TH 23 Access Management Study
Richmond to Paynesville

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I. Introduction

A. Purpose of Study

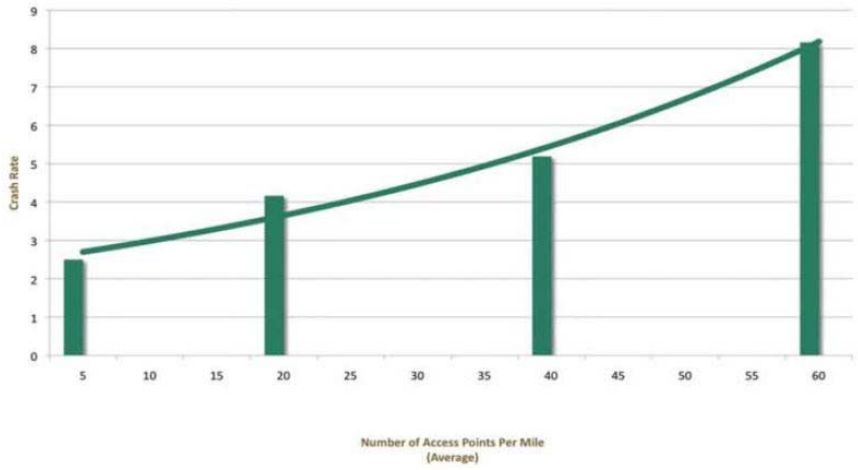
The objective of the TH 23 Access Management Study is to provide an assessment of existing roadway characteristics and access conditions that guides potential access strategies for the proposed two-lane to four-lane conversion of the TH 23 corridor between Richmond and Paynesville. This study area is included within MnDOT's Corridors of Commerce program. This report is based on the MnDOT Access Management Manual and collected roadway information and will assist in the design process of the study area's two-lane to four-lane conversion.

B. What is Access Management?

Access management is a planning, design, and implementation tool for providing access to land developments, while simultaneously preserving the safety, capacity and operation of a roadway. The ability of people and goods to move safely and efficiently is essential to economic development and a primary objective of MnDOT's Corridors of Commerce program.

Research from all levels of government and academic institutions has consistently shown that crash rates increase as the number of access points along a roadway increases. MnDOT demonstrates this relationship in Figure 1 below.

Figure 1: Effects of Access Point Density on Crash Rate (Source: MnDOT[1])



However, suitable access to residential, commercial and industrial property is also important and a key component of a community's economic vitality. The purpose for applying access management strategies along this portion of TH 23 is to better maintain mobility and safety, while also providing the access necessary to support local land uses and economic conditions.

C. Access Management & TH 23 from Richmond to Paynesville

MnDOT develops access management guidelines based upon an access category classification system. The segment of TH 23 from Richmond to Paynesville is identified as a 2A corridor, or a Rural Medium-Priority Interregional Corridor. The 2A classification forms the foundation for analysis within this report.

[1] MnDOT, Highway 10 Access Planning Study, 2013. http://www.dot.state.mn.us/metro/projects/hwy10study/pdfs/boards.pdf

See Section III for additional information about the 2A classification. Current access conditions and access management guidelines will be considered within the context of the proposed two-lane to four-lane conversion.

II. Roadway Characteristics

A. Study Area Limits

The study segment of TH 23 extends approximately 8.7 miles from the western City of Richmond limits to the existing Paynesville bypass. Within this study corridor, TH 23 is currently a two-lane undivided highway.

B. Traffic Volumes[2]

2011 average annual daily traffic (AADT) volumes through the study area range from 7,300 in the segment's western portion (Paynesville bypass to CSAH 12/CSAH 43) to 9,200 in the segment's eastern portion (CSAH 12/CSAH 43 to City of Richmond limits/CSAH 9[3]). County roads with access to TH 23 within the study area have AADT volumes ranging between 335 and 1,400. See Table 1 below for additional information about historical AADT volumes on TH 23 and relevant county roads.

