

TECHNICAL MEMORANDUM

TO: Amber Miller, AICP/Ann Arbor DDA

FROM: Lori Pawlik, PE, PTOE/Wade Trim and Kristy Thullen, EIT/Wade Trim

DATE: August 16, 2023

RE: Catherine/Miller Bikeway Before and After Safety Analysis

This analysis is the first follow-up examination of the Catherine Street/5th Avenue intersection in comparison to the safety evaluation that was conducted in 2021 prior to road improvements along the corridor (Miller Avenue/Catherine Street from 1st Street to Division Street). At this time, there is not a definitive conclusion that can be made using safety data as only approximately nine months have passed since construction concluded and the bikeway was open to the public. Typically, a longer period of data is evaluated after the treatment is installed to allow traffic patterns to return to normal and stabilize as detours may have routed traffic away, or people may have generally been avoiding the area during construction. In addition, more time during the after period accounts for people acclimating to the new condition and provides a better sample size. However, in response to a public concern of the two-way bike lane at the intersection of Catherine Street and 5th Avenue during the Ann Arbor City Council meeting held August 7, 2023, a preliminary crash review has been conducted to ensure that there is not a new crash pattern. Construction of the two-way bike lane on Miller Avenue/Catherine Street was completed in November 2022 and while there has not been enough time to report statistical significance, the after period crash data has shown decreases in crash frequency and severity throughout the corridor.

1.0 INTRODUCTION

The City of Ann Arbor Downtown Development Authority (DDA) developed the People Friendly Streets program to create a connected network of streets which provide safe and equitable mobility for all users, particularly in the downtown area. Within the downtown, the Miller Avenue/Catherine Street corridor was selected for corridor-wide improvements to bike and pedestrian facilities, adding a two-way protected bikeway along the south side of Miller Avenue/Catherine Street from 1st Street to Division Street. Prior to these improvements, Wade Trim Associates conducted a safety evaluation that included a five-year crash analysis between 2016 and 2020, examining corridor-wide statistics and further investigating intersections within the corridor to provide insight to the expected safety impacts garnered by planned and/or potential engineering modifications.

The bikeway opened in November 2022 and the intersection of Catherine Street and 5th Avenue was highlighted as an area of concern during the public comment portion of the Ann Arbor City Council meeting held August 7, 2023. As a result, the DDA has requested an updated analysis of available crash data to evaluate impacts of the bikeway installation in comparison to the previous safety evaluation to determine whether this type of crash is happening more frequently than expected and if it suggests potential design changes.

2.0 CRASH ANALYSIS

Crash data were obtained using the Transportation Improvement Association's Traffic Crash Analysis Tool website. The five-year (60 month) study period between January 1, 2016, and December 31, 2020, is referred to as the Before Period throughout this analysis. The After Period is defined as the nine-month period of available crash data since the project's completion (November 1, 2022, through July 30, 2023). It important to recognize that analysis is typically conducted for 12-month periods and the After Period is not a usual duration for analysis. Table 2-1 compares the total crashes reported throughout the corridor during each period.

2.1 Corridor-Wide Crashes

A total of 144 crashes were reported in the Before Period (12 crashes were removed after further examination of their police report narratives revealed they involved parked vehicles), averaging 29 crashes per year. There were no fatalities and the rate of injury (ranging from the most severe, Type A Incapacitating Injury, to a suspected injury Type C Possible Injury) was 12.5 percent of reported crashes.

During the After Period, 17 crashes were reported (3 crashes were related to parked vehicles and were removed from the total).

The most frequent crash types in the Before Period were Angle and Rear End crashes. These are also the two most frequent crash types in the nine-month After Period, with the estimated monthly averages showing similar frequencies.

There have been no fatal crashes reported in either period. **The monthly average of injury occurrence in the Before Period is 0.30 crashes per year. The estimated monthly average for the After Period is 0.22 crashes per year.** In fact, the most severe incapacitating injury crash type is reduced from 0.03 crashes to zero per month during the before period, and non-incapacitating injuries have seen a significant decrease from 0.17 crashes per month to zero. The only two crashes resulting in injury in the After Period were both Type C Possible Injury, the least severe in the police reporting scale.

