FTA
FEDERAL TRANSIT ADMINISTRATION

PTASP
TECHNICAL ASSISTANCE CENTER

Safety Event Investigation in an SMS

July 28, 2021

FTA
FEDERAL TRANSIT ADMINISTRATION

Webinar Objectives

- Discuss requirements for safety event investigation
- Discuss and provide considerations for conducting safety event investigations in an SMS

Agenda

- Public Transportation Agency Safety Plan (PTASP) regulatory requirement for safety event investigation
- Considerations for carrying out safety event investigation in an SMS
- Transit agency presentations
- Q&A

Rail Transit Agencies and Safety Event Investigation

- State Safety Oversight Agencies may establish additional requirements for safety event investigation for the rail transit agencies under their jurisdiction
- This presentation will not cover requirements related to the State Safety Oversight regulation, 49 CFR Part 674

PTASP REQUIREMENT FOR SAFETY EVENT INVESTIGATION

Safety Management Systems (SMS)

The PTASP regulation establishes requirements for a Safety Management Policy and an SMS, including Safety Risk Management, **Safety Assurance**, and Safety Promotion

Three Elements of Safety Assurance

Safety Assurance

Safety Performance Monitoring and Measurement
§ 673.27(b)

Management of Change
§ 673.27(c)
Not required for small public transportation providers

Continuous Improvement
§ 673.27(d)
Not required for small public transportation providers

Home of safety event investigation!

Safety Performance Monitoring and Measurement

Safety Assurance

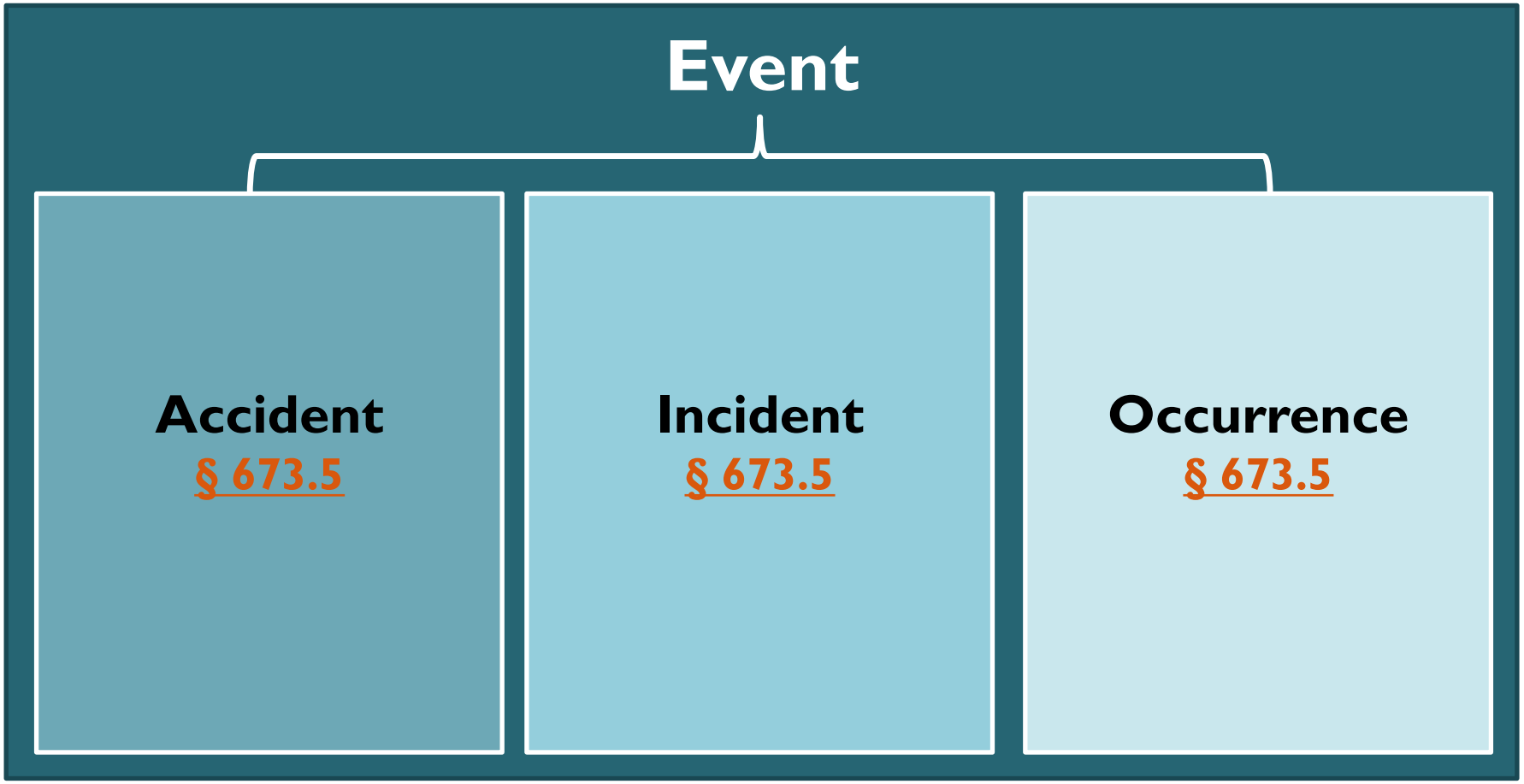
Safety Performance Monitoring and Measurement § 673.27(b)

- **Monitor compliance with and sufficiency of operations and maintenance procedures § 673.27(b)(1)**
- **Monitor safety risk mitigations § 673.27(b)(2)**
- **Monitor internal safety reporting programs § 673.27(b)(3)**
- **Conduct investigations of safety events to identify causal factors § 673.27(b)(4)**

Management of Change
Not required for small public transportation providers

Continuous Improvement
Not required for small public transportation providers

Safety Event Definitions



Safety Event Definitions

Accident

An event that involves any of the following:

- A loss of life
- A report of a serious injury to a person
- A collision of public transportation vehicles
- A runaway train
- An evacuation for life safety reasons
- Any derailment of a rail transit vehicle

Incident

- A personal injury that is not a serious injury
- One or more injuries requiring medical transport
- Damage to facilities, equipment, rolling stock, or infrastructure that disrupts operations

Occurrence

An event without any personal injury in which any damage to facilities, equipment, rolling stock, or infrastructure does not disrupt operations

Investigation Definition

Investigation: The process of determining the causal and contributing factors of an accident, incident, or hazard, for the purpose of preventing recurrence and mitigating risk § 673.5

- **Risk:** The composite of predicted severity and likelihood of the potential effect of a hazard § 673.5
- **Risk mitigation:** A method or methods to eliminate or reduce the effects of hazards § 673.5

Causal and Contributing Factors Definition

- Although not defined by Part 673, agencies could define **causal factors** as factors that directly led to the event and **contributing factors** as factors that made the event more likely to occur or the effects of the event more severe
- For example:
  - **Causal factor:** Key actions, situations, or conditions that, had they not been present, would have prevented or reduced the effects of a safety event
  - **Contributing factor:** Actions, situations, or conditions that made the event more likely to happen or made the effects of the event more severe

Example of Causal vs. Contributing Factors

A worker trips and falls over a tool left on the shop floor while carrying a large box

What are the factors in this example?

