

Traffic Investigation Report



Department of Transportation
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Level 2 Final
Study: EN-2739-24
Location: US-36 and US-183 E Junction in Phillipsburg, Phillips County, Kansas
Date: 1/22/2024

City: Phillipsburg
County: Phillips
District/Area: 3 / 1
Study Type: Speed Limit
Engineer: Pat Byrd, PE, PTOE, *PB*
Embedded Traffic Engineer

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Carla P. Anderson, P.E., State Highway Safety Engineer



- Investigation Report Structure**
- **Part 1:** Document concerns/issues, background, initial observations for the study location, and crash history.
 - **Part 2:** Determine the appropriate speed limit(s) for a rural highway or city connecting link.
 - **Part 3:** Recommendations

Part 1 Concerns/Issues, Background, Initial Observations, and Crash History

- Concerns/Issues**
- Locals are concerned about the safety and traffic flow at the intersection of US-36 and US-183. A new Casey's was placed on the Southwest side of the intersection, and there is a current expansion on the north leg (E 100 Rd) at the Amber Wave grain processing facility.

- District/Area Input**
City Input
- No additional input at this time.

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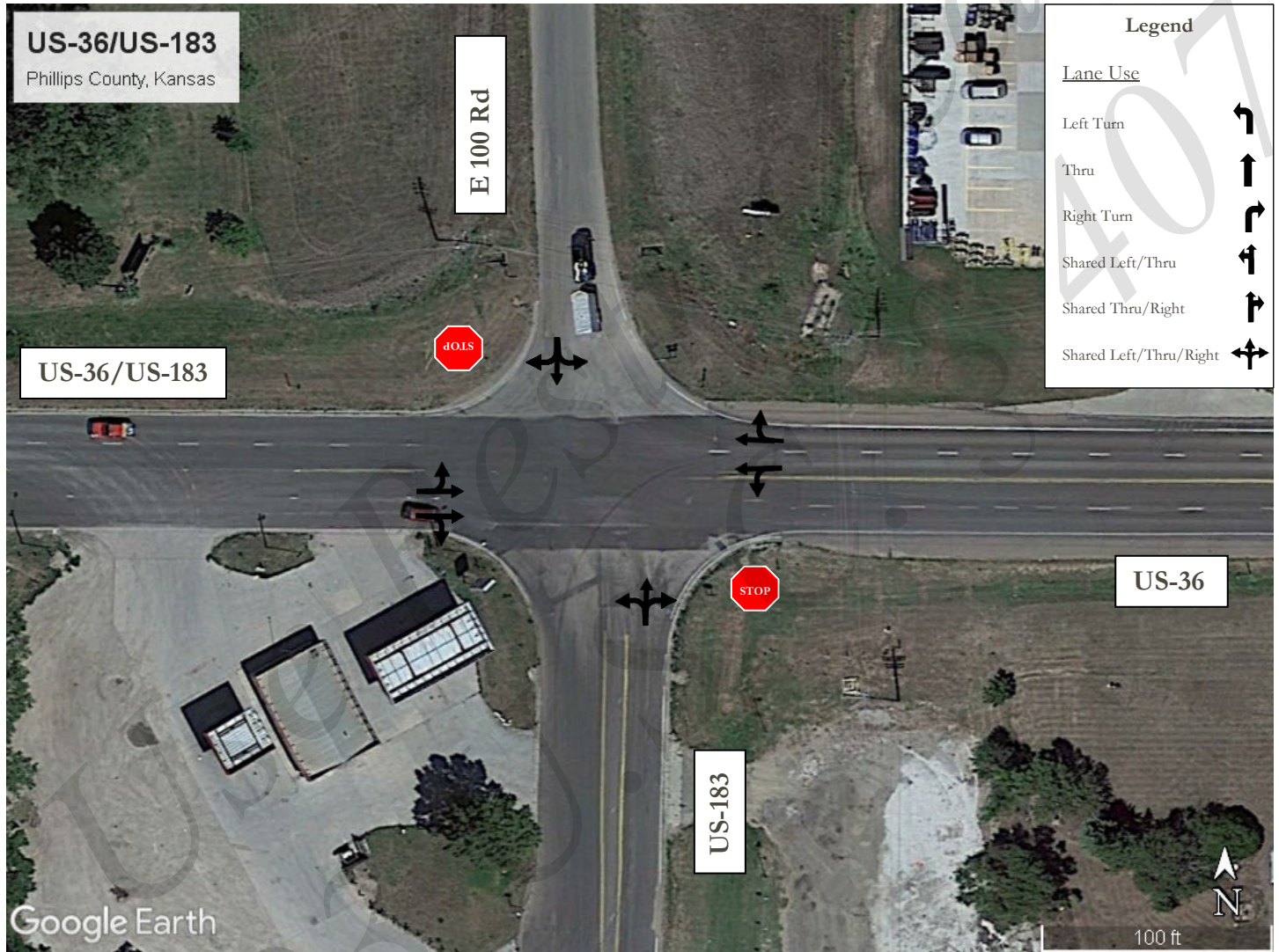
Level 2 Final

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Date: 1/22/2024

Study Location (source: Google Earth, Imagery Date: 8/21/2022)



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Date: 1/22/2024

Background

*ADT = Average Daily
Travel in vehicles per day*

*Speed limit in miles per
hour*

*AADT Source: KanPlan
2021*

US-36 ADT: Speed Limit:

Traffic Control: None

KDOT Route Classification: Class B: The most important corridors of statewide and interstate travel.

Functional Classification: Principal Arterial - Other

US-183 ADT: Speed Limit:

Traffic Control: Stop Sign

KDOT Route Classification: Class B: The most important corridors of statewide and interstate travel.

