



U.S. Department of Transportation

## COMPLETE TRIP

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ITS  US

The logo for ITS4US features a stylized number '4' in blue. A dashed orange line with a red location pin at the top and bottom ends forms a path through the '4'. The '4' is positioned between the letters 'S' and 'U' of the word 'ITS4US'.

**Task 5 Training:**  
Performance Measurement and Evaluation Support Plan



# Murat Omay

Senior Transportation Program Analyst

FTA - Office of Research, Demonstration,  
and Innovation (TRI)

# Agenda

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- **Brief Program Overview**
  
- **Performance Measurement and Evaluation Support Plan**
  - Task 5 Overview and Deliverable Schedule
  - Performance Measures and Targets
  - Confounding Factors and Mitigation Approach
  - System Deployment Impact Analysis Design
  - Independent Evaluation Support
  - Data Collection Plan and Data Sharing Framework
  - Performance Reporting
  
- **Resources**
  
- **Q&As**

# 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

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Spur high-impact integrated Complete Trip deployments nationwide



Identify needs and challenges by populations



Develop and deploy mobility solutions that meet user needs

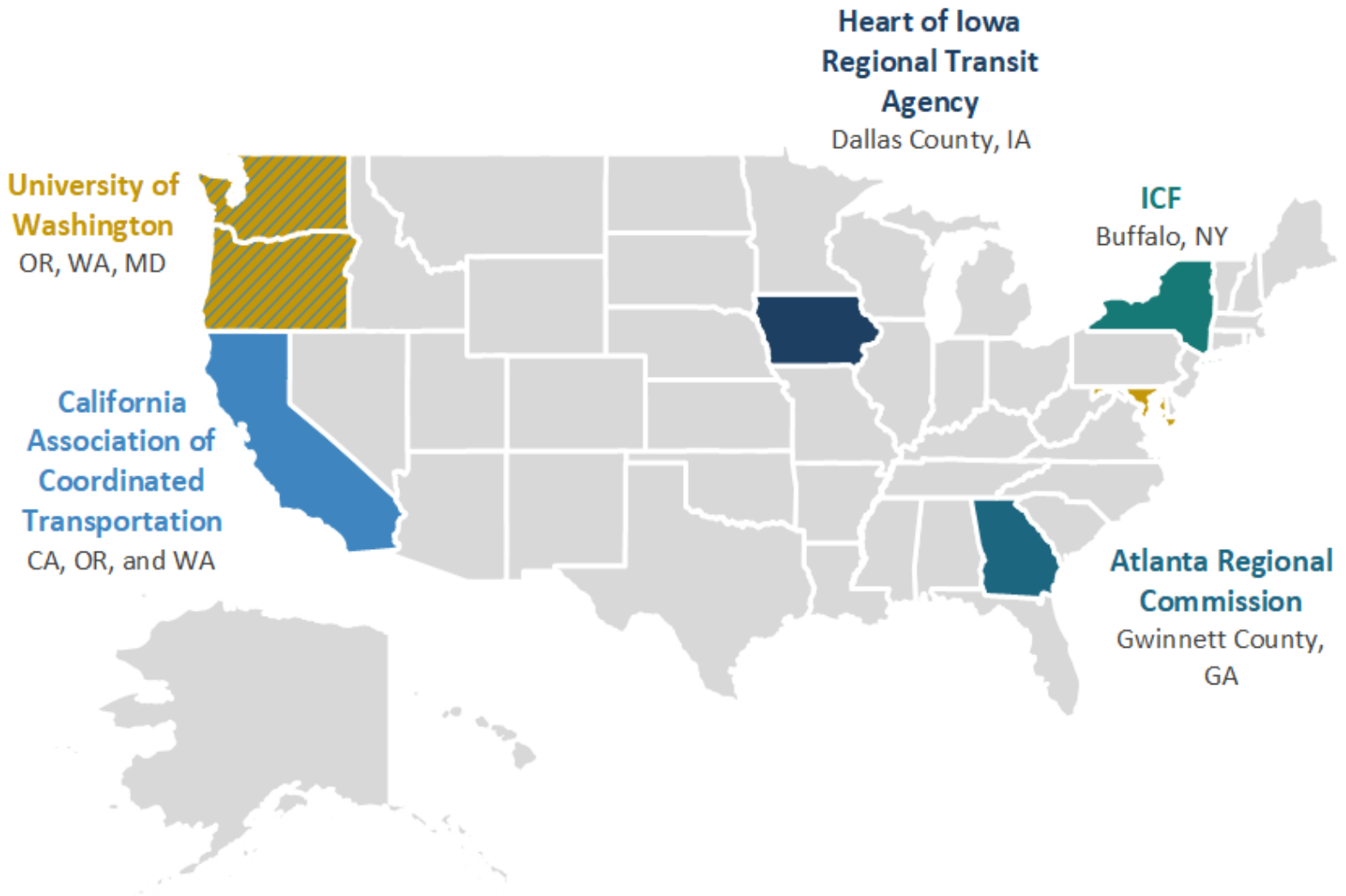


Measure impact of integrated deployments

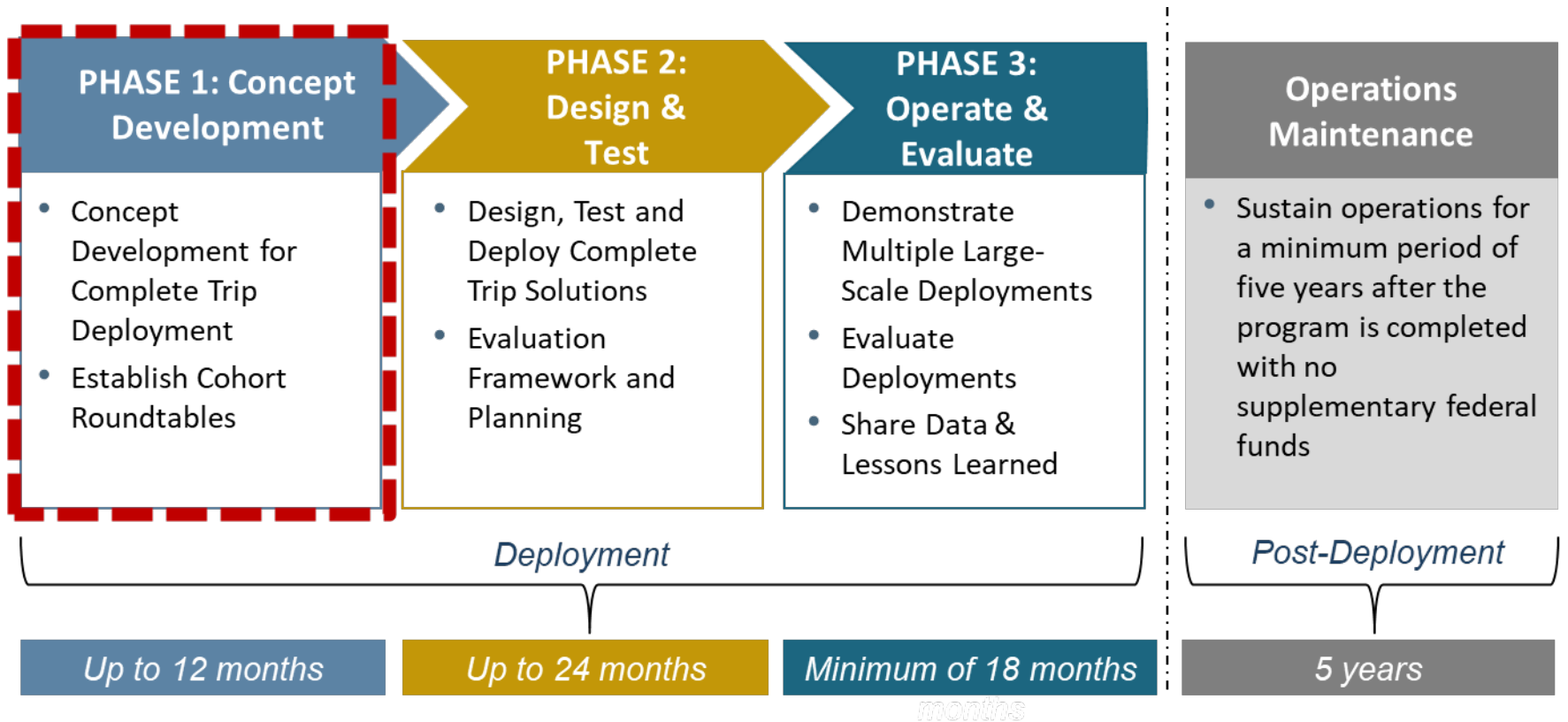


Identify replicable solutions and disseminate lessons learned

# Complete Trip Phase 1 Awardees



# Deployment Phases





# Overview of Performance Measurement and Evaluation Support Plan (PMESP)



# Performance Measurement and Evaluation Support Plan (PMESP)



Task 5

Provides the performance measures that will be used to measure the success of the deployment. Furthermore, it will describe the plan for collecting and analyzing key data to report on performance of the system.

