IndyGo Red Line Post-Operations Traffic Study

Technical Memorandum

Before/After Comparison of Vehicular Traffic Performance Metrics: Crash History and Speeds

Prepared for: IndyGo

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Executive Summary

The purpose of this Technical Memorandum is to summarize the findings of the before/after traffic performance metrics for vehicular traffic along the Meridian Street and College Avenue Red Line corridors. The metrics evaluated in this document focus on a comparison of the crash history and vehicle speeds. Surrounding roadways, denoted as benchmarking segments, were included in the evaluation process to establish a set of baseline conditions for the before/after comparison. A general summary of the crash history and speed comparisons are provided in the following tables. The contents included in the body of the memo provide a more-detailed description of the methodology, including a more in-depth summary of the results comparison.

Corridor	Parameter	Before (2015-2017)	After (2021-2023)	% Reduction
	Total Crashes	520	310	40%
	Fatal/Injury Crashes	73	42	42%
College Ave	Left-Turn Crashes	78	32	59%
	Crash Rate (per million vehicles)	7.29	7.24	1%
Meridian St	Total Crashes	658	422	36%
	Fatal/Injury Crashes	122	91	25%
	Left-Turn Crashes	62	34	45%
	Crash Rate (per million vehicles)	14.27	14.94	-5%
	Total Crashes	1,178	732	38%
Combined	Fatal/Injury Crashes	195	133	32%
	Left-Turn Crashes	140	66	53%

Crash Comparison – Red Line Corridors

Average Speed Comparison – Red Line Corridors

Speed Parameter	Meridian Street		College Avenue		
(MPH)	Before	After	Before	After	
50 th Percentile	15	18	14	16	
85 th Percentile	24	29	21	25	
Posted Speed	35		35		



1.0 Introduction

The purpose of this Technical Memorandum is to summarize the findings of the before/after traffic performance metrics for vehicular traffic along the Meridian Street and College Avenue Red Line corridors. The "before" period reflects the conditions prior to construction of the Red Line, and the "after" period reflects the conditions with the Red Line fully operational and vehicular traffic normalized along Meridian Street and College Avenue. The metrics evaluated in this document focus on crash history and average vehicle speeds. Surrounding roadways, denoted as benchmarking segments, were included in the evaluation process to establish a set of baseline conditions for the before/after comparison.

The analysis focuses on the Meridian Street corridor from 18th Street to 38th Street and the College Avenue corridor from 38th Street to 66th Street. The analysis also includes six (6) benchmarking corridors, consisting of: Michigan Road, 38th Street, 10th Street, Kessler Avenue, Emerson Avenue, and Keystone Avenue. The extents of the benchmarking segments are listed in **Table 1.1**. A graphical representation of the study area is provided in **Figure 1.1**.

Benchmarking Segments	Limits
10 th Street	White River Parkway to Emerson Avenue
38 th Street	Michigan Road to Emerson Avenue
Michigan Road	Westlane Road/71 st Street to 10 th Street
Keystone Avenue	71 st Street to 10 th Street
Kessler Boulevard	Cooper Road to Allisonville Road
Emerson Avenue	56 th Street to 10 th Street

Table 1.1 – Study Segments

Crash data for the study area roadways was obtained for a three-year period before (2015-2017) and after (2021-2023) the construction of the Red Line for the evaluation of the crash history comparison. StreetLight Data was obtained for a before period (2017-2018) and after period (2021-2022) to evaluate the vehicular average speed comparison.



Red Line Corridors:

 $\begin{array}{l} \mbox{Meridian Street} - 18^{th} \mbox{ St to } 38^{th} \mbox{ St} \\ \mbox{College Avenue} - 38^{th} \mbox{ St to } 66^{th} \mbox{ St} \\ \end{array}$

-egend

Benchmarking Corridors:

10th St – White River Pkwy to Emerson Ave 38th St – Michigan Rd to Emerson Ave Michigan Rd – Westlane Rd to 10th St Keystone Ave – 71st St to 10th St Kessler Blvd – Cooper Rd to Allisonville Rd Emerson Ave – 56th St to 10th St



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Red Line Study Segments
 Benchmarking Study Segments

