USDOT Guidance Summary for Connected Vehicle Deployments

Evaluation Support

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16. Abstract

The document provides guidance to Pilot Deployers in the timely and successful completion of Concept Development Phase deliverables, specifically in developing the Performance Measurement and Evaluation Support Plan in Task 5, identifying evaluation-support related needs in the Concept of Operations (ConOps) in Task 2 and corresponding requirements in the System Requirements Specification (SyRS) document in Task 6, and other activities related to providing support to evaluation of Connected Vehicle (CV) Pilot Sites. In addition, this report provides the context and USDOT's framework for conducting an effective and practical independent evaluation of the CV Pilot Deployment Program and CV Pilot Sites.

An evaluation of a project or a program is essential to discover how well it attains its goals. An *independent* evaluation by a third party who has no vested interest or stake in the project will eliminate bias in the findings. The independent evaluation will help the Sites in: identifying the impacts of their pilot deployments; determining if their actions achieved desired objectives; and ultimately, in extracting lessons that can be used to improve the continued operation of their deployments and future such endeavors. The CV Pilot Sites should view the independent evaluation effort as additional resource provided by USDOT to help provide an unbiased view of the impacts of their pilot deployments.

The document provides a summary of key challenges that the Sites may face and methods that can be used to overcome them. The document also identifies key deliverables that are pertinent to the support of the independent evaluation effort and a summary of the technical support available from the USDOT.

This document does not replace or alter the work statement defined in the Broad Agency Announcement (BAA); rather it provides technical guidance to the pilot deployers in completing the tasks and deliverables described in the statement of work.

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1 Introduction

1.1 Purpose of the Report

The purpose of the report is to assist Pilot Deployers in the timely and successful completion of Concept Development Phase deliverables, specifically in developing the Performance Measurement and Evaluation Support Plan in Task 5, identifying evaluation-support related needs in the Concept of Operations (ConOps) in Task 2 and corresponding requirements in the System Requirements Specification (SyRS) document in Task 6, and other activities related to providing support to evaluation of Connected Vehicle (CV) Pilot Sites. In addition, this report provides the context and USDOT's framework for conducting an effective and practical independent evaluation of the CV Pilot Deployment Program and CV Pilot Sites.

An evaluation of a project or a program is essential to discover how well it attains its goals. An *independent* evaluation by a third party who has no vested interest or stake in the project will eliminate bias in the findings [1]. The independent CV Pilots evaluation will help inform the USDOT: if the CV Pilots program was effective in achieving its goals of transformational safety, mobility, and environmental improvements; of the lessons that can be used to improve the design of future projects; and of how resources should be applied in the future. In parallel, the independent evaluation will help the Sites in: identifying the impacts of their pilot deployments; determining if their actions achieved desired objectives; and ultimately, in extracting lessons that can be used to improve the continued operation of their deployments and future such endeavors. The CV Pilot Sites should view the independent evaluation effort as additional resource provided by USDOT to help provide an unbiased view of the impacts of their pilot deployments.

An approach to ensure evaluations are neutral is to preclude entities acting as Independent Evaluators for a specific Pilot Deployment from acting in any capacity within that Pilot Deployment Site team.

This document does not replace or alter the work statement defined in the Broad Agency Announcement (BAA, [2]); rather it provides technical guidance to the pilot deployers in completing the tasks and deliverables described in the statement of work.

1.2 Organization of the Report

Section 2 provides the USDOT's framework for conducting an effective and practical independent evaluation of the CV Pilot Deployment Program and CV Pilot Sites. Section 3 identifies key deliverables that are pertinent to the support of the independent evaluation effort. Section 4 summarizes the key challenges that the Sites may face and methods that can be used to overcome them. Section 5 provides a summary of the technical support available to the Sites.

2 USDOT Framework for Evaluation

This section lays out the context for the independent evaluation by defining the purpose, identifying evaluation needs, identifying the federal team structure, and cataloging constraints; and offers a framework for the independent evaluation effort that is complementary to the CV Pilot schedule.

2.1 Purpose of CV Pilots Independent Evaluation

The overall purpose of the *independent* CV Pilot Deployment Sites evaluations are to:

(1) Inform prospective deployers of CV-enabled applications of likely safety, mobility, environmental, and public agency efficiency (SMEP) impacts; quantify costs; and identify practical institutional and financial models for long-term deployment

(2) Inform the USDOT on the effectiveness of the CV Pilots program in creating proven and transferable deployment concepts demonstrating measureable short-term SMEP impacts and longer-term transformational changes, overcoming deployment challenges, documenting lessons learned, and accelerating deployment of successful and sustainable CV applications.