North Leg: Functional Classification: Local

South Leg: Functional Classification: Principal Arterial - Other

Observations

*From Google Earth
Previous RSA*

- Stop sign control is on the intersection's northbound and southbound approaches.
- There is a 48" X 48" Stop sign on the northbound approach and a 36" X 36" Stop sign on the southbound approach.
- There is a 48" X 48" W3-1 "Stop Ahead" warning sign present on the northbound approach and a 36" X 36" W3-1 "Stop Ahead" warning sign present on the southbound approach.
- The east and west leg is a four-lane, undivided principal arterial roadway. The north and south leg is a two-lane undivided roadway. There is a painted median located on the south leg of the intersection.
- Some sight-distance obstructions appear to be present for the northbound approach. Those obstructions include the light pole and signs west of the intersection. Potential sight obstruction is also present on the southbound approach from the trailblazer signs on the east side of the intersection.
- Stop lines are not present on the northbound and southbound approaches.
- There is poor alignment on the north and south legs of the intersection.

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Date: 1/22/2024

Guidance

Critical Crash Rate

- The critical crash rate provides a statistical threshold. It is calculated by weighing the statewide average crash rate for a similar intersection or road section by the existing traffic volumes of the study location.
- If the intersection or segment crash rate for the study location is greater than the critical crash rate, it is an indicator that there may be a safety concern.
- If the study location's crash rate is at or less than the critical crash rate, it implies that the rate does not deviate significantly from the statewide average rate.

Crash History

2018-2022

Crash rates are noted in crashes per million entering vehicles (mev) for intersections and per million vehicle-miles (mvm) for segments.

CR = location's crash rate

CCR = critical crash rate

- All crashes resulting in fatality, injury, or property damage in an amount greater than or equal to \$1,000 are included in the crash analysis.
- Number of Crashes: Total Fatal Injury PDO
- Crash Rates: Study Location State Average Critical



Relationship of Crash Rate (CR) to Critical Crash Rate (CCR)

- Crash Pattern(s):
 - Note: A collision diagram for the US-36 and US-183 intersection is attached.
 - There were six reported crashes at the intersection, with five of these crashes due to one vehicle failing to yield the right of way. Of those five crashes, three attempted to turn left, with two attempting to turn from the minor street and the other from the major street.
 - Two of these crashes involved a left-turning vehicle failing to yield the right of way and were also injury crashes.

Conclusion(s)

- The crash rate for the study location is above the statewide average crash rate but below the intersection's critical crash rate.
- Three of four crashes on the minor street involved a vehicle failing to yield the right of way and/or running the stop sign.

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Part 2

Speed Limit Analysis

Definitions

85th Percentile Speed

- The **85th percentile speed** is defined as the speed at or below which 85 percent of the observed free-flowing vehicles travel.

Pace Speeds

- The **pace** is defined as the 10-mph range containing the highest number of vehicles in the study sample data.

Speed Limit

- The **speed limit** is the maximum speed a driver is legally permitted for a given roadway segment.

Statutory Speed Limits

- Kansas **statutes establish maximum speed limits** of 30 mph in any urban district, 75 mph on any separated, multilane highway designated by the Secretary of Transportation, 55 mph on any county or township highway, and 65 mph on other highways.

Speed Zone

- A **speed zone** is a section of roadway with a posted speed limit different than the statutory speed limit and is determined based on an engineering study.

Guidance

MUTCD Section

2B.13

Speed Limits

- Speed limits (other than statutory speed limits) shall only be established based on an engineering study.
- The engineering study shall include an analysis of the current speed distribution of free-flowing vehicles.
- The speed limits displayed shall be in multiples of 5 mph. Speed limit signs shall be posted at the points of change from one speed limit to another.
- When a speed limit is posted, it should be within five mph of the 85th percentile speed of free-flowing traffic.

Research Findings

Referenced in
NCHRP 17-76

*Impact of Speed Limit
Change on Speeds*

*Driver's Role in Setting
Speed Limits*

- While the research findings indicate a change in the numerical value of a speed limit sign can affect the observed mean and 85th percentile speeds, it is not as influential as the magnitude of the speed limit value change.
- One of the most extensive studies examined data from 22 states with speed limit changes. Lowering the limit by up to 20 mph or increasing the limit by up to 15 mph resulted in changing speeds of less than 1.5 mph on average.
- The driver plays a key role in the speed limit setting process. During free-flow conditions, drivers select speeds that they believe optimize the tradeoffs between travel time and risk.
- Drivers are good at assessing these tradeoffs, and their judgment is trustworthy in establishing a limit where drivers who exceed that speed may be cited by law enforcement.

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-
- Basing the speed limit on the 85th percentile indicates a speed that most drivers believe is reasonable and prudent.