- Tool left on the shop floor
- Large box

How do we tell whether these are causal factors?

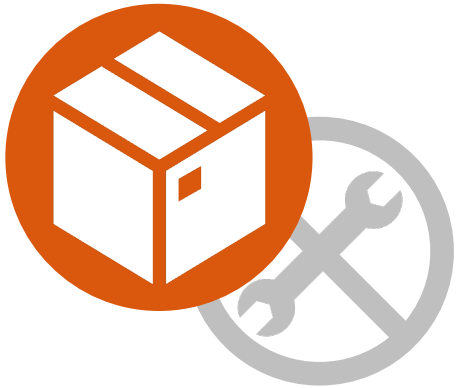
- The causal factor will be the one that directly resulted in the trip and fall – there could be more than one causal factor, but let's only consider one for this example
- Consider the event without each of the factors

Example of Causal vs. Contributing Factors

A worker trips and falls over a tool left on the shop floor while carrying a large box

What would have happened if the tool was not left on the shop floor?

- The worker tripped over the tool
- If the tool was not left on the shop floor, the trip and fall would not have happened
- The causal factor in this example is related to the tool on the floor – this led directly to the trip and fall

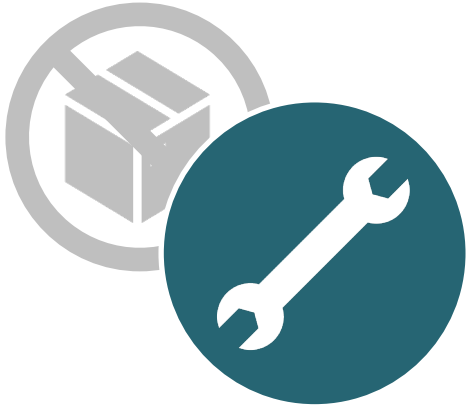


Example of Causal vs. Contributing Factors

A worker trips and falls over a tool left on the shop floor while carrying a large box

What would have happened if the worker was not carrying a large box?

- The worker may still have tripped over the tool left on the floor
- The large box, which obscured their vision, made the worker more likely to trip



Example of Causal vs. Contributing Factors

A worker trips and falls over a tool left on the shop floor while carrying a large box

What does this mean?

- The trip and fall may still have happened if the worker was not carrying the box; however, the trip and fall would not have happened if the tool was not on the shop floor
  - The causal factor is related to the tool left on the shop floor
  - The contributing factor is related to the large box

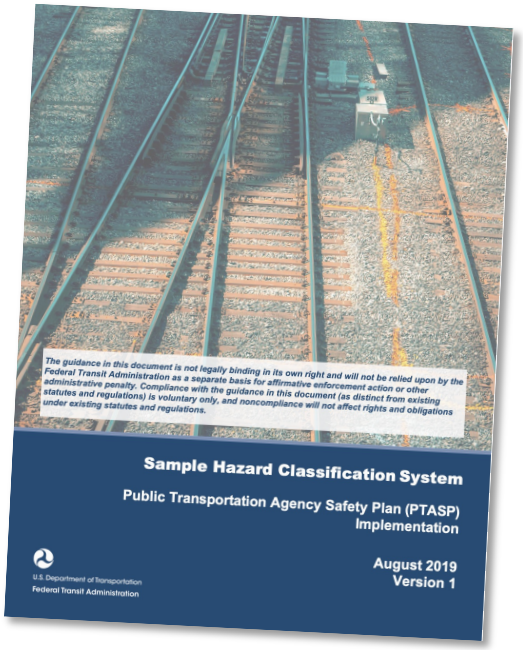
SAFETY EVENT INVESTIGATION IN AN SMS

Pre-SMS Safety Event Investigations

- Every transit agency carried out some form of event investigation prior to the PTASP regulations and SMS
- The process, form, and outcome of investigations varied from agency to agency; however, many agencies conducted investigations in order to determine fault or preventability

Safety Event Investigations in an SMS

- **Safety event investigations conducted** under an SMS are conducted in order **to determine causal and contributing factors for the purpose of preventing recurrence and mitigating risk**
- This focuses on the organizational, human, equipment, and environmental factors that allowed the event to occur, rather than on the individual
  - FTA published a Sample Hazard Classification System that describes categories agencies can use to classify hazards and factors



