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Report No. UT-23.18

BEST PRACTICES FOR RESPONDING TO AND EVALUATING FATAL CRASHES

Prepared For:

Utah Department of Transportation
Research & Innovation Division

Final Report
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16. Abstract

Each time a crash results in a fatality, UDOT staff conduct a fatality investigation to identify key characteristics and circumstances that may have contributed to the crash. Each UDOT region bears the responsibility of conducting these investigations, and each does so using their own methods which results in various levels of detail and diversity in the specific data collected. Currently, many states are employing state-of-the-art techniques to streamline their fatality investigations and improve data comparability. In many cases, agencies use a checklist to ensure that all necessary and appropriate data is collected at the scene and that subsequent follow-up information is not overlooked, as often happens after the initial report is submitted. This research examined and summarized national best practices for collecting fatal crash data at the time of the crash to provide UDOT with recommendations and a template which would enable all region offices to standardize data collection procedures. A survey including questions on the topic of fatal crash evaluations was developed and sent out nationwide; 42 responses were received, which represents a majority of state DOTs. The research also conducted several interviews with personnel from each UDOT region who currently oversee fatal crash evaluation procedures. Findings from the survey and region interviews were compiled and compared. These results allowed the research team to develop a list of potential options for an enhanced fatal crash evaluation form which UDOT could utilize in their procedures. A series of recommendations was also developed, including suggestions to improve the evaluation process, standardize procedures and data storage, develop a statewide training program, and others.

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UNIT CONVERSION FACTORS

SI* (MODERN METRIC) CONVERSION FACTORS				
APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. (Adapted from FHWA report template, Revised March 2003)

LIST OF ACRONYMS

AAA	Acquire, Analyze, and Action Model
AASHTOWare	American Association of State Highway and Transportation Officials Software
ALDOT	Alabama Department of Transportation
ARDOT	Arkansas Department of Transportation
DAR	Daily Activity Report
DDOT	District Department of Transportation (District of Columbia)
DelDOT	Delaware Department of Transportation
DOT	Department of Transportation
DI-9	Model Minimum Uniform Crash Criteria Compliant Driver Investigation Form
DPS	Utah Department of Public Safety
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
GDOT	Georgia Department of Transportation
GIS	Geospatial Information Systems
GRAMA	Government Records Access and Management Act
HSIP	Highway Safety Improvement Program
IDOT	Illinois Department of Transportation
IMO	Interstate Management Office
INDOT	Indiana Department of Transportation
KABCO	Injury Severity Classification (K - Fatal to O - No Injury)
LaDOTD	Louisiana Department of Transportation
MAIT	Multidisciplinary Accident Investigation Team
MDOT	Maryland Department of Transportation
MMUCC	Model Minimum Uniform Crash Criteria
MnDOT	Minnesota Department of Transportation
MPD	Metropolitan Police Department
MoDOT	Missouri Department of Transportation
MSP	Maryland State Police
NCDOT	North Carolina Department of Transportation
NDDOT	North Dakota Department of Transportation

NHTSA	National Highway Traffic Safety Administration
OH DOT	Ohio Department of Transportation *(officially uses ODOT)*
OR DOT	Oregon Department of Transportation *(also officially uses ODOT)*
PCD	Personal Crash Data
PennDOT	Pennsylvania Department of Transportation
RSA	Road Safety Assessment
RIDOT	Rhode Island Department of Transportation
TDOT	Tennessee Department of Transportation
TOC	Traffic Operations Center
UDOT	Utah Department of Transportation
VDOT	Virginia Department of Transportation
WisDOT	Wisconsin Department of Transportation
WYLFIWYF	'What-You-Look-For-Is-What-You-Find'

EXECUTIVE SUMMARY

Each time a crash results in a fatality, Utah Department of Transportation (UDOT) staff conduct a fatality investigation to identify key characteristics and circumstances that may have contributed to the crash. Each UDOT region bears the responsibility of conducting these investigations. However, UDOT regions vary greatly in the content and depth of detail provided for fatal crash investigations, and each does so using their own methods. This results in various levels of detail and diversity in the specific data collected. The UDOT Traffic and Safety Division has not historically mandated specifically how these investigations should be conducted, however they do provide guidance and conduct department-wide reviews of each fatal crash. Currently many states are employing state-of-the-art techniques to streamline their fatality investigations and improve data comparability. In many cases, agencies use a checklist to ensure that all necessary and appropriate data is collected at the scene and that subsequent follow-up information is not overlooked, as often happens after the initial report is submitted. This research examined and summarized national best practices for collecting fatal crash data at the time of the crash.

The best methods and practices to gather the desired information on fatal crash evaluation methods were discussed with the UDOT project team. It was decided that surveying the fatal crash evaluation practices of other Departments of Transportation (DOTs) would be the most effective method for learning more about national best practices. As a result, a survey was developed by the research team utilizing Microsoft Teams. This allowed the research team to create a link to the survey for sharing with DOTs. Then, responses from the DOTs were gathered and stored in a centralized manner through the Teams application. Regarding survey structure, questions on the topic of fatal crash evaluations were presented in the survey; primary topics were divided into three main sections, including methods and data handling, on-site investigation processes, and logistics. It was also decided that interviews should be conducted with region personnel at UDOT currently responsible for fatal crash evaluations. This allowed for identification of current practices and existing gaps in UDOT procedure.

Forty-two responses to the survey were received, signifying that a majority of DOTs around the country responded to the survey inquiry. A majority of DOTs indicated that they do

conduct a type of fatality investigation process. Information was gathered from DOTs on this subject through the survey and used to create recommendations for fatality-evaluation best practices. In addition to data gathered from the national survey, the research team conducted virtual interviews with personnel who oversee fatal crash evaluation procedures at each UDOT region. This allowed the research team to compare the current state of practice within UDOT with national practices. It also allowed for the comparison of practices between regions themselves.

The overall findings from the survey and from UDOT region personnel interviews were compiled and analyzed. Findings indicate that while there is significant variety in practices from a national view, particular trends and methods of fatal crash evaluations can be identified which create greater evaluation effectiveness and ensure that good data is collected. Region interviews suggested that opportunities exist for improvement of current UDOT fatal crash evaluation processes and methods, as different regions utilize varying methods and storage of data in their processes. These findings allowed the research team to develop a checklist template for fatal crash evaluations and general recommendations for improvement, which would ensure that the UDOT Traffic and Safety Division gets accurate and appropriate depth on fatal crash data.

Checklist options include gathering more detail on crash location information, crash characteristics (such as demographics, physical and behavioral contributing factors, etc.), roadway type and weather conditions, surface conditions, and other variables. Such items would expand on what information is collected by UDOT personnel currently and provide greater depth of information on crashes. General recommendations include developing standardized data collection and data storage methods, creation of statewide training procedures for UDOT personnel who conduct evaluations, ensuring good working relationships with law enforcement, and designating back-up personnel to fill in when designated individuals are unable to complete evaluations. These recommendations will provide UDOT with a greater opportunity to evaluate and understand characteristics of fatal crashes and to make informed decisions on strategies for mitigation.

1.0 INTRODUCTION

1.1 Problem Statement

Each time a crash results in a fatality, Utah Department of Transportation (UDOT) staff conduct a fatality investigation to identify key characteristics and circumstances that may have contributed to the crash. Each UDOT region bears the responsibility of conducting these investigations, and each does so using their own methods which results in various levels of detail and diversity in the specific data collected. The UDOT Traffic and Safety Division has not historically mandated specifically how these investigations should be conducted, however they do provide guidance and conduct department-wide reviews of each fatal crash.

Currently, many states are employing state-of-the-art techniques to streamline their fatality investigation and improve data comparability. In many cases agencies use a checklist to ensure that all necessary and appropriate data is collected at the scene and that subsequent follow-up information is not overlooked, as often happens after the initial report is submitted. This research will examine and summarize national best practices for collecting fatal crash data at the time of the crash and provide UDOT with recommendations and a template which will enable all region offices to get on the same page with their data collection efforts. This will ensure that the UDOT Traffic and Safety Division obtains accurate and appropriate depth on fatal crash data.

1.2 Objectives

This project will examine existing resources to identify best practices from different state departments of transportation (DOTs) around the United States. Findings from this effort will be compiled, analyzed, and used to provide a checklist of critical data and data collection processes which will provide a path to systemic data collection and analysis for UDOT. The checklist and other resources will be used to create a system that provides clear and consistent data and qualitative information about fatal crashes.

1.3 Scope

This project will utilize coordination with the project team and UDOT’s Traffic and Safety Division to guide project structure and ensure that all objectives are met. A nationwide survey will be developed. This survey will be made available to DOT representatives around the United States. The survey will inquire on common practices related to fatal crash evaluation data collection and analysis seen at other DOTs. Survey data will be compiled, analyzed, and compared to UDOTs current practices. Interviews will be conducted with personnel at each UDOT region who currently conduct fatal crash evaluations. Interview data will be compared with survey data, and findings shall then be used to create a checklist system for UDOT to utilize during fatal crash evaluation.

1.4 Outline of Report

The report is organized into five additional chapters, as follows:

- Chapter 2 provides a brief literature review examining existing research on factors regarding fatal crash evaluations at DOTs, including established resources and suggested practices, specific processes and tools, and potential challenges in evaluation procedures. It also includes a description of the study methods and justifications.
- Chapter 3 presents the data collected in the survey and regional interviews.
- Chapter 4 presents a review of findings from the data collection.
- Chapter 5 provides conclusions based upon the project findings.
- Chapter 6 outlines recommendations and the implementation plan.

2.0 RESEARCH METHODS

2.1 Overview

A thorough literature review was conducted which examined the topics associated with Roadway Fatality Investigation, including established resources, suggested best practices, and challenges. The literature review provided valuable insight into what information pertains to fatality investigation and informed methods utilized by the research team to gain more understanding of fatality evaluations and analysis.

2.2 Literature Review

This section details the literature review performed on Roadway Fatality Investigation as part of the overall project.

2.2.1 Introduction

Immediate investigation of roadway crash fatalities is of utmost importance to understand the causation, attributes, and contributing factors to the fatality. Numerous factors may contribute to a roadway fatality, including human behaviors, possible impairment, time of day, roadway design, etc. There are numerous resources available to state agencies in determining what crash investigation practices should be put in place, ranging from federal resources on investigation procedure and templates for crash reporting forms, to research studies on specific investigation topics or challenges. Establishment of effective practices for investigation is of great value for law enforcement, transit agencies, and other traffic-related entities to understand what may contribute to roadway fatalities, and how to best mitigate fatalities moving forward. It is also important to understand the potential challenges in the investigation process, as faulty investigation and reporting procedures may lead to unreliable data, while training for investigators may not be complete or comprehensive in scope for how to effectively perform investigations (Noland et al., 2017).

State agencies will typically establish their own specific investigation practices, while other sources may provide suggested guidelines or methodologies. In review of existing literature on roadway fatality investigation, many different practices and recommended methods exist. These may be sourced from federal agencies such as the Federal Highway Administration (FHWA), state agencies, municipal governments, or interested private parties. These agencies will often explore existing methodologies and tools in order to lay out suggested guidelines or practices for effective investigation of incidents. This may include a general overview of research methods, on-site practices, tools and technology, and other factors. Other literature exists which details research into specific aspects of investigation processes, such as specific tools, alternative methods, reporting, and so on (Walton et al., 2005 and Williams et al., 2015). Additionally, literature exists which highlights potential challenges in crash fatality investigation, and potential solutions to these challenges (Carson, 2010).

Overall, studies on roadway fatalities can be found which address multiple aspects related to such incidents. This chapter provides a summary of existing literature and resources related to the subject of roadway fatalities. Findings are summarized within established resources and suggested practices, specific tools and investigation processes, and potential challenges to roadway fatality investigations. Awareness and understanding of suggested practices and other related subjects can lead to more effective implementation of road fatality investigations and subsequent mitigation efforts.

2.2.2 Established Resources and Suggested Practices

Established practices for roadway fatality investigation may come from various sources. Generally, each state requires that crashes which involve a certain level of property damage, injury, or death be reported to law enforcement, with a timeline for reporting the incident ranging from immediately to within 30 days of the occurrence. In Utah, for example (as of November 2022), crashes involving property damage in excess of $2,500, injury, or fatality must be reported within 10 days, and all states require the instance of a fatality to be reported (Enjuris, n.d.). When a roadway fatality is reported and identified, at that point, law enforcement and other state officials begin an official investigation into the causes and attributes of the fatality.

The standards for roadway fatality investigation vary in detail, with some basic similarities. Typically, roadway fatality investigation is the process of documenting, diagramming, and determining the basic circumstances of the incident which caused the fatality, while crash reconstruction techniques may be performed afterward to further identify crash dynamics (Dix et al., 2000). Ultimately, state government and law enforcement will typically be responsible for development and oversight of the investigation process. Law enforcement officials will generally be responsible for investigation at the scene of the incident, with medical examiners and other investigators involved in determining cause of death and other factors (Dix et al., 2000). Crash reporting forms will be filled out by law enforcement investigators at the scene, typically containing information on crash location, time, individuals involved, vehicle information, etc. Data from these forms constitutes overall crash data, which are recorded by agencies. Guidelines may stem from the federal government, but each state will adopt their own practices and policy regarding investigation. These policies are not always available to the public. However, several federal resources are available with suggested standards and guidelines.

As stated previously, many sources on roadway fatality investigation are found within the framework of overall traffic incident management practices. One example is found within the FHWA report "Best Practices in Traffic Incident Management," which describes general suggested practices for a plethora of traffic incident types (Carson, 2010). These practices cover a wide range of potential traffic incidents and responses to them. Regarding roadway fatalities, these practices establish parameters for the safe removal of victims while protecting first responders and ensuring that investigation practices can still be effectively carried out. Numerous protocols which relate to crash investigation are also discussed, as are task-specific strategies, involvement of various agencies in the investigation, and implementation of practices. Ultimately, this report suggests that overall standardization of practices while taking local conditions into account is the best way forward with incident management, and by extension, fatality investigation (Carson, 2010).

The National Highway Traffic Safety Administration (NHTSA) has established standards for crash investigation that govern various aspects of performing a crash investigation. The NHTSA Highway Safety Program Guideline contains section number 18: "Accident Investigation and Reporting," which establishes the requirement for each state to have a highway safety program for crash investigation and reporting. This outline requires such programs to set up responsible administration of crash investigation process and reporting, guides reporting of incidents, and determines a set of criteria for investigation that should be met (including identification of physical and behavioral contributing factors to the incident, driver and pedestrian characteristics, location attributes, etc.) (NHTSA, n.d.). The NHTSA also has established Special Crash Investigation standards designed to collect the most basic in-depth crash investigation data. This consists of a combination of basic data standards in conjunction with professional investigation team data. These standards are used to study crashes involving unusual circumstances or for the purpose of establishing outcomes from an engineering perspective. Such standards may be used to improve safety systems, infrastructure, and performance of vehicles (NHTSA, n.d., b)

An essential practice of a fatality or other roadway crash investigation is the collection of data elements on crash reporting forms to develop an accurate crash narrative. The FHWA has established basic safety fundamentals, part of which dictate the data elements, narratives, and basic information that should be captured by law enforcement investigators at crash sites (n.d.). Quality crash data is a necessity to road safety analysis, and it is the most widely used type of safety data for the purpose of understanding what causes roadway crashes and fatalities. Ensuring that effective crash investigation practices are enacted requires essential data elements to be captured at the incident scene. The FHWA lists several general data elements which should be recorded on crash forms in order to construct an accurate narrative (n.d.):

- Date
- Location
- Injury severity or fatality
- Vehicle type
- Characteristics of persons involved
- Associated diagrams detailing the incident

More detailed standards of what common crash elements are essential for recording on crash forms are available from the NHTSA, which has developed a set of recording standards known as the Model Minimum Uniform Crash Criteria (MMUCC) Guideline (NHTSA, 2017). The MMUCC is a set of detailed attribute fields which can be included on crash reports and filled in based on crash investigation, in order to record the essential elements of the crash and persons involved. This includes essential crash data elements (crash location, diagrams, environmental conditions, contributing circumstances, etc.), vehicles involved, persons involved, and roadway data elements. There are also special sections for potential characteristics such as heavy truck/vehicle involvement, hazardous waste involvement, and pedestrian (non-motorist) involvement. Importantly, a subsection exists for details on fatalities as well (NHTSA, 2017).

