Request for Research Funding for FY 2021-2022			
Requesting Office	District 7 Traffic Operations	**Priority**	13 of 15
Proposed Title	Evaluation on Pilot Deployment of Portable Visual Barriers to Reduce Rubbernecking Impact during Freeway Crashes		
Justification	A common problem in the U.S. is motorists "rubbernecking" to look at crashes or incidents in the opposing travel lanes. Rubbernecking is a form of distracted driving and can reduce the speed of many vehicles in the same travel direction and potentially cause significant traffic congestion and secondary accidents depending on traffic and roadway conditions. Figure 1 shows a long northbound queue caused by rubbernecking on a southbound crash on I-75 near Brandon, Florida. Congestion caused by rubbernecking also impacts environmental pollution. This type of traffic congestion is preventable. Many research projects have examined the influence of incidents on traffic traveling in the direction of incidents, but only a few studies have investigated the influence on traffic in the opposite direction, and no research was found on evaluating countermeasures for preventing rubbernecking. Therefore, it is important to explore the effects of rubbernecking on traffic mobility and safety in detail and develop effective ways to significantly reduce the effect of traffic congestion caused by rubbernecking.		

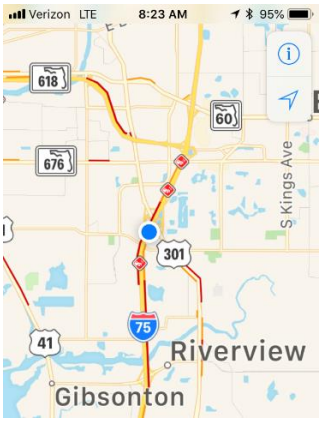

Figure 1. NB traffic congestion caused by rubbernecking of crash on I-75 SB

Past research has revealed that external distractions cause the highest number of vehicle crashes (29.4%) compared to other categories of driver distraction (Stutts et al., 2001). "An Analysis on the Impact of Rubbernecking on Urban Freeway Traffic" (J. Masinick et al., 2014) evaluated the rubbernecking impact of accidents on traffic in the opposite direction based on traffic and accident data, which indicated that about 10% of accidents cause rubbernecking, with an average capacity reduction of 12.7%. This impact is significant and requires mitigation measures such as physical barriers, which, with adequate height, can effectively block the view of incidents and reduce the likelihood of rubbernecking. The U.S. Centers for Disease Control estimate that 25% of all car accidents are the result of a distracted driver.

Crashes, disabled vehicles, and other roadway incidents cause nearly 25% of traffic congestion in the U.S., according to the Federal Highway Administration (https://ops.fhwa.dot.gov/program_areas/ reduce-non-cong.htm). This nonrecurring traffic congestion comes primarily from crashes/accidents. The sample data from the Masinick study showed that about 10% of accident caused rubbernecking and resulted in traffic congestion on the opposite direction of the accidents. About 50% of congestion occurs on freeways, Therefore, traffic congestion caused by rubbernecking is about 1.25% (=25% x 50% x 10%) of total traffic congestion which is still very significant.

The purpose of this research is to conduct a pilot study through the FDOT Road Ranger program to evaluate the effectiveness of portable visual barriers in reducing the impact of rubbernecking on access-controlled highways. The research proposes the use of portable visual barriers to block crash scenes from passing traffic and evaluation of its cost-effectiveness. If successful, visual barriers can be used by incident responders. In addition, this research will provide guidelines on implementing portable visual barriers in incident management.

In Florida, traffic incidents on access-limited interstate highways and expressways can easily cause significant traffic congestion, travel delay, and potential for secondary accidents. As Road Rangers respond to numerous incidents every year, it would be beneficial to research the practical benefits of developing portable, reusable, and easily-deployable visual barriers made from lightweight material that can be stored on a spool on the back of a Road Ranger truck. The Ranger can deploy and set up the portable screen barrier

