U.S. Department of Transportation

COMPLETE TRIP

ITS4US

Task 12 Training:

Systems Engineering Management Plan

Deborah Curtis

Highway Research Engineer

Office of Operations Research and Development

Program Overview

Complete Trip - ITS4US Deployment Program

- A USDOT Multimodal Deployment effort, led by ITS JPO 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

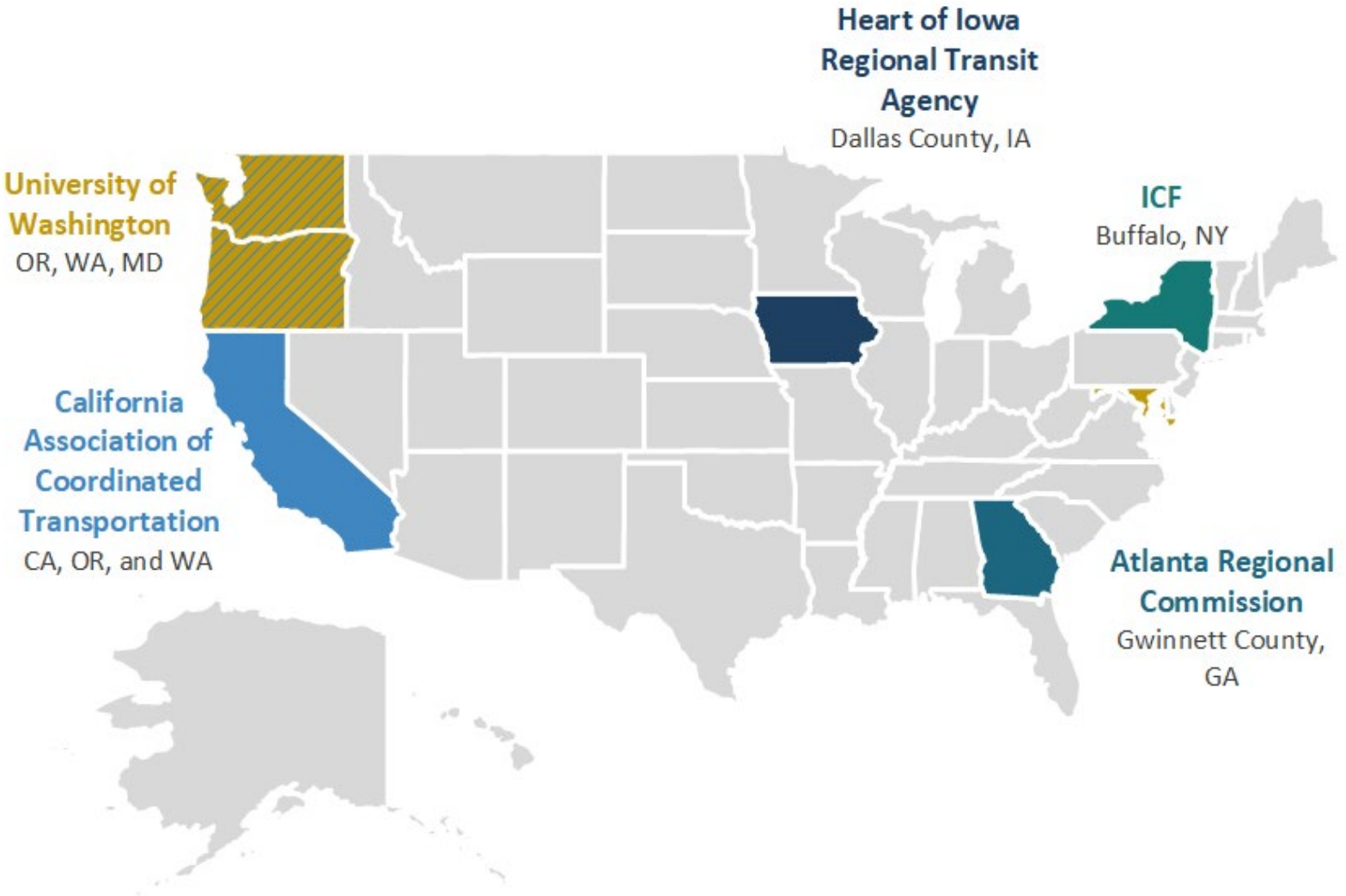
Identify needs and challenges by populations