This subsection on fatalities is particularly notable, as it provides more specific detail on the investigation of fatalities as opposed to other resources where fatalities may not be covered specifically and are merely rolled into overall crash investigation. In essence, the MMUCC guidelines build on the standards suggested by the FHWA by listing out elements of a roadway crash and any associated fatalities which should be recorded along with attributes associated with each element. By ensuring that these items are collected at the scene of a crash, investigators will be able to develop an effective crash narrative and capture essential attributes of what may have contributed to the incident occurring. FHWA and NHTSA standards provide a good example of the resources and procedure suggestions that have been provided from a federal level to decision-makers on the state level regarding roadway crash investigation, and by extension, fatality investigation.

Federal funding programs and initiatives also work to continually improve the investigation process by exploring updates to standards and new investigative techniques. For example, the FHWA Crash Data Collection Expert System Program evaluated the use of expert systems technology to improve accuracy and consistency of police-reported data (Thielman and Griffith, 1999). These endeavors seek to improve data collection methods and could be utilized by law enforcement and agencies in post-crash investigation.

Different states establish their own practices and procedures involving roadway fatality investigations. Generally, these procedures will fall within the framework of overall crash investigation standards and other state plans. For example, the Utah Highway Safety Plan established by the Utah Department of Public Safety (DPS) details presentations on training and standards for crash investigation, and by extension, fatality investigation (Utah DPS, 2021). These plans may be updated yearly, reflecting new methods and techniques in order to acknowledge advances in experience and technology. Such plans may also draw from guidelines set by federal agencies governing investigation procedure; the Utah plan acknowledges the

NHTSA Safety Program Guidelines as standards adhered to during investigations (Utah DPS, 2021).

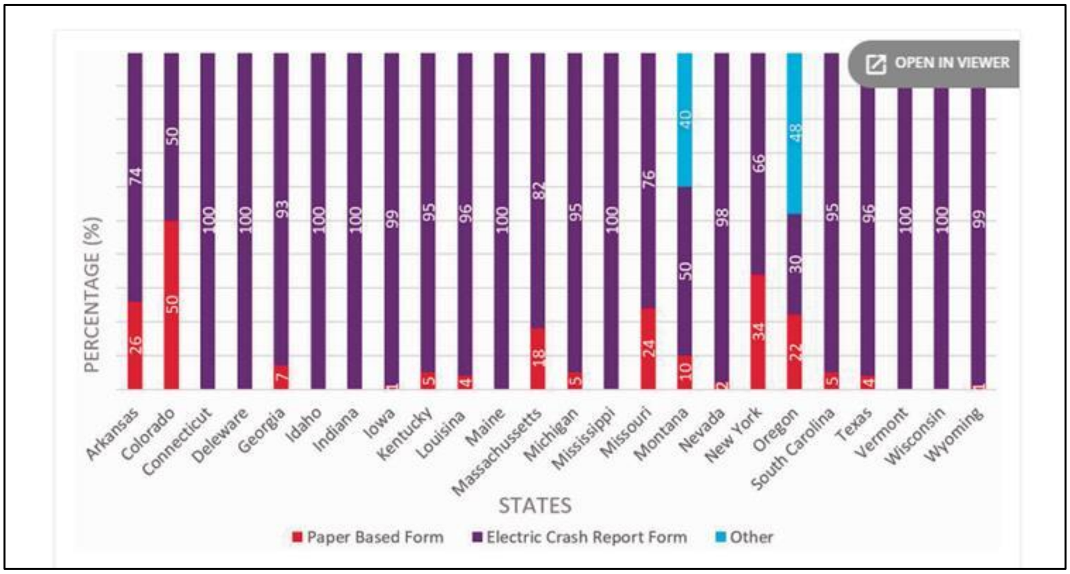

Figure 2.1 Proportions of Crash Report Forms by Paper-Based, Electronic, or Other Methods, by State (Iqbal et al., 2020)

Each state requires law enforcement investigators to use an approved crash report form when investigating a crash scene. These forms are the source of crash investigation data and are essential to effectively documenting crash details, including fatalities and other information. The actual structure and format of these forms varies from state to state. In some cases, the form may be filled out and collected differently; Figure 1 above shows that many states allow the use of both paper- and electronic-based forms, with varying percentages for each (along with other formats). The exact content of the forms may also vary depending on the state, though all forms will collect basic information suggested by resources such as the MMUCC (e.g., date, location, injury/fatality, vehicle type, etc.).

Other resources for roadway fatality and crash investigation exist which have been developed outside of the federal or state sphere. Numerous private organizations exist which provide resources and suggested practices to governing agencies on investigation methodology. One example is the “Technical Traffic Investigators Handbook,” which provides detailed reference on investigation procedures, speed analysis, photography, measurements, and other topics related to crash investigation and reporting (Rivers, 1997).

The handbook “Evidence in Traffic Crash Investigation and Reconstruction” develops similar ideas even further, providing advanced detail on crash reconstruction and highlighting the importance of injury examination, position of passengers within vehicles, impact to non-motorists, etc. This handbook also expands on the contribution of various environmental factors to the crash and ensures these factors are covered in the investigation process. This includes conduction of speed analysis and vehicle examinations, identification of roadway obstructions or defects, accounting for human error, human biology factors, and much more (Rivers, 2006).

The handbook “Investigation of Road Traffic Fatalities: An Atlas” details investigation procedures for first responders and medical examiners to determine extent of injuries and cause of death in roadway fatalities, along with general crash contributors (Dix et al., 2000). Such handbooks are valuable to the development of roadway fatality investigation practices by expanding the level of detail within investigation practices over standards from federal sources. These handbooks reveal a high level of information on both the practices required to perform an effective investigation and the contributing factors that must be considered. This information provides increased value to the development of an investigation, providing effective suggestions and analysis beyond the marking of a checkbox on reporting forms. Where federal standards and suggested guidelines provide the ‘what’ to look for during an investigation, technical handbooks and other resources from outside the government sphere may assist by providing the ‘why’ certain elements are important during an investigation.

Law enforcement officers and other individuals have unique duties as investigators at a crash scene, and in most cases, they are the first investigators to be present at the incident (Codd, 2014). The data which officers collect is ultimately the data referenced as crash data and used in numerous traffic safety initiatives. As a result, law enforcement agencies must ensure that officers are trained and competent in the process of conducting a traffic crash investigation, particularly when fatalities are involved. Significant resources exist for law enforcement agencies to provide proper training to officers and officials. Some resources suggest that law enforcement agencies create a specific traffic crash investigation unit which complements normal patrol units with specialized investigative methods and procedures at the scene of traffic crashes (Theis, 2016). Through such action, law enforcement officers and investigators can ensure that their procedures and data collection processes are effective and ensure that a proper investigation can be performed on any crash site or roadway fatality incident, regardless of challenges or varying circumstances.

A fundamental part of fatality and crash investigation is ultimately using the data collected during the investigation to create reforms, improvements, and mitigation techniques, in order to prevent further incidents from occurring. Challenges may be faced in this process, however; Shuey and Myers (2021) write that the potential from investigation findings may not be fully realized due to a lack of effective connection and communication between the investigation process and initiatives to create reforms and improvements. In order to overcome these issues, a more streamlined framework is suggested, drawing from the example of the AAA model ("Acquire, Analyze, and Action") (Shuey and Myers, 2021). Crash and fatality data acquired from the field should be analyzed effectively and thoroughly, with action following based directly on the analysis performed. Simplicity is the key; involvement of other factors or procedures that do not directly contribute to the eventual action of making improvements should not hold up the data collection and analysis process. This model ensures that road safety improvements are based on identified root causes both locally and at larger scales. This system can also be used to simplify the training of investigators and ensure that investigation procedures are carried out directly and efficiently.

2.2.3 Specific Processes and Tools

A number of different processes and tools have been created for the investigation of roadway crashes and fatalities, with subsequent literature detailing their development and use published. These various processes have created more effective procedures for the investigation of roadway fatalities which can assist in identifying causes that previously may have gone undetected.

Traditionally, data is collected at a crash scene using the coordinate method procedure. This procedure involves using a tape measure or other measuring tool to document distances and other aspects at the crash scene. Electronic/laser measuring devices may also be used for this process (Walton et al., 2005). Law enforcement and other investigators may be exposed to dangerous conditions at incident scenes using such methods, and it is also possible to unintendedly neglect certain crash contributors when using hand tools to capture details of a crash scene.

The FHWA has detailed the development and experience of crash investigation and reconstruction technology, which has introduced new types of equipment and innovation to the investigation process (Williams et al., 2015). Such technology allows for crash scene investigators to effectively recreate the crash scene and contributing factors in the aftermath of the incident. This re-creation then allows investigators to determine conditions that may have led to the crash. Different technologies used for investigation have varying levels of safety and maintenance requirements for operators. The different technology types include mechanical measurement tools, photogrammetry, LiDAR systems, electronic/reflectorless/semi-robotic/robotic total stations, GPS, imaging stations, total station hybrids, 3-D laser scanning, and unmanned aerial devices. These technologies range significantly in cost and time of use.

Williams, et al. (2015) note that each tool has distinct advantages and possible determinants, and agencies choosing to utilize this technology must test and determine what type is best based on their own requirements and specific needs. These tools may be used for both on-scene investigation by law enforcement, and post-crash investigation and reconstruction by other designated investigators. Traffic crash reconstruction is a more extensive process than many aspects of basic investigation; where investigation documents the facts of the incident for purposes of identification, data collection, and determining cause of death in case of fatality, reconstruction is a detailed process which applies retrospective analysis and traffic engineering to clarify crash dynamics and sequence of events (Dix et al., 2000).

Issues in ensuring that law enforcement investigators at the scene of a crash collect data that will be accurate and usable for analysis purposes has led to exploration of different tools and systems that will gather data more accurately. There may be some differences in how law enforcement investigators approach investigation, as compared to post-crash investigators from a DOT or other agency. One method to improve data collection on-site has been the involvement of computer technology and electronic forms to gather data, as opposed to traditional paper forms. The FHWA has established programs investigating the use of 'expert systems' where pen-based computers are used by police investigators in the aftermath of a crash to record and store crash data, including narratives and crash characteristics (Thielman and Griffith, 1999). Electronic forms and the use of digital technology to record crash data is becoming increasingly common. As can be seen in Figure 1 displayed earlier in this document, some US states have completely replaced paper documentation of crash characteristics with e-forms (Iqbal et al., 2020). The use of electronic forms may provide advantages to investigators such as ease of use, and more uniform and usable data entry.

Advances in technology and equipment used by crash scene investigators provide many new opportunities to collect more accurate data on roadway fatalities. Tools such as total stations and survey equipment have been used to document crash sites for investigation purposes, with associated training given to users (Arnold, 2007). The total station method uses equipment to measure distances and angles around the crash site, which are then stored and processed to create a visual diagram of the crash scene (Walton et al., 2005). GPS technology may be used to document the crash site as well; one person can use a GPS receiver to document measurements and other attributes of the crash scene (Walton et al., 2005). Crash investigation procedures utilizing such equipment for measurements offer significant advantages over traditional measuring methods. Equipment such as total stations or GPS can pinpoint measurements much more accurately than taking measurements by hand, often to within an inch of actual distance (Walton et al., 2005).

These tools may also greatly expand the ability of investigators to take measurements at the scene and increase efficiency; one study found that the use of a total station by police investigators allowed for 70% more measurements to be taken per hour, while only requiring 46% of the time needed to take the same measurements and provide more accurate data compared to traditional methods (Jacobson et al., 1992). While these methods and procedures provide much more accurate measurements and data from the crash scene, the equipment is expensive and requires advanced training to operate correctly (Walton et al., 2005).

The use of photogrammetry technologies for fatality investigation has been explored for use by law enforcement. This technology involves taking pictures of a crash scene using a series of markers, in order to develop a three-dimensional representation of a crash (Walton et al., 2005). The 3-D model is then used to make measurements and other observations. Photogrammetry provides the benefit of reducing the amount of time required at the crash site and gives investigators the ability to quickly capture images of the incident needed for analysis, as opposed to more hands-on methods in the field that may expose investigators to roadway hazards or cause other issues (Arnold, 2007).

Agencies and law enforcement investigating crashes and fatalities may also find benefit in the reduced costs associated with photogrammetry relative to equipment such as a total station, and photogrammetry may also require less training (Walton et al., 2005). However, the analysis of photographs captured will require a longer time for data analysis procedures away from the scene, leading to a trade-off between time spent in the field investigation versus subsequent analysis. Investigators using photogrammetry either as a main tool or as a supplement to other investigation tools will benefit from the more rapid collection process and easier use of photogrammetry tools (Arnold, 2007).

Increases in technology utilizing geospatial information systems (GIS) and geocoded reporting have provided new opportunities to increase quality in the accuracy of crash location data. Crash location data is of significant importance to crash analysis, as without a spatial context for a crash it is difficult to identify potential contributing factors (Iqbal et al., 2020). Ensuring that investigating officers initially at the site of the crash can record the exact location of the incident provides a higher quality of data for investigators to use. A particular method to ensure that location accuracy is preserved during the investigation process is to implement geospatial mapping software within the reporting forms officers utilize at a crash site. This technology allows officers to pinpoint the exact location of a crash on a GPS-enabled map connected to the reporting form. In this way, investigators can accurately note the location of a crash to the correct position on the street. Investigators can even note the location of the crash without having to stand directly at the crash site, as with a single GPS receiver (Iqbal et al., 2020).

Within the process of investigating traffic fatalities from roadway crashes, growing advances in scientific procedures and forensic study offer increased capability for investigation and crash reconstruction. Taki et al. (2019) details the experience of using DNA analysis of traffic fatality victims to better understand certain characteristics of roadway crashes. This study particularly found that the use of DNA analysis often provided breakthroughs in properly excluding or including contributing factors to an accident. In one case, DNA analysis of hair samples from a crash ruled that a dog suspected of being involved in the crash was in fact, not involved, allowing for exclusion of that possibility. The use of DNA analysis was also successful in identifying perpetrators of hit-and-run pedestrian fatalities, where DNA from the victim was matched with DNA samples left on the suspected vehicle (Taki et al., 2019). The increasingly rapid availability of DNA testing results in effective and accurate identification of individuals involved in roadway fatalities and in the identification of contributing factors to such incidents.

2.2.4 Potential Challenges in Roadway Fatality Investigation

Numerous challenges exist in roadway fatality investigation and may potentially inhibit the investigation process. Several past studies have been performed with the goal of identifying common challenges to fatality investigation. In a similar vein to the studies discussed previously, many of these studies do not solely focus on issues of fatality investigation but look at crash investigation holistically.

