ROSE ISLAND ROAD COMMUNITY PRESERVATION ALLIANCE, LLC (RIRCPA)

RoseIslandRoadCommunityPreservation.com
PreserveRoseIslandCommunity@gmail.com

December 8, 2023

Judge David Voegele, Oldham County
Deputy Judge Kevin Nuss, Oldham County
James Urban, Director Oldham County Planning and Zoning Department
James Silliman, Oldham County Engineer
Louisville Metro Councilman Scott Reed
Debbie Carroll, Office of Councilman Reed
Secretary Jim Gray, Kentucky Transportation Cabinet
Matt Bullock, P.E., KYTC Chief Engineer, District 5
Kevin Bailey, P.E., KYTC Transportation Engineering Branch Manager
Shelli Venable, Office of KYTC Chief Engineer

Dear All:

At least four recent, serious crashes prompt us to again plead for urgent implementation of additional speed reduction strategies on KY 3222 to address community concern for driving safety on Rose Island Road.

A. 11/22/2023 – **Serious crash** in Oldham County near mile marker 1.89 at approximately 6 PM; driver struck same tree that caused a fatal crash on 8/12/2022; See photo below; KSP Collision Analysis database ID# 32501321 (See Appendix 1) and Crash #9 (See Appendix 2)
B. 11/22/2023 – **Crash** in Jefferson County near mile marker 0.9 (Curve 5 from Highway 42) at approximately 3 PM; this crash was reported on community social media but has not yet been added to the KSP Collision Analysis database.
C. 8/28/2023 – **Head-on injury crash** in Oldham County near mile marker 1.614, an area of repeated incidents; KSP Collision Analysis database ID# 32114060 and Crash #7 (See Appendix 2)
D. 6/03/2023 - **Fatal crash** in Oldham County near mile marker 0.403. The young man killed lived in the Goshen area and was a friend to many in the community; KSP Collision Analysis database ID# 317231015 and Crash #4 (See Appendix 2)

11/22/2023 Crash in Oldham County mile marker 1.89, KSP ID# 32501321

Driver speeding is a leading common factor amongst these and many crashes on Rose Island Road. While the posted speed limit is 35 mph, an LMPD Extended Speed Study in February 2023 showed that the 85th percentile observed speed was 43.85 mph. This is why we contend that Rose Island Road could qualify for the various solutions we previously proposed if KYTC were to grant special consideration and grant exception to policies. The various strategies we previously proposed [(1)] to reduce speeding have been dismissed to date by KYTC District 5. The only recommendation offered by KYTC District 5 was to contact police agencies for additional speed enforcement. This suggestion is pro forma at best, considering the practical limitations on police resources and manpower which make additional active enforcement unrealistic.

Traffic expert Adam Kirk [(2)] predicted that there would be 6.4 crashes on Rose Island Road annually based several measures including an assessed Road Hazard Rating 6 (scale of 1 to 7). Based on KSP data, there have been 13 crashes on Rose Island Road to date, excluding 4 crashes on US42 that used KY3222 as a reference point. This crash rate is **more than double** the expert's prediction for this specific roadway and 1.4 times more than the 9 crashes in all of 2022. There are technological solutions available to reduce this speed-related carnage and we must move forward with these solutions.

REQUESTED ACTIONS

1. **We renew our request that OLDHAM COUNTY install permanent dynamic signage to alert and warn drivers to slow down and use extra caution near Oldham County mile markers 1.4 and 1.9.** We understand that this is a state road so KYTC D5 must agree to the placement of such signage. Oldham County has experienced 9 of 13 crashes, including a fatal crash, on Rose Island Road to date in 2023. Since the County must pay for and maintain the signs and since other counties in the area have made independent decisions to allow such dynamic signage, ***we therefore direct this request to Oldham County officials.*** Dynamic Speed Display Signs (DSDS) [(3)] can include targeted warning messages in addition to actual speed profile messages. (Example: Use Extreme Caution, Reduce Speed, Dangerous Curve)