## ***Deliverables***

1. Draft PMESP Document – Kickoff + 26 weeks
2. Final PMESP Document – Kickoff + 35 weeks
3. PMESP Webinar – Kickoff + 38 weeks

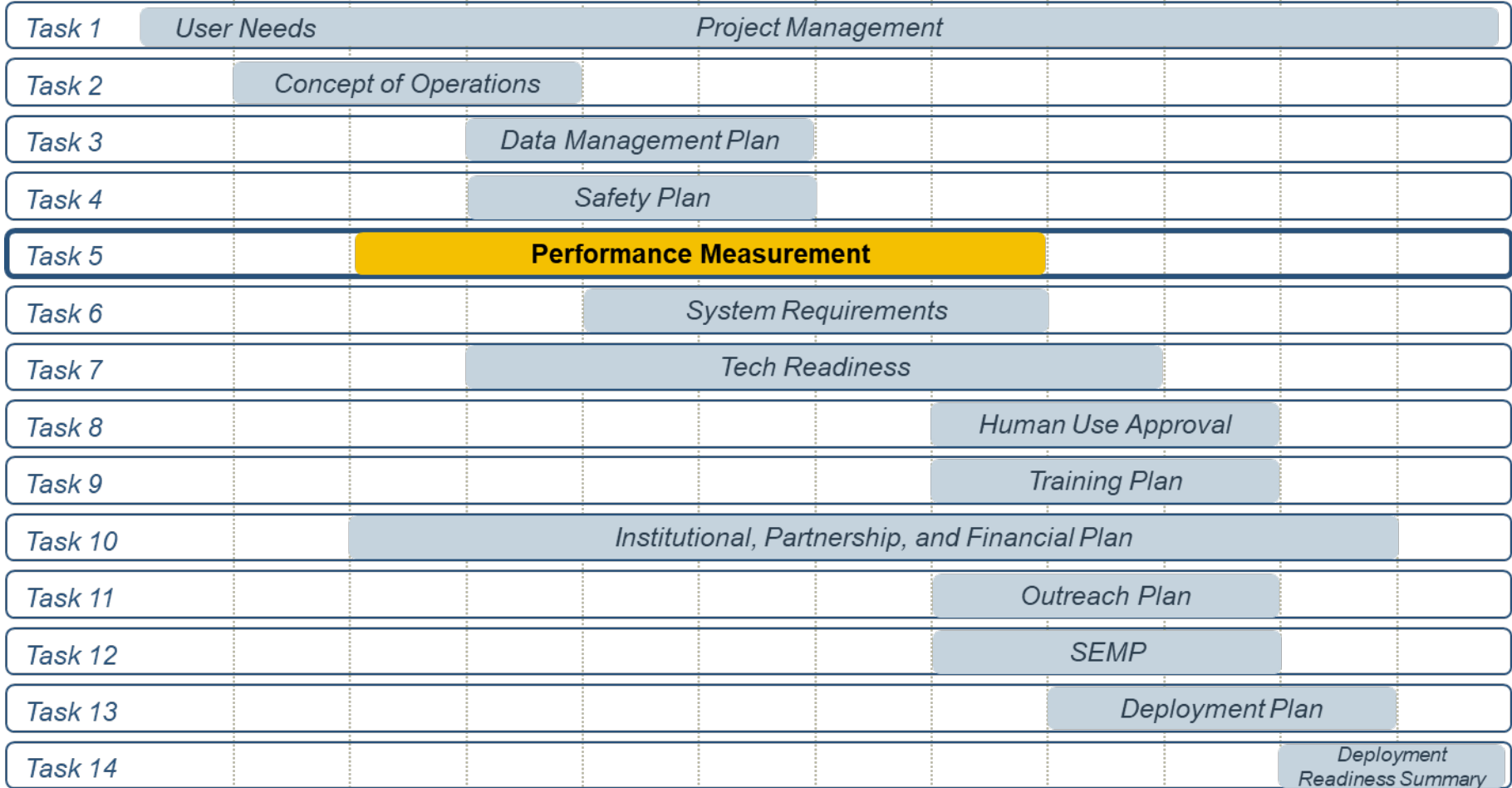