Actions of an Individual and Causal Factors

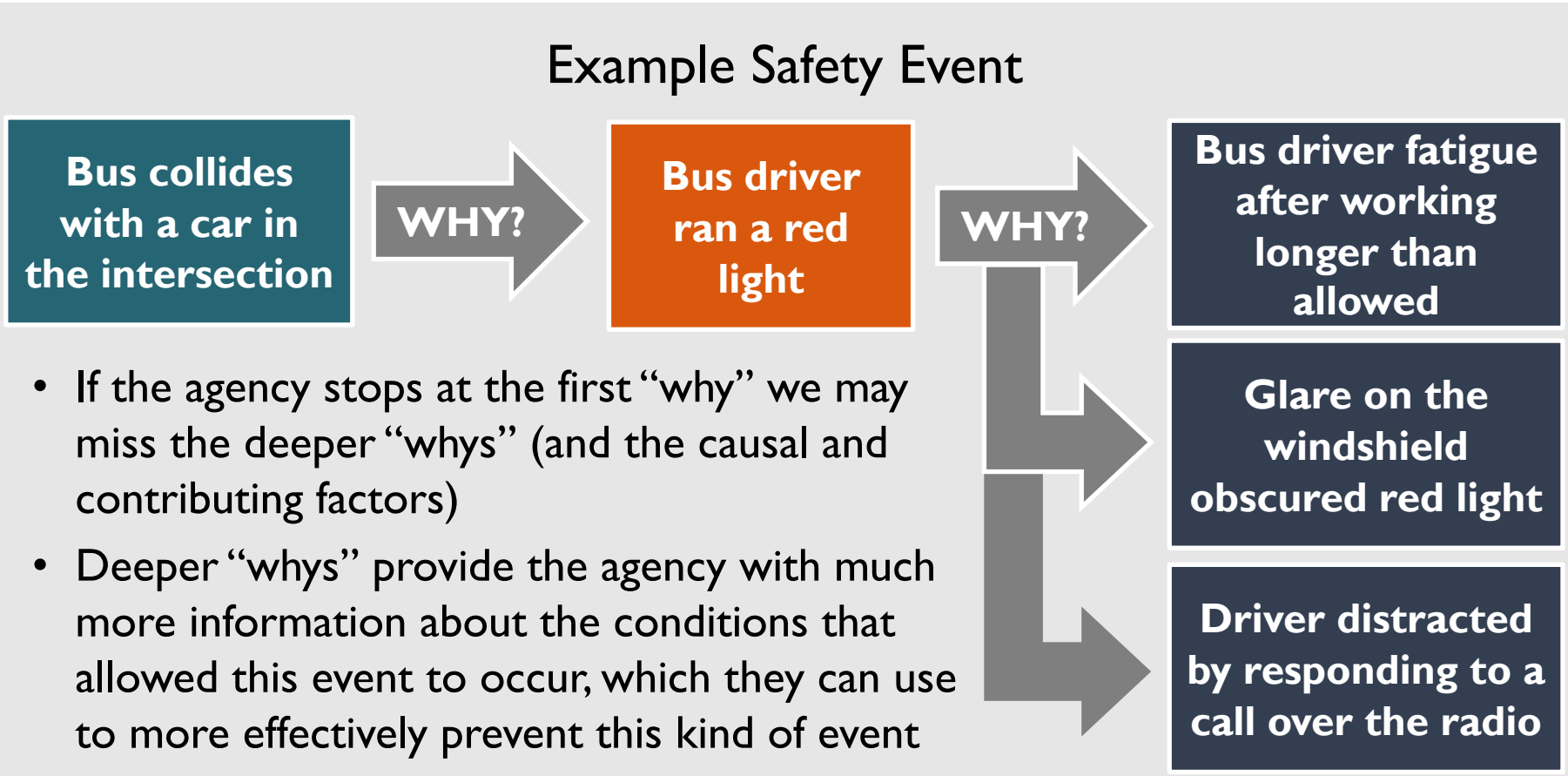
- The actions of the individual are still important in investigations conducted under an SMS
  - However, the **reason** a person acted a certain way is much more important to an investigation under an SMS
- Addressing the causal and contributing factors can be much more effective in preventing recurrence
  - Addressing the condition(s) that allowed the event to occur rather than addressing the actions of an individual
  - Don't forget that causal factors can include other factors, not just behavior!

Example:
Actions of an Individual and Causal Factors

Example Safety Event

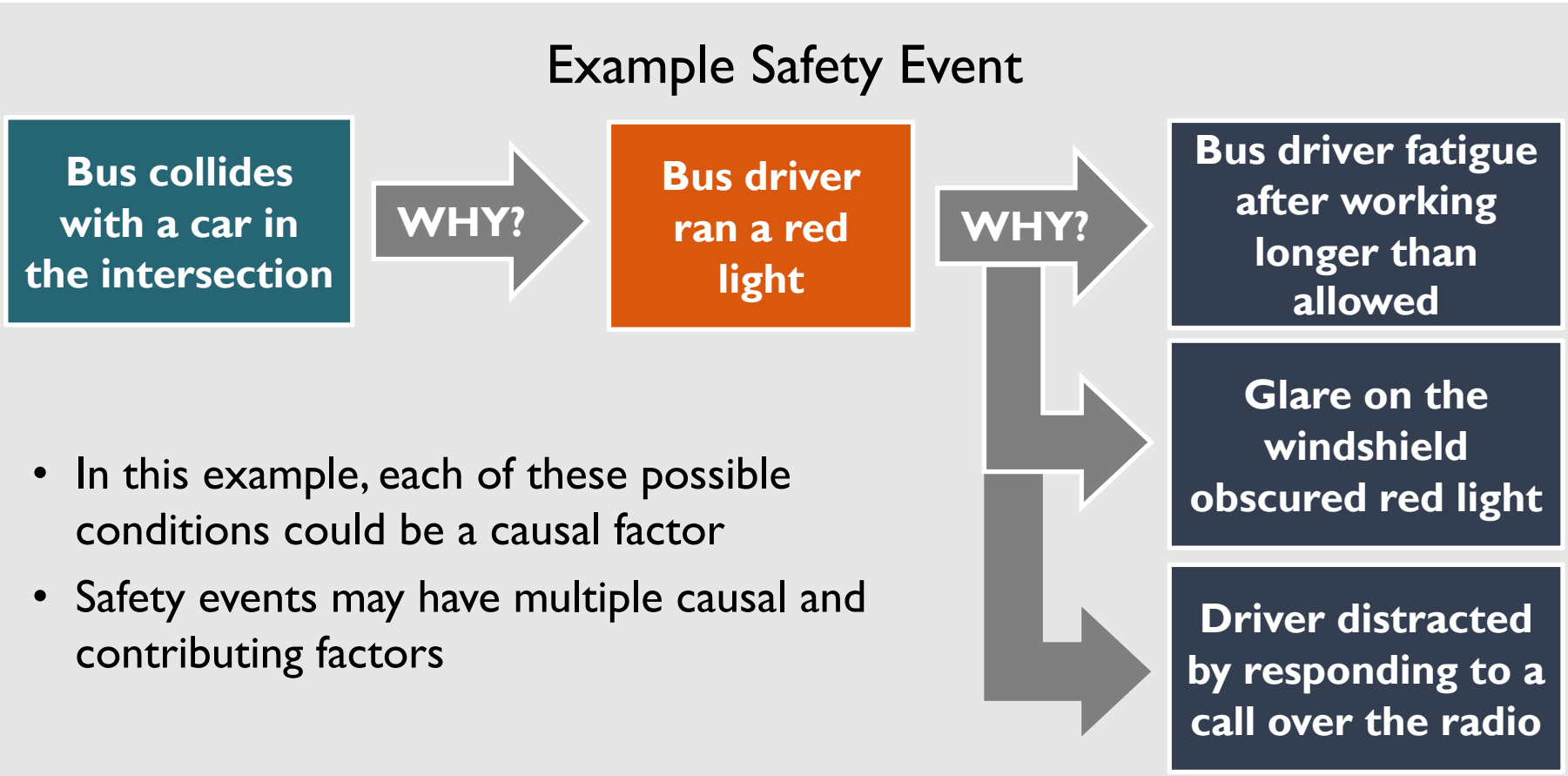
- A bus collides with a car in the intersection and the initial investigation determines that this occurred because the bus driver ran a red light
- This is enough information to determine fault and preventability and the agency could suspend or retrain the bus driver
- **Why continue to investigate?**