Table 1: Historical AADT Demands, 2008-2013[4]

Route	Description	2006	2007	2009	2011	2012	2013
TH 23**	Paynesville bypass	-	-	-	-	-	2,550
TH 23*	Paynesville bypass to CR 12/CR 43	7,100	-	6,900	7,300	-	7,600
TH 23*	CR 12/CR 43 to CR 9	8,400	-	8,700	9,200	-	8,700
TH 23	CR 9 to CR 71	11,300	-	11,000	11,400	-	11,100
CR 123	East of TH 23; East of Paynesville	-	355	335	-	-	-
CR 123	South of TH 23; 253rd Avenue	-	375	345	-	-	-
CR 10	North of TH 23	-	800	720	-	-	810
CR 114	North of TH 23	-	450	455	-	-	-
CR 123	South of TH 23; East of Roscoe	-	400	365	-	-	-
CR 12	North of TH 23	-	1,050	1,100	-	-	1,200
CR 43	South of TH 23	-	1,450	1,400	-	-	1,500
CR 9***	North of TH 23	-	2,300	2,450	-	-	-

* TH23 Project Study Segments; ** Segment changed by new Paynesville bypass; *** Technically located outside of the study area and anticipated project limits.

Forecasted AADT demands were obtained through a regression analysis of historical AADT data. Based on an estimated timeline for the proposed TH improvements, forecasted 2040 AADT demands are approximately 12,200 vehicles per day in the segment's western portion and 14,000 vehicles per day in the eastern portion, amounting to a 2.2% and 2.3% growth rate, respectively. Forecasted traffic volumes fall within the capacity of what a proposed 4-lane roadway will provide. The highest forecast demand on county roads connecting to TH 23 within the immediate study area is approximately 2,700 vehicles per

[2] See the *Highway 23 North Gap – Daily Traffic Forecasts* memo dated 7.6.2015 for complete analysis.
[3] The TH 23 and CSAH 9 intersection will technically be located east of the anticipated project limits.
[4] 2013 data is limited per MnDOT data collection procedures and considered in "draft" status. MnDOT switched from an "even" year count to an "odd" year count between 2006 and 2009. County-level AADT information limited.

day on CR 43 south of TH 23, below capacity of a typical 2-lane facility. See Table 2 below for additional information about forecast AADT demands.

Table 2: Forecast AADT Demands, 2020 & 2040

Route	Description	2020 AADT	2040 AADT	Growth Rate***
TH 23**	Paynesville bypass	6,700	9,200	2.2%
TH 23*	Paynesville bypass to CR 12/CR 43	8,800	12,200	2.2%
TH 23*	CR 12/CR 43 to CR 9	10,100	14,000	2.3%
TH 23	CR 9 to CR 71	13,000	18,300	2.4%
CR 123	East of TH 23; East of Paynesville	450	660	3.1%
CR 123	South of TH 23; 253rd Avenue	460	660	2.9%
CR 10	North of TH 23	880	1,070	1.2%
CR 114	North of TH 23	510	610	1.1%
CR 123	South of TH 23; East of Roscoe	400	470	0.9%
CR 12	North of TH 23	1,370	1,850	2.0%
CR 43	South of TH 23	1,810	2,700	3.0%
CR 9	North of TH 23	3,010	4,030	2.1%

* TH23 Project Study Segments; ** Segment recently changed as a result of Paynesville bypass completion; *** Linear growth rate from existing 2009/2011/2013 AADT

C. Crash History

A 10-year crash analysis was conducted for crashes occurring from January 1st, 2005 through December 31st, 2014. Crash and severity rates were calculated for all intersections and segment sections along the corridor. These rates were compared to the MnDOT statewide average rates for similar intersections and sections. A critical crash and severity rate was also calculated for each intersection and segment; the critical rates are a statistical rate calculated for each individual intersection or segment based on amount of vehicle exposure. If an intersection or segment crash rate is at or above the critical rate, there is a sustained crash problem and these locations are considered to be unsafe.

In summary, three intersections along TH 23 at 263rd Ave., 210th St. and CSAH 43 are above the statewide average crash rates for a similar intersections. 263rd Ave. and CR 43 are also above the state wide severity rate averages. The only intersection along TH 23 that is at or near calculated critical rates is at CR 43 where the critical severity rate is exceeded. All four identified corridor segments have crash rates and severity rates above the statewide average. The only segment above a calculated critical rate is the short segment between the existing 4-lane section and 263rd Avenue where the critical severity rate is exceeded. All other segments are below the calculated critical rates.