# PMESP Schedule

2021

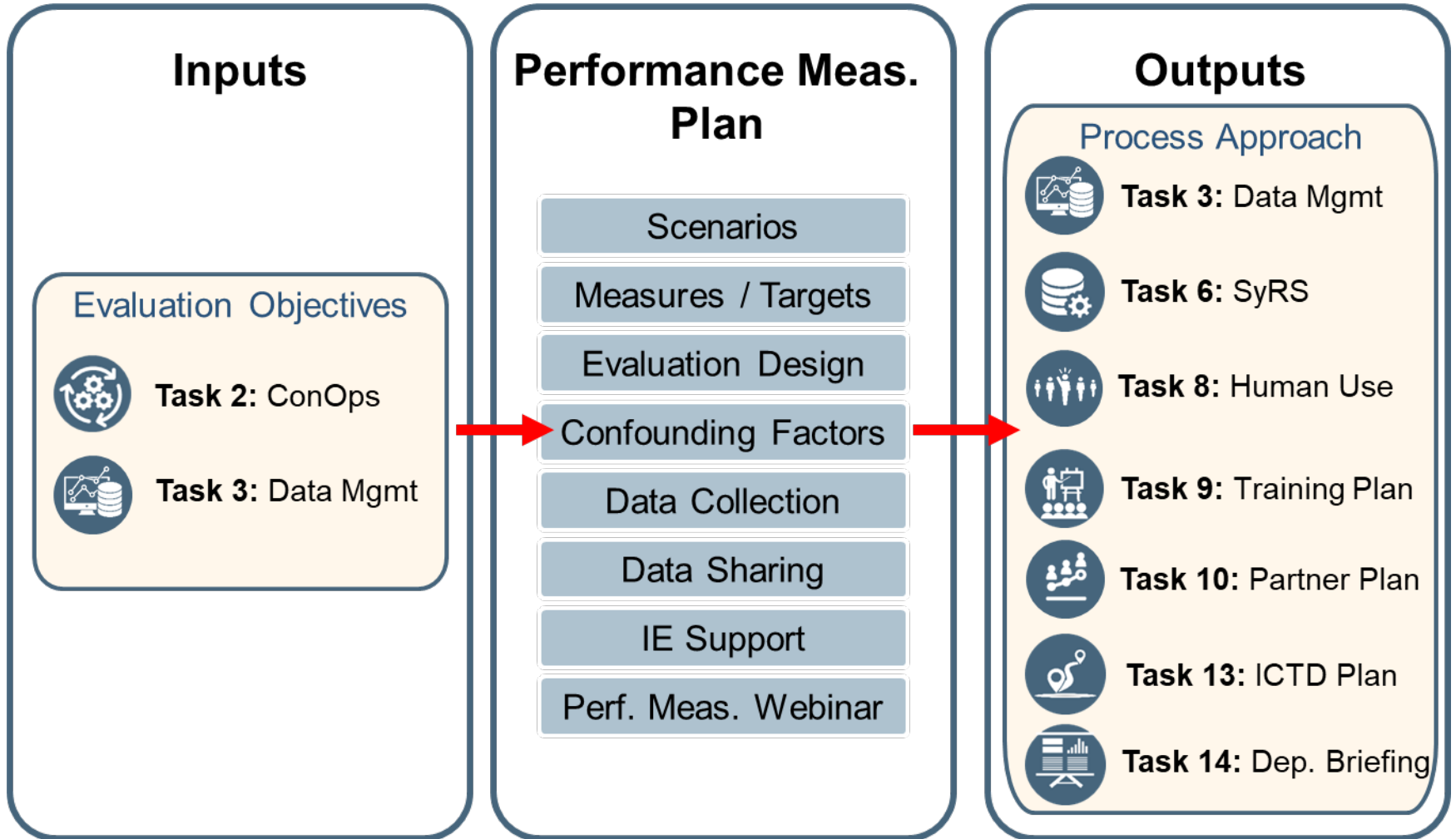
2022

Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
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# PMESP Interdependencies

