Task 4 Training:
Safety Management Plan
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ITS Safety Program Manager
FHWA Office of Safety
Agenda

- Brief Program Overview

- Safety Management
  - Project Overview and Relationships
  - Safety Needs and Scenarios
  - Assessment of Safety Risks
  - Safety Operational Concept
  - Safety Management Summary

- Resources
  - Useful References
  - Stay Connected
Program Overview
Complete Trip - ITS4US Deployment Program

- A USDOT Multimodal Deployment effort, led by ITSJPO and supported by OST, FHWA and FTA
- Supports multiple large-scale replicable deployments to address the challenges of planning and executing all segments of a complete trip

Vision

Innovative and integrated complete trip deployments to support seamless travel for all users across all modes, regardless of location, income, or disability
Program Goals

- Spur high-impact integrated Complete Trip deployments nationwide
- Identify needs and challenges by populations
- Develop and deploy mobility solutions that meet user needs
- Measure impact of integrated deployments
- Identify replicable solutions and disseminate lessons learned
Complete Trip Phase 1 Awardees

- University of Washington
  OR, WA, MD

- California Association of Coordinated Transportation
  CA, OR, and WA

- Heart of Iowa Regional Transit Agency
  Dallas County, IA

- ICF
  Buffalo, NY

- Atlanta Regional Commission
  Gwinnett County, GA
Deployment Phases

**PHASE 1: Concept Development**
- Concept Development for Complete Trip Deployment
- Establish Cohort Roundtables

**PHASE 2: Design & Test**
- Design, Test and Deploy Complete Trip Solutions
- Evaluation Framework and Planning

**PHASE 3: Operate & Evaluate**
- Demonstrate Multiple Large-Scale Deployments
- Evaluate Deployments
- Share Data & Lessons Learned

**Operations Maintenance**
- Sustain operations for a minimum period of five years after the program is completed with no supplementary federal funds

**Deployment**
- Up to 12 months
- Up to 24 months
- Minimum of 18 months

**Post-Deployment**
- 5 years
Safety Management Plan (SMP)
Safety Management Plan (SMP)

A Safety Management Plan:
- Reviews and assesses safety needs and risks in how travelers and others interact with the planned deployment.
- Develops strategies to minimize risks in design, development, and operation and respond to potential safety issues.
- Communicates overall safety management efforts to the end user, developer, agencies, organizations, and staff involved in the system.

**Deliverables**
2. Final Safety Management Plan – Kick-Off + 26 weeks
<table>
<thead>
<tr>
<th>Major Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Relationships</td>
<td>Safety-relevant stakeholders and processes to result in a tailored safety management approach</td>
</tr>
<tr>
<td>Safety Scenarios</td>
<td>Scenarios identified based on the applications and technologies selected for deployment</td>
</tr>
<tr>
<td>Safety Needs</td>
<td>Needs derived from an analysis of the scenarios, including likelihood and potential impact</td>
</tr>
<tr>
<td>Levels of Safety Risk</td>
<td>Levels of safety risk associated with the deployment, using established processes where possible</td>
</tr>
<tr>
<td>Safety Operational Concept</td>
<td>Requirements and actions to reduce the likelihood and impact in each safety scenario, and responses to safety-related events</td>
</tr>
</tbody>
</table>
# Safety Management Plan Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>User Needs</td>
<td>Feb Apr</td>
<td>May Jun</td>
</tr>
<tr>
<td>Task 2</td>
<td>Concept of Operations</td>
<td>Mar</td>
<td>Jul Aug</td>
</tr>
<tr>
<td>Task 3</td>
<td>Data Management Plan</td>
<td>Apr</td>
<td>Sep Oct Dec</td>
</tr>
<tr>
<td>Task 4</td>
<td><strong>Safety Plan</strong></td>
<td>May</td>
<td>Nov Jan</td>
</tr>
<tr>
<td>Task 5</td>
<td>Performance Measurement</td>
<td>Jun</td>
<td>Feb</td>
</tr>
<tr>
<td>Task 6</td>
<td>System Requirements</td>
<td>Jul</td>
<td></td>
</tr>
<tr>
<td>Task 7</td>
<td>Tech Readiness</td>
<td>Aug</td>
<td></td>
</tr>
<tr>
<td>Task 8</td>
<td>Human Use Approval</td>
<td>Sep</td>
<td></td>
</tr>
<tr>
<td>Task 9</td>
<td>Training Plan</td>
<td>Oct</td>
<td></td>
</tr>
<tr>
<td>Task 10</td>
<td>Institutional, Partnership, and Financial Plan</td>
<td>Nov Jan</td>
<td></td>
</tr>
<tr>
<td>Task 11</td>
<td>Outreach Plan</td>
<td>Dec</td>
<td></td>
</tr>
<tr>
<td>Task 12</td>
<td>SEMP</td>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Task 13</td>
<td>Deployment Plan</td>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Task 14</td>
<td>Deployment Readiness Summary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Safety Management Interdependencies

