

# Speed Zone Evaluation

## Butler Avenue

Milton Road to Sawmill Road



CITY OF FLAGSTAFF

TRANSPORTATION ENGINEERING SECTION

FEBRUARY 2024



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## Executive Summary

This engineering study was conducted in response to Council's request during the May 23, 2023 special meeting/work session to investigate if the speed limits on Butler Avenue between Milton Road and Sawmill Road could be lowered. This study will outline the laws and guidelines in Arizona for speed zoning and will determine the appropriate speed limits for this section of roadway with consideration for road characteristics, 85<sup>th</sup> percentile speed, free flow speed, roadside conditions, and crash history. Based on the results it is apparent the current posted speed limits should remain unchanged because they match the operating speed and the design speed of the roadway. The current speed limits promote voluntary compliance and uniform flow.

## Speed Zoning Concepts

An engineering study is required for setting speed limits in Arizona, as defined by [Arizona Revised Statute \(ARS\) 28-703](#):

*"A local authority shall determine by an engineering and traffic investigation the proper maximum speed for all arterial streets in its jurisdiction..."*

Speed zoning concepts are defined in the ADOT Traffic Guidelines and Processes. Please see the excerpt below from [ADOT TGP 221 Speed Zoning Concepts](#) for more information:

*"The majority of operators of motor vehicles drive at a speed that they consider reasonable and prudent for existing conditions and or environment that they are driving in. Posted limits that are set higher or lower than those dictated by roadway and traffic conditions are ignored by the majority of motorists. A speed limit should be set so that the majority of motorists comply with it voluntarily and enforcement can be directed to the minorities that do not adhere to.*

*Speed zoning in Arizona is defined as the process of determining the numerical maximum speed, for a defined roadway segment, on the basis of a traffic engineering investigation or study. Speed zoning is based on the principle of setting the limit as near as practicable to the speed that 85 percent of the drivers consider to be reasonable and prudent, i.e., the 85<sup>th</sup> percentile speed. The 85<sup>th</sup> percentile correlates to the first standard deviation above the mean; statistically the first standard deviation is the average speed of motorists above the mean speed."*

An excerpt from [ADOT TGP 222 Speed Studies](#):

*"To improve safety and efficiency it is desirable for traffic to be going close to a uniform speed as differential in speeds leads to higher crash potential. Once the roadway is constructed, drivers operate at a speed they determine to be reasonable and prudent, based on their perspective of the roadway conditions usually represented by the 85<sup>th</sup> percentile speed of free flow traffic. To encourage uniformity in traffic speeds the 85<sup>th</sup> percentile speed of free flowing traffic is the standard starting point for determining the appropriate speed limit. Several factors may also affect the appropriate speed limit. Analysis of these factors (listed below) in conjunction with the 85<sup>th</sup> percentile speed provides an accurate representation of traffic*

*operating conditions along any given section of highway and provides a scientific basis for the selection of speed limits:*

- A. Pace Speed*
- B. Length of section*
- C. Alignment*
- D. Roadway width and shoulders*
- E. Surface condition*
- F. Sight distance*
- G. Traffic volume*
- H. Crash experience/history*
- I. Maximum comfortable speed on curves*
- J. Side friction (roadside development, parking, bicycle use, and pedestrian activity)*
- K. Signal progression*
- L. Other factors”*

## Roadway and Traffic Characteristics

Butler Avenue between Milton Road and Sawmill Road is a 0.9-mile-long Minor Arterial roadway. The cross section of Butler Avenue is a 5-lane roadway, with two through lanes in each direction, a center median/left turn lane, and bicycle lanes for each direction of travel (curb separated bike lanes from Milton Road to Lone Tree Road and double striped bike lanes between Lone Tree Road and Sawmill Road). Sidewalks, which range between 5' and 6' wide, are present on both the north and south sides of the roadway. The width of the travel lanes range from 10'-6" to 12', while the width of the bicycle lanes range from 5' to 5'-6". The average daily traffic (ADT) is approximately 21,300 vehicles per day (vpd).