Develop and deploy mobility solutions that meet user needs

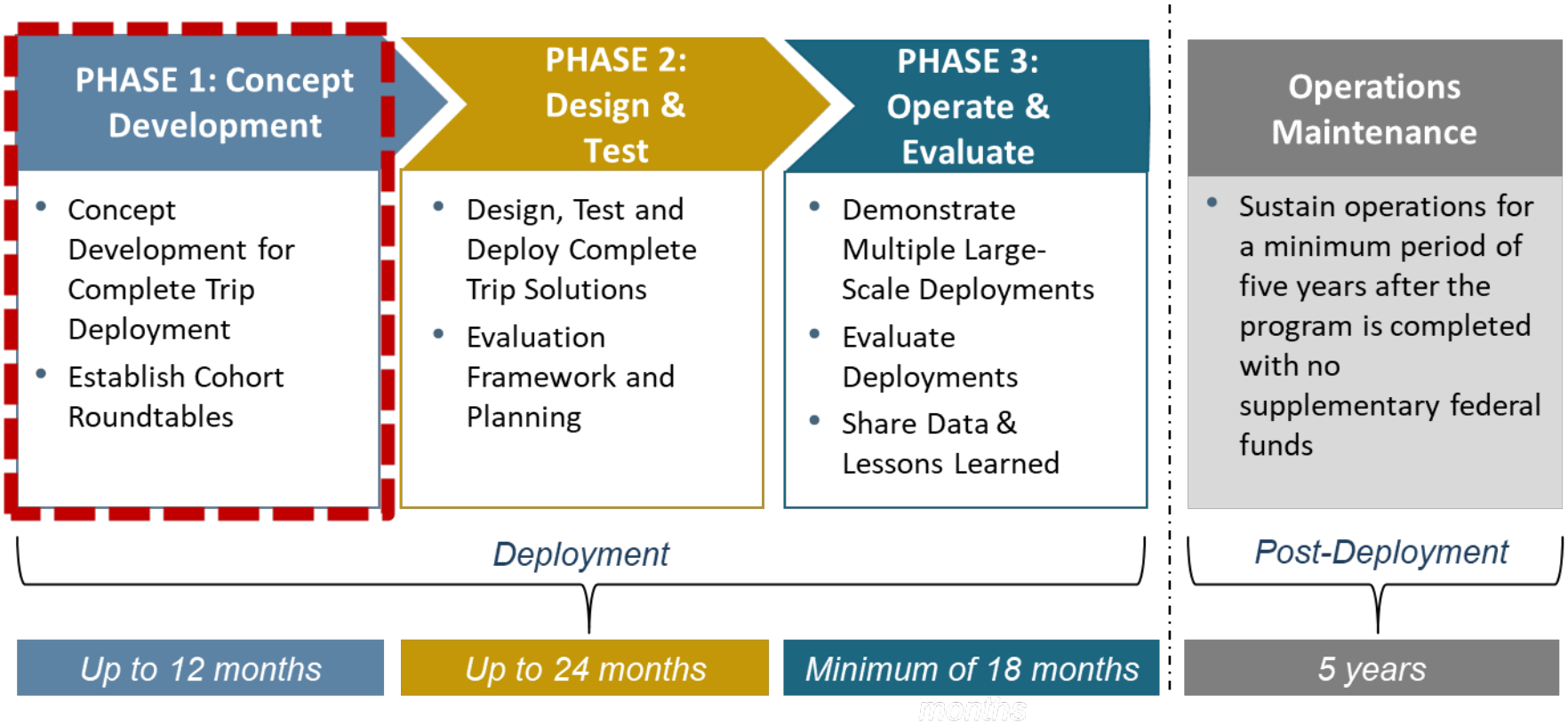
Measure impact of integrated deployments

Identify replicable solutions and disseminate lessons learned

Complete Trip Phase 1 Awardees



Deployment Phases



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Task 12 Training:

Systems Engineering Management Plan (SEMP)