2. **We renew our request for JEFFERSON COUNTY to install permanent dynamic signage in the area of mile markers 0.2 to 0.9** to alert and warn drivers to slow down, stay in their lane, and use extra caution in this sequence of 5 curves**.** Sequential Dynamic Curve Warning Systems (SDCWS) [(4)] have been shown to be effective at reducing speeding and are recommended to reduce the incidence of speeding in horizontal curves. Again, we understand that this is a KY state road so KYTC D5 must agree to the placement of this signage; however, Jefferson County allows dynamic signage in other areas of the County, and the County must pay for and maintain the signs. Note that 4 of 13 crashes to date occurred on the Jefferson County segment of Rose Island Road, including the cited fatality; ***we therefore direct this request to Jefferson County officials.***

3. **We request legislative action in the 2024 Kentucky legislative session to approve, fund and conduct a traffic safety study** and apply appropriate road configuration, advanced signage options and other crash reduction strategies as soon as possible. We understand that this study may take at least 1 year; therefore, we call on KTC D5 and local county administrators to identify and install interim speed reduction strategies. We communicated this request to our State elected representatives via a separate letter sent on 11/27/2023 [(5)].

REQUEST FOR KYTC INNOVATION

Dynamic Speed Display Systems [(3)] and **Sequential Display Curve Warning Systems** [(4)] are examples of two innovative technological solutions to speed management. The **USDOT Highways for LIFE Technology Partnership Program** acknowledges *"There are a number of traditional low-cost countermeasures to help keep vehicles on the*

road and in their lane, however, their applications can be limited. This leads to the need for additional research and testing of more dynamic devices to assist traffic engineers in managing speed and safety across their roadway networks."

This statement almost exactly describes the situation on Rose Island Road. If the KYTC compliance policy does not support the use of permanent display signs, then we ask that:

1. The Kentucky Transportation Cabinet reviews its policies on dynamic speed display signage to take advantage of current research on these strategies.
2. An exception be made for Rose Island Road given the KYTC constrained alternative strategies and increasing number of fatal and injury crashes on this roadway.

ANALYSIS OF MOST RECENT (YEAR TO DATE) CRASHES ON ROSE ISLAND ROAD

Reviewing the KSP Collision Analysis data (See Appendix 1), we identified **13 crashes** on Rose Island Road from January through November 27, 2023 - **an actual crash rate more than double the expert's prediction for this roadway**[(2)].

To date in 2023, there have been 9 recorded crashes in Oldham County and 4 recorded crashes in Jefferson County. These crashes include:

- 5 crashes involved vehicles crossing the centerline,
- 3 hit and run crashes,
- 1 fatality crash involving the road shoulder,
- 1 head on collision leading to 1 injury,
- 4 sideswipe collisions (can be considered *almost* head on),
- 2 crashes involving a fixed object,
- 1 injury crash involving an animal,
  1 angle collision in a curve and grade.

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(1) Various Rose Island Road Community Preservation Alliance documents, correspondence with elected local and state Officials, and with KYTC D5 regarding Rose Island safety matters. See documents 1 thru 4 at [https://drive.google.com/drive/folders/1_o5PPPhfHRu3fpH02q3JcpJw4c9rCGkK?usp=drive_link]

(2) Adam Kirk Engineering Rose Island Road Safety Analysis Report dated 2.27.2023. See excerpt in Appendix 3. Full report at [https://drive.google.com/file/d/1HecXl4-H01UOf4OOjICsU-Za0E7CAs8s/view?usp=drive_link]

(3) Rose Island Dynamic Speed Display Signs (DSDS) – Transportation Research Part F: Traffic Psychology and Behavior, Volume 98, October 2023, Pages 157 [https://www.sciencedirect.com/science/article/abs/pii/S1369847823001857]; and USDOT FHA Public Roads - March/April 2016[https://highways.dot.gov/public-roads/marchapril-2016/spotlighting-speed-feedback-signs]

(4) Sequential Dynamic Curve Warning System (SDCWS). Approaching vehicles trigger a controller that wirelessly activates the LED signs to flash sequentially through the curves to warn speeding drivers to slow down. Analysis showed the SDCWS treatment appeared to be effective in reducing speed and crashes with a positive impact in improving curve navigation and safety [https://www.fhwa.dot.gov/hfl/partnerships/pdfs/tapco_12_22_11.pdf]

(5) *Road Community Preservation Alliance letter to elected State Officials dated 11/27/2023 [https://drive.google.com/file/d/1k4Ui3qukZCxsLKhStPdNKCnE4Wd6_dLW/view?usp=drive_link]*