2.2 Evaluation Needs

The independent evaluation should address the following needs:

(1) **Site-Specific Evaluation:** Assess SMEP cost-benefit and user acceptance/satisfaction of CV Pilot Deployment sites; assess efficacy of deployed institutional and financial models; and document lessons learned from the pilot deployments

(2) **National-Level Evaluation:** Conduct national-level evaluation of CV Pilots Deployments; calculate national-level short-term and long-term safety, mobility, environmental, and public agency (SMEP) impacts of CV-enabled applications; infer practical institutional and financial models for short-term and long-term deployment; and document lessons learned, challenges and approaches for overcoming them, and approaches for accelerating deployment of CV applications

(3) **Program Evaluation:** Evaluate the CV Pilots Program; assess whether performance-management focus of pilot deployments was beneficial; estimate the total impacts, costs, and return on investment (ROI) of the CV Pilots Program; and assess if the CV Pilots Program achieved its vision cost-effectively

2.3 Federal Team Structure

Figure 1 shows a notional organizational chart for CV Pilots deployment and evaluation efforts. The chart illustrates the key players and their roles.

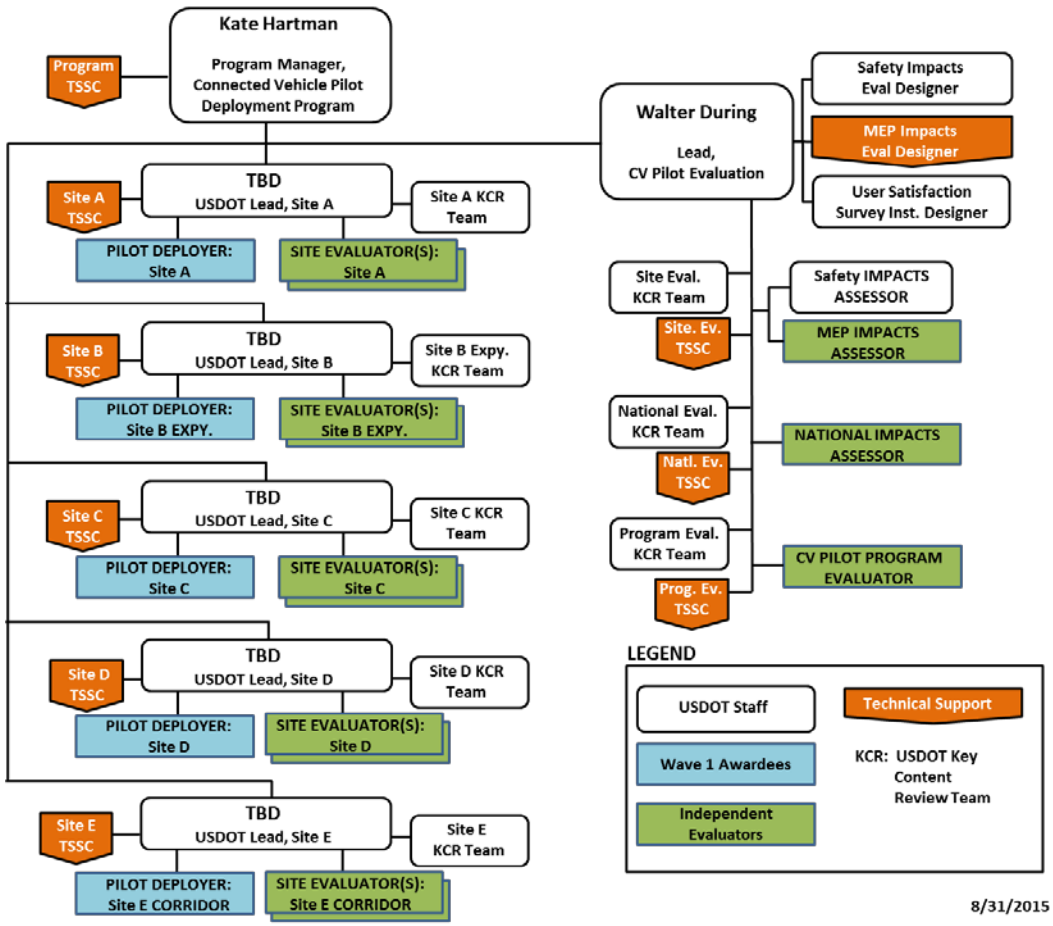

Figure 1: Notional Organizational Chart for Connected Vehicle Pilots Deployment and Evaluation (Source: Noblis, 2015)

