SMART COLUMBUS

Project Management Plan for the Smart Columbus Demonstration Program

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Final – February 1, 2018
**Project Management Plan for the Smart Columbus Demonstration Program**

The Project Management Plan (PMP) defines the project management principles and procedures for how the Smart Columbus program will be managed to ensure that the project is delivered within the agreed to scope, schedule, and budget. The Smart Columbus PMP was developed with inputs from various city departments, seasoned Project Managers (PMs), and combined with the guidelines from the Project Management Body of Knowledge (PMBOK). The PMP describes the overall program structure; project partners and participants; organizational structure; project governance; scope; schedule; budget; project management approach; deliverables; document management; work breakdown structures (WBS); and the methods used to plan, monitor, control and improve program delivery.
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Chapter 1. Introduction

The United States Department of Transportation (USDOT) pledged $40 million to Columbus as the winner of the Smart City Challenge (SCC). By challenging American cities to use emerging transportation technologies to address their most pressing problems, USDOT aimed to spread innovation through a mixture of competition, collaboration and experimentation. The SCC called on cities to do more than merely introduce new technologies onto city streets. It called on them to boldly envision new solutions that would change the face of transportation in our cities by closing the gap between rich and poor, capturing the needs of both young and old, and bridging the digital divide through smart design so that the future of transportation meets the needs of all city residents.

As the winner of the SCC, Columbus seeks to demonstrate and evaluate a holistic approach to improving surface transportation performance and where feasible, integrate this approach with other city domains such as public safety, public services and energy. Columbus intends to address how emerging transportation and other data, technologies and applications can be integrated with existing and new systems to address transportation challenges. Columbus will help define what it means to be a “Smart City” and become the country’s first to fully integrate a breadth of innovative technologies including intelligent transportation systems (ITS), connected vehicles (CV), automated vehicles (AV), a Smart Columbus Operating System (SCOS) and other advanced technologies into the transportation network.

Columbus will serve as an example for cities looking to pursue similar efforts. The City plans to work closely with residents, community and business leaders and technical experts to implement an innovative Smart City demonstration. In doing so, Columbus will act as a laboratory for ITS, CVs, AVs and other Smart City technologies, providing information and documentation regarding the planning, design, implementation and operation of the various program components. The City will document the program’s successes and lessons learned, which other cities can use as a roadmap for their evaluation, planning and execution of similar efforts. The program includes a robust outreach component to achieve this communication and messaging. To enable this, Smart Columbus is combining the $40 million from USDOT, $10 million from Paul G. Allen’s Vulcan and monies raised from partners to create a transportation network to improve safety, enhance mobility, build ladders of opportunity and accelerate the transition to a clean transportation system. The USDOT and the City of Columbus signed the Columbus Cooperative Award DTFH6116H00013 outlining the USDOT and Columbus commitments on August 30, 2016 (Award).

1.1. Scope of the Project Management Plan (PMP)

The Smart Columbus program is an integrated and holistic solution that can help all residents move better and access opportunity. To be successful, the program must be managed in a coordinated way that is not possible if projects are managed individually.

The PMP defines the principles and procedures for how the Smart Columbus program will be managed to ensure that it is delivered within the agreed scope, schedule and budget. The Smart Columbus PMP was developed with inputs from various city departments, seasoned Project Managers (PMs) and the
guidelines from the Project Management Body of Knowledge (PMBOK). The PMP describes the overall program structure, project partners and participants, organizational structure, project governance, scope, schedule, budget, project management approach, deliverables, document management, work breakdown structures (WBS), and the methods used to plan, monitor, control and improve the program delivery. The PMP is a dynamic document and will be updated on a periodic basis to reflect organizational change, lessons learned and advancement in methodologies that occur through the program’s life cycle.

1.2. Intended Audience

This PMP is intended to provide the entire Smart Columbus team (partners, participants, stakeholders) and the USDOT with detailed information on how the USDOT-funded SCC program will be managed and the standard operating procedures (SOP) for it.

1.3. PMP Update Process

The PMP will be monitored monthly and updated on a quarterly basis during the Smart Columbus program lifecycle. The Program Manager (PgM) for Smart Columbus will trigger the update process for the PMP. In case of major change to organizational structure, project scope, schedule or budget, an update of the P will be generated immediately versus waiting until the next quarterly update. As changes are made to the PMP, there will be a formal review process by members of the Smart Columbus Program Management Office (PMO) before sending it to the USDOT for approval. Upon approval, the PMO will post the updated PMP documents to the Smart Columbus SharePoint site and then announce the release of a new PMP via email and provide a link to all interested parties.

1.4. Relation to the Systems Engineering Management Plan

The PMP is the overall master planning document for the Smart Columbus program. The PMP is a formal document used to manage project execution. The PMP documents the actions necessary to define, prepare, integrate and coordinate the various planning activities. The PMP defines how the project is executed, monitored and controlled, and closed. The PMP describes all activities, including technical activities, to be integrated and controlled during the life of the program. Conversely, the SEMP outlines the technical plans and systems engineering activities that will be used to develop, integrate, test, validate and deploy the Smart Columbus projects. Developed early in the SE process as a supplement to the PMP, the SEMP uses the foundation laid by the PMP to build the framework for executing the SE technical tasks for the program and individual projects.

Both documents are important in terms of understanding and managing the scope of work, how to plan for critical activities, how to manage efforts while reducing risk, and how to successfully complete deliverables. The PMP must be consistent and evolve in concert with the SEMP. They must complement each other and be cross-referenced. They should consistently define the roles and responsibilities of the technical and management staff, the processes for planning and monitoring technical activities, and identifying and mitigating program and technical risk. The main difference is that the PMP includes all activities to be integrated and controlled during the life of the program, whereas the SEMP emphasizes the SE activities that are important to the program and individual projects.
The City Program Manager (PgM) and Consultant PgM will resolve differences between the PMP and the SEMP on a case by case basis to determine which document takes precedence. Changes to either document will be logged as they are identified and incorporated into the next quarterly update to the appropriate document.

As outlined in the Federal Highway Administration's (FHWA's) Systems Engineering Guidebook for ITS\(^1\), the PMP is the first step in describing the plan for the project and needs to be created before the project moves into problem definition and decomposition.

### 1.5. Specific Plans within the PMP

The PMP is a compilation of various processes necessary for successful project management. These processes are either specified in the PMBOK or identified as critical for the Smart Columbus program based on experience and city processes. They are organized by various knowledge areas and process groups. This document describes the executing, monitoring control and closing processes that will be used for the following areas:

- Scope Management
- Document Management
- Change Management
- Schedule/Time Management
- Cost Management
- Policy
- Procurement Management
- Partnerships
- Human Resources Management
- Quality Management
- Communications Management
- Risk Management

\(^1\)https://ops.fhwa.dot.gov/publications/seitsguide/index.htm
Chapter 2. Smart Columbus Program

2.1 Strategic Framework

While the definition of a “smart city” varies, the USDOT SCC specifically asked applicants how they would use emerging transportation technologies to address their most pressing problems and envision bold new solutions that could change the face of transportation by meeting the needs of residents of all ages and abilities; and bridging the digital divide; so that everyone, not just the tech-savvy, can be connected to everything their city has to offer. As the fourteenth largest city in the country, Columbus is experiencing challenges such as traffic congestion, crashes, infant mortality, poverty and unemployment; challenges not uncommon to urban cities, that are worth trying to solve. Columbus believes equitable access to transportation is an integral piece to solving these complex issues. Moreover, as the fastest growing city in the Midwest, Columbus must plan for and implement ITS solutions that allow for the efficient and effective flow of people and goods throughout the city to remain competitive. Solving for urban challenges and creating a Smart City are integral to Columbus’s future as a thriving city.

The City of Columbus’ guiding smart city principle is that mobility is the great equalizer of the twenty-first century. More specifically, equitable access to transportation is the key to opening opportunities such as access to jobs, healthcare and services. Columbus plans to use transportation, powered by holistic solutions and integrated, open-source data, to give its residents access to opportunities that empower them. This could be access to healthcare providers, jobs, school, job training or other destinations. We are attempting to shift the paradigm on transportation to ensure all residents can traverse the city in a safe and efficient manner of their choice.

Smart Columbus will demonstrate how advanced technologies can be integrated into other operational areas within the city, utilizing advancements in ITS, CV, AV, electric vehicles (EV) to meet these challenges, while integrating data from various sectors and sources to simultaneously power these technologies while leveraging the new information they provide. Community and customer engagement will be present throughout the program, driving the requirements and outcomes for each project. This end-user engagement reinforces the idea that the residents of Columbus are ultimately the owner and co-creator of the Smart Columbus program.

2.1.1 Vision
Smart Columbus’ vision is:

To empower our residents to live their best lives through responsive, innovative and safe mobility solutions.

2.1.2 Mission
Smart Columbus’ mission is:
To demonstrate how an ITS and equitable access to transportation can have positive impacts on everyday challenges faced by cities.

2.1.3 Outcomes

Outcomes of the Smart Columbus Program include:

- **Improve Safety**: Columbus wants to create safer streets where vehicles, cyclists, and pedestrians are less likely to be involved in accidents.
- **Enhance Mobility**: Columbus wants to make traversing the city and parking as efficient and convenient as possible.
- **Enhance Access to Opportunities & Services**: Columbus wants to make multi-modal transportation options and the ability to access them equitably available to all residents; especially those who need to access to opportunities related to health care, jobs, school, and training.
- **Reduce Environmental Impact**: Columbus wants to reduce the negative impact transportation has on the environment through becoming more efficient and embracing multi-modal options.

Figure 1 shows the Smart Columbus vision, mission, and outcomes.

![Source: City of Columbus, January 2018](image-url)

**Figure 1. Smart Columbus Vision**
2.2 Program Overview

2.2.1 Site Overview

Smart Columbus is taking a district-oriented approach to best demonstrate effective implementation of a comprehensive portfolio of connected technologies that solve focused, relatable city issues and enhance mobility across the region. Four deployment districts were strategically identified based on the unique problem-solving proving ground they offer which creates a foundation of nationwide scalability.

1. Residential (Linden): Linden is a high-opportunity Columbus neighborhood in need of economic improvement. Linden was chosen as the first neighborhood district for its numerous socio-economic challenges, including low household income, lack of major employers and high infant mortality rates. These problems are compounded by the lack of access to transportation options. Despite proximity to the central core of the city, basic services such as healthcare, grocery stores and banking are scarce within its boundaries. Many residents are transit-reliant, yet planning and completing a trip to access employment and services can be challenging, particularly for parents with young children, seniors and travelers with disabilities. There are also many first-mile/last-mile (FMLM) challenges in the district.

2. Commercial (Easton): Easton is a high-traffic retail destination and jobs center. Located in the northeast part of Columbus, the Easton area is a mixed-use environment consisting of retail, dining, commercial office space, warehousing and residential units accessed primarily by light-duty vehicles and some bus service operating along the fringes of the area. While a major employment center, the jobs are typically low paying and have a high rate of turnover. Research has demonstrated that a major contributor to the instability in these types of jobs is the lack of reliable transportation as well as FMLM challenges related to safety and mobility. Meanwhile, current traffic volumes in the area, particularly during peak times, have caused roadway capacity concerns. Adding an additional freeway exit to support the present volume would be costly and could increase harmful emissions. There are opportunities to improve mobility and reduce emissions and their sources through a reduction in single occupancy vehicles and/or enhanced existing transit service.

3. Downtown: Downtown Columbus is a regional economic anchor and growing urban core. One challenge to continued growth and development of Downtown is the lack of parking availability. The commercial office vacancy rate for all classes of space is 12 percent. Commercial real estate brokers report that they cannot lease office space because prospective tenants cannot find parking for employees. Hotels and other service industries report high staff turnover because of the cost of parking. Major employers report an inability to add jobs downtown. Visitors for events and guests of everyday business activity report regular frustration with finding parking. Experience Columbus, the convention and visitors’ bureau for greater Columbus, receives feedback from visitors as well as meeting and travel planners that parking, especially during large events and conventions, negatively impacts the visitor experience in Columbus.

4. Logistics (Rickenbacker): Rickenbacker International Airport, Rickenbacker Intermodal Terminal and Rickenbacker Logistics Park make this area the 10th most active logistics hub in America. Freight-induced congestion and queuing are significant challenges at the south end of the city where distribution centers have been established in proximity to Rickenbacker International Airport. One significant access road where truck volume and freight-induced
Congestion routinely occurs along Alum Creek Drive on the south side of Rickenbacker Logistics Park. Each of these four deployment districts is shown in Figure 2. While there are unique and distinct deployment districts, many projects will also be deployed citywide and be designed in an integrated manner with the SCOS being the integral backbone and heart of all current and future smart city projects.
Figure 2. Smart Columbus Deployment Map

Source: City of Columbus, October 2017
The eight other Smart Columbus projects are grouped into three overarching themes: Enabling Technologies, Enhanced Human Services and Emerging Technologies.

- **Enabling Technologies**: These technologies leverage today’s foundation in new and innovative ways to greatly enhance the safety and mobility of the transportation infrastructure. These advanced technologies empower deployments that increase our capabilities because of rich data streams and infrastructure that are designed to handle on-demand responses. The connected vehicle environment (CVE) is an enabling technology that will improve safety by leveraging cutting edge technology to advance the sustainable movement of people and goods.

- **Enhanced Human Services (EHS)**: These services encompass meeting human needs through the application of technology that focuses on prevention as well as remediation of problems, and maintain a commitment to improving the overall quality of life of users of the technology-based solutions. Opportunity will be created as a result of the EHS projects that improve access to jobs, healthcare and events.

- **Emerging Technologies**: New technologies that are currently developing or will be developed over the next five to ten years will substantially alter the business and social environment. By focusing on key Emerging Technologies, the city will be able to exhibit potential solutions to address and mitigate future transportation and data collection challenges.

The method of themes demonstrates an integrated and holistic approach to delivering the Smart Columbus program.

### 2.2.2 Project Descriptions

Figure 3 summarizes the SCOS and portfolio of USDOT projects. It depicts the criticality of the SCOS tying in these three themes, as well as their supporting projects, together. It also indicates the documentation and management of the overall program, anchored by the tools and documentation used in coordination and cooperation between the city and USDOT.

#### 2.2.2.1 Smart Columbus Operating System

The SCOS is envisioned as a web-based, dynamic, governed data delivery platform built on a federated architecture that is at the heart of the Smart Columbus system. It will ingest and disseminate data while providing access to data services from multiple sources and tenants, including the planned Smart Columbus technologies, traditional transportation data and data from other community partners, such as food pantries and medical services. The SCOS will embody open-data, best-of-breed technologies including open-source and commercial off-the-shelf concepts that enable better decision-making and problem solving for all users. It will support a replicable, extensible, sustainable data delivery platform. The SCOS will be the source for performance metrics for program monitoring and evaluation; serve the needs of public agencies, researchers and entrepreneurs; and assist health, human services organizations and other agencies in providing more effective services to their clients. The SCOS will be scalable and demonstrate the potential for serving city and private sector needs well beyond the life of the SCC Award period.
2.2.2.2 Enabling Technologies

2.2.2.2.1 Connected Vehicle Environment

There are corridors and intersections in Columbus that have high crash numbers with vehicles, bicyclists and pedestrians. In addition, there are several corridors that are congested that result in poor mobility conditions for emergency vehicles, freight and transit buses. The CVE corridors were selected based on regional crash data, enhanced transit services, recent infrastructure investments and relationship to other projects. For example, the CVE corridors have 17 intersections in the top 100 regional high-crash intersections.

The anticipated outcomes of the CVE project are to enhance safety and mobility throughout the city's transportation system utilizing CV technologies and applications with an emphasis on congested and high crash intersections and corridors. Safety applications are intended to be installed on multiple vehicle types including transit buses, first responder vehicles, city and partner fleet vehicles and private vehicles. Applications will be deployed to ensure emergency vehicles and the Central Ohio Transit Agency (COTA) Bus Rapid Transit (BRT) fleet can utilize signal prioritization when needed to ensure safety and efficiency. While the CV applications the city plans to deploy will be identified as part of the planning phase of the systems engineering process, examples of strategies include:

- Enhanced emergency vehicle pre-emption that reduces delays at signalized intersections for emergency vehicles responding to incidents and other emergencies
- Transit signal priority that reduces delays at signalized intersections for transit vehicles helping to improve transit operations

Source: City of Columbus, October 2017

Figure 3. Smart Columbus Framework

U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology
Intelligent Transportation Systems Joint Program Office

Project Management Plan for the Smart Columbus Demonstration Program – Final
Chapter 2. Smart Columbus Program

- Pedestrian detection and red-light safety applications for improved safety of pedestrians and drivers of vehicles at signalized intersections
- School zone warnings that increase school zone visibility and alert drivers of posted speeds, helping to improve safety

The Performance Measurement Plan establishes the measures and methods through which the goals and objectives of the CVE project will be evaluated to determine the project's effectiveness of meeting the Smart Columbus vision and mission. The City of Columbus has identified the following preliminary objectives to evaluate the measurable impact the CVE project is intended to provide:

- Reduce emergency response times
- Improve reliability of transit schedules
- Increase driver's awareness of pedestrians in crosswalks
- Increase driver's awareness of traffic signals
- Increase driver's awareness of speed in school zones
- Increase driver's awareness of speed in work zones
- Increase transit rider satisfaction
- Improve bicyclist safety

2.2.2.3 Enhanced Human Services

2.2.2.3.1 Multimodal Trip Planning Application/Common Payment System (MMTPA/CPS)

Columbus residents and visitors do not have access to a system that allows for the seamless planning of or paying for a trip involving multiple transportation service providers and parking providers. Moreover, some Columbus residents are unbanked and therefore cannot access alternative modes of transportation including car and bike sharing systems. The multimodal trip planning application (MMTPA) will make multimodal options easily accessible to all by providing a robust set of transit and alternative transportation options including routes, schedules and dispatching possibilities. The application will allow travelers to request and view multiple trip itineraries and make reservations for shared-use transportation options such as bikeshare, transportation network companies (TNC) and carshare. Using the multimodal trip planning application, users will be able to compare travel options across modes, plan and pay for their travel based upon current traffic conditions and availability of services. Payment for transportation service providers and parking providers will be processed through a Common Payment System (CPS) that may be the first of its kind in the United States. It is the city's goal that this application will allow residents to more easily access the transportation systems available in Columbus today and in the future, so they can maximize services to live their best lives. This project is anticipated to provide an innovative solution to improve mobility and access to opportunity. The City of Columbus identified the following objectives to evaluate the measurable impact the MMTPA/CPS project is intended to have:

- Facilitate improved access to multi-modal trip planning information
- Increase usage of the available transportation services
- Improve ease of multi-modal trip planning
- Provide travelers with more convenient access to transportation service options
- Increase access to jobs and services
- Increase customer satisfaction

2.2.2.3.2 Mobility Assistance for People with Cognitive Disabilities

Mobility assistance is needed to provide more independence to residents with cognitive disabilities. Persons with cognitive disabilities who wish to independently use public transit services in Columbus must either qualify for special paratransit services in accordance with federal law, or they must be sufficiently independent such that they are able to safely use fixed route bus service without assistance. The city’s goal is to develop and deploy an application that would allow this population to independently traverse the city via COTA’s fixed bus route system. The mobile application will be a highly-accurate, turn-by-turn navigator designed to be sufficiently intuitive such that older adults and groups with disabilities including the cognitively and visually disabled can travel independently.

This project provides an opportunity for users to empower themselves and gain mobility independence and not rely upon caregivers or COTA paratransit system for transportation. The City of Columbus identified the following objectives to evaluate the measurable impact the mobility assistance project is intended to provide:

- Move certain paratransit riders to fixed route bus service
- Improve independence of travelers moving from paratransit to fixed route service

2.2.2.3.3 Prenatal Trip Assistance

Columbus has one of the highest infant mortality rates in the country, which is partially caused by expectant mothers not getting necessary prenatal healthcare. The existing Non-Emergency Medical Transportation (NEMT) system does not always provide reliable round-trip transportation. Linden residents have challenges accessing healthcare services due to the current NEMT model and technologies. It is our goal to work with Franklin County and Celebrate One to develop a means for bridging the gap among healthcare providers, expectant mothers and NEMT services that are paid for through the Medicaid system.

This project will be further vetted with key stakeholders to identify goals and measurable objectives. A driving force for deployment of this project is the need to provide a more streamlined and efficient NEMT system to improve mobility and satisfaction for users.

2.2.2.3.4 Smart Mobility Hubs (SMH)

Currently, there are no enhanced mobility or multimodal transit features to alleviate FMLM challenges in the Linden area or along the Cleveland Ave corridor. Columbus is working to make mobility a great equalizer in part by embracing multi-modal transportation and making it as accessible and easy to use as possible. Our vision is to transform some COTA bus stops along the BRT CMAX corridor and transit centers into smart mobility hubs, where someone getting on or off the bus can easily access the next leg of their trip. Public Wi-Fi will be a key enabler for the hub and its points of connection (Wi-Fi is also present in COTA’s stations, CMAX, and buses). The city plans to outfit the hubs with kiosks to assist in travel planning and expanded transportation options via other modes, such as bike and car-sharing. The smart mobility hubs will be linked with COTA systems to provide transit information with real-time arrival and departure times to the passengers waiting at the hubs. This project will also explore the utility of these hubs in the commercial district, which also faces similar FMLM challenges in connecting travelers to their destinations.
This project provides an opportunity for residents and visitors to access multiple modes of travel to solve FMLM challenges. The City of Columbus identified the following objectives to evaluate the measurable impact the SMH project is intended to provide:

- Encourage use of multiple modes of transportation
- Improve overall traveler experience

2.2.2.3.5 Event Parking Management (EPM)

The City of Columbus lacks an integrated system for residents and visitors to easily and efficiently view available parking spaces at parking garages, surface lots and parking meters; especially at large events. Non-direct routing of travelers causes congestion and inefficiency in the transportation network. It is the city’s goal to integrate parking information from multiple providers into a single availability and reservation services solution. This will allow travelers to plan and search for parking options at certain locations to reserve and book a parking space with the CPS. More direct routing of travelers during large events is expected to reduce congestion during those times. The City of Columbus identified the following objectives to measure the impact the EPM is expected to provide:

- Reduce parking related congestion
- Reduce vehicle emissions
- Increase knowledge of available parking around events

2.2.2.4 Emerging Technologies

2.2.2.4.1 Connected Electric Autonomous Vehicles (CEAV)

In the Easton area, many businesses and retail centers are more than a mile walking distance from current COTA bus stops, which is outside of typically acceptable walking distances from transit. It is Columbus’ goal to connect COTA riders to opportunities in the Easton area. In addition, it is Columbus’ goal to reduce congestion in the Easton area by encouraging visitors to “park once.” The CEAVs will be deployed to meet these goals and are expected to operate in a mixed-traffic environment, interacting with other vehicles, bicyclists and pedestrians. The project provides an accessible and easily expandable FMLM transportation solution to the region by deploying a fleet of multi-passenger EAVs that leverage the enhanced connectivity provided by the CVE and leverages the citywide travel planning and payment solutions.

The implementation of this innovative FMLM solution in this region also extends the access to jobs by expanding the reach of the new CMAX BRT system immediately to the west of this location, and the deployment of smart connected intersections throughout the region, allowing for more efficient traffic flow to, from, and within the region. The potential routes for the CEAVs will include both work-center and retail-center shuttles; work center shuttle routes will be synchronized with the schedules of the local employers and the COTA fleet, and will likely start and end at the COTA Transit Center. The retail shuttle will operate within the confines of the retail area, serving the largest parking facilities and retail areas. These routes are still under development and may be altered depending on the feasibility of running electric autonomous vehicles (EAV) on certain roads, and considering current travel behavior and potential passenger demand.

This project provides an opportunity for residents and visitors to access cutting edge mobility technologies to solve FMLM challenges. The City of Columbus identified the following objectives to evaluate the measurable impact the CEAV project is intended to provide:

- Increase COTA ridership
- Reduce vehicle movements after initial park
• Provide convenient, reliable first mile/last mile transportation

2.2.2.4.2 Truck Platooning

Logistics providers need more safe, efficient and environmentally beneficial ways to deliver goods. In Columbus, the Rickenbacker International Airport, Rickenbacker Intermodal Terminal and Rickenbacker Logistics Park make this area the 10th most active logistics hub in America. Freight-induced congestion and queuing are significant challenges within Columbus. It is the city’s goal to ensure the efficient and safe movement of logistics-related vehicles through the use of ITS. Specifically, freight signal prioritization on CV-enabled trucks will be deployed to reduce freight-induced congestion and queuing.

In addition, multiple two-vehicle CV-enabled truck platoons will be deployed from Columbus to the eastern Ohio area. Wireless communications will be added to existing vehicle technologies to allow trucks to reduce their headways when traveling on freeways. On arterials, these vehicles will receive platoon intent signal priority enabling two trucks to traverse an intersection during the same signal phase cycle. Platooning is also expected to save fuel and reduce vehicle emissions.

This project is anticipated to increase the efficiency and stewardship of logistics companies by improving freight mobility and reducing emissions. The City of Columbus identified the following objectives to evaluate the measurable impact the CEAV project is intended to provide:

- Reduce truck delay at signalized intersections
- Increase the number of truck turns per day
- Reduce freight vehicle emissions
- Reduce truck fuel consumption

2.3 Outcomes and Performance Measures

The Smart Columbus program will reorient Columbus to deliver more diversified and nimble transportation options by using data and a connected, complete network that supports healthy activity and a more attractive and sustainable urban form. The desired outcomes for the projects directly reflect the USDOT’s expectations for the program. These include:

- **Improve Safety:** Columbus wants to create safer streets where vehicles, cyclists and pedestrians are less likely to be involved in accidents.
- **Enhance Mobility:** Columbus wants to make traversing the city and parking as efficient and convenient as possible.
- **Enhance Access to Opportunities & Services:** Columbus wants to make multimodal transportation options and the ability to access them equitably available to all residents, especially those who need access to opportunity.
- **Reduce Environmental Impact:** Columbus wants to reduce the negative impact transportation has on the environment by becoming more efficient and embracing multimodal options.

Additionally, the draft Performance Measurement Plan provides two impacts applicable to the projects being developed as part of the demonstration, identified as:
- **Agency Efficiency**: Columbus wants to provide tools and access to the data generated by the projects to improve operations and efficiency of the city services.
- **Customer Satisfaction**: Columbus wants to provide resources and information to the citizens to increase their satisfaction with city services through the use and application of technology.

These potential impacts especially relate to the potential impact of the Smart Columbus Operating System (SCOS) and the overall Smart Columbus vision to empower residents (customers). As part of the next quarterly PMP update, a consolidated list of all outcomes will be provided to be consistent among the PMP, SEMP, and future deliverables such as the Performance Measurement Plan (PfMP).

Table 1 below identifies the relationship between the various demonstration projects and the potential outcomes. The outcomes will be evaluated based on the PfMP.

### Table 1. Project Outcomes

<table>
<thead>
<tr>
<th>SMART COLUMBUS PROJECTS</th>
<th>SMART COLUMBUS OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td>1. Smart Columbus Operating System (SCOS)</td>
<td></td>
</tr>
<tr>
<td>2. Connected Vehicle Environment</td>
<td>X</td>
</tr>
<tr>
<td>3. Multi-Modal Trip Planning Application/Common Payment System</td>
<td></td>
</tr>
<tr>
<td>4. Mobility Assistance for Cognitive Disabilities</td>
<td>X</td>
</tr>
<tr>
<td>5. Prenatal Trip Assistance</td>
<td></td>
</tr>
<tr>
<td>6. Smart Mobility Hubs</td>
<td>X</td>
</tr>
<tr>
<td>7. Event Parking Management</td>
<td></td>
</tr>
<tr>
<td>9. Truck Platooning</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>
Together, the Smart Columbus projects will collect data informing transportation-related operations and performance as well as trends of the city. These data will allow operators to evaluate and enhance how the city is operating its facilities, systems and services and how it provides information to the public. The city plans to integrate data from the Smart Columbus projects with existing transportation data and operations, allowing the city to improve operations of the transportation network.

The SCOS platform will play a critical role in helping the city understand and analyze data to address complex urban challenges and measure the performance of the transportation network. In a data-rich environment, Columbus, its residents, businesses, nonprofits and visitors will be increasingly able to share, use and leverage previously unavailable datasets to address complex problems and improve current operations and capabilities. Urban analytics will allow users to create value from the data that is collected from CVs, connected residents and sensors throughout the city or available from the internet using information generated by private companies. Analytics that utilize data from across various systems in Columbus will have tremendous potential to identify new insights and unique solutions for delivering services, thereby improving outcomes. Analytics will also be used to predict future conditions and the potential benefits of implementing different operational strategies, control plans and response plans coordinated among agencies and service providers. Furthermore, analytics can be applied across sectors to create new and different applications. Data analytics can also be used to understand the potential benefits of deployed solutions. To do so, transportation-related performance measures and evaluation are needed to quantify the intended and measured impact of all proposed solutions on personal safety and mobility, network efficiency and environmental sustainability, representing the priorities of the Smart Columbus program.
Chapter 3. Project Management Approach

3.1 Project Management Approach

The development of the PMP is based on the project management standards described in the PMBOK published by the Project Management Institute. The format and content of this document reflects the guidance provided in the PMBOK Guide in combination with City of Columbus processes. The project management approach incorporates a partnership-driven leadership structure, a robust stakeholder engagement process using working groups, and clear roles and responsibilities for the entire project team. More details on project procurement, staffing, contingencies and communications are provided in later sections of the plan. In addition, the definition of staffing assignment and management for each project within the Smart Columbus program is detailed in Section 11 (Human Resources Management).

3.2 Organizational Chart

This section provides two organizational charts to indicate the management of the Smart Columbus program from two perspectives:

- The City of Columbus Smart Columbus PMO
- USDOT

The city also wishes to acknowledge that it is performing an assessment of all roles, working to ensure that the right roles are established in the organizational chart and that the individuals occupying those roles have the correct skill set. There are also several roles that have been identified as a need but have not yet been filled. The city will fill the vacant positions. Additionally, the city will be evaluating resource needs during the systems engineering approach development task and will update the organizational chart during a PMP refresh anticipated to occur in early 2018.

3.2.1 City of Columbus

- The Smart Columbus PMO reports to the Chief Innovation Officer (CINO – Michael Stevens) located in the City of Columbus Office of the Mayor. The CINO is the most senior level city staff person overseeing the Smart Columbus program. The CINO is accountable for the Smart Columbus program and all other smart city related initiatives. The deputy CINO (DCINO - Brandi Braun) supports the CINO and serves as his back-up. The PMO has been established at 421 West State Street, 43215.

- The PMO is responsible for delivery and execution of the Smart Columbus program. Working with the USDOT, the PMO defines and maintains the approach for project management of the Smart Columbus program. The PMO is accountable for ensuring all commitments are met per the Award and facilitates all the necessary governance to make it happen. The PMO is responsible for scope management, schedule, budget, risk management, resource management, communications and
end-user engagement, partnerships, policy and procurement, status reporting and the overall program success. The PMO has a designated program manager (PgM–Mandy Bishop) who has the responsibility for delivering on the Smart Columbus program, overseeing the delivery and execution of all defined tasks and deliverables as well as managing the financials. The PgM has two deputy PgMs (DPgM–Jodie Bare and Randy Bowman). Jodie is responsible for serving as back up to the PgM and overseeing the information technology elements in the program. Randy is responsible for managing Partnerships; aligning program needs with right fit partners. He vets the partners and coordinates the necessary paperwork and meetings to formalize the arrangement. Additionally, Randy is responsible for ensuring the necessary policies are in place to support the program initiatives. The PMO efforts are supported by a consulting team comprised of Project Leads (supplied through HNTB, except for information technology project management resources), subject matter experts and technical resources. The HNTB consultants report in through the consultant PgM, Diane Newton. The Consultant PMO reports in through the Smart Columbus PgM. There are three dedicated city PMs to manage the daily work related to each project, including leading scope, schedule, risk and budget efforts and compiling necessary documentation for reporting on status of efforts to both the PMO and the USDOT. The city PM is responsible for facilitating meetings, leading discussions and following up on action items. Andy Wolpert and Ryan Bollo are two PMs with strong technical experience in transportation and engineering and the city will have one PM, Brian King, who has a strong information technology background with experience in Agile methodologies, data delivery, software development and systems integrations. The organizational charts in this section detail the reporting structure and other members of the team.

Each project will have an assigned leadership team comprised of a PMO lead, business owner, PM and Project Lead. The Business Owner is the designated department expected to continue the operations and support of the respective project (if project is considered successful and viable) at the end of grant period. Table 2 summarizes the current assignment per project. Specific roles and responsibilities for city staff are outlined later in this section.

Table 2. Leadership by Major Task / Project

<table>
<thead>
<tr>
<th>Theme</th>
<th>Project / USDOT Task</th>
<th>PMO Lead</th>
<th>Business Owner</th>
<th>PM (City)</th>
<th>Project Lead (Consultant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Data Management</td>
<td>Jodie Bare</td>
<td>Michael Stevens (City)</td>
<td>Brian King</td>
<td>Sherry Kish</td>
<td></td>
</tr>
<tr>
<td>All Data Privacy</td>
<td>Jodie Bare</td>
<td>Michael Stevens (City)</td>
<td>Brian King</td>
<td>Sherry Kish</td>
<td></td>
</tr>
<tr>
<td>All Performance Measures</td>
<td>Mandy Bishop</td>
<td>Mandy Bishop</td>
<td>Andy Wolpert</td>
<td>Caron Kloser</td>
<td></td>
</tr>
<tr>
<td>Enabling Technologies</td>
<td>CVE</td>
<td>Mandy Bishop</td>
<td>Jennifer Gallagher (City)</td>
<td>Ryan Bollo</td>
<td>Tom Timcho</td>
</tr>
</tbody>
</table>
### 3.2.2 USDOT

The USDOT is the sponsor of the SCC Demonstration. The USDOT designated Kate Hartman (USDOT ITS Joint Program Office [JPO]) as the lead and Agreement Officer Representative (AOR) for this contract. Sarah Tarpgaard (USDOT) is designated as the Agreement Officer (AO).

### 3.2.3 Consultant Team

The Project Leads will take daily direction from the PM to help in delivery of the program. Project Leads are expected to provide a level of domain expertise and help shape the overall project success. The Smart Columbus technical consultant team PgM, Diane Newton, is responsible for deliverables and overall consultant team management and will be supported by a large team including the following key consultant Project Leads:

- Alex Kavanagh (HNTB) will lead the design, development, deployment and testing of the MMTPA/CPS, Mobility Assistance
• Tom Timcho (WSP) will lead the design, development, deployment, and testing of the CVE and CEAV projects.

• Sherry Kish (HNTB) will lead the design, development, deployment, and testing of the EPM and Prenatal Trip Assistance projects. She will also lead the development of the Data Management and Data Privacy Plans, with inputs from the SCOS development team.

• Matt Graf (HNTB) will lead the design, development, deployment, and testing of the SMH project.

• Randy Butler (CDM Smith) will lead the design, development, deployment, and testing of the truck platooning project.

• Marie Keister (Engage-Murphy Epson) is the Smart Columbus communications and outreach consultant PgM. She provides direction and oversight on communications, outreach and end-engagement, supported by several support staff. Marie will work closely with the PMO to manage stakeholder expectations and ensure the correct information is disseminated to the local communities and media.
U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology
Intelligent Transportation Systems Joint Program Office

Figure 4. Smart Columbus Program Management Office Structure
Figure 5. USDOT Organization Chart

Source: USDOT, September 2017
3.3 Roles and Responsibilities

This section summarizes the roles and responsibilities within the Smart Columbus PMO. It also provides a view of the Smart Columbus program by task area, mapping all points of contact for the City of Columbus, the USDOT and the Smart Columbus consultant team to the task and project areas for this effort.

Table 3. Roles and Responsibilities for Program Management

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDOT AOR</td>
<td>• Provides final approval of overall program scope, schedule and budget. Reviews monthly updates to these items. Verifies scope requirements have been met for submitted deliverables. Provides written comments and acceptance of deliverables to city PM. Provides input and recommendation to change management authorizations (cost, scope, schedule)</td>
</tr>
<tr>
<td>USDOT AO</td>
<td>• Manages contractual changes for the program sponsor. Provides budget and schedule oversight. Provides final change management authorizations (cost, scope, and schedule). Communicates Award requirements, questions and invoicing, and notifies the PgM of any contract concerns.</td>
</tr>
<tr>
<td>Mayor</td>
<td>• Accountable for the entire Smart Columbus program. Responsible for articulating city priorities and communicating them to CINO and PMO staff.</td>
</tr>
<tr>
<td>CINO/Program Owner (City)</td>
<td>• Accountable for the entire Smart Columbus program and enterprise-wide program management framework. Accountable for developing and implementing citywide innovation solutions aligned with Mayor’s priorities.</td>
</tr>
<tr>
<td>DCINO (City)</td>
<td>• Directly supports CINO’s vision for innovation including enterprise-wide program management and citywide innovation solutions. Serves as acting CINO in CINO’s absence. Responsible for strategic partnerships and relationships.</td>
</tr>
<tr>
<td>PgM (City)</td>
<td>• Responsible for overall delivery of the program. This includes adding expertise to the team as needed to ensure delivery.</td>
</tr>
<tr>
<td></td>
<td>• Responsible for PMO leadership and processes, scope, schedule, budget, policy, reporting and risk management for the total Smart Columbus program and the primary interface to the USDOT team.</td>
</tr>
<tr>
<td></td>
<td>• Acts as the point of contact for the AO regarding Award requirements, questions and invoicing, manages the fiscal reporting process, submits formal changes to the AO for approval and escalates any USDOT contract concerns to CINO for consideration.</td>
</tr>
<tr>
<td>DPGM (Partnerships and Policy) (City)</td>
<td>• Responsible for overseeing the development of partnerships benefitting the USDOT; coordinates partner awards with the PMO; coordinates legislation related to partnerships; manages vendor engagement and tracking; coordinates policy-related issues and assists with development of policy solutions; oversee development of procedures for legislation and procurement; serve as escalation point for partner and vendor issues to PMO.</td>
</tr>
<tr>
<td>Individual/Group</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DPgM</td>
<td>• Responsible for overseeing IT elements within each project, ensuring proper representation is engaged for consultation and solution delivery, providing senior level program support for the SCOS project team, overseeing the Data Working Group and deliverables, serves as the voice of IT to the PMO to bridge all projects and SC initiatives, and serving as the escalation point for city Department of Technology (DoT) to address project concerns and as the voice to DoT from the PMO.</td>
</tr>
<tr>
<td>(Technology)</td>
<td></td>
</tr>
<tr>
<td>(City)</td>
<td></td>
</tr>
<tr>
<td>Communications PM</td>
<td>• The Communications PM is responsible for planning and implementing the communications and outreach strategy for the projects. This includes managing any communications consultants including their scope, budget and schedule.</td>
</tr>
<tr>
<td>(City)</td>
<td></td>
</tr>
<tr>
<td>IT PM</td>
<td>• The information technology (IT) PM is responsible for delivery of SCOS, Data Management Plan and Data Privacy Plan, as well as the lead for data collection, data management, integration and dissemination. Responsibilities includes oversight of deliverables, project scope, budget, risks, schedule, and policy. The IT PM is responsible for engaging the Data Working Group to assist with the evolution of the SCOS. PM is responsible for facilitating escalations, scope variances, policy changes, coordinating between projects, working with partners, and identifying resource needs for the overall success of the project. The IT PM is responsible for is responsible for updating PMO on project status.</td>
</tr>
<tr>
<td>(City)</td>
<td></td>
</tr>
<tr>
<td>Product Manager</td>
<td>• The product owner provides direction and goals for the team and prioritizes what will be done. The Product Owner is appointed by the Business Owner and is empowered to make decisions within a framework of governance defined within the department and independent of the SC program.</td>
</tr>
<tr>
<td>Chief Architect</td>
<td>• The chief architect (CA) is responsible for integrating the component applications; managing concept development, design, deployment, testing, operating and maintenance and evaluation; and ensuring all projects and systems can be integrated as designed in the systems engineering documentation or work to adjust the approach.</td>
</tr>
<tr>
<td>(City)</td>
<td></td>
</tr>
<tr>
<td>SE/QS</td>
<td>• The SE/QS will serve as a dedicated resource reporting into the PMO looking at project initiatives to ensure they are holistic in approach and tightly integrated with SCOS. The SE/QS will also communicate and coordinate with the Smart Columbus team to facilitate decisions and encourage collaboration. Specific SE activities for this staff including providing review and guidance to the PMO regarding all program and project level SE activities, ensuring consistency among the approach, integration among all projects and that sound SE practices and documentation are applied.</td>
</tr>
<tr>
<td>Quality Auditor</td>
<td>• The quality auditor will serve as a dedicated resource reporting into the PMO, and will be responsible for the overall implementation and management of the quality assurance (QA) process described in the Quality Management Plan (QMP). This includes conducting deliverable reviews, ensuring that technical reviewer comments are appropriately adjudicated and resolved, auditing to verify that design packages are in</td>
</tr>
</tbody>
</table>
### Individual/Group Responsibilities

- **Fiscal/Procurement Officer (City)**
  - The designated fiscal/procurement officer for the city will provide fiscal oversight and delegate coordination authority to the fiscal analyst.

- **Fiscal/Procurement Analyst (City)**
  - The Fiscal Analyst provides direct oversight of any procurement processes, and interacts with the City PMs, DPgM and PgM as needed to complete procurements.

- **PM (City)**
  - The PM is responsible for delivery of the overall project including oversight of deliverables, project scope, budget, risks, schedule, and policy. The PM is responsible for facilitating escalations, scope variance, policy change, coordinating between projects, working with partners, and identifying resource needs for the overall success of the project. The PM is responsible for updating the PMO on project status.

- **Project Lead (Consultant)**
  - The Project Lead provides technical leadership for the project and has the overall responsibility for delivering a Project to the Business Owner. The Project Lead coordinates tasks within project team, facilitates and summarizes project meetings and action items, holds the team accountable for deliverables, manages to scope, facilitates change management, governs the project per the PMP and SEMP, creates and maintains schedule and risk registers, works with the PM to establish budget and recognize policy needs, and partners with the PM to establish necessary reporting for the PMO/USDOT.

### Table 4. Staff by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>Name</th>
<th>USDOT</th>
<th>City or City Representative</th>
<th>Consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Program Management</td>
<td>Kate Hartman</td>
<td>Mandy Bishop</td>
<td>Diane Newton (HNTB)</td>
</tr>
<tr>
<td>B</td>
<td>Systems Engineering</td>
<td>Ed Fok</td>
<td>Maurice &quot;Skip&quot; Tourville</td>
<td>Bob James (HNTB)</td>
</tr>
<tr>
<td>C</td>
<td>Performance Measures</td>
<td>Elina Zlotchenko</td>
<td>Andy Wolpert</td>
<td>Caron Kloser (HNTB)</td>
</tr>
<tr>
<td>D</td>
<td>Data Privacy</td>
<td>Claire Barrett</td>
<td>Jodie Bare</td>
<td>Brian King (Proteon Software)</td>
</tr>
<tr>
<td>E</td>
<td>Data Management</td>
<td>Ariel Gold</td>
<td>Jodie Bare</td>
<td>Brian King (Proteon Software)</td>
</tr>
<tr>
<td>F</td>
<td>Safety Management</td>
<td>Chris Monk</td>
<td>TBD</td>
<td>Greg Krueger (HNTB)</td>
</tr>
<tr>
<td>G</td>
<td>Communications and Outreach</td>
<td>Tim Klein</td>
<td>Brandi Braun</td>
<td>Marie Keister (ME/Engage)</td>
</tr>
<tr>
<td>H</td>
<td>International Collaboration</td>
<td>Kevin Gay</td>
<td>Mandy Bishop</td>
<td>Diane Newton</td>
</tr>
</tbody>
</table>
### 3.4 Project Governance

Figure 6 depicts the organizational framework that will be used to deliver an integrated and holistic program. The Smart Columbus governance structure is organized to help the city gather and develop ideas from other public agencies, community leaders, residents, specialists and national experts in an efficient and timely manner. It facilitates reviews and inputs from subject matter experts to ensure accuracy, detail and quality. Finally, it communicates project status and results to relevant and interested parties.
3.5 Stakeholders and Working Groups

Smart Columbus working groups serve as technical resource advisors and provide input to the Smart Columbus project team which includes the city and consultant team as they develop concepts of operations, consider use cases, data needs and deployment of the projects. The working groups and their members advise on goals, metrics, data needs and benefits, use cases for data, budget, policy, operations, end-user needs, deployment strategies, needed adjustments and other project-specific
decisions as needed. Working groups assist the Smart Columbus project team to identify new opportunities and relationships to enhance participation and performance of the projects and overall program. Per the Award, two working groups are required, the data and the electrification working groups.

Upon the award in 2016, the PMO set up additional individual working groups to support stakeholder engagement related to additional areas, specifically:

- Connected vehicles
- Connected travelers
- FMLM challenges
- Downtown parking
- Mobility assistance
- CEAV
- Truck platooning

These working groups met numerous times during the first 12 months of the project, supporting stakeholder engagement and user need definition for the various projects. As the projects have progressed through systems engineering development, many working groups have served their purpose of assisting with goals, objectives, performance metrics, technical advisory, policy, operations, etc. On January 10, 2018, the PMO provided the USDOT an evaluation of each working group’s contributions and future role. The PMO recommended that all working groups should be disbanded, except for the Data Technical Working Group and Electricfication Working Group; both will continue to meet regularly.

The rosters for the working groups initiated in 2016 will be archived, so that the project teams may still engage with the members to assist and contribute to document reviews and input during project development.

For archive purposes, the original list of working groups supporting the USDOT Award in 2016, refer to Table 5.

<table>
<thead>
<tr>
<th>Working Group</th>
<th>Projects</th>
<th>Chair/Co-Chair (Agency)</th>
<th>Business Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Connected Vehicles</td>
<td>CVE</td>
<td>Reynaldo Stargell, City of Columbus</td>
<td>City of Columbus Department of Public Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Greg Zink, Battelle</td>
<td></td>
</tr>
<tr>
<td>2. Connected Travelers</td>
<td>MMTPA/CPS</td>
<td>Sam Orth, City of Columbus</td>
<td>Project Management Office</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nicole Woodward, City of Columbus</td>
<td></td>
</tr>
<tr>
<td>3. Data</td>
<td>SCOS</td>
<td>Jodie Bare, City of Columbus</td>
<td>Project Management Office</td>
</tr>
</tbody>
</table>

Table 5. Smart Columbus USDOT Working Groups
<table>
<thead>
<tr>
<th>Working Group</th>
<th>Projects</th>
<th>Chair/Co-Chair (Agency)</th>
<th>Business Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. FMLM</td>
<td>SMH</td>
<td>Ben Blaquera, Columbus Collaboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sam Orth, City of Columbus</td>
<td>COTA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nicole Woodward, City of Columbus</td>
<td></td>
</tr>
<tr>
<td>5. Downtown Parking</td>
<td>EPM</td>
<td>Kevin McSweeney, City of Columbus</td>
<td>City of Columbus Department of Public Service/ Division of Traffic Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amanda Ford, City of Columbus</td>
<td>City of Columbus Department of Public Service/ Division of Traffic Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>City of Columbus Department of Public Service/ Division of Traffic Management</td>
<td></td>
</tr>
<tr>
<td>6. Mobility Assistance</td>
<td>Mobility Assistance for People with Cognitive Disabilities</td>
<td>Frank Williams, City of Columbus</td>
<td>COTA</td>
</tr>
<tr>
<td>7. Connected Electric Autonomous Vehicles</td>
<td>CEAV</td>
<td>Reynaldo Stargell, City of Columbus</td>
<td>COTA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carla Bailo, The Ohio State University (OSU)</td>
<td></td>
</tr>
<tr>
<td>8. Truck Platooning</td>
<td>Truck Platooning</td>
<td>James Young, City of Columbus</td>
<td>City of Columbus Department of Public Service/ Division of Traffic Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carla Bailo, OSU</td>
<td></td>
</tr>
<tr>
<td>9. Electrification</td>
<td>Vulcan</td>
<td>Patricia Austin, City of Columbus</td>
<td>City of Columbus, Division of Power</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ryan Houk, American Electric Power</td>
<td></td>
</tr>
</tbody>
</table>

Note: Working groups as of 6/5/2017.
3.6 USDOT and Vulcan Program Coordination

The eight Smart Columbus projects funded by the USDOT award align with the priorities funded through the $10M award from the Paul G. Allen Vulcan foundation. As background, the four Vulcan priorities include 1) decarbonization, 2) electric vehicle fleet adoption, 3) consumer electric vehicle adoption, and 4) charging infrastructure. Although the two grant awards are funded and managed separately, the USDOT and Vulcan programs have three (3) primary points of intersection that should be acknowledged:

- The Connected Electric Autonomous Vehicle (CEAV) – Vulcan priority 3
- Smart Mobility Hubs (SMH) – Vulcan priority 5
- The Smart Columbus Operating System (SCOS) – Vulcan priority 2-5

The work for the three USDOT projects are led by the City Project Managers (PMs). These PMs coordinate with the Vulcan PM regarding these projects to ensure both programs are aware of the work being done within the respective efforts and duplication avoided. The Vulcan PM is informed about the CEAV project. The SMH and SCOS require the most coordination: the City is deploying electric vehicle infrastructure (EVI) as part of the hubs while the operating system will ingest and ultimately disseminate data from the charging infrastructure as well as electric fleet vehicles. Therefore, the City and Vulcan PMs are actively coordinating regarding infrastructure and data needs for the USDOT projects and Vulcan priorities and will continue to do so throughout the program.

This coordination is accomplished through the City’s already scheduled, regular meeting: the Smart Columbus PMO meets for both programs every Monday for 60 minutes. The agenda for these meetings include upcoming deliverables, status of those deliverables, blockers to delivery and strategies and next steps for delivery. This meeting ultimately serves as the first point of the inter-program coordination between USDOT and Vulcan where coordination needs are identified.

3.7 Team Directory and Contacts

Table 6 provides the contacts for the key project team personnel in the project. As staff changes occur, this directory will be updated.

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency/Firm</th>
<th>E-mail</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken Leonard</td>
<td>USDOT</td>
<td><a href="mailto:Ken.leonard@dot.gov">Ken.leonard@dot.gov</a></td>
<td>202-366-9536</td>
</tr>
<tr>
<td>Kate Hartman</td>
<td>USDOT</td>
<td><a href="mailto:Kate.hartman@dot.gov">Kate.hartman@dot.gov</a></td>
<td>202-366-2742</td>
</tr>
<tr>
<td>Sara Tarpgaard</td>
<td>USDOT</td>
<td><a href="mailto:Sara.tarpgaard@dot.gov">Sara.tarpgaard@dot.gov</a></td>
<td>202-366-5750</td>
</tr>
<tr>
<td>Kevin Dopart</td>
<td>USDOT</td>
<td><a href="mailto:Kevin.dopart@dot.gov">Kevin.dopart@dot.gov</a></td>
<td>202-366-5004</td>
</tr>
<tr>
<td>Ed Fok</td>
<td>FHWA</td>
<td><a href="mailto:Ed.fok@dot.gov">Ed.fok@dot.gov</a></td>
<td>415-744-4848</td>
</tr>
<tr>
<td>Elina Zlotchenko</td>
<td>USDOT</td>
<td><a href="mailto:Elina.zlotchenko@dot.gov">Elina.zlotchenko@dot.gov</a></td>
<td>202-366-1697</td>
</tr>
<tr>
<td>Name</td>
<td>Agency/Firm</td>
<td>E-mail</td>
<td>Phone</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------</td>
<td>------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Claire Barrett</td>
<td>Office of the Secretary of Transportation (OST)</td>
<td><a href="mailto:Claire.barrett@dot.gov">Claire.barrett@dot.gov</a></td>
<td></td>
</tr>
<tr>
<td>Ariel Gold</td>
<td>USDOT</td>
<td><a href="mailto:Ariel.gold@dot.gov">Ariel.gold@dot.gov</a></td>
<td>202-366-4374</td>
</tr>
<tr>
<td>Chris Monk</td>
<td>National Highway Transportation Safety Administration (NHTSA)</td>
<td><a href="mailto:Chris.monk@dot.gov">Chris.monk@dot.gov</a></td>
<td>202-366-5195</td>
</tr>
<tr>
<td>Tim Klein</td>
<td>USDOT</td>
<td><a href="mailto:Timothy.klein@dot.gov">Timothy.klein@dot.gov</a></td>
<td>202-366-0075</td>
</tr>
<tr>
<td>Steve Sill</td>
<td>USDOT</td>
<td><a href="mailto:Steve.sill@dot.gov">Steve.sill@dot.gov</a></td>
<td>202-366-1603</td>
</tr>
<tr>
<td>Egan Smith</td>
<td>USDOT</td>
<td><a href="mailto:Egan.smith@dot.gov">Egan.smith@dot.gov</a></td>
<td>202-366-9224</td>
</tr>
<tr>
<td>Diane Turchetta</td>
<td>FHWA</td>
<td><a href="mailto:Diane.turchetta@dot.gov">Diane.turchetta@dot.gov</a></td>
<td>202-493-0158</td>
</tr>
<tr>
<td>Michael Stevens</td>
<td>City of Columbus</td>
<td><a href="mailto:mhstevens@columbus.gov">mhstevens@columbus.gov</a></td>
<td>614-325-1030</td>
</tr>
<tr>
<td>Brandi Braun</td>
<td>City of Columbus</td>
<td><a href="mailto:bjbraun@columbus.gov">bjbraun@columbus.gov</a></td>
<td>614-852-7344</td>
</tr>
<tr>
<td>Mandy Bishop</td>
<td>City of Columbus</td>
<td><a href="mailto:mkbishop@columbus.gov">mkbishop@columbus.gov</a></td>
<td>614-645-7723</td>
</tr>
<tr>
<td>Jodie Bare</td>
<td>City of Columbus</td>
<td><a href="mailto:jmbare@columbus.gov">jmbare@columbus.gov</a></td>
<td>614-724-1276</td>
</tr>
<tr>
<td>Ryan Bollo</td>
<td>City of Columbus</td>
<td><a href="mailto:rjbollo@columbus.gov">rjbollo@columbus.gov</a></td>
<td>614-645-3946</td>
</tr>
<tr>
<td>Randy Bowman</td>
<td>City of Columbus</td>
<td><a href="mailto:rjbowman@columbus.gov">rjbowman@columbus.gov</a></td>
<td>614-645-2464</td>
</tr>
<tr>
<td>Andy Wolpert</td>
<td>City of Columbus</td>
<td><a href="mailto:adwolpert@columbus.gov">adwolpert@columbus.gov</a></td>
<td>614-645-2872</td>
</tr>
<tr>
<td>Bud Braughton</td>
<td>City of Columbus</td>
<td><a href="mailto:nlb@columbus.gov">nlb@columbus.gov</a></td>
<td>614-645-8241</td>
</tr>
<tr>
<td>Kevin McSweeney</td>
<td>City of Columbus</td>
<td><a href="mailto:kmmcsweeney@columbus.gov">kmmcsweeney@columbus.gov</a></td>
<td>614-645-7248</td>
</tr>
<tr>
<td>J.D. Schneeberger</td>
<td>Noblis</td>
<td><a href="mailto:John.schneeberger@noblis.org">John.schneeberger@noblis.org</a></td>
<td>202-551-1171</td>
</tr>
<tr>
<td>Diane Newton</td>
<td>HNTB</td>
<td><a href="mailto:dnewton@hntb.com">dnewton@hntb.com</a></td>
<td>317-332-3020</td>
</tr>
<tr>
<td>Aaron Ford</td>
<td>HNTB</td>
<td><a href="mailto:aford@hntb.com">aford@hntb.com</a></td>
<td>312-798-0281</td>
</tr>
<tr>
<td>Tom Timcho</td>
<td>WSP</td>
<td><a href="mailto:Tom.timcho@wsp.com">Tom.timcho@wsp.com</a></td>
<td>614-791-5189</td>
</tr>
<tr>
<td>Alex Kavanagh</td>
<td>HNTB</td>
<td><a href="mailto:akavanagh@hntb.com">akavanagh@hntb.com</a></td>
<td>312-798-0225</td>
</tr>
<tr>
<td>Matt Graf</td>
<td>HNTB</td>
<td><a href="mailto:mgraf@hntb.com">mgraf@hntb.com</a></td>
<td>614-493-5516</td>
</tr>
<tr>
<td>Sherry Kish</td>
<td>HNTB</td>
<td><a href="mailto:skish@hntb.com">skish@hntb.com</a></td>
<td>614-493-5510</td>
</tr>
<tr>
<td>Randy Butler</td>
<td>CDM Smith</td>
<td><a href="mailto:butlerrw@cdsmith.com">butlerrw@cdsmith.com</a></td>
<td>703-691-6925</td>
</tr>
<tr>
<td>Marie Keister</td>
<td>Engage Public Affairs</td>
<td><a href="mailto:mkeister@engagepublicaffairs.com">mkeister@engagepublicaffairs.com</a></td>
<td>614-221-2885</td>
</tr>
<tr>
<td>Brian King</td>
<td>Proteon Software</td>
<td><a href="mailto:bjkings@columbus.gov">bjkings@columbus.gov</a></td>
<td>614-724-2887</td>
</tr>
<tr>
<td>Skip Tourville</td>
<td>Acquisition Logistics Engineering (ALE)</td>
<td><a href="mailto:mtourville@ale.com">mtourville@ale.com</a></td>
<td>614-436-1609</td>
</tr>
</tbody>
</table>
3.8 Team Engagement

The Smart Columbus PMO will utilize several tools to engage and communicate within and outside the team. All internal team communications tools are summarized in section 15 within the PMP; more detail regarding external communications is available in the Smart Columbus Communications and Outreach Plan, which is currently in progress.