Guidance

Current KDOT

Practice

- Speed limits are normally set based upon the 85th percentile speed of the free-flowing vehicles using the roadway. The upper end of the pace should also be considered.
 - The 85th percentile speed is rounded to the nearest 5 mph increment when setting speed limits.
 - Studies have shown that the observed 85th percentile speed generally reflects the collective judgment of most drivers as to a reasonable speed for given traffic and roadway conditions.
 - The 85th percentile speed is believed to represent a speed that minimizes crashes.
 - Speed limit transition zones, when used, should be a minimum of 0.25 miles in length.
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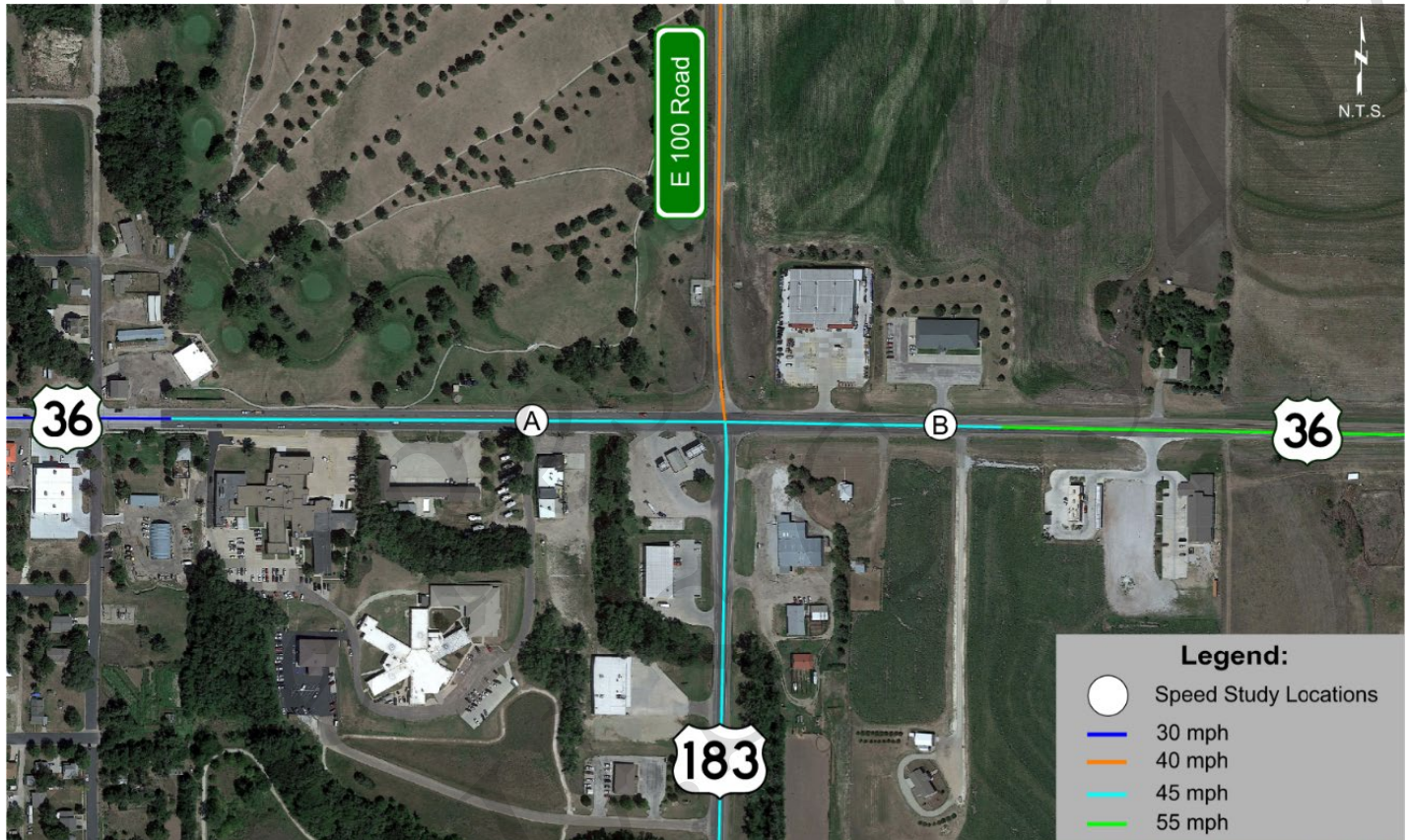
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Existing Speed Limits

The existing speed limits are shown in the aerial image below.



Analysis

- The table on the next page summarizes the results of the spot speed study for US-36 in Phillipsburg.

Data Collection

Completed:

09-12-2023

Detailed speed data sheets are attached to the report.

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Location	Direction	Pace (mph)	Median of Pace	50 th Percentile Speed (mph)	85 th Percentile Speed (mph)	Existing Speed Limit (mph)
A (US-36, 0.1 Miles West of US-183 Junction)	EB	31-40	35	35.0	40.9	45
	WB	28-37	32	31.7	35.2	45
	Combined	28-37	32	33.7	38.7	45
B (US-36, 0.1 Miles East of US-183 Junction)	EB	34-43	38	36.0	42.9	45
	WB	34-43	40	37.3	42.7	45
	Combined	34-43	39	36.2	42.8	45

Conclusion(s)

- The observed 85th percentile speeds at US-36, 0.1 Miles West of US-183 Junction going westbound, is at least 5 MPH below the posted speed limit (45 MPH).
- It is also observed that the 85th percentile speeds at US-36, 0.1 Miles East of US-183 Junction falls within 5 MPH of the existing speed limit.
- If the speed limit were reduced to 40 MPH, observed 85th percentile speeds would still fall within 5 MPH for locations A and B.

Part 3

Recommendations

Recommendation(s)

- The following items are recommended to be installed at this intersection:
 - The southbound stop sign should be upgraded from the existing 36" X 36" to the enlarged 48" X 48."
 - Add a "Stop Ahead" warning sign (W3-1) on the left side of the northbound approach.
 - Reflective tape should be added to the northbound and southbound stop signs and the "Stop Ahead" warning signs (W3-1).
 - Pavement markings should be adjusted to include northbound and southbound stop lines.
 - There is currently only one street light pole located at Casey's. Consider reviewing lighting levels to determine the need for additional streetlights at the intersection.
- If the city wishes, the existing 45 MPH speed zone could be changed to 40 MPH. Both speed limit (R2-1) and speed reduction (W3-5) signs would need to be replaced, indicating the speed limit change. Placement of speed

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reduction signs should be located per the current KDOT Highway Sign Manual.