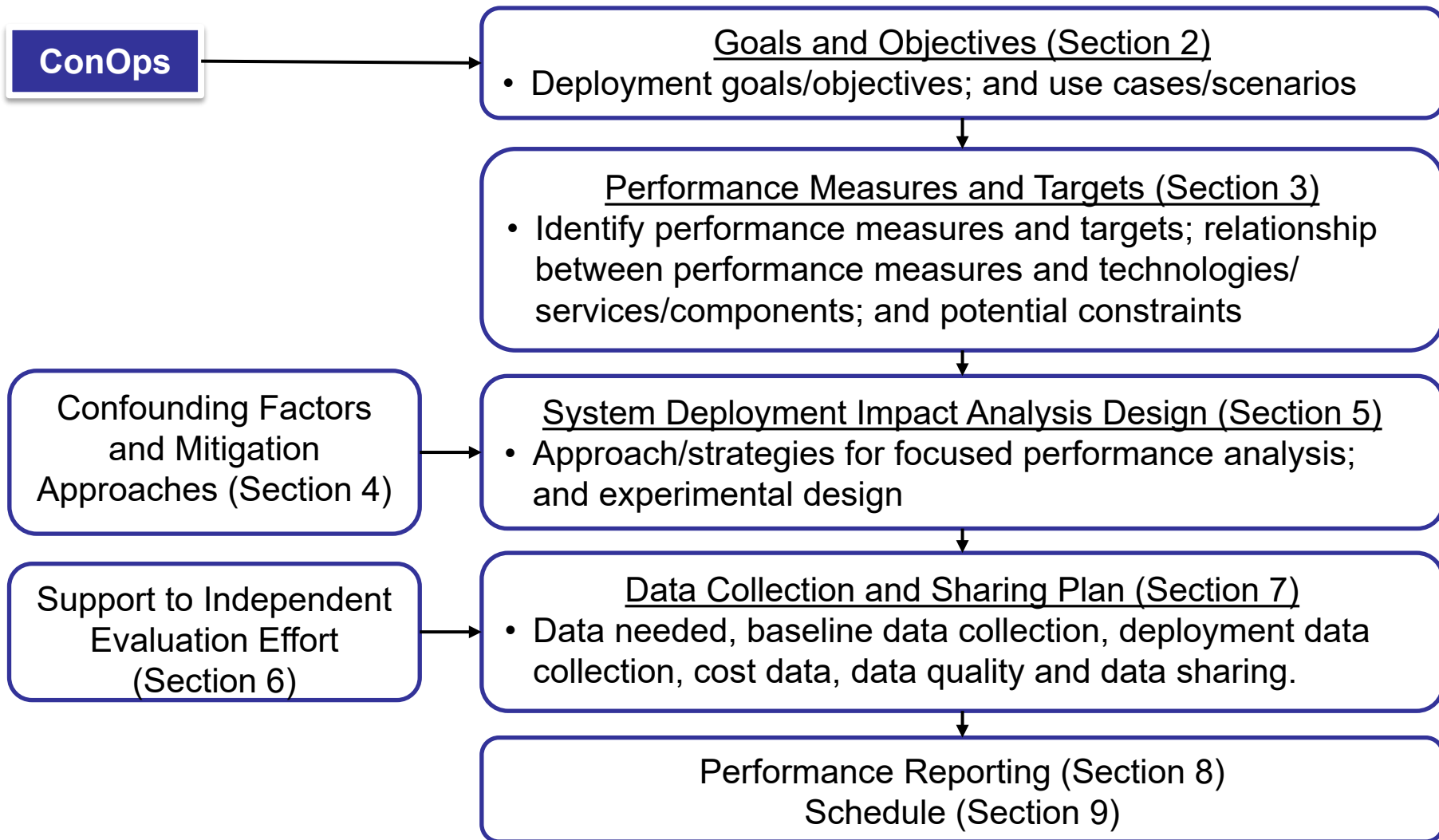




# PMESP Major Components

Use Cases/Scenarios	Identify the specific use cases where the deployment is expected to have the most impact in achieving target performance goals
Performance Measures & Targets	Define and describe measures and targets for assessing enhancements for communities (for both groups and system-wide)
Perf. Measurement / Evaluation Approach	Explain planned approaches to assess impacts including experimental designs and statistical methods for chosen measures
Confounding Factors	Identify expected confounding factors that might influence performance measurement and describe mitigation strategies
IE Support	Provide support and data for the Independent Evaluation effort
Data Collection	Discusses data needed to support the performance measures, including system and individual level, and timing / methods
Data Sharing Framework	Plans for sharing performance measurement data including processes, update frequency, and presentation / formats
Performance Measurement Webinar	Describes the performance measurement plan to engage the broader Complete Trip-ITS4US Deployment Program community