With regards to documentation and written collaboration, the Smart Columbus PMO has created a SharePoint site; details on the use and structure of this platform is contained in Section 5 (Document Management).
Chapter 4. Scope Management

The PMBOK defines scope management as the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. The Scope Management Plan provides the guidance on how project scope will be defined, documented, verified, managed and controlled by the Smart Columbus PMO. This section presents the scope management plan for the program. It includes the following:

- Roles and Responsibilities
- Project Tasks
- WBS
- WBS Dictionary and Deliverables
- Scope Control and Verification

4.1 Roles and Responsibilities

Table 7 lists the responsibilities assigned to specific individuals and groups regarding the management of the project scope. The primary responsibilities in this area rely upon the USDOT AOR, USDOT AO and PgM. The USDOT AOR is ultimately responsible for verification of the scope and acceptance of the deliverables produced under this project. The USDOT AO is responsible for executing any contractual actions that may result from scope changes. Additional groups responsible for the scope management are identified in Table 7 as well. Scope management for the USDOT portion of the Smart Columbus program will be the responsibility of the PgM. The scope for this project is defined by the scope statement as detailed in the Award.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDOT AOR</td>
<td>Verify scope requirements have been met for submitted deliverables</td>
</tr>
<tr>
<td></td>
<td>Provide written acceptance of deliverables to PM</td>
</tr>
<tr>
<td></td>
<td>Provide written comments of deliverables to PM</td>
</tr>
<tr>
<td></td>
<td>Send and receive written request of scope variance with the PgM</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDOT AO</td>
<td>• Review and approve any changes to the scope, schedule or budget</td>
</tr>
<tr>
<td>USDOT Technical Support Team</td>
<td>• Support verification of scope for USDOT AOR with written comments on deliverables submitted</td>
</tr>
<tr>
<td>PgM (City)</td>
<td>• Verify that scope requirements have been met with deliverables</td>
</tr>
<tr>
<td></td>
<td>• Maintain written record of submittals, acceptances and change requests from USDOT</td>
</tr>
<tr>
<td></td>
<td>• Review and consider identified variances of the scope from the PM</td>
</tr>
<tr>
<td></td>
<td>• Provide written requests for scope variances to the AOR</td>
</tr>
<tr>
<td>PM (City)</td>
<td>• Verify scope requirements have been met for deliverables to be submitted</td>
</tr>
<tr>
<td></td>
<td>• Identify variances of the scope and submit a technical memorandum for Smart Columbus leadership for review</td>
</tr>
<tr>
<td></td>
<td>• Lead the development and review deliverables</td>
</tr>
<tr>
<td></td>
<td>• Submit deliverables to USDOT AOR after concurrence from Smart Columbus program leadership</td>
</tr>
<tr>
<td>Project Lead (Consultant)</td>
<td>• Review deliverables to ensure scope requirements are met</td>
</tr>
<tr>
<td></td>
<td>• Identify possible scope changes for elevation to PM</td>
</tr>
<tr>
<td>Scrum Master (Consultant)</td>
<td>• Lead the Scrum process and oversee how it should be applied</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the Business Owner and development team stay within the Scrum process</td>
</tr>
<tr>
<td></td>
<td>• Coach the other team members on how to use Scrum in the most effective manner</td>
</tr>
<tr>
<td>Business Owner (City)</td>
<td>• Responsible for defining the work that needs to be completed and prioritizing that work</td>
</tr>
<tr>
<td></td>
<td>• Provide direction and goals for the team</td>
</tr>
<tr>
<td></td>
<td>• Participate in daily Scrum meetings throughout each sprint. The Business Owner grooms user stories and prepares them in priority order for backlog where the development team will identify ownership of stories and size for each sprint during sprint planning sessions.</td>
</tr>
<tr>
<td></td>
<td>• Provide approval of all user stories/sprint setup. Business Owner is responsible for confirming business owner's view is represented. Business Owner is appointed by the business owner and is empowered to make decisions within a framework of governance defined within the department and independent of the Smart Columbus program</td>
</tr>
<tr>
<td>Technical Team (City and Consultant)</td>
<td>• Develop deliverables following the project scope</td>
</tr>
</tbody>
</table>
4.2 Project Tasks

This section summarizes tasks, as identified in the Award organized by task area. The value in the brackets [ ] following items in the list of deliverables and subtask headings refers to the WBS number as identified in Table 7.

4.2.1 Task A – Program Management

The activities to be performed as part of Task A outline a disciplined approach to managing the execution of the work and establishing the framework to allow for the highest quality products on time and within budget. Common processes and procedures will be identified and documented to ensure quality, timeliness and cost control. Per the Award, there are five required deliverables, and in addition, the city is preparing and submitting one additional, related deliverable. These deliverables are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

- Kick-off Meeting [P1]
- PMP [P2]
- Project Schedule (including monthly updates) [P3]
- Partnership/Stakeholder Status Summary [P4]
- Quarterly Progress Reports and Briefings [P5], to include:
  - Updated project schedule
  - Schedule risk narrative
  - Technical risk narrative
  - Partnership risk narrative
  - Retrospective risk narrative
  - Projected cost-to-complete narrative

Note that the various risk narratives and their status will be maintained within the project risk register; the risk register will be submitted quarterly to cover these required areas.

The following are additional deliverables:

- Monthly Progress Reporting and Invoicing [P5]

4.2.1.1 Kickoff Meeting [P1]

The Smart Columbus kick-off meeting was held in Columbus, Ohio on September 12 and 13, 2016. This was within four weeks of the Award, as required. USDOT representatives, the Smart Columbus program management team, city and community leaders were in attendance. The meeting defined a common understanding of the AOR’s requirements and expectations as it related to the city’s application.
The city brought its key personnel to this meeting while the AOR arranged the location, the agenda and the list of other attendees.

4.2.1.2 Project Management Plan (PMP) [P2]

The city shall prepare a PMP that describes the activities required to perform the work, per current PMBOK guidance. The PMP will explain the roles and responsibilities of all key individuals within the program/project team. At a minimum, the PMP shall contain a Scope Management Plan, a Schedule Management Plan, a Communications Management Plan, a Cost Management Plan, a QMP, a Configuration Management Plan, and a Risk Management Plan. Updates to the PMP will be prepared and submitted to USDOT on a quarterly basis, as needed.

4.2.1.3 Monthly Schedule (SCS) Updates [P3]

In conjunction with the submittal of the monthly progress report, the city will provide an updated version of the Smart Columbus schedule. It is expected that a total of 48 monthly updates will occur during the performance of this scope. The updated schedule will reflect the status of work performed to date and include both a baseline and revised schedule if appropriate. The schedule will be made available in both Microsoft (MS)Project format and PDF.

4.2.1.4 Partnership/Stakeholder Status Summary [P4]

The city will continue coordination with the national and local partners including our key leveraged partners and work through expectations related to products and services to be provided. These awards will be confirmed in individual meetings and documented in formal term sheets for each partner. The initial meetings and term sheets will outline an ongoing engagement plan which is expected to include: recurring meetings, approach to partner engagement activities (i.e. consulting), primary points of contact, expectations and timelines. Monthly updates are included in the monthly status report. Any change in assumed key leveraged partners will be coordinated with USDOT as required by and in accordance with the requirements of the Award.

4.2.1.5 Monthly Progress Reporting and Invoicing [P5]

The city will deliver monthly progress reports to USDOT for the duration of the Award period. The progress reports will include activities performed, deliverables submitted, budget status, risks and issues identified, risk mitigation efforts (if necessary) and expected tasks for the subsequent reporting period.

4.2.1.6 Quarterly Progress Reports and Briefings [P5]

The city will deliver quarterly progress reports to the USDOT. The quarterly progress reports and briefings shall identify deliverables and deliverable status (not initiated, in progress X% complete, draft delivered, in revision X% complete, final delivered, or accepted). Quarterly reports shall contain a narrative of accomplishments by task and projected activities in the next quarterly period. Quarterly reports shall also contain an updated project schedule with a schedule risk narrative, a technical risk narrative, a partnership risk narrative, a retrospective cost narrative and a projected cost-to-complete narrative. Following submission of the quarterly progress report, a briefing will be held between the USDOT and the city.
4.2.2 Task B – Systems Engineering

Application of a rigorous SE approach is critical for the effective development and implementation of the technical and institutional solutions envisioned by Smart Columbus and supports an efficient, interoperable and replicable smart city demonstration. Further, an SE approach serves to reduce the risk of schedule and cost overruns and increases the likelihood that the development outcomes will meet user needs.

While the Waterfall (or “Vee”) SE approach is the traditional approach, some projects may be best completed under an Agile approach while others may be executed through the purchase of an off-the-shelf product. As part of the program re-set, the Smart Columbus PMO will prepare a summary of the program-level SE approach and process for determining the best methodology for each project. This will include the documentation that accompanies each of the approaches: Vee or Agile. The PMO will then complete an evaluation of each project within the program to determine which SE methodology is most appropriate and provide this documentation within the SEMP.

Per the Award, there are multiple required SE deliverables. Three of these deliverables are aligned with the overarching Smart Columbus program. The SEMP, the Demonstration Site Map and Installation Schedule, and the System Architecture and Standards Plan will all be produced to address the holistic view of the city’s approach. The SEMP shall further describe which SE process will be applied to each project, and in turn, the specific SE activities and deliverables that will be performed during the project. In accordance with the SEMP, the city may also prepare and submit one, some or none of identified, additional deliverables. These additional deliverables expand on the core SE documents, support the instances where an Agile approach is used, or when vendor solutions dictate an approach that does not require a full V-Model approach.

Finally, as part of the engineering process, a set of artifacts that support other processes or internal decisions may also be prepared but are not expected to be submitted to USDOT. These deliverables and artifacts are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

- SEMP [S1.1]
- Concept of Operations (ConOps) [S2.X.1]
- Demonstration Site Map and Installation Schedule (DSMIS) [S1.2]
- Systems Requirements Specification (SyRS) [S2.X.2]
- System Design Document (SDD) [S2.X.4]
- System Architecture and Standards Plan [S1.3]
- Test Plan (TP) [S2.X.5 or S3.X.4]
- Interface Control Document (ICD) [S2.X.3]
- Testing Documentation [S2.X.6 or S3.X.5]
- Operations and Maintenance (O&M) Plan [S2.X.6]

The following are additional deliverables related to vendor-provided solutions:
The following are other work products related to Agile projects:

- Strategy Plan [S4.X.1]
- Management and Collaboration Tools Administration [S4.X.3]
- Product Roadmap and Release Planning [S4.X.4]
- User Story Definition [S4.X.5]
- Development [S4.X.6]

**4.2.2.1 Systems Engineering Management Plan [S1.1]**

The city will prepare a complete SEMP that details the specific activities to be performed with respect to the design and deployment of the proposed technologies. A draft and a final version will be submitted. The SEMP will describe the SE process the city plans to follow during the execution of the project’s work and how it plans to manage the specific SE activities that will be performed during the project. The SEMP is intended to be at a more detailed level than the PMP, however some duplication is inevitable. In instances where there are shared components, the detailed project schedule being an example, the SEMP will include those elements by reference.

**4.2.2.2 Concept of Operations (ConOps) [S2.X.1]**

For those projects identified as requiring such, the city will prepare and submit a ConOps document, consistent with Institute of Electrical and Electronics Engineers (IEEE) Standard 1362-1998. The ConOps will serve as the foundational document that frames the specific project elements of the Smart Columbus system and sets the technical course for a project. Its purpose is to clearly convey a high-level view of the system to be developed that each stakeholder can understand. The ConOps will describe the city’s holistic, integrated solution to be deployed for the SCC and how operational practice should be altered based on the introduction of new technologies. Among other elements, the ConOps will include a set of proposed high-priority “needs” through structured stakeholder interaction, a context diagram, a discussion of enhancements to operational practices and use cases or scenarios. The ConOps will also explicitly describe how the city plans to interface with proposed partners.

**4.2.2.3 Demonstration Site Map and Installation Schedule (DSMIS) [S1.2]**

The city will produce a draft Demonstration Site Map and Installation Schedule for delivery to USDOT. The Demonstration Site Map will identify the specific geographic area(s) and indicate locations related to key issues, current and proposed roadside technology locations, CV and AV operations, and other explanatory features to support the city’s proposed strategies.

The Site Installation Schedule will be produced as a subset of the Smart Columbus schedule, and will identify the specific infrastructure installation activities. For each type of infrastructure element to be installed, the schedule will indicate:
• The type of infrastructure element to be installed
• Planned installation start and end dates
• Organization or individual responsible for the installation
• Milestone(s) identifying when the installation of each type of infrastructure element is completed
• Planned start and end dates for unit testing the operation of each infrastructure element (by type)

4.2.2.4 Systems Requirements Specification (SyRS) [S2.X.2]

For those projects identified as requiring such, and using the ConOps previously developed for the project as the basis for the development of the requirements, the city will prepare and submit a comprehensive system requirements document. The SyRS will address functional, interface, performance, security, data and reliability requirements. These requirements will be evaluated to ensure that they are required, testable and are independent of technology. Further, the SyRS will include necessary requirements to satisfy the capture of agreed-to data from both the city’s defined performance measures, as well as those of the independent evaluator. All the requirements included as part of the SyRS will be developed in accordance with IEEE Standards 1233: “Guide for Developing Systems Requirements Specifications.”

Once the requirements are captured, the corresponding traceability matrices will be developed to tie these requirements to the ConOps. The requirements will identify what the systems must accomplish; identify the subsystems; and define the functional and interface requirements among the subsystems. The role of each subsystem in supporting system-level performance requirements will be identified, including associated subsystem functional, interface, performance, security, data, and reliability requirements.

4.2.2.5 System Design Document (SDD) [S2.X.4]

For those projects identified as requiring such, the city will prepare and submit a SDD that addresses the breadth of the specific project. The SDD will be created based on the SyRS, including a high-level design that defines the overall framework for the system. Subsystems of the system will be identified and decomposed further into components. Requirements are allocated to the system components, and interfaces are specified in detail. Detailed specifications will be created for the hardware and software components to be developed, and final product selections will be made for off-the-shelf components. IEEE Standard 1016-1998 (IEEE Recommended Practice for Software Design Descriptions) will be used as guidance for format and content of the SDD.

4.2.2.6 System Architecture and Standards Plan [S1.3]

The city will prepare and submit a Systems Architecture and Standards Plan. This deliverable will document the architecture for systems associated with the city’s demonstration and associated standards that will be used. In preparing the systems architecture, the city will, to the extent the systems align, extend the existing ITS regional architecture, as well as capture the CV-related elements in the USDOT-developed Connected Vehicle Reference Implementation (CVRIA). Other elements not presently captured in these tools will be documented in a comparable tool, using consistent terminology and symbols. The architecture document will consider:

• Enterprise Architecture
• Functional Architecture
• Physical Architecture
• Communications Architecture

Further, the city will develop a Standards Plan that identifies the nature of required interfaces to other systems, utilizing existing networking or other standards when available. In following the systems engineering process, the city will identify information exchange needs and/or use cases. To the extent that such exchanges are supported by standards, the city will catalog applicable standards that will be used. Where new standards are needed, these needs should be fully documented in the standards plan.

4.2.2.7 Test Plan (TP) [S2.X.5 or S3.X.4]

For those projects identified as requiring such, the city will prepare a system TP that will be used as the planning tool for all phases of test, verification and validation, and to demonstrate that the system satisfies all the requirements specified. The TP will identify what methods (i.e., analysis, demonstration, inspection, and testing) will be used to ensure that the developed system satisfies the system’s requirements.

Given the complexity of the systems associated with the Smart Columbus program, it is envisioned that up to five different phases of testing may be necessary. These phases include:

• Component Testing
• Sub-System Testing
• System Testing
• Interoperability Testing
• Final Acceptance Testing

Both component and sub-system testing are typically associated with developing and building the individual product/project. These typically align with the specifics on the detailed design. System testing involves the testing of the system in the fully operational environment and typically aligns with the verification of system requirements, i.e. does the system perform as expected. Interoperability testing evaluates the functioning of the system when interacting with all other systems. It too is an element of verification of system requirements. Final acceptance testing aligns with validation of the user needs, ensuring the system not only functions without error, but that it serves the purpose for which it was intended. The TP will include the system, interoperability and final acceptance testing phases.

Component and sub-system testing will likely be delegated/required of the respective vendor. The TP will reflect this approach.

4.2.2.8 Interface Control Document (ICD) [S2.X.3]

For those projects identified as requiring such, the city will prepare and submit a draft ICD that documents the external interfaces published by the project, and for which other systems may require connectivity.

ICDs could be as simple as specifying what types of connecting wires must be used to couple two manufacturers’ devices together. ICDs may be as complex as specifying the protocol suites and standards that must be used to ensure that two different computer devices can communicate over some form of telecommunications.
4.2.2.9 Testing Documentation [S2.X.6 or S3.X.5]

Testing will take place for the elements of the program per the respective TPs. To support testing the city will consider the following:

- **Test descriptions**: Test descriptions include written descriptions of the individual verification and validation processes that will occur as part of the effort to ensure that the system was built correctly and that the correct system was built. Test descriptions should be linked back to the requirements whose fulfillment they will determine. The document should include a requirements-to-test procedure matrix that shows the test coverage relationship among the tests and the requirements. Every requirement should have at least one test case associated with it and each test case should have at least one requirement associated with it.

- **Test cases**: Each test case includes a set of test inputs, execution conditions and expected results developed for a unique objective, such as to exercise a path within a system, a software application, or to verify compliance with a specific requirement or set of requirements.

- **Test procedures**: Test procedures identify the specific steps to verify and validate that the component of the system undergoing integration functions as intended and as desired. If test data are going to be used as part of the verification and validation process in this step, the test procedures should also identify that the system performed the correct transformations on the data entered.

- **Test data**: Test data should include scripts used to execute software operations, data that must be supplied as part of the process of verification and validation of the system and its component integration, or a description of what system-generated data will flow through different components of the system to accomplish a system function.

- **Test results**: Documents that describe the results of each test conducted.

The results of any testing activities will be documented in a test report that will be submitted to USDOT during the deployment period and will also be included with the final report.

4.2.2.10 Operations and Maintenance Plan (O&MP) [S2.X.6]

For each project, the city will generate initial O&MPs for submittal to USDOT. The O&MP will describe the policies and high-level procedures governing operation and maintenance of the system. This plan will discuss who will “own” and be responsible for each of the specific elements within the Smart Columbus deployment, both during the demonstration period as well as after the demonstration period is over.

4.2.2.11 Technical Memo [S3.X.1]

If determined by the process outlined in the SEMP, a Technical Memo, in the form of a Trade Study, may be conducted as one of the initial steps in the SE process. When a Trade Study is performed, the purpose is to identify the most balanced technical solution against other viable alternative solutions. These viable solutions are judged by their ability to satisfy a series of user needs and the cost feasibility of implementation. The SEMP may also identify other documentation to support decisions made by the city, such as a pre-qualification process to support product or system evaluation. This process is typically applied when a vendor solution has been identified and which the city intends to implement, eliminating the need to conduct the remaining development process.
4.2.2.12 Installation Plan [S3.X.3]

An Installation Plan will be prepared for instances where detailed engineering plans are not required to deploy specific hardware technology. The Installation Plan will provide guidance to all affected parties related to the deployment of hardware technology to support one or more of the Smart Columbus projects. The Installation Plan will include the list of stakeholders with roles and responsibilities, a schedule of activities, dependencies, necessary skillset of implementers, acceptance criteria and remedies for inoperable systems. The plan will be prepared and agreed to by all parties for which it affects prior to being submitted to USDOT.

4.2.2.13 Strategy Plan [S4.X.1]

The city will prepare a Strategy Plan that documents the specific tasks necessary to successfully conduct the selected and tailored SE effort and subsequent procurement and installation of the specific technology. The Strategy Plan will be documented in the form of a technical memorandum.

4.2.2.14 Product Vision [S4.X.2]

In instances where the Agile approach has been selected as the systems engineering process, a Product Vision will be developed in lieu of the ConOps. The Product Vision statement is an elevator pitch — a quick summary — to communicate how the product supports the given project or specific organization’s strategies. The statement must articulate the goals for the product and be collaboratively defined by the Business Owner, development team and the designated project key stakeholders.

4.2.2.15 Management and Collaboration Tools Administration [S4.X.3]

In instances where the Agile approach has been selected as the SE process, an important aspect of the transparent documentation is use of software tools, such as those shown in Table 8, to enable all involved parties to access centralized and most up-to-date content during all development stages.

<table>
<thead>
<tr>
<th>Software Platform</th>
<th>General Use</th>
<th>Smart Columbus Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivotal Tracker</td>
<td>Agile project management software</td>
<td>The Smart Columbus program will use Pivotal Tracker to manage all Scrum backlog and sprint progress by the development team.</td>
</tr>
<tr>
<td>SharePoint</td>
<td>Smart Columbus document management and collaboration portal</td>
<td>The Smart Columbus program has already established a SharePoint Portal³ on the program. This platform will be used for storing and sharing all development artifacts throughout the development process.</td>
</tr>
</tbody>
</table>

³ smartcolumbusprogram.sharepoint.com

U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office
4.2.2.16 Product Roadmap and Release Planning [S4.X.4]

In instances where the Agile approach has been selected as the SE process, a product roadmap and release planning shall occur as initial and ongoing activities by the Business Owners and development team as shown in Table 9.

A Product Roadmap communicates how a product is likely to evolve across several major releases. The roadmap looks beyond an individual project or release: It describes the journey of the product over the next 12 months or so. The format is flexible for the roadmap: whatever is deemed effective by the Business Owners to communicate with identified stakeholders.

Closely related to the Roadmap is a Release Plan, which forecasts how a major release is developed. It’s a type of project plan that is flexible in nature and typically covers the next three to six months organized into themes and epics. This should be an embedded artifact managed by Pivotal Tracker.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Characteristics</th>
<th>Planning Horizon</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Roadmap</td>
<td>Strategic Plan</td>
<td>12 months or more</td>
<td>Release goals, high-level features / product capabilities</td>
</tr>
<tr>
<td>Release Plan</td>
<td>Tactical Plan</td>
<td>3 to 6 months</td>
<td>Product backlog items, including user stories organized into themes and epics</td>
</tr>
</tbody>
</table>

4.2.2.17 User Story Definition [S4.X.5]

In instances where the Agile approach has been selected as the SE process, the Product Manager and development team should engage in continuous user engagement to define and refine user stories.

A user story is a tool used in Agile software development to capture a description of a software feature from an end-user perspective. The user story describes the type of user, what they want and why. A user story helps to create a simplified description of a requirement as well as acceptance criteria specific to each user story. As progress on the product continues, the Product Manager takes the primary responsibility of grooming (refining and prioritizing) user stories.

This work includes organizing the user stories into epics. Epics are larger bodies of work that stories roll up into. An epic can span across multiple sprints and versions. Versions are different from epics because they are a point in time where software is released to the customer. A version might contain multiple epics. Epics create hierarchy and structure that enables teams to keep track of specific tasks and sub-tasks.
4.2.2.18 Development [S4.X.6]

In instances where the Agile approach has been selected as the SE process, application or software development will proceed per a sprint-based schedule. Sprints will typically be scheduled per a two-week or three-week duration, defined by the Business Owner and Scrum master. As development continues, the following ceremonies and artifacts should be published by the team:

- Product Vision (if any updates are required)
- Product Backlog (viewable in real time from Pivotal Tracker)
- Product Increment (viewable in real time from Pivotal Tracker)
- Sprint Backlog (viewable in real time from Pivotal Tracker)
- Sprint Planning (viewable in real time from Pivotal Tracker)
- Sprint Review (documented and posted to SharePoint at the end of each sprint)
- Sprint Retrospectives (documented and posted to SharePoint at the end of each sprint)

4.2.3 Task C – Performance Measurement

A primary objective of the SCC is to demonstrate, quantify, and evaluate the impact of advanced technologies, strategies and applications toward addressing a city’s challenges. To understand the impacts of smart city strategies, a set of rigorously defined performance measures and associated quantitative performance targets for each performance measure that are achievable within the timeframe of the SCC shall be defined. A Performance Measurement Plan shall be developed by the city that identifies performance measures as well as plans for collecting data and reporting on performance. Per the Award, there are two required deliverables related to Task C. These deliverables are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

- Performance Measurement Plan [D1]
- Response to USDOT Deployment Tracking Surveys (as required) [D2]

4.2.3.1 Performance Measurement Plan [D1]

The PMO will develop a Performance Measurement Plan that addresses how integrated smart city strategies impact safety, mobility, opportunity, a transition to clean transportation, economic vitality, and address environmental impacts. It will identify performance measurements as well as plans for collecting data and reporting on the performance. The Performance Measurement Plan will discuss the types of data the city plans to collect and how the city plans to use the data to support ongoing performance of the SCC. Proposed hypotheses will be documented as well as methodologies for collecting:

- Pre-demonstration data that can be used as a performance baseline
- Continuous data during life of the demonstration to support performance monitoring and evaluation
- Cost data including unit costs and O&M costs
• Information on the timeframe that technology solutions are deployed during the demonstration period

The Performance Measurement Plan will also address how the city will release these performance measures as open data.

4.2.3.2 Response to USDOT Deployment Tracking Surveys [D2]

To measure the deployment of ITS technology nationally, the USDOT-sponsored ITS Deployment Tracking Project surveys transportation agencies in the largest U.S. cities on a regular basis. With the addition of several advanced technology solutions, Columbus will be expected to respond to this survey if/when it is again conducted. The previous survey was conducted in 2010. As this survey had been conducted on a bi-annual basis, the PMO is prepared to respond to two cycles of this survey, but no timeframe has been identified.

4.2.4 Task D – Data Privacy

Per the Award, there is only a single required deliverable related to Task D, the Data Privacy Plan (DPP). Following is a detailed discussion of the DPP.

The following are the required deliverables:

• Data Privacy Plan [D3]

4.2.4.1 Data Privacy Plan (DPP) [D3]

The city’s PMO will develop a DPP intended to meet the privacy requirements of both the City of Columbus as well as that of USDOT. The DPP will consider partners, both public and private, who are contributing/accessing data associated with Smart Columbus. Specifically, the plan will document the technical, policy and physical controls that it will put in place to mitigate potential privacy harms. The plan will include documentation sufficient to verify that the city will store Personally Identifiable information (PII) only on IT infrastructure that is subject to appropriate security controls. Final versions of the DPP will also be incorporated into the awards with the city’s contractors.

4.2.5 Task E – Data Management and Support for Independent Evaluation

Management systems within a smart city – both within transportation and across other sectors of a city – are expected to share data to allow for communication between cities and their residents and enable an open, growing ecosystem of third-party services that provide additional benefits to residents. Systems that allow for data sharing also enable cities to maximize efficiencies through intelligent management of assets across sectors. Open data and technology enable the efficient coordination, use, and management of all mobility services in the system. Per the Award, there are four required deliverables related to Task E. These deliverables are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

• Data Management Plan (DMP) [D5]
• Independent Evaluation (IE) Support Plan [D4]
• Data to support USDOT’s IE
4.2.5.1 Data Management Plan (DMP) [D5]

The PMO will prepare and submit a DMP per the requirements of the USDOT Public Access Plan as outlined at http://ntl.bts.gov/publicaccess/creatingDMP.html. The plan will describe how data – including data across multiple departments in a city – will be collected, managed, integrated, and disseminated before, during, and after the SCC. This includes real-time and archived data that are inputs to and outputs from systems managed by the city and its partners. The document will discuss the city’s plans for managing its data as a strategic asset and making open, machine-readable data available to the public – subject to applicable privacy, security and other safeguards. In cases where the data includes PII or other restrictions, the document shall address how Columbus will make that data available, as possible, in a secure environment for the use of qualified researchers.

The PMO will prepare a draft DMP, and in consultation with the Data Working Group revise the draft. This draft will then be submitted to the USDOT for review. Comments will be captured and addressed as part of a comment resolution matrix, again, in cooperation with the Data Working Group, and the final resolution report and updated DMP will be submitted to USDOT. Because of the sensitive nature, a discussion will be held on how much of the DMP, if any, will be published publicly, and the ensuring response will be considered for Section 508 compliance.

4.2.5.2 Independent Evaluation Support Plan (IESP) [D4]

USDOT has hired an IE consultant for the Smart Columbus deployment. In this capacity, the IE consultant will perform before and after performance assessments; cost-benefit analysis; user acceptance/customer satisfaction assessments; lessons learned, challenges and approaches for mitigating, addressing and /or overcoming them; estimate total impacts, costs and return-on-investment (ROI) of the demonstration; and assess if the SCC achieved its vision. To achieve the objectives, the IE will require access to plans, data, algorithms, system providers, vendors and possibly users. This data that may include PII. Thus, considerations in the design, deployment and operation of the Smart Columbus projects must consider these specific requirements.

In support of this requirement, the PMO, in coordination with the USDOT IE, will prepare an Independent Evaluation Support Plan (IESP). This plan will identify the types, source and frequency of data to be collected, the mechanism for providing the data and any privacy, security and access restrictions that need to be put in place. The IESP will also identify additional surveys, experiments and data capture exercises that may be necessary to fully conduct the evaluation. Design considerations for the SCOS will also be contemplated.

Upon completion of the initial draft, a review meeting consisting of USDOT, the IE and the PMO will be convened to review, revise and accept the awards outlined in the IESP. A final version of this plan will then be prepared and submitted to USDOT. Requirements identified in this process that affect the design of the Smart Columbus projects will then be reflected in the respective system requirements documents.

4.2.5.3 Data to support USDOT’s Independent Evaluation

The PMO will support the IE in the provision of frequently collected data, corresponding metadata, frequently monitored performance measures, estimates and desired targets. When data availability is limited or if the data is not available, the IE will evaluate the need. If the data is needed, the IE will collect it and the city will assist if feasible. In addition, the PMO will participate in surveys and interviews.
conducted by the IE. Support provided by the city will be guided by the activities defined in the IESP. The PMO recognizes the IESP will require updates based on the evolving needs and ongoing collaboration with the IE and USDOT. Data is tentatively expected to be transmitted on a monthly basis.

4.2.5.4 Data provided to the USDOT's Research Data Exchange (RDE)

To support the continued research objectives of USDOT, appropriately prepared system control, performance and evaluation data are expected to be shared with the USDOT and posted on an annual basis to the USDOT RDE⁴. No PII will be submitted to the RDE.

4.2.6 Task F – Safety Management and Safety Assurance

Per the Award, the PMO shall describe any underlying safety needs associated with the safety of all travelers, subjects, and other personnel associated with the SCC. Per the Award, there are two required deliverables related to Task F. These deliverables are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

- Safety Management Plan (SMP) [D7]
- Human Use Approval Summary [D6]

4.2.6.1 Safety Management Plan (SMP) [D7]

The city will prepare and submit a draft Safety Management Plan (SMP) to local officials including safety/emergency management staff from City of Columbus, Franklin County, State of Ohio, COTA and Easton Town Center, etc. Upon incorporating their initial comments, a draft version of the SMP will be submitted to USDOT. Following the receipt of USDOT comments, the PMO will prepare and submit a comment resolution report (CRR) along with the final, updated version of the SMP.

The SMP will identify a systematic approach to achieving acceptable levels of safety risk with the SCC. It will establish and define the methods, processes and organizational structure needed to meet safety goals. These processes will build upon the existing city processes and procedures for operations, and will also consider how new strategies deployed as part of Smart Columbus impact those processes. Safety scenarios will be developed that are related to the technologies – including but not limited to CVs and CEAVs. These scenarios will include an analysis of the likelihood and potential impact of safety incidents. Potential mitigating actions taken at various times and locations will also be identified for each scenario. A set of “safety needs” shall be derived from this scenario-based analysis. Further, the PMO will identify levels of safety risk associated with the SCC using established processes where possible, (e.g., ISO 26262 ASIL).

⁴ www.its-rde-net
4.2.6.2 Human Use Approval [D8]

Smart Columbus includes several projects that require review, and as necessary, approval from an Institutional Review Board (IRB), to identify and establish the necessary research protocols associated with the program. The city will prepare the necessary IRB applications for the Smart Columbus program and submit them to the IRB of record (to be determined). Further, the city will respond to other questions or additional data that the IRB may require obtaining Human Use Approval. Any decisions from IRB that necessitate additions or changes to the design of the Smart Columbus projects will subsequently be reflected in the corresponding System Requirements. Additionally, changes to the program that require reconsideration by the IRB will be prepared and submitted to the IRB. Status of the Human Use Approval process will be documented as part of monthly status reports.

4.2.7 Task G – Communications and Outreach

The PMO shall develop a comprehensive communications and outreach program that covers both outreach activities and the accommodation of requests for site visits by media, researchers and others. Per the Award, there are six required deliverables. In addition, the PMO is preparing and submitting additional, related deliverables. These deliverables are listed below, followed by a detailed discussion for each.

The following are the required deliverables:

- Communications and Outreach Plan (Comm. Plan) [C.1]
- A Promotional Video about the SCC, including two additional updates [C.2]
- A SCC Website [C.3]
- Travel and participation in six workshops/conferences/trade shows each year with at least one outside of the U.S. or in support of international cooperation [C.4]
- Participation in four public USDOT-organized webinars per year regarding SCC progress/performance and lessons learned. [C.5]

The following are additional public relations and marketing materials [C.6]:

- Communications Toolkit
- Stakeholder Engagement
- Media Relations

4.2.7.1 Communications and Outreach Plan [C.1]

The PMO will develop a Comm. Plan that will be updated annually. This plan will detail specific communication and engagement strategies for each project theme/area and project, conferences, trade shows, media relations, website, videos and the other communication items outlined in the Award and Smart Columbus projects. The Comm. Plan is intended to be at a more detailed level than the PMP, however, some duplication is inevitable.
4.2.7.2 Promotional Video [C.2]

The PMO will share the existing 3-minute Smart Columbus video on the website and at presentations during the first year. Updated videos will be produced and posted online as needed.

4.2.7.3 Website/Blogs [C.3]

The PMO will update the existing Smart Columbus website. The website will reflect the USDOT approved branding and messaging, and will be updated monthly or as needed to report project progress and updates.

4.2.7.4 Workshop, Conference, Trade Show Participation [C.4]

The city will participate in up to six workshops/conferences/trade shows each year with at least one outside of the United States. The purpose of attending these events in the first year of the Award is to learn best practices; in future years the purpose will be to share progress updates and lessons learned. Coordination for workshops, conferences, and trade shows that the city will seek USDOT reimbursement for will be submitted for approval in advance to the AO and AOR.

4.2.7.5 Public USDOT Webinar Participation [C.5]

The PMO will prepare information as needed and participate in four public USDOT-organized webinars per year regarding progress/performance and lessons learned.

4.2.7.6 Public Relations and Marketing Material [C.6]

The following additional items have been identified by the PMO as necessary to conduct the scope for Public Relations and Marketing:

- **Communication Toolkit:** The city will develop and produce informational materials in a communication toolkit for use on the web, on social media sites, at meetings and various other communication channels. This includes:
  - News releases, talking points, media pitches, website and district-specific communication/engagement tools
  - Annual updates

- **Stakeholder and End-User Engagement:** This task will be implemented throughout the duration of the Award. At minimum, it will include the engagement of subject matter experts in the working groups; engagement of potential users and affected communities through one-on-one interviews, focus groups, surveys and public meeting discussions; and digital tools to solicit input, promote deployment and share lessons learned.

- **Media Relations:** The PMO will develop the media relations protocols and strategy in partnership with the Office of the Mayor’s spokespersons to ensure placement of up to one story per quarter in trade and local media (USDOT requires 3 articles in trade media each year). PMs and Project Leads will assist with content/interview preparation as needed. Expected work products include:
  - Media relations strategy updates (included in Comm. Plan)
  - List of possible story ideas/media pitches for the trade media (three required each year)
  - News releases and talking points for media interviews
4.2.8 Task H – International Collaboration

The USDOT is interested in sharing lessons learned from the SCC with its international partners. The USDOT currently has memoranda of understanding (MOUs) with the European Commission, Japan, South Korea, Canada and Mexico. The city will collaborate on similar projects with international partners with which USDOT has research coordination awards for expanded learning. The format of the collaboration may include hosting foreign scanning tours, complementary alignment of evaluation activities, or it could involve a partial alignment of deployment or research activities and objectives to create twinned complementary project components. These exchanges assume that the international partners will fund projects on topics of relevance to the USDOT, and that an agreement can be reached among the international partners, USDOT and the PgMs of the research and deployment programs. The USDOT will identify areas of shared interest with its international partners from among awarded programs and initiate collaboration discussions. No funds will be exchanged between USDOT and foreign-funded programs; each side will have responsibility for their respective budgets.

The following are the required deliverables:

- Participation in one International Collaboration meeting each year of approximately three days duration, plus six days of effort for meeting preparation and six days for reports preparation associated with the collaboration aspects of this project [C.6]

4.2.8.1 International Collaboration Meeting [C.6]

The city will support, on an annual basis, collaboration with another country with whom USDOT has identified concept and information sharing opportunities, and whom is pursuing related technology advances.

4.2.9 Task I – Participation in Relevant ITS Architecture and Standards Development Efforts

The city will support USDOT-sponsored Architecture and Standards meetings both in an in-person capacity as well as remotely, serving as an active participant and relaying the appropriate needs and lessons learned from the city’s deployment.

The following are the required deliverables:

- Attendance at six architecture and standards meetings, of which four are expected to be held outside of the United States [S1.4]
- Architecture and Standards Meeting Trip Reports [S1.4]

4.2.9.1 Attendance at Architecture and Standards Meetings

Per the Award, in-person participation requirements shall not exceed six meetings of three days each per year, two of which are expected to be held outside of the U.S. The specific meetings and working groups will be coordinated during the initiation phase of the Award. In addition to the in-person meetings, support...
shall include remote participation not to exceed 24 hours per month to support conference calls/webinars as well as drafting of technical input. This is expected to support the products of three different standards development organizations (SDOs). Approval of participation will be approved in advance by USDOT.

4.2.9.2 Architecture and Standards Meeting Trip Reports
For each working group/committee meeting with in-person participation the PMO shall provide a report to the USDOT describing the meeting outcomes, impacts to the SCC and inputs made by the Smart Columbus program.

4.2.10 Task J – Interim and Final Reporting
The USDOT requires the PMO to submit Interim and Final Reports. Interim Reports shall be submitted each year discussing the progress to date and summarizing issues and opportunities. A Final Report for the SCC shall provide a summary of what was accomplished, the benefits, costs and lessons learned. This document shall be developed with the intent to share publicly and be formatted for Section 508 compliance.

The following are the required deliverables:

- SCC Interim Reports (annually) [P6]
- SCC Final Report [P6]

4.2.10.1 Annual Interim Reports [P6]
The PMO will deliver the initial Smart Columbus Interim Report to USDOT after completion of the first year of the Award. The annual Interim Reports shall discuss the progress to date and summarize issues and opportunities, what was accomplished, the benefits and costs and lessons learned. The PMO will first prepare an annotated outline to obtain USDOT approval for the content and organization. After USDOT approval on the annotated outline, the PMO will develop a draft SCC Interim Report for review. The PMO will develop a final Smart Columbus Interim Report that reflects comments received from USDOT review within 10 working days of receipt of comments. The first Smart Columbus Interim Report was submitted on September 29, 2017.

4.2.10.2 Final Report [P6]
The PMO will deliver the draft Smart Columbus Final Report to USDOT approximately two months prior to the completion of the project. It will include:

- Deployment costs (i.e., systems and unit costs) and operational costs (i.e., O&M costs) of the project compared to the benefits and cost savings the project provides.
- How the project addressed city challenges and met the original expectations defined in the city’s smart city vision.
  - Data on how the demonstration helped to improve safety, mobility, sustainability, access to opportunity, economic vitality and/or reduce environmental impact.
  - The effectiveness of providing a holistic approach to addressing transportation challenges by deploying projects and strategies consistent with the USDOT’s 12 vision elements.
Lessons learned and recommendations describing how the Smart Columbus program met the objectives identified by the USDOT for the SCC and recommendations for other locations considering implementation of similar solutions.

After comment from USDOT within 10 working days of receipt, the PMO will develop the final Smart Columbus Final Report that reflects comments received.

4.2.11 Task X – Additional Scope

Upon USDOT approval of the detailed design as embodied in the individual SDDs, the PMO will commence with the implementation of the projects. Due to the varying complexity of the individual projects, the specific elements to achieve successful deployment will vary. At present, there is not enough detail to describe the exact process, but the following articulates the plan as best understood based on the city's proposal efforts, and the initial engagement with USDOT and partners. Please note the specific timing of each of these projects is outlined in the SCC Schedule, and includes known dependencies internal to each project as well as those external to the projects. For instance, deployment of Dedicated Short-Range Communications (DSRC) infrastructure performed as part of the CVE project is necessary before the platoon signal priority found in the Truck Platooning project may be implemented. General dependencies as known today are indicated. Depending on the specific needs of each project, it is expected that the following major activities may occur. The city intends the program to be developed and tested within the first portion of the Award period. The latter part of the Award will be used for finalizing the evaluation of the demonstration. The city intends to operate the systems and services implemented in the program after completion of the USDOT Award period.

4.2.11.1 Engineering Design

City policy dictates that construction projects shall be accompanied by detailed engineering plans that include proposed modifications, environment impacts and communication diagrams, when necessary. It is expected that the CVE, the CEAV and SMH will require detailed engineering plans be prepared. The PMO will conduct a three-phase review process of the plans prepared and submitted by the design consultant prior to conducting the procurement of the construction contractor.

4.2.11.2 Procurement

Procurement includes the purchase of items such as hardware units, software licenses and services, as well as the hiring of contractors to perform software development, equipment installation, surveying, etc. Procurement shall also include any activities related to securing the offerings of partners, both the USDOT and PMO. Procurement procedures are further detailed in Section 12.

4.2.11.3 Development

Development activities relate to any components of a project that may need to be created new or modified from existing components to fulfill the specific requirements of the city. For instance, Columbus proposed use of software from a third-party provider to fulfil the requirements for the EPM project. If this approach still makes the most sense after completing the SE process, it is likely that development activities will need to occur to integrate the software with the current parking providers.
4.2.11.4 Test

Prior to going "live", all projects will be subjected to rigorous testing as defined in the previously prepared and approved, updated TP. Depending on the project, there may be as many as five different phases of testing, some of which will be conducted by the vendor, and others that must be coordinated by Columbus and the PMO. These five phases of testing include component testing, sub-system testing, system testing, interoperability testing and final acceptance testing. In all cases, component, system and final acceptance testing must be performed, of which the latter two are certain to be performed by Columbus. Component testing is expected to be performed by the vendor with oversight/evidence provided to the city. Other testing phases will be conducted, as needed, and the responsible party determined as part of the detailed planning phase.

4.2.11.5 Deployment

Deployment, and the prior activity, Test, are tightly coupled. Deployment is the act of installing the project components with the intent to commence operations. The approach for deployment and responsible party will be determined as part of the procurement process. However, in nearly all cases, system components will need to be fully deployed before system testing, and ultimately acceptance testing, can be completed. Deployment is also likely to occur in phases depending on the complexity of the project. CVE for instance will require several months to be fully deployed, and will likely be tested concurrently as equipment is fielded along select corridors, etc. In contrast, the EPM, upon successful testing, would simply be made available for use on a specific date.

4.2.11.6 Operations Support

Upon successful initiation of the operational periods for each of the proposed projects, the PMO will operate and maintain each component of the initiative in accordance with the approved O&M Plans. This will include transferring responsibilities of several components of the system to various departments, and related agencies within the City of Columbus, as well as partner organizations. For instance, the SCOS will be operated by the PMO. As part of this process the PMO will continually monitor the operational performance and consider adjustments to the various systems to ensure that they are operating as expected. Further, the city will ensure that all performance measures and data required for the IE, and overall monitoring of the system, are being collected as documented and as required. It is recognized that there will be variance in the operational period of the systems based on when they become operational. A critical activity of this task will be the collection and documentation of key information that will not only be included in the interim report, but also be considered in the development of the transition plans for each of the projects. This data includes but is not limited to operational issues, opportunities for improvement and observed O&M costs.

4.2.11.7 Transition Planning

In accordance with the Transition Plans developed during the early stages of the O&M phase, the PMO will also prepare and implement the necessary steps to transition the Smart Columbus program from the current governance and funding model to that of a model that intends to support the long-term sustainability outside of USDOT funding and where practical, expand/extend beyond the current footprint. For each project (as appropriate), the PMO will implement these plans as detailed in the following sections.
4.3 WBS

The WBS shown in Figure 7 and the WBS dictionary and deliverable table shown in Table 7 identifies each of the major deliverables. The WBS allows the team to quickly and clearly visualize the program structure and organization of deliverables that must be completed as part of the project. The Smart Columbus PMO has chosen a balanced level of detail Figure 7 and Table 7 and Appendix B. The team will use the schedule, based on this WBS, as the primary deliverable management tool for tracking progress, estimating resources, and sequencing work.
Figure 7. Smart Columbus WBS

Source: City of Columbus, October 2017
4.4 WBS Dictionary and Deliverables

The WBS is broken into four primary areas: program management, design guidance planning documents, systems engineering deliverables, and communications and outreach activities. These are further disaggregated into sub-tasks. Table 10 summarizes the deliverables, serves as a WBS dictionary with task definitions, identifies which documents/key touch points (draft, walkthrough, final, 508, updates) are associated with each deliverable and notes the completion criteria.

<table>
<thead>
<tr>
<th>WBS</th>
<th>Task</th>
<th>Task/Deliverable</th>
<th>Definition</th>
<th>Draft</th>
<th>Walkthrough</th>
<th>Final</th>
<th>508</th>
<th>Updates</th>
<th>Completion</th>
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<td>P1</td>
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<td></td>
<td>Meeting</td>
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<td>Detailed program schedule covering all deliverables</td>
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<td>A</td>
<td>Monthly and Quarterly Reports</td>
<td>Recurring reports on accomplishments, schedule, budget, and other related program activities</td>
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<td>X</td>
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<td>Monthly/Quarterly</td>
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<td>J</td>
<td>Interim and Final Reporting</td>
<td>Annual report of the program for public consumption</td>
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<td>D</td>
<td>C</td>
<td>Design Guidance Planning Documents</td>
<td>Criteria and method upon which city can measure success of projects</td>
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<td>City response to USDOT survey, if/when conducted.</td>
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<td>C</td>
<td>Deployment Tracking Survey</td>
<td>Plan to protect PII and other privacy of data collected</td>
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<td>Plan for how data will be shared with the IE</td>
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<td>Demonstration Site Map and Installation Schedule</td>
<td>Identifies locations of technology installation and schedule for deployment</td>
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<td>B</td>
<td>System Architecture and Standards Plan (SASP)</td>
<td>Document to consolidate architecture including use of regional ITS Architecture, CVRIA and standards</td>
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<td>X</td>
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<td>X</td>
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<td>I</td>
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<td>Support ongoing USDOT standards development activities as relates to Smart Columbus needs and findings</td>
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U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology
Intelligent Transportation Systems Joint Program Office
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<th>Definition</th>
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<th>Updates</th>
<th>Completion</th>
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<td>Concept of Operations (ConOps)</td>
<td>High-level concept for system including user needs and use cases. Intended for stakeholder concurrence.</td>
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<td>Detailed breakdown of needs into functions and features the system must exhibit</td>
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<td>Plan to verify and validate system functions meet requirements and needs</td>
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<td>Per SCS</td>
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<td>X</td>
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<tr>
<td>S3</td>
<td></td>
<td>Vendor-provided V-Model Projects</td>
<td>Work elements associated with the selection of a</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>WBS</td>
<td>Task</td>
<td>Task/Deliverable</td>
<td>Definition</td>
<td>Draft</td>
<td>Walkthrough</td>
<td>Final</td>
<td>508</td>
<td>Updates</td>
<td>Completion</td>
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</tr>
<tr>
<td>S3.X. 1</td>
<td>B</td>
<td>Technical Memo</td>
<td>Comparison of technical alternatives and cost feasibility</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>S3.X. 2</td>
<td>B</td>
<td>ICD</td>
<td>Defines external interfaces of the system</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>S3.X. 3</td>
<td>B</td>
<td>Installation Plan</td>
<td>Instructions for deployment of projects not requiring engineering plans</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>S3.X. 4</td>
<td>B</td>
<td>Test Plan (TP)</td>
<td>Plan to verify and validate system functions meet requirements and needs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>S3.X. 5</td>
<td>B</td>
<td>Test Documentation</td>
<td>Results of TP conducted</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>S3.X. 6</td>
<td>B</td>
<td>O&amp;M Plan</td>
<td>Instructions on how to operate the system post-deployment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>S4</td>
<td></td>
<td>Agile Projects</td>
<td>Work products associated with the use of the Agile process for implementing</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>WBS</td>
<td>Task</td>
<td>Task/Deliverable</td>
<td>Definition</td>
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<td>Walkthrough</td>
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<td></td>
<td></td>
<td></td>
<td>software-only projects</td>
<td></td>
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</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>Strategy Plan***</td>
<td>Detailed plan for how various engineering and non-engineering tasks will be integrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>Product Vision</td>
<td>Reflects the needs and attributes of the system to be developed</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>Management and Collaboration Tools</td>
<td>Ongoing administration and use of the tools as defined</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>Product Roadmap and Release Planning</td>
<td>Initial and ongoing refinement of the roadmap and release plan</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>User Story Definition</td>
<td>Continual user story capture, refinement and management through implementation</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4.X.</td>
<td>B</td>
<td>Development</td>
<td>Application/ software development and the implementation of the Scrum process</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Per SCS</td>
</tr>
<tr>
<td>6</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>Communications &amp; Outreach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>WBS</td>
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<td>508 Updates</td>
<td>Completion</td>
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<td></td>
</tr>
<tr>
<td>C.1</td>
<td>G</td>
<td>Communications &amp; Outreach Plan (Comm. Plan)</td>
<td>Approach to facilitate internal and external communications, outreach, marketing, end-user engagement, etc.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
<td></td>
</tr>
<tr>
<td>C.2</td>
<td>G</td>
<td>Promotional Video and Updates</td>
<td>Tool to inform public and stakeholder about program</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Per SCS</td>
<td></td>
</tr>
<tr>
<td>C.3</td>
<td>G</td>
<td>Smart City Demonstration Website</td>
<td>Tool to inform public and stakeholder about program</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>** X</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>C.4</td>
<td>G</td>
<td>Workshop, Conference, Trade Show Participation*</td>
<td>Supporting USDOT national outreach efforts for smart city programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>C.5</td>
<td>G</td>
<td>Public USDOT Webinars*</td>
<td>Sharing of successes and lessons learned with interested parties in USDOT-sponsored public forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Quarterly</td>
<td></td>
</tr>
<tr>
<td>C.6</td>
<td>G</td>
<td>Public Relations and Marketing Materials</td>
<td>City identified additional products needed to support end-user research, stakeholder engagement and deployment</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### WBS Task/Task/Deliverable Definition

<table>
<thead>
<tr>
<th>WBS</th>
<th>Task</th>
<th>Task/Deliverable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.7</td>
<td>H</td>
<td>International Collaboration Meetings*</td>
<td>Supporting USDOT international outreach efforts for smart city programs</td>
</tr>
</tbody>
</table>

*Only the Smart Columbus Final Report will be 508-compliant  
** City website will be nominally 508-compliant.  
*** City-internal planning document  
*No physical deliverable – meeting only

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### 4.5 Scope Control and Verification

#### 4.5.1 Scope Control

Scope control for the USDOT portion of the Smart Columbus program will be the responsibility of the Smart Columbus program leadership. The scope for this project is defined by the Award, which is the primary source of information with regards to scope control as well.