The FHWA has identified numerous challenges that face investigators (Carson, 2010). Such challenges may include:

- Confusion over authority and roles among response and investigation personnel
- On-scene maneuverability issues
- Responder safety
- Secondary incidents stemming from the crash
- Excessive delay of traffic and associated costs
- Inaccurate incident reports
- Dispatcher overload
- Slow detection and response in rural areas.

Other potential problems include crashes going unreported, and long lengths of time to upload recorded crash information to road safety databases (FHWA, n.d.). These issues and others may impact the ability of investigators to identify important information related to roadway crashes, and by extension, roadway fatalities. The FHWA (Carson, 2010) suggests that such challenges may be overcome through efficient administration and chain of command among personnel, use of technologies for on-site efficiency, and effective traffic management and control around the crash area. Implementation of such practices is essential for investigators to thoroughly review incidents and capture the contributing factors to a roadway fatality, while preventing excessive negative impacts to the investigators and surrounding traffic.

Challenges that face traffic fatality investigation may bear similarities to general investigation of crashes both within and outside the transportation sphere. Roed-Larsen and Stoop (2012) identify five general areas within the investigation process that may pose challenges to investigators working across various crash types. These are independence, scope, methodology, training, and competence. Each area may possibly present a challenge to the process. Investigational procedure should be independent in view but may be hampered by dependence on requirements from existing organizational structure. Scope of investigation may pose a challenge when the investigation 'checklist' does not take outside factors into account. Standardized and singular methodologies may prevent more advanced analysis from identifying incident characteristics, and flaws in training and competence of investigators or their process may naturally limit investigation effectiveness. The study authors suggest that these general issues will be common across investigations in general, and therefore could be expected in traffic fatality investigation.

Traffic investigators could understandably encounter issues within investigation methodologies and training of individuals, and courts of law will often invalidate certain crash findings if training of investigators is found to be lacking (Nguyen, 2010). A range of methods should be utilized during an investigation due to a complex chain of events or multiple factors that may influence a crash, while training and competence of investigators must be kept up to a high standard, perhaps involving training from an academic level in addition to in-house training (Roed-Larsen and Stoop, 2012).

During investigation of roadway fatalities, it is possible for investigation structure and procedure to unintentionally cause investigators to 'look for' certain possible causes and contributors to a crash, even when such factors may not have played the sole major role in the incident. This may cause other contributors to be overlooked by the investigation. Lundberg et al. (2009) detailed this issue, noting that underlying models common in investigation handbooks and training procedures may cause the issues of looking for specific crash attributes instead of approaching causation holistically; essentially, 'what-you-look-for-is-what-you-find' (WYLFIWYF). This author approached incident investigations generally, however, the WYLFIWYF issue could easily be apparent within roadway fatality and crash investigation. Investigators may identify, for example, that a pedestrian fatality was under the influence of alcohol, and this is labeled as the primary cause, while potential issues such as lack of street lighting or designated crossing areas are not identified (Burbidge et al., 2022).

Lundberg et al. (2009) note that underlying models, standards, and procedure used to guide investigations often focus on events and factors leading up to events, which may cause preoccupation with parts of crashes, rather than taking stock of the whole situation. To counter this, the use of a systemic model for investigation procedure is suggested, which moves from an overall analysis of the various factors to effectively capture the scope of the situation and identify overall causes. As discussed previously regarding handbooks, considering all possible factors that contribute to a crash and subsequent fatality while using a higher level of detail in investigation procedure will also help to prevent WYLFIWYF phenomena. This may include consideration of human errors, human behaviors and biology, infrastructure obstructions or damage, environmental conditions, and detailed study of involved vehicles in addition to the contributing factors first identified in the investigation (Rivers, 2006).

WYLFIWYF and other bias issues present in investigation procedure may also occur within the framework of interviews performed during the investigation. Retrospective interviews with witnesses to an incident will likely be required during an investigation to gather accounts of what occurred. Sheehy (2007) has found that the demands for accuracy, reliability, and consistency in reporting may promote bias in witness accounts, and the theoretical retrospective technique used in interviews may contribute to casually linking together variables present in an incident. A correlational association of variables gathered from interviews would be more effective to prevent casual inaccurate conclusions derived from interviews with witnesses, preventing biases and WYLFIWYF phenomena from occurring.

Another issue that may arise during the investigation of a roadway fatality is the inaccurate classification of the fatality. Faulty or inconsistent classification of fatalities can create unreliable data, which subsequently may hinder mitigation efforts. Classification of certain fatalities may be more unreliable than others. One study performed in New Jersey found that one-fifth of recorded pedestrian roadway fatalities in the state should not have been recorded as pedestrian fatalities, while NHTSA definition of ‘pedestrian’ in a traffic context was faulty and a hinderance to safety analysis (Noland et al., 2017). Faulty classification of fatality types will cause discrepancies within traffic fatality data recorded during investigations. Traffic data is important to public health and safety, as it is used to make decisions on where to invest resources to reduce deaths and injuries due to traffic-related issues. Faulty data may lead to resources being invested in locations where they are not as highly needed while other issues go unaltered. Improved collection methods and ensuring that classification of fatalities is as accurate as possible is important to ensure that data remains accurate and usable (Noland et al., 2017).

Further building on the issue of classification of roadway fatalities is the occurrence of suicides within roadway fatalities. There is often an underestimation of suicide within roadway traffic due to shortages of information allowing for effective judgement of the fatality type (Andersson and Sokolowski, 2012). This issue is one example of classification and reporting issues that may arise during the investigation process of a roadway fatality. Issues of classification may affect the data collected on fatalities and over- or underestimate certain types of fatalities, which can complicate attempted mitigation efforts and understanding of roadway fatality trends. Confusion on classification of fatalities may also lead to ‘undetermined’ fatalities being listed.

Andersson and Sokolowksi (2012) detail an effort to introduce new classification of roadway fatalities separate from suicides. This was performed by introducing new criteria defining differences between fatality by suicide from other roadway fatalities and adding new psychosocial reviews to investigations of suspected roadway suicides. These improvements led to an increase in the number of fatal crashes classified as suicides, improved differentiation between fatalities and suicides, and a reduction in the number of ‘undetermined’ fatalities reported. This study determined that a standardized procedure and effective classification method for roadway suicides involving psychosocial study and on-site recognition is a great benefit to efforts to mitigate and intervene in suicide.

While perhaps not thought of to the degree of other challenges discussed previously, the possible mental toll that occurs for investigators and other responders at the scene of a roadway fatality can pose a serious challenge to individuals responsible for investigative procedures. The effect of dealing with death, particularly in the immediate aftermath of a crash which caused a fatality, can have a significant psychological effect on a person. As a result, post-traumatic stress disorder and other lingering psychological issues are a challenge for roadway fatality and crash investigators (Codd, 2014). Outside of the mental impact, investigators affected by such mental strain may have issues in carrying out investigative duties and enacting procedure. As such, agencies need to be prepared to effectively deal with such issues in the aftermath of an incident. Agencies should develop resources and plans to help investigators handle mental issues and prepare for future events. Beforehand, agency training should also address this issue, and help investigators and other personnel be as prepared as possible for potential mental impacts related to the scene of a crash.

2.2.5 Literature Review Conclusion

Investigation of roadway fatalities and the crashes associated with them is a complex and often arduous process. Investigators will face several challenges while performing an investigation. Effective investigation methods and standards are required in order for crash site investigators to accurately and fully analyze and identify contributing factors and causation of the crash. Each state agency will establish its own methods and procedures for doing so. Many federal and non-federal resources exist which may assist agencies in establishing effective standards. Federal agencies such as the FHWA and NHTSA have developed and established standards which determine what investigation procedures should look for and what details should be gathered.

In addition to federal resources, private firms and interested parties have created technical handbooks and manuals also describing crash investigation details and suggested practices.

These resources often go even further in their detail, describing theoretical principles and top-down thinking that should be applied to investigations beyond identifying specific crash characteristics. Such items are important to identifying more abstract causations of crashes and fatalities, while encouraging more detailed approaches to investigation. This may include environmental issues (such as traffic flow and danger presented by other vehicles), problems in command structure and training of investigators, phenomena such as ‘what you look for is what you find,’ or simply attributing crash causation partially or wholly to the wrong factors. Proper establishment of effective investigation practices and adherence to those procedures will ensure that such issues are avoided and accurate data on roadway fatalities can be recorded**.**

2.3 Summary

A thorough literature search was conducted which examined the topics associated with Roadway Fatality Investigation, including established resources, suggested best practices, and challenges. The literature review provided insight on these characteristics of fatal crash evaluations at different DOTs. There is noted variety in methods from state to state which depend on factors determined most appropriate by the acting DOT; differences may be seen in how data is collected, who performs data collection, how it is stored, etc. Federal agencies such as the FHWA and NHTSA have developed and established standards guiding fatal crash evaluations, while private firms and interested parties have created technical handbooks and manuals also describing crash investigation details and suggested practices. These resources provide a high level of detail to DOTs on how to best perform fatal crash evaluations and can inform agency decisions.

3.0 DATA COLLECTION

3.1 Overview

To effectively analyze best practices related to fatality evaluation throughout the US, a survey was developed and sent out to various DOT representatives in more than 40 states. Responses to this survey were used to develop recommendations and suggested practices to UDOT on fatality evaluation procedures. Additionally, interviews were conducted with the regional personnel in each UDOT region responsible for fatality evaluations, as described in section 4.0.

3.2 DOT Practices Survey

After discussion with representatives of UDOT, it was decided that the use of a survey for data collection relating to the fatal crash evaluation practices of other DOTs would be the most effective method for this study. As a result, a survey was developed by the research team utilizing Microsoft Teams. This allowed the research team to create a link to the survey and share it with DOTs. Then, responses from the DOTs were gathered and stored in a centralized manner through the Teams application. Regarding survey structure, questions on the topic of and fatal crash evaluations were presented in the survey; primary topics were divided into three main sections, including methods and data handling, on-site investigation processes, and logistics. Questions were either multiple choice or short answer in structure based upon the desired information. This organization and variety in question type allowed the survey team to collect information on all aspects of a fatal crash investigation procedure at a DOT.

The survey contained a branching function, where based on answers to certain questions, the following questions would be different. For example, for Question 2 in the survey inquiring as to what type of evaluation the DOT performs, survey respondents would be presented Questions 3 through 7, or 8 through 18. The first set was presented to DOTs which do not have an on-site investigation process, where the second set was presented to those who do. This branching allowed for more specific questions to be asked based on investigation type, while keeping the survey questions topical to each DOT who responded. The remainder of the questions in the survey were presented to each DOT.

In total, 42 responses to the survey were received, meaning that a majority of DOTs around the US responded to the survey inquiry (two DOTs had two different individuals submit responses, in each case both responses were included in analysis to acknowledge any differing details between them). As seen in the responses below, many of the DOTs indicated that they do conduct a type of fatality investigation process. Information was gathered from DOTs on this subject through the survey and used to create recommendations for fatality best practices.

In the subsections below, the questions to the survey are included. A summary of answers received from each DOT is then provided. Where respondents were given a selection of multiple-choice answers to choose from, a chart displaying results is included. Where questions specifically requested DOTs to include a summary of their fatality evaluation procedures, or other more detailed responses, the full answers from each DOT have been included for reference. Note that responses from DOTs directly included in this report have been left unedited for any spelling or grammatical errors, in order to preserve statements from DOT personnel in full.

3.2.1 Introductory Questions

1. *Does your DOT have a fatal crash investigation/evaluation process in addition to and not associated with the standard law enforcement investigation?*
    - *Yes*
    - *No*

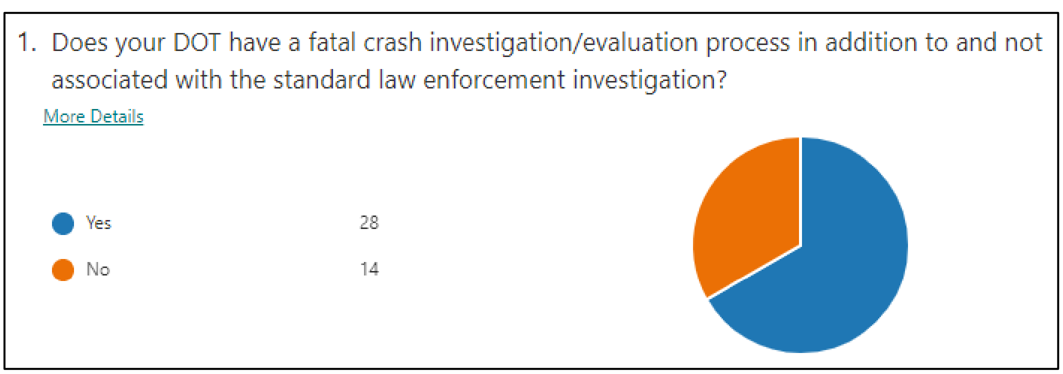

Figure 3.1 Question 1 Compiled Responses

Summary: Currently, 28 DOTs have a fatality evaluation process while 14 do not. As a result, it can be considered that most DOTs have some process in place to conduct a fatality investigation separate from investigations conducted by law enforcement agencies.

2. *What type of fatal crash evaluation does your DOT perform?*
   - *Report of review and analysis*
   - *On-site investigation*
   - *Both*
   - *Other________________*

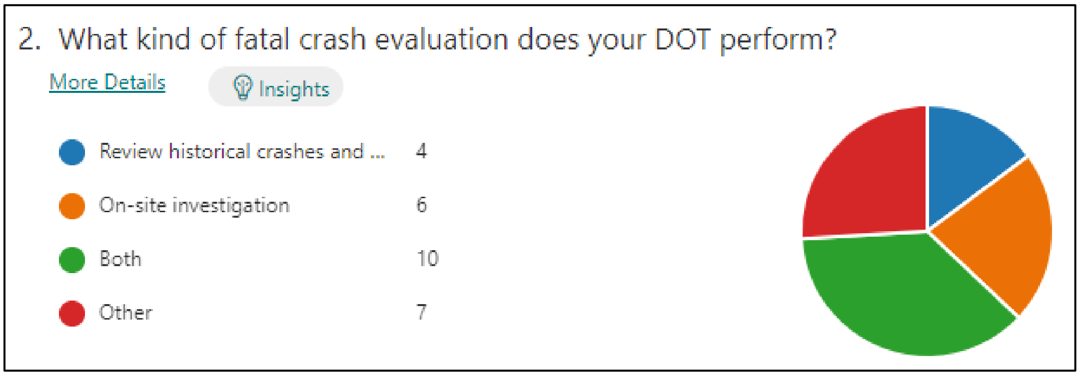

Figure 3.2 Question 2 Compiled Responses

Summary: Six DOTs indicate they conduct an on-site evaluation, four indicate that they review historical crash data and create a report of analysis, and 10 indicate that both evaluation types are performed.

It can be considered that most DOTs will likely conduct an on-site investigation and create a report of the results. A minority of DOTs conduct just one of these processes but not the other, while other DOTs have additional elements to their investigation process that make those processes unique (see below).

Seven responses indicated ‘other.’ These ‘other’ processes varied widely between each DOT. However, some of these responses could be considered to fall within the other bulleted options above. One DOT noted that the DMV and a separate Crash Analysis/Reporting Unit had fatal review teams which both analyzed the crash event and have separate processes (this could be considered to fall under ‘on-site investigation,’ but it was not disclosed if these teams also create reports). Three of the ‘other’ responses could be considered forms of ‘report of review and analyses,’ where DOTs conduct off-site reviews on a weekly basis or on trends present in crashes instead of individual crashes, but no on-site investigation is conducted.