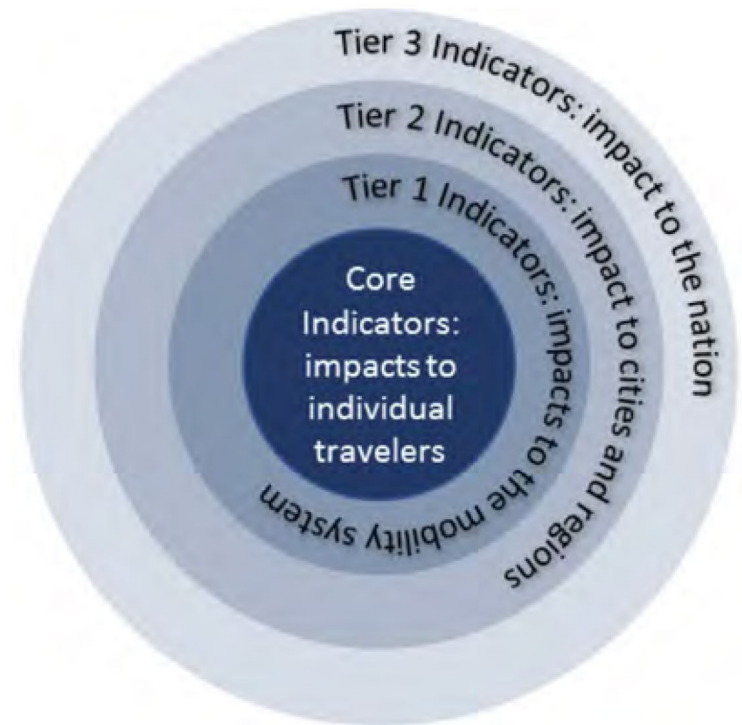
# PMESP Structure



# Performance Measures and Targets

# Performance Measures and Targets

- Types of Performance Measures
  - **Core** – Metrics measuring how well the integrated mobility system meets the needs of **individual** travelers.
  - **Tier 1** – Metrics measuring how effectively and efficiently the integrated mobility **system** performs while meeting the needs of individual travelers.
  - Tier 2 – Metrics measuring how the integrated mobility system impacts the region in terms of sustainability, accessibility, environment, workforce, etc.
  - Tier 3 – Metrics measuring how the integrated mobility system impacts national goals for societal benefits, economic benefits, return on infrastructure investment, etc.





# Performance Measures and Targets

- Keep in mind the *Complete Trip* for the underserved community.
  - Ex. Travel Activity Links concept
- Consider both traveler and system performance measures and targets.
  - Example traveler-centric performance measures (Core)

Trip Stage	Traveler Question	Performance Metric	Unit of Measurement	Metric Description
Trip	How long will my total journey time be?	Total journey time	Minutes, seconds	Wait time plus trip time plus connecting time

- Example system-centric performance measures (Tier 1)

Trip Stage	Mobility System Question	Performance Metric	Unit of Measurement
Trip	What is the maximum number of trips that can be served by the system? How well is supply meeting demand?	Maximum number of trips per hour	Trips taken
		Median wait time	Minutes, seconds
		Number of deadheading (no travelers in the vehicle) miles per day	Miles/24 hours
		Number of deadheading (no travelers in the vehicle) hours per day	Hours/24 hours

# Performance Measures and Targets

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- Consider barriers for underserved community from the following aspects:
  - **Spatial**
    - Spatial factors that compromise daily travel needs (e.g., excessively long distances between destinations, lack of public transit within walking distance).
  - **Temporal**
    - Travel time barriers that inhibit a user from completing time-sensitive trips, such as arriving to work (e.g., public transit reliability issues, limited operating hours, traffic congestion).
  - **Economic**
    - Direct costs (e.g., fares, tolls, vehicle ownership costs) and indirect costs (e.g., smartphone, Internet, credit card access) that create economic hardship or preclude users from completing basic travel.
  - **Physiological**
    - Physical and cognitive limitations that make using standard transportation modes difficult or impossible.
  - **Social**
    - Social, cultural, safety, and language barriers that inhibit a user's comfort with using transportation (e.g., neighborhood crime, poorly targeted marketing, lack of multi-language information)
  - **Other considerations**
    - Potential disbenefits and/or unintended impacts of the technology.
    - Access to technologies
    - Technology usage barriers

# Performance Measures and Targets

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- Potential constraints
  - Any known or anticipated constraints in obtaining, processing, and analyzing necessary data, including resolution and granularity necessary for the performance measure to be functionalized.
  - The potential constraints will be considered in Section 5 (System Deployment Impact Analysis Design) and the experimental design/approach should be able to address the constraints.
  