Formal changes to the scope will be initiated and managed through the change management process outlined in Section 7 (Change Management). While scope changes can be proposed by any project stakeholder, it is the responsibility of the Project Lead to formalize the request and initiate the change management process. The Smart Columbus PMO will provide a recommendation and appropriate documentation (assessing the impact of the scope change) regarding the scope change request to the USDOT AOR for final approval. All change requests, whether approved or rejected, will be uniquely numbered and archived for tracking purposes. If a change to the scope is approved and authorized by USDOT, the project scope statement (and any associated deliverables such as the WBS, schedule or budget) will be revised to reflect the approved changes.

Official modification of the scope of services can only be executed by the USDOT AO (Sarah Tarpgaard). This authorization will be the only basis upon which scope and budget modifications are made and change orders issued.

The Smart Columbus PMO will not perform any out of scope work. Any scope changes to the USDOT Award will need approval before the Smart Columbus PMO performs work on the scope change.

#### 4.5.2 Scope Verification

As the project progresses USDOT will verify project deliverables against Section 5 of the Award, which describes the tasks and deliverables for this opportunity. All deliverable submissions will be sent to the ITS Projects mailbox (itsprojects.gov) in addition to the AOR and AO.
All deliverables will be submitted as draft documents and reviewed by USDOT. Changes to drafts and comments will be provided in writing to the Smart Columbus PM. The PM will revise the documents and provide a comment disposition matrix along with the final deliverable.

The USDOT AOR will issue a written acceptance of the deliverable once they have verified that the deliverable meets the requirements defined in the Award.
Chapter 5. Document Management

5.1 Project Collaboration Site

The Smart Columbus PMO will use SharePoint, a document management and collaboration tool, to share files with Smart Columbus PMO team members and the USDOT. The USDOT SharePoint collaboration site is located at: https://smartcolumbusprogram.com. Request for access are made through the PMO (PgM, any of the DPgM, City PM, Consultant PgM and Project Leads), evaluated, account permissions determined, and if granted, a user account is created and log-in privileges provided by email to the requestor. The consultant team maintains a file with all users created and access level for use by the PMO.

This file sharing application is designed to work seamlessly to provide secure, organized access to documents and content, and to enable ease of sharing documents between and among the Smart Columbus staff and consultant teams, the city and USDOT. The Smart Columbus SharePoint home page also contains an updated project calendar with meetings and deliverables dates. The project calendar can be edited by project team members. Once regular project activity resumes, the calendar will be updated and actively maintained by all project team members. Access to the site will be controlled through secure login information.

This site is structured to meet projects need and provide access at multiple levels using secure user groups. The first level of access and the users responsible for managing the SharePoint site are administrators; these users are responsible for the structure, access to the site and training. The next level of access is for the core team and is made up of Smart Columbus PMO members who will be contributing to the content of the site. These users have access to both deliverables and working documents. The final set of users is the USDOT review team with limited access to the content that has been restricted to purview – these documents are mainly in the “Deliverables” folders for the various tasks.

The Smart Columbus PMO developed a User Guide5 that provides assistance to users of the SharePoint site. The subsections below outline the structure of the Smart Columbus SharePoint site and file name convention.

5.1.1 SharePoint Project Library

The SharePoint site is organized by task areas consistent with the USDOT Award. The list of project deliverables is specified in the Award, which is provided in Appendix C. All final deliverables will be posted to SharePoint. The document libraries for Smart Columbus are listed along the left side of the window.

https://smartcolumbusprogram.SharePoint.com/_layouts/15/guestaccess.aspx?docid=1d69e30f6a8fb4dfcb452bc7e847a8711&authkey=AV8Q1bUW8ggsjzvcZUXPBBA
Sections:

- **A - Program Management**
  
  - Task A Working
  - Task A Deliverables

- **SCOS**
  
  - SCOS Working Documents
  - SCOS Deliverables

- **Task B**
  
  - Task B – Program Systems Engineering: Working
  - Task B – Program Systems Engineering: Deliverables
  - Task B - CVE: Working
  - Task B - CVE: Deliverables
  - Task B - MMTPA AND CPS: Working
  - Task B - MMTPA AND CPS: Deliverables
  - Task B - Mobility Hubs: Working
  - Task B - Mobility Hubs: Deliverables
  - Task B - Mobility Assistance: Working
  - Task B: Mobility Assistance: Deliverables
  - Task B- Prenatal Trip Assistance: Working
  - Task B- Prenatal Trip Assistance: Deliverables
  - Task B - CEAV: Working
  - Task B - CEAV: Deliverables
  - Task B - EPM: Working
  - Task B - EPM: Deliverables
  - Task B - Truck Platooning: Working
  - Task B - Truck Platooning: Deliverables

- **Task C**
  
  - Task C Working Documents
  - Task C Deliverables

- **Task D**
  
  - Task D Working Documents
  - Task D Deliverables

- **Task E**
  
  - Task E Working Documents
  - Task E Deliverables
• Task F
  o Task F Working Documents
  o Task F Deliverables

• Task G
  o Task G Communications and Outreach Plan
  o Task G Videos
  o Task G Website
  o Task G Workshops, conferences and trade shows
  o Task G Webinars
  o Task G Meeting Minutes
  o Task G Stakeholder Registry
  o Task G Templates, Logos, Branding

• Task H
  o Task H Working Documents
  o Task H Deliverables

• Task I
  o Task I Working Documents
  o Task I Deliverables

• Task J
  o Task J Working Documents
  o Task J Deliverables

Resources:

• Contact List
  o This includes contact information for team members, USDOT, stakeholders, partners and interested parties.

• Project Schedule
  o This includes the MS project file and pdf of the current work schedule.
  o Smart City Public Website⁶

⁶ https://www.columbus.gov/smartcity/
The libraries are structured so that identifying documents related to a task can be easily found. Each section has libraries to help manage documents by their readiness. There are two libraries for each section: Working Documents and Deliverables.

5.1.2 Standard Naming Structure

All deliverables shall adhere to the file naming convention outlined in Figure 8

![Figure 8. Smart Columbus File Naming Convention](source: City of Columbus, October 2017)

The following abbreviations shall be used for the project name:

- Connected Vehicle Environment (CVE)
- Smart Columbus Operating System (SCOS)
- Multimodal Trip Planning and Common Payment (MMTPA_CPS)
- Smart Mobility Hubs (SMH)
- Mobility Assistance Application (MobAA)
- Connected Electric Autonomous Vehicle (CEAV)
- Event Parking Management (EPM)
- Truck Platooning (TRPL)
- Prenatal Trip Assistance (PTA)

The following abbreviations shall be used for the Document name:

- Project Management Plan (PMP)
- Systems Engineering Management Plan (SEMP)
- Concept of Operations (CONOPS)
- Demonstration Site Map and Installation Schedule (SITE)
- Systems Requirements Specifications (SYRS)
- Interface Control Document (ICD)
- System Design Document (SDD)
- Test Plan (TP)
- System Architecture and Standards Plan (SASP)
- Performance Measurement Plan (PfMP)
- Data Privacy Plan (DPP)
For another example, the final Connected Vehicle Environment System Requirements document would have the following naming structure: SCC-B-CVE-SYRS-FINAL-v1.pdf

5.2 Project Collaboration Site – Partnerships

The city has established a tool and process for logging inquiries from prospective vendors, and for tracking the status of partnership development. The city is using Hubspot\(^7\), a free, cloud-based customer relationships management application. In addition, the city has added a library to the Smart Columbus SharePoint site to store documents received in association with vendor interactions and partnerships. Documents stored in the SharePoint site are linked to the corresponding entries in Hubspot. These items do not include any confidential materials protected by a non-disclosure agreement. Management of materials and the project team involvement is also covered in Chapter 12, Procurement Management.

- **Types of Users** - A limited number of members of the PMO, including representatives of key partners working in the PMO office space, have been given editing access to the Hubspot application to ensure data integrity and security. These editors include the DPgM (Policy and Partnerships) and his intern. Other members of the PMO have read-only access to Hubspot. Those who have editing access are team members who enter partnership status information and establish new vendor contacts.

- **Intended Audience** - Members of the PMO can access the Hubspot application to obtain current information on vendor contacts and partnership status to assist them in performing duties. A monthly report on partnership status is generated from the Hubspot online application, which is attached to the Smart Columbus monthly report submitted to USDOT.

- **Organization of Content:**
  - Private Sector, by status:
    - Contact initiated
    - Old

\(^7\) [www.hubspot.com](https://www.hubspot.com/)
- New
- Further Action
- No Further Action
  - Stakeholders, Key Associates and Collaborators, by name
  - Existing Partners, by name
  - Individual Submissions, by name

- Type of Content - Information contained within the Hubspot online application includes the following content:
  - Company name, website, contact information
  - Economic development information such as company size, location, work type, minority/disadvantaged business enterprise (MBE/DBE) status
  - Company offering alignment with Smart Columbus projects
  - Chronological logging of engagement activity with a company
  - Status of partnership development

5.3 Maintenance of Agile Code and Documentation

As with all artifacts and deliverables associated with this project, documentation is important within the Scrum methodology that will be used in the development of certain components. Unlike written deliverables, Scrum documentation is provided in a real-time, continuous and transparent manner, evolving along with the product rather than upfront as its own process. An important aspect of the transparent documentation is use of software tools to enable stakeholders access to centralized and up-to-date content during all development stages. The Agile efforts within Smart Columbus will leverage Pivotal Tracker to manage scrum stories, backlog and sprint iterations; GitLab for version control of code, technical documentation and transparent replicability of the SCOS; and SharePoint for overall document control, collaboration and preparation of working documentation related to the SCOS and development artifacts produced through the Scrum process. SharePoint, GitLab and Pivotal Tracker are discussed in more detail in the subsections below.

5.3.1 SCOS SharePoint

The SCOS team will use the dedicated SCOS subsite\(^8\) for documentation of USDOT deliverables, sprint

\(^8\) https://smartcolumbusprogram.SharePoint.com/IDE/SitePages/Home.aspx
artifacts and collaboration between the program and products owners, SE staff and the project teams related to the SCOS.

5.3.2 GitLab

The SCOS will follow a modified approach to managing technical documents using GitLab Flavor Markdown within GitLab based on the established best practice from GitLab\(^9\) as described in their documentation style-guide \(^10\) and detailed below. A log in is required.

The documentation hierarchy within GitLab will be structured per Table 11 to provide improved layout and organization of directories and related documentation.

Table 11 defines the GitLab document structure and identifies the type of documentation contained within each directory.

<table>
<thead>
<tr>
<th>Directory</th>
<th>What Belongs Here</th>
</tr>
</thead>
<tbody>
<tr>
<td>doc/user/</td>
<td>User related documentation</td>
</tr>
<tr>
<td>doc/administration/</td>
<td>System administration related documentation</td>
</tr>
<tr>
<td>doc/development/</td>
<td>Documentation related to the development of SCOS</td>
</tr>
<tr>
<td>doc/install/</td>
<td>Installation and configuration documentation</td>
</tr>
<tr>
<td>doc/legal/</td>
<td>Legal documents</td>
</tr>
</tbody>
</table>

5.3.3 Pivotal Tracker

Pivotal Tracker is a straightforward project-planning tool that helps software development teams form realistic expectations about when work might be completed based on the team’s ongoing performance. Tracker visualizes the project in the form of stories (virtual cards) moving through the scrum process, encouraging the team to break down epics into manageable stories and have important conversations about deliverables and scope. As the team estimates and prioritizes those stories, Tracker divides them into future iterations, learning from the team’s natural pace of work to accurately predict when future work will be finished. Tracker provides a transparent team view of priorities, and is used to help the team keep pace and plan work, as well as adjust and change course when the unexpected happens. The overall goal of the tool is to assist the team in delivering earlier and more consistently.

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\(^9\) https://gitlab.com/smartcolumbus-ide/
\(^10\) https://docs.gitlab.com/ee/development/doc_styleguide.html
Pivotal Tracker for the Smart Columbus Operating System is currently private and requires a user login\(^\text{11}\). Alternatively, the project can be made public with read-only access for the public to support total transparency. As currently deployed, user need to request access through the PMO and should contact the DPgM (Technology).

### 5.4 Public Facing Site

The city has established a public facing website\(^\text{12}\) to provide information about the Smart Columbus program to the public. The website content is managed by city staff and communications consultants.

Information contained within the Smart Columbus website includes the following content:

- Information about the Smart Columbus program projects, including fact sheets
- Program partners
- Information for interested vendors
- Links to contact the PMO
- Current news and blogs about events and status of the program
- Final deliverables

The website is maintained by staff from the PMO and the Mayor’s communications team. Requests to update content or add new content are made to the Communications PM. The website maintenance staff are assigned the responsibility to ensure current versions of documents are posted to the website.

### 5.5 508 Compliance

The Rehabilitation Act of 1973 was amended in 1998 to require that all federal agencies make their electronic documents and data accessible to people with disabilities. Under Section 508, agencies must give disabled employees and member of the public access to files that is comparable to content available to others. Specific Smart Columbus deliverables that will be posted on the USDOT website and in the National Transportation Library (NTL) should meet this standard as described in Section 6 (Data Governance). Visual disability is the main concern for compliance work; this includes color-blindness, partial blindness, and complete blindness. All figures must have a proper color contrast ratio and not solely depend on color to convey information. Figures and tables in the documents must contain alternative text for assistive technology (i.e. screen readers) to describe the information to the reader. The documents also require nonvisual formatting to prevent assistive technology failure. The USDOT requires submissions of both MS Word and PDF versions of all 508 required submittals.

\(^{11}\) https://www.pivotaltracker.com/n/projects/1946257

\(^{12}\) https://www.columbus.gov/smartcity/
Compliance confirmation is first checked by running “Check Accessibility” on the MS Word file. Most errors consist of table formatting and alternative text. After corrections are made on the Word file, a PDF is created and using Adobe Acrobat Pro a “Full Check” under Accessibility is done. Non-visual alterations are made here, commonly tags and other embedded formatting. For the final accessibility check, PAC: PDF Accessibility Checker 2.0 is used. The errors discovered by PAC are resolved using Adobe, and then the file is re-uploaded and tested using PAC. PAC is used to locate nonvisual errors that are not discoverable by Adobe.

### 5.6 Email Naming Conventions

Given the volume of email transactions associated with this program, the PMO has established a naming convention for all messages. All email correspondence within the Smart Columbus team shall include the following transitions for email subject lines:

- Program Management Office  PMO | subject of email
- Enterprise Wide Program Management Office ePMO | subject of email
- USDOT Program  USDOT | subject of email
- USDOT Communications  COMM | subject of email
- Connected Vehicle Environment  CVE | subject of email
- Smart Columbus Operating System  SCOS | subject of email
- Multimodal Trip Planning/Common Payment  MTPCPS | subject of email
- Smart Mobility Hubs  SMH | subject of email
- Mobility Assistance Application  MobAA | subject of email
- Connected Electric Autonomous Vehicle  CEAV | subject of email
- Event Parking Management  EPM | subject of email
- Truck Platooning  TRPL | subject of email
- Prenatal Trip Assistance  PTA | subject of email
Chapter 6. Data Governance

Data governance (DG) is the overall management of the availability, usability, integrity and security of data used in an enterprise, or in this case a large-scale program. While there are several potential elements within a data governance program, the Smart Columbus program includes two key components:

1. A Data Management Plan (DMP), which is a documented set of guidelines for ensuring the proper management of the project’s digital information; and
2. A Data Privacy Plan (DPP), which specifically addresses the policies and procedures related to security and privacy.

The compilation of both plans will involve representation from each of the Smart Columbus Projects as well as Business Owners and Stakeholders that make-up the Data Working Group as defined in Section 3 (Project Management Approach). The Deputy PgM (Technology) will oversee this effort which will be led by the IT PM (city), working with the Working Group Chairs and DPgM (Technology). While the specific plans do not yet exist, it is understood that both Tasks D and E will result in a DPP and DMP, respectively. The timeframe for the development and submission of these plans is dependent on the requirements for the various projects. The DMP will be drafted first followed by the DPP. Both the DMP and DPP will be complete before the SCOS is completed.

6.1 Data Management Plan

The DMP will address how to handle data under regular circumstances and include an established process for handling unexpected issues. The DMP will specifically address how data will be collected, managed, integrated and disseminated before, during and after the Smart Columbus program. It will include real-time and archived data that are inputs and outputs from systems managed by the city and the city’s partners. The DMP will account for open, machine-readable data being made available to the public. PII may be introduced and the DMP will address how the city will make that data available in a secure environment for the use of qualified researchers.

The DMP will contain an overview of the system, specifically documenting the external interfaces and all components. Beyond this overview, the fundamental components of a standard DMP will include:

- Description of data to be produced or collected including the source of the data, and relevant data standards/formats
- Identification of workflows to help manage data throughout the program (normal and exceptions)
  - Documentation means of data collection and transmission
- Description of documentation and metadata standards to describe the data
- Description of known and potential intellectual property issues
- Plan for data cleansing and quality control (QC)
• Plan for short-term data storage and back-up
• Plan for sharing data including necessary security
• Plan for data preservation – archiving and long-term access
• Plan for allocation responsibility for ongoing data management
• An introduction to data privacy issues and solutions
• A discussion of performance measures for the program and how the data supports their calculation

6.2 Data Privacy Plan

A DPP conveys how the system administrator (in this case, the city) will keep data secure, who is responsible for managing the data and what action will be taken if there is a breach. The DPP for Smart Columbus will document the technical, policy and physical controls that will be put into place to mitigate potential privacy harms. This will include a System Security Plan to verify that PII will only be stored on IT Infrastructure that is subject to appropriate security controls. The DPP will be provided to contractors and partners who access data through the Smart Columbus program for awareness to the program policy and privacy requirements. The DPP will:

• Establish who owns the oversight of data privacy and compliance
• Provide a project level security analysis to identify where private and sensitive information exists
• Document data privacy controls, including:
  o Establish policies to meet privacy and security requirements
  o Identify technical controls:
    • Access
    • Logging and monitoring
    • Encryption
    • Database
  o Identify relevant standards
• Limit the locations where private and sensitive information can be stored and who can access it, making it easier to protect
• Dispose of unnecessary information to avoid liability and simplify the infrastructure
• Identify resources such as hardware and security solutions and where they can be applied
• Document and identify how compliance will be measured
• Provide full audit, logging, monitoring, and alerting capabilities

Additionally, page 26-27 of the Award clearly identifies the required privacy controls that need to be included in the DPP and such will be incorporated in the future DPP. A DPP will be completed and
provided later and referenced at that time within the PMP. The DPP will be dependent on the DMP described above.

### 6.3 Roles and Responsibilities

Table 12 shows the roles and responsibilities for data governance.

**Table 12. Roles and Responsibilities for Data Governance**

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| IT PM                             | • Work with Data Working Group chair to establish agenda and objectives for meeting; follow-up meeting with minutes and action items.  
• Drive team toward DMP and DPP drafts  
• Draft plans working with team members for input, coordinating subject matter expertise if required especially in areas such as network and data security best practices  
• Helps establish business process to support any activities required by the DMP and DPP. |
| Deputy PgM (Technology)           | • Work with IT PM and working group chairs to set objectives for discussions and desired outcomes  
• Seek regular counsel from USDOT subject matter expert to ensure best practices and USDOT expectations are being met |
| Data Working Group                | • Chairs will work with IT PM to facilitate discussions around components of data management and data privacy  
• Chairs assist in steering conversation to arrive at strong outcomes leading to inputs for the DMP and DPP  
• Group will offer their industry experience and expertise to help advise the city on building a comprehensive DMP and DPP  
• Group will help the team through compiling plans; dividing and conquering on some of the work to be done to achieve desired state  
• Chairs will serve in an advisory role and check thought process and documentation for thoroughness, quality and consistency |
| Project Leads                     | • Participate in working group discussions to represent respective projects and the respective data that will be produced, ingested and/or disseminated |
| USDOT Subject Matter Expert       | • Participate in working group as expert resource to help drive the team toward a solid DMP and DPP  
• Advisor to the Deputy PgM and IT PM |
<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Reviewer of draft plans for consistency, accuracy and thoroughness</td>
</tr>
<tr>
<td>Systems Engineering and Quality Support</td>
<td>• Participate in the process to ensure continuity between projects and the SCOS</td>
</tr>
<tr>
<td></td>
<td>• Ensure all data aspects are being effectively covered in the process</td>
</tr>
<tr>
<td>Communications PM</td>
<td>• Review documents for marketing and branding consistency</td>
</tr>
<tr>
<td></td>
<td>• Assist with communicating the plans to stakeholders</td>
</tr>
</tbody>
</table>
Chapter 7. Change Management

The PMBOK defines change management or change control as the process of identifying, documenting, approving or rejecting, and controlling changes to project baselines. Changes can have a significant impact on project scope, budget and schedule, and can occur gradually. If not managed, they can impact the success of the project. The process for identifying and controlling project changes will be performed from project inception through completion. The level of detail associated with the management of each change identified will vary depending on the complexity of the change. The three objectives of the change management approach for the Smart Columbus program are:

- Provide a mechanism to identify and request changes to the project baseline and assess/validate these changes
- Provide an opportunity to assess the impact of the change
- Provide the mechanism to communicate all changes to project stakeholders

The planning and design phase of the Smart Columbus project will focus on "change control" versus "configuration management." Change control, per PMBOK, is the procedures that define how deliverables and documentation are controlled, changed and approved. The implementation/deployment phase will expand to include "configuration management," to indicate the entire system for submitting, tracking, reviewing, approving and validating changes to the project, both for project deliverables and documentation as well as system components.

7.1 Planning and Design Phase

The city recognizes the need for change management both as a tool to ensure success of the project, but also to keep necessary decision makers informed, and as warranted, part of the change process. As this program is transformative in nature, change is expected, but depending on the change, has varying impact.

Further, per the USDOT Award, any deliverable or budget change must be approved at the AO level. Technical changes that don't affect budget or deliverables are typically approved at the AOR level, subject to AO concurrence. Changes to schedule must be approved by both the AOR and AO.

In consideration of these factors, the city has developed a change process that is responsive to the USDOT approval policy, considers the impact of the change to the program, and informs and includes all necessary stakeholders in the change process. This process may employ a Change Control Board (7.1.1 Change Identification and Logging

Changes can be identified by any stakeholder in the Smart Columbus program. All change requests need to be submitted to the PM in writing by the requester and should include:
• Name of the individual submitting the change
• Organization
• Description of the change
• Justification of the change
• Impact to scope, schedule or budget (if known, if needed).

The PM will log each change request within the Task A working documents in the SharePoint Collaboration portal with a unique tracking number and a status tag (open, accepted, denied). The PM will conduct the first level of evaluation and will communicate their recommendation to the PgM. Program leadership may determine that additional analysis on the impact of the change in terms of cost, schedule and resources is needed prior to further considering the change. Depending on the nature of the change, program leadership may request a high-level review or a full cost-schedule analysis; the information will be compiled by the PM. Based on this analysis, the PM will provide a recommendation to the PgM along with the analysis results for another evaluation by the PgM.

Changes to approved scope, critical path items and major budget impacts all fall purview to the CCB. Changes that do not require CCB will be approved by the PgM; these include minor adjustments to the schedule and technical approach. It will be at the discretion of the PgM for initiating the change request with the CCB. Figure 9 outlines the city decision process for engaging CCB.

7.1.2 CCB Engagement

The CCB is comprised of all key stakeholders as well as other agencies and organizations that have contributed financially to the program and shall be consulted regarding any significant program changes. The CCB and ultimately the USDOT is responsible for reviewing, evaluating, approving, delaying, or rejecting major changes to the program.

The CCB shall include:

• Director, Department of Public Service – Jennifer L. Gallagher
• Director, Department of Technology – H. Sam Orth
• CINO – Michael H. Stevens
• The Ohio State University (OSU) – TBD (not yet defined)
• COTA Interim Executive Director – Emille Williams
• Celebrate One (Infant Mortality Non-Profit) – Executive Director, Erika Clarke Jones
• Ohio Department of Transportation (ODOT) – Andrew Bremer (Deputy Director, Strategic Initiatives and Programs)
• Franklin County – Erik Janas (Deputy County Administrator),
• Franklin County Engineer – Cornell Robertson
• Columbus Partnership – Mark Patton
Figure 9. CCB Selection Process

Source: City of Columbus, October 2017
SharePoint can provide automatic notification to the CCB that the change request has been initiated and the PgM may notify the CCB via email of the new request. CCB participants will have the opportunity to review the proposed changes in advance; however, each change will also be detailed during the CCB meeting. CCB meetings will be planned monthly and available both in-person and via webinar. If no changes requests have been published two-days prior to the planned meeting, the meeting will be cancelled. A minimum of five attendees is desired for all meetings. If five members cannot attend and a change request review is necessary, the meeting will be rescheduled.

The PgM will be the lead for presenting the proposal to the CCB with support from the PM. The CCB must either accept or reject each formal change request received. If the formal change request is approved by CCB, the PM will draft a formal request to USDOT for the PgM’s review. A rework request may also occur, after which the change request will be re-submitted into the review process. Upon review and approval by the CINO, the PgM will send the request to the city’s Fiscal/Procurement Officer for final review and submittal to the AO and AOR.

The USDOT AOR is the final approver for any formal change requests. Once the change has been approved/rejected, the PM will update the change log with the final decision and change the status to “closed”.

### 7.1.3 Minor Changes

Change requests not requiring CCB will be discussed as part of the standing program leadership meetings. As with the CCB process, the change will be presented by the leadership team. If necessary, the change request will be revised and resubmitted. As with those changes reviewed by CCB, the USDOT AOR will be the final approver of any change requests. Once the change has been approved or rejected, the PgM will update the change log with the final decision and change the status to “closed”. Results will be conveyed to the appropriate Project Lead for incorporation as well as broadcast to the stakeholders.

### 7.2 Deployment and Operations Phase

The Smart Columbus Project Configuration Management Plan (CMP) will manage the life cycle of all physical and logical assets that support the Smart Columbus program. This includes the projects and supporting systems of the program.

The first step is to identify the various components that will fall under change management. This will be accomplished during the design phase as the various projects and applications are developed and tested.

In general, components that will fall under change management will include physical assets, applications, service contracts, and subscriptions. Configuration items (CI), items that can be modified, will be maintained in a Configuration Management Database (CMDB). A standard nomenclature will be utilized to name each CI. The nomenclature will follow the guidelines:

- **Physical Attributes**
  - The CI name will be consistent with device type. Additionally, the installation/operational location site will be referenced in the name. i.e. DSRC Roadside Unit_High at Morse, DSRC Vehicle Device_City Veh1, etc.
• Application
  o The CI name will utilize the common name of the application as described by the SA and include a revision number if multiple iterations of the application are required. In distributed applications, the installation site will be referenced in the name.

• Service Contracts and Subscriptions
  o The CI name will be based on the Vendor and Service(s) provided, Amazon Web Service_x, Siemens_x, etc.

Before users and non-project team members are provided access to a project or service, each associated configuration item of the respective project or service will be base-lined as the starting point for operation. Official configuration management will begin once an application or service is made available to users (i.e. goes “live”). Once live, if it is determined a configuration change is required, the respective Task Lead will submit a change request form to the CCB for review. Figure 10 details the change management process for the deployment phase of Smart Columbus.

Source: City of Columbus, October 2017

Figure 10. Change Management Process
### 7.3 Roles and Responsibilities

Table 13 lists the roles and responsibilities for change management.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USDOT AO</strong></td>
<td>• Review and approve any changes to deliverables and budget</td>
</tr>
<tr>
<td></td>
<td>• Document change requests through contract modifications</td>
</tr>
<tr>
<td><strong>USDOT AOR</strong></td>
<td>• Communicate with USDOT AO on any scope changes</td>
</tr>
<tr>
<td></td>
<td>• Work with PgM to understand impacts of change.</td>
</tr>
<tr>
<td><strong>CINO</strong></td>
<td>• Communicate CCB decisions to AOR and AO</td>
</tr>
<tr>
<td><strong>Fiscal/Procurement Officer</strong></td>
<td>• Designated fiscal/procurement officer for the city</td>
</tr>
<tr>
<td><strong>CCB</strong></td>
<td>• Determines is change request is approved or denied</td>
</tr>
<tr>
<td><strong>PgM</strong></td>
<td>• Proactively identify any change requests to scope, budget, or costs</td>
</tr>
<tr>
<td></td>
<td>• Review and consider identified variances of the scope from the PM</td>
</tr>
<tr>
<td></td>
<td>• Sends change request to the CCB</td>
</tr>
<tr>
<td></td>
<td>• Provide a recommendation to USDOT AOR on the decision</td>
</tr>
<tr>
<td></td>
<td>• Provide written requests for scope variances to the AOR &amp; AO</td>
</tr>
<tr>
<td><strong>PM</strong></td>
<td>• Receives potential change request</td>
</tr>
<tr>
<td></td>
<td>• Determines if change request is necessary</td>
</tr>
<tr>
<td></td>
<td>• Document change requests through log</td>
</tr>
<tr>
<td><strong>Technical Team</strong></td>
<td>• Identify potential change request</td>
</tr>
<tr>
<td></td>
<td>• Implements changes as directed by the PM</td>
</tr>
</tbody>
</table>
Chapter 8. Schedule and Time Management

The purpose of the Schedule and Time Management Plan is to define the approach the project team will use in creating the project schedule. This plan also includes how the team will monitor the project schedule and manage changes after the baseline schedule has been approved. This includes identifying, analyzing, documenting, prioritizing, approving or rejecting, and publishing all schedule-related changes.

8.1 Schedule Management Approach

The project schedule for Smart Columbus will be created using MS Project starting with the deliverables identified in the project’s WBS. Specific work packages that must be performed to complete each deliverable are identified. Activity sequencing will be used to determine the order of work packages and assign relationships between project activities. Activity duration estimating will be used to calculate the number of work periods required to complete work packages.

As this program is complex with many interrelationships, critical path method (CPM) scheduling must be employed to identify relationships and interdependencies as well as identify the true critical path to deliver the Smart Columbus program. Baseline and revised schedule tracking will be used to allow for review of any changes to the schedule over time. A current schedule will be included in every Monthly Report submitted to the USDOT.

The Smart Columbus Schedule will follow the USDOT ITS JPO Template and will include three or more WBS levels as needed to show all deliverables and AOR review times. The USDOT Project Schedule Baseline and WBS are contained in Appendix B.

8.2 Roles and Responsibilities

Table 14 describes the roles and responsibilities for schedule management.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDOT AO</td>
<td>• Responsible for approving schedule changes</td>
</tr>
<tr>
<td>USDOT AOR</td>
<td>• Responsible for recommending approval of schedule changes</td>
</tr>
<tr>
<td>CINO/Program Owner (City)</td>
<td>• Accountable for the entire Smart Columbus program including final approval of recommended schedule changes</td>
</tr>
</tbody>
</table>
### Individual/Group | Responsibilities
--- | ---
DCINO (City) | • Directly support CINO. Serves as acting CINO in CINO’s absence
PgM (City) | • Responsible for overall delivery of the program. This includes responsibility for recommending schedule changes to the CIO and deputy CIO and task additions to the schedule.
DPgM (Partnerships and Policy) (City) | • Responsible for establishing schedule to negotiate and execute partnership awards
DPgM (Technology) (City) | • Responsible for overseeing the SCOS, DMPs and DPPs. Working with the IT PM, a WBS and schedule will need to be developed.
Communications PM (City) | • The Communications PM is responsible for establishing the WBS for the communications program including the Comm. Plan. The Communications PM is also responsible for identifying events and providing a WBS for preparation for and attendance of USDOT approved events. The Communications PM is also responsible for relaying schedule changes to external parties.
PM | • Responsible for identifying risks to meeting the schedule as well as new tasks that may be necessary to accomplish the project. The PM is the elevation point to the PgM for schedule risks.
Consultant PgM | • Responsible for management of the lead scheduler and ensuring project level coordination is occurring when schedule risks are identified
Lead Scheduler (Consultant) | • Responsible for developing and maintaining the project schedule. Responsible for coordinating with Project Leads (consultant) to identify schedule risks and adjust WBS as needed to deliver the program
Project Lead (Consultant) | • Responsible for elevating schedule risks to the city PMs and lead scheduler for coordination with the PgM and consultant PgM

### 8.3 Schedule Baseline

Section 4 (Scope Management) includes an updated WBS. Appendix E contains a short-term excerpt of the master schedule, with a focus on the activities and deliverables for the next six months. A complete update of the master schedule will be completed within 60 days, and once completed, will be included in the PMP, with monthly updates submitted as per the Award.

As Smart Columbus is resetting its systems engineering approach, there are some unknowns. The city has submitted a schedule outline for the necessary tasks and timeline to determine the unknowns. This approach is not an opportunity to shift and move deadlines, but rather to build the schedule detail as the city gathers more information.
This WBS and short-term schedule will be used by the PMO to develop a holistic and complete master schedule for the overall program. The short-term schedule reflects the current end date for the program (August 2020). The definition, approval and execution of the SE approach and activity will likely result in an extension of this end date into early 2021; the master project schedule will be updated once the SE approach is approved. A milestone and duration is included for this process and its completion. A key task is developing the SE approach for the program as outlined in Section 3 (Project Management Approach). Developing an integrated SE approach will establish which project development methodology our program and projects will follow.

8.4 Schedule Control Process

Following the establishment of a baseline, the PgM in collaboration with the City PMs and USDOT will review the schedule monthly and discuss the status of project activities. During this review, critical path and near critical path items will be identified and discussed as well as the needs to keep the items on schedule, get the items back on schedule or identify the delay. The Microsoft Project schedule will be submitted monthly to the AOR and AO during the period of performance of this project. In addition, the exhibit shown in Table 15 will be used to quickly identify upcoming deliverables and their actual submission dates as compared to approved submission dates. This table also tracks where revised, deliverable due dates have been requested and either approved or rejected by USDOT.

The sample exhibit does not contain current dates, but provides the data elements that will be reported. This "snapshot" view is included as part of each monthly report, providing a view of upcoming deliverables and when they will be submitted. Table 15 is an excerpt of a recent submission and will be updated to align with the re-baseline of the Project Schedule, and will include all required tasks and deliverables. N/A indicates not applicable.
<table>
<thead>
<tr>
<th>Task</th>
<th>Deliverable</th>
<th>Original Cooperative Agreement</th>
<th>Approved Revised Dates</th>
<th>Requested Revised Dates</th>
<th>Actual Submittal Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Draft Due Date</td>
<td>Final Due Date</td>
<td>508 Compliant</td>
<td>Draft Due Date</td>
<td>Final Due Date</td>
<td>508 Compliant</td>
</tr>
<tr>
<td>A Kick-off Meeting</td>
<td>N/A</td>
<td>4 weeks of Award</td>
<td>N/A</td>
<td>N/A</td>
<td>9/12/16</td>
<td>N/A</td>
</tr>
<tr>
<td>A Project Management Plan (PMP)</td>
<td>10/24/16</td>
<td>TBD</td>
<td>N/A</td>
<td>10/24/16</td>
<td>12/8/16</td>
<td>N/A</td>
</tr>
<tr>
<td>A Project Schedule</td>
<td>9/20/16</td>
<td>N/A</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A Project Schedule Monthly Updates</td>
<td>N/A</td>
<td>Monthly</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A Partnership/Stakeholder Status Summary</td>
<td>9/26/16</td>
<td>N/A</td>
<td>N/A</td>
<td>9/26/16</td>
<td>2/23/17</td>
<td>N/A</td>
</tr>
<tr>
<td>A Quarterly Progress Reports and Briefings</td>
<td>N/A</td>
<td>Quarterly</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B Concept of Operations (ConOps)</td>
<td>2/27/17</td>
<td>TBD</td>
<td>TBD</td>
<td>9/1/17</td>
<td>11/7/17</td>
<td>1/18/18</td>
</tr>
<tr>
<td>B Demonstration Site Map and Installation Schedule</td>
<td>3/31/17</td>
<td>TBD</td>
<td>TBD</td>
<td>1/30/18</td>
<td>11/6/18</td>
<td>1/17/19</td>
</tr>
<tr>
<td>B SyRS</td>
<td>6/12/17</td>
<td>TBD</td>
<td>TBD</td>
<td>1/4/18</td>
<td>3/9/18</td>
<td>4/20/18</td>
</tr>
<tr>
<td>B Test Plan (TP)</td>
<td>8/13/17</td>
<td>TBD</td>
<td>TBD</td>
<td>7/18/18</td>
<td>8/29/18</td>
<td>10/19/18</td>
</tr>
<tr>
<td>B Other Systems Engineering documents – as identified by the Recipient and agreed to by the USDOT – that provide evidence of following a SE approach</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C Performance Measurement Plan</td>
<td>12/21/16</td>
<td>TBD</td>
<td>TBD</td>
<td>9/1/17</td>
<td>11/1/17</td>
<td>1/17/18</td>
</tr>
<tr>
<td>C Response to USDOT Deployment Tracking Surveys (as required)</td>
<td>N/A</td>
<td>TBD</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D Data Privacy Plan</td>
<td>7/31/17</td>
<td>TBD</td>
<td>TBD</td>
<td>2/21/18</td>
<td>9/7/18</td>
<td>1/2/19</td>
</tr>
<tr>
<td>E Data to support USDOT’s Independent Evaluation</td>
<td>N/A</td>
<td>TBD</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Any schedule slippage will be noted by the PM to the PgM and USDOT along with the remedial action and the impact of the slippage. If significant schedule variance occurs, the PM will be responsible for tasking the team to conduct an analysis of the variance and its impact. The team will determine how best to recover from this deviation. If an adjustment is not possible, the change management process will kick in to officially request a change to the schedule baseline.

The WBS is again the starting point for schedule control. Work activities are identified for each of the WBS work package elements and form the building blocks of the project schedule. More complex projects, such as the Smart Columbus program, require a CPM schedule.

The critical path is the path through the network that has the longest duration and therefore determines the duration of the project. The sums of the durations along all other paths through the network are shorter than the critical path. The critical path is important because it focuses management’s attention on the activities that contribute to the longest path through the schedule. If the critical activities are completed on time, then the project will finish on schedule. In practice, it is prudent to focus schedule control on critical and near critical activities on other paths. A near critical activity is identified by the size of its float. The float is the number of days the activity can be delayed before it becomes critical. Activities with little float are near critical (and by definition, activities on the critical path have zero float).

The schedule baseline will be updated at the reset of the Smart Columbus program and approval of the SE approach for the program and each project. As the project progresses through the systems engineering, development/design and construction activities, the schedule performance will be monitored, the outstanding durations of incomplete activities estimated, the critical path updated and compared to baseline. Our team will then take management action to address schedule slippages of critical and near critical activities. Potential corrective actions may be to add resources or adjust the schedule.

When changes to the project occur, it is important to assess their impact on the schedule along with their scope and cost impact. The change management process is discussed in detail in Section 7 (Change Management), while the scope management process is documented in Section 4 (Scope Management). The schedule will be reviewed and approved by the AOR on a monthly basis with the submittal of the Monthly Report.
Chapter 9. Cost Management

9.1 Cost Management Approach

Cost management includes all processes involved in controlling costs so that the program can be completed within the approved budget; post-Award, cost management is focused on influencing the factors that create cost variances and controlling changes to the project budget.

The PgM is responsible for overall cost management for the Smart Columbus program. The city PMs and the technology and communications consultant PgMs are responsible for managing and reporting on the program’s cost throughout its duration. The PMs will present and review the project’s cost performance during the monthly project status meeting and include in the quarterly reports. As not all tasks utilize the same amount of budget each month, to ensure appropriate budget adherence the PMs will create an estimated “burn” budget (by task, milestone or month) to ensure that the costs expended are aligned with expectations for that period.

The program fiscal staff will check proposed purchases for acceptability under the Award, conduct the bid process, establish contracts in accordance with the bid documents; obtain USDOT approval for reasonableness for the contracts; issue purchase orders (POs), notices to proceed (NTPs) and task authorization letters against the contracts; audit invoices against contracts; monitor and report expenses to the team; and measure performance against the budget. The fiscal staff will also prepare all legislation needed for Columbus City Council approval of contracts and expenditures, in addition to ensuring an adequate cash flow to keep the project moving forward.

9.2 Roles and Responsibilities

This section summarizes the roles and responsibilities pertaining to cost management. The CINO has final approval prior to seeking approval of contracts from Columbus City Council. A detailed breakout of the roles and responsibilities for cost management are in Table 16.

Table 16. Roles and Responsibilities for Cost Management

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| CINO/Program Owner     | • Approves contract recommendations and executes contracts and awards authorized by Columbus City Council  
                        | • Approves program budget increases for elevation to USDOT  
<pre><code>                    | • Accountable for USDOT budget                                                   |
</code></pre>
<p>| DCINO                  | • Serves as acting CINO in CINO’s absence                                        |</p>
<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| PgM (PgM)       | • Provides guidance and management regarding cost increases; works to mitigate cost increases; elevates cost increases to CINO for approval  
• Responsible for USDOT budget management  
• Supervises the MAI  
• Approves invoices for payment |
| DPgM (Technology) | • Manages any SCOS consultants including their budget  
• Facilitates escalations regarding cost increases and budget needs to PgM; PM is responsible for updating DPgM Technology on project and consultant contract status as it relates to the SCOS, including budget |
| Communications PM | • Manages any communications consultants including their budget  
• Facilitates escalations regarding cost increases and budget needs; PM is responsible for updating PgM on project and consultant contract status including budget |
| PMs (City)      | • Delivers the elements of the program (projects) provides oversight of deliverables; manages project budget  
• Facilitates escalations including cost increases  
• PM is responsible for updating PgM on project and consultant contract status |
| IT PM (City)    | • Delivers the elements of the SCOS  
• Provides oversight of SCOS deliverables and serves as an escalation point to the DPgM (Technology) on matters related to scope that may impact cost  
• Responsible for updating PgM and DPgM (Technology) on project and consultant contract status |
| PgM (Consultant) | • Monitors project team performance and budget  
• Provides oversight for all deliverables  
• Serves as point of escalation to PgM on matters related to scope that may impact cost |
| Project Lead (Consultant) | Holds project team accountable for deliverables, manages to scope and budget, facilitates change management, governs the project per the PMP and SEMP, creates and maintains schedule and risk registers, works with PM to establish budget and recognize policy needs, partners with PM to establish necessary reporting for the PMO/USDOT. Ensures compliance of the project team with project budgets and communicates budget changes to responsible PM. |
| Management Analyst I (MAI) | • Compiles financial data and financial reports  
• Conducts bids; runs procurement processes; puts contracts in place  
• Monitors performance against the contract |
9.3 Cost Baseline

Per the PMBOK, the cost baseline is a time phased budget that is used as a basis to measure, monitor and control overall performance on the project, typically costs by period. Given that the city invoices USDOT each month, cost baseline will be assessed each year. The Award references the baseline of costs – Volume II Budget Application. This baseline will be restructured as part of the program reset and used to measure performance going forward.

The Smart Columbus program budget is based on the Award and shown in Table 17. It was most recently reported in the Annual Budget Review and Program Plan Report in June 2017.

<table>
<thead>
<tr>
<th>Task</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Estimated Cost to Complete Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Program Management</td>
<td>$1,857,054</td>
<td>$3,567,984</td>
<td>$3,475,062</td>
<td>$2,036,045</td>
<td>$10,936,145</td>
</tr>
<tr>
<td>2 Communications and Outreach</td>
<td>$637,511</td>
<td>$992,801</td>
<td>$1,170,400</td>
<td>$569,285</td>
<td>$3,369,997</td>
</tr>
<tr>
<td>3 Enabling Technologies (Integration)</td>
<td>$1,184,974</td>
<td>$2,148,615</td>
<td>$15,663,050</td>
<td>$9,617,643</td>
<td>$28,614,282</td>
</tr>
<tr>
<td>4 Projects within the Districts (Implementation)</td>
<td>$1,026,733</td>
<td>$6,811,730</td>
<td>$5,889,222</td>
<td>$2,351,891</td>
<td>$16,079,576</td>
</tr>
<tr>
<td>Total</td>
<td>$4,706,272</td>
<td>$13,521,130</td>
<td>$26,197,734</td>
<td>$14,574,864</td>
<td>$59,000,000</td>
</tr>
</tbody>
</table>

Table 18 reflects the current PMO estimate to complete the tasks associated with USDOT SCC Demonstration.
Table 18. Smart Columbus Program Budget Breakout

<table>
<thead>
<tr>
<th></th>
<th>Federal Share</th>
<th>Cost Share</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Management</td>
<td>$4,857,319</td>
<td>$7,917,144</td>
<td>$12,774,463</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>$1,750,000</td>
<td>$1,750,000</td>
<td>$1,750,000</td>
</tr>
<tr>
<td>Communications and Outreach</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Enabling Technologies</td>
<td>$17,280,992</td>
<td>$7,616,856</td>
<td>$24,897,848</td>
</tr>
<tr>
<td>Residential District</td>
<td>$5,982,500</td>
<td>$265,000</td>
<td>$6,247,500</td>
</tr>
<tr>
<td>Commercial District</td>
<td>$1,930,000</td>
<td>$3,000,000</td>
<td>$4,930,000</td>
</tr>
<tr>
<td>Downtown District</td>
<td>$1,886,473</td>
<td>$1,886,473</td>
<td>$1,886,473</td>
</tr>
<tr>
<td>Logistic District</td>
<td>$3,312,716</td>
<td>$201,000</td>
<td>$3,513,716</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$40,000,000</td>
<td>$19,000,000</td>
<td>$59,000,000</td>
</tr>
</tbody>
</table>

Note: Program budget will be updated when partner cooperative awards are finalized.

9.4 USDOT Reimbursement

The reimbursement of USDOT for costs associated with the Smart Columbus program and associated projects consists of three processes:

- The Task Authorization approval process
- The Contractor Invoicing process
- The Requesting Reimbursement process

9.5 Task Authorization

The PMO will procure professional services, construction contracting and equipment, material and goods from suppliers (all jointly referred to as “contractors”) according to the Award, and as further described in detail in Section 12 (Procurement Management).

For the PMO to authorize a task, the contractor must submit a scope of work and task authorization request to the PMs for review. The PM reviews and approves the request and submits to the PgM for approval. The MAI verifies the requested task is within the scope of the contractor contract, checks for acceptance of the task under the Award, verifies the task was budgeted, and verifies there are unused funds available for that budget line item to support issuance of the authorization letter. The MAI then submits task authorizations approved by the PgM via email to USDOT AO for concurrence.

With concurrence from the AO, the MAI will submit the task authorization letter to the CINO for signature. The MAI then sends the signed letter via email to the contractor informing them of the approval. The task authorization letter details the scope of work to be performed in the task, the hours and titles required to perform the task, any other direct costs (ODCs) that may be necessary to complete the task, and the
deliverables expected upon completion and authorization to proceed with the proposed work. The task authorization letter clears the contractor to perform the approved work and submit an invoice.

9.6 Contractor Invoicing

The contractor invoicing process consists of the review and approval of a request for payment from a contractor for work that has been completed on an approved task. This assessment includes review by the PMO and once complete, the invoice is processed for payment in the city’s internal, enterprise-wide financial system (“DAX”). City of Columbus fiscal staff is authorized to use the DAX system. The timeframe for the contractor invoicing process is about 30-35 days from receipt of a properly submitted and documented contractor invoice.

- The FA receives and reviews the contractor invoice, auditing the invoice against the purchase order and the contract. The FA enters the consultant invoice into a tracking spreadsheet used to keep track of PO balances and invoice payments. The spreadsheet is maintained by the FA on the city’s internal network, and it is accessible by Department of Public Service fiscal staff. The invoice is then sent to the PM for review.

- The PM reviews the contractor invoice to verify goods received. In the case of a service invoice, the PM reviews the progress report section of the invoice. The PM will verify if the work described in the progress report section of the invoice was performed, and if the number of hours billed is appropriate. Once PM has completed review, the PM returns the invoice to the FA with approval or with comments to be addressed. The FA returns the invoice with PM comments back to the contractor, who makes corrections and then resubmits the invoice for approval. The FA enters the service invoice information into a tracking database used to generate spend statistics with Disadvantaged Business Enterprises (DBEs) and subconsultants. The database is maintained by the FA on the city’s internal network, and it is accessible by Department of Public Service fiscal staff. The FA then sends the service invoice approved by the PM to the MAI.

- The MAI reviews the service invoice database entry and approves the payment of the invoice.

- The FA then scans the approved invoice, initiating a voucher into the DAX system, and sends the approved invoice to the fiscal manager (FM) for approval for payment.

- The FM reviews the audit data for each invoice, compares the voucher to the invoice. If the FM finds an error, the FM requests the FA to correct the error. The FM then approves the voucher for payment.

- Upon approval for payment by the FM, the FA initiates the electronic workflow approval process in DAX to pay the approved voucher. The DAX electronic workflow approval process is an automatic process managed by the Columbus Department of Finance and Management and Office of the City Auditor with differing levels of human approvers depending upon the dollar amount of the voucher. Any approver can stop the process and ask for corrections or reject the invoice back to the FA if there are errors in the voucher.

The City Auditor issues a warrant (the city’s term for a check) and mails it to the contractor within one to two days of the last DAX approval of the voucher.
9.7 Requesting Reimbursement

The process of requesting reimbursement from USDOT is a collaborative process between the PMO, USDOT AO and AOR. The PMO receives an invoice from a contractor that is related to an approved activity based on the scope of work, which is then reviewed, audited and approved for payment. Contractors will typically submit invoices to the PMO monthly. The prime contractor submits subcontractor invoices with their invoice to the PMO.

The PMO will review, audit and approve payment of invoices from duly contracted consultants, contractors, equipment suppliers and partners (collectively, “contractors”) monthly. Each month, the PMO submits an invoice to the AO based on payments made to date to contractors. The MAI is responsible for preparing and submitting grant reimbursement requests to the AO following these steps:

1. Create an updated folder within the city network corresponding with the request number
2. Update internal records regarding the status of the invoice
3. Prepare a reimbursement request including the following documents:
   - Reimbursement Submission Summary page
   - USDOT SF270 Request for Advance or Reimbursement form
   - Reimbursement Submission Attachment page
   - Hourly breakdown for reimbursement period
   - Invoices from reimbursement period
   - Copies of paid checks from reimbursement period
4. Following completion of the reimbursement request documents, the MAI compiles all the documents above into one complete PDF file.
5. The MAI submits the reimbursement package via email to the AO for a Delphi eInvoicing System submission review. Delphi is the payment system used by USDOT. The MAI informs the CINO, PgM and FM by email that the reimbursement request has been submitted along with the date and dollar amount of the request. The AO reviews the submission and informs the MAI of any questions regarding the reimbursement request.
6. The MAI will work with the PMO to address the questions from the AO. If the questions cannot be addressed prior to the city submitting the request through the USDOT Delphi payment system, the items in question are removed from the reimbursement request and resolved later.

The AO reviews and approves the reimbursement request in the Delphi system, with payment deposited into the city account within two weeks of AO approval.

9.8 Cost Reporting Format

Reporting of cost management will be included in the Quarterly Progress Report submitted by the PgM to the AO and AOR. The Report will include a section labeled, “Financial Status.” This section will contain
the task-by-task planned expenditures and actual costs expended to date. The section will also include
the reimbursement requests that have been submitted to USDOT. Actual contractor costs are measured
based on paid invoices.

9.9 Cost Variance Reporting

Cost will be reported monthly by the city and consultant PMs to the PMO PgM. Variances of 5% change
the estimated cost to yellow or cautionary. These will be reported to the PgM and if it is determined that
there is no or minimal impact on the program’s cost or schedule baseline, then there may be no action
required. Cost variances of 10% will change the status of the cost to red or critical. These will be reported
to the PgM and require corrective action from the city PM, the consultant Team PM and PgM to bring the
cost and/or schedule performance indexes (SPI) back in line with the allowable variance or accept the
cost variance and obtain resources to execute the cost variance.

Cost variances as outlined above will be elevated to the PgM via email and will also be discussed during
the Smart Columbus program management weekly meetings. Required elements of the email notification
will be:

1. A description of the cost increase including what is driving the cost (e.g., inflation, estimate vs.
   actual, etc.)
2. Potential mitigation(s) of the cost increase
3. Recommendation of acceptance/denial of the cost increase
4. Identification of potential sources of funding for the cost increase (can be deferred until weekly
   meeting)
5. Discussion of potential needs to access potential funding source (e.g., additional funding
   request to the finance director, council action, etc.)

Cost increases that will result in a program budget increase will be elevated to the CINO for formal
approval/denial. The CINO is accountable for the USDOT program budget. Any approval of a program
budget increase will be elevated to the USDOT AO and AOR for formal approval/denial.
Chapter 10. Policy

10.1 Policy Management Approach

The City of Columbus is a chartered political subdivision of the State of Ohio. Under the State of Ohio Constitution, a chartered community may enact certain laws and codes. However, under the State of Ohio Constitution, a chartered community may not enact laws or codes that conflict with certain state laws, including traffic laws. As such, when the need arises to create policy where none previously exists or to amend existing policy to accommodate the needs of the Smart Columbus program and associated projects, the City of Columbus will either have sole authority to make such policy, or the city must work with the State of Ohio to make policy depending on the requirements of the State of Ohio Constitution. The city has established a process of managing policy change and enactment, which is described in Table 19.