- Consideration should be given to relocating the existing street light pole south of the southwest curb return. Trailblazer signs should also be relocated to the west to improve intersection sight distance for northbound right and left-turn movements.
 - KDOT should review access management options for Casey's, located on the southeast corner of the intersection, to eliminate redundant access points (preferably the driveways closest to the study intersection) to improve intersection sight distance and intersection operations.
 - Per KDOT policy, rumble strips are not recommended for roads within the city limit. If safety issues continue on the southbound approach after implementing the recommendations above, the county could consider adding rumble strips on the southbound approach.
 - Based on current ADT, a road diet could be considered for US-36, reducing exposure for left-turning vehicles from US-183 and E 100 Rd. When a reconstruction project occurs on US-36, a road diet feasibility study should be conducted. In the interim, a road diet could be implemented from 10th Street to where US-36 currently transitions to a two-lane section outside of the city limits. (See attached Phillipsburg Concept Design.)
 - Place on the list for follow-up field review.
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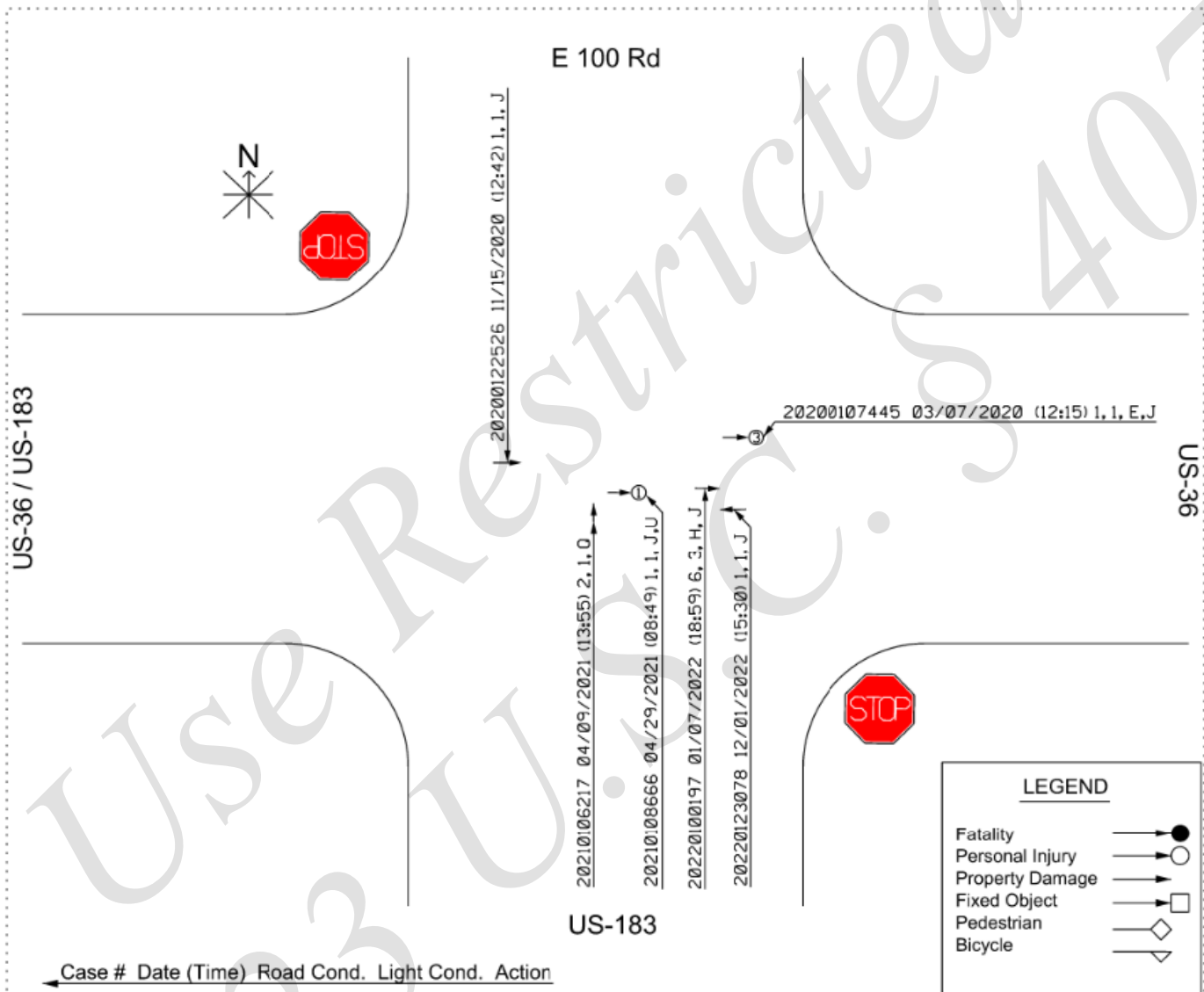
Attachments: Collision Diagram, 4-Hour Turning Counts, Peak-Hour Turning Counts Diagram, Speed Data, Phillipsburg Concept Design

Traffic Investigation Report – Collision Diagram

Location: US-36 and US-183 E Junction in Phillipsburg, Phillips County, Kansas

Study Period: 2018 – 2022

	Total	Fatal	Injury	PDO	Crash Rate	Critical Crash Rate
Number of Crashes	6	0	2	4	0.64	0.69
# Fatalities/Injuries	4	0	4		ADT	Average
<i>PDO = Property Damage Only</i>					5,155	0.33
<i>Rates are given in the number of crashes per million entering vehicles (mev)</i>						



CONTRIBUTING FACTORS

ROAD SURFACE COND.	LIGHT COND.
1. Dry	1. Daylight
2. Wet	2. Dawn/Dusk
3. Water Const.	3. Dark, LTG.
4. Snow/Ice	4. Dark, NO LTG.
5. Slippery	5. Unknown
6. Slush	
7. Unknown	

DRIVER ACTION

A. Illegal or Unsafe Speed	J. Fail to Yield R/W	R. Alcohol Related
B. Impeding Traffic	K. Drove Left of Center	S. Unknown Reason
C. Following Too Close	L. No or Improper Signal	T. Hit & Run
D. Improper Overtaking	M. Careless- Inattention	U. Vision Obstructed
E. Improper Turn	N. Avoid Vehicle, Object, Ped.	by Other Vehicles
F. Improper Start, Stop, Park	O. Improper Lane Change	and/or Sun
G. Traf. Control Viol'n. Lights	P. Ill or Med. Condit.	V. Broken Trailer Axle
H. Traf. Control Viol'n. Signs	Q. Brakes Failed	

Traffic Investigation Report – Four-Hour Turning Counts
 Location: US-36 and US-183 E Junction in Phillipsburg, Phillips County, Kansas



File Name: \\jeo.local\share\Projects\Engineering\221734.01 - KDOT FY2024 Traffic Engineering Section E\6 Traffic
 Start Date: 9/12/2023
 Start Time: 6:30:00 AM
 Site Code: 00000000
 Comment 1: City: Phillipsburg
 Comment 2: County: Phillips
 Comment 3: Location: US-36 @ US-183 E Junction
 Comment 4: Counted By: JC