- Possible approach to understand constraints
  - Approaches such as initial feasibility analysis can help understand the constraints in a systematic way.

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# Confounding Factors & Mitigation Approaches

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- Definition
  - Confounding factors are external factors which can distort the validity of experimental findings if not controlled for.
  
- Example confounding factors
  - Construction/work zone activities during pre/post-deployment periods
  - Change in weather or unusual weather events
  - Change in travel demand
  - Change in economy
  - Change or shift in population
  
- Consider confounding factors at an early stage.

# Confounding Factors & Mitigation Approaches

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- Possible Solutions
  - Identify feasible methods to isolate the effect of each confounding factor and accurately estimate the impact.
    - Ex. appropriate experimental designs or statistical techniques
  
- In the PMESP
  - List all anticipated confounding factors that may affect the performance measures and associated analyses.
  - Provide approaches to avoid, minimize and/or mitigate the impacts of the identified confounding factors.
  - Review and update the confounding factors when the PMESP is updated based on the proposed schedule.

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# System Deployment Impact Analysis Design

# Select Focused Performance Analysis

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- Purposes
  - Capture use cases considered by stakeholders where the deployment is expected to have the most impact in achieving target performance goals.
  - Ensure the selected focused performance analysis can be executed with confidence.
- Example factors to be considered
  - Most impactful areas
  - Confounding factors
  - Data sources
  - Experimental design challenges
  - Participant recruitment
  - Policy
  - Potential threats in emerging or less tested technologies to work as planned
  - Any potential changes to the system



# Experimental Design

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- Types of the experimental design
  - Non-Experimental Design
  - Before/After Design
  - Randomized Experimental Design
  - Quasi-Experimental Design
  
- Components to be included in the design, at a minimum:
  - Experimental design/analysis approach
  - Required participants and recruitment
  - Pre-deployment or baseline conditions

# Summary of Performance Measures

Use Case #1; Performance Measure #1: XXyyZZ	
Description	<i>Provides a clear definition and description of the performance measure</i>
Data Needs	<i>Provide the type of data that will be collected, timing/frequency of data, baseline, etc.</i>
Experimental Design	<i>Describes the approach used to capture and analyze (measurement technique) the performance measure, this may be a before-after, with-without, modeling, qualitative, quantitative and/or behavior assessment.</i>
Modeling/Tools	<i>Provide modeling or tools to be used, such as simulation, survey/interview, time-series model analysis</i>
Hypothesis	<i>Provide the proposed expectation for this performance measure.</i>
Targets	<i>Provide the target for the performance measure that would show a successful deployment.</i>
Risks	<i>Provide potential risks in achieving successful final analysis for this performance measure.</i>
Other information could be included with more rows...	

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# Independent Evaluation Support

# Independent Evaluation Support

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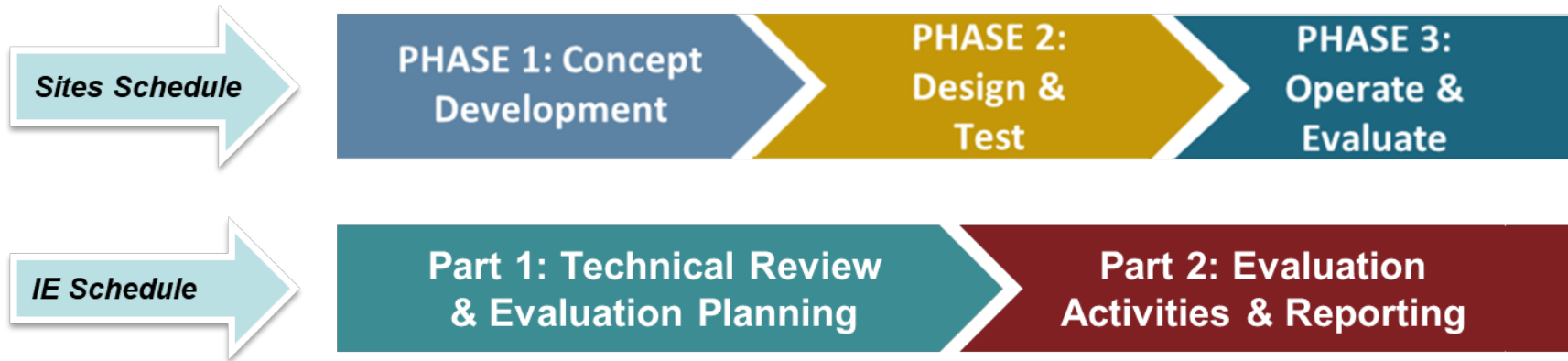
- The IE Team: USDOT Volpe National Transportation Systems Center
  