KYTC IMPROVEMENTS TO DATE

In December 2022 and again in March 2023 the Rose Island Road Community Preservation Alliance asked KYDOT District 5, Jefferson County and Oldham County officials to take specific hazard mitigation measures to reduce the frequency of crashes on Rose Island Road [(1)]. We acknowledge and appreciate the measures KYTC D5 completed in the spring of 2023, which included centerline striping in Oldham County, signs warning of bicyclists, specific tree removal, and pothole patching. But these modest measures have not been effective in reducing speed as evidenced by the year-to-date crash rate, nor do they address the shoulder improvement (short and long term), centerline crossing, and other factors which are contributing causes to crashes as we have previous outlined in our study and letters, leaving these and other additional critical strategies unaddressed.

ACTION NEEDED NOW

In closing, dangerous and fatal crashes are occurring on Rose Island Road at a rate that is double what the expert traffic study model predicts. New and effective technology systems have been studied and recommended by the US Department of Transportation. It is time for these or other appropriate systems to be brought to bear on the ongoing accident carnage occurring on Rose Island Road.

Inaction or minimal action cannot be our collective response to these known and potentially solvable problems. Hence, we again plead for action now, seeking a concrete demonstration of willingness and commitment by the County and State to be proactive in protecting motorists who must use Rose Island Road.

Sincerely,

Janet Dewey

Janet Dewey

and

William A. Schmitt

William A. Schmitt
On behalf of the Rose Island Road Community Preservation Alliance

Cc:
Senator Lindsey Tichenor
Representative Ken Fleming
House Speaker David Osborne
Caelan O'Connor, Office of the Speaker

Endnote: All documents cited in footnotes of this letter can be found at: [https://drive.google.com/drive/folders/1_o5PPPhfHRu3fpH02q3JcpJw4c9rCGkK?usp=drive_link].

The Rose Island Road Community Preservation Alliance website [https://roseislandroadcommunitypreservation.com] also provides additional background, information and references on this subject.

Appendix 1

Kentucky State Police Collision Analysis Data for Rose Island Road - January thru November 2023