For ‘other’ responses that were unique, one DOT indicated that their separate districts had different crash investigation procedures, and the processes would vary based on what district conducts the analysis. The Wisconsin Department of Transportation (WisDOT) had the most detailed ‘other’ response. The department holds quarterly meetings with each county in Wisconsin to review fatal/serious injury crashes. Meanwhile, the department performs a crash reconstruction of most fatal crashes, fills out reports, and identifies patterns and potential countermeasures based on analysis.

3.2.2 Questions on Methods and Data Handling

3. *What triggers a DOT evaluation of a fatal crash?*

Summary: Five responses were given in total. There is a wide variety of what triggers a DOT evaluation of a fatal crash; for example, one DOT reviews any crash which occurred on a state-maintained roadway. In another example, the Tennessee Department of Transportation (TDOT) indicated that evaluations are triggered by a daily request for investigation into fatal crashes, which stems from the TDOT Director. TDOT uses AASHTOWare safety software’s screening capability to identify fatal crash locations; these investigations determine qualification for Highway Safety Improvement Program (HSIP)-funded safety projects. In another example, the Arkansas Department of Transportation (ARDOT) conducts investigations when a trend is occurring in a specific area, or a crash receives high media attention, while another also conducts actions based on public complaints or on the initiative of a District Traffic Safety Branch. MnDOT indicated their ‘Toward Zero Death’ coalitions conduct reviews to understand what leads to crashes. Overall, the factors which trigger a review vary from state to state and may take a number of different elements into account; these are often unique to each DOT.

4. *Please provide a short summary of your process for fatal crash evaluation.*

Summary: The following descriptions were taken directly from survey responses from DOT representatives. These responses are from agencies which largely conduct off-site reviews of fatal crashes. As can be seen from the responses below, there is a fair amount of variation in how crashes are reviewed. Some DOTs review each individual crash, while others approach fatal crash investigation based on trends or on several crashes together. Despite variations in each process, generally the purpose of off-site reviews is to identify what factors may have contributed to the fatal crash. Those factors are then used to generate safety solutions designed to reduce the potential for future fatal crashes. This may involve looking at crash statistics, investigation of elements of each crash, or both.

- Unknown DOT: A DOT Executive Committee receives preliminary information about the fatal crash. The DOT District Engineer may reach out to the investigating law enforcement agency for more information to share. If any one of the Executive Committee members deems an on-site review necessary, an on-site team is deployed for review and a report is generated with safety solutions for implementation. The on-site review is to look for systemic solutions to road safety based on the crash factors involved.
- Unknown DOT: Anonymous, evaluate the crash history of the location looking for correctable patterns. Look into prior investigations in the same area. Review site conditions for possible roadway deficiencies which can be corrected.
- TDOT: When a location is identified they prepare a crash summary and crash listing as well as calculate a severe crash rate. The severe crash rate is compared to the statewide average severe crash rate for that type of facility.
- ARDOT: We do not chase every fatal crash as the fact that a crash is fatal as opposed to another severity is random. However, when we do initiate an investigation because of the reasons given earlier, we do a summary of crash analysis on the area to see if the area has a high proportion of fatal and serious injury (KA) crashes. If it does, we first forward it to our Traffic Investigators to do a site visit and look for low-cost safety improvements. If those can't be done or do not work, we then do a more in-depth study and look for counter measures and let a project to install more counter measures.

- MnDOT: Typically, ad hoc and based on availability of staff and urgency that the crash is creating.

5. *Does the DOT have access to/use any additional information that law enforcement officers may collect for a fatal crash?*
    - *Yes*
    - *No*
    - *Not Applicable*

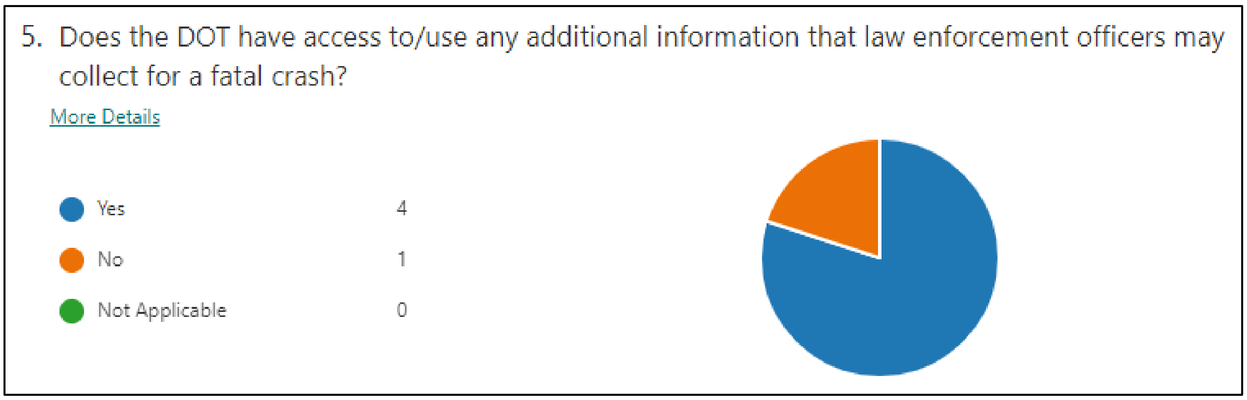

Figure 3.3 Question 5 Compiled Responses

Summary: Four DOTs do have access to additional information while one does not, indicating that most DOTs will utilize information outside of what is used by law enforcement during fatality investigation processes.

6. *Are you willing to share any forms or support documents used in the DOT fatal crash evaluation process? If yes, please provide us with your email address. A member of the study team will contact you.*

Summary: One DOT provided an email address. TDOT indicated that the forms they use can be accessed from the TN Department of Safety. Some DOTs indicated that they do not have access to these forms as they are stored and managed by different departments or personnel at the DOT.

7. *How many years of historical crash data is reviewed as a part of fatal crash evaluations?*

Summary: DOTs indicated that 3 to 5 years is the general range of historical data that is reviewed as a part of crash evaluations. The Minnesota Department of Transportation (MnDOT) noted that review of historical data and the timeline of data that is reviewed is ad hoc depending on the needs of each case.

3.2.3 On-Site Fatal Crash Evaluation

8. *What triggers an on-site fatal crash evaluation?*

Summary: 23 responses were given in total to this question. DOTs commonly indicated that they investigated all fatal crashes in the state on roadways, or at least investigated all crashes that met some additional criteria (this commonly consisted of DOTs investigating all fatal crashes on state-owned roads and highways, but not other roadways). Such responses made up a majority of responses to the question, therefore it can be assumed that most DOTs will investigate all fatal roadway crashes, or at least crashes occurring on state-owned roads.

For DOTs whose responses varied from the above responses, what triggers an evaluation varies from state to state; several DOTs indicated that investigations were enacted by requests from an outside source or other DOT group, such as a fatal crash review team, legal department, or from public officials. Some DOTs indicated that they enacted a fatal crash review whenever law enforcement did, so they essentially followed the actions of law enforcement. These examples indicate that there is some variability in what triggers a crash investigation based on the parameters and characteristics of a particular DOT.

9. *Please provide a short summary of your process for fatal crash evaluation.*

Summary: The following descriptions were taken directly from survey responses. These summaries contain information on the fatal crash evaluations for each agency. These responses are from agencies which indicated that on-site reviews of fatal crashes are typically utilized in fatal crash investigations. As can be seen in the descriptions below, there is again a great amount of variability in exactly how DOTs will approach fatal crash investigations. The process may be divided into two schools of thought.

1. DOTs respond directly to a fatal crash and a team from the DOT is sent out for investigation.
2. DOTs receive a request from another department for a fatal crash investigation or receive information on fatal crashes that occurred recently from law enforcement; the DOT then conducts their investigations based on this information.

Collaboration with law enforcement or other safety departments on these investigations was commonly referred to in responses, and information-sharing between departments and law enforcement may contribute to more effective investigation. Many DOTs (but not all) compile an output deliverable report or other document detailing crash information and findings, which is then sent to the DOT safety department or legal department. Historical reviews of fatal crashes at the site of current crashes may be utilized within the investigation.

- <u>Alabama Department of Transportation (ALDOT):</u> Locations of concern are identified either due to a particular incident or a pattern of incidents. Crash history at the location is reviewed including mapping of crashes and a review of individual crash reports to gain an understanding of what is occurring at the location. A site review is then conducted involving a team that includes agency personnel, local agencies if appropriate, law enforcement and emergency services are invited.
- <u>District Department of Transportation (DDOT):</u> Within 24 hours of the fatal crash, DDOT (Washington, D.C.) staff joins Metropolitan Police Department (MPD) staff at the scene to discuss the dynamics of the crash. The DOT staff member then briefs the fatal review group on a weekly call. Attendees of this meeting span the full agency at DDOT involved in safety, including planning, traffic engineering (safety, signals, and construction), bike/ped, community engagement, and communications. During this call both improvements associated with the fatality, and general opportunities to improve safety at the location are discussed. These improvements are then tasked out to the appropriate parties for action. All these actions are tracked in a fatal review memo, which is completed for each fatality.
- <u>Delaware Department of Transportation (DelDOT) (1):</u> During the crash investigation, staff assess various conditions and documents their findings. Based on the findings, they

initiate a study/evaluation. In other cases, external requests may be received regarding the crash which initiates a study/evaluation. Crash investigation response times vary based on each case.

- DelDOT (2): A safety officer is dispatched for every fatal crash that occurs in Delaware. They are responsible for securing the scene with respect to traffic control and detours, then performing a rudimentary review of traffic control devices, pavement condition, lighting, etc. They then enter this information on a form which is then sent to a Traffic Safety Engineer (among others) to determine if further action is to be taken.
- Georgia Department of Transportation (GDOT): Has a data collection form that is shared with the Fatal Analysis Reporting System (FARS) team. Upon notification of a fatal crash they send a GDOT district investigator to the site to review the crash and record conditions, also note any possible contributing factors.
- Illinois Department of Transportation (IDOT): Crash Investigator is notified of a fatal crash and they review the crash report for missing or inaccurate information. They contact the appropriate law enforcement agency and have them correct the report and resubmit as a supplemental report. The Investigator also uses information from a crash reconstruction report and may fill in the information themselves.
- Indiana Department of Transportation (INDOT): A field investigator or staff engineer in the district traffic office will normally review the fatal crash report, look at the road segment in Google Maps, the videolog, or on-site, and search for other crashes at the location. The results may be used for a work order to add signs, markings, or other traffic control devices at the location, or in the scope documents of a potential HSIP project at the location. Fatal crash reviews typically occur at a monthly interval, where the fatal crashes on the state highway system in the prior month for each district are reviewed. As a result, it can be between 10 and 50 days after a fatal crash before it is reviewed by the district traffic office.
- Louisiana Department of Transportation and Development (LaDOTD): Typically, the district office will go out to the field and make observations. Depending on the location, crash data may be pulled in conjunction with the site visit.
- Maryland Department of Transportation (MDOT): The Maryland State Police (MSP) provide automated daily reports that capture fatal crashes that occur around the state. The

regional district traffic offices investigate the crash which includes a site visit to document the condition of the traffic control devices and geometric conditions of the roadway. The condition of the infrastructure-related items is noted. Once the final crash report is obtained from MSP, an additional review of the site may be warranted. Depending on the circumstances of the crash; historical crash data may be pulled for the location and if any infrastructure related items are not in good condition or suspected to have contributed to the crash, actions are taken to correct either via maintenance or capital projects.

- <u>Missouri Department of Transportation (MoDOT) (1):</u> It differs by district. Every district and the central office are conducting fatal crash data analysis. However, only some districts review the circumstances of every individual fatal crash. For those that do, this typically consists of visiting the site, reviewing prior crash data, and possibly conducting a road safety assessment (RSA).
- <u>MoDOT (2):</u> The legal department makes a request for an evaluation to be done then a member of the traffic staff goes out and does the review. They gather strictly the facts of the crash and send that in a report to the legal department.
- <u>North Carolina Department of Transportation (NCDOT) (1):</u> NCDOT has scripts that they run every other day to identify new fatal crashes that come into the crash database. They prepare an email that goes out every Monday, Wednesday, and Friday to inform the field workers and executive management of new fatal crashes. These crashes then get entered into a SharePoint system which is where the workflow is managed. Crash histories at those crash sites are prepared, and the locations are field investigated. Recommendations are documented in SharePoint as well in the same place where the workflow is managed.
- <u>NCDOT (2):</u> NCDOT Traffic Safety Unit completes a 5-year crash history at the site that is sent out to their field team to investigate the site and recommend any potential safety countermeasures needed.
- <u>Ohio Department of Transportation (OH DOT):</u> DPS/law enforcement agency sends weekly fatal crashes to OH DOT. We load them into a page where DOT districts can review the fatal crashes that occur in their district and do a crash analysis.

- Oregon Department of Transportation (OR DOT): Compiles all case materials prior to analysis and codes into their crash data system. Law enforcement reports, citizen reports, news media, death certificates, toxicology results, DOT incident details, etc.
- Pennsylvania Department of Transportation (PennDOT) (1): DOT data collectors receive notification of fatal crashes either from the State Police through a FARS report email that is sent out after each fatal crash, through news sources, and other areas. Once they have the location for the fatal crash, they go to the site to collect data and photograph items such as sight distance, status of signs and vegetation, drainage issues, guiderail condition, and other pieces of data that may not be present at the site at a later date. This data collection can be used to remediate any deficiencies that may have been identified, and the data is used to help the DOT in any future litigation that may arise from the crash. The guidelines and process of Personal Crash Data (PCD) Collection has its own internal publication, Pub 159.
- PennDOT (2): The District office will visit the crash site of fatal and some serious injury crashes upon notification. The object of the visit is to look for deficiencies in the system (guiderail, drainage, roadway) and take some appropriate pictures, if applicable.
- Rhode Island Department of Transportation (RIDOT): Performs a field review with a review team that includes an Engineer from the RIDOT Office of Safety and its safety engineering consultant. This takes place on a quarterly basis. In addition, there are quarterly meetings between Engineering and the Office of Highway Safety (Behavioral) to review the facts at the time about each of the fatal crashes.
- Virginia Department of Transportation (VDOT): Prior to the field visit, VDOT District staff will review data in the office including the FR300 report for the fatal crash, 5-year crash history around the crash site, volume and speed data, and other pertinent information. The field review includes evaluating roadway features at the crash site such as traffic control devices, roadway geometries and taking measurements of ball banks and sight distance. The investigation is documented in a site investigation report with recommendations if identified. Once the report is completed by the staff, it will be sent to VDOT Residency staff (or Interstate Management Office [IMO] for limited access roads) for review. If concurred, the Residency/IMO will implement the recommendations if applicable. While a report is always prepared for a fatal crash, a field visit may not be

conducted for cases involving DUI or eluding police. The duration between the occurrence of a fatal crash and conducting a field review is typically 1-2 months. Every week VDOT Central Office sends out a Daily Activity Report (DAR) report documenting the fatal crashes in the last 7 days for each VDOT Maintenance Region. From the report District staff will identify the fatal crashes to be reviewed and schedule field visits in the following weeks, which will proceed as described above.

- <u>WisDOT:</u> Does not specifically treat fatal crashes differently when compared to other severe injuries. They typically screen using KAB (fatal injury, incapacitating injury, and non-incapacitating injury) crashes in their HSIP program and KABC (fatal injury, incapacitating injury, non-incapacitating injury, and possible injury) crashes in their improvement project process.