Table 3 below represents the 10-year crash history for all intersections in the study area that had at least two crashes. Almost all minor street stop controlled intersections had at least one crash occur during the 10-year analysis. The highest number of crashes for a single intersection in the study area was 15 crashes. TH 23 at 263rd Ave. and CR 43 are the only intersections to have both a crash rate and severity rate higher than the statewide average rates. The only critical rate surpassed is at the intersection of TH 23 and CR 43 where the critical severity rate is exceeded.

There is a high percentage of rear end (21%) and run-off-road (43%) crashes at the intersections. Contributing factors to these types of crashes can be the number of access points, left turning vehicles,

drivers following too closely or being distracted. There is also a high percentage of crashes that occur when the pavement is not dry (46%) and in poor weather conditions (38%).

Table 3: 10-Year Intersection Crash History, 2005-2014

TH 23 @	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
E. Becker Lake Cir.	0	0	1	0	2	3	0.09	0.15	0.52	0.77
W. Becker Lake Cir.	0	0	1	2	0	3	0.09	0.21	0.52	0.77
CR 43	0	1	3	4	7	15	0.43	0.81	0.52	0.77
CR 123	0	0	0	1	1	2	0.07	0.11	0.55	0.81
CR 114	0	0	0	1	3	4	0.15	0.18	0.55	0.81
190th St.	0	1	0	2	1	4	0.15	0.34	0.56	0.82
210th St.	0	0	2	1	5	8	0.28	0.46	0.55	0.81
205th St.	0	0	2	0	1	3	0.11	0.26	0.55	0.82
253rd Ave.	0	0	0	3	1	4	0.15	0.26	0.55	0.81
CR 123	0	0	1	2	0	3	0.11	0.26	0.55	0.81
263rd Ave.	0	0	0	6	6	12	0.44	0.66	0.55	0.81
							Above Statewide Average Rate		Above Critical Rate	

Table 4 below represents the 10-year crash history for the four different segments in the crash analysis. All intersection crashes at the segment splits were removed from the segment crash data analysis. All of the segments are at or above the statewide non-junction average crash and severity rates. The short segment between the existing 4-lane section and 263rd Avenue is above the critical severity rates; all other segments are below the calculated critical rates. A total of 93 crashes occurred along TH 23 in the 10-year analysis period.

Of the 93 segment crashes, 54% of the crashes occurred during daylight conditions, 57% occurred on wet or icy pavement, and 20% of the crashes occurred on Saturdays. There is a high percentage of rear-end (17%) and run-off-road (52%) crashes along each segment. Contributing factors to these types of crashes can be the number of access points, left turning vehicles, drivers following too closely or being distracted.

Table 4: 10-Year Segment Crash History, 2005-2014

From	To	Length (Miles)	Segment ADT	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
Ref. 185+00.780	CR 43	1.49	9,200	0	1	3	6	10	20	0.40	0.70	0.50	0.71
CR 43	210th St.	4.35	7,300	0	3	3	13	22	41	0.35	0.59	0.43	0.67
210th St.	263rd Ave.	2.42	7,300	0	0	6	8	11	25	0.39	0.70	0.47	0.71
263rd Ave.	Ref. 177+00.057	0.45	7,300	0	0	2	1	4	7	0.58	1.00	0.66	0.94
										Above Statewide Average Rate		Above Critical Rate	

III. Access Management Analysis

A. Access Management Category

MnDOT utilizes an access management classification system that separates roadways into primary access categories and subcategories, each having their unique guidelines. MnDOT's Access Management Manual notes this Access Category System "consists of seven primary categories and five subcategories. Primary categories are based on the functional classification of the highway and its strategic importance within the statewide highway system. The subcategories address the highway facility types and differing land use patterns surrounding the specific highway segment."[5] Importantly, the establishment of a specific access management category is a reflection of the long-term function of a roadway for 20 years into the future. It is not necessarily a reflection of existing surrounding land uses or roadway characteristics.

MnDOT has designated the Richmond to Paynesville segment of TH 23 with an access management category assignment of 2A, or a Rural Medium-Priority Interregional Corridor.