10.2 Roles and Responsibilities

The overall roles and responsibilities for policy management are indicated in Table 19.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>PgM</td>
<td>• Account for and track the impacts of potential policy issues with respect to the management of overall program deliverables, schedule and budget</td>
</tr>
<tr>
<td>CINO</td>
<td>• Serves as the entry point into the legislative process for city policies</td>
</tr>
<tr>
<td>DCINO</td>
<td>• Works with Council and the Mayor’s Office to inform about the implications and need for the policy</td>
</tr>
<tr>
<td>Communications PM</td>
<td>• Responsible for overall communications and community engagement. Ensure policy processes are engaged at the appropriate time and level.</td>
</tr>
</tbody>
</table>
| DPGm (Partnerships and Policy)    | • Determine if formal change to policy is required in consultation with the PgM, Project Leads, and the legal and compliance officer  
  • Initiate contact and define project policy needs, delivery timeline and coordinate any follow up with ODOT |
| City PMs                          | • Identify and monitor potential policy risks and alert the DPGm (Partnerships and Policy) for tracking and follow up.  
  • Determine if formal change to policy is required in consultation with the DPGm (Partnerships and Policy) and legal and compliance officer |
| Legal and Compliance Officer      | • Identify, evaluate, and manage policy, legal, liability and other risks.  
  • Consult with the DPGm (Partnerships and Policy) and Project Leads to determine if formal change to policy is required |
### Individual/Group Responsibilities

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Officials</td>
<td>- Depending on the type of policy matter to be addressed, specific city offices must be engaged in the process. These include the appropriate department director (responsibilities and authority in Columbus City Charter(^{13})), Columbus City Council (responsibilities and authorities granted in Columbus City Charter), Columbus City Attorney (chief legal authority for City of Columbus), Mayor (see Columbus City Charter), and Columbus City Auditor (refer to Columbus City Charter for responsibilities and authority).</td>
</tr>
<tr>
<td>State Officials</td>
<td>- Depending on the type of policy matter to be addressed, specific state offices must be engaged in the process. These include the appropriate Department director, Legislature and Governor’s Office. Transportation policy matters will require engagement of ODOT and Ohio Department of Public Safety (ODPS). The State Legislature is responsible for amending state laws; the appropriate state Department director is responsible for authorized policy within their department and coordinating state law changes with the Legislature; the Governor’s Office is responsible for coordinating and championing changes in state policy and state law changes.</td>
</tr>
<tr>
<td></td>
<td>- ODOT Deputy Director of Strategic Initiatives and Program serves as the city's point of contact for all program coordination at the state level.</td>
</tr>
</tbody>
</table>

### 10.3 Policy Drafting and Process for Approval

Columbus City Code sets forth the process for adopting policy. Title 1\(^{14}\) of Columbus City Code establishes the structure of the municipal government and the process for changing city code. Figure 11 summarizes the hierarchy of policies within the city.

The Columbus City Charter serves as the constitution for the city as a political subdivision of the state of Ohio and establishes the form of local government. The voters of the City of Columbus authorize amendments to the charter through elections. The Columbus Code of Ordinances constitute the laws and regulations of the City of Columbus, which are voted upon by the Columbus City Council, its legislative body. Under Columbus City Charter, Columbus City Council has the responsibility and authority to legislate laws and regulations, known as the Columbus Code of Ordinances. The Mayor and department directors are also established by the Columbus City Charter, and are vested executive authority through the charter and code of ordinances to establish rules and regulations to carry out the laws, or ordinances, of the city. Furthermore, the Mayor and department directors are authorized to enact procedures to carry out the laws and rules and regulations. This hierarchy of policy starts with the Columbus City Charter and cascades down through laws (ordinances) to rules and regulations, then procedures. Columbus City

**References**

13 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=CHTR_THECICOOH_DEDI
14 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT1ADCO
Charter and Columbus City Code describe the process for exacting new laws (ordinances) or amending existing laws, and for establishing rules and regulations by department directors. The following graphic shows this flow of policy from ordinance to procedure.

Figure 11. City of Columbus Policy Process

10.3.1 Process for Policy Approval (City)

Figure 12 outlines the process for policy change within the City of Columbus.
10.3.2 Legislative Process (City)

Legislation considered by Columbus City Council takes one of two forms – a resolution or an ordinance. A resolution expresses the views of council on a topic, while an ordinance directs that a specific action be taken. Resolutions are adopted; ordinances are passed.

To enact a new "law" or to enact any of the legislation necessary for the operation of the city, action is required by Columbus City Council and at least one other branch of municipal government. Some ordinances allow for the purchase of equipment, supplies or services. Others change the zoning standards for specific property. Still others make amendments to city codes.
The department requesting authorization writes the specific ordinance or resolution. They are submitted to Columbus City Council using a prescribed format and contain background information, a fiscal impact, specific accounting information, and, when appropriate, reference to the applicable city codes.

The CINO is responsible for coordinating with department directors on matters of policy and legislating changes to Columbus Code of Ordinances to support the Smart Columbus program and associated projects. The CINO and the appropriate department director will determine which entity will be responsible for proposing changes to rules and regulations or legislation amending Columbus Code of Ordinances to Columbus City Council. More information about the City of Columbus legislative process is found online at the council website.

10.3.3 Guidelines for Policy and Legislation

The city has documented guidelines and procedures for elected officials, department directors, and division administrators. This guidance is available to city staff through the city's internal intranet and described below:

- **Guidelines and Procedures for the Preparation and Submission of Legislation to Columbus City Council:** This memo details the guidelines and procedures for submitting legislation to council.

- **Process for Amendment of Regular Legislation to Emergency:** If an emergency amendment is determined to be necessary, the person requesting the amendment (either within or outside of city government) must e-mail the "reason for requesting the amendment" to the city clerk.

- **Process for Amendment of Legislation as Submitted to the City Clerk:** If amendments contain substantive changes to the policy or fiscal impact of the ordinance, a new ordinance must be created with Legistar (the city's application for routing and approving legislation), rerouted through approval process and resubmitted to the city clerk for council consideration.

10.3.4 Potential Policy Issues

As mentioned in the Policy Management Approach, the city must engage the State of Ohio in order to necessitate some policy changes including changes to State of Ohio Traffic Code. Potential policy issues outlined below will necessitate legislative changes in the operation of AV and coordination regarding truck platooning on public roadways.

ODOT serves as the entryway to the State of Ohio’s legislative process on transportation matters. The Deputy Director of Strategic Initiatives and Programs, has been designated as ODOT’s Smart Columbus contact and serves as our point of contact for all program coordination.

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15 https://www.columbus.gov/council/How-Do-I/Legislative-Process/
16 https://www.columbus.gov/council/How-Do-I/Legislative-Process/
Upon identification of known policy issues necessitating State of Ohio legislation changes, the DPgM (Partnerships and Policy) will initiate contact and define the policy need, delivery timeline and coordinate any follow up with the ODOT Deputy Director of Strategic Initiatives and Programs.

The Smart Columbus program will identify and track policy issues as policy risks within the project Risk Register. These risks are classified under the category “Legislative” on the risk register. The risk register, risk tracking and risk categories are discussed in the Risk Management plan in Chapter 16.
Chapter 11. Human Resources Management

11.1 Approach

Human Resource Management is the processes that organize and manage the project team (those people who have assigned roles and responsibilities for completing the project). While project execution is at the forefront of this activity, it also includes activities that relate to the projects’ planning and decision-making, tracking performance, resolving issues, and coordinating staffing to enhance project performance. Components of the Smart City Columbus Human Resource Management Plan include:

1. A key component of the Human Resource Management plan identifying the connections between the work that needs to be done and project team members. The Smart Columbus PMO will use a "RACI" format for the responsibility assignment matrix for this purpose (Responsible, Accountable, Consult, and Inform).

2. The project staffing management plan describes how human resource requirements will be met; it will be at a high level, identifying the tools and processes used for staff planning, staff management and staff transitions.

11.2 Roles and Responsibilities

Table 20 lists the roles and responsibilities for human resources management.

<table>
<thead>
<tr>
<th>Individual/Group Responsibilities</th>
<th>Individual/Group Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDOT AO</td>
<td>• Review and approve any changes to key personnel</td>
</tr>
<tr>
<td>USDOT AOR</td>
<td>• Communicate with USDOT AO on any key personnel changes</td>
</tr>
<tr>
<td></td>
<td>• Work with project leadership to understand impacts of change.</td>
</tr>
<tr>
<td></td>
<td>• Review and provide recommendations regarding the right to apply project resources, make decisions and make approvals regarding staffing.</td>
</tr>
<tr>
<td>PgM</td>
<td>• Manage staff planning, tracking and transitions for the entire program.</td>
</tr>
<tr>
<td></td>
<td>• Provide formal written notification of key personnel changes to USDOT (including recommendations regarding application of project resources) · Responsible for overall delivery of work by the project team.</td>
</tr>
</tbody>
</table>
### Individual/Group Responsibilities

<table>
<thead>
<tr>
<th>Individual/Group Responsibilities</th>
<th>Individual/Group Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Review monthly staff performance, identify and monitor issues, and work with the city PMs and Consultant PM to identify and implement corrective and/or preventative actions if necessary.</strong></td>
<td><strong>Maintain an issue log to monitor issues until closure</strong></td>
</tr>
<tr>
<td><strong>Manage staff resources and assignments at the individual project level</strong></td>
<td><strong>Observe team behavior, manage conflict, resolve issues and appraise team member performance and escalate issues to PgM as needed.</strong></td>
</tr>
<tr>
<td><strong>Manage staff resources and assignments at the individual project level</strong></td>
<td><strong>Track and report individual team member performance (hours by month)</strong></td>
</tr>
<tr>
<td><strong>Observe team behavior, manage conflict, resolve issues and appraise team member performance and escalate issues to PgM as needed.</strong></td>
<td><strong>Coordinate with Project Leads to ensure required skill sets are made available to the projects</strong></td>
</tr>
<tr>
<td><strong>Manage consultant staff resources and assignments at the individual project level</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 11.2.1 Responsibilities by Project

The Smart Columbus team PMO will use responsibility assignment matrices to identify connections between work that needs to be done and project team members. Given the scope of the Smart Columbus project, the PMP includes a RAM which maps the project staff to the project name. The Smart Columbus PMO team is using a format known as “RACI”, because the names of roles documented are: responsible, accountable, consult and inform. The roles are outlined as follows:

- **R** - Responsible (the person who is assigned to do the work - responsible for execution)
- **A** - Accountable (the person who makes final decision and has ultimate ownership)
- **C** - Consulted (the person who must be consulted before a decision or action is taken)
- **I** - Informed (the person who must be informed that a decision has been made)

The high-level RACI chart for Smart Columbus is shown in Table 21. This matrix tracks responsibility by project and deliverables. Furthermore, detailed project-level RACI assignment matrices will be developed to identify roles and responsibilities with respect to the specific deliverables associated with each project. All RACI matrices will be maintained in a single MS Excel workbook for cross-referencing and version control purposes. Project-level matrices will be developed upon USDOT approval of the revised systems engineering approach for Smart Columbus.
<table>
<thead>
<tr>
<th>Category</th>
<th>Project Name</th>
<th>CINO + Deputy</th>
<th>PgM + Deputy (Technology)</th>
<th>Comms PM</th>
<th>SE/Quality Spt</th>
<th>Business Owner</th>
<th>Busine ss Owner/ Mngr</th>
<th>Project Mgr (City)</th>
<th>Project Lead</th>
<th>Scrum master</th>
<th>Dev Team</th>
<th>Sys Eng</th>
<th>Stkhid rs</th>
<th>Wking Grp</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOS</td>
<td>Smart Columbus Operating System (SCOS)</td>
<td>A</td>
<td>R</td>
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<td>C</td>
<td>R - PMO</td>
<td>R - Brian King (Interim)</td>
<td>C - IT PM</td>
<td>C - TBD</td>
<td>C - Aaron Ford</td>
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<td>C - Ryan Bollo</td>
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<td>Multimodal Trip Planner-Common Payment System (MMTPA/CPS)</td>
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<td>R - PMO</td>
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<td>C - Alex Kavanaugh</td>
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<td>C - Matt Graf</td>
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<td>C - Andy Wolpert</td>
<td>C - Alex Kavanaugh</td>
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<tr>
<td>Category</td>
<td>Project Name</td>
<td>CINO + Deputy</td>
<td>PgM + Deputy (Technolgy)</td>
<td>Comms PM</td>
<td>SE/ Quality Spt</td>
<td>Business Owner</td>
<td>Busines Owner/Mngr</td>
<td>Project Mgr (City)</td>
<td>Project Lead</td>
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<td>C - DPS</td>
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<td>Enhanced Human Services</td>
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<td>C - CelebriateOne</td>
<td>C - TBD</td>
<td>C - Andy Wolpert</td>
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<td>Emerging Technologies</td>
<td>Truck Platooning</td>
<td>A</td>
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<td>C - DPS</td>
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<td>Task A - Program Management</td>
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<tr>
<td>Program Management Tools &amp; Deliverables</td>
<td>Task B - System Engineering (Program Level)</td>
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<td>Project Name</td>
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<td>PgM + Deputy (Technolo gy)</td>
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<td>SE/ Quality Spt</td>
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<td>Busine ss Owner/ Mngr</td>
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<td>Project Lead</td>
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<td>Task D - Data Privacy / CyberSecurity</td>
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<td>Program Management Tools &amp; Deliverables</td>
<td>Task G - Communication s and Outreach</td>
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<td>C</td>
<td>R - PMO</td>
<td>C - TBD</td>
<td>C - Brandi Braun</td>
<td>C - Marie Keister</td>
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<td>Program Management Tools &amp; Deliverables</td>
<td>Task H - International Collaboration</td>
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<td>R - PMO</td>
<td>C - TBD</td>
<td>C - Brandi Braun</td>
<td>C - Marie Keister</td>
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<td>Category</td>
<td>Project Name</td>
<td>CINO + Deputy</td>
<td>PgM + Deputy (Technology)</td>
<td>Comms PM</td>
<td>SE/Quality Spt</td>
<td>Business Owner</td>
<td>Businees Owner/Mngr</td>
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<td>Program Management Tools &amp; Deliverables</td>
<td>Task I - ITS Architecture and Standards Development</td>
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<td>R - PMO</td>
<td>C - Ryan Bollo</td>
<td>C - Robert James</td>
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<tr>
<td>Program Management Tools &amp; Deliverables</td>
<td>Task J - Interim and Final Reporting</td>
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<td>C</td>
<td>R - PMO</td>
<td>C - Ryan Bollo</td>
<td>C - Diane Newton</td>
<td>NA</td>
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</tbody>
</table>
11.3 Staffing Management

Staffing management consists of the following three elements for this project:

- **Staff Planning**: Understanding the requirements for each task in the project and matching technical skills and availability to required WBS elements.
- **Staff Tracking**: tracking of resource use and performance on tasks.
- **Staff Transitions**: managing departures and re-assignment of resources throughout the course of the project.

11.3.1 Staff Planning

Staff planning will be implemented in two phases. The PgM has identified some gaps and is beginning to procure (direct hires only, not consulting resources) those resources. Currently, the staff are linked to program deliverables and will serve as PMs for projects in the WBS.

**Phase 1 – Identifying and Filling Program Skill Gaps**

Identifying required technical skills to deliver the program for each project will be the key activity. Major tasks and technology needs will be considered when identifying the skills needed. Once technical skills are identified, city personnel and/or consultant team resources will be chosen to fill those roles. Should the resource not be available via employed city personnel or consultant team resources, they will be identified as a “gap” to be procured – either as a direct hire or consulted position. See Section 12 (Procurement Management) for procurement processes.

**Phase 2 – Implement Staff Planning Using the PMO Weekly Meeting**

A standing topic for the PMO Weekly meeting will be staffing: needs and gaps. Each Project Lead will discuss their staffing resources for the next two weeks and two months; this will be a recurring agenda item at the weekly meeting. Additionally, a monthly staff planning meeting will be established with the PMO and Consultant team(s) in attendance; this agenda will focus on longer-term staff needs: two-month, six-month and one-year outlooks, to help identify near term needs as well as long term needs.

The city will look at methods to develop a manpower schedule and determine if this or another method can be implemented during long-term project execution.

11.3.2 Staff Tracking

On a bi-weekly basis, PMs submit timesheets to the PMO’s MAI. These hours are aggregated in a spreadsheet by staff member. The PMO will work with the MAI to develop a tool in excel using this spreadsheet that helps identify staff members that are working over 20% overtime (48+ hours /week) during the bi-weekly period.

Those staff members working over the 20% overtime threshold will be asked to identify whether this is a short or long-term scenario. Ultimately, if the scenario is determined to be long-term, the staff will be determined to be “overloaded” and new resources will be hired or procured.
A high level of performance is required for execution of the Smart Columbus program. While the City of Columbus has formal performance appraisals, feedback is given weekly to the PMO team. In this age of information, where news is pushed to you, the PgM, DPgM, CINO and DCINO regularly “push” feedback via text, emails, calls and in-person exchanges to members of the PMO and consultant team. The PgM and DPgM are responsible for coaching team members on performance. Acknowledging missed and achieved deadlines and discussing what were the lessons learned for the task is key to maintaining and improving performance.

After key deadlines are met or missed, a retrospective to talk about “what worked, what didn’t and how to use what we learned” to improve our delivery will be held. This will be scheduled within two (2) business days of the scheduled date for submittal of the deliverable.

11.3.3 Contingency Plan

The Smart Columbus program includes a back-up and a replacement candidate for the two key personnel roles. Back-up staff provide coverage during short-term absences while replacements would permanently assume a position should a key role be vacated. While the back-ups might not have the seniority to step into the vacated role just yet, they ensure continuity of project knowledge and expertise and can help transition the new personnel seamlessly to the task. Table 22 identifies the contingency plan for the consultant team in case of unanticipated departures for key personnel on the consultant team. Key personnel are those staff that are specified in the USDOT agreement.

<table>
<thead>
<tr>
<th>Role</th>
<th>Current</th>
<th>Backup</th>
<th>Replacement</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>PgM</td>
<td>Mandy Bishop</td>
<td>Jodie Bare</td>
<td>Jodie Bare</td>
<td>As a DPgM – Technology and former Chief Operating Office of an Architectural/Engineering firm, Jodie is best equipped to step into this role.</td>
</tr>
<tr>
<td>DPgM (Partnerships and Policy)</td>
<td>TBD</td>
<td>Mandy Bishop</td>
<td>Andy Wolpert</td>
<td>As a former design-build leader, Andy would be best equipped to provide the velocity required in this position. Additionally, most of Andy’s projects are working with partners.</td>
</tr>
<tr>
<td>DPgM (Technology)</td>
<td>Jodie Bare</td>
<td>Mandy Bishop</td>
<td>TBD</td>
<td>TBD</td>
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</tbody>
</table>

The city recognizes that the above contingency plan lacks depth. As the staff evaluation process is undertaken as described earlier in this section, the city will work to develop a stronger contingency plan with more depth as the project progresses.
Chapter 12. Procurement Management

12.1 Procurement Management Approach

The procurement management approach includes processes, including all functions that pertain to the acquisition, including description of requirements, selection and solicitation of sources, preparation and award of contract, and all phases of contract administration to purchase or acquire the goods and services needed from outside the PMO to perform the work necessary to execute the Smart Columbus program. Procurements for the program will follow Columbus Code of Ordinances Chapter 329 inasmuch as the city's procurement code does not conflict with 2 CFR 200\textsuperscript{17}, in which case 2 CFR 200 governs.

The Smart Columbus program procurement management approach assumes the vendors to be external to the PMO and project team. The procurement management approach includes:

- Establishing legal authority for procurement
- Defining roles and responsibilities
- Describing the systems used for procurement and contract management
- Establishing the types of procurements allowable under law
- Instituting the processes for procurement and contract management
- Creating the process for engaging vendors
- Managing consultants

12.2 Columbus Procurement Code

The purpose of Chapter 329 of Columbus Code of Ordinances\textsuperscript{18} is to establish a purchasing and procurement system of quality and integrity that will maximize the purchasing value of public funds and provide fair and equitable treatment to all persons involved in public purchasing. This chapter applies to any purchase of materials, supplies, equipment, construction, service and/or professional service by a city agency and the sale of any city property, whether real or personal. The law applies to all expenditures of public funds by a city agency for purchasing irrespective of the source of the funds. When the procurement involves the expenditure of federal and/or state assistance or contract funds, the procurement shall be conducted in accordance with all applicable federal and/or state laws and

\textsuperscript{18} https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR
regulations. Nothing in this chapter prevents any city agency from complying with the terms and conditions of any grant, gift or bequest that is otherwise consistent with law.

12.3 Roles and Responsibilities

Table 23 shows the roles and responsibilities for procurement management.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbus City Council</td>
<td>• Awards procurement contracts per Columbus City Charter and Code of Ordinances Chapter 329</td>
</tr>
<tr>
<td>CINO</td>
<td>• Authority to execute contracts for Smart Columbus authorized by Columbus City Council Ordinance 1901-201719</td>
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<tr>
<td>DCINO</td>
<td>• Serve as backup for CINO during absence</td>
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<tr>
<td></td>
<td>• Review contracts as requested by CINO</td>
</tr>
<tr>
<td>PgM</td>
<td>• Provides input/evaluation on procurement strategy</td>
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<td>• Leads the evaluation of bids and offers</td>
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<td></td>
<td>• Coordinates procurement with other project aspects (scheduling and performance reporting)</td>
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<tr>
<td></td>
<td>• Serves as contract administrator for the CINO (Code of Ordinances Section 329.10)</td>
</tr>
<tr>
<td>DPgM (Partnerships and Policy)</td>
<td>• Engages with vendors</td>
</tr>
<tr>
<td></td>
<td>• Reports status of the Smart Columbus projects and upcoming procurement opportunities to partners and vendors</td>
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<td></td>
<td>• Provides educational opportunities on how to do business with the city</td>
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<tr>
<td>Fiscal/Procurement Officer</td>
<td>• Develops and manages the procurement process from opportunity to award</td>
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<td></td>
<td>• Submits subcontract awards to firms</td>
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<tr>
<td></td>
<td>• Receives and assists the PgM in evaluating bids and offers</td>
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<tr>
<td></td>
<td>• Negotiates contract terms and conditions</td>
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<td>• Closes out subcontracts upon completion of the task</td>
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</table>

### Individual/Group Responsibilities

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
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</thead>
<tbody>
<tr>
<td>PM (City)</td>
<td>• Provides input/evaluation on procurement strategy</td>
</tr>
<tr>
<td></td>
<td>• Negotiates contract scope and fees</td>
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<tr>
<td></td>
<td>• Provides input/evaluation on vendor statements of work</td>
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<tr>
<td></td>
<td>• Manages the contract once awarded</td>
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<tr>
<td>Project Lead</td>
<td>• Provides input/evaluation on vendor statements of work</td>
</tr>
<tr>
<td>(Consultant)</td>
<td>• Coordinate review/input from project team as needed</td>
</tr>
</tbody>
</table>

### 12.4 Procurement Management Systems

The City of Columbus utilizes three internal systems to manage procurement and contract administration, as explained below:

- **Vendor Services portal**: A publicly accessible city website[^20] where vendors register with the city for notification of procurement opportunities, which are advertised through the portal.
- **DAX system**: An internal system for city staff, including the fiscal/procurement officer, to manage invoices, purchase orders, and vendor payments.
- **Legistar**: A publicly accessible system[^21] for all legislation presented to and acted upon by Columbus City Council.

### 12.5 Procurement Types

Chapter 329 of Columbus Code of Ordinances[^22] establishes the types of procurement Smart Columbus may employ, which include the following:

- **Invitation for Bid (IFB)**: All documents used to solicit competitive or multi-step sealed bids (also known as Invitation to Bid (ITB)).
- **Request for Proposal (RFP)**: The document used to solicit proposals from potential providers for goods and services (Offerors).
  - Price is usually not a primary evaluation factor

[^22]: https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR
o Provides for the negotiation of all terms, including price prior to contract award
o May include a provision for the negotiation of Best and Final Offers
o May be a single step or multi-step process.

- **Sole Source Procurement**: A situation created due to the inability to obtain competition.
  
o May result because only one vendor or supplier possesses the unique ability or capability to meet the particular requirements of the solicitation
  
o The purchasing authority may require a justification from the requesting agency explaining why this is the only source for the requirement

- **Waiver of Bids**: A process, usually statutory, whereby a government purchasing office may procure items without formal bidding procedures because of unique circumstances related to that particular action. For example, bids are waived for emergency purchases that are needed, due to a threat to the public safety.

- **Quote**: An informal purchasing process which solicits pricing information from several sources. This procurement alternative applies to small purchase amounts as defined in Columbus City Code.

- **Purchases from Not-For-Profit Organizations**: Allows for purchases from other governmental organizations or not-for-profit organizations (as recognized by the Internal Revenue Service).
  
o Purchases less than $20,000 do not need Columbus City Council approval.
  
o Purchases that are $20,000 or more require Columbus City Council approval.

- **Direction from USDOT to Engage Resources**: Allows for USDOT to direct the grantee to take certain procurement actions in certain situations.

Exceptions to the procurement process, including sole source and bid waiving is governed by Columbus Code of Section 329.19.  

### 12.6 Procurement Process

#### 12.6.1 Overview

The procurement management process for Smart Columbus will follow the steps listed below.

1. **Identify procurement need**: The PM recommends and the PgM approves procurement needs for the Smart Columbus program.
2. **Identify procurement type.** The PM works with the Fiscal/Procurement Officer to recommend a procurement type, and the PgM reviews, approves or modifies the recommendation.

3. **Write specifications.** The PM is responsible for drafting specifications.

4. **Advertise procurement.** The Fiscal/Procurement Officer manages bid advertisements and bid addenda.

5. **Evaluate bidder responses.** The PgM approves the team responsible for evaluating bidder responses. The Fiscal/Procurement Officer recommends the lowest and most responsible bidder. The CINO approves lowest and most responsible bidder and recommends award of contract to Columbus City Council.

6. **Award contract.** Columbus City Council has the authority and responsibility to award contracts.

7. **Execute contract.** The CINO is authorized by Columbus City Council to execute contracts for the PMO following Council passage of a contract award ordinance.

### 12.6.2 Procurement of Equipment

Sections 329.18 through 329.19 of Columbus Code of Ordinances prescribe the process for procuring equipment, summarized as follows:

- Section 329.18: Competitive sealed bidding.
- Section 329.19: Exceptions to competitive sealed bidding.

### 12.6.3 Procurement of Construction Contracts

Sections 329.20 through 329.23 of Columbus Code of Ordinances prescribe the process for procuring construction contracts (e.g., consulting contracts), summarized as follows:

- Section 329.20: General provisions.
- Section 329.21: Responsibility prequalification requirements for construction contracts.

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24https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.18COSEBI
26https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.20GEPR
27https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.21REPRRECOCO
• Section 329.211 - Responsibility prequalification criteria.
• Section 329.212 - Local preference for construction contracts. (conflicts with 2 CFR 200, so not applicable to USDOT-funded Smart Columbus contracts)
• Section 329.22 - Process for awarding construction contracts not exceeding one-hundred thousand dollars ($100,000.00).
• Section 329.23 - Process for awarding construction contracts exceeding one hundred thousand dollars ($100,000.00).

12.6.4 Procurement of Professional Services

Sections 329.24 through 329.28 of Columbus Code of Ordinances prescribe the process for procuring professional services (e.g., consulting contracts), summarized as follows:

• Section 329.24 - Process for awarding professional service contracts under twenty thousand dollars ($20,000.00).
• Section 329.25 - Process for awarding professional service contracts equal to or exceeding $20,000.00 thousand dollars ($20,000.00), but not exceeding fifty thousand dollars ($50,000.00).
• Section 329.26 - Processes for awarding professional service contracts exceeding fifty thousand dollars ($50,000.00).
• Section 329.27 - Awarding professional service contracts through requests for statements of qualifications.

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28https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.211REPRCR
29https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.212LOPRCOCO
30https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.22PRAWCOCONOEXONDTHDO100000.00
31https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.23PRAWCOCOEXONHUTHDO100000.00
32https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.24PRAWPRSECONOEXTWTHDO200000.00
33https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.25PRAWPRSECOEXTWTHDO200000.00BUNOEXFITHDO50000.00
34https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.26PRAWPRSECOEXFITHDO50000.00
35https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.27AWPRSECOTHRESTQU
• Section 329.28 - Awarding professional service contracts through requests for proposals.

12.6.5 Not-for-Profit Service Contracts

The PMO may need to enter into a service contract with a not-for-profit entity to assist with the implementation of the Smart Columbus program. Section 329.01 of Columbus Code of Ordinances defines a Not-for-Profit Contract as an award for the delivery of services to the public, which are not currently performed or provided by an existing city agency, for maintaining or improving the health and welfare of the citizens of the city, which is made between a city agency and another governmental agency or a not-for-profit organization as recognized by the Internal Revenue Service, the Department of Housing and Urban Development, or any other applicable federal or state agency, which is not in direct competition with a private for-profit organization capable of delivering the same services.

Sections 329.29 through 329.30 of Columbus Code of Ordinances prescribe the process for procuring equipment, summarized as follows:

• Section 329.29 - Process for awarding not-for-profit service contracts estimated to cost less than twenty thousand dollars ($20,000.00).

• Section 329.30 - Process for awarding not-for-profit service contracts estimated to exceed twenty thousand dollars ($20,000.00).

12.6.6 Socioeconomic Subcontracting

The PMO will ensure compliance with 2 CFR 200.321 with respect to contracting with small and minority business, women’s business enterprises, and labor plus area firms. The City of Columbus has set a goal of 15% participation by this sector of the business community as it procures professional services and construction contracts for the program projects. The city has a cabinet-level authority in the Chief Diversity Officer (CDO), who leads the Office of Diversity and Inclusion and is responsible for ensuring diversity and inclusion within city departments, ensuring diversity in city suppliers (professional services, construction contracting, equipment and goods), and workforce diversity within the Columbus community.

The CDO will be assisting the PMO in achieving the city’s participation goal through engagement with key representatives of the community education, economic development, non-profit, government, and

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36 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.28AWPRSECOUGHTREPR
37 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.01DE
38 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.29PRAWNOFSECOSEXCOLEWTWTHDO20000.00
39 https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.30PRAWNOFSECOSEXWTWTHDO20000.00
41 https://www.columbus.gov/odi/
business levels. This advisory group will act in an advisory capacity to the Smart Columbus program Office in the areas of supplier diversity, workforce development and training for the purpose of:

1. Prioritizing diversity activities related to the Smart Columbus activities
2. Supporting and developing the capacity of the local workforce to take advantage of the opportunities that arise from the Smart Columbus projects; and
3. Fostering partnerships with private sector, public sector, educational, nonprofit, labor union and community groups to raise awareness and engagement with Smart Columbus related to supplier diversity and workforce development.

12.7 Contract Management

12.7.1 Contract Administrator

According to Section 329.10\(^\text{42}\) of Columbus City Code, promptly after awarding any contract for services under Sections 329.22\(^\text{43}\), 329.23\(^\text{44}\), 329.25\(^\text{45}\), 329.26\(^\text{46}\), 329.27\(^\text{47}\), or 329.28\(^\text{48}\), the director of the city agency shall designate an employee of the city agency as contract administrator. For Smart Columbus, the CINO has designated the PgM as the contract administrator for contracts executed under the Smart Columbus program. According to Section 329.10, the contract administrator has the following responsibilities:

\(^{42}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.10COADEV
\(^{43}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.22PRAWCOCONOEXONDTHDO100000.00
\(^{44}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.23PRAWCOCOEXONHUTHDO100000.00
\(^{45}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.25PRAWPRSECOEXTWTHDO200000.00BUNOEXFITHDO50000.00
\(^{46}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.26PRAWPRSECOEXFITHDO50000.00
\(^{47}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.27AWPRSECOTHRESTOU
\(^{48}\)https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.28AWPRSECOTHREPR
• To determine whether the contractor (any individual or business entity which has a contract with a city agency) is in compliance with the terms and conditions of the contract before any scheduled payment is made

• To initiate action in the event of nonperformance or other breach of the contract

• To file an evaluation of the contractor's performance with the director of finance and management or designee and the city agency within sixty days after the completion of the contract. This evaluation shall be completed in a form prescribed by the director of finance and management or designee. The completed evaluation shall become part of the contract file. Copies of such evaluation shall be retained by the director of finance and management or designee to assist in the evaluation of contractors for future city contracts and shall be provided to the contractor upon request. The PMO will follow the Department of Public Service procedure for contractor evaluation.

12.7.2 City Attorney Review

Section 329.08 of Columbus Code of Ordinances requires that all contracts shall be reviewed by and approved as to form by the City Attorney or a representative of the City Attorney. Any contract which has not been reviewed and approved by the City Attorney or his/her designated representative shall be void and unenforceable against the city and its officials. The City Attorney, in consultation with the director of finance and management or designee, may establish standard procurement contracts and standard contract language and clauses for use in or as procurement contracts where appropriate.

12.7.3 Specifications and Standards

The scope of the Smart Columbus program is a Demonstration Deployment and such, projects within the program will not be construction-heavy in nature, but some project elements may need to be procured for construction activities to install the project elements. For example, the installation of roadside units (RSUs) for the CVE projects may require the excavation of sidewalks or pavement to install conduits or connecting cables. The City of Columbus and ODOT maintain construction and material standards and standard detail drawings governing construction. The PMO will adhere to City of Columbus and ODOT’s Construction and Material Standards and standard drawings for construction procurements.

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49https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.08CIATRESTSTTCOCOCL


51http://www.dot.state.oh.us/Divisions/ConstructionMgt/Specification%20Files/2013%20CMS%2011142012%20FINALL.PDF

12.7.4 Qualified Products List
The PMO will follow the Department of Public Service’s procedure for qualifying products for use in equipment and construction procurements. In addition, if applicable the PMO will also utilize ODOT’s Qualified Products List (QPL)\textsuperscript{53} for use in equipment and construction procurements.

12.7.5 Purchasing, Contract Management, and Invoicing
The Fiscal/Procurement Officer is responsible for handling and directing the flow of invoices and purchase orders. The PM is responsible for reviewing and recommending invoices and purchase orders, and monitoring schedule and scope modifications. As the designated PMO Contract Manager, the PgM is responsible for approving purchase orders and invoices, schedule changes and scope modifications.

12.7.6 Contract Modifications
Section 329.09\textsuperscript{54} of Columbus Code of Ordinances establishes the responsibilities and process for contract modifications. The Fiscal/Procurement Officer is responsible for handling and directing the flow of contract modifications. The PM is responsible for recommending contract modifications to the PgM. As the designated PMO Contract Manager, the PgM is responsible for approving contract modifications to be legislated by Columbus City Council.

12.7.7 Contract Closeout
The PM is responsible for reviewing and recommending final contract close-out, including punch lists and final documentation. The fiscal manager is responsible for managing and directing the contract close out process. The PgM has the authority and responsibility for approval of closing out contracts.

12.8 Vendor Management and Engagement

12.8.1 Introduction
Since the City of Columbus originally developed its SCC application to the USDOT, interested parties have approached the city to offer potential solutions in support of program goals. The Smart Columbus program office has developed a standard template with which vendors can initiate contact with the city. This document details the process by which vendors can register interest with the Smart Columbus program office; the process that will be used to determine the order in which vendors will be granted opportunities to present to the city via engagement meetings; and, the process that will guide how these

\textsuperscript{53}http://www.dot.state.oh.us/Divisions/ConstructionMgt/Materials/Pages/QPL.aspx
\textsuperscript{54}https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.09COMO
meetings will transpire. Participation in any of the above activities does not represent formal acceptance to do business with the city, nor are the activities part of a formal procurement process.

In general, the city reviews vendors that may have solutions for the program. Often, vendor engagement helps inform the city as to the realm of possibilities. Vendors do not drive city decision-making, but they do certainly assist with educating the team. Decision-making is based on addressing user needs.

The PMO is coordinating vendor engagement meetings over the duration of the program to gather information about products and services that may be procured as part of Smart Columbus projects. These sessions will also give vendors the opportunity to share their products and services with the City of Columbus.

The city maintains a publicly accessible website for vendors interested in the Smart Columbus program. Vendors are given guidance on how to contact the PMO for program information and to share information on their products and services through a vendor inquiry form. This website also provides guidance to vendors on how to register with the city’s vendor services portal. The Vendor Services portal is a publicly accessible website administered by the city’s Department of Finance and Management. Vendors register to do business with the city through this portal. Registered vendors can view current and past procurements and manage their registrations through the portal.

### 12.8.2 Vendor Registration

Vendors may register their interest in providing products or services to the Smart Columbus program Office by completing online contact form at the program website or by emailing smartcolumbus@columbus.gov and requesting a contact form. The contact form will be used to request information from vendors about their product and service offerings in a consistent manner. The following information will be requested from potential vendors, at a minimum:

- What is your company/contact information?
- Do you propose to provide a product or service to Smart Columbus? Yes / No (please indicate). If yes, please provide a description of your product or service
- What role do you propose for your company regarding Smart Columbus?
- Based on the attached WBS for the USDOT and Vulcan projects, please indicate the specific project elements for which you propose to provide products or services to Smart Columbus.
- Will your role be as an advisor or would you be seeking compensation?

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• Are you willing to make a full or partial in-kind contribution to the Smart Columbus program? Please describe the nature of your potential in-kind contribution to the program with as much detail as you can provide at this time.

• Please list what perceived strengths and value you bring to Smart Columbus.

As the Smart Columbus program evolves, additional information may be sought of potential vendors. The city reserves the right to change the contact form and ask clarifying questions as needed to ensure complete information is received from each potential vendor. As information is received from potential vendors, the city will input responses into a database.

12.8.3 Selection Process for Vendor Engagement Meetings

Due to the amount of interest expressed by potential vendors in the Smart Columbus program, it will not be feasible for the city to meet with every vendor in the first round of vendor engagement meetings. The Smart Columbus PMO will work in consultation with USDOT, committed project partners, and local economic development groups to place vendors into groups and send invitations to present at engagement meetings. The following factors will determine the order in which potential vendors are contacted:

• Alignment with work elements identified in the scope of work for the USDOT contract
• Willingness to make an in-kind contribution to the Smart Columbus program
• Alignment with city, regional, or state economic development goals

The DPgM (Partnerships and Policy) convenes a weekly meeting to review new vendor contacts and determine which potential vendors to contact. Additional participants in the meeting include a private sector small business representative (not a vendor or prospective vendor); a representative from the Mayor’s office assigned to Smart Columbus; a representative of the city’s Economic Development Division. The DPgM (Partnerships and Policy) will confer with PMs and Project Leads when contacting vendors for insights and confirmation of a vendor’s relevance to the Smart Columbus program.

The team participating in the review of vendor contacts assists in engaging vendors not found to have immediate and direct interest to the grant funded projects. Recognizing DBEs may not have the resources to make an in-kind contribution to the program, the city has set a goal of 15% DBE participation to encourage the consulting teams to solicit work from minority and women-owned businesses. Additionally, the city hosted a Small Business Conference in August 2017 to help small and start-up businesses develop synergies with prominent, national companies that have interest in participating in the program.

12.8.4 Vendor Engagement Meeting Structure

The city will invite potential vendors to participate in engagement meetings based on the above criteria as internal city resources and project needs allow. The following guidelines shall be observed:

• In accordance with the City of Columbus Ethics Policy, no gifts or other items of value should be provided to any staff of the Smart Columbus PMO.

• Each vendor will have 45 minutes to present (30-minute presentation, 10-minute question and answer (Q&A) Session, and 5-minute Wrap-up). Time limits will be strictly enforced. The city may
request that potential vendors speak to specific topics in their presentations in order to ensure uniformity in the information that is received.

- Presentations can be done remotely with arrangements made at least 5 business days in advance of scheduled presentation date.
- Vendors are asked to limit presentation attendees to 4.
- Peripheral equipment will be provided for vendor presentations upon request. Requests should be made at least 5 business days prior to scheduled presentation date.
- There is no cost to vendors to participate in a vendor engagement meeting. Time spent by PMO staff for these meetings is charged to USDOT only if specifically related to a project or includes a cost-share partner as per the Award.

Vendors will participate in vendor engagement meetings at their own cost.

12.9 Consultant Management

12.9.1 Consulting Team Leadership

Table 24 provides key points of contact for the consultants already under contract on the Smart Columbus program.

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Lead</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prime Consultants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HNTB Ohio Inc.</td>
<td>Diane Newton</td>
<td>Project Management, Data, System Development and Integration, Implementation, SCOS, EHS, and EV</td>
</tr>
<tr>
<td>Engage Public Affairs</td>
<td>Marie Keister</td>
<td>Communications/Outreach</td>
</tr>
<tr>
<td><strong>Sub-Consultant to HNTB Ohio Inc.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WSP</td>
<td>Tom Timcho</td>
<td>Connected Vehicle Environment</td>
</tr>
<tr>
<td>*ZED Digital</td>
<td>Sumithra Jagannath</td>
<td>Data Aggregation</td>
</tr>
<tr>
<td>*Diversified Systems</td>
<td>Archie Williamson</td>
<td>IT Services</td>
</tr>
<tr>
<td>EMH&amp;T, Inc.</td>
<td>Sandy Doyle-Ahern</td>
<td>Easton Coordination and Signals</td>
</tr>
<tr>
<td>CDM Smith</td>
<td>Randy Butler</td>
<td>Freight, Truck Platooning</td>
</tr>
<tr>
<td>*AEC</td>
<td>Jordan Steele</td>
<td>Power and Lighting</td>
</tr>
<tr>
<td>CTL Engineering, Inc.</td>
<td>Jason Standingfer</td>
<td>Wireless testing</td>
</tr>
<tr>
<td>*Smart Services, Inc.</td>
<td>Todd Stanhope</td>
<td>Data Collection and Survey</td>
</tr>
<tr>
<td>*CCI Engineering</td>
<td>Jack Ray</td>
<td>CADD Support</td>
</tr>
</tbody>
</table>
### Firm Name

<table>
<thead>
<tr>
<th>Lead</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savvas Sophocleous</td>
<td>SUE</td>
</tr>
</tbody>
</table>

**Sub-Consultant to Engage Public Affairs**

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Lead</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy Epson</td>
<td>Missi Burris</td>
<td>Media Relations/ PR/ Social Media</td>
</tr>
<tr>
<td>Warhol &amp; WALL ST.</td>
<td>Yohannan Terrell</td>
<td>Creative</td>
</tr>
<tr>
<td>The Saunders Company</td>
<td>Gayle Saunders</td>
<td>Media Relations</td>
</tr>
<tr>
<td>Policy Works LLC</td>
<td>Dannette Palmore</td>
<td>Engagement/ Outreach</td>
</tr>
<tr>
<td>L. Price &amp; Associates</td>
<td>Larry Price</td>
<td>Engagement/ Faith Leader</td>
</tr>
<tr>
<td>PMM Agency</td>
<td>Kimberly Blackwell</td>
<td>Conferences/ Events</td>
</tr>
<tr>
<td>Ice Miller LLP</td>
<td>Greg Dunn</td>
<td>Thought Leadership/ Telecommunications</td>
</tr>
</tbody>
</table>

*ODOT DBE Certified

#### 12.9.2 Travel and Other Expenses

All travel and other allowable expenses will be subject to the federal guidelines. Travel by the city will be approved by USDOT before expenses are incurred and billed.
Chapter 13. Partnerships

13.1 Partnership Management Approach

The focus of this section is on the management of partners and potential partners. For the Smart Columbus program, partners are generally defined as the agencies, non-profits or companies that have committed to contribute resources such as cash, program funds or in-kind donations toward the Smart Columbus program that offset expenditure of grant or local match resources that otherwise would need to be invested to implement that program and associated projects. Potential partners are those that have proposed a partnership to the Smart Columbus program, which is under evaluation by the PMO and may include discounted services or two-way partnerships as outlined in the application.

The Award assigns partners to three categories:

- **Cost Sharing Contributions:** Public sector partners which provide cash or in-kind contributions to the program, which count as a local match to the USDOT grant funding, and which are subject to the terms of the Award and the requirements of the grant regulation at 2 CFR 200. Costs must be incurred during the period of performance of the Award.

- **Key Leveraged Partners and Key Leveraged Electrification Partners:** Third-party organizations contributing resources in support of the Smart Columbus program. These partner resources are considered essential to the demonstration and are, therefore, approved and incorporated into the Award for informational and reporting purposes. These partner resources are not subject to the terms of the award and the requirements of the grant regulation at 2 CFR 200.

13.2 Current Partnerships

Table 25 lists Cost Share Contributions and Table 26 lists Key Leveraged Partners from Section B of the Award and updated contributions and new Key Leveraged Partners added since executing the Award.

<table>
<thead>
<tr>
<th>Estimated Funding Source</th>
<th>Estimated Cost Share Amount</th>
<th>Estimated Cash/In-kind</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Columbus</td>
<td>$8,000,000</td>
<td>Cash</td>
</tr>
<tr>
<td>State of Ohio (ODOT)</td>
<td>$7,000,000</td>
<td>In-kind</td>
</tr>
<tr>
<td>Franklin County</td>
<td>$4,000,000</td>
<td>$1,000,000 cash, $3,000,000 in-kind</td>
</tr>
<tr>
<td>Total</td>
<td>$19,000,000</td>
<td></td>
</tr>
<tr>
<td>Key Partner</td>
<td>Description of Resources</td>
<td>Estimated Amount</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Paul Allen’s Vulcan, Inc.</td>
<td>Funding to support the deployment of electric vehicles and other carbon emission reduction strategies.</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>Autodesk</td>
<td>Access throughout the duration of USDOT grant to <em>Autodesk AEC Collection</em>, an information modeling platform that uses 3-D visualizations and real-world data to plan major engineering projects; $50,000 for consulting services to use AEC Collection; on-site training; and support.</td>
<td>$219,060 *</td>
</tr>
<tr>
<td>Amazon Web Services (AWS)</td>
<td>Credits to AWS Cloud services and AWS Professional Services. AWS will also provide solution architecture and best practices guidance to the Recipient.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>NXP</td>
<td>Wireless communication modules that allow cars to securely exchange data, such as hazard warnings, over distances of more than a mile to prevent accidents and improve traffic flow.</td>
<td>$2,500,000</td>
</tr>
<tr>
<td>Alphabet’s Sidewalk Labs</td>
<td>Consultation and recommendations on best practices for solutions to non-emergency medical transportation needs for expectant mothers.</td>
<td>$230,000</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>AT&amp;T has committed to provide in-kind partnering to the city to assist with the deployment of the Connected Vehicle Environment (CVE), or other projects to be determined during system engineering. The proposed partnering includes professional services and technical support resources; communications and data management technologies; USB cellular modems and SIM cards and connectivity; hardware to support communications and data management services.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Continental</td>
<td>Continental will deploy a roadside infrastructure sensing system; onboard vehicle-to-everything (V2X) system, and DSRC to enable communication between roadside and onboard systems; API interfaces on cloud backend comprised of APIs for accessing data from both onboard and roadside V2X systems; basic safety messages to demonstrate the effectiveness of the CVE on alleviating transportation-</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Key Partner</td>
<td>Description of Resources</td>
<td>Estimated Amount</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Experience Columbus</td>
<td>Experience Columbus will provide funding from local parking providers to assist with the deployment of the Event Parking Management project.</td>
<td>$100,000</td>
</tr>
<tr>
<td>OSU</td>
<td>OSU will provide funding to assist with the implementation of the CEAV project.</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Greater Columbus Art Council (GCAC)</td>
<td>GCAC will provide funding to assist in the communications and outreach of the USDOT grant projects.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>HERE, Inc.</td>
<td>HERE is proposed to provide in-kind mapping and application support to the MMTPA/CPS project.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>INRIX</td>
<td>INRIX is proposed to provide in-kind traffic data for use in performance measurement; and the INRIX ParkMe mobile app in support of the Event Parking Management project.</td>
<td>$1,424,000</td>
</tr>
<tr>
<td>SPARC</td>
<td>SPARC is proposed to support the testing of vehicles pre-deployment for the CVE, CEAV, freight signal priority and truck platooning projects.</td>
<td>$388,200</td>
</tr>
<tr>
<td>Peloton</td>
<td>Peloton is proposed to implement the truck platooning project.</td>
<td>$165,000</td>
</tr>
<tr>
<td>Honda</td>
<td>Honda is proposed to provide 200 Honda associate vehicles to be equipped by Smart Columbus with On-Board Units for the CVE project.</td>
<td>$2,600,000</td>
</tr>
<tr>
<td>Battelle</td>
<td>Battelle is proposed to support the PMO for program management; safety plan development; and system integration of the CVE project.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Econolite</td>
<td>Econolite is proposed to support the CVE project with in-kind traffic signal.</td>
<td>$900,000 *</td>
</tr>
</tbody>
</table>
### Key Partner

<table>
<thead>
<tr>
<th>Key Partner</th>
<th>Description of Resources</th>
<th>Estimated Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbus Partnership</td>
<td>Columbus Partnership is proposed to assist in the implementation of the CEAV project ($5,000,000) and to provide sustainment cash as needed for USDOT and/or electrification deployments ($10,000,000)</td>
<td>$15,000,000</td>
</tr>
<tr>
<td>Siemens</td>
<td>Siemens is proposed to support the CVE project with in-kind traffic signal equipment, including Roadside Units and management software.</td>
<td>$385,000 **</td>
</tr>
<tr>
<td>COTA</td>
<td>As the owner of public transit in central Ohio, COTA is proposed to support through collaboration with Smart Columbus, all the projects in the program where COTA has an interest or need to participate and collaborate to ensure project success, including SMH, MMTPA/CPS, CEAV, and Mobility App for Users with Cognitive Disabilities.</td>
<td>$9,000,000 **</td>
</tr>
</tbody>
</table>

**TOTAL** $52,901,260 *

*Amount updated subsequent to execution of Award*  
**New Key Leveraged Partner Resources**

### 13.3 Roles and Responsibilities

Table 27 shows the roles and responsibilities of city staff on partnering.

**Table 27. Roles and Responsibilities for Partnering**

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>CINO</td>
<td>• Executes awards for Smart Columbus as authorized by Columbus City Council Ordinance 1901-2017**<a href="#">57</a></td>
</tr>
</tbody>
</table>
| DCINO            | • Provides input/evaluation on partnership strategy  
|                  | • Acts as backup for the CINO in absence                                           |
| PgM              | • Approves and provides input/evaluation on partnership strategy  
|                  | • Reviews and approves partnership proposals                                       |

---

*Amount updated subsequent to execution of Award*  
**New Key Leveraged Partner Resources**

---

### Individual/Group Responsibilities

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Coordinates partnering with other project aspects (scheduling and performance reporting)</td>
</tr>
<tr>
<td>DPgM (Partnerships and Policy)</td>
<td>• Negotiates and develops partnerships</td>
</tr>
<tr>
<td></td>
<td>• Reports on partnership status</td>
</tr>
<tr>
<td>Fiscal/Procurement Officer</td>
<td>• Provides input/evaluation on partnership strategy</td>
</tr>
<tr>
<td>City PM</td>
<td>• Provides input/evaluation on partnership strategy and partnership proposals</td>
</tr>
<tr>
<td></td>
<td>• Manages partners during implementation</td>
</tr>
<tr>
<td>Project Leads (Consultant)</td>
<td>• Provides input/evaluation on partnership proposals</td>
</tr>
</tbody>
</table>

### 13.4 Partner Awards

The PMO has established a standard partnering award with the Fiscal/Procurement Officer and City Attorney. The standard partnering award, draft partnering awards in negotiation and executed partnering awards are maintained in the Vendor Management Documentation section of the PMO SharePoint site. Refer to Section 5 (Document Management) for more information on the SharePoint site.

Per Section B.5 of the Award, the city will provide the USDOT AO an electronic copy of all executed partnering awards within one week after execution. The city will also provide to the AO for approval any subsequent partnering award amendments executed during the award period of performance.

The Award Task E: Data Management and Support for IE stresses the importance of data management and open data to the Smart Columbus program and provides necessary guidance and requirements for data generated by the Smart Columbus program and program partners. As such, when the PMO enters partnering awards with third-party providers of data, the partnering award will document the terms under which the data is being provided or acquired. The PMO will require, to the extent possible, partnering awards to state that third-party data sources shall be provided as real-time data streams and provided to the PMO with unlimited rights to use and disseminate the real-time and archived data for any purpose, consistent with applicable data security and privacy requirements. The agreed upon language is included for use below:

---

• Preference for real-time data from third-party providers, etc.

The Recipient shall sign a MOU or equivalent with third-party providers of data, including Contractors, that document the terms under which the data is being provided or acquired. The Recipient shall require, to the extent possible, such awards to state that third-party data sources shall be provided as real-time data streams and provide the Recipient with unlimited rights to use and disseminate the real-time and archived data for any purpose, consistent with applicable data security and privacy requirements.

• Requirement for real-time Basic Safety Message (BSM) data feed, though flexibility on scale

During the SCC Demonstration, the Recipient shall provide a real-time, streaming data feed from CV, including but not limited to the Recipient’s standards-compliant BSMs data, for operational testing and use by the Recipient and third-party users.

Note: To control costs and complexity, the Recipient may choose to limit the scale and scope of this real-time data feed. For example, the Recipient may limit the geographic area from which this real-time data will be disseminated or the length of time the real-time feed will be made available.

• Preference for open source tools

The USDOT strongly prefers that the Recipient acquire and develop open source technologies throughout the course of the SCC Demonstration and that any code developed for the project is, via contract or equivalent mechanism, open source and available for license-free use and enhancement by third parties. Data rights under the Award shall be in accordance with 2 CFR 200.315, Intangible property.

13.5 Partnership Approvals and Changes

The Award addresses process and requirements for removing, replacing or diverting its program and project partners.

In the event the city determines the need to remove, replace, or divert a Key Leveraged Partner Resource, or significantly change the nature of a Key Partner award, the city must notify the AO in writing to request prior written approval of the change.

The city must obtain prior written approval from the AO before entering into a new award with the proposed replacement partner or resource, or executing an amendment that significantly changes a Key Partner award. This requirement will enable the USDOT to review and approve in advance significant changes in the planned use of Key Leveraged Partner Resources. The city’s request shall provide the following:

• Details of the proposed change
• Describe the circumstances of the change
• Provide the city’s assessment of the impact of the change upon the demonstration

The author of the request shall draft the proposed request and submit to the PgM for approval. The PMO has drafted a template for the written request to USDOT, which is available for use in the Vendor Management Documentation section of the PMO SharePoint site.
13.6 Partnership Management System and Reporting

Partner status reports and documentation will be maintained in the Vendor Management Documentation section of the PMO SharePoint site. Refer to Section 5 (Document Management) for a detailed description of the system and information used to maintain and report on the status of partnerships. Members of the PMO may obtain status of partnerships by directly accessing the site. The PMO includes in its Monthly Progress Report a monthly partnership report generated from the system and provided to USDOT and PMO members.