Table 2-1 Miller Avenue/Catherine Street Crash Summary

Characteristic	Before Period			After Period	
	No. of Crashes	Yearly Average	Monthly Average*	No. of Crashes	Monthly Average*
Crash Type					
Angle	48	9.6	0.80	7	0.78
Rear End	43	8.6	0.72	7	0.78
Sideswipe – Same Direction	24	4.8	0.40	1	0.11
Single Motor Vehicle	11	2.2	0.18	0	0.00
Bicycle	7	1.4	0.12	1	0.11
Pedestrian	4	0.8	0.07	0	0.00
Backing	3	0.6	0.05	1	0.11
Head On – Left Turn	2	0.4	0.03	0	0.00
Head On	1	0.2	0.02	0	0.00
Sideswipe – Opposite Direction	1	0.2	0.02	0	0.00
Total	144	28.8	2.40	17	1.89
Injury Severity					
Type A Incapacitating Injury	2	0.4	0.03	0	0.00
Type B Non-Incapacitating Injury	10	2.0	0.17	0	0.00
Type C Possible Injury	6	1.2	0.10	2	0.22
Total	18	3.6	0.30	2	0.22
Percentage of Injury Crashes	12.5			11.8	

Transportation Improvement Association Traffic Crash Analysis Tool

*Estimated using nine months of data

2.2 Crashes by Intersection

The corridor of Miller Avenue/Catherine Street from 1st Street to Division Street includes seven intersections that were evaluated separately. The intersection with Main Street was found to have the highest frequencies of crashes and crashes resulting in injury in both the Before and After Periods. The following tables summarize the crash history at each intersection of the corridor for each period.

2.2.1 Crashes at Miller Avenue and 1st Street

The calculated monthly average for the After Period at the intersection of Miller Avenue and 1st Street shows the crash frequency slightly decreased, maintaining Angle and Rear End crashes as the most frequent crash types. The Angle crashes in the After Period in reviewing the details of the police reports, both crashes were related to vehicles failing to stop at a red light. These circumstances do not indicate the crashes were influenced by the bikeway or the two-way conversion on First Street. The number of non-motorized crashes has decreased to zero and the number of crashes resulting in injury has also decreased to zero in the After Period. This could indicate an increase in bike and pedestrian safety compared to the Before Period.

Characteristic	Before Period			After Period		
	No. of Crashes	Yearly Average	Monthly Average	No. of Crashes	Monthly Average*	
Crash Type						
Angle	9	1.8	0.15	2	0.22	
Rear End	8	1.6	0.13	1	0.11	
Single Motor Vehicle	4	0.8	0.07	0	0.00	
Sideswipe – Same Direction	3	0.6	0.05	0	0.00	
Bicycle	3	0.6	0.05	0	0.00	
Head On – Left Turn	1	0.2	0.02	0	0.00	
Total	28	5.6	0.47	3	0.33	
Injury Severity						
Type A Incapacitating Injury	2	0.4	0.03	0	0.00	
Type B Non-Incapacitating Injury	1	0.2	0.02	0	0.00	
Type C Possible Injury	2	0.4	0.03	0	0.00	
Total	5	1.0	0.08	0	0.00	

Transportation Improvement Association Traffic Crash Analysis Tool

*Estimated using nine months of data

2.2.2 Crashes at Miller Avenue and Ashley Street

The calculated monthly average for the After Period at the intersection of Miller Avenue and Ashley Street shows negligible increase of 0.16 crashes. Angle and Bicycle crashes were reduced but there were two Rear End crashes that occurred since November 2022. After reading the details of the police reports, one crash was due to a vehicle being rear ended while stopping for a pedestrian in the crosswalk and the other was due to a vehicle being rear ended while slowing for traffic at a red light. These circumstances do not indicate the crashes were in relation to the bikeway. There were no crashes resulting in injury within the After Period and the absence of non-motorized crashes can indicate an increase in bike and pedestrian safety compared to the Before Period.

Characteristic		Before Period			After Period	
		No. of Crashes	Yearly Average	Monthly Average	No. of Crashes	Monthly Average*
Crash Type						
Angle		8	1.6	0.13	1	0.11
Rear End		0	0.0	0.00	2	0.22
Bicycle		1	0.2	0.02	0	0.00
Total		9	1.8	0.15	3	0.33
Type A Incapacitating Injury		0	0.0	0.00	0	0.00
Type B Non-Incapacitating Injury		0	0.0	0.00	0	0.00
Type C Possible Injury		2	0.4	0.03	0	0.00
Total		2	0.4	0.03	0	0.00

Transportation Improvement Association Traffic Crash Analysis Tool

*Estimated using nine months of data

2.2.3 Crashes at Miller Avenue/Catherine Street and Main Street

Rear End, Sideswipe – Same Direction, and Angle crashes remain the greatest generators of crashes in the Before and After Periods on Miller Avenue/Catherine Street and Main Street. The overall monthly average shows more than a 50 percent reduction in crash frequency. There were no crashes involving bicyclists or pedestrians, which can indicate an increase in non-motorized safety compared to the Before Period.