10. *Does the DOT have access to/use any additional information that law enforcement officers may collect for a fatal crash?*
    - *Yes*
    - *No*
    - *Not Applicable*

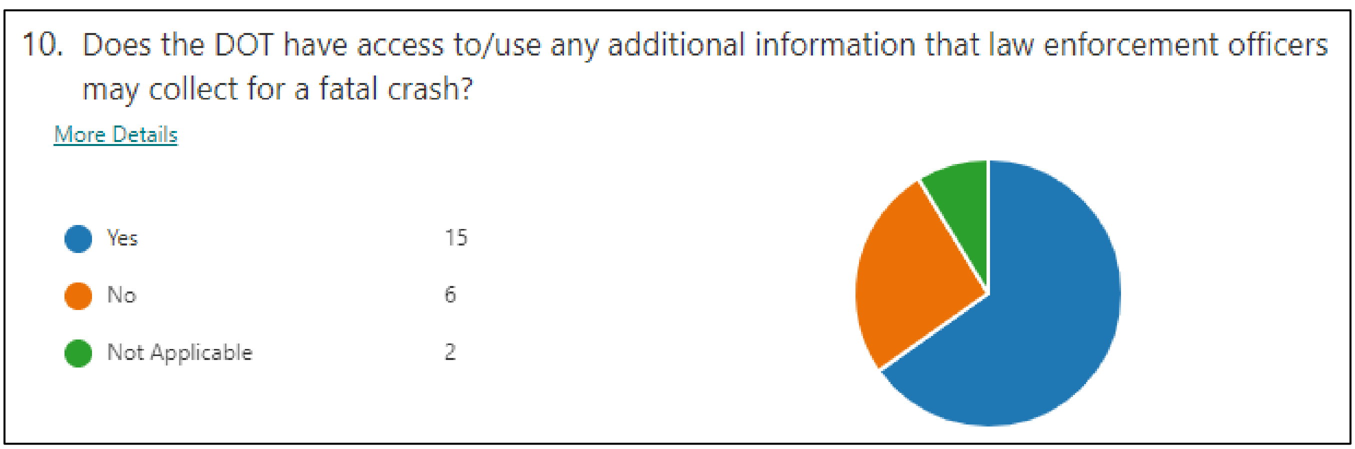

Figure 3.4 Question 10 Compiled Responses

Summary: Figure 3.4 summarizes responses. It appears that most DOTs do have access to and use information collected by law enforcement within their own investigation. It can be surmised from this question and responses throughout the survey that collaboration with law enforcement may lead to more effective investigation results and better-quality data.

11. *Please provide us your email address. The project team will reach out to you requesting the form.*

    Summary: Every DOT left an email address.

12. *How many years of historical crash data is reviewed as a part of fatal crash evaluations?*

Summary: 23 responses were again received to this question. Responses were more varied than in the similar question for DOTs which do not have an on-site review process, and there was no clear majority among the answers. Three to five years of historical data was again a common timeframe for fatality investigations by DOTs, but just as common if not more was five-plus years of historical crash review. Some DOTs indicated that records are explored up to 10 or 20 years in the past if needed. A minority of DOTs indicated that only data going back less than three years was used, or that no historical crashes were reviewed. Overall, it seems that DOTs use of historical data varies based on the department and what data they find to be most useful, ranging most commonly from three to 10 years.

13. *What triggers an on-site fatal crash evaluation?*

Summary: Most of these answers correspond to the earlier question given to DOTs who conduct off-site reviews. Many DOTs noted that every or at least most fatal crashes which occur in the state are reviewed on-site. Another common response is that an on-site review occurs when requested by the state/DOT legal department or another division associated with safety. A minority of DOTs indicated that it is coordinated with law enforcement, where law enforcement will request a review by the DOT or their investigations function as the principal trigger to a DOT investigation.

14. *If applicable, how does the DOT typically collect the information during an on-site evaluation?*

    - *Electronic form*

- *Paper form*
- *Hybrid*
- *Other_________*

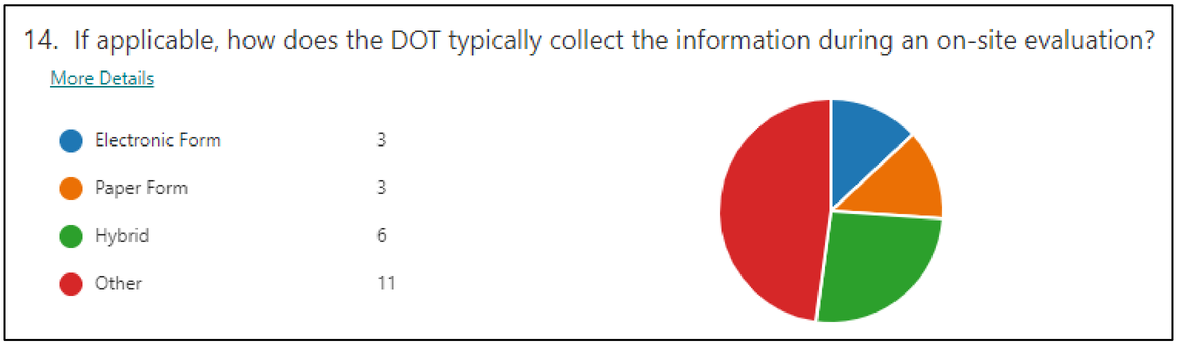

Figure 3.5 Question 14 Compiled Responses

Summary: Figure 3.5 summarizes responses. Of responses indicating ‘other,’ several DOTs indicated that the choice is left to the on-site investigator how to take notes and gather information, or it depends on what office/staff in the DOT conducts the investigation. Many of these responses could likely be considered to fall under the ‘hybrid’ response, and as such a hybrid method based on what is best for the investigator appears to be the most common method utilized by DOTs. Overall, it appears that there is some variability allowed in how information is collected by DOT representatives during an investigation. It also may be possible that DOTs are in the process of implementing electronic form use while phasing out paper use, which would also be considered a hybrid use.

15. *Please provide us your email address. The project team will reach out to you requesting the form.*

    Summary: Every DOT left an email address.

16. *Please list internal/external DOT division(s) or group(s) that is(are) ultimately responsible and note the roles/responsibilities of division(s) or group(s) involved with on-site fatal crash evaluation procedures.*

    Summary: Responses varied in specific details, but generally the Traffic/Traffic and Safety Division or an individual/group within such divisions would be responsible for fatality evaluation review. In some cases, individual regions or districts within a DOT are responsible for fatal crashes which occur within their boundaries. Commonly, state law enforcement is indicated as being involved in the process to a degree.

17. *If applicable, what equipment is used as part of the on-site fatal crash evaluation? Choose all that apply.*
    - *Hand tools (measuring tape, hand level, etc.)*
    - *Laser Scanners*
    - *Total Station*
    - *Hand-Held GPS Receiver*
    - *GIS Mapping Software*
    - *Camera*
    - *Drone*
    - *Other________________________*

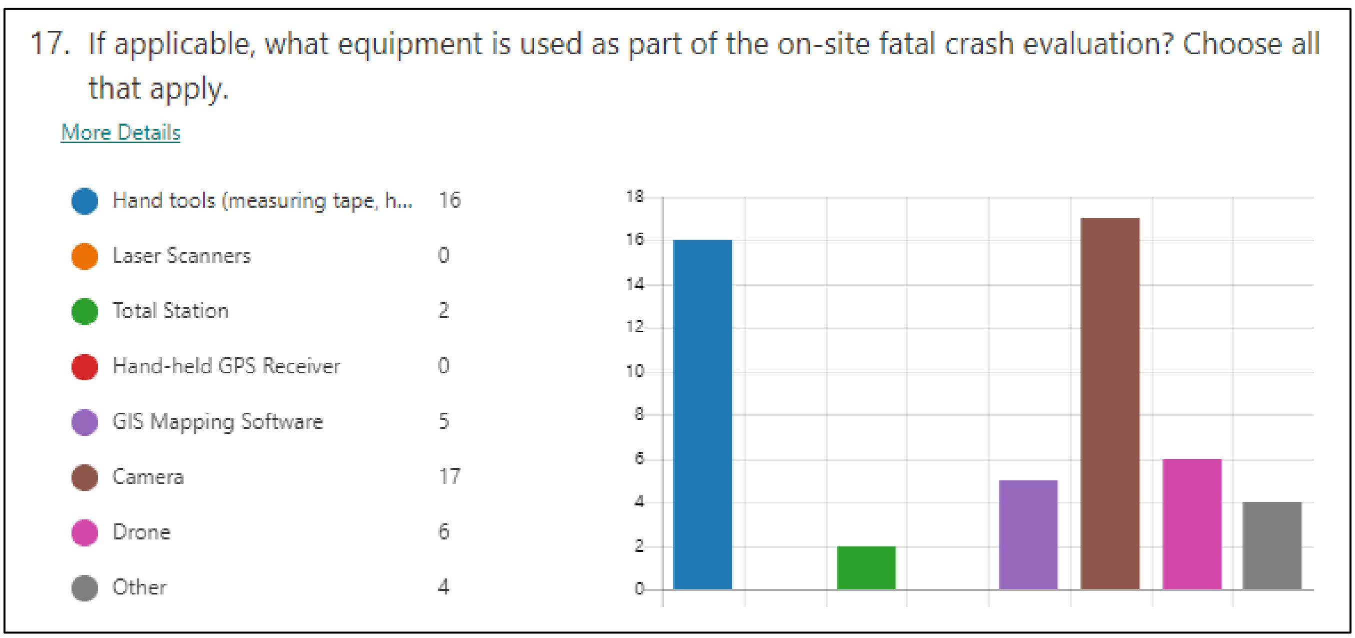

Figure 3.6 Question 17 Compiled Responses

Summary: 21 DOTs in total responded to this question. Figure 3.6 summarizes responses. Of DOTs indicating 'other' as their response, one marked not applicable, one said that paper notes were utilized in investigations, and the other two were not specified. Overall, most DOTs rely on basic hand tools and cameras for scene investigation, however, there are several departments which have begun using more advanced equipment such as drones and GIS software.

18. *If applicable, what challenges have on-site review personnel from the DOT experienced during the fatal crash evaluation processes?*

Summary: 16 DOTs responded to this question. A number of challenges were identified which varied from DOT to DOT. They can be summarized under the following list:

- Arranging the review in a timely manner.
- Getting notification of the crash occurrence in a timely manner.
- Some data, such as toxicology reports, are not available until months after the review.
- Inability to set up work zones.
- Employee turnover requiring more training for on-scene evaluation.
- Staff shortage.
- Finding a safe place to park while conducting evaluations.
- Crash-site hazards (high speed traffic).
- Environmental impacts (lighting, weather).

Overall, there was not a specific challenge that stood out as reported the most among DOTs, indicating that DOTs experience a number of different, notable challenges during investigation that may be tied to their own specific processes.

3.2.4 Fatal Crash Evaluation Logistics

19. *After a fatal crash evaluation is conducted, how is the information shared, stored, or otherwise managed?*

Summary: In similar fashion to other survey responses, DOTs vary to a great degree in how they store and share fatal crash investigation information. Each agency has some elements of data logistics that are particular to the operation of that specific agency. Generally, DOTs share the findings of the fatal crash investigation (regardless of storage location) with associated parties at the DOT. These may consist of review teams, safety departments, legal, traffic department, or a combination of these parties. Typically, the information will be available to divisions at a DOT with responsibility over roadway safety and associated matters. Regarding storage, often a DOT will have a designated database, SharePoint, or similar file location for fatality investigation data. Another possibility is that the information is stored with other crash records or traffic investigation data. Ownership over stored data may vary, whether being managed by the group responsible for investigation, another group at the DOT, or possibly a county or other state department. The following descriptions were taken directly from survey responses.

- ALDOT: A road safety review report will be prepared and delivered to the appropriate Area/Agency responsible for the roadway.
- ARDOT: All studies are stored by county in a network folder. We also have a folder for multi county and one for statewide.
- DDOT: DDOT Vision Zero develops the associated documentation and follows up with parties that have associated action items. Once completed, the fatal review "report" is added to a publicly available archive on the DDOT Vision Zero webpage.
- DelDOT (1): Internal databases.
- DelDOT (2): Reports are stored on a secure drive within Traffic. Recommendations, if any, are issued via work orders to the applicable section(s).
- GDOT: If a site repair/improvement is identified, the district maintenance teams will perform the work, also the data is shared with multiple individuals through our daily fatality report, our FARS team has access to the data and reports, last our HSIP team reviews the data and crash history to determine if an HSIP project is needed.
- IDOT: Information is entered into our state and federal systems and passed along to investigating agencies if necessary.
- INDOT: Typically, the fatal crash reviews are kept by year and stored with other district traffic files.
- LaDOTD: District level.

- MDOT: For vulnerable user crashes, it is posted on a public facing website. We are currently transitioning vehicular fatal crashes to the website although it is not public facing at this time.
- MnDOT: District/Towards Zero Deaths saving process.
- MoDOT (1): The districts who conduct these reviews may use the results to determine if changes to the roadway are warranted.
- MoDOT (2): There is a brief report written and then the legal department stores the information for future use if necessary.
- NCDOT (1): All documents are stored on a SharePoint site.
- NCDOT (2): NCDOT uses a SharePoint site that tracks assignments, due dates, and all data performed to complete the investigation such as the crash analysis, filed notes, and recommendations.
- NDDOT: The information is presented to the Executive Fatal Crash Review Team.
- OH DOT: We have it stored in our crash data warehouse and a SharePoint site.
- OR DOT: 170 data elements entered into our Crash Data System. Internal and External access to data through a number of data tools.
- PennDOT (1): The forms that are completed by the data collectors are filed and managed by the District Risk Management Engineers and/or Tort coordinator. Any deficiencies that are identified are shared with the groups best suited to address them.
- PennDOT (2): Unknown.
- RIDOT: By HSIP consultant.
- TDOT: A packet containing the analysis documents is saved in a PDF file and a register is updated to track the analysis was done.
- VDOT: The report is shared with VDOT Residency/IMO for concurrence and implementation. Each District and Region retain the original and the signed reports from the residency indicating concurrence electronically.
- WisDOT: Unknown how it is stored. Each reconstruction report is electronic.
- Unknown DOT: It is usually stored with other traffic investigations records. For my District, when I ran the Traffic Safety Branch, they were kept electronically in the investigations database.

- Unknown DOT: It's shared with the Executive Committee for implementation and shared in the DOT record management system with shared viewing access by Executive Team members.

20. *Approximately what is the typical duration between when a fatal crash has occurred and when the DOT begins a fatal crash evaluation?*

Summary: Responses received from DOTs to this question were widely diverse, and procedures were commonly indicated as having some variety within themselves depending on the situation. Some DOTs conduct evaluations within 48 hours of the crash occurring, if not immediately after a crash. However, several other DOTs indicated that the process will not begin until some days, weeks, or even months after the crash. Evaluations occurring within a week or two of the crash was a common response, although no clear majority answer emerged. Overall, the response duration seems to be quite different across DOTs, and there is significant variability within the process at DOTs which may depend on staffing availability, workload on other tasks, and even department initiative to complete reviews. However, it can be considered that conducting a fatal crash evaluation within a week or two of a crash occurring is a widespread practice.