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Agenda

- **Systems Engineering Management Plan (Task 12) Overview**
- **Systems Engineering Management Plan Template**
  - Systems Engineering Process Planning
  - Systems Engineering Technical Processes
  - Agile Process Application
- **Final Thoughts**
  - Useful References
  - Stay Connected

Systems Engineering Management Plan (SEMP)

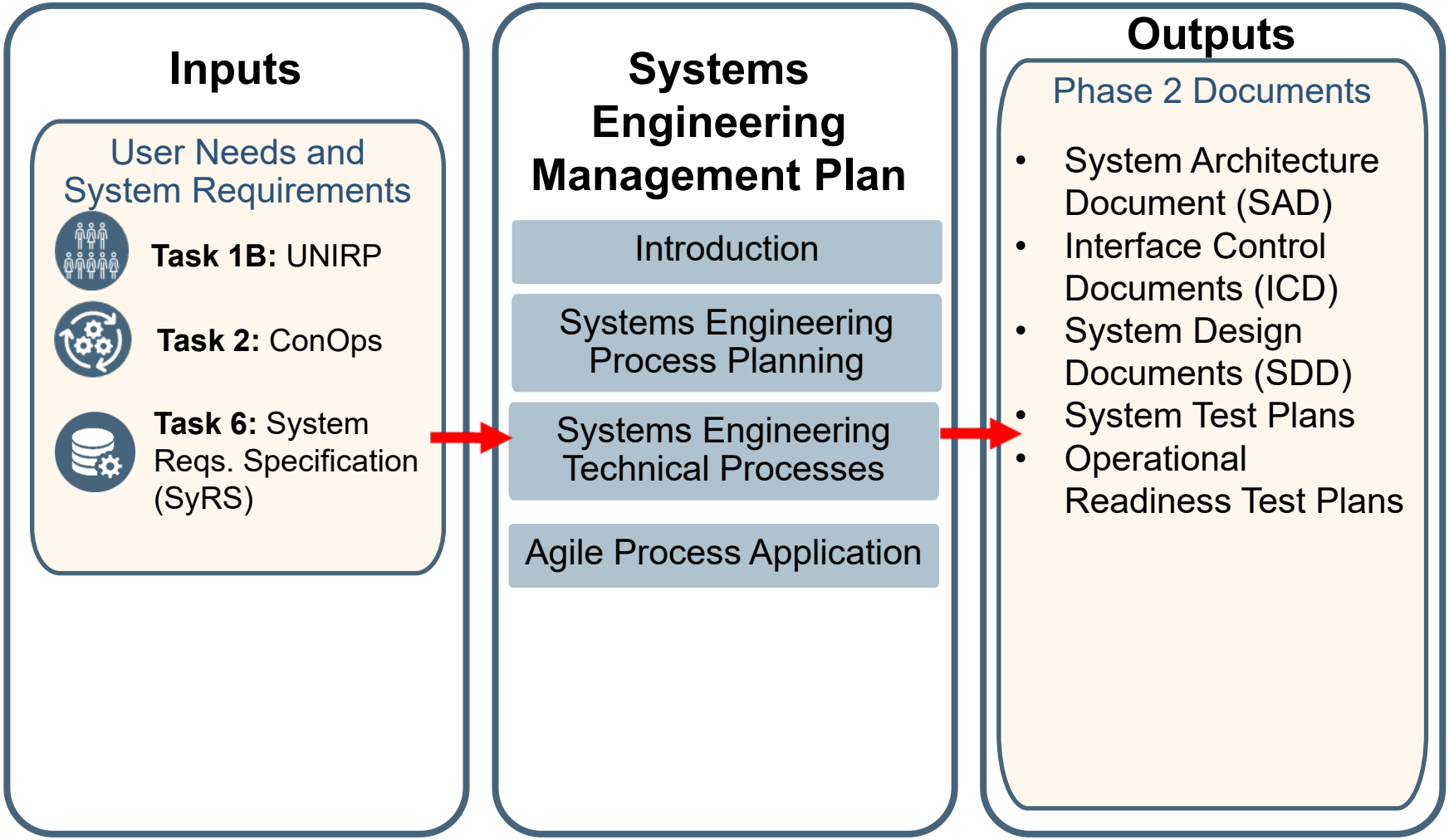
Task 12 Overview

- A **Systems Engineering Management Plan (SEMP):**
  - Defines the technical systems engineering processes that your project will use throughout the systems engineering lifecycle.
  - Since many projects plan to utilize Agile processes for some development areas, this project will also define your high-level Agile processes
  - The previously developed User Needs Identification and Requirements Planning (UNIRP) document already defines the processes for User Needs and System Requirements development
- Major components of the SEMP:
  - Systems Engineering Process Application
    - Systems Engineering Process Planning
    - Systems Engineering Technical Processes
  - Agile Process Application

Deliverables

ID	BAA Section	Deliverable	Due Date	Format	Site Specific Date
P1T12D1	5.12	Systems Engineering Management Plan Draft	11/29/2021	Word	
P1T12D2	5.12	Systems Engineering Management Plan Final	12/27/2021	Word	

SyRS Interdependencies



SEMP Template Sections

Section 1: Introduction

- Sections 1.1 and 1.2 of the SEMP should address:
  - **1.1 Document Purpose**: This section should briefly describe the purpose of the SEMP and how it will describe the systems engineering processes for the remainder of the project lifecycle
  - **1.2 Project Overview:** This section should briefly provide an overview of the overall project. Content should be re-used/duplicated from previous project reports, where possible.

Section 2: Systems Engineering Process Application

- Section 2 consists of two main sections
  - Section 2.1: Systems Engineering Process Planning
  - Section 2.2: Systems Engineering Technical Processes
- Systems Engineering Process Planning discusses overall project organization and processes that cut across the different technical processes
- Systems Engineering Technical Processes discusses the processes your project will use to conduct the other systems engineering technical processes such as Architecture and Interface Definition, Development, Integration, Implementation and Testing, etc.