**Inputs**
- Planned Concepts and Scenarios
  - Task 2: ConOps

**Safety Management Plan**
- Safety Scenarios
- Safety Needs
- Levels of Safety Risk
- Safety Op. Concept

**Outputs**
- Safety Requirements / Controls / Actions
  - Task 1: Prog. Mgmt
  - Task 6: SyRS
  - Task 7: Enabling Tech.
  - Task 8: Human Use
  - Task 9: Training Plan
  - Task 13: ICTD Plan
  - Task 14: Dep. Briefing
Safety Overview and Relationships
The nature and extent of the planned deployment and users will help guide development of adequate and appropriate safety management processes.
Safety Stakeholders

List Safety Stakeholders by:

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Roles</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>

Include

- Personnel within the project team as well as external parties (e.g., affected infrastructure agencies)
- Individuals with safety responsibilities, and people with specific expertise and understanding of safety relating to underserved communities
Safety Risk Process and Approach

- Explain the overall approach being applied by the project to define, assess, and manage safety risks relating to the deployment.
- The approach should be tailored to the specific nature of the project and proposed components, users, and surrounding infrastructure environment.
- Leverage established processes (e.g., Public Transportation Agency Safety Plan, UL 4600, ISO 26262, ASIL, etc.) when appropriate.
- Validate with stakeholders and objective expertise.
Safety Needs and Scenarios
Build Upon ConOps Scenarios

**Needs** and **scenarios** should include input and feedback from safety stakeholders to ensure that complete and relevant information is included.

- Build upon the scenarios defined in the ConOps:
  - Describe the various components and users of the project
  - Use a systematic approach to define the safety needs and scenarios
# Safety Needs and Scenarios

## Safety Needs

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a description of the safety needs relating to each component.</td>
<td></td>
</tr>
<tr>
<td>Pay close attention to communities with specific needs that may warrant additional focus.</td>
<td></td>
</tr>
</tbody>
</table>

## Safety Scenarios

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a description of the system- or application-level scenarios that cover the safety needs.</td>
<td></td>
</tr>
<tr>
<td>Provide sufficient detail to understand the hazard, impacts, potential exposure, and probabilities.</td>
<td></td>
</tr>
<tr>
<td>Particular attention should be given to new technologies and applications where prior assessments may not be available.</td>
<td></td>
</tr>
</tbody>
</table>

Discuss additional expertise / assistance utilized in defining the needs and scenarios and coordinating with external parties.
Assessment of Safety Risks
Safety Risk Assessment

**Step 1**
Apply safety management process to assess scenarios developed in ConOps

- Apply tailored process developed earlier in Safety Management Planning.

**Step 2**
Determine which scenarios may need countermeasures and controls

- Gather input from the relevant safety stakeholders and not solely based on vendor or project team decision.

**Step 3**
Create Safety Risk Assessment

- Provide supporting information to explain the assessment of safety risks.
# Example Safety Risk Assessment - THEA

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Safety Impacts</th>
<th>Prevention/ Mitigation Measures</th>
<th>Safety Incident Response Plans</th>
<th>QM Plan/ Response Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>The Bus Rapid Transit Signal Priority and Progression malfunctions causing poor progression and increased route times.</td>
<td>Safety of the transit users. Riders may be stranded at bus stop locations longer than anticipated without alternate transportation options. This may result in riders stranded unexpectedly at night in a dangerous situation.</td>
<td>Include lessons learned and best practices in the design. Perform reviews and verify communication software and equipment before deployment, including testing and checklists.</td>
<td>Bus driver participants will be provided a phone number to call any time to report issues and gain assistance. An estimated time of arrival will be provided to passengers as well as a phone number to call any time to report issues.</td>
<td>COT SOP 23.2 Vendor QM Plan (Section 6.1.1) HART, THEA, COT</td>
</tr>
</tbody>
</table>