Example:
Actions of an Individual and Causal Factors



- If the agency stops at the first "why" we may miss the deeper "whys" (and the causal and contributing factors)
- Deeper "whys" provide the agency with much more information about the conditions that allowed this event to occur, which they can use to more effectively prevent this kind of event

Example:
Actions of an Individual and Causal Factors



- In this example, each of these possible conditions could be a causal factor
- Safety events may have multiple causal and contributing factors

Outputs of Safety Event Investigations: Safety Assurance

- Safety event investigations provide valuable information for other Safety Assurance activities
- Interviews, records reviews, measurements, and other investigative activities can provide valuable information for:
  - Monitoring compliance with and sufficiency of operations and maintenance procedures
  - Monitoring safety risk mitigations
  - Monitoring internal safety reporting programs
  - Continuous improvement (not required for small public transportation providers)

Outputs of Safety Event Investigations: Safety Risk Management

- Investigations may uncover areas of safety concern that the agency may assess under Safety Risk Management
- Investigations may provide context for prioritizing hazards based on the safety risk of their consequences
  - For example, the agency may revise its likelihood ranking for consequences in its safety risk register

Outputs of Safety Event Investigations: Safety Promotion

- Investigations may uncover hazards that need to be communicated out to workers who could come into contact with the hazard
- Investigations may identify gaps in safety training or the need for additional safety training

Inputs of Safety Event Investigations: Safety Assurance

- Conversely, safety event investigations can benefit greatly from inputs from other SMS processes
- Investigators can use the following Safety Assurance elements to help narrow down causal and contributing factors:
  - Data on compliance with and sufficiency of operations and maintenance procedures
  - Reports from internal safety reporting programs and trends in safety reports
  - Information on relevant mitigations that may or may not have performed as expected

Inputs of Safety Event Investigations: Safety Promotion

Training records may help investigators narrow down causal or contributing factors

IMPLEMENTING SAFETY EVENT INVESTIGATION IN AN SMS

Implementing Safety Event Investigation in an SMS

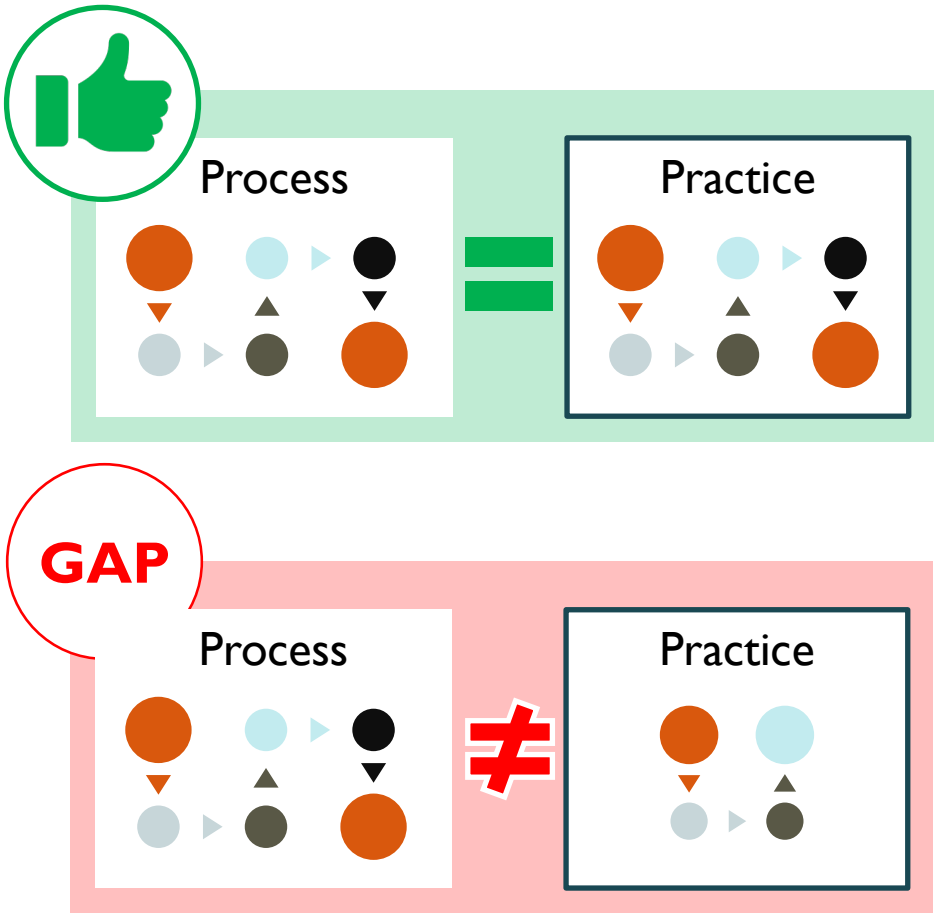
To prepare to implement the safety event investigation process outlined in your ASP, your agency could:

1. Evaluate your implementation status
2. Characterize any implementation gaps
3. Address implementation gaps

1. Evaluate Safety Event Investigation Implementation Status

Evaluating implementation status can start with comparing the process for safety event investigation your agency describes in your ASP to your agency's current activities

- Any areas that don't match up can be considered an "implementation gap"



2. Characterize Implementation Gaps

- Not all implementation gaps are the same
- Your agency may need to:
  - Do something new (establish a new activity)
  - Do something differently (modify an existing activity)
  - Do something consistently (restore a sporadic or dormant activity)

3. Address Implementation Gaps

Develop a project to address the implementation gaps, which could include tasks, roles and responsibilities, and timelines or due dates

Common Gap: Preventability vs. Causal Factors

- Many agencies conducted accident investigations with the goal of determining fault and preventability; however agencies may not currently identify causal factors
  - This is the implementation "gap!"
- Agencies may need to modify this existing activity (do something differently) to determine causal factors as required in the ASP

Common Gap: Preventability vs. Causal Factors

- **Sample Implementation Gap:** The agency does not currently identify causal factors as part of its safety event investigations
- **Sample Characterization of the Gap:** Need to do something differently (modify an existing activity)
- **Sample Project:** The agency will ensure that it identifies causal factors as specified in their ASP by modifying existing investigation materials and documents and providing retraining for those working on safety event investigations