13.7 Partnership Process

Refer first to Section 12 (Procurement Management) for how the PMO engages vendors and potential partners. If a potential partner has been identified through the vendor engagement process, the DPgM (Partnerships and Policy) engages the potential partner, the PMs and Consultant Project Leads (collectively, “Project Team”) to vet the partner and negotiate a partnership award to the point of either an executed partnership award, or no partnership. The following steps are followed to negotiate a partnering award:

1. The DPgM (Partnerships and Policy) and Project Team hold introductory discussion with potential partner.
2. The DPgM (Partnerships and Policy) and Project Team next determine should the PMO conclude discussion with the potential partner or continue to the next step in the negotiation. The DPgM (Partnerships and Policy) updates the Partner Management System.
3. If the determination is to conclude the discussion, then the DPgM (Partnerships and Policy) sends a closing email to potential partner, updates the Partner Management System and notifies the PgM and Project Team.
4. If the determination is to proceed to the next step, then the DPgM (Partnerships and Policy) drafts the partnering award and emails it to the potential partner.
5. Following the potential partner returning a mark-up of the draft partnering award, the DPgM (Partnerships and Policy) reviews the proposed changes with the Project Team. The DPgM (Partnerships and Policy) provides status update to the PgM.
6. The DPgM (Partnerships and Policy) may hold a meeting with the potential partner and the Project Team to review and clarify comments.
7. Depending on the nature of comments proposed by the potential partner and review comments by the Project Team, the DPgM (Partnerships and Policy) will consult with the Columbus City Attorney representative assigned to the PMO.
8. The DPgM (Partnerships and Policy) addresses comments from the Project Team and City Attorney representative, and emails the cooperative award draft with comments to the potential partner. The DPgM (Partnerships and Policy) updates the Vendor Management System and provides status update to the PgM.
9. Steps 5 – 8 will be repeated until all comments by the PMO and potential partner are mutually agreed upon, or if not, the DPgM (Partnerships and Policy) recommends to the PgM to close the
negotiations. If the PgM approves closing the negotiations, the DPgM (Partnerships and Policy) updates the Vendor Management System and notifies the potential partner. If the PgM disapproves closing the negotiation, the DPgM (Partnerships and Policy) repeats steps 6-8 with the potential partner, Project Team and PgM.

10. If all comments are mutually agreed upon by the PMO and the potential partner, the DPgM (Partnerships and Policy) provides a copy of the final award to the PgM for approval. Upon PgM approval, the DPgM (Partnerships and Policy) emails the final award to the potential partner in PDF format for signature. The DPgM (Partnerships and Policy) updates the Vendor Management System and provides status update to the PgM.

11. The potential partner signs the PDF of the award and sends back to the DPgM (Partnerships and Policy).

12. The DPgM (Partnerships and Policy) checks the signed award for completeness, initials the award, then sends to the CINO for signature. The CINO signs the award and returns it to the DPgM (Partnerships and Policy). The DPgM (Partnerships and Policy) updates the Vendor Management System and provides status update to the PgM.

13. The DPgM (Partnerships and Policy) scans the PDF of the executed award, uploads the signed PDF to and updates the Vendor Management System, and emails the executed award to the partner, and USDOT AO and AOR.

14. The DPgM (Partnerships and Policy) notifies the PgM, appropriate PM and Project Leads and hands off the partner to the appropriate PM. The DPgM (Partnerships and Policy) updates the Vendor Management System.

15. If the executed partnership requires expenditure of local match or grant funds, the DPgM (Partnerships and Policy) then prepares with the Project Team a justification request for bid waiver or sole source following 2 CFR 200.320.

16. The DPgM (Partnerships and Policy) provides the draft justification request to the PgM for review. The PgM provides review comments back to the DPgM (Partnerships and Policy). The DPgM (Partnerships and Policy) edits the document and provides back to the PgM for approval. The PgM approves the document and provides to the CINO for approval. The CINO approves the justification.

17. The PgM emails the justification request to the AO for approval. The AO reviews and approves or disapproves the justification request.

If the justification request is denied, the PgM reviews the denial with the AO and DPgM (Partnerships and Policy) and addresses the comments. Once the justification request is approved by the AO, the DPgM (Partnerships and Policy) then works with the Project Team to draft legislation for City Council approval. Refer to Section 12 (Procurement Management Approach) of the PMP for the legislation preparation and approval process.
Chapter 14. Quality Management

Quality Management includes the processes and activities of the Smart Columbus Team that determine quality policies, objectives, and responsibilities so that the Smart Columbus program will achieve its objectives. The QMP documents the plan for effectively managing the quality of the deliverables and products produced for the Smart Columbus program. This section strictly discusses the quality planning, QC and QA processes. Other processes that can affect the quality of a deliverable, such as assignment of the proper staff, are discussed in other sections of the PMP.

14.1 Management Approach

All members of the Smart Columbus Project Team will play a role in quality management. It is imperative the city ensures work is completed at an adequate level of quality defined by the QMP from individual work packages to the final project deliverable. The QMP establishes and maintains documented procedures to control and verify that design documents adhere to the project scope of services. Quality Control (QC) will apply to all stages of the project development process and to all work products, including planning documents, trade studies, plans, reports, white papers, procurement documents, cost estimates, inspection and testing reports, specifications, computer programs, software input and output files, design tables, or other products that provide analytical results to develop and/or check designs.

A QC Team will consist of a Systems Engineer from the Project Technical Team and QC Reviewer(s) from the Smart Columbus PMO. The primary role of the Systems Engineer is to perform reviews to ensure the documents are technically correct, consider how an individual project is integrated with other Smart Columbus projects or existing systems, and confirm that the Smart Columbus program is delivering a holistic, integrated smart city solution. The primary role of the QC Reviewer(s) is to perform detailed checks of technical documents, specifications, design calculations, and review of design plans as outlined in the QMP. Refer to Appendix E for Forms SMRT-08 (Review of Reports Guide) and Form SMRT-09 (Review and Checking of Technical Specifications Guide) for additional information. The QC Team will also include the Project Lead responsible for directly supervising the project design. They will certify the QC form for a given submittal of the project. The (Consultant) Quality Manager will monitor, audit, report, and analyze processes to determine compliance with quality procedures and requirements. The (Consultant) Quality Manager will be responsible for management of the design QA tasks.

QA will be monitored by performing quality audits to verify that project quality management activities comply with QMP procedures. The (Consultant) Quality Manger shall be responsible for managing the project audit program. The City Quality Auditor has the overall responsibility for ensuring compliance with the QMP procedures. Regularly scheduled audits will be supplemented with unscheduled audits when it is suspected that QC problems exist. The Quality Auditor will prepare an audit report that includes a description of any violation of procedures and a recommended response to correct violations.
14.2 Roles and Responsibilities

The entire Smart Columbus Team has the responsibility and authority to contribute to the achievement of quality objectives. The responsibilities of all personnel who manage, perform, and ensure the quality of the work include:

- Initiate action to prevent the occurrence of non-conforming work
- Identify, evaluate, and document quality problems
- Recommend or initiate quality improvement solutions
- Stop incorporating the work into the projects, when non-conforming work is identified, until the deficiency is corrected.

The primary roles and responsibilities of the individuals that comprise the Quality Organization and personnel interacting within are summarized in Table 28.

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Columbus PgM</td>
<td>• Review Nonconformance Reports.</td>
</tr>
<tr>
<td></td>
<td>• Assist in developing a plan for process change to eliminate non-</td>
</tr>
<tr>
<td></td>
<td>conformance trends.</td>
</tr>
<tr>
<td></td>
<td>• Ensure deliverables adhere to the project schedule.</td>
</tr>
<tr>
<td></td>
<td>• Monitor project controls and administration to maintain timely</td>
</tr>
<tr>
<td></td>
<td>tracking and reporting of project progress.</td>
</tr>
<tr>
<td></td>
<td>• Has authority to stop any and all work that does not meet the</td>
</tr>
<tr>
<td></td>
<td>standards, specifications, or criteria established for the</td>
</tr>
<tr>
<td></td>
<td>projects.</td>
</tr>
<tr>
<td>Quality Manager (Consultant)</td>
<td>• This includes conducting deliverable reviews, ensuring that</td>
</tr>
<tr>
<td></td>
<td>technical reviewer comments are appropriately adjudicated and</td>
</tr>
<tr>
<td></td>
<td>resolved, auditing to verify that design packages are in</td>
</tr>
<tr>
<td></td>
<td>conformance with the QMP, looking at project initiatives to</td>
</tr>
<tr>
<td></td>
<td>ensure they are holistic in approach and tightly integrated</td>
</tr>
<tr>
<td></td>
<td>with SCOS, ensuring the QMP is followed, and compiling and</td>
</tr>
<tr>
<td></td>
<td>maintaining documentation. The QM will also communicate and</td>
</tr>
<tr>
<td></td>
<td>coordinate with the Smart Columbus team to facilitate decisions</td>
</tr>
<tr>
<td></td>
<td>and encourage collaboration.</td>
</tr>
<tr>
<td></td>
<td>• Responsible for the overall implementation and management of</td>
</tr>
<tr>
<td></td>
<td>the QA process described in the QMP.</td>
</tr>
<tr>
<td></td>
<td>• Conduct deliverable reviews.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that technical reviewer comments are appropriately</td>
</tr>
<tr>
<td></td>
<td>adjudicated and resolved.</td>
</tr>
<tr>
<td></td>
<td>• Audit to verify that design packages are in conformance with</td>
</tr>
<tr>
<td></td>
<td>the QMP.</td>
</tr>
<tr>
<td></td>
<td>• Ensure QMP is followed.</td>
</tr>
<tr>
<td>Individual/Group</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>• Compile and maintain documentation.</td>
</tr>
<tr>
<td></td>
<td>• Communicate and coordinate with Smart Columbus Team to keep Team informed, facilitate decisions, and encourage collaboration.</td>
</tr>
<tr>
<td>Quality Auditor (City)</td>
<td>• Responsibility for ensuring compliance with the QMP procedures.</td>
</tr>
<tr>
<td></td>
<td>• Perform periodic audits to verify that design documents have been checked and/or reviewed in accordance with the QMP.</td>
</tr>
<tr>
<td></td>
<td>• Prepares an audit report that includes a description of any violation of procedures and a recommended response to correct violations.</td>
</tr>
<tr>
<td>Consultant PM</td>
<td>• Ensure conformance with contract documents and client requirements.</td>
</tr>
<tr>
<td></td>
<td>• Ensure QC processes and activities as described in the QMP are being followed.</td>
</tr>
<tr>
<td></td>
<td>• Determining in concert with the QM, the appropriate quality check and review activities to be performed on deliverables.</td>
</tr>
<tr>
<td></td>
<td>• Overseeing implementation of the QMP and resolving related issues.</td>
</tr>
<tr>
<td></td>
<td>• Ensuring appropriate reviewers, resources, schedule and budget for QMP activities are provided.</td>
</tr>
<tr>
<td></td>
<td>• Has authority to stop any and all work that does not meet the standards, specifications, or criteria established for the Project.</td>
</tr>
<tr>
<td>City of Columbus PM</td>
<td>• Ensure conformance with the Award.</td>
</tr>
<tr>
<td></td>
<td>• Responsible for coordinating city and stakeholder reviews.</td>
</tr>
<tr>
<td></td>
<td>• Ensure QC processes and activities as described in the QMP are being followed.</td>
</tr>
<tr>
<td></td>
<td>• Review QA audit findings and ensure that corrective actions are implemented when deficiencies are reported by the QM or others involved in the work.</td>
</tr>
<tr>
<td>Project Lead (Consultant)</td>
<td>• Responsible for supervising design within their respective areas of expertise in accordance with the contract documents.</td>
</tr>
<tr>
<td></td>
<td>• Coordinate the design work effort with the design efforts of technical support staff.</td>
</tr>
<tr>
<td></td>
<td>• Compile and maintain review documents and quality records required by the QMP.</td>
</tr>
<tr>
<td>Systems Engineer (Consultant)</td>
<td>• Responsible for the overall process of defining, developing, operating, and maintaining, the proposed project/system.</td>
</tr>
<tr>
<td></td>
<td>• Ensuring the integration of related projects.</td>
</tr>
<tr>
<td></td>
<td>• Organize and coordinate other engineering activities.</td>
</tr>
<tr>
<td></td>
<td>• Ensure technical accuracy and conformance with relevant Systems Engineering standards.</td>
</tr>
</tbody>
</table>
**Individual/Group** | **Responsibilities**
--- | ---
QC Reviewers (City and Consultant) | - Support the Project Leaders throughout the project. Available for discussions with the project team members prior to formal deliverable review points.
- Responsible for detailed checks of all work products, including plans, reports, white papers, procurement documents, cost estimates, inspection and testing reports, specifications, computer programs, software input and output files, design tables, or other products that provide analytical results to develop and/or check designs for their technical disciplines.
- Evaluate and comment on the following:
  - Do the results support the conclusions?
  - Have the requirements been satisfied?
  - Are the methods/procedures appropriate?
  - Are there requirements that were not met?
  - Are these appropriately documented?

### 14.2.1 Technical Review Responsibilities by Project

Table 29 contains a breakdown of systems engineering, quality control and quality manager review responsibilities for each project.

**Table 29. Review Responsibilities**

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Lead</th>
<th>City of Columbus PM</th>
<th>Systems Engineer</th>
<th>QC Reviewer(s)</th>
<th>Quality Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Connected Vehicle Environment</td>
<td>Tom Timcho</td>
<td>Ryan Bollo</td>
<td>Robert James</td>
<td>Scott Shogan</td>
<td>Skip Torville</td>
</tr>
<tr>
<td>2. SCOC</td>
<td>TBD</td>
<td>Brian King</td>
<td>Robert James</td>
<td>Aaron Ford</td>
<td>Skip Torville</td>
</tr>
<tr>
<td>3. Common Payment System</td>
<td>Alex Kavanagh</td>
<td>Andy Wolpert</td>
<td>Robert James</td>
<td>Jeff Siegel</td>
<td>Skip Torville</td>
</tr>
<tr>
<td>4. Multi-Modal Trip Planning App</td>
<td>Alex Kavanagh</td>
<td>Andy Wolpert</td>
<td>Robert James</td>
<td>Jeff Siegel</td>
<td>Skip Torville</td>
</tr>
<tr>
<td>5. SMH</td>
<td>Matt Graf</td>
<td>Andy Wolpert</td>
<td>Robert James</td>
<td>Jason Smallwood</td>
<td>Skip Torville</td>
</tr>
<tr>
<td>6. Mobility Assistance for People with Cognitive Disabilities</td>
<td>Alex Kavanagh</td>
<td>Andy Wolpert</td>
<td>Robert James</td>
<td>Jeff Siegel</td>
<td>Skip Torville</td>
</tr>
</tbody>
</table>
14.3 Quality Objectives

The following represents the quality objectives which support the execution of the QMP:

- Thorough understanding of requirements and expectations.
- Selecting and assigning the right resources to meet the needs of the Smart Columbus program.
- Managing the quality of applicable work and deliverables.
- Submitting deliverables that meet project requirements, on schedule and within program budget.
- Maintaining quality records providing objective evidence of execution of the QMP.
- No work product shall be released without an independent review deeming the work product is of an acceptable level of quality.

Quality reviews are conducted by the assigned systems engineer and QC reviewers prior to submittal of deliverables and are overseen by the QM. Comments and changes identified in these reviews shall be incorporated into the deliverables before submittal. A Form SMRT-01 Quality Compliance and Form SMRT-02 Comment Resolution (see Appendix E) shall be completed for every project deliverable.

14.4 Quality Verification

The USDOT, City of Columbus, Project Team, and appropriate stakeholders will have input on the projects as they are developed, through document/design reviews performed at defined stages. The review process will consist of distribution of systems engineering documents, design packages, preparation of written comments by reviewers, and comment resolution. The types of reviews to be performed along summarized in the following sections.
14.4.1 Vee Systems Engineering Document Submittal

The two primary submittal types are described below. Systems Engineering Documents are defined in the Systems Engineering Management Plan. All submittals shall be made in accordance with the project scope.

- **Draft Submittal**
  - Provide a formal opportunity for USDOT, City of Columbus, partners, and stakeholders to review the document to ensure the project has progressed appropriately along the Systems Engineering process and conforms to the scope and requirements. Prior to submittal to the USDOT, the City of Columbus, partners, and stakeholders review and provide comments to the Project Lead.
  - Confirm project is being coordinated with connected projects, project owners, partners, and stakeholders.
  - USDOT will provide review comments within 14 working days of receipt.
  - After the City of Columbus has reviewed the comments and provided draft responses, a walkthrough will occur with the USDOT to discuss comments and finalize the disposition of comments. Refer to the SEMP for more information.

- **Final Submittal**
  - The Final Submittal is prepared when all comments from the Draft Submittal have been addressed and appropriately incorporated.
  - The submittal will include comment responses from the Draft Submittal.

USDOT will confirm acceptance of the Final Submittal within 10 working days of receipt.

14.4.2 Quality Assurance/Quality Conformance Process

The following summarizes the QA/QC verification process for the Smart Columbus program. The QA/QC process is summarized in Figure 13, with the steps described immediately following the Figure.
Figure 13. Vee Systems Engineering QA/QC Verification Process

Source: City of Columbus, October 2017
1. The Project Lead will initiate the QA/QC review process by providing a Quality Compliance Form, blank Comment Resolution form, review plans and documents to the following reviewers as noted in Table 29:
   a. Systems Engineer(s)
   b. QC Reviewer(s)

2. The Systems Engineer and QC Reviewer(s) will provide comments via a Comment Resolution Form and tracked changes/check prints. The Systems Engineer and QC Reviewer(s) will sign the Quality Compliance Form.

3. The Project Lead will review comments and schedule a comment resolution meeting/conference call with the reviewers, if necessary.

4. The (Consultant) Quality Manager will confirm whether the review comments from the reviewers have been addressed and will ensure compliance of technical and management aspects of project quality plan. After verification, the (Consultant) Quality Manager will sign the Quality Compliance Form for the deliverable and notify the Consultant PgM and Project Lead that the package is ready for submittal to the City of Columbus.

5. After revisions to plans and documents are completed, the Project Lead will post the Quality Compliance Form, Comment Resolution Form, and “Clean Copy” of documents in the appropriate folder on SharePoint.

6. The Project Lead will send an email to the City of Columbus PM with the link to the “Clean Copy” for review.

7. The City of Columbus, partners, and stakeholders will have 6 calendar days to review and provide comments to the Project Lead. Comments will be provided on a Comment Resolution Form and tracked changes/check prints.

8. The Project Lead will review comments and schedule a comment resolution meeting/conference call with the City of Columbus, if necessary.

9. The Project Lead will address comments and initiate the final review process by providing a Quality Compliance Form, final Comment Resolution form, review plans and documents to the Systems Engineer and QC Reviewer(s).

10. The Systems Engineer and QC Reviewer(s) will verify the City of Columbus comments have been addressed and will sign the Quality Compliance Form.

11. The (Consultant) Quality Manager will ensure compliance of technical and management aspects of the QMP. After verification, the (Consultant) Quality Manager will sign the Quality Compliance Form for the deliverable and notify the Consultant PgM and Project Lead that the package is ready for submittal to the City of Columbus. The (Consultant) Quality Manager will log, scan and electronically file QC documentation on SharePoint.

12. The Project Lead will send an email to the City of Columbus PM with the link to the “Clean Copy” for submittal to the USDOT.

14.4.3 Agile Systems Engineering Quality Process

QA is the responsibility of the entire agile team and plays a role throughout the entire scrum process to ensure that products and processes conform to their specific requirements and acceptance criteria.
defined in their user stories and overall product vision. Taking an agile philosophy of retrospection and continual improvement, each ceremony within scrum is an opportunity to evaluate and revise processes, set up measurement programs to evaluate those processes, and identify opportunities for improvement of those processes. This includes analysis tools and metrics available through Pivotal Tracker, processes defined within the SEMP and PMP, development team’s definition of done, and testing procedures. The following represents how quality processes are integrated in to the various scrum ceremonies and activities.

14.4.3.1 Grooming

Agile led projects follow the process identified in the Form SMRT-10, Grooming Process (see Appendix E), to promote the maturation of actionable well-defined stories ready for sprint. This process ensures that the backlog remains populated with items that are relevant, detailed and estimated to a degree appropriate with their priority, and in keeping with current understanding of the project and its objectives as defined in the Product Vision. As the backlog is dynamic, grooming supports the idea that at any moment a "sufficient" number of stories should be ready for scheduling in the next few sprints. Lastly, the process allows for a smoother Sprint Planning meeting and Sprint Execution because it provides a way for the team to ask questions ahead of time, plan, and identify gaps to mitigate issues.

14.4.3.2 Sprint Planning

Agile led projects follow the process identified in Form SMRT-11, Definition of Ready (see Appendix E) to promote the maturation of actionable well-defined stories ready for sprint. This process avoids beginning work on stories that do not have clearly defined acceptance criteria, which usually translates into costly back-and-forth discussion. The process also provides the team with an explicit award allowing it to "push back" on accepting ill-defined features to work on. Lastly, setting a strong definition of ready substantially improves the Scrum team’s chance of successfully meeting its sprint goal, acceptance of the story and value to the originating user or persona of the story.

14.4.3.3 Sprint

Agile led projects support a collaborative team environment where each member plays a role in the quality process. The daily stand ups allow for the team to identify potential variances and risk early in the process, mitigate and resolve those risks to bring the product back into compliance with the acceptance criteria, and optionally revise the process to ensure the error doesn't occur again. The daily stand ups also provide an opportunity for the team to identify any blockers restricting or precluding their ability to deliver to the acceptance criteria.

Demonstrations and engagement during the sprint cycle allows the development team to show the Business Owner exactly how the new feature works and allows them to ask questions to ensure the product being produced meets the acceptance criteria and is on track for acceptance at sprint review. These demonstrations also bring to light issues the developer may not have thought of yet and help shorten the review time between development and acceptance.

Agile led projects follow the process identified in the Definition of Done document to promote the common, consistent and well-defined understanding of what done looks like for a story to be accepted. Key quality components of the definition of done are peer testing, documentation and regression testing, which must be completed before the story can be reviewed for acceptance. With testing happening throughout the entire duration of the sprint, issues can be found and resolved earlier leading to a higher quality product. Additionally, having the code, product and process well documented promotes efficient
testing and serves to highlight any gaps in the product that need to be addressed prior to review. Agile led projects keep documentation lean and adaptive to change, but sufficient to add value and serve as the basis for evaluation, repeatability, and guide the development of test scripts. All source code and related product documentation is stored and managed within GitLab as living files.

**14.4.3.4 Retrospective**

Agile led projects conduct a retrospective ceremony at the end of each sprint to evaluate and revise processes, set up measurement programs to evaluate those processes, and identify opportunities for improvement of those processes. While agile supports in-sprint optimizations and improvements, the retrospective ceremony allows for issues to be openly and constructively discussed, changes to be documented and refinements made to processes like grooming, definition of ready and definition of done to increase the efficacy of the team and ultimately the quality of the product. The outcome of each retrospective is documented and managed within SharePoint as living files.

**14.5 Quality Improvement Process**

Quality audits shall be conducted to verify that project quality management activities comply with QMP procedures. The (Consultant) Quality Manager shall be responsible for managing the project audit program. Audits shall occur on a quarterly basis, until notified by the City of Columbus. Auditors shall be independent of the activity being audited. Auditors shall be qualified based upon previous lead quality auditor experience, or completion of a Quality Audit course.

**14.5.1 Quality Audit Preparation**

The auditor shall schedule a quality audit by working with the Project Lead to be audited in advance of the audit, to determine an appropriate time to conduct the audit. The Project Lead shall be notified of the scope of the audit, potential participants and approximate duration of the quality audit.

Auditors shall review the QMP and applicable program plan documents to familiarize themselves with requirements. Based upon these requirements, the auditor shall enter audit specific questions into Form SMRT-04, Quality Audit Checklist. The quality auditor should also review the previous quality audit report (if one exists) to determine areas of follow-up, inclusive of resulting corrective or preventive improvement actions, and make such notations for follow up on the Quality Audit Checklist.

**14.5.2 Opening Meeting**

Quality auditors shall conduct an opening meeting, inviting the Consultant PgM, Project Lead and any other team members that may be applicable to the scope of the quality audit. The purpose of the opening meeting is to go over the scope and duration of the audit, the identification of any other potential participants, the handling of observations, findings and improvement opportunities, timing for the closing meeting, and content and expected date of quality audit report. Participant attendance at the opening meeting shall be captured on Form SMRT-03, Quality Audit Roster.

**14.5.3 Closing Meeting**

Quality auditors shall conduct a closing meeting (this meeting may not be necessary if the review results in no findings), inviting the Consultant PM, Project Lead and any other team members that participated in the quality audit. The purpose of the closing meeting is to review findings, observations, and improvement
opportunities, the handling of findings, and the content and expected date of quality audit report. Participant attendance at the closing meeting shall be captured on Form QF-PM 08, Quality Audit Roster.

14.5.4 Quality Audit Report

The quality auditor shall prepare and submit a quality audit report to the Consultant PgM and Project Lead. After resolution of issues identified in the report, Form SMRT-05, Quality Audit Report Resolved will be prepared to document next steps.

14.5.5 Corrective and Preventative Action

Upon notice of a potential corrective or preventive action opportunity, a corrective/preventive action request (CAR/PAR) is submitted. Sources of such opportunities may come from observation of a QMP noncompliance, quality audit findings, client complaints, client satisfaction results, project review actions, lessons learned, nonconformance trends, or improvement ideas.

- The Originator shall submit a corrective/preventive action request (CAR/PAR) by filling out Form SMRT-07, Corrective/Preventive Action Request describing the actual or potential problem in sufficient detail, and the name of the Project Lead with responsibility and authority to address the issue and submit to the QM.
- The QM shall enter the CAR/PAR into Form SMRT-06, Corrective/Preventive Action Request Log, and issue it to the Project Lead with a response due within 14 calendar days.
- The QM shall determine and enter Form SMRT-07, Corrective/Preventive Action Request, the date of response, the root cause of the actual or potential nonconformance, an action plan sufficient to prevent recurrence or occurrence, and the date upon which the action plan will be implemented.
- The QM shall review the root cause, action plan and implementation date to determine if indeed root cause has been determined, that the action plan appears sufficient to prevent recurrence or occurrence, and that the implementation date is reasonable in terms of program objectives and schedule, and approve the response.
- Upon implementation, the QM shall take appropriate actions to verify that the action plan was indeed implemented and that it was effective to resolve the actual or potential problem, and at that point shall close the CAR/PAR. The Project Lead may be required to submit data or other verification information to support this decision.

Form SMRT-06, Corrective/Preventive Action Request Log shall be updated throughout the process. CAR/PAR records shall be maintained.

14.6 Tools and Checklists

A copy of the blank Quality Compliance Form and Comment Resolution Form are in Appendix E. The electronic documents are located on SharePoint.

Additional QA/QC documents and guides are provided in Appendix E. The electronic documents are shown in Table 30 and located on SharePoint.
Table 30. Quality Guides and Forms

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMRT-01</td>
<td>Quality Compliance</td>
</tr>
<tr>
<td>SMRT-02</td>
<td>Comment Resolution</td>
</tr>
<tr>
<td>SMRT-03</td>
<td>Quality Audit Roster</td>
</tr>
<tr>
<td>SMRT-04</td>
<td>Quality Audit Checklist</td>
</tr>
<tr>
<td>SMRT-05</td>
<td>Quality Audit Report Resolved</td>
</tr>
<tr>
<td>SMRT-06</td>
<td>Corrective/Preventive Action Request Log</td>
</tr>
<tr>
<td>SMRT-07</td>
<td>Corrective/Preventive Action Request Form Resolved</td>
</tr>
<tr>
<td>SMRT-08</td>
<td>Review of Reports Guide</td>
</tr>
<tr>
<td>SMRT-09</td>
<td>Review and Checking of Technical Specifications Guide</td>
</tr>
<tr>
<td>SMRT-10</td>
<td>Grooming Process</td>
</tr>
<tr>
<td>SMRT-11</td>
<td>Definition of Ready</td>
</tr>
<tr>
<td></td>
<td>City of Columbus Division of Design and Construction Checklist – Capital</td>
</tr>
<tr>
<td></td>
<td>Improvements Projects[59]</td>
</tr>
<tr>
<td></td>
<td>City of Columbus Traffic Signal Design Manual[60]</td>
</tr>
</tbody>
</table>

Chapter 15. Communications

15.1 Communication Plan

The Communications Management Plan provides the framework for effective communications and stakeholder engagement throughout the life of the project. It documents the processes and tools that will be used to ensure timely and appropriate generation, collection, distribution, management and disposition of all project information both internal (among the team) and external (among stakeholders and other interested parties).

The plan will be updated as communication needs change and the stakeholders change. Building from the project management approach, this section identifies and defines the roles of people involved in this project. It also includes a table of scheduled internal and external communications as part of this project, a summary of the communications platforms that support the outreach activities, and a process for ensuring that the meetings and interactions are effective.

15.2 Stakeholder Registry

A stakeholder registry will be created as part of the Task G Communications and Outreach Plan. The following bullets list the critical internal and external stakeholders that have been identified thus far. These stakeholder categories will be used in the organization of the registry contained in the plan.

- **Internal:**
  - USDOT
  - PMO
  - Consultant Team
    - Technical
    - Communications

- **External:**
  - Working Groups: As part of the project re-start taking place in September 2017, the PMO is evaluating the need to continue and/or create additional working groups to support the gathering of user needs, validation of requirements, and similar activities. For a detailed discussion on this process and the working groups that have been engaged as of September 2017, refer to Section 3. The two working groups that will continue with certainty are:
    - Data
    - Electrification
  - Executive Partners: Organizations that have committed significant resources to the Smart Columbus program and/or have access to resources and knowledge that are
integral to the strategic direction of the Smart Columbus program. Many are represented on the Smart Columbus Executive Committee.

- **Partners**: Agencies, non-profits or companies that have committed to contributing resources such as cash, program funds or in-kind donations to the Smart Columbus program. Potential Partners have proposed a partnership to the program.

- **Stakeholders**: Residents, neighborhood groups, civic associations, professional organizations, trade associations, and political subdivisions that are directly affected by Smart Columbus projects, have an interest in Smart Columbus and/or are those that provided letters of support.

- **Key Associates**: Organizations that must be engaged for successful implementation of the Smart Columbus program such as original equipment manufacturers.

- **Collaborators**: Government agencies, companies, and trade associations that are not directly involved with Smart Columbus program, but have extensive experience or expertise in relevant smart city strategies or tactics. It may be mutually beneficial for them to share information or resources on the Smart Columbus program.

- **Vendors**: Companies, contractors, and consultants that seek to provide products or services to the city as part of the Smart Columbus program through the city’s established procurement process.

**Customers/Users**: Residents, truckers, transit customers, businesses, third-party application developers, various local, regional, state and federal agencies and others who may use, ride or access the various projects.

### 15.3 Roles and Responsibilities

The PgM will take the lead role in ensuring effective communications on this project, both internal and external. The Smart Columbus Team Communications and Partner/Stakeholder Engagement PM will be responsible for coordination with external stakeholders. Table 31 lists the roles and responsibilities for these staff and other individuals who will be involved in project communications.

**Table 31. Roles and Responsibilities for Communications Management**

<table>
<thead>
<tr>
<th>Individual/Group</th>
<th>Type</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>PgM</td>
<td>Internal (primary)</td>
<td>• Be the single point of communication with leadership, USDOT grant sponsors and the project team as it relates to items of scope, schedule, budget and policy as well as other elevated decisions.</td>
</tr>
<tr>
<td></td>
<td>External (secondary)</td>
<td>• Support meeting requests and identify locations to host various scheduled meetings other project working groups.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resolve conflicts between team members and facilitate technical delivery of the project.</td>
</tr>
<tr>
<td>Individual/Group</td>
<td>Type</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Communications PM</strong></td>
<td>External</td>
<td>• Ensure USDOT awareness about communication requests being made of the project team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensuring USDOT approval of communications on project-related document and deliverables</td>
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<tr>
<td></td>
<td></td>
<td>• Use appropriate reporting templates for monthly reporting and program management.</td>
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<tr>
<td></td>
<td></td>
<td>• Serves the point of contact for the AO regarding Award requirements, questions and invoicing.</td>
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<td></td>
<td></td>
<td>• Submits formal changes to the AO for approval.</td>
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<tr>
<td></td>
<td></td>
<td>• Escalates any USDOT contract concerns to CINO for consideration.</td>
</tr>
<tr>
<td><strong>DPgM for Partnerships and Policy</strong></td>
<td>External</td>
<td>• Ensure continued commitments to participate in the SCC project from stakeholders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lead the development of the outreach plan and strategy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lead the development of outreach products such as fact sheets, presentations, news releases etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordinate external requests for project information with the project team and USDOT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordinate conferences and event approval with USDOT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify presenters on the SCC project at various stakeholder forums identified by the project team</td>
</tr>
<tr>
<td><strong>Communications and Outreach Consultant PM</strong></td>
<td>External</td>
<td>• Direction and facilitation for stakeholder, local communities and media engagement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Communications and Outreach Crisis Plan development and maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Create and manage messaging and website content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Create and execute media strategy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordinate conferences and events</td>
</tr>
<tr>
<td>Individual/Group</td>
<td>Type</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>------------------</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Develop outreach products such as factsheets, news releases, presentations</td>
</tr>
</tbody>
</table>
| USDOT AOR        | Internal | Review requests for communications and information sharing from project team  
|                  |      | Coordinate with USDOT task lead on any communication that requires their approval  
|                  |      | Facilitate discussion with USDOT Task G and H leads regarding guidance on potential partnerships, review of Task G and H deliverables |
| Working Group Members | Internal and external | Serve as technical resource advisors to the Smart Columbus project team which includes the city and consultant team as they develop concepts of operations, consider end user profiles and needs, and deploy the projects. The working group will meet regularly through completion of ConOps phase and then only as needed beyond ConOps phase. |
| Stakeholders     | External | Provide consultation and engagement as part of the technical and development processes to ensure projects reflect their wants and needs.  
|                  |      | Key stakeholders are the collective group of Business Owners for each project which is comprised of cross-functional areas within the city and outside the city. The Key Stakeholders will be consulted regularly about the status of the program and will be engaged for consultation around considerable changes. This group will make-up the CCB amongst others.  
|                  |      | Within the Agile projects, the Stakeholders are the ones who have desires, wants, and needs for data and can help the team understand the value the data brings and use cases for data |
| Subject Matter Expert | Internal and/or external | The SME engaged by the PMO to work with the project teams as necessary to offer domain expertise in specified areas to help advance the program and ensure best practices are considered & applied where necessary. |
15.4 Communications Matrix

Per PMBOK, the communications management plan is typically contained within the PMP. Given the complexities of the Smart Columbus program, the PMP contains a short summary of both internal and external communications:

- Internal: persons responsible for communicating and receiving the information are members of the Smart Columbus project team (city and consultant) and/or the project sponsor (USDOT).
- External: persons responsible for receiving the information are external to the project team and sponsor (i.e., community, partners, City Council, media, etc.)

The Award requires delivery of a stand-alone Comm. Plan as part of Task G. As such, the PMP contains an abbreviated summary of the communications requirements for internal and external communications. More detail regarding the communications requirements, audience, and information to be communicated is contained in the stand-alone Task G plan. The summary matrices for internal and external communications provide an overview of requirements:

- Type
- Description
- Point of contact (person responsible)
- Audience
- Methods/technologies
- Frequency

15.4.1 Internal

The PgM will take the lead role in ensuring effective communications on this project. The communications requirements are documented in Table 32.
Table 32. Internal Communications Matrix

<table>
<thead>
<tr>
<th>Communication Type</th>
<th>Description</th>
<th>Frequency</th>
<th>Format</th>
<th>Participants/Distribution</th>
<th>Deliverable</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Coordination Meeting</td>
<td>Internal city meeting to discuss technical items, meetings, upcoming deliverables</td>
<td>Daily</td>
<td>In-Person</td>
<td>city PMs</td>
<td>Coordination of project activities, meetings and progress</td>
<td>PM</td>
</tr>
<tr>
<td>Program Leadership Meeting</td>
<td>Internal city meeting to discuss and set program priorities</td>
<td>Weekly</td>
<td>In-Person</td>
<td>PgM, DPgMs, city PM, city Vulcan PM, and city Communications PM, other key city and consultant staff as needed</td>
<td>Coordination of program wide activities Updated Decisions, Risks, and Action Items</td>
<td>PgM</td>
</tr>
<tr>
<td>Project Management Meetings</td>
<td>Consultant coordination meeting to review progress and set priorities for the upcoming week</td>
<td>Weekly</td>
<td>Conference call</td>
<td>PgM, DPgMs, city PMs, Consultant PMs, Consultant leads</td>
<td>Updated action lists and project risk register</td>
<td>Project Lead (Consultant)</td>
</tr>
<tr>
<td>USDOT Coordination Meetings</td>
<td>Weekly Meeting with the USDOT and their support staff to discuss progress, upcoming deliverables and action items.</td>
<td>Weekly</td>
<td>Conference Call</td>
<td>PgM, USDOT AOR, consultant staff as needed.</td>
<td>Discuss action items and project status</td>
<td>PgM</td>
</tr>
<tr>
<td>Communication Type</td>
<td>Description</td>
<td>Frequency</td>
<td>Format</td>
<td>Participants/ Distribution</td>
<td>Deliverable</td>
<td>Owner</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
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<td>---------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Project Team Meetings</td>
<td>Meetings to review action register and status</td>
<td>Bi-Weekly</td>
<td>Conference call</td>
<td>AOR and required personnel as needed &amp; Project Team</td>
<td>Updated Action Register &amp; Minutes</td>
<td>PgM</td>
</tr>
<tr>
<td>Schedule Updates</td>
<td>Updates to baseline CPM Schedule</td>
<td>Monthly</td>
<td>MS Project</td>
<td>AOR and required personnel as needed, PgM, DPgMs, PMs, Consultant PMs</td>
<td>Confirmation of CPM Schedule or Revised CPM Schedule</td>
<td>PgM</td>
</tr>
<tr>
<td>Quarterly Progress Meetings</td>
<td>Meeting to review and report progress</td>
<td>Quarterly</td>
<td>In-Person/ Conf. call</td>
<td>AOR and required personnel as needed, PgM, DPgMs, PMs, Consultant PMs</td>
<td>Briefing Presentation, Updated CPM Schedule, Action Register, Risk Register and Minutes</td>
<td>AOR / PgM</td>
</tr>
<tr>
<td>Technical Review (including Walkthroughs)</td>
<td>Review of any technical document prior to delivery</td>
<td>As Needed at Milestones</td>
<td>Conf. call / Email</td>
<td>PgM, PMs, Consultant PMs, and QA/QC Staff</td>
<td>Approved for distribution document</td>
<td>PMs</td>
</tr>
<tr>
<td>Performance Measurement Meetings</td>
<td>Review of performance measurement deliverables and inputs/outcomes from each project</td>
<td>As Needed at Milestones</td>
<td>Conf. call / Email</td>
<td>PgM, PMs, Consultant PMs, USDOT AOR and consultant staff.</td>
<td>Minutes and action items</td>
<td>PMs</td>
</tr>
<tr>
<td>Communication Type</td>
<td>Description</td>
<td>Frequency</td>
<td>Format</td>
<td>Participants/Distribution</td>
<td>Deliverable</td>
<td>Owner</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>---------</td>
<td>--------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Daily Scrums for Agile Projects</td>
<td>Discuss what was worked on yesterday and will be worked on today. Discuss any blockers/issues</td>
<td>Daily</td>
<td>Conf. call</td>
<td>DPgM (Technology), Scrum Master, city IT PM, Product Manager, Development Team</td>
<td>Verbal update on status of current sprint activity</td>
<td>Scrum Master</td>
</tr>
<tr>
<td>Grooming Meetings for Agile Projects</td>
<td>Prioritize product backlog items. Opportunity for team to ask questions, plan, and identify gaps</td>
<td>Bi-weekly</td>
<td>Conf. call</td>
<td>DPgM (Technology), Scrum Master, city IT PM, Product Manager, Development Team</td>
<td>Prepare stories in Ice Box for Backlog</td>
<td>Scrum Master</td>
</tr>
<tr>
<td>Retrospectives for Agile Projects &amp; Program Deliverables</td>
<td>What worked, what didn’t and how to use what we learned</td>
<td>Every three weeks</td>
<td>Conf. call</td>
<td>DPgM (Technology), Scrum Master, city IT PM, Product Manager, Development Team, AOR and required personnel as needed</td>
<td>Minutes</td>
<td>Scrum Master</td>
</tr>
<tr>
<td>Sprint Planning/demonstration meetings for Agile Projects</td>
<td>Backlog management, user story prioritization, demonstration of development</td>
<td>Every three weeks</td>
<td>Conf. Call</td>
<td>DPgM (Technology), Scrum Master, city IT PM, Product Manager, Development Team, AOR and required personnel as needed</td>
<td>Approved user stories</td>
<td>Scrum Master</td>
</tr>
</tbody>
</table>
This Internal Communications Matrix will be used as the guide for what information to communicate, who is to do the communicating, when to communicate it, and to whom. Internal communications utilize both formal and informal communications: formal communications being pre-determined appointments and deliverable submissions, using platforms like teleconference and webinar, and tracking/recording of comments and comment response.

- Formal communications will typically be accompanied by meeting materials or written deliverables and be followed by a written summary (meeting minutes, comment response log) of the event.
- Informal communications rely on as-need phone calls, emails and text messages among all internal team members. They are typically unscheduled, and may or may not be accompanied by meeting materials and summaries.

Platforms such as SharePoint and Web Ex will be used to enable both formal and informal communications. The Smart Columbus SharePoint site is discussed in Section 5.

15.4.1.1 Submission of Deliverables
All deliverable submissions will be sent by the PgM to the USDOT ITS Projects mailbox (ITSProjects@dot.gov) in addition to the AOR. The AO and city PMs will also be copied. Deliverables will also be uploaded to the appropriate USDOT Task Deliverables folder on the Smart Columbus SharePoint site; the library structure is detailed within the Section 5 (Document Management).

15.4.1.2 Communication with USDOT
The primary lines of communication for Smart Columbus will be between the PgM and the AOR; financial and contract correspondence may be executed between the USDOT AO the city fiscal/procurement analyst, with the PgM and AO copied. Contract-related communications will be escalated from the city fiscal/procurement analyst to the PgM before being communicated to USDOT.

The PgM will be responsible for the submission of all deliverables; this activity may be conducted by a DPgM if authorized; if so, the PgM will be copied on the transmission.

Any other communication with USDOT – for example, a request for subject matter expertise – will be initiated by the PgM through the USDOT AOR. The USDOT AOR will then direct the inquiry/request as needed and provide a response to the PgM.

15.4.2 External
The Communications PM will take the lead role in facilitating effective and productive external communications on this project. Table 33 provides a summary of the external communications tools. As discussed in the introduction to this section, Table 33 is intended to provide an abbreviated guide for what information to communicate, who is to do the communicating, when to communicate it, and to whom.
<table>
<thead>
<tr>
<th>Communication Type</th>
<th>Description</th>
<th>Frequency</th>
<th>Format</th>
<th>Participants/Distribution</th>
<th>Deliverable</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Working Group Meetings</strong></td>
<td>Provide advisory input on various aspects of the Smart Columbus projects, including surface issues of importance to the various project end users, help leverage engagement efforts, and assist with identifying additional research and outreach required to ensure their needs are considered and their voices are heard.</td>
<td>At least twice; then as needed.</td>
<td>In person</td>
<td>Working group roster members</td>
<td>Agenda and meeting minutes</td>
<td>PgM, PMs</td>
</tr>
<tr>
<td><strong>Executive Committee</strong></td>
<td>Discussion on the strategic direction, status and upcoming actions for the Smart Columbus.</td>
<td>Quarterly</td>
<td>In person</td>
<td>Smart Columbus D PgM (Partnerships and Policy) Executive partners, current and potential partners</td>
<td>Agenda and meeting minutes</td>
<td>D PgM (Partnerships and Policy)</td>
</tr>
</tbody>
</table>
| **Website and Blog**                    | • Smart Columbus goals and overview messaging  
• Frequently asked questions and a fact sheet  
• The Smart Columbus video                                                                                                                           | Variable         | Web        | All (internal and external)                       | Website and blog              | Communications PM      |
<table>
<thead>
<tr>
<th>Communication Type</th>
<th>Description</th>
<th>Frequency</th>
<th>Format</th>
<th>Participants/Distribution</th>
<th>Deliverable</th>
<th>Owner</th>
</tr>
</thead>
</table>
|                    | • A form to submit comments, inquire about business opportunities and be added to the Smart Columbus e-mail list  
• Overview information about the 15 projects and 4 Districts  
• Overview presentations regarding the USDOT and resources  
• Press releases  
• Links to Smart Columbus social media pages  
• Link to Smart Columbus blog content | N/A | N/A | PMO Team and Executive Partners | Presentation materials  
Fact sheet  
Talking Points  
Media Protocol  
Web content  
Newsletter updates  
Video | Communications PM, Consultant  
Communications PM |
| Communications Toolkit | • Brand guidelines and imagery  
• Presentation and presentation template (also usable for training modules and exhibits)  
• Fact sheet and talking points  
• Media relations protocol and boilerplate messages | N/A | N/A | PMO Team and Executive Partners | Presentation materials  
Fact sheet  
Talking Points  
Media Protocol  
Web content  
Newsletter updates  
Video | Communications PM, Consultant  
Communications PM |
<table>
<thead>
<tr>
<th>Communication Type</th>
<th>Description</th>
<th>Frequency</th>
<th>Format</th>
<th>Participants/Distribution</th>
<th>Deliverable</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Blog post template</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Materials for use at conferences and trade shows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• The Smart Columbus video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Social Media Toolkit</strong></td>
<td>Project-specific information, graphics, an editorial calendar and guidance on usage. Includes Smart Columbus-branded social media sites in year two. Content will include, at minimum, monthly blog posts from the Smart Columbus website, e-newsletter updates and short video clips generated during systems engineering, community engagement, and deployment of projects.</td>
<td>N/A</td>
<td>N/A</td>
<td>PMO Team and Executive Partners</td>
<td>Blog updates, Web content, Newsletter updates, Video</td>
<td>Communications PM, Consultant, Communications PM</td>
</tr>
<tr>
<td><strong>Weekly e-newsletter</strong></td>
<td>This weekly update was sent to a database of 789 as of December 2016, which is expected to grow significantly as more people sign up via the website, direct requests and through attendance at public meetings. A means for signing up for e-newsletters is available on the website. As</td>
<td>Weekly</td>
<td>Email, on-demand</td>
<td>External: people sign up via the website, direct requests and through attendance at public meetings</td>
<td>Weekly newsletter</td>
<td>Communications PM</td>
</tr>
<tr>
<td>Communication Type</td>
<td>Description</td>
<td>Frequency</td>
<td>Format</td>
<td>Participants/Distribution</td>
<td>Deliverable</td>
<td>Owner</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>--------------</td>
<td>---------------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Smart Columbus progresses, more in-depth</td>
<td>Smart Columbus progresses, more in-depth project-focused content will be</td>
<td>As needed</td>
<td>In-person,</td>
<td>General Public</td>
<td>Exhibits, presentation material, handouts</td>
<td>PgM, Consultant Communications</td>
</tr>
<tr>
<td>project-focused content will be generated and shared.</td>
<td>generated and shared.</td>
<td></td>
<td>or web</td>
<td></td>
<td></td>
<td>PM, Communications PM</td>
</tr>
<tr>
<td>Conferences, trade shows, webinars</td>
<td>Attendance at planned events with the goal of providing an overview and</td>
<td>As needed</td>
<td>In-person,</td>
<td>General Public</td>
<td>Exhibits, presentation material, handouts</td>
<td>PgM, Consultant Communications</td>
</tr>
<tr>
<td></td>
<td>status of Smart Columbus and the projects, while maintaining consistent</td>
<td></td>
<td>or web</td>
<td></td>
<td></td>
<td>PM, Communications PM</td>
</tr>
<tr>
<td></td>
<td>messaging. The presentation can be customized based on the audience and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PM, Communications PM</td>
</tr>
<tr>
<td></td>
<td>duration of the presentation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PM, Communications PM</td>
</tr>
<tr>
<td>Vendor Engagement Meetings</td>
<td>A forum for vendors to learn about services and products; they may be</td>
<td>As needed</td>
<td>In person</td>
<td>Vendors</td>
<td>Invite and attendee lists, Summary of outcomes</td>
<td>DPgM (Partnerships and Policy), Fiscal/Procurement Officer</td>
</tr>
<tr>
<td></td>
<td>invited in to share their product/service expertise in priority order</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DPgM (Partnerships and Policy), Fiscal/Procurement Officer</td>
</tr>
<tr>
<td></td>
<td>based on service, product or expertise needed; opportunity to partner;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DPgM (Partnerships and Policy), Fiscal/Procurement Officer</td>
</tr>
</tbody>
</table>
15.5 Communications Platform

15.5.1 Collaborations Platforms

The Smart Columbus program (for both the USDOT and Vulcan grant efforts) are utilizing SharePoint as their resource repository. In addition, the collaboration among current and potential partners also will utilize SharePoint in conjunction with Hubspot. The SharePoint partner collaboration portal is currently under construction as of the date of this PMP; once active, a link will be added to the list below.

Lastly, all projects developed using the Agile methodology will use a combination of SharePoint, Pivotal Tracker and GitLab in the communication and collaboration process.

The function of these tools and structure of the libraries for the information stored on them is discussed in detail in Section 5 Document Management). This section includes a discussion on the capabilities of the tools, how they will be used and access to various areas of the site. This includes a breakout of what information is available to the Smart Columbus Project team (city and consultants), versus USDOT versus external partners (current and potential). Regardless of what area of the sites you wish to access, all users for these tools require log-in privileges.

15.5.2 Public Facing Website (External – Final Deliverables)

The City of Columbus has created a public facing website within their city website to provide the public with information about the program, its outcomes and how to stay informed on progress and activity. This site is also discussed in detail in Section 5 (Document Management) with respect to the site administration and maintenance.

The City of Columbus understands that certain deliverables, once finalized, will be remediated for Section 508 compliance, and then uploaded to the NTL.61

High level contents include:

- Smart Columbus overview:
  - Projects
  - Communities
- Connections:
  - Blog
  - Social Media (Facebook, Twitter, Instagram)

---

61 https://ntl.bts.gov/
• Newsroom:
  o Smart Columbus outreach materials (fact sheets, presentations, videos)
  o USDOT SCC outreach materials
  o Documents and publications (final deliverables) – likely link to USDOT NTL once documents are published by USDOT.

15.6 Meeting Approach

The following guidelines will be used for all meetings on this project:

• **Meeting Agenda:** Meeting Agenda will be distributed 2 business days in advance of the meeting. The Agenda should identify the presenter for each topic along with a time limit for that topic. The first item in the agenda should be a review of action items from the previous meeting.

• **Meeting Minutes:** Meeting minutes will be distributed within 1 business day following the meeting. Meeting minutes will include the status of all items from the agenda along with new action items and the Parking Lot list.

• **Action Items:** Action Items are recorded in both the meeting agenda and minutes. Action items will include both the action item along with the owner of the action item. Meetings will start with a review of the status of all action items from previous meetings and end with a review of all new action items resulting from the meeting. The review of the new action items will include identifying the owner for each action item.

• **Meeting Chair Person:** The PM is responsible for distributing the meeting agenda, facilitating the meeting and distributing the meeting minutes. The Chair Person will ensure that the meeting starts and ends on time and that all presenters adhere to their allocated time frames.

• **Scribe:** The Scribe is responsible for documenting the status of all meeting items, maintaining a Parking Lot item list and taking notes of anything else of importance during the meeting. The Scribe will give a copy of their notes to the Chair Person at the end of the meeting and the Chair Person will use the notes to create the Meeting Minutes. The Scribe will be the PM, or an appointee.

• **Parking Lot:** The Parking Lot list is used to record and defer items which aren’t on the meeting agenda; however, merit further discussion later or through another forum. A parking lot record should identify an owner for the item as that person will be responsible for ensuring follow-up. The Parking Lot list is to be included in the meeting minutes.
Chapter 16. Risk Management

Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, monitoring and controlling risk on a project. Risk is an uncertain event of condition that, if it occurs, influences the project’s scope, schedule, cost, and/or quality. The objective of risk management is to increase the likelihood and impact of positive events and decrease the likelihood and impact of negative events in the project.

16.1 Risk Management Approach

The approach for managing risks for the Smart Columbus program includes a defined methodical process by which the city identifies, scores, and ranks potential risks and their impacts. Every effort will be made to proactively identify risks throughout the project to develop and implement mitigation strategies before a risk is realized. A manager for each risk will be assigned at the time the risk is identified and will have the responsibility of managing the risk throughout its life cycle.

The following steps are necessary for a clear approach to identifying, analyzing, responding, and monitoring risk:

- **Risk Identification:** Identification of the risks that may potentially affect the project and documentation of the characteristics.
- **Risk Analysis:** Assessment of the potential outcomes on project activities of each identified risk based on qualitative and quantitative evaluations, and prioritization of risks based on anticipated outcomes.
- **Response Planning:** Development of options and actions to enhance opportunities to manage identified risks and to reduce threats to project objectives.
- **Risk Monitoring and Control:** Processes to implement developed risk response plans, track risks, monitor residual risks, identify new risks, and evaluate risk process effectiveness.

The most probable and highest impact risks will be added to the project schedule to ensure the assigned risk managers take the necessary steps to implement the mitigation strategy at the appropriate time. Risk managers will provide status updates on their assigned risks in monthly project team meetings and when the meeting includes the risk’s planned timeframe.

The Smart Columbus Project Team will utilize the following step-by-step process to manage program risk.

16.2 Risk Identification

To identify risks, the city as part of the weekly Project Management Meeting will uncover, recognize, and describe risks that might affect individual projects as well as the impacts to the overall program or their
outcomes. Once identified, each risk will be added to the program Risk Register which will be developed like the ITS JPO’s template. The Risk Register will serve as the repository of information regarding identified project risks and mitigation strategies.

Within the Risk Register, each risk will have a unique number assigned to it and contain the following attributes in the “Risk Identification” section of the Risk Register:

- Number (No.)
- Name
- Risk Group
  - Contractual
  - Cost
  - Legislative
  - Organizational
  - Technical
  - Schedule
  - Usability
- Category
  - Enabling Technologies
  - Enhanced Human Services
  - Emerging Technologies
  - Smart Columbus Operating System
  - Outreach
  - Project Management
  - Residential
  - All
- Project
  - CVE
  - Smart Columbus Operating System
  - Integrated Dynamic Traveler Operations
  - SMH
  - Mobility Assistance
  - Prenatal Trip Assistance
  - CEAV
  - EPM
  - Truck Platooning
  - All
- Phase (V-Model)
  - Concept
  - Close Out
The Risk Register will be maintained by the PM and will document the description, project stage, trigger, outcome, as well as the originating source of the risk. Once the trigger occurs, the risk becomes a problem to be solved.