- The SEMP is a living document and the processes that are defined in these sections are a snapshot in time. These processes can be updated as each project progresses through each of the SE processes

Section 2.1: Systems Engineering Process Planning

- Section 2.1 covers the overarching project structure and cross-cutting processes that apply throughout the SE Lifecycle.
  - Many of the sub-sections can be pulled from other documents

SEMP Section	Description	Existing Document
2.1.1 Project Team Organization	Provides overview of team structure and roles and responsibilities	PMP
2.1.2 Systems Engineering Deliverables	List the SE related deliverables for all phases of the project.	PMP
2.1.3 System Overview	Provides an overview of your system	ConOps
2.1.4 System Constraints	Provides the programmatic, technical and policy constraints placed on the system.	PMP, ConOps, SyRS

Section 2.1: Systems Engineering Process Planning (continued)

- Within Section 2.1 there are a few subsections that are new
- **2.1.5 System Milestones/Decision Gates**
  - Discuss the major project milestones and decision gates both external (Phase 1, 2, 3) and Internal
- **2.1.6 Standardized Processes**
  - Discuss any standardized processes used by the project which could include CMMI, ISO/IEC 90003, ISO/IEC/IEEE 15288.1, etc.
- **2.1.7 Defect/Discrepancy Processes**
  - Discuss how defects/discrepancies are reported, categorization of defects/discrepancies and the resolution process

Section 2.2: Systems Engineering Technical Processes

- Within Section 2.2 should define the remaining systems engineering processes that will be used in Phases 2 and 3
  - For completeness User Needs and Requirements Processes are listed in Sections 2.2.1 and 2.2.2, however it is completely acceptable to reference the UNIRP for those sections.
- **2.2.3 Architecture and Interface Development Processes**
  - Discuss any tools you will use for architecture and interface definition, deliverables and artifacts developed as part of this process and how traceability to system requirements or system elements will be defined.
- **2.2.4 Design Processes**
  - Discuss system requirements to design traceability, deliverables and artifacts developed as part of this process and any design analysis methodologies that will be utilized.