	quickly. An evaluation would be conducted on wind-resistant portable traffic screen barriers currently available on the market that have flexible fabric screens and adjustable legs that can be easily telescoped vertically and transported to an accident scene by the Road Ranger. Driving behaviors of the drivers on the other side of the freeway of the crash incident would be also be evaluated. Figure 2 shows a portable screen device for stopping rubbernecking, invented by Carl Cannova (pictured). According to WTSP-TV Tampa-St. Petersburg (https://www.usatoday.com/ /news/ nation/2014/09/ 10/invention-stop-rubbernecking/ 15376965/), the Sarasota Police Chief indicated that the device is easy to set up quickly and also can protect victims in a traffic accident and allow traffic to flow more smoothly. Several lightweight portable incident screens are available on the market, and some can be set up by one person in one minute.  *Figure 2. Portable screen device for stopping rubbernecking (photo courtesy of WTSP)* According to findings from the 2019 Urban Mobility Report, congestion cost in Florida major urban areas reached $9.9B. Florida is an excellent geographical region to evaluate the effectiveness of portable barriers to reduce congestion and costs caused by rubbernecking. Any promising countermeasures to reduce traffic congestion and improve traffic safety should be explored and pilot-tested, as traffic congestion caused by rubbernecking is mostly preventable. This proposed research project aims to acquire, implement, and evaluate the capabilities of portable visual screen barriers to reduce rubbernecking impacts during freeway incidents via pilot deployments. The proposed research will also develop implementation guidelines to set up the barriers to reduce or prevent rubbernecking. The proposed project fully supports the traffic engineering principles and practices of FDOT Traffic Engineering and Operations to improve mobility and safety. Reduction in and prevention of rubbernecking can significantly reduce preventable traffic congestion it causes as well as the possibility of secondary crashes. Objectives and associated tasks of the proposed project are as follows: 1. Perform a comprehensive literature review regarding the impact of rubbernecking on traffic mobility and safety and potential countermeasures to prevent rubbernecking. Identify types of portable visual screen barriers available and examine their potential use. 2. Develop a data collection, implementation, and evaluation plan for evaluating the effectiveness of portable visual screen barriers to reduce rubbernecking. 3. Research the size requirements of portable visual screen barriers and optimal setup configuration to maximize blockage to reduce or prevent rubbernecking. Acquire suitable portable visual screen barriers suitable for Road Rangers to carry on their trucks for pilot implementations. 4. Conduct a before-after study of congestion reduction for implementation of portable visual screen barriers through the Road Rangers program. 5. Perform in-depth data analyses to evaluate the effectiveness and benefits on the use of portable visual screen barriers with respect to reduction in traffic congestion across interstate highways in Florida. 6. Develop implementation guidelines on when, who, where, and how to deploy portable visual screen barriers. Document analysis results and research findings from the evaluation and provide recommendations.
Impact	Drivers traveling in the opposite direction of a highway incident who engage in rubbernecking can potentially create traffic congestion and even traffic incidents, especially rear-end collisions. The likelihood of rubbernecking in the opposite direction of an incident can be reduced by using portable visual screen barriers that prevent drivers from viewing the incident scene. Research results and findings can directly impact practices. The cost of portable visual screen barriers on the market is low and affordable, so cost will not be a barrier for future widespread implementation. Florida Road Rangers or other traffic incident

	responders can follow the implementation guidelines developed from this research to easily and effectively deploy portable visual screen barriers to reduce or stop rubbernecking. It is anticipated that significant traffic congestion due to rubbernecking and associated secondary crashes will be reduced by successful deployment of portable visual screen barriers. Consequences of <u>not</u> conducting the research include the following: • FDOT will not obtain a detailed literature review on the impact of rubbernecking on traffic congestion and its associated secondary crashes. • FDOT will not obtain detailed information about the use of portable visual screen barrier to reduce preventable traffic congestion due to rubbernecking. • FDOT will not be able to evaluate portable visual screen barriers as a viable solution for preventing rubberneck-related congestion and accidents in Florida or obtain information on the effectiveness of portable visual screen barriers to reduce traffic congestion. • FDOT will not be able to reduce traffic congestion caused by rubbernecking, which occurs frequently on Florida interstate and access-limited highways. • FDOT will not obtain the guidelines for successful implementation of portable visual screen barriers to reduce traffic congestion and associated secondary crash due to rubbernecking. • FDOT will not receive a comprehensive research report documenting the impact of rubbernecking, pilot implementations, analysis results, research findings, conclusions, recommendations, and implementation guidelines for successful implementation to reduce traffic congestion and secondary crashes caused rubbernecking.
Affected Offices	State Traffic Engineering & Operations
Existing Work	The existing literature provides insights on how to minimize rubbernecking impact during incidents by using portable visual barriers on access limited highways: • **Temporary Barriers to Reduce the Effects of Rubbernecking (Nicholas P. Colon, Michael A. Rupp, and Mustapha Mouloua, University of Central Florida, Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting, 2013)** – Research on driver distractions due to rubbernecking and examination of the efficiency of crash barriers on crash sites in three separate drives (two control drives and one with a highly salient traffic crash) with either no occlusion, partial occlusion, or full occlusion. Full barrier occlusion was the most successful at decreasing the amount of time participants spent looking at crashes. • **The Impact of Rubbernecking on Urban Freeway Traffic (Jonathan Masinick, Hualiang Teng, Nesley Orochena, *Journal of Transportation Technologies*, 4, 116-125, 2014) –** Investigated traffic incidents that occur in opposite directions and identified factors causing rubbernecking and traffic delay with the help of a binary logit model and a linear regression model to develop effective countermeasures. • **Spatiotemporal Analysis of Traffic Congestion Caused by Rubbernecking at Freeway Accidents (Younshik Chung, Wilfred W. Recker, *IEEE Transactions on Intelligent Transportation Systems*, 14(3), 2013)** – Developed analytical methodology based on a binary integer programming formulation to estimate capacity reduction due to rubbernecking, used to identify the spatiotemporal region affected by the influence of an accident. The methodology has the ability to separate non-recurrent delay from recurrent delay present on the road at the time and place of a reported accident and estimate the contribution of non-recurrent delay caused by the specific accident. Included a study on an inductance loop detector to define the patterns and magnitudes of the delay. Potential factors contributing to delay were examined, including accident characteristics, geometric characteristics, environmental conditions, traffic characteristics, and congestion characteristics, for their effects by using the semiparametric Cox proportional-hazards model. • **Invention: Portable Traffic Incident Screen (Donna Allison, March 2018)** – Portable incident screening system that reduces rubbernecking, provides adaptive screening configurations, is easy to store,