The corridor consists of signalized intersections at Milton Road, Beaver Street, San Francisco Street, Lone Tree Road, and Sawmill Road. A pedestrian rapid flashing beacon is located at Humphreys Street. The posted speed limit varies throughout this area, with an existing posted speed limit of 35 mph between Milton Road and Lone Tree Road, and an existing posted speed limit of 40 mph between Lone Tree Road and Sawmill Road. The alignment consists of moderate horizontal curves near the Murdoch Community Center, with very minimal to no vertical curves. All intersections have adequate sight distance.

The geographic context includes both urban and suburban due to the Southside neighborhood on the western half of the corridor and the Sawmill shopping center on the eastern half. Most of the parcels between Milton Road and San Francisco Street are zoned Community Commercial, while between San Francisco Street and Elden Street is zoned High Density Residential. All parcels east of Elden Street and north of Butler Avenue are zoned Light Industrial, while the parcels south of Butler Avenue are zoned Highway Commercial. A zoning map is included in Appendix A: City of Flagstaff Zoning Map.

There are nine blocks between Milton Road and Lone Tree Road and four blocks between Lone Tree Road and Sawmill Road. Table 1: Driveway and Alley Count below shows the number of driveways and alleys in each block along the corridor. All driveways and alleys along the corridor between Milton Road and Sawmill Road are access controlled with either a median or striping, which makes them function as right in/right out only driveways.

Table 1: Driveway and Alley Count

Speed	Roadway	to	Roadway	EB Driveways / Alleys	WB Driveways / Alleys
35 mph	Milton	to	Kendrick	1	0
	Kendrick	to	Humphreys	0	3
	Humphreys	to	Beaver	3	1
	Beaver	to	Leroux	1	1
	Leroux	to	San Francisco	1	2
	San Francisco	to	WC Riles	3	4
	WC Riles	to	O'Leary	0	0
	O'Leary	to	Elden	1	0
	Elden	to	Lone Tree	1	2
<b>Total Number of Driveways</b>				<b>11</b>	<b>13</b>
<b>Average Number of Driveways / Block</b>				<b>2.20</b>	<b>1.44</b>

40 mph	Lone Tree	to	Windsor/Gabel	0	4
	Windsor/Gabel	to	Regent/Lumber	0	2
	Regent/Lumber	to	Cambridge	0	0
	Cambridge	to	Sawmill	0	0
<b>Total Number of Driveways</b>				<b>0</b>	<b>6</b>
<b>Average Number of Driveways / Block</b>				<b>0</b>	<b>1.5</b>

The Butler Avenue corridor is one block north of Northern Arizona University and about four blocks south of Downtown Flagstaff. There is moderate pedestrian and bicycle activity through the corridor. Bicycle counts were collected from approximately 12-hours' worth of video footage in April of 2023 and there were 12 bicycles in the peak hour. All signalized intersections have striped crosswalks and are programmed with a pedestrian phase. At each signalized intersection there are green striped two-stage bicycle turn boxes.

There are six bus stops along the 0.9-mile-long stretch of Butler Avenue. Three in the westbound direction and three in the eastbound direction. There are two stops adjacent to one another just west of the Butler Avenue and San Francisco Street signalized intersection which has a stop frequency of 8 stops per hour in the westbound direction and 7 stops per hour in the eastbound direction. There are two stops adjacent to one another just west of the Butler Avenue and Elden Street stop-controlled intersection which also has a stop frequency of 8 stops per hour in the westbound direction and 7 stops per hour in the eastbound direction. Lastly, there are two stops adjacent to one another west of the Butler Avenue and Sawmill Street signalized intersection which each have a stop frequency of 5 stops per hour.

The posted speed limits of 35 mph/40 mph are appropriate for the context of Butler Avenue based on the urban/suburban land use type and the minor arterial roadway classification from the City of Flagstaff Engineering Design Standards which were used to create the curves and operating conditions that exist today. It has no on-street parking nor store front access. There are a moderate number of driveways and alleyways, but they are access controlled and do not have high volumes of traffic utilizing them.