Crash Map #	Incident ID#	AgencyName	County	RdwyNumber	IntersectionRdwyName	BetweenStRdwyName1	BetweenStRdwyName2	Latitude	Longitude	Milepoint	Collision Date	Collision Time	Motor Vehicles Involved	Number Killed	Number Injured	Weather	Rdwy ConditionCode	HitandRun	DirAnalysisCode	MannerofCollision	RdwyCharacter	LightCondition
Oldham County																						
Crash #1	31199032	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222		RIVER GLEN	ROSE WYCOMBE	38.371127	-85.615796	0.179	2/5/2023	0415	1	0	0	CLEAR	DRY	TRUE	COLLISION WITH FIXED OBJECT NON - INTERSECTION - FIRST EVENT COLLISION 09 - 32 EXCLUDING 16	SINGLE VEHICLE	CURVE & LEVEL	DARK-HWY LIGHTED/ OFF
Crash #2	31518804	OLDHAM COUNTY SHERIFF DEPT	OLDHAM	KY3222		SPRING	RIVER GLADES	38.379571	-85.619051	0.784	4/11/2023	1737	3	0	0	CLEAR	DRY	FALSE	SIDESWIPE COLLISION - OPPOSITE DIRECTION	SIDESWIPE-OPPOSITE DIRECTION	STRAIGHT & GRADE	DAYLIGHT
Crash #3	31539234	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222		RESERVE	SPRING	38.39002	-85.618821	1.521	4/22/2023	2126	1	0	1	CLEAR	DRY	TRUE	COLLISION WITH ANIMAL NON INTERSECTION	SINGLE VEHICLE	CURVE & LEVEL	DARK-HWY NOT LIGHTED
Crash #4	31731015	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222				38.374172	-85.617253	0.403	6/3/2023	0058	2	1	0	CLEAR	DRY	FALSE	SIDESWIPE COLLISION - SAME DIRECTION	SIDESWIPE-SAME DIRECTION	STRAIGHT & GRADE	DARK-HWY NOT LIGHTED
Crash #5	31862268	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222	RIVER GLEN			38.370718	-85.615853	0.15	7/5/2023	1412	2	0	0	CLEAR	DRY	FALSE	ANGLE COLLISION - OTHER	ANGLE	CURVE & GRADE	DAYLIGHT
Crash #6	31928033	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222	SPRING			38.387147	-85.61894	1.319	7/18/2023	1002	2	0	0	CLEAR	WET	TRUE	OPPOSITE DIRECTION - BOTH VEHICLES GOING STRAIGHT AHEAD	SIDESWIPE-OPPOSITE DIRECTION	CURVE & LEVEL	DAYLIGHT
Crash #7	32114060	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222	RESERVE			38.391386	-85.618668	1.614	8/28/2023	1830	2	0	1	CLEAR	DRY	FALSE	HEAD-ON COLLISION	HEAD ON	CURVE & LEVEL	DAYLIGHT
Crash #8	32378441	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222		SPRING	RESERVE	38.388767	-85.618897	1.433	10/20/23	1400	1	0	0	CLEAR	DRY	FALSE	NON - INTERSECTION - FIRST EVENT COLLISION 09 - 32 EXCLUDING 16	SINGLE VEHICLE	STRAIGHT & LEVEL	DAYLIGHT
Crash #9	32501321	OLDHAM COUNTY POLICE DEPT.	OLDHAM	KY3222	OLDHAM ACRES			38.394638	-85.61611	1.89	11/22/23	1758	1	0	0	CLEAR	DRY	FALSE	COLLISION WITH FIXED OBJECT IN INTERSECTION - FIRST EVENT COLLISION 09 - 32	SINGLE VEHICLE	CURVE & HILLCREST	DARK-HWY NOT LIGHTED
Jefferson County																						
Crash #10	31908369	PROSPECT POLICE DEPARTMENT	JEFFERSON	KY3222				38.364151	-85.616754	0.698	7/18/2023	1055	2	0	0	CLOUD	DRY	FALSE	SIDESWIPE COLLISION - OPPOSITE DIRECTION	SIDESWIPE-OPPOSITE DIRECTION	STRAIGHT & LEVEL	DAYLIGHT
Crash 11	32134093	LOUISVILLE METRO POLICE DEPT	JEFFERSON	KY3222				38.363077	-85.617422	0.628	8/6/2023	1742	1	0	1	CLEAR	DRY	FALSE	OTHER COLLISIONS ON SHOULDER	SINGLE VEHICLE	CURVE & LEVEL	DAYLIGHT
Crash #12	32385014	PROSPECT POLICE DEPARTMENT	JEFFERSON	KY3222		US42	US42	38.359614	-85.61409	0.311	10/27/23	0055	1	0	0	CLEAR	DRY	FALSE	NON - INTERSECTION - FIRST EVENT COLLISION 09 - 32 EXCLUDING 16	SINGLE VEHICLE	CURVE & LEVEL	DARK (UNKNOWN
Crash #13	32441805	PROSPECT POLICE DEPARTMENT	JEFFERSON	KY3222				38.368022	-85.617523	0.996	11/09/23	2130	1	0	0	CLEAR	DRY	FALSE	NON - INTERSECTION - FIRST EVENT COLLISION 09 - 32 EXCLUDING 16	SINGLE VEHICLE	CURVE & LEVEL	DARK-HWY NOT LIGHTED

2023 Data (Period 1.1.2023 to 11.30.2023)	
# Crashes	13
# Vehicles Involved	20
# inuries	3
# Property Damage	20
# Fatalities	1
Hit & Run	3