	and provides a standalone system that frees up responders to concentrate on more important tasks at an incident scene. • **Invention: Portable Wind-Resistant Traffic Screen and Related Method (Carl S. Cannova, March 2015)** – Invention that contemplates wind-resistant portable traffic screen comprising a screen, vertical member, and fastener that is adjustable, scalable, and wind resistant. • **Traffic Congestion and Congestion Pricing (C. Robin Lindsey, Erik T. Verhoef, Tinbergen Institute Discussion Paper, No. 00-101/3)** – Analyses economic principles behind congestion pricing in static and dynamic settings, derived from externalities created by travelers. Addresses complications include pricing in networks, heterogeneity of users, stochastic congestion, interactions of the transport sector with the rest of the economy, and tolling on private roads. • **Invention: Traffic Collision Cover (John Patrick Dempsey, November 2017)** – Traffic collision cover that restricts view of physical damage to one or more vehicles involved in a traffic accident to passing motorists and pedestrians due to rubbernecking. Used by responding agencies based on various criteria and situations.		
Keywords Used in Existing Work Search	Rubbernecking, Traffic congestion, Traffic delays, Secondary crash portable visual screen barriers, Wind resistance, Distraction, Incident,		
Related Contracts (Give contract numbers)	• BDV34-977-10 – Evaluation of Incident Response Improvements for Statewide Application: Learnings from the New Regional Traffic Management Center in Jacksonville, FL • BD 544-14 – Road Ranger Benefit Cost Analysis • BDV26-762-07 – Optimization of Road Rangers Operations for FDOT District 7 Freeway Systems • BDV34-977-07 – Evaluation of Project Processes in Relation to Transportation System Management and Operations (TSM&O) • BDK77-931-04 – Travel Time Reliability Implementation for the Freeway SIS Note: No rubbernecking-related FDOT research project found		
Funding Request	$160,000	**Anticipated Duration**	18 months
Project Manager	Ms. Megan Arasteh, PE Co-PM: Shawn Kinney	**Contracting Method**	Direct contract with USF Center for Urban Transportation Research (CUTR)
Urgency	1	Florida has the 3rd largest number of traffic fatalities in the U.S. Congestion cost for the major urban areas in Florida was $9.9B based on the 2019 Urban Mobility Report. Mobility is very important for Florida's economy, tourism, and quality of life. Rubbernecking is a major distraction for drivers on interstate and access-limited highways and has contributed a to nonrecurring traffic congestion, which could mostly be prevented; therefore, there is an urgency to conduct a pilot deployment and evaluate the effectiveness of using portable visual barriers to reduce preventable traffic congestion and associated secondary crashes due to rubbernecking. FDOT can also consider including it in its incident management program.	
Implementability	1	This proposed research will conduct a pilot deployment, evaluate effectiveness, document evaluation results and findings, and provide practical guidelines to successfully implement portable visual barriers via Road Rangers operations to reduce traffic congestion and secondary accidents caused by rubbernecking. The cost for portable visual screen barriers on the market is low and affordable, so cost will not be a barrier for future widespread implementation. Several portable visual barriers are available on the market. Some law enforcement agencies have	

		verified the value of using portable visual barriers to protect crash victims in traffic accidents, allowing traffic to flow more smoothly.