## Crash Experience

Crashes are considered in speed zone studies to determine if the study area has a higher than average crash rate, or if the portion of speed related crashes is higher than average. Three other arterial roadway segments were analyzed in this study for comparison: West Route 66 between Woodlands Village Boulevard and Milton Road, Fourth Street between Route 66 and Lockett Road, and Milton Road between Plaza Way and Phoenix Avenue. The crashes along these segments were analyzed to determine total crash incidents and speeding related crashes. The results of this analysis can be seen below. It should be noted that Butler Avenue has a high percentage of intersection related crashes due to high cross street volumes and signalized intersection density. Staff have successfully pursued a Safe Streets and Roads for All grant to improve safety at all signalized intersections along the corridor.

Table 2: Crash Data Analysis

Road Section	Speed Limit (mph)	Length (miles)	Signals	ADT (vpd)	Time Range	Speed Related Crashes (%)	Intersection Related Crashes (%)	Crash Rate Per Million Vehicle Trips
<b>W Butler Avenue</b>	35-40	0.9	5	21,300	2018-22	32%	70%	7.3
<b>N Fourth Street</b>	30	0.8	3	17,000	2018-22	25%	58%	4.8
<b>W Route 66</b>	30-40	0.7	3	20,200	2018-22	33%	66%	3.3
<b>S Milton Road</b>	30	0.7	4	34,000	2018-22	44%	53%	7.9
<b>Citywide Data</b>	NA	NA	NA	NA	2018-22	32%	49%	NA

## Operating Speeds

Several pneumatic tube studies have been conducted on Butler Avenue to gather vehicle speed and volume data. Pneumatic tube counters were placed on Butler Avenue at three different locations during October 2023 for a continuous 9-day period in order to gather existing condition data for this study. Tube counters were also placed in April 2022 and October 2021 as part of evaluating how the pilot bike lanes were affecting driving conditions. Tube data is also provided from 2009 before the medians were installed on Butler Avenue. Please see the table below for the results of the studies. These results are also included on a map in Appendix B: Butler Speed Study Existing Conditions.

The results include the 85<sup>th</sup> percentile speed, the 50<sup>th</sup> percentile speed and the pace speed. The ADOT Traffic Guidelines and Processes defines how the 85<sup>th</sup> percentile speed is used to set speed limits:

*“Speed zoning is based on the principle of setting the limit as near as practicable to the speed that 85 percent of the drivers consider to be reasonable and prudent, i.e., the 85<sup>th</sup> percentile speed. The 85<sup>th</sup> percentile correlates to the first standard deviation above the mean; statistically the first standard deviation is the average speed of motorists above the mean speed.”*

The 50<sup>th</sup> percentile speed represents the median, or the speed at which 50% of drivers are traveling at or below. The pace speed represents the 10 mph speed range in which the highest percentage of drivers were traveling.

Table 3: Traffic Study Results

Date	Location	Posted Speed (mph)	85 <sup>th</sup> (mph)	50 <sup>th</sup> (mph)	Pace (mph)
10/2023	Drury Inn	35	34	29	25-34
10/2023	Murdoch Community Center	35	37	32	28-37
9/2009*	East of O’Leary	35	39	35	30-39
10/2021**	Speedway Gas Station	35	35	30	25-34
4/2022***	Speedway Gas Station	35	34	28	26-35
10/2023	Dutch Bros Coffee	40	39	35	31-40

\*Before medians

\*\*Before the separated bicycle lane curbs were installed

\*\*\*After the separated bicycle lane curbs were installed

It should be noted that all 85<sup>th</sup> percentile speeds have a minimum gap time of 5-seconds applied, and the 85<sup>th</sup> percentile speeds at each location were determined by taking the average of the 85<sup>th</sup> percentile speeds of each direction of travel (eastbound and westbound). Gap time is the time difference between the rear of a vehicle and the front of its follower, and applying a minimum gap time of 5 seconds helps identify the free flow speed when vehicles are unincumbered by signal queues or pedestrians crossing.

## Federal Highway Administration USLIMITS2

The Federal Highway Administration (FHWA) USLIMITS2 is an Expert System Approach which utilizes a web-based program designed to help practitioners set reasonable, safe, and consistent speed limits for specific segments of roads. The details of Butler Avenue were inputted into the website to generate a recommended speed limit based on several factors including 85<sup>th</sup> percentile speed and 50<sup>th</sup> percentile speed based on road context, crash history, roadway geometry, and pedestrian and bicyclist activity. Butler Avenue was analyzed in three segments: Milton Road to San Francisco Street, San Francisco Street to Lone Tree Road, and Lone Tree Road to Sawmill Road. The results of the USLIMITS2 analysis are illustrated below. Detailed output sheets are included in Appendix C: FHWA USLIMITS2 Results.