Common Gap: Interfacing Safety Event Investigations with Other Agency Functions

- **Sample Implementation Gap:** The agency does not have a process for documenting information gathered as part of safety event investigations
- **Sample Characterization of the Gap:** Need to do something new (establish a new activity)
- **Sample Project:** The agency develops a process for documenting relevant information by:
  - Identifying the types of information safety event investigators typically gather during investigations
  - Defining authorities, accountabilities, and responsibilities associated with documenting investigation information
  - Training safety event investigators on the kinds of information they should document

TRANSIT PRESENTATION

Frank Knorek
Compliance Analyst
Luzerne County
Transportation Authority
(LCTA)
Kingston, Pennsylvania

Biography

- Program coordinator within LCTA's Office of Regulatory Compliance & Administrative Services
- Responsible for managing LCTA's internal and external public policy development, program management, state and federal regulatory compliance monitoring, legislative research, and government affairs activities throughout the agency
- Ten years of public administration experience, seven years in public transit
- Graduate of Wilkes University, BA in Political Science/Pre-Law Studies, Minor in Business Administration

Agency Characteristics and Services

Agency

- Established October 10, 1972
- 170 total employees
- Service area is a mixture of urban, suburban, industrial, and rural communities

Fixed Route Bus

- Operates six (6) days a week: 4:45 AM to 1:17 AM
- Services 36 of 76 municipalities in Luzerne County, with a service area of 56 sq. miles
- 18 Regular Routes (Weekday/Saturday) and 5 Night Service Routes (Weekday Only)
- Bus Fleet Size: 40 (35' Gillig Phantom Diesel, and 35' Gillig Low Floor Hybrid and CNG).
- Fixed-route provider for the cities of Wilkes-Barre, Nanticoke, and Pittston
- Serves as a connector to the cities of Hazleton, and Scranton in Lackawanna County.
- 1.1M Annual UPT (2018-2019 RY)

Paratransit

- 49 (Ford E350/E450 Cutaway Vans and Ford Transit Passenger Vans)
- Operating throughout Luzerne County (906 sq. miles)
- 116,000 Average Annual UPT

Safety Event Investigation in an SMS

Discussion

- The process LCTA established in our Agency Safety Plan for safety event investigation

- How LCTA identifies safety event causal factors

Safety Event Investigation in an SMS

The process LCTA established in our Agency Safety Plan for safety event investigation

- The safety event investigation process is housed within the Safety Assurance section of our ASP
- LCTA staff was already conducting most of the safety event investigation activities
- The ASP allowed the agency to place all activities and documents into an organized written process that is standardized and repeatable for use across the organization
- Uses data from safety reporting process, and safety performance monitoring process to determine if risk mitigations are working in preventing a safety event before it occurs
- Safety Performance Monitoring activities are designed to support safety oversight and performance monitoring, with recordable data and physically observable standards being critical to the safety assurance methodology

Safety Performance Monitoring and Measurement Activities

- Safety audits (Training, safety committee meeting minutes)
- Informal inspections
- Monitoring operational and maintenance data (Dispatch logs, TAM Fleet/Facility Inspections)
- Assess external information (Industry, DOT, NTD, insurance, customer complaints)
- Regular review of onboard camera footage to assess drivers and specific incidents
- Conduct safety surveys (Driver and passenger)
- Assess the ESRP (Number and type of complaints)
- Conduct evaluations of the SMS (Are we safer?)
- Investigation of safety occurrences (Accident reports - both reported events and near misses)
- Safety review prior to the launch or modification of any facet of service (Tabletop exercise)
- Daily data gathering and monitoring of data related to the delivery of service (including field observations)
- Regular vehicle inspections and preventative maintenance (TAM, Ecolane, FRITS, and Dossier reports)

When a safety event occurs, was it because of a current risk mitigation failure or a newly developed causal factor?

How LCTA identifies safety event causal factors

The following activities are conducted as part of the event investigation process (data, physical observations, protocols, mitigations):

- Physical in-person interviews with all involved actors
- Review of CCTV video footage
- Review of FTA DOT Drug and Alcohol Testing Program documents
- Review of Accident/Incident/Police Reports
- Review of historical NTD S&S reporting data
- Review of service delivery activities (field observations)
- Review of operational, training, and maintenance data
- Development of simulated physical event using a tabletop exercise
- Development of mitigation and communication strategy
- Development of training update/implementation

Safety Assurance Event Investigation Causal Factor Analysis Form

Causal Factor	Contributing Factor Present (Y/N)	Describe Causal Events Leading to Event	Describe the Mitigation Strategy for Causal Event
Operator Error			
Operator Fitness for Duty (DA/RS/Med)			
Operator Action(s)			
Vehicle Placement			
Vehicle Condition			
Road Conditions			
Weather Conditions			
Passenger/Public Contribution			
Training Deficiency			
Regulation/Policy Deficiency			
Existing Mitigation Failure			
External Conditions/Factors (other)			

Event Type:	Event Date:	Investigatior:
Investigation Start Date:	Event Location:	LCTA Division:
Investigation End Date:		Incident Number:
Investigation Review Dates:		Video Footage Review:

Document Review (attachments):

Investigation Closeout Process

Upon completion of the investigation process, the Authority CSO shall draft a written investigation report. The CSO shall determine in this report the following (who, what, when, where, why and how):

- Was the accident was preventable or non-preventable;
- Do personnel require discipline or retraining (risk matrix analysis);
- Do the causal factor(s) indicate(s) that a safety hazard contributed to or was present during the event; and
- Does the accident appears to involve underlying organizational causal factors beyond just individual employee behavior.

The Authority CSO shall meet with the applicable employees, union representatives and managers to discuss any facets of the investigation that identified causal factors, and mitigation/training/monitoring/communication strategies. Finally, upon the investigation close out or ongoing monitoring, the safety hazard/event database shall be updated. If an ongoing training or mitigation phase it implemented, the review schedule shall also be documented by the CSO.