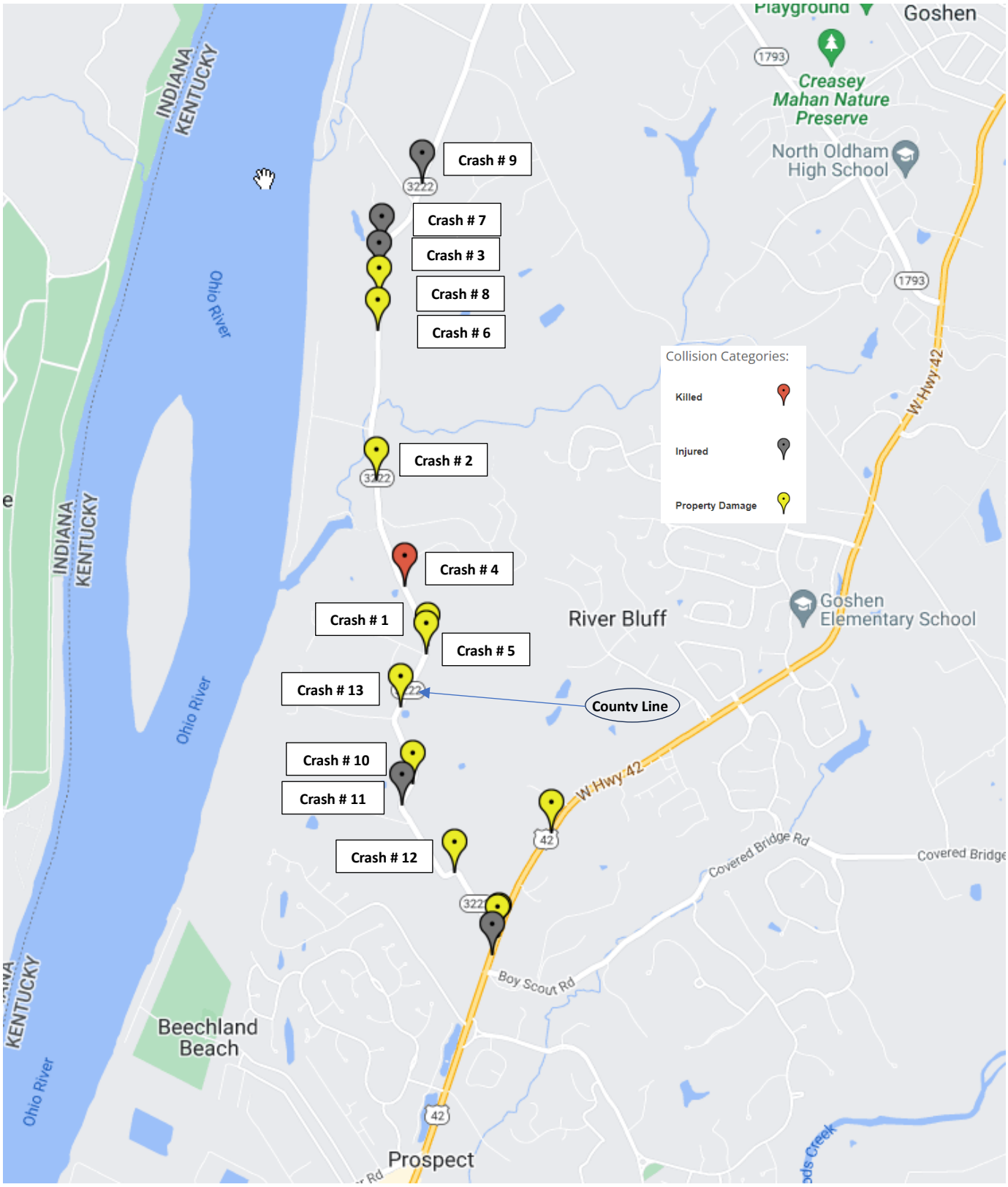
HEAD-ON COLLISION	1
SAME DIRECTION	2
DIRECTION	3
COLLISION WITH ANIMAL	1
COLLISION WITH FIXED OBJECT	2
OTHER COLLISIONS ON SHOULDER	1

In 11 months of 2023, there have been 13 crashes as compared with 9 crashes in all of 2022. Moreover, in the 11 months of 2023, there have been more than double the number of crashes (13 versus 6.4 annually) than an expert traffic study predicted for this 3.5 mile hazardous segment of Rose Island Road - a roadway rated as Hazard Category 6 (Scale 1 to 7) because of its numerous physical hazards (trees and utility poles, blind sharp curves and encroaching embankments.

Appendix 2

Kentucky State Police Crash Data Map

January 1 to November 30, 2023



Appendix 3

ADAM KIRK ENGINEERING

Rose Island Road Safety Analysis dated February 27, 2023

Conducted for the Rose Island Road Community Preservation Alliance*

*Presented to the Oldham County Planning Commission on 2.28.2023 as expert witness testimony fin the hearing for Docket PZ-23-004

adam kirk engineering

MEMORANDUM

TO: Rose Island Road Community Preservation Alliance, LLC

FROM: Adam Kirk
Adam Kirk Engineering
137 McClelland Springs Drive
Georgetown, KY 40324

DATE: February 27, 2023

RE: Rose Island Road Safety Analysis

The purpose of this document is to summarize the safety analysis conducted for Rose Island Road from US 42 to KY 1793 in Oldham County, KY. This analysis was conducted to determine the impact additional traffic would have on this section of roadway and what improvements would be capable of mitigating the increased crash risk along the roadway due to the additional traffic generated by the proposed Rose Island Glen residential development.