Excerpt from Tampa (THEA) CV Pilot Safety Management Plan
## Example Safety Risk Assessment - WYDOT

<table>
<thead>
<tr>
<th>ID</th>
<th>Risk Reg. Ref.</th>
<th>Category</th>
<th>Safety Risk Description</th>
<th>Likely Impacts</th>
<th>Risk Response Plan</th>
<th>E</th>
<th>S</th>
<th>C</th>
<th>ASIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>27</td>
<td>Infrastr. Install.</td>
<td>The CV system negatively impacts the VSL algorithm to cause the roadside VSL system to go down.</td>
<td>The symptom is the same as if a lightning strike caused a power outage. There are failsafe already built into the VSL system and the default mode would be no variable speed limit posted similar to other roadway sections with no VSL system. Therefore, the Pilot Deployment does not increase the potential severity to a driver's normal day-to-day activities.</td>
<td>System monitoring will be used to reduce the length of time for failures. WYDOT maintenance and Network Operations Center (NOC) teams are available 24x7x365 for emergency repairs.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>QM</td>
</tr>
</tbody>
</table>

Excerpt from WYDOT CV Pilot Safety Management Plan

E=Exposure, S=Severity, C=Controllability, Automotive Safety Integrity Level (ASIL)
## Example Safety Risk Assessment – NYC DOT

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>ASIL</th>
<th>Type</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Audible messages are indistinguishable from other sounds.</td>
<td>B</td>
<td>Functional Safety Requirements</td>
<td>Develop vehicle-specific design guidelines, followed by testing in a realistic traffic environment</td>
</tr>
</tbody>
</table>

Excerpt from NYC DOT CV Pilot Safety Management Plan  
ASIL = Automotive Safety Integrity Level
Safety Operational Concepts
Strategies to Address Safety Needs

- Based on safety risk assessment, select appropriate strategies
- Quality Management – Include continued monitoring and reassessment if information suggests need or if changes occur

Describe how the application or component will include **design elements** to avoid or prevent safety impacts.
- **Example**: Include requirement for wayfinding human interface to avoid causing distractions while in roadway.

Describe how the project will develop and execute **operational processes** to control safety risks.
- **Example**: Include additional input validation for location data relating to steps or areas where falls may occur.
Describe the **mitigation and fail-safe measures** to control severity of impacts if/when safety impacts occur.

- **Example:** Develop verification and notification mechanism to investigate if a participant’s outdoor pickup is delayed or missed in severe weather conditions.

Describe the **processes to respond** to safety incidents.

- **Example:** Document technology-related response mechanisms (e.g., instructions for disabling automation) and inform emergency response services or infrastructure repair.

Describe the **processes to track and report** potential safety incidents.

- **Example:** Provide supporting tool to allow potential safety issues or incidents/near-incidents to be easily reported by electronic form to appropriate personnel, including external parties as appropriate.
Safety Management Summary
Safety Risk Summary

- Provide a summary table to facilitate understanding of overall areas of risk, structured based on the safety management approach described in section 2.4.

Summary table items:

<table>
<thead>
<tr>
<th>ID</th>
<th>Safety Risk</th>
<th>Safety Assessment</th>
<th>Safety Operational Concept Strategies</th>
<th>Factors to Monitor</th>
<th>Overall Status</th>
</tr>
</thead>
</table>

Summary table allows coordination with overall project risk management processes and external coordination as needed.
Continuing Safety Planning

Plan to Make Updates

- Describe the steps to be taken to continue the safety management processes beyond this document.
- Follow-up on actions taken to address risks

Example Updates

- Additional risks may be identified as the systems are developed and tested.
- Updates can be provided on working with local DOT to coordinate related infrastructure safety needs and improvements.
- Safety stakeholders may need to be added or removed over time.
Resources
Useful References

**USDOT**


**International Organization for Standardization**


**US DoD**

Stay Connected

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Visit the Complete Trip - ITS4US Deployment Program Website and FAQs:
https://its.dot.gov/its4us/
https://its.dot.gov/its4us/htm/faqs.htm
Any questions?