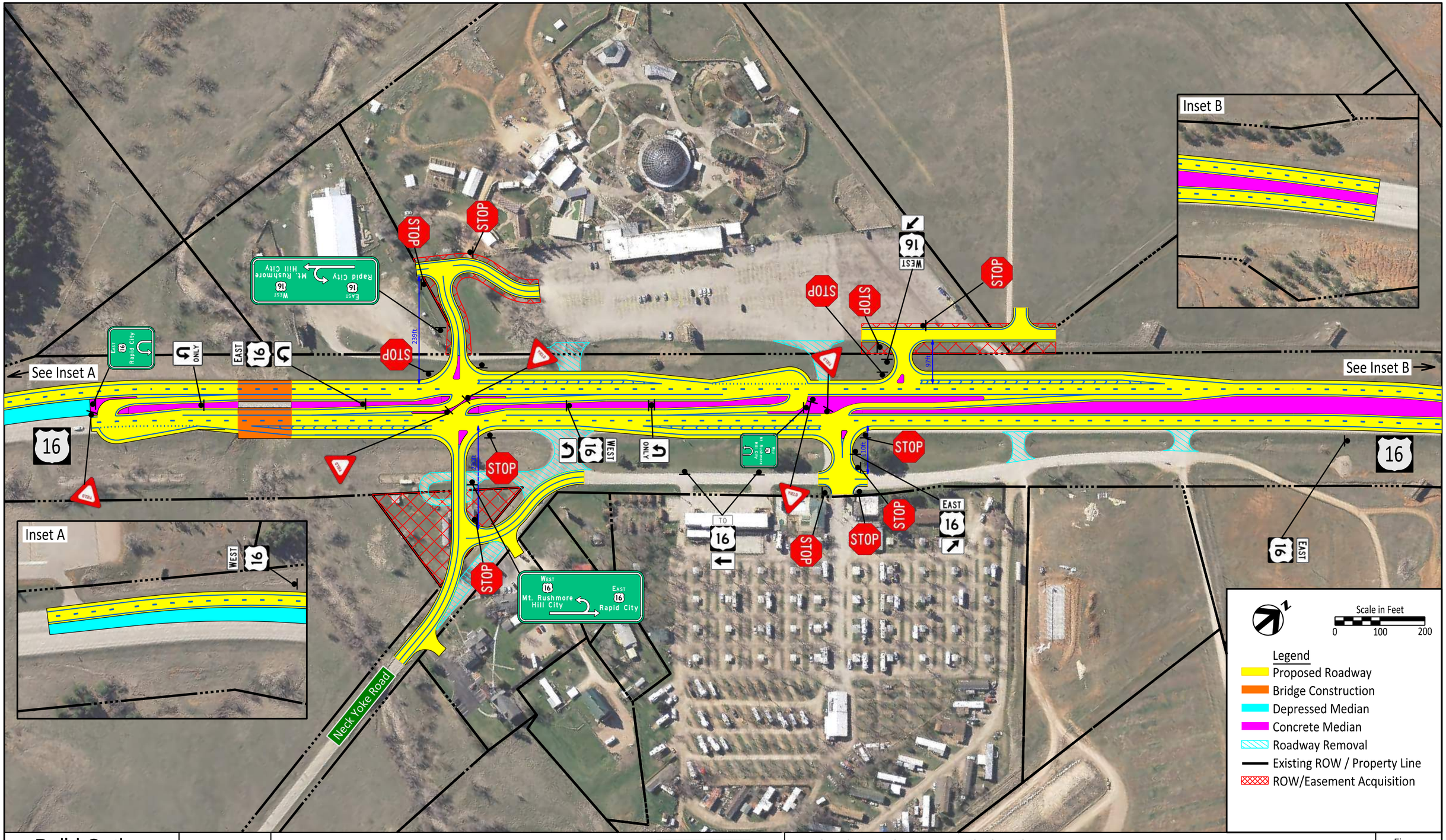
US Highway 16
CORRIDOR STUDY

Neck Yoke Road - Recommended Build Option Signing Plan (1.1d)
Reduced Conflict Intersection (RCI) - Neck Yoke Road