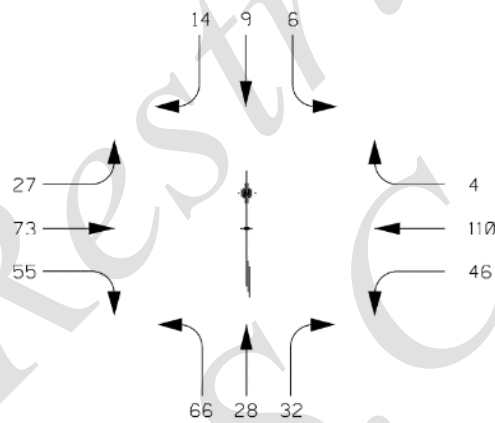
Start Time	E 100 Rd From North			US-36 From East			US-183 From South			US-36/US-183 From West		
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
6:30:00 AM	0	2	0	6	13	6	4	20	15	4	7	35
6:45:00 AM	1	1	0	13	16	2	2	14	9	8	6	60
7:00:00 AM	5	4	0	1	10	10	6	2	11	13	11	6
7:15:00 AM	4	2	1	1	26	9	4	5	16	9	22	2
7:30:00 AM	2	2	0	0	31	19	9	2	9	15	14	7
7:45:00 AM	3	3	1	1	35	11	16	13	28	16	18	13
8:00:00 AM	5	2	4	2	18	7	3	8	13	15	19	5
8:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
12:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
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1:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
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4:15:00 PM	3	3	3	0	28	4	10	0	21	26	23	1
4:30:00 PM	3	4	2	1	25	9	14	2	26	22	26	3
4:45:00 PM	4	1	1	1	24	10	12	2	21	23	35	0
5:00:00 PM	24	17	0	1	24	10	7	3	20	18	34	2
5:15:00 PM	2	5	3	0	32	8	12	4	16	19	29	1
5:30:00 PM	41	20	10	0	28	7	8	2	24	23	34	1
5:45:00 PM	8	9	2	0	28	8	7	3	13	21	21	4

FIELD DATA

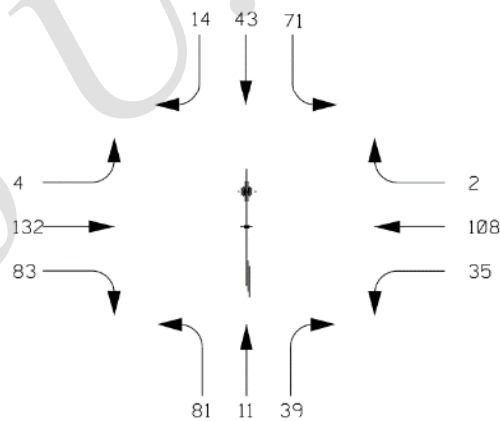
US-36 @ US-183 E Junction
 PHILLIPS COUNTY
 9/12/2023

PEAK HOUR TURNING MOVEMENT

7:15 - 8:15 AM



4:45 - 5:45 PM



Traffic Investigation Report – Speed Data

Location: US-36, 0.1 Miles West of US-183 in Phillipsburg, Phillips County, Kansas



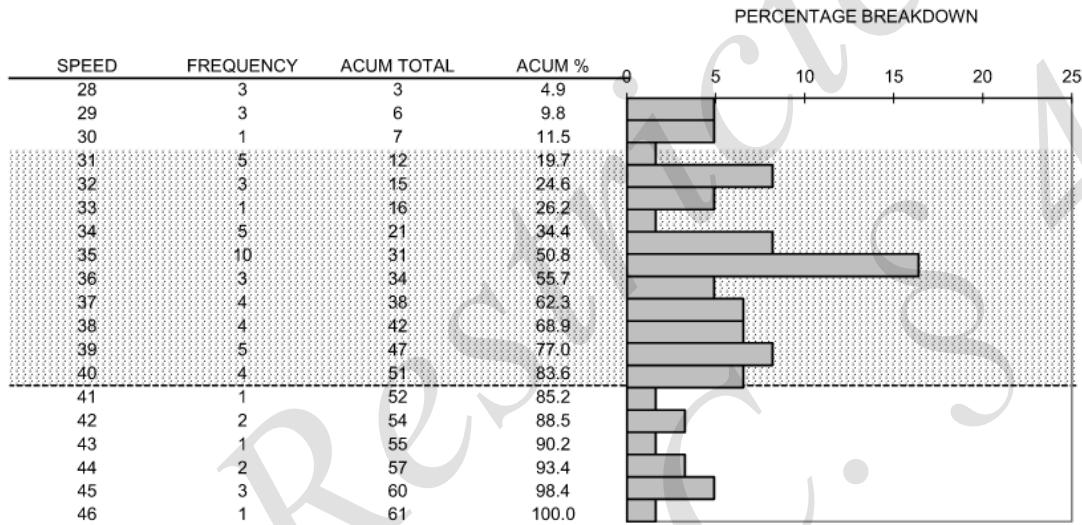
SPEED STUDY

KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: JC
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: EASTBOUND ONLY

LOCATION: US-36, 0.1 Miles West of US-183
TIME START: 11:43 AM
TIME END: 11:58 AM



AVERAGE SPEED = 36.1
50th PERCENTILE = 35
85th PERCENTILE = 40.9
90th PERCENTILE = 42.9
95th PERCENTILE = 44.3

PACE = 31 - 40
VEHICLES IN PACE = 44
% IN PACE = 72.1
% BELOW PACE = 11.5
% ABOVE PACE = 16.4

SAMPLE VARIANCE = 22.1945355
STANDARD DEVIATION = 4.7111077
RANGE 1*S = 72.13114
RANGE 2*S = 98.36066
RANGE 3*S = 100.