2.4 Constraints

There are few constraints to the independent evaluation, including:

- **Multiple Players:** There are multiple players, including the federal team, Sites, and independent evaluators, as seen in Figure 1. It is essential to make the roles well-defined and synergistic, and reduce the overlap and redundancy in responsibilities to minimize wasted resources.
- **Diverse Projects:** There are multiple projects with diverse deployments, each with different objectives, performance targets, and impacts.
- **Multiple Tiered Evaluations:** There are multiple tiers of evaluations. Evaluations need to be conducted both at site-level as well as national-level, and for examining both current as well as future impacts. The evaluation needs to encompass assessment of SMEP impacts, user satisfaction, ROI, and institutional and financial models.
- **Unbiased Evaluation Findings:** Evaluations can become biased due to an inability to isolate the impacts of the pilot deployments from those of exogenous factors (e.g., rising fuel prices, series of adverse weather events) or competing projects. A rigorous evaluation design is required for an effective, unbiased evaluation.

2.5 Evaluation Framework

This section presents USDOT's evaluation framework that deals with the constraints identified in the previous section and adapts to the uncertainty that comes with the multi-phased pilot deployment.

Independent evaluations will be initiated only for those sites that advance to the Design/Deploy/Test Phase. However, since it is not possible to know which sites will advance to the Design/Deploy/Test Phase with certainty, it is imperative that evaluation-related needs and requirements are identified for all sites so that these can be incorporated into the Concept Development Phase ConOps and SyRS, Performance Measurement and Evaluation Support Plans, and Comprehensive Pilot Deployment (CPD) Plans, and implemented when a site progresses to the Design/Deploy/Test Phase. The USDOT approach to dealing with this uncertainty and the previously mentioned constraints is to establish two entities in two critical areas: Safety Evaluation Designer (SED) and a Mobility/Environmental/Public Agency Efficiency Evaluation Designer (MED). The Volpe team that performed the evaluation of the Safety Pilot Model Deployment program will serve as the SED. The SED will also conduct safety-related experiments and assess safety-related impacts. The ITS JPO technical support services team that is experienced in the DMA and AERIS programs will serve as the MED. The USDOT will also establish a third entity, the Survey Instrument Designer (SID) to design survey instruments. For this purpose, the USDOT will bring in staff from Volpe that are experts in the design of survey instruments.

2.5.1 Concept Development Phase Evaluation Activities

In the Concept Development Phase, the SED and MED will articulate evaluation-related needs and requirements while Sites are developing Concept Development Phase deliverables. For example, consider a pilot deployment which implements Freight Advanced Traveler Information System, Drayage Optimization, Curve Speed Warning, Smart Truck Parking, and Weather Response Traffic Information applications to improve productivity (i.e., reduce truck travel times and empty trips) and safety. In this case, the SED would articulate needs for the evaluation of the Curve Speed Warning and Smart Truck Parking applications, while the MED would articulate needs for the evaluation of the Freight Advanced Traveler Information System and Drayage Optimization applications. The SED and MED would work together to develop needs for the Weather Response Traffic Information application, since it has both mobility and safety implications. If safety impacts are likely to be the major deployment impact from this application for the site, the SED will lead this activity; conversely, if mobility or environmental impacts are likely to be the major focus, then the MED will lead this activity.

The SED and MED, working on behalf of the CV Pilot Deployment Program, the USDOT Site Leads and the Evaluation Lead, will provide evaluation-related needs to the Sites. The Sites will incorporate the evaluation-related needs in their ConOps, and develop requirements corresponding to these needs and document them in their SyRS. The USDOT will verify that these needs and corresponding requirements are adequately addressed in the ConOps, SyRS and CPD Plan.

The Sites will need to plan the flow of data that have been removed of Personally Identifiable Information (PII) to the Research Data Exchange (RDE) from the deployed system to support the evaluation. The Sites will also need to plan the flow of data that may include PII to the SED to support the evaluation of safety impacts. These data sharing plans will be included in the Concept Development Phase Performance Measurement and Evaluation Support Plan.

Sites will need to establish an IRB approval process that incorporates human participation in the pilot deployment (Task 8).