US16 Corridor Study

Rapid City, SD

Figure
29

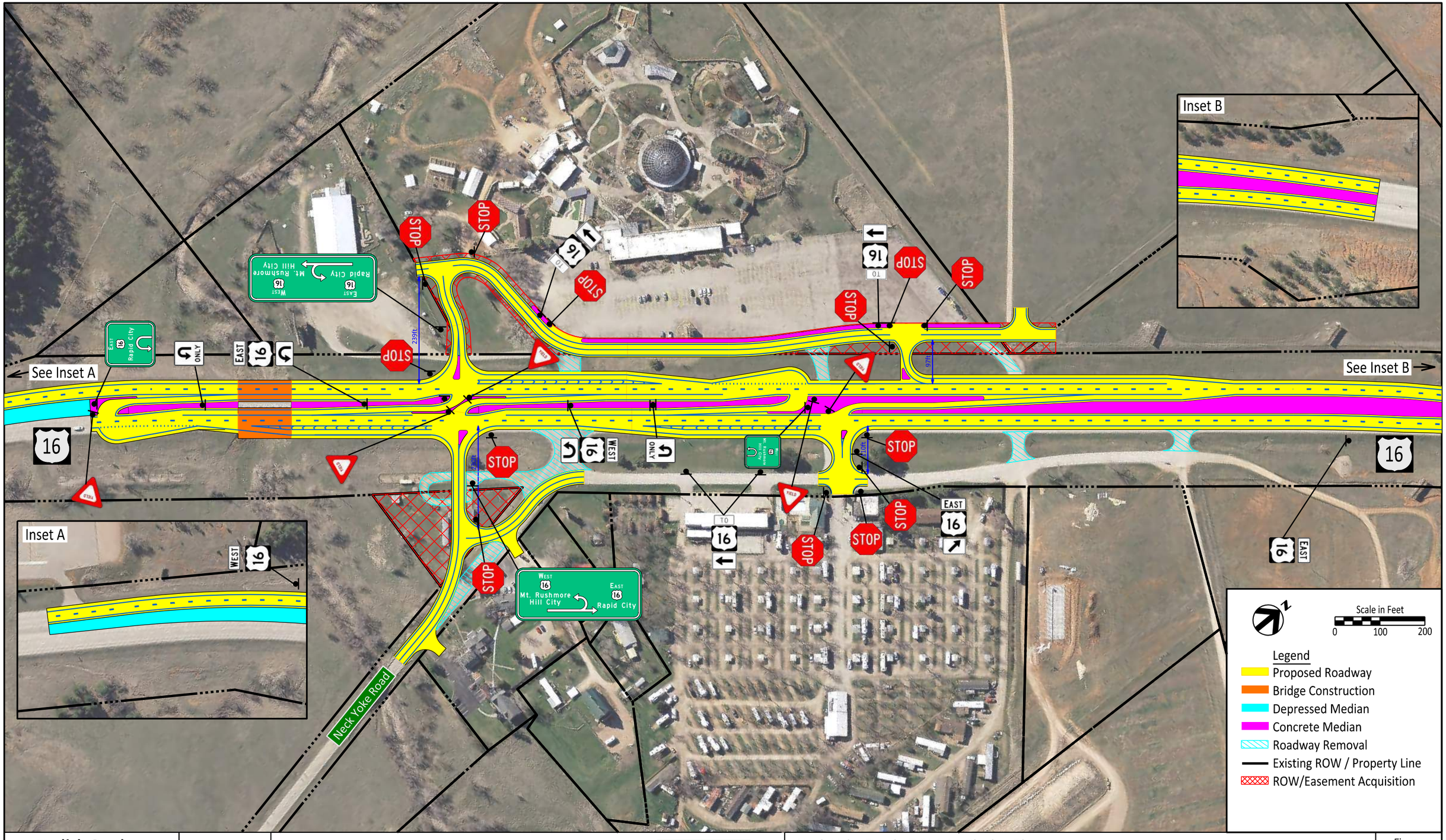


Build Option
1.1e

US Highway 16
CORRIDOR STUDY

Neck Yoke Road - RCI 1.1e Signing Plan
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure
30



Build Option 1.1e

US Highway 16 CORRIDOR STUDY

Neck Yoke Road - RCI 1.1e Signing Plan
Reduced Conflict Intersection (RCI) - Neck Yoke Road
US16 Corridor Study
Rapid City, SD

Figure 30

Appendix A. Methods and Assumptions Document

Appendix B. 2019 Existing Conditions Traffic Operations Technical Memo

Appendix C. US16 Corridor Study Crash History Review Report

Appendix D. US16 Corridor Study Traffic Forecasts Technical Memo

Appendix E. 2026 No-Build Conditions Traffic Operations Technical Memo

Appendix F. 2050 No-Build Conditions Traffic Operations Technical Memo

Appendix G. US16/Neck Yoke Road Intersection Concept Evaluation Report

Appendix H. US16/Neck Yoke Road Intersection Build Option Evaluation Report

Appendix I. 2050 Build Options HCS Reports

Appendix J. US16/Neck Yoke Road – Signalized Intersection Build Options Lane Utilization Analysis Technical Memo

Appendix K. 2026 Build Options HCS Reports

Appendix L. Predictive Safety Analysis for Neck Yoke Road Study Area Technical Memo

Appendix M. US16/Neck Yoke Road Intersection Study Area – Roadway Profiles, Earthwork, and Utility Coordination Memo