The Traffic Impact Study submitted by the developer and prepared by Diane Zimmerman Traffic Engineering, LLC describes the existing conditions as such:

> *"Rose Island Road, KY 3222, is maintained by the Kentucky Transportation Cabinet (KYTC) with an estimated 2021 ADT of 2,500 vehicles per day between Spring Road and KY 1793, as estimated from the 2017 count at KYTC station 505. The road has two nine-foot lanes with an estimated two-foot shoulder. The road is classified as a collector in the Oldham County Functional Classification system. The speed limit is 35 mph. There are no sidewalks."*

Review of the roadway agrees with the characterization of the roadway, except that shoulders are not present on the majority of Rose Island Road, being present only on the southern 1 mile of the 4.7 mile long roadway in Jefferson County. The remaining 3.7 miles of roadway is characterized by no edgeline, no paved shoulder with frequent pavement edge drop offs and poor drainage as shown in Figure 1. These conditions appear to be recognized in the Traffic Impact Study which states the following on page 7.

> *"Rose Island Road has not been constructed to modern standards. The roadway lacks a roadway drainage system (either ditches or curb and gutter). A clear zone from the edge of the pavement has not provided. While this is typical of many rural roadways within Kentucky, the roadway needs to be modernized."*

The Traffic Impact Study identifies a "proportional share" of improvements to offset the impact of the development by 1) providing shoulder for 150 feet along the 4.7 mile roadway, correcting drainage at Mayo Lane, and removing 4 trees.

Figure 1: Typical Section of Rose Island Road in Oldham County.

Safety Analysis

This analysis seeks to quantify the impact of the additional traffic on Rose Island Road and evaluate the proportionality of the proposed improvements. Safety analysis was conducted using the Rural Two-Lane Road Spreadsheet (v3.1) developed by the National Cooperative Highway Research Program (NCHRP) to assist with the implementation of the Highway Safety Manual predictive safety models. The tool provides an estimate of annual crashes and severity based on roadway characteristics, including lane width, roadside character and traffic volume.

Two scenarios were evaluated as part of this analysis:

1. Existing conditions. Nine (9) foot lanes, no shoulders, roadside hazard rating of 6 (scale of 1 to 7) and an ADT of 2500 vpd.
2. Proposed conditions. Nine (9) foot lanes, no shoulders, roadside hazard rating of 6 (scale of 1 to 7) and an ADT of 3,482 vpd, consistent with the projected increase of 982 vehicles identified in the Traffic Impact Study.

Note: Roadside Hazard Rating Scales used to classify Rose Island Road are provided in Attachment A.

Based on these conditions, the HSM methodology provides a predictive crash frequency. **Table 1** summarizes the annual predictive crash model for these scenarios. A crash review from January 1, 2017 to September 23, 2022 indicated a total of 57 crashes (18 fatal and injury; 39 property damage only). Annual crash frequency on this section of roadway is 9.9 crashes per year, which

is higher than the predicted model. This analysis indicates that with the projected 39 percent increase in traffic on Rose Island Road, crashes would increase 38 percent.

Table 1: Predicted Crash Frequency and Observed Crash Frequency

Crash severity level	Predicted average crash frequency (crashes/year)		Observed Crashes (crashes/year)
	Existing Conditions	Proposed Conditions	
Total	6.4	8.8	9.9
Fatal and Injury (FI)	2.1	2.8	3.1
Property Damage Only (PDO)	4.4	6.0	6.8

Corrective analysis based on observed crashes cannot be performed for future conditions, but the proportional increase in crashes from the predictive models can be applied to the observed patterns. A 38 percent increase in observed crashes would result in 3.8 more total crashes per year including 1.2 fatal and/or injury crashes per year.

Iterative analysis was performed with the rural road spreadsheet to determine what improvements if any would be capable of mitigating the increased crash risk associated with the increase in traffic. This analysis indicated that the lane widths would need to be widen from 9 feet to 11 feet and that a 2 foot shoulder be constructed along the entire length of the roadway to offset the almost 40 percent increase in crashes caused by the additional traffic. This indicates that the 150 foot of shoulder widening proposed by the development is not proportional to the safety impact that would be experienced on the roadway.