Figure 2 shows an illustration of these activities.

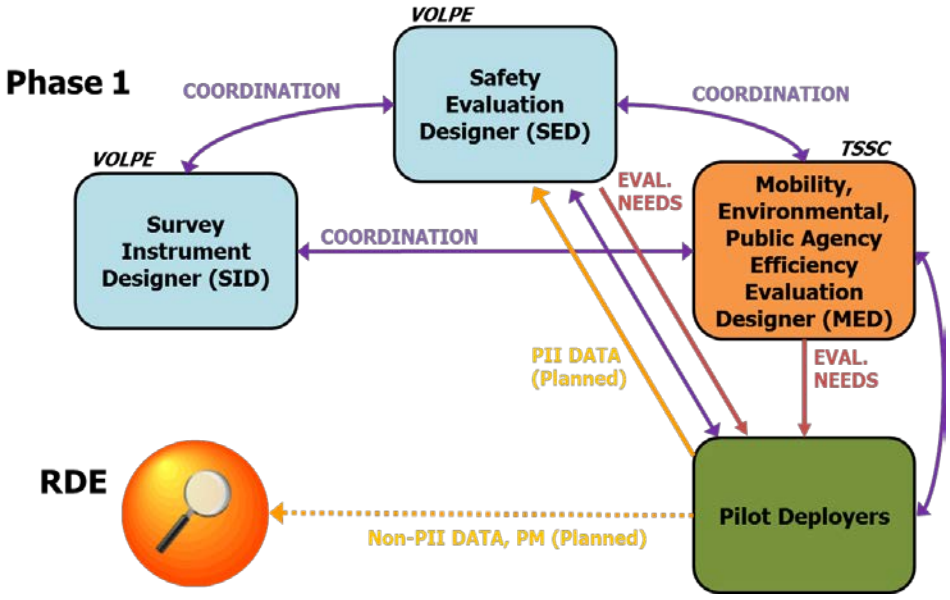

Figure 2: Concept Development Phase Evaluation-Related Activities (Source: Noblis, 2015)

2.5.2 Design/Deploy/Test Phase and Maintain/Operate Phase Evaluation Activities

When a Pilot Deployment Site advances to the Design/Deploy/Test Phase, the Site will design and build their systems to generate the data and performance measures detailed in their Concept Development Phase ConOps, SyRS, Performance Measurement and Evaluation Support Plan, and the CPD Plan. The Sites will follow their Performance Measurement and Evaluation Support Plans to make raw and cleansed data available on the RDE on a regular basis. In addition, the full set, including data potentially containing PII to conduct the evaluation, will be provided to the SED. These data may be archived at the USDOT Saxton Laboratory or other appropriate repositories to be preserved for additional research.

In parallel, the SED and MED entities will collaborate in the creation of site-specific evaluation designs to be followed in the evaluation. These designs will include a specific technical approach that may include: the assembly of observed data, the collection of additional primary or contextual data (i.e., in addition to what is collected by the Sites during the pilot deployment), survey instruments, modeling and simulation efforts, interviews, and other evaluation techniques. The SID will design site-specific surveys.

In the case of Safety-related evaluations, the SED will analyze the data to be consistent with the methods used in the Safety Pilot Model Deployment. The SED may conduct safety-related experiments to collect additional data. Note that it is unknown at this stage if the SED will design and conduct the safety-related experiments or if they will design the experiments and contract with another

entity to conduct these experiments. For now, the SED implies the SED as well as any entity contracted by the SED to specifically conduct safety-related experiments.

If the SED decides to use human participants, then the SED will need to get IRB approval for use of humans. The SED will conduct the analysis and generate safety estimates and other reports.

Independent evaluators will follow the government-furnished evaluation designs (developed by the MED) to conduct the independent evaluation. In the case of Mobility, Environmental, and Public Agency Efficiency (MEP) evaluations, the independent evaluators may need to deploy data collection technologies and conduct field experiments to collect additional data, as detailed in the government-furnished evaluation design. If the field experiments make use of human participants, then the independent evaluator will need to get IRB approval for use of humans. The field observations may be further supplemented by AMS models. The independent evaluators may further supplement this information by choosing to become active participants in the pilot deployment to gain more insight into the pilot deployment. The independent evaluators will conduct the analysis and generate MEP estimates and other reports. Thus, the independent evaluators will execute a specific set of actions, including but not limited to:

- Deploy, maintain, and remove ancillary data collection technologies/applications in mobile devices, vehicles or the infrastructure
- Conduct non-safety related field data collection experiments
- Collect, clean, and aggregate field data (not available from the Sites through the RDE)
- Develop and/or refine methodologies and tools for conducting site-specific evaluations
- Develop and calibrate supporting analysis, modeling, and simulation (AMS) models
- Analyze field data and outputs from analytical tools and AMS models
- Conduct benefit-cost analyses
- Conduct survey and analyze findings

The independent evaluators will follow the government-furnished survey design (developed by Volpe staff), and conduct user satisfaction/acceptance surveys and interviews. The independent evaluators will also survey or interview the Pilot Deployment team to gather feedback from site-specific decision makers, pilot deployment managers, operators, and partner agencies to determine:

- if the pilot deployment was able to achieve the vision/goals/SMEP impacts that were laid out at the onset of the deployment;
- technical challenges and adopted solutions; and
- strengths and limitations of deployed financial and institutional models.

These activities are graphically shown in Figure 3.

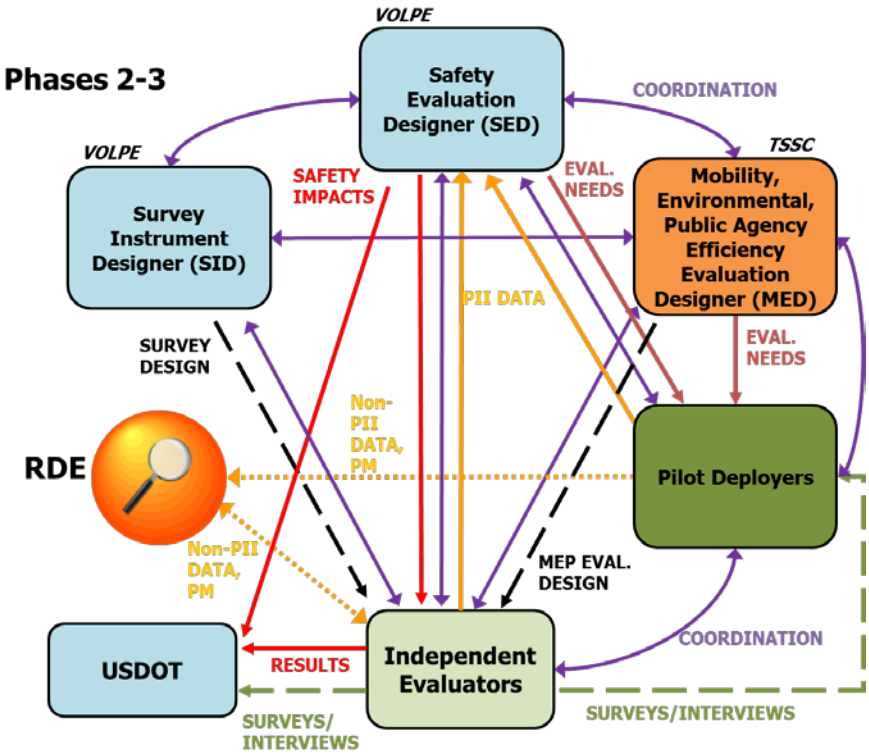

Figure 3: Design/Deploy/Test and Maintain/Operate Phase Evaluation-Related Activities (Source: Noblis, 2015)

To summarize, in the Concept Development Phase all Sites will need to incorporate in their ConOps, the set of evaluation-related needs given to them by the SED and MED, working on behalf of USDOT. The Sites will need to develop requirements that correspond to these evaluation-related needs. All Sites will also need to develop a Performance Measurement and Evaluation Support Plan that documents the plan to support the evaluation activities, including sharing of data, and periodic coordination with the SED and MED. Sites will also need to develop a process for obtaining IRB approval for human participation within the pilot deployment. Thus, the approval should be for participants recruited directly by the Site as well as participants who may be recruited by the SED or independent evaluators to conduct additional field experiments, and independent evaluators themselves who may want to be active pilot deployment participants.

In the Design/Deploy/Test Phase, the Sites that have advanced will need to design and build their systems to generate the data and performance measures detailed in their Concept Development Phase ConOps, SyRS, Performance Measurement and Evaluation Support Plan, and the CPD Plan. Baseline data (i.e., prior to the deployment) will need to be shared based on the plan proposed in the Performance Measurement and Evaluation Support Plan.