Nicholas Oldham
Senior Safety Program Manager
WeGo Public Transit
Nashville, TN

Biography

- B.S. Computer Science
- M.A. Theology
- Supply Chain Management, CERT
- Data Analytics, CERT
- Started as Bus Operator

Agency Characteristics and Services

- The Nashville Metropolitan Transit Authority (Nashville MTA) and the Regional Transportation Authority (RTA) are operating bodies of WeGo Public Transit, which offers three main types of bus service: Local, regional, and Access:
  - 26 local bus routes
  - 8 regional bus routes
  - 1 train serving Davidson and Wilson counties
- Local service operates from 4 a.m. to midnight
- Access (ADA Paratransit) operates specialized van services for persons with disabilities and provides door-to-door service within Davidson County

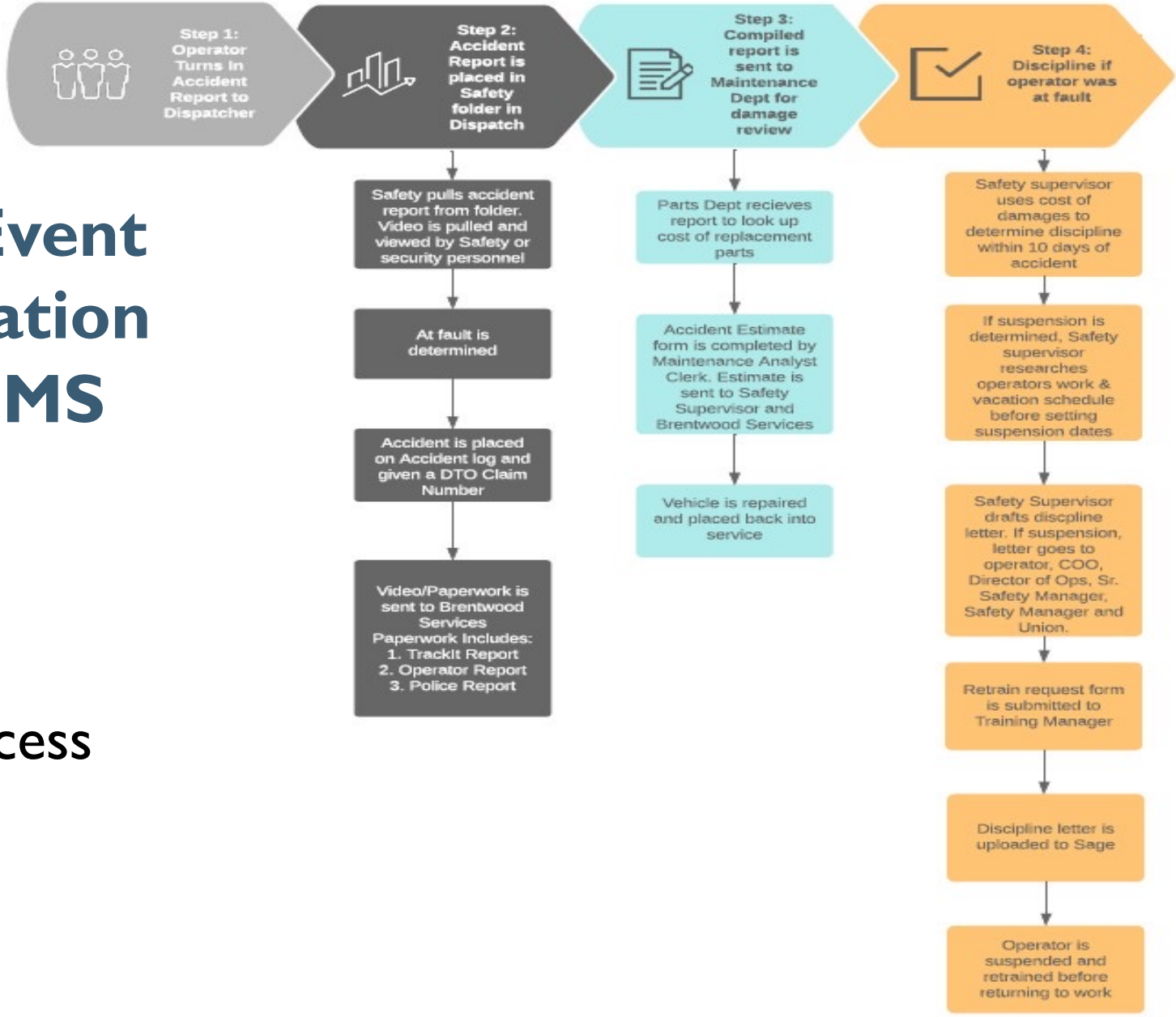
Safety Event Investigation in an SMS

Overview

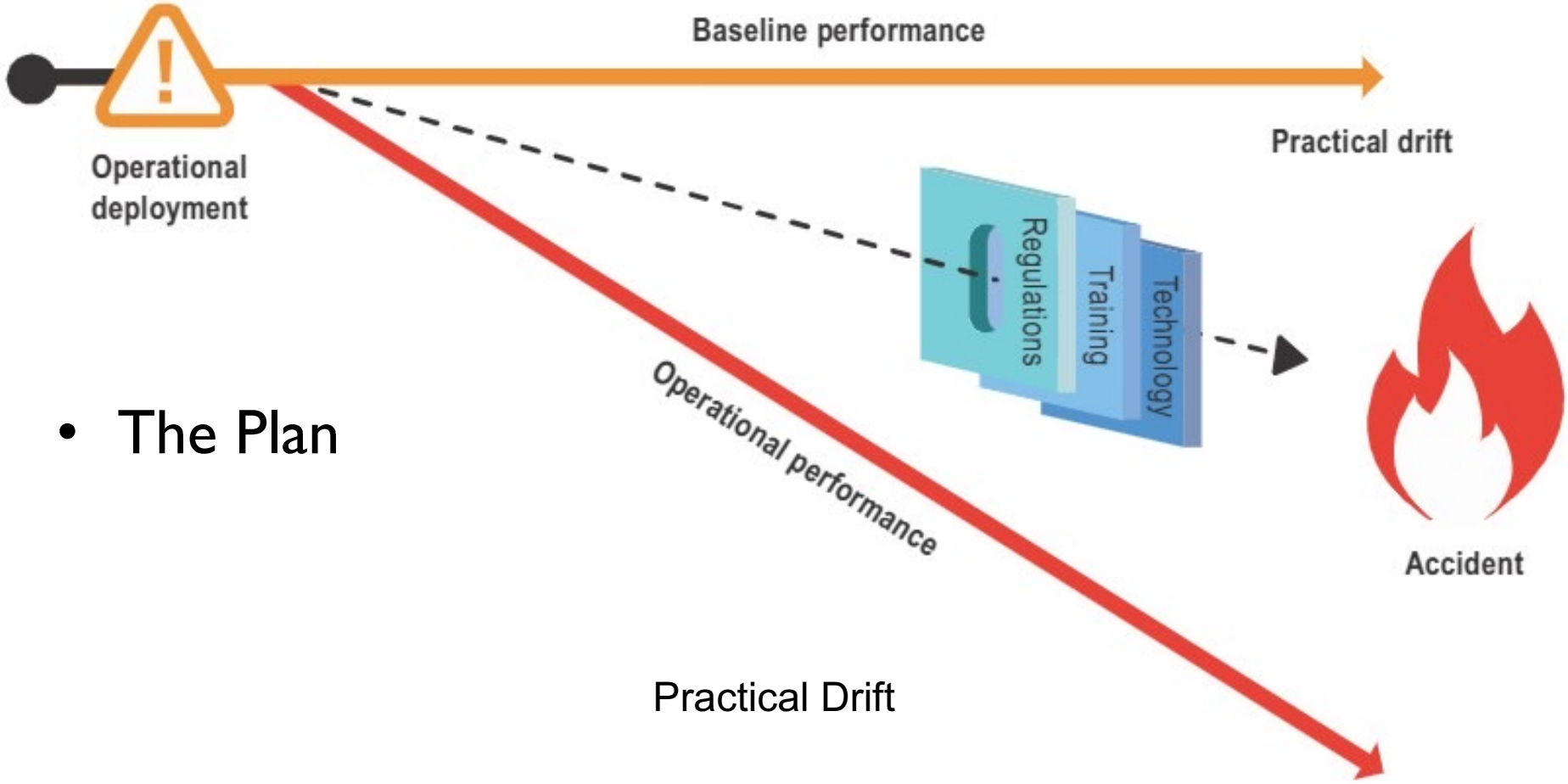
- The Process
- The Plan
- The Improvement
- The Lessons

