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File:	Sand Creek Township - TH 169 (Johnson Memorial Drive) Corridor Study	Date:	April 10, 2018

**Reference:** Task 500b - Sand Creek Township TH 169 (Johnson Memorial Drive) Corridor Study Safety Analysis

### Introduction

The purpose of this memo is to document potential highway safety issues along a 3.6-mile section of TH 169 (Johnson Memorial Drive) within the Sand Creek Township Boundary limits from Bluff Drive to TH 21 (Broadway Street North). TH 169 within the study area is a divided four-lane Rural Other Principal Arterial with a posted speed limit of 65 mph and is designated as a High Priority Interregional Corridor (IRC), Category 1AF (non-interstate freeway). As outlined in the State Highway 169 – Corridor Management Plan (2002), the long-term goal for the study corridor is full access control with one-mile to half-mile spacing between interchanges. Currently, access to intersecting public roadways is maintained via at-grade two-way stop-controlled intersections and private driveways. Conditions along TH 169 which affect safety include growing traffic volumes, high proportion of heavy vehicles (10%), high average speeds (67-mph), and high access densities (3.3 per mile). The scope of the safety analysis included the identification of crash hotspots for the 3.6-mile segment of TH169 which included the following at-grade intersections:

- TH 169 and Bluff Drive
- TH 169 and W 166<sup>th</sup> Street
- TH 169 and 173<sup>rd</sup> Street W
- TH 169 and Broadway Street N

### Overall Crash Trends

Crash data was obtained from the Minnesota Crash Mapping Analysis Tool (MnCMAT) for the period January 1<sup>st</sup>, 2011 through December 31<sup>st</sup>, 2015. A total of Eighty-four (84) crashes were recorded within the analysis period with the predominant crash type being ran off road crashes (37%), followed by rear ends (36%). There was a steady increase in the number of crashes per year along the corridor for the analysis period as shown in **Table 1**. Fifty-five percent (55%) of crashes which occurred along the corridor were intersection related. Twenty-four (24%) percent of collisions occurred at night-time and thirty-nine (39%) percent of collisions involved slippery conditions.

**Table 1 – Number of Crashes by Year**

Location/Facility	Number of Crashes by Year					
	2011	2012	2013	2014	2015	Total
TH169 Segment (3.6-mi) *	13	9	20	16	26	84
TH169 Segment (3.6-mi)	10	4	7	7	11	39
TH 169 @ Bluff Dr.	1	2	6	2	5	16
TH 169 @ W 166 <sup>th</sup> St.	0	0	1	1	2	4
TH 169 @ 173 <sup>rd</sup> St. W	1	2	3	3	4	13
TH 169 @ Broadway St.	1	1	3	3	4	12

\* including intersection crashes

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**Table 2 – Crashes by Type (2011-2015)**

Location/Facility	Number of Crashes by Type								
	Rear-End	Sideswipe	Left-Turn	Ran Off Road	Right-Angle	Right-Turn	Head-On	Other	Total
TH169 Segment (3.6-mi) *	30	6	2	31	4	3	2	6	84
TH169 Segment (3.6-mi)	17	1	0	15	1	0	1	4	39
TH 169 @ Bluff Dr.	3	2	2	7	1	1	0	0	16
TH 169 @ W 166 <sup>th</sup> St.	3	0	0	1	0	0	0	0	4
TH 169 @ 173 <sup>rd</sup> St. W	2	2	0	5	1	1	1	1	13
TH 169 @ Broadway St.	5	1	0	3	1	1	0	1	12

\* including intersection crashes

In terms of severity, one ‘fatal’ crash, twelve ‘non-incapacitating’ injuries, twenty-one ‘possible’ injuries and fifty ‘property damage only’ crashes were recorded with more than half of injury crashes occurring at intersections. The intersection of TH 169 and 173<sup>rd</sup> Street had the highest severity with one fatal crash and three non-incapacitating crashes occurring in a five-year period. The angled fatal collision which occurred in 2014 involved a sport utility vehicle which attempted to make a prohibited left-turn from eastbound 173<sup>rd</sup> Street and failing to yield right-of-way to a southbound semi-truck. Left-turns from 173<sup>rd</sup> Street onto TH 169 are not allowed due to the reduced conflict intersection layout. Overall, the intersection of TH 169 at 173<sup>rd</sup> Street accounted for 78% of crash costs along the study corridor due to one fatal crash in the five year period.

**Table 3 – Crashes by Severity (2011-2015)**

Location/Facility	Number of Crashes by Type					Crash Costs*** (\$)
	K-Fatal	A-Incap. **	B-Non-Incap. **	C-Possible	O-PDO	
TH169 Segment Total (3.6-mi) *	1	0	12	21	50	15,257,000
TH169 Segment (3.6-mi)	0	0	6	10	27	2,100,600
TH 169 @ Bluff Dr.	0	0	2	4	10	727,000
TH 169 @ W 166 <sup>th</sup> St.	0	0	0	1	3	110,400
TH 169 @ 173 <sup>rd</sup> St. W	1	0	3	4	5	11,897,000
TH 169 @ Broadway St.	0	0	1	2	9	414,200

\* including intersection crashes

\*\* Incapacitating (Incap.)