The estimated monthly average for Rear End and Angle crashes show a negligible increase in the After Period and after further review of the police reports, none of these crashes were in relation to the bikeway installation. All crashes in these two categories were due to failure to stop at a red/flashing light or failure to assure proper clearance of the vehicle ahead. The two injury crashes reported in the After Period were Angle crashes also unrelated to the bikeway installation. Both crashes were reported as Type C Possible Injury as the most severe to one or more persons involved. The reduction of Type B Non-Incapacitating Injury crashes can indicate an increase in safety.

Characteristic		Before Period			After Period	
		No. of Crashes	Yearly Average	Monthly Average	No. of Crashes	Monthly Average*
Crash Type						
Rear End		24	4.8	0.40	4	0.44
Sideswipe – Same Direction		17	3.4	0.28	1	0.11
Angle		13	2.6	0.22	3	0.33
Single Motor Vehicle		6	1.2	0.10	0	0.00
Bicycle		2	0.4	0.03	0	0.00
Pedestrian		2	0.4	0.03	0	0.00
Head On – Left Turn		1	0.2	0.02	0	0.00
Sideswipe – Opposite Direction		1	0.2	0.02	0	0.00
Backing		1	0.2	0.02	0	0.00
Total		67	13.4	1.12	8	0.89
Type A Incapacitating Injury		0	0.00	0.00	0	0.00
Type B Non-Incapacitating Injury		5	0.08	0.56	0	0.00
Type C Possible Injury		2	0.03	0.22	2	0.22
Total		7	0.12	0.78	2	0.22

Transportation Improvement Association Traffic Crash Analysis Tool

*Estimated using nine months of data

2.2.4 Crashes at Catherine Street and 4th Avenue

There were no crashes reported within the intersection of Catherine Street and 4th Avenue during the nine-month After Period. The previous safety evaluation reported nine crashes with zero crashes resulting in injury (four crashes were related to parked vehicles and were removed from the total). No bike or pedestrian crashes were reported during that study period. While the After Period has not been a full 12-months, a report of zero crashes can indicate an improvement to safety for all road users.

2.2.5 Crashes at Catherine Street and Detroit Street

There were no crashes reported within the intersection of Catherine Street and Detroit Street during the nine-month After Period. The previous safety evaluation reported one crash with zero crashes resulting in injury (one crash was related to parked vehicles and was removed from the total). No bike or pedestrian crashes were reported during that study period. While the After Period has not been a full 12-months, a report of zero crashes can indicate an improvement to safety for all road users.

2.2.6 Crashes at Catherine Street and 5th Avenue

The estimated monthly crash average in the After Period only shows a slight decrease in crashes. There has been one crash reported since November 2022 at the intersection of Catherine Street and 5th Avenue during the after period analyzed. Since the rest of the August 2023 crash data isn't available, the tables in this memo do not include crashes occurring in August of 2023 and do not include the subject bike crash. The 2022 crash involved a bicyclist and was due to an eastbound vehicle making a right turn at the intersection and crashing into a bicyclist traveling westbound through the intersection. The bicyclist was using the protected bikeway but was in the intersection when the crash occurred. This resulted in a Type C Possible Injury to the bicyclist. It should be noted that a positive trend in severity may be occurring as the number of more serious Type B Non-incapacitating Injury crashes has been reduced from 3 crashes to zero.

Additionally, during the August 7, 2023 Ann Arbor City Council Meeting, a resident gave public comment reporting a crash they were involved in at this intersection. No date of the incident was provided (the most recent data available on the TCAT website is up to July 30, 2023). The resident later detailed by email that the crash occurred while they were westbound on Catherine Street making a left turn and crashed into a bicyclist who was also westbound. The bicyclist was using the protected bikeway but was in the intersection when the crash occurred. The resident stated that both parties were traveling with caution and at low speeds and no injuries occurred.