In the Maintain/Operate Phase, the Sites will need to share the “deployment” data based on plan. The Sites may need to accommodate any additional field experiments conducted by the SED and independent evaluators. The Sites will also need to participate in any surveys and interviews conducted by the independent evaluators. There will be periodic coordination with the independent evaluators, SED and MED.

The next section will provide guidance on how Sites may wish to structure their Concept Development Phase deliverables to support the independent evaluation effort.

3 Deliverables

As stated in the statement of work for the BAA (see page 68 of the BAA [2]):

"The Contractor is required to interact with other CV Pilot Deployment Program efforts, including an independent evaluation effort, in all three Phases. In Phase 1, the USDOT will articulate broader evaluation-related needs and requirements while Pilot sites are developing Phase 1 deliverables. The USDOT will ensure independent evaluation support needs met by the Pilot Deployment system are documented in the Concept of Operations (ConOps), System Requirements Specification (SyRS) document, and Comprehensive Pilot Deployment (CPD) Plan. The USDOT will also ensure that the planned flow of data from the deployed system supporting independent evaluation is included in the Phase 1 Pilot Deployment deliverables."

To fulfill the above BAA requirements, each CV Pilot Site will need to:

- Identify evaluation-related needs and incorporate any USDOT-identified needs for supporting an independent evaluation effort (Task 2 ConOps)
- Specify requirements corresponding to the evaluation-related needs and incorporate requirements corresponding to USDOT-identified needs for supporting an independent evaluation effort (Task 6 SyRS)
- Identify data flows to support an independent evaluation effort (Task 5 Performance Measurement and Evaluation Support plan)

When a Site has advanced to the Design/Deploy/Test Phase, site-specific independent evaluators may be procured to execute USDOT-designed experimentation, data analysis, and qualitative evaluation. Each Site is expected to coordinate with and support these evaluation efforts in the Design/Deploy/Test Phase and the Maintain/Operate Phase. The precise nature and type of this support will be detailed in the agreements created for each Site for each Phase.

This section describes the deliverables for which the guidance is intended. The deliverables are identified by task as documented in the CV Pilots BAA [2].

3.1 Task 2: Pilot Deployment Concept of Operations (ConOps)

The BAA states that (see page 7 of the BAA [2]):

"***The purpose of this task is to refine and improve the proposed pilot deployment concept and document this in a complete Pilot Deployment Concept of Operations.***"

The BAA also states that (see page 9 of the BAA [2]):

"***…COR will also provide input on any expected additional needs supporting a broader independent evaluation effort that will run concurrently with Phases 2 and 3 of the Pilot Deployment.***"

The USDOT Site Lead or the COR will provide the Sites with evaluation-related needs. The Sites may wish to coordinate with the USDOT if the needs are unclear. Site-specific webinars may be held to facilitate this discussion (Please see Section 5.1).

The USDOT-furnished needs may not be formulated to comply with IEEE Standard 1362-1998. However, the Sites may wish to follow the guidelines to reformat the USDOT needs and incorporate them into the ConOps, as stated in the BAA (see page 9 of the BAA [2]):

"***The Contractor shall follow the guidelines for format and content in IEEE Standard 1362-1998 to develop a ConOps that describes the proposed Pilot Deployment.***"

3.2 Task 6: Pilot Deployment System Requirements

The BAA states that (see page 17 of the BAA [2]):

"***The Contractor shall develop a System Requirements Specification (SyRS) Document based on the COR-approved ConOps, following the guidance in IEEE Standard 1233-1998.***"

To support the independent effort, the Sites may wish to develop requirements that correspond to the evaluation-related needs identified by USDOT. The Sites may wish to formulate these requirements so that these comply with IEEE Standard 1233-1998.

3.3 Task 5: Performance Measurement and Evaluation Support Plan

The BAA states that (see page 16 of the BAA [2]):

"***Support to Independent Evaluation Effort. COR will provide broader evaluation-related capabilities required support a site-specific independent evaluation effort. The Performance Measurement Plan shall specifically identify data flows (including but not limited to field data, calculated performance measures, and action log entries) that will be provided to support the evaluation effort.***"

The Sites may wish to include a section on Support to Independent Evaluation Effort, and may wish to identify data that will be provided to support the evaluation effort. For completeness, the Sites may wish to include the following data:

- Raw and cleaned field data
- Performance measures
- Action log entries contemporaneous with collected field data

According to the BAA (see page 67 of the BAA [2]):

"***…data sharing is subject to the protection of intellectual property rights and personal privacy. Appropriately prepared system control, performance and evaluation data are expected to be shared with the USDOT and posted in timely fashion on resources such as the Research Data Exchange (www.its-rde.net).***"

The Sites may wish to refer the guidance on *Data Sharing Framework* for information on how data may be shared as well as the guidance on *Privacy Considerations* for information on what steps should be taken to collect and share PII data.