21. *How long does it generally take the DOT to complete and finalize a fatal crash evaluation?*
    - *Days*
    - *Weeks*
    - *Months*

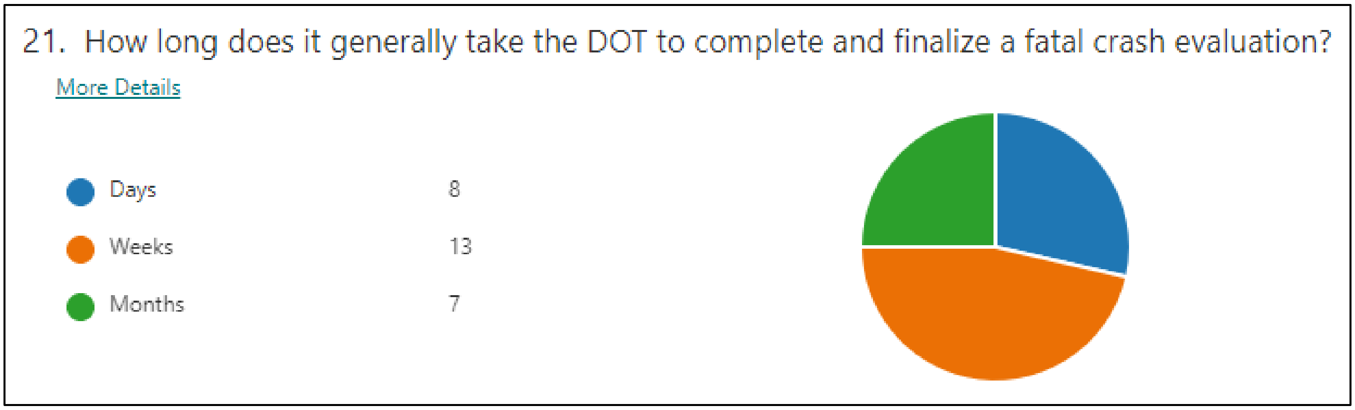

Figure 3.7 Question 21 Compiled Responses

Summary: Figure 3.7 summarizes responses. A majority of DOTs complete the investigation process within a matter of weeks, but it is common to see investigations take less or more time (this will likely depend on the variables discussed in the last question, where the time to begin the investigation varies). Also, in a comparable manner to the last question, a matter of weeks to begin and complete an investigation appears to be common.

22. *Are there any plans in place within the DOT involving new fatal crash evaluation methods, reporting, or equipment?*
    - *Yes*
    - *No*
    - *Not Appliable*

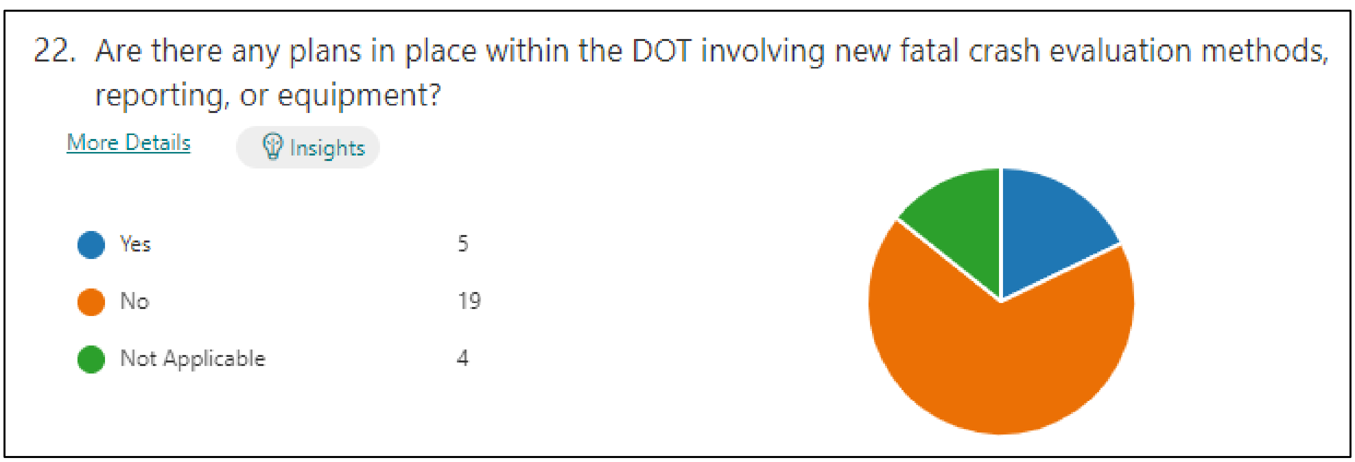

Figure 3.8 Question 22 Compiled Responses

Summary: As shown in Figure 3.8, most DOTs indicated that there are no plans to create new fatality evaluation methods, reporting, or equipment.

23. *Please provide a few details of the new plans.*

Summary: Of the four DOTs that indicated that plans were in place, these plans typically involved implementing innovative technologies and/or reviewing and improving existing practices. Plans specified included the following:

- New crash data system and improving crash data collection/reporting processes.
- Reviewing national best practices and internal processes with the goal of creating better collaboration, coordination, and uniformity of processes.
- Updated forms used for collection.
- Implementation of AASHTOWare safety software to improve crash evaluations.

24. *How are the findings of the fatal crash evaluations implemented into the DOT practices?*

Summary: Results of fatality investigations are commonly used to inform general roadway safety initiatives overseen by DOTs. Report findings may be discussed in DOT traffic safety meetings and used as evidence for certain safety initiatives and actions. Such actions can include a number of different initiatives, such as informing the design and construction of roadway safety infrastructure, general traffic planning decisions, and other implementations. Fatal crash investigation findings may also inform statewide strategic traffic plans and traffic safety plans where applicable. Also, findings may occasionally not lead to any implementation of safety measures or further evaluation. The following descriptions were taken directly from survey responses.

- ALDOT: Recommendations from road safety review are typically implemented by maintenance forces or through next upcoming project as appropriate and feasible. Depending on severity, a project may be initiated to address issues.
- ARDOT: See answers above.
- DDOT: The fatal reviews develop their own discrete improvements/actions. They typically do not impact larger project decisions which will usually utilize injury data (which fatal crashes are rolled into).

- DelDOT (1): Work orders are issued directly to staff to schedule implementation of recommendations.
- DelDOT (2): The investigations allow the engineers to consider potentially problematic geometries when designing roadway segments and intersections, and therefore can include countermeasures (or select another option altogether) as part of their designs on a proactive level. Patterns seen in fatal crashes also allow for hyper-focused strategies to be developed as part of Delaware's Strategic Highway Safety Plan.
- GDOT: See previous answers.
- INDOT: Specific recommendations from a fatal crash review are normally implemented as either a work order for district maintenance to install or modify the signing, markings, or other traffic control devices at the location, or in the scope of a potential HSIP project at the location.
- IDOT: They are entered into our systems and if necessary, shared with the investigating agencies. If an investigation involves a deficient roadway, structure, or obstacle, the findings are passed along to other bureaus within our department.
- LaDOTD: Information from the evaluations along with annual network screening data is used to identify and prioritize safety improvements.
- MDOT: Fatal crashes represent such a small fraction of the total crashes. We look for any patterns or trends and try to apply Safe System approaches to address the crashes. If there are any infrastructure items that contribute to the fatal crashes; we strive to address those infrastructure items.
- MnDOT: Usually this is more common at the district safety planning level, where numerous crashes are used to set direction and project types. Individual fatal crashes sometimes lead to project deployment.
- MoDOT (1): The districts who conduct these reviews may use the results to determine if changes to the roadway are warranted.
- MoDOT (2): If there is a change that should be made on the roadway that is noted and scheduled in some way.
- NCDOT (1): Projects may be developed as a result of the field investigations.
- NCDOT (2): As mentioned in a previous answer, the recommendations and implementation are discussed between the regional staff and division staff.

- NDDOT: A decision document is written to include any recommendations into practice.
- OH DOT: We use crash data (prioritizing fatal and serious injury crash locations) to fund safety improvements on our roadways.
- OR DOT: Safety, planning, and leadership, as well as local governments, law enforcement, and other extremal data users nationwide use the data to make improvements to our transportation system.
- PennDOT (1): They are used to help remediate any deficiencies on the roadway that may have contributed to the crash.
- PennDOT (2): As mentioned in the answer to question 11, each PennDOT District Tort Coordinator reports relevant information to the central office PennDOT individual working on tort related crash information. This individual works directly for the Department's Safety Engineer and information from this process is used as part of the safety planning process.
- RIDOT: Incorporate potential near-term improvements through Maintenance work orders (signing and striping). Assists Office on Highway Safety with adding focus on behavioral programs. Assists Engineering with systemic focused projects (ex. Curves, guardrail for addressing ROR crashes) and how to better focus funding based on the crash trends we are finding.
- TDOT: The investigations determine the eligibility for HSIP funding. The criteria for eligibility is agreed upon between TDOT and FHWA.
- VDOT: The review includes evaluating roadway features at the crash site such as traffic control devices, roadway geometries and taking measurements of ball banks and sight distance. The investigation is documented in a site investigation report with recommendations if identified. Due to the random and unpredictable nature of a crash, identifying these factors is often difficult and sometimes impossible especially for a fatal crash. It is not uncommon for an evaluation with no further action being recommended.
- WisDOT: Depends on the findings of the report. The purpose of the Traffic Safety Commission meetings is to discuss how to prevent fatal and serious injury crashes. In those discussions we have representatives from law enforcement, engineering, public health, behavioral, education, etc. If a solution is discussed, the group tries to address it through their appropriate channels.

- Unknown DOT: Systemic solutions are identified. DOT policy is revised as necessary to account for systemic safety solutions.
- Unknown DOT: A project is unlikely to be initiated based on a single crash, but it may identify a pattern which needs to be addressed. A safety project may then be developed.

25. *Are there any other thoughts you would like to share on this topic?*

Summary: Fatal crashes have been found by some DOTs to be somewhat random in occurrence, and it can be difficult to draw concrete conclusions from them. As such, they may be used in overviews of traffic improvement reviews or overall safety initiatives, instead of going into great detail into specific cases. A number of DOTs provided contact information and shared that they would be willing to discuss fatality evaluation processes further. The following descriptions were taken directly from survey responses.

- ARDOT: Chasing just fatal crashes is not a good practice for the reasons I mentioned above. Example: there could be 10 nearly identical crashes in a specific curve. Nine had no injury and one was fatal. The fatal one might have involved a drunk person, going 100mph, not wearing a seatbelt. We have no engineering fix for something like that.
- DDOT: Our fatal reviews rarely determine that missing/deficient infrastructure is at cause. As such, we use fatal reviews as opportunities to review a complete intersection/section for any typical improvements we are installing at large. This approach has resulted in a more robust fatal review process as we aren't defeated before we started (e.g., "there is nothing we can do about this type of crash"). However, we recognize that our environment and relatively small number of fatals allow for this type of approach and it may not be readily scalable.
- MoDOT: It is not our practice to do these reviews for every fatal crash. This takes a toll on our staff mentally and because of that this is not something that we require regularly.
- TDOT: We have good data for both crashes and roadway inventory and this data is integrated.
- INDOT: INDOT has found it beneficial to review fatal crashes, but they occur somewhat randomly, so using crashes where the responding officer has marked it as having fatal or

incapacitating injury is more useful for identifying problem areas on the state highway system.

- WisDOT: Wisconsin has their state patrol office within our Department of Transportation so we share information quite well. If there are law enforcement-specific questions that we weren't able to answer, we can provide a secondary contact.

3.3 Summary

The principal form of data collection in this study consisted of developing a survey on best practices related to fatality evaluation. A survey was developed and sent out to various DOT representatives in more than 40 states; 42 responses from a majority of DOTs were eventually received. Responses to this survey reveal that there is significant variety in detail regarding fatal crash evaluation state to state, however, some general trends can still be inferred. Findings from the survey can be used to develop recommendations and suggested practices to UDOT on fatality evaluation procedures by highlighting the general best practices which exist. Additionally, interviews were conducted with personnel responsible for fatality evaluations in each UDOT region office. These interviews are reviewed in Chapter 4.

4.0 DATA EVALUATION

4.1 Overview

UDOT region interviews were conducted to learn more about the practices and procedures which form fatal crash evaluations at the different UDOT regions. Region personnel responsible for evaluations were interviewed over a virtual call and asked questions similar to those on the national best practices survey. Findings from the interviews were also summarized. Results of the survey and interview findings from UDOT personnel were compared and evaluated to determine the state of UDOT practices in comparison to national trends, and to compare practices between the varying UDOT regions. Seeing the difference in how regions conduct fatal crash evaluations creates opportunities to identify gaps in practice, or areas where standardization of methods can take place.

4.2 UDOT Region Interviews

The region interviews were conducted over virtual calls. Representatives were asked questions which were similar to the questions given to DOTs in the national survey. The questions asked to UDOT personnel, and responses to these questions where applicable, are included in the subsections below.

4.2.1 Region Responses: Introductory Questions

1. *Does your DOT have a fatal crash investigation/evaluation process in addition to and not associated with the standard law enforcement investigation?*
    - *Yes*
    - *No*

    All regions have a fatal crash evaluation process separate from law enforcement.

2. *What type of fatal crash evaluation does your DOT perform?*
    - *Report of review and analysis*

- *On-site investigation*
- *Both*
- *Other__________________*

All regions typically complete both an on-site evaluation and off-site review and analysis.

Region 1: Note: the region considers two kinds of fatal crashes, immediate crashes, and ones within 28 days.

Region 2: Region representatives stressed that they complete ‘documentation’ not an ‘investigation’ for legal reasons.

Region 3: Individual evaluations are conducted for each crash, which may include site visits. Quarterly crash review meetings are held between the regions and the central Traffic & Safety Division where DI-9 forms are analyzed and discussed. Regarding site visits, the department has a policy in place to go out to the site within 7 to 10 days, but this does not always occur. Important note: the DOT does not ‘investigate,’ they document conditions of the site.

4.2.2 Region Responses: Methods and Data Handling

3. *What triggers a DOT evaluation of a fatal crash?*

Region 1: The occurrence of a fatal crash on a state route. They do not hear about all fatalities, and it may be days or weeks later. Fatalities may be reported by maintenance in some cases. Patrolmen used to call in about fatalities directly, but they stopped doing this. Region personnel usually hear about fatal crashes through the radio. The Traffic Operations Center (TOC) does send out a ‘j-page,’ which is where most crash notifications come from, but not all. Overall, there is not a standard method for the region to receive notification on crashes.

Region 2: All fatal crashes on state routes are reviewed. A region representative responsible for on-site reviews is usually notified directly by law enforcement of a crash.

Region 3: Evaluations are triggered when a fatal incident/crash occurs, and highway patrol investigates the crash. The notification typically comes from the TOC ‘j-page.’ When local law enforcement investigates, the notification only comes in the few days before quarterly crash reviews.

Region 4: Most fatal crashes are reviewed and the act of a crash on a highway triggers the evaluation. They occasionally get notifications of crashes on other roadway types, but they are most concerned about crashes on state highways. Proactive documentation may be created for a crash that could possibly turn into a fatal if a person involved dies within 28 days after the crash.

4. *Please provide a short summary of your process for fatal crash evaluation.*

Region 1: Personnel go into the field to take pictures and make sure that the roadway did not cause the crash. They do not take photos of the victims if they are on-scene immediately after the crash occurs. They will receive a narrative from the officer involved if they are there while the scene is active. It is noted in particular if the roadway or other infrastructure is suspected of being involved. Handwritten notes are used in conjunction with the pictures to develop a crash description. Just state routes are analyzed as a part of fatal crash evaluation.

Region 2: The on-site review is conducted after notification of a crash comes in. Pictures are taken at the site and notes are made detailing the event. The region does not contribute to determining what caused the crash. The review is conducted to identify any potential roadway safety issues. After the review information is shared with the region group, this information is then discussed in monthly internal meetings where data is parsed over and crashes are discussed in depth. This information then goes to statewide meetings and senior staff. A statewide crash meeting is held every two months with Central where information from crashes, findings, potential safety issues, and DI-9 reports are discussed.