Based on the available crash data, no significant crash patterns have been identified at this intersection upon installation of the bikeway. However, there was one bike crash in November 2022 and one in August 2023, which are further evaluated below to help inform whether action needs to be taken:

- November 2022 bike crash – as previously mentioned, the 2022 crash involved a bicyclist when an eastbound vehicle making a right turn at the intersection crashed into a bicyclist traveling westbound through the intersection. The crash information indicates this may have been motorist turning against a No Turn on Red sign. This is an enforcement issue; however, giving the benefit of doubt to the motorist if they had turned on red – this is a new condition that they might not have realized. Time for people to get acclimated to the new conditions will help if this is the case.
- August 2023 bike crash – although there isn't a police report available for use in this evaluation, the driver's verbal summary to city council was stated that they turned left (assuming during the green phase of the traffic signal) and hit the biker traveling in the bikeway (assuming during the Walk phase of the pedestrian signal). This is a failure to yield which is the responsibility of the driver according to state law. However, it is recognized that the Catherine Street and 5th Avenue intersection has an unusual configuration with a partial one-way split on Catherine Street and a full one-way operation on 5th Avenue, where users must have a good understanding of operations when traveling through it. In consideration of this, a short-term treatment to consider is

installation of a Turning Vehicles Yield to Bikes/Peds sign to remind drivers to yield to crossing pedestrians and bicyclists that conflict with the driver's turning movement. A long-term solution that may be considered and could improve area circulation in general may include evaluation of one-way street operations.

As bike crashes are the only type of crash that have occurred during the after period, there are no other crash patterns or safety concerns at this time.

Table 2-5 Catherine Street and 5th Avenue					
Characteristic	Before Period			After Period	
	No. of Crashes	Yearly Average	Monthly Average	No. of Crashes	Monthly Average*
Crash Type					
Sideswipe – Same Direction	4	0.8	0.07	0	0.00
Angle	3	0.6	0.05	0	0.00
Rear End	3	0.6	0.05	0	0.00
Pedestrian	2	0.4	0.03	0	0.00
Bicycle	1	0.2	0.02	1	0.11
Total	14	2.8	0.23	1	0.11
Injury Type					
Type A Incapacitating Injury	0	0.0	0.00	0	0.00
Type B Non-Incapacitating Injury	3	0.6	0.05	0	0.00
Type C Possible Injury	0	0.0	0.00	1	0.11
Total	3	0.6	0.05	1	0.11

Transportation Improvement Association Traffic Crash Analysis Tool

**Estimated using nine months of data*

2.2.7 Crashes at Catherine Street and Division Street

The estimated monthly crash average in the After Period shows a negligible decrease in crashes. The two crashes reported were not found to be related to the bikeway installation. After further review of the police reports, one crash was due to failure to stop at a Stop Sign and the other was due to a vehicle backing in the middle of the intersection and hitting a vehicle behind them.

Characteristic		Before Period			After Period	
		No. of Crashes	Yearly Average	Monthly Average	No. of Crashes	Monthly Average*
Crash Type						
Angle		10	2.0	0.17	1	0.11
Rear End		6	1.2	0.10	0	0.00
Backing		0	0.0	0.00	1	0.11
Total		16	3.2	0.27	2	0.22
Type A Incapacitating Injury		0	0.0	0.00	0	0.00
Type B Non-Incapacitating Injury		1	0.2	0.02	0	0.00
Type C Possible Injury		1	0.2	0.02	1	0.11
Total		2	0.4	0.03	1	0.11

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**Estimated using nine months of data*

3.0 CONCLUSION

3.1.1 Catherine-Miller Safety Trends

The statements of this analysis cannot definitively determine effects of the bikeway installation due to the short period of time that has passed since construction was completed in November 2022. In general, the available data shows preliminary data trending positively in terms of safety as there have been reductions in total crash frequency, number of injuries and severity of injuries.

In the before period analyzed from 2016 through 2020, four pedestrian crashes occurred, while none have been recorded after installation of the bikeway. Seven bicycle crashes occurred during those years; while two crashes have occurred since installation of the bikeway, it is important to note that the severity of crashes is especially encouraging, with a noticeable trend in the reduction of severe injuries. In the before period, there were two very serious incapacitating injuries, ten non-incapacitating injuries, and six possible injuries. After installation of the bikeway, **zero serious and zero non-incapacitating injuries have occurred**, with only 2 possible injuries. In addition, the preliminary data shows a reduction in total injury crashes from 12.5 to 11.0 per month, respectively.

Although no statistically significant determinations can be made at this time, there is an overall positive trend that supports the safety treatments including the bikeway design on Catherine/Miller as effective in reducing the frequency and severity of crashes along the entire corridor. **In addition, there is a positive trend that supports the success of designing for safe speeds to reduce the severity of crashes, as only two crashes resulting in injury in the After Period were both Type C Possible Injury, the least severe in the police reporting scale** At the Catherine Street/5th Avenue intersection, there have been two bike crashes since installation of the bikeway; however, the crash details from the 2022 police report indicates someone had violated the signal control, and the 2023 crash resident statement indicates failing to yield which is not unique to two-way bikeways.