\*\*\*Based on MnDOT 2016 Crash Costs

A systemic safety analysis was performed in addition to numerical analysis of crash data in order to identify at-risk locations for crashes along the corridor. Due to the rural nature of the study area, the following systemic criteria were used: skewed approach, on or near curve, ADT ratio between 0.2 and 0.8, proximity to rail crossing, proximity to last stop sign (>5 miles), and commercial development in quadrant. Results of the systemic analysis, summarized in **Table 4**, show that the intersection of TH 169 at 173<sup>rd</sup> Street West met the most systemic risk factors for crashes with five. The intersection of TH 169 at Bluff Drive met four risk factors. These intersections would be considered as priorities for future safety improvements along the corridor.

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**Table 4 – Systemic Risk Factors for Rural Intersections**

Intersection	Geometric Risk Factor		Volume	Proximity		Commercial in Quadrant	Total Risk Factors
	Skew	Near Curve	ADT Ratio	Previous STOP	RR-Xing		
TH 169 @ Bluff Dr.		x		x	x	x	4
TH 169 @ W 166 <sup>th</sup> St.					x		1
TH 169 @ 173 <sup>rd</sup> St. W	x	x		x	x	x	5
TH 169 @ Broadway St.	x	x					2

**Crash Analysis**

Frequency, rate, and severity performance measures were compared to statewide/critical averages to determine areas of concern. The intersection of TH 169 and 173<sup>rd</sup> Street W exceeded the statewide severity crash rate but did not exceed the critical rate. Results of the screening in **Table 2** below show that critical crash rates were not exceeded at any location along the corridor.

**Table 4 – Crash Screening (2011-2015)**

Location/Facility	Crash Rate			Severity Rate		
	Calculated	State Avg.	Critical	Calculated	State Avg.	Critical
TH169 Segment (3.6-mi) *	0.60	0.87	1.05	0.53	1.78	3.30
TH 169 @ Bluff Dr.	0.33	0.25	0.44	0.00	1.05	3.86
TH 169 @ W 166 <sup>th</sup> St.	0.08	0.25	0.44	0.00	1.05	3.86
TH 169 @ 173 <sup>rd</sup> St. W	0.25	0.25	0.44	<b>1.93</b>	1.05	3.86
TH 169 @ Broadway St.	0.21	0.25	0.44	0.00	1.05	3.86

\* including intersection crashes

Overall, the corridor performed well below statewide and critical rates but showed a steady increase in the frequency of crashes within the 5-year period analyzed. Contributing factors to predominant rear-end and ran-off-road crashes obtained from crash reports included ‘slippery pavement’, ‘high speeds’, ‘distracted driving’, and ‘following too closely’. Contributing factors and recommended safety studies to confirm issues in the field are summarized in **Table 5**.

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**Table 5 – Contributing Factors & Future Safety Studies**

Crash Pattern	Contributing Factors	Future Safety Studies	Potential Countermeasures
Rear-End	<ul style="list-style-type: none"> <li>Following too closely</li> <li>Distracted driving</li> <li>Failure to yield right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>Spot Speed Study</li> <li>Pavement Skid Resistance Study</li> <li>Highway Lighting Study</li> <li>Gap Study</li> </ul>	<ul style="list-style-type: none"> <li>Improve warning signs</li> <li>Pavement Overlay</li> <li>Prohibit left-turns</li> <li>Improve roadway lighting</li> </ul>
Ran-Off-Road	<ul style="list-style-type: none"> <li>Illegal Speed</li> <li>Improper Lane</li> <li>Slippery Pavement</li> <li>Over-correcting</li> </ul>	<ul style="list-style-type: none"> <li>Spot Speed Study</li> <li>Pavement Skid Resistance Study</li> <li>Sign Inventory</li> <li>Sight Distance Study</li> <li>Check Drainage</li> </ul>	<ul style="list-style-type: none"> <li>Pavement overlays</li> <li>Rumble strips</li> <li>Refresh pavement markings</li> <li>Improve lighting</li> <li>Upgrade shoulders</li> </ul>

Rear-end crashes were concentrated at intersection and private driveways approaches which could indicate insufficient gaps for minor street movements due to heavy volumes. Ran-Off-Road collisions were also clustered near intersections which could indicate excessive speed, inadequate pavement, poor visibility, and inadequate shoulders. Since most crashes occurred at intersections, access management strategies which eliminate at-grade crossings, relocate driveways to frontage roads, or restrict access to right-in right-out have the greatest potential to improve safety. Possible short to midterm countermeasures to reduce crashes include installing rumble strips, improving warning signs, pavement overlays, dynamic mainline warning signs, and improved lighting.

**Recommendations**

Gap studies should be performed at two-way stop-controlled intersections along the study corridor to determine whether sufficient gaps exist for vehicles making turning movements onto TH 169. Potentially unsafe movements should be restricted, or auxiliary lanes provided to assist drivers making turning movements from minor approaches onto TH 169. It is also recommended that field reviews are conducted to determine whether warning signs, pavement markings and rumble strips need to be improved or installed.

**Limitations**

The crash analysis did not consider data updated through 2017 as current data is not yet available through MnCMAT.

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Attachment:

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