Safety Event Investigation in an SMS

- The Process



Safety Event Investigation in an SMS



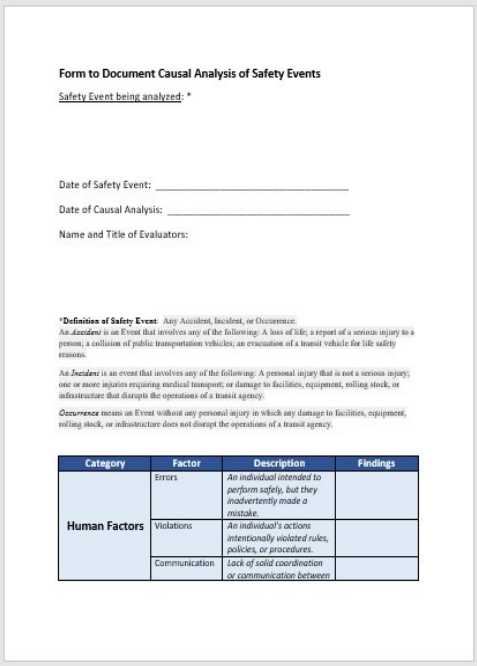
- The Plan

Practical Drift

* Figure Adapted from ICAO Safety Management Manual, Barnaby O'Connor pg 32

Safety Event Investigation in an SMS

- The Improvement



Form to Document Causal Analysis of Safety Events

Safety Event being analyzed: *

Date of Safety Event: _____

Date of Causal Analysis: _____

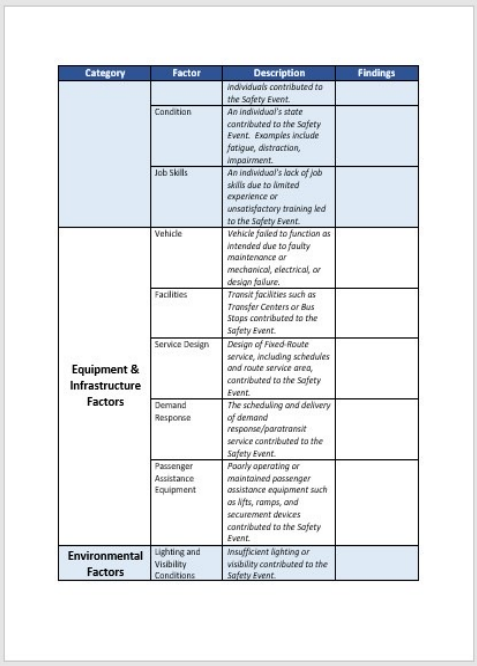
Name and Title of Evaluators:

*__Definition of Safety Event__: Any Accident, Incident, or Occurrence.
An *Accident* is an Event that involves any of the following: A loss of life; a report of a serious injury to a person; a collision of public transportation vehicles; an evacuation of a transit vehicle for life safety reasons.

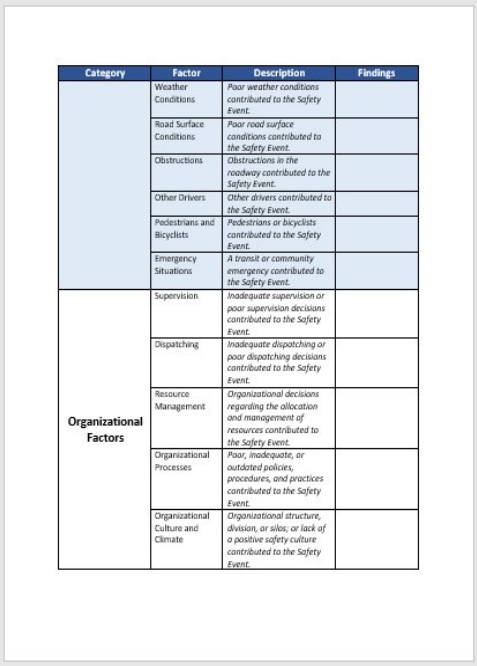
An *Incident* is an event that involves any of the following: A personal injury that is not a serious injury; one or more injuries requiring medical transport; or damage to facilities, equipment, rolling stock, or infrastructure that disrupts the operations of a transit agency.

Occurrence means an Event without any personal injury in which any damage to facilities, equipment, rolling stock, or infrastructure does not disrupt the operations of a transit agency.