Section 2.2: Systems Engineering Technical Processes (continued)

- **2.2.5 Development Processes**
  - Discuss how the different parts of the system will be developed or procured. Agile specific developments can be referred to Section 3.
  - This section should also detail any open source development plans. Per the BAA, projects developing new software should make that software open source. Existing software need not be open source, however updates or enhancements to existing software should be open source.
  - This section can reference Appendix C of this document which will provide guidance for providing a Source Code Management Plan.
- **2.2.6 Implementation, Integration and Testing Processes**
  - Discuss the process for how systems will be implemented and integrated, including any testing that is necessary before those activities can occur

Section 2.2: Systems Engineering Technical Processes (continued)

- **2.2.7 Verification and Validation Processes**
  - Discuss your verification and validation processes including what levels of testing your program will use, test case to requirement traceability and how these processes support operational readiness.
- **2.2.8 Operations and Maintenance Processes**
  - Discuss how operations and maintenance will be handled within your system. This could include how issues are identified and resolved, if there are plans for specific maintenance windows, if training will be provided to operators and maintainers, etc.
- **2.2.9 Post Phase 3 Processes**
  - Discuss the high-level plans for the system post Phase 3. This could include whether the system will continue to operate in the same way, if service will be increased or reduced, if there is a plan for change in ownership and maintenance of the system, etc.

Section 3: Agile Process Application

- Section 3 is meant to provide a high-level overview of what systems/subsystems will be developed using an Agile process, how your Agile process integrates into the larger Systems Engineering Process and what your specific Agile development processes look like.
- **3.1 Systems/Subsystems/Components Using Agile Development**
  - This section should have a subsection for each major system or subsystem that will be developed using an Agile process.
- **3.2 Systems Engineering-Agile Integration**
  - This section should detail how your Agile implementation will integrate with the larger Systems Engineering processes your project will utilize. This would include how you will maintain traceability between Agile artifacts such as Epics and User Stories and System Requirements.

Section 3: Agile Process Application (continued)

- **3.3 Agile Team Roles**
  - This section should describe who will be supporting the different Agile roles. Be sure to include information how the USDOT and stakeholders will be included into the Agile process.
- **3.4 Communities of Practice**
  - This section should describe high-level processes for setting up Communities of Practice and any likely known Communities of Practice your project will include.
- **3.5 Sprint and Release Planning**
  - This section should discuss how releases and sprints will be planned, what the process for the development roadmap will be and how/if a Minimum Viable Product (MVP) will be determined and released.

Section 3: Agile Process Application (continued)

- **3.6 Agile Development Tools**
  - This sections should discuss the use of any Agile development tools, who will have access to those tools and any special roles and privileges assigned to certain users and how those tools will support testing and deploying any subsystems/components of your system.

- **3.7 Agile User Demonstrations**
  - This section should discuss how you will conduct User Demos, how feedback will be gathered and prioritized for future development efforts.

Appendix C: Source Code Management Plan

- Appendix C of this document will contain a Source Code Management Plan
- This appendix will further detail open source code and documentation processes
- Further guidance and training will be provided in the near future.

Final Thoughts

Useful References

FHWA

- FHWA's Systems Engineering for Intelligent Transportation Systems http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf
- FHWA Systems Engineering Guidebook for ITS, Concept of Operations Template http://www.fhwa.dot.gov/cadiv/segb/views/document/sections/section8/8_4_5.cfm
- FHWA Applying Scrum Methods to ITS Projects https://rosap.ntl.bts.gov/view/dot/32681

State DOT

- Caltrans SEMP Template https://www.fhwa.dot.gov/cadiv/segb/views/document/sections/section8/8_4_2.cfm

IEEE

- IEEE/ISO/IEC 24748-4-2016 - ISO/IEC/IEEE International Standard for Systems and Software Engineering -- Life Cycle Management -- Part 4: Systems Engineering Planning https://standards.ieee.org/standard/24748-4-2016.html

NASA

- NASA Management Plan (SEMP) Technical Content https://www.nasa.gov/consortium/SystemsEngineeringManagementPlanTechnicalContent
- NASA Systems Engineering Handbook https://www.nasa.gov/seh/appendix-c-how-to-write-a-good-requirement

Stay Connected

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Visit the Complete Trip - ITS4US Deployment Program Website and FAQs:
https://its.dot.gov/its4us/
https://www.its.dot.gov/its4us/its4us_faq.htm

Q&A

Any questions?