Please note that some PII data may need to be collected and shared with the SED (please see Section 2), who will assess safety impacts. The Sites may not wish to post these data on the RDE due to restrictions on data containing PII; instead the Sites may wish to share such data directly with the SED.

3.4 Task 9: Participant Training and Stakeholder Education Plan

The BAA states that (see page 19 of the BAA [2]):

"***The Contractor shall prepare a high-level plan for the recruitment and training of all travelers, drivers, and other personnel participating in the Pilot Deployment.***"

The independent evaluators will rely primarily on field and analytical data and performance measures, and Site-provided documents for conducting the evaluation. However, they might supplement this knowledge by becoming active participants in the Pilot Deployment (see Section 2). Hence, the Sites may wish to make provision in their Participant Training and Stakeholder plan for training the independent evaluators, similar to other Site-recruited participants.

3.5 Task 8: Human Use Approval

In this task (see page 19 of the BAA [1]):

"***The Contractor shall obtain Human Use Approval from an accredited Institutional Review Board (IRB)… The Contractor is responsible for granting IRB approval for human participation within the Pilot Deployment***."

As noted in Section 3.4, the independent evaluators themselves may wish to be active pilot deployment participants. Furthermore, as mentioned in Section 2, the SED and independent evaluators may need to conduct experiments to collect additional data and may recruit additional participants. While the SED and independent evaluators will be responsible for getting IRB approvals for use of humans in their experiments, the Sites' IRB will likely need to consider that participants in evaluation-related activities may also be participants in the deployment. Hence, IRB approvals will likely be needed for use of humans by Sites, independent evaluators, and SED.

3.6 Task 12: Comprehensive Pilot Deployment Plan

The BAA states that (see page 21 of the BAA [2]):

"***The Contractor shall prepare a Comprehensive Pilot Deployment (CPD) Plan. Drawing on all materials prepared in Tasks 2-11, this plan shall summarize the overarching pilot deployment concept and expected outcomes***."

The BAA also states that (see pages 21, 22 of the BAA [2]):

"***The plan shall specifically identify the data to be generated by the system and shared with USDOT, including but not limited to their nature, frequency, and attendant meta-data.***"

Hence, in support of the independent evaluation effort, the Sites may wish to identify the data to be generated by the system, including non-PII data that will be broadly shared through the RDE with the USDOT and the community, and PII that will be shared with the SED (a USDOT agency).

The Sites may also wish to address the following:

- Type or nature of data (e.g., raw or cleaned; disaggregate or aggregate; transit schedule delays; dray orders; trip times; number of curve speed warning messages; SPaT data)
- Sources (e.g., vehicle onboard unit)
- Frequency of updates (e.g., daily, hourly, weekly)
- Corresponding meta-data

The BAA states that (see page 22 of the BAA [2]):

"***The CPD Plan shall contain, at a minimum, the following sections:***

- ***Phase 2 and Phase 3 Pilot Site Schedule***
- ***Phase 2 and Phase 3 Pilot Site Cost Estimate***
- ***…***"

As noted in Section 2, the Pilot Deployment team will need to coordinate with the SED, MED, and the independent evaluators, and respond to surveys and interviews conducted by the independent evaluators. Secondly, the independent evaluator and the SED may need to conduct additional field tests. Hence, the Sites may wish to incorporate the time and cost needed for coordinating with these teams and supporting the independent evaluation effort by responding to surveys and making the Site available for additional tests. Please see Section 4 on possible challenges with the use of the Site for additional tests.

4 Key Challenges

This section identifies the key challenges that may arise during the CV Pilots, and what can be done to ensure that the support to an independent evaluation effort is adequate.

4.1 Retention of Knowledge

Retention of knowledge as the Site progresses from the Concept Development Phase to the later phases will be a challenge for all Sites due to the long duration of the CV Pilots. Sites might see turnover of staff, and will need to re-train new staff. In some instances the re-training of staff might occur multiple times. If procedures and processes are not well-documented, the Sites will need to reverse engineer the software or system, and this can lead to wasted resources and falling behind schedule.