### 16.3 Risk Analysis

Once a risk is identified, the team will determine its likelihood of occurring and the consequences if it occurs. This will help the team understand the nature of the risk and its potential to affect program/project goals and objectives. This information will be listed in the “Qualitative Baseline Assessment” section of the Risk Register with the following attributes:

- **Probability of Occurrence**
  - Very High (5 points)
  - High (4 points)
  - Moderate (3 points)
  - Low (2 points)
  - Very Low (1 point)

- **Impact to Cost**
  - Very High (5 points)
  - High (4 points)
  - Moderate (3 points)
16.4 Response Planning

The team will develop a strategy to reduce the risk to a manageable extent focusing on the high-priority risks. Consistent with the PMBOK, strategies considered will include avoidance, transfer, mitigation, and acceptance. These are defined as follows:

- Avoid – Eliminate the threat or condition or to protect the project objectives from its impact by eliminating the cause
- Mitigate – Identify ways to reduce the probability or the impact of the risk
- Accept – Nothing will be done
- Contingency – Define actions to be taken in response to risks
- Transfer – Shift the consequence of a risk to a third-party together with ownership of the response by making another party responsible for the risk (buy insurance, outsourcing, etc.)

For each risk subject to response planning, the PM, in collaboration with project team members responsible for activities potentially impacted by the risk if triggered, will be tasked with identifying ways to prevent the risk from occurring or reduce its probability of occurring.

During the course of the project, should an identified risk be triggered, the PM will then record the date the risk became active and assign the task of implementing a suitable mitigation of the risk to a specific team member. The responsible team member and the PM may refine the mitigation strategy as needed as the risk becomes active.

16.5 Risk Monitoring and Control

The Risk Register will be reviewed during the Project Management Meetings to monitor, track, review, and reassess new risks, and provide an update on the impact of the risk reduction strategy. As risks are resolved, they will be retired and no longer monitored. The focus will be on the high-priority risks identified in the register. As new risks are identified, they get added to the risk register as well. The entire team will be responsible for ensuring proper risk management policies and procedures are being followed and the effectiveness of risk response strategies are maintained. The “Monitor and Control” section of the Risk Register will have the following attributes:
• Status
  o Active
  o Inactive
  o Retired
  o Closed

• Status Notes as of <date>
  o Risk Manager identified and additional notes

Appendix F contains an example of the Smart Columbus Risk Register. Upon the completion of the project, during the closing process, the PM will analyze each risk as well as the risk management process. Based on this analysis, the PM will identify any improvements that can be made to the risk management process for future projects. These improvements will be captured as part of the lessons learned knowledge base.
Appendix A

List of Acronyms
# ACRONYM LIST

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO</td>
<td>Agreement Officer</td>
</tr>
<tr>
<td>AOR</td>
<td>Agreement Officer Representative</td>
</tr>
<tr>
<td>AV</td>
<td>Automated Vehicles</td>
</tr>
<tr>
<td>AWS</td>
<td>Amazon Web Services</td>
</tr>
<tr>
<td>BSM</td>
<td>Basic Safety Message</td>
</tr>
<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
</tr>
<tr>
<td>CAR/PAR</td>
<td>Corrective/Preventive Action Request</td>
</tr>
<tr>
<td>CCB</td>
<td>Change Control Board</td>
</tr>
<tr>
<td>CDO</td>
<td>Chief Diversity Officer</td>
</tr>
<tr>
<td>CEAV</td>
<td>Connected Electric Autonomous Vehicles</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CI</td>
<td>Configuration Items</td>
</tr>
<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
</tr>
<tr>
<td>CINO</td>
<td>Chief Innovation Officer</td>
</tr>
<tr>
<td>CMDB</td>
<td>Configuration Management Database</td>
</tr>
<tr>
<td>CMP</td>
<td>Configuration Management Plan</td>
</tr>
<tr>
<td>ConOps</td>
<td>Concept of Operations</td>
</tr>
<tr>
<td>Comm. Plan</td>
<td>Communications and Outreach Plan</td>
</tr>
<tr>
<td>COTA</td>
<td>Central Ohio Transit Authority</td>
</tr>
<tr>
<td>CPS</td>
<td>Common Payment System</td>
</tr>
<tr>
<td>CPM</td>
<td>Critical Path Method</td>
</tr>
<tr>
<td>CRR</td>
<td>Comment Resolution Report</td>
</tr>
<tr>
<td>CV</td>
<td>Connected Vehicle</td>
</tr>
<tr>
<td>CVE</td>
<td>Connected Vehicle Environment</td>
</tr>
<tr>
<td>CVRIA</td>
<td>Connected Vehicles Reference Implementation</td>
</tr>
<tr>
<td>DAX</td>
<td>City of Columbus' internal, enterprise-wide financial system</td>
</tr>
<tr>
<td>DBE</td>
<td>Disadvantaged Business Enterprise</td>
</tr>
<tr>
<td>DCINO</td>
<td>Deputy Chief Innovation Officer</td>
</tr>
<tr>
<td>DG</td>
<td>Data Governance</td>
</tr>
<tr>
<td>DMP</td>
<td>Data Management Plan</td>
</tr>
<tr>
<td>DPgM</td>
<td>Deputy Program Manager</td>
</tr>
<tr>
<td>DPP</td>
<td>Data Privacy Plan</td>
</tr>
<tr>
<td>DSMIS</td>
<td>Demonstration Site Map and Installation Schedule</td>
</tr>
<tr>
<td>DSRC</td>
<td>Dedicated Short Range Communications</td>
</tr>
<tr>
<td>EAV</td>
<td>Electric Autonomous Vehicle</td>
</tr>
<tr>
<td>EHS</td>
<td>Enhanced Human Services</td>
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<tr>
<td>EPM</td>
<td>Event Parking Management</td>
</tr>
<tr>
<td>EVI</td>
<td>Electric Vehicle Infrastructure</td>
</tr>
<tr>
<td>FA</td>
<td>Fiscal Assistant</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FM</td>
<td>Fiscal Manager</td>
</tr>
<tr>
<td>FMLM</td>
<td>First-mile/Last-mile</td>
</tr>
<tr>
<td>GCAC</td>
<td>Greater Columbus Art Council</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>IE</td>
<td>Independent Evaluation</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IESP</td>
<td>Independent Evaluation Support Plan</td>
</tr>
<tr>
<td>IFB</td>
<td>Invitation for Bid</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
</tr>
<tr>
<td>ITB</td>
<td>Invitation to Bid</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>JPO</td>
<td>Joint Program Office</td>
</tr>
<tr>
<td>MAI</td>
<td>Management Analyst I</td>
</tr>
<tr>
<td>MORPC</td>
<td>Mid-Ohio Regional Planning Commission</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MMTPA</td>
<td>Multi-Modal Trip Planning Application</td>
</tr>
<tr>
<td>MS</td>
<td>Microsoft</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>NEMT</td>
<td>Non-Emergency Medical Transportation</td>
</tr>
<tr>
<td>NHTSA</td>
<td>National Highway Transportation Safety Administration</td>
</tr>
<tr>
<td>NTL</td>
<td>National Transportation Library</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>O&amp;MP</td>
<td>Operations and Maintenance Plan</td>
</tr>
<tr>
<td>ODC</td>
<td>Other Direct Costs</td>
</tr>
<tr>
<td>ODOT</td>
<td>Ohio Department of Transportation</td>
</tr>
<tr>
<td>ODPS</td>
<td>Ohio Department of Public Safety</td>
</tr>
<tr>
<td>OST</td>
<td>Office of the Secretary of Transportation</td>
</tr>
<tr>
<td>OSU</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>PII</td>
<td>Personally Identifiable Information</td>
</tr>
<tr>
<td>PM</td>
<td>Project Manager</td>
</tr>
<tr>
<td>PMBOK</td>
<td>Project Management Body of Knowledge</td>
</tr>
<tr>
<td>PMP</td>
<td>Project Management Plan</td>
</tr>
<tr>
<td>PgM</td>
<td>Program Manager</td>
</tr>
<tr>
<td>PMO</td>
<td>Program Management Office (Smart Columbus program Management Office)</td>
</tr>
<tr>
<td>Q&amp;A</td>
<td>Question and Answer</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>QM</td>
<td>Quality Manager</td>
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<tr>
<td>QMP</td>
<td>Quality Management Plan</td>
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<td>QPL</td>
<td>Qualified Products List</td>
</tr>
<tr>
<td>RDE</td>
<td>Research Data Exchange</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposals</td>
</tr>
<tr>
<td>ROI</td>
<td>Return on Investment</td>
</tr>
<tr>
<td>RSU</td>
<td>Roadside Unit</td>
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<tr>
<td>SASP</td>
<td>System Architecture and Standards Plan</td>
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<tr>
<td>SCC</td>
<td>Smart City Challenge</td>
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<tr>
<td>SCOS</td>
<td>Smart Columbus Operating System</td>
</tr>
<tr>
<td>SCS</td>
<td>Monthly Schedule</td>
</tr>
<tr>
<td>SDD</td>
<td>System Design Document</td>
</tr>
</tbody>
</table>
SDOs  Standards Development Organizations
SEMP  Systems Engineering Management Plan
SMH  Smart Mobility Hubs
SMP  Safety Management Plan
SOP  Standard Operating Procedure
SPI  Schedule Performance Index
SyRS  Systems Requirements Specification
SE  Systems Engineering
TNC  Transportation Network Companies
TP  Test Plan
TRP  Transit Safety Retrofit Package
USDOT  United States Department of Transportation
V2I  Vehicle-to-Infrastructure
V2V  Vehicle-to-Vehicle
V2X  Vehicle-to-X
WBS  Work Breakdown Structure
Appendix B

Work Breakdown Structure
SMART COLUMBUS WORK BREAKDOWN STRUCTURE

**PROGRAM MANAGEMENT**
- TASK A: KICK-OFF MEETING
- TASK A: PROJECT MANAGEMENT PLAN (PMP)
- TASK A: SCHEDULE
- TASK A: PARTNERSHIP/STAKEHOLDER STATUS
- TASK A: MONTHLY & QUARTERLY REPORTS
- TASK J: INTERIM & FINAL REPORTING

**DESIGN GUIDANCE PLANNING DOCUMENTS**
- TASK C: PERFORMANCE MEASUREMENT PLAN
- TASK C: DEPLOYMENT TRACKING SURVEY
- TASK D: DATA PRIVACY PLAN (DPP)
- TASK E: INDEPENDENT EVALUATION SUPPORT PLAN (IESP)
- TASK E: DATA MANAGEMENT PLAN (DMP)
- TASK F: HUMAN USE APPROVAL
- TASK F: SAFETY MANAGEMENT PLAN (SMP)

**SYSTEMS ENGINEERING**
- TASK B: MANAGEMENT
- TASK B: TRADITIONAL V-MODEL PROJECTS
  - S2.X.1 - CONCEPT OF OPERATIONS
  - S2.X.2 - SYSTEMS REQUIREMENTS (SyRS)
  - S2.X.3 - INTERFACE CONTROL DOCUMENT (ICD)
  - S2.X.4 - SYSTEM DESIGN DOCUMENT (SDD)
  - S2.X.5 - TEST PLAN
  - S2.X.6 - TEST DOCUMENTATION
  - S2.X.7 - OPERATIONS & MAINTENANCE PLAN (O&M)
- TASK B: LEGACY V-MODEL PROJECTS
  - S3.X.1 - TECHNICAL MEMO
  - S3.X.2 - INTERFACE CONTROL DOCUMENT (ICD)
  - S3.X.3 - INSTALLATION PLAN
  - S3.X.4 - TEST PLAN
  - S3.X.5 - TEST DOCUMENTATION
  - S3.X.6 - OPERATIONS & MAINTENANCE PLAN (O&M)
- TASK I: BI-ANNUAL ARCHITECTURE & STANDARDS MEETINGS & TRIP REPORT

**COMMUNICATIONS & OUTREACH**
- TASK G: COMMUNICATIONS & OUTREACH PLAN (& END-USER ENGAGEMENT)
- TASK G: PROMOTIONAL VIDEO & UPDATES
- TASK G: SMART CITY DEMONSTRATION WEBSITE
- TASK G: WORKSHOP, CONFERENCE, TRADE SHOW PARTICIPATION
- TASK G: PUBLIC USDOT WEBINARS
- TASK G: PUBLIC RELATIONS & MARKETING MATERIALS
- TASK H: INTERNATIONAL COLLABORATION MEETING

X = PROJECT NUMBER
Appendix C

DTFH6116H00013 Award Document
U.S. Department of Transportation

Cooperative Agreement Award Number DTFH6116H00013

Title: "Smart City Challenge Demonstration"
(Phase 2 Award)

<table>
<thead>
<tr>
<th>Signatures</th>
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<tbody>
<tr>
<td>City of Columbus</td>
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<tr>
<td>Jennifer Gallagher</td>
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<tr>
<td>Printed Name: Jennifer Gallagher</td>
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<tr>
<td>Title: Director of Public Service</td>
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<td>Date: 8-30-16</td>
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Award Information
## Award Information

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<th>Award No.:</th>
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<tr>
<td>Effective Date:</td>
<td>August 30, 2016</td>
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| Awarded to: | City of Columbus  
90 West Broad Street  
Columbus, Ohio 43215-9004  
DUNS No: 609679548  
TIN No.: 316400223 |
| Sponsoring Office/ Federal Agency Name: | U.S. Department of Transportation (USDOT)  
Federal Highway Administration (FHWA)  
Office of Acquisition and Grants Management  
1200 New Jersey Avenue, SE  
Mail Drop: E62-204  
Washington, DC 20590  
Attn: Sarah Tarpgaad, HCFA-32 |
| Total Amount: | Federal Share: $40,000,000  
Recipient Cost Share: $19,000,000  
Total Value: $59,000,000*  
*See also Leveraged Partner Resources clause, Section B |
| Catalog of Federal Domestic Assistance (CFDA) Number: | 20.200 Highway Research & Development |
| Period of Performance | Four Years |
| Type of Award: | Cooperative Agreement (Cost Reimbursement, Cost-Sharing) |
| Authority: | 23 U.S.C. §516(a) |
| Procurement Request (PR): | # HOIT211216168 |
| Funds Obligated at Award: | $15,000,000 |
| Accounting Data: | 15X0447060-0000-021DT20672-2101-000000-41010-61006600, $15,000,000 |
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### ATTACHMENTS

1. Smart City Vision Elements - 9 pages
2. Approved Volume 1 Technical Application dated 07/29/2016 - 77 pages
SECTION A – PROGRAM DESCRIPTION

1. STATEMENT OF PURPOSE

The purpose of the Smart City Challenge is to demonstrate and evaluate a holistic, integrated approach to improving surface transportation performance within a city and integrating this approach with other smart city domains such as public safety, public services, and energy. The United States Department of Transportation (USDOT) intends for this challenge to address how emerging transportation data, technologies, and applications can not only be integrated with existing systems in a city to address transportation challenges, but used to spur reinvestment in underserved communities. The Recipient shall carry out the Smart City Challenge to effectively test, evaluate, and demonstrate the significant benefits of smart city concepts.

The Recipient shall demonstrate how advanced data and intelligent transportation systems (ITS) technologies and applications can be used to reduce congestion, keep travelers safe, use energy more efficiently, respond to climate change, both connect and create opportunities for underserved communities, and support economic vitality.

The Smart City Demonstration is expected to provide safety improvements, enhance mobility, increase ladders of opportunity by incentivizing reinvestment in underserved communities, reduce energy usage, and address climate change.

2. LEGISLATIVE AUTHORITY

Specific statutory authority for conducting this effort is found in the Intelligent Transportation Systems Research Program in 23 U.S.C. §516(a), which authorizes the Secretary of Transportation to “…carry out a comprehensive program of intelligent transportation system research and development, and operational tests of intelligent vehicles, intelligent infrastructure systems, and other similar activities.”

Funding is authorized under Section 6002(a) of Public Law 114-94, the Fixing America’s Surface Transportation Act (FAST Act).

The authority to enter into a cooperative agreement for this effort is found under 23 U.S.C. § 502 - Surface Transportation Research, Development, and Technology, paragraph (b), which states:
(3) cooperation, grants, and contracts. — The Secretary may carry out research, development, and technology transfer activities related to transportation—
(A) independently;
(B) in cooperation with other Federal departments, agencies, and instrumentalities and Federal laboratories; or
(C) by making grants to, or entering into contracts and cooperative agreements with one or more of the following: the National Academy of Sciences, the American Association of State Highway and Transportation Officials, any Federal laboratory, Federal agency, State agency, authority, association, institution, for-profit or nonprofit corporation, organization, foreign country, or any other person.

3. BACKGROUND

In February of 2015, the USDOT released “Beyond Traffic: Trends and Choices 2045.” Beyond Traffic examines the long-term and emerging trends affecting our Nation’s transportation system and the implications of those trends. It describes how demographic and economic trends, as well as changes in technology, governance, and our climate are affecting how people and goods travel today, and how they could affect travel in the future. It outlines choices that will require cities to think differently about how we move, how we move things, how we move better, how we adapt, and how we align decisions and dollars.

Smart cities are emerging as a concept that can be used to address these issues starting today. The trends identified in Beyond Traffic 2045 have major implications for cities. Cities deliver many benefits – greater employment opportunities, greater access to healthcare and education, and greater access to entertainment, culture and the arts. People are moving to cities at an unprecedented rate. Our population is expected to grow by 70 million over the next 30 years, and most of this population growth will be concentrated in metropolitan areas or cities. Growing urbanization will continue to put significant strain on city infrastructure and transportation networks.

Transportation is critical to making a city work. Transportation is deeply connected to economic opportunity providing Americans with connections to employment, education, healthcare, and other essential services. Many cities see advantages in urbanization, but these cities are also saddled with concentrated growth, shrinking revenues, and increased transportation demand. Inefficiencies in our transportation system cost Americans, on average, each over 40 hours stuck in traffic each year – an annual financial cost of $121 billion. At the same time, Americans spend more on transportation than they do on food, healthcare, and clothing. Low-income Americans spend nearly a
quarter of their annual income on transportation while high-income American spend about one-tenth on transportation. Finally, research indicates that cities account for 67% of all greenhouse gases (GHGs) released into the atmosphere. The transportation sector is the second-biggest source of GHGs, responsible for 28% of U.S. emissions.

To overcome these challenges, cities must find ways to foster the emergence of technologies that have the potential to transform transportation. A number of trends in technology are taking place. Improvements to how we collect and analyze data, how communications and mobile platforms evolve, how rapidly connected and automated vehicle technologies emerge, and how soon all modes of transportation transition to using clean forms of energy hold the promise of making our future transportation system safer, more accessible and efficient, and more environmentally sustainable.

With Intelligent Transportation Systems (ITS) laying the groundwork for innovative transportation solutions, many cities are currently serving as laboratories for new types of transportation services and cleaner transportation options leveraging those solutions. Smart cities are emerging as a next-generation approach for city management by taking steps forward along the transportation technology continuum. Integrating ITS, connected vehicle technologies, automated vehicles, electric vehicles, and other advanced technologies – along with new mobility

## EXPECTED OUTCOMES OF THE SMART CITY CHALLENGE

- **Improve Safety** – By using advanced technologies, including connected vehicle technologies, to reduce the number of collisions, fatalities, and injuries for both vehicle occupants and non-vehicle occupants.

- **Enhance Mobility** – By providing real-time traveler information and emerging mobility services to improve personal mobility for all citizens including people with lower incomes, people with disabilities, and older adults.

- **Enhance Ladders of Opportunity** – By providing access to advanced technology and its benefits for underserved areas and residents, increasing connectivity to employment, education and other services, and contributing to revitalization by incentivize reinvestment in underserved communities.

- **Address Climate Change** – By implementing advanced technologies and policies that support a more sustainable and cost-effective relationship between transportation and the environment through more efficient fuel use and emissions reductions.
concepts that leverage the sharing economy – within the context of a city will provide enhanced travel experiences and makes moving people and goods safer, more efficient, and more secure. By enhancing the effective management and operation of the transportation system, smart city solutions can leverage existing infrastructure investments, enhance mobility, sustainability, and livability for citizens and businesses, and greatly increase the attractiveness and competitiveness of cities and regions.

4. VISION AND GOALS OF THE SMART CITY DEMONSTRATION

This section describes the USDOT’s vision of a successful Smart City, and the specific goals that collectively describe important elements of the demonstration.

To show what is possible when communities use technology to connect transportation assets into an interactive network, the USDOT’s Smart City Challenge concentrates federal resources into one city, selected through a nationwide competition. The Smart City Challenge seeks to demonstrate and evaluate a holistic, integrated approach to improving surface transportation performance within a city and integrating this approach with other smart city domains such as public safety, public services, and energy. The USDOT intends for this challenge to address how emerging transportation and other data, technologies, applications, and clean energy can be integrated with existing and new systems in a city to address transportation challenges.

This section presents the USDOT’s high-level vision and goals without making each item an award requirement. Rather, this section provides a framework for the Recipient to consider in conducting the demonstration.

The USDOT’s vision for the Smart City Challenge is to identify an urbanized area where advanced technologies are integrated into the aspects of a city and play a critical role in helping cities and their citizens address the challenges in safety, mobility, access to opportunity, sustainability, clean energy, economic vitality, and climate change. Advancements in ITS, connected vehicles, automated vehicles, electric vehicles, and other advanced technology will be a critical part of meeting these transportation challenges, as will the merging Internet of Things (IoT) which offers data from various sectors (e.g., energy and weather) and sources (e.g., the private sector and connected citizens). A smart city uses these data to maximize efficiencies within their management systems while enabling an open, growing ecosystem of third party services that provide additional benefits to citizens.
The Smart City Demonstration shall seek to improve access to reliable, clean, safe, and affordable transportation for a wider spectrum of its underserved communities. The Smart City Demonstration shall develop novel ways to reform the digital divide and use smart technologies and concepts to strengthen connections to jobs, remove physical barriers to access, and strengthen communities through neighborhood redevelopment. The Smart City Demonstration shall sequence deployment of these technologies and innovations so they benefit underserved communities early in the process. The Smart City Challenge identifies these concepts as Ladders of Opportunities. Ladders of Opportunity projects may increase connectivity to employment, education, services and other opportunities, increase access to digital resources, broaden the availability of affordable clean transportation options, support workforce development, or contribute to community revitalization, particularly for underserved areas.

The Smart City Demonstration shall seek to improve safety, enhance mobility, enhance ladders of opportunity, accelerate the transportation to clean transportation, and address climate change. Specific goals of the Smart City Demonstration include:

- Identify the transportation challenges and needs of the citizen and business community and demonstrate how advanced technologies can be used to address issues in safety, mobility, access to opportunity, energy efficiency, and climate change, now and into the future.
- Determine which technologies, strategies, applications, and institutional arrangements demonstrate the most potential to address and mitigate, if not solve, transportation challenges identified within a city.
- Support and encourage cities to take the evolutionary and revolutionary steps to integrate advanced technologies – including connected vehicles, automated vehicles, and electric vehicles – into the management and operations of the city, consistent with the USDOT vision elements (see Attachment 1).
- Demonstrate, quantify, and evaluate the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods.
- Examine the technical, policy, and institutional mechanisms needed for realizing the potential of these strategies and applications – including identifying technical and policy gaps and issues – and work with partners to address them.
- Assess reproducibility of interoperable solutions and qualify successful smart city systems and services for technology and knowledge transfer to other cities facing similar challenges. Follow systems engineering best practices and utilize
available architectures and standards to develop interoperable, reproducible systems with national extensibility, including the use of open source technologies.

- Work with Federal partners and programs focused on providing technical and financial resources for optimizing the usage of advanced and affordable clean transportation options.

- Collaborate with regional agencies on the best use of a city’s Federal transportation assets and Federal workforce to accelerate the deployment of clean transportation and connected and automated vehicle technologies.

The Smart City Demonstration shall include a commitment to integrating with the sharing economy; and a clear commitment to making open, machine-readable real-time and archived data accessible, discoverable and usable by the public to fuel entrepreneurship and innovation.

The USDOT identified twelve vision elements that comprise a Smart City. The Smart City Demonstration shall align to some or all of the USDOT’s vision elements and foster integration between the elements. Through alignment with these vision elements, the Smart City Demonstration is expected to improve safety, enhance mobility, enhance ladders of opportunity, accelerate the transition to clean transportation, and address climate change. See Attachment 1, Smart City Vision Elements.

5. STATEMENT OF WORK

The Recipient shall conduct the Smart City Demonstration in accordance with the approved Technical and Budget Applications, incorporated herein as Attachments 2 and 3, subject to the terms of the award.

The Recipient shall perform and provide the following tasks (Tasks A – J, below) and deliverables needed to demonstrate, quantify, and evaluate the impact of advanced technologies, strategies, and applications towards improved safety, efficiency, ladders of opportunity, and sustainable movement of people and goods. The following tasks and deliverables are also needed to foster transferability/reproducibility to support technology and knowledge transfer to other cities facing similar challenges.
TASKS:

TASK A: PROGRAM MANAGEMENT
TASK B: SYSTEMS ENGINEERING APPROACH
TASK C: PERFORMANCE MEASUREMENT
TASK D: DATA PRIVACY REQUIREMENTS
TASK E: DATA MANAGEMENT AND SUPPORT FOR INDEPENDENT EVALUATION
TASK F: SAFETY MANAGEMENT AND SAFETY ASSURANCE
TASK G: COMMUNICATIONS AND OUTREACH
TASK H: INTERNATIONAL COLLABORATION
TASK I: PARTICIPATION IN RELEVANT ITS ARCHITECTURE AND STANDARDS DEVELOPMENT EFFORTS
TASK J: INTERIM AND FINAL REPORTING

Delineation of Tasks and Deliverables

TASK A: PROGRAM MANAGEMENT

Implementation of a Smart City Demonstration will require a disciplined approach to manage the execution of the work and make sure the team responsible for implementing the Smart City Demonstration delivers the highest quality products on time and within budget. Common processes and procedures should be used to ensure quality, timeliness, and cost control. Effective program management should consider:

- **Scope Management.** This includes ensuring that all required activities are performed. The Recipient should have mechanisms in place for verifying and controlling the overall scope of the Smart City Demonstration.
- **Schedule Management.** This includes managing the timely execution of work activities. A Project Schedule should list all activities required to bring all required work to a successful completion. Successful schedule management should identify how the team will monitor the project schedule and manage changes after a baseline schedule has been approved. Schedule management includes
identifying, analyzing, documenting, prioritizing, approving or rejecting, and publishing all schedule-related changes.

- **Communications Management.** This includes the systematic planning, implementing, monitoring, and revision of all the channels of communication within the project partners and with other stakeholders. For the purposes of the Smart City Challenge, a *partner* refers to an organization or individual on the Smart City Team. A *stakeholder* refers to an organization or individual potentially impacted by the Smart City demonstration itself, regardless of whether they are team members (partners) or not. Communications management ensures effective internal team communications and governance methods, as well as communications with the USDOT’s Agreement Officer Representative (AOR).

- **Cost Management.** This includes the process of planning and controlling the budget for the Smart City Demonstration. Effective cost management should ensure that any issues with funding surface quickly, before cost overruns can occur.

- **Quality Management.** This includes effectively managing the quality of the products produced, from planning to delivery. Quality management includes procedures to be followed to implement a quality program and provide the USDOT with visibility into product quality (e.g., process and product evaluations, record keeping, nonconformance tracking, and reporting channels). Quality management addresses both Quality Control (QC) and Quality Assurance (QA) processes. QC is defined as the monitoring and controlling actions required during a project to ensure that a product – or performed service – adheres to a defined set of quality criteria. QA ensures that the appropriate quality planning and QC mechanisms are defined and utilized to prevent mistakes or defects.

- **Configuration Management.** This includes managing how items to be placed under configuration control are identified, when they are identified, and when they are placed into a configuration control process or system. Configuration management may include establishing a Configuration Control Board (CCB) and include procedures for handling proposed changes to items under configuration control, and the role of the USDOT in configuration control.

- **Risk Management.** This includes identifying, prioritizing, and managing program risks in a timely and efficient manner. Risks that may impact the schedule, scope, or costs of activities performed under the program should be identified, documented, and tracked. Plans for mitigating risks should be identified and implemented.
Shortly after award, representatives from the Recipient’s Smart City Demonstration team shall attend a kick-off meeting to be held in Washington, DC, or the Recipient’s location, with the AOR and its representatives to ensure that all parties have a common understanding of the AOR’s requirements and expectations. The Recipient shall bring its key personnel to this meeting and the host (either USDOT or the Recipient) shall arrange the location, the agenda, and the list of other attendees. This kickoff meeting shall occur no later than four weeks after award of the Cooperative Agreement.

The Recipient shall prepare a Program Management Plan (PMP) that describes the activities required to perform the work, per current PMBOK guidance\(^1\). The PMP shall explain the roles and responsibilities of all key individuals within the program/project team. At a minimum, the PMP shall contain a Scope Management Plan, a Schedule Management Plan, a Communications Management Plan, a Cost Management Plan, a Quality Management Plan, Configuration Management Plan, and a Risk Management Plan.

The PMP shall be accompanied by a detailed Smart City Demonstration Project Schedule, considered to be a logical component of the PMP, although it may be a physically separate electronic file. The Project Schedule shall list all activities required to bring all required work to a successful completion and shall contain – at a minimum – three levels of the Work Breakdown Structure (WBS). The Project Schedule shall be updated monthly. The Project Schedule shall describe the following:

- Name of the work activity;
- Expected start and end dates;
- Name of the individual with the primary responsibility for accomplishing the work;
- Dependencies with other work activities in the Project Schedule; and
- All deliverables, procurements, or milestones resulting from the work activity.

The PMP shall be delivered in draft to the Agreement Officer’s Representative (AOR). The AOR will provide the Recipient review comments on the draft PMP, estimated to be provided within two weeks after receipt of the draft PMP. After receiving the AOR’s comments and resolving them, the Recipient shall provide the “final” version of the PMP and its related documents. During the course of the Smart City Demonstration, the

\(^1\) PMI (2012), A Guide to the Project Management Body of Knowledge, 5th Ed.
Recipient may propose modifications to the PMP. Any such modifications shall go through the cycle of draft submission, AOR review and comment, comment resolution, and submission of a “final” version.

The Recipient shall document the status of developing and implementing agreements, contracts, and subcontracts among partner organizations in a Partnership Status Summary. This includes all agreements associated with the planning, development or implementation of the main elements of the ConOps, performance measures and targets, operational changes associated with the Smart City Demonstration, governance framework and processes, and financial agreements. This agreement shall also include a vision of how these arrangements are expected to be altered or adapted in the post-grant period to ensure a transition to permanent operational practice. The Recipient shall deliver a draft version of the Partnership Status Summary to the AOR for review in accordance with the project master schedule. The Recipient shall prepare a revised document in response to AOR comments. The AOR must accept and approve all comment resolutions before the revised document is considered final or return for re-revision with comments.

The USDOT requires the Recipient to provide Quarterly Progress Reports and Quarterly Progress Briefings. See Section C.3. Reporting, for format and due dates.

Quarterly Progress Reports and shall include:

- A narrative of accomplishments by task and projected activities in the next quarterly period.
- All list of all deliverables and deliverable status (not initiated, in progress X% complete, draft delivered, in revision X% complete, final delivered, accepted).
- Identification of any problems, planned solutions, and/or requests for USDOT assistance.
- An updated project schedule with a schedule risk narrative, a technical risk narrative, a partnership risk narrative.
- A summary of costs incurred for the reporting period and to date to include Federal share, Cost share, and total.
- A comparison of costs incurred to the budgeted costs for the reporting period and to date to include Federal share, Cost share, and total.
- Projected cost-to-complete.
- A summary of communication and outreach efforts.
• Subcontractor Status Summary: A summary of Subcontractor Coordination and Management activities to include as applicable:
  o Status of key procurements if available (do not provide procurement sensitive information but rather only general status information).
  o Status of key subcontract awards.
• Leveraged Partner Resources Status Summary: A summary of activities related to Leveraged Partner Resources, to include the following items as applicable.
  o Progress, achievements, deliverables/milestones, problems, risks.
  o Status of developing and implementing Partnership agreements.
  o Changes to partnership agreements, arrangements or plans.

For Quarterly Progress Briefings, the Recipient shall present the information contained in Quarterly Progress Reports. Briefings shall be conducted in person to the extent possible, alternating quarters between the Smart City Demonstration site and at the USDOT headquarters in Washington, DC, or as otherwise mutually agreeable to the parties.

Required Deliverables

• Kick-off Meeting
• Project Management Plan (PMP)
• Project Schedule and Monthly Project Schedule Updates
• Partnership/Stakeholder Status Summary (Draft and Final)
• Quarterly Progress Reports and Briefings

TASK B: SYSTEMS ENGINEERING APPROACH

Effective development and implementation of the technical and institutional solutions to enable an efficient, interoperable, and replicable smart city demonstration requires rigorous application of established systems engineering best practices. To reduce the risk of schedule and cost overruns and increase the likelihood that the demonstration will meet users’ needs, the Recipient shall provide evidence of following a systems engineering process when implementing its vision. Benefits of following such an approach include improved stakeholder participation; more adaptable, resilient systems; verified functionality and fewer defects; higher level of reuse from one project to the next; and better documentation.
The International Council of Systems Engineering (INCOSE) defines Systems Engineering as:

“An interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem.

Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.”

The USDOT recognizes the benefits of following a systems engineering approach and supports innovative approaches that a Recipient may follow that are tailored to fit the needs of their demonstration. The USDOT also recognizes that components of the Smart City Demonstration may be digital in nature and may use other incremental and iterative development concepts, such as agile software development, to deliver applications. These modern systems engineering techniques represent practical approaches that allow for system developers to provide an initial capability followed by successive deliveries to reach the desired final product. Iterative development considers adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible response to change. This incremental, fast-paced style of development may help keep the solution open and flexible to accept new features and technologies. These techniques can be used to reduce the risk of failure and enable the ability to test and deploy so that features may be added often and put into production easily. By addressing the whole experience from start to finish (e.g., actions taken on-line, through mobile applications, and off-line touch point) system developers are able to identify pain points and prioritizes activities according to public needs. Incremental and iterative development emphasizes velocity and adaptability throughout the entire lifecycle.

To document how the Recipient plans to follow a systems engineering approach, a Systems Engineering Management Plan (SEMP) shall be developed. The SEMP shall describe what systems engineering process the Recipient plans to follow during the execution of the project’s work and how the Recipient plans to manage the specific systems engineering activities that will be performed during the project.
Systems engineering deliverables to support the smart city demonstration include:

- **Concept of Operations (ConOps).** A Concept of Operations (ConOps) serves as the foundation document that frames the overall smart city system and sets the technical course for a project. Its purpose is to clearly convey a high-level view of the system to be developed. A Smart City Demonstration ConOps should describe the city’s holistic, integrated solution to be deployed for the Smart City Demonstration, and how operational practice should be altered based on the introduction of new applications. Among other elements, the ConOps should include a set of proposed high-priority “needs” through structured stakeholder interaction, a context diagram, discussion of enhancements to operational practices, and use cases or scenarios. The ConOps shall explicitly describe how the Recipient plans to interface with all proposed partners including current and anticipated USDOT partners Paul Allen’s Vulcan, Inc., Mobileye, Autodesk, Amazon Web Services, NXP, Alphabet’s Sidewalk Labs, and others. IEEE Standard 1362-1998 includes guidelines for format and content to support development of a ConOps.

- **Demonstration Site Map and Installation Schedule.** The Demonstration Site Map should identify the specific geographic area and indicate locations related to key issues, current and proposed roadside technology locations, connected automated vehicle operations, and other explanatory features to support strategies that align with the city’s proposed strategies. During the course of the effort, the Demonstration Site Map should be updated to reflect any changes decided during the demonstration effort. In addition, the Recipient Project Team should create a Site Installation Schedule that identifies infrastructure installation activities. For each type of infrastructure element to be installed, this schedule shall indicate:
  - The type of infrastructure element to be installed;
  - Planned installation start and end dates for each infrastructure element;
  - Organization or individual responsible for the installation;
  - Milestone(s) identifying when the installation of each type of infrastructure element is completed; and
  - Planned start and end dates for unit testing the operation of each infrastructure element (by type).
• **Systems Requirements Specification (SyRS).** System requirements define *what* the system will do but not *how* the system will do it. Working closely with stakeholders, requirements should be elicited, analyzed, validated, documented, and baselined. IEEE Standard 1233-1998 includes guidelines for format and content to develop a System Requirements Specification (SyRS). Requirements should include:
  
  o **Functional Requirements.** Including communications, security, and safety requirements.
  
  o **Interface Requirements.** Including identification of relevant standards (where appropriate).
  
  o **Data Requirements.** Including data-sharing requirements.
  
  o **Performance Requirements.** Including system performance targets and performance requirements.
  
  o **Security Requirements.** Including limits to physical, functional, or data access, by authorized or unauthorized users.

  The requirements should identify what the systems must accomplish; identify the subsystems; and define the functional and interface requirements among the subsystems. The role of each subsystem in supporting system-level performance requirements should be identified, including associated subsystem functional, interface, performance, security, data, and reliability requirements.

• **System Architecture and Standards Plan.** A Systems Architecture Document and Standards Plan should be developed that documents the architecture for systems associated with the Smart City Demonstration and associated standards that will be used. The architecture document should consider:
  
  o **Enterprise Architecture.** Describes the relationships between organizations required to support the overall system architecture.
  
  o **Functional Architecture.** Describes abstract functional elements (processes) and their logical interactions (data flows) that satisfy the system requirements.
  
  o **Physical Architecture.** Describes physical objects (systems and devices) and their application objects as well as the high-level interfaces between those physical objects.
  
  o **Communications Architecture.** Describes the communications protocols between application objects.
The National ITS Architecture is a mature architecture that provides a common framework for the ITS community to plan, define, and integrate ITS solutions. The Connected Vehicle Reference Implementation (CVRIA) was developed to extend the National Architecture to include detailed information to support development of fully interoperable regional connected vehicle architectures. The CVRIA and the associated SET-IT software tool will be fully integrated into a comprehensive National ITS Architecture and single comprehensive software toolset to support development of interoperable regional architectures including complete ITS infrastructure and connected vehicle capabilities along with interface information needed for standards selection. Prior to integration into a single comprehensive ITS architecture with a single integrated software tool, the CVRIA (and associated SET-IT tool) and the National ITS Architecture (and the associated Turbo Architecture Tool) will be available to support systems architecture efforts. The USDOT envisions that the Recipient will use the CVRIA, the National ITS Architecture, and published and under-development ITS standards to demonstrate interoperable ITS capabilities which are nationally extensible.

To the extent viable, the USDOT envisions the Recipient will define and demonstrate integration of ITS systems with other systems which comprise a smart city. As part of this effort, the Recipient shall develop a Standards Plan that identifies the nature of required interfaces to other systems, which should be defined to utilize existing networking or other standards when available. In following the systems engineering process, the Recipient shall identify information exchange needs and/or use cases. To the extent that such exchanges are supported by standards, the Recipient should catalog applicable standards that will be used. Where new standards are needed, these needs should be fully documented in the Standards Plan. Further, to the extent viable, these interfaces should be documented using the CVRIA system architecture tools and feedback should be provided to the USDOT to facilitate expansion of CVRIA to accommodate these additional interfaces. To support nationwide deployment of ITS infrastructure and connected vehicle technologies, the Recipient should use existing ITS standards, architectures, and certification processes for ITS and connected vehicle based technologies whenever viable, and document those cases where such use is not viable. To provide information required to refine ITS architecture and standards in support of nationwide deployment, the Recipient should also document their experiences and cooperate with architecture and standards developers to improve the quality of these products based on lessons learned in deployment.
• **System Design Document (SDD).** System design is created based on the system requirements specification (SyRS) including a high-level design that defines the overall framework for the system. Subsystems of the system are identified and decomposed further into components. Requirements are allocated to the system components, and interfaces are specified in detail. Detailed specifications are created for the hardware and software components to be developed, and final product selections are made for off-the-shelf components. IEEE Standard 1016-1998 (IEEE Recommended Practice for Software Design Descriptions) includes guidelines for format and content in to develop a System Design Document (SDD).

• **System Test Plan.** A System Test Plan should be used to demonstrate that the system satisfies all of the requirements. The System Test Plan should identify what methods (i.e., analysis, demonstration, inspection, and testing) will be used to ensure that the developed system satisfies the system’s requirements.

• **Interface Control Documents (ICDs).** Since there will be likely be multiple organizations involved in the Smart City Demonstration development effort, Interface Control Documents (ICDs) should be developed so that all parties can build components of the system that will work together. ICDs inform different organizations building parts of the system that must interact with each other what the specific elements of that interface are and how those elements must be expressed. ICDs could be as simple as specifying what types of connecting wires must be used to couple two manufacturers’ devices together. ICDs may be as complex as specifying the protocol suites and standards that must be used to ensure that two different computer devices can communicate over some form of telecommunications.

• **Testing Documentation.** System Integration should take place to ensure that the different pieces of the Smart City system interoperate correctly. Integration Unit testing should take place to ensure that individual components meet their specifications. Integration should take place to confirm that all interfaces have been correctly implemented and to confirm that all requirements and constraints have been satisfied. System testing should verify that the developed system satisfies the system’s requirements To support testing the Recipient should consider the following:

  - **Test Descriptions.** Test Descriptions include written descriptions of the individual verification and validation processes that will occur as part of the effort to ensure that the system was built correctly and that the correct system was built. Test descriptions should be linked back to the
requirements whose fulfillment they will determine. The document should include a requirements-to-test procedure matrix that shows the test coverage relationship among the tests and the requirements. Every requirement should have at least one test case associated with it and each test case should have at least one requirement associated with it.

- **Test Cases.** Each test case include a set of test inputs, execution conditions, and expected results developed for a particular objective, such as to exercise a particular path within a system or a software application or to verify compliance with a specific requirement or set of requirements.

- **Test Procedures.** Test Procedures spell out exactly how one verifies and validates that the component of the system undergoing integration actually functions as intended and as desired. If test data are going to be used as part of the verification and validation process in this step, the test procedures should also spell out how one will determine that the system actually performed the correct transformations on the data entered.

- **Test Data.** Test Data should include scripts used to execute software operations, data that must be entered by someone as part of the process of verification and validation of the system and its component integration, or a description of what system-generated data will flow through different components of the system to accomplish a system function.

- **Test Results.** Documents that describe the results of each test conducted.

- **Operations and Maintenance Plans.** Operations and Maintenance (O&M) plans should describe policies and high-level procedures governing operation and maintenance of the system. Minimally, it should address the activities described in the project’s Concept of Operations and any other activities needed to achieve the project's objectives.

**Note:** The Recipient may elect to conduct formal walkthroughs (see IEEE Standard 1028-1997) for key systems engineering deliverables to solicit inputs and feedback from stakeholders to help ensure consensus.

To support knowledge and technology transfer efforts, all systems engineering documentation developed for the Smart City Demonstration should be developed with the intent to share publically and be formatted for Section 508 compliance.
**Required Deliverables**

- Systems Engineering Management Plan (SEMP)
- Concept of Operations (ConOps)
- Demonstration Site Map and Installation Schedule
- Systems Requirements Specification (SyRS)
- System Design Document (SDD)
- System Architecture and Standards Plan
- System Design Document (SDD)
- System Test Plan
- Interface Control Documents (ICDs)
- Testing Documentation
- Operations and Maintenance Plans
- Other Systems Engineering documents – as identified by the Recipient and agreed to by the USDOT – that provide evidence of following a systems engineering approach

**TASK C: PERFORMANCE MEASUREMENT**

A primary objective of the Smart City Challenge is to demonstrate, quantify, and evaluate the impact of advanced technologies, strategies, and applications toward addressing the city’s challenges. To understand the impacts of smart city strategies, a set of rigorously defined performance measures and associated quantitative performance targets for each performance measure that are achievable within the timeframe of the Smart City Demonstration shall be defined. A Performance Measurement Plan shall be developed by the Recipient that identifies performance measures as well as plans for collecting data and reporting on performance.

The Smart City Demonstration should focus on combinations of technology solutions that align with the USDOT’s twelve vision elements. As part of the demonstration, the Recipient shall identify performance measures and a set of quantitative performance targets associated with each performance measure. Performance measures shall be developed to address how integrated Smart City strategies impact safety, mobility, ladders of opportunity, a transition to clean transportation, economic vitality, and/or address climate change.
In particular, performance measures should describe how the Smart City Demonstration may:

- Reduce traffic-related fatalities and injuries;
- Reduce traffic congestion
- Improve travel time reliability;
- Increase the use and integration of electric vehicles;
- Increase the transition to clean energy;
- Reduce transportation-related emissions;
- Improve personal mobility and increase accessibility for all citizens, including low-income individuals and persons with disabilities;
- Optimize multimodal system performance;
- Increase the number of mobility options and services;
- Improve public access to real-time integrated multimodal transportation information;
- Provide cost savings to transportation agencies, businesses, and the traveling public;
- Increase the connectivity between city services and connected travelers;
- Increase connectivity to employment, education, services and other opportunities; and/or
- Provide other benefits to transportation users and the general public.

The Performance Measurement Plan should discuss the types of data the Recipient plans to collect and how the Recipient plans to collect the data to support ongoing performance of the Smart City Demonstration. Proposed hypotheses should be documented as well as methodologies for collecting: (i) pre-demonstration data that can be used as a performance baseline, (ii) continuous data during life of the demonstration to support performance monitoring and evaluation, (iii) cost data including unit costs and operations and maintenance costs, and (iv) information on the timeframe that applications or other technology solutions are deployed during the course of the demonstration period. The Performance Measurement Plan should also address how the Recipient will release these performance measures as open data.

As part of the Smart City Demonstration, the Recipient is expected to respond to the USDOT’s Survey on Deployment Tracking. The USDOT’s Deployment Tracking Project has conducted national surveys on a regular basis since 1997, with the most recent previous survey conducted in 2013. The purpose of this effort is to assist the USDOT in measuring the deployment of ITS technology nationally. The ITS Deployment Tracking
Project surveys transportation agencies in the largest U.S. cities on a regular basis. For more information, visit: http://www.itsdeployment.its.dot.gov/. In addition, the Recipient may also be asked to respond to other USDOT survey instruments related to ITS or other deployment tracking.

**Required Deliverables**

- Performance Measurement Plan
- Response to USDOT Deployment Tracking Surveys (as required)

**TASK D: DATA PRIVACY REQUIREMENTS**

As noted elsewhere in this document, data collected by the Recipient in connection with the Smart City Demonstration will include Personally Identifiable Information (PII) and Sensitive Personally Identifiable Information (SPII).

- **PII** is information that can be used to distinguish or trace an individual's identity, such as their name, Social Security number, biometric records, etc., alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother’s maiden name. The definition of PII is not anchored to any single category of information or technology. Rather, it requires a case-by-case assessment of the specific risk that an individual can be identified by examining the context of use and combination of data elements. Non-PII can become PII whenever additional information is made publicly available. This applies to any medium and any source that, when combined with other available information, could be used to identify an individual.

- **SPII** is a subset of PII which if lost, compromised or disclosed without authorization, could result in substantial harm, embarrassment, inconvenience, or unfairness to an individual. Sensitive PII requires stricter handling guidelines because of the increased risk to an individual if the data are compromised. The following PII is always (de facto) sensitive, with or without any associated personal information:
  - Social Security number (SSN)
  - Passport number
  - Driver’s license number
  - Vehicle Identification Number (VIN)
  - Biometrics, such as finger or iris print
• Financial account number such as credit card or bank account number
• The combination of any individual identifier and date of birth, or mother’s maiden name, or last four of an individual’s SSN

In addition to de facto Sensitive PII, some PII may be deemed sensitive based on context.

**Categories of Records Collected.** Typically, the Recipient may include many of the following forms of personal information about individual participants and their motor vehicle and motor vehicle use:

**Participant Background Information**
- Individual Identifiers;
- Full Name (First, Middle, Last);
- Demographic information, including age and gender;
- Individual subject research identifier created by DOT; and
- Driver’s license number, issuing state, and qualifiers.

**Vehicle Identifiers**
- Personal vehicle identification number (VIN) and registration information;
- Vehicle Identification Number (VIN) of government issued vehicles; and
- Identifiers for equipment installed by DOT in personal or government issued vehicle.

**Contact Information**
- Mailing/Residential Address;
- Phone number(s);
- Email address(es);
- Institutional or organizational affiliation;
- Work/Business related contact information; and
- Occupation and work schedule.

**Eligibility Information**
- Driver history and habits;
- Medical history relevant to the scope of the research project; and
- Outcomes of criminal background check.
Project Information

- Vehicle sensor information;
- Video or still images, including infrared;
- Audio recordings;
- Dynamic information about a vehicle, including location, heading, proximity to and interaction with other vehicles and infrastructure;
- Dynamic information about a driver’s interaction with the vehicle, including steering wheel, turn signal, and accelerator and brake pedal positions; and
- Data collected from drivers by means of surveys, focus groups, or interviews.

USDOT Data Privacy Policy. Improper handling of PII or SPII by a Recipient could have significant adverse impacts on the privacy of individuals. For this reason, USDOT is committed to ensuring that the Recipient institutes sufficient data privacy controls to mitigate the risk of harm to individuals that would result in the improper handing or disclosure of the PII and SPII collected from individuals in connection with a DOT-funded Smart City Transportation Project.

The Recipient shall:

- Devote sufficient resources, and develop and adhere to policies and procedures to ensure that privacy-risks stemming from a Smart City Demonstration are mitigated appropriately and in accordance with the privacy controls identified below;

- Develop and submit for USDOT approval a Data Privacy Plan that documents the technical, policy and physical controls that it will put in place (and require its sub-grantees and contractors to put in place) to mitigate potential privacy harms; the plan should include a System Security Plan (SSP) or other documentation sufficient to verify that the Recipient will store PII only on IT infrastructure that is subject to appropriate security controls;

- Ensure that sub-recipients, contractors, and partners who handle or may access PII or SPII developed by the Recipient in connection with a Smart City Demonstration adhere to the Recipient’s Data Privacy Plan and have policies and procedures in place to safeguard the security and privacy of participant data. To this end, the Recipient shall include in all sub-grant agreements and contracts appropriate data security and privacy requirements;

- Upon request by USDOT, provide sufficient documentation to demonstrate that its IT infrastructure, policies and procedures (and those of any sub-grantee or
contractors having access to PII or SPII) comply with the privacy control requirements set forth below, including but not limited to confirming that PII and SPII will be stored only on IT infrastructure employing security controls commensurate with the risk to the individual that would result from unauthorized access, disclosure, or use of the information.

Required Privacy Controls. Generally, the Recipient (and their sub-awardees and contractors) shall develop and document in their Data Privacy Plan the following privacy controls, which shall apply (as appropriate) throughout the data lifecycle:

- **Collection of PII**
  - Collect only PII that the researcher has been authorized to collect by USDOT.
  - Collect the minimum PII required for the research and not more.

- **Notice to Human Subjects**
  - Provide appropriate advanced notice, if at all possible at the point of collection, to the individuals from whom the PII is being collected.
  - Obtain advanced approval for the notice from the USDOT Contracting Officer.

**Use and Sharing of PII**
- Ensure that Recipient personnel acknowledge PII responsibilities to ensure that PII is used only as authorized.
- Not use PII for purposes other than those authorized by USDOT.
- Ensure that access to PII is on a “need to know” basis for authorized purposes only.
- Not exceed authorized access to PII, or disclose PII to unauthorized persons.

- **Security**
  - Protect all PII, electric or hardcopy, in their custody from authorized disclosure, modification, or destruction so that the confidentiality, integrity and availability of the information are preserved.
  - Store PII only on IT infrastructure employing security controls commensurate with the risk to the individual that would result from unauthorized access, disclosure, or use of the information.
  - Encrypt all PII in transit or at rest.
  - Encrypt all PII transmitted or downloaded to mobile computers/devices.
- Ensure that all individuals having access to PII have received training in the policies and procedures that protect PII.

**Maintenance and Disposal**
- Maintain PII in accordance with the applicable NARA records schedule (available from the NHTSA Contracting Officer or, in the case of NHTSA-conducted research, from the NHTSA Records Officer).
- After conclusion of the research project, maintain PII only as permitted by the NARA schedule and, in the case of contractor-conducted research, relevant data rights classes in the applicable contract.

**Privacy Documentation**
- Document compliance with the provisions of the Recipient's Data.
- Privacy Plan and the Data Privacy and Security provisions in the Grant Agreement.
- Upon request, provide to the USDOT Contracting Officer sufficient documentation to demonstrate compliance with the Recipient's Data Privacy Plan and the Data Privacy and Security provisions in the Grant Agreement.

**Privacy Reporting**
- Immediately report to the USDOT Contacting Officer any suspected loss of control or any unauthorized disclosure of PII by the Recipient, its sub-grantees or contractors.
- Immediately report to the USDOT Contacting Officer all suspected or actual unauthorized collection, use, maintenance, dissemination or deletion of PII by the Recipient, its sub-grantees or contractors.

**Additional Information.** There are many types of privacy and security controls available to safeguard the confidentiality of PII. NIST Special Publication 800-122 (Guide to Protecting the Confidentiality of PII)\(^2\) provides guidelines for a risk-based approach to protecting the confidentiality of PII. Additional information about privacy and security safeguards that may protect PII can be found in Appendix J to NIST Special Publication 800-53.\(^3\) Furthermore, NIST provides guidance regarding big data

\(^2\) NIST Special Publication 800-122 (Guide to Protecting the Confidentiality of PII) may be found at: [http://csrc.nist.gov/publications/nistpubs/800-122/sp800-122.pdf](http://csrc.nist.gov/publications/nistpubs/800-122/sp800-122.pdf)

architectures and security requirements in NIST Special Publication 1500-1\textsuperscript{4} and NIST Special Publication 1500-4.\textsuperscript{5}

The Recipient may wish to include in their Data Privacy Plan the following checklist to help demonstrate that they considered the privacy and security controls detailed above. It also may be used by the Recipient to help verify that its subawardees and subcontractors have done so.