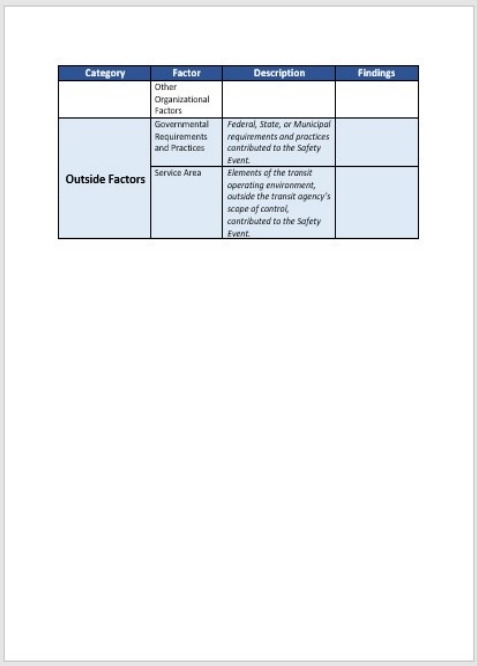
Category	Factor	Description	Findings
Human Factors	Errors	*An individual intended to perform safely, but they inadvertently made a mistake.*	
	Violations	*An individual's actions intentionally violated rules, policies, or procedures.*	
	Communication	*Lack of solid coordination or communication between*	



Category	Factor	Description	Findings
		individuals contributed to the Safety Event.	
	Condition	*An individual's state contributed to the Safety Event. Examples include fatigue, distraction, impairment.*	
	Job Skills	*An individual's lack of job skills due to limited experience or unsatisfactory training led to the Safety Event.*	
Equipment & Infrastructure Factors	Vehicle	*Vehicle failed to function as intended due to faulty maintenance or mechanical, electrical, or design failure.*	
	Facilities	*Transit facilities such as Transfer Centers or Bus Stops contributed to the Safety Event.*	
	Service Design	*Design of Fixed-Route service, including schedules and route service area, contributed to the Safety Event.*	
	Demand Response	*The scheduling and delivery of demand response/paratransit service contributed to the Safety Event.*	
	Passenger Assistance Equipment	*Poorly operating or maintained passenger assistance equipment such as lifts, ramps, and securement devices contributed to the Safety Event.*	
Environmental Factors	Lighting and Visibility Conditions	*Insufficient lighting or visibility contributed to the Safety Event.*	



Category	Factor	Description	Findings
	Weather Conditions	*Poor weather conditions contributed to the Safety Event.*	
	Road Surface Conditions	*Poor road surface conditions contributed to the Safety Event.*	
	Obstructions	*Obstructions in the roadway contributed to the Safety Event.*	
	Other Drivers	*Other drivers contributed to the Safety Event.*	
	Pedestrians and Bicyclists	*Pedestrians or bicyclists contributed to the Safety Event.*	
	Emergency Situations	*A transit or community emergency contributed to the Safety Event.*	
Organizational Factors	Supervision	*Inadequate supervision or poor supervision decisions contributed to the Safety Event.*	
	Dispatching	*Inadequate dispatching or poor dispatching decisions contributed to the Safety Event.*	
	Resource Management	*Organizational decisions regarding the allocation and management of resources contributed to the Safety Event.*	
	Organizational Processes	*Poor, inadequate, or outdated policies, procedures, and practices contributed to the Safety Event.*	
	Organizational Culture and Climate	*Organizational structure, division, or silos; or lack of a positive safety culture contributed to the Safety Event.*	



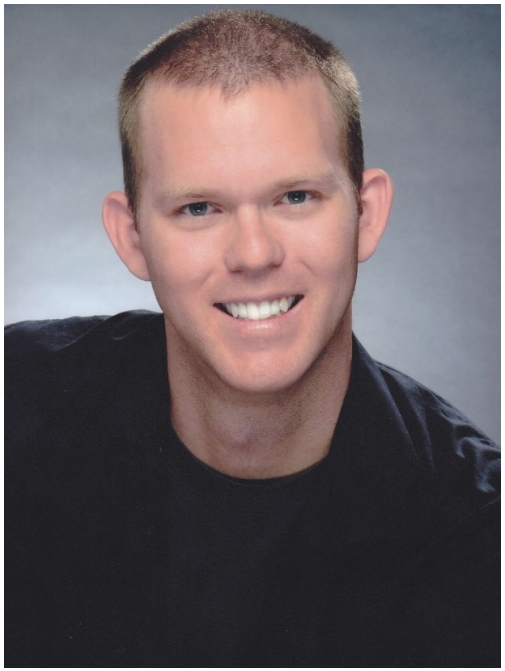
Category	Factor	Description	Findings
	Other Organizational Factors		
Outside Factors	Governmental Requirements and Practices	*Federal, State, or Municipal requirements and practices contributed to the Safety Event.*	
	Service Area	*Elements of the transit operating environment, outside the transit agency's scope of control, contributed to the Safety Event.*	

Causal Analysis Form

Safety Event Investigation in an SMS

- The Lessons

* Picture adapted from https://www.solutions360.com/lessons-learned-process/



BJ Takushi
Principal Safety Specialist
LA Metro
Los Angeles, CA

Biography

- 12 years of transportation experience
- 5 years at LA Metro, Corporate Safety (performing accident investigations, conducting internal audits, and managing corrective action plans for Metro Rail)
- Serves as Lead for LA Metro's PTASP effort
- MS Engineering Management
- Certified Safety Specialist
- TSSP (Bus and Rail) & PTSCTP from TSI

LA METRO Characteristics and Services

- Multimodal Transit Agency (Bus and Rail)
- Serving 18+ Million riders per month (June 2021)
- 2400+ Bus Fleet
- 400+ Light Rail and Heavy Rail Cars
- 100+ Miles of Track (6 Rail Lines)
- 10,000+ Employees
- 27+ Divisions/Locations to support Public Transit

Safety Event Investigation in an SMS

- Read the Regulation, identify the requirements, comply
- Adapt Existing Processes
  - Internal Processes
  - State Safety Oversight Agency (SSOA) Requirements
- Use Resources
  - Feedback from SSOA and other stakeholders
  - FTA guidance (checklist, PTASP- Technical Assistance Center)

Safety Event Investigation in an SMS

At LA Metro:

– Majority of events are investigated at the local level and input into an electronic record management system.
– Typical accident investigations include collisions, fatalities, fires, derailments.
– Rail Accidents: Facts gathered & reviewed with our SSOA and a primary and contributory causal factors may be identified.

Safety Event Investigation in an SMS

- National Transportation Safety Plan
  - https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/National%20Public%20Transportation%20Safety%20Plan_1.pdf
- NTD Safety and Security Policy Manual
  - https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-05/2021%20Safety%20and%20Security%20Policy%20Manual_0.pdf
- 49 CFR 674 and Two-Hour Accident Reporting Guidance

PTASP Technical Assistance Center (TAC) Links and Contact Information

Technical Assistance Center

- www.transit.dot.gov/PTASP-TAC

PTASP Community of Practice

- www.transit.dot.gov/PTASP-COP

Frequently Asked Questions

- www.transit.dot.gov/PTASP-FAQs