A possible solution is to frequently document procedures, processes, challenges, and resolutions, and share information frequently with the independent evaluators. Public information (e.g., challenges, lessons learned) may be shared frequently with other sites. The Sites may wish to share information through a CV Pilots discussion forum or a Site-Specific discussion forum.

4.2 Multiple Coordination Events with Multiple Entities

Coordination with and support to the independent evaluation effort might become challenging if staff and resources are not dedicated for the purpose. Although meta-data, ConOps, SyRS, performance measure calculation processes, system design documents, and other system documents will be made available to the independent evaluators, lesson learned from previous USDOT funded prototyping and impacts assessment efforts is that data and documents should always be supplemented with some level of human support. It is best to have dedicated staff respond to the independent evaluators' questions for clarification.

As seen in Section 2, there will be multiple entities working on evaluating various aspects of the pilot deployment. The Sites may wish to have staff capable of responding to surveys and interviews on all aspects of the CV Pilots. The staff should be aware of the process, challenges, issues, resolution, and lessons learned for the entire lifecycle of the pilot deployment. They should be able to respond to questions on: data, applications, devices, standards (lack of it or gaps), participant training and stakeholder education, human use approval, coordination within site (i.e., issues, what worked or was great), outreach, system architecture, design, build/test, and deployment.

A possible solution is to assign dedicated staff skilled in various aspects of the pilot deployment, and allocate resources and time for coordination and support in the CPD Plan.

4.3 CV Pilot Deployment Participation by Independent Evaluators

The independent evaluators may want to be active and passive participants in the pilot deployment. Participation will give them more insight into the pilot deployment, and can make the findings more plausible, which in turn can help the Sites tell their story more effectively. The Sites may wish to accommodate the independent evaluators and train them to become active participants without hindering the pilot deployment or disrupting the operations.

4.4 Scoping Support to Additional Field Tests by SED and Independent Evaluators

The independent evaluators and the SED may need to conduct additional field tests and experiments. This can disrupt the pilot deployment if the roles and responsibilities are not clearly defined upfront. The Sites may wish to clearly identify the scope or limits of the support that they would provide to the independent evaluators and the SED. The Sites may also wish to work out the cost, schedule and clearly identify who will be liable for new equipment or technology installed by the independent evaluators and the SED. The Sites may wish to address all these aspects in the CPD Plan.

5 Technical Support

A series of USDOT-sponsored webinars were developed to assist early deployers of connected vehicle technologies with Concept Development activities. The webinar described below provides support for the development of an Evaluation Support Plan.

1. Preparing an Effective Performance Measurement Plan for Connected Vehicle Deployments

This webinar presents the USDOT perspective on the development of a Performance Measurement Plan, a key step in the concept development phase for deployment planning. Performance measurement is essential for improving an agency's internal operations as well as for providing accountability for public expenditure. Dr. John Halkias of Federal Highway Administration describes the concept and the requirements of an effective Performance Measurement Plan, including identifying confounding factors and methods to mitigate their impacts; crafting meaningful and feasible use cases/scenarios; and preventing issues that may arise if performance measurement is not carefully planned.

To access the presentation slides and audio recording for this webinar, please visit the technical assistance page of the CV Pilots website: http://www.its.dot.gov/pilots/technical_assistance_events.htm.

References

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2. Connected Vehicle Pilot Deployments: Phase 1 Concept Development, Broad Agency Announcement No. DTFH6115R00003, Federal Highway Administration, January 2015.

   https://www.fbo.gov/index?s=opportunity&mode=form&id=4bb6693ac3021c178595d83fab3b5d73&tab=core&_cview=1

Appendix: List of Acronyms

Table A-1: List of Acronyms

Acronym	Meaning
AMS	Analysis, Modeling, and Simulation
BAA	Broad Agency Announcement
ConOps	Concept of Operations
COR	Contracting Officer's Representative
CPD	Comprehensive Pilot Deployment
CV	Connected Vehicles
DMA	Dynamic Mobility Applications
ITS	Intelligent Transportation Systems
MED	Mobility, Environmental, and Public Agency Efficiency Evaluation Designer
MEP	Mobility, Environmental, and Public Agency Efficiency
PII	Personally Identifiable Information
RDE	Research Data Exchange
SED	Safety Evaluation Designer
SID	Survey Instrument Designer
SMEP	Safety, Mobility, Environmental, and Public Agency Efficiency
SyRS	System Requirements Specification

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