**Checklist.** Please review NIST Special Publication 800-122 for additional information about the questions below or the information that the Recipient may be required to produce in connection with their Privacy Plans. If you still require assistance, please contact the Agreement Officer handling the relevant procurement/contract for additional information.

1. Has your organization ever performed work for a Federal agency that involved handling PII?
   - **Yes.** The City handles Federal Tax Information governed by IRS Publication 1075. IRS Contact: Jackie Nielson, Fed State Coordinator, Ohio District Dept. of the Treasury, 614-280-8739

2. Does your organization have any policies/procedures to protect the security and confidentiality of PII?
   - **Yes.** The City has Executive Orders, policies and procedures to protect the security and confidentiality of PII. City Executive Orders and Policies are posted at https://www.columbus.gov/hr/Executive-Orders-and-Policies/

3. Does your organization have any policies/procedures to control and limit access to PII?
   - **Yes.** The City has Executive Orders and Policies to control and limit access to PII. City Executive Orders and Policies are posted at https://www.columbus.gov/hr/Executive-Orders-and-Policies/

\textsuperscript{4} NIST Big Data Interoperability Framework: Volume 1 Definitions, http://dx.doi.org/10.6028/NIST.SP.1500-1

\textsuperscript{5} NIST Big Data Interoperability Framework: Volume 4, Security and Privacy, http://dx.doi.org/10.6028/NIST.SP.1500-4
4. Does your organization store PII on network drives and/or in application databases with proper access controls (i.e., User IDs/passwords)?
   
   Yes. The City assigns unique identifiers and requires complex passwords.

5. Does your organization limit access to PII only to those individuals with a valid need to know?
   
   Yes. The City limits access to PII only to those individuals with a valid need to know.

6. Does your organization prohibit or strictly limit access to PII from portable and mobile devices, such as laptops, cell phones, and personal digital assistants (PDA), which are generally higher-risk than non-portable devices (e.g., desktop computers at the organization's facilities)?
   
   Yes. Executive Order 2007-03 prohibits such actions.

7. Does the information system used by your organization to store PII contain automated or easy-to-use process to ensure that only authorized users access PII – and only to the extent that each user has been authorized to do so?
   
   Yes. The City uses Active Directory to assign unique identifiers, require complex passwords and control access to private or sensitive information.

8. Does your organization monitor events that may affect the confidentiality of PII, such as unauthorized access to PII?
   
   Yes. The City monitors events and configures alerts for events that may affect the confidentiality of PII.

9. Does your organization audit its information systems on a regular or periodic basis?
   
   Yes. The City performs security assessments by various methods including access, rule and configuration reviews. The City is also subject to external audits including an IRS Safeguards Review.
10. Does your organization analyze information system audit records for indications of inappropriate or unusual activity affecting PII, investigate suspicious activity or suspected violations, report findings to appropriate officials, and take necessary actions?

**Yes.** The City has a Security Incident Response Plan written to provide a well-defined, organized approach for handling any potential threat to systems and data.

11. Does your organization restrict access to information system media containing PII, including digital media (e.g., CDs, USB flash drives, backup tapes) and non-digital media (e.g., paper, microfilm)?

**Yes.** The City maintains strict control over the internal or external distribution of any kind of media. Digital containing sensitive information is physically secured from unauthorized access, labeled, inventoried and is tracked via logs. Non-digital media containing sensitive information is only kept when necessary for business purpose and physically secured from unauthorized access.

12. Does your organization restrict access to portable and mobile devices capable of storing PII?

**Yes.** Executive Order 2007-03 prohibits copying sensitive information to such devices.

13. Does your organization require that information system media and output (such as printed documents) containing PII be labeled to indicate appropriate distribution and handling?

**Yes.** PO 22 requires that media must be classified so that the sensitivity of the data can be determined.

14. Does your organization securely store PII, both in paper and digital forms, until the media are destroyed or sanitized using approved equipment, techniques, and procedures?

**Yes.** Physical and logical access to media containing PII is strictly controlled. Encryption is used on digital media.
15. Does your organization sanitize digital and non-digital media containing PII before disposing of or reusing the media?

**Yes.** Paper media is destroyed using cross cut shredders. Digital media is sanitized prior to reuse or destroyed as part of disposal.

**Required Deliverables**

- Data Privacy Plan

**TASK E: DATA MANAGEMENT AND SUPPORT FOR INDEPENDENT EVALUATION**

Management systems within a smart city – both within transportation and across other sectors of a city – are expected to share data to allow for communication between cities and their citizens and enable an open, growing ecosystem of third part services that provide additional benefits to citizens. Systems that allow for data sharing also enable cities to maximize efficiencies through intelligent management of assets across sectors. Open data and technology enable the efficient coordination, use, and management of all mobility services in the system. A Data Management Plan should be submitted per requirement of the USDOT Public Access Plan. Requirements are outlined at [http://ntl.bts.gov/publicaccess/creatingaDMP.html](http://ntl.bts.gov/publicaccess/creatingaDMP.html).

The Recipient shall develop a Data Management Plan that describes how data – including data across multiple sectors in a city – will be collected, managed, integrated, and disseminated before, during, and after the Smart City Demonstration. This includes real-time and archived data that are inputs to and outputs from systems managed by the city and its partners. The document shall discuss the city’s plans for managing their data as a strategic asset and making open, machine-readable data available to the public – subject to applicable privacy, security and other safeguards – to fuel entrepreneurship and innovation to improve citizens’ lives, create jobs, and spur economic development. In cases where the data includes PII or other restrictions, the document shall address how the city the city will make that data available, as possible, in a secure environment for the use of qualified researchers. The Data Management Plan shall also describe:

- The data the city currently collects and plans to collect as part of the Smart City Demonstration and how these data will be used by the lead agency, project partners, other agencies, and stakeholders to further address city challenges.
• Opportunities to integrate transportation data with other functions or services in a city (such as public safety, human services, transit, and public works) to improve the management and operations of the city. Likewise, it shall describe how other data could be integrated with transportation data to improve transportation operations.

• The terms of existing and future data sharing agreements that will be put in place during the project period and the city’s approach to preserving project data for future use. If the city plans to partner with outside organizations (nonprofits, universities, corporations, etc.) it shall address whether and specify how (e.g., limitation on sharing or use) data from those organizations or interests will be collected, managed, and shared across sectors or with the public, if appropriate.

• The terms and conditions that exist or will be established and managed in partnership agreements, data or information sharing agreements, agency specific policies and operating procedures to establish and maintain the systems and interfaces to maintain the integrity of the data and share the information identified in the plan.

• Practices that safeguard data, privacy, and physical assets. The Data Management Plan shall identify the extent to which their system or systems will collect or store Personal Identifiable Information (PII) and PII-related information, and ensure that there is a legitimate need for this information to meet the goals of the system and that the data is only accessible for and used for these legitimate purposes. If PII is collected, practices for scrubbing or removing PII from data sets shall be described so that data may be used for independent evaluation and/or made available to the USDOT’s Research Data Exchange (RDE).

As part of the Smart City Demonstration, an Independent Evaluation will be conducted by the USDOT. The Independent Evaluator will conduct an evaluation applying quantitative and qualitative evaluation methodologies to conduct before and after performance assessments; cost-benefit assessments of the demonstration; assess user acceptance/citizen satisfaction of the demonstration; document lessons learned, challenges and approaches for mitigating, addressing, and/or overcoming them; estimate total impacts, costs, and return-on-investment (ROI) of the demonstration; and assess if the Smart City Demonstration achieved its vision.

The Recipient shall develop an Evaluation Support Plan detailing their expected support to the independent evaluation effort. During demonstration, the Recipient shall execute its Evaluation Support Plan. The support may include provision of frequently collected
data and corresponding meta data; provision of frequently monitored performance measures estimates and desired targets; limited availability of the site for the independent evaluators to conduct additional field tests and experiments to supplement data not available from the site; and participation in surveys and interviews conducted by the independent evaluators.

Systems deployed as part of the Smart City Demonstration must be capable of generating the data needed to calculate measures over time – that is, to show how well the systems are performing with respect to performance measures and targets identified in the Performance Measurement Plan. Independent evaluation will also be required to validate site system performance with respect to the targeted measures, to collect or infer contextual data that allows for the isolation and mitigation of confounding factors, and to provide supplementary evaluation with respect to a broader set of safety, environmental, mobility and public agency efficiency measures of interest to USDOT. The Recipient is responsible for supporting the independent evaluator’s access to the site and to site staff to conduct evaluation-related experiments, interviews, and surveys.

To support independent evaluation, the Recipient shall apply data quality measures and processes including security protocols to convert the raw data into processed, quality data and ensure that those data are stored in a secure database, with the database schema defined by the Independent Evaluator. The Recipient shall securely transmit these data to support evaluation, on a schedule and using a medium agreed upon with the Independent Evaluator, to the Independent Evaluator’s location. Data collected for use by the Independent Evaluator shall be considered “owned” by the USDOT. The Recipient shall transmit only those data required to support evaluation by the Independent Evaluator; any additional data that the site collects for its own use shall also be stored in its own secure data storage system, but kept separate from data required by the Independent Evaluator and the USDOT. However, the Recipient may use data collected for the Independent Evaluator in its own analyses.

Connected vehicle, mobile device, and infrastructure sensor data captured during the Smart City Demonstration are expected to be broadly shared with the community to inform prospective deployers of smart city applications. Incorporating data sharing practices into the overall design of the Smart City Demonstration will also enable more innovation and participation. However, data sharing is subject to the protection of intellectual property rights and personal privacy and must be handled securely. 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 (RDE) (www.its-rde.net) stripped of PII. The USDOT envisions that this data sharing capability will better support the needs of ITS researchers and developers while reducing costs and encouraging innovation. Data accessible through the RDE will be well-documented and freely available to the public. The USDOT expects appropriate data – determined by the Recipient and the USDOT – to be made freely available to the public on the RDE. Hence, the Recipient shall transfer appropriate data collected under the Smart City Demonstration to the RDE.

While the RDE currently only supports dissemination of archival data that has been stripped of PII, the USDOT may develop future capabilities to support the dissemination of real-time data, sharing sensitive data with qualified researchers, and automate cleansing of data sets to remove PII to enable public dissemination. The USDOT expects to work closely with the Recipient to ensure that data produced during the demonstration is shared efficiently and cost effectively, leveraging these and other shared resources as appropriate to increase the completeness and timeliness of data exchange.

Preference for real-time data from third party providers, etc.
The Recipient shall enter into Memoranda of Understanding (MOU) or equivalent with third party providers of data, including Contractors, that document the terms under which the data is being provided or acquired. The Recipient shall require, to the extent possible, such agreements to state that third party data sources shall be provided as real-time data streams and provide the Recipient with unlimited rights to use and disseminate the real-time and archived data for any purpose, consistent with applicable data security and privacy requirements.

Requirement for real-time BSM data feed, though flexibility on scale
During the Smart City Demonstration, the Recipient shall provide a real-time, streaming data feed from Connected Vehicles (CV), including but not limited to the Recipient’s standards-compliant Basic Safety Message (BSM) data, for operational testing and use by the Recipient and third party users.

Note: To control costs and complexity, the Recipient may choose to limit the scale and scope of this real-time data feed. For example, the Recipient may limit the geographic area from which this real-time data will be disseminated or the length of time the real-time feed will be made available.
Preference for open source tools
The USDOT strongly prefers that the Recipient acquire and develop open source technologies throughout the course of the Smart City Demonstration and that any code developed for the project is, via contract or equivalent mechanism, open source and available for license-free use and enhancement by third parties. Data rights under this agreement shall be in accordance with 2 CFR 200.315, Intangible property.

Required Deliverables

- Data Management Plan
- Independent Evaluation Support Plan
- Data to support USDOT’s Independent Evaluation
- Data provided to the USDOT’s Research Data Exchange (RDE)

TASK F: SAFETY MANAGEMENT AND SAFETY ASSURANCE

The Recipient shall describe any underlying safety needs associated with the safety of all travelers, subjects, and other personnel associated with the Smart City Demonstration.

The Recipient shall develop a Safety Management Plan that includes a systematic approach to achieving acceptable levels of safety risk with the demonstration. The Recipient shall establish and define the methods, processes, and organizational structure needed to meet safety goals. These processes should build upon the processes and procedures that already exist for city operations, but also consider how new strategies deployed as part of the Smart City Demonstration may impact those processes. Safety scenarios shall be developed that are related to the applications and technologies – including but not limited to automated vehicle deployments – selected for demonstration. These scenarios shall include an analysis of likelihood and potential impact. Potential mitigating actions taken at various times and locations shall be identified for each scenario. A set of “safety needs” shall be derived from this scenario-based analysis. The Recipient shall identify levels of safety risk associated with the Smart City Demonstration, using established processes where possible, (e.g., ISO 26262 ASIL). The nature of these assessment processes will be dependent on the applications selected and the nature of the specific safety risks.

During the demonstration, the Recipient shall evaluate the continued effectiveness of implemented risk control strategies and support the identification of new hazards. The
Recipient shall continually provide insight and analysis regarding methods/opportunities for improving safety and minimizing risk.

If some or all components of the Smart City Demonstration plan to use human participants, the Recipient shall obtain Human Use Approval from an accredited Institutional Review Board (IRB). Under federal regulations, an IRB is a group of individuals that has been formally designated to review and monitor research involving human subjects. In accordance with federal regulations, an IRB has the authority to approve, require modifications in (to secure approval), or disapprove research. This review serves an important role in the protection of the rights and welfare of human research subjects. The purpose of IRB review is to assure, both in advance and by periodic review, that appropriate steps are taken to protect the rights and welfare of humans participating as subjects in the research. Certain IRBs have been “accredited” by private accreditation agencies. Note that the USDOT will not act as an IRB for the purposes of this award. The Recipient is responsible for obtaining IRB approval for human participation within the Smart City Demonstration.

**Required Deliverables**

- Safety Management Plan
- Human Use Approval Summary

**TASK G: COMMUNICATIONS AND OUTREACH**

The Recipient shall have a comprehensive communications and outreach program that covers both outreach activities and the accommodation of requests for site visits by media, researchers, and others. Communications and outreach should consider:

- Media strategy for both local and national press;
- Media coordination with the USDOT;
- Web/social media presence;
- Trade show strategy;
- Outreach strategy to promote the demonstration locally;
- Community awareness strategy;
- Crisis communications plan in case of unforeseen events, natural disasters, and other threats; and
- Accommodation of site visits and demonstration of capabilities.
Public relations and marketing should consider the delivery of:

- News articles, press releases, brochures, fact sheets;
- Photos;
- Website content;
- Videos;
- Talking points, press events, PowerPoint slide decks; and
- Trade show events.

For Recipient consideration, levels of outreach are expected to include:

- Two local press conferences each year;
- Three articles a year to be published in industry trade journals;
- A promotional video (6-12 minutes) about the Smart City Demonstration, including two additional updates;
- A Smart City Demonstration website;
- Travel and participation in six workshops/conferences/trade shows each year with one of them being international; and
- Participation in four public USDOT-organized webinars per year regarding Smart City Challenge Demonstration progress/performance and lessons learned.

The Recipient shall include regular coordination with USDOT communications staff, to facilitate the branding, re-use and re-distribution of materials developed by USDOT and the Smart City Demonstration team.

**Required Deliverables**

- Communications and Outreach Plan
- Public relations and marking materials defined by the Recipient
- Outreach Products, including:
  - A promotional video (6-12 minutes) about the Smart City Demonstration, including two additional updates;
  - A Smart City Demonstration website;
  - Travel and participation in six workshops/conferences/trade shows each year with at least one outside of the United States or in support of international cooperation; and
  - Participation in four public USDOT-organized webinars per year regarding Smart City Challenge Demonstration progress/performance and lessons learned.
- Other communications and outreach deliverables as identified by the Recipient
**TASK H: INTERNATIONAL COLLABORATION**

The USDOT is interested in sharing lessons learned from the Smart City Demonstration with its international partners. The USDOT currently has memorandums of understanding (MOUs) with the European Commission, Japan, Korea, Canada, and Mexico. The Recipient will be expected to collaborate on similar projects with international partners with which USDOT has research coordination agreements for the purpose of expanded learning. The format of the collaboration may include hosting foreign scanning tours, complementary alignment of evaluation activities, or it could involve a partial alignment of deployment or research activities and objectives to create twinned complementary project components. These exchanges assume that the international partners will fund projects on topics of relevance to the USDOT, and that an agreement can be reached among the international partners, USDOT, and the program managers of the research and deployment programs. The USDOT will identify areas of shared interest with its international partners from among awarded programs and initiate collaboration discussions. No funds will be exchanged between USDOT and foreign-funded programs; each side will have responsibility for their respective budgets.

The proposal should include an estimate of travel funds needed for three team members to participate in one international and one US meeting each year of approximately three days duration, plus six days of effort for meeting preparation, and six days for reports preparation associated with the collaboration aspects of this project. These terms are for planning purposes only and do not constitute a commitment by the USDOT to support research exchange with foreign-funded programs; USDOT reserves the right to renegotiate these terms as funding, priorities, and opportunities for collaboration with the international partners may change.

**Required Deliverables**

- Participation in one International Collaboration meeting each year of approximately three days duration, plus six days of effort for meeting preparation, and six days for reports preparation associated with the collaboration aspects of this project
TASK I: PARTICIPATION IN RELEVANT ITS ARCHITECTURE AND STANDARDS DEVELOPMENT EFFORTS

The Recipient shall assist in supporting activities of the ITS Architecture and Standards Programs where those activities are impacted by Smart City initiatives. Making use of published and developmental ITS architectures and standards, the Recipient will encounter cases where additional needs become evident as well as cases where improvements or corrections to existing architecture and standards are warranted. The Recipient shall take appropriate actions to assure that these lessons-learned are made available to support evolution of architecture and standards to improve suitability to support nationwide or greater interoperability of ITS as well as interoperability of ITS with other smart city systems and architectures. Such support will include participation in select Standards Development Organization (SDO) working groups/committees, including providing input to their work in the form of technical information (e.g., objectives, user needs, data requirements) about the Smart City initiative and lessons learned from Smart City Development and deployment activity. When appropriate, in-person participation in select meetings will be included. Participation in relevant ITS Standards development efforts may include providing technical input for multiple SDOs and standards-relevant organizations such as the International Organization for Standardization (ISO) Technical Committee 204 (TC204) and possibly TC22, European Telecommunications Standards Institute (ETSI), European Committee for Standardization (CEN), Institute of Electrical and Electronics Engineers (IEEE), SAE International (SAE), Institute of Transportation Engineers (ITE), American Association of State Highway and Transportation Officials (AASHTO), National Electrical Manufacturers Association (NEMA), and National Institute of Standards and Technology (NIST).

The Recipient is expected to provide one appropriately knowledgeable expert for this participation. In-person participation requirements are estimated at 6 meetings of 3 days each per year, of which 2 are expected to be held outside of the United States. Additional efforts are expected to be required including remote participation during conference calls/webinars as well as drafting of technical input. The Recipient shall request USDOT prior approval for all international travel. The USDOT covers labor and travel costs associated with architecture and standards participation from the Recipient and private sector participants. For each working group/committee meeting with in-person participation, the Recipient shall provide a report to the USDOT describing the meeting outcomes, any impacts to the Smart City Demonstration, and inputs made by the Smart City program.
Required Deliverables

- Attendance at 6 architecture and standards meetings, of which 2 are expected to be held outside of the United States
- Architecture and Standards Meeting Trip Reports

TASK J: INTERIM AND FINAL REPORTING

The USDOT requires the Recipient to submit interim and final reports. Interim reports shall be submitted each year discussing the progress to date and summarizing issues and opportunities. A final report for the Smart City Demonstration shall provide a summary of what was accomplished, the benefits and costs and lessons learned. This document shall be developed with the intent to share publically and be formatted for Section 508 compliance. The final report shall describe:

- Deployment costs (i.e., systems and unit costs) and operational costs (i.e., operations and maintenance costs) of the project compared to the benefits and cost savings the project provides; and
- How the project addressed city challenges and met the original expectations defined in the city’s Smart City vision, such as —
  - Data on how the demonstration helped to improve safety, mobility, sustainability, ladders of opportunity, economic vitality, and/or address climate change;
  - The effectiveness of providing a holistic approach to addressing transportation challenges by deploying applications and strategies consistent with the USDOT’s twelve vision elements; and
  - Lessons learned and recommendations describing how the demonstration met the objectives identified by the USDOT for the Smart City Challenge and recommendations for other locations considering implementation of similar solutions.

Required Deliverables

- Smart City Demonstration Interim Reports (annually)
- Smart City Demonstration Final Report
6. **TABLE OF DELIVERABLES**

The following due dates are based on an estimated award effective date of August 31, 2016.

In the event an update to the due dates contained in the following Table of Deliverables is required and/or deemed necessary by the parties, the update, when expressly approved by the AOR in writing, shall replace the previously approved version of the Table and will be considered incorporated into this award by reference with no formal agreement amendment needed. The Recipient shall comply with the latest version of the Table as expressly approved in writing by the AOR. The Recipient shall implement a version tracking approach to efficiently manage updates to the Table. The Recipient shall include the latest approved version of the Table in the Task A Project Schedule Monthly Updates, or if applicable, include a proposed Table update for consideration by the AOR. Proposed Table updates shall be supported by adequate narrative justification to fully explain the need for the update.

<table>
<thead>
<tr>
<th>Task</th>
<th>Deliverable</th>
<th>Due Date</th>
<th>Section 508 Compliant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Kick-off Meeting – conduct a kickoff meeting at the USDOT or the Recipient's site.</td>
<td>Within four weeks after award</td>
<td>No</td>
</tr>
<tr>
<td>A</td>
<td>Project Management Plan (PMP)</td>
<td>10/24/2016</td>
<td>No</td>
</tr>
<tr>
<td>A</td>
<td>Project Schedule</td>
<td>9/26/2016</td>
<td>No</td>
</tr>
<tr>
<td>A</td>
<td>Project Schedule Monthly Updates</td>
<td>Monthly</td>
<td>No</td>
</tr>
<tr>
<td>A</td>
<td>Partnership/Stakeholder Status Summary (Draft and Final)</td>
<td>9/26/2016</td>
<td>No</td>
</tr>
<tr>
<td>A</td>
<td>Quarterly Progress Reports and Briefings – submit progress reports to document technical activities performed. See Quarterly Progress Reports clause below.</td>
<td>Quarterly</td>
<td>No</td>
</tr>
<tr>
<td>B</td>
<td>Systems Engineering Management Plan (SEMP)</td>
<td>11/21/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>Task</td>
<td>Deliverable</td>
<td>Due Date</td>
<td>Section 508 Compliant?</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>B</td>
<td>Concept of Operations (ConOps)</td>
<td>2/27/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Demonstration Site Map and Installation Schedule</td>
<td>3/31/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Systems Requirements Specification (SyRS)</td>
<td>6/12/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Interface Control Document (ICD)</td>
<td>7/3/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>System Design Document (SDD)</td>
<td>9/18/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Test Plan (TP)</td>
<td>8/13/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>System Architecture and Standards Plan</td>
<td>3/24/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Other Systems Engineering documents – as identified by the Recipient and agreed to by the USDOT – that provide evidence of following a systems engineering approach</td>
<td>TBD</td>
<td>Yes</td>
</tr>
<tr>
<td>C</td>
<td>Performance Measurement Plan</td>
<td>12/21/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>C</td>
<td>Response to USDOT Deployment Tracking Surveys (as required)</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>Data Privacy Plan</td>
<td>7/31/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Data Management Plan</td>
<td>7/3/2017</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Independent Evaluation Support Plan</td>
<td>12/21/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Data to support USDOT's Independent Evaluation</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>Data provided to the USDOT's Research Data Exchange (RDE)</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>Safety Management Plan</td>
<td>11/21/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>Task</td>
<td>Deliverable</td>
<td>Due Date</td>
<td>Section 508 Compliant?</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>F</td>
<td>Human Use Approval Summary</td>
<td>2/1/2017</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Communications and Outreach Plan</td>
<td>12/5/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>A promotional video (6-12 minutes) about the Smart City Demonstration, including two additional updates;</td>
<td>TBD</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>A Smart City Demonstration website</td>
<td>11/18/2016</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>Travel and participation in six workshops/conferences/trade shows each year with one of them being international</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Participation in four public USDOT-organized webinars per year regarding Smart City Challenge Demonstration progress/performance and lessons learned</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>H</td>
<td>Participation in one International Collaboration meeting each year of approximately three days duration, plus six days of effort for meeting preparation, and six days for reports preparation associated with the collaboration aspects of this project</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>I</td>
<td>Attendance at 6 architecture and standards meetings, of which 2 are expected to be held outside of the United States</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>I</td>
<td>Architecture and Standards Meeting Trip Reports</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>Task</td>
<td>Deliverable</td>
<td>Due Date</td>
<td>Section 508 Compliant?</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>J</td>
<td>Smart City Demonstration Interim Reports (annually)</td>
<td>Last Friday of September (annually)</td>
<td>No</td>
</tr>
<tr>
<td>J</td>
<td>Smart City Demonstration Final Report</td>
<td>9/23/2020</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Note:** Section 508 requirements are included in the General Terms and Conditions available online at: [http://www.fhwa.dot.gov/aaa/generaltermsconditions.cfm](http://www.fhwa.dot.gov/aaa/generaltermsconditions.cfm).

**7. PUBLICATION GUIDELINES**

All ITS reports funded in full or in part by the USDOT'S ITS Joint Program Office (JPO), such as this award, must be published in the National Transportation Library (NTL), formerly EDL. NTL was established in 1998 by the Transportation Equity Act for the 21st Century (TEA-21) to maintain and facilitate access to statistical (and other) information needed for transportation decision-making at the Federal, State, and local levels and to coordinate with public and private transportation libraries and information providers to improve information sharing among the transportation community. All reports are cataloged, meta tagged, sourced, summarized in abstract form and are published by the USDOT.

For the documents designated to be Section 508 Compliant above, the ITS JPO Publication Guidelines apply. The Guidelines are available online:

[http://its.dot.gov/communications/pubsguidance.htm](http://its.dot.gov/communications/pubsguidance.htm)
SECTION B – FEDERAL AWARD INFORMATION

1. TYPE OF AWARD

The award type is a Cooperative Agreement. This agreement is a cost-reimbursement award.

2. COST SHARING OR MATCHING

Cost sharing or matching is required in the amount cited on page 2 of this agreement. Per 2 CFR 200.29, Cost sharing or matching means the portion of project costs not paid by Federal funds. See 2 CFR 200.306, Cost sharing or matching. The following amounts, as included in the approved Budget Application (Attachment 3), are hereby incorporated into this award as required Cost Sharing or Matching, subject to the terms of the award and the requirements of 2 CFR 200.

<table>
<thead>
<tr>
<th>Estimated Funding Source</th>
<th>Estimated Cost Share Amount</th>
<th>Estimated Cash/In-kind</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Columbus</td>
<td>$8,000,000</td>
<td>Cash</td>
</tr>
<tr>
<td>State of Ohio (Ohio DOT)</td>
<td>$7,000,000</td>
<td>In-kind</td>
</tr>
<tr>
<td>Franklin County</td>
<td>$4,000,000</td>
<td>$1,000,000 cash, $3,000,000 in-kind</td>
</tr>
<tr>
<td>Total</td>
<td>$19,000,000</td>
<td></td>
</tr>
</tbody>
</table>

Costs incurred by the Recipient to satisfy the cost sharing or matching requirement must be allowable under 2 CFR 200 and incurred during the period of performance of the agreement.

3. PERIOD OF PERFORMANCE

The period of performance for this Cooperative Agreement is four years from the effective date of the award.

The USDOT expects the demonstration to be implemented and tested within three years. The fourth year is expected to be used for finalizing the evaluation of the demonstration.
Ideally, the awardee, on a self-sustaining basis, will continue to operate the systems and services implemented in the Smart City Challenge after completion of the USDOT funded demonstration.

The Recipient may charge to the Federal award only allowable costs incurred during the period of performance (except as described in 2 CFR §200.461 Publication and printing costs) and any costs incurred before the Federal awarding agency made the Federal award that were authorized by the Federal awarding agency.

4. DEGREE OF FEDERAL INVOLVEMENT

The USDOT anticipates substantial Federal involvement between it and the Recipient during the course of this demonstration. The anticipated Federal involvement will include technical assistance, education and guidance to the Recipient.

5. LEVERAGED PARTNER RESOURCES

In addition to the Federal Share and the Recipient Cost Share identified on page 2 of the agreement, the Recipient shall use Leveraged Partner Resources to fund and perform the demonstration. Leveraged Partner Resources are resources from third party organizations in support of the demonstration. "Key" Leveraged Partner Resources, listed below, are considered essential to the demonstration and are, therefore, approved and incorporated into this award for informational and reporting purposes. The Key Leveraged Partner Resources listed herein are not subject to the requirements of 2 CFR 200, or the terms of the award, except as cited below.

The Technical Application and Budget Application dated July 29, 2016 are based on knowledge of partnership agreements as of the application date. Any new partnership agreements may affect the Applications, requiring updates/amendments in the future.

Requirement to Provide Copies of Key Partner Agreements: The Recipient shall provide to the Agreement Officer electronic copies of all signed Key Partner agreements, and any subsequent agreement amendments executed during the award period of performance. The Recipient shall submit such agreements and amendments within one week after execution of the agreement or amendment.

Requirement for Prior Approval of Changes to Key Partners and Agreements: The following list of Key Leveraged Partner Resources is hereby approved and incorporated into this award for informational and reporting purposes. In the event the Recipient
determines the need to remove, replace, or divert a Key Leveraged Partner Resource, or significantly change the nature of a Key Partner agreement, the Recipient must notify the Agreement Officer in writing to request prior written approval of the change. The Recipient's request shall provide details of the proposed change, describe the circumstances of the change, and provide the Recipient's assessment of the impact of the change upon the demonstration. The Recipient must obtain prior written approval from the Agreement Officer before entering into a new agreement with the proposed replacement partner or resource, or executing an amendment that significantly changes a Key Partner agreement. This requirement will enable the USDOT to review and approve in advance significant changes in the planned use of Key Leveraged Partner Resources.

Requirement for Notification of Non-Key Partner Changes: In the event the Recipient determines the need to remove, replace, or divert Leveraged Partner Resources that are part of the demonstration but are not designated as Key in the list below, the Recipient must notify the Agreement Officer in writing of the proposed change in partner, circumstances surrounding the change, and the Recipient’s analysis of the impact upon the demonstration.

### Key Leveraged Partner Resources

<table>
<thead>
<tr>
<th>Key Partner</th>
<th>Description of Resources</th>
<th>Estimated Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul Allen's Vulcan, Inc.</td>
<td>Funding to support the deployment of electric vehicles and other carbon emission reduction strategies.</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>Mobileye</td>
<td>Installation of Mobileye's Shield +TM technology on transit buses.</td>
<td>$1,950,000</td>
</tr>
<tr>
<td>Autodesk</td>
<td>A year-long subscription to Infraworks, an information modeling platform that uses 3-D visualizations and real-world data to plan major engineering projects as well as on-site training.</td>
<td>$34,520</td>
</tr>
<tr>
<td>Key Partner</td>
<td>Description of Resources</td>
<td>Estimated Amount</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Amazon Web Services (AWS)</td>
<td>Credits to AWS Cloud services and AWS Professional Services. AWS will also provide solution architecture and best practices guidance to the Recipient.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>NXP</td>
<td>Wireless communication modules that allow cars to securely exchange data, such as hazard warnings, over distances of more than a mile to prevent accidents and improve traffic flow.</td>
<td>$2,500,000</td>
</tr>
<tr>
<td>Alphabet’s Sidewalk Labs</td>
<td>Flow technology, an analytics platform that the Recipient can use to identify traffic-prone areas and parts of a city that are underserved by public transportation — all by using traffic patterns culled from aggregated, anonymized data. From that information the software can suggest solutions like ride-sharing, new transportation access or a rerouting of traffic to better serve the community.</td>
<td>$230,000</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>AT&amp;T has committed to provide in-kind partnering to the City to assist with the deployment of the Columbus Connected Transportation Network (CCTN). The proposed partnering includes professional services and technical support resources; communications and data management technologies; USB cellular modems and SIM cards and connectivity; hardware to support communications and data management services.</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>
### Key Leveraged Partner Resources

<table>
<thead>
<tr>
<th>Key Partner</th>
<th>Description of Resources</th>
<th>Estimated Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Solar</td>
<td>DC Solar will partner with the City to deploy eight to ten mobile solar generators or EV charging stations in 11 month increments at locations in the City to be determined. Mobile solar generators and EV charging stations will demonstrate the use of renewable energy sources in support of fleet electrification and power generation.</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Continental</td>
<td>Continental will deploy a roadside infrastructure sensing system; onboard V2X system, and DSRC communication systems to enable communication between roadside and onboard systems; API interfaces on cloud backend comprised of APIs for accessing data from both onboard and roadside V2X systems; basic safety messages to demonstrate the effectiveness of the CCTN on alleviating transportation-related issues such as intersection safety warnings, traffic management, automated system to regulate the flow of traffic according to real time traffic information, in-car productivity and safety, V2X warnings based on driver profile, route optimization or navigation, and reduced traffic congestion through load balancing via rerouting services enhanced with real time navigation data; and gamification of driving with incentives for drivers to behave responsibly to improve traffic condition and safety.</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Experience Columbus</td>
<td>Included in Event Parking (Downtown)</td>
<td>$100,000</td>
</tr>
<tr>
<td>Key Partner</td>
<td>Description of Resources</td>
<td>Estimated Amount</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Ohio State University</td>
<td>Included in EAV (Commercial)/Program Management</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Greater Columbus Art Council</td>
<td>Included in Communications and Outreach</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>HERE, Inc.</td>
<td>Included in Information Data Exchange (Enabling Technology)</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>INRIX</td>
<td>Included in Information Data Exchange (Enabling Technology)</td>
<td>$1,424,000</td>
</tr>
<tr>
<td>Mass Factory (App&amp;Town)</td>
<td>Included in Enhanced Human Services (Enabling Technology)</td>
<td>$40,000</td>
</tr>
<tr>
<td>SPARC</td>
<td>Included in CCTN Vehicles (Enabling Technology)</td>
<td>$388,200</td>
</tr>
<tr>
<td>Peloton</td>
<td>Included in Truck Platooning (Logistic)</td>
<td>$165,000</td>
</tr>
<tr>
<td>Honda</td>
<td>Included in CCTN Vehicles (Enabling Technology)</td>
<td>$2,600,000</td>
</tr>
<tr>
<td>Battelle</td>
<td>Included in Program Management</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Econolite</td>
<td>Included in CCTN (Enabling Technology)</td>
<td>$280,000</td>
</tr>
<tr>
<td>Columbus Partnership</td>
<td>Included in Testing of Autonomous Vehicles (Commercial)</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>Columbus Partnership</td>
<td>Sustainment Cash Available as needed for USDOT and/or electrification deployments</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>$44,211,720</td>
</tr>
</tbody>
</table>
In addition to the Federal Share and the Recipient Cost Share identified on page 2 of the agreement, the Recipient shall use Leveraged Electrification Partner Resources to fund and perform demonstrations in conjunction with the Vulcan electrification grant. Leveraged Electrification Partner Resources are resources from third party organizations in support of the Vulcan electrification demonstration. "Key" Leveraged Partner Resources, listed below, are considered essential to the Vulcan electrification demonstration and are, therefore, referenced and incorporated into this award for informational and reporting purposes. The Key Leveraged Electrification Partner Resources listed herein are not subject to the requirements of 2 CFR 200, or the terms of the award.

### Key Leveraged Electrification Partner Resources

<table>
<thead>
<tr>
<th>Key Partner</th>
<th>Description of Resources</th>
<th>Estimated Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Columbus</td>
<td>Deploying EV and EV charging infrastructure.</td>
<td>$ 2,500,000</td>
</tr>
<tr>
<td>American Electric Power</td>
<td>Decarbonization of power supply and deployment of electric vehicles and other carbon emission reduction strategies.</td>
<td>$ 29,100,000</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td>Deploying EV and EV charging infrastructure, and University investment in mobility and smart grid related research.</td>
<td>$ 13,000,000</td>
</tr>
<tr>
<td>Columbus Partnership</td>
<td>Deploying EV and EV charging infrastructure, and investment in mobility and smart grid related research.</td>
<td>$ 7,500,000</td>
</tr>
<tr>
<td>Mid-Ohio Regional Planning Commission</td>
<td>Installation of EV charging infrastructure</td>
<td>$ 600,000</td>
</tr>
<tr>
<td>FleetCarma</td>
<td>Installation of advanced telematics devices to track and optimize fleet fuel efficiency strategies.</td>
<td>$ 300,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$ 53,000,000</strong></td>
</tr>
</tbody>
</table>
6. ELECTRIFICATION TECHNICAL WORKING GROUP

To leverage, collaborate, align and integrate the USDOT-funded Smart City demonstration activities with the Smart City demonstration activities funded and managed by the Key Partner, Paul Allen’s Vulcan, Inc., and other Partners, the Recipient shall establish and manage an Electrification Technical Working Group (TWG) to meet, communicate and coordinate on a regular basis with the goal of facilitating integration of electrification activities within the Smart City demonstration and beyond as appropriate. The TWG meetings and interactions shall be designed to facilitate communications, knowledge sharing, identification of project risks, review and provision of feedback on project deliverables of mutual interest, and allow for the Recipient to brief the TWG on progress, schedule and discuss any problems related to electrification activities in the Smart City demonstration.

7. DATA TECHNICAL WORKING GROUP

To leverage, collaborate, align and integrate the USDOT-funded Smart City demonstration activities with the Smart City demonstration activities funded and managed by Partner organizations, the Recipient shall establish and manage a Data Technical Working Group (TWG) to meet, communicate and coordinate on a regular basis with the goal of facilitating integration of data management activities within the Smart City demonstration and beyond as appropriate. The TWG meetings and interactions shall be designed to facilitate communications, knowledge sharing, identification of project risks, and using best practices to fulfil requirements around replicability, openness, independent evaluation, and sharing of open, controlled access, real-time, and archival data. The TWG will enable review and provision of feedback on project deliverables of mutual interest, and allow for the Recipient to brief the TWG on progress, schedule and discuss any problems related to data management activities in the Smart City demonstration.
8. INTEGRATION OF EMERGENT CONCEPTS AND TECHNOLOGY

During the period of performance, the parties anticipate new and updated concepts and technology to emerge and/or mature. In order to ensure the Smart City demonstration is adequately and flexibly positioned to embrace promising emergent new concepts and technology and/or reconsider use of planned concepts and technology, the parties agree to evaluate and discuss, on a regular basis, changes to the Smart City demonstration activities, plans, budget and schedule. During the course of performance, changes to the demonstration plans may be appropriate to adapt emergent concepts, enhance the goals of the demonstration, support other relevant research, and/or support relevant and related testing activities. If a change is deemed appropriate, necessary, and in the best interest of the Government and the Recipient, the agreement may be amended by mutual agreement of the parties accordingly.
SECTION C - FEDERAL AWARD ADMINISTRATION INFORMATION

1. FEDERAL AWARD NOTICES

Only the Agreement Officer (AO) can commit the USDOT. The award document, signed by the AO, is the authorizing document. Only the AO can bind the Federal Government to the expenditure of funds.

2. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

General terms, conditions, and governing regulations that apply to this agreement are available online at: http://www.fhwa.dot.gov/aaa/generaltermsconditions.cfm

The online list dated March 6, 2015 of “GENERAL TERMS AND CONDITIONS FOR ASSISTANCE AWARDS” apply to this award and are incorporated herein by reference. The online general terms include Payment, Section 508 compliance, AOR authority, Travel, etc. The Recipient shall comply with the list of general terms available online at the website listed above.

In addition to the general terms available online, the following special terms and conditions apply to this agreement.

A. PUBLIC ACCESS TO DOCUMENTS

The Recipient agrees that the resulting deliverables/documentation submitted to the USDOT under this Agreement may be posted online for public access and/or shared by USDOT with other interested parties. The USDOT anticipates the documents cited herein may be posted on a USDOT website or other appropriate website.
B. INDIRECT COSTS

The Recipient is authorized for reimbursement of fringe benefits and insurance costs related to direct labor incurred. No other indirect costs are allowable under this Agreement. The following estimated rates are hereby approved for use under this agreement:

<table>
<thead>
<tr>
<th>Type*</th>
<th>Indirect Rate</th>
<th>Estimated Rate (%)</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prov.</td>
<td>Fringe</td>
<td>18.95%</td>
<td>City Direct Labor</td>
</tr>
<tr>
<td>Prov.</td>
<td>Insurance Rate</td>
<td>Varies by employee from 13.81% - 46.76%</td>
<td>City Direct Labor except Student Interns</td>
</tr>
</tbody>
</table>

*Types of Rates: Pred - Predetermined; Fixed - Fixed; Final – Final; Prov: Provisional/billing; or De minimus.

In the event the Recipient determines the need to adjust the above listed rates, the Recipient will notify the AO of the planned adjustment and provide rationale for such adjustment. In the event such adjustment rates have not been audited by a Federal agency, the adjustment of rates for billings must be pre-approved in writing by the AO.

This Indirect Cost provision does not operate to waive the limitations on Federal funding provided in this document. The Recipient’s audited final fringe benefits and insurance costs are allowable only insofar as they do not cause the Recipient to exceed the total obligated funding.

C. DATA RIGHTS

The Recipient must make available to the FHWA copies of all work developed in performance with this Agreement, including but not limited to software and data. Data rights under this agreement shall be in accordance with 2 CFR 200.315, Intangible property.

D. PERSONALLY IDENTIFIABLE INFORMATION (PII)

Personally Identifiable Information (PII) as defined at 2 CFR 200.79 and 2 CFR 200.82 at will not be requested unless necessary and only with prior written approval of the AO with concurrence from the Agreement Officer’s Technical Representative (AOR).
E. AVAILABLE FUNDING

The total estimated amount of Federal funding that may be provided under this Agreement is $40,000,000 for the entire period of performance, subject to the limitations shown below:

(1) Currently, Federal funds in the amount of $15,000,000 are obligated to this agreement.

(2) Subject to availability of funds, and an executed document by the AO, the difference between the current funding and the total estimated amount of Federal funding may be obligated to this Agreement.

(3) The FHWA’s liability to make payments to the Recipient is limited to those funds obligated under this Agreement as indicated above and any subsequent amendments.

F. KEY PERSONNEL

Pursuant to 2 CFR 200.308(c)(2), the Recipient must request prior written approval from the AO for any change in Key Personnel specified in the award. The following person(s) are/have been identified as Key Personnel:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aparna Dial</td>
<td>Program Manager</td>
</tr>
<tr>
<td>Randy Bowman</td>
<td>Deputy Program Manager</td>
</tr>
</tbody>
</table>

G. PROGRAM INCOME

Pursuant to 2 CFR 200.307, Program income earned during the agreement period must be added to the Federal award and used for the purposes and under the conditions of the Federal award, unless otherwise approved by the AO. Program income must not be used to offset the Federal or Recipient contribution to this project.

H. SUBAWARDS AND SUBCONTRACTS APPROVAL

Note: See 2 CFR §200.330, Subrecipient and contractor determinations, for definitions of subrecipient (who is awarded a subaward) versus subcontractor (who is awarded a subcontract).
Note: Recipients with a procurement system deemed approved and accepted by the Government or by the AO are exempt from the requirements of this clause. See 2 CFR 200.317 through 200.326.

Unless described in the application and funded in the approved award, the Recipient must obtain prior written approval from the AO for the subaward, transfer, or contracting out of any work under this award. **This provision does not apply to the acquisition of supplies, material, equipment, or general support services.**

The following subawards and subcontracts are currently approved under the Agreement:

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

Approval of each subaward and subcontract is contingent upon a fair and reasonable price determination, and approval by the AO for each proposed subcontractor/sub-recipient. Consent to enter into subawards and subcontracts will be issued through written notification from the AO or a formal amendment to the Agreement.

**I. ORDER OF PRECEDENCE**

The Recipient's technical and budget applications are accepted, approved, and incorporated herein as Attachments 2 and 3. In the event of any conflict between this agreement document and the Recipient's applications, this Agreement document shall prevail.

**J. DESIGNATION AS RESEARCH OR NON-RESEARCH AGREEMENT**

This agreement is designated as: RESEARCH

**K. CONFERENCE SUPPORT RESTRICTIONS**

The Recipient must obtain written approval from the AOR prior to incurring any costs for conference support. See the definition of conference as contained in 2 CFR 200.432.
Food and beverage costs are not allowable conference expenses for reimbursement under this Agreement.

**Note**: Costs of meals are allowable as a travel per diem expense for individuals on travel status and pursuant to the Travel clause of this Agreement.

**L. AGREEMENT PERFORMANCE REQUIREMENTS SUMMARY**

N/A

**M. DISPUTES**

The parties to this Agreement will communicate with one another in good faith and in a timely and cooperative manner when raising issues under this provision. Any dispute, which for the purposes of this provision includes any disagreement or claim, between the FHWA and the Recipient concerning questions of fact or law arising from or in connection with this Agreement and whether or not involving alleged breach of this Agreement, may be raised only under this Disputes provision.

Whenever a dispute arises, the parties will attempt to resolve the issues involved by discussion and mutual agreement as soon as practical. In no event will a dispute which arose more than three months prior to the notification made under the following paragraph of this provision constitute the basis for relief under this article unless FHWA waives this requirement.

Failing resolution by mutual agreement, the aggrieved party will document the dispute by notifying the other party in writing of the relevant facts, identify unresolved issues and specify the clarification or remedy sought. Within five working days after providing written notice to the other party, the aggrieved party may, in writing, request a decision from one level above the AO. The AO will conduct a review of the matters in dispute and render a decision in writing within thirty calendar days of receipt of such written request. Any decision of the AO is final and binding unless a party will, within thirty calendar days, request further review as provided below.

Upon written request to the FHWA Director, Office of Acquisition and Grants Management or designee, made within thirty calendar days after the AO’s written decision or upon unavailability of a decision within the stated time frame under the preceding paragraph, the dispute will be further reviewed. This review will be
conducted by the Director, Office of Acquisition and Grants Management. Following the review, the Director, Office of Acquisition and Grants Management, will resolve the issues and notify the parties in writing. Such resolution is not subject to further administrative review and to the extent permitted by law, will be final and binding. Nothing in this Agreement is intended to prevent the parties from pursuing disputes in a United States Federal Court of competent jurisdiction.

N. DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM REQUIREMENTS

The DBE regulatory requirements at 49 CFR Part 26 apply to this agreement, but rather than developing its own DBE Program, the Recipient may apply the FHWA-approved DBE Program Plan of the State Department of Transportation (State DOT) in which it is located. The Recipient should set a DBE goal for the project through procedures set forth at 49 CFR 26.45 and the State DOT’s Program Plan, and make its own determination about whether or not race conscious goals are appropriate and necessary to help meet its project goal.

3. REPORTING

ADDRESSES FOR SUBMITTAL OF REPORTS AND DOCUMENTS

The Recipient must submit all required reports and documents, under transmittal letter referencing the Agreement number, as follows:

Submit an electronic copy to the Agreement Officer at the following address:

Sarah.Tarpgaard@dot.gov

Submit an electronic copy to the AOR at the following address:

Kate.Hartman@dot.gov

Submit an electronic copy to the ITS JPO at the following address:

ITSPроjects@dot.gov
QUARTERLY PROGRESS REPORTS

The Recipient must submit an electronic copy of the Standard Form - Performance Progress Report (SF-PPR), to the AOR and the Agreement Officer on or before the 30th of the month following the calendar quarter being reported.

The SF-PPR content directions are available online in various locations such as:

http://www.fema.gov/media-library/assets/documents/29485

The Performance Progress Report must include the required certification pursuant to 2 CFR 200.415.

<table>
<thead>
<tr>
<th>Calendar quarters are defined as:</th>
<th>Reports due on or before:</th>
</tr>
</thead>
<tbody>
<tr>
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<td>April 30\textsuperscript{th}</td>
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<td>2\textsuperscript{nd}: April – June</td>
<td>July 30\textsuperscript{th}</td>
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<td>3\textsuperscript{rd}: July – September</td>
<td>October 30\textsuperscript{th}</td>
</tr>
<tr>
<td>4\textsuperscript{th}: October – December</td>
<td>January 30\textsuperscript{th}</td>
</tr>
</tbody>
</table>

NOTE: The first Quarterly Progress Report shall include the period from award through December 2016, and is due January 30, 2017.

Include the following information as attached pages:

a. SF-425, Federal Financial Report, and


The Recipient shall include in Block 10, Performance Narrative, the items listed in Task A above. USDOT recommends an attachment to the SF-PPR to provide the quarterly progress report content.

See the Statement of Work, Task A, for progress report content requirements.
ANNUAL BUDGET REVIEW AND PROGRAM PLAN

The Recipient must submit an electronic copy of the Annual Budget Review and Program Plan to the AOR and the Agreement Officer 60 days prior to the anniversary date of this Agreement. The Annual Budget Review and Program Plan must include the required certification pursuant to 2 CFR 200.415. The Annual Budget Review and Program Plan must provide a detailed schedule of activities, estimate of specific performance objectives, include forecasted expenditures, and schedule of milestones for the upcoming year. If there are no proposed deviations from the Approved Budget Application (Attachment 3), the Annual Budget Review must contain a statement stating such. The Recipient must meet via teleconference or web conference with the USDOT to discuss the Annual Budget Review and Program Plan. Work proposed under the Annual Budget Review and Program Plan must not commence until AO’s written approval is received.
SMART CITY VISION ELEMENTS

The USDOT identified twelve vision elements that comprise a Smart City. The Smart City Demonstration shall align to some or all of the USDOT’s vision elements and foster integration between the elements. Through alignment with these vision elements, the Smart City Demonstration is expected to improve safety, enhance mobility, enhance ladders of opportunity, accelerate the transition to clean transportation, and address climate change.

![Figure 1. Beyond Traffic: The Smart City Challenge Vision Elements](image)

The vision elements reflect the strategic priorities and themes put forth in the USDOT’s ITS Strategic Plan 2015-2019 ([http://www.its.dot.gov/strategicplan/](http://www.its.dot.gov/strategicplan/)) and the USDOT’s Strategic Plan 2014-2018 ([https://www.transportation.gov/dot-strategic-plan](https://www.transportation.gov/dot-strategic-plan)). Vision elements were derived from foundational research conducted by the ITS JPO’s Connected Cities Research Program and communicated to 570 stakeholders during a free public webinar held by the ITS JPO on February 26, 2015. The USDOT vision elements build on enablers defined by the Smart Cities Council ([http://smartcitiescouncil.com/smart-cities-information-center/the-enablers](http://smartcitiescouncil.com/smart-cities-information-center/the-enablers)). The twelve vision elements are depicted in Figure 1 and described in more detail below.
TECHNOLOGY ELEMENTS

This group of three Vision Elements includes technologies that are of the highest priority to the USDOT.

Vision Element #1: Urban Automation. Automated transportation offers tremendous possibilities for enhancing safety, mobility, accessibility, equity, and the environment. The Smart City can provide national leadership through its demonstration and assessment of automated transportation applications and systems for the movement of goods and people. There are many ways to incorporate automated transportation into a Smart City. For the purpose of illustration, some examples of automated transportation in an urban environment include:

- Self-driving vehicles coupled with smart infrastructure;
- Self-driving shuttles and other forms of fully automated vehicles operating at low speeds to enable new mobility options for services such as first/last mile travel to local destinations and access to public transportation;
- Fully automated trucks and buses used in intermodal facilities, such as ports, depots, and maintenance facilities to improve driver and vehicle efficiencies; and
- Driver-assisted automation to reduce congestion and localized pollution and smog.

Vision Element #2: Connected Vehicles. Connected vehicles use vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications to provide connectivity that will enable countless safety, mobility, and environmental applications. Connected vehicle technologies allow vehicles to send and receive information about their movements in the network – offering cities unprecedented opportunities to provide more responsive and efficient mobility solutions in real-time and in the long term. Data derived from connected vehicles provide insights to transportation operators, help to understand demand, and assist in predicting and responding to movements around a city. When made accessible to a broader ecosystem of developers, these data can enable new research and applications that further benefit citizens.

A successful Smart City may demonstrate safety, mobility, and/or environmental applications. These applications – which can increase efficiency and accessibility, enhance safety and reduce congestion – may provide more responsive mobility solutions in real-time. Applications may be developed and managed by cities or third parties. In deploying connected vehicle and infrastructure services, Smart Cities may seek to integrate a variety of commercially available communication technologies including cellular, satellite, Wi-Fi and others. At the same time, Dedicated Short Range Communication (DSRC) technology operating in the 5.9GHz range may be used to
expand demonstrations of V2V and V2I applications based on DSRC¹. (For more information on the USDOT’s Connected Vehicle Research Program and potential applications, visit: http://www.its.dot.gov/research.htm.)

Vision Element #3: Intelligent, Sensor-Based Infrastructure. Smart cities contain and use a collective intelligent infrastructure that allows sensors to collect and report real-time data to inform transportation-related operations and performance and trends of a city. These data allow city operators to evaluate how the city is operating and how to enhance the operation of facilities, systems, services, and information generated for the public. Intelligent infrastructure includes sensors that collect traffic, pedestrian, bicyclist, environmental data, and other information available throughout the city. A successful Smart City will integrate these data with existing transportation data and operations, allowing the city to improve operations of the transportation network. Additionally, infrastructure could be used to monitor transportation assets to improve infrastructure management, reduce maintenance costs, prioritize investment decisions, and ensure a state of good repair. Where possible, a Smart City will make these data accessible to a broader ecosystem of developers to enable new research and applications. Smart Cities should leverage existing infrastructure investments, including sensors operated by other public sector agencies, academia, the private sector, and personal mobile devices.

INNOVATIVE APPROACHES TO URBAN TRANSPORTATION ELEMENTS

This group of six Vision Elements includes innovative approaches to urban transportation and is categorized as a high priority by the USDOT.