Traffic Investigation Report – Speed Data

Location: US-36, 0.1 Miles West of US-183 in Phillipsburg, Phillips County, Kansas



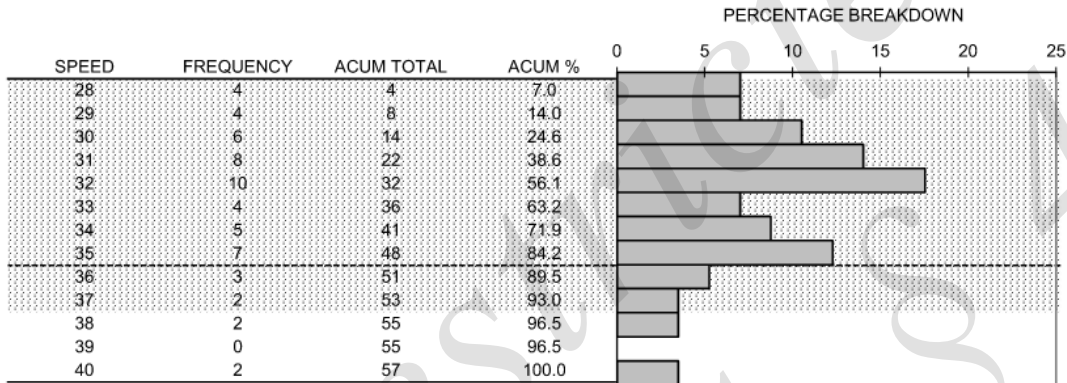
SPEED STUDY

KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: JC
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: WESTBOUND ONLY

LOCATION: US-36, 0.1 Miles West of US-183
TIME START: 11:43 AM
TIME END: 11:58 AM



AVERAGE SPEED = 32.6
50th PERCENTILE = 31.7
85th PERCENTILE = 35.2
90th PERCENTILE = 36.2
95th PERCENTILE = 37.6

PACE = 28 - 37
VEHICLES IN PACE = 53
% IN PACE = 93.
% BELOW PACE = .
% ABOVE PACE = 7.

SAMPLE VARIANCE = 8.8032581
STANDARD DEVIATION = 2.9670285
RANGE 1*S = 70.17544
RANGE 2*S = 96.49123
RANGE 3*S = 100.

Traffic Investigation Report – Speed Data

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SPEED STUDY

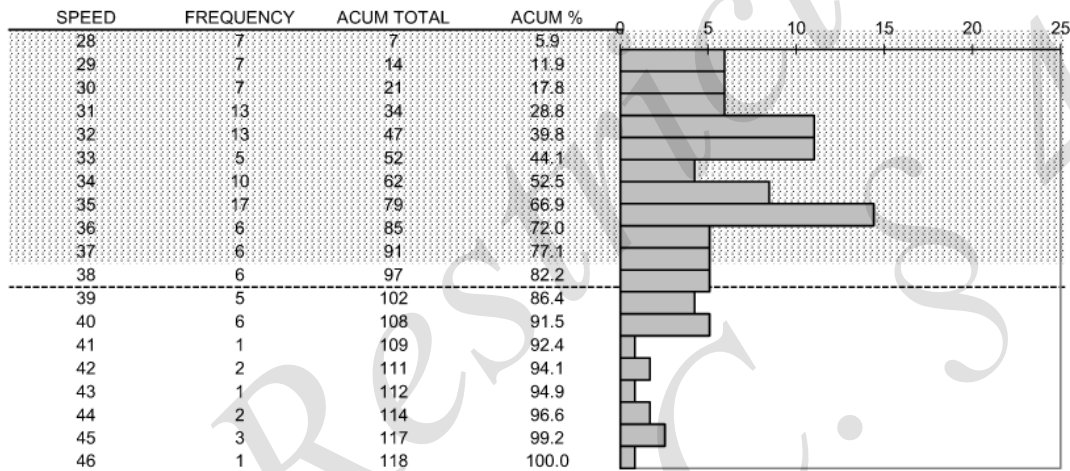
KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: JC
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: Combined WB & EB

LOCATION: US-36, 0.1 Miles West of US-183
TIME START: 11:43 AM
TIME END: 11:58 AM

PERCENTAGE BREAKDOWN



AVERAGE SPEED = 34.5
50th PERCENTILE = 33.7
85th PERCENTILE = 38.7
90th PERCENTILE = 39.7
95th PERCENTILE = 43.1

PACE = 28 - 37
VEHICLES IN PACE = 91
% IN PACE = 77.1
% BELOW PACE = .
% ABOVE PACE = 22.9

SAMPLE VARIANCE = 18.6776764
STANDARD DEVIATION = 4.3217677
RANGE 1*S = 70.33898
RANGE 2*S = 94.91525
RANGE 3*S = 100.

Traffic Investigation Report – Speed Data

Location: US-36, 0.1 Miles East of US-183 in Phillipsburg, Phillips County, Kansas



SPEED STUDY

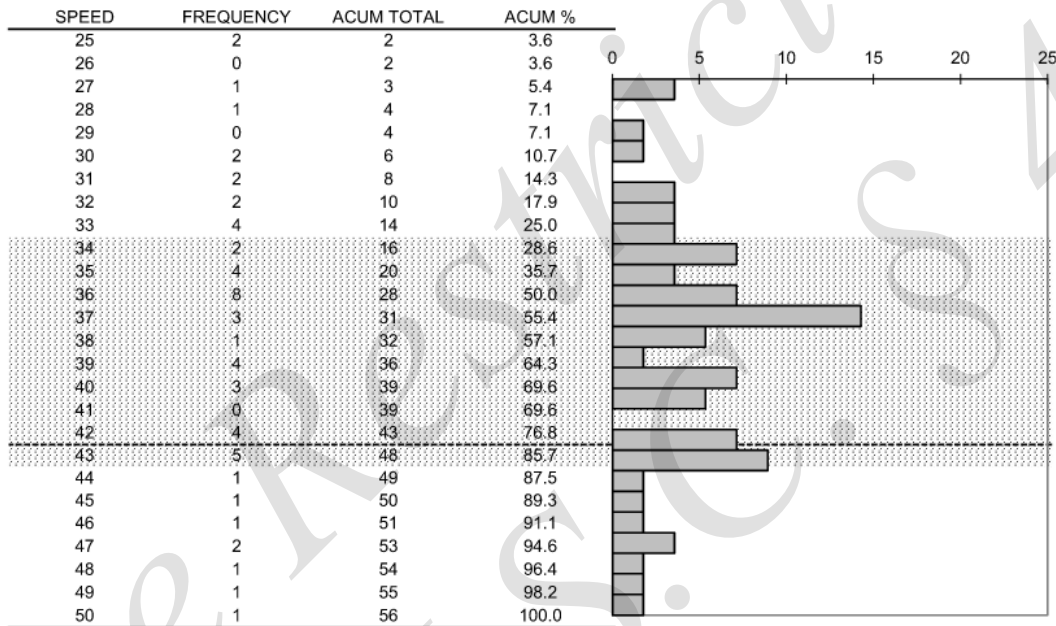
KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: JC
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: EASTBOUND ONLY