Category 2 or Medium-Priority Interregional Corridors are functionally classified as Principal Arterials that provide interstate and intrastate travel with an emphasis on mobility.[6] Subcategory A or rural corridors "extend through agricultural, open, or forested areas with limited development" and are "planned for long-term, low-density development, characterized by scattered, large-lot residential development and limited commercial or industrial use."[7]

B. Category 2A Guidelines

MnDOT access management categories have different guidelines for appropriate spacing between primary intersections, secondary intersections, and driveways. In general, recommended public street spacing increases in distance as a location becomes more rural.

The MnDOT Access Management Manual guidelines for Category 2A roadways are outlined in Table 5 below. Recommended spacing between primary intersections is one mile. Recommended spacing between secondary intersections is 0.5 mile.

The Texas Transportation Institute (TTI) has developed recommended spacing for rural driveways. Spacing between adjacent driveways on 65 mph rural roadways, the speed limit for the proposed improvement, is recommended to be 645 feet between high-volume driveways. Due to data unavailability, low-volume driveway spacing guidance was not developed for posted speeds above 60 mph. See Table 6 for additional information.

Table 5: Recommended Street Spacing for Access Category 2A

Category	Area or Facility Type	Typical Functional Class	Primary Full Movement Intersection	Secondary Intersection
2A	Rural	Principal Arterial	1 mile	½ mile

Source: MnDOT Access Management Manual, Chapter 3, Figure 3.1

[5] MnDOT, MnDOT Access Management Manual, 2008. Chapter 2, Page 2. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter2.pdf
[6] MnDOT, MnDOT Access Management Manual, 2008. Chapter 2, Page 6. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter2.pdf
[7] MnDOT, MnDOT Access Management Manual, 2008. Chapter 2, Page 10. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter2.pdf

Table 6: Spacing between Adjacent Driveways

Posted Speed Limit	Rural ((Types 1 & 2) Spacing between Adjacent Driveways (feet)	Rural & Urban/Urbanizing (Type 3) Spacing between Adjacent Driveways (feet)
40	-	305
45	50	360
50	75	425
55	100	495
60	100	570
65	-	645

Source: MnDOT Access Management Manual, Chapter 3, Figure 3.27

Rural areas introduce unique driveway access and allowance issues. MnDOT developed guidelines to help determine appropriate driveway access for different access categories. MnDOT provides the following guidance for Category 2A roadways[8]:

- If a property retains access rights but no reasonably convenient and suitable alternative access is available, a driveway is permitted.

- The driveway should be located and designed to minimize the impact on the safety and operations of the highway.

- All driveways (Types 1, 2 [low-volume or less than 100 trips/day] and 3 [high-volume or greater than 100 trips/day]) should be spaced in accordance with Figure 3.27 (in Chapter 3 of the MnDOT Access Management Manual, also Table 6 above).

MnDOT notes that "except where MnDOT has acquired access rights, abutting property owners are entitled to reasonably convenient and suitable access to the highway."[9] It is important to note that the definition of "reasonably convenient and suitable access to the highway" can vary depending on the unique characteristics of both the subject roadway and adjacent land uses.

C. Existing Access Conditions

To assess existing access conditions on TH 23 within the context of MnDOT access management guidelines, an inventory of access locations was conducted within the study area. Aerial photography was utilized from three different sources (highway layouts, Google Maps and Bing Maps) to identify various access types. Access types identified were public road/alley way, commercial/multiple residential, single family residential, and field access. A best judgment assessment was used to determine specific access types throughout the study segment. See the attached Exhibit 1 for a map of existing access location information.

[8] MnDOT, MnDOT Access Management Manual, 2008. Chapter 3, Page 18. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter3.pdf
[9] MnDOT, MnDOT Access Management Manual, 2008. Chapter 3, Page 17. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter3.pdf

Table 7 below summarizes the number of access locations by type and segment within the study area. Note that "Public Road/Alley Way" includes both 3-legged and 4-legged intersections. Roadway segment divisions are based upon logical termini as similar to the one mile primary intersection and 0.5 mile secondary intersection spacing as possible. Some segments have termini independent of traditional public roadway intersections (e.g., private roadways or field access points). Public roads functioning as segment termini are counted within the following westward segment (e.g., segment terminus intersection of TH 23 and CR 12/CR 43 access point counted within Segment ID 2 and not Segment ID 1).