Vision Element #4: Urban Analytics. This vision element includes platforms for understanding and analyzing data to address complex urban challenges (e.g., personal safety and mobility, network efficiency, and environmental sustainability) and/or measure the performance of a transportation network. In a data-rich environment, cities and citizens are increasingly able to share, use, and leverage previously unavailable datasets to address complex urban problems and improve current operations and capabilities. Urban analytics create value from the data that is collected from connected vehicles, connected citizens, and sensors throughout a city or available from the Internet using information generated by private companies. Analytics that utilize data from across various systems in a city have tremendous potential to identify new insights and unique solutions for delivering services, thereby improving outcomes. Analytics can be used to predict future conditions and the potential benefits of implementing different

¹ Specifically, IEEE P1609, 802.11p, and SAE J2945/1 and J2735 standards
operational strategies, control plans and response plans coordinated among agencies and service providers. Furthermore, analytics can be applied across sectors to create new and different applications. One example might be an application of travel demand management that also factors in environmental and energy consumption as part of the optimization – providing more context to citizens’ personalized recommendations. Additionally, data analytics can also be used to understand the potential benefits of deployed solutions. To do so, transportation-related performance measures and evaluation are needed to quantify the intended and measured impact of all proposed solutions on personal safety and mobility, network efficiency, and environmental sustainability, representing the priorities of this challenge. For example, performance measurement may indicate greater access to jobs and services; reduction in congestion and delays; increase in transit, walking, or cycling; a reduction in crashes, injuries, and or fatalities; improved incident response and clearance times; and reductions in emissions. In a Smart City, these performance measures should be made publicly available as open data.

**Vision Element #5: User-Focused Mobility Services and Choices.** This vision element consists of strategies, initiatives, and services that increase transportation choices and options by supporting and improving mobility across all modes for all travelers, including aging Americans and persons with disabilities. A major component includes advanced traveler information systems that provide real-time traffic, transit, parking, and other transportation-related information to travelers. Smart cities support sustainable mobility using traveler-oriented strategies that deliver innovative solutions across all transportation modes, including transit, bicycling, electric vehicles, and shared use mobility services, to improve the mobility of all travelers, including older Americans as well as people with disabilities. Shared-use transportation has grown tremendously in recent years with the increase in smartphone applications. The sharing economy and new transportation services provide people with more options and help to overcome barriers to the use of non-driving forms of transportation. Advanced technology and services deployed throughout a city empower people to adopt “car-free” and “car-light” lifestyles with dramatically less driving if they so choose. For people to be willing to share assets there must be a seamless, low-friction way to do so. Mobility on Demand (MOD) is an emerging concept built on shared use approaches and a shift in mass transit. It augments public transportation and supports the efficient movement of people. Open data and technology enable the efficient coordination, use, and management of all mobility services in the system. From the user’s perspective, travel choices are simplified through open data and communications technology that provides personalized information – including traveler information, travel options, and integrated mobile payment – directly to the user. In smart cities, the integration of new
technologies into the transportation system facilitates a dynamic supply of mobility services and operations by leveraging emerging mobility services, integrated transit networks and operations, real-time data, connected travelers, and cooperative ITS. The result is a more traveler-centric, transportation system-of-systems approach, providing improved mobility options to all system users.

**Vision Element #6: Urban Delivery and Logistics.** This vision element includes innovative solutions that support efficient goods movement through use of data or technology to create opportunities for a more efficient supply chain approach that delivers safer logistics management, improved on-time pickups and delivery, improved travel time reliability, reduced energy use, and reduced labor and vehicle maintenance costs. As populations increase and urbanization continues, cities need to identify innovative ways to effectively and efficiently move goods – including food, energy, and manufactured goods – into and throughout cities. The Smart City may consider improving urban goods movements by including freight-specific information exchanges that enable dynamic travel planning to improve freight movement efficiency, including load matching and drayage operations. Additional strategies may leverage urban delivery hubs that use connected urban delivery vehicles and flexible (shared use) commercial delivery solutions.

**Vision Element #7: Strategic Business Models and Partnering Opportunities.** Opportunities exist to leverage creative strategic partnerships that draw in stakeholders – including those from the private sector, non-profit organizations, foundations and philanthropic organizations, academia/University Transportation Centers (UTC), Federal agencies, and other public agencies – to advance smart city solutions. The private sector is pushing innovation and developing new technologies and approaches that can be augmented through new collaborations with government. The public sector is also pushing innovation, creating new opportunities/models for governance and interagency partnerships that will increase return on investment while accelerating deployment. Successful implementation of a Smart City will likely rely on strategic partnering opportunities between public agencies and the private sector – especially for cities that have limited resources to bring to bear on the challenges they face. Innovative partnerships among city or local government, regional Federal agencies, planning organizations, the private sector, vehicle manufacturers, academia, associations, and other stakeholder groups are needed to advance smart city solutions and identify sustainable business models to maintain and expand capabilities in the future. Through cooperation, city governments may partner with non-governmental organizations that can bring resources to the city.
Note: The Connected Vehicle Reference Implementation Architecture (CVRIA) and associated SET-IT software tool provides a means to depict the institutional relationships with the enterprise layer of the architecture. For more information, visit: www.iteris.com/cvria.

Vision Element #8: Smart Grid, Roadway Electrification, and Electric Vehicles. This vision element includes strategies and initiatives that leverage the smart grid – a programmable and efficient energy transmission and distribution system – in an effort to support the adoption or expansion of roadway electrification, robust electric vehicle charging infrastructure, and the acceleration of electric vehicle deployment. With electric vehicles (note: the term electric vehicles or “EVs” include full Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Extended Range Electric Vehicles (EREVs)) becoming more prevalent and more advanced, increasing opportunities exist for the vehicle to interact with the smart grid. Opportunities also exist for the integration of intelligent transportation systems with the smart grid and other energy distribution and charging systems. For example, smart-grid technology can enable electric vehicle-charging [grid-to-vehicle (G2V)] load to be shifted to off-peak periods, thereby flattening the daily load curve and significantly reducing both generation and network investment needs. Technology like this can help bring the numerous economic and environmental benefits of electric vehicles to the forefront of a city by coupling and integrating with a robust deployment of electric vehicle charging infrastructure. Likewise, wireless inductive charging technologies increase opportunities for uninterrupted usage of electric vehicles, allowing electric vehicles to charge their batteries wirelessly while the vehicle is stopped or, with certain technologies, even while in motion. Electric vehicles are increasingly available across vehicle class (e.g., transit buses and medium duty vehicles) and price points. Providing access to electric vehicles through car share programs can provide increased access for underserved communities, reduce total operational costs, and contribute to improvements in local air quality.

Vision Element #9: Connected, Involved Citizens. Connected citizens generate, share, and use data and information in new and useful ways. This vision element consists of strategies, local campaigns, and processes to proactively engage and inform citizens at the individual level by deploying hardware, software, and open data platforms in an effort to increase personal mobility. Advanced technologies would be used to enhance overall mobility for all citizens including people with disabilities, older adults, and young Millennials who will act as an important engine of the future economy. One example of connected, involved citizens is leveraging the use of crowdsourcing. Crowdsourced data provides communication conduits through mobile technologies to
connect citizens with city operators about a myriad of topics. In a successful Smart City, citizens would provide user-generated content to cities, opting-in to provide data from smartphones. Another example of connected, involved citizens includes leveraging broad access to open government data providing a platform for citizens and entrepreneurs to serve as co-creators and co-producers of new and innovative transportation services.

SMART CITY ELEMENTS

This group of Vision Elements includes three smart city elements and is categorized as a priority by the USDOT.

Vision Element #10: Architecture and Standards. This vision element emphasizes complete and well-documented systems architectures – governed by rules, documentation, and standards – that may be extended to a nationwide or broader deployment and support interoperability between systems. Because vehicles and travelers move broadly across regions, uniform operation that is accessible to everyone is essential for safe and efficient transportation operations. Interoperable regional ITS and other infrastructure system architectures that can be extended to a nationwide or broader deployment based on accessible, well-defined standards is needed for consistent implementations that will lead to the required uniformly accessible operation. Multiple system architectures will need to interoperate with the ITS architecture to efficiently support a smart city.

Vision Element #11: Low-Cost, Efficient, Secure, and Resilient Information and Communications Technology (ICT). This vision element includes strategies and practices that advance information and communications technology (ICT) that is affordable, adaptable, scalable, efficient, secure and resilient. This may include telecommunications platforms, enterprise software, storage, visualization systems, and operations to inform decision making. This will include ICT that contributes to one common operating platform to inform city government decision-making. ICT infrastructure, technologies, and services are a critical part of a Smart City. ICT consists of interoperable, unified communications and the integration of telecommunications, and computing as well as necessary enterprise software, storage, and visualization systems, which enable users to access, store, transmit, and manipulate information. The success of a Smart City depends upon affordable ICT that enables dynamic ingest, sharing, and use of data. The ICT in a Smart City, including telecommunications and computing, needs to be resilient, secure and respectful of privacy. Resilient design includes supporting standards common technology architectures and integrative policies. If one
part of the system fails or is compromised, the entire system should not collapse, and the gap in service should be bridged effectively and restored quickly.

Privacy and security play a critical role in enabling smart cities because they build trust with people. Privacy and security constitute practices that safeguard data, privacy, and physical assets. Private information relates to any data emitted, collected, or stored about individuals. A key concept in privacy analysis is Personal Identifiable Information (PII). PII is any information that can be used to distinguish or trace an individual’s identity, which is not specific to any category of information or technology; each case and associated risks must be individually examined for context and the combination of data elements that are provided or obtainable. The Smart City needs to determine the extent to which their system or systems will collect or store PII and PII-related information, and ensure that there is a legitimate need for this information to meet the goals of the system and that the data is only accessible for and used for these legitimate purposes which may include sharing it with qualified researchers. Wherever possible, efforts should be made to provide public access to versions of the data that remove any PII-related elements.

Note on Smart City Challenge Demonstration Award: The USDOT is developing a prototype security credential management system (SCMS) which will be available for use in DSRC-based communications in the Smart City Demonstration. The SCMS will provide digitally signed certificates that can be used to ensure trusted DSRC communications between connected vehicle devices, roadside devices and the SCMS. The USDOT will provide the Recipient technical support for interfacing with the prototype SCMS, as well as tools intended to support the Smart City. Physical security of the deployed devices and security for non-DSRC communications are not covered by the SCMS and should be addressed using existing appropriate best practices in the demonstration. Rigorous, proven processes are needed to ensure that security mechanisms are embedded in systems and infrastructure to protect against attacks. Secure solutions must be integrated into architecture designs and security risks must be continually managed. Smart cities are expected to use industry best practices as they relate to objects and interfaces used in their installations.
**Vision Element #12: Smart Land Use.** This vision element includes strategies and practices that ensure land use is optimized through a combination of planning and innovation deployments designed for a better connected community that expands the range of transportation choices and access to employment, housing, education, and health services. A successful Smart City ensures that land use is efficiently optimized. Urban land use concentrates growth in compact walkable urban centers to avoid sprawl. It also advocates compact, transit-oriented, shared-use, walkable, bicycle-friendly land use, including neighborhood schools, complete streets, and mixed-use development with a range of housing choices. Smart land use values long-range, regional considerations of sustainability and citizen needs with the goals of achieving a unique sense of community and place; expanding the range of transportation, employment, and housing choices; equitably distributing the costs and benefits of development; preserving and enhancing natural and cultural resources; and promoting public health.
Appendix D

Schedule Baseline
<table>
<thead>
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<th>ID</th>
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<th>Task Name</th>
<th>Duration</th>
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<th>Finish</th>
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<tbody>
<tr>
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<td>Project Milestones</td>
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<td>Thu 8/18/16</td>
<td>Mon 8/31/20</td>
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<td>USDOT Authorization to Resume Phase I - Systems Engineering Activities</td>
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<td>13</td>
<td>1.P.2</td>
<td>Project Management Plan (PMP)</td>
<td>957 days</td>
<td>78%</td>
<td>Thu 7/30/20</td>
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<td>37</td>
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<td>41 days</td>
<td>96%</td>
<td>Mon 9/1/17</td>
<td>Tue 11/17</td>
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<td>1.P.2.2.31</td>
<td>Incorporate Comments PMP</td>
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<td>75%</td>
<td>Wed 10/18/17</td>
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<td>0%</td>
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<td>Tue 10/31/17</td>
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<td>5 days</td>
<td>0%</td>
<td>Mon 11/17</td>
<td>Tue 11/17</td>
</tr>
<tr>
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<td>1.P.2.2.34</td>
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<td>0%</td>
<td>Tue 11/17</td>
<td>Tue 11/17</td>
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<td>72</td>
<td>1.P.2.3</td>
<td>Quarterly PMP Update (as necessary)</td>
<td>864 days</td>
<td>11%</td>
<td>Wed 1/18/17</td>
<td>Thu 7/30/20</td>
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<td>1.P.3</td>
<td>Schedule</td>
<td>958 days</td>
<td>36%</td>
<td>Thu 8/18/16</td>
<td>Fri 7/31/20</td>
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<td>87</td>
<td>1.P.3.1</td>
<td>Detailed SmartColumbus Schedule (SCS)</td>
<td>362 days</td>
<td>71%</td>
<td>Thu 8/18/16</td>
<td>Fri 2/23/18</td>
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<td>1.P.3.1.8</td>
<td>Develop Program Schedule Version 2.0</td>
<td>28 days</td>
<td>30%</td>
<td>Tue 1/16/18</td>
<td>Fri 1/23/18</td>
</tr>
<tr>
<td>96</td>
<td>1.P.3.2</td>
<td>SCP Monthly Updates</td>
<td>909 days</td>
<td>29%</td>
<td>Thu 10/27/16</td>
<td>Fri 7/31/20</td>
</tr>
<tr>
<td>112</td>
<td>1.P.3.2.16</td>
<td>SCP Monthly Updates 16</td>
<td>7 days</td>
<td>0%</td>
<td>Wed 1/23/18</td>
<td>Wed 1/31/18</td>
</tr>
<tr>
<td>143</td>
<td>1.P.3.2.17</td>
<td>SCP Monthly Updates 17</td>
<td>7 days</td>
<td>0%</td>
<td>Wed 2/20/18</td>
<td>Wed 2/28/18</td>
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<tr>
<td>114</td>
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<td>SCP Monthly Updates 18</td>
<td>7 days</td>
<td>0%</td>
<td>Thu 3/22/18</td>
<td>Fri 3/30/18</td>
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<tr>
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<td>SCP Monthly Updates 19</td>
<td>7 days</td>
<td>0%</td>
<td>Fri 4/20/18</td>
<td>Mon 4/30/18</td>
</tr>
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<td>1.P.3.3</td>
<td>SCP Monthly Submittal (Task A)</td>
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<td>0%</td>
<td>Mon 10/31/16</td>
<td>Fri 7/31/20</td>
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<td>SCP Monthly Submittal (Task A) 16</td>
<td>0 days</td>
<td>0%</td>
<td>Wed 2/31/18</td>
<td>Wed 1/31/18</td>
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<tr>
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<td>1.P.3.3.17</td>
<td>SCP Monthly Submittal (Task A) 17</td>
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<td>0%</td>
<td>Wed 2/28/18</td>
<td>Wed 2/28/18</td>
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<tr>
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<td>SCP Monthly Submittal (Task A) 18</td>
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<td>0%</td>
<td>Fri 3/30/18</td>
<td>Fri 3/30/18</td>
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<tr>
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<td>0%</td>
<td>Mon 4/30/18</td>
<td>Mon 4/30/18</td>
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<td>213</td>
<td>1.P.5</td>
<td>Monthly and Quarterly Reports</td>
<td>883 days</td>
<td>24%</td>
<td>Tue 1/3/17</td>
<td>Wed 8/12/20</td>
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<td>224</td>
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<td>Prepare Quarterly Progress Report (Task A)</td>
<td>875 days</td>
<td>25%</td>
<td>Tue 1/3/17</td>
<td>Thu 7/30/20</td>
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<td>Submit Quarterly Progress Report (Task A)</td>
<td>855 days</td>
<td>0%</td>
<td>Mon 1/30/17</td>
<td>Thu 7/30/20</td>
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<td>Quarterly Project Briefing (Task A)</td>
<td>858 days</td>
<td>13%</td>
<td>Wed 2/8/17</td>
<td>Wed 8/12/20</td>
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<tr>
<td>287</td>
<td>1.P.7</td>
<td>Program Execution</td>
<td>979 days</td>
<td>65%</td>
<td>Thu 8/18/16</td>
<td>Mon 8/31/20</td>
</tr>
<tr>
<td>288</td>
<td>1.P.7.1</td>
<td>Human Resources Management</td>
<td>130 days</td>
<td>73%</td>
<td>Mon 9/11/17</td>
<td>Mon 9/11/17</td>
</tr>
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<td>289</td>
<td>1.P.7.1.1</td>
<td>Urgent Needs</td>
<td>101 days</td>
<td>75%</td>
<td>Mon 9/11/17</td>
<td>Fri 2/16/18</td>
</tr>
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<td>293</td>
<td>1.P.7.1.1.4</td>
<td>Develop Contracting Plan</td>
<td>72 days</td>
<td>46%</td>
<td>Mon 10/23/17</td>
<td>Fri 2/16/18</td>
</tr>
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<td>294</td>
<td>1.P.7.1.2</td>
<td>Long Range Planning</td>
<td>110 days</td>
<td>71%</td>
<td>Tue 10/10/17</td>
<td>Fri 3/30/18</td>
</tr>
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<td>297</td>
<td>1.P.7.2.3</td>
<td>Execute Advertisement, Selection and Award Process</td>
<td>55 days</td>
<td>30%</td>
<td>Fri 3/30/18</td>
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<tr>
<td>298</td>
<td>1.P.7.7</td>
<td>Cost Management</td>
<td>946 days</td>
<td>69%</td>
<td>Sat 9/10/16</td>
<td>Mon 8/10/20</td>
</tr>
<tr>
<td>402</td>
<td>1.P.7.3.4</td>
<td>Update Staffing</td>
<td>46 days</td>
<td>50%</td>
<td>Wed 11/15/17</td>
<td>Fri 2/2/18</td>
</tr>
<tr>
<td>403</td>
<td>1.P.7.3.5</td>
<td>Monthly Invoice</td>
<td>946 days</td>
<td>0%</td>
<td>Sat 9/10/16</td>
<td>Mon 8/10/20</td>
</tr>
<tr>
<td>453</td>
<td>1.P.7.4</td>
<td>Technical Working Groups (TWGs)</td>
<td>568 days</td>
<td>88%</td>
<td>Thu 8/18/16</td>
<td>Mon 12/24/18</td>
</tr>
<tr>
<td>467</td>
<td>1.P.7.4.2</td>
<td>Technical Working Group Review</td>
<td>44 days</td>
<td>99%</td>
<td>Thu 11/17</td>
<td>Thu 11/17</td>
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<td>474</td>
<td>1.P.7.4.2.7</td>
<td>USDOT Acceptance</td>
<td>0 days</td>
<td>0%</td>
<td>Thu 1/18/18</td>
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<tr>
<td>475</td>
<td>1.P.7.4.3</td>
<td>Working Group Coordination Version 2.0</td>
<td>75 days</td>
<td>70%</td>
<td>Wed 11/1/17</td>
<td>Mon 3/5/18</td>
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<tr>
<td>477</td>
<td>1.P.7.4.3.2</td>
<td>Prepare Prenatal Trip Due Diligence Findings and Recommendation</td>
<td>28 days</td>
<td>50%</td>
<td>Wed 3/1/18</td>
<td>Fri 2/9/18</td>
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<td>478</td>
<td>1.P.7.4.3.3</td>
<td>CoC / Partner Review</td>
<td>5 days</td>
<td>0%</td>
<td>Mon 2/12/18</td>
<td>Fri 2/16/18</td>
</tr>
<tr>
<td>479</td>
<td>1.P.7.4.3.4</td>
<td>Prepare Prenatal Trip Due Diligence Report</td>
<td>5 days</td>
<td>0%</td>
<td>Mon 2/12/18</td>
<td>Fri 2/16/18</td>
</tr>
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<td>480</td>
<td>1.P.7.4.3.5</td>
<td>Submit to USDOT</td>
<td>0 days</td>
<td>0%</td>
<td>Fri 2/23/18</td>
<td>Fri 2/23/18</td>
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<td>1.P.7.4.3.6</td>
<td>USDOT Stand-up</td>
<td>1 day</td>
<td>0%</td>
<td>Mon 3/8/18</td>
<td>Mon 3/8/18</td>
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<td>1.P.7.4.3.7</td>
<td>Get USDOT Concurrence</td>
<td>0 days</td>
<td>0%</td>
<td>Mon 3/8/18</td>
<td>Mon 3/8/18</td>
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<td>567</td>
<td>1.D.2</td>
<td>Design Guidance Planning Documents</td>
<td>782 days</td>
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<td>Thu 6/15/17</td>
<td>Thu 8/31/20</td>
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<td>599</td>
<td>1.D.2.1</td>
<td>Deployment Tracking Survey</td>
<td>423 days</td>
<td>0%</td>
<td>Fri 12/1/17</td>
<td>Wed 8/28/19</td>
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<tr>
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<td>1.D.2.1.1</td>
<td>USDOT ITS Deployment Tracking Survey Response</td>
<td>423 days</td>
<td>0%</td>
<td>Fri 12/1/17</td>
<td>Wed 8/28/19</td>
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<tr>
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<td>1.D.2.1.1.1</td>
<td>Prepare and submit response (est. 2017)</td>
<td>10 days</td>
<td>0%</td>
<td>Fri 12/17</td>
<td>Thu 12/14/17</td>
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<td>Data Privacy Plan (DPP)</td>
<td>231 days</td>
<td>0%</td>
<td>Fri 1/19/18</td>
<td>Wed 12/26/18</td>
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<td>1.D.3.1</td>
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<td>Thu 5/3/18</td>
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<tr>
<td>ID</td>
<td>Task Name</td>
<td>Duration</td>
<td>% Complete</td>
<td>Start</td>
<td>Finish</td>
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<tr>
<td>605</td>
<td>Prepare Draft DPP</td>
<td>25 days</td>
<td>0%</td>
<td>Fri 1/19/18</td>
<td>Thu 2/22/18</td>
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<td>606</td>
<td>CoC Review</td>
<td>5 days</td>
<td>0%</td>
<td>Fri 2/23/18</td>
<td>Thu 3/1/18</td>
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<tr>
<td>607</td>
<td>Update DPP</td>
<td>5 days</td>
<td>0%</td>
<td>Fri 3/3/18</td>
<td>Thu 3/8/18</td>
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<tr>
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<td>Submit Draft Data Privacy Plan (Task D)</td>
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<td>0%</td>
<td>Thu 3/8/18</td>
<td>Thu 3/15/18</td>
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<td>609</td>
<td>USDOT Review Draft DPP</td>
<td>10 days</td>
<td>0%</td>
<td>Thu 3/19/18</td>
<td>Thu 3/22/18</td>
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<tr>
<td>610</td>
<td>Receive USDOT Comments on Draft DPP</td>
<td>0 days</td>
<td>0%</td>
<td>Thu 3/22/18</td>
<td>Thu 3/25/18</td>
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<tr>
<td>611</td>
<td>Prepare Revised Draft of DPP</td>
<td>10 days</td>
<td>0%</td>
<td>Fri 3/23/18</td>
<td>Thu 4/5/18</td>
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<tr>
<td>612</td>
<td>CoC Review</td>
<td>5 days</td>
<td>0%</td>
<td>Fri 4/6/18</td>
<td>Thu 4/9/18</td>
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<td>613</td>
<td>Update DPP</td>
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<td>0%</td>
<td>Fri 4/13/18</td>
<td>Thu 4/19/18</td>
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<td>0%</td>
<td>Thu 4/19/18</td>
<td>Thu 4/19/18</td>
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<td>10 days</td>
<td>0%</td>
<td>Fri 4/20/18</td>
<td>Thu 5/3/18</td>
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<tr>
<td>617</td>
<td>Data Management Plan (DMP)</td>
<td>158 days</td>
<td>0%</td>
<td>Fri 1/19/18</td>
<td>Fri 8/31/18</td>
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<td>618</td>
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<td>0%</td>
<td>Wed 5/16/18</td>
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<td>619</td>
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<td>0%</td>
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<td>Wed 2/28/18</td>
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<td>620</td>
<td>CoC Review</td>
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<td>0%</td>
<td>Thu 3/1/18</td>
<td>Wed 3/14/18</td>
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<td>Wed 3/11/18</td>
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<td>Submit Draft Data Management Plan (Task E)</td>
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<td>0%</td>
<td>Wed 3/21/18</td>
<td>Wed 3/21/18</td>
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<td>0%</td>
<td>Thu 3/22/18</td>
<td>Wed 4/4/18</td>
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<td>Receive USDOT Comments on Draft DMP</td>
<td>0 days</td>
<td>0%</td>
<td>Wed 4/4/18</td>
<td>Wed 4/4/18</td>
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<td>Prepare Updated DMP</td>
<td>10 days</td>
<td>0%</td>
<td>Thu 4/5/18</td>
<td>Wed 4/18/18</td>
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<td>626</td>
<td>Update Comment Resolution Report based on USDOT Comments on DMP</td>
<td>10 days</td>
<td>0%</td>
<td>Thu 4/5/18</td>
<td>Wed 4/18/18</td>
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<tr>
<td>627</td>
<td>CoC Review</td>
<td>5 days</td>
<td>0%</td>
<td>Thu 4/19/18</td>
<td>Wed 4/25/18</td>
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<tr>
<td>628</td>
<td>Update DMP</td>
<td>5 days</td>
<td>0%</td>
<td>Thu 4/26/18</td>
<td>Wed 5/2/18</td>
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<td>Human Use Approval</td>
<td>747 days</td>
<td>0%</td>
<td>Fri 8/4/17</td>
<td>Mon 8/31/20</td>
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<td>631</td>
<td>IRB</td>
<td>747 days</td>
<td>0%</td>
<td>Fri 8/4/17</td>
<td>Mon 8/31/20</td>
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<td>632</td>
<td>Engage IRB</td>
<td>20 days</td>
<td>10%</td>
<td>Fri 8/4/17</td>
<td>Thu 7/19/18</td>
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<td>Human Use Approval Summary</td>
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<td>0%</td>
<td>Wed 2/28/18</td>
<td>Fri 6/26/20</td>
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<td>Prepare Final Human Use Approval Summary</td>
<td>3 days</td>
<td>0%</td>
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<td>Fri 3/2/18</td>
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<tr>
<td>715</td>
<td>Systems Engineering</td>
<td>6509 days?</td>
<td>12%</td>
<td>Thu 8/16/16</td>
<td>Fri 11/29/16</td>
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<tr>
<td>749</td>
<td>Management</td>
<td>6509 days?</td>
<td>12%</td>
<td>Thu 8/16/16</td>
<td>Fri 11/29/16</td>
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<tr>
<td>750</td>
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<td>314 days</td>
<td>97%</td>
<td>Mon 10/16/16</td>
<td>Wed 1/11/18</td>
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<td>69 days</td>
<td>94%</td>
<td>Tue 10/10/17</td>
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<td>0%</td>
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<td>0%</td>
<td>Wed 1/31/18</td>
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<tr>
<td>850</td>
<td>Bi-Annual Architecture and Standards Meetings</td>
<td>873 days</td>
<td>23%</td>
<td>Mon 9/19/16</td>
<td>Fri 5/1/20</td>
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<td>880</td>
<td>Phase 1- Systems Engineering</td>
<td>961 days</td>
<td>44%</td>
<td>Thu 8/18/16</td>
<td>Wed 8/5/20</td>
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<td>883</td>
<td>Concept of Operations (ConOps)</td>
<td>376 days</td>
<td>33%</td>
<td>Mon 12/17</td>
<td>Mon 6/4/19</td>
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<tr>
<td>884</td>
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WBS

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SmartColumbus Project Schedule
90 Day Look Ahead

Task Name

Submit 508 Compliant Document
SmartColumbus Operating System (ScOS)
ScOS Platform Framework Development
ScOS Platform Framework Sprint 17
ScOS Platform Framework Development Sprint 17
QA/QC
ScOS Platform Framework Development Sprint 17 Review/Retrospective
Subscriber Custom API MVP
ScOS Platform Framework Sprint 18
ScOS Platform Framework Development Sprint 18
QA/QC
ScOS Platform Framework Development Sprint 18 Review/Retrospective
ScOS Platform Framework Sprint 19
ScOS Platform Framework Development Sprint 19
QA/QC
ScOS Platform Framework Development Sprint 19 Review/Retrospective
ScOS Platform Framework Sprint 20
ScOS Platform Framework Development Sprint 20
QA/QC
ScOS Platform Framework Development Sprint 20 Review/Retrospective
ScOS Platform Framework Sprint 21
ScOS Platform Framework Development Sprint 21
QA/QC
ScOS Platform Framework Development Sprint 21 Review/Retrospective
Data Management Platform MVP
IDE Platform Development USDOT Retrospective
ScOS Data Exchange Workshop
Conduct Story Workshop
Prioritize and Size Stories
ScOS Data Exchange Development
ScOS Data Exchange Sprint 1
ScOS Data Exchange Sprint 1
QA/QC
Connected Vehicle Environment (CVE)
CVE Concept of Operations (ConOps)
Final CVE ConOps
Finalize City Internal and COTA Comments
Update Final CVE ConOps
QA/QC
CoC Review
Address Comments and Backcheck Final CVE ConOps
CoC Final Review
Submit Final CVE ConOps to USDOT
USDOT Review Final CVE ConOps
Receive USDOT Final Comments on CVE ConOps
Address USDOT Comments and Backcheck Final CVE ConOps
CoC Review
Address CoC Comments and Backcheck Final CVE ConOps
CoC Final Review
Submit Final CVE ConOps to USDOT
USDOT Review Final CVE ConOps
Multi Modal Trip Planning Application/Common Payment System (MMTPA/CPS)
MMTPA/CPS Concept of Operations (ConOps)
Draft MMTPA/CPS ConOps
Elicit User Needs for MMTPA/CPS

Data Date = January 31, 2018

Page 3 of 5

Duration

% Complete

Start

Finish

0 days
464 days
258 days
10 days
9 days
9 days
1 day
0 days
11 days
9 days
9 days
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4 days
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676 days
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Tue 1/23/18
Tue 1/23/18
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Fri 3/23/18

01/29/2018


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Data Date = January 31, 2018
## SmartColumbus Project Schedule
### 90 Day Look Ahead

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Appendix E

Quality Documentation
Quality Compliance Form

This is to certify that the attached document(s) has been produced in accordance with established quality procedures.

Project Name: 

Document ID: 

Technical Lead (originator): ____________________________ (Date): ____________

(Signature)  

(Name, FIRM)  

QC Reviewer(s): ____________________________ (Date): ____________

(Signature)  

(Name, FIRM)  

Systems Engineer: ____________________________ (Date): ____________

(Signature)  

(Name, FIRM)  

Quality Manager: ____________________________ (Date): ____________

(Signature)  

(Name, FIRM)
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# Quality Audit Roster

## Audit Number and Opening Meeting Date

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## Quality Audit Scope Documents

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## Opening Meeting Agenda:

- Review of Quality Audit Scope and duration
- Handling of findings/observations
- Approximate date of Closing Meeting
- Content & expected date of Quality Audit Report

## Closing Meeting Agenda:

- Review of Quality Audit Scope
- Review of commendable efforts
- Review of findings/observations
- Expected date of Final Quality Audit Report
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**PM/CM Functional Group or Entity being audited**

**Audit Scope (List QP procedures, program plan documents, or external entity QP being audited):**

**Auditor:**

**Date of Quality Audit:**

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**Audit Scope Specific Questions (add rows as necessary)**

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</tbody>
</table>

**Additional Auditor Comments**
Form SMRT-05 Quality Audit Report Resolution

Audit Scope:

Lead Auditor:
Auditor(s):
Auditee(s):
Opening Meeting Date:
Closing Meeting Date:
Final Quality Audit Report Date:
Quality Audit Report Distribution:

Executive Summary:

This Quality Audit of the Smart Columbus Program was conducted in accordance with the Quality Audit Schedule.

This Quality Audit resulted in the capturing of commendable efforts, \( \text{XX} \) findings resulting in Corrective Action Requests (CAR), and \( \text{XX} \) observations as further detailed within this report.

<table>
<thead>
<tr>
<th>CAR/PAR Number</th>
<th>Description</th>
<th>Responsible Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARXXXX</td>
<td></td>
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<tr>
<td>CARXXXX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Commendable Efforts (Good Points):

Findings:

Finding #1:
Responsible Manager:

Finding #2:
Responsible Manager:

Observations: The following \( \text{XX} \) observations were made during the Quality Audit. While not being issued as formal corrective action requests, the auditee(s) are encouraged to address these observations to achieve continual improvement and to prevent nonconformance in the future:

Observation #1:

Observation #2:
<table>
<thead>
<tr>
<th>CAR/PAR No.</th>
<th>Office/Project</th>
<th>Originator</th>
<th>Date Issued</th>
<th>Responsible Manager</th>
<th>Response Due Date</th>
<th>Response Received Date</th>
<th>Implementation Date</th>
<th>Verification Date</th>
<th>Date Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
### Form SMRT-07 Corrective-Preventative Action Request Form Resolved

<table>
<thead>
<tr>
<th>Issue Date:</th>
<th>Response Due Date:</th>
<th>Tracking #:</th>
</tr>
</thead>
</table>

**Originator:**

**Classification:**
- [ ] Corrective Action
- [ ] Preventive Action

**Description of Problem or Potential Problem:**

<table>
<thead>
<tr>
<th>Responsible Manager:</th>
<th>Date of Response:</th>
</tr>
</thead>
</table>

**Root Cause:**

**Action Plan sufficient to prevent recurrence or occurrence:**

<table>
<thead>
<tr>
<th>Implementation Date:</th>
</tr>
</thead>
</table>

**Quality Manager Review and Approval:**

**Quality Manager Verification of Implementation/Effectiveness:**

<table>
<thead>
<tr>
<th>Closed</th>
<th>Date:</th>
</tr>
</thead>
</table>
Review of Reports Guide

1.0 Purpose
This procedure describes checking of systems engineering reports.

2.0 Scope
This procedure applies to all systems engineering reports developed as part of the project work.

3.0 Requirements
Each report must meet the following requirements:
• Assumptions, methods and relevant facts are verified.
• Analysis was conducted at a level that is commensurate with industry standards, as applicable.
• Information required to validate the relevant facts, including backup documentation, is correct and is included or referenced in the report.
• Conclusions and recommendations can be justified from the relevant facts, methods and calculations. Particular attention will be given to checking supporting calculations, figures, tables and drawings.
• Inappropriate, redundant, or inconsistent information is eliminated.
• Grammar, physical workmanship of illustrations, typing, printing, and binding is commensurate with client requirements.

4.0 Procedures
• Use USDOT report templates.
• After the document drawings, tables, and calculations have been checked by the Technical Lead, the Technical Lead spell checks the document.
• The Technical Lead sends the report to technical publications group for word processing and editing. A minimum editorial review should be conducted on most reports to assure uniform format, proper sentence structure, proper syntax and spelling.
• The Technical Lead reviews the report for completeness, and once complete, passes the electronic review copy to the Systems Engineer and QC Reviewer(s) assigned to review the document, as well as assigns the scope of their review work. The Technical Lead instructs the reviewers on appropriate file version control naming, so that originators of all comments can be easily differentiated.
• Each reviewer examines the Review Copy for conformance to project design criteria and requirements, professional practices, and content. Suggested edits are made directly into the document in track changes mode, comments are inserted using the insert comments feature. Each reviewer’s primary responsibility is those sections of the report
in which he/she has professional expertise. However, reviewers should check the entire report to ensure that there are no conflicts.

- Upon receipt of the completed Review Copy and review comment forms, the Technical Lead, shall evaluate each of the review comments and determine its disposition. In case of disagreement between reviewers, the reviewers are consulted. The Technical Lead distributes the responses to review comments and final dispositions to the Reviewers. Responses can be provided electronically or on printed hardcopy using the word “Done” for agreement with each comment or providing written rebuttals to the comment. For electronic comments, responses to comments can be recorded within the original comments from the reviewer.

- Once corrections are made, and the document has been reprocessed through technical publications group, the Technical Lead verifies the dispositions made on the document and indicates his approval, either electronically into an electronic version of the document saved to the server, or on a hardcopy stored in the project files.
Review and Checking of Technical Specifications Guide

1.0 Purpose
This procedure describes review and checking of project technical specifications (special provisions).

2.0 Scope
This procedure applies to all technical specifications developed as part of the project work.

3.0 Requirements
Each technical specification must meet the following minimum requirements:
- References to and cites applicable version of Standard Specifications and industry standards.
- Specification format is consistent with industry standards or client requirements.
- Specification is achievable in implementation and constructible and biddable.
- Information in specification is compatible with information depicted in the drawings and calculations.
- Covers standard items of work that are not referred to in the Standard Specifications.

The specifications writer must:
- Ensure that all work to be performed under the contract is covered by either the Standard specifications or the technical specifications, regardless of how the work is to be paid for.
- Ensure that documentation for editing decisions is maintained, either in hidden text within the electronic document, or in the hardcopy project specification files.
- Clearly identifies all edits and changes he/she has made to standard or published documents by notations made in the electronic document (underlines, color fonts, strikethroughs, etc.) or by adding hidden text notations.
- Review the project plans and provide comments as necessary to the plan sheet designers to assure compliance with the project technical specifications and Standard Specifications.
- Ensure that the final printed document for advertisement reflects the edits he/she has made and that hidden text, comments or other editing marks do not show up in the final printed document used by the client.
4.0 Procedures

- The lead specification engineer spell checks the document, reproduces the complete document for a Review Copy either by printing hardcopy and applying the Check Print stamp to the first page of the Review Copy, or by electronically locking the document and turning on the track changes mode, and forwards it to the Technical Lead.

- The Technical Lead reviews the specification Review Copy for completeness, and passes the review copy to the Reviewer assigned to review the document.

- The QC Reviewer(s) checks the Review Copy for conformance to project design criteria and requirements, professional practices, and content. The QC Reviewer(s) highlights information identified as incorrect by marking on the hardcopy or by electronically adding review comments to the document. The QC Reviewer(s) returns the comments to the Technical Lead or directly to the specification engineer.

The specification engineer(s) backchecks the Reviewer’s marks on the Review Copy and makes changes as appropriate. To document the back checking process, the specification engineer adds the word “done” and his initials by the comments, if working with hardcopy, or makes electronic changes to the document with color coding or notations that indicate and document the change. Where the specification engineer disagrees with a QC Reviewer’s comment, a clear explanation or rebuttal is added either to the hardcopy or to the electronic document as hidden text or as a comment. The specification engineer returns the corrected technical specification to the Technical Lead or directly to the QC Reviewer for back checking.

- Any disputes that cannot be reconciled between the specification engineer and QC Reviewer shall be reported to the Technical Lead to initiate a dispute resolution process. If the Technical Lead is unable to resolve the dispute, the Consultant Program Manager will be consulted to make a final determination of the resolution.

- The Technical Lead will overview the work. Copies of the specification and Review Copy will be maintained as records.

The specification engineer creates a final version of the document for delivery to the City of Columbus being careful to remove all review formatting and editing marks, and if necessary, hidden text from the electronic document.
Grooming Process

General Definition

Product backlog grooming refers to the activities of writing, refining, estimating, and prioritizing product backlog items. Also called Product Backlog Refinement, this activity occurs on a regular basis and may be an officially scheduled meeting or an ongoing activity.

Expected Benefits

- Ensures that the backlog remains populated with items that are relevant, detailed and estimated to a degree appropriate with their priority, and in keeping with current understanding of the project and its objectives as defined in the Product Vision.
- As the backlog is dynamic, grooming supports the idea that at any moment a "sufficient" number of stories should be ready for scheduling in the next few sprints.
- Allows for a smoother Sprint Planning meeting and Sprint Execution because it provides a way for the team to ask questions ahead of time, plan, and identify gaps.

Our Process

Our team has a standing Grooming meeting every other week to ensure that we have a dedicated time at least once per sprint to groom the backlog as a team. This is held the Wednesday before the end of the Sprint. The team typically focuses on making sure stories for the next sprint are ready, per Definition of Ready, and it also gives the team time to address any questions. We also have informal grooming activities that occur throughout the sprint on an as-needed basis. These are done by individuals, small groups, or the whole team and should include internal and external stakeholders and users as appropriate.

Our Checklist

During grooming, we typically perform the following types of activities. Activities may include but are not limited to those listed here.

- **Removing user stories** that no longer appear relevant
- **Creating new user stories** in response to newly discovered needs
- Re-assessing the relative **priority order** of stories
- **Assigning points** to stories which have yet to receive one
- **Correcting points** considering newly discovered information
- **Splitting user stories** which are high priority but too coarse grained to fit in an upcoming sprint
- **Team asks questions** that would normally arise during Sprint Planning/Execution and updates/clarifications are documented appropriately in Pivotal Tracker
- **Improve user stories** that are poorly written and otherwise insufficient
- **Update the tagging** in Pivotal Tracker as appropriate (Label options are: Opportunity Queue, Ideation, Maturation, Grooming, and Ready) – ideally, we are moving from “Grooming” to “Ready” but this helps the Product Owner and team know what is “Ready” and what requires additional preparation
Grooming Process

References

► Agile Alliance
► Innolution: When, Who, What
Definition of Ready

1 General Definition

Explicit and visible criteria, often a checklist of conditions that must be true before a Product Backlog Item is considered ready to be brought into a Sprint during Sprint Planning.

2 Expected Benefits

- Avoids beginning work on stories that do not have clearly defined acceptance criteria, which usually translates into costly back-and-forth discussion
- Provides the team with an explicit agreement allowing it to "push back" on accepting ill-defined features to work on
- A strong definition of ready will substantially improve the Scrum team's chance of successfully meeting its sprint goal.

3 Our Process

Our team mentally checks off the documented checklist items to determine if a product backlog item is ready. Once it is deemed ready, we update the stories label in Pivotal Tracker to “Ready” (Label options are: Opportunity Queue, Ideation, Maturation, Grooming, and Ready). This usually happens during grooming sessions but can happen at any point in time when it meets the criteria. Only stories that are labeled as “Ready” should be committed to the Sprint Backlog during Sprint Planning.

4 Our Checklist

The following items are our teams’ definition of ready. This checklist should and can be revisited and updated as frequently as needed. Pivotal Tracker fields are listed if applicable.

- Meets our User Story Standards
  - **Story Title** (Well defined user story with “who”, “what” and “why”)
  - **Story Type**
  - **Points** (Ideally story points should be 1 to 5 points. Stories of 8 points or above should be broken out.)
  - **Owner** (A member of the development team has taken ownership of the story)
  - **Description** (Additional detail/perspective on the story)
  - **Labels** ("Ready" stage and any related epic labels should be set)
  - **Blockers** (a story cannot be brought into sprint if any blockers exist)
  - **Tasks** (Acceptance Criteria for the story should be sufficient for sizing, prioritization and development)
- Passes the INVEST test (Independent, Negotiable, Valuable, Estimable, Small, Testable)
- **Dependencies** clearly identified (if present) and no external dependencies would block the item from being completed
- **Details are discussed, updated and understood by the development team** so they can make an informed decision as to whether they can complete the item
- **Estimated** and small enough, 1 to 5 points, to be completed in one sprint (Points field)
- Team understands **how to demonstrate story** at the Sprint Review
Definition of Ready

5 References

► Agile Alliance
► Innolution
Appendix F

Risk Register
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Risk Group</th>
<th>Category</th>
<th>Project</th>
<th>Phase</th>
<th>Type</th>
<th>Description (Cause, Effect)</th>
<th>Risk Trigger</th>
<th>Engage USDOT</th>
<th>Probability of Occurrence</th>
<th>Impact to Cost</th>
<th>Impact to Schedule</th>
<th>On or near CP?</th>
<th>Rank</th>
<th>Status</th>
<th>Status Notes as of 07-18-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multi-Media Planning is limited to a couple services</td>
<td>Technical</td>
<td>Enhanced Human Services</td>
<td>3 - MMTPA/CPS</td>
<td>Design</td>
<td>Threat</td>
<td>If at the time of deployment, COTA is the only confirmed provider. Will limit user access to services.</td>
<td>Confirmation of MMTPA service providers.</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>No</td>
<td>12</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>2</td>
<td>Limited FMLM providers engaged</td>
<td>Technical</td>
<td>Enhanced Human Services</td>
<td>6 - Smart Mobility Hubs</td>
<td>Design</td>
<td>Threat</td>
<td>If at the time of deployment, we have not confirmed FMLM service providers we will not improve existing conditions.</td>
<td>Substantial of demonstration site map and installation schedule.</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>No</td>
<td>12</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>3</td>
<td>Cannot Recruit 3000 Aftermarket Safety Device (ASD) Participants</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>2 - C-V2</td>
<td>Requirements</td>
<td>Threat</td>
<td>At conclusion of installation, less than 3000 units have been installed. Reduces amount of data collected and extends schedule</td>
<td>Number of signed up interested participants by the time installation begins</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>No</td>
<td>15</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>4</td>
<td>Media driven scope creep</td>
<td>Organizational</td>
<td>Outreach</td>
<td>All</td>
<td>All Phases</td>
<td>Threat</td>
<td>Media mis-interprets or misrepresents the message on the scope of the project. Creates expectations to include more scope in the project.</td>
<td>Media event</td>
<td>Yes</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>No</td>
<td>18</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>5</td>
<td>Media driven negative perception of project</td>
<td>Organizational</td>
<td>Outreach</td>
<td>All</td>
<td>All Phases</td>
<td>Threat</td>
<td>Media mis-interprets or misrepresents the scope of the project. Creates negative response and lack of participation/support by the user/public.</td>
<td>Media event</td>
<td>Yes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>No</td>
<td>18</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>6</td>
<td>RFID Parking Permit &quot;system&quot; cannot be integrated into CoC System</td>
<td>Technical</td>
<td>Downtown</td>
<td>11-Enhanced Permit Parking</td>
<td>Design</td>
<td>Threat</td>
<td>During development of requirements workshop, we identify the system is incompatible. Parking improvements/benefits not realized.</td>
<td>During the system requirements development phase</td>
<td>Yes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td>Active</td>
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<tr>
<td>7</td>
<td>Retired</td>
<td>Technical</td>
<td>Downtown</td>
<td>11-Enhanced Permit Parking</td>
<td>Concept</td>
<td>Threat</td>
<td>City preference identified in CorOps approach versus technology solution specified in the application (RFID).</td>
<td>Technology decision during SE process</td>
<td>Yes</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>No</td>
<td>24</td>
<td>Active</td>
<td>Retired</td>
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<tr>
<td>8</td>
<td>Delivery zone availability application development</td>
<td>Usability</td>
<td>Downtown 10-Delivery Zone Availability</td>
<td>Deployment</td>
<td>Threat</td>
<td>Development of end user application not in the scope, but identified as a user need</td>
<td>Deployment phase</td>
<td>Yes</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Yes</td>
<td>29</td>
<td>Active</td>
<td>Active</td>
<td>INRIX is providing the application; risk is retired. Project removed from program.</td>
</tr>
<tr>
<td>9</td>
<td>City not able to use designated partner</td>
<td>Technical</td>
<td>All</td>
<td>All</td>
<td>All Phases</td>
<td>Threat</td>
<td>City is unable to access partner offerings.</td>
<td>Decision on partner agreement</td>
<td>Yes</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Yes</td>
<td>29</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>10</td>
<td>Wi-Fi coverage not sufficient to improve access to education/employment resources</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>2-Smart Street Lighting</td>
<td>Design</td>
<td>Threat</td>
<td>During field testing, system does not meet service expectations. Access to education/employment services not realized</td>
<td>SDD</td>
<td>Yes</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>No</td>
<td>20</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>11</td>
<td>Development required for OBUs &amp; RSUs to meet requirements</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>All</td>
<td>Procurement</td>
<td>Threat</td>
<td>Off-the-shelf OBUs &amp; RSUs do not meet requirements. Delay deployment/change in scope.</td>
<td>During vendor pre-qualification process</td>
<td>Yes</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>Yes</td>
<td>14</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>12</td>
<td>CV product does not meet technical requirements</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>Threat</td>
<td>Off-the-shelf application does not meet specifications. Delay deployment/change in scope.</td>
<td>During lab testing</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
</tr>
<tr>
<td>13</td>
<td>Development required for off-the-shelf applications to meet requirements</td>
<td>Technical</td>
<td>All</td>
<td>All</td>
<td>All Phases</td>
<td>Threat</td>
<td>Off-the-shelf applications do not meet requirements. Delay deployment/change in scope.</td>
<td>During the RFOs / Procurement process</td>
<td>Yes</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Yes</td>
<td>32</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>14</td>
<td>USDOT funding priorities</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>Concept</td>
<td>Threat</td>
<td>After Administration change, funding is interrupted/cancelled. If interrupted - delay in schedule/stop work order.</td>
<td>Policy change in USDOT.</td>
<td>Yes</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>No</td>
<td>16</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>15</td>
<td>Informative procurement process duration with City</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>All Phases</td>
<td>Procurement</td>
<td>Unable to shorten typical procurement process. Delayed schedule.</td>
<td>During the RFOs / Procurement process</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>16</td>
<td>Informative procurement process with partners</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>All Phases</td>
<td>Procurement</td>
<td>Unexpected change in partner delivery date. Delayed schedule.</td>
<td>When installation is scheduled to begin</td>
<td>Yes</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>24</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>17</td>
<td>Timeframe to install on AEP Assets</td>
<td>Schedule</td>
<td>Enabling Technologies</td>
<td>2 - C-V2</td>
<td>Deployment</td>
<td>Threat</td>
<td>Do not have authorization to attach to AEP places. Delayed Schedule</td>
<td>Deployment phase</td>
<td>No</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>24</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>18</td>
<td>Equipment attachment point on poles not high enough and limited coverage</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>2 - C-V2</td>
<td>Deployment</td>
<td>Threat</td>
<td>Existing infrastructure cannot support additional equipment at the required height. Delayed schedule/increase cost</td>
<td>Deployment phase</td>
<td>No</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>No</td>
<td>18</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>19</td>
<td>Lack of &quot;Mobility Assistance&quot; resources</td>
<td>Technical</td>
<td>Enhanced Human Services</td>
<td>4 - Mobility Assistance</td>
<td>Deployment</td>
<td>Threat</td>
<td>Limited ability to fully test the Mobility Assistance application and application does not provide benefit to people with Cognitive Disabilities.</td>
<td>During field testing</td>
<td>Yes</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>No</td>
<td>16</td>
<td>Active</td>
<td>Retired</td>
</tr>
<tr>
<td>20</td>
<td>Sensible PI becomes compromised</td>
<td>Technical</td>
<td>SoC</td>
<td>1 - SoC</td>
<td>Deployment</td>
<td>Threat</td>
<td>Data privacy safeguard policies are circumvented and personally identifiable information (PII) is compromised</td>
<td>During deployment phase</td>
<td>Yes</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>Yes</td>
<td>14</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>21</td>
<td>Legislation for the deployment of the planned autonomous shuttles</td>
<td>Legislative</td>
<td>Emerging Technologies</td>
<td>8 - CEAV</td>
<td>Deployment</td>
<td>Threat</td>
<td>Legislation will likely be required for the deployment of AV on City streets</td>
<td>Appropriate legislation not in place prior to deployment commencing</td>
<td>Yes</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Yes</td>
<td>16</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>19</td>
<td>Significantly more stakeholders to coordinate with than anticipated</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>Concept</td>
<td>Threat</td>
<td>Due to the enthusiasm and interest in the Smart Columbus Program, there have been many more players to coordinate with to allow appropriate time to listen and respond to user needs.</td>
<td>Concept of Operation development</td>
<td>Yes</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Yes</td>
<td>24</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Legislation for automated trucks and truck platooning on public streets</td>
<td>Legislative</td>
<td>Emerging Technologies</td>
<td>9 - Truck Platooning</td>
<td>Deployment</td>
<td>Threat</td>
<td>Legislation will likely be required to following distance for trucks engage in platooning on public streets and highways.</td>
<td>Deployment phase</td>
<td>yes</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Partners: SPARC, local partner in the City’s grant application, delayed their groundbreaking development</td>
<td>Schedule</td>
<td>Emerging Technologies</td>
<td>8 - CEAV</td>
<td>Deployment</td>
<td>Threat</td>
<td>SPARC, a committed local partner in the City’s grant application, has not yet broken ground on their development, which is the City’s proposed primary site for vehicle testing prior to deployment.</td>
<td>During deployment phase</td>
<td>Yes</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>No</td>
<td>20</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>COTA Mobility Assistance Call Center Support Liability</td>
<td>Organizational</td>
<td>Enhanced Human Services</td>
<td>4 - Mobility Assistance</td>
<td>Concept</td>
<td>Threat</td>
<td>COTA is not able to provide call center support, as it creates a “special duty” that may result in COTA being held liable for negligence related to mobility app user care.</td>
<td>Upon COTA legal team making a decision.</td>
<td>Yes</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>No</td>
<td>16</td>
<td>Retired</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Projects not deployed in time to collect 12 months of performance data.</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>Deployment</td>
<td>Threat</td>
<td>Project delays result in projects not be operational for 12 months during the 4-year grant period.</td>
<td>Schedule indicates projects will not be completed by the end of the grant's 3rd year.</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Delayed agreement with TRC to test vehicles</td>
<td>Schedule</td>
<td>Emerging Technologies</td>
<td>8 - CEAV</td>
<td>Deployment</td>
<td>Threat</td>
<td>With SPARC unavailable, we need to establish an agreement with TRC to test vehicles.</td>
<td>During deployment phase</td>
<td>Yes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>No</td>
<td>18</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Delayed definition of partner scope</td>
<td>Schedule</td>
<td>All</td>
<td>All</td>
<td>Procurement</td>
<td>Threat</td>
<td>Unexpected late change in partner scope definition/contribution. Increased costs and delayed schedule.</td>
<td>Notification of scope of change</td>
<td>Yes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Common Payment System has limited partners</td>
<td>Technical</td>
<td>Enhanced Human Services</td>
<td>3 - MMTPA/CPS</td>
<td>Design</td>
<td>Threat</td>
<td>May not be able to integrate with several backoffice pay distribution systems.</td>
<td>Confirmation of CPS service providers</td>
<td>Yes</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Yes</td>
<td>18</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>CV Interoperability</td>
<td>Technical</td>
<td>Enabling Technologies</td>
<td>2 - CVE</td>
<td>Procurement</td>
<td>Threat</td>
<td>CV vendor provides proprietary solution that is not interoperable with other vendor’s products based on the latest standards</td>
<td>Deployment phase</td>
<td>Yes</td>
<td>Moderate</td>
<td>Low</td>
<td>No</td>
<td>15</td>
<td>Active</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This Project Management Plan has been approved by City of Columbus Program Manager:

[Signature]
Mandy K. Bishop
City of Columbus Program Manager

Date:__________