LOCATION: US-36, 0.1 Miles East of US-183
TIME START: 10:41 AM
TIME END: 11:17 AM

PERCENTAGE BREAKDOWN



AVERAGE SPEED = 37.6
50th PERCENTILE = 36.
85th PERCENTILE = 42.9
90th PERCENTILE = 45.4
95th PERCENTILE = 47.2

PACE = 34 - 43
VEHICLES IN PACE = 34
% IN PACE = 60.7
% BELOW PACE = 25.
% ABOVE PACE = 14.3

SAMPLE VARIANCE = 35.087987
STANDARD DEVIATION = 5.9235114
RANGE 1*S = 71.42857
RANGE 2*S = 94.64286
RANGE 3*S = 100.

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SPEED STUDY

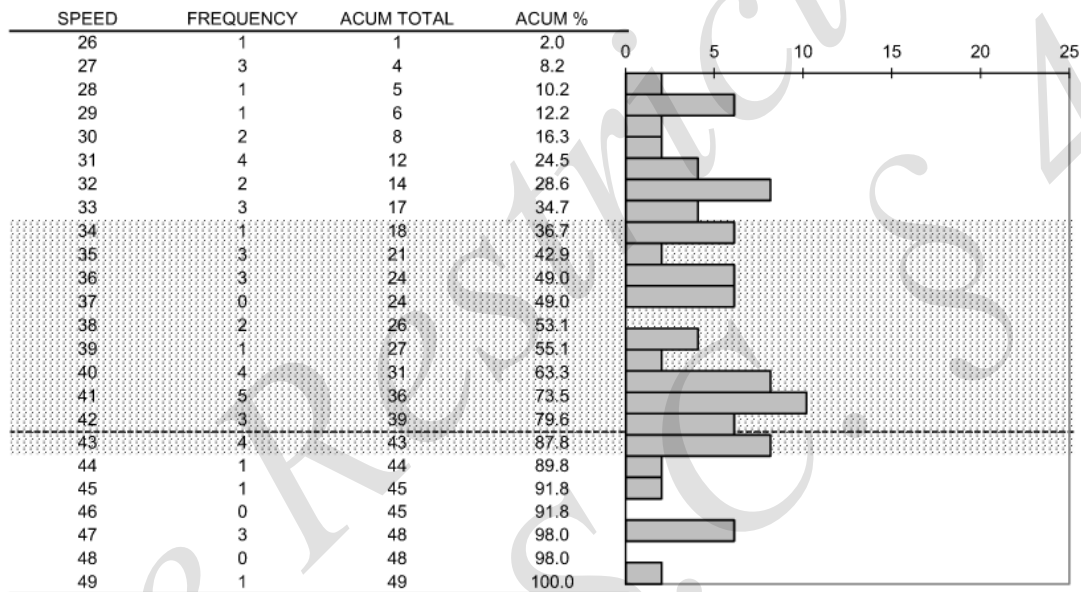
KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: JC
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: WESTBOUND ONLY

LOCATION: US-36, 0.1 Miles East of US-183
TIME START: 10:41 AM
TIME END: 11:17 AM

PERCENTAGE BREAKDOWN



AVERAGE SPEED = 37.
50th PERCENTILE = 37.3
85th PERCENTILE = 42.7
90th PERCENTILE = 44.1
95th PERCENTILE = 46.5

PACE = 34 - 43
VEHICLES IN PACE = 26
% IN PACE = 53.1
% BELOW PACE = 34.7
% ABOVE PACE = 12.2

SAMPLE VARIANCE = 38.0816327
STANDARD DEVIATION = 6.1710317
RANGE 1*S = 71.42857
RANGE 2*S = 100.
RANGE 3*S = 100.

Traffic Investigation Report – Speed Data

Location: US-36, 0.1 Miles East of US-183 in Phillipsburg, Phillips County, Kansas