Region 3: When a site visit is not conducted (due to time/work constraints), the DI-9 form is used to review and record crash information. Roadview Explorer will also be used to gather imagery of the site where the crash occurred. A review of the DI-9 form always occurs whether or not a site visit is conducted. During an on-site review, the location of the incident will be determined. Personnel do not have to visit the site immediately after the incident, but within 7-10 days (it was determined that it was better to have personnel avoid seeing the aftermath of a crash). Pictures are taken of the area within 500-600 feet of the crash on either side. Roadway conditions are noted. A smart level is used to determine slope compliances if needed. Notes are taken on a Form A sheet by hand, with sketches being made in some cases. No opinion or conjecture is given on what may or may not have led to the crash.

Region 4: When there is a fatal crash, the safety teams respond to notification of crashes on highways. A site review is conducted, but not during active crash investigation (usually within five days). They are most interested in roadway conditions. Roadway conditions such as signs, slopes, and other infrastructure are reviewed. Every now and then all fatal crashes are reviewed in the region using law enforcement DI-9 reports. Pictures are looked at; law enforcement's experience is reviewed. These occur six times a year, and a statewide meeting is held afterward.

5. *Does the DOT have access to/use any additional information that law enforcement officers may collect for a fatal crash?*

    - *Yes (DI-9)*
    - *No*
    - *Not Applicable*

Region 1: The DI-9 report comes to them later and they are reviewed during quarterly meetings. Quarterly meetings are held which include several members from the region. They will review the DI-9 forms and discuss the details that are shared in the DI-9. Region design squads are starting to be involved in the process as well to identify what design/roadway issues may need to be addressed.

Region 2: After DI-9s are submitted, they are reviewed in statewide review meetings held every two months. The region reviews the forms for inconsistencies and compares their findings to the DI-9. Any inconsistencies are reported to law enforcement for alteration.

Region 3: This information can be accessed before fatal crash reviews, and it contributes to those discussions, but it is not available for every crash. This information is redacted, and all personal information is withheld. Vehicle type, age of driver, and other information is still provided. These parameters are discussed during quarterly reviews.

Region 4: Meetings are held every two months with law enforcement to review the DI-9 reports. This allows for a review of conditions, and decisions on behavior.

6. *Are you willing to share any forms or support documents used in the DOT fatal crash evaluation process? If yes, please provide us with your email address. A member of the study team will contact you.*

   The research team was able to access any forms and documents used by UDOT in fatal crash evaluations as needed.

7. *How many years of historical crash data is reviewed as a part of fatal crash evaluations?*

   Region 1: No historical data is reviewed. At the broader regional level, some analysis of clustering will be performed during quarterly meetings, but no standard is in place for this.

   Region 2: Numetric (UDOT's crash database) is used to look at certain locations for a specific number of years to identify crash clustering and potential safety issues. This is not standard; it takes place when they notice crashes occurring on the same routes. It occurs as needed.

   Region 3: Quarterly meetings involve some review of historical crashes; crashes have been mapped to analyze any possible clustering. Individual crash evaluations do not use historical data. Five years' worth of data is believed to have been mapped.

   Region 4: Historical data is not specifically used. The statewide meetings do use data which goes back three to five years, but those are not used right now. If something jumps out that needs a deeper dive, it will be reviewed. This may come from noticing the impact of roadways, or memory of fatal crashes that occurred in an area before.

4.2.3 On-Site Fatal Crash Evaluation

8. *What triggers an on-site fatal crash evaluation?*

   Region 1: The occurrence of a crash should in theory trigger an evaluation, though the region will only start an investigation when they find out about the crash.

   Region 2: The occurrence of a fatal crash and receiving notification of it.

   Region 3: Evaluations are triggered when a fatal incident/crash occurs, and highway patrol investigates the crash. Technically a site visit will be conducted for each crash, but this does not always occur in reality.

   Region 4: See earlier answers

9. *If applicable, how does the DOT typically collect the information during an on-site evaluation?*

   - *Electronic form*
   - *Paper form*
   - *Hybrid*
   - *Other*__________

   Region 1: They do not have a form that they use. Region representatives indicated that it would be nice for them to have one (they do not appear to use Form A which the other regions said was standardized a few years back). They do not know what information the central Traffic and Safety Division really wants. It seems to them that the Traffic and Safety Division wants more information on road plans and features, but they are not certain of this.

   Region 2: They take their own notes, then use those notes to fill out Form A.

   Region 3: Form A is used to record crash information.

   Region 4: Form A is used to take crash information, conditions, road conditions, and environmental factors.

10. *Please provide us your email address. The project team will reach out to you requesting the form.*

    This question did not require a response from the region personnel as part of this study.

11. *Please list internal/external DOT division(s) or group(s) that is(are) ultimately responsible and note the roles/responsibilities of division(s) or group(s) involved with on-site fatal crash evaluation procedures.*

    Region 1: Two representatives from Region 1 principally conduct on-site visits. There are some area supervisors and technicians that will occasionally go out for site visits as well. If it is thought that a larger issue with design is involved, then more people will go out, but this is rare.

    Region 2: One representative in Region 2 conducts on-site reviews.

    Region 3: One representative in Region 3 conducts on-site reviews and is involved in the crash evaluation process overall.

    Region 4: Because of the wide area, Region 4 safety personnel typically go out by themselves to a crash area. Three representatives from Region 4 are designated to go out and conduct data collection after a crash has occurred.

12. *If applicable, what equipment is used as part of the on-site fatal crash evaluation? Choose all that apply.*

    - *Hand tools (measuring tape, hand level, etc.)*
    - *Laser Scanners*
    - *Total Station*
    - *Hand-Held GPS Receiver*
    - *GIS Mapping Software*
    - *Drone*
    - *Other*________________________

Region 1: Just cameras/cellphones are used to take photos. They have a tool to measure angles, but they do not use it.

Region 2: Camera, measuring wheel, smart level. No advanced equipment (this would be considered investigative).

Region 3: Additional hand tools include a smart level for slope calculation and a measuring wheel. Law enforcement uses some more advanced equipment.

Region 4: Cameras, smart levels, tape measures, wheel measures, no advanced equipment. Much of it is based on pictures. Pictures are taken from multiple angles, and vehicle marks on the roadway are recorded in pictures as well.

13. *If applicable, what challenges have on-site review personnel from the DOT experienced during the fatal crash evaluation processes?*

Region 1: No major challenges. Safety of employees is the biggest issue when preparing the scene and navigating about. Communication is a challenge; communicating with the central Traffic and Safety Division, with each other at times, etc.

Region 2: Going back out for any reason or conducting reviews without traffic control presents a hazard for personnel. When on site at the time of the initial official meeting, it is not as bad due to traffic controls. Weather can be an issue at times.

Region 3: Post-incident documentation means that the scene is not controlled (but the trade-off of not seeing the crash aftermath, in the opinion of the region, is worth it). This means that personnel must avoid traffic and other environmental factors at the scene.

Region 4: Weather is an issue and can inhibit crash evaluations, particularly during winter and during storms. Distance constitutes a major challenge as it is a long way to drive across Region 4. Recording conditions right when the crash happened (without information from law enforcement/maintenance) is difficult and cannot be captured. There is some hazard from traffic, particularly in the cities, but those challenges have not been too excessive. Holiday traffic can be an issue contributing to congestion and is difficult to represent in the data collection (the specific roadway has an impact on this).

4.2.4 Fatal Crash Evaluation Logistics

14. *After a fatal crash evaluation is conducted, how is the information shared, stored, or otherwise managed?*

    Region 1: They have a shared drive which they use to store photos. Information on notes and photos with a description is sent to a regional representative overseeing the process for review. There's no centralized way that data is shared or necessarily stored. Only a few people at the region have access to the shared drive. At one point someone at the central Traffic and Safety Division had access, but they're not sure if that's the case now. The Traffic and Safety Division does not appear to access the drive.

    Region 2: A general email description is created with notes on roadway characteristics, and a Google Map image is created. This is sent into the UDOT system to a Google Drive with limited access. Very few have access to this; only the personnel who oversee the process and upload information. The region representative who conducts site visits does keep a notebook with handwritten notes for personal use.

    Region 3: Information/pictures are entered into the Form A Risk Application system. The region representative overseeing the evaluation process keeps paper copies of the forms (it is currently unknown by the region how long these must be kept) in case a review is needed for any legal purposes.

    Region 4: Information is put into an ArcGIS story map by the GIS team, which consolidates all of the information. The safety review team has access to this; other UDOT personnel may have access. It is not password protected, but the link may be protected. The link is sent out to persons participating in the statewide meetings. The scanned forms and photos are stored on a shared Google Drive which limited Region 4 personnel and some statewide personnel have access to; only about 10 people. No physical copies of the forms are kept.

15. *Approximately what is the typical duration between when a fatal crash has occurred and when the DOT begins a fatal crash evaluation?*

Region 1: Policy states that a site visit must occur within five days. They do not hear about some fatal crashes, so they may miss those. It varies overall; many times, it is right away, and they are on-scene before the crash is cleaned up.

Region 2: Very quickly, usually within 30 minutes. They go on scene while the scene is still active. The policy is within five days (O6C-40 policy). Region 2 personnel have a particularly good relationship with law enforcement, and this is a great benefit.

Region 3: 7-10 days (the Region 3 representative does not go out to the site while the scene is active for any crash).

Region 4: Typically, the following day, or if the crash occurred on a weekend, then the following Monday or Tuesday. Up to five days are allowed for a review to be conducted. The review meetings occur two months after the review period (e.g., in June they meet on February-March crashes).

16. *How long does it generally take the DOT to complete and finalize a fatal crash evaluation?*

- *Days*
- *Weeks*
- *Months*

Region 1: Most crashes do not take long. Preparation for quarterly meetings takes longer; it takes two months for a DI-9 form to be delivered to the region.

Region 2: They can get the evaluation out right away in some cases. No more than a few days are needed.

Region 3: 1-2 working days, however this is spread out over a period of time that may take months. This is not consistent overall. They are at least completed before each quarterly crash review meeting.

Region 4: Within a couple of days.

17. *Are there any plans in place within the DOT involving new fatal crash evaluation methods, reporting, or equipment?*
   - *Yes*
   - *No*
   - *Not Applicable*

No feedback on specific plans was obtained during this study from UDOT Region personnel.

18. *Please provide a few details of the new plans.*

    N/A

19. *How are the findings of the fatal crash evaluations implemented into the DOT practices?*

    Region 1: Depends on what affects the crash. When it is a design, maintenance, or a sign issue identified behind the crash, the region can take action to fix the problems and increase safety. They can even get funding to improve roadway conditions. Usually, the crash was due to operator error, and they cannot do much with it from an improvement standpoint. Some evaluation of signal-related crashes will occur during quarterly reviews, if needed. The region representative noted that the purpose of the quarterly meetings is to improve safety and reduce fatalities across the region. Part of the purpose is to involve people with design/construction backgrounds to get their input on those aspects of roadways and to identify particular issues that may need fixing.

    Region 2: Engineering can take the information collected during evaluations and improve conditions for roadway users. This will work to prevent further crashes.

    Region 3: The findings ultimately help to drive decisions and inform safety-based decisions. They lead to discussions during regional staff meetings on what can be put into place to reduce crashes and improve safety generally. Information helps to identify what areas need to be analyzed regarding fatal crashes. Crashes are random, but this information is helping the central Traffic and Safety Division to identify infrastructure that could be improved.

Region 4: Informs roadway safety and design decisions. Clusters of crashes can be used to identify areas where guardrails, warning signs, slow-down signs, etc., may be implemented. While many crashes are driver error, clustering of crashes can show where driver attention needs to be gained to prevent such crashes from occurring. Hotspots generally will inform decisions on how to improve the roadway. Crashes are random and often due to driver error. However, they still inform statewide decisions and identity changes in conditions that may contribute to crashes. These findings may also inform UDOT's statewide initiatives to put in barriers and other safety measures.

20. *Are there any other thoughts you would like to share on this topic?*

Region 1: Region representative added that with pedestrian and bike crashes at crosswalks, they can submit information for a traffic study to be done on that crosswalk to see if it warrants more signal phasing or alterations of some kind. That is a valuable part of the process, they have found.

Region 2: The region representative who conducts these crash evaluations enjoys their role in the process. In the case of Region 2 overall, having a designated person over the evaluation role has been a great benefit.

Region 3: The Region 3 representative wonders about the value of the effort to go out and physically review the site as part of the process. Documentation is largely based on the DI-9 form and this can be completed in-office. Roadview Explorer is updated continually and allows for imagery to be gathered in-office as well. Example: When a fatal crash occurs in the wintertime in Flaming Gorge, it is difficult to get to that location and takes a large amount of time. When personnel arrive, conditions may be completely different than when the crash occurred. The DI-9 form filled out by law enforcement likely has the most accurate information on conditions. Drawing on the NDOT example, perhaps some extra questions could be added to the DI-9 which would take changes and other conditional effects into account, adding to form effectiveness. The DI-9 and the crash narrative recorded at the scene in the past have had errors and inconsistencies. Some additional support would need to be included as a part of collection efforts.

Region 4: N/A

4.3 Evaluation of Data

With the compilation of data collected in the survey and evaluation of region interview results, practices between UDOT regions regarding fatal crash evaluations and national practices can be compared. The following subsections contain comparison information which was utilized to inform the conclusions in Chapter 5.

4.3.1 Survey Findings

National practices reveal that there is variety in what procedures DOTs utilize for fatal crash evaluations, but general trends can be identified, listed as follows.

- Many DOTs have a fatality evaluation process of some kind in place for the purpose of investigating fatal crash occurrences, reviewing trends on a yearly or bi-yearly basis, and identifying potential solutions to these crashes.
- The fatality team and fatal crash investigation process is overseen by the DOT traffic safety division, or another division focused on safety.
- Most DOTs will conduct an on-site fatal crash evaluation as part of the fatality evaluation process (though not all), in addition to offsite and/or historical reviews.
- A fatal crash review will most commonly be triggered by the crash event itself. The time to respond to a crash event and begin the investigation will vary but will most commonly occur within weeks of the crash, and the investigation process will be completed in a matter of weeks as well.
- The exact nature of the investigation process will vary. However, the process will generally consist of review of the crash details and dynamics, and observation of any patterns and trends when compared to other crashes. Historical review of crashes may be conducted. Agencies who conduct a site visit will collect measurements and information from the scene which will be used with the off-site review to develop final investigation findings.

- Most DOTs have access to information gathered by law enforcement agencies, and there is collaboration between the DOT and law enforcement on fatal crash investigations, to a degree.
    - Other teams may be involved in collaboration and investigation procedures, such as Multidisciplinary Accident Investigation Teams (MAIT) and other safety teams, depending on the DOT.
- Tools used during on-site investigations will typically involve hand tools and cameras for taking measurements and recording pictures. There is an increasing trend of using more advanced equipment, such as drones and GIS mapping software.
- Most DOTs do not have major plans in place for improving or expanding their fatality evaluation process.
    - Plans that are in place mainly are focused on continual improvement of data collection, collaboration, and other factors involved in fatality evaluation procedures.
- Findings of fatal crash investigations are typically used to inform roadway safety initiatives, by providing evidence and data on issues contributing to safety risks. They are used to inform the design of infrastructure, local traffic planning, and statewide strategic plans.