Summary output from the HSM analysis spreadsheet is provided in **Attachment A**.

{Pages 4 to 10 of this report are omitted here for brevity. See footnote 2 for link to the full report.}

Appendix 4

RESEARCH SHOWS THAT DYNAMIC SPEED DISPLAY SIGNS (DSDS) DO WORK TO REDUCE DRIVER SPEEDING

DO DYNAMIC SPEED FEEDBACK SIGNS IMPACT DRIVERS DIFFERENTLY BASED ON SPEEDING TENDENCIES? INSIGHTS FROM APPLICATIONS AT SELECT CRITICAL ROADWAY CONTEXTS

Transportation Research Part F: Traffic Psychology and Behaviour
October 2023, Volume 98, Pages 157-169
https://www.sciencedirect.com/science/article/abs/pii/S1369847823001857
https://doi.org/10.1016/j.trf.2023.09.002

CONCLUSION:

DSDS yields a reduction in the speed indicators. Average speed decreased between 0.7 km/h and 3.1 km/h, 85th percentage speed between 1.0 km/h and 3.0 km/h, and vehicles exceeding the speed limit between 6.6% and 28.6% points. All speed reductions are statistically significant, which is not surprising given the large sample sizes. After dismounting all DSDS speed levels returned to its baseline.

STUDY:

A total of 5 sites were selected, which included a freeway exit ramp, two speed transition zones, and **two high-speed rural highway curves.** Vehicle speed profiles approaching and entering these critical locations were collected before and after installing the DSFS. Based on the tracked speed of the free-flowing vehicles before the influence area, drivers were categorized as slower drivers, average drivers, and faster drivers using the 15th and 85th percentile speed at each site. **Overall, installing the DSFS resulted in a significant reduction in speed across all locations for all sites. Drivers were found to reduce their speed while approaching the curve, traversing through the speed transition zones, and entering the curves or reduced speed limit areas. Results showed that faster drivers tend to reduce speed more than the average or slower drivers at every location. The faster drivers also reacted to the sign earlier compared to the slower or average drivers**. The overall results are encouraging as they indicate that DSFS impact faster drivers more, which can ultimately reduce speeding-related crashes when transitioning from a high-speed environment. Based on the findings, the continued use of DSFS as a speed reduction strategy is recommended.

Such targeted warning messages can be but are not limited to: “SLOW DOWN,” “YOU ARE SPEEDING SLOW DOWN,” “HIGH SPEED SLOW DOWN,” “REDUCE SPEED IN WORK ZONE,” and “EXCESSIVE SPEED SLOW DOWN.”

EVALUATION OF DIFFERENT TYPES OF DYNAMIC SPEED DISPLAY SIGNS (DSDS):
https://www.researchgate.net/publication/271582037_Evaluation_of_different_types_of_dynamic_speed_display_signs

Appendix 5

Low-Cost Treatments for Horizontal Curve Safety 2016

APPENDIX E: Application Of Sequential Dynamic Curve Warning Systems (SDCWS)

BACKGROUND

Roadway departure crash rates are three times higher at horizontal curve locations relative to tangent segments of roadway. Sequential Dynamic Curve Warning Systems (SDCWS) have been implemented as a countermeasure on two-lane rural highway curves as a means to reduce vehicle operating speeds and improve curve delineation. The anticipated benefit of implementing SDCWS is reductions in total and severe crashes.

COUNTERMEASURE DETAILS

SDCWS are horizontal curve chevron signs with solar powered flashing lights embedded in the sign. The flashing lights can be simultaneous (i.e., each sign is flashing at the same time as the other signs); or, more often, there may be a pattern associated with the flashing lights (i.e., a sequence of lights moving toward or away from the driver). In the latter case, this is typically accomplished by having each sign flash at least once per second, with each flash lasting at least 100 milliseconds. Each sign begins flashing at a time that is offset relative to the adjacent sign, producing a sequential flashing effect.

Figure E-1. Photo. SDCWS.