As previously mentioned, due to the unusual configuration of the intersection, a short-term treatment to consider is installation of a Turning Vehicles Yield to Bikes/Peds sign to remind drivers to yield to crossing pedestrians and bicyclists that conflict with the driver's turning movement. As bike crashes are the only type of crash that have occurred during the after period at this intersection, there are no other crash patterns or safety concerns at this time. Progress toward Vision Zero goals will continue to be monitored and tracked for their effectiveness through crash and conflict analysis on all bikeway streets.

3.1.2 Vision Zero Progress – Collective Bikeway Safety Trends

As part of the Ann Arbor Moving Together Toward Vision Zero Comprehensive Transportation Plan (Moving Together), one of the two critical goals is: *No one dies or is seriously injured in crashes on Ann Arbor's streets. By 2025, we have all worked together to eliminate fatalities and serious injuries resulting from traffic crashes.* As the most vulnerable road users include walkers and bicyclists not protected by a vehicle, these road users are more frequently killed or seriously injured in traffic crashes and preventing these types of crashes is a priority and has significant impacts to improving road safety. For instance, although only 4 percent of the total crashes that occurred in Ann Arbor from 2017-2021 involved a person walking or biking, disproportionately 45 percent of those persons were seriously injured or killed. With Vision Zero in mind, In recognizing that human error is an inevitability, the focus in infrastructure design is to provide an environment that makes it easier for people to use it as intended.

Other measures for tracking Vision Zero progress involved analyzing before and after data collectively for all of the recently installed bikeway streets:

- First Street between Madison Street and Kingsley Street
- William Street between First Street and State Street.
- Division Street between Packard Street and Catherine Street.

Evaluating several the safety statistics of several locations together further supports the trend of safety measures moving forward in the right direction. Tables 3-1, 3-2 and 3-3 show the percent change in crashes for a three-year before period (2017-2019) and approximately 1 1/2 -year after period (2022- July 2023). During this time, the following total positive safety goal advances can be seen trending upon installation and opening of the bikeways:

- Overall percent change in crashes resulting in injury have decreased by -44%
- Pedestrian-wide percent change in crashes have decreased by -44%
- Bike-wide percent change in crashes have decreased by -42%
- Fatal and serious injury crashes have been significantly reduced, with 3 of these severe type crashes occurring in the before period reduced to zero during the after period.

Although the after period is still considered somewhat short, these statistics indicate a critical safety statistic as no fatal or serious injuries have been reported in relation to pedestrians or bicyclists since installation of the bikeways. The safety progress and crash data will continue to be monitored as details of incidents are used to inform design tweaks that can be made to existing and future projects.

Table 3-1 Before-and-After Overall Crashes Resulting in Injury Summary for First, William, and Division Streets.

Road Segment	Before				After			% change
	2017	2018	2019	Average	2022	Jan-July 2023	Average	
First Street	5	5	7	5.67	4	3	4.42	-22.0%
William Street	6	2	7	5.00	2	2	2.53	-49.5%
Division Street	7	13	9	9.67	6	1	4.42	-54.3%
Total:	18.00	20.00	23.00	20.33	12.00	6.00	11.37	-44.1%

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Table 3-2 Before-and-After Pedestrian Crash Frequency and Severity Summary for First, William, and Division Streets.

Road Segment	Before (2017 - 2019)			After (2022+Jan-July 2023)			% change
	Number of Ped. Crashes	Ped FAT+INJ A Crashes Total	Ped. Crash Frequency (crashes/year)	Number of Ped. Crashes	Ped FAT+INJ A Crashes Total	Ped. Crash Frequency (crashes/year)	
First Street	7	1	2.33	4	0	2.53	8.3%
William Street	2	0	0.67	0	0	0.00	-100.0%
Division Street	8	0	2.67	1	0	0.63	-76.3%
Total:	17.00	1.00	5.67	5.00	0.00	3.16	-44.3%

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Table 3-3 Before-and-After Bike Crash Frequency and Severity Summary for First, William, and Division Streets.

Road Segment	Before (2017 - 2019)			After (2022+Jan-July 2023)			% change
	Number of Bike Crashes	BIKE FAT+INJ A Crashes Total	Bike Crash Frequency (crashes/year)	Number of Bike Crashes	BIKE FAT+INJ A Crashes Total	Bike Crash Frequency (crashes/year)	
First Street	4	1	1.33	0*	0	0.63	-52.6%
William Street	1	0	0.33	1*	0	0.63	89.5%
Division Street	8	1	2.67	3	0	1.90	-28.9%
Total:	13.00	2.00	4.33	4.00*	0.00	2.53	-41.7%

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***1 Bike crash occurred in the after period on William Street just west of First Street