Despite these general trends, it is important to note that significant variances exist in how DOTs ultimately conduct their fatal investigation reviews. These differences range from granular details (e.g., tools used for data collection, storage and sharing of data) to significant details (e.g., investigation oversight, investigation procedures, use of data). These variances in process highlight how particular aspects and characteristics of operation at each DOT will likely lead to unique aspects of each fatality investigation procedure. The exact nature of the investigation process will vary and may involve different personnel. The oversight of fatal crash review procedures may fall under different responsibilities; sometimes only one or two people are responsible for overseeing the process, while at other DOTs a committee may be responsible for reviewing crashes and directing the investigation. The level of collaboration with other groups and/or law enforcement may vary as well. There were also significant differences identified in how DOTs collect and store crash data.

4.3.2 Comparison to Regional Practices

In comparing UDOT's current fatal crash evaluation procedures to that seen at other DOTs, UDOT's current procedures are more similar to DOTs where individual districts/regions or other groups are responsible for their own investigations, with more limited central oversight and involvement from DOT headquarters. UDOT regions currently conduct both on-site and supplemental off-site reviews, incorporating both data collection on current crashes and historical review (albeit in different group processes), which is similar to other DOTs who have both evaluation types in place. Sometimes on-site visits are not conducted; this depends on the region. UDOT typically uses hand tools and basic equipment for evaluation, on par with many DOTs but less advanced than drones or other survey equipment used by some DOTs (though region personnel had indicated this is intentional to avoid the scope of evaluation becoming too 'investigative').

The primary difference in UDOT fatal crash evaluations and many DOTs identified by the research team is less standardization and centralization of the process. It should be noted that not all DOTs have a centralized process, but many DOTs have centralized and standardized practices for data collection and data storage. UDOT does not have as many standardized processes in place, and as a result, some gaps and variances exist in evaluation procedures between the regions. In some cases, UDOT has tried to implement standardized practices, but these have not fully been implemented; for example, personnel should use Form A, a designated form, for fatal crash evaluation data collection, but its use across the regions is not universal.

Some examples of these gaps in process can be identified from the region interviews. UDOT regions currently collect data on their own, and what they do with the data varies. Region 1 indicated they put data onto a shared drive and are unaware of what happens to it at that point, while Region 3 inputs data in the Form A system, for example. The regions are informed of crashes in varying ways; Region 2 hears directly from law enforcement at the time of the crash, while Region 1 often only hears about crashes after the fact. The process of collection may vary as well, and not all UDOT regions utilize the form created for data collection (known as Form A; see Appendix A for a sample). There is a discrepancy in on-site visits as well; all regions indicated the standard is to conduct a site visit, but there is variety in how that visit is conducted.

Region 1 may visit the site right away or within five days, Region 2 always conducts a visit while the crash scene is active, while Regions 3 and 4 visit the site after the crash scene is no longer active.

Despite these variances, UDOT does have good practices in place which can be built upon to improve the effectiveness of the fatal crash evaluation process. All UDOT regions conduct evaluations (which is not always the case nationally), and data is eventually used to help inform safety decisions. UDOT holds regular crash meetings between the Traffic and Safety Division and the regions where findings from crash evaluations are discussed. These practices can be seen at other DOTs as well and contribute to data from fatal crash evaluations helping to inform safety decisions within the department.

4.4 Summary

UDOT region interviews were conducted to learn more about the practices and procedures which form fatal crash evaluations at the different UDOT regions. Region personnel responsible for evaluations were interviewed over a virtual call and asked questions similar to those on the national best practices survey. Findings revealed that some general trends and a number of differences can be identified in region practices. These findings were compared to the general findings taken from the national best practices survey. Several gaps and variances exist in current UDOT practices, particularly related to standardization of data collection and storage.

5.0 CONCLUSIONS

5.1 Summary

The findings from the national best practices survey and region interviews with UDOT personnel provided valuable information on suggested methods for fatal crash evaluations. Using these findings, the research team developed a checklist of data variables which should be collected by a DOT during fatal crash evaluations. The research team also developed a set of more general recommendations for UDOT regarding the overall fatal crash evaluation process. These related to topics such as standardization of process, data storage, training, and other recommendations.

5.2 Checklist

DOTs typically utilize a checklist on an official form to collect data during a fatal crash evaluation. Samples of these forms were provided by DOTs to the research team as part of the best practices survey. Based on the findings of the survey, examples from sample forms, and region interviews, the research team developed a checklist of options which could be included on a UDOT form as part of fatal crash evaluations to expand upon what information is currently collected on Form A (see Appendix A). These options indicate different data and information which can be collected regarding a fatal crash. This data can then be utilized to inform safety decisions and strategies which UDOT can implement. The following subsections detail various checklist options which can be included on the form.

5.2.1 Basic Information

- UDOT Crash Evaluation Personnel Name
- Date of Evaluation and Time of Start/Completion
- Crash Date and Time

5.2.2 Crash Location

- County/City
- Specific Location (description and/or coordinates)
- Route
- Milepost
- Urban vs. Rural
- Roadway Location
    - Intersection
    - Midblock
    - Highway/Freeway
    - Other___________________________

5.2.3 Vehicle Information

- Vehicle Type
    - Passenger or Truck
    - Heavy Truck
    - Semi-Truck
    - Utility/Commercial Vehicle
    - Motorcycle
    - Other
- Make
- Model
- Year
- Crash Impact Area
    - Front, Rear, Side, etc.

5.2.4 Crash Characteristics

- Crash Narrative and Description
- Roadway Emphasis

- Roadway Departure
    - Left
    - Right
    - Crossover
- Rollover
- Passing (non-passing area)
- Incline and Decline (percentage of grade)
- Curve
- Tangent
- Functional Classification

- Demographic Information of Driver
- Other Persons Involved
    - Other Vehicle
    - Pedestrian
    - Bicycle
    - Motorcycle
- Potential Physical and Behavioral Contributing Factors
    - Wrong-Way Driver
    - Suspected Impaired Driver
    - Speeding
    - Suspected Distracted Driving
    - Tailgating
    - Improper Passing
    - Improper Lane Change
    - Reckless Driving
    - Improper Load
    - Mechanical Failure
        - Specify____________________________
    - Other____________________________

5.2.5 Roadway Type

- Concrete
- Asphalt
- Dirt/Gravel
- Other____________________________

5.2.6 Surface Conditions

- Dry
- Wet
  - Standing Water
  - Moving Water
- Ice/Frost
- Mud/Dirt/Gravel
- Snow
- Potholes/Surface Damage
- Roadway Under Construction
  - Specify Construction Type____________________________
- Other____________________________

5.2.7 Weather Conditions

- Clear
- Overcast
- Rain
- Snow
- Windy
- Fog/Smoke
- Other____________________________

5.2.8 Lighting Conditions

- Daylight
- Dawn
- Dusk
- Dark (Lighted or Not Lighted)
- Other___________________________

5.2.9 Construction Impacts

- Work Zone Presence
    - Yes/No
        - Active
        - Inactive
    - Work Zone Area Where Crash Occurred
        - Advance Warning Area
        - Taper/Shift Area
        - Activity Area
        - Termination Area

5.2.10 Contributing Factors

- Signage Issues (faded, knockdowns, damage)
- Pavement Marking Issues (faded, damaged)
- Pavement Edge Issues
- Shoulder Issues (sloping)
- Potholes/Surface Damage
- Debris/Obstructions in Roadway
- Animals in Roadway
- Guardrails
- Walls
- Lighting

- Barrier
- Traffic Control Devices
- Specify Details of Possible Contributing Factors___________________________

5.2.11 Certification and Legal Statement

- Certification
  - UDOT only documented the road conditions of the crash scene for the express purpose to analyze roadways and weather conditions.
  - No personal opinions were expressed in this report.
  - Information contained in this report was not shared with witnesses, media, or any other outside sources.
- Additional Notes
- Legal Statement
  - *All UDOT records associated with fatal crash reviews are controlled, protected, or otherwise constitute privileged information that is not subject to GRAMA disclosure (see UCA 63G-2-305(18) & (24)). These records may also be protected against discovery and admission of evidence under 23 USC 407 or other applicable law. Any employee accessing these records shall limit their access to a specifically identified business purpose. Any copying, sharing, or reproduction of these records without written authorization from UDOT General Legal Counsel or a UDOT Director (or data steward designee) is strictly prohibited.*

5.3 Limitations and Challenges

Some limitations apply to this study. As noted in the discussion with survey results, the unique variables and characteristics of each state DOT mean that no one policy, procedure, or set plan would likely meet the needs of all DOTs. While the recommendations included in this section are intended to meet the majority of concerns related to fatal crash evaluations, it is not possible for the research team and UDOT personnel to predict every potential issue arising in the fatal crash evaluation process. As a result, it is possible that UDOT will encounter additional questions or challenges in the fatal crash evaluation procedure. These may be associated with legal concerns, data collection difficulties, or other topics.

While UDOT region interviews provided useful information on the process and procedure used by personnel in each region, it is possible that additional nuances may be present within each region related to fatal crash evaluations. While standardization of practices and procedures is expected to benefit the agency, it may be found that different regions have varying capabilities related to evaluations which were not identified in initial discussion. If such issues were to arise, UDOT would need to implement procedures which are realistic and attainable by each region.

It should be noted that there are inherent difficulties and challenges in fatal crash evaluations, regardless of what procedures or processes are in place. Fatal crash events are traumatic experiences which have a severe mental impact and can take an emotional toll on all people involved. They also require the use and analysis of personally identifiable information which carries privacy and security concerns. Effective training and implementation of well-planned fatal crash evaluations can work to mitigate more severe impacts of fatal crash evaluations, but challenges will always be present, to a degree.

6.0 RECOMMENDATIONS AND IMPLEMENTATION

6.1 General Recommendations

Outside of the fatal crash evaluation data collection checklist, the research team has identified several general recommendations for the project. These recommendations were based upon the evaluation of findings from the best practices survey and region interviews. The findings can be listed under several categories and are included in the subsections below. These recommendations will allow UDOT to standardize and enhance the current fatality evaluation process in place at the department and ensure that effective procedures are in place. These recommendations were utilized to inform the final recommendations and implementation plan described in Chapter 6.

6.1.1 Standardization of Procedures

- Recommendation: Ensure that standardization of processes has been effectively carried out. This allows for effective data collection and analysis.
  - Example: Ensure that Form A is being used by all regions for crash reviews (this does not appear to be the case currently).
- Recommendation: Standardize data storage procedures.
  - All data collected by the regions should eventually be stored centrally on a secure server or other electronically based location. Access to this data should be limited to region personnel and UDOT Traffic and Safety Division personnel.
  - Notes from the DI-9 crash form should be utilized to fill out information on potential physical and behavioral contributing factors associated with the crash.

6.1.2 Personnel

- Recommendation: Create a statewide training procedure for fatal crash evaluation processes aimed at UDOT personnel.
  - This training should encourage personnel to follow the same procedures and actions while conducting fatal crash evaluations.

    - Training should cover all form usage, on-site and in-office procedures, and safety/legal information.
- Recommendation: Ensure that there is at least one person qualified to conduct a crash evaluation acting as a ‘backup’ for each region. This will ensure that if the designated individual is not available, another person can carry out the evaluation.
- Recommendation: Each region should foster a good relationship with local and state law enforcement regarding evaluations.
    - Review what Region 2 has done to build their relationship with law enforcement. Personnel in Region 2 find out quickly from law enforcement when a fatal crash has occurred. This is not the case for all regions.
    - Pursue standards and methods of working with law enforcement in training procedures.

6.1.3 Site Visits and ‘Desktop’ Evaluations

- Reconsider and evaluate the need to perform ‘on-scene’ visits, particularly while the crash scene is active, due to health/safety concerns and personnel availability.
    - There is a discrepancy in the regions on this practice. Region 2 emphasizes on-scene visits while the crash scene is active, while the others do not. Region 1 indicated that in some cases they are unable to conduct on-scene visits at all.
    - Alternative process: Examine what crash data has been collected by law enforcement at the scene, identify what is still needed, and then conduct a site visit to gather this information and general information about the site.
- If site visits are not conducted while the crash scene is active, but a site visit is still desired, replicate conditions at the time of the crash for on-site collection as closely as possible.
    - Conduct the visit at a similar time of day/similar conditions to the crash, within safe and reasonable measures.
    - Prior to the field visit, staff should review all information available in the report for the fatal crash, five-year crash history around the crash site, volume and speed data, and other pertinent information.

6.2 Implementation Plan

The recommended Implementation Plan should contain sufficient information to: a) provide direction on steps needed to implement the technology or products developed under this contract; b) provide recommendation on staffing needs and resources; and c) list individuals and organizational roles and responsibilities recommended for implementation.

1. Review results with the UDOT Risk Management Division, Traffic and Safety Division, and region representatives. (Robert Miles, Jeff Lewis, and Rod McDaniels)
2. Update policy and supporting documentation (e.g., Form A) to reflect findings and recommendations. (Robert Miles and Jeff Lewis)
3. Create or identify a platform for storing and maintaining evaluation data. (Rod McDaniels and Robert Miles)
4. Create a training for region evaluators and identify who takes responsibility for training. (Rod McDaniels and Robert Miles)
5. Identify personnel/positions for the Evaluator role. (Region Leadership)
6. Identify a feedback loop for fatal reviews. Create accountability for conducting evaluations. (Robert Miles, Jeff Lewis, and Rod McDaniels)

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APPENDIX A: UDOT FORM A

The current UDOT standard for fatal-crash-evaluation data collection consists of utilizing their ‘Form A’ to document fatal crash information. The form contains basic information including location, route, some roadway information, and basic crash details/narrative information. Samples of the form are provided in this appendix.

Form A
FATAL CRASH DOCUMENTATION

06/07/2023 11:19:58 AM

GENERAL INFORMATION

Form A #:	22
Region:	3
Employee Name:	Linn La
Report Date:	09/28/2021

CRASH LOCATION

Location:	testing 2	
Route:		
Mile Post:		
GPS Location:	Longitude:	Latitude:
Roadway Info:	☑ Aspalt ☐ Concrete	Number Of Lanes: 1
Veh1 Direction of Travel:	☐ NB ☐ SB ☑ EB ☐ WB	

CRASH DETAILS

Crash Date and Time:	09/28/2021		
Number Veh. Involved:			
Construction Zone YN:	N	Construction Zone Type:	
Weather Conditions During the Crash:			
Permanent Speed Limit:		Temporary/Active t Speed Limit:	
Additional Road Condition:	test - testing updated by 9/12/2022		

UDOT CRASH NARRATIVE

Description of the Event (who, what, where, when):	
Note: Cite sources if information came from other sources:	

DOCUMENTATION CHECK LIST

I have documented the following (as applicable):

- ☐ Photos of roadway, scale, slopes, rumble strips, skid marks, close/wide angles
- ☐ Landmarks and traffic environment
- ☐ Traffic control devices, street lights, construction zone
- ☐ Weather conditions
- ☐ Other vehicles on the scene
- ☐ Other documentation collected

Notes:

PHOTO CHECKLIST

- ☐ Photos of roadway, scale, slopes, rumble strips, skid marks, close/wide angles
- ☐ Landmarks and traffic environment
- ☐ Traffic control devices, street lights, construction zone

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UDOT

UDOT Form A Page 1

- [ ] Weather conditions
- [ ] Other vehicles on the scene
- [ ] Images overlay
- [ ] Images capture entire scene of the crash

Notes:

UDOT CRASH RESPONDER CERTIFICATION

- [ ] UDOT only documented the road conditions of the crash scene for the express purpose to analyze roadways and weather conditions.
- [ ] No personal opinions were expressed in this report.
- [ ] UDOT did not photograph persons or personal items.
- [ ] Information contained in this report was not shared with witnesses, media, or any other outside sources.

Notes:

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