- IE major activities
  - Coordinate with deployment sites in Phase 1 to understand how these efforts can support a broader program evaluation effort
  - Independently review deployer-reported performance measurement results
  - Conduct interviews with federal team, site key personnel, and other stakeholders
  - Assess financial and institutional frameworks resulting from each deployment
  - Review documented lessons learned
  - Estimate potential of each deployment to be replicated across the nation

## Documents Related to IE Support Effort

- Task 2: Complete Trip Deployment ConOps
- Task 3: Data Management Plan
- Task 5: Performance Measurement and Evaluation Support
- Task 10: Plan Institutional, Partnership, and Financial Plan
- Task 13: Integrated Complete Trip Deployment Plan

# Independent Evaluation Support

- Timeline



- Note:

- Interactive discussion with both USDOT and IE will be expected in terms of IE support.
- Any coordination effort or requests made to/from the IE team needs to go through the Program Manager and the CORs.

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# Data Collection Plan and Data Sharing Framework

# Data Collection Plan

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- Purpose of the data collection and sharing
  - To support the performance measures at a system and individual impact level.
  - To support IE effort
- In the PMESP
  - Data needed
  - Data sources and methodologies
    - Baseline data; deployment data; cost data; other data collected outside the deployment system or through survey and/or interview.
    - Data constraints
  - Data quality check approach
- The Data Collection Plan should correspond with the Task 3 Data Management Plan

# Data Sharing Framework

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- Groups to share data with
  - Project partners
  - USDOT
  - IE
  - Public
- Types of data to be shared
  - Baseline data, deployment data, cost data, survey/interview data, other data
- Sensitive data issue
- Timing and frequency



Baseline



Deployment



Cost



Timeframe



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# Performance Reporting

# Reporting Format and Frequency

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- BAA:
  - *Performance against baseline measurements and targets are anticipated to be routinely and publicly reported throughout Phase 3.*
  - *Summaries/dashboards of performance to date covering key measures are anticipated to be required features in all Phase 3 deployment sites.*
- In the PMESP
  - Discussion of performance measure results to reporting processes and dashboards along with any corresponding barriers applicable to each performance measure and target audience group.
  - Illustration of planned reporting format(s) for summaries, dashboards, or tables.
  - Reports should include periodic reports expected to be updated in a weekly or monthly basis, and the final performance impact analysis reporting.

# Resources

# Useful References

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- USDOT, USDOT Guidance Summary for Connected Vehicle Deployments: Performance Measurement, July 2016, <https://rosap.ntl.bts.gov/view/dot/31557>
- USDOT, USDOT Guidance Summary for Connected Vehicle Deployments: Evaluation Support, July 2016, <https://rosap.ntl.bts.gov/view/dot/31558>
- Accessible Transportation Technologies Research Initiative (ATTRI) Performance Metrics and Evaluation, Final Evaluation Framework Report, FHWA-JPO-20-784, <https://rosap.ntl.bts.gov/view/dot/50748/>
- Mobility Performance Metrics (MPM) for Integrated Mobility and Beyond, FTA Report 0152, <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/147791/mobility-performance-metrics-integrated-mobility-and-beyond-fta-report-no-0152.pdf>
- Travel Behavior: Shared Mobility and Transportation Equity, FHWA Report PL-18-007, [https://www.fhwa.dot.gov/policy/otps/shared\\_use\\_mobility\\_equity\\_final.pdf](https://www.fhwa.dot.gov/policy/otps/shared_use_mobility_equity_final.pdf)

# Stay Connected

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**For more information please contact:**

Elina Zlotchenko Program Manager, ITS JPO

[Elina.Zlotchenko@dot.gov](mailto:Elina.Zlotchenko@dot.gov)

Murat Omay, Task 5 Lead, FTA

[Murat.Omay@dot.gov](mailto:Murat.Omay@dot.gov)

Visit the Complete Trip - ITS4US Deployment Program Website and FAQs:

<https://its.dot.gov/its4us/>

[https://www.its.dot.gov/its4us/its4us\\_faq.htm](https://www.its.dot.gov/its4us/its4us_faq.htm)

Any questions?