Project Benefits (Succinct, complete explanation)

- FDOT will obtain research results and findings on the impact of rubbernecking on freeway mobility and safety and the effectiveness of using portable visual barriers via Florida Road Rangers operations to reduce preventable traffic congestion and associated secondary crashes on freeways and access-limited highways in Florida.
- FDOT can successfully deploy portable visual barriers to significantly reduce traffic congestion caused by rubbernecking on freeways and access-limited highways in Florida.
- FDOT can add significant value to Florida Road Rangers operations with a large increase in benefit/cost ratio.
- FDOT will obtain a comprehensive report that documents evaluation results and research findings for pilot deployment of portable visual barriers to reduce traffic congestion and associated secondary crashes on Florida's freeways and access-limited highways.
- FDOT will obtain practical implementation guidelines for successful deployment of portable visual barriers to reduce or stop rubbernecking on Florida's freeways and access-limited highways.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc.…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
○ Materials Enhancement		
○ Materials Savings		
○ Time Savings	Reduction in travel delay in person-hours, truck congestion costs, and fuel consumption Total annual of reduction on travel delay in person-hours, truck congestion cost, and fuel consumption in Florida can save $124M	According to findings from the 2019 Urban Mobility Report, congestion cost in Florida major urban areas reached $9.9B per year. For urban areas over 1 million population, 54% of travel delay is on freeways, and for urban areas under 1 million population, 34% of travel delay is on freeways. As 4 out of 7 urban areas in Florida included in the report had a population over 1 million, it can be reasonably assumed that 50% of travel delay in these seven major Florida urban areas was on freeways. Based on analysis of sample data from Masinick's study, about 10% of accident caused rubbernecking and resulted in traffic congestion on the opposite direction of the accidents. Rubbernecking causes about 1.25% (=25% x 50% x 10%) of total traffic congestion. Therefore, with successful implementation of portable visual barriers to stop rubbernecking on Florida freeways and access-limited highways, the total annual reduction on travel delay in person-hours, truck congestion cost, and fuel consumption in Florida can reach $124M (= $9.9B x 1.25%)
○ Lives Saved/Injuries Prevented	Reduction on number of crashes, fatalities and injuries On average, 3.1 lives per year can be saved, and 22.3 incapacitating injuries and 72.7 non-incapacitating injuries per year can be prevented. Total annual saving from lives saved and	Based on the Florida DHSMV data, there are about 10% fatalities, 13% incapacitating injuries (serious injuries) and 11% non- incapacitating injuries (moderate injuries) occurred on freeways and access-limited highways. According to FDOT KABCO crash costs as shown on Table 23.5.2 (https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/roadway/bulletin/rdb14-12.pdf?sfvrsn=dd9f8e48_0), the crash costs for a fatal crash, serious injury, and moderate crash are $10,100,000, $818,636, and $163,254, respectively. Based on data from Florida DHSMV (https://www.flhsmv.gov/pdf/crashreports/crash_facts_2019.pdf), there were 313 fatalities, 1,716 incapacitating injuries, and 6,611 non-incapacitating injuries on freeways in Florida in 2019. About 10% of accident can cause rubbernecking and resulted in traffic congestion on the opposite direction of the accidents. The chance of the secondary crashes is about 10% due to congestion caused from the original crash. Therefore, by successful implementation of portable visual

	injuries prevented can reach $61.4M.	barriers to stop rubbernecking on our freeways and access-limited highways, 3.1 lives (= 313 x 0.1 x 0.1) can be saved, 22.3 (= 1,716 x 0.1 x 0.13) incapacitating injuries and 72.7 (= 6,611 x 0.1 x 0.11) non-incapacitating injuries can be prevented. The total annual saving from lives saved and injuries prevented can reach $61.4M (= $10,100,000 x 3.1 + $818,636 x 22.3 + $163,254 x 72.7), which will be very significant.
○ Other (Explain)	Large additional increase in the benefit/cost ratio for Florida Road Rangers operations; successful and innovative approach and addition to FDOT Traffic Incident Management (TIM) The benefit/cost ratio can be up to 337 to 1	Through successful deployment of portable visual barriers to reduce rubbernecking-related traffic congestion and secondary crashes via Road Rangers, the benefit/cost ratio for Road Rangers operations can increase significantly. In total, about 110 Road Rangers trucks will be used for cost estimation. The cost of a portable visual barrier ranges is $500–$4,000; a cost computation would be $2,500 for a portable visual barrier, with two portable visual barriers for each Road Ranger truck; a rough estimated cost would be $0.55M (= $2,500 x 2 x 110). The estimated benefit in terms of reduction in travel delay in person-hours, truck congestion cost, and fuel consumption, and lives saved and injuries prevented would be $ $606M (= $124M + $61.4M), and the increased benefit/cost ratio could up to 337 to 1.