Table 7: Study Area Access Points by Type and Segment (east to west)

Segment ID	Description	Length (mi.)	Public Road/Alley Way	Commercial/Multi-Family Residential	Single Family Residential	Field	Total
0.5	Eastern terminus to Field access/CR 111 cut-thru	0.51	1	1	0	0	**2**
1	Field access/CR 111 cut-thru to CR 12/CR 43	0.99	3	4	3	1	**11**
2	CR 12/CR 43 to gravel pit/farm driveway	1.08	3	4	3	0	**10**
3	Gravel pit/farm driveway to CR 123	1.09	0	7	0	4	**11**
4	CR 123 to CR 114	1.05	1	2	0	3	**6**
5	CR 114 to CR 10	1.19	2	2	2	5	**11**
6	CR 10 to 253rd Ave.	0.99	2	3	1	4	**10**
7	253rd Ave. to CR 123	1.07	1	2	4	2	**9**
8	CR 123 to Western terminus	0.78	2	3	1	4	**10**
	Total	**8.75**	**15**	**28**	**14**	**23**	**80**

D. Compliance with Access Management Guidelines

The existing area roadway network is largely an artifact of the Public Land Survey System and township-range lines. The existing roadway alignment and its horizontal curvature prohibit a completely standardized approach to access management spacing, but the segment termini highlighted in Table 7 above demonstrate that public roadways often naturally serve as approximately one mile segment termini. This is particularly true for the western portions of the project segment.

However, the "primary intersection" and "secondary intersection" spacing concept is loosely present within the corridor; there are twice as many 3-leggged public roadway intersections (10) as 4-legged intersections (5), and traditional 4-legged primary intersections are not prominent throughout the corridor. See additional segment-specific access management details below.

In addition, access management discussions and the potential to change existing turning movement conditions at intersections should incorporate the Gap Analysis Procedure and related risk-conflict graphs as outlined in Chapter 3 of the MnDOT Access Management Manual.[10]

Primary Intersection Access Management Compliance

Segment 0.5/1: This initial eastern segment of the corridor does not contain a traditional full-movement 4-legged primary intersection until the TH 23's intersection with CR 12/CR 43 (the segment's western terminus).

Segment 2: The western terminus of Segment 2 is not a traditional full-movement 4-legged primary intersection but rather a large driveway to an existing gravel pit.

Segment 3: The western terminus of Segment 3 is a 3-legged public roadway intersection of TH 23 and CR 123.

Segment 4: The western terminus of Segment 4 is complex 5-legged public roadway intersection of TH 23 and CR 114 of the City of Roscoe limits. Spacing between primary intersections (TH 23/CR 123 and TH 23/CR 114) is approximately 1.05 miles.

Segment 5: Spacing between primary intersections (TH 23/CR 114 and TH 23/CR 10) is approximately 1.19 miles. This is a greater distance than access management guidelines recommend.

Segment 6: Spacing between primary intersections (TH 23/CR 10 and TH 23/253rd Ave.) adheres to one mile spacing recommendation.

Segment 7: Spacing between primary intersections (TH 23/253rd Ave. and TH 23/ CR 123) is approximately 1.07 miles, approximately meeting MnDOT one-mile spacing guidelines.

Segment 8: The intersection of TH 23/263rd Ave. is a full-movement intersection. It could be considered a primary intersection, and is spaced approximately 0.36 mile from the intersection of TH 23/CR 123. This is shorter spacing than MnDOT guidelines recommend.

Secondary Intersection Access Management Compliance

Segment 0.5/1: Becker Lake Cir. has two separate intersections with TH 23 approximately 0.35 mile apart. Neither function as a traditional full-movement primary intersection and instead serve more as secondary intersection access points. Finley Cir. functions in a similar manner, with access points approximately 0.18 mile apart. These four secondary intersections occur in greater frequency and proximity than MnDOT access management guidelines recommend.

Segment 2: Two secondary intersections exist within this one mile segment, violating the 0.5-mile spacing recommendations within MnDOT guidelines.

Segment 3: This segment contains no secondary intersections (e.g., a public road/public alley way intersection).

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[10] MnDOT, MnDOT Access Management Manual, 2008. Chapter 3, Pages 8-12. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter3.pdf

Segment 4: This segment contains no secondary intersections (e.g., a public road/public alley way intersection).