SPEED STUDY

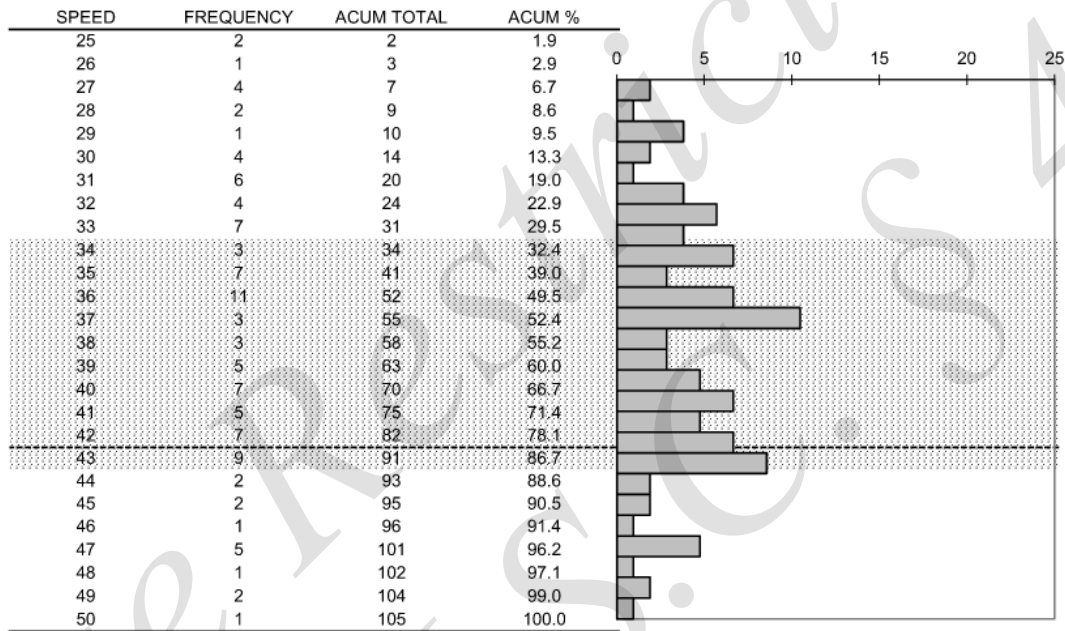
KANSAS DEPARTMENT OF TRANSPORTATION BUREAU OF TRAFFIC ENGINEERING

CITY: Phillipsburg
OBSERVER: jc
DATE: September 12, 2023

COUNTY: Phillips
SPEED LIMIT: 45 mph
DIRECTION: Combined WB & EB

LOCATION: US-36, 0.1 Miles East of US-183
TIME START: 10:41 AM
TIME END: 11:17 AM

PERCENTAGE BREAKDOWN



AVERAGE SPEED = 37.3
50th PERCENTILE = 36.2
85th PERCENTILE = 42.8
90th PERCENTILE = 44.8
95th PERCENTILE = 46.8

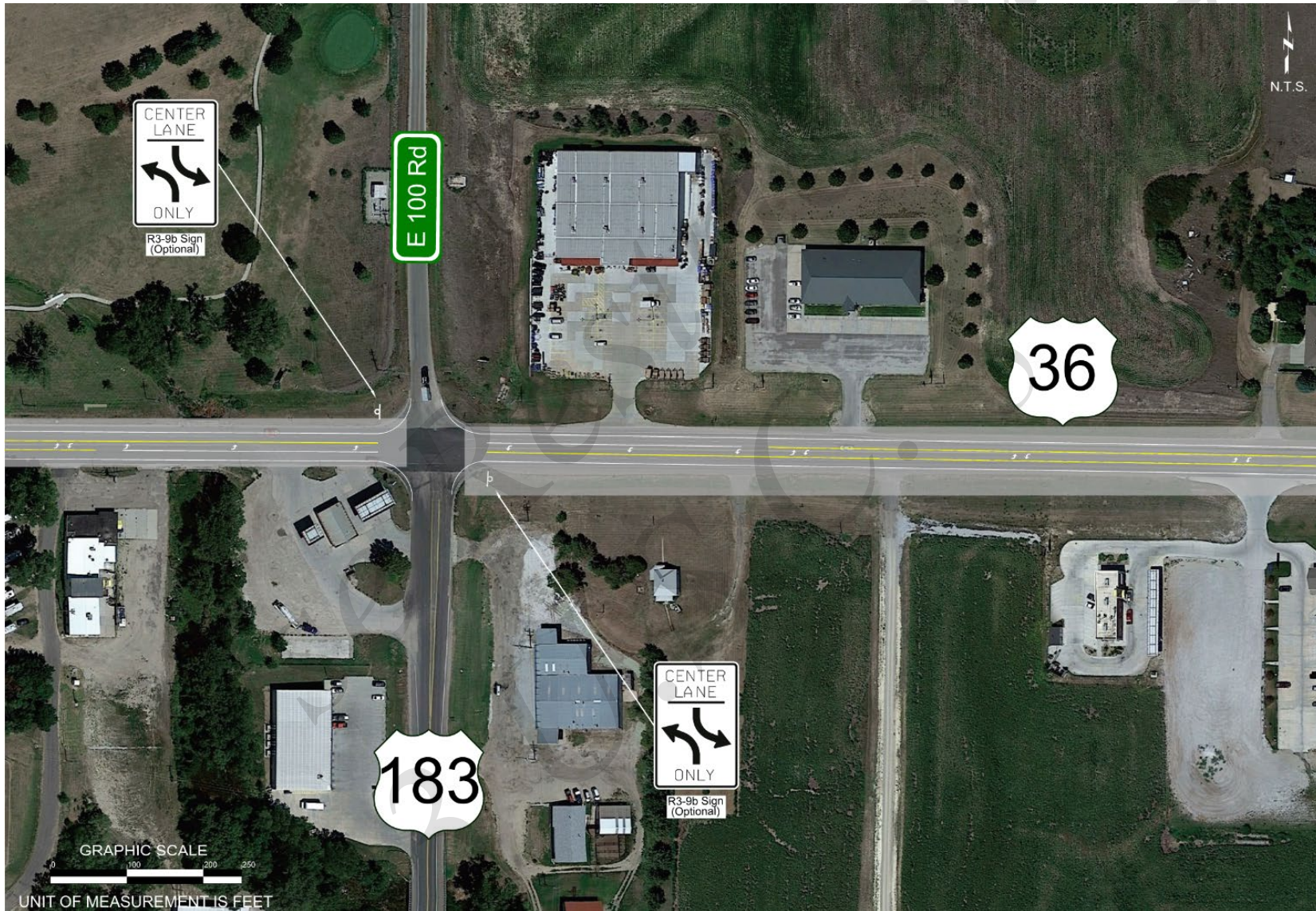
PACE = 34 - 43
VEHICLES IN PACE = 60
% IN PACE = 57.1
% BELOW PACE = 29.5
% ABOVE PACE = 13.3

SAMPLE VARIANCE = 36.1983516
STANDARD DEVIATION = 6.0165066
RANGE 1*S = 73.33334
RANGE 2*S = 99.04762
RANGE 3*S = 100.

Traffic Investigation Report – Phillipsburg Concept Design
Location: US-36 in Phillipsburg, Phillips County, Kansas



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