Table 4: USLIMITS2 Results

Road Segment	Posted Speed Limit (mph)	USLIMITS2 Recommendation (mph)
Milton Road to San Francisco Street	35	30
San Francisco Street to Lone Tree Road	35	30
Lone Tree Road to Sawmill Road	40	35

## Discussion and Conclusions

The 85<sup>th</sup> percentile speeds are within 2 mph of the existing posted speed limit at each study location. This demonstrates an accurate relationship between the posted speed limit and the natural free-flow speed of traffic on the roadway. Under current speed limit signage, between 7% and 17% of vehicles violate the speed limit. If the speed limit were reduced by 5 mph on each section of roadway, between

35% and 63% of vehicles would violate the speed limit. It should be noted that changing only the number on the speed limit sign has little to no effect on how people actually drive, so it is safe to assume the percentage of vehicles traveling above the speed limit will remain constant. Artificially lowering the speed limit sign increases the number of vehicles violating the speed limit, and it also leads to more differentials in speeds between vehicles, for a proportion will try to adhere to the new limit, and the majority will travel at the natural speed of the road. Large differentials in speed between traveling vehicles has been found to increase the likelihood of a crash and should be avoided.

Table 5: Vehicles Traveling Over the Speed Limit

Segment of Butler	Current Speed Limit (mph)	Existing Vehicles Violating the Speed Limit (%)	Speed limit reduced by 5 mph (mph)	Potential Vehicles Violating the Speed Limit (%)
Milton to San Francisco	35	7%	30	35%
San Francisco to Lone Tree	35	17%	30	63%
Lone Tree to Sawmill	40	8%	35	41%

The crash analysis shows that the portion of speed related crashes reported on Butler Avenue in the last five years of data matches the portion of speed related crashes City wide in that same time frame at 32%. When compared to Fourth Street and Route 66, 33% of crashes were speeding related on Route 66, which matches City wide data and Butler Avenue data. Fourth street reported less speed related crashes at 25% of all crashes. Milton Road experienced 44% of all crashes being speed related. This suggests that there are not an excessive number of speed-related crashes on Butler Avenue when compared to City wide data and other similar arterial road segments. Butler Avenue did have the highest crash rate per million vehicle trips of the minor arterials, but this is attributed to the additional signals present on that section of roadway, which is reflected in the higher proportion of intersection related crashes seen on Butler Avenue when compared to the other sites and the Citywide. Protected intersections will be included in future grant projects to improve intersection safety.

USLIMITS2 recommended lowering the speed limit by 5 mph along all of Butler Avenue, but staff does not see this as a viable solution because the 85<sup>th</sup> percentile speeds found in the study already align with the existing speed limits. It is desirable to set speed limits as close as possible to the 85th percentile speed to encourage voluntary compliance and avoid enforcement issues, as is outlined in ADOT Traffic Guidelines and Principles. When literature was reviewed to understand the effect of lowering speed limits on vehicle speeds, it was determined that, overall, lowering only the posted speed limit did not meaningfully impact the driving speed of vehicles. It should also be noted that USLIMITS2 states:

*“A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.”*

## Recommendation

The results of the speed study show that the existing posted speed limits closely align with the 85<sup>th</sup> percentile speeds of drivers. The current posted speed limits promote voluntary compliance and do not create an enforcement issue. ADOT Traffic Guidelines and Processes recommends setting the speed limit

as near as practical to the 85<sup>th</sup> percentile speed, which is reflected in the current posted speed limits. The crashes analyzed in the last 5 years of available data do not indicate that there has been an excessive amount of speed related crashes along Butler Avenue. Due to these results and the guidance from ADOT regulations, staff recommend no changes to the existing posted speed limits. A visual representation of this recommendation is included in Appendix D: Butler Speed Study Recommendation.

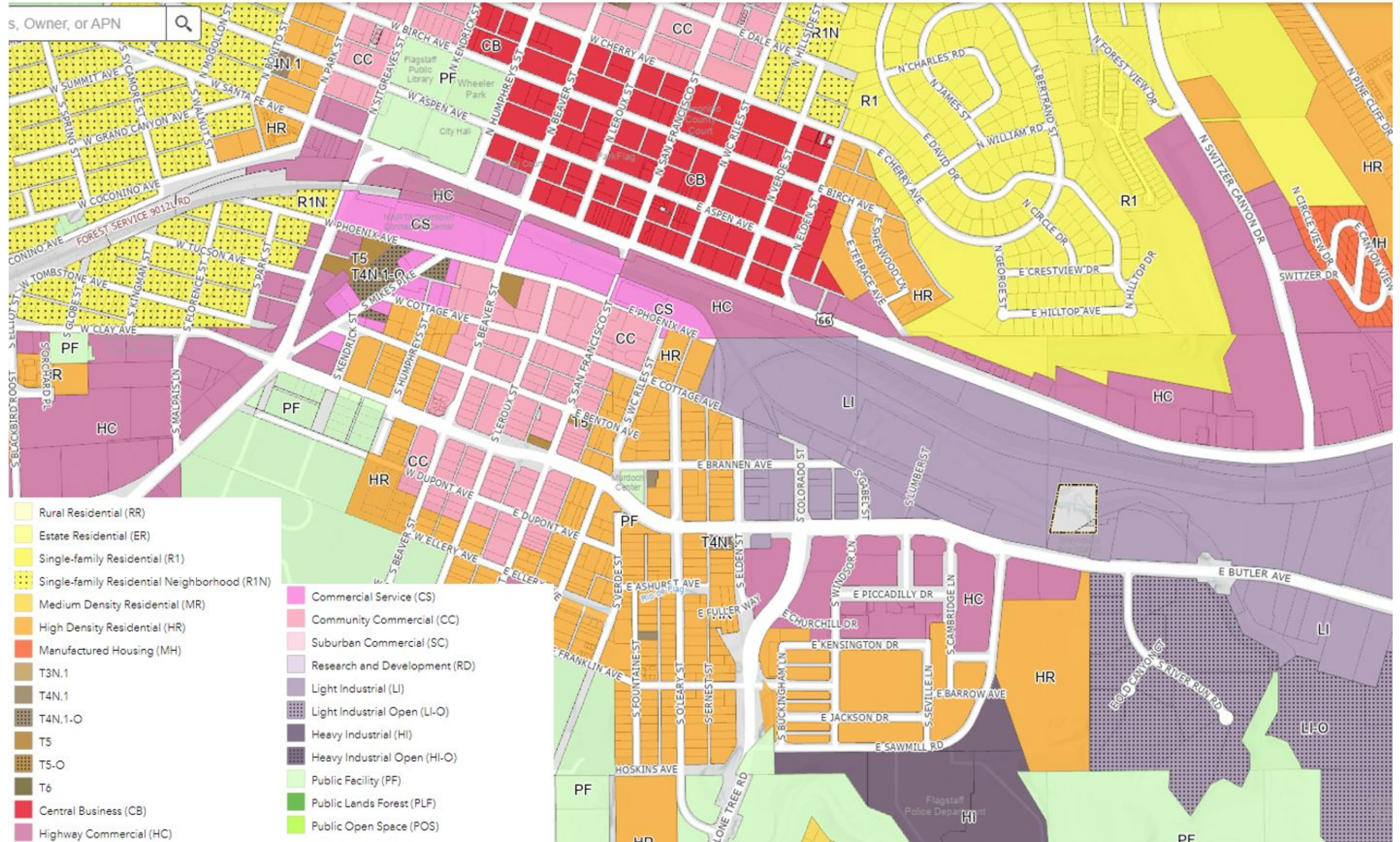
Lowering the speed limit alone has a negligible effect on driver's speeds, drivers continue to drive at the speed they deem to be reasonable and prudent for the conditions present on the segment of roadway. This leads to an enforcement issue because people will continue to travel at the natural speed of the road, and a larger portion will be violating the now lowered speed limit. This also results in safety concerns for there will be a larger differential in speed among drivers between the small proportion that adhere to the lowered speed limit and the majority who travel at the natural speed of the road. Differentials in speed have been found to increase the potential for vehicle crashes and should be avoided. For all these reasons, it is recommended that the speed limits along Butler Avenue between Milton Road and Sawmill Road remain the same.

Butler Avenue from Milton Road to Sawmill Road has recently been studied and is now funded for pedestrian and bicycle upgrades at all of its major intersections – Beaver Street, San Francisco Street, Lone Tree Road and Sawmill Road. These projects are all at different stages of development and also include raised and separated bikeways on both sides of Butler Avenue. These projects will move from concepts to physical construction and eventually opening for public use. Staff will continue to monitor prevailing speeds along with crash records along Butler Avenue to determine if adjustments to existing posted speed limits should be implemented as roadway conditions and the resulting operating speeds adjust to the new roadway design.

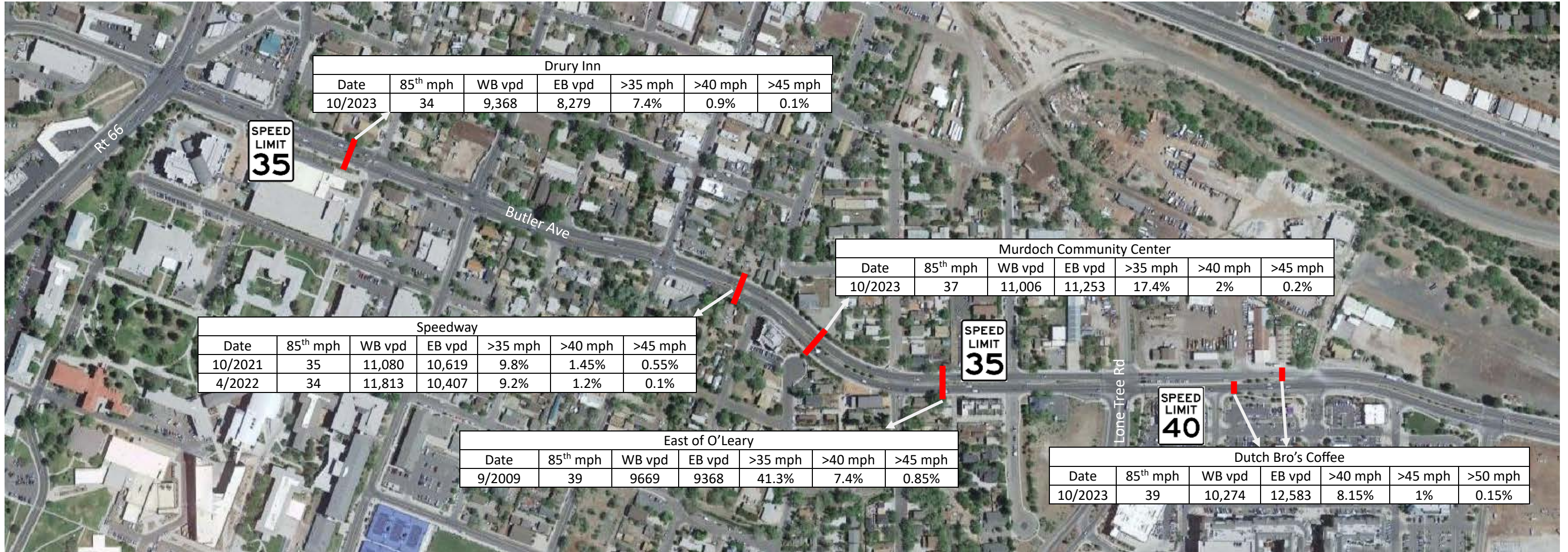
## References

- 1) ADOT Traffic Guidelines and Processes, Subsection 220, *Speed Zoning*. Website. Issued March 2021. [TGP0220 2021-03 TSMO Speed Zoning \(azdot.gov\)](#)
- 2) ADOT Traffic and Guidelines and Processes, Subsection 221, *Speed Zoning Concepts*. Website. Issued March 2021. [TGP0221: 2021-03 TSMO Speed Zoning Concepts \(azdot.gov\)](#)
- 3) ADOT Traffic Guidelines and Processes, Subsection 222, *Speed Studies*. Website. Issued March 2021. [TGP0222-2021-03 TSMO Speed Studies \(azdot.gov\)](#)
- 4) Arizona Revised Statute 28-703. *Alteration of speed limits by local authority*. [28-703 - Alteration of speed limits by local authority \(azleg.gov\)](#)
- 5) FHWA *Manual on Uniform Traffic Control Devices*. 2009. <https://mutcd.fhwa.dot.gov/>
- 6) Insurance Institute for Highway Safety (IIHS). *Lowering the speed limit from 30 to 25 mph in Boston: effects on vehicle speeds*. Website. Issued August 2018. [iihs-dropspeed.pdf \(thenewspaper.com\)](#)

Appendix A: City of Flagstaff Zoning Map



Appendix B: Butler Speed Study Existing Conditions



NOTES:

- 1) All 85<sup>th</sup> percentile speeds have a minimum gap time of 5 seconds applied.
- 2) The 85<sup>th</sup> percentile speeds were determined by taking the average of the 85<sup>th</sup> percentile speeds of each direction of travel.
- 3) Volumes are the average of available Tuesday, Wednesday, and Thursday counts.

# USLIMITS2 Speed Zoning Report

## Project Overview

**Project Name: Butler - Southside West**

**Analyst:** Martin Ince

**Date:** 2023-10-30

### Basic Project Information

Project Number: B001  
 Route Name: Butler Ave  
 From: Milton  
 To: San Francisco  
 State: Arizona  
 County: Coconino County  
 City: Flagstaff city  
 Route Type: Road Section in Developed Area  
 Route Status: Existing

### Crash Data Information

Crash Data Years: 5.00  
 Crash AADT: 22000 veh/day  
 Total Number of Crashes: 124  
 Total Number of Injury Crashes: 3  
 Section Crash Rate: 908 per 100 MVM  
 Section Injury Crash Rate: 22 per 100 MVM  
 Crash Rate Average for Similar Roads: 231  
 Injury Rate Average for Similar Roads: 77

### Roadway Information

Section Length: 0.34 mile(s)  
 Statutory Speed Limit: 35 mph  
 Existing Speed Limit: 35 mph  
 Adverse Alignment: No  
 One-Way Street: No  
 Divided/Undivided: Divided  
 Number of Through Lanes: 4  
 Area Type: Residential-Collector/Arterial  
 Number of Driveways: 18  
 Number of Signals: 3

### Traffic Information

85th Percentile Speed: 34 mph  
 50th Percentile Speed: 29 mph  
 AADT: 22000 veh/day  
 On Street Parking and Usage: Not High  
 Pedestrian / Bicyclist Activity: High

**Project Description:** Speed limit study for Butler Ave from Milton to San Francisco through Southside

**Recommended Speed Limit:**



**Note:** The section crash rate of 908 per 100 MVM is above the critical rate (303). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

**Disclaimer:** The U.S. Government assumes no liability for the use of the information contained in this report. This report does not constitute a standard, specification, or regulation.

## Equations Used in the Crash Data Calculations

*Exposure (M)*

$$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$$

$$M = (22000 * 365 * 0.34 * 5.00) / (100000000)$$

$$M = 0.1365$$

*Crash Rate (Rc)*

$$Rc = (\text{Section Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Rc = (24.80 * 100000000) / (22000 * 365 * 0.34)$$

$$Rc = 908.36 \text{ crashes per 100 MVM}$$

*Injury Rate (Ri)*

$$Ri = (\text{Section Injury Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Ri = (0.60 * 100000000) / (22000 * 365 * 0.34)$$

$$Ri = 21.98 \text{ injuries per 100 MVM}$$

# USLIMITS2 Speed Zoning Report

## Project Overview

**Project Name: Butler - Southside East**

**Analyst:** Martin Ince

**Date:** 2023-10-30

### Basic Project Information

Project Number: B002  
Route Name: Butler Ave  
From: San Francisco  
To: Lone Tree  
State: Arizona  
County: Coconino County  
City: Flagstaff city  
Route Type: Road Section in Developed Area  
Route Status: Existing