Segment 5: This segment contains a single secondary intersection (TH 23/190th St.) approximately 0.25 mile from the segment's western terminus, about ½ the recommended distance than MnDOT guidelines recommend.

Segment 6: A single secondary intersection (TH 23/205th St.) spaced approximately 0.5 mile from either primary intersection segment terminus adheres to MnDOT spacing recommendations.

Segment 7: No secondary intersections exist along Segment 7.

Segment 8: As noted within the Segment 8 primary intersection description above, the intersection of TH 23/263rd Ave. is a full-movement intersection and is spaced approximately 0.36 mile from the intersection of TH 23/CR 123. This is shorter spacing than MnDOT guidelines recommend.

Driveway Access Management Compliance

The proposed conversion of the study segment from a two-lane to four-lane highway significantly changes access management throughout the corridor. The introduction of a median brings access management issues and turning movement restrictions to many existing access points on the corridor, particularly private driveways. The MnDOT Access Management Manual states that new median openings should not be provided to driveways[11].

Per MnDOT guidelines, driveway access throughout the corridor should be consolidated when feasible, as this is the most conductive to safety and mobility. Alternative access through the local street network should be explored before direct access to the trunk highway system is granted or maintained. Compliance via frontage road access should also be considered, although cost restrictions need to be accounted for.

It is important to note that several issues must be considered with implementations of driveway consolidations and turning movement restrictions, including attention to "reasonably convenient and suitable access." The MnDOT Access Management Manual notes "this distance should not exceed the recommended spacing of public intersections," which for Category 2A roadways is one mile between primary intersections and 0.5 mile between secondary intersections. Many driveways within the study segment are within 0.5 mile of a secondary intersection and all driveways are within one mile of a primary intersection.

Most driveways along the project corridor can be classified as low-volume driveways (generating less than 100 trips/day) and therefore do not have adopted spacing guidelines. Driveways that could potentially be considered higher volume are generally compliant with the recommended 645 feet spacing guidance between adjacent high-volume driveways. However, few driveways are likely actually "high-volume," or generating greater than 100 trips per day.

There are, however, multiple areas of duplicative driveway access for potentially higher-volume parcels (including near the City of Roscoe and many light industrial or commercial parcels). These areas should

[11] MnDOT, MnDOT Access Management Manual, 2008. Chapter 3, Page 38. http://www.dot.state.mn.us/accessmanagement/pdf/manualchapters/chapter3.pdf

be given more consideration to comply with spacing guidance for location next to primary and secondary intersections. Specific driveway consolidations within the study area should be reviewed on a case-by-case basis.

Field Access Management Compliance

Field access points obtain identical treatment to other low-volume driveway access management guidelines. Within the study area, multiple field access points exist for single parcels of land. These multiple access points are candidates for access consolidation subject to the "reasonably convenient and suitable access" language previously discussed.

Other Notes

Several intersections contain unique or complex intersection roadway geometrics and access management conditions that should be reviewed throughout the preliminary engineering phase. These locations include:

- 5-legged intersection of TH 23 and CR 114 (Segment 4/5)
- 5-legged intersection of TH 23 and CR 10 (Segment 5/6)
- 4-legged intersection of TH 23 and 263rd Ave. (Segment 8)

IV. Summary and Conclusion

Considerations of access management within the study area should include:

- Consolidation of private driveways and field access where alternative access exists
- Median-related turning movement restrictions
- Analysis of specific primary and secondary intersection access changes per Gap Analysis Procedure and risk-conflict graphs
- Improvement of complex four and five-legged intersections

Per MnDOT recommendation, initial design of the two-lane to four-lane conversion will follow primary intersection, secondary intersection, and driveway access guidance established within MnDOT's Access Management Manual to the maximum extent possible. This includes one mile and 0.5 mile spacing recommendations for primary and secondary intersections, respectively. In addition, driveway access conditions will be reviewed for consolidation dependent on factors like redundant access points and reasonable and suitable alternative access.

This study represents an initial step in the planning process for improvements on TH 23 from Richmond to Paynesville. Conditions might exist that preclude potential access management strategies from being implemented. Land ownership, geometric design standards, and alternative access issues are a sampling of factors that can ultimately influence access management decisions.