The States of Missouri, Texas, Washington, and Wisconsin collectively installed 12 TAPCO SDCWS's along horizontal curves on two-lane rural highways as part of an FHWA Highways for Life evaluation. Because there were only 12 SDCWS locations included in the study sample, only one manufacturer's product was selected for implementation in the evaluation to ensure consistency in system design and application. The TAPCO system was selected as a typical representation of SDCWS's. The study sites were identified based on a high-crash history, as well as vehicle operating speeds that exceeded the advisory (if present) or posted speed limit.

All curves selected for treatment with SDCWS were on a two-lane rural paved road and have the following:

- A posted speed limit of 50 mph or higher.
- Existing chevrons.
- No railroad crossing or major access points within the curve.
- At least 10 non-animal related crashes in the previous 5 years (preferably high-speed related crashes),
- No major rehabilitation or changes in alignment in the previous 5 years,
- No rehabilitation or alignment changes planned in the 2 years following installation of the SDCWS.

All installations of SDCWS at the curves occurred between June and September of 2012. A total of 24 similar horizontal curves in the same States were used as a control group, without SDCWS.
Speed data were collected before installation, and 1, 12, 18, and 24 months after installation of the SDCWS. Crash data were also compiled for each of the SDCWS and control sites, including five years before and two years after implementation.

RESULTS

The results showed that vehicle operating speeds were lower at the beginning and midpoint of horizontal curves for all periods after the SDCWS were installed. The mean and 85th percentile speeds were 1.1 to 1.7 mph lower in the 1-, 2-, 8-, and 24-month periods after installing the SDCWS. The results were generally consistent when comparing speeds at the beginning and the midpoint of horizontal curves. The percentage of vehicles exceeding the posted and advisory speed limits was also lower after installing the SDCWS, and results were generally consistent across all time periods after implementation. The change in the fraction of vehicles exceeding the advisory speed by 20 mph or more decreased by an average of 32 percent at the beginning of the horizontal curve. Similarly, the change in the fraction of vehicles exceeding the advisory speed by 15 mph or more decreased by an average of 30 percent at the beginning of the horizontal curve. The fraction of vehicles exceeding the advisory speed by 20 mph or more at the midpoint of the curve decreased by 26 percent, while the fraction of vehicles exceeding the advisory speed by 15 mph or more declined by 16 percent after SDCWS installation. The results of the study suggest that SDCWS have long-term and consistent effect on vehicle operating speeds. While the magnitude of the effect was relatively small, there was a pronounced effect on those vehicles substantially exceeding the advisory speed.
With regards to safety, a simple before-after analysis of crash data found that the total number of crashes per year declined by 17 to 91 percent at 7 locations after the SDCWS was installed. At 2 sites, the total number of crashes per year increased by 7 and 11 percent. At three locations, no crashes were reported after the SDCWS were installed, so simple before-after safety comparisons could not be made. Research is underway to develop crash modification factors for SDCWS.

CONSIDERATIONS

The research referenced in this case study identified candidate sites for the SDCWS based on high crash histories (at least 5 crashes in previous 5 years) and excessive speeds on the same horizontal curves. Excessive vehicle operating speeds were defined as those with either of the following conditions:

- Mean speed exceeded the advisory speed limit by 5 mph or more, or, if an advisory speed was not posted, exceeded the posted speed limit by 5 mph or more.

- 85th percentile speed exceeded the advisory speed limit by 5 mph or more, or exceeded the posted speed limit by 5 mph or more, if an advisory speed was not present.

- A radar device on the sign can detect vehicles 300 feet in advance of the horizontal curve. The SDCWS is set to activate only when it detects approaching vehicles exceeding a certain speed threshold. The threshold is commonly at or slightly below the advisory speed of the curve. A wireless communication system maintains synchronization among the chevron signs within the system.

CONTACT INFORMATION

Julie Zirlin at the FHWA provided information for this case study. Visit https://www.fhwa.dot.gov/accelerating/ for more information. Images are courtesy of FHWA.

REFERENCES

Smadi, O., N. Hawkins, S. Hallmark, and S. Knickerbocker. *Evaluation of the TAPCO Sequential Dynamic Curve Warning System*. Report No. FHWA-HIF-13-040, Federal Highway Administration, Washington, DC, June 2013.

Smadi, O., N. Hawkins, S. Knickerbocker, S. Hallmark, and A. Pike. *Evaluation of the TAPCO Sequential Dynamic Curve Warning System*. Report No. FHWA-HIF-13-040, Federal Highway Administration, Washington, DC, June 2013.