Red Line Technical Memorandum

Figure 1.1 Study Area



2.0 Crash Comparison

Crash data for Marion County was provided by Indy DPW for a three-year period before (2015-2017) and after (2021-2023) the construction of the Red Line to evaluate the crash history. The crash data was filtered based upon coordinate (lat/long) data by using ArcGIS Pro to isolate crashes that only occurred along the roadways included in the study area. The filtering was done by tracing a polygon around the limits of each roadway to remove all crashes that occurred outside of the roadway limits (e.g. crashes occurring within an adjacent parking lot or crashes down a side-street that were independent of the mainline corridor). The data was then parsed for accuracy and uploaded into Power BI, a data-analytics tool capable of sorting large amounts of data with the ability to create visualizations that display datasets in a useful format. The crashes in Power BI were sorted by corridor and by year to assemble a comprehensive set of crashes for the before and after periods along each study corridor. Power BI filters were also used to sort crashes by crash type and severity to obtain a full dataset of crash statistics.

For the purposes of determining crash rates, AADT volumes were obtained from Streetlight Data for the equivalent before and after periods that correlate with the crash data. The AADT volumes were taken from a one-year period before and after the Red Line construction and were considered to be representative of the corresponding three-year period for the crash data. Using this information, the number of crashes, crash type distributions, and crash rates were compiled for each of the corridors in the study area.

2.1 Red Line Corridors

Crash statistics were evaluated for the before and after periods along the two (2) Red Line corridors included in this study: Meridian Street and College Avenue. The crash data comparison indicated an overall 38% reduction in the total crash frequency (the number of crashes over the respective three-year periods) for the Red Line corridors (combined) in the after period as compared to the before period. The total crash frequency comparison for the Red Line corridors (individually) indicated a 36% reduction along Meridian Street, and a 40% reduction along College Avenue.

The crash rates (the number of crashes per X number of vehicles) were also calculated for both analysis periods based upon AADT data. This calculation indicated crash rates on Meridian Street of 14.27 and 14.94 crashes per million vehicle-miles for the before and after periods, respectively. The comparison for College Avenue indicated crash rates of 7.29 and 7.24 crashes per million vehicle-miles for the before and after periods, respectively.

The distribution of crash types was also computed for the before and after periods for both Red Line corridors. Rear end crashes were the most common occurrence, followed by right angle and same-direction sideswipes. The distributions remained somewhat similar between the before and after periods for both corridors. Additionally, the percentage of fatal/injury crashes remained consistent across both periods. Breakdowns of the before/after crash frequency and crash type comparisons are shown in **Table 2.1** and **Table 2.2** on the following page. The distribution of crash types and crash severity is shown in further detail in the exhibits provided in **Appendix A**.



Corridor	Parameter	2015-2017	2021-2023	% Reduction
	Total Crashes	520	310	40%
	Fatal/Injury Crashes	73	42	42%
College Ave	Left-Turn Crashes	78	32	59%
	Crash Rate (per million vehicles)	7.29	7.24	1%
Meridian St	Total Crashes	658	422	36%
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	Crash Rate (per million vehicles)	14.27	14.94	-5%
	Total Crashes	1,178	732	38%
Combined	Fatal/Injury Crashes	195	133	32%
	Left-Turn Crashes	140	66	53%

Table 2.1 – Crash Frequency Comparison (Red Line)

Table 2.2 – Crash Type Comparison (Red Line)

Corridor	Crash Type	2015-2017	2021-2023	% Reduction
	Rear End	173	102	41%
	Angle	102	45	56%
	Left-Turn	78	32	59%
	Sideswipe Same Dir.	69	56	19%
College Ave	Backing	22	12	45%
	Head On	20	7	65%
	Ran Off Road	13	17	-31%
	Other	43	39	9%
	Total Crashes	520	310	40%
	Rear End	233	116	50%
	Angle	141	110	22%
	Left-Turn	62	34	45%
	Sideswipe Same Dir.	93	61	34%
Meridian St	Backing	47	32	32%
	Head On	22	12	45%
	Ran Off Road	7	12	-71%
	Other	53	45	15%
	Total Crashes	658	422	36%





The crash comparison for the Red Line corridors combined shows a reduction in total crash frequency (38%), fatal/injury crash frequency (32%), and left-turn crash frequency (53%). While the crash rates remained relatively consistent, there are several factors other than reduced volumes that likely contributed to a decrease in crashes during the after period for the Red Line. Construction of the Red Line included the implementation of raised center-running medians, left-turn restrictions, and other access management measures such as lane reductions along both Meridian Street and College Avenue that reduced the total number of conflict points at nearly every intersection along each of the corridors.

2.2 Benchmarking Segments

To verify the validity of the data set and observed trends in the crash history, the crash frequency of the benchmarking segments was evaluated for both the before and after periods. The crash frequency comparison of the benchmarking roadways indicated variable trends of either a decrease or increase in the total crash frequency. The combined crash frequency comparison for all benchmarking roadways indicated that the crash frequency decreased from the before period to the after period, by an average of 6% overall. This reduction is notably less than the observed reduction for the Red Line corridors and is indicative that the benchmarking segments experienced a consistent crash history in comparison between the before and after periods. The benchmarking corridor crash frequency comparison is shown in **Table 2.3** on the following page.





Corridor	Parameter	2015-2017	2021-2023	% Reduction
	Total Crashes	1,244	1,189	4%
10th St	Fatal/Injury Crashes	242	199	18%
	Left-Turn Crashes	164	136	17%
	Total Crashes	1,330	1,300	2%
38th St	Fatal/Injury Crashes	330	243	26%
	Left-Turn Crashes	157	133	15%
	Total Crashes	1,221	1,232	-1%
Michigan Rd	Fatal/Injury Crashes	236	269	-14%
	Left-Turn Crashes	140	165	-18%
Keystone Ave	Total Crashes	1,924	1,553	19%
	Fatal/Injury Crashes	352	273	22%
	Left-Turn Crashes	216	157	27%
	Total Crashes	411	498	-21%
Kessler Blvd	Fatal/Injury Crashes	73	103	-41%
	Left-Turn Crashes	59	48	19%
	Total Crashes	759	680	10%
Emerson Ave	Fatal/Injury Crashes	164	184	-12%
	Left-Turn Crashes	115	120	-4%
	Total Crashes	6,889	6,452	6%
Average	Fatal/Injury Crashes	1,397	1,271	9%
	Left-Turn Crashes	851	759	11%

Table 2.3 – Crash Comparison (Benchmarking)



3.0 Speed Comparison

A speed comparison along the study corridors for the before and after periods was evaluated based upon average trip speeds that were obtained from StreetLight Data, using the Zone Analysis function. This speed data represents the average speed of all vehicles along the entire length of a given corridor, which incorporates stops and delay times at controlled intersections (i.e. traffic signals), as well as factoring-in the progression and/or impedance of vehicles along the corridor as other vehicles enter and exit along the way. Spot speed data for the Red Line corridors will be evaluated as part of the full post-operations traffic study to be completed at a later date.

For the purposes of gathering the average trip speeds, the StreetLight Data portal provides data based upon Location Based Services (LBS) and Connected Vehicle Data (CVD). Within the StreetLight Data portal, LBS data is available for the time period between 01/01/2016 - 04/30/2022, and CVD data is available for the time period between 01/01/2022 - 5/31/2023. Due to the date ranges of the data sources, LBS data was used for this study to compare the Red Line before and after data with an equivalent source of data. The following time periods, of which are considered to represent an annualized set of data averages across a 1-year period, were utilized for the average trip speeds obtained from StreetLight Data:

- Before: 05/01/2017 04/30/2018
- After: 05/01/2021 04/30/2022

3.1 Red Line Corridors

A summary of the average trip speeds along the Meridian Street and College Avenue Red Line corridors, for the respective before and after periods, is provided in **Table 3.1**.

Speed Parameter		Meridian Street		College Avenue		
	(MPH)	Before	After	Before	After	
	50 th Percentile	15	18	14	16	
	85 th Percentile	24	29	21	25	
	Posted Speed	35		3	5	

Table 3.1 – Average Trip Speed Comparison (Red Line)

The average trip speed comparison indicates that both the 50th percentile and the 85th percentile speeds increased by approx. 2-5 MPH along the Red Line corridors. In all scenarios, the 85th percentile speeds are well-below the posted speed of 35 MPH. There are many potential contributing factors to the differential in the reported speed values as a result of the implementation of the Red Line. The primary impact of the Red Line on general traffic along both Meridian Street and College Avenue was the reduction in capacity from two (2) travel lanes in each direction to one (1) travel lane in each direction. Traffic volumes along Meridian Street and College Avenue were observed to have decreased between the before and after periods. Additionally, the implementation of access management and left-turn restrictions are considered to be contributing factors resulting in a slight increase to the 50th percentile and 85th percentile speeds. The bullet



points listed below further describe the contributing factors that were anticipated to have an impact on average trip speeds:

- Improved Progression for Traffic Flow / Reduced Congestion
 - The traffic signal timings were optimized upon implementation of the Red Line. While transit operations were prioritized the highest during development of the signal timings, general traffic operations still benefited from the optimized signal timings.
 - With the after condition consisting of one (1) travel lane in each direction, signal progression through the coordinated signal systems is improved. As a result, vehicle speeds become more consistent and maintain an improved reliability across the entire length of the corridors.
 - The increase in vehicle speeds is also indicative of a correlation between reduced congestion.
- Improved Access Management
 - The Red Line eliminated left turns at all minor street intersections and driveways, which significantly reduced the number of conflicts from turning left-turning movements across the corridors.
 - Vehicle progression improved along the corridors due to less slowing/stopping from the eliminated left-turning movements.

3.2 Benchmarking Segments

A summary of the average trip speeds along the benchmarking corridors, for the respective before and after periods, is provided in **Table 3.2**.

Speed Parameter	10 th Street		38 th Street		Michigan Road	
(MPH)	Before	After	Before	After	Before	After
50 th Percentile	14	15	17	22	17	21
85 th Percentile	18	24	25	33	25	30
Posted Speed	30		3	5	4	5

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Speed Parameter	Keystone Avenue		Kessler Boulevard		Emerson Avenue	
(MPH)	Before	After	Before	After	Before	After
50 th Percentile	13	17	16	18	16	21
85 th Percentile	22	26	23	27	25	30
Posted Speed	35		35		4	0



The average trip speed comparison indicates that both the 50th percentile and the 85th percentile speeds increased by a range of 1-8 MPH along the various benchmarking segments. In all scenarios, the 85th percentile speeds are well-below the posted speed. The consistent trend observed for all benchmarking segments is indicative of a potential area-wide occurrence of increased vehicle speeds. A slight reduction in total traffic volume along the benchmarking segments is a potential contributing factor to the increase in speeds, as a lesser volume would likely indicate less congestion along the roadways.

4.0 Findings

The crash comparison for the Red Line corridors shows a combined reduction in total crash frequency (38%), fatal/injury crash frequency (32%), and left-turn crash frequency (53%) between the before period of 2015-2017 and the after period of 2021-2023. The rate of crashes based upon traffic volume remained similar between the before and after periods. Several factors likely contributed to the decrease in crashes along the Red Line corridors between the before and after periods, lane reductions, and other access management measures that significantly reduced the total number of conflict points along each corridor.

The average trip speed comparison along both the Meridian Street and College Avenue Red Line corridors indicates that the 50th percentile and 85th percentile speeds increased slightly between the before period in comparison to the after period. The increase in speeds for general traffic along the Red Line corridors suggests that an improvement to overall traffic flow occurred as a result of the implementation of access management, of which likely contributed to improved progression and reduced congestion.





Appendix A – Crash Data Exhibits







10th Street

(White River Parkway to Downey Avenue)

Total Crashes

Before (2015-2017)

1244

Total Crashes

After (2021-2023)

1189



REAR END
RIGHT ANGLE
SAME DIRECTION SID...
30.16%
LEFT TURN
BACKING CRASH
HEAD ON BETWEEN T...
OTHER - EXPLAIN IN ...
RAN OFF ROAD
LEFT/RIGHT TURN
OPPOSITE DIRECTION...
20.89%

Crash Type

RIGHT TURNNON-COLLISION

After (2021-2023)

- 26.34%

- 21.84%

Before (2015-2017)

2.36% ^{0.5}7% ⁻

1.78% -

3.14%

17.76%

3.31%

4.59%

5.61% -

9.77% -

3.5%

4.8%

6.1%



Crash Severity Cr Before (2015-2017)



Crash Severity

After (2021-2023)