### Crash Data Information

Crash Data Years: 5.00  
Crash AADT: 22000 veh/day  
Total Number of Crashes: 75  
Total Number of Injury Crashes: 4  
Section Crash Rate: 492 per 100 MVM  
Section Injury Crash Rate: 26 per 100 MVM  
Crash Rate Average for Similar Roads: 231  
Injury Rate Average for Similar Roads: 77

### Roadway Information

Section Length: 0.38 mile(s)  
Statutory Speed Limit: 35 mph  
Existing Speed Limit: 35 mph  
Adverse Alignment: No  
One-Way Street: No  
Divided/Undivided: Divided  
Number of Through Lanes: 4  
Area Type: Residential-Collector/Arterial  
Number of Driveways: 15  
Number of Signals: 2

### Traffic Information

85th Percentile Speed: 37 mph  
50th Percentile Speed: 32 mph  
AADT: 22000 veh/day  
On Street Parking and Usage: Not High  
Pedestrian / Bicyclist Activity: High

**Project Description:** Speed limit study for Butler Ave from San Francisco to Lone Tree through the Southside

**Recommended Speed Limit:**



**Note:** The section crash rate of 492 per 100 MVM is above the critical rate (299). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

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## Equations Used in the Crash Data Calculations

*Exposure (M)*

$$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$$
$$M = (22000 * 365 * 0.38 * 5.00) / (100000000)$$
$$M = 0.1526$$

*Crash Rate (Rc)*

$$Rc = (\text{Section Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$
$$Rc = (15.00 * 100000000) / (22000 * 365 * 0.38)$$
$$Rc = 491.58 \text{ crashes per 100 MVM}$$

*Injury Rate (Ri)*

$$Ri = (\text{Section Injury Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$
$$Ri = (0.80 * 100000000) / (22000 * 365 * 0.38)$$
$$Ri = 26.22 \text{ injuries per 100 MVM}$$

# USLIMITS2 Speed Zoning Report

## Project Overview

**Project Name: Butler - Sawmill**

**Analyst:** Martin Ince

**Date:** 2023-10-30

### Basic Project Information

Project Number: B003  
Route Name: Butler Ave  
From: Lone Tree  
To: Sawmill  
State: Arizona  
County: Coconino County  
City: Flagstaff city  
Route Type: Road Section in Developed Area  
Route Status: Existing

### Crash Data Information

Crash Data Years: 5.00  
Crash AADT: 23000 veh/day  
Total Number of Crashes: 42  
Total Number of Injury Crashes: 3  
Section Crash Rate: 435 per 100 MVM  
Section Injury Crash Rate: 31 per 100 MVM  
Crash Rate Average for Similar Roads: 231  
Injury Rate Average for Similar Roads: 77

### Roadway Information

Section Length: 0.23 mile(s)  
Statutory Speed Limit: 40 mph  
Existing Speed Limit: 40 mph  
Adverse Alignment: No  
One-Way Street: No  
Divided/Undivided: Divided  
Number of Through Lanes: 4  
Area Type: Commercial  
Number of Driveways: 11  
Number of Signals: 2

### Traffic Information

85th Percentile Speed: 39 mph  
50th Percentile Speed: 35 mph  
AADT: 23000 veh/day  
On Street Parking and Usage: Not High  
Pedestrian / Bicyclist Activity: High

**Project Description:** Speed limit study for Butler Ave from Lone Tree to Sawmill through Sawmill district

**Recommended Speed Limit:**



**Note:** The section crash rate of 435 per 100 MVM is above the critical rate (317). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

**Note:** A speed zone of 0.23 miles is generally too short for the recommended speed limit. Consider lengthening the speed zone (if that is possible) or using the speed limits from adjacent sections (if they are appropriate for this section). If the speed and other data you provided are representative of conditions for this short section, then the speed limit noted above may be considered.

**Note:** The road section is in an area with high pedestrian or bicycle activity. Consider implementing engineering measures to reduce speeds before lowering the recommended speed limit. See [Engineering Countermeasures for Speed Management](#) and [PedSafe](#) for more guidance.

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## Equations Used in the Crash Data Calculations

*Exposure (M)*

$$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$$
$$M = (23000 * 365 * 0.23 * 5.00) / (100000000)$$
$$M = 0.0965$$

*Crash Rate (Rc)*

Appendix D: Butler